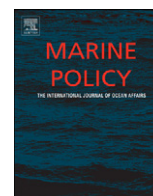




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## Near-term priorities for the science, policy and practice of Coastal and Marine Spatial Planning (CMSP)

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### ABSTRACT

There is currently a rare opportunity to inform emerging efforts to implement coastal and marine spatial planning (CMSP) in the United States, Europe and elsewhere around the world. In particular, the newly formed US National Ocean Council is developing a strategic action plan for CMSP over the next 18–24 months. In order to identify priority needs for significantly advancing CMSP, a group of experts in the science, policy and practice of CMSP developed recommendations for (1) process development, (2) communication and engagement efforts, (3) tradeoff and valuation analyses, and (4) decision support. Some of these priorities are supported by existing activities in the United States and elsewhere. Others have yet to be addressed and merit immediate attention.

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### 1. Introduction

The last five years have seen a rapid increase in interest and action at local, state, national, and international levels to implement spatially explicit management of marine resources [1–11]. In July 2010 US President Obama signed Executive Order 13547 establishing a national ocean policy that incorporates recommendations from his Interagency Ocean Policy Task Force [12,13] and calls for ecosystem-based coastal and marine spatial planning (CMSP). A strategic planning process has been initiated to inform

**Box 1**–Near-term priorities for advancing CMSP. Within each of the four categories, items are listed in approximate order of priority. All items should be addressed immediately, although need not be solved in the short-term for important and significant progress to be made in CMSP.

### **Process**

- Provide guidance on how Regional Planning Bodies (RPBs) should establish operational, location-specific objectives, and boundaries nested within the national goals for CMSP.
- Develop methods for CMSP processes that are proactive rather than reactive, in particular with respect to locally new or emerging uses of the oceans and climate change.
- Build coordination in planning, objective setting, and governance across nested geographic scales and laterally among existing and emerging local, state, and regional plans.
- Conduct a legal gap, obstacle, and opportunity assessment at national, state, regional, and international levels that evaluates the potential of existing laws, obligations to aboriginal peoples, and regulatory mechanisms to support CMSP and promote cross-border cooperation.
- Take advantage of opportunities to learn-by-doing in contexts ripe for moving forward with CMSP (contexts may be particular locations, sets of uses/pressures or services, combinations of agencies/sectors, or motivated communities) and quickly document lessons learned.
- Recommend how RPBs can build transparency and accountability for agencies, industries, and other users into their CMSP processes and outputs.
- Recognize and include aboriginal rights and other treaties in CMSP processes.

### **Communication and engagement**

- Develop a compelling ‘business case’ that clearly presents why CMSP is needed and is an essential addition to both current sectoral and future integrated management. The business case should identify and describe the potential benefits (to whom), the costs and risks of inaction, and the incentives for engagement, while also identifying potential challenges with equal clarity.
- Develop and implement strategic communication plans – initially broadly about CMSP, and more regionally focused as planning efforts gain momentum – that articulate the business case in easily understood language. These plans should use a variety of media and incorporate concrete, regionally pertinent examples where possible.
- Develop and disseminate guidance on best practices for full engagement of and cooperation among national, state, tribal/indigenous, public, private, and other stakeholder interests in the CMSP process.
- Develop guidance on approaches to balance top-down development of mandates for CMSP with bottom-up engagement within CMSP processes.

### **Tradeoffs and valuation**

- Provide guidance and science-based approaches for how to evaluate the relative compatibility and incompatibility of existing or proposed uses in CMSP plans under alternative management schemes.
- Develop or refine models and methods for assessing and optimizing tradeoffs among social, economic, and environmental objectives at multiple spatial and temporal scales.
- Identify a currency (or currencies) for comparing outcomes of alternative CMSP plans, noting the critical need to include market and non-market benefits from nature in the overall assessment.
- Recognize and develop methods for addressing diverse value systems within and among human communities that can lead to different core objectives within a single CMSP process.

