

Commissioned by



HIGH LEVEL PANEL for
**A SUSTAINABLE
OCEAN ECONOMY**

BLUE PAPER

Integrated Ocean Management

LEAD AUTHORS

Jan-Gunnar Winther and Minhan Dai

CONTRIBUTING AUTHORS

Fanny Douvere, Leanne Fernandes, Patrick Halpin, Alf Håkon Hoel, Marie Antonette Juinio-Meñez, Yangfan Li, Karyn Morrissey, Therese Rist, Fabio Rubio Scarano, Amy Trice, Sebastian Unger and Sandra Whitehouse

About the High Level Panel for a Sustainable Ocean Economy

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) is a unique initiative by 14 world leaders who are building momentum for a sustainable ocean economy in which effective protection, sustainable production and equitable prosperity go hand in hand. By enhancing humanity's relationship with the ocean, bridging ocean health and wealth, working with diverse stakeholders and harnessing the latest knowledge, the Ocean Panel aims to facilitate a better, more resilient future for people and the planet.

Established in September 2018, the Ocean Panel has been working with government, business, financial institutions, the science community and civil society to catalyse and scale bold, pragmatic solutions across policy, governance, technology and finance to ultimately develop an action agenda for transitioning to a sustainable ocean economy. Co-chaired by Norway and Palau, the Ocean Panel is the only ocean policy body made up of serving world leaders with the authority needed to trigger, amplify and accelerate action worldwide for ocean priorities. The Ocean Panel comprises members from Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau and Portugal and is supported by the UN Secretary-General's Special Envoy for the Ocean.

The Ocean Panel's approach is both ambitious and practical. Collaborative partnerships are essential to converting knowledge into action. To develop a common understanding of what a sustainable ocean economy looks like, the Ocean Panel gathers input from a wide array of stakeholders, including an Expert Group and an Advisory Network. The Secretariat, based at World Resources Institute, assists with analytical work, communications and stakeholder engagement.

In the spirit of achieving the UN Sustainable Development Goals (SDGs), providing value to the UN Decade of Ocean Science for Sustainable Development and meeting the objectives of the Paris Agreement, the Ocean Panel commissioned a comprehensive assessment of ocean science and knowledge that has significant policy relevance. This includes a series of 16 Blue Papers and various Special Reports that offer a synthesis of knowledge, new thinking and perspectives, and opportunities for action. This body of work is informing a new ocean narrative in the forthcoming Towards a Sustainable Ocean Economy report. Together, this research and new narrative serve as inputs to the Ocean Panel's deliberations for its forthcoming action agenda.

Ultimately, these papers are an independent input to the Ocean Panel process and do not necessarily represent the thinking of the Ocean Panel, Sherpas or Secretariat.

Suggested Citation: Winther, J-G., M. Dai, et al. 2020. *Integrated Ocean Management*. Washington, DC: World Resources Institute. Available online at www.oceanpanel.org/blue-papers/integrated-ocean-management

Table of Contents

Foreword.....	1
Highlights	2
1. Introduction.....	3
2. The Concept of Integrated Ocean Management	7
3. The Implementation of Integrated Ocean Management.....	10
4. Integrated Ocean Management in Practice	15
5. Conclusions and Opportunities for Action	31
References	35
Endnotes	37
List of Abbreviations	37
Acknowledgements	38
About the Authors	38

Foreword

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) commissioned us, the co-chairs of the Ocean Panel Expert Group, to produce a series of Blue Papers to explore pressing challenges at the nexus of the ocean and the economy to ultimately inform a new ocean report and the Ocean Panel's action agenda. The Ocean Panel identified 16 specific topics for which it sought a synthesis of knowledge and opportunities for action. In response, we convened 16 teams of global experts—over 200 authors from nearly 50 countries—who reviewed and analysed the latest knowledge. They then provided new thinking and perspectives on how technology, policy, governance and finance can be applied to catalyse a more sustainable and prosperous relationship with the ocean. In short, these Special Reports and Blue Papers provide the information needed to transition to a sustainable ocean economy.

The Expert Group, a global group of over 70 experts, is tasked with helping to ensure the high quality and intellectual integrity of the Ocean Panel's work. All Blue Papers are subject to a rigorous and independent peer-review process. The arguments, findings and opportunities for action represent the views of the authors. The launches of these papers, which are taking place between November 2019 and October 2020, create opportunities for exchange and dialogue between political leaders, policymakers, the financial community, business leaders, the scientific community and civil society.

A growing ocean economy creates both opportunities and challenges for the future. As the pressure on the ocean is amplified—by increased human uses, climate change, loss of biodiversity and pollution—the discrepancy between short-term economic gain or immediate needs versus long-term prosperity from a healthy ocean providing sustained benefits becomes increasingly apparent. Integrated ocean management (IOM) provides an understanding of the breadth of options for ocean uses and a means to evaluate priorities and trade-offs among those options. This Blue Paper provides an overview of how the framework of IOM has been established at global, regional and national levels and assesses what is lacking in terms of framework and implementation. The paper identifies the avenues and opportunities for action to achieve successful IOM and a sustainable ocean economy. We are pleased to share this paper.

As co-chairs of the Expert Group, we are excited to share this paper and wish to warmly thank the authors, the reviewers and the Secretariat for supporting this research. We are also grateful for the vision of the Ocean Panel members in commissioning this important body of work. We hope they and other parties act on the opportunities identified in this paper.



Hon. Jane Lubchenco, Ph.D.
Oregon State University



Professor Peter Haugan, Ph.D.
Institute of Marine Research, Norway



Hon. Mari Elka Pangestu, Ph.D.
University of Indonesia

Highlights

- The foundation of a sustainable ocean economy is healthy, productive and resilient marine ecosystems. Currently, our ocean is under pressure from the diversity and multitude of human activities, driven by our need for food, energy, transportation and recreation. These pressures are amplified by climate change, loss of biodiversity and pollution. Despite progress on some fronts, the current trajectory is in the wrong direction and rapidly growing more serious.
- Efforts to implement effective sectoral management of ocean-based human activities and address issues such as climate change are necessary but insufficient for achieving a sustainable ocean economy. Integrated ocean management (IOM) is essential.
- Extensive and diverse experiences with IOM provide a wealth of models, best practices and guidance for success. Common features of success include harnessing science and knowledge, establishing partnerships between public and private sectors, engaging relevant stakeholders through legitimate processes, improving capacity building, implementing regulatory frameworks and developing adaptive management systems.
- It is vital to strengthen our knowledge about the ocean by developing and disseminating new data as well as better using existing knowledge, including traditional knowledge. We urge policymakers to further develop international cooperation in marine science and related sciences by building on established structures such as the Intergovernmental Oceanographic Commission and using the United Nations (UN) Decade of Ocean Science for Sustainable Development as a vehicle for this.
- Private businesses are central for achieving a sustainable ocean economy. Ocean-related businesses at all scales should be encouraged to cooperate in developing principles and guidelines for sustainable conduct. For example, the UN Global Compact's Sustainable Ocean Business Action Platform, which has developed principles and guidelines for sustainable ocean business that several of the world's largest ocean-related businesses have signed on to, can serve as an inspiration. This can help ensure IOM takes place across all sectors of ocean business, and through partnerships between the private and public sectors.
- Another avenue for success is stakeholder engagement and stewardship. In all stages of developing and implementing IOM, governments should ensure transparency and the active involvement of local communities and other relevant stakeholders. In designing well-managed engagement processes, it is vital to consider the scientific, cultural, societal, economic and political contexts.
- One obvious opportunity for action is for each nation, or regions with multiple nations, to develop IOM that is appropriate for their circumstances. Capacity building is key for achieving IOM in all parts of the world. It is well-documented that scientific capacity is inadequate in many countries, and that lack of institutional capacity is also a challenge. Nations and other entities that have pursued IOM must share their experiences, and regional cooperation can therefore accelerate capacity building. Successful regional efforts at IOM should inspire similar efforts in other regions.
- Failure to implement existing international instruments is one of the most important weaknesses of our ocean governance systems. It is vital to have mechanisms in place not just to develop IOM plans, but also to implement them. States need to ensure effective implementation of international agreements. Regulations for managing human activities in the high seas should be compatible with and at least as strict as those that are applied in areas under national jurisdiction.
- One of the most serious challenges facing our ocean today is climate change. This also highlights the dynamic nature of the ocean, which calls for adaptive and holistic ocean management. A static approach in, for example, establishing marine protected areas, may—due to climate change—lose its efficiency over time. Ocean governance must therefore consider expected changes in the marine environment and in human interactions with the ocean, by using the best available scientific knowledge on climate change and including adaptive mechanisms as a vital part of IOM.

1. Introduction

With the unprecedented growth in economic activities relating to the ocean economy, the need for a sustainable concept where socioeconomic development can occur without environmental degradation is widely recognised. This is manifested at the global level by the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which provides the basic global framework for ocean governance (United Nations 1982). Since then, the ocean economy has continued to grow alongside our need for food, energy, transportation and recreation from the ocean. Existing ocean industries expand while new ones appear. At the same time, new challenges are emerging as a result of climate change, loss of biodiversity, pollution and extractive activities. Our ocean is now facing these pressures at unprecedented rates and magnitudes. The mismatch between the drive for short-term economic gain versus long-term prosperity and a healthy, resilient ocean is increasingly apparent. As a result, we see a pressing need for holistic, knowledge-based and ecosystem-based approaches to ocean management. Integrated ocean management (IOM) is such an approach.

IOM considers multiple uses and pressures simultaneously and helps reconcile competing uses with the objective of ensuring the sustainability of societies and marine ecosystems. The need for a comprehensive perspective on the management of marine ecosystems and their resources was observed many years ago (e.g. Underdal 1980) and is now widely recognised at the global as well as regional and national levels of governance. There are, however, still many challenges relating to the implementation of existing governance frameworks, including knowledge and capacity shortages, incomplete legislation, lack of enforcement, poor coordination among ministries and other government bodies, and no overarching mandate across ministries or mechanisms to harmonise conflicting mandates among ministries.

The goal of IOM is to support a ‘sustainable ocean economy’: long-term, sustainable use of ocean resources in ways that preserve the health and resilience of marine ecosystems and improve livelihoods and jobs, balancing protection and production. IOM brings together relevant actors from government, business, academia and civil society from the entire spectrum of ocean-related human activities (e.g. petroleum, fishing, aquaculture, shipping, tourism, mining, renewable energy, conservation) to collaborate toward a sustainable future for our ocean environment. Here, ‘ocean’ refers to both marine and coastal areas. The functions of IOM include promoting environmentally sound economic development, protecting coastal and marine habitats and biodiversity, providing ecosystem services and balancing and deconflicting interests through spatial planning. IOM also addresses issues such as the conservation of coastal and marine habitats and biodiversity, protection of coastal and marine environments from land-based pollution, fisheries and tourism, as well as impacts from climate change such as sea level rise, ocean warming and deoxygenation, ocean acidification, changing storm intensities and more. IOM is a dynamic process, building on existing initiatives and bringing industries and sectors together, whether under the umbrella of marine spatial planning, ecosystem-based management or others. Biodiversity, intact habitats and ecosystem functioning are essential to a healthy, productive and resilient ecosystem. A comprehensive toolbox of measures to accomplish this exists, including area-based management measures.

The purpose of this paper is to provide an overview of how the framework of IOM is established at different levels of governance and what is lacking in terms of both frameworks and implementation. Implementation failure is a key issue for IOM, and we discuss cases of IOM from different parts of the world to exemplify this. While these lessons learned are useful for further developing

IOM, we also recognise that successful implementation is highly context dependent, making capacity building and location flexibility critical to achieving effective IOM globally.

This paper is written as an input to the work of the High Level Panel for a Sustainable Ocean Economy. It begins by outlining the concept of IOM, explaining its key components and providing an overview of the global

ocean governance framework. The paper continues by discussing IOM both in the exclusive economic zones and in areas beyond national jurisdiction. This is followed by a discussion of IOM implementation—both its challenges and the key components for success. Next, we present selected case studies of IOM in practice. To conclude, the paper offers opportunities for action on how IOM can contribute to a sustainable ocean economy.

Box 1. Integrated Ocean Management and Related Planning and Management Approaches

To discuss integrated ocean management (IOM) further, it is vital to define a few central terms that are often associated with IOM. The below list is not exhaustive but demonstrates the variety of means that have evolved to achieve smart planning and management in coastal and marine areas. IOM uses a variety of these tools to ensure the sustainability of marine ecosystems. These ideas, terms and concepts have evolved through time and have had different histories in different places. They are not necessarily interchangeable, and they often overlap.

Ecosystem-based management

Ecosystem-based management (EBM), also referred to as an ‘ecosystem-based approach’, is central to IOM and defined as management of natural resources focusing on the health, productivity and resilience of a specific ecosystem, group of ecosystems or selected natural assets as the nucleus of management (Domínguez-Tejo et al. 2016). EBM is a management approach that recognises the full array of interactions within an ecosystem, including with humans, and drives the integration of management planning and implementation across sectoral agencies. Focusing on recognising connections and ensuring coherence, EBM differs from historical approaches that focus on a single species, sector, activity or concern, considering the cumulative impacts of different factors. Specifically, ecosystem-based management has the following features:

- Emphasis on the protection of ecosystem structure, functioning and key processes
- Accounts explicitly for the interconnectedness within systems, recognising the importance of interactions between many target species or key services and other non-target species
- Acknowledgement of the interconnectedness among systems, such as that among air, land and sea
- Integration of ecological, social, economic and institutional perspectives, recognising their strong interdependencies
- Focused on a specific ecosystem and the range of human activities affecting it

Integrated coastal zone management

Integrated coastal zone management (ICZM) is ‘the process of managing the coast and nearshore waters in an integrated and comprehensive manner with the goal of achieving conservation and sustainable use’ (Katona et al. 2017). It is also called ‘integrated coastal management’.

Box 1. Integrated Ocean Management and Related Planning and Management Approaches (Cont'd)

ICZM covers the full cycle, including information collection, planning, decision-making, management and implementation. The approach seeks informed participation and cooperation from all relevant stakeholders. It seeks integration of the goals and instruments needed to meet these objectives; of different policy areas, sectors and levels of administration; and of the land and sea components of the target area.

Marine spatial planning

Marine spatial planning (MSP) is used to create geospatial plans that identify what spaces of the ocean are appropriate for different uses and activities. These plans have similarities with sustainable ocean economy plans, which describe how to sustainably use the ocean and its resources to advance economic and social development.

Marine spatial planning (also known as 'maritime spatial planning' and 'coastal and marine spatial planning') extended the ICZM approach further out to sea in the 2000s. Marine spatial planning aims to create a framework for the ocean that minimises conflicts between economic sectors and maintains 'good environmental status' of the ocean through the identification of ocean spaces that are appropriate for different uses and activities. MSP is increasingly seen as a practical way to create and establish a more rational organisation of the use of marine space and the interactions between its uses, to balance demands for development with the need to protect marine ecosystems and to achieve social and economic objectives in an open and planned way. MSP is widely used for setting targets for and implementing ecosystem-based management (Katona et al. 2017). The characteristics of effective marine spatial planning include the following:

- Ecosystem-based, balancing ecological, economic and social goals and objectives toward sustainable development
- Integrated across sectors, agencies and levels of government
- Area-based
- Adaptive and capable of learning from experience
- Strategic and anticipatory, focused on the long term
- Focused on participation, with stakeholders actively involved in the process

Adaptive ocean management

Adaptive ocean management is 'a systematic process for continually improving management policies and practices toward defined goals by learning from the outcomes of previous policies and practices' (Katona et al. 2017). It recognises the inherent variability and dynamic nature of the ocean in terms of its bio-chemo-physical properties and social and economic factors in addition to scientific uncertainties. By scheduling periodic reviews of and updates to management plans, in addition to adding ad hoc opportunities for responding to unexpected events, adaptive ocean management acknowledges that changes in conditions and knowledge are likely.

Box 1. Integrated Ocean Management and Related Planning and Management Approaches (Cont'd)

Area-based measures including marine protected areas

Area-based measures are important tools in the management of the ocean and seas and can be used in all approaches outlined here. A marine protected area (MPA) is ‘a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’ (Oregon State University et al. 2019). Likely developed independently in many cultures, area-based measures are a regulatory tool for conserving the natural or cultural resources of the ocean and for managing human uses.

If managed in isolation, coastal and marine protected areas are vulnerable to the impacts of resource development and exploitation occurring outside these areas, in particular overfishing, alteration and destruction of habitats, climate change and marine pollution. Thus, protecting coastal and marine areas—including species, habitats, landscapes and seascapes—should be integrated into spatial development strategies for larger areas, under the umbrella of integrated coastal and ocean management, including land-ocean interactions.

2. The Concept of Integrated Ocean Management

This chapter outlines the global governance framework. International ocean governance is based on coastal states¹ jurisdiction over their 200 nautical mile exclusive economic zones (EEZs). The authority to manage the EEZs and activities rests with (often multiple) agencies and the laws governing those agencies. While useful for efficient management, divisions of authority over different activities and zones can create challenges for oversight and coordination and thus limit holistic approaches to management. It is therefore important to identify and harmonise the possibly conflicting mandates of different agencies, as well as cover the gaps where no agency or entity is responsible. As pressures on the ocean increase, assessing the cumulative impacts of increasing uses and pressures also becomes increasingly important.

