Chapter S11. Marine Spatial Planning and Marine Renewable Energy

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Marine Spatial Planning (MSP) is advocated internationally as an improved approach to managing marine activities that addresses competing sectors and balances environmental, social, and economic interests (Ehler 2008; Ehler and Douvere 2009; Secretariat of the Convention on Biological Diversity 2012). The benefits of MSP are cited as increasing transparency and certainty for industry, improving environmental protection, reducing sectoral conflicts, and providing opportunities for synergies. Approaches to implementation of MSP vary by country and sometimes within countries. As a relatively new and novel approach to managing marine activities, it can be difficult to determine when success has occurred or what might constitute more effective and efficient management systems. The growth of marine renewable energy (MRE) will result in the increasing use of sea space and potential for conflict with existing marine uses, both of which can be addressed, in part, through implementation of MSP.

S11.1. INTRODUCTION

All MSP systems try to reflect key principles that are science- or evidence-based, integrated, adaptive, strategic, and participatory (Figure S11.1). These principles can present challenges for implementation because they necessitate a departure from traditional forms of marine management, whereby activities are managed on a sectoral basis with limited consideration of other activities occurring in the same space or the potential effects on the receiving environment individually or cumulatively. As such, sectoral management has resulted in a somewhat *ad hoc* approach to planning, that is allocation of sea space primarily occurs on a case-by-case basis, hence lacking an integrated and strategic approach. While definitions of MSP are numerous, the most widely adopted is that of the United Nations Educational, Scientific and Cultural Organization, which defines MSP as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process" (Ehler 2014; Ehler and Douvere 2009). MSP is a future-oriented process that can be used to assign space to different uses and manage the location of specific human activities in time and space, but practical production of marine goods and services will continue to be conducted through the granting of consents/permits (hereafter consents), permissions, and licenses for specific activities. MSP does not always culminate in the allocation of zones for marine activities but could be used to advocate preferred activities or priorities, reflecting national policy objectives, for example. As a future-oriented process, MSP enables decision makers to plan and take management actions that should lead to some agreed-upon future spatial vision for marine areas and help to manage potential new uses, such as MRE.

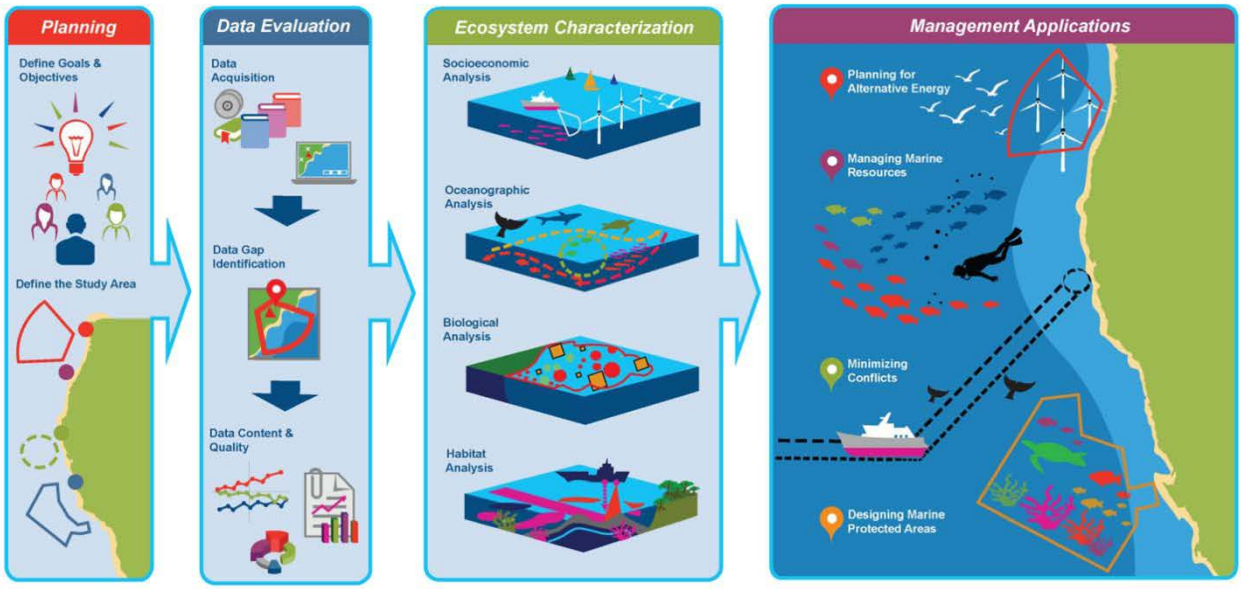

Figure S11.1. Example of a decision support process for marine spatial planning, implemented in a logical sequence of steps in information synthesis: 1) Planning: talking with managers to determine priorities; 2) Data evaluation: assessing the data and identifying data gaps; 3) Ecosystem characterization: describing the ecosystem patterns and processes including human activities across the area of interest; and 4) Management applications: working with managers to support specific management applications. (Image courtesy of the National Oceanic and Atmospheric Administration – National Centers for Coastal Ocean Science)

This chapter documents how MSP is currently being used to plan and develop MRE in the 15 countries that are involved in Ocean Energy Systems (OES)-Environmental. The information presented in this chapter derives from answers to a questionnaire completed by OES-Environmental participant country representatives or their suggested contacts and, where appropriate, supplemented by relevant external sources. The questionnaire, also available online as supplemental material (at https://tethys.pnnl.gov/state-of-the-science-2020-supplementary-marine-spatial-planning), requested input about the approaches to MSP in each country; if and how MRE policies link to MSP; how scientific information informs the process; how potential conflicts are managed; zoning for MRE; tools used to implement MSP; how consenting processes link to MSP; possible challenges to implementation of MSP for MRE; how the public is involved in MSP; and an option to include any further comments.

Each of the questionnaire topic areas is covered thematically in the following sections, closing with a final section on key findings and conclusions derived from questionnaire answers. Given the strong legal basis for MSP in the European Union (EU), findings from participating countries in the EU (Denmark, France, Ireland, Portugal, Spain, and Sweden) are presented first followed by those from the United Kingdom (UK) and its countries (England, Northern Ireland, Scotland, Wales), Australia, India, Japan, South Africa, and the United States (U.S.). The terminology used reflects that used in the country; for example, certain countries refer to offshore renewable energy in their legislation and policies, covering all forms of marine renewables (wave, tidal, offshore wind, etc.), whereas elsewhere explicit technology types are referred to in policy. In each section, information is given for countries for which respondents provided detailed answers; therefore, not every section addresses each country.

S11.2. APPROACHES TO MSP IN OES-ENVIRONMENTAL PARTICIPATING COUNTRIES

Approximately 70 countries worldwide are now estimated to have some form of MSP in varying stages of implementation (Marine Spatial Planning Programme 2018). Some countries and regions have a legal basis for implementing MSP, whereas others have conducted MSP on a less formal, non-statutory basis.

In the **EU**, MSP has had a basis in law since 2014 due to the adoption of a framework MSP Directive 2014/89/EU (Directive 2014/89/EU), which requires coastal member states to have maritime spatial plans in place for their waters by March 2021. As a result, all coastal member states are currently at varying stages of progress in implementing MSP. Certain countries and regions had MSP in place before the EU MSP Directive came into force, such as Belgium, Scotland, England, the Netherlands, and a number of the Baltic Sea countries. Other EU countries, such as France, Ireland, and Spain are in the initial stages of plan development.

Denmark has had legislation mandating MSP since 2016 but no comprehensive plan exists yet. A range of sectoral plans covering energy infrastructure, fisheries, and nature protection currently exist, and these will inform the forthcoming national marine plan.

In **France**, MSP is being implemented through "Strategic Facade Planning Documents" coordinated by the Ministry for the Solidarity and Ecological Transition that covers each of the four national sea basins (Décret n ° 2017-724) and liaise via a national Facade Maritime Council. There are two implementation phases: a strategic phase and as operational phase. The strategic phase aimed to identify environmental and socio-economic objectives. The results of this phase were adopted at the end of 2019 by inter-prefectural orders (dates differ according to sea basin) (European MSP Platform 2020a). The second phase is on-going and involves defining the associated action plan and monitoring process. For the region covering the North Atlantic sea basin, an important step linked to the process of updating the Strategic Facade Planning Document was completed with the launch of a large public consultation in 2019 (March 4 – June 4) in order to take into account opinions of public and environmental nongovernmental organizations on the future Strategic Facade Planning Document. The operational phase of MSP implementation will occur until 2021 and will involve setting up concrete actions schemes and monitoring programs to implement the over-arching Strategic Facade Planning Documents.

Ireland is currently developing their first national marine spatial plan. The responsible Minister published a Roadmap to set out Ireland's approach to MSP in the document '*Towards a Marine Spatial Plan for Ireland'* in 2017 (Department of Housing, Planning and Local Government 2017). This was followed by a baseline report on existing activities and the challenges from marine planning (Department of Housing, Planning and Local Government 2018) and a Marine Planning Policy Statement in 2019 (Department of Housing, Planning and Local Government 2019a). MSP will be implemented in Ireland via the National Marine Planning Framework (NMPF), including modernization of the development permitting process. A draft version of the plan was published for consultation in November 2019 (Department of Housing, Planning and Local Government 2019a). Four broad stages were identified in the development of the plan. The start-up or activation phase where the Government's proposed approach to developing MSP was announced and initial contact was made with stakeholders. The main development stage, commenced in Q1 of 2018 and ran until the end of Q3 of 2019, involved the analysis and identification of data and information required to provide a robust evidence base to underpin the marine spatial plan which is contained in the baseline report. This process has informed the development of the full draft plan published in Q4 2019 (Department of Housing, Planning and Local Government 2019b). The finalization phase will see a final version of the plan prepared for

submission to the Government in 2020 with supporting environmental assessments (strategic environmental assessment under the EU Strategic Environmental Assessment Directive (Directive 2001/42/EC) and Appropriate Assessment under the EU Birds and Habitats Directives (Council Directive 2009/147/EC and 92/43/EEC) for approval before forwarding the final plan to the European Commission ahead of the March 2021 deadline. Implementation and review will commence and continue on the publication of the final marine spatial plan. All information on progress of the NMPF is publicly available (Department of Housing, Planning and Local Government 2019c).

In **Portugal**, there are several mechanisms for MSP that operate in a complementary manner and can be divided by strategic mechanisms (such as the National Strategy for the Ocean, which acts as the planning and management policy) and operational mechanisms (the Situation Plan and the Allocation Plans which implement MSP). The Situation Plan identifies protected and conservation sites as well as the spatial and temporal distribution of existing and potential marine uses and activities (Direção-Geral de Recursos Naturais 2018). The Situation Plan is the instrument of reference for licensing private uses of the national marine space. The Situation Plan is subject, by law, to a strategic environmental assessment and the Plan includes information relating to the location of navigational facilities and structures, geo-spatial representation of existing and potential uses and activities, rules and restrictions on the use of public resources, safeguards and protections for natural and cultural resources, and good practices to be followed in the use and management of the maritime space. The Allocation Plan enables the allocation of areas or volumes for marine uses or activities not identified in the Situation Plan. For the purposes of assessing the impacts of the use or activity in the marine environment, the Allocation Plan is considered a project and is therefore subject to an environmental impact assessment (EIA) for developments falling within certain categories. Public or private entities can therefore submit an allocation plan for consideration and decision by the appropriate authority.

In **Spain**, while no MSP currently exists, the EU MSP Directive (Directive 2014/89/EU) was transposed into Spanish law through Royal Decree 363/2017 (Real Decreto 363/2017). The Directorate General of Sustainability of the Coast is coordinating the preparation of the management plans required by the legislation, and will be responsible for submitting the final plans to the European Commission. This legislation specifies that five management plans will be prepared for the regions of North Atlantic, South Atlantic, Estrecho and Alboran, Levantine-Balearic, and Canary Islands. These regions correspond with the marine sub-divisions used to implement the EU's Marine Strategy Framework Directive (Directive 2008/56/EC). There are no marine spatial plans in existence as yet in Spain, but preparatory work is underway. A working group has been created, to facilitate coordination between the different departments of the Central Government, together with the regional administrations, responsible for ports, tourism, environment, underwater cultural heritage, fisheries and aquaculture. Work is also progressing on the development and agreement of a set of MSP objectives, which will be subject to public consultation, before being endorsed by the Inter-Ministerial Commission of Marine Strategies.

Sweden also has legislation in place for MSP as a result of the EU MSP Directive (Directive 2014/89/EU) but prior to it, the Swedish Planning and Building Act (Plan-och bygglag 2010) contained an obligation for municipalities to plan the entire Swedish territory, covering land as well as internal waters and the territorial sea to 12 nautical miles. The EU MSP Directive also covers the territorial sea hence one function of national marine planning will be to guide municipality planning in the areas of overlap. Swedish territorial water is divided into two categories: public waters and private waters. The marine spatial plans being prepared currently will encompass the area one nautical mile from the baseline seawards and will include the exclusive economic zone but will not cover privately owned sea areas (private waters). Municipalities are responsible for planning

in the territorial sea and County Administration Boards have a coordinating role for national interests whilst also checking and enforcing the plans. In the exclusive economic zone, the State has sole responsibility. Nationally, the Ministry of Environment and Energy is the competent authority for MSP, supported by the Swedish Agency for Marine and Water Management. According to the Swedish Marine Planning Regulation 2015: 400 (2015), Swedish Agency for Marine and Water Management, with the input of the relevant County Administration Boards, will lead the development of three draft marine spatial plans covering the Gulf of Bothnia, the Baltic Sea, and Western Waters (Skagerrak/Kattegat). The draft plans were published for review, following incorporation of consultation submissions, in early 2019 (Swedish Agency for Marine and Water Management 2018a, European MSP Platform 2020b). The marine spatial plans being currently prepared will encompass the area one nautical mile from the baseline seaward and will include the exclusive economic zone, but will not cover privately owned sea areas.

The **UK** has been carrying out MSP since 2010 with the adoption of the UK Marine and Coastal Access Act (2009), which has been complemented by legislation in both **Scotland** and **Northern Ireland**.