### **Decision support**

- Assess which information is necessary to develop different types of CMSP plans, including traditional and local knowledge, and identify the best scale(s) for collecting and reporting data.
- Compile available data, models and other information and identify gaps relevant to assessing:
  - Cumulative impacts across a range of spatial scales;
  - Potential interactions among human uses;
  - Non-linear responses of systems to increasing human use and natural forces, including social and economic tipping points;
  - Connectivity (of positive and negative impacts) among locations, via ecological or social processes, within and outside the planning area;
- Develop user-friendly, open-source, efficient and transparent tools for data visualization, integration, and sharing
- Advance and refine existing decision support tools to address CMSP-specific needs, including but not limited to:
  - moving from (past) impact analysis to (predictive) vulnerability assessment;
  - shifting from cost-benefit analysis to full valuation assessments.
- Develop clear, reliable, and measurable indicators for monitoring effectiveness of CMSP at achieving objectives set during the planning process.

CMSP at both national and regional scales. Similar efforts are underway in Australia, Canada, and the European Union (e.g., [4,9,14–18]), and at the state level within the US in California, Massachusetts, Oregon, and Rhode Island, among others [19–21]. This is a case where policy development and implementation are in step with, if not leading, the science, and policy-makers are seeking expert guidance on how to translate policy into effective practice. These MSP initiatives urgently require advice on how to establish robust, transparent, and accountable public processes, and how to fill key information needs and gaps with limited resources.

As defined in Obama's Executive Order, CMSP is a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process for analyzing current and anticipated uses of ocean and coastal areas. The process involves identifying areas most suitable for various types of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security, and social objectives [13]. Multiple use of the ocean has been the norm for centuries, with fisheries, oil and gas extraction, shipping and transportation, the military, mining, recreation, and conservation, among others, all sharing or competing for space or resources. Where space has been allocated to specific uses, management decisions have rarely been coordinated with other sectors, or informed by ecological principles. Burgeoning demands for ocean space and resources, particularly for activities that require exclusive or near-exclusive use of space (e.g., some types of aquaculture, ocean energy), mean that coordinated and comprehensive management is no longer an option but a necessity [8,22].

To inform ongoing and emerging CMSP processes, a group of 35 experts met to identify the most pressing needs, obstacles, or opportunities that, if addressed, would help significantly advance CMSP in the near-term (one to five years). Experts were selected by a steering committee to provide roughly equal representation of (1) experience in the science, policy, and practice of CMSP, (2) US State, US Federal, and international perspectives, and (3) academic, governmental, and non-governmental experience. During the workshop participants developed comprehensive lists of priority issues within the science, policy, and practice of CMSP as well as cross-cutting themes and then refined and ranked these lists by their potential immediate impact on emerging CMSP efforts. Here we present and explain the top priorities that emerged.

Participants followed several core principles when identifying top priorities for CMSP. First, rather than a review of what is already known about CMSP, as such studies are already available [5,7,8,22,23], participants identified near-term needs and priorities for practical implementation of CMSP, particularly in the United States. Consequently this paper provides guidance on where effort and resources should be directed over the next one to five years to help move CMSP forward as quickly and efficiently as possible. Similar scoping efforts have already been undertaken in several US regions and elsewhere. Many of these efforts were represented in the workshop, ensuring that experience derived from them was reviewed and incorporated into our deliberations. Second, the workshop focused on engaging a small group of people with real-world recent experience in the science, policy, or practice of CMSP. Thus the workshop did not include everyone with relevant experience (for example, private industry and tribal interests were underrepresented). Finally, to produce a short and feasible list of priorities, participants evaluated each potential issue for the value of information it would provide if addressed successfully. Thus, items that could be addressed relatively quickly and would directly inform and support ongoing CMSP processes in the United States were ranked higher, while items

that were important but more financially, resource, or politically costly to address were ranked lower.

