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Chapter 30

Marine Spatial Planning

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30.1 INTRODUCTION

Planning of marine areas, from coastal to open-ocean regions, is being developed worldwide to foster sustainable ocean management and governance. This planning process is most often termed "marine spatial planning" (MSP), although there are many other designations to define it, such as maritime spatial planning (used in Europe, and within the context of planning maritime uses), ocean planning, marine planning, ocean zoning, marine spatial management, sea use management, etc. MSP deals with the spatial and temporal distribution of human uses in the ocean, striving to minimize conflicts and foster compatibilities among such uses, and between uses and the environment (Ehler & Douvere, 2009). MSP is widely acknowledged as going beyond the sector-by-sector approach to ocean management, replacing it by an integrated, coordinated process within a framework that seeks to balance development and conservation goals and objectives. MSP has also long been acknowledged as a practical approach toward implementing long-term ecosystem-based management (Ehler & Douvere, 2007; Douvere, 2008), the latter being an established paradigm for ocean management that may provide the best means to ensure long-term sustainability and resilience of marine ecosystems and the services they provide (McLeod & Leslie, 2009; Katsanevakis et al., 2011).

Ensuring sustainable planning and management of the ocean space is of paramount importance, as no area of the world's oceans is unaffected by human activities. On the contrary, a significant percentage is strongly affected by anthropogenic pressures (Halpern et al., 2008, 2015). MSP is globally widespread and a topic of increasing importance in the scientific and policy realms. However, despite its acceptance and use, development and implementation of MSP still faces a myriad of conceptual and practical challenges, from political to institutional, social, economic, scientific, and environmental sources. The present chapter provides an overview on the current status of MSP, starting by addressing what MSP is and why is it needed. It then reviews the global distribution of MSP around the world and, finally, analyses some of the most prominent and widespread challenges, present and future, that are linked to the development of MSP.

30.2 MARINE SPATIAL PLANNING "101"

30.2.1 What Is MSP?

What is MSP? What does it entail? Why is it needed and what are the benefits of having it in place? Many baseline references on MSP do address these questions (e.g., Agardy, 2010; Agardy, Christie, & Nixon, 2012; Büning, Heine, & Janßen, 2017; Ehler & Douvere, 2007, 2009; Foley et al., 2010; Gilliland & Laffoley, 2008; Hassan, Kuokkanen, & Soininen, 2015; Portman, 2016). As it is most commonly defined, MSP is 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 & Douvere, 2009). In a nutshell, MSP is a practical way to organize the use of the ocean space, and the interactions among human uses (e.g., fisheries, aquaculture, shipping, tourism, renewable energy production, marine mining) and between uses and the marine environment. MSP is a continuous and interactive process that should be regularly funded and adapted, planning cycle after planning cycle, and one that requires the engagement of "multiple actors and stakeholders at various governmental and societal levels" (Olsen et al., 2014) due to its "public" nature.

The concept of MSP emerged almost 40 years ago in the context of marine conservation planning, dating back to the 1980s (Day, 2002). Some suggest MSP has its roots in marine conservation and the original zoning plan of the Great Barrier

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Reef Marine Park (GBRMP) in Australia is a "pioneering example of MSP" (Jay et al., 2013). However, as MSP spread worldwide, it seems that its conservation foundation has in some instances become diluted (Merrie & Olsson, 2014). There has been a perceptible shift toward an increasing need to manage conflicting maritime uses, both existing and future, especially in crowded ocean spaces and highly industrial maritime areas (Young et al., 2007).

As the number of countries with MSP initiatives increased around the world, and MSP processes started being implemented, monitored, and revised, so did the amount of MSP-related information and expertise. Scientific literature on MSP started in the 1960s–1970s, and from 2006 onward there was a significant expansion in the number of scientific articles, books, book chapters, reports, and academic theses on the topic (Fig. 30.1). According to Merrie and Olsson (2014), much of this increase in academic interest in MSP seems to have derived from the first international workshop on MSP that

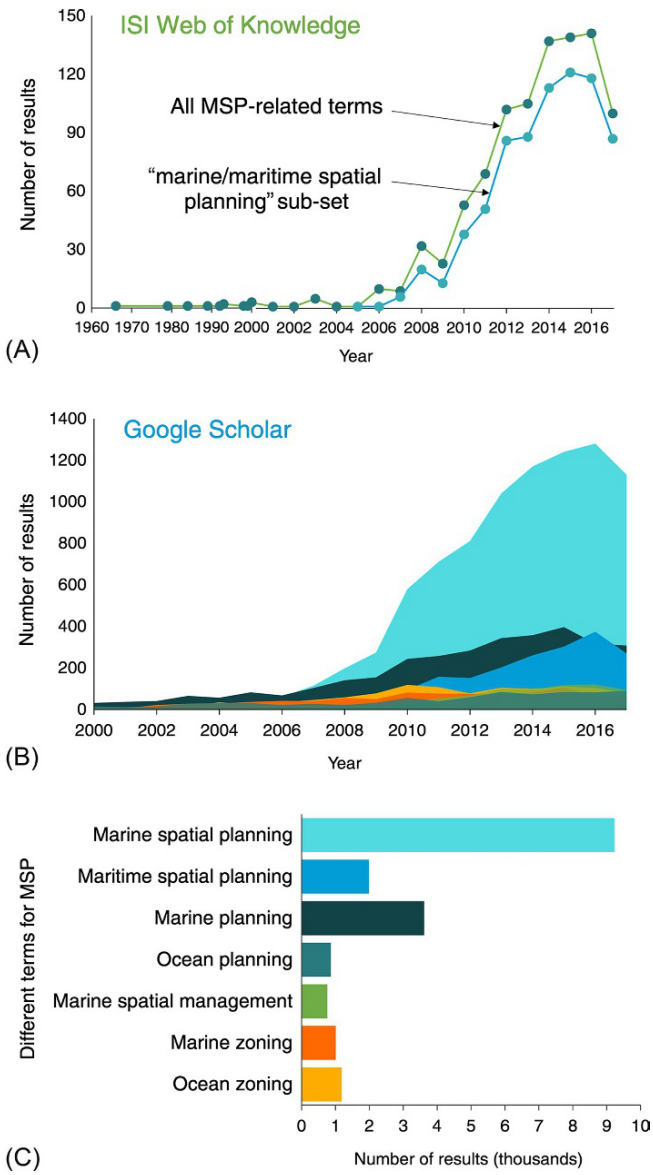

FIG. 30.1 Trends in marine spatial planning (MSP) related literature up to 2017. (A) Evolution of the number of scientific publications addressing MSP per year, between 1960 and 2017, as identified in the ISI Web of Knowledge (data collected searching all databases and using the terms "marine spatial planning," "maritime spatial planning," "ocean planning," "marine planning," "marine zoning," "ocean zoning," or "marine spatial management"). The subset of results found only for "marine spatial planning" or "maritime spatial planning" is highlighted (representing c.80% of all results). For visual purposes only, the length of the horizontal scale differs for the intervals 1960–2000 and 2000–2017. (B) Evolution of the number of articles found in Google Scholar for each MSP-related term per year, between 2000 and 2017 (color codes as in C). (C) Total number of articles found in Google Scholar for different MSP-related terms. Data search was performed in November 2017, thus including all results available by then.

was organized by UNESCO's Intergovernmental Oceanographic Commission (IOC) in 2006. Currently, there are over 900 scientific papers published in international peer-reviewed journals on MSP (Fig. 30.1A) and almost 10,000 articles in Google Scholar when searching for "marine spatial planning" alone (Figs. 30.1B and C). A growing number of MSP-specific training programs are also further stimulating MSP expertise and proficiency, for example, short courses such as the Blue Solutions' *Blue Planning in Practice* and the Duke University's *Marine Planning Advancement Training*, or full graduate programs such as the *Erasmus Mundus Master Course on Maritime Spatial Planning* (Università Iuav di Venezia, University of Seville, and University of the Azores), and the *Marine Spatial Planning and Management Master of Marine Studies* (Memorial University of Newfoundland) (MEAM, 2017).

One of the best known and applied documents on MSP is the IOC-UNESCO guide entitled *Marine spatial planning: a step-by-step approach toward ecosystem-based management* (Ehler & Douvere, 2009). Although MSP is a complex process, full of intricacies, the IOC-UNESCO guide explains it in a very thorough, clear, and objective way. Therefore, the following sections largely build on that source.