In **England**, marine plans for a total of eleven plan areas will be developed by the Marine Management Organisation. So far, six plans have been published: the East Marine Plans, North East Marine Plan, North West Marine Plan, South West Marine Plan, South Marine Plans, and South East Marine Plan (Department for Environment, Food and Rural Affairs 2014, 2018; Marine Management Organisation 2020a, 2020b, 2020c, 2020d). Each plan sets out a vision for the marine plan area as well as a series of objectives and policies. These plans will take a long-term view of 20 years and will be reviewed every three years. The policies are intended to provide guidance on how decisions should be made to ensure the plan objectives are achieved. For each policy, detailed information is contained in the main chapters of the draft plans. This includes background information, existing policies, and measures; where the policy applies, a justification and explanation in support of the policy; and relevant maps.

A formal marine spatial plan does exist in **Scotland**, The Scottish National Marine Plan (SNMP) (Marine Scotland 2015), and Marine Scotland is the responsible body. The SNMP applies to inshore waters around Scotland from the Scottish coast out to 12 nautical miles (therefore, applying to coastal waters) and offshore waters between 12 and 200 nautical miles. The Marine (Scotland) Act (2010) (an act of the Scottish Parliament) and the UK Marine and Coastal Access Act (2009) are the key pieces of legislation that resulted in the production of MSP within Scotland. Under the 2009 Act, the Scottish Ministers had to ensure a marine plan was in place for offshore waters (Scottish Government 2015). Under the 2010 Act, Scottish Ministers had to prepare and adopt a National Marine Plan for Scottish inshore waters. The requirements of the 2010 Act, its interaction with the National Marine Plan, and where the 2009 Act fits within this process are shown in Figure S11.2. Scotland's MSP process takes an ecosystem-based approach; ensuring the sustainable use of the marine environment, the quality of the environment itself and sustainable economic development are incorporated into the decision-making process, as well as a role in climate change adaptation management. It should be noted that under the 2010 Act, Regional Marine Plans are to be developed for 11 Scottish Marine Regions by Marine Planning Partnerships. To date, only the Clyde and Shetland Isles regions have taken forward regional MSP, though Orkney is in the beginning stages of development and is currently in the process of establishing a Marine Planning Partnership.

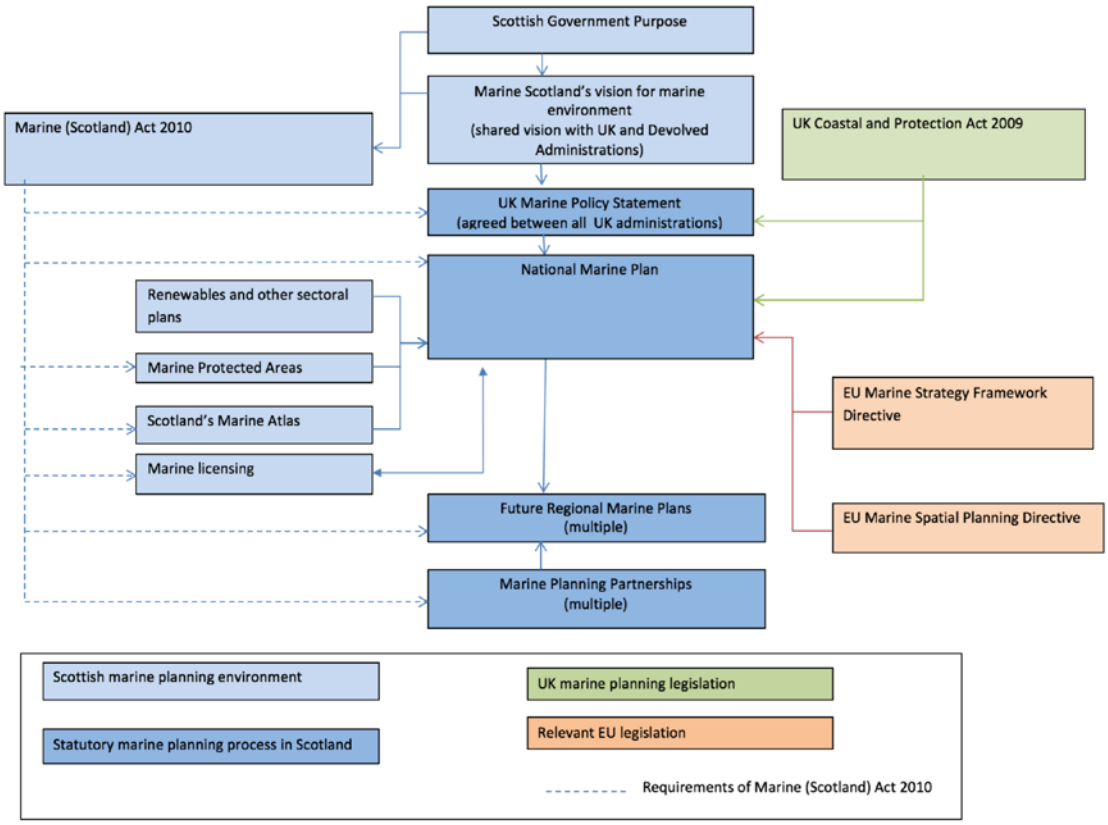

Figure S11.2. The legislation that influences marine planning and policy in Scotland (From Scottish Government 2014a).

In **Wales**, the Welsh Government published its first marine plan for Welsh inshore and offshore waters, the Welsh National Marine Plan (WNMP) in November 2019 (Welsh Government 2019a). The plan was developed in accordance with the UK Marine and Coastal Access Act (2009), the UK Marine Policy Statement (HMG 2011), and the EU MSP Directive (Directive 2014/89/EU), as represented in Figure S11.3. It extends from mean high water spring tide to cover the inshore and offshore (beyond 12 m Welsh offshore plan region). Local authority jurisdiction is from the mean low water mark landward so the two planning regimes overlap. The Welsh Government carried out a formal consultation on a first draft Wales National Marine Plan between December 2017 and March 2018. Those responsible for decision-making, regulators and statutory consultees, must ensure their advice is consistent with the policies in the WNMP. Similarly, developers will need to ensure compliance of their project proposals with the WNMP policies. All public authorities are to consider the Marine Policy Statement and relevant marine plans when making decisions regarding the marine area. This ensures that marine resources are used in a sustainable way in line with the high-level marine objectives.

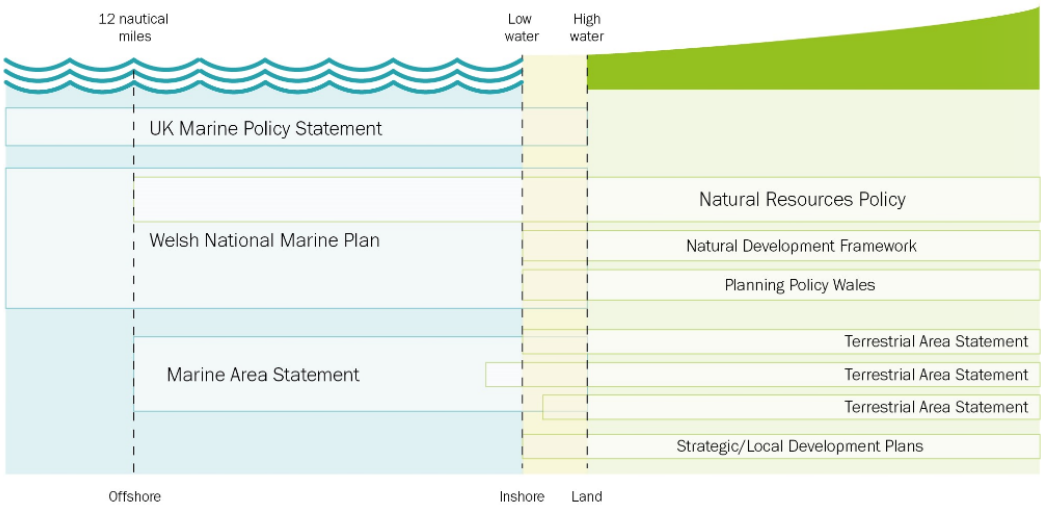

Figure S11.3. Interactions between the United Kingdom (UK) Marine Policy Statement (UK Marine and Coastal Access Act 2009) and Welsh Natural Resources Policy (Welsh Government 2017a)) and associated plans across the land-sea interface (From Welsh Government 2020a)

In **Northern Ireland**, the Department of Agriculture, Environment and Rural Affairs is the authority responsible for preparing plans, with other relevant departments and agencies providing assistance on areas where they have policy responsibilities. A national marine plan for both the inshore and offshore area, will be published as one document, and will contain provisions relating to retained functions (matters not fully devolved to Northern Ireland). A draft Marine Plan for Northern Ireland was published for public consultation in April 2018, accompanied by a Sustainability Appraisal (Department of Agriculture, Environment and Rural Affairs 2018a). The latter evaluates the economic, environmental, and social impacts of the Marine Plan and its policies. Due to the lack of government from 2017 to 2019 in Northern Ireland, the Marine Plan has been at a standstill as it requires Ministerial sign-off before it can be formally adopted and implemented.

Australia has formal MSP processes, but these operate across several jurisdictions. In 1998, Australia implemented a world leading ocean policy driving marine bioregional planning (Department of the Environment and Heritage 2006). However, the integrated management objectives of this policy balancing social, economic, and environmental objectives have not been delivered and marine plans under this policy dissipated (Vince et al. 2015). South Australia published the Marine Planning Framework in 2006 to provide a structure to manage, in an ecologically sustainable way, natural resources in marine areas that were not part of the protected area system (Department of the Environment and Heritage 2006). More recently, along with its Marine and Coastal Reforms Final Transition Plan (State of Victoria Department of Environment, Land, Water and Planning 2018), Victoria enacted the Marine and Coastal Act (2018), which requires the development of an MSP Framework as a component of a state-wide Marine and Coastal Policy. The legislation requires that the Framework "establishes a process for achieving integrated and coordinated planning and management of the marine environment." The Victorian State Government published a draft Marine and Coastal Policy for public consultation in 2020 (State of Victoria Department of Environment, Land, Water and Planning 2020). This encompasses a draft MSP Framework for the State for the first time. The MSP Framework outlines a process for creating marine plans in Victoria so industry, government, and community can work together to better plan how to use and protect the marine environment. It consists of three parts: the first contains guidance for planning and management to promote integration across sectors; the second relates

to guidance for determining where and when MSP is required and the steps to seek authorization to proceed; and the third part details the steps necessary to complete the MSP process (State of Victoria Department of Environment, Land, Water and Planning, 2019). Legally the Framework will apply to the 'marine environment', as defined in the associated legislation, covering the area from the high water mark out to the boundary of Victoria's state jurisdiction of three nautical miles (5.5 km), and to a depth of 200 m below the surface of the seabed. The Framework does, however, recognize that the planning process may extend beyond this area to include Commonwealth waters and coastal waters of New South Wales, South Australia, and Tasmania as well as land and catchment planning.

India has no MSP in place and there is no use of specific MSP terminology in relevant legislation or policy. However, the principles of MSP are a basic requirement for developing marine projects in India and a part of any EIA (Dineshbabu et al. 2019). There are also several laws and policies for coastal zone management, which include an Integrated Coastal Regulatory Zone, Integrated Management Plan, and Integrated Management Plans under the Environment (Protection) Act (1986).

In **Japan** there is no formal MSP process. A Basic Act on Ocean Policy (2007) was enacted in 2007 to assist with aspects such as marine development, security, scientific knowledge, and governance, and to develop a comprehensive ocean policy, reviewed on a five-year basis. In May 2018, the Third Basic Plan on Ocean Policy was approved by the Meeting of the Headquarters for Ocean Policy, followed by a Cabinet decision This provides a framework for developing a number of specific policies, including on maritime security; the promotion of industrial use of the ocean; maintenance and conservation of the marine environment; improving scientific knowledge; promotion of an Arctic policy; international collaboration and cooperation; and development of human resources with knowledge of the ocean to advance national understanding. While MSP is not mentioned explicitly, a number of the objectives, such as industrial ocean uses and maintenance and conservation, will necessitate consideration of planning systems. The Ocean Policy contains 370 measures to achieve the policy objectives. One such measure explicitly relates to improving systems relating to the use of marine space for offshore wind generation.

In **South Africa**, the Marine Spatial Planning Act (2018) entered into force in May 2019. The objectives of the Act, specified in Article 2, are to develop and implement a shared MSP system to manage a changing environment that can be accessed by all sectors and users of the ocean; to promote sustainable economic opportunities through coordinated and integrated planning; to conserve the marine environment; to facilitate responsible use of the ocean; to provide for the generation of more scientific knowledge on the ocean; and to give effect to South Africa's international obligations in South African waters. Under the Act, South African waters are defined as including internal waters, the territorial sea, exclusive economic zone, and the continental shelf. There is also a National Framework for MSP that provides high-level direction for undertaking MSP in the context of other relevant legislation, policies and planning regimes, and various Marine Area Plans are in the development process (The Republic of South Africa 2017). The Department of Environmental Affairs is the lead Department for MSP and has convened a National Working Group on MSP that is in the process of finalizing the Current Status Report which will contain information on the various sectors currently operating in the ocean space. Subsequently this Working Group will begin the process of developing Marine Area Plans. The Framework and Plans developed are subject to approval by two committees. These committees will also have responsibility for dealing with decisions on conflict resolution, trade-offs and other matters relating to the MSP process. The Ministerial Committee on MSP has ultimate and final authority on the adoption and implementation of MSP.

In the **United States** (U.S.), there is no formal overarching MSP process, legal framework, or founding legislation primarily due to the separation of powers that exists between federal and state levels. The formation of a formal MSP process on a national level faces considerable political barriers and the multijurisdictional and sector-specific nature of jurisdiction over marine space does not lend itself well to comprehensive and prescriptive MSP. Outside of the federal context, states such as Massachusetts, Oregon, Rhode Island, and Washington have enacted MSP (respectively Commonwealth of Massachusetts 2020; Department of Land Conservation and Development 2020; Rhode Island State 2020; State of Washington 2020) to help guide conservation and use of ocean space through the implementation of marine plans or the explicit adoption of MSP principles. Additionally, in 2016 while the previous Executive Order 13547 that called for regional MSP across the U.S. was in place, both a Northeast Ocean Plan (Northeast Regional Planning Body 2016) and a Mid-Atlantic Regional Ocean Action Plan (Mid-Atlantic Regional Planning Body 2016) were developed and implemented through Regional Planning Bodies. In 2018, Executive Order 13547 was revoked by Executive Order 13840, which eliminated the Regional Planning Bodies, established an Ocean Policy Committee, and removed the impetus for federal agencies to comply with both 2016 plans (Executive Order 13840). Executive Order 13840 does address some concerns with implementing MSP and the Regional Planning Body processes where economic uses of U.S. Ocean, Coasts, and Great Lakes were not adequately represented, such as MRE.