## 2. Near-term priorities

The top 20 near-term priorities for CMSP fall into four broad categories: process, communication and engagement, tradeoffs and valuation, and decision support (see Box 1). At least some priorities in all four categories must be addressed to advance CMSP in the near-term. Within each category, items are listed roughly in the order in which they should be addressed, considering both urgency and logical progression of CMSP implementation. However, the rank order of adjacent items holds less importance than the ranking of top and bottom priorities. For example, CMSP processes always need to first establish management goals; after that, the order is more flexible and case specific.

### 2.1. Process

CMSP, like all planning, is a process, not an endpoint. Planning processes can be implemented in ways that range from highly effective to counterproductive. CMSP is a relatively new and promising approach to managing our interactions with the ocean, requiring a shift from single-sector management towards more comprehensive and coordinated management. This shift in focus requires specific and deliberate processes.

In the United States, it is expected that nine Regional Planning Bodies (RPBs) will be in charge of implementing CMSP [12,13]. Although details of regional priorities will almost certainly differ, the *process* of setting goals for each region should be similar. Providing guidance on how best to set goals and evaluate strategies to achieve them will help make RPB efforts more robust and effective. For example, articulating who needs to be engaged in goal setting and that this needs to happen early in the planning process should be a part of any CMSP effort. Because goals define the whole planning process, this step has the highest priority within this category.

While management usually intends to be proactive, in practice it is often reactive due to: the extra political will that is needed for proactive planning, limited budgets allocated to more pressing needs, greater upfront resources often required for proactive planning, and institutional tendency to avoid change until impacts directly affect social and economic well-being. CMSP encourages proactive planning as it aims to coordinate and efficiently plan across multiple sectors, user groups, and temporal and spatial scales, which in general cannot be done reactively. In other words, addressing issues at the beginning rather than the end of policy-making processes should avoid many conflicts that result from reactive management [7,24] and help find constructive compromises for conflicts that cannot be resolved (e.g. inherent tradeoffs).

The emergence of CMSP processes at state, regional, and federal levels within the United States and across regions and scales elsewhere suggests a transition to more comprehensive and coordinated management of the ocean. However, two key challenges emerge with this transition. First, for nested processes (e.g. state within region; region within federal), coherence of planning and implementation across nested scales is critical both for stakeholder understanding of and adherence to CMSP management plans and for regulators at each scale to avoid impeding outcomes at other scales. Coherence means that goals, objectives, management tools, and actions link across the nested hierarchy without gaps. Second, for contiguous planning areas, it is essential to acknowledge and coordinate across planning region boundaries. For example, managing processes such as transport of

pollutants or connectivity of marine populations across boundaries require coordinated planning. For both cases, CMSP needs institutional flexibility within existing agencies and an explicit statement or reconciliation of scales of operation (data, process, etc.).

Although CMSP represents a novel approach to ocean management, it will by necessity be implemented within the current management structure. It will be predominately supported and constrained by existing laws and regulations, usually implemented by existing regulatory bodies. To help understand how best to navigate this legal landscape, CMSP will benefit from an analysis of legal gaps, obstacles, and opportunities. In the US, this analysis is underway at the federal level but not broadly at regional levels where state-to-state (or other scale) coordination will be imperative.

As ongoing and emerging CMSP processes move forward, it will be invaluable to make the process adaptive by learning from these efforts and incorporating lessons into future planning processes. The need for adaptive management has been recognized for decades [25,26] and this need is equally true if not more pressing for CMSP [8,24]. The changing ocean climate and the emergence of offshore aquaculture and alternative energy are just a few examples of large changes CMSP will face in the near-term. Since no single CMSP process can anticipate all potential outcomes, it will be important to learn from different geographies, sets of human uses, agencies and institutions, and ecosystem types. This priority suggests at least two concrete actions: (1) evaluate existing planning processes as they occur and garner lessons learned shortly after the processes finish and (2) incorporate existing planning activities and data collection into future CMSP implementation efforts. This second point is particularly important as it helps engage and leverage past (often expensive) planning processes.

