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Managing Risk Through Marine Spatial Planning

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1 Introduction

Marine spatial planning (MSP) is ultimately the allocation of spatial and temporal measures to ensure that human activities or, more specifically, sector and socio-economic development in the sea can take place in a sustainable manner (Cormier et al. 2015). Planning is a management process to establish objectives, in order to reach strategic goals set by a governance process. In this context, the planning process has to allocate space to address development objectives to reach the goals set by the policymaking process of the political system (Douvere and Ehler 2009; Cormier et al. 2017). In this discussion, the political system governs the process of policymaking: The planning process is a management function that follows the direction set by the governance processes (Anthony and Dearden 1980).

Planning does not occur in complete isolation from ongoing activities and existing legislation or policies (Maes 2008). Although MSP may often be confused with conservation planning within an ecosystem approach (Ansong et al. 2017), environmental, health and safety considerations also have to be integrated into the spatial allocation to achieve the development objectives of the sectors seeking opportunities (Christie et al. 2014). The European Maritime Spatial Planning Directive (MSPD) (EC 2014) is primarily socio-economic legislation that has to integrate the other European environmental directives

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such as the Water Framework Directive (EC 2000) and the Marine Strategy Framework Directive (EC 2008) (Moss 2008; Junier and Mostert 2015). It also has to integrate health and safety requirements that are set in legislative and regulatory frameworks of sector activities such as international and national legislation for shipping safety and safety buffer zones around marine wind farms (Aps et al. 2015) which trumps other environmental and socio-economic considerations.

Regulatory planning (on the essence of regulatory planning, see Chap. 1) is not an output per se. It is a process for which the output is a marine spatial plan (Cormier et al. 2015). From a regulatory perspective—and recognizing that the success of MSP or a planning process may be defined differently—the success of the regulatory planning process is the production of a plan. The success of the regulatory plan, in turn, is the implementation of its spatial allocation in the daily operations of the industry sectors and other human activities. Indeed, it is the implementation of the marine spatial plan in the regulatory approval processes of the sectors that will carry into effects the objectives stipulated by the plan to reach the development goals set by the political system (Cormier et al. 2017).

Based on the risk management standards of International Organization for Standardization (ISO) 31000 (ISO 2018), risk is the effect of uncertainty on achieving objectives. In risk management, processes, procedures, controls, tasks and reporting are used to reduce the uncertainties of achieving the objectives (Cormier et al. 2015). Thus, the objectives of managing the risks in a planning process are to reduce the uncertainties of producing a marine spatial plan. The objective of managing the risks in the plan is to reduce the uncertainties of achieving environmental, social and economic objectives once implemented. Therefore, risk management in the regulatory planning process and the plan is not dealing with the same risks. For example, an ill-managed planning process could lead to mistrust from stakeholders because they feel that their cultural sensitivities are not being acknowledged (Gee et al. 2017), or industry feels that they are being fingered as the problem. The planning process could fail to deliver a plan that has specific, measurable, achievable, realistic and time-bounded objectives (e.g. SMART objectives), or deliver a plan that cannot be implemented effectively and efficiently to achieve development and conservation objectives (Rice et al. 2005; Cormier and Elliott 2017). The plan may not incorporate pre-established regulatory requirements of given sectors in order to provide space for another activity such as shipping safety regulation and environmental standards and regulations (Aps et al. 2015). Scientific, management and operational uncertainties may have been inadvertently missed during the planning process (Cormier et al. 2015).

This chapter discusses the nuances of risk management between the regulatory planning process and the resulting plan, providing insight into perceived mismatches between stakeholders, science and policy. It also contrasts differences and the purpose of policymaking within a governance context, planning within a management context and implementation within a regulatory context. International risk management and quality management standards are also introduced to demonstrate how these standards can help address and integrate such varied risks.

2 The Confusing Jargon of Policy Development and Implementation

There is a very broad understanding of what is meant by management. It is sometimes confused as policy development initiatives, assessments of environmental concerns or managing human activities, all of which are elements of management (Chun and Rainey 2005; Cormier et al. 2019; Loehle 2006; Mingers and White 2010). In environmental realms, assessment and monitoring activities are often viewed as management, or the mere knowledge of scientific facts is viewed as good management practices (Browman and Stergiou 2004). The underlying problem is in understanding the differences between policymaking, planning processes and implementation of measures.

In management disciplines (Anthony and Dearden 1980; Green 2015), policymaking is a function of the governance system for setting long-term goals (Ackoff 1990). In MSP, the political system assumes that role through international collaboration and national political processes (Anderson 2011) that sets development and conservation goals expressed in either conventions, legislation or policies. Examples are the United Nations Convention on the Law of the Sea (UNCLOS 1982) as well as the European MSPD (EC 2014), the Marine Strategy Framework Directive (EC 2008) or the Integrated Maritime Policy (EC 2011). In addition to setting long-terms goals and in some cases shorter-term objectives, they also set the scope and the context for planning initiatives. For example, once adopted as national legislation, the competent authority delegated under the MSPD has to achieve the objectives outlined in Article 5 to reach the goals of Article 1. In contrast, planning is a function of the management process undertaken by administrations and departments that were delegated to lead such a process (Anthony and Dearden 1980). In MSP, the competent authority assumes the management role of the planning process through consultation and advisory processes to produce a marine spatial plan within the scope and context established by the conventions, legislation and policies established by the political system (Gavaris 2009; Cormier et al. 2017). The competent authority or the person delegated the job of leading the planning processes has to manage the stakeholder, scientific and technical consultation and advisory processes that are needed to identify the spatial and temporal allocations needed to address development and environmental objectives as well as stakeholder concerns. So-called policy integration has more to do with recognizing the constraints of existing regulatory frameworks and stakeholder concerns that can be addressed by a marine spatial plan (Long et al. 2015; Cormier et al. 2015; Creed et al. 2016). In some cases, there may be environmental quality requirements, socio-economic issues or health and safety concerns that cannot be addressed solely by a spatial plan. These may be identified in the plan as additional requirements that are being addressed by other mechanisms and jurisdictions. Implementation, however, is a function of the operational processes driven by the regulators that ultimately are delegated the authority to license the sector to undertake their activities (Girling 2013; Hupe and Hill 2016). Here, the regulators need to include the spatial and temporal allocations of the marine spatial plan for their sector as conditions of authorizations, licences or permits. It is this last step that ultimately implements the plan into the operations of sector activity.