30.2.2 What Does MSP Entail?

As a planning process, MSP involves a number of key phases, steps, and tasks that should be fulfilled to ensure its effective development (Fig. 30.2). In the ideal case, MSP begins with a "preplanning" phase (Phase 1) that includes not only the definition of planning principles, planning goals, and SMART objectives (i.e., specific, measurable, achievable, relevant, and time bound) for a particular marine management area, but also the identification of MSP spatial and temporal boundaries, and very importantly, the need for MSP. Indeed, having a clear understanding of the problems either existing or anticipated in the management area (e.g., conflicting uses, loss of biodiversity or services, inadequate management), and clearly

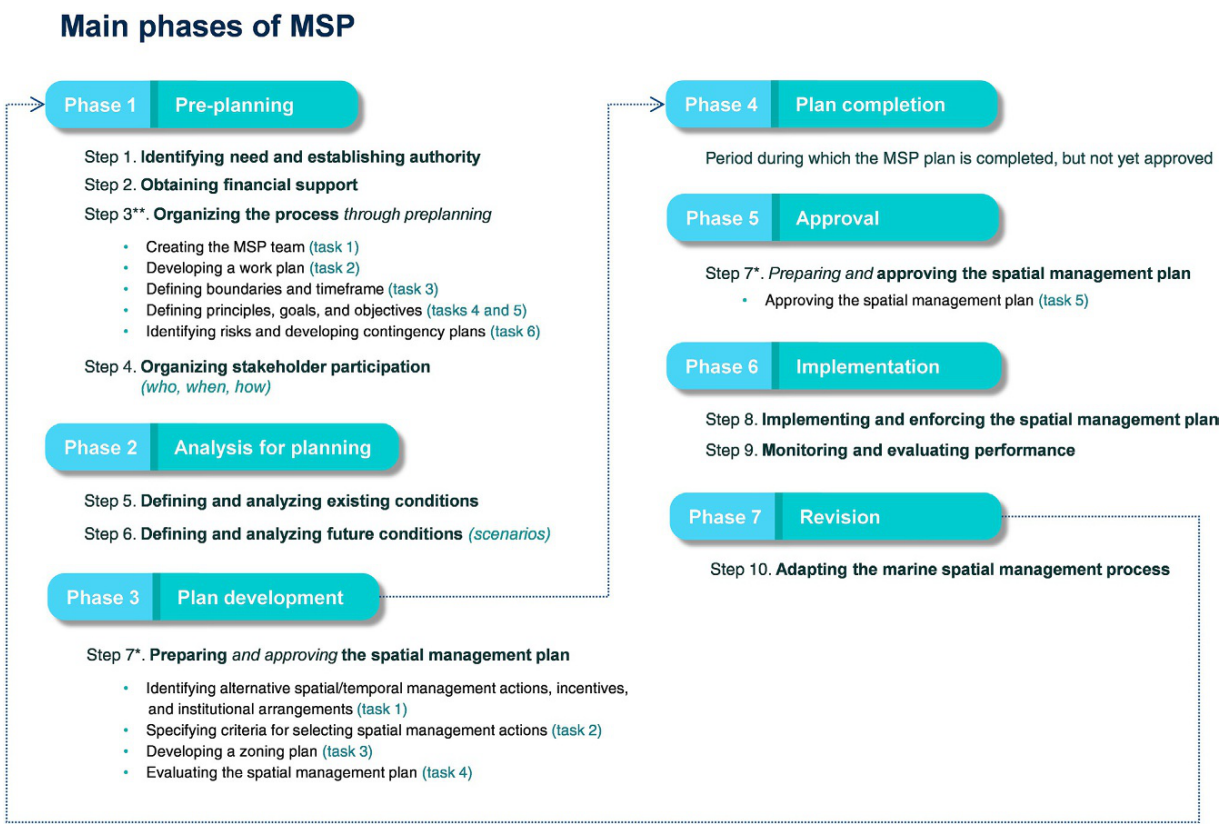

FIG. 30.2 Main phases of marine spatial planning (MSP). Phases are defined according to IOC-UNESCO (2017a), and corresponding key steps and tasks are defined as in the UNESCO's guide on MSP (Ehler & Douvere, 2009). Different tasks from step 7 correspond to different phases of MSP development: tasks 1–4 are included in Phase 3, while task 5 corresponds to Phase 5. Phase 4 is not a "step" in MSP development, therefore not having any equivalence in Ehler and Douvere (2009). It is instead a stage between steps, which sometimes takes place during a substantial period of time. Terminology of step 3 might seem redundant with Phase 1. To avoid misinterpretations, tasks involved in step 3 are identified showing that they do not encompass the entire range of action included in Phase 1. After the completion of Phase 7, a new round of planning takes place.

identifying them are aspects of paramount importance to keep the planning efforts focused and to ensure the effectiveness of the MSP process (Büning et al., 2017). This first phase should also include the designation of an appropriate MSP authority responsible for leading the process, the identification of continuing financing mechanisms, the analysis of potential risks, and very importantly, the organization of stakeholder engagement in the process (Ehler & Douvere, 2009). An MSP team should also be assembled and a work plan developed on how to proceed.

Following this initial stage, "analysis for planning" should take place (Phase 2). This phase pertains to the definition and analysis of both present and future conditions (e.g., ecological, oceanographic, socioeconomic, political), which starts with the collection and mapping of data on existing biophysical conditions and human activities, and the subsequent identification of corresponding conflicts and compatibilities. Based on the information collected, alternative scenarios should be developed on both the spatial and temporal needs of existing human activities, and on requirements for new demands of ocean space. After analyzing and evaluating such scenarios a desired future spatial vision should be selected.

When such selection occurs, the development of a spatial management plan, often designated as a "marine spatial plan," begins (Phase 3, "management plan development"). Here, spatially explicit management actions are identified to lead to the desired spatial vision for the use of the ocean, and an ocean zoning scheme is developed to support the implementation of these actions (Agardy, 2010). Zones are usually defined using a combination of maps and regulations (Büning et al., 2017) and a number of analytical and decision support tools are available to support zoning, for example, geographic information systems, SeaSketch, MARXAN (Agardy, 2015). In this phase of MSP, performance criteria, or indicators, should be defined to evaluate the management actions. Concomitantly, incentives are specified to foster the implementation of such actions, institutional arrangements (authorities and responsibilities) are identified, and the overall marine spatial plan is evaluated (e.g., through a strategic environmental assessment).

From this point onwards, and until approval of the marine spatial plan, MSP is in the "management plan completion" phase (Phase 4). According to the specificities and intricacies of each management context, this phase may correspond to a shorter or a longer period.

Once the marine spatial plan is approved through a formal adoption process (Phase 5, "approval of the management plan") it should be implemented and monitored (Phase 6, "implementation of the management plan"). The latter is a critically important stage to the success of any MSP process, where not only the management actions of the plan are put in place, but also the responsible entities should ensure compliance with plan's requirements together with the enforcement of the plan. A performance monitoring and evaluation program should also be developed at this stage, and corresponding data are gathered, evaluated, analyzed, and reported (Ehler & Douvere, 2009).

Finally, the first round of MSP development is "concluded" with the "revision, amendment, and adaptation of the management plan" (Phase 7). In this last stage, results from monitoring and evaluation are used to adapt the elements of the planning process in light of lessons learned, that is, through a process of adaptive management (Douvere & Ehler, 2011; Frazão Santos, Domingos, Ferreira, Orbach, & Andrade, 2014). This will ultimately result in proposals for adapting management goals, objectives, outcomes, and strategies for the next round of planning, as well as in the identification of research needs.

30.2.3 Benefits of Having MSP in Place

Although the concept of MSP emerged in the context of marine conservation, MSP is not the same as conservation planning. Instead of primarily focusing on establishing marine protected areas (MPAs), MSP is a multiobjective, multiuse planning process that seeks to integrate and balance economic, social, and environmental objectives for all uses of the ocean space (Ehler, 2012). Still, MSP may contribute to overcome some of the shortcomings of conservation planning (Agardy, di Sciara, & Christie, 2011; Agardy et al., 2012) and networks of MPAs are often an output of the planning process (Ehler, 2012).

Managing conflicting maritime uses (use-use conflicts) together with conflicts between these uses and marine ecosystems goods and services (use-environment conflicts) is exactly why MSP is most needed and a useful tool. MSP is in effect a future-oriented process that can offer the best means to address conflicts and foster compatibilities, many times beforehand (i.e., prior to having any activities in place). Indeed, one of the biggest "myths" of MSP is that if a marine area does not have any problems today (e.g., because the intensity of human uses is low) MSP is not needed (Ehler, 2012). On the contrary, as stated by Ehler "the best time to begin planning is before problems arise" (Ehler, 2012). In such context, instead of "reacting" to events, decision makers have the chance to plan and select management actions that are expected to lead to a desired future spatial vision for the marine area.

According to Ehler and Douvere (2009), when properly developed MSP can produce a variety of environmental, social, and economic benefits. By reducing use-use and use-environment conflicts, MSP promotes an efficient use of marine

resources and space, as well as the reduction of cumulative human impacts, thereby contributing to preserving marine ecosystem services. In addition, MSP contributes to the allocation of space for marine conservation outcomes, such as MPAs. At the social level, MSP can improve opportunities for public and stakeholder engagement in ocean use management. Concomitantly, it allows for the identification of cultural heritage sites, for example, and their subsequent protection. At the economic level, one of the major benefits of MSP is increasing the certainty for private sector investments as well as the transparency in permitting and licensing procedures. MSP also identifies compatible human uses within a marine management area, and reduces conflicts between incompatible uses (see more examples of MSP benefits in Ehler & Douvere, 2009).

30.3 GLOBAL STATUS OF MARINE SPATIAL PLANNING

Because of its potential and relevance for the implementation of operational ocean management and governance, MSP has gained considerable importance over the last decade, and many nations worldwide have begun developing their own spatial planning processes. As stated many times before, MSP "is an idea whose time has come" and, thus, one that ultimately should not be resisted (e.g., Ehler, 2012; Ehler & Douvere, 2009). In fact, it has been argued that the global dimension of MSP "reflects the international scientific and policy discourse calling for the adoption of MSP in the interests of environmental integrity and sustainable use of the world's seas and oceans" (Jay et al., 2013).