Management is generally more effective when it is transparent and clear lines of accountability exist, so that both resource users and managers understand when they may participate and who is responsible for which aspects of the planning process (and the resulting agreements that may lead to new or altered regulations). Within the US, clear guidance to RPBs on how to build this type of accountability into CMSP will help avoid confusion. It may also enhance participation in the process and increase compliance with resulting plans (e.g. [27]).

Finally, CMSP processes must recognize and honor aboriginal rights to natural resources, especially because these rights are usually place-based. CMSP planning should be structured so that tribal governments can engage to the full extent of their sovereign authority, and because only nations can negotiate with each other, the federal government must play a key role here.

## 2.2. Communication and engagement

CMSP will benefit greatly from clear communication about exactly what is being done and why, and who will be affected by the changes and how. Similarly, CMSP processes will benefit if all stakeholders feel fully engaged in the process.

Perhaps the greatest challenge CMSP efforts currently face is demonstrating and communicating when and how CMSP leads to better outcomes than conventional sectoral management for a range of audiences, including businesses, government, and taxpayers. To overcome this challenge, a 'business case' needs to be developed that clearly articulates the advantages of CMSP, while also being candid about the challenges. It should articulate how CMSP can advance existing government mandates, be both politically and economically cost-effective, and engage managers and stakeholders to ensure their concerns are addressed appropriately. The business case should be based on economic and

social as well as natural science information, and specifically address benefits (and costs) for each group that will be affected by CMSP plans. Because different individuals and groups may bring very different value sets to the table, there will likely be need for several business cases that are tailored to these different perspectives. Once developed, business cases should be broadly communicated.

To ensure this communication is effective, strategic communication plans need to be developed using simple, sector-specific, and direct language that is tailored to each geographic region and interest group. While the goal is not to produce a marketing plan, as it would be counterproductive to oversell the positives or underplay the negatives of CMSP, there is value in adopting some of the marketing techniques used for commercial products and political campaigns. For example, enlisting respected people to engage and communicate with their own stakeholder groups can significantly help translate and transmit ideas [28]. These strategic communications plans should be prepared and activated as quickly as possible.

Stakeholder engagement has long been recognized as a cornerstone of successful management, and this will certainly be true for CMSP [8,12,24,29]. Stakeholder engagement within sectors is common (e.g., [30–33]), but the scope and diversity of groups that need to be engaged in CMSP will likely require new or modified approaches. It will be helpful to distribute best-practice guidelines on how to effectively and meaningfully engage the full range of stakeholders, including federal, state, aboriginal, business/industry, other non-governmental, and public interests (e.g., [10]), and how best to engage key individuals and groups across the broad stakeholder diversity.

Finally, CMSP will necessarily emerge from both top-down mandates and varying levels of bottom-up desire and support for change. The best outcomes will be achieved by a balanced dialog between these two motivating forces, rather than a unidirectional push [34]. Guidance on how to encourage and facilitate this dialog will be particularly important.

## 2.3. Tradeoffs and valuation

This category focuses on two areas of information and knowledge that are particularly important for effective CMSP. The first is assessing, and to the extent possible quantifying, tradeoffs among uses that result from management decisions. The second is recognizing that people value many different features and benefits provided by the sea.

Information about compatibilities and incompatibilities of human uses of the ocean will provide valuable guidance on a basic structure for CMSP efforts, clarifying planning constraints. The nature of these compatibilities/incompatibilities is generally context-specific, with habitat and social vulnerability, intensity of human uses, and other factors determining which uses can coexist sustainably. Guidance on how to evaluate different scenarios for incompatibilities within a regional context would allow CMSP plans to make rapid initial progress.