The confusion may stem from concerns regarding the goals and objectives of the marine spatial legislation and policies, and the hope that these can be addressed through the planning process. Given that the planning process is conducted within the scope and context of the same legislation, the planning process cannot necessarily address these concerns without going back to the political system. The manager of the planning process still has to follow the direction provided by the legislation and policies. As an example, a regulator for a specific sector may initiate a planning process for a marine area in isolation of the other activities occurring in that area. Such an approach would ultimately have an impact on development and conservation objectives, but these would be outside the span of authority of that particular regulator. In most cases, the confusion lies in the lack of understanding of the respective roles of governance processes of the political system, management processes of MSP and the operational processes of regulatory approvals (Green 2015).

Without standardized processes and harmonized vocabulary, the various approaches and processes used in integrated oceans management and MSP continue to propagate a broad range of definitions, concepts and understandings that are most often implied, not explicitly defined and therefore provoke misunderstandings between planners from different countries and/or sectors as well as between planners and stakeholders. Abspoel et al. (forthcoming) conceptualize language and communication problems in MSP, concluding that the "lingua franca" of marine planning is evolving but not fully developed yet. According to Abspoel et al. (forthcoming) "few planners master the language already. For stakeholders, the language is unclear and not yet accepted". In addition, taking into account the increasing need for transnational cooperation in MSP, this "lingua franca" needs to bridge also different planning cultures and terminology of planning in different countries. Generally, a common language will need to evolve from practice and root deeply into the community and also be emphatic, fair and related to practical experiences and languages of stakeholders (Abspoel et al. forthcoming). For scientific (risk) assessments to be supportive in policymaking and policy implementation, a suitable language must therefore be found, not least to show how data are linked to the decision context. In practice, scientific understanding needs to be transferred into what it means for the specific decision-making context; it must also be related to policy or management language. In the context of risk assessment, this means that risk assessments for policy formulation and risk assessments for policy implementation may have to address different types of questions, need to use a different analytical approach and require a different way of interpretation, presentation and communication.

3 Assessing Versus Managing Risk

Historically, the ecosystem approach to management has relied on significant contributions from the ecological sciences (Christensen et al. 1996; McLeod et al. 2005; Browman and Stergiou 2004). Over time, this has spawned a variety of ecological assessment frameworks and state of the environment reporting activities that have been tailored to specific ecological and management contexts (Borja et al. 2009; Paetzold et al. 2010). Both environmental impact assessments and strategic environmental assessment are considered the hallmark of decision-making regarding specific projects or industry sector ecological considerations in legislation today (MacKinnon et al. 2018). However, the diversity in the approaches used in various assessments is most often cited as an impediment in making such knowledge usable in decision-making. Assessments and monitoring without a policy context is only an assessment that reflects the concerns of the person or the stakeholders doing the assessment (Holsman et al. 2017). In addition, MSP requires an assessment of a much broader set of concerns (Cormier et al. 2015). In planning, there are cultural, social, economic and liability concerns that have to assessed systematically given that the plan has to address a broader set of objectives than a strict focus on marine ecosystem impacts. The policy context also helps identify the concerns that can be managed by a marine spatial plan and the concerns that fall outside the span of control of such a plan. Keeping the planning process on the policy is a very important aspect in planning to avoid the so-called scope creep where assessments spawn more assessments and discussions, resulting in stakeholder fatigue and loss of credibility in the process.

Uncertainty is also considered an impediment to decision-making with the view that reducing scientific uncertainty would help the uptake of assessment knowledge in decision-making (Leung et al. 2016; Uusitalo et al. 2015). In fact, there are more than scientific uncertainties that are taken into account in decision-making (DFO 2014). They include management uncertainties that arise from a lack of coordination and vertical integration policies for specific sectors or misinterpretations of legislation and policies by the stakeholders involved in the planning process. There are also operational uncertainties related to the effectiveness of the management measures that are implemented to achieve the objectives as well as the potential of accidental failure (Veland and Aven 2015). Monitoring and adaptive management are typically considered a management approach that will tell us where to make improvements (Behn 2003; Douver and Ehler, 2010; Stelzenmüller et al. 2015). In risk management, the spatial and temporal allocations of a marine spatial plan should reduce the uncertainties of achieving development and conservation objectives.

In planning, assessments have to be conducted to identify the concerns that can be addressed by a marine spatial plan and the concerns that should be addressed by other management regimes. The assessments have to inform the planner and the stakeholders as to their concerns. The outcomes of the spatial and temporal allocations being considered also has to be assessed to evaluate which can best address the objectives of the plan. The uptake of such knowledge depends on the relevance of such information to the context of the decisions being made. Understanding the nuances between risk assessment and risk management would shed light as to some of the mismatch between the knowledge generated by science and the uptake of usable knowledge in decision-making.