S11.3. MRE POLICIES AND LINKS TO MSP

MSP tends to be strategic in nature and often contains broad management principles and objectives that apply to multiple marine sectors rather than being prescriptive on where an activity can occur. As such, it is relevant to document whether countries have national MRE strategies or policies and whether these strategies and policies have been explicitly recognized in the MSP process. Beginning with the **EU**, and possibly as a result of legislation on renewable energy, a number of countries have dedicated policies specific to offshore wind or MRE (wave and tidal) in particular.

In **Denmark**, a technical report was published in 2012 that focused on the strategy for research, development, and demonstration of wave energy in the country (Nielsen et al. 2012) and more recently a Partnership for Wave Power - Roadmaps was published in 2015 (Nielsen et al. 2015). The latter was produced by a consortium that includes nine Danish wave energy developers.

France has defined targets and quantified objectives to improve the contribution of MRE to the national energy mix. The legal framework for MRE development is provided by the 2015 law on energy transition, supplemented by the Energy Multiannual Programming (Programmations Pluriannuelles de l'Énergie [PPE] in French), the French Strategy for Energy and Climate Multi Annual Energy Plan last updated in February 2019 (Ministère de la Transition Écologique et Solidaire 2019a). This outlines the future contribution of bottom-mounted and floating offshore wind as the PPE plans an increase of offshore wind production to total 2.4 GW by 2023 and up to 5.2 GW by 2028. The objectives for MRE were defined considering the limits of the sea space when reconciled with other marine uses and activities, as highlighted during the MSP process and specifically the preparation of the Strategic Facade Planning Document. It also states that whilst tidal technologies have matured, they are still expensive and, accordingly, there will not be a call for tenders for such projects in the near future. With the La Rance tidal barrage project, France has been a pioneer in ocean energy but politically wave energy is not a priority for the short term, and tidal energy technologies are currently considered by the government not to be mature enough to develop into industrial projects. The 2019 PPE decree project and the MSP process both place the emphasis on the development of offshore wind (Ministère de la Transition Écologique et Solidaire 2019a).

Currently there is no specific sectoral spatial plan for MRE in **Ireland** but it is intended to be established (Department of Housing, Planning and Local Government 2017). Offshore renewable energy development to date has been guided by the Offshore Renewable Energy Development Plan (OREDP) (Department of Communications, Energy and Natural Resources 2014, Department of Communications, Climate Action and Environment 2018). The implementation of the OREDP is led by the Department of Communications, Climate Action, and Environment who have put in place the Offshore Renewable Energy Steering Group in order to ensure successful implementation. The Steering Group consists of the main Government departments and agencies with roles and responsibilities that relate to energy and the marine environment, developers and broader interest, and user groups when necessary. There are key actions in the plan that the Steering Group works to deliver and while there are indications of potential offshore renewable energy opportunities, there are no targets for delivery. The OREDP was reviewed in 2017 by relevant stakeholders at government and industry level to ascertain progress on actions; to ensure continued focus on appropriate priority areas; and to realign the plan with any changes in political or technical landscapes. The review of the OREDP was subject to a full public consultation in November/December 2017 and a final report was published in May 2018 (Department of Communications, Climate Action and Environment 2018). The review contains 26 recommendation actions. It does not make any changes to the OREDP, rather the review aims to chart progress on the plan, identify challenges that have emerged, and identify areas that need to be prioritized or require attention. Separately, the Irish government published a Climate Action Plan in 2019 (Department of Housing, Planning and Local Government 2019d). Together with the NMPF (Department of Housing, Planning and Local Government 2019b) and the reform of the marine consenting system, the Plan will drive both designation of sites for MRE and their subsequent development in the coming years.

The development of the MRE sector in **Portugal** has been addressed in several strategic government documents since 2007 (Government of Portugal 2006, 2013; National Renewable Energy Action Plan 2009). The main strategic actions and measures in these documents are shown in Table S11.1. The link between MRE development and the availability and distribution of wave and wind resources has been highlighted in these documents in order to optimize the use of available marine space, increase synergies, and minimize conflict between all marine activities. Specific targets for MRE are not included in any of the strategic documents, but the recent roadmap for the MRE industrial strategy (Government of Portugal 2017) estimates an installed capacity of 400 MW (260 MW for offshore wind and 140 MW for wave energy) by 2030, resulting in the creation of 7200 new jobs. This installed capacity is reflected in the MSP through the inclusion of the Aguçadoura test site, the spatial designation of a Pilot Zone in San Pedro de Moel, and its extension to Viana do Castelo where a cable for the WindFloat Atlantic project is being installed.

Table S11.1. Portuguese policies and strategies of relevance to marine renewable energy (MRE).

Document name	Strategies
National Ocean Strategy 2006-2016 (Government of Portugal 2006)	The development of the MRE sector is recognized as a strategic pillar **Actions and measures** ● Promote investment in MRE to reduce dependence on external energy and the emission of greenhouse gases ● Speed up licensing procedures mobilizing and attracting private investment and supporting technological innovations ● Development of an industry of goods, equipment and services that promotes job creation, export of equipment, technology and know-how, and industry diversification, e.g., in the metalwork industry and the naval shipyards. **Strategic actions** Support for new forms of technology for maritime activities: creation of conditions for the installation, testing and development of emerging forms of technology such as renewable forms of energy.
National Renewable Energy Action Plan (2009)	It is established that specific national plans would be implemented for MRE generation through marine spatial planning.
National Ocean Strategy 2013-2020 (government of Portugal 2013)	MRE is recognized as an intervention domain due to the resource potential for wave and offshore wind. **Objectives of the action programs for marine energy resources** Research and assessment of the potential for combined marine energy resources, ensuring good environmental practices and social benefits from its future exploitation through: 1) Zoning the potential areas for combining marine energies, renewable and non-renewable, conventional and non-conventional, aimed at increasing economic value, energy security and reducing carbon footprint, utilizing good practices. 2) Improving scientific and technological research capacity on marine energies, including mapping and assessing the long-term economic potential and environmental impact. 3) Promoting specialized employment in the marine energy sector, associated with a renewable energy park. 4) Governance that promotes research and exploitation of marine energy resources, including creating access and safeguarding conditions for preservation of the environment and marine biodiversity, and measures to reduce the carbon footprint.
Roadmap for an MRE Industrial Strategy (2016)	The state of the art for wave and offshore wind technology is presented and a prediction for installed capacity of these two types of technology is made up to 2030 based on investment, funding

	schemes, levelized cost of energy, efficient licensing procedures, supply chain and infrastructure development.

In **Spain**, the National Renewable Energy Action Plan 2011-2020 (Ministerio de Industria, Turismo y Comercio 2010), approved in November 2011, includes targets for ocean energy (100 MW of installed power by 2020); however, it is unlikely these targets will be achieved since the Spanish Government has suspended feed-in tariff support to all new renewable energy installations since January 2012. This Plan includes targets for ocean energy for the first time, with the first 10 MW of installed ocean power expected by 2016 and an anticipated annual growth rate of 20 - 25 MW between 2016 and 2020 reaching 100 MW by 2020. The Plan saw development of ocean energy occurring in three phases. Firstly, between 2010-2015, the focus was on simulation, modelling, and prototypes with little focus on the cost of the electricity. The focus for the second stage (2016-2020) has been on technology development comprising of the demonstration of full-scale prototypes with generation costs between €21 and €33 per MWh. Finally, the third phase (2021-2030) will focus on technology consolidation with commercial deployment of ocean power plants and cost reducing to €7- €15 per MWh. During 2018, the Spanish Government began to work on the National Integrated Energy and Climate Plan 2021-2030 (Gobierno de España 2020), the Draft Bill on Climate Change and Energy Transition (Ministry of the Presidency 2019). The law has not yet been enacted but the Plan has been updated and presented to the European Commission. The aim is to achieve up to 42 percent consumption of renewable energies out of the total energy use by the year 2030. The Plan contains a trajectory for growth of wind, but this is combined for land-based and offshore wind. It recognizes that other ocean technologies may have a role to play in future renewable energy scenarios. In 2017, the Basque Government approved its Energy Strategy for 2030 (Basque Energy Agency 2017), which includes a specific initiative to speed up technology and commercial development for ocean energy and sets a target of 60 MW by 2030. It is expected that the targets for offshore wind will be developed in suitable areas identified by the Strategic Environmental Plan for Offshore Wind Development approved by the Spanish Government in 2009 (Ministry of the Presidency 2009). MRE is taken into account in the MSP process, and representatives from the sector have participated in meetings relating to marine plan development.

In **Sweden**, under the energy agreement published by the Swedish Government in 2016, the objective is a full transition to a completely renewable electricity system, with the goal of 100 percent renewable electricity production, by 2040 (Government Offices of Sweden 2016). To achieve this goal, the Swedish Energy Agency has estimated that about 80 to 100 TWh of new, renewable electricity production will need to be installed by 2040–2045. The proposed marine spatial plan has a chapter on energy, which includes information on current and planned offshore wind and wave energy activities (Swedish Agency for Marine and Water Management 2019a). The MSP process has also assisted in the identification of other suitable sites for offshore wind and recognizes development zones and areas for testing wave energy. The Energy Agency's assessment is that marine spatial plans should enable the installation of around 50 TWh of offshore wind power (Swedish Energy Agency 2018). The draft marine spatial plan document also states that several municipalities are planning for offshore energy development close to the coast by zoning suitable areas in their comprehensive plans under the Planning and Building Act (Plan-och bygglag 2010).

The **UK** Government has a target date of 2050 to have reduced their emissions by 80 percent (The Climate Change Act 2008), though there are no specific targets at UK level for marine renewable energy. For certain policy areas, the UK Government in Westminster makes the policy and/or legislation, which is then applied in the devolved administrations (Scotland, Wales, and Northern Ireland) by their authorities. The Crown Estate

is a UK entity that manages lands held by the Crown as sovereign. This includes the foreshore and seabed (out to 12 nautical miles) and as landowner in the exclusive economic zone out to 200 nautical miles. The Crown Estate has legal authority to alienate property through granting seabed or foreshore rights to a third party for specific purposes such as MRE generation. The Crown Estate has run six offshore wind leasing rounds since 2000. Leases specify the type and scale of the project and are supplemented by offshore strategic environmental assessment. During this process, prospective developers have the opportunity to identify and propose their own project sites within these leased areas, informed by characterization data and analysis made available through The Crown Estate. Currently the fourth leasing round for offshore wind is underway in UK waters. As managers of the seabed and a number of important marine sectors, The Crown Estate must have regard to any applicable marine plans and associated policy documents when making their decisions.

In **Scotland**, there is not a specific MRE strategy document in place, but there is a Scottish national energy strategy (Scottish Government 2017). This document sets out the high-level support the Scottish Government is committed to advance MRE in the country. The Scottish Energy Strategy (Scottish Government 2017) was published prior to the review of the SNMP and made reference to how the SNMP review would assess if the Strategy priorities were addressed in it. It is unclear if this aspect of the review was undertaken as the review document refers to documents that may have an impact on the SNMP and gives the Strategy as an example. Chapter 11 of the SNMP sets out that offshore wind and MRE shall "contribute to achieving the renewables target to generate electricity equivalent to 100 percent of Scotland's gross annual electricity consumption from renewable sources by 2020" (Marine Scotland 2015). Furthermore, it sets out that offshore wind and MRE shall "contribute to achieving the decarbonization target of 50g CO_2/kWh by 2030 (to cut carbon emissions from electricity generation by more than four-fifths)" (Marine Scotland 2015). The MSP, therefore, does not provide specific targets for offshore wind, wave, and tidal energy but makes it clear that the Scottish Government expects them to contribute to their wider renewable and decarbonization targets. Marine renewables (including wind, wave, and tidal energy) are incorporated into the SNMP as its own specific sector. Objectives and policy are set out in Annex B and Chapter 4 of the Plan. The Scottish Government is, however, also developing plans for offshore wind, wave, and tidal energy in Scottish waters (Scottish Government 2012, 2018).

In **Wales,** specific generation targets for MRE have not been identified, but there are a number of strategic plans and policies which identify growth of MRE as a target/priority. The Welsh Government's aim to enhance the economic, social and wellbeing of the people and communities of Wales is set out in Energy Wales: A Low Carbon Transition (Welsh Government 2012), which contains priorities for leading the transition to a low carbon economy in a way that delivers long term benefit for the people of Wales. Growth in renewables, rather than a specific megawatt target, is also identified as one of three priorities in the Welsh Natural Resources Policy (Welsh Government 2017a) produced under the Environment (Wales) Act (2016). As a requirement of the Environment (Wales) Act (2016), Natural Resources Wales has produced a Marine Area Statement (Natural Resources Wales 2020) which sets out how this priority will be delivered in the marine environment. Given that one of the three priorities identified in the National Resources Policy is growth in renewables, this could have a key role in MSP for marine renewable energy. Finally, the WNMP (Welsh Government 2019a) identifies MRE as one of four priority sectors for Wales and includes a number of supportive policies intended to support the sustainable development of wave, tidal stream, tidal range and offshore wind (Welsh Government 2019a), through:

- supporting the development and demonstration of tidal stream and wave energy technologies over the next 5-10 years

- increasing (where appropriate) the number of generation devices deployed in commercial scale developments over the next 10-20 years
- supporting (where appropriate) further commercial development of offshore wind and tidal lagoon technologies over the next 5-10 years taking advantage of any favorable UK government financial mechanisms under the Contract for Difference
- promoting evidence gathering and research on tidal range development to support the sustainable development and deployment of the technology.

Separate to MSP, Natural Resources Wales is also developing the Wales Marine Area Statement, as a requirement of the Environment (Wales) Act (2016). The Marine Area Statement will set out how priorities in the Welsh Natural Resources Policy will be achieved in the marine environment. Given that one of the three priorities identified in the Natural Resources Policy is growth in renewables, this could have a key role in spatial planning for MRE.

Northern Ireland has had an Offshore Renewable Energy Strategic Action Plan 2012-2020 in place since 2012 (Department of Enterprise, Trade and Investment 2012). An initial leasing round resulted in The Crown Estate granting development rights to one offshore wind and two tidal energy projects. The offshore wind project has decided not to proceed, one of the tidal projects backers in is liquidation and the other tidal project is proceeding with the marine licensing process (Department for the Economy 2019). During 2018, Northern Ireland officials worked closely with The Crown Estate with regard to the potential for Northern Ireland to participate in a further seabed leasing round in UK waters in 2019, however Northern Ireland waters have been excluded from leasing round proposals at this time (Department for the Economy 2019).