CMSP would be greatly improved by a transparent assessment of tradeoffs among users and interests under alternative management scenarios. To do so, planners need to assess services derived from nature and the relative value of social and economic benefits that result from these services [35]. Planners also need to establish which uses and services are likely to have strong tradeoffs, paying close attention to perceived tradeoffs that may not actually exist (i.e. where win-win solutions may exist). Tradeoffs can be among different locations, resources, ecosystem services, sectors, and times (short vs. long-term benefits or impacts). Clearly identifying and quantifying tradeoffs helps make clear who or which sectors likely benefit under different

management scenarios. Many methods and models exist for assessing tradeoffs (e.g., [36–38]), but there is need for guidance on how best to use or refine these approaches.

A key hurdle for comprehensive tradeoff analysis is identifying the currencies necessary to allow measurement and comparison of very different ecosystem services (e.g. cultural values vs. seafood). Assets need to be measured in currencies that reflect their values to people, and some methods exist for such comparisons [39]. In addition to more standard economic (dollar) assessments, currencies will likely include measures of social value, esthetic and cultural significance, and protection of natural biodiversity [24,40]. Developing guidance on how to best work with multiple currencies would greatly advance the use of tradeoff analyses.

Equally challenging is the need to integrate widely divergent values that people place on coastal and ocean ecosystems, and resulting differences in preferences for ocean uses and benefits. Finding acceptable compromises is particularly difficult when different participants are highly risk averse to different outcomes, reflecting value-based differences in weights attached to social, economic or environmental aspects of a decision. Guidance on how to best include these diverse values in valuation methods will help make these assessments more accurate.

#### 2.4. Decision support

Decision support refers to the types of data, information and tools that are needed to facilitate CMSP implementation. Addressing the process, communication, and tradeoff priorities identified above will determine the types of decisions that will be made in each CMSP plan, in turn guiding the types of data and knowledge that should be assembled to inform those decisions. Clearly articulating those needs will help ensure that resources are focused on gathering and synthesizing only information that is most useful and relevant to the CMSP process at hand. Regular and sustained involvement of experts in a broad range of natural and social sciences and local and traditional knowledge specific to each region will be essential (e.g., [41]).

Once these needs are articulated, the next step is to assess what is known, from both scientific sources and local and traditional knowledge, and identify key knowledge gaps. In doing so, it is important to assess the scale (how big an area) and resolution (how fine-grained the information) necessary to support management decisions. Because of the comprehensive, multi-sectoral nature of CMSP, information needs will include, among others, the status of indicators of system goals, cumulative impacts of human activities on marine systems, and interactions and synergies among uses. Because CMSP is intrinsically spatial, it will also be essential to have information on connectivity between the planning area and surrounding regions with respect to both negative impacts such as pollution transport and positive impacts such as larval dispersal that replenishes biological populations. While efforts to identify and fill key knowledge gaps are essential, they should not thwart ongoing planning processes that are necessarily based on the best available science. Because CMSP is intended to be adaptive, plans and the process of collecting information should be reviewed periodically and refined to accommodate new information.

The integrated and cross-sectoral nature of CMSP requires tools that allow for easy and transparent data sharing, integration, and visualization. In particular, the highly diverse nature of data and information needed for CMSP requires new data visualization tools. Such tools play a large role in effective stakeholder engagement and therefore require immediate attention [10,42].

A wide range of existing decision support tools can help CMSP processes, but several would have more immediate value if

modified to more directly serve CMSP. For example, cost-benefit analysis would better serve CMSP if it could provide a more comprehensive assessment of the value of different management decisions relative to the variety of ways in which people value ocean systems and services. Management should invest in these improvements, informing them with direct dialog between decision support tool developers and CMSP practitioners.

Finally, in order to assess and communicate how CMSP processes are working scientists need to work with managers to develop and implement appropriate, effective, and measurable indicators that assess performance in relation to stated goals and objectives. These indicators should include measures of benefits to people and be able to represent tradeoffs. Guidance on how to efficiently develop or obtain these indicators will help move CMSP forward quickly.