4 The Perception and Understanding of Risk in Planning

The scientific and technical communities involved in risk assessment define risk as a function of magnitude and probability (Renn 2008). However, society generally perceives risks in terms of the magnitude of the consequences

(Gardner 2009). Few conceptually appreciate the likelihood aspect of the consequence in terms of the meaning of risk (Slovic 1986). Even though a given consequence is highly unlikely, people generally focus on the severity of the consequences of risk as the basis to drive policy decisions (Aven 2015; Leung et al. 2016). The most obvious example are public debates on the risk of accidents in nuclear power plants and the risks associated with the storage of nuclear waste, which focus mostly on the sheer magnitude of impacts of any risk event independent of its likelihood. The role of science is to explicitly address perceptions based on the current knowledge of a given risk and associated uncertainties (Conrad and Ferson 1999). However, it is the role of policymakers to identify and frame the risks in consultation with the public (Harremoës and Turner 2001). Given that policymaking is a social process (Fletcher 2007; Fletcher et al. 2013), it is the process of policymaking that provides the space and time for policymakers and the public to acquire an understanding of the risks in contrast to their perception of those risks (Pouyat 1999). In such a process, scientific advice informs decisions regarding the selection of a course of action, which is most often expressed through legislation and public policy objectives.

In planning, there is a risk that the marine spatial plan does not address the development and conservation objectives that it was intended to achieve. The negotiations and debate may lead a planner and the stakeholder to lose sight of the initial objectives or may even be influenced by objections and obstructions that may be inadvertently introduced during the process. Given that the planning has to ensure that it is conducted within the legislative and policy context that started the process, the quality of the process itself is as important as the quality of the marine spatial plan at the end of the process (Cormier et al. 2015). The quality management principles of Hoyle (2011) provide a short list of quality elements for a process. Adapted to MSP, the principles provide a checklist to evaluate the outputs of the planning process step as the process is progressing (Table 15.1).

Referring back to the issue of jargon and communication, a well-documented and clearly understandable scientific and technical assessment which refers back to the diverse perceptions of risk helps to create transparency of decision-making. This then helps to avoid mistrust among policymakers, planners, stakeholders and different groups in society, even when not everybody agrees to the policy objectives and legislation resulting from the policy process or agrees with the interpretation of risk that underpins these decisions. For policy implementation and planning, however, the objectives and legislation from the policy process define its route, clarify which issue might get specific priority and which constraints need to be taken into account,

Table 15.1 Hoyle's quality management principles adapted to marine spatial planning from Cormier et al. 2015

Hoyle's Principles	Quality management principles in MSP
Consistency of purpose	The MSP process will deliver the required marine spatial plan when there is consistency between the purpose of outputs of the MSP process steps and the objectives. When this principle is applied, the outputs of the MSP process step in terms of feedback and advice would have been guided and derived from the feedback, advice and expectations of the competent authorities, industry stakeholders and communities of interest.
Clarity of purpose	Clear, measurable objectives with defined outputs for each step of the MSP process establish a clear focus for all actions and decisions and enable the tracking of progress as expected by the competent authorities, industry stakeholders, communities of interest and scientific experts. When this principle is applied, people involved in the MSP process understand what they are expected to provide as feedback and advice and understand what they are trying to achieve and how the plan performance will be measured and reported in addressing the objectives.
Connectivity with objectives	The actions and decisions that are undertaken in the MSP process will be those necessary to achieve the objectives and hence there will be demonstrable connectivity between the two. When this principle is applied, the actions and decisions of the people involved in the planning process will be those necessary to deliver the outputs needed to achieve the objectives and no others as stipulated by the policy context.
Competence and capability	The quality of the MSP process outputs is directly proportional to the competence of the people, including their behaviour. When this principle is applied, people involved in scientific advisory peer review activities and consultation tables should have the competencies that reflect their role at the deliberation tables as well as contribute the view and opinions of the constituency they represent.
Certainty of results	Desired results are more certain when the output of each step of the MSP process has performance indicators and planned periodic reporting requirements. When this principle is applied, people involved in the MSP process and, in some cases, the public will have the knowledge and understanding of the progress and performance of the planning process as stipulated by the policy context and the objectives.
Conformity to best practice	The performance of the MSP process is greatly optimized and efficient when actions and decisions conform to established and recognized practices. When this principle is applied, MSP process activities are performed in the manner intended providing confidence that it is being performed in the most efficient and effective way as stipulated by the policy context.

(*continued*)

Table 15.1 (continued)

Hoyle's Principles	Quality management principles in MSP
Clear line of sight	The MSP process outputs are more likely to satisfy everyone involved when periodic reviews are conducted to verify whether there is a clear line of sight between the objectives and the requirements and expectations of the competent authorities, industry stakeholders and communities of interest. When this principle is applied, the scope or objectives of the MSP process may have to be periodically changed causing realignment of activities and resources, thus ensuring continual improvement of the planning process in light of new developments and knowledge.

often with details left to be sorted out in the planning and implementation process. Different types of assessment, in combination with stakeholder involvement processes, therefore form a significant component of the policy-making process and the resulting process of developing (spatial) plans by creating joint understanding of the associated risks (but not necessarily agreement on the outcomes).

5 The Perception and Understanding of Risk in Policy Implementation

In policy implementation, the role of science does not change significantly as it still has to provide advice based on the current knowledge and uncertainties of a given risk. The risks, however, are expressed in terms of achieving the legislative or public policy objective established by the policymakers (Assmuth et al. 2010; Olagunju and Gunn 2016). The role of management is to identify and structure the issues that need to be managed to achieve the objectives in consultation with stakeholders (Harremoës and Turner 2001). In this situation, the role of science is to address the risk perceptions of stakeholders in terms of the potential impact that management measures will have on their vested interest (Soma and Vatn 2014). In contrast to policymaking, integrated planning and management processes provide the space and time for managers and stakeholders to acquire an understanding of the implementation of measures to reduce the risks of not achieving a policy objective (Vigerstad and McCarty 2000). In such process, the scientific advice informs decisions regarding the selection of management measures most often expressed through regulations, standards and guidelines.