MSP is currently under development in over 66 countries around the world (IOC-UNESCO, 2017a), encompassing six continents (Europe, Africa, Asia, Australia (Oceania), North America, and South America) and four ocean basins (Atlantic, Pacific, Indian, and Arctic). Fig. 30.3 and Table 30.1 present the global status of MSP development in 2017, while Fig. 30.4 summarizes the total number of countries per geographical region and phase of MSP.

While most countries (c.70%) are still in the early phase of their MSP initiatives, others have already approved, implemented, or even revised marine spatial plans (Fig. 30.4). In effect, MSP is already in place (i.e., approved by the government) in 22 countries (Table 30.1) that together represent almost 27% of the world's exclusive economic zones (EEZs) (EEZs percentages are calculated based on information from Claus et al. (2017) excluding overseas territories, except when they are expressly mentioned in Table 30.1). These include Belgium, Germany, the Netherlands, Norway, China, and Belize, where MSP covers the majority of the maritime space by focusing on their EEZ and/or territorial sea (TS), but also countries where MSP is in place just for a particular area under national jurisdiction, such as a province, a municipality, or a state, for example, United States, Canada, and Croatia (see Table 30.1). The additional 44 countries where MSP is currently under development (and that make up for an additional c.26% of the world's EEZs) are expected to have their MSP processes approved in the coming years. Countries with marine spatial plans already completed and pending approval will probably have MSP in place in the near future, including Member States of the European Union (EU) that must have marine spatial plans approved by 2021 to comply with the European Directive on MSP (European Commission, 2014). This means that around 2030, a key date for the conservation and sustainable use of the oceans (see United Nations' Sustainable Development Goal 14), MSP will be in place in over half of the world's EEZs, that is, the ocean space under national sovereignty.

From a regional perspective, Europe and the Americas are the regions with the greatest number of countries and territories working on MSP—namely 37% and 28% of all countries and territories, respectively (Fig. 30.4). This prevalence of Europe and the Americas is also valid for every phase of MSP development as these two regions encompass approximately three-quarters of countries/territories in each phase. On the contrary, in the Middle East only two countries (3%) are currently developing MSP, both in an intermediate phase of the process. In Africa, MSP initiatives, particularly in Angola, Namibia, and South Africa, essentially covering the Benguela Current large marine ecosystem, are recent and in their early stages (11% of countries), while in both Oceania and Asia (10% and 11%, respectively) MSP is found from preplanning to revision stages (Fig. 30.4).

At the national level, prominent maritime nations such as Norway and China are leading the way on MSP development (Ehler, 2013). The following sections provide an overview on national initiatives per geographical region. For detailed information on individual national MSP processes, visit the IOC-UNESCO website on MSP around the world (IOC-UNESCO, 2017b), the European MSP platform (European Commission, 2017), reviews from Jay et al. (2013), Collie et al. (2013), Agardy et al. (2012), and Douvere and Ehler (2009a, 2009b), or specific scientific literature identified in Table 30.1.

30.3.1 Europe

In Europe, several countries have had MSP in place for about a decade and are currently in the second or third round of planning. Norway is one of these countries, where three marine spatial plans cover the entire EEZ of over 2 million km^2: the Barents Sea-Lofoten Area plan (approved and implemented in 2006 and first updated in 2011), the Norwegian Sea plan

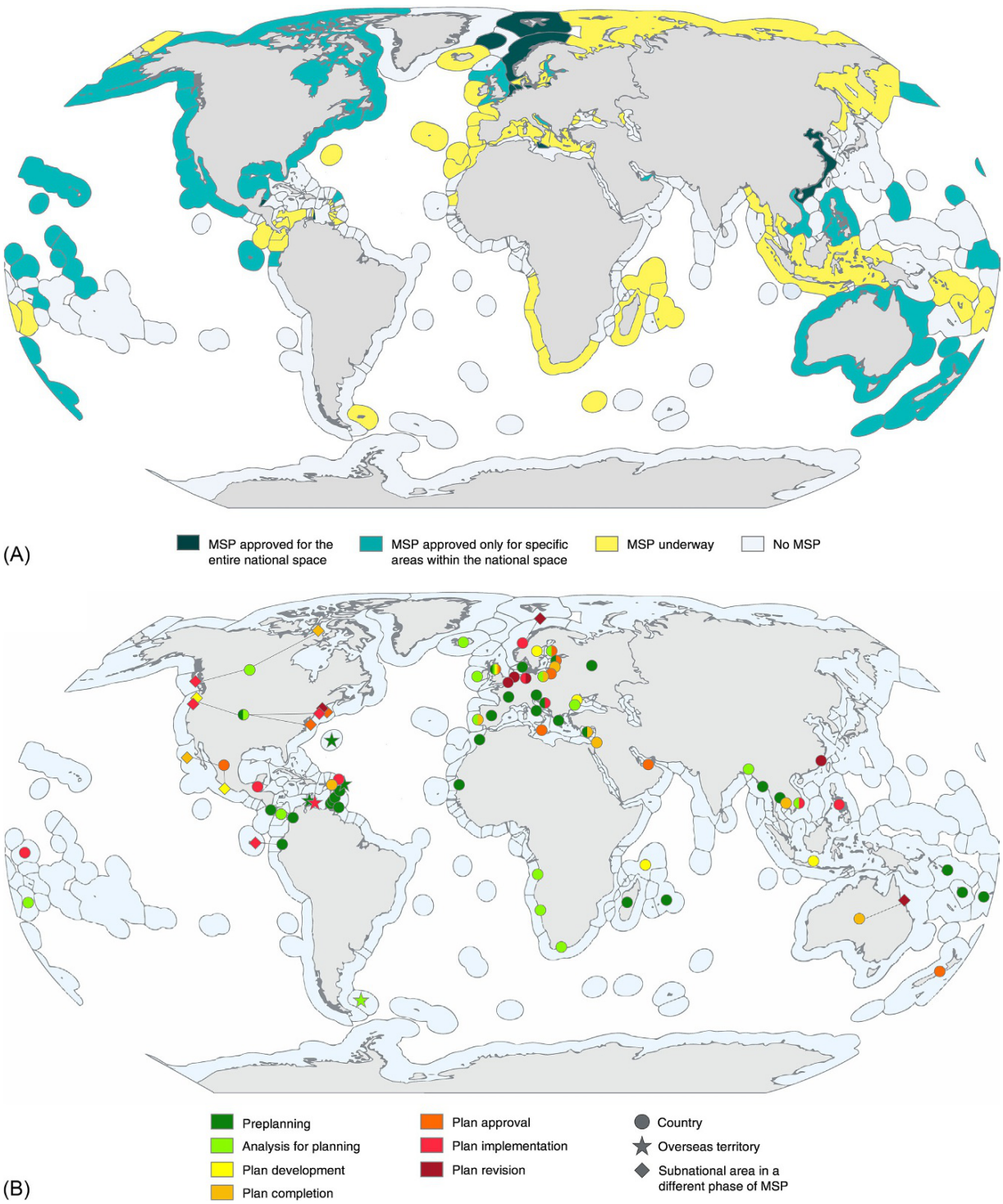

FIG. 30.3 Global status of marine spatial planning (MSP) development in 2017. (A) Exclusive economic zones (EEZs) of countries where: MSP is approved for the entire national space; MSP is approved only for a specific marine area within the country (e.g., province, municipality, state, etc.); MSP is under development; or, no MSP is being carried. Map is based on information from Table 30.1. (B) Phase of MSP development by country (circle shapes) and overseas territory (star shapes) identified in Table 30.1. Particular subnational areas that are in a different phase of MSP development (diamond shapes) are also identified. Some countries include more than one phase of MSP development (multicolor shapes).

TABLE 30.1 Global Status of Marine Spatial Planning (MSP) Development in 2017

Country/Territory (Per Region)	Phase of MSP Development (Number and Description)		Names of Completed Marine Spatial Plans	Examples of Scientific Publications on National MSP Initiatives
Europe				
Belgium (EEZ and TS)	7	Revision	Maritime Spatial Plan for the Belgian Part of the North Sea	Douvere, Maes, Vanhulle, and Schrijvers (2007), Douvere and Ehler (2009a, 2009b)
Bulgaria	2	Analysis for planning	N/A	
Croatia	1 and 6	Preplanning, except for Zadar county where sea use management plan is implemented	Zadar County Integrated Sea Use and Management Plan	
Cyprus	1 and 4	Preplanning, except for Limassol district where a nonlegally binding pilot plan is completed	Pilot Plan for Coastal and Marine Area of the District of Limassol	Hadjimitsis et al. (2016)
Denmark	1	Preplanning	N/A	
Estonia	1 and 5	Preplanning, expect for Hiiumaa Island and Pärnu Bay areas where pilot plans are approved	Hiiu Island MSP Pilot Plan; Pärnu Bay MSP Pilot Plan	
Finland	2 and 5	Analysis for planning, except for Kymenlaakso Region where land-use plan for the TS is approved	Regional Land Use Plan for the Sea, Kymenlaakso Region	
France	1	Preplanning	N/A	
Germany (EEZ and TS)	6–7	Implementation, except for coastal states of Mecklenburg-Vorpommern and Lower Saxony where spatial plans are revised	Maritime Spatial Plan for the EEZ of the Baltic Sea; Maritime Spatial Plan for the EEZ of the North Sea; State Development Plan for Schleswig-Holstein; Spatial Development Programme of Mecklenburg-Vorpommer; Spatial Planning Programme of Lower Saxony	Jay, Alves, et al. (2016), Jay, Klenke, and Janßen (2016), Kannen (2014)
Greece	1	Preplanning	N/A	Papageorgiou (2016), Tsilimigkas and Rempis (2017)
Iceland	2	Analysis for planning	N/A	
Ireland	2	Analysis for planning	N/A	
Italy	1	Preplanning	N/A	
Latvia (EEZ)	4	Plan completion (approval expected in 2017)	Draft Maritime Spatial Plan for the internal marine waters, territorial waters and exclusive economic zone of the Republic of Latvia	Veidemane et al. (2017)
Lithuania (EEZ and TS)	5	Approval	Comprehensive Plan of the Republic of Lithuania	