#### 2.5. Additional needs

Three additional albeit less pressing needs were discussed at length during the workshop but were ultimately not considered top priorities. First, development of clear organizational and responsibility charts for all government agencies involved with CMSP will greatly help communication, data sharing, and task assignment in each region. The US federal process alone is engaging 24 agencies and departments, and when state and tribal processes are coordinated with regional and federal processes, the number greatly increases. Second, given that most or all planning areas span multiple jurisdictions, compatible regulatory language and guidelines will allow resource users to cross jurisdictions without confusion. Legal coherence helps streamline administration and enforcement as well, directly benefiting users via clarity and consistency of requirements. Finally, although industries are often wary of new regulations, they can quickly become advocates if they feel regulations create an 'even playing field' where all companies are truly subject to the same rules, or if regulatory efficiency (e.g., time to permitting) is improved. In other words, CMSP will be most successful if it achieves equity and efficiency, and only reaches its full potential if it is "the only game in town". If key players can skirt CMSP processes, it will be difficult to maintain the confidence and commitment of other parties.

### 3. Discussion

CMSP efforts can leverage numerous emerging activities and opportunities to help tackle these needs. Priority items identified here are not about making CMSP possible but about making it more efficient and effective. Addressing any of these items will lead to significant short-term progress and will also underpin delivery of long-term goals; addressing all or even most of them is not necessary to make meaningful progress towards effective CMSP. In fact, incremental progress is expected and beneficial as it allows for adaptive management and priority setting. Decisions about the order in which to address issues will depend on opportunities (such as available resources, political or public expectations) and the specific characteristics, needs and goals of each CMSP process (e.g., complexity of sectoral interactions, history of stakeholder engagement, and strength of political leadership). In many cases, goals of a specific planning process may be addressed with only minor shifts to existing information and procedures, for example changing the resolution of spatial data used for analyses or facilitating wider data sharing. The need to be targeted, opportunistic, and modest in addressing these priorities is particularly important in the current economic climate.

Although priorities need to be addressed in all four categories, there was consistent emphasis in our workshop discussions on



the value of a rigorous, well-communicated and convincing case showing the benefits of CMSP relative to current sectoral management. There are many possible ways to evaluate these differences, including (1) predictability and types (but not exact details) of decisions that would be made, information needed, and who would and would not participate in any given decision process, (2) efficiency and equity of permitting and spatial allocation decisions, and (3) resilience and overall health of the ecosystem. For non-commercial users, metrics that capture the likelihood of successfully preserving or restoring ecological, cultural, recreational, or spiritual values and benefits will be paramount, while commercial users will likely care more about the first two measures. Stakeholder groups that see demonstrable improvement in activities and services that matter to them are more likely to become CMSP allies.

A related communication hurdle is addressing the concern that CMSP may lead to a host of new regulations and rules, or potentially a 'land-grab' of access rights. However, CMSP is a process rather than a specific outcome. Whether coordination is implemented through more or fewer regulations will be case specific. That being said, greater certainty in who can do what where, and what information should inform decision-making, may reduce the regulatory maze faced by some users, particularly those subject to multiple levels of regulation.

The development of coastal and marine spatial plans is intended to achieve better coordination among ocean uses and enable more integrated, ecosystem-based approaches to planning and managing for multiple uses across sectors [13]. Thus, CMSP is an important step in the implementation of comprehensive, ecosystem-based management (EBM) – a foundational principle for comprehensive management [12]. As is true for all approaches to EBM, CMSP cannot simply be an 'add-on' to existing structures or ways of managing resources or something for managers to do on top of their current workloads. In other words, EBM is not equivalent to perfect sectoral management. Planning should focus on the collective costs and benefits of all managed activities in a particular area to assess progress towards social, economic and environmental objectives and an explicit analysis of tradeoffs among planning options. Furthermore, there is no single right way to do CMSP or EBM, and any given process will need to be adapted to the ecological, technological, social, and political context [32].