As mentioned earlier, the marine spatial plan has to reduce the uncertainties in achieving the development and conservation objectives established in legislation and policy. As with Hoyle's principles for the MSP process, The ten tenets (Barnard and Elliott 2015) of environmental management for the successful and sustainable development of environmental management strategies provide for comprehensive quality considerations for the marine spatial plan (Cormier et al. 2015).

1. **Environmentally/ecologically sustainable**: That the measures will ensure that the ecosystem features and functioning and the fundamental and final ecosystem services are safeguarded.
2. **Technologically feasible**: That the methods, techniques and equipment for ecosystem protection are available.
3. **Economically viable**: That a cost-benefit assessment of environmental management indicates viability and sustainability.
4. **Socially desirable/tolerable**: That the environmental management measures are as required or at least are understood and tolerated by society as being required; that societal benefits are delivered.
5. **Legally permissible**: That there are regional, national or international agreements and/or statutes, which will enable and/or force the management measures to be performed.
6. **Administratively achievable**: That the statutory bodies such as governmental departments, environmental protection and conservation bodies are in place and functioning to enable successful and sustainable management.
7. **Politically expedient**: That the management approaches and philosophies are consistent with the prevailing political climate and have the support of political leaders.
8. **Ethically defensible**: That the environmental management measures that allow development at the risk of losing ecosystem services upon which people depend on are ethically defensible.
9. **Culturally inclusive**: That the environmental management measures also integrate cultural ecosystem consideration that may not have societal or economic value.
10. **Effectively communicable**: That the environmental management objectives are communicated and understood by all the stakeholders, especially to achieve the vertical and horizontal integration of the other nine tenets.

Therefore, scientific advice and assessments from whatever scientific discipline need to be targeted towards impacts of potentially alternative sets of measures for achieving the policy objectives and at the same time minimizing impacts on vested interests or conflicts between implementation of several policy objectives.

This may imply, for example, the need to identify technical or regulatory measures and analyse them in terms of efficiency of enabling or constraining impacts on different vested interests, sectors and policy objectives. It can refer to regulatory measures such as zoning and the designation of priority areas for specific sectors (thereby constraining other sectors within the same area), including any follow-on conflicts these may trigger. It can refer to regulation of activities in time or regulatory demands for technical mitigation of environmental impacts, which would then become part of approval processes for a particular sector activity. Practical examples are the zoning approach used in the marine spatial plan for the German Exclusive Economic Zone (EEZ) (BSH 2009; Kannen 2014), which spatially separates shipping and offshore wind farms by designating priority areas for both sectors. Other risk mitigation measures include a closure of offshore wind farm areas for fishing activities due to safety reasons (avoiding collisions) or demanding mitigation measures for noise (minimizing risk of disturbing marine mammals) to be part of the construction approval process.

6 The Benefits and Efficiencies of Risk Management Standards

International standards such as the ISO 31000 risk management standard or the ISO 9001 quality management system can be applied to any management situation and policy context (ISO 2008, 2018). Updated in 2018, ISO 31000 provides definitions, performance criteria and a common overarching process for identifying, analysing, evaluating and managing risks within a policy context. These are written by experts in their field and are off-the-shelf processes and procedures. Applying these standards can reduce the start-up time of an MSP initiative by eliminating the need to develop a planning process, including the principles and framework, recognizing there may be reasons to develop or adapt these principles and framework to suit particular contexts. More importantly, they also come with a lexicon of technical terms and definitions that are consistent across the standards provided by the ISO. Adopting such standards also formalizes the planning process and provides a common road map for all parties involved in the planning process (Ciocoiu and Dobrea 2007). Given that the standard can be acquired by anyone, standards can also improve transparency and help align expectations. The parties involved are provided with the step ahead of the planning process starting that allows them to prepare questions and contributions ahead of time. Instead of debating the steps of the planning process, or where to start, ISO 31000 already comes with a structured process starting with policy context and followed by a risk assessment to identify and implement measures to achieve objectives. Cormier et al. (2015) undertook the exercise to link the ISO 31000 risk management approach with the general approaches of applying a policy cycle (Douvere and Ehler 2009; MMO 2014) to MSP.

As MSP is about the allocation of spatial and temporal measures to achieve development objectives, the MSP policy context according to ISO 31000 is the development of objectives for the various sectors. The risk assessment is subsequently used to identify the impediments to achieving those objectives. The aim of such a risk-based approach to planning is to ultimately find solutions to resolve the spatial and temporal conflicts between marine uses and produce a plan. Generally, Cormier et al. (2015) propose to structure the MSP process along the various steps of risk assessment ranging from risk identification and risk analysis to risk treatment, with the latter being the step to define the measures (regulatory or technical) to deal with the risks identified and recognized as relevant in the specific planning context. Furthermore, decision-making in the planning process is accompanied by a process of stakeholder involvement and a (separate) process of scientific advice in each of the risk assessment steps. These are elements to guarantee that the planning process is properly informed by scientific assessments and stays involved in a regular communication with stakeholders in order to provide transparency on the decisions taken.

However, in order to avoid the risk of a failing process, MSP needs more than a structured process to successfully produce a plan. It also needs to have criteria to review the quality of the process and the quality of the plan. Hoyle's process principles (Hoyle 2011) provide the quality management objectives for the planning process as such (Cormier et al. 2015). The principles are criteria to ensure that the planning process maintains consistency and clarity of the MSP purpose while ensuring that the process and the debates stay connected to the objectives of the planning process. The principles recognize the need for competence and capability to deliver the process conducted, thereby providing certainty of the expected results or outcomes of each step of the process. But a well-structured regulatory planning process, even when creating a lot of common understanding and a large amount of agreement from various stakeholders, does not automatically guarantee an implementable plan that achieves the intended outcomes. Therefore, the quality of the plan itself, its outputs and its intended outcomes depend entirely on a different set of criteria (Cormier et al. 2015). The ten tenets of adaptive management and sustainability provide one holistic framework and criteria for understanding and managing the socioecological system (Barnard and Elliott 2015).