There is no specific ocean energy strategy, target, incentive, or legislation for MRE in place for **Australia**. The Australian Renewable Energy Agency funds some research into ocean energy and several demonstrations deployments (less than 500 kW) have occurred in Australian waters. To date, the only MSP process to have incorporated ocean energy as a specific sector is the Marine and Coastal Policy (State of Victoria Department of Environment, Land, Water and Planning 2020). The MSP framework of the policy was co-designed with a range of marine stakeholders, in which representatives of Australia's ocean energy community participated. In particular, this included proponents of Australia's first proposed offshore wind energy farm (Star of the South), which currently holds an exploration license for a site in Victoria's marine domain, and representatives of Australian marine renewable energy industry group (the Australian Ocean Energy Group). No distinction is made for alternate technologies. Prior MSP processes predate serious consideration of ocean energy as a significant user of the marine domain.

In **India**, the Draft National Renewable Energy Act 2015 (Ministry of New and Renewable Energy 2015) covers promotion of all forms of renewable energy including ocean energy. Ocean energy is still in demonstration stages in India, but it is now part of the non-solar Renewable Purchase Obligation promoted by the Government of India though no specific targets have been defined yet. Ocean energy is still in its infancy and in demonstration stages in India. Hence there is no formal environmental clearance procedure that is specific to ocean energy projects. In relation to planning, however, any activity on the shore needs to get Coastal Regulatory Zone clearances by the Ministry for Environment and Forests. There are formal procedures for getting EIA clearances. For ocean energy and desalination projects, clearance by the Ministry of the Environment and Forests is completed in the same manner as for other identified activities.

In **Japan,** there are no policies or targets specific to MRE. The country has a Strategic Energy Plan which is reviewed every three years. The 4th Strategic Energy Plan (Ministry of Economy, Trade, and Industry 2014) addressed the need for more research and development in "ocean energy, including wave and tidal power" as

well as large emphasis in strengthening measures to accelerate the introduction of wind (including offshore wind) and outlines an energy mix to 2030 that includes only 1.7% of wind energy, both on land and offshore. The 5th Strategic Energy Plan (Ministry of Economy, Trade, and Industry 2018) does not include additional recommendations for ocean energy, although it does cover measures to make wind power a major power source, stating "further introduction of offshore wind power is indispensable for Japan where appropriate places in which onshore wind power can be introduced are limited" (Ministry of Economy, Trade, and Industry 2018). Additionally, The Third Basic Plan on Ocean Policy (Cabinet Office of Japan 2018), published in 2018, targets offshore wind specifically. Accordingly, new legislation was introduced in 2018 (the Act of Promoting Utilization of Sea Areas in Development of power Generation Facilities Using Marine Renewable Energy Resources Act 2018), and entered into force in April 2019, which covers the utilization of sea areas for the generation of power from offshore wind. In 2016 the Port and Harbor Law was modified to promote offshore wind energy development (Japan Wind Power Association 2016). This allows wind developers to occupy a designated water zone in the port area for 20 years. It also introduced an auction system for offshore wind power development in port areas. According to the Port and Harbor Law, development in port areas is preferred as these already have good infrastructure and grid connection.

South Africa has no MSP in place yet despite strong legal and policy bases (Marine Spatial Planning Act 2018) and there are no targets in place for MRE.

As there is no federal MSP system in place for the **U.S.**, there is no inclusion of MRE as a specific sector. In June 2019, however, the Bureau of Ocean Energy Management (BOEM) published a new regional offshore wind leasing strategy (Bureau of Ocean Energy Management 2019), mentioning the U.S. Outer Continental Shelf provides a world-class wind resource on both the Atlantic and Pacific coasts. The Presidential Executive Order 13783 (2017) established a federal policy of promoting clean and safe development of domestic energy resources, including renewable energy, to ensure national security and provide affordable, reliable, safe, secure, and clean energy. In addition, many of the regional ocean partnerships, as called for in the 2018 Presidential Executive Order 13840 (2018) are heavily focused on developments in renewable energy industries, predominantly on offshore wind but also MRE and hydrokinetic technologies.

S11.4. TAKING MRE INTO ACCOUNT IN MSP

MRE has specific requirements from a planning process perspective. For example, MRE needs to link with other infrastructure such as grid provision and access to ports. Any development planning process must be cognizant of the receiving environment. To ensure that these aspects are considered before a decision is made, many countries implement some form of environmental assessment (at strategic or project level), which can then inform future planning processes. As part of environmental assessment requirements, and as a good practice generally, stakeholder consultation is also a fundamental part of the wider planning process. This consultation can occur with the public at large, with individual sectors, or with representative groups and ultimately should lead to a more robust and trusted planning process. These specific requirements of the MRE sector can be considered in the development of MSP processes in many ways. Given the implementation status of MSP across the globe, not all countries have addressed these requirements (namely **India**, **South Africa** and the **U.S.**). In countries and regions where MSP is progressing, specific sectoral requirements are fed into the MSP process, primarily via consultation mechanisms either on an individual sectoral basis or through a dedicated stakeholder mechanism and are described below. This is likely to evolve as implementation of MSP begins.

The **EU** countries are most advanced in this respect, probably as a result of the EU MSP Directive (Directive 2014/89/EU) and over-arching climate and energy policies. Under the EU MSP Directive, all marine spatial plans must be subject to a strategic environmental assessment to address environmental impacts at the earliest possible stage in decision-making.

In **France**, some strategic documents and plans at the national, regional, and local scales relating to MSP and PPE take the requirements of the MRE sector into account. The PPE's strategic environmental assessment underlines the need for coherence and compatibility between MRE projects and those from other sectors (Ministère de la Transition Écologique et Solidaire 2019a). Key interactions between sectors are taken into account in the various strategy levels, for example, at the national scale, the Climate-Energy Plan (Projet de Plan National Intégré Énergie-Climat de la France 2019), the Low-Carbon National Strategy (Ministère de la Transition Écologique et Solidaire 2020), the Climate Change Adaptation National Plan (Observatoire National sur les Effets du Réchauffement Climatique 2006) and at the regional/sea basin scale, the Action Plan for the Marine Environment and the Strategic Facade Planning Documents (Décret n ° 2017-724). At regional and local scales, consultation between marine sectors is structured by the main administrative authorities, the coordinating prefectures (maritime, regional, and departmental prefectures). Each marine region commonly organizes its Regional Conference on Marine and Coast where stakeholders in socio-economic sectors (fisheries, maritime transport, tourism, etc.), environmental sectors (marine protected areas, NGOs), public authorities, scientific and academic sectors, etc., work together on a common regional approach for MRE development. Permanent public structures play the role of coordinators and facilitate meetings between key actors. These structures are notably: the Interregional Directorate for the Sea; the Regional Direction for Environment, Planning, and Housing; the Regional Council; and the Departmental Direction for Territories and Sea.

In **Ireland**, representatives from the MRE sector are included in the National Advisory Board for MSP and meet quarterly with the responsible Minister on the progress of MSP. Feedback from the industry is used to direct the development of the policy.

In **Portugal**, a final Situation Plan (Direção-Geral de Recursos Naturais 2018) has been developed with information for MRE resource along the Portuguese coast. This information was provided by sectoral actors and was used along with data available for the designation of hotspots regarding the development of wave and wind energy were used. The information was developed in conjunction with and verified by developers, to produce a final number of specific areas that were incorporated into the final version of the Situation Plan.

In **Spain**, the MSP process is at too early a stage to determine how sectoral MRE interests will be included.

Sweden had the benefit of already having planning evidence and information available, as the country has a system whereby national sectoral agencies identify areas of national interest for their purposes. In addition, new analyses on areas suitable for offshore wind were made, involving industry players as well as national agencies. Industry players provided information on areas suitable for offshore wind, which was then examined in the planning process (when possible process-wise). There have been a number of meetings with trade organizations as well as individual companies.

In **Scotland**, it has been recognized that not all the objectives can necessarily be achieved directly through the marine planning system but each objective was considered highly important for planning and decision making. In terms of gauging what the MRE sector requires, many different avenues have been used. Scotland has a strong heritage of research and development in MRE generation technologies and associated infrastructure (including energy storage and demand management technology) and experience in testing these generation devices in Scottish Waters. The European Marine Energy Centre is based in the Orkney Islands

where there is an established MRE industry cluster with extensive experience in developing and testing devices and bringing them closer to commercialization. For this reason, Orkney was selected as the location for a Pilot Marine Spatial Plan Case Study (Marine Scotland 2016). This included stakeholder engagement and a variety of workshops, which gave Marine Scotland, Council planners, and the general marine planning forum a vast amount of knowledge regarding the requirements for MRE development and from a marine planning perspective (Aquatera Ltd. 2015). Furthermore, Marine Scotland has gathered extensive information from stakeholders through their strategic route map documents for offshore wind (Marine Scotland 2011; Scottish Government 2013).

In **Wales**, the WNMP was informed by a Stakeholder Reference Group, which included industry representatives (Welsh Government 2019a). The consultation on the draft WNMP (from December 2017 to March 2018) provided an opportunity for all stakeholders to submit comments to inform the development of the final plan. Some individual MRE developers provided comments, as well as industry bodies (such as Renewable UK and Marine Energy Wales). A Sustainability Appraisal, which included a strategic environmental assessment, was also undertaken by Welsh Government, as well as a plan-level Habitat Regulations Assessment (Welsh Government 2019b).

In **Australia**, specifically Victoria, the draft MSP framework was developed collaboratively through a co-design process. Marine stakeholders involved in this process included government and partner agencies, fishing and boating regulator bodies, the resources sector (including the ocean energy sector), environment groups, academics, and the Victorian Fisheries Authority.

In **Japan**, EIAs for projects exist and drive consents for MRE. The Japanese Ministry of Environment is conducting several zoning projects for offshore wind energy development and as part of this process they consult with key energy industry players as well as stakeholders, including local fishermen. The aim of this process is to inform the Primary Environmental Impact Consideration document (largely equivalent to EIA report). Previously, the Ministry of the Environment conducted a Study on the Potential for the Introduction of Renewable Energies in 2009-2010 and the Development of Basic Zoning Information Concerning Renewable Energies from 2011-2016. These aimed to estimate the abundance of renewable energies (Photovoltaic, wind, hydropower (both small and medium-scale), geothermal heat, solar heat, and underground heat), assess the potential to introduce the different forms of renewable energies in Japan, produce different scenarios for these, and develop basic zoning information (Ministry of the Environment 2017).

S11.5. SCIENTIFIC INFORMATION TO INFORM MSP

Guidance on MSP development emphasizes the role of evidence in the form of scientific data and information. It is clear that in many countries, introduction of marine planning systems has necessitated the collection and collation of scientific data.

In **France**, scientific information in the MSP process is mostly driven by the Oceanographic and Hydrographic Service of the National Navy. Oceanographic and Hydrographic Service of the National Navy prepares maps of marine uses and activities (including non-public information about French Navy activities); collects information from different research institutes and academies; and leads and/or participates in research projects to better understand the actual and future ecological status of the sea, environment, and socio-economic impacts of marine activities. Data used for MSP are then developed through research and

development or fundamental research projects such as SIMNORAT, APPEAL, SIMCelt and SIMAtlantic[1]. Data collected for the implementation of the EU Marine Strategy Framework Directive (Directive 2008/56/EC) to achieve Good Environmental Status of the EU's marine waters by 2020 are also incorporated in the MSP.

In **Ireland**, marine data used for the development of the NMPF is being managed and housed by the Marine Institute. The Marine Institute is Ireland's national marine data center and hosts Ireland's Marine Atlas which will be the principal repository for marine-related data to support both the development of the NMPF and evidence-based decision making under the NMPF by marine regulatory authorities (Marine Institute 2016). The Atlas has been developed as a publicly accessible reporting and investigative tool for Ireland's reporting on ocean conditions as required under the EU Marine Strategy Framework Directive (Directive 2008/56/EC), MSP Directive (Directive 2014/89/EU), Water Framework Directive (Directive 2000/60/EC), and other relevant EU Directives. The atlas includes marine data such as administrative boundaries, protected sites, oil and gas, ocean features, fisheries and aquaculture, marine monitoring, seabed habitats, tourism and leisure, transport, infrastructure, discharge point sources, International Maritime Organization protected areas and current/historical disposal sites.

In **Portugal**, a geoportal has been created with information for the Portuguese coastal area including activities, available resources, marine protected areas, and similar type information (Direção-Geral de Recursos Naturais, Segurança e Serviços Maritimos 2020). Information on the EU Marine Strategy Framework Directive (Directive 2008/56/EC) and Water Framework Directive (Directive 2000/60/EC), have been considered in the MSP process. The MSP strategic environmental assessment was developed using information based on several criteria: marine environmental status, blue growth development, risks and climate change, defense and surveillance issues, existing technological knowledge, scientific ability, and institutional cooperation. For several of these criteria, scientific information was used in order to improve the strategic environmental assessment and how this will be used in MSP implementation is explained in the non-technical summary of the strategic environmental assessment (República Portuguesa 2018).

Spain is currently collating information required for the planning process using a sectoral approach. Future sectoral developments and their spatial needs are also being considered (e.g. for aquaculture). After collating all this information, additional meetings and consultation processes will take place prior to the final ordination of marine space.

In **Sweden**, different scientific disciplines have been involved, mainly linked to knowledge generation and preparation of planning evidence (e.g. information on climate refugia). The strategic environmental assessment has been an integral part of the MSP process, with three versions of the strategic environmental assessment published to date, following public consultation submissions (Swedish Agency for Marine and Water Management 2018b; 2018c; 2018d). The three strategic environmental assessments were combined into a final document that was submitted to the Swedish Government in December 2019 (Swedish Agency for Marine and Water Management 2019b). In preparation for the consultation phase, the Swedish Agency for Marine and Water Management developed the Symphony planning support, which enabled analysis of interactions and cumulative environmental effects (Swedish Agency for Marine and Water Management 2018d).