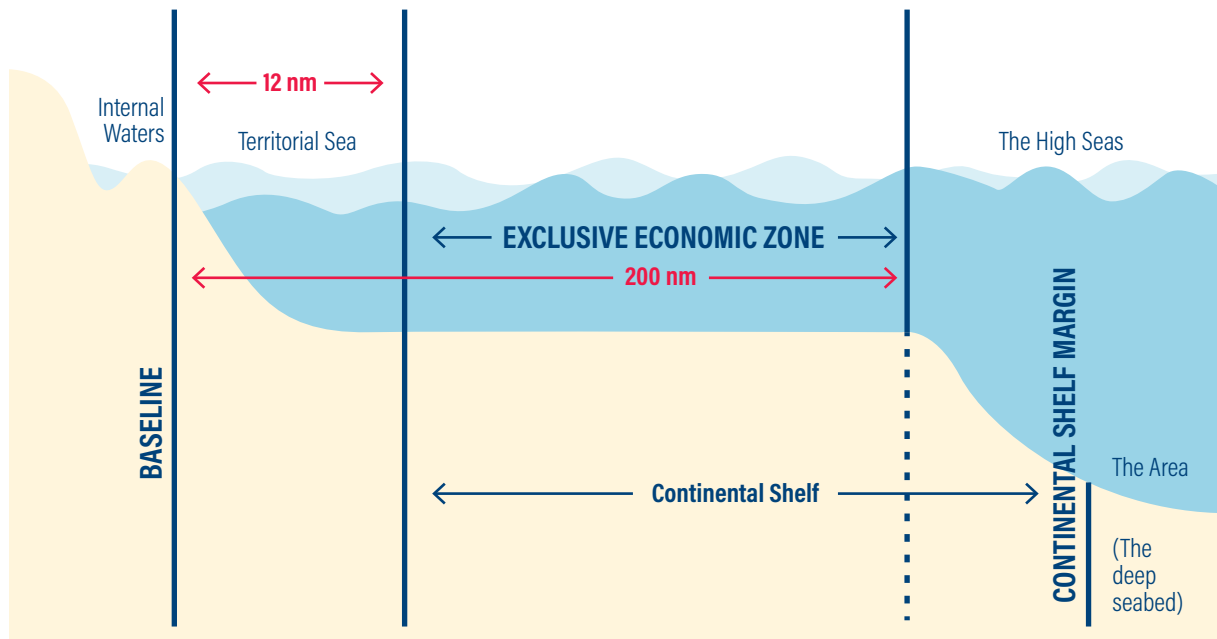
The purpose of IOM is to enhance our ability to use and manage ocean resources sustainably, and ensure that the health, productivity and resilience of ocean ecosystems, which provide multiple benefits to humans, are not impaired by human activities. Examples of some supporting, regulating and cultural ecosystem services provided by ocean ecosystems include partial climate regulation, control of pests and pathogens, nutrient cycling, primary production, cultural identity, inspiration and recreation. Management institutions need to effectively measure, monitor and manage ocean space adaptively as complex adaptive systems (Lubchenco et al. 2016). To achieve this, incorporating participation from governance institutions, academic knowledge (multidisciplinary), other knowledge (transdisciplinary) and multiple stakeholder interests is crucial. Therefore, we argue that stakeholder involvement, the effective use of science and capacity building are keys to achieving real integration.

2.1 The Global Ocean Governance Framework

Responding to technological developments, increasing demands for natural resources and a growing use of ocean space for human activities, the global framework for ocean governance has evolved significantly over the last decades. The centrepiece of this framework is the UN Convention on the Law of the Sea—‘the constitution of the ocean’—which was negotiated between 1973 and 1982 and entered into force in 1994 (United Nations 1982). UNCLOS states in its preamble that ‘the problems of ocean space are closely interrelated and need to be considered as a whole’. The convention aims to establish ‘a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment’. As of 2019, 168 countries are parties to the convention. The implementation of UNCLOS is overseen by the UN General Assembly, which adopts annual resolutions on the ocean and the law of the sea addressing a comprehensive range of issues relating to the implementation of the convention.

UNCLOS establishes a legal order for the ocean where coastal states can exert sovereign rights over the natural resources in a 200 nautical mile exclusive economic zone and on the continental shelf also beyond 200 nautical miles (Figure 1). Where continental shelves extend beyond 200 nautical miles, their outer limits are established based on recommendations of the Commission on the Limits of the Continental Shelf. The mineral resources at the deep seabed beyond national

Figure 1. Maritime zones as defined by the UN Convention on the Law of the Sea



Source: Anders Skoglund, Norwegian Polar Institute 2020.

jurisdiction ('the Area') are considered the common heritage of mankind, and the International Seabed Authority (ISA) is tasked with their management. The ISA is currently responsible for developing regional environmental management plans for deep-sea mining regions. The International Tribunal for the Law of the Sea is one of several options for resolving disputes.

To provide guidance on the implementation of the convention, implementation agreements have been negotiated for deep seabed minerals (United Nations 1994) and fisheries (United Nations 1995). The latter require application of a precautionary approach to fisheries management and regional cooperation in the management of fisheries on the high seas. In response to growing concerns related to conservation and use of marine biodiversity, a third implementation agreement is under negotiation, addressing area-based management, marine genetic resources, environmental impact assessments and technology transfers, and capacity building for the areas beyond national jurisdiction. Governance bodies are also in place for specific themes. For example, the International Maritime Organization (IMO) regulates the shipping industry. IMO has adopted

a number of international agreements setting out the standards for the industry related to the environment, operations and labour, among others.

In fisheries, additional layers of governance to the convention and the 1995 implementing agreement are provided by agreements adopted by the UN Food and Agriculture Organization (FAO) that address the ecosystem effects of fishing as well as the need to confront illegal activities. One example of this is the 2009 *Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing* (FAO 2009). Regional cooperation is important in the management of transboundary fish stocks on the high seas, with about 20 regional fisheries management organisations providing international cooperation for the management of such stocks.

Separately, many environmental concerns are addressed in instruments relating to various types of pollution, climate change (e.g. the United Nations Framework Convention on Climate Change) and the 1992 Convention on Biological Diversity at global as well as regional levels of governance. This includes the UN Environment Programme (UNEP) and its regional seas programmes.

International cooperation in marine science is centred around the Intergovernmental Oceanographic Commission (IOC) and the Regular Process under the UN General Assembly at the global level, as well as in several regional bodies such as the International Council for the Exploration of the Sea (ICES) in the North Atlantic, and the North Pacific Marine Science Organization (PICES).

With increasing uses and pressures on the ocean and its ecosystems, concern for the cumulative impact on marine ecosystems has grown. UNCLOS explicitly recognises this concern. Various efforts have been made to address these issues; however, solutions are often insufficient to address the accelerating challenges facing the ocean, such as biodiversity depletion and plastic pollution. Several global summits, such as the 2012 Rio Conference and its 'The Future We Want' declaration, have highlighted the need to consider the total impacts of ocean use.

The World Ocean Assessment of the Regular Process to assess the status of the marine environment under the UN General Assembly concluded with the following in its first report (United Nations 2015):

The sustainable use of the ocean cannot be achieved unless the management of all sectors of human activities affecting the ocean is coherent. Human impacts on the sea are no longer minor in relation to the overall scale of the ocean. A coherent overall approach is needed. This requires considerations of the effects on ecosystems of each of the many pressures, what is being done in other sectors and the way that they interact.

The annual UN General Assembly resolutions on the ocean and law of the sea address these issues and have done so since 1999 in what constitutes a de facto global ocean coordination. The preamble of the 2018 resolution states the following:

... the problems of ocean space are closely interrelated and need to be considered as a whole through an integrated, interdisciplinary and intersectoral approach, and reaffirming the need to improve cooperation and coordination at the national, regional and global levels, in accordance with the Convention, to support and supplement the efforts of each State in promoting the

implementation and observance of the Convention and the integrated management and sustainable development of the oceans and seas . . .

Also, as a follow-up to the Millennium Development Goals, the UN General Assembly in 2015 adopted 17 Sustainable Development Goals (SDGs) as part of the 2030 Agenda. Several of the SDGs are relevant to the ocean and contain specific targets and timetables for achieving them. Goal 14, 'Life below water', addresses marine issues specifically. This goal provides opportunities to facilitate concrete actions for ocean sustainability and to foster greater integration among the sectors of ocean governance.

It is, however, evident that the implementation of the global governance framework leaves a lot to be desired. In some regions, pollution levels (from toxins, nutrients and plastic) are high, about one-third of the world's fish stocks are overfished, illegal fishing is a serious problem and the ocean is increasingly impacted by the effects of increased emissions of anthropogenic carbon dioxide such as warming, acidification and deoxygenation. As coastal states' abilities and capacities to implement existing rights and obligations are hampered by inadequate science and weak and poorly enforced regulatory frameworks, it is widely recognised that institutional capacity building is a critical factor to strengthen ocean governance. Capacity building is therefore now at the forefront of the global ocean debate and on the agendas of the UN General Assembly and subsidiary bodies such as the FAO and the IOC. The 2005 Millennium Ecosystem Assessment and the 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' global assessment of biodiversity provide further understanding of why we should care about biodiversity and what the major drivers of change are.

Integrated ocean management can be implemented across several ocean economy sectors, jurisdictions and spatial scales. These applications may take the form of localised ocean management within national waters, sector-defined ocean management across adjacent jurisdictions, at regional seas or at ocean basin scales, or international ocean management occurring across large ocean areas in areas beyond national jurisdiction, including in the Area (i.e. the deep seabed beyond national jurisdiction).

3. The Implementation of Integrated Ocean Management

This chapter analyses the challenges of implementing IOM and identifies key components of success. It continues by discussing how IOM can contribute to a healthy, productive and resilient ocean for long-term, sustainable economic growth. It highlights the need to calibrate the sophistication of management plans to the situation at hand, authority and political will, available data and societal values. It concludes by arguing that supplementing sector-based management with collaborative and coordinating mechanisms across sectors would be highly beneficial.

The rising demand for various uses of ocean space increases the complexity in modern ocean governance and management, and thus calls for better coordination among sectors and other stakeholders (Klinger et al. 2018). In some countries, the legal and institutional arrangements that divide ocean management are long-standing and the legal mechanisms to coordinate these arrangements at the domestic level as well as with adjacent nations are lacking. This makes it difficult to account for the cumulative effects—including those over time—of economic development, management and environmental change on marine ecosystems. Overcoming such institutional barriers requires political will from government leaders as well as from businesses and civil societies across all sectors of human activity. For the benefit of both human and natural resource values, a defined mechanism to coordinate sector management and enhance collaboration within and among countries is essential for defining and advancing IOM. A complex adaptive systems lens has thus emerged as a new approach to help identify key indicators to refine IOM. The rapidly growing data and knowledge about our ocean will clearly add feasibility in this regard.

3.1 Components of Successful IOM

Every IOM plan depends on the country or region, as specific problems, challenges and institutional conditions vary and are highly context dependent. However, regardless of the legal underpinning of IOM, experience demonstrates that the following components are important:

- A survey of the existing institutional structures within a given context, including an assessment of agency authorities, how they overlap and their regulatory responsibilities
- An evaluation of the current situation, variations and future trends in the environment and ecosystem by examining the available data and scientific knowledge, and initiation of science and monitoring programmes for establishing and maintaining marine data
- An assessment of human activity information and trends, including conflicts of interest and cumulative impacts
- Engagement of relevant ocean user groups

These components must be structured thoughtfully for IOM to be effective. More importantly, every integrated ocean management plan should be specific to the country or region. The variation in institutional conditions and challenges also underlines the importance of local capacity building, particularly to enable the collection and adequate use of marine data and transformation of these data into useful information and knowledge.

3.1.1 Institutional structures

A legal structure can provide direction for IOM within or among nations, thus creating the context for defining and advancing cross-sectoral, long-term, ocean-related goals and objectives. In many cases this is absent, and alternatives such as interpreting existing law to take an integrated management approach, adding provisions to existing laws, issuing an administrative order or finding other mechanisms can also be effective. At the regional level, the European Union (EU) created the 2008 Marine Strategy Framework Directive (European Union 2008). This is an EU legal instrument that provides a framework and requirements for member countries to implement marine plans aiming for 'good environmental status' by 2021. A different example is from U.S. state Massachusetts, which created legislation with the Oceans Act of 2008 that provided authority and direction to create an ocean plan (Commonwealth of Massachusetts 2008). This act also provided guidance and identified representation categories for who should serve on the science and policy advisory bodies that made recommendations as the management plan was developed.

Reinterpreting or adding to existing legislation, or finding other mechanisms such as administrative orders and directives to establish authority for IOM, can facilitate improved coordination and supplement the sector-by-sector approach. The Netherlands took the reinterpretation-of-existing-law approach as it developed an integrated ocean management plan for its nearshore areas through an Inter-Ministerial Consultation Body for the North Sea involving all relevant ministries, such as defence, transport, public works and water management, economic affairs and the environment (Douvere and Ehler 2009). U.S. state Rhode Island voluntarily developed an ocean plan in partnership with the federal government that implements ecosystem-based management principles by reinterpreting the state Coastal Resources Management Council's authorising legislation within the national Coastal Zone Management Act (CZMA). The plan was approved by the National Oceanic and Atmospheric Administration's Office for Coastal Management, which enhances the state's influence in federal waters through the Federal Consistency provisions in the CZMA.

Legislative provisions can also be added to existing law to establish authority and provide clarity for developing a more holistic management process. This can potentially be achieved by adding provisions to legislation that regulates new ocean uses to make IOM a requirement for new development to be permitted. These provisions can include making strategic environmental assessments a requirement. Developing directive language that ensures positive outcomes for the regulated sector for which the original legislation was written is necessary to demonstrate the added value of requiring a more integrated approach with other sectors.

Administrative orders or directives can also be used to define a framework for coordinated management. These directives may articulate high-level targets and leave the definition of specific management goals and objectives to relevant regulatory agencies or planning entities. This approach was taken by the United States for its entire EEZ through an executive order from the president that instructed federal agencies to coordinate with state and tribal authorities to develop regional ocean plans for each Large Marine Ecosystem in U.S. waters (Executive Office of the President 2010; Lubchenco and Sutley 2010). The executive order provided a clear overarching mandate: to protect and restore ocean ecosystems to a healthy, productive and resilient state. Two regions, the Northeast and Mid-Atlantic, successfully completed and are implementing their regional ocean plans. Norway is another example demonstrating that IOM does not have to be grounded in law if political authority is provided. Norway's integrated management plan is based on mapping and assessing the status of marine ecosystems, identifying ecologically valuable and vulnerable areas and setting conditions for the use of ocean space including for the petroleum industry (Norwegian Ministry of the Environment 2006). These examples are further explored later in this paper.

It is recognised, however, that a comprehensive legal regime alone is not enough to achieve the desired outcome when, for example, illicit activities or lacking enforcement or capacity create a gap between the legal framework and reality.

3.1.2 Ocean and coastal data and use of science

Many countries do not have enough monitoring and scientific capacity to provide the knowledge foundation required to implement the international governance frameworks they are bound by. The 2017 Global Ocean Science Report demonstrated clearly that many countries lack fundamental scientific capacity to underpin their efforts at ocean governance (IOC-UNESCO 2017). Scientific capacity to assemble the information required to manage the ocean's ecosystems and economic activities and establish regulatory measures needs to be developed. New technologies have revolutionised how governments can monitor and police inappropriate behaviour at sea. Global Fishing Watch, offering near real-time tracking of fishing activity via a public map, is an example of how new technologies and transparency can lead to improved means for sustainable governance. If such tools are combined with coordinated policing efforts and effective prosecution, they can become very powerful.

In developing IOM, it is critical to take a systematic approach to building scientific capacity that addresses the needs in the regions concerned. Capacity building needs to remain at the top of the international agenda. Regional solutions do have the potential to be effective, as demonstrated by ICES in the North Atlantic. Regional cooperation can help pool resources for IOM and facilitate the sharing of experiences. The UN Decade of Ocean Science for Sustainable Development (2021–2030) could be a suitable process and platform to accelerate the development and use of ocean science. The purpose of the UN Decade is to provide a common framework to ensure that ocean science can fully support countries' actions to sustainably manage the ocean and achieve the 2030 Agenda for Sustainable Development.

Furthermore, we recognise the extensive knowledge on the ocean that already exists. Thus, there is a need to not only foster new science but also use existing and historical information—and lack of data should not limit action. There must be explicit mechanisms in place in

the IOM decision-making process to make use of existing science. A body of knowledge, for reference, exists on how to cope with data-poor situations in managing, for example, fisheries (Pilling et al. 2008). Incorporating traditional knowledge into the management process must also be a priority. The challenge is to integrate new information while simultaneously managing a dynamic ocean environment within IOM.