These tenets outline the type of stakeholder consultation and feedback as well as scientific and technical advice needed to ensure that any marine spatial plan addresses the objectives, concerns and expectation of the parties involved and is implementable along existing legislative and administrative realities (Cormier et al. 2015). Without a roster of quality objectives for the planning process on one hand and the plan on the other hand, confusion is likely to happen as the participants will focus the planning process and set priorities that reflect their individual agendas and views.

In Fig. 15.1, we created a matrix that combines the ISO 31000 risk management process steps with the ten tenets of environmental management with the MSP elements in line with Hoyle's principles. In summary, "establishing the context" sets the purpose for the planning process, as well as competencies, capabilities and best practices that will support the planning process. The role of "risk identification" and "risk analysis" is to provide clarity and understanding to the perceptions of the risks as to what are the causes that may have an effect on achieving objectives. Based on the "risk analysis", the role of "risk evaluation" is to gain an understanding of the severity of risks using criteria and identify which are the risks that are unacceptable in relation to achieving objectives and that will require management guided by precautionary principles. Based on the "risk evaluation", "risk treatment" is the selection of management measures in the development and implementation of a management plan to achieve the objectives. The row for "Effectively communicate" highlights the information and support functions as well as the oversight, consultation and feedback activities for the entire process. The last two columns have been organized in terms of the "monitoring and review" and "communication and consultation" activities that will be required once the management plan has been implemented. As stipulated by ISO 31000, these activities generate the information that will be needed to evaluate the effectiveness of the plan in the future, enabling improvements to the plan adhering to adaptive management principles. Successful environmental management can only be achieved by environmental and compliance monitoring and review.

7 Conclusion

Even though it may sound very technical, linking risk management structures and quality management objectives with approaches referred to in spatial planning literature and practice may help to develop well-accepted MSP regu-

Quality Objectives 10-tenets	Establishing the Context	Risk Assessment: Risk Identification	Risk Assessment: Risk Analysis	Risk Assessment: Risk Evaluation	Risk Treatment	Monitoring and Review	Communication and Consultation
Tenet 1	Consistency of Purpose	Clarity of Purpose	Clarity of Purpose	Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Environmentally/ ecologically sustainable	Development objectives Environmental objectives	Ecologically and Biologically Significant Areas	Environmental Impact Assessments	Severity of the Consequences	Selection of the Areas to be Protected and Conserved	Environmental Effects Monitoring	Ecosystem Status and Trends Overview Reports
Tenet 2	Competence and Capability	Clarity of Purpose	Clarity of Purpose	Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Technologically feasible	Industry Stakeholders Representatives	Driver Activity Significant Pressures	Cause and Effect Pathways	Identification of Pressures that Require Management	Selection of Guidelines, Standards and Procedures	Environmental Monitoring of the Pressures	Human Use and Environmental Atlases
Tenet 3	Competence and Capability	Clarity of Purpose	Clarity of Purpose	Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Economically viable	Management Area Economic Activities	Economically Significant Ecosystem Services	Economic impact Assessments	Severity of the Consequences	Management Plan Costs and Benefits	Economic and Development Monitoring	Economic Ecosystem Services Overview Reports
Tenet 4	Competence and Capability	Clarity of Purpose	Clarity of Purpose	Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Socially desirable/ tolerable	Communities of Interest Representatives	Socially Significant Areas	Social Impact Assessments	Severity of the Consequences	Selection of the Areas to be Protected and Conserved	Monitor Trends Social Values	Cultural Ecosystem Services Overview Reports
Tenet 5	Consistency of Purpose			Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Legally permissible	National and Trans-National Legislation and Policies			Legislative Legal Liabilities and Repercussions	Management Plan Legislative Tools	Regulatory Compliance Verification	Compliance Reports
Tenet 6	Competence and Capability			Competence and Capability	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Administratively achievable	Management Area Governance Structure			Institutional Program Costs and Repercussions	Competent Authorities Agreement	Program Performance Monitoring	Program Priorities and Performance Reports
Tenet 7	Consistency of Purpose			Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Politically expedient	Development Public Policy Mandate Timeframe			Public Policy Implications	Management Strategy Public Policy Endorsement	Monitor Public Policy Trends and Priorities	Public Policy Announcements
Tenet 8	Conformity to Best Practice			Connectivity with Objectives		Certainty of Results	
Ethically defensible	Charter of Rights ISO 26000: Social Responsibility			Human Rights Social Responsibility Implications		Monitor Ethical Concerns	
Tenet 9	Competence and Capability	Clarity of Purpose	Clarity of Purpose	Connectivity with Objectives	Connectivity with Objectives	Certainty of Results	Clear Line of Sight
Culturally inclusive	Traditional Communities Representatives	Culturally Significant Areas	Cultural Impact Assessments	Severity of the Consequences	Selection of the Areas to be Protected and Conserved	Monitoring Trends Traditional Values	Cultural Ecosystem Services Overview Reports
Tenet 10	Conformity to Best Practice	Connectivity with Objectives			Connectivity with Objectives	Clear Line of Sight	Conformity to Best Practice
Effectively communicable	Terms of References Decision Business Rules Advisory Bodies	Management Oversight Stakeholder Advice and Feedback Scientific and Technical Advice			Governance Oversight Stakeholder Feedback	Planning Process Evaluations and Auditing	Communication and Consultation Reporting Procedures

Fig. 15.1 Activities and outputs of the planning process steps in relation to the ten tenets

latory planning processes as well as the implementation of the resulting plans. It aims to avoid an unstructured "muddling through" and associated unintended consequences by defining clear milestones and competencies, providing criteria for decision-making and supporting transparency.