[1] In order of the text, more information for each project can be found at the following: SIMNORAT research project: https://www.msp-platform.eu/projects/supporting-implementation-maritime-spatial-planning-north-atlantic-region; APPEAL research project: https://www.france-energies-marines.org/R-D/Projets-en-cours/APPEAL; SIMCelt research project: http://www.simcelt.eu/; SIMAtlantic research project: https://www.marei.ie/simatlantic/

In **Scotland** and indeed elsewhere, the primary reason for developing a marine planning system is to make all marine matters as coherent and integrated as possible, this also means the incorporation of strong robust scientific information into the marine planning framework system. This diverse range of evidence requirements necessitates drawing on data and research outputs from a wide range of sources from within the Scottish Government together with its agencies and elsewhere, nationally and internationally. Requirements for new evidence are assessed continually and priorities identified in accordance with existing strategies such as the Scottish Marine Science Strategy 2010-2015 (Scottish Government 2011) and the UK Marine Science Strategy 2010-2025 (Department for Environment, Food and Rural Affairs 2010) as well as sectoral strategies such as the Aquaculture Science and Research Strategy (Marine Scotland 2014a) and the UK's Offshore Renewable Energy Joint Industry Programme (ORJIP) Ocean Energy's Forward Look (Aquatera Ltd. 2017). Prioritization of new evidence is often part of a connected process involving other national and international bodies. For example, Marine Scotland is currently working with the academic marine science community in Scotland through the Marine Alliance for Science and Technology for Scotland to identify priorities for regional planning. Prioritized evidence requirements can be addressed in a number of ways and resourced through multiple funding sources, for example:

- Direct allocation of Marine Scotland resources to specific projects, either operated internally by Marine Scotland Science or commissioned to agencies (e.g. Nature Conservation Bodies) or contractors.
- By directing research funds to priority projects, such as through the Scottish Government Contract Research Fund, the new European Maritime and Fisheries Fund, or sectoral funding bodies (e.g. Scottish Aquaculture Research Forum).
- Partnership working with Scottish Universities and the Marine Alliance for Science and Technology Scotland (MASTS), such as providing joint funding for PhD studentships and research fellows.
- UK Research Council funding or EU funding sources (e.g. Horizon 2020 grants, INTERREG, European Training Networks etc.).

In **Wales** prior to the development of the draft WNMP, the Welsh Government carried out a strategic scoping exercise and commissioned the production of a Marine Evidence Report to provide a robust evidence base (Welsh Government 2015). Marine evidence work to support Welsh MSP is continuing under a project funded through the EU's European Marine and Fisheries Fund entitled Sustainable Management of Marine Natural Resources. Phase 1 of this project was completed in July 2019, with Phase 2 to further develop the evidence base to inform MSP now underway (Welsh Government 2019c).

In **Australia**, in the context of the draft Victorian MSP Framework, the Victorian Marine and Coastal Council is the State's highest advisory body for coastal and marine issues. It is established under the Marine and Coastal Act 2018 to provide independent advice on marine and coastal issues to the Minister for Energy, Environment, and Climate Change. The Council has a Science Panel to provide independent, strategic, and scientific advice to the Council on emerging marine and coastal issues and knowledge gaps. The Council has guided development of the draft policy and will continue to guide its finalization. Furthermore, the Victorian Government has conducted targeted consultation with key stakeholders, including the scientific community in preparing the draft policy, via an MSP summit and follow-on 'co-design' workshops. The draft policy was open for public comment from early July 2019 to mid-August 2019, providing further opportunity for input. More generally, previous MSP and ecosystem-based management processes in Australia, such as Australia's Oceans Policy (Commonwealth of Australia 1998), found science to lag behind policy, however, for now it is

considered that in Australia this balance has now shifted, such that the policy now lags the science (Smith et al. 2017).

In **India**, EIAs are now mandatory under the Environment (Protection) Act (1986) for 29 categories of developmental activities involving investments of USD $7,037,250 and above. The Environmental Appraisal Committees evaluate the impact of the project based on the data furnished by the project authorities and if necessary, site visits or on-the-spot assessment of various environmental aspects are also undertaken. Based on that examination, the Committees make recommendations for approval or rejection of the project, which are then processed by the responsible Ministry for approval or rejection.

In **Japan**, most of the information is collected from existing literature and reports. Both physical scientific and social information are required for the zoning process. Certain key information, such as bird migration routes and fishing grounds, are collected through direct observations. Modelling is sometimes used for predicting changes in the physical environment (water current, waves, sound, etc.). Usually, data from other industries are not utilized.

Scientific information is playing an important role in developing the MSP process in **South Africa**, where the information and data collected has largely been based on scientific knowledge from the various sectors that operate currently. Scientific information has been obtained from scientific reports as well as consultation with research officials of the departments involved in this process. Assessments such as the strategic environmental assessment and socio-economic impact assessments are being considered and will be fundamental in the process of developing Marine Area Plans.

In the **U.S.**, considerable work has been done to catalogue data available for MSP and to make these datasets accessible to the public through the Marine Cadastre (National Oceanic and Atmospheric Administration – Office for Coastal Management 2020). A few of the regional ocean partnerships also support open source data portals which provide datasets, maps, and lease area information for development and planning, such as for BOEM's Offshore Wind Lease Areas. Through these efforts data gaps are identified and addressed by federal and State research programs such as BOEM's environmental studies program, U.S. Department of Energy's Water Power Technologies Office, and the National Labs. The National Labs, such as the National Renewable Energy Laboratory and the Pacific Northwest National Laboratory, provide key datasets on ocean characterization, cable routes, competing use analyses, transmission infrastructure, significant energy loads, energy demand growth, and many other types of scientific information relevant to MSP.

S11.6. DEALING WITH CUMULATIVE IMPACTS

It is necessary to understand how current and planned human activities impact the marine environment in order to minimize risks from increasing and future activities. As levels of activity increase in the marine environment, pressures on those ecosystems also increase and can lead to numerous adverse effects on different species and habitats so many countries use cumulative effects assessments or cumulative impact assessments to help assess such effects and incorporate the findings into their planning and management frameworks, such as MSP.

In the **EU**, cumulative impacts are not explicitly mentioned in the EU MSP Directive (Directive 2014/89/EU), though the range of marine activities and sectors occurring therein and the fact that these may impact the marine environment is acknowledged. Additionally, Member States are advised to have 'due regard to' such impacts when developing their marine spatial plans. In the scientific literature, there is little consensus

on the 'best' methodology to use to conduct cumulative impact assessments in practice and little consistency in how the subject has been approached.

In **France**, cumulative impacts include: i) all the impacts addressed by one activity or one marine project; ii) impacts of a future marine project in association with other existing projects; and iii) the sum of impacts on the sea basin of multiple projects of the same nature, such as MRE and offshore wind farm projects. French MSP considers cumulative impacts on the environment, social, and economic activities. Data about cumulative impacts on the environment are mainly addressed through the Marine Strategy Framework Directive descriptors for Good Environmental Status (Directive 2008/56/EC). The main descriptors of relevance to this topic relate to habitats (benthic and pelagic from Descriptors 1 and 6), marine mammals, birds, turtles, cephalopods (descriptor 1), fish species (Descriptors 1 and 3), ecosystems and food webs (Descriptor 4) (Directive 2008/56/EC).

Spain has also considered cumulative impacts through its implementation of the EU Marine Strategy Framework Directive (Directive 2008/56/EC).

In **Ireland, Portugal, Spain, and Sweden** the marine spatial plans prepared have or will be subject to a strategic environmental assessment under EU law, which necessitates the consideration of cumulative impacts; however, no details as to how this would be conducted were given.

In **Sweden**, the Swedish Agency for Marine and Water Management has also used the Symphony process to assess cumulative impacts for each of the three marine spatial plans being developed (Swedish Agency for Marine and Water Management 2018b; 2018c; 2018d; 2018e). The results from the cumulative assessment (in addition to other assessments) has influenced the planning solutions put forward in the marine spatial plans.

In **Scotland**, the SNMP states that a "cumulative impact on a resource and ecosystem service may occur because of a series of developments or activities of the same type or from the combined effects of a mix of different types of activities" (Marine Scotland 2015). The accumulation of impacts from multiple developments or activities across space and/or time may reach unacceptable levels, yet this is often poorly understood or assessed. Informed by the strategic environmental assessment, MSP should develop policies that take a risk-based approach to avoiding unacceptable cumulative impacts. Emerging techniques, such as interaction matrices, sensitivity assessments, and cumulative pressure mapping provide a useful step forward. In terms of the formal planning system, cumulative impacts assessments are, as a legal requirement, carried out in respect of any developments subject to an EIA as set out in UK and Scottish legislation[2].

In **Wales**, the draft WNMP included a section on cumulative impacts, with relevant policies. The implementation guidance for the WNMP, which will be published alongside the final plan, will provide further information on how to address cumulative impacts. The sustainability appraisal and plan-level Habitats Regulations Assessment also considered cumulative and in-combination effects of the plan itself.

In **Australia**, the Victorian draft Marine and Coastal Policy (State of Victoria Department of Environment, Land, Water and Planning 2020) aims to take into account and seek to minimize current and future cumulative and synergistic effects on ecosystems and habitats in the marine and coastal environment. From a science perspective, significant challenges identified from lessons learned in the Australian community include better understanding of complex socio-ecological systems, dealing explicitly with uncertainty, scaling

[2] Specifically, The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects from 0-12nm); The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017 (relevant to projects from 12-200nm); and The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

transdisciplinary approaches across all the scales required in ecosystem-based management, and assessing non-linear cumulative impacts (Smith et al. 2017).

In **Japan**, cumulative impacts are recognized as a problem requiring a solution but there is no clear description as to how this can be addressed in the legislation covering EIAs.

In **India**, cumulative impacts have not been addressed as yet.

In **South Africa**, the National Working Group on MSP is building a sector compatibility matrix and an approach to zoning plan (both forming part of the approach to marine area plans) which will assist in addressing and/or mitigating cumulative impacts.

In the **U.S.**, all federal actions are subject to the National Environmental Policy Act (NEPA) (1970) and subsequent analysis which does take cumulative effects into account, however this process is not inherently identified or prioritized within any national MSP system.

S11.7. DEALING WITH POTENTIAL CONFLICTS

An important consideration for MSP is potential conflict between different marine sectors and/or users, especially as demand for marine space increases and, on occasion, because certain sectors will be interested in the same spatial area. As a relatively new sector, MRE in particular has the potential to overlap with more traditional uses such as fishing and navigation. When multiple-use situations like this arise, it can be challenging to address the different interests and needs of multiple users in mutually satisfying ways. Compatibility between uses and activities depends not only on oceanographic conditions (such as sea turbulence, the nature of the seabed, or the size of the water column), but also on the size and characteristics of each project. Compatibility between activities within the same marine space can still be achieved if, for example, the activities can be carried out at different times of the year. This could be the case, for example, for dredging activities in overlying seawater columns where non-metallic resources could be exploited. One of the rationales for MSP is that it can prevent or minimize conflict, because it clarifies who or what activity can operate within particular spatial areas. Such conflicts tend to be resolved on a case-by-case basis with negotiations between both interested parties (Freeman et al. 2016) and sometimes an independent arbiter. Very few MSP systems contain specific provisions or mechanisms related to conflict resolution, despite the recognition of the potential for conflict in light of increasing use of marine space and associated competition between uses.

In **France**, potential conflicts are managed and reduced by way of early consultation with marine users and activities in the MSP process and mapping of existing uses of space. After discussions on how to map maritime uses, actors are invited to give their opinions on the State's diagnosis about major maritime stakes, ecological, economic, and social objectives of the future MSP. The first strategic phase of MSP implementation relied heavily on mapping specific uses of marine space, thereby reducing conflicts and strengthening cross-sectoral cooperation. A second important phase of consultation occurs before the final vote of the Strategic Façade Planning Documents. The fisheries sector provided information about fishing areas through the GIS VALPENA, which is a geographic information system tool comprising information on fishing areas, fleets, etc. (Université de Nantes 2019). Based on this dynamic and scalable tool, conflicts were avoided. In Brittany, for example, a proposed floating offshore wind farm area overlapped with traditional fishing activities in the same area and consequently, the location for the floating offshore wind farm was changed to one in the Bay of Biscay, between Groix and Belle-Ile islands.

In **Ireland** and **Spain**, the situation has not yet arisen but it most likely to be addressed on a case by case basis rather than by MSP.

In **Portugal**, the Situation Plan (Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2018) favors the multi-use of the marine space and compatibility between uses, especially because it enables optimization of the economic potential of a space. Some conflicts were raised during consultation relating to the MSP process. Specifically, this related to private activities (e.g. fish aquaculture) which was not allowed in the 1.5 nautical mile strip along the Portuguese coastline. This strip is supposed to be reserved for common uses, defined as leisure activities (recreational tourism) including bathing, research, fisheries, and navigation/transportation. the Situation Plan prohibits the installation of floating platforms (unless used for recreation/tourism) and aquaculture activity in a 1.5 nautical mile strip along the coast. In the Situation Plan, a table providing an overview of the potential or theoretical compatibilities, incompatibilities, and synergies between various private activities is presented to assist this, reproduced in Figure S11.4. Figure S11.4 is theoretical and the fact that two activities are indicated as compatible does not mean that this happens in practice or out of necessity. Conflict of uses are managed by the Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos (Directorate-General for Natural Resources, Safety and Maritime Services) when decisions are being made on consent applications for a given marine activity.