Continued

TABLE 30.1 Global Status of Marine Spatial Planning (MSP) Development in 2017—cont'd

Country/Territory (Per Region)	Phase of MSP Development (Number and Description)		Names of Completed Marine Spatial Plans	Examples of Scientific Publications on National MSP Initiatives
Malta (marine area up to 25 nm)	5	Approval	Strategic Plan for Environment and Development	
Netherlands (EEZ)	7	Revision	Policy Document on the North Sea 2016–2021	Douvere and Ehler (2009a, 2009b); Platjouw (2018)
Norway (EEZ and TS)	6–7	Implementation, except for Barents Sea where integrated management plan is revised	Integrated Management Plan for the Marine Environment of the Barents Sea—Lofoten Area; Integrated Management Plan for the Marine Environment of the North Sea and Skagerrak; Integrated Management Plan for the Marine Environment of the Norwegian Sea	Ehler and Douvere (2010); Platjouw (2018)
Poland	2 and 4	Analysis for planning, except for the Gulf of Gdańsk, Pomeranian Bight/Arkona Basin and Southern Middle Bank where three nonbinding MSP plans are completed	Pilot Maritime Spatial Plan for the Western Part of the Gulf of Gdańsk; Pilot Maritime Spatial Plan for Pomeranian Bight/Arkona Basin; Pilot Maritime Spatial Plan for the Southern Middle Bank	Zaucha (2012, 2014)
Portugal	2 and 4	Analysis for planning, except for the continental part of the EEZ where a nonbinding pilot project is completed	"POEM" Marine Spatial Plan	Ferreira et al. (2016), Frazão Santos et al. (2015)
Romania	3	Plan development	N/A	
Russia	2	Analysis for planning	N/A	Andrey and Larisa (2015)
Slovenia	1	Preplanning	N/A	
Spain	1	Preplanning	N/A	Rodríguez-Rodríguez et al. (2016), Vivero and Mateos (2012)
Sweden	3	Plan development	N/A	
United Kingdom (EEZ and TS)	1–5	Preplanning to approval	East Inshore and East Offshore Marine Plans (England); South Inshore and South Offshore Marine Plans (England); Scotland's National Marine Plan; Marine Plan for Northern Ireland; Welsh National Marine Plan	Kelly et al. (2014), Smith and Jentoft (2017)
The Americas				
Antigua and Barbuda (only Barbuda coastal waters)	6	Implementation	Barbuda Marine Zoning Plan	

TABLE 30.1 Global Status of Marine Spatial Planning (MSP) Development in 2017—cont'd

Country/Territory (Per Region)	Phase of MSP Development (Number and Description)		Names of Completed Marine Spatial Plans	Examples of Scientific Publications on National MSP Initiatives
Belize (TS)	6	Implementation	Belize Integrated Coastal Zone Management Plan	Arkema et al. (2015)
Bermuda (United Kingdom)	1	Preplanning	N/A	Lester et al. (2017)
Bonaire (the Netherlands)	6	Implementation	Bonaire National Marine Park Management Plan	
Canada (EEZ and TS)	2 and 4 and 6	Analysis for planning, except for the Pacific North Coast where four subregional MSP plans are implemented, and Nnunavut where a land use plan is completed (approval expected in 2017)	Haida Gwali Marine Plan; North Coast Marine Plan; Central Coast Marine Plan; North Vancouver Island Marine Plan; Nunavut Land Use Plan	Flannery et al. (2016), Gunton and Rutherford (2010)
Colombia	1	Preplanning	N/A	Mow et al. (2007)
Costa Rica (only Gulf of Nicoya)	1	Preplanning	N/A	
Curaçao (the Netherlands)	1	Preplanning	N/A	
Dominica	1	Preplanning	N/A	
Ecuador	1 and 6	Preplanning, except for the Galapagos marine reserve where zoning plan is Implemented	Galapagos Marine Reserve Management Plan	Castrejón and Charles (2013)
Falkland Islands (United Kingdom)	2	Analysis for planning	N/A	
Grenada	1	Preplanning	N/A	
Mexico (EEZ and TS)	3–5	Plan development to approval	Ocean Use Plan for the Gulf of California; Ocean Use Plan for the Gulf of Mexico and Caribbean Sea; Ocean Use Plan for the Northern Pacific	Díaz-de-León and Díaz-Mondragón (2013)
Montserrat (United Kingdom)	1	Preplanning	N/A	
Panama (Gulf of Montijo)	2	Analysis for planning	N/A	
Saint Kitts and Nevis (EEZ)	4	Plan completion	Pilot Marine Zoning Plan for Saint Kitts and Nevis	Agostini et al. (2015), Schill et al. (2011)
Saint Lucia	1	Preplanning	N/A	
St Vincent and the Grenadines	1	Preplanning	N/A	
Trinidad and Tobago (only northwest coast of Trinidad)	1	Preplanning	N/A	

Continued

TABLE 30.1 Global Status of Marine Spatial Planning (MSP) Development in 2017—cont'd

Country/Territory (Per Region)	Phase of MSP Development (Number and Description)		Names of Completed Marine Spatial Plans	Examples of Scientific Publications on National MSP Initiatives
The United States of America (EEZ and TS)	1–7	Preplanning to revision	Northeast Ocean Plan; Mid-Atlantic Regional Ocean Action Plan; Massachusetts Ocean Management Plan; Rhode Island Ocean Special Area Management Plan; Oregon Territorial Sea Plan; Draft Marine Spatial Plan for Washington's Pacific Coast	Bates (2017), Gopnik et al. (2012)
Oceania				
Australia (EEZ, including Norfolk Island)	4 and 7	Plan completion, except for Great Barrier Reef Marine Park where zoning plan is revised	Great Barrier Reef Marine Park Zoning Plan 2003; Marine Bioregional Plan for the South-west Marine Region; Marine Bioregional Plan for the North-west Marine Region; Marine Bioregional Plan for the North Marine Region; Marine Bioregional Plan for the Temperate East Marine Region; South-east Regional Marine Plan	Kenchington and Day (2011), Vince (2014)
Fiji	1	Preplanning	N/A	
Kiribati (only Phoenix Islands)	6	Implementation	Phoenix Islands Protected Area (PIPA) Management Plan, 2010–2014	
New Zealand (only Hauraki Gulf)	5	Approved	Hauraki Gulf Marine Spatial Plan	Scott (2016)
Solomon Islands	1	Preplanning	N/A	
Tonga	2	Analysis for planning	N/A	
Vanuatu	1	Preplanning	N/A	
Asia				
Bangladesh	2	Analysis for planning	N/A	
Cambodia (only Sihanoukville Province)	4	Plan completion	Coastal Use Zoning Plan for Province of Sihanoukville	
China (EEZ and TS)	7	Revision	National Marine Functional Zoning, Year 2011–2020	Mu et al. (2013), Lu et al. (2015)
Indonesia	3	Plan development	N/A	
Myanmar	1	Preplanning	N/A	
Philippines (only Bataan Province)	6	Implementation	Batangas Bay Water Zoning Pilot Project	
Thailand (only Trat Province)	1	Preplanning	N/A	

TABLE 30.1 Global Status of Marine Spatial Planning (MSP) Development in 2017—cont'd

Country/Territory (Per Region)	Phase of MSP Development (Number and Description)		Names of Completed Marine Spatial Plans	Examples of Scientific Publications on National MSP Initiatives
Vietnam (TS)	2 and 6	Analysis for planning, except for Danang Municipality where zoning plan is implemented	Danang Master Plan Towards 2030	
Middle East				
United Arab Emirates (only Abu Dhabi marine area)	5	Approval	The Plan Maritime 2030: Abu Dhabi Coastal and Marine Framework Plan	
Israel (EEZ)	4	Plan completion	Israel Marine Plan	Portman (2015)
Africa				
Angola	2	Analysis for planning	N/A	
Madagascar	1	Preplanning	N/A	Allnutt et al. (2012)
Mauritania	1	Preplanning	N/A	
Mauritius	1	Preplanning	N/A	
Morocco	1	Preplanning	N/A	
Namibia	2	Analysis for planning	N/A	
Seychelles	3	Plan development	N/A	
South Africa	2	Analysis for planning	N/A	

The status of MSP development for each country/territory is based on information from IOC-UNESCO (2017a, 2017b), European Commission (2017) and particular scientific references on national MSP initiatives. Designations of completed marine spatial plans are also presented. Countries are presented in alphabetical order, by region. *EEZ*, exclusive economic zone; *TS*, territorial sea; *N/A*, not applicable.