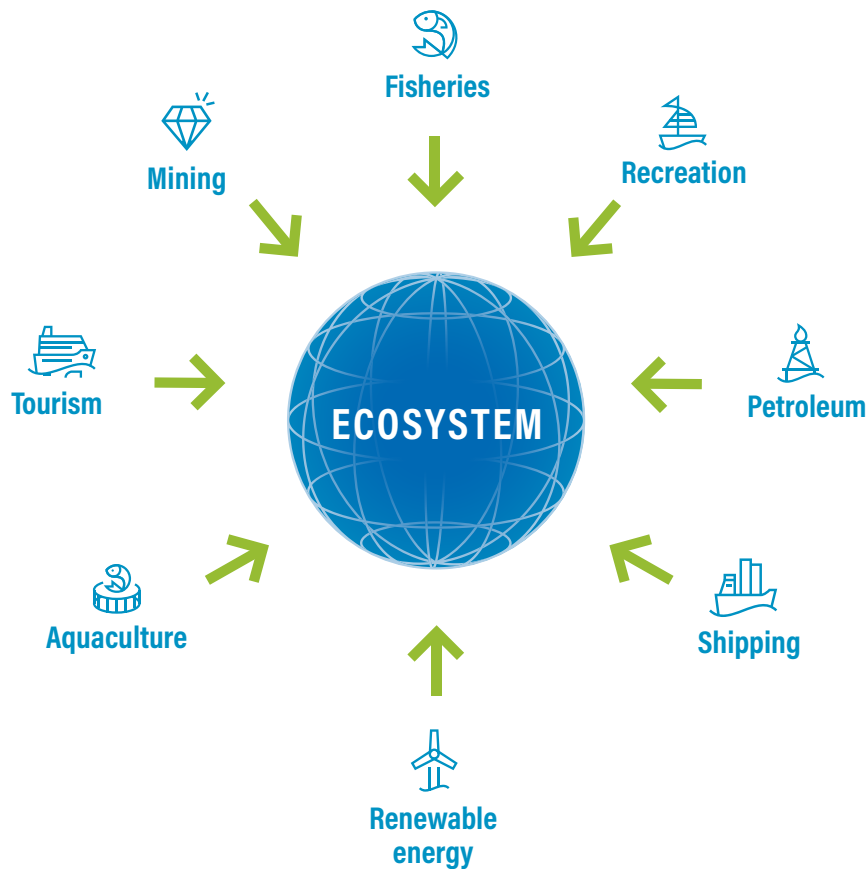
3.1.3 Engagement of relevant user groups

Planning at the local level, especially in developing countries and small island developing states (SIDS), requires taking approaches tailored to the diverse environmental, socioeconomic and governance systems in those regions. Incorporating local knowledge can ensure active community participation to develop appropriate strategies for IOM. Participatory approaches have proven to be effective at the local level for all phases of establishing and operating ocean governance. However, even with thorough planning, implementation remains constrained. Scaling up and reorienting local actions to larger-scale activities, governance regimes at national and regional levels and appropriate ecological scales are important and difficult and require specific time and resources in themselves (Figure 2).

In the context of IOM, it is particularly important to engage ocean businesses at the global, national and local levels. There are different ways of organising this, and recent years have seen several cases of ocean businesses joining forces for sustainability. One example is the UN Global Compact Action Platform for Sustainable Ocean Business, which has developed principles and guidelines for sustainable ocean businesses—several of the largest ocean-related businesses globally have signed on to it.

As will be demonstrated by the case studies later in this paper, while successful engagement processes will vary as they take into account the local context, engaging relevant user groups is always a central component of successful IOM.

Figure 2. The Ecosystem is at the Core of Integrated Ocean Management



Note: An ecosystem- and knowledge-based integrated ocean management ensures a sustainable ocean economy. Stakeholder engagement is key. Source: Centre for the Ocean and the Arctic, Norway 2019.

3.2 The Case of the ‘Collective Arrangement’: Toward IOM in Area-Based Management in Areas beyond National Jurisdiction

The development of integrated ocean management approaches in areas beyond national jurisdiction (ABNJ) is hindered by legal gaps in the global ocean governance framework. One of the key functions of the new global agreement for the conservation and sustainable use of marine biological diversity beyond national jurisdiction (BBNJ) is to provide a legal framework for the development of a comprehensive approach to area-based management, including marine protected areas (Gjerde et al. 2019).

One of the few examples of how integrated approaches in area-based management in ABNJ can be developed is the ‘Collective Arrangement’ between the OSPAR Commission and the North East Atlantic Fisheries Commission, or NEAFC (NEAFC and OSPAR 2014). The objective of the Collective Arrangement is to facilitate cooperation on area-based management between legally competent organisations for the conservation and sustainable use of marine resources in the Northeast Atlantic. In 2010, the OSPAR Commission established the world’s first network of marine protected areas in ABNJ. But OSPAR does not have the mandate to establish legally binding measures to regulate human activities such as fisheries, shipping or, in the future, deep seabed mining. However, in a parallel process, NEAFC as the competent organisation for fisheries management

has closed fisheries to protect vulnerable marine ecosystems in broadly the same areas (Kvalvik 2011). Both organisations received scientific advice from ICES leading to a coherent approach in establishing those area-based measures. To facilitate future coordination and cooperation in the region, OSPAR and NEAFC set up the Collective Arrangement—which includes regular meetings between the parties and exchanges of relevant information and planned activities—and invited others, including the IMO and ISA, to join (Ásmundsson and Corcoran 2015).

The agreement has already demonstrated its value by providing a framework for consultations with other sectors in the process of establishing new high seas MPAs in the Northeast Atlantic, though it remains somewhat incomplete without the other management bodies. The Collective Arrangement does not include any legal changes to the current governance framework in the Northeast Atlantic. Instead, it can be seen as a first step in the departure from a purely sectoral approach in ocean management to a more integrated one that could inform the development of comparable approaches in other regions and the negotiation of the new global legally binding agreement for marine biodiversity in areas beyond national jurisdiction.

3.3 A Healthy, Productive and Resilient Ocean for Long-Term Economic Growth

The overall goal of IOM is to enable economic development while maintaining a healthy ocean ecosystem. The ocean has always attracted multiple uses, including fisheries, oil and gas extraction, shipping and transportation, military, mining, and recreation, among others. Many areas attract a variety of competing uses, which cause conflicts between users (user-user conflicts) and users and the environment (user-environment conflicts) (Tuda et al. 2014). The need to

minimise user-user and user-environment conflicts while taking advantage of new economic opportunities offered by the ocean—and maintaining a sustainable marine ecosystem—has seen increased interest and action at varying political levels in the spatial management of marine resources (Gustavsson and Morrissey 2018; Domínguez-Tejo et al. 2016).

Marine spatial planning is an emerging paradigm for sustainable ocean management (Douvere 2008; Domínguez-Tejo et al. 2016) and the operationalisation of a sustainable ocean economy. MSP aims to move away from a traditional, sectoral focus to a more holistic approach which takes into account the full use of the ocean space (White et al. 2012). Within the sustainable ocean economy framework, MSP should ideally be a means of creating an optimal investment climate for maritime sectors and give operators more certainty as to what opportunities for economic development are possible, though inequity, greater conflict and faster rates of degradation may occur if not calibrated appropriately with ecosystem goals and monitored over time. As a management tool, MSP allocates areas of the ocean for different uses and activities to reduce conflicts and achieve ecological, economic and social objectives. A key theme of MSP is the adoption of an ecosystem-based approach to ocean management. This involves focusing on the functional relationships and processes within the marine ecosystem, paying attention to the distribution of benefits that flow from ocean ecosystem services, using adaptive management practices, carrying out management actions at multiple scales and cooperating at an intersectoral level (Douvere and Ehler 2009). This approach is in direct contrast to current ad hoc, sector-by-sector responsibilities and practices for the management and regulation of ocean activities. Although MSP is currently underway in 66 countries worldwide, only 22 countries have government-approved marine spatial plans (Santos et al. 2019).

4. Integrated Ocean Management in Practice

Below are a set of case studies selected to illustrate differences in implementation goals, jurisdictional types and management scales of IOM in different parts of the world: the Coral Triangle, the Seychelles, Norway, the United States and China (Figure 3). There are common traits among them, such as the need for robust information about the relevant ecosystems and human activities, the need to tailor IOM to local contexts and the use of mechanisms to estimate the cumulative impact of uses and pressures on marine ecosystems.

4.1 The Coral Triangle and the Seychelles

Tropical nearshore coastal ecosystems (i.e. mangrove forests, seagrass beds and coral reefs) are among the most diverse and productive ecosystems in the ocean. A wide range of stakeholders, particularly low-income coastal communities, are highly dependent on the goods and services provided by these ecosystems, which are also the most vulnerable to climate change. Strengthening the resilience of these ecosystems to sustain the direct and indirect goods and services they provide is at the core of ocean management initiatives at the national and transnational levels.

This section discusses how IOM has been used with a focus on climate change adaptation, marine protected areas and fisheries management to address social, economic and conservation objectives simultaneously in some SIDS—here exemplified by the Coral Triangle (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste) and the Seychelles.

4.1.1 Conservation and the case of fisheries management in the Coral Triangle

MPAs range from small, local and community-based networks to national networks to regional, multistate

initiatives. In SIDS, most MPAs are managed by local community members, particularly small-scale fishers. Since these MPAs are small, there is often a spatial mismatch relative to important ecological processes (Horigue et al. 2012; Mills et al. 2010). To date, a major challenge with implementing MPAs has been that they are seen as serving conservation or protectionist interests, not human interests, thus driving a top-down, nature-centric agenda that alienates local communities and ends up marginalising conservation. If MPAs are seen as promoting only a nature-centric agenda and not supported by local users, or their relevance to recovering depleted fisheries is not obvious, then a more comprehensive approach involving ecosystem-based management, marine spatial planning or ocean zoning might be a better option. Nonetheless, area-based management measures are important and the most prevalent management intervention used to meet conservation and fisheries management goals in developing tropical states, including SIDS. To maximise their impact, MPA planning should be integrated into broader marine spatial planning and ocean zoning efforts (Agardy et al. 2011).

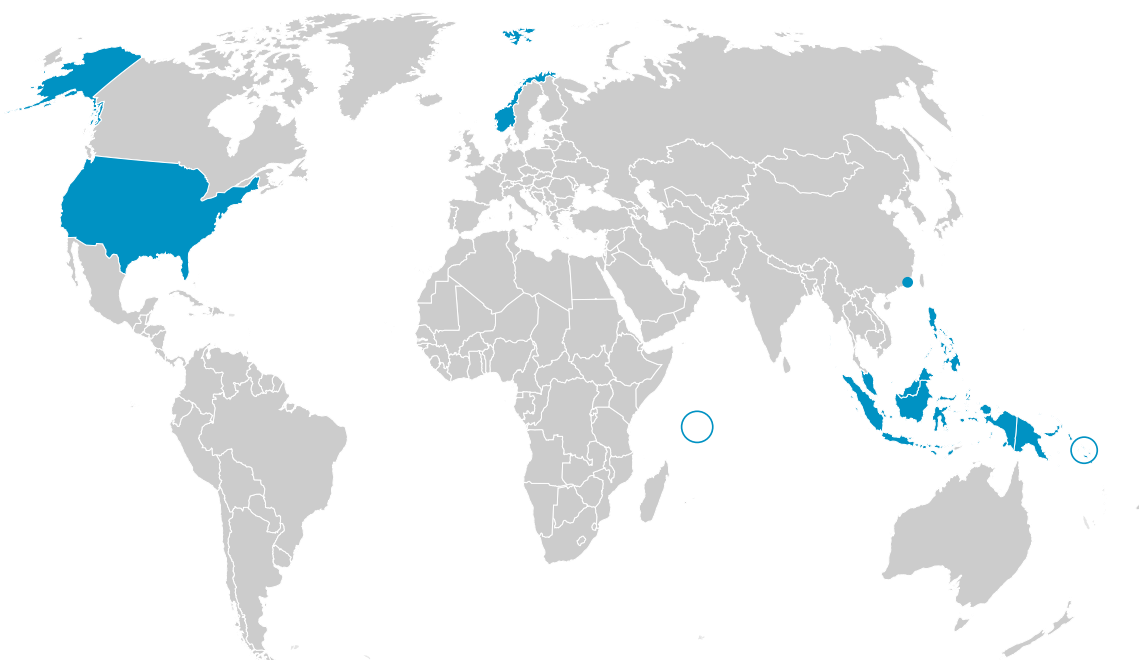
Regarding effectiveness, improvements in fish biomass—including the recovery of functionally important groups reported for many small MPAs—indicate that conservation objectives can also be achieved at the local scale. For example, in community-based MPAs in Papua New Guinea that protect grouper aggregations, there was a 10-fold increase in the reproductive population compared with an unprotected site after five years (Hamilton et al. 2011). In the Philippines, a study on fish biomass showed that 32 percent of MPAs had estimated fish biomass within and above the estimated maximum sustainable yield (MSY) (McClanahan et al. 2015). However, further research (Muallil et al. 2019) found that areas adjacent to the MPAs were below the MSY. This indicates that small, locally managed MPAs alone

are not enough for coral reef fisheries management. However, despite limited perceived impact on improving the state of the local fisheries resources, community-based MPAs have been effective in empowering the local fishing communities (Maliao et al. 2009). Thus, the MPAs provide social benefits and enable active community participation in resource management. Further, demonstrating the local impacts of MPAs has been important in sustaining and scaling up efforts.

On a regional scale, MPAs are part of a holistic approach of the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). The CTI-CFF is

a formal intergovernmental partnership among the six countries: Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste to sustain marine and coastal resources and address food security, climate change and marine biodiversity. The adoption of a regional plan of action (RPOA) by member countries and implementation of national plans of actions illustrate implementation at regional and national levels. Establishment of marine protected areas and networks is a centrepiece of national plans on integrated coastal resources management to address conservation and local fisheries enhancement.

Figure 3. Map of Case Studies of IOM in Practice



Source: Authors.

Box 2. Goals and Targets of the Coral Triangle Initiative's Regional Plan of Action

The regional plan of action of the Coral Triangle Initiative (CTI) has the following goals and targets:

- **Goal 1: 'Priority Seascapes' Designated and Effectively Managed**
 - Target 1: 'Priority seascapes' are designated, with investment plans completed and sequenced.
 - Target 2: Marine and coastal resources within all priority seascapes are sustainably managed.
- **Goal 2: Ecosystem Approach to Management of Fisheries and Other Marine Resources Fully Applied**
 - Target 1: Strong legislative, policy and regulatory frameworks are in place for achieving an Ecosystem Approach to Fisheries Management (EAFM).
 - Target 2: Improved incomes, livelihoods and food security exist in an increasingly significant number of coastal communities across the region through a new sustainable coastal fisheries and poverty reduction initiative ('COASTFISH').
 - Target 3: Effective measures are in place to help ensure that the exploitation of shared tuna stocks is sustainable, with tuna spawning areas and juvenile growth stages adequately protected.
 - Target 4: More effective management of and a more sustainable trade in live reef fish and reef-based ornamentals is achieved.
- **Goal 3: Marine Protected Areas Established and Effectively Managed**
 - Target 1: The region-wide Coral Triangle MPA System is in place and fully functional.
- **Goal 4: Climate Change Adaptation Measures Achieved**
 - Target 1: The region-wide Early Action Plan for Climate Change Adaptation for the nearshore marine and coastal environment and small island ecosystems is developed and implemented.
 - Target 2: Networked national Centers of Excellence (COEs) on climate change adaptation for marine and coastal environments are established and in full operation.
- **Goal 5: Threatened Species Status Improving**
 - Target 1: Improved statuses are achieved for sharks, sea turtles, seabirds, marine mammals, corals, seagrass, mangroves and other identified threatened species.

Source: Coral Triangle Initiative 2019.

The RPOA is guided by principles of integration, inclusive stakeholder participation, multilevel governance mechanisms to implement action plans, and recognition of the uniqueness, fragility and vulnerability of island ecosystems. There are technical working groups for each of the five programmes to address each goal; government working groups for financial resources, monitoring and evaluation; and other committees for various cross-cutting themes for capacity building, such as a regional leaders' forum, a female leaders' forum and local government networks. The CTI-CFF also has international development partners and collaborators that provide financial and technical assistance.

To support systematic conservation planning, guidelines for designing marine reserve networks within broader spatial planning and management frameworks to address biodiversity conservation, fisheries management, climate change adaptation and coastal management have been formulated (Green et al. 2014). A geospatial database and analyses of those data have been useful to inform planning efforts at different scales and provide a knowledge base for improved decision-making (Asaad et al. 2018, 2019). National plans of action support the regional goals through national interagency and multisectoral partnerships and programmes. Each member country has its own implementation activities aligned with improving governance of the ocean.

4.1.2 Climate change adaptation in the Seychelles

Coping with climate change impacts, such as sea level rise, is complicated in the SIDS because of the countries' small sizes, isolation and exposure, and high dependence on natural resources for their populations' livelihoods. Ecosystem-based adaptation (EBA) has been highlighted as one approach to address declines in ecosystem health and enable sustainable adaptation to climate change at national or community scales. As in other countries, MSP has been used to support ecosystem-based management.