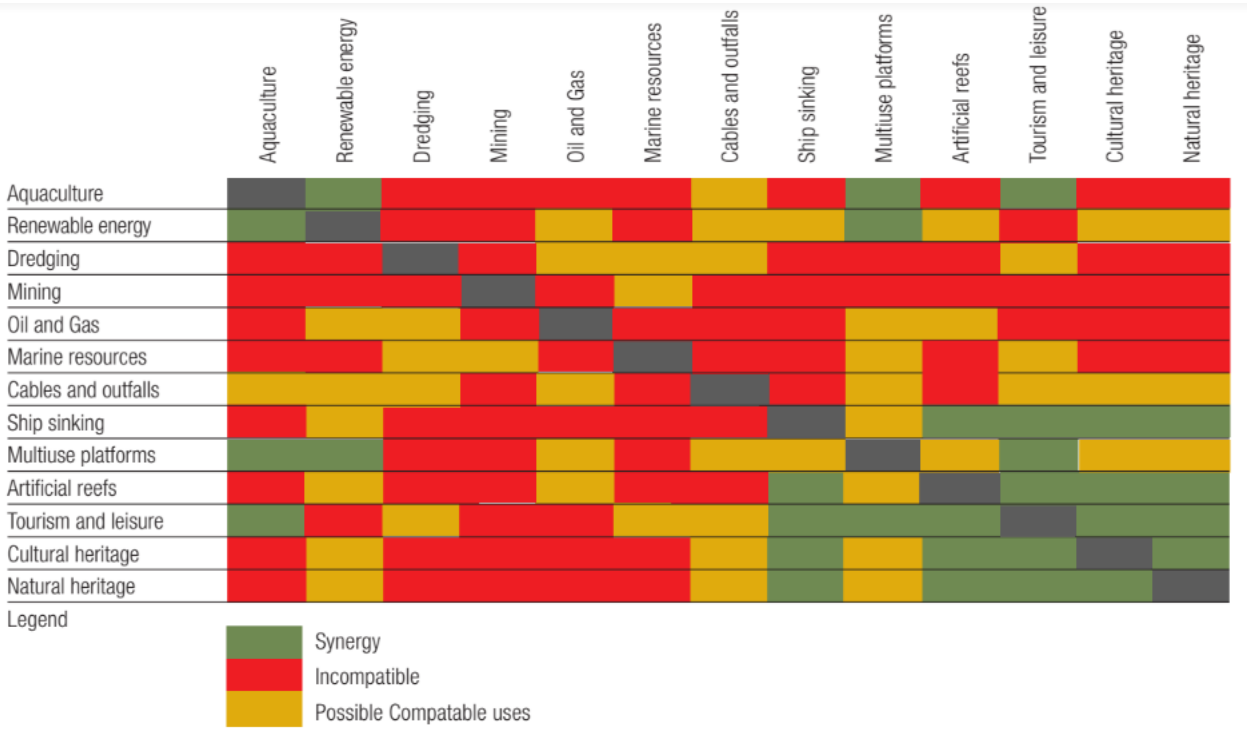

Figure S11.4. Compatible, incompatible, and synergistic marine sectors, as identified in the Portuguese Situation Plan. (Adapted and translated from Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2018)

In **Sweden**, activities related to defense and security have priority under Swedish legislation as part of their marine spatial plans (European MSP Platform 2020b; Swedish Agency for Marine and Water Management 2018a). This has meant that some areas suitable for other activities have been restricted, such as offshore wind, which have not been included in the proposed marine spatial plan. For the remaining areas, particular consideration was given to all defense activities whereby it may be necessary to restrict, for example, the height

of turbines or the installation of fixed structures. This is because defense and security is one of the ten goals of Swedish national MSP. The proposed plan also outlines where certain activities may need to be adapted in order to coexist with defense activities. In certain locations, nature conservation has been given priority over other activities and in other locations the proposed plan promotes coexistence such as in some Natura 2000 (network of nature protection) areas. However, the plan is only guiding, and any activity that may significantly affect a Natura 2000 site will require a Natura 2000 permit, as explicitly stated in the proposed marine spatial plan.

In **Scotland,** the National Marine Planning system identifies potential conflicts and addresses and reduces these conflicts before they arise. For example, the establishment of the 11 Scottish Marine Regions will, in turn, result in corresponding Regional Marine Plans which should help identify and mitigate conflicts early in the planning process. They will be developed by Marine Planning Partnerships. The system currently in place is highly communicative where different sectors have the opportunity to engage in the planning process, assuring their voices are heard, and incorporating their thoughts in the plan. This reduces conflict and significantly reduces the potential for future conflict. At a local government level, for example, Orkney Islands Council takes a holistic approach to MSP where different marine users are consulted at each stage in the planning process, are encouraged to take part in the planning approach, and receive regular updates. At present, the establishment of the Orkney Marine Planning Partnership is underway. In terms of addressing different marine user interests an extract from the council's Marine Planning Management Stakeholder Update (Orkney Islands Council 2018) states that "the Council aims to take a lead role in the future Orkney Islands Marine Planning Partnership, supported by an Advisory Group of stakeholders representing local economic, environmental, community, and recreational interests. The Council's Development and Marine Planning team will continue to work with stakeholders through 2018 to 2019 to develop the governance arrangements for the Marine Planning Partnership".

In **Wales**, the WNMP is to be accompanied by implementation guidance, which will include conflict resolution procedures (Welsh Government 2019a). As much as possible, the plan has encouraged measures to reduce conflict, such as co-location of activities and sectors.

In **Australia**, Part C of Victoria's draft MSP Framework provides high level guidance for considering conflicts between sectors when completing an MSP process.

In **Japan**, stakeholder consultation is fundamental to minimizing conflict and critical to successful zoning of marine activities. Conservation areas are avoided as prescribed by related legislation, such as the Natural Park Act (1957). Shipping routes and emergency access routes are also avoided. When zoning for recreational activities, conservation of the environment is the key issue. Coexistence with fishing activity is regarded as the most important issue and accordingly, there are frequent meetings with these representatives when carrying out planning.

In **South Africa**, addressing conflict between marine users is one of the main drivers for MSP and the development of marine plans is being conducted specifically for the purpose of addressing known and anticipated future conflicts between sectors.

This situation has not yet been considered in **India** or the **U.S**.

S11.8. AREAS AVAILABLE FOR MRE DEVELOPMENT

MSP is often interpreted to be synonymous with ocean zoning. Ocean zoning designates a specific space to marine uses and can be used to limit an area to a single activity or to accommodate multiple uses. While zoning approaches can be used to implement MSP, it is just one tool for delivering the objectives of the MSP

process. Some countries have zoned areas of their marine space for specific sectors, activities, and uses. These can be limited to a single activity or may be designed to accommodate multiple uses.

In **France**, MRE projects are strongly excluded from military zones (for training, navigation, or security operations). Marine Protected Areas (MPAs) are also heavily protected, though in some cases, where it can be demonstrated through the EIA process that a MRE project would have limited impacts on the MPA or on protected species, or that measures to avoid, reduce, or compensate for these impacts, would suffice, then the project can in theory be allowed. For each sea basin, under the supervision of the Ministère de la Transition Écologique et Solidaire (Ministry for the Ecological and Inclusive Transition), macro-zones that could potentially host MRE projects have been identified by Cerema (the Center for studies and expertise on risks, the environment, mobility and development), one of the French public authorities responsible for MSP. These macro-zones mostly take into account physical environmental conditions, geomorphology, risks to maritime security, etc. Based on these macro-zones, local stakeholders are then invited to carry out consultation with socio-economic and ecological stakeholders in order to develop a low-cost zone for an MRE project. This consultation covers one specific project and concludes with authorization to carry out the project in an agreed location. Following this, the MRE project cannot be sited anywhere else, unless the developers start a new consultation as prescribed by law.

In **Ireland**, no areas have been identified as prohibited for MRE activities. However, there are some areas where MRE development could be challenging, for example, within or adjacent to Natura 2000 sites. New proposed legislation for MSP and marine development, in the form of the Marine Planning and Development Management Bill (Department of Housing, Planning and Local Government 2019e), should facilitate the designation of zones for various purposes in the future and it is expected this will cover MRE in due course.

In **Portugal**, there are areas allocated in the marine spatial plan for MRE, but a Title for the Private Use of the Maritime Space is still required. Other uses or activities may be allowed in line with the contents of Figure S11.4, namely those activities deemed compatible can be co-located. If MRE projects are to be located outside designated areas, an allocation plan needs to be developed and approved by the authorities; if approved, this plan will be directly incorporated in the Situation Plan (Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2018). Specific regulations are also in place for certain sectoral activities which take the form of exclusion areas and safety zones. For example, there is a prohibition on floating offshore wind in the 1.5 nautical mile strip along the coastline.

In **Spain**, the Strategic Environmental Plan for Offshore Wind Development identified some areas that were not suitable for this type of project (Ministry of the Presidency 2009). These areas were mainly those associated with military training, marine protected areas, fishing zones. No such prohibitions are known for wave or tidal energy, nor are there preferred deployment areas. Studies were conducted to identify the most suitable areas for wave and tidal energy, but this consisted of their resource potential and not development potential per se and they were not designated.

In **Sweden**, no areas are fully prohibited for MRE development, though it may be more difficult in certain areas, such as those designated for conservation purposes where there is additional licensing requirement. Areas used for defense and security purposes are also given priority in certain locations.

Generally, in **Scotland,** there are limited areas where the development of MRE projects is prohibited. However, there are areas where it would be so difficult to successfully obtain the necessary planning permission and consents (or consents that are ‘viable’ commercially) that effectively make development impossible. For example, in MPAs, a Public Authority will not grant authorization of an activity unless it is satisfied there is no significant risk of the activity hindering the achievement of the objectives of the site. MRE

projects are prohibited from areas designated as firing ranges used by the Ministry of Defence. Preferred zones and locations for MRE are under development as part of the Sectoral Plans put together by Marine Scotland (Marine Scotland 2014b, Scottish Government 2020). For example, Marine Scotland has undertaken a planning exercise in order to inform the spatial development of the latest offshore wind leasing auction by the Crown Estate Scotland. The development plan process has identified spatial "Areas of Search" – the initial areas for the sustainable development of offshore wind. This process has been undertaken but will be subject to a "Sustainability Appraisal" which considers the impacts on communities, other users of the sea, the economy, and the environment (this will encompass a strategic environmental assessment and a habitats regulations appraisal to identify the potential effects on European nature conservation) (Scottish Government 2018). There are also pilot spatial plans such as the Pilot Pentland Firth and Orkney Waters (PFOW) Marine Spatial Plan (Marine Scotland 2016) which puts in place a planning framework in advance of statutory regional MSP. It is thought this pilot will be used to inform the marine spatial plans for the Orkney and North Coast Scottish Marine Regions as it sets out sectors within the PFOW area which can be used for wave, tidal and offshore wind developments. It will also be used as material consideration by Marine Scotland when they determine marine licensing and section 36 permit applications (for large scale MRE projects) within the PFOW area. In respect of MRE development, it is likely that "preferred areas" and their associated operation will become clearer as more Scottish Marine Regions develop their Regional Marine Plans.

In **Wales**, constraints identified include those related to the Ministry of Defence, shipping lanes and safety zones around existing infrastructure. The application and implications of these tend to be managed on a case by case basis. The WNMP identifies a series of Strategic Resource Areas for MRE, identified mainly on the basis of the available energy resource (Welsh Government 2019a). The consultation on the draft WNMP raised a number of issues in relation to the Strategic Resource Areas, including lack of clarity amongst stakeholders about intended purpose and the consequences for other sea users and activities. Welsh Government removed the Strategic Resource Areas from the published WNMP but have retained an ambition to move toward spatial specificity within future iterations of the plan.

Australia has no preferred locations for ocean energy. It has one of the most mature examples of zoning in marine waters, developed by the Park Authority through the Great Barrier Reef Marine Park Act (1975). MSP and zoning form central approaches to the management of the park, which seeks to maintain biological diversity and to manage impacts of increasing tourist activity, effects of fishing, and impacts of pollution and shipping. Management plans exist for intensively used or vulnerable islands and reefs and the zoning system operates through permits for certain activities. Given the large spatial area concerned, the park's spatial management is based on eight zones from a "general use zone" (with least restriction) in which shipping and most commercial fishing are allowed, to the most restrictive "preservation zone," in which no use is permitted. The Great Barrier Reef Marine Park Act (1975) excludes extractive industries, but it is unclear as to whether this includes ocean energy. Several existing uses of the marine space are managed via lease (e.g., petroleum and greenhouse gas titles, aquaculture leases). Like other parts of the world, leases tend to be issued for one specific activity, hence, they automatically exclude new users of these sites or co-location, unless the leaseholders wish to exploit ocean energy in their domain (co-benefit) and were consented to do so under their lease conditions. In the state of Victoria, MPAs currently consist of no-take MPAs and multiple-use MPAs. The no-take MPAs are highly protected areas with no extractive uses allowed and are managed primarily for ecosystem protection, conservation of natural features, and recreation.

In **India**, protected areas around islands and coastal areas with mangroves, national parks, sanctuaries are not allowed as sites for MRE devices. Naval bases are also prohibited for marine renewable energy development. No preferred areas or zones exist for MRE at this time.

In **Japan**, there are no areas where MRE development is prohibited, however, it is challenging to develop MRE and other ocean energy projects in protected areas such as natural parks, tidal flats, seaweed beds, coral reefs, and fish spawning grounds. In the past, MRE projects could not be developed in ports and harbor areas, however, the associated legislation was modified in 2016 to allow for future energy developments in these areas. There are designated demonstration sites for research and development activities relating to MRE, as shown in Figure S11.5. Local governments propose the demonstration sites and the national government then selects their approved areas. Before an area can be selected there must be an agreement between fishermen on the temporal use of that selected sea area for demonstration.

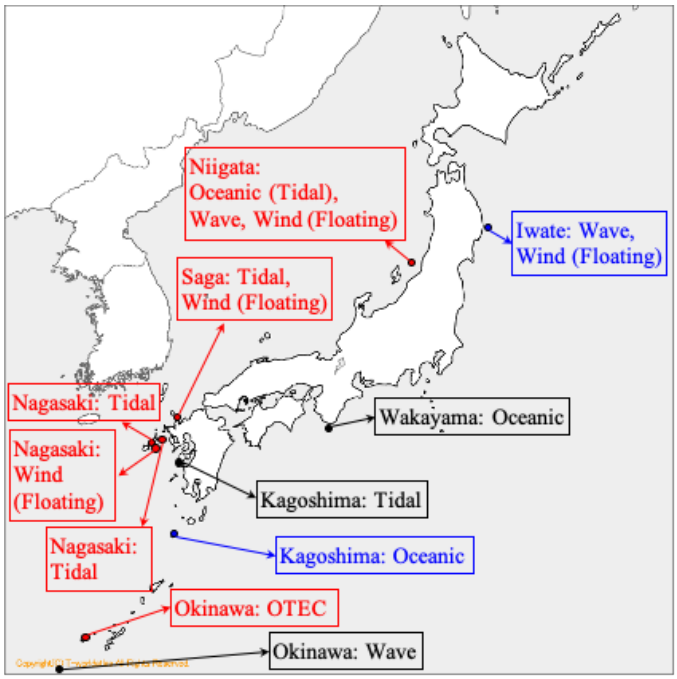

Figure S11.5. Selected demonstration sites for wind, wave, and tidal energy in Japan. Sites shown in red were selected in 2014; the Iwate site, in blue, in 2015; and the Kagoshima site, also in blue, in 2017 as demonstration sites. Sites shown in black were proposed but not selected. (Image courtesy of Daisuke Kiazawa)

In **South Africa**, the South African National Working Group on MSP is in the process of finalizing the Current Status Report, which will provide information on where sectoral activities are located in the ocean space. Given the current status of MSP in the country, there are no known prohibited areas for MRE or preferred locations for deployment.