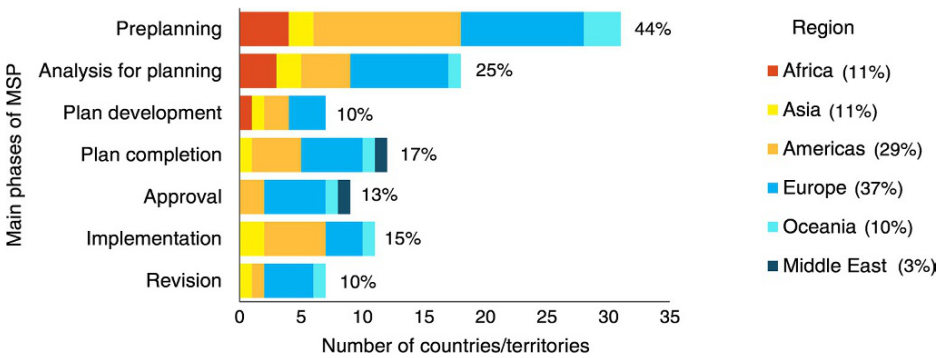

FIG. 30.4 Number of countries with marine spatial planning (MSP) initiatives in 2017, per main phase of MSP development and geographical region. Percentages are based on the total number of countries with MSP in place or underway, that is, 66. Percentages per main phase of MSP do not sum up to 100%, as some countries have more than one phase of MSP development. Diagram is based on information from Table 30.1.

(approved in 2009 and implemented), and the North Sea and Skagerrak plan (approved in 2013 and implemented) (IOC-UNESCO, 2017b). Norway's marine spatial plans are very comprehensive and establish guidelines for management actions across economic sectors (including fisheries) together with actions for the conservation and sustainable use of its marine areas (IOC-UNESCO, 2017b). In Belgium, MSP has also been in place for over a decade—Belgium was one of the first nations to have an operational MSP system in place. Its initial master (zoning) plan was completed and implemented in 2003 to manage its intensively used EEZ of only c.3500 km^2, and in 2014 Belgium approved a new, legally binding marine

spatial plan (IOC-UNESCO, 2017b). Belgium MSP addresses the management of human uses within nature protection zones and MPAs, together with offshore wind development (European Commission, 2017). The Netherlands is also an MSP "pioneer." With one of the most intensively used ocean spaces in the world (EEZ of c.65,000 km^2), it completed its first marine spatial plan in 2005, which was further revised and adapted in both 2009 and 2015 (European Commission, 2017). The Netherlands MSP process started not only due to a need for integrated spatial planning because of new uses requiring ocean space, primarily offshore wind farms and protected areas, but also due to potential growth in existing uses (IOC-UNESCO, 2017b). Finally, in Germany MSP has been developed at two levels: the EEZ level, since 2009, when two regulatory and enforceable marine spatial plans were approved for both the Baltic Sea and the North Sea parts of the German EEZ (c.57,000 km^2), and the state (länder) level where authority to manage the TS resides. Three legally binding marine spatial plans are in place for the three länders: the Mecklenburg-Vorpommern plan (approved in 2005 and revised in 2016), the Lower Saxony spatial planning program (approved in 2008 and amended in 2012), and the Schleswig-Holstein plan (approved in 2010 and currently under revision). MSP in Germany is primarily focused on planning for offshore wind farms and shipping (European Commission, 2017).

Other European countries are less advanced in MSP development. In Malta, a Strategic Plan for Environment and Development that provides a framework policy for the use of land and sea was approved by parliament in 2015, but is yet to be implemented (European Commission, 2017). In Lithuania, a mandatory marine spatial plan, developed as an extension of the national terrestrial spatial plan, was also approved by parliament in 2015 (European Commission, 2017). In Latvia, the first draft marine spatial plan for the EEZ was completed in 2016, and government approval is expected soon (European Commission, 2017). The United Kingdom is at various stages of MSP development, according to different marine zones: England has 11 inshore/offshore planning areas where marine plans are being developed on a sequential basis (the East Inshore and East Offshore plans were approved in 2014, and the South Inshore and South Offshore plans were completed in 2016; remaining plans are to be in place by 2021); Scotland has a national marine spatial plan, approved since 2015, which is to be supplemented by 11 regional plans providing detailed guidance for the TS; marine spatial plans for Northern Ireland and Wales are currently under development (European Commission, 2017).

In Croatia, Finland, Estonia, Poland, Cyprus, and Portugal, MSP processes at the national level are at their early stages. However, in all cases marine spatial plans have been further developed at the local level: Croatia has already implemented a legally binding integrated sea use management plan (focused on aquaculture) for the Zadar county; Finland has a regional land-use plan for the marine waters (TS) of the Kymenlaakso Region approved in 2014; Estonia has two approved marine spatial pilot projects, one for the area around the Hiiumaa Island (adopted in 2016) and another for the Pärnu Bay (adopted in 2017); Poland has three nonbinding marine spatial pilot plans already completed (the Gulf of Gdańsk plan, developed in 2008 and published in 2010, and the Pomeranian Bight/Arkona Basin plan and the Southern Middle Bank plan, both developed between 2009 and 2011); Cyprus has a nonbinding marine spatial pilot plan for Limassol area completed in 2015; and Portugal has a nonbinding marine spatial pilot project for the continental part of its EEZ completed in 2012 (European Commission, 2017). Remaining European countries—Bulgaria, Denmark, France, Greece, Iceland, Ireland, Italy, Romania, Russia, Slovenia, Spain, and Sweden—have MSP processes in earlier stages of development, that is, "pre-planning" to "plan development" (Table 30.1). However, all that are EU Member States must have their marine spatial plans implemented by 2021 (European Commission, 2014).

30.3.2 The Americas

Canada (the seventh largest EEZ in the world) began its MSP initiatives in 2008, with the development of five strategic plans for five Large Ocean Management Areas (the Pacific North Coast Integrated Management Area, Beaufort Sea, Gulf of St. Lawrence, Eastern Scotian Shelf, and Placentia Bay/Grand Banks), encompassing almost 6 million km^2 of ocean area. However, none of these plans have been implemented. From 2011 to 2016 MSP did move forward in Canada when the Marine Plan Partnership for the Canadian Pacific North Coast (MaPP) developed and approved four sub-regional marine spatial plans for the Pacific North Coast region (Haida Gwaii, the North Coast, the Central Coast, and North Vancouver Island), together with a regional implementation plan in 2016. A land-use plan covering marine areas of the northernmost territory of Nunavut (c.1 million km^2 of marine waters) was completed in 2016, and its approval is expected in 2018 (IOC-UNESCO, 2017b).

The United States, with the second largest EEZ in the world (over 11 million km^2), is also experienced in MSP development. Here, MSP is taking place at two main levels: the federal level, where nonregulatory regional marine spatial plans are to be developed for the EEZ; and the state level, where regulatory marine spatial plans are developed for state waters within three nautical miles from shore (IOC-UNESCO, 2017b). For the EEZ, nine regional planning areas are considered: Northeast, Mid-Atlantic, South Atlantic, Gulf of Mexico, Caribbean, West Coast, Alaska/Arctic, Pacific Islands, and the

Great Lakes. In 2016, two nonregulatory regional plans were completed and approved: the Northeast Ocean Plan (EEZ and state waters of Maine, Vermont, New Hampshire, Massachusetts, Connecticut, and Rhode Island) and the Mid-Atlantic Regional Ocean Action Plan (EEZ and state waters of New York, Pennsylvania, New Jersey, Delaware, Maryland, and Virginia). At the state level, four states have MSP processes that are further developed, some being already in place for years: Massachusetts (regulatory marine spatial plan approved in 2009 and amended in 2015), Rhode Island (regulatory marine spatial plan approved and implemented in 2010, and currently being updated), Oregon (regulatory plan for the TS adopted in 1994, and amended in 2013 to incorporate a renewable energy section), and Washington (draft regulatory plan available and expected to be implemented in 2018). Remaining regional and state-level MSP initiatives are still in their early stages, for example, in Alaska and the US Gulf of Mexico.

Mexico, another large maritime nation (EEZ with over 3 million km^2), started addressing MSP in 2003 and developed four regional marine spatial plans, one for each marine planning region: the Gulf of California plan (completed and approved in 2006), the Gulf of Mexico and Caribbean Sea plan (completed and approved in 2012), the Northern Pacific plan (completed in 2015 and pending approval), and the Central Southern Pacific Ocean plan (expected to be completed by 2018).