The Seychelles was the first nation to participate in an ocean-based debt-for-nature swap. Part of the agreement required incorporating climate change adaptation into a marine spatial planning process in support of the country's ocean economy goals. The goals of the Seychelles Marine Spatial Plan (SMSP)

Initiative are to address climate change adaptation, protect 30 percent of the Seychelles' waters, including 15 percent with high protection status, and support the Blue Economy Roadmap and other national strategies. The geographic scope of the SMSP Initiative is the entire 1.4 million square kilometres (km²) of the EEZ and territorial sea. The process is led by the Ministry of Environment, Energy and Climate Change of the government of the Seychelles (GOS), with planning and facilitation managed by The Nature Conservancy (TNC) and TNC Canada, in partnership with the government management system for the United Nations Development Programme (UNDP) and the Global Environmental Facility (GEF) environmental programme in the Seychelles (the GOS-UNDP-GEF Programme Coordination Unit). Funding for the initiative is being provided through several grants to the government of the Seychelles from The Nature Conservancy and a number of philanthropic foundations, and through the creation of blue bonds.

The MSP Executive Committee has representation from all the ministries and parastatal agencies related to the marine sectors. The process includes public workshops and public information sessions to generate input from all major sectors including commercial fishing, tourism and marine charters, biodiversity conservation, renewable energy, port authority, maritime safety, and non-renewable resources (SMSP Initiative 2019). The process began in February 2014 and will be completed by December 2020. The SMSP Zoning Framework has three zones: high biodiversity protection; medium biodiversity protection and sustainable use; and multiple use.

Existing uses were mapped in 2014–15 and are used to inform proposals for new marine protection areas. Notably, the SMSP Initiative is a component of the government-led Debt-for-Climate-Change-Adaptation swap. The Seychelles Conservation and Climate Adaptation Trust, which was operationalised in November 2016 to fund climate change adaptation and conservation projects in the Seychelles, will also provide partial funding to implement the SMSP Initiative.

Other SIDS have not gone through a national, government-led, comprehensive MSP process as that in the Seychelles but have experiences in ecosystem-based management and spatial planning linked to climate change adaptation (CCA) strategies. However,

these experiences have often not been successful without a national, government-led framework. This demonstrates that both political will and funding are needed in addition to robust stakeholder engagement processes. For example, in the central Pacific, top-down coastal adaptation approaches usually fail because coastal communities in the tropical Pacific have customary land, island and coastal tenure, supported by traditional governance (Grantham et al. 2011). To facilitate active participation, global climate change is addressed in the Pacific context in discussions with communities. Traditional adaptations—for example, to maintain food security given unpredictable climate events—are incorporated in CCA planning to engage communities and boost awareness. Planning is primarily small scale, with bottom-up processes directly engaging local communities through participatory approaches supporting spatial planning. In the Caribbean, an analysis by Mercer et al. (2012) has shown inconsistencies in EBA theory and practice. The CCA plan in the Caribbean centred upon coastal ecosystems at a regional level as opposed to the full range of ecosystems, which is especially important given the tight linkages between terrestrial and marine ecosystems in small island states. Likewise, integrating local knowledge with external knowledge was identified as a gap in developing appropriate context-specific adaptation strategies (Mercer et al. 2012).

4.1.3 Challenges and lessons learned

There are various ongoing initiatives in SIDS and tropical island developing states that are working toward a more integrated ocean management regime. We have presented two examples where key priorities have focused on improving the resilience of coastal communities and marine ecosystems linked to the overarching need for climate change adaptation. Despite various challenges, experiences in planning and ecosystem-based management provide valuable lessons that may help make future efforts more efficient and effective.

First, planning at the local and national levels requires taking into consideration the local environmental, socioeconomic and governance systems. In all cases, stakeholder participation and incorporation of local knowledge are essential in developing appropriate strategies. Experiences in these countries indicate that ecosystem-based management and MSP should build

on and strengthen community-based management. Participatory approaches have been demonstrated to be effective at the local level for climate change adaptation planning and all phases of the MPA process (i.e. MPA planning, implementation, monitoring and evaluation, feedback and adaptation of the management plan).

Second, scaling up and reorienting local actions to larger-scale activities and appropriate ecological scales are essential and require improved governance regimes at national and regional levels. In many cases, even with improved planning, implementation remains constrained. There are many challenges to integrated ocean management in the CTI (Weeks et al. 2015) that constrain effective implementation at the regional and national levels. They include a failure to institutionalise conservation planning within governments at different levels nationally and systematic planning across nations with different governance systems, poor integration of planning efforts across these governance systems and levels, and failure to overcome short-term funding and political cycles relative to long-term planning and implementation timeframes (Weeks et al. 2015). Funding and technical support for IOM planning including MSP in the CTI and SIDS have been facilitated through various development programmes, partnerships with nongovernmental organisations (NGOs) and public-private partnerships, but national funding mechanisms for the long-term implementation of plans, such as the Seychelles Conservation and Climate Adaptation Trust, are needed (SMSP Initiative 2019).

Third, formal and informal social networks for data sharing and capacity building are essential at different levels of government to accelerate integration and scale. Regional alliances such as the CTI have been forged to facilitate regional and broader-scale policy support and frameworks to harmonise national plans of actions. The SIDS Accelerated Modalities of Action (SAMOA) pathway is anchored on the conviction that sustainable development can be achieved through strong partnerships. These high-level alliances are supported by social networks for capability building and implementation, and multisectoral consortia of private and public organisations, researchers, practitioners, and policymakers. Examples include Many Strong Voices, a collaboration between the Arctic and SIDS (Mercer et al. 2012), and the MPA Support Network in the Philippines (Horigue et al. 2012).

Knowledge gaps on socioecological interactions at various scales are a persistent limitation in integrated ocean management planning and implementation in the SIDS and CTI (e.g. Khan and Amelie 2015; Mills et al. 2010). To help support capacity building and address the lack of sufficient information, technical assistance programmes on MSP have been provided, studies to address data gaps (e.g. socioeconomic data) undertaken and information compiled to make it more accessible (e.g. in databases). For example, the CTI atlas, initiated through partnerships among international NGOs supporting the CTI, is a repository of geospatial information and used to track progress. However, keeping the information up-to-date and enhancing functionality remains a challenge due to a lack of local capabilities and financial resources (Cros et al. 2014; Asaad et al. 2019).

4.2 The Norwegian Ocean Management Plans

Norway's ocean areas span 3,000 km from boreal to polar climates and measure 2.1 million km², five times the country's land area. The dominant physical influence is the Atlantic current transporting heat from the southwest Atlantic to the north, making the country (and northwestern Europe) several degrees Celsius warmer than corresponding latitudes in North America. Its three major marine regions are the Barents Sea in the north, the Norwegian Sea, and the North Sea in the south. While the Barents and North Seas are shallow shelf seas, the Norwegian Sea is a deep ocean with a narrow continental shelf along the coast. Ocean currents and other oceanographic conditions are favourable for biological productivity, and these seas are therefore very rich in fish resources. Also, the fjords provide favourable conditions for aquaculture, and the continental shelves contain abundant petroleum resources as well as other minerals.

The Barents Sea (1.4 million km²) is divided between Norway and Russia following a boundary agreement in 2010 and is limited to the north by the high seas in the central Arctic Ocean. The Norwegian Sea is bound to the west with the waters of Greenland, Iceland and the Faroes, as well as the high seas there. In the North Sea, Norway's waters (and continental shelf) meet those of the United Kingdom, Denmark and Sweden (Figure 4). That Norway shares ocean boundaries with seven other countries is an important determinant of its marine

policies, as transboundary resources and ecosystems require international cooperation for their management, at bilateral as well as regional levels of cooperation. Another important determinant is the global framework for ocean governance described at the outset of this paper.

4.2.1 Economic activity and ocean governance

Petroleum is by far the most important industry in Norway, contributing US\$60 billion in 2018—approximately one-quarter of Norway's export earnings. Fisheries and aquaculture contribute about \$11 billion in export value. In addition, shipping, shipbuilding, tourism, petroleum services and other ocean-related activities are significant contributors to Norway's ocean economy, together constituting 70 percent of the national gross domestic product. Recent developments include increasing interest in renewables, exploitation of new species of living marine resources, minerals other than petroleum and marine bioprospecting. The ocean economy is critical to the welfare of both the general population and, in particular, coastal communities.

The management of the ocean has evolved over centuries, with active government regulation in the fisheries sector dating back to at least the mid-1800s. The petroleum and aquaculture industries started in earnest in the 1970s and were accompanied by the development of management institutions and legal regimes for their regulation. At the same time, regulations to protect the marine environment were established. Since then, the regulatory regime has evolved significantly. Today, all major sectors—including petroleum, the environment, transportation, fisheries, aquaculture and minerals—have modern and effective regulatory regimes based on sector-specific acts.

Following the growth in the ocean economy, the need for more and better regulation of the various economic activities was accompanied by a need for more oversight over an increasingly complex regulatory environment—to reconcile competing interests and address management challenges in an integrated and comprehensive manner (Hoel and Olsen 2012). The issue was first recognised in the 1970s, with efforts to this end in relation to petroleum activities and fisheries. The northward expansion of the petroleum industry

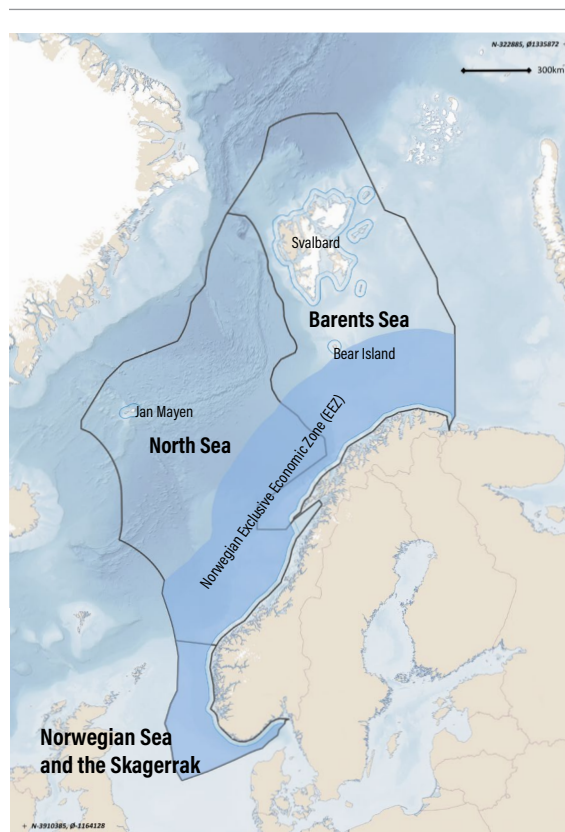
brought a recognition that more comprehensive approaches to ocean management were needed. A report to the Norwegian Parliament in 2002 represented a turning point in this regard, laying the foundation for what became the management plans for the ocean and explicitly recognising the need to manage entire ecosystems as opposed to individual sectors and activities (Norwegian Ministry of the Environment 2002).

4.2.2 Comprehensive management plans

The first comprehensive management plan for the Barents Sea and the coast of northern Norway was adopted by the parliament in 2006 (Norwegian Ministry of the Environment 2006). The plan's overall objective was to facilitate value creation through the sustainable use of natural resources and goods while maintaining the structure, functioning and productivity of ecosystems.² Its geographic scope was limited to the waters outside one nautical mile off the baseline with nearshore ocean and coastal zone management outside the remit of the plan. It was also limited in time, foreseeing regular updates as new knowledge became available. Key features of the plan were the identification of valuable and vulnerable areas, and limitations on where petroleum activities could take place. Updates to the plan were adopted in 2011 and 2015. The first plan for the Norwegian Sea was adopted in 2009 and updated in 2017. The first North Sea plan was adopted in 2013. Apart from the effects of climate change, the challenges are rather different in the three areas covered by the plans.

The foundation of the work on the plans is an ambitious scheme for collecting and assembling information about the marine ecosystems, undertaken in the course of fisheries surveys and mapping programmes (Olsen et al. 2014). This work is institutionalised in the Advisory Forum on Monitoring, with participation from central research institutions and agencies. Stakeholder consultations are also an important element in the decision-making process. The development of the scientific and practical basis for the plans is carried out by a coordination group consisting of government agencies, now called the Management Forum on Norwegian Sea Areas. The work is overseen and coordinated at the ministerial level by a group of ministries coordinated by the Ministry of Climate and Environment. The interministerial group is responsible for developing the actual management plans

Figure 4. Map of Norway's Marine Management Plan Areas



Source: Data from Barentswatch 2020 (<https://kart.barentswatch.no/arealverktoy>). Map by Centre for the Ocean and the Arctic, Norway 2020.

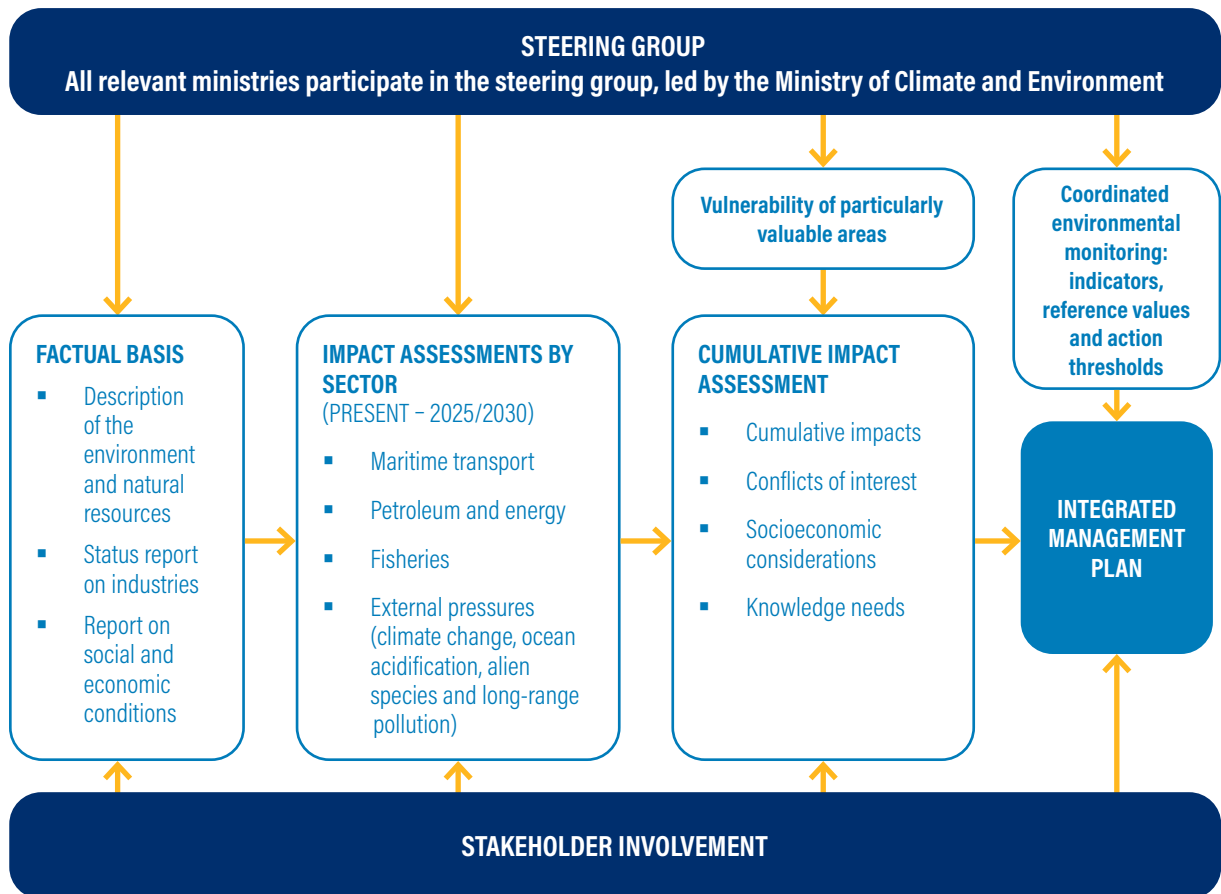
and reconciling the various concerns that are brought to bear on the work. In 2020, the work on the three plans will be merged into one report to the parliament, and subsequent updates and revisions will occur on a decadal basis (Figure 5).

4.2.3 Challenges and lessons learned

After nearly two decades of work, Norway offers several important lessons on holistic ocean management. The first is that the work relies on comprehensive and demanding scientific monitoring (Olsen et al. 2016). These monitoring efforts are largely part of regular monitoring programmes as opposed to efforts designed specifically to monitor work related to the management plans.

Second, at the level of the two forums, the work on the plans has brought research institutes and agencies

Figure 5. Process for Developing an Integrated Ocean Management Plan in Norway



Source: Norwegian Ministry of the Environment 2009.

from various sectors together, contributing to a better understanding of each other’s missions and methods.

Third, the plans are adopted by parliament based on government white papers, lending the plans political authority.