In the **U.S.**, areas that are protected by statute, such as National Marine Sanctuaries which are protected by the National Marine Sanctuaries Act (2000), prohibit activities that would alter the seabed or subsoil or potentially effect environmental conditions within the sanctuary. Generally, areas designated as shipping lanes, and MPAs are also excluded from project development activities. In addition, areas identified by the Department of Defense as critical to their activities require additional layers of consultation and review before they can be leased for development. Neither BOEM nor the Federal Energy Regulatory Commission can

approve a project in a National Park or National Monument located on the Outer Continental Shelf. Finally, BOEM, through its leasing authority cannot approve a project in a National Marine Sanctuary or National Wildlife Refuge.

S11.9. TOOLS THAT SUPPORT MSP IMPLEMENTATION

Many tools can be used to assist in the implementation of MSP at a variety of scales. These include different spatial management tools such as designated sites and zones (see Section 11.6), as well as more technological based tools like a dedicated marine atlas or cadastre based on geographic information systems (GISs). In the **EU**, marine GIS tools are an increasingly popular method of making marine related information accessible to the public, and a convenient way of illustrating complex data from a wide variety of sources.

In **France**, implementation of MSP mostly uses geographic information relating to marine activities, land-sea interactions, and spatial demands and trends for future maritime activities. Some methodological challenges have arisen, however, particularly in relation to the most appropriate scale in which to operate, how to assess and convey stakeholder perceptions, how to improve coordination on sectorial policies, and how to select available data and to deal with gaps.

In **Ireland**, the Marine Institute had previously led the development of Ireland's marine atlas as part of its implementation of the EU Marine Strategy Framework Directive (Directive 2008/56/EC). This is now being expanded so as to assist with the implementation of MSP and will include the development of appropriate tools and data management systems.

In **Portugal**, a dedicated geoportal, Geoportal of the Situation Plan, was developed as part of marine plan development (Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2020). Specific regulations are also in place for certain sectoral activities which take the form of exclusion and safety areas.

In **Spain**, all marine information is being collated into GIS layers. This includes environmental information, maritime uses but also existing zones for aquaculture, anchoring, military use, sand extraction zones and MPAs.

Sweden also uses GIS for MSP purposes as well as the Symphony process to assess cumulative impacts of the plans (Swedish Agency for Marine and Water Management 2020).

For **England**, a Marine Information System was created initially which contained information on applicable plans and policies, as well as supporting data and information, for use by sectoral interests in their consenting applications. This system was replaced in November 2019 with the Explore Marine Plans digital service, which has improved functionality for the user including spatially integrated marine plan policies, relevant data layers and marine licensing information (Marine Management Organisation 2020e).

In **Scotland**, a number of tools are used to implement MSP. These are shown in Table S11.2.

Table S11.2. Tools that support marine spatial planning implementation in Scotland.

Tool	Contents
Marine Scotland MAPS NMPI https://marinescotland.atkinsgeospatial.com/nmpi/	National Marine Plan interactive
Scotland's Marine Atlas: Information for The National Marine Plan https://www2.gov.scot/Publications/2011/03/16182005/0	An assessment of the condition of Scotland's seas, based on scientific evidence from data and analysis and supported by expert judgement
Marine Scotland's Regional Locational Guidance http://marine.gov.scot/information/regional-locational-guidance	Information relating to the search areas for future offshore wind, wave and tidal energy plan options
Regional Marine Plans https://www2.gov.scot/Topics/marine/seamanagement/regional/Boundaries	Only Clyde and Shetland Marine Regions have taken this forward to date
Sectoral Planning https://www2.gov.scot/Topics/marine/marineenergy/Planning	Specifically for offshore wind, wave and tidal energy
Environmental Impact Assessment Regulations https://www2.gov.scot/Topics/marine/Licensing/marine/guidance/EIARegulations	Different regulations are used depending on the location of the marine development and installed capacity of the development. These determine which marine developments are required to undertake an Environmental Impact Assessment Report prior to obtaining planning permission and the necessary permits

In **Wales**, the Welsh Government has developed a Marine Planning Portal to provide access to the evidence base in GIS based format (Welsh Government 2020b). An online video has also been produced to provide guidance on its content and use (Welsh Government 2017b).

In **Northern Ireland**, the Department of Agriculture, Environment, and Rural Affairs has developed a publicly accessible Marine Mapviewer (Department of Agriculture, Environment and Rural Affairs 2018b), to show the existing uses and activities that occur in the Northern Ireland Marine Area, which might also assist with the wider planning process.

There is a proliferation of spatial mapping tools available in **Australia** to support MSP, as shown in Table S11.3. In addition to these GIS-based resources, many other studies have been completed in Australia to assess marine values associated with industries and trends (Victorian Environmental Assessment Council 2019). Such assessments identify current environmental, economic, social, and cultural values of the marine environment and their spatial distribution. Potential threats are also usually identified as part of this process. This means that this information can then be reflected in any future plans to prevent and/or minimise damage from consenting new activities. Victoria is also progressing a Marine Knowledge Framework to facilitate a more integrated approach to research efforts and undertake a more frequent and extensive monitoring of marine habitats by embracing new technology (State of Victoria Department of Environment, Land, Water and Planning 2018). The Marine Knowledge Framework will encompass all marine environments across the state.

Table S11.3. Tools for implementing marine spatial planning in Australia.

Mapping Tool	Contents
http://www.nationalmap.gov.au	A spatial database of Australian data, including marine spatial layers in support of marine spatial planning at Commonwealth level.
http://www.nationalmap.gov.au/renewables	Spatial information specific to Australia's energy resources and infrastructure
http://aodn.org.au	Australia's Ocean Data Network, providing Australian marine and climate science data, including spatial layers.
http://www.nespmarine.edu.au/maps	Maps from Australian National Environmental Science Program Marine Biodiversity hub, including maps of pressures on the marine environment and species maps amongst others.
https://marine.ga.gov.au/	Geoscience Australia AusSeabed Marine Data Discovery, providing bathymetry and backscatter data access.
https://www.operations.amsa.gov.au/Spatial/	Includes a spatial database for use in geographic information system associated with Australia's shipping and maritime safety.
http://maps.ga.gov.au/interactive-maps/#/theme/amsis	The Australian Marine Spatial Information System is a web-based interactive mapping and decision support system that improves access to integrated government and non-government information in Australian marine Jurisdictions.
https://data.marinemammals.gov.au/	National Marine mammal database.
http://seamapaustralia.org	Includes, for example, national marine habitat maps.
https://research.csiro.au/atlantis/home/about-atlantis/	The Atlantis model, used internationally as a decision support tool for marine spatial planning.

India has not produced any tools to aid ocean energy development.

In **Japan**, GIS has been used to assist with the zoning process by incorporating many layers of information and overlapping them in order to assess and identify suitable areas for MRE development.

South Africa has developed a National Ocean and Coastal Information Management System with accompanying Decision Support Tools, which will be instrumental during the implementation phase of the MSP process and will aid in displaying MSP data and maps (Department of Environment, Forestry and Fisheries and Department of Science and Innovation 2020).

There are a number of tools that have been developed to aid in the MSP process at the national, regional, and state level in the **U.S.** At a national level, websites like the Marine Cadastre provide user-friendly access to a wealth of spatially explicit data throughout the U.S. waters (National Oceanic and Atmospheric Administration – Office for Coastal Management 2020). The Marine Cadastre was developed through a partnership between the National Oceanic and Atmospheric Administration Office for Coastal Management and BOEM. This provides data, tools, and technical support for ocean and Great Lakes planning and was designed specifically to support renewable energy siting on the U.S. Outer Continental Shelf but is also being used for other ocean-related efforts. Regional programs are able to use and incorporate data from the Marine

Cadastre and apply it to their region of interest. For example, the Northeast Regional Ocean Council, Mid-Atlantic Regional Council on the Ocean, and West Coast Governors Alliance on Ocean Health maintain data portals that serves as online toolkits and resource centers to visualize and analyze ocean resources and human use information for their respective regions (Northeast Regional Ocean Council 2020, Mid-Atlantic Ocean Data Portal 2020, West Coast Ocean Partnership 2020).

S11.10. CONSENTING PROCESS AND MSP

MSP is both strategic and anticipatory. To achieve the objectives of MSP there must be clear links to the project level. All MRE projects will require some form of consent to occupy sea space and generate electricity from natural marine resources. It is therefore imperative that MSP aid decision-making for consenting processes. Every country has a different method of consenting development in their marine space, but the method should align with higher, national-level policy objectives reflected in MSP.

In the **EU**, under the MSP Directive (Directive 2014/89/EU) there is a set of minimum requirements specifying what marine spatial plans must contain, but there is nothing similar for marine development. Consent of development remains a member state competence, although requirements of other EU legislation must be adhered to in state practices. In the case of MRE development, for example, depending on the size, location, and nature of the proposed development, most proposed projects will require an EIA (Directive 2014/52/EU). EU conservation legislation (Birds and Habitats Directives) must also be complied with and such compliance regularly involves the completion of an Appropriate Assessment (Council Directive 92/43/EEC, Directive 2009/147/EC).

In **France**, consenting decisions to deploy MRE devices are granted by the coordinating prefectures, which are also responsible for the MSP consultation process at the level of their associated sea basin. The consenting decisions of the coordinating prefectures are based on coherence between the MRE project and the macro-zones identified by the French public authority, Cerema; existing marine uses as mapped and defined in the Strategic Facade Planning Documents (Décret n ° 2017-724); the results of an EIA clarifying environmental impacts of the project and measures to avoid, reduce, or compensate these impacts; and stakeholders providing input on social, economic, and cultural challenges to the MRE project.

In **Ireland**, the existing consenting system for MRE development is limited to licenses for site investigation, research, or testing facilities. Proposed legislation that would modernize the consenting system has been published but has not yet been enacted into law. The intention is that it will be a statutory requirement for all public bodies with a marine remit to take the objectives of the NMSP into account when conducting their activities.

In **Portugal**, the DGRM is the competent authority for MSP and responsible for allocation of marine spatial use and granting a Title for the Private Use of the Maritime Space. The latter is required for licensing any activity that requires a specific spatial area at sea. The Title for the Private Use of the Maritime Space can only be issued if it is in accordance with the Situation Plan (Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2018).

In **Spain**, there is no strategic plan in place for wave and tidal energy, so licensing is done on a case by case basis. Currently, a number of consents are needed to deploy an MRE device. These cover environmental aspects, use of the sea space, energy production, and must be approved by the Ministry for Ecological Transition. In relation to offshore wind, consenting decisions for certain projects, such as the BiMEP test site in the Basque Country, took the findings of the Strategic Environmental Plan for Offshore Wind Development into account (Ministry of the Presidency 2009).

In **Sweden**, the Environment Court, who is responsible for licensing decisions, should have regard to and take guidance from, the marine spatial plan, but is not obligated to as its contents are not binding.

In the **UK** and all its various devolved administrations, there is a presumption that all planning decisions must align with UK Government policy, specifically the Marine Policy Statement (Her Majesty's Government 2011), as well as applicable legislation such as the Marine and Coastal Access Act (2009). This means that when someone is applying for a license or other approval they will need to show how they have considered the adopted marine plan or the Marine Policy Statement, explaining how the marine plan supports the activity, and how the project will contribute to achieving the objectives of the applicable marine plan.

In **Scotland**, a complete review of all the MRE licensing decisions has not yet been conducted; however, the planning and consenting authorities will consider the objectives and planning recommendations of the SNMP (Marine Scotland 2015), and the associated Sectoral and Regional Marine Plans (Marine Scotland 2014b), when they come to their decisions. Failure to do so could leave decisions subject to appeal and, ultimately, judicial review – both of which are expensive and time-consuming processes.

In **Wales**, all licensing and consenting decisions will need to demonstrate compliance with the policies in the WNMP (Welsh Government 2019a). Similarly, license and consent applicants will need to demonstrate how their proposed activity is compliant with policies in the plan. The Welsh Government will be publishing implementation guidance for the WNMP to provide guidance to applicants and decision-makers to help facilitate plan compliance.

In **Northern Ireland**, the Marine Plan (when adopted) will be used by public authorities in making decisions that affect or might affect the marine area, including authorization or enforcement decisions and decisions that relate to the exercise of any function capable of affecting the marine area.

In **Australia**, any development has to comply with federal Environmental Protection and Biodiversity Conservation Act (1999) requirements as all marine areas are automatically considered to fall under that Act's jurisdiction regardless of whether they sit in state or federal waters. The Marine and Coastal Policy (State of Victoria Department of Environment, Land, Water and Planning 2020) for Victoria states that in Victorian jurisdictional waters, use and development of marine and coastal Crown land and seabed requires consent from the Minister responsible for the Marine and Coastal Act (2018). Ocean energy developments will also be subject to consent condition, which are site specific. In making a decision about the issuing of consent, the policies and MSP Framework in the Marine and Coastal Policy and the direction set in a range of other instruments developed under the Marine and Coastal Act (2018) would be considered.

In **Japan**, the priority is for development to be acceptable to other stakeholders, with no involvement of other regulatory authorities in individual project consents.

This question was not applicable to the current situations in **India**, **South Africa,** or the **U.S.**, where consent is granted on a case by case basis as there is no over-arching MSP process in place.

S11.11. FACTORS LIMITING IMPLEMENTATION OF MSP FOR MRE

Across countries, there are a multitude of factors that lead to challenges implementing MSP. It is important to understand key challenges to provide lessons for other countries developing MSP and to tackle challenges that may arise across MSP implementation. The statements in this section were provided by respondents. . Only certain countries that have MSP already in place or are working towards implementation were in a position to discuss limiting factors and challenges. These were primarily the countries in the EU.

In **France**, the main factors limiting implementation of MSP are attributed to the availability of marine data particularly in relation to the actual status of the marine environment and how this could be impacted by

climate change. Data are also needed to improve knowledge on environmental impacts of MRE technologies, impacts on the economy, and on social and political interactions. In France, and globally, better information is needed on marine socio-ecological systems and marine governance.