As Barnard and Elliot highlighted (2015), effective environmental management does not simply rely on science underpinning and a participative planning process to address the sustainability concerns of stakeholders. It relies on the management of human activities by the implementation of management practices and measures that operate under voluntary conformity, industry sector standards or legislative compliance. In management, standards and certification play a huge role in a variety of services and industries, particularly in terms of quality management and risk management where most countries have adopted ISO standards as their own. Although most would argue that each planning initiative is unique to the institutional make-up of governance, stakeholder concerns and ecological considerations of the planning area, ISO standards of framework, process and vocabulary can still be adapted to harmonize environmental management across planning process initiatives. The use of international standards, such as the ones available under ISO, can avoid the need to develop a framework and debate definitions that can consume valuable time and use the scarce resources that are usually allocated for these initiatives. In addition to training in the use of these standards that is already available for most ISO standards, standardized frameworks can facilitate knowledge transfer and lessons learnt between initiatives improving future processes. Finally, ISO also provides a suite of standards that can guide and facilitate effectiveness and performance evaluations.

In the marine environment, MSP could greatly benefit from such standards. As these initiatives are just starting to get under way in Europe, they could facilitate and minimize start-up costs and public investment. Give the widespread use of these standards in various countries, they may enhance public trust in environmental management as well as alleviate concerns through a structured process that can educate and inform as well as consult. By tracing environmental impacts from the effects to the causes combined with the effectiveness of management practices, such process may reduce uncertainty for some decisions while providing justification for further research in others. There are also links to MSP evaluation (see Chap. 18 in this book) and benchmarking.

In the future, there may be a need to develop a standard that would be designed specifically for an ecosystem approach to management, particularly in relation to the ever increasing level of human activities in the marine environment. There may also be a need to develop a new educational approach for graduate and post-graduate students as well as training approach for practitioners (see Chap. 19 in this book). For those wishing to pursue a career in environmental planning and management, course curricula and training workshops could bring a broader set of competencies and skills that are not always acquired by existing academic fields of study in the natural sciences, social sciences and economics.

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References

Abspoel, L., Mayer, I., Keijser, X., Fairgrieve, R., Ripken, M., Abramic, A., Kannen, A., Cormier, R., & Kidd, S. (forthcoming). *Does the Helmsman Speak English? Improving Communication in Maritime Spatial Planning with the MSP Challenge Games*. Paper submitted to Marine Policy.

Ackoff, R. L. (1990). Strategy. *System Practice, 3*, 521–524.

Anderson, J. E. (2011). *Public Policymaking: An Introduction* (7th ed.). Boston: Wadsworth Cengage Learning, 342 pp.

Ansong, J., Gissi, E., & Calado, H. (2017). An Approach to Ecosystem-Based Management in Maritime Spatial Planning Process. *Ocean & Coastal Management, 141*, 65–81. https://doi.org/10.1016/j.ocecoaman.2017.03.005.

Anthony, R. N., & Dearden, J. (1980). *Management Control Systems* (4th ed.). Homewood, IL: Richard D. Irwin, Inc.

Aps, R., Fetissov, M., Goerlandt, F., Helferich, J., Kopti, M., & Kujala, P. (2015). Towards STAMP Based Dynamic Safety Management of Eco-Socio-Technical Maritime Transport System. *Procedia Engineering, 128*, 64–73. https://doi.org/10.1016/j.proeng.2015.11.505.

Assmuth, T., Hildén, M., & Benighaus, C. (2010). Integrated Risk Assessment and Risk Governance as Socio-Political Phenomena: A Synthetic View of the Challenges. *Science of the Total Environment, 408*, 3943–3953. https://doi.org/10.1016/j.scitotenv.2009.11.034.

Aven, T. (2015). On the Allegations that Small Risks Are Treated out of Proportion to Their Importance. *Reliability Engineering & System Safety, 140*, 116–121. https://doi.org/10.1016/j.ress.2015.04.001.

Barnard, S., & Elliott, M. (2015). The 10-tenets of Adaptive Management and Sustainability: An Holistic Framework for Understanding and Managing the Socio-ecological System. *Environmental Science & Policy, 51*, 181–191. https://doi.org/10.1016/j.envsci.2015.04.008.

Behn, R. D. (2003). Why Measure Performance? Different Purposes Require Different Measures. *Public Administration Review, 63*, 586–606. https://doi.org/10.1111/1540-6210.00322.

Borja, Á., Ranasinghe, A., & Weisberg, S. B. (2009). Assessing Ecological Integrity in Marine Waters, Using Multiple Indices and Ecosystem Components: Challenges for the Future. *Marine Pollution Bulletin, 59*, 1–4.

Browman, H. I., & Stergiou, K. I. (2004). Perspectives on Ecosystem-based Approaches to the Management of Marine Resources. *Marine Ecology Progress Series, 274*, 269–303.

BSH. (2009). Anlage zur Verordnung über die Raumordnung in der deutschen ausschließlichen Wirtschaftszone in der Nordsee (AWZ Nordsee-ROV) vom 21. September 2009: Raumordnungsplan für die deutsche ausschließliche Wirtschaftszone in der Nordsee.

Christensen, N. L., Bartuska, A. M., Brown, J. H., Carpenter, S., D'Antonio, C., Francis, R., Franklin, J. F., et al. (1996). The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management. *Ecological Applications, 6*, 665–691.

Christie, N., Smyth, K., Barnes, R., & Elliott, M. (2014). Co-location of Activities and Designations: A Means of Solving or Creating Problems in Marine Spatial Planning? *Marine Policy, 43*, 254–261. https://doi.org/10.1016/j.marpol.2013.06.002.

Chun, Y. H., & Rainey, H. G. (2005). Goal Ambiguity and Organizational Performance in U.S. Federal Agencies. *Journal of Public Administration Research and Theory, 15*, 529–557. https://doi.org/10.1093/jopart/mui030.