Four other countries/territories have MSP in place in the Americas: Belize, Antigua and Barbuda, Ecuador, and Bonaire (the Netherlands). Belize has been carrying out coastal and ocean planning for over a decade, both at the level of the entire barrier reef and at local scales (Arkema et al., 2015). Such efforts resulted in the approval and endorsement of an integrated coastal zone management plan in 2016, which includes the TS and much of the EEZ (IOC-UNESCO, 2017b). In Antigua and Barbuda, a zoning plan was approved and implemented in 2014, with technical support from the Blue Halo Initiative, but limited to coastal waters (within 3 nautical miles) around Barbuda. In Ecuador, MSP is in place for almost two decades in the Galapagos Marine Reserve, where a zoning plan was approved in 2000 and implemented in 2006 (Castrejón and Charles, 2013). For the continental part of the Ecuadorian EEZ, however, MSP is still in its early stages (IOC-UNESCO, 2017b). Finally, in Bonaire MSP has also been in place since 2006, when a management plan was completed for the Bonaire National Marine Park (first established in 1979), which includes the entire marine waters of the island; a corresponding zoning plan was implemented in 2010.

MSP in Saint Kitts and Nevis is also further advanced, although not yet approved: a pilot zoning plan, developed within a multi-objective, integrated approach, was completed in 2010 for the nation's coastal waters with support from The Nature Conservancy (Agostini et al., 2010). Remaining countries and territories in the Americas—Colombia, Costa Rica (Gulf of Nicoya), Dominica, Grenada, Panama (Gulf of Montijo), Trinidad and Tobago, Saint Lucia, Saint Vincent and the Grenadines, Bermuda (United Kingdom), Curaçao (the Netherlands), Falkland Islands (United Kingdom), and Monserrat (United Kingdom)—all have MSP processes in their early developing stages (Table 30.1).

30.3.3 Oceania

Many advocate that important lessons can be drawn from the long-standing experience of MSP and sea-use management in Australia, namely in the GBRMP, where a zoning plan was first prepared in 1981 (Day, 2002) and approved and implemented in 1987 (IOC-UNESCO, 2017b). Such lessons include the appropriate establishment of objectives based on a clear understanding of the problems to be solved by MSP, as well as the need to conduct MSP in a continuous and adaptive manner, engaging stakeholders in the process and ensuring sustainable financing (Kenchington & Day, 2011). The original zoning plan of the Marine Park was further revised and adapted in 2003, and corresponding 5-year outlook reports (examining progress in protecting the Great Barrier Reef by assessing its condition, use, management effectiveness, etc.) were published in 2009 and 2014 (IOC-UNESCO, 2017b). Concomitantly, a lesser known MSP process in Australia—Marine Bioregional Plans (MBPs)—started with the development of the Australia's Oceans Policy from 1998 (Vince, 2014). Several nonbinding regional marine plans (RMPs) began being developed for the entire EEZ of Australia (c.8 million km^2, not including dependent territories). However, only one was completed: the Southeast Regional Marine Plan in 2004. RMPs were replaced with MBPs after the ocean policy first review, where its focus changed from a broad multiple use perspective to an environmental one (Vince, 2014). Accordingly, in 2012 Australia has completed four MBPs for the Southwest, Northwest, North and Temperate East marine regions (IOC-UNESCO, 2017b).

In Oceania, New Zealand and Kiribati are the only other countries where MSP is further developed, as Fiji, Solomon Islands, Tonga, and Vanuatu are still in the early stages of MSP (see Table 30.1). However, in both cases MSP is only in place for a particular area within the EEZ. In New Zealand, it is limited to the Hauraki Gulf Marine Park, where a marine spatial plan was completed and approved in 2016 (IOC-UNESCO, 2017b). In Kiribati, MSP pertains essentially to the Phoenix Islands Protected Area (PIPA) where a management plan, including a zoning map, is approved and implemented—the plan was published in 2009 (IOC-UNESCO, 2017b).

30.3.4 Asia

China is another country where MSP started 30 years ago, and the one in Asia where MSP is most developed. The idea of "marine functional zoning" was first proposed in China in 1988, in 2002 its first National Marine Zoning Plan was approved and implemented, and in 2004 marine zoning started being approved for coastal provinces, autonomous regions, and municipalities (Feng et al., 2016). In 2010, a new round of planning took place, and as a result, in 2012 China formally approved a revised version of its marine spatial plan—the National Marine Functional Zoning, Year 2011–2020 (IOC-UNESCO, 2017b). China also has an "eco-environmental redlining" process to identify, delineate, and create zones to protect areas of high concentration of ecosystem services, which is now being "superimposed" on the existing marine plans (Wang et al., 2015).

In the Philippines, MSP is in place only at the municipal level. A marine zoning pilot project was developed in 1999 for the Batangas Bay area, focused on the resolution of multiple use conflicts, and a municipal integrated land and sea-use zoning plan was adopted in 2006, after being developed with support from the Partnership for Environmental Management of Seas of East Asia (PEMSEA). In Cambodia, MSP is also only developed at the municipal level in the Sihanoukville Province, where a coastal use zoning scheme was approved in 2005 (IOC-UNESCO, 2017b). In Vietnam, MSP is underway for eight coastal provinces, encompassing its TS, in the context of a government project on coastal sustainable development with the support of the World Bank. Here, although most provinces are still in an "analysis for planning" phase, a zoning plan for marine and coastal areas was approved for the Danang Municipality in 2010 (IOC-UNESCO, 2017b). Other Asian countries—Bangladesh, Indonesia (East Kalimantan Province), Thailand (Trat Province), and Myanmar—also have MSP underway, but still in its early stages (Table 30.1).

30.3.5 Middle East

In the Middle East, only two countries are currently developing MSP. In the United Arab Emirates, MSP was started in 2013 for the maritime area of the Emirate of Abu Dhabi, focusing on the development of a MSP framework plan (the spatial plan) and its implementation plan. These plans were completed and approved in 2016, and MSP implementation is now underway. In Israel, a pilot marine spatial plan covering the entire EEZ was completed in 2015. It was an academic initiative led by the Technion—Israel Institute of Technology, and was developed with the engagement of many stakeholders, including national governmental representatives.

30.3.6 Africa

In Africa, MSP is underway in eight countries, being in all cases in its early stages (Table 30.1). In Morocco, Mauritania, Madagascar, and Mauritius, discussions on MSP have indeed just begun at the national level. In Angola and Namibia, national MSP started in 2016 as part of a larger marine management and governance program—the Marine Spatial Management and Governance Program (MARISMA)—with financial and technical assistance from the Deutsche Gesellschaft für Internationale Zusammenarbeit (IOC-UNESCO, 2017b). This transboundary arrangement—which also includes South Africa—resulted from a collaborative approach among these three countries, made possible by the intergovernmental Benguela Current Commission (BCC, 2017). In South Africa, planning started in 2015 with the development of an MSP framework that identified four marine spatial plans covering the entire EEZ, to be completed by 2021. A bill authorizing MSP is now in the Parliament of South Africa. Finally, in Seychelles, a government-led MSP initiative was started in 2014 and is being developed with the support of The Nature Conservancy and The Nature Conservancy-Canada to achieve a regulatory marine spatial plan for the EEZ and TS by 2020.

30.4 MAJOR CHALLENGES FACED IN MARINE SPATIAL PLANNING

Most of the existing MSP-related literature (Fig. 30.1) focuses on the analysis of MSP case studies as well as on the discussion of challenges (present and future, conceptual and operational) that are linked to the development of MSP. For example, the Convention on Biological Diversity report on MSP (Agardy et al., 2012) lists a number of challenges in implementing MSP together with means to overcome them. Although differences are found across distinct biophysical, social, economic, and political contexts, some challenges seem to be more striking and widespread. These include shortcomings in political and institutional frameworks, challenges in balancing economic development and marine ecosystem conservation, difficulties in ensuring proper monitoring and evaluation, constraints in engaging stakeholders, finding ways to encompass human and social dimensions in MSP, addressing transboundary issues, and adapting to global environmental change (Fig. 30.5).

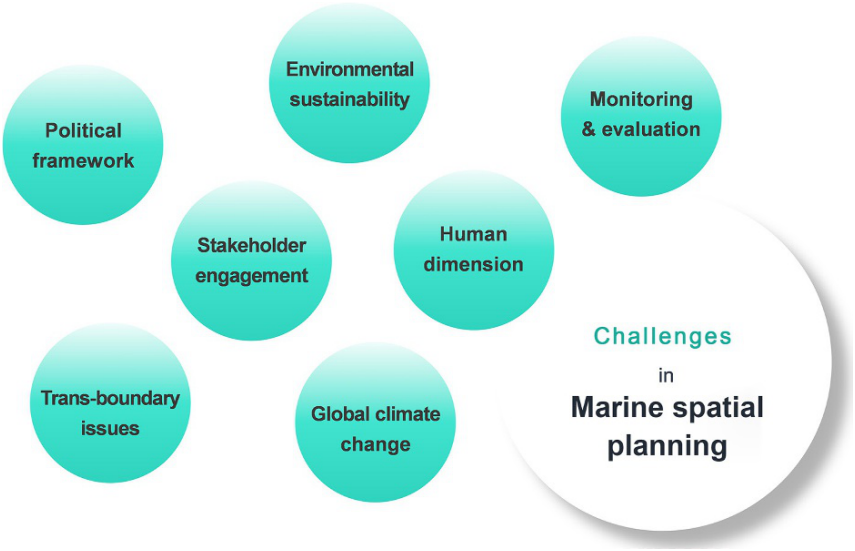

FIG. 30.5 Prominent challenges linked to the development of marine spatial planning that are addressed in this chapter.