Fourth, the plans are implemented through sector-based legislation and regulatory measures. The management plans are just that—plans. However, since they are adopted by parliament, and reflect compromises in government, they represent national policy. Modern and efficient sector-based legislation is an effective vehicle for bringing the plans from paper to practice.

Fifth, the plans evolve over time as new scientific knowledge is generated and new management challenges arise. It is important that the plans be dynamic and provide for adaptive management through regular updates and revisions.

4.3 Approaches to Integrated Ocean Management in the United States

The United States has approached integrated ocean management at three scales: state, regional (multiple state) and national. Several U.S. states—Massachusetts, Rhode Island, Washington, Oregon, New York and Connecticut—have developed ocean plans for state waters (0–3 nautical miles offshore). Regions, comprised of multiple states and defined mostly by ecosystems, have worked toward IOM within federal waters (3–200 nautical miles), in response to and consistent with a national directive in the form of a presidential executive order. State plans often have a clear legal structure through legislation that provides direction for integrated ocean management as was the case for Massachusetts,

Washington, Oregon and Connecticut. States that do not have a clear legal structure for IOM can also develop and implement ocean plans by reinterpreting existing legal authorities, as Rhode Island did. Regional IOM plans were developed in response to an executive order that provided guidance for regions to take an ecosystem-based management approach. As part of the executive order, federal agencies with a stake in ocean management were directed to engage with regional planning bodies to develop plans for areas where there was interest in improving coordination among management agencies (Executive Office of the President 2010). The executive order directed federal agencies but engagement by states and tribes was voluntary.

4.3.1 Northeast and Mid-Atlantic regional ocean plans

Administrative orders or directives can define a framework for coordinated management. These directives may articulate high-level targets but look to regulatory agencies to define specific management goals and objectives. The ocean plans in the Northeast and Mid-Atlantic regions of the United States, which largely align with major ecosystems, are examples of management plans developed without an overarching legislative structure to provide a directive or framework. Both plans were created through a presidential executive order that provided an overarching mandate, outlined federal authority, and built on the existing legal authorities of management agencies. The order provided guidance for regions to take an ecosystem-based management approach through the development of ocean plans, but no new laws were created (Executive Office of the President 2010). Planning was voluntary, and two of the nine defined regions of the United States completed plans by late 2016. In 2018, a new presidential administration rescinded the earlier executive order directing management agencies to develop plans. A new executive order was issued that allows planning to continue in those regions where IOM is supported and directs federal agencies to coordinate with states and regions to solve management challenges (Executive Office of the President 2018). Such political transitions can challenge the stability of IOM, especially in cases with no overarching legislative structure.

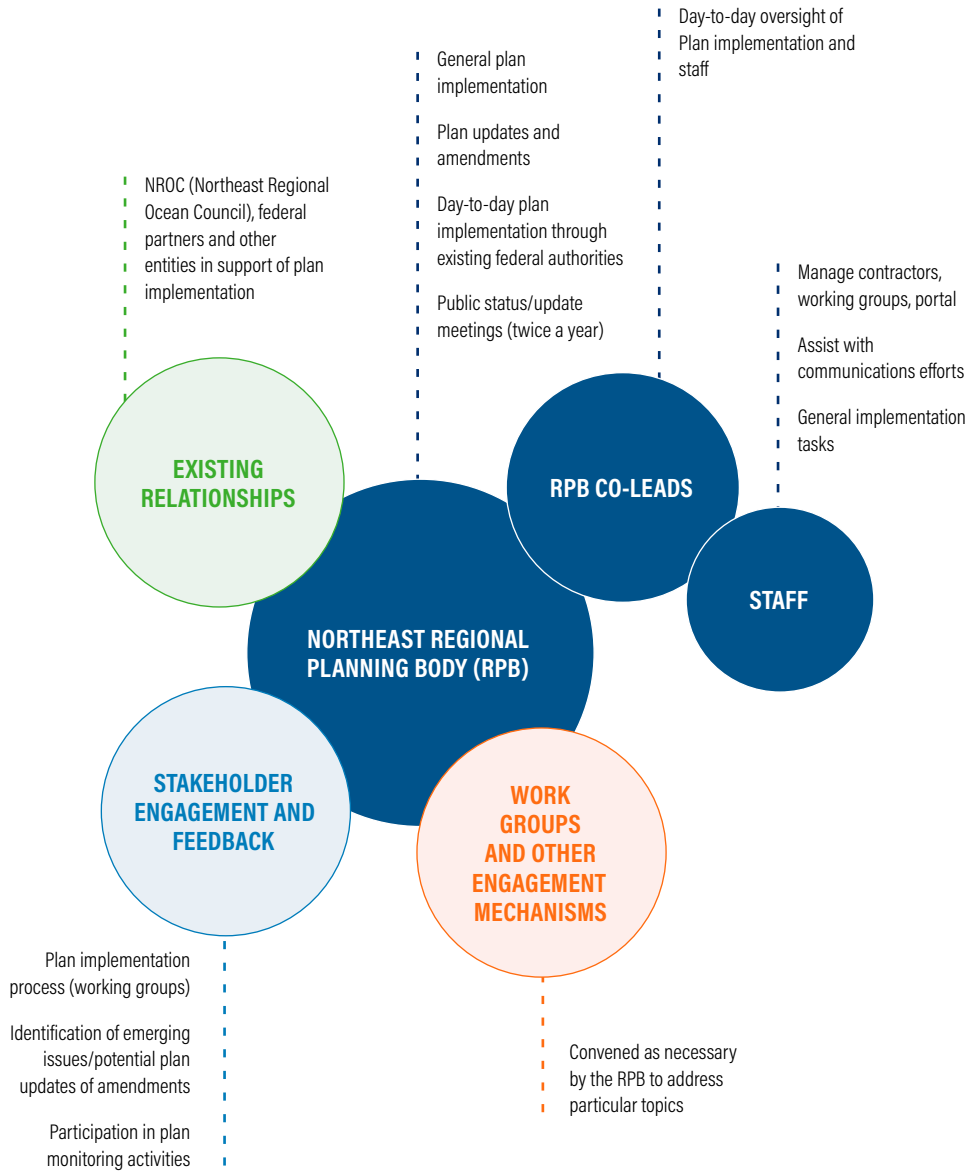
The Northeast and Mid-Atlantic regions, where Massachusetts and Rhode Island had already developed state ocean plans, were the first two regions to advance more integrated approaches to ocean management. The impetus for regional planning was a combination of the collaboration among state, tribal and federal management authorities and ocean users already ongoing in the region, leadership provided by state and federal agency representatives, political will and an interest in avoiding potential conflicts with existing users and emerging industries such as offshore renewable energy. The Northeast and Mid-Atlantic regions both completed regional ocean plans in 2016 (Northeast Regional Planning Body 2016; Mid-Atlantic Regional Planning Body 2016) (Figure 6). Goals for both regional plans focused on the following:

- Improving decision-making by coordinating managing authorities and stakeholders, coordinating early in the process and enhancing awareness of human activity needs, interests and resources
- Promoting healthy ocean and coastal ecosystems by characterising the region’s ecosystems, economy and cultural resources, and by identifying opportunities to conserve, restore and maintain healthy ecosystems
- Ensuring compatibility among past, current and future ocean uses

With regional plans now in the implementation phase, it is apparent how public and private sector organisations are benefitting from the data information systems—referred to as ‘regional ocean data portals’—that were developed as part of the ocean plans. Examples of how the Northeast Ocean Data Portal has been used include the following (Northeast Ocean Data 2009):

- To create a new economic opportunity by establishing the first shellfish aquaculture farm in federal waters off the Atlantic coast
- To increase maritime safety and improve weather forecasts through a wave-monitoring buoy
- To select a test site for an unmanned underwater vehicle for the United States Navy
- To assist the New England Fishery Management Council in balancing deep-sea coral protection and commercial fisheries

Figure 6. Framework for Implementing the Northeast Ocean Plan



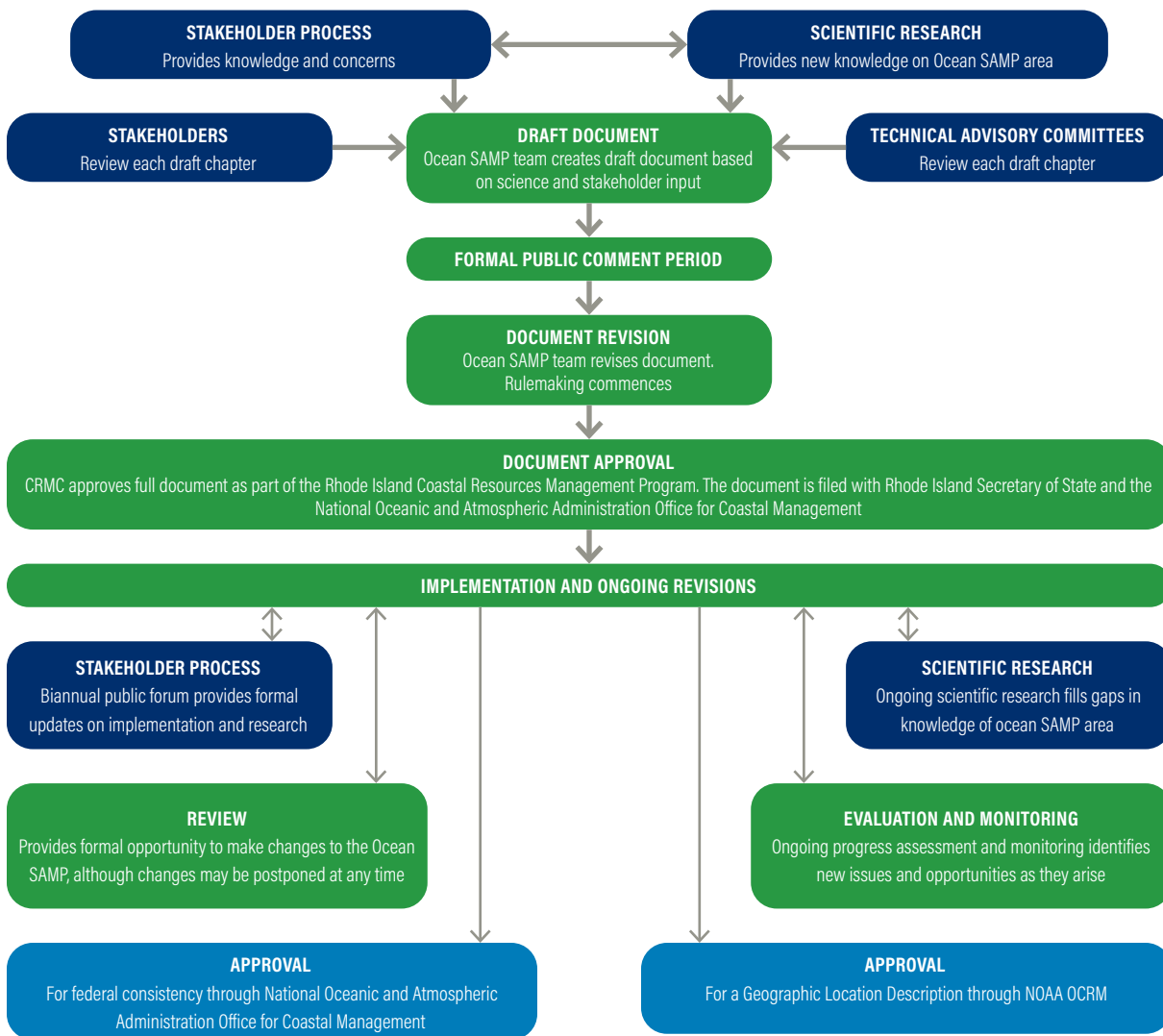
Source: Northeast Regional Planning Body 2016.

4.3.2 Balancing ecosystems and economy with the Rhode Island Ocean Special Area Management Plan

As the United States enters a new era with offshore renewable energy innovation, a project in Rhode Island demonstrates the value of using an IOM approach. Faced with increased demands on ocean space, an ambitious renewable energy goal for the state and

political leaders interested in advancing offshore wind, the state management agency, the Coastal Resources Management Council, took the lead in developing an Ocean Special Area Management Plan (McCann 2010). With an overall goal of balancing ocean resources with development, the state created an open and transparent planning process that was backed with science, critical stakeholder input and productive public fora (Figure 7).

Figure 7. Methods Flowchart for the Rhode Island Ocean Special Area Management Plan



Note: CRMC stands for Coastal Resources Management Council and NOAA OCRM for National Oceanic and Atmospheric Administration Office for Coastal Management. NOAA approved as a state plan amendment May 11, 2011 (Federal Consistency authority granted for state waters). NOAA approved Geographic Location Description for federal consistency September 2011 (Federal Consistency authority granted for Federal Waters in the GLD for 15 Federal Authorizations which now needed Consistency sign offs by CRMC).

Source: Adapted from Mulvaney 2013.

Data collected through this plan not only identified a renewable energy area that would minimise conflicts with other ocean users and ecological resources but also provided information on aspects like key fishing grounds, marine mammal migration routes and recreational boating activities.

4.3.3 Challenges and lessons learned

IOM can be harder to achieve without a mandate and structure defined by law. For states with new legislation directing management agencies to coordinate and develop plans, it was, in general, easier to define goals and objectives because legal authority and overall

direction were clear. Reinterpreting existing legal structures is also an option, as demonstrated by the Rhode Island experience. External drivers such as a new ocean use or emerging technology can stimulate integrated management approaches by creating the political and societal will for IOM.

In the case of regional plans developed through an executive order, administrative leadership provided the overarching mandate of maintaining healthy ocean ecosystems. The executive order also created clear direction for federal agencies to act within their legal authorities to coordinate among agencies and with states to advance IOM. The challenge is that these orders are voluntary for states so the key players in the regions—including representatives from states, tribes, fishery management councils, industry, academia, nongovernmental organisations and local communities—must perceive added value from taking a holistic, integrated approach. In the United States, two of the nine regions have completed integrated ocean management plans and an additional one is in development. If a state, region, territory or nation wants to commit itself to IOM, the clearest and most efficient path is with a new law directing specific actions. However, other approaches can be taken depending on political context and institutional arrangements.

Under the United States system outlined above, experience demonstrates that data and information are the foundation of IOM. Ocean businesses want managers to understand their interests when developing a comprehensive management plan. Data and specific information help managers demonstrate their understanding of different ocean uses. Ocean users should have an opportunity to provide and verify data, and therefore see their activities reflected explicitly within the IOM process. This data can be used to describe not only existing human activities or ecological resources but also future goals and trends. Developing a regional ocean data portal (information management system) that is open and transparent and has all relevant data, including the metadata, in a central location will go a long way toward building support from decision-makers, local communities, scientists, nongovernmental organisations and various sectors of human activity. If resources and available data permit, government entities should consider prioritising the development of information management systems, referred to in the

United States as ocean data portals. A centralised ocean data portal not only improves coordination among various management agencies with responsibility for human use activities but also has the potential to improve coordination among ocean users who can now view all activities in one central location. A data portal is not needed to define societal objectives and express those in a holistic plan, but the United States' experience demonstrates their value for facilitating an integrated management approach.

Stakeholders, or ocean users, need to be consulted and involved in data collection, to corroborate the accuracy of data and provide data about anticipated future activities and trends. This consultation process helps establish collaboration and trust within IOM. Several mechanisms to gather information have proven beneficial in the United States. These include the following:

- Arranging sector-specific meetings to gain a better understanding of a sector's needs, concerns and future trends
- Developing industry-specific white papers that review the current status, future trends and planning needs of a specific sector—through the white paper approach, industry can easily share information with interested members to gather comments and feedback
- Identifying data gaps and, where possible, outlining stakeholder-driven projects that could fill those gaps

Developing a research and science agenda to better understand the ecosystem within the IOM framework can help advance and fill priority gaps in the data. In the United States, federal agencies with various management authorities have collaborated to identify data gaps and, even more importantly, to determine how to prioritise them to best meet planning objectives. Defining a research and science agenda provides management entities with a common goal of advancing data objectives to ensure that future iterations of the plan will have the necessary additional information to better inform decisions. This process also allows for collaboration on budget discussions and prioritises time and resources within a structure that all engaged entities have agreed to.

Robust stakeholder engagement is critical to successful IOM. A key component and lesson learned from the United States is to reach out to sector-specific thought leaders or trusted organisers who are proven leaders in the community and can help disseminate information to and enlist participation of those within their given sectors. For example, variations in the fishing community must be taken into consideration as an IOM process moves forward since data and information will differ depending on gear type, port community and fish species. This approach of seeking adequate representation across industry, the nonprofit sector and the scientific community should be taken with all groups.

Ocean users may have a natural distrust of the new and potentially complex process that is IOM. It is vital that IOM remains an inclusive and transparent process so trust can be built. Meeting stakeholders where they are and ensuring that their input is adequately incorporated throughout the process has been shown to be more effective at ensuring stakeholders find value in a holistic approach rather than selling them on a concept.