The US National Ocean Council (NOC) is responsible for coordinating and engaging each of the 9 planning regions and all of the individual states and territories within those planning regions, and must determine how to operationalize CMSP given limited resources over the next two years. The priorities described here are relevant to each of the regions. For example, some regions are beginning to discuss how to formalize their RPB, engage stakeholders, and integrate data and information for decision-making. Development of communication tools (the 'CMSP business case') will greatly facilitate each RPB's engagement of stakeholders, especially among those who remain skeptical about investing time and resources towards informing regional plans.

Many other countries are working to develop spatially explicit management plans for coastal areas. Thus, although our focus was primarily the US, most priority items listed here are highly relevant to both developed and developing country contexts. For example, in Chile CMSP is being developed through the National Policy of Coastal Uses (Política Nacional de Uso del Borde Costero) with a focus on building transparency, taking advantage of opportunities and learning-by-doing contexts, and integrating different types of knowledge [43]. Similarly, a national level program of marine bioregional planning within Australia has experienced challenges relevant to many priorities identified here (<http://www.environment.gov.au/coasts/mbp/index.html>). There are also recent and ongoing scoping activities on particular topics

(e.g., ecological principles [23]) and at the international level on development of integrated and complementary ocean governance and science needs related to CMSP (e.g., [44]).

In the US, as in other countries, the transition to CMSP has been marked by rapid policy development. This poses challenges for those charged with implementation, as they need to make best use of existing information and prioritize new work to meet ambitious timetables. The medium to long-term success of CMSP, including the extent to which it helps achieve social, economic, and environmental objectives, will depend on perceived success of the near-term process. We hope that our efforts to identify near-term priorities will help guide implementation and make best use of scarce resources.

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## Appendix A. Workshop participant list<sup>1</sup>

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**Stefan Gelcich:** Associate Researcher, Centre for Advanced Studies in Ecology & Biodiversity, Pontificia Universidad Católica de Chile.

\***Mary Gleason:** Lead Marine Scientist, CA Coastal and Marine Program, The Nature Conservancy.

\***Benjamin Halpern:** Research Biologist, Project Coordinator, National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara.

**Simon Jennings:** Principal Scientist, Centre for Environment, Fisheries and Aquaculture Science.

**Sarah Lester:** Project Scientist, Marine Science Institute, University of California, Santa Barbara.

**Kathleen Leyden:** Director, Maine Coastal Program, State of Maine **Amber Mace** Executive Director, California Ocean Protection Council.

<sup>1</sup> The symbol \* denotes steering committee member.

**Laurence McCook:** Manager, Ecosys. Health & Resilience, Great Barrier Reef Marine Park Authority.

\***Karen McLeod:** Director of Science, COMPASS, Department of Zoology, Oregon State University.

\***Nicholas Napoli:** Science Program Manager, Massachusetts Ocean Partnership.

**Kit Rawson:** Conservation Science Program Manager, Treaty Rights Office, Tulalip Tribes.

**Jake Rice:** Director of Advice and Assessment, Fisheries and Oceans, Canada.

\***Andrew Rosenberg:** Senior Vice President for Science and Knowledge, Conservation International.

\***Mary Ruckelshaus:** Managing Director, The Natural Capital Project, Stanford University.

**Bettina Saier:** Director, Oceans Program, World Wildlife Fund, Canada.

**Astrid Scholz:** Vice President of Knowledge Systems, Ecotrust.

**Malcolm Williams:** Center for Maritime Policy and Strategy Studies, US Coast Guard Academy.

**Anna Zivian:** Marine Spatial Planning Manager, Ocean Conservancy.

### A.1. Advising on policy context

**Chris Caldwell:** Acting Branch Chief, National Oceanic and Atmospheric Administration.

**Paul Doremus:** Director of Strategic Planning, National Oceanic and Atmospheric Administration.

**Andrew Lipsky:** Ocean Policy Advisor, Ocean and Coastal Policy, Council on Environmental Quality.

**Jennifer Lukens:** Acting