In **Ireland**, work on the NMPF has progressed well since 2017 (Department of Housing, Planning and Local Government 2018, 2019a, 2019b, 2019c, 2019d, 2019e) and it is anticipated that a system will be in place by 2021 but legislation is needed to give it full effect and also to modernize the consenting system. As a result, no commercial scale MRE can currently be consented in Irish waters.

In **Portugal**, marine data availability was also raised as a challenge. Since the development of the geoportal on marine activities and resources, it has been easier to compile information. However, additional effort is needed to assemble a comprehensive collection of data, including all entities responsible for data collection (e.g., data from navy cruises, data derived from national implementation of the EU's Water Framework Directive [Directive 2000/60/EC] and Marine Strategy Framework Directive [Directive 2008/56/EC], as well as from university research projects).

In **Spain**, the key limiting factor is limited human resources.

In **Sweden**, there is a lack of data for some specific aspects of the marine environment. Additionally, as a new planning system is currently being developed, this could pose challenges as there are likely to be different requirements.

In **Scotland**, limited financial resources is the key limiting factor to furthering MSP implementation. Most MSP activity is driven by public authorities/bodies which are, by and large, facing budgetary constraints. As a result, it is no surprise that the Sectoral Plans related to Offshore Wind (Scottish Government 2019) are currently being developed further as it is a more mature technology in comparison to wave and tidal energy. Investments in Offshore Wind Sectoral Plans, therefore, are more likely (in the short to medium term) to result in a better financial return in comparison to wave and tidal energy. The willingness of stakeholders is another limiting factor in the implementation of the MSP. For example, Regional Marine Plans are to be developed by Marine Planning Partnerships which are to be made up of marine stakeholders reflecting interests in their region. However, they will need sufficient buy in and willingness to participate from regional stakeholders in order to be effective. Furthermore, the ability to establish these partnerships has been in existence since the designation of the Scottish Marine Regions in 2015 and, to date, only two have been established – Clyde and Shetland Isles.

In **Wales**, the WNMP is extremely supportive of MRE, which provides a solid policy foundation to achieve MSP for MRE (Welsh Government 2019a). The key challenges are practical implementation of the plan and ensuring the supportive policies translate through to practical measures in order to streamline consenting and help deliver a more proportionate, risk-based approach to consenting for MRE. The extensive spatial coverage of the Natura 2000 network in Welsh waters (over 70 percent) and the precautionary nature of practical implementation of the Habitats Directive in relation to Article 6(3) assessment will continue to challenge the implementation of MSP process, in relation to sustainable development in Wales (Council Directive 92/43/EEC).

The lack of a government in **Northern Ireland** likely causes a delay in progress as there are limits on the powers that can be exercised by the civil service.

In **Australia**, some key lessons have been learned from its attempts to implement integrated ocean management (Smith et al. 2017). While Australia's ocean policy was an early adopter of MSP, it was unable to deliver on expectations, and includes factors such as the policy being too ambitious, a lack of jurisdictional ownership, poor clarity of objectives and nature of integration, insufficient scientific understanding, and

inadequate tools to enable implementation (Vince et al. 2015). Progress in terms of science and tools have potentially shifted these limiting factors. While jurisdictional complexity remains as the key limitation for implementation of MSP.

In **India**, the lack of priority given to ocean energy was identified as the main challenge for MSP planning processes.

In **Japan**, limited data availability was identified as a challenge, as well as lower technology readiness levels leading to a lack of planning priority, limited financial resources, difficulties associated with acceptance by fishermen, and barriers for grid connection.

In the **U.S.**, there is no formal, national MSP process, legal framework, or founding legislation at present. However, ongoing work is devoted to providing the best available ocean data for national, state, and local decision-making, through the Marine Cadastre (National Oceanic and Atmospheric Administration – Office for Coastal Management 2020) site and through Regional Ocean Partnerships and their data portals. Many state-led initiatives exist but it can be difficult to determine if or how these interact with other initiatives in other states or wider federal level.

S11.12. PUBLIC INVOLVEMENT IN MSP

It is widely accepted that transparency, accountability, and openness are key principles for successful planning and decision-making processes. Therefore, to achieve the desired planning objectives, it is essential that the parties whose interests may be affected, or have a role to play, should take part in the design and operation of the planning process. Public and stakeholder involvement can help responsible authorities to carry out their responsibilities, set appropriate priorities, and balance environmental, economic, and social objectives. Having contributed to the process, the public and stakeholders are more likely to have a sense of ownership for it and thus be more committed to its successful implementation. Aside from these factors, public participation is regularly a legal requirement in policy- and decision-making processes.

The **EU** MSP Directive (Directive 2014/89/EU) requires member states to create means of public participation by informing all interested parties and consulting with relevant stakeholders, authorities, and the public at an early stage in the development of their marine spatial plans.

In **France**, the French Code for Environment prescribes a pre-project public consultation on a Strategic Facade Planning Document (Décret n ° 2017-724) but the EU MSP Directive (Directive 2014/89/EU) provisions have higher demands for public consultation, which necessitate earlier public involvement in development. Due to these two regulatory obligations, and in relation to the MSP process for the North Atlantic sea basin, the public has been involved in two rounds of MSP consultations. The first round (2016-2017) asked for opinions on activities, uses, and stakeholder interests linked to the sea basin, and the second round (2019) asked for feedback from public and environmental non-governmental organizations on the plans for actions and monitoring programs of the future Strategic Facade Planning Document (Décret n°2017-724) (Ministère de la Transition Écologique et Solidaire 2018, 2019b).

In **Ireland**, to date in the national MSP process, there has been a strong focus on public engagement, including a number of formal public consultation processes and environmental assessments. These are being supplemented with a number of public regional workshops, seminars, and interactive web-based workshops. (Department of Housing, Planning and Local Government 2019f).

In **Portugal**, there were two consultation periods and a number of public sessions held during the preliminary and draft versions of the Situation Plan (Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos 2018).

In **Spain**, due to the early stage of the implementation of MSP, no public involvement has happened as yet.

In **Sweden**, there have been four rounds of public consultation so far, in addition to dialogue at the outset of the MSP process. The general public has only participated to a limited degree in the consultation, although they have been invited. Most of the coastal municipalities have participated, and in that way, local perspectives have been represented.

In **England,** public involvement has been at the center of regional plan development by the Marine Management Organisation. A Statement of Public Participation for each marine plan area is legally required. This describe how and when the Marine Management Organisation will engage with stakeholders and what it will do with the outcomes of any views and opinions received so as to increase transparency. In each plan area, the Marine Management Organisation identifies key stakeholders and seeks to provide them with opportunities to input into plan development. It then considers all stakeholder responses and, where possible, integrates these into the plan, ensuring they do not contravene law or other government policies. Stakeholder responses are then compiled and, where possible, integrated into the plan, provided they align with other law and policy. A summary of responses, explaining how they have informed the plan, is then published (Marine Management Organisation 2019a, 2019b, 2019c, 2019d). A similar approach has been followed in Scotland, Wales, and Northern Ireland.

In **Scotland**, Marine Scotland and the Scottish Government have a commitment to "[involve] all relevant stakeholders and members of the public in the development of policies that will impact upon them" (Marine Scotland 2015). In the formulation of the SNMP, involvement of stakeholders was central to development. Full details on the procedures and policies used, including those to ensure stakeholder engagement and cross-boundary working are set out in the Statement of Public Participation (Scottish Government 2014b).

In **Wales**, the consultation carried out from December 2017 to March 2018 provided an opportunity for public comment. The Welsh Government also produces regular newsletters to provide updates on progress. The stakeholder reference group included regulators from a number of non-governmental environmental organizations and provided opportunity for input. In terms of the general public, it has probably been a relatively exclusive and inaccessible process involving lots of jargon and alienating, technical language.

In **Northern Ireland**, stakeholder engagement is informed by the published Statement of Public Participation. This included 12 public information events in coastal locations around Northern Ireland, engagement with primary and secondary school students, six sectoral workshops, as well as continued engagement with Northern Ireland and UK departments with responsibilities in the Northern Ireland marine areas to ensure their respective responsibilities are accurately reflected (Department of the Environment 2012). Northern Ireland officials also meet regularly with officials responsible for MSP in the Republic of Ireland, as they share a marine border.

In **Australia**, the draft MSP Framework in Victoria was developed collaboratively through a co-design process. Marine stakeholders were involved in this process, and included government and partner agencies, fishing and boating peak bodies, the resources sector (including MRE sector), environment groups, academics, and the Victorian Fisheries Authority. A draft policy was made available for public comment from early July 2019 to mid-August 2019, providing further opportunity for input.

In **Japan**, while there is no formal MSP process the public is generally involved at the stage of consensus building and EIA development when licensing a project.

In **South Africa**, stakeholder engagement sessions were held in the initial stages of the MSP process and further stakeholder engagement is planned for other phases. For example, once the Current Status Report has

been finalized, there will be stakeholder engagement to communicate the progress in the process and to fill any gaps in the available information.

In the **U.S.**, Executive Order 13840 (2018) supports federal agency engagement with stakeholders, including Regional Ocean Partnerships, under existing laws and regulations to address ocean-related matters that may require interagency or intergovernmental solutions. Regional Ocean Partnerships provide a public forum to discuss ocean planning issues in the U.S. The partnerships generally host discussions with members, stakeholders, and the public; provide a shared regional vision; identify regional goals and objectives; analyze data, uses, services, concurrent uses, potential threats, and impacts; and provide work plans and collaborative products for public comment. Engagement with stakeholders has also been incorporated at multiple points in BOEM's MRE authorization process for leasing on the U.S. Outer Continental Shelf. Through mechanisms like BOEM's Intergovernmental Renewable Energy Task Forces, BOEM carries out its mandate to consult with relevant federal agencies, the Governor of any affected state, the executive of any affected local government, and any affected Tribal Nation within the U.S. The public is welcome to attend and observe these meetings and to ask questions and provide comment during designated public question-and-answer sessions. With respect to planning for individual projects, stakeholder consultation starts at the very beginning of the project development, and public comment periods are incorporated at multiple stages in the regulatory process. Any federal action, such as issuance of a BOEM lease, approval of a Construction and Operations Plan, or issuance of a Federal Energy Regulatory Commission license, is subject to the National Environmental Policy Act (NEPA) (1970) and other applicable laws. One of the first steps in the NEPA process, scoping, solicits input from the public to inform the environmental analysis.

S11.13. KEY FINDINGS AND CONCLUSIONS

MSP is an approach that can be used locally, regionally, and nationally as a way of improving marine governance and achieving sustainable development. It is clear from the preceding sections that almost all the countries surveyed are advancing some form of MSP. This progress varies by country and can be attributed to a wide range of factors. In the EU, for example, countries are legally mandated to have maritime spatial plans in place by March 2021 (Directive 2014/89/EU), yet some member states are still at the early stages of plan development, whereas others are already reviewing and adapting their plans. This variability of progress can be attributed to a variety of reasons such as different policy drivers, government priorities, and more operational-level challenges relating to human and financial resources. Scale can also be an issue because a number of EU member states have large maritime jurisdictional areas.

While good practice guidance about how to implement and evaluate MSP exists, it is possibly too early to successfully evaluate the impacts of MSP on any one sector, because of the status of MRE in the studied countries. A number of country respondents stated that marine renewables, and MRE specifically, are still very much a developing sector in their country. The difference in the development of MSP for MRE is probably a reflection of how much importance is placed on the growth of the sector in different administrations and countries. Few countries have allocated zones for MRE development, despite acknowledgement in national and regional energy policies of the potentially transformative role MRE could have in their energy futures. This could be due to the difficulties involved in spatially zoning areas and the need to avoid conflict with existing users. Often it is more appropriate and easier to have supporting policies and financial assistances.

Once MSP is further on in the implementation process, it would be interesting to look at precisely how, in what way, and at what point MRE and its related infrastructural requirements are incorporated into the marine

spatial plans. Currently, this seems to occur primarily via stakeholder engagement mechanisms and dedicated meetings with sectoral representatives or their organizations. Development of MSP systems appear to have driven data and information collection and collation in almost every country. This can be motivated by policy requirements, but interestingly can come about as the result of a realization that such data will support other law and policy objectives, putting the principle of 'collect data once and use many times' into practice. In the EU, this is particularly the case where implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC) necessitates data collection and environmental monitoring. Research projects, both in terms of funded MSP research projects as well as trial MRE demonstrations and deployments, also act as a scientific data source that can be utilized in MSP design and implementation. Generation of data and often the requirement to make the data publicly accessible have also driven the development of various web portals and repositories, some of which have been further advanced and refined to become tools to assist in implementing MSP. Such tools are wide-ranging in that, in some cases, their aim is to increase public knowledge about the marine environment and activities that occur there. Elsewhere, these dedicated web tools are designed for use by regulatory authorities when they are making decisions on applications relating to developments in the marine space. In the UK, for example, there has already been advances in their online data system to make it more iterative, user-centered, and streamlined.

In terms of moving MSP forward, there is a need to ensure that planners and policy-makers are aware of the needs of MRE. This includes up-to-date information from experiences with deployments and their interactions with the marine environment, but also their requirements in terms of supporting infrastructure such as access to ports, transport routes, energy storage options, and grid connections. As the MRE industry looks to both commercialization and the development of large arrays as well as smaller deployments that serve remote or off-grid communities, these needs may vary, and MSP will need to address differences such as the appropriate scale for planning processes. Such alignment would assure that key land-based measures to support the MRE sector could be identified at a national, regional, or local scales, and targeted to align with, and support, areas or zones of sectoral potential. If these types of needs are better understood and recognized by planners, they may help to frame MSP going forward. Developing knowledge about environmental interactions could also assist in minimizing the spatial areas where MRE is prohibited or where there are more consenting and licensing obligations. As more and more countries recognize the potentials presented by MRE in meeting renewable energy targets and reducing greenhouse gas emissions, demands on maritime space are likely to increase. To minimize impacts and maximize sustainable development opportunities, it is critical to have a forward-planning process, such as MSP, supported by an efficient and effected development consenting/licensing system and enforcement regime.

11.14. ACKNOWLEDGEMENT

The author would like to thank all the international OES-Environmental Participant Country representatives for taking the time to complete the questionnaire and garnering additional input from their colleagues. The support of the Sustainable Energy Authority of Ireland is also acknowledged. This contribution is based upon works supported by the Navigate project (Grant-Aid Agreement No. 842 PBA/IPG/17/01), carried out with the support of the Marine Institute and funded under the Marine Research Programme by the Irish Government, and by MaREI: the SFI Research Centre for Energy, Climate and Marine (12/RC/2302).

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