4.4 Integrated Coastal Management in Xiamen, China

Xiamen, with a population of 4.11 million in 2018, is a port city located on the west coast of the Taiwan Strait. As of 2018, it was the 7th largest container port in China and the 14th largest in the world. Xiamen Island is surrounded by 394 km² of sea and has a coastline of about 234 km. Xiamen Bay, including the Jiulong River Estuary, West Sea, Tongan Bay and East Sea (Figure 8), is home to nearly 2,000 marine species including protected species like Chinese white dolphins, lancelets and egrets. The bay has been a vital part of Xiamen's economy for centuries.

Following China's major reform initiative in the late 1970s, Xiamen became one of the first four special economic zones. Since then, Xiamen has experienced an economic boom that has brought with it a series of resource use conflicts and pollution problems. This was particularly visible in the early stages as little attention was paid to ecosystems and the environment (Chua et al. 1997; Xue et al. 2004). Seawall constructions and reclamations drastically modified the coastal morphology and hydrodynamics and reduced the area of surface water and tidal influence.

Starting in the 1980s, marine aquaculture grew rapidly and was further intensified in the mid-1990s. By 2001, it covered nearly half of the West Sea area. Waste from coastal aquaculture ponds and excess feeds from fish cages polluted the marine environment. Nearly all domestic and industrial wastewater was discharged into the sea untreated. Many natural habitats were damaged by pollution. Mangrove forests declined from 1.8 km² in 1987 to 0.2 km² in 1995. Major events of fish deaths occurred around twice per year in the period from 1984 to 1996 (PEMSEA 2006a) and populations of dolphins, egrets and lancelets declined (ITTXDP 1996; XDPO 1998; Xue et al. 2004; Lin et al. 2005; PEMSEA 2006a, 2006b).

Faced with environmental degradation, sea-use conflicts and ineffective management as well as deficiencies in legislation, funds, public awareness, information and pollution-prevention capabilities (PEMSEA 1998), Xiamen implemented a new ocean and coastal management system in 1994. Integrated coastal management (ICM) in Xiamen has undergone four stages of development: structural design from 1994 to 2000, marine ecosystem rehabilitation from 2000 to 2009, co-governance of land and sea from 2009 to 2015 and sustainable ocean economy since 2015 (Hou et al. 2019).

4.4.1 Early stages of ICM in Xiamen

With this backdrop, the Chinese government decided in 1994 to make Xiamen a demonstration site for ICM in collaboration with GEF, UNDP and IMO's regional programme (Xue et al. 2004; Cao and Wong 2007; Fang et al. 2011; Mao and Kong 2018; Hou et al. 2019).

Between 1994 and 2000, in the early stage of ICM in Xiamen, a coordinating, law-enforced and science-supported mechanism was established. From 1994 to 1996, to advance ICM, individual projects were selected under the guidance of international organisations such as GEF, UNDP and IMO. These projects included, for example, establishing pollution management plans and sea use zoning (GEF et al. 2009). In 1996, the municipality of Xiamen initiated an ICM leadership group consisting of the mayor and officials from different governmental departments, under which an ocean office was established and tasked with organising regular meetings with ocean-related sectors within aquaculture, transportation, construction and science and technology (Xue et al. 2004) (Figure 9). During

this phase, a series of marine laws and regulations, including the Administrative Regulations on Xiamen Sea Area Use for development and use and the Regulation on the Management of Natural Protected Areas for Chinese White Dolphin for environmental protection and ecological conservation, were adopted. A series of spatial planning programmes, including the Functional Zoning of Xiamen Sea Area, were also initiated. To provide support in developing these new tools, a municipal ocean specialist team consisting of leading researchers was formed.

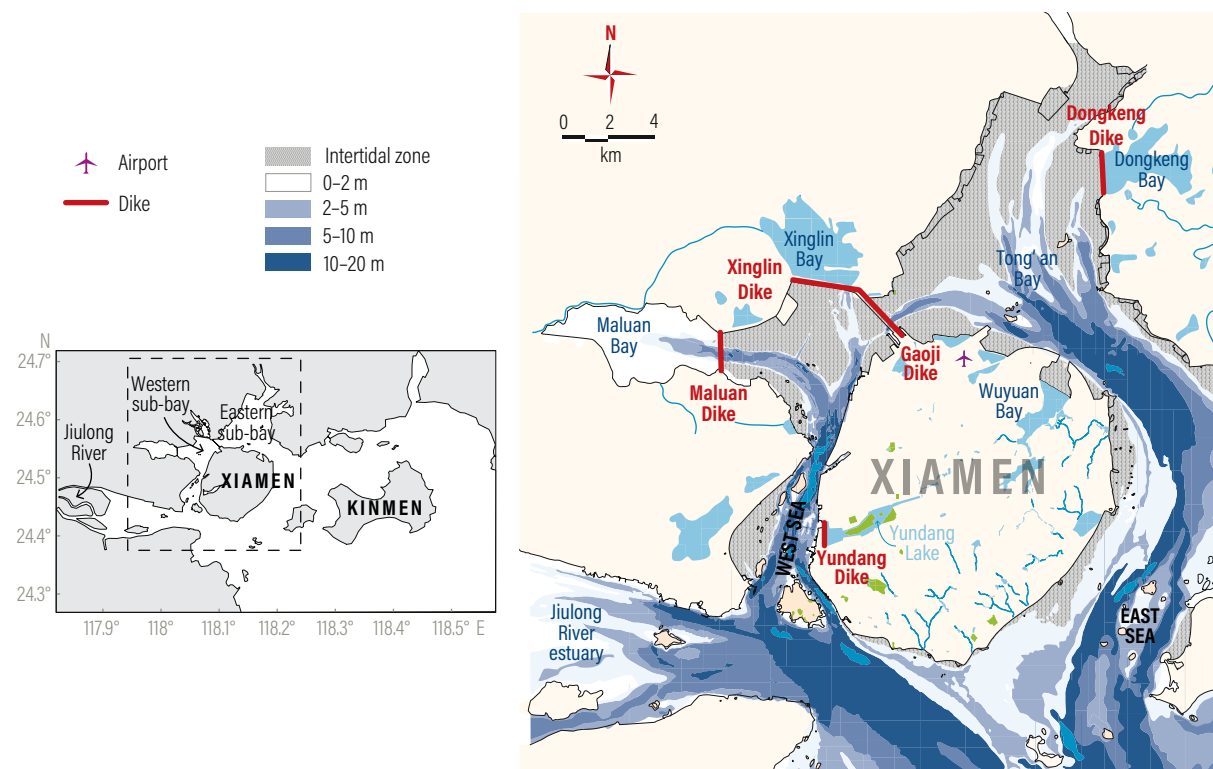
4.4.2 Ecosystem rehabilitation

Xiamen's ICM entered a new phase in the early 2000s with the initiation of several marine ecosystem rehabilitation projects. The first was established in the Yundang Lagoon, located in the downtown area of Xiamen Island. This lagoon used to be a fishing harbour connected to the Western Sea of Xiamen, enriched by mangroves, and had once sheltered huge flocks of egrets. During the 1970s, a dam was built at the mouth of the

lagoon to cut off the water flow, converting the lagoon into an enclosed body of water. In addition, the surface water area was reduced from 10 km² to 2.2 km² due to reclamation for agriculture purposes. Untreated industrial and domestic wastewater was also being discharged into the lagoon. Residents began leaving the area (PEMSEA 2006b). Due to the poor environmental conditions, the site was blacklisted by the national Environmental Protection Agency. This situation was not resolved until a series of cleaning actions were implemented, including improving the waste management systems, constructing sewage treatment plants, building a retaining wall and performing dredging. The water exchange between the Yundang Lagoon and the sea was improved and mangroves were replanted.

According to the Functional Zoning of Xiamen Sea Area, the dominant functions of the area are ports, shipping and tourism. However, aquaculture was its primary function until the 1990s. In 2002, Xiamen stopped its aquaculture activity to solve ocean-use conflicts and initiate ecosystem rehabilitation in the area.

Figure 8. Map of the Xiamen Area



Note: In the legend, m stands for water depth in metres.
Source: Redrawn from Wang et al. 2013.

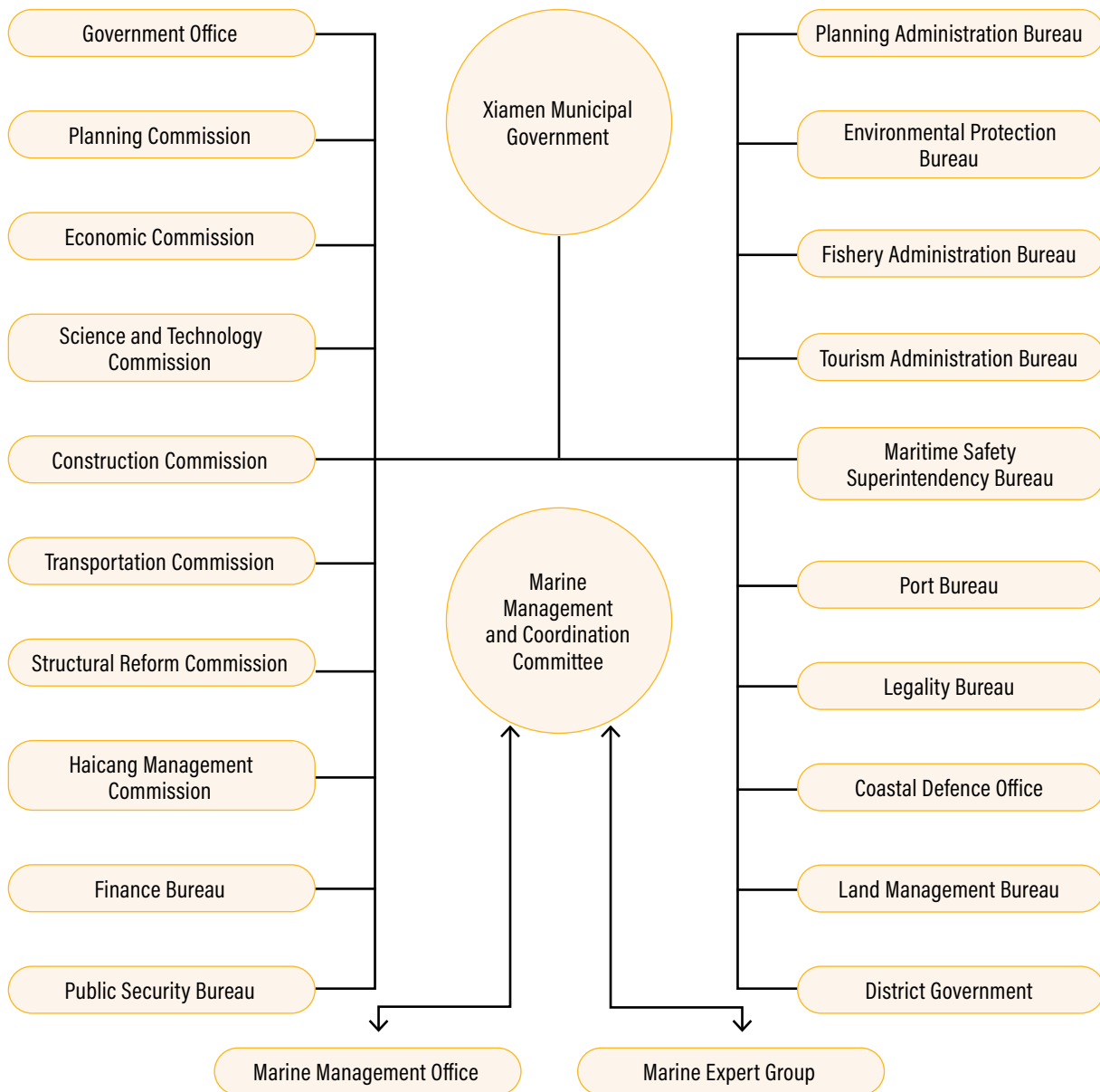
The aquaculture facilities were completely removed, and waterways were dredged to ensure their prime functionality.

Several other rehabilitation initiatives were also implemented, including building a wetland park, restoring the shoreline, planting mangroves, building uninhabited islands for birds to forage and improving the sewage

treatment system (Wang et al. 2018). In Wuyuan Bay, 89 hectares of wetland were established. Various measures improved the water exchange in the East Sea by 30 percent. Combined with better water quality, the conditions for the Chinese white dolphins improved significantly.

Following the successful rehabilitation projects, Xiamen's efforts in ICM during 2009–2015 were mainly focused on

Figure 9. Organisational Structure for Integrated Coastal Management in Xiamen



Source: Xue et al. 2004.

governing the rivers and sea by establishing a system for controlling the terrestrial pollution. Since 2015, after over 20 years of ICM practices and in response to major national guidelines ('Managing Land and Sea as a Whole' and 'Constructing Ecological Civilization'), Xiamen has begun stage four of development—integrating land-sea management and the concept of developing 'blue growth' (Mao and Kong 2018).

4.4.3 Challenges and lessons learned

ICM in Xiamen can be characterised by the establishment of a legal framework and enforcement mechanisms, science-policy integration, marine monitoring system and information sharing, and public awareness mechanisms. As a management instrument to rationalise the use of marine and coastal resources and environment, marine spatial planning (called 'marine function zoning' in China) is a significant component of the ICM programme in Xiamen (Su and Peng 2018). There are a number of lessons to be learned from Xiamen's experience.

First, coordinating numerous stakeholders—from sectors including urban planning, fisheries, shipping, transportation, science, port authority and conservation—has been a challenge. To meet this challenge, the existing and successful concept of 'River Chief System', where one stakeholder is given extended responsibility, is also being implemented for the ocean space, as the 'Bay Chief System'.

Second, a comprehensive ICM system for laws and regulations was developed without fully aligning with existing regulations for terrestrial management in the same area (Su and Peng 2018; Peng et al. 2006). Thus, land and ocean management has been insufficiently integrated, something that needs to be refined when ICM in Xiamen is further developed. This may include, for example, creating zoning plans that account for both land and ocean.

Third, more management efforts and enforcement measures are needed to control non-point source pollution from land-based activities in watersheds with runoff to estuaries and bays.

Finally, integrating science and technological guidance throughout the process—including during design, implementation, evaluation and refinements—has been very valuable.

4.5 What Does Experience Teach Us about IOM Implementation?

The five case studies of IOM reviewed here represent vastly different situations with respect to climatic and oceanic conditions, geographical scales, the nature of economic activities and regulatory environments. Nevertheless, there are some significant commonalities—described below—that provide useful lessons for other contexts. The common denominator is that increasing uses and pressures on marine ecosystems drive the need to consider the totality of pressures on the entire ocean space.

First, climate change is manifesting itself in tropical, temperate and Arctic marine environments and represents a major challenge to ocean management. In this respect, IOM is a critically important way of addressing multiple ocean uses while considering the impacts of climate change.

Second, due regard needs to be given to the local context. It is critically important to tailor IOM to the characteristics and needs of the region in question. The concrete economic activities, community needs, societal goals and environmental pressures should be the point of departure for the development of IOM.

Third, information is critical. It is essential to have robust data series on the evolution of critical environmental variables as well as on economic activities. Without information, management decisions cannot be effectively made. Information should be accessible, easy to find and subject to data quality standards in appropriate formats for public accessibility.

Fourth, implementation—moving from paper to practice—is essential. Several cases demonstrate that this can be done effectively without a separate legal basis for IOM.

Fifth, stakeholder involvement is critical to ensuring that the practical information needed to develop IOM measures is available and building the understanding and legitimacy required for effective implementation.

Finally, institutional mechanisms for IOM are needed, whether formal or informal. There has to be a designated process for how to consider the various pressures and uses of ocean space in a comprehensive manner and make decisions on that basis.

5. Conclusions and Opportunities for Action

This paper argues for the need for integrated ocean management and has identified several central components of successful IOM. Achieving a healthy, productive and resilient ocean requires taking a holistic perspective on ocean use and management, and effectively implementing relevant national and international measures. Given current levels of pressures on our ocean, few human activities can be viewed in isolation. Most activities have impacts that need to be accounted for and viewed in relation to other activities and concerns to fully capitalise on the economic potential of the ocean in a sustainable way. Achieving effective sectoral management is necessary, but not enough. We also need to realise that a sustainable ocean economy depends directly upon healthy, productive and resilient ocean ecosystems and act accordingly. Thus, the need for an integrated, ecosystem-based and knowledge-based approach to ocean governance is pressing.

We need to ensure that ocean industries do not degrade the environment that they and others depend on. It is critical that short-sighted solutions with negative environmental impacts are replaced with long-term, sustainable solutions that strike a better balance between protection and production. Quantitative assessments and strategies for factoring in long-term benefits by implementing sustainable solutions should be developed. Despite progress on some fronts, the current trajectory is in the wrong direction and rapidly growing more serious, e.g. biodiversity loss and plastic pollution. Moreover, important information often exists but is not used in decision-making. Effective ocean governance must consider developments in technology, the impacts of climate change, the dynamic nature of the ocean and seas and the interactions and synergies between land, ocean and people. Connecting

management plans for coastal land areas with the adjacent ocean management plans would significantly improve today's situation in many regions.