Ciocoiu, C. N., & Dobrea, R. C. (2007). The Role of Standardization in Improving the Effectiveness of Integrated Risk Management. *Advanced Risk Management,* 1–19.

Conrad, S., & Ferson, S. (1999). Decision Making. *Risk Analysis, 19*, 63–68.

Cormier, R., & Elliott, M. (2017). SMART Marine Goals, Targets and Management—Is SDG 14 Operational or Aspirational, Is 'Life Below Water' Sinking or Swimming? *Marine Pollution Bulletin, 123*, 28–33. https://doi.org/10.1016/j.marpolbul.2017.07.060.

Cormier, R., Elliott, M., & Rice, J. (2019). Putting on a Bow-Tie to Sort Out Who Does What and Why in the Complex Arena of Marine Policy and Management. *Science of the Total Environment, 648*, 293–305. https://doi.org/10.1016/j.scitotenv.2018.08.168.

Cormier, R., Kannen, A., Elliott, M., & Hall. P. (2015). *Marine Spatial Planning Quality Management System*. ICES Cooperative Research Report No. 327. 106 pp.

Cormier, R., Kelble, C. R., Anderson, M. R., Allen, J. I., Grehan, A., & Gregersen, Ó. (2017). Moving from Ecosystem-based Policy Objectives to Operational Implementation of Ecosystem-based Management Measures. *ICES Journal of Marine Science, 74*, 406–413. https://doi.org/10.1093/icesjms/fsw181.

Creed, I. F., Cormier, R., Laurent, K. L., Accatino, F., Igras, J. D. M., Henley, P., Friedman, K. B., Johnson, L. B., Crossman, J., Dillon, P. J., & Trick, C. G. (2016). Formal Integration of Science and Management Systems Needed to Achieve Thriving and Prosperous Great Lakes. *BioScience, 66*, 408–418. https://doi.org/10.1093/biosci/biw030.

DFO. (2014). *Science Advice for Managing Risk and Uncertainty in Operational Decisions of the Fisheries Protection Program*. DFO Canadian Science Advisory Secretariat Science Advisory Report 2014/015.

Douvere, F., & Ehler, C. (2009). New Perspectives on Sea Use Management: Initial Findings from European Experience with Marine Spatial Planning. *Journal of Environmental Management, 90*, 77–88.

Douvere, F., & Ehler, C. (2010). The Importance of Monitoring and Evaluation in Adaptive Maritime Spatial Planning. *Journal of Coastal Conservation, 15*, 305–311.

EC. (2000). European Community. Directive 2000/60/EC of October 23 2000 of the European Parliament and of the Council Establishing a Framework for Community Action in the Field of Water Policy. *Official Journal of the European Communities, L327*, 1–72.

EC. (2008). Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 Establishing a Framework for Community Action in the Field of Marine Environmental Policy (Marine Strategy Framework Directive). OJ L 164, 25.6.2008, p. 19.

EC. (2011). Regulation (EU) No 1255/2011 of the European Parliament and of the Council of 30 November 2011 Establishing a Programme to Support the Further Development of an Integrated Maritime Policy. OJ L 321, 5.12.2011, p. 1.

EC. (2014). Directive 2014/89/EU OF THE European Parliament and of the Council of 23 July 2014 Establishing a Framework for Maritime Spatial Planning. OJ L157. 28.82014, p. 135.

Fletcher, S. (2007). Converting Science to Policy Through Stakeholder Involvement: An Analysis of the European Marine Strategy Directive. *Marine Pollution Bulletin, 54*, 1881–1886. https://doi.org/10.1016/j.marpolbul.2007.08.004.

Fletcher, S., McKinley, E., Buchan, K. C., Smith, N., & McHugh, K. (2013). Effective Practice in Marine Spatial Planning: A Participatory Evaluation of Experience in Southern England. *Marine Policy, 39*, 341–348.

Gardner, D. (2009). *The Science of Fear: How the Culture of Fear Manipulates Your Brain*. London: Penguin Books Ltd.

Gavaris, S. (2009). Fisheries Management Planning and Support for Strategic and Tactical Decisions in an Ecosystem Approach Context. *Fisheries Research, 100*, 6–14. https://doi.org/10.1016/j.fishres.2008.12.001.

Gee, K., Kannen, A., Adlam, R., Brooks, C., Chapman, M., Cormier, R., Fischer, C., Fletcher, S., Gubbins, M., Shucksmith, R., & Shellock, R. (2017). Identifying Culturally Significant Areas for Marine Spatial Planning. *Ocean and Coastal Management, 136*, 139–147.

Girling, P. X. (2013). Operational Risk Management: A Complete Guide to a Successful Operational Risk Framework. 1st ed. Wiley & Sons.

Green, P. E. J. (2015). *Enterprise Risk Management: A Common Framework for the Entire Organization*. Elsevier Inc. 240 pp.

Harremoës, P., & Turner, R. K. (2001). Methods for Integrated Assessment. *Regional Environmental Change, 2*, 57–65. https://doi.org/10.1007/s101130100027.

Holsman, K., Samhouri, J., Cook, G. S., et al. (2017). An Ecosystem-based Approach to Marine Risk Assessment. *Ecosystem Health and Sustainability, 3*, e01256. https://doi.org/10.1002/ehs2.1256.

Hoyle, D. (2011). *ISO 9000 Quality Systems Handbook: Using the Standards as a Framework for Business Improvement* (6th ed.). New York: Routledge. ISBN 978-1-8561-7684-2. 802 pp.

Hupe, P. L., & Hill, M. J. (2016). And the Rest Is Implementation. Comparing Approaches to What Happens in Policy Processes Beyond Great Expectations. *Public Policy and Administration, 31*, 103–121. https://doi.org/10.1177/0952076715598828.