Dealing and responding to each of these challenges is key to ensure the long-term suitability and sustainability of MSP. In the following sections, each of them is further presented together with primary recommendations to respond to it.

30.4.1 Political and Institutional Frameworks

The analysis of policy, governmental and institutional frameworks in the context of any marine region at any scale is critical to the success of corresponding MSP initiatives. According to Olsen et al. (2014), an MSP initiative should be based on a comprehensive understanding of the traditions and structures of the existing governmental system. This is important because "governments hold the primary power and responsibility over the content of an MSP. However, to varying degrees markets and the desires and values of civil society influence the MSP process and its contents (…) [and this] relative influence (…) [depends] upon the governance traditions and the institutions by which influence and authority are exercised" (Olsen et al., 2014). Indeed, MSP is never properly implemented, let alone revised and adapted, if the institutional and governmental frameworks do not support the initiative, or if they are susceptible to undue influence from particular sectors. As a consequence, in many marine and coastal management initiatives, "policy cycles," that is, the sequence of actions that characterize the development of an initiative, are never fully completed (Olsen et al., 2014). Instead, management processes end up consisting of a number of portions of unconnected cycles. This is the case of MSP in Canada, for example, where in 2008 an integrated management plan for the Eastern Scotian Shelf was completed but never approved by the Department of Fisheries and Oceans, and in 2011 the federal government withdrew from an agreement with the Province of British Columbia and Coastal First Nations to fund the Pacific North Coast Integrated Management planning process, following aggressive lobbying by the marine shipping and oil and gas sectors (Ehler, 2013). It is also the case of Portugal, where in 2012, after 4 years of work by an interministerial commission to develop the first national MSP initiative, the completed marine spatial plan ended up being acknowledged as a "baseline study" and further substituted by a new planning initiative (Frazão Santos, 2016). This disruption or abandonment of planning initiatives can lead to a number of problems, such as the delaying of the entire planning process, the lack of credibility of responsible entities, the disengagement of stakeholders, and ultimately, the absence of essential MSP management actions and marine spatial plans (Frazão Santos, 2016). Fragmentation and mismatches in current governance of marine resources is in fact widespread and difficult to overcome (Crowder et al., 2006). However, entities responsible for leading the MSP process must overcome the institutional resistance to change (Crowder et al., 2006). The analysis of performance of governance (Lieberknecht et al., 2013), together with the analysis of policy cycles (Olsen et al., 2014) allow for the identification of factors that enable or hinder the transition from the development and formal approval of MSP, to the success or failure of its implementation, and are therefore of the utmost importance to overcome policy-driven constraints and to ensure the proper development of MSP processes.

30.4.2 Environmental Sustainability and Ecosystem-Based Management

Ensuring the right balance between socioeconomic development and environmental protection is one of the major challenges for MSP. MSP has been long acknowledged as a fundamental process for the sustainable development of marine and coastal areas (European Commission, 2007, 2010) and a practical way to support the ecosystem-based management approach (Ehler & Douvere, 2007; Douvere, 2008). However, many of the current MSP processes are more about the growth of blue economy rather than really balancing conservation and development objectives. In these cases, marine conservation is often perceived as just "another" spatial use of the ocean—being treated at the same level as fisheries, shipping, renewable energy, etc.—and the balance is heavily weighted toward economic development (Qiu & Jones, 2013), with a real risk of social and economic factors overshadowing the importance of environmental conservation (Frazão Santos et al., 2014). It is important to note that the process of allocating ocean space, which is the core of MSP, may or may not entail the development of new conservation measures (e.g., establishing new protected areas, conducting new environmental assessments) within the planning area. Ideally, these two aspects, that is, spatial planning and conservation, should be developed together. However, many times there are no attempts to address actual conservation instruments and regimes in addition to the spatial allocation of maritime activities. Indeed, in some cases conservation is at best just another "weak voice" at the decision-making table, and limited to the inclusion of opportunistic MPAs (not designed to maximize biodiversity protection or maintain ecosystem health) in the marine management area. This is partly because MSP processes do not usually create new authorities and responsibilities for the conservation realm, leaving them instead to the already legislatively created entities that govern each sector (fisheries, oil and gas, water quality, shipping, etc.), which unfortunately are usually not well integrated with each other in the development of conservation approaches.

In Europe, for example, the EU legal framework on MSP opted for a "maritime" approach to spatial planning, viewing its MSP primarily as an opportunity for economic growth, framed within EU's blue growth strategy. Drawing on the analysis of four MSP efforts around Europe, Jones et al. (2016) highlight that "the current 'blue gold rush' is undermining the achievement of GES [good environmental status]," and that "real-world MSP'ing (…) as opposed to some of the more idealistic theoretical concepts underpinning discussions in the academic literature (…) is arguably more about political expedience than it is about conceptual ideals of proactive, consensual, and ecosystem-based approaches."

Still, in some MSP initiatives ensuring ecosystems health is *the* priority, and ecosystem goods and services are the basis, or foundation, of the entire planning process (Qiu & Jones, 2013). These "ecosystem-based" MSP processes begin by developing a "plan for conservation"—that is, establishing how to manage human uses so as to maintain biodiversity and ecosystem processes to the maximum extent possible—and only then move on to the spatial and temporal allocation of different uses in the same ocean space. Ecosystem-based MSP should therefore be based on a deep understanding of ecological processes, functions, interconnectivity, and the delivery of services and thus values. In this context, marine scientists can play a major role in providing information and guidance to marine planners. Similarly, ecosystem services identification, assessment, and valuation will be key for informing MSP that is environmentally sustainable (Agardy, 2015; White et al., 2012).

Discussions on the role of marine conservation in MSP are far from being resolved, as there is a plethora of different interpretations on the topic, and no common approaches (Kyriazi et al., 2013). Yet, broad recommendations to address this challenge include further placing marine goods and services in a central position within the planning process (Kyriazi et al., 2013), adopting adaptive approaches to MSP (Frazão Santos et al., 2014), and developing critical analyses of MSP case studies where they are compared with, and analyzed for consistency with, MSP ideal concepts (Jones et al., 2016).

30.4.3 Performance Monitoring and Evaluation

Monitoring and evaluation are two of the most important phases of MSP. Indeed, as stated in the IOC-UNESCO guide on evaluating marine spatial plans (Ehler, 2014a) "without knowing what it is that existing marine spatial plans are achieving (or not achieving), how will it be possible to improve them the second time around?" These two phases are the "vehicles" that allow responsible entities to learn about the effects of planning and management actions, and to further adjust and adapt them accordingly (Laffoley et al., 2004). In particular, monitoring and evaluating MSP "performance," that is, assessing the effects of management actions, are especially important as they allow responsible entities to establish if observed changes in the managed system are due to MSP actions or due to other factors (Douvere & Ehler, 2011). Some of the challenges that performance monitoring and evaluation enshrine are identified by Ehler (2014a): (1) different evaluation needs require different evaluation approaches, and there is no "one" approach to fit all needs; (2) inconsistent use of terminology in evaluation approaches impedes communication and understanding among organizations; (3) confusion among components of evaluation systems hinders the ability of practitioners to choose appropriate components for their needs; and (4) monitoring

cannot be limited to quantitative ecological or biological data, it should also include social, political, and cultural information. Establishing a set of relevant, informative, and objective-oriented indicators to assess MSP performance that cover socioeconomic, ecological, and governance dimensions, and that are closely attached to MSP goals is also a very complex task (Ehler, 2014a; Ferreira, 2017). For some authors, the short implementation time of most MSP initiatives and subsequent reduced planning for, and implementation of, monitoring and evaluation is the origin of many of these limitations (Carneiro, 2013). These, however, are expected to be overcome as MSP evolves and spreads globally (Carneiro, 2013).

30.4.4 Stakeholder Engagement

Proper engagement of stakeholders in MSP is a key factor to its acceptance and uptake. There is a vast literature on stakeholder engagement in decision-making (Agardy, 2010; Gopnik et al., 2012), and it is well recognized that successful implementation of MSP initiatives depends on "the identification and understanding of different stakeholders, their practices, expectations and interests" (Pomeroy & Douvere, 2008). Engaging stakeholders is key to properly balance the economic, social, and environmental objectives of the MSP framework (Ehler, 2012), and to reduce conflicts among ocean users (Katsanevakis et al., 2011). Still, major issues such as poor communication, the perception that decision-making is deliberately biased, or fragmented governance contribute to the exclusion and nonengagement of stakeholders in MSP (Flannery, Healy, & Luna, 2018). In turn, the latter also raises questions about MSP legitimacy, inclusivity, and social equity (Flannery et al., 2018). The primary recommendation to overcome this challenge is that responsible entities engage stakeholders at the earliest opportunity, from the very beginning and throughout the entire planning process instead of only when a final marine spatial plan is developed (Gilliland & Laffoley, 2008; Gopnik et al., 2012; Pomeroy & Douvere, 2008). Concomitantly, stakeholder engagement in MSP should be meaningful, conducted through open and transparent procedures, and reflect (or at least address) the existing complexity of socio-spatial relationships in the marine environment, that is, stakeholder representatives should represent all stakeholder groups (Agardy et al., 2011; Flannery et al., 2018; Pomeroy & Douvere, 2008).