The statuses of marine ecosystems and their properties and characteristics vary considerably. IOM provides not only an understanding of the totality of ocean uses and pressures but also guidance for how to prioritise among these various uses. Government solutions need to be tailored to the characteristics and problems of the specific marine region—one size does not fit all, and context is essential. The relevant economic activities, community needs, societal goals, traditional and local knowledge and environmental pressures should be included in a tailor-made IOM process.

That said, IOM supplements but does not replace sector-based management. It is important to maintain and further develop effective sector-based legislation and other measures and keep them up to date with the most recent international standards in, for example, shipping and fisheries. However, coordinating across sectors is needed, including regarding how to collectively prepare for future scenarios.

Furthermore, the need for regional collaboration is evident. Ecosystems and economic activities often occur in several jurisdictions and across national boundaries. Also, activities in the marine realm can have widespread impacts. In the case of such transboundary situations, regional cooperation in, for example, fisheries management or the prevention of marine pollution is necessary to address the problems at an appropriate geographical scale. Also, regional collaboration would greatly benefit from those nations or entities with experience with IOM providing mechanisms for sharing information, data and knowledge. At the local level, connectivity—particularly increased dialogue among

locals and institutions—plays a vital role in ensuring sustainable ocean governance.

Finally, as pointed out when summarising experiences from our case studies, climate change represents a challenge vastly larger than anything we have faced before, and the future of the ocean depends on our ability to address this issue properly. Questions of adaptation and risk management loom large in this respect and are critical dimensions of all opportunities for action discussed below. Adaptive ocean management must make use of the best available science to account for how future climate change will affect ocean businesses (individually and combined), ecosystems and societies. For example, when localising MPAs or ocean industries, authorities must account for changing conditions in the relatively near future due to climate change.

Through five case studies, we have emphasised that conditions vary across countries and regions. We have identified key features for successful IOM such as the need for both a mandate (top-down) and engagement (bottom-up) approach, adequate funding and explicit mechanisms to implement plans, not just create them. Practical and implementable solutions of ocean governance can serve as inspiration and guidance. We can also learn from mistakes. Developed countries with established institutions for marine planning and management do of course not represent the whole picture. In this context, some countries have a clean slate to work with, and therefore the opportunity to get it right the first time. This may be an advantageous starting point for building capacity and establishing IOM.

This paper identifies six main aspects of successful IOM:

- harness science and knowledge
- establish partnerships between public and private sectors
- strengthen stakeholder engagement
- improve capacity building
- implement regulatory frameworks
- develop adaptive management systems

The following opportunities for action respond to each of these in turn.



5.1 Opportunity for Action 1: Harness Science and Knowledge

Tools to develop, strengthen and coordinate governance of the ocean include increased science and monitoring efforts, sharing of knowledge, and transfer of technology and digital infrastructure, especially in the least developed countries and SIDS. For example, the goal of ecosystem-based management is impossible to achieve if data on the ecosystems and the societies depending upon them are lacking. Relevant data and clearly defined goals for management coupled with research and science plans are important to advance and achieve IOM.

In some regions, there are large knowledge gaps for a range of ocean-related issues such as the abundance and interactions among living marine resources, impacts of human activities (existing and future), opportunities embedded in the expected digital and technological revolution, consequences of marine litter and the impacts of climate change. To address this, we recommend strengthening the global ocean science enterprise—including social science—building on the efforts by the UN Regular Process and the IOC, as well as the ongoing efforts at the regional level. Strengthening the role of IOC in IOM would build on already existing structures, enhance the attention given to marine science and help generate the resources needed to develop scientific knowledge and scientific capacity building worldwide. A platform for its development could be the coming UN Decade of Ocean Science for Sustainable Development (2021–2030) as a framework to be hosted within the IOC. Another important output would be the World Ocean Assessments following up on the 2015 and 2020 editions, which can support regional and national ocean governance.

We suggest strengthening the global ocean science enterprise and better using existing knowledge, building on established structures such as the IOC and using the UN Decade of Ocean Science for Sustainable Development as a vehicle for further developing international cooperation in marine and related sciences.



5.2 Opportunity for Action 2: Establish Partnerships between Public and Private Sectors

With a growing blue economy and increasing use of ocean space for human activities, maintaining a productive and healthy ocean becomes more difficult. Currently, investments and infrastructure in the ocean space are developed across various industries and sectors with differing standards of performance and governance. In practice, enduring sustainability can be achieved only if best practices are applied in both the public and private sectors and where productive partnerships between the two are encouraged and advanced. Good governance can bring long-term solutions that advance the economy while supporting societies and protecting the environment.

Advancing and clarifying the responsibilities of the private sector by developing ‘Ocean Principles’ for a sustainable ocean economy, modelled after the Carbon Principles, is a way forward. The UN Global Compact Action Platform for Sustainable Ocean Business has developed principles and guidelines for sustainable ocean businesses that several of the largest ocean-related businesses and financial institutions globally have signed on to (UN Global Compact 2019). A further development would be to give credits to nations and retailers that are able to develop transparent and traceable supply chains that demonstrate sustainability and contribute to the implementation of the 2030 Agenda for Sustainable Development. We suggest strengthening the commitments in business to further develop technological solutions with transparency at their core, thus empowering consumers to change the markets.

We suggest that ocean-related businesses at local, regional, national and international levels cooperate to develop principles and guidelines for the sustainable conduct of ocean businesses.



5.3 Opportunity for Action 3: Strengthen Stakeholder Engagement

To achieve sustainability in the uses of the ocean, including the achievement of the UN Sustainable Development Goals, it is critical to incorporate the insights, ownership and engagement of local stakeholders. National strategies for strengthening ocean management will not work without implementing sustainable projects at local levels of governance. Thus, actively involving communities and including local knowledge are important. Planning at the local level in developing countries, especially SIDS, requires tailoring approaches to the diverse environmental and socioeconomic contexts and governance systems in these regions.

For successful IOM, both mandate (top-down) and engagement (bottom-up) elements are needed. As demonstrated in the case studies, there are a number of approaches to local stakeholder engagement, which are highly context dependent. In all cases, however, designing well-managed engagement processes that consider the scientific, cultural, societal, economic and political contexts and encourage active stakeholder participation is crucial.

We suggest that governments support the active involvement of local communities in all stages of planning and development for integrated ocean management.



5.4 Opportunity for Action 4: Improve Capacity Building

Capacity building—efforts to enhance scientific and regulatory proficiency as well as institutional and collaborative capability—is vital for developing integrated ocean management. In this regard, IOM must address how to handle current and future challenges such as climate change, biodiversity loss and pollution. The scientific capacity needed to implement international governance frameworks is severely lacking in many countries (IOC-UNESCO 2017). Capacity building, primarily building on but also amplifying existing regional and intergovernmental organisations and institutions, needs to remain at the top of the international agenda. At the national level, it

is essential that government agencies involved in ocean management are properly institutionalised, and have the skills, knowledge, authority and capacity—including funding—to address challenges relating to the ocean and coastal communities in a long-term, integrated manner. Here, collaboration and coordination among stakeholders is essential. New technologies combined with transparency give rise to new opportunities for monitoring and policing inappropriate behaviour at sea, bringing practical and inexpensive solutions for the transfer of know-how. Additionally, the ocean science enterprise is advancing technologies that allow us to collect scientific data with less cost and greater efficiency than ever before. To effectively advance capacity, this must be done with transparency, tailored to context, and with data standards in place. In this respect, regional cooperation can be an effective vehicle for strengthening the role of science and providing advice for management, as demonstrated by ICES in the North Atlantic and Western Indian Ocean Marine Science Association (WIOMSA) in the western Indian Ocean.

We suggest identifying and using the best and most relevant principles, practices and procedures from regional efforts at IOM to develop integrated management in other regions.

5.5 Opportunity for Action 5: Implement Regulatory Frameworks

Failure to implement existing international instruments is perhaps the most important weakness of our ocean governance systems. It is vital to have mechanisms in place not just to develop IOM plans, but also to implement them. A comprehensive global ocean governance framework, supplemented with many regional instruments and often adequate national laws, does exist. However, implementation of the legal framework is too often inadequate and ineffective. In some cases, only immediate needs are prioritised in the allocation of resources to implement laws and regulations. There is also a need for local and subnational action plans and direct leadership to achieve successful implementation of IOM. Furthermore, inadequate implementation of existing regulatory frameworks in coastal states is a bottleneck for efficient and sustainable governance.

Important work is underway to address these shortcomings, including efforts to implement regional fisheries management organisation regulations, negotiations on biodiversity beyond national jurisdiction and the development of the seabed mining code by the International Seabed Authority.

A leading principle should be effective implementation of international agreements in domestic legislation and practices, including activities in the high seas. In practice, this means that rules for managing human activities in the high seas should be compatible with and at least as strict as those that apply in areas under national jurisdiction. Ratification of the basic international instruments for ocean governance and adherence to their provisions provided by UNCLOS is a precondition for this.

We suggest that regulatory frameworks for areas beyond national jurisdiction as well as those in areas under national jurisdiction be effectively implemented, building on the best available science. Rules for managing human activities in the high seas should be compatible with and at least as strict as those that apply in areas under national jurisdiction.

5.6 Opportunity for Action 6: Develop Adaptive Solutions

The ocean is highly dynamic, and its governance needs to reflect this. The dynamic nature of the ocean contrasts with the relatively static land areas, and it is important to address land-ocean interactions when developing integrated management of coastal regions.

This dynamism is further amplified by climate change. Many regions are already suffering from the effects of climate change, especially developing countries and small island states where coastal communities and even entire populations are threatened. Climate projections suggest that forward-looking, adaptive solutions where risk is explicitly considered will become an even more important element of IOM.

We suggest that IOM capture the connectivity and differences between land and ocean in an integrated and adaptive manner. Further, we suggest that ocean governance consider the expected future changes in the ocean environment by using the best available scientific knowledge on climate and other environmental changes.

References

- Agardy, T., G. Notarbartolo di Sciarra and P. Christie. 2011. "Mind the Gap: Addressing the Shortcomings of Marine Protected Areas through Large Scale Marine Spatial Planning." *Marine Policy* 35 (2): 226–32. <https://doi.org/10.1016/j.marpol.2010.10.006>.
- Asaad, I., C.J. Lundquist, M.V. Erdmann and M.J. Costello. 2019. "An Interactive Atlas for Marine Biodiversity Conservation in the Coral Triangle." *Earth System Science Data* 11 (1): 163–74. <https://doi.org/10.5194/essd-11-163-2019>.
- Asaad, I., C.J. Lundquist, M.V. Erdmann, R. Van Hooidonk and M.J. Costello. 2018. "Designating Spatial Priorities for Marine Biodiversity Conservation in the Coral Triangle." *Frontiers in Marine Science* 5: 400. <https://doi.org/10.3389/fmars.2018.00400>.
- Ásmundsson, S., and E. Corcoran. 2015. "The Process of Forming a Cooperative Mechanism between OSPAR and NEAFC." 196. UNEP Regional Seas Reports and Studies. United Nations Environment Programme.
- Cao, W., and M.H. Wong. 2007. "Current Status of Coastal Zone Issues and Management in China: A Review." *Environment International* 33 (7): 985–92. <https://doi.org/10.1016/j.envint.2007.04.009>.
- Chua, T.E., H.M. Yu and G.Q. Chen. 1997. "From Sectoral to Integrated Coastal Management: A Case in Xiamen, China." *Ocean & Coastal Management*. 37 (2): 233–51.
- Commonwealth of Massachusetts. 2008. *Massachusetts Ocean Management Plan*. <https://www.mass.gov/service-details/massachusetts-ocean-management-plan>.
- Coral Triangle Initiative (Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security). 2019. "Home." Accessed November 1. <http://www.coraltriangleinitiative.org>.
- Cros, A., N. Ahamad Fatan, A. White, S.J. Teoh, S. Tan, C. Handayani, C. Huang, et al. 2014. "The Coral Triangle Atlas: An Integrated Online Spatial Database System for Improving Coral Reef Management." *PLOS ONE* 9 (6): e96332. <https://doi.org/10.1371/journal.pone.0096332>.
- Domínguez-Tejo, E., G. Metternicht, E. Johnston and L. Hedge. 2016. "Marine Spatial Planning Advancing the Ecosystem-Based Approach to Coastal Zone Management: A Review." *Marine Policy* 72 (October): 115–30. <https://doi.org/10.1016/j.marpol.2016.06.023>.
- Douve, F. 2008. "The Importance of Marine Spatial Planning in Advancing Ecosystem-Based Sea Use Management." *Marine Policy* 32 (5): 762–71. <https://doi.org/10.1016/j.marpol.2008.03.021>.
- Douve, F., and C.N. Ehler. 2009. "New Perspectives on Sea Use Management: Initial Findings from European Experience with Marine Spatial Planning." *Journal of Environmental Management* 90 (1): 77–88. <https://doi.org/10.1016/j.jenvman.2008.07.004>.
- European Union (European Parliament and Council of the European Union). 2008. *Marine Strategy Framework Directive*.
- Executive Office of the President (United States). 2010. "Executive Order 13547. National Policy for the Stewardship of the Ocean, Our Coasts, and the Great Lakes." Washington, DC: United States Government.
- Executive Office of the President (United States). 2018. "Executive Order 13840. Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States." Washington, DC: United States Government.
- Fang, Q., R. Zhang, L. Zhang and H. Hong. 2011. "Marine Functional Zoning in China: Experience and Prospects." *Coastal Management* 39 (6): 656–67. <https://doi.org/10.1080/08920753.2011.616678>.
- FAO (United Nations Food and Agriculture Organization). 2009. *Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unregulated and Unreported (IUU) Fishing*. Rome: FAO.
- GEF, UNDP, UNOPS and PEMSEA (Global Environment Facility, United Nations Development Programme, United Nations Office for Project Services and Partnerships in Environmental Management for the Seas of East Asia). 2009. *Environmental Rehabilitation in a Rapidly Developing Urban Area*. <http://pemsea.org/publications/case-studies/environmental-rehabilitation-rapidly-developing-urban-area>.
- Gjerde, K.M., N.A. Clark and H.R. Harden-Davies. 2019. "Building a Platform for the Future: The Relationship of the Expected New Agreement for Marine Biodiversity in Areas beyond National Jurisdiction and the UN Convention on the Law of the Sea." *Ocean Yearbook Online* 33 (1): 1–44. https://doi.org/10.1163/9789004395633_002.
- Grantham, H.S., E. McLeod, A. Brooks, S.D. Jupiter, J. Hardcastle, A.J. Richardson, E.S. Poloczanska, et al. 2011. "Ecosystem-Based Adaptation in Marine Ecosystems of Tropical Oceania in Response to Climate Change." *Pacific Conservation Biology* 17 (3): 241–58.
- Green, A.L., L. Fernandes, G. Almany, R. Abesamis, E. McLeod, P.M. Aliño, A.T. White, et al. 2014. "Designing Marine Reserves for Fisheries Management, Biodiversity Conservation, and Climate Change Adaptation." *Coastal Management* 42 (2): 143–59. <https://doi.org/10.1080/08920753.2014.877763>.
- Gustavsson, M., and K. Morrissey. 2018. "The Varying Economic Impacts of Marine Spatial Planning across Different Geographical Scales: A Q Methodology Study." In *Towards Coastal Resilience and Sustainability*, edited by C.P. Heidkamp and J. Morrissey. London: Taylor and Francis.
- Hamilton, R.J., T. Potuku and J.R. Montambault. 2011. "Community-Based Conservation Results in the Recovery of Reef Fish Spawning Aggregations in the Coral Triangle." *Biological Conservation* 144 (6): 1850–58. <https://doi.org/10.1016/j.biocon.2011.03.024>.
- Hoel, A.H., and E. Olsen. 2012. "Integrated Ocean Management as a Strategy to Meet Rapid Climate Change: The Norwegian Case." *AMBIO* 41 (1): 85–95. <https://doi.org/10.1007/s13280-011-0229-2>.
- Hou, Y.T., Y.D. Xu and X.Z. Xue. 2019. "The Evolution of ICM Practices in Xiamen: Experiences and Challenges." Case study of task team 1 report on integrated and ecosystem-based ocean management of The China Council for International Cooperation on Environment and Development (CCICED) Special Policy Study on Global Ocean Governance and Ecological Civilization.
- Horigue, V., P.M. Aliño, A.T. White and R.L. Pressey. 2012. "Marine Protected Area Networks in the Philippines: Trends and Challenges for Establishment and Governance." *Ocean & Coastal Management* 64 (August): 15–26. <https://doi.org/10.1016/j.ocecoaman.2012.04.012>.
- IOC-UNESCO (Intergovernmental Oceanographic Commission of UNESCO). 2017. *Global Ocean Science Report: The Current Status of Ocean Science around the World*, edited by L. Valdés et al. Paris: UNESCO Publishing.
- ITXDP (Integrated Task Team of the Xiamen Demonstration Project). 1996. "Coastal Environmental Profile of Xiamen." In MPPEAS Technical Report. No. 6. Quezon City, Philippines: GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas.
- Katona, S., J. Polsenberg, J. Lowndes, B.S. Halpern, E. Pacheco, L. Mosher, A. Kilponen, et al. 2017. "Navigating the Seascape of Ocean Management: Waypoints on the Voyage toward Sustainable Use." Preprint. MarXiv. <https://doi.org/10.31230/osf.io/79w2d>.