ISO. (2008). Quality Management Systems—Requirements. International Organization for Standardization, Geneva. ISO 9001:2008(E).

ISO. (2018). Risk management—Guidelines (2nd ed.). International Organization for Standardization. ISO 31000:2018(E).

Junier, S. J., & Mostert, E. (2015). The Implementation of the Water Framework Directive in The Netherlands: Does It Promote Integrated Management? *Physics and Chemistry of the Earth, 47–48*, 2–10. https://doi.org/10.1016/j.pce.2011.08.018.

Kannen, A. (2014). Challenges for Marine Spatial Planning in the Context of Multiple Sea Uses, Policy Arenas and Actors Based on Experiences from the German North Sea. *Regional Environmental Change, 14*, 2139–2150.

Leung, W., Noble, B. F., Jaeger, J. A. G., & Gunn, J. A. E. (2016). Disparate Perceptions About Uncertainty Consideration and Disclosure Practices in Environmental Assessment and Opportunities for Improvement. *Environmental Impact Assessment Review, 57*, 89–100. https://doi.org/10.1016/j.eiar.2015.11.001.

Loehle, C. (2006). Control Theory and the Management of Ecosystems. *Journal of Applied Ecology, 43*, 957–966. https://doi.org/10.1111/j.1365-2664.2006.01208.x.

Long, R. D., Charles, A. T., & Stephenson, R. L. (2015). Key Principles of Marine Ecosystem-Based Management. *Marine Policy, 57*, 53–60. https://doi.org/10.1016/j.marpol.2015.01.013.

MacKinnon, A. J., Duinker, P. N., & Walker, T. R. (2018). The Application of Science in Environmental Impact Assessment. Routledge.

Maes, F. (2008). The International Legal Framework for Marine Spatial Planning. *Marine Policy, 32*, 797–810. https://doi.org/10.1016/j.marpol.2008.03.013.

McLeod K. L., Lubchenco J., Palumbi S. R., & Rosenberg A. A. (2005). Scientific Consensus Statement on Marine Ecosystem-Based Management. Signed by 221 academic scientists and policy experts with relevant expertise and published by the Communication Partnership for Science and the Sea. 21 pp.

Mingers, J., & White, L. (2010). A Review of the Recent Contribution of Systems Thinking to Operational Research and Management Science. *European Journal of Operational Research, 207*, 1147–1161. https://doi.org/10.1016/j.ejor.2009.12.019.

MMO. (2014). Guidance: Marine Planning and Development. The 12-stage Process on How a Marine Plan Is Made from Selection to Implementation and Monitoring and How You Can Get Involved. Retrieved from https://www.gov.uk/marine-plans-development.

Moss, B. (2008). The Water Framework Directive: Total Environment or Political Compromise? *Science of the Total Environment, 400*, 32–41. https://doi.org/10.1016/j.scitotenv.2008.04.029.

Olagunju, A. O., & Gunn, J. A. E. (2016). Integration of Environmental Assessment with Planning and Policy-Making on a Regional Scale: A Literature Review. *Environmental Impact Assessment Review, 61*, 68–77. https://doi.org/10.1016/j.eiar.2016.07.005.

Paetzold, A., Warren, P. H., & Maltby, L. L. (2010). A Framework for Assessing Ecological Quality Based on Ecosystem Services. *Ecological Complexity, 7*, 273–281 Elsevier B.V.

Pouyat, R. V. (1999). Science and Environmental Policy-making Them Compatible. *BioScience, 49*, 281–286.

Renn, O. (2008). Concepts of Risk: An Interdisciplinary Review. *GAIA, 17*, 50–66.

Rice, J., Trujillo, V., Jennings, S., Hylland, K., Hagstrom, O., Astudillo, A., & Jensen, J. (2005). Guidance on the Application of the Ecosystem Approach to Management of Human Activities in the European Marine Environment. *ICES Cooperative Research Report, 273*, 1–22.

Slovic, P. (1986). Perception of Risk. *Science, 236*, 280–285.

Soma, K., & Vatn, A. (2014). Representing the Common Goods—Stakeholders vs. Citizens. *Land Use Policy, 41*, 325–333. https://doi.org/10.1016/j.landusepol.2014.06.015.

Stelzenmüller, V., Vega Fernández, T., Cronin, K., Röckmann, C., Pantazi, M., Vanaverbeke, J., Stamford, T., Hostens, K., Pecceu, E., Degraer, S., Buhl-Mortensen, L., Carlström, J., Galparsoro, I., Johnson, K., Piwowarczyk, J., Vassilopoulou, V., Jak, R., Louise Pace, M., & van Hoof, L. (2015). Assessing Uncertainty Associated with the Monitoring and Evaluation of Spatially Managed Areas. *Marine Policy, 51*, 151–162. https://doi.org/10.1016/j.marpol.2014.08.001.

UNCLOS. (1982). United Nations Convention on the Law of the Sea of 10 December 1982. Retrieved 2018-06-07 from http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

Uusitalo, L., Lehikoinen, A., Helle, I., & Myrberg, K. (2015). An Overview of Methods to Evaluate Uncertainty of Deterministic Models in Decision Support. *Environmental Modelling and Software, 63*, 24–31. https://doi.org/10.1016/j.envsoft.2014.09.017.

Veland, H., & Aven, T. (2015). Improving the Risk Assessments of Critical Operations to Better Reflect Uncertainties and the Unforeseen. *Safety Science, 79*, 206–212. https://doi.org/10.1016/j.ssci.2015.06.012.

Vigerstad, T. J., & McCarty, L. S. (2000). The Ecosystem Paradigm and Environmental Risk Management. *Human and Ecological Risk Assessment, 6*, 369–381. https://doi.org/10.1080/10807030091124518.