There is a range of types of potential stakeholder engagement in MSP, some of them more interactive than others, from simple communication (not very interactive) to actual negotiation (where decision-making power is shared among stakeholders) (Pomeroy & Douvere, 2008). While traditional forms of public comment tend to generate low attendance, more interactive and proactive approaches tend to result in greater satisfaction among stakeholders, as well as in more innovative and lasting solutions (Gopnik et al., 2012). Using stakeholder analysis to identify and describe stakeholders, their interrelationships, current and future interests, and objectives is also a useful tool to foster engagement in an adequate and sustainable way (Pomeroy & Douvere, 2008).

30.4.5 Human Dimensions and Social Data

Effective MSP requires adequate understanding of both ecological and social dimensions, along with spatial information on them (Ehler & Douvere, 2009; Strickland-Munro et al., 2016). For both types of data, a key rule is that information should be "up-to-date, objective, reliable, relevant, and comparable" (Ehler & Douvere, 2009) and should cover most, if not all, of the marine planning area. Even though methods to assess biophysical attributes are well established, they have limitations. For example, biophysical data often pertain to ecosystem structure, not function; and the use of ecological datasets is usually related to data availability and ease of georeferencing, not their importance in understanding the areas that are most ecologically important, vulnerable, or resilient. On the contrary, the role and assessment of social data in MSP seem not to be so well established (Le Cornu et al., 2014). In some cases, MSP processes were actually criticized for providing inadequate attention to social data (Flannery et al., 2016; St. Martin & Hall-Arber, 2008). To be effective, MSP initiatives should recognize the complexity of human dimensions as they should do with biophysical ones, and acknowledge that the set of existing processes is "complex, integrated, and multi-scalar" (St. Martin & Hall-Arber, 2008). People's values and preferences should be well understood (Strickland-Munro et al., 2016), together with the spatial and temporal distribution of human interactions with the environment, and the factors that influence such distribution (Dalton et al., 2010). After conducting a global assessment on the incorporation of social data in MSP, Le Cornu et al. (2014) concluded that: (1) little funding is dedicated to the collection and incorporation of social data in marine spatial plans; (2) information on ecosystem services and social-ecological linkages do not get sufficient attention; and (3) ecosystem-based MSP typically engages less social data than integrated-use MSP. Le Cornu et al. (2014) further suggested that improving the capacity and sophistication in acquiring critical (spatial) social data is needed to provide all-inclusive information for decision-support tools, and that "moving beyond people as impacts to people as beneficiaries, through ecosystem services assessments" is essential to ensure true ecosystem-based management. As stated by Dalton et al. (2010), MSP efforts are more likely to achieve their ecological, economic, and social objectives if they take a comprehensive approach that accounts for complex, fine-scale interactions among people and their environment.

30.4.6 Transboundary Issues

Since the "behavior" of the biophysical ocean does not follow political boundaries, transboundary effects are a major issue in marine planning and management, and it has increasingly been recognized that MSP should take account of cross-border considerations (Hassan et al., 2015; Jay, Alves, et al., 2016). Several types of boundaries, or frontiers, should be accounted for in MSP, namely, the sea-land interface, cross-border effects with neighboring nations, cross-border effects with areas beyond national jurisdiction (ABNJ), and connections among different EEZ "fractions" of the same nation. The latter occurs in situations where national marine waters are not continuous (e.g., in Australia, Portugal, Norway, the United States, Mexico, and many others) but where MSP objectives and goals, management approaches, monitoring and revision procedures, etc., must be common to ensure consistency within the planning process. Issues related to the sea-land interface are among the most referred ones in the scientific literature (e.g., Álvarez-Romero et al., 2011; Kerr et al., 2014). Several challenges arise not only from the biophysical differences between terrestrial and marine environments, but also from the traditionally distinct planning and governance frameworks. Cross-border effects with adjacent countries refer directly to potential impacts from national maritime activities in neighboring marine waters (e.g., decisions on shipping routes in the Portuguese EEZ may affect the risk of pollution in Spanish waters; and species depletion in Spain may limit recruitment to Portuguese stocks). Cross-border effects with ABNJ follow the same reasoning, although considering effects in (or from) ABNJ, instead of neighboring countries. Entities involved in MSP must bear in mind that marine ecosystems "move," although sometimes at imperceptible speeds, and that their boundaries are more difficult to perceive and establish than terrestrial ones (Norse et al., 2005). Hence, planning authorities should consult neighboring authorities on MSP-related matters (Jay, Alves, et al., 2016; Jay, Klenke, & Janßen, 2016) and national MSP initiatives should be further developed into regional and international contexts to be truly sustainable (Katsanevakis et al., 2011).

The ABNJ are of special importance as most of the open ocean lies in international waters and there is a growing concern on the protection, conservation, and recovery of their ecosystems (Norse et al., 2005). Even though MSP initiatives are in general confined within national boundaries (Table 30.1), the need for transboundary MSP in international waters has long been advocated (Agardy et al., 2012). Almost a decade ago, MSP was pointed out as "practical way forward" regarding marine management in the high seas (Ardron et al., 2008). Since then, the need for MSP in the Arctic, one of the most pristine but vulnerable ecosystems in the world, has been supported by different authors (Aspen Institute, 2011; Hoel, 2009). Recognizing the importance of moving beyond national MSP initiatives, a pan-Arctic approach for MSP has been identified as essential to guide the future of the Arctic, especially in the context of external economic factors and effects of a changing climate (Ehler, 2014b). In the Southern Ocean, the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) has also committed to a transboundary spatial planning initiative—although not formally identified as a MSP process—where MPAs, fishing zones, and research zones were designated through a consensus decision-making process (Brooks et al., 2016). Spatial planning in ABNJ is also occurring in the context of the exploitation of deep seabed mineral resources, where the International Seabed Authority has the responsibility to both allocate leases for exploratory mining and establish networks of no-mining areas to protect seabed ecosystems (Wedding et al., 2015).

30.4.7 Global Climate Change

On top of the challenges that MSP already faces, climate change will present an additional and evolving challenge (Frazão Santos et al., 2016). Climate-related drivers of change, such as ocean warming, ocean acidification, and sea level rise, among others, will alter present ocean conditions, thereby leading to a redistribution of marine ecosystem goods and services (Pörtner et al., 2014). As a consequence, ocean uses that rely on those services (e.g., fisheries, aquaculture, shipping, tourism) will undergo spatial and temporal change, which may lead to increased use-use and use-environment conflicts (e.g., maritime activities may move to areas already allocated for other uses, and cumulative environmental impacts may grow significantly). Examining potential changes in the distribution of ocean uses and marine resources due to climate change is an important step in MSP (Ehler, 2014b; Ehler & Douvere, 2009). While some uses of the ocean space are expected to be more resilient and less exposed to climate change effects, others are globally more vulnerable (Frazão Santos et al., 2016). Fisheries and conservation are the most sensitive ones, being potentially affected by all climate-related drivers, from low to high impact levels. In contrast, renewable forms of energy or seabed mining are expected to be less affected globally, suffering impacts from only a reduced number of drivers of change (Frazão Santos et al., 2016). Because MSP focuses on the spatial and temporal distribution of ocean uses, all these potential changes will deeply affect its development. The best way forward is to ensure that MSP can respond to and incorporate change, by becoming increasingly flexible and adaptive. This entails an identification of operational approaches to foster such flexibility—such as dynamic ocean management (Lewison et al., 2015) or anticipatory zoning (Craig, 2012)—and the establishment of regular revision mechanisms. But the underlying premise is the recognition of climate change as a real and rising challenge (Frazão Santos et al., 2016).

30.5 FINAL CONSIDERATIONS

Over the past 30 years significant progress has been made by governments in their thinking about integrated planning and management of the ocean. Indeed, more than one out of every three countries with marine waters (66 of 150) has started some form of MSP initiative, and the interest in MSP continues to grow. For example, MSP is mandatory throughout an entire region—Europe—where more than 20 countries *must*, not *should*, have their marine spatial plans in place by 2021 according to binding EU legislation. However, not all MSP initiatives have been successful. While it is important to realize that both "development" and "conservation" are important to accomplish, and that we need to further develop the capability and political will to do both, the balance between them has varied a great deal from place to place. In many cases, MSP has taken the form of "full-on development planning," with too little thought to sustainability—conservation taking a "back seat" instead of being the foundation on which to build a sustainable future. At the same time, large investments in MSP around the world have resulted in many planning processes that have not been implemented, or will likely not be implemented, because of resource constraints or sociopolitical and "realpolitik" factors. Still, there are reasons to believe that people are looking critically at the challenges faced by, and the shortcomings of, MSP—and that these can, and will, be addressed in future rounds of planning. Learning from experience and integrating lessons learned in a continuing and adaptive manner will be key to ensure that MSP becomes truly sustainable, integrated, and operational.

Finally, we note that because the vast majority of MSP processes to date have been developed within EEZs, this chapter is largely focused on planning marine areas under national sovereignty. Yet, the majority of the world ocean, c.60%, is not within EEZs but rather in international waters (i.e., areas beyond national jurisdiction). This means that, ultimately, it will be imperative for MSP to be developed for the entire world ocean—what has been previously referred to as "the policy enclosure of the world ocean" (Gorina-Ysern, 2004; Orbach, 2003)—which will be quite a challenging, but necessary undertaking.

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