- Khan, A., and V. Amelie. 2015. "Assessing Climate Change Readiness in Seychelles: Implications for Ecosystem-Based Adaptation Mainstreaming and Marine Spatial Planning." *Regional Environmental Change* 15 (4): 721–33. <https://doi.org/10.1007/s10113-014-0662-4>.
- Klinger, D.H., A.M. Eikeset, B. Davíðsdóttir, A.M. Winter and J.R. Watson. 2018. "The Mechanics of Blue Growth: Management of Oceanic Natural Resource Use with Multiple, Interacting Sectors." *Marine Policy* 87 (January): 356–62. <https://doi.org/10.1016/j.marpol.2017.09.025>.
- Kvalvik, I. 2011. "Managing Institutional Overlap in the Protection of Marine Ecosystems on the High Seas. The Case of the North East Atlantic." *Ocean & Coastal Management* 56 (January). <https://doi.org/10.1016/j.ocecoaman.2011.09.009>.
- Lin, T., X.Z. Xue, S. Shen and C.Y. Lu. 2005. "Systematic Analysis of Coastal Wetland Changes and Their Ecological Impacts: A Case Study in Xiamen, China." *Environmental Informatics Archives* 3: 137–45.
- Lubchenco, J., and N. Sutley. 2010. "Proposed U.S. Policy for Ocean, Coast and Great Lakes Stewardship." *Science* 328: 1485–6.
- Lubchenco, J., E.B. Cerny-Chipman, J.N. Reimer and S.A. Levin. 2016. "The Right Incentives Enable Ocean Sustainability Successes and Provide Hope for the Future." *Proceedings of the National Academy of Sciences* 113 (51): 14507–14.
- Maliao, R.J., R.S. Pomeroy and R.G. Turingan. 2009. "Performance of Community-Based Coastal Resource Management (CBCRM) Programs in the Philippines: A Meta-Analysis." *Marine Policy* 33 (5): 818–25. <https://doi.org/10.1016/j.marpol.2009.03.003>.
- Mao, Z., and H. Kong. 2018. "What Results in the Success of Xiamen's ICM Practices: A New Study of the ICM System from the Perspective of 'Paradigm Shift.'" *Ocean & Coastal Management* (December). <https://doi.org/10.1016/j.ocecoaman.2018.12.001>.
- Mid-Atlantic Regional Planning Body. 2016. *Mid-Atlantic Regional Ocean Action Plan (OAP)*. Via Bureau of Ocean Energy Management, U.S. Department of the Interior. <https://www.boem.gov/Ocean-Action-Plan/>.
- McCann, J. 2010. Rhode Island Ocean Special Area Management Plan. Volume 1. University of Rhode Island Coastal Resources Center/Rhode Island Sea Grant College Program. Prepared for Rhode Island Coastal Resources Management Council.
- McClanahan, T.R., N.A.J. Graham, M.A. MacNeil and J.E. Cinner. 2015. "Biomass-Based Targets and the Management of Multispecies Coral Reef Fisheries." *Conservation Biology* 29 (2): 409–17. <https://doi.org/10.1111/cobi.12430>.
- Mercer, J., I. Kelman, B. Alftan and T. Kurvits. 2012. "Ecosystem-Based Adaptation to Climate Change in Caribbean Small Island Developing States: Integrating Local and External Knowledge." *Sustainability* 4 (8): 1908–32. <https://doi.org/10.3390/su4081908>.
- Mills, M., R.L. Pressey, R. Weeks, S. Foale and N.C. Ban. 2010. "A Mismatch of Scales: Challenges in Planning for Implementation of Marine Protected Areas in the Coral Triangle." *Conservation Letters* 3 (5): 291–303. <https://doi.org/10.1111/j.1755-263X.2010.00134.x>.
- Muallil, R.N., M.R. Deocadez, R.J.S. Martinez, W.L. Campos, S.S. Mاماуаg, C.L. Nañola and P.M. Aliño. 2019. "Effectiveness of Small Locally-Managed Marine Protected Areas for Coral Reef Fisheries Management in the Philippines." *Ocean & Coastal Management* 179 (September): 104831. <https://doi.org/10.1016/j.ocecoaman.2019.104831>.
- Mulvaney, K.K. 2013. *First Biennial Assessment of the Rhode Island Ocean Special Area Management Plan Process*. Prepared for the Rhode Island Coastal Resources Management Council and the University of Rhode Island Coastal Resources Center.
- NEAFC and OSPAR (North East Atlantic Fisheries Commission and OSPAR Commission). 2014. "Collective Arrangement between Competent International Organisations on Cooperation and Coordination Regarding Selected Areas in Areas beyond National Jurisdiction in the North-East Atlantic." <https://www.ospar.org/documents?v=33030>.
- Northeast Ocean Data. 2009. "Northeast Ocean Data Portal." www.northeastoceansdata.org.
- Northeast Regional Planning Body. 2016. *Northeast Ocean Plan*. <https://neooceanplanning.org/plan/>.
- Norwegian Ministry of Climate and Environment. 2016. *Nature for Life*. Report No. 14 (2015–2016) to the Storting. Oslo: Government of Norway.
- Norwegian Ministry of the Environment. 2002. *Protecting the Riches of the Seas*. Report No. 12 to the Storting (2001–2002). Oslo: Government of Norway.
- Norwegian Ministry of the Environment. 2006. *Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands*. Report No. 8 to the Storting (2005–2006). Oslo: Government of Norway.
- Norwegian Ministry of the Environment. 2009. *Integrated Management of the Marine Environment of the Norwegian Sea*. Report No. 37 (2008–2009) to the Storting. Oslo: Government of Norway.
- Olsen, E., D. Fluharty, A.H. Hoel, K. Hostens, F. Maes and E. Pecceu. 2014. "Integration at the Round Table: Marine Spatial Planning in Multi-Stakeholder Settings," edited by J. Hewitt. *PLoS ONE* 9 (10): e109964. <https://doi.org/10.1371/journal.pone.0109964>.
- Olsen, E., S. Holen, A.H. Hoel, L. Buhl-Mortensen and I. Røttingen. 2016. "How Integrated Ocean Governance in the Barents Sea Was Created by a Drive for Increased Oil Production." *Marine Policy* 71 (September): 293–300. <https://doi.org/10.1016/j.marpol.2015.12.005>.
- Oregon State University, IUCN World Commission on Protected Areas, Marine Conservation Institute, National Geographic Society, and UNEP World Conservation Monitoring Centre. 2019. "An Introduction to The MPA Guide." <https://www.protectedplanet.net/c/mpa-guide>.
- PEMSEA (Partnerships in Environmental Management for the Seas of East Asia). 1998. *The Integrated Coastal Management in Xiamen*. Beijing: China Ocean Press. (In Chinese).
- PEMSEA. 2006a. "Xiamen: An ICM Journey." In 2nd edition PEMSEA Technical Report No. 18. Quezon City, Philippines: GEF/UNDP/IMO PEMSEA.
- PEMSEA. 2006b. "A Perspective on the Environmental and Socioeconomic Benefits and Costs of ICM: The Case of Xiamen, PR China." In PEMSEA Technical Report. No. 17. Quezon City, Philippines: GEF/UNDP/IMO PEMSEA.
- Peng, B., H. Hong, X. Xue and D. Jin. 2006. "On the Measurement of Socioeconomic Benefits of Integrated Coastal Management (ICM): Application to Xiamen, China." *Ocean & Coastal Management* 49 (3): 93–109. <https://doi.org/10.1016/j.ocecoaman.2006.02.002>.
- Pilling, G.M., P. Apostolaki, P. Failler, C. Floros, P.A. Large, B. Morales-Nin, P. Reglero, et al. 2008. "Assessment and Management of Data-Poor Fisheries." In *Advances in Fisheries Science*, edited by A. Payne, J. Cotter and T. Potter, 280–305. Oxford, UK: Blackwell Publishing Ltd. <https://doi.org/10.1002/9781444302653.ch12>.
- Santos, C.F., C.N. Ehler, T. Agardy, F. Andrade, M.K. Orback and L.B. Crowder. 2019. "Marine Spatial Planning." In *World Seas: An Environmental Evaluation, Volume III: Ecological Issues and Environmental Impact*, edited by C. Sheppard, 571–92. Cambridge, MA: Academic Press.
- SMSP Initiative (Seychelles Marine Spatial Plan Initiative). Last updated 2019. "The Initiative." <https://seymsp.com/the-initiative/>.
- Su, J., and B. Peng. 2018. "Evaluating the Trade-Offs between Alternative Coastal Policies: Evidence from Xiamen's ICM Programme." *Ocean & Coastal Management* (May). <https://doi.org/10.1016/j.ocecoaman.2018.05.012>.
- Tuda, A., T.F. Stevens and L.D. Rodwell. 2014. "Resolving Coastal Conflicts Using Marine Spatial Planning." *Journal of Environmental Management* 133: 59–68.

Underdal, A. 1980. "Integrated Marine Policy: What? Why? How?" *Marine Policy* (July): 159–69.

United Nations. 1982. *United Nations Convention on the Law of the Sea*.

United Nations. 1994. *Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982*.

United Nations. 1995. *The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*.

United Nations. 2015. "The First Global Integrated Marine Assessment." Regular Process for Global Reporting and Assessment of the State of the Marine Environment, Including Socioeconomic Aspects. <https://www.un.org/regularprocess/content/first-world-ocean-assessment>.

UN Global Compact. 2019. "Homepage." Accessed November 1. <https://www.unglobalcompact.org/>.

Wang, J., H.S. Hong, L.M. Zhou, J.Y. Hu and Y.W. Jiang. 2013. "Numerical Modeling of Hydrodynamic Changes Due to Coastal Reclamation Projects in Xiamen Bay, China" *Chinese Journal of Oceanology and Limnology* 31 (2): 334–44.

Wang, Q., Y. Li and Y. Li. 2018. "Realizing a New Resilience Paradigm on the Basis of Land-Water-Biodiversity Nexus in a Coastal City." *Ocean & Coastal Management* (September). <https://doi.org/10.1016/j.ocecoaman.2018.09.004>.

Weeks, R., R.L. Pressey, J.R. Wilson, M. Knight, V. Horigue, R.A. Abesamis, R. Acosta, et al. 2015. "Ten Things to Get Right for Marine Conservation Planning in the Coral Triangle [Version 3; Peer Review: 2 Approved]." *F1000Research* 3 (91). <https://doi.org/10.12688/f1000research.3886.3>.

White, C., B.S. Halpern and C.V. Kappel. 2012. "Ecosystem Service Tradeoff Analysis Reveals the Value of Marine Spatial Planning for Multiple Ocean Uses." *Proceedings of the National Academy of Sciences* 109 (12): 4696. <https://doi.org/10.1073/pnas.1114215109>.

XDPO (Xiamen Demonstration Project Office). 1998. *Integrated Coastal Management in Xiamen, 1994–1998*. Quezon City, Philippines: GEF/UNDP/IMO. Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas.

Xue, X., H. Hong and A.T. Charles. 2004. "Cumulative Environmental Impacts and Integrated Coastal Management: The Case of Xiamen, China." *Journal of Environmental Management* 71 (3): 271–83. <https://doi.org/10.1016/j.jenvman.2004.03.006>.

Endnotes

1. A coastal state is a nation state that exercises jurisdiction and sovereign rights in its exclusive economic zone and continental shelf. Note that when using this term regarding the United States, it is applicable to the country as a federal state. U.S. states have jurisdiction over 3 nautical miles from the coastline, while the area from 3 to 200 nautical miles is under federal jurisdiction.
2. The original text in Norwegian reads as follows: 'Formålet med denne forvaltningsplanen er å legge til rette for verdiskaping gjennom bærekraftig bruk av ressurser og goder i Barentshavet og havområdene utenfor Lofoten og samtidig opprettholde økosystemenes struktur, virkemåte og produktivitet.'

Abbreviations

ABNJ	Areas beyond national jurisdiction
BBNJ	Marine biodiversity of areas beyond national jurisdiction
CCA	Climate change adaptation
CTI	Coral Triangle Initiative
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
EBA	Ecosystem-based adaptation
EBM	Ecosystem-based management
EEZ	Exclusive economic zone
FAO	United Nations Food and Agriculture Organization
GEF	Global Environment Facility
ICES	International Council for the Exploration of the Sea
ICM	Integrated coastal management
ICZM	Integrated coastal zone management
IMO	International Maritime Organization
IOM	Integrated ocean management
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IPCC	Intergovernmental Panel on Climate Change
ISA	International Seabed Authority
MPA	Marine protected area
MSP	Marine spatial planning
MSY	Maximum sustainable yield
NEAFC	North East Atlantic Fisheries Commission
NGO	Nongovernmental organisation
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PICES	The North Pacific Marine Science Organization
SAMOA	SIDS Accelerated Modalities of Action
SDG	Sustainable Development Goal
SIDS	Small island developing states
RPOA	Regional plan of action
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

Acknowledgements

The authors thank the paper's technical reviewers, Tundi Agardy, David Balton, Joachim Claudet, Stuart Green and Louise Lieberknecht, as well as its arbiter, Jane Lubchenco, who all provided helpful technical comments. The authors also thank World Resources Institute for providing support as the Ocean Panel Secretariat. While our colleagues were very generous with their time and input, this report reflects the views of the authors alone. The authors also thank Sarah DeLucia for copyediting and Billie Kanfer for design.

About the Authors

Lead authors

Jan-Gunnar Winther is the director of the Centre for the Ocean and the Arctic in Norway. He is also a specialist director at the Norwegian Polar Institute, and serves on a number of national and international committees and delegations including World Economic Forum, UN Global Compact Sustainable Ocean Business Action Platform, China Council for International Cooperation on Environment and Development and the Expert Group for the High Level Panel for a Sustainable Ocean Economy.

Minhan Dai is a chair professor at Xiamen University in China, where he serves as director of the faculty of Earth Science and Technology, and director of State Key Laboratory of Marine Environmental Science. His research interests include ocean biogeochemistry and sustainability. He has served on many national and international committees including the Expert Group for the High Level Panel for a Sustainable Ocean Economy.

Contributing Authors

Fanny Douvere has been the coordinator of the Marine Program at UNESCO's World Heritage Centre in Paris, France, since October 2009. The mission of the programme is to ensure that the 49 marine sites on UNESCO's World Heritage List are conserved and sustainably managed.

Leanne Fernandes is a senior manager and the marine coordinator at the International Union for Conservation of Nature. Over the last decade she has applied her knowledge to address marine resource management problems on the islands of Hawaii, the Maldives and the Caribbean and in the North Sea and coastal Australia.

Patrick Halpin is a professor of marine geospatial ecology at Duke University in the United States. He leads the Marine Geospatial Ecology Lab with laboratory facilities located at the main campus of Duke University as well as the Duke University Marine Lab.

Alf Håkon Hoel is a professor at UiT The Arctic University of Norway. He is a political scientist who has written extensively on issues relating to the management of living marine resources and the marine environment. His core interest is international relations in the field of ocean management, in particular in the Arctic and the Antarctic. Recent publications include analyses of the use of ecosystem-based management approaches in the Arctic.

Marie Antonette Juinio-Meñez is a professor at the University of the Philippines. Her research interests are invertebrate ecology and culture, coastal resources management, and marine science and marine biology.

Yangfan Li is a professor at Xiamen University in China. His main research interest is integrated coastal management. His work focuses on understanding the coupling mechanisms of coastal land-sea and social-ecological systems.

Karyn Morrissey is a senior lecturer at Exeter University in the United Kingdom. She is an economist specialised in the science-policy-industry interface and focused on understanding the impact of socioeconomic and environmental inequalities on health outcomes, using data both big and small.

Therese Rist is an advisor at the Centre for the Ocean and the Arctic in Norway, whose mandate is to contribute to a sustainable blue economy. She holds a postgraduate degree in public and international law from Melbourne Law School.

Fabio Rubio Scarano is a professor at the Federal University of Rio de Janeiro in Brazil. His main research interests are climate change adaptation, sustainability science, the science-policy interface and biodiversity conservation.

Amy Trice is the director of ocean planning at the Ocean Conservancy. She is a policy

expert and scientist advancing solutions that integrate marine industry, conservation and science in ocean management decisions. Her research informs congressional staff as well as state and federal agencies on the value of comprehensive and coordinated ocean policies for economic and ecosystem resilience.

Sebastian Unger is the research group lead for ocean governance at the Institute for Advanced Sustainability Studies in Germany. His research focuses on global governance processes for ocean sustainability, including the development of a new international agreement for marine biodiversity in areas beyond national jurisdiction, the UN Sustainable Development Goals and the governance of deep seabed mining.

Sandra Whitehouse is a scientist and consultant at the Ocean Conservancy who has served for over 20 years as an ocean policy advisor to multiple organisations and institutions.



HIGH LEVEL PANEL *for*
**A SUSTAINABLE
OCEAN ECONOMY**

10 G Street NE
Suite 800
Washington, DC 20002, USA
+1 (202) 729-7600

oceanpanel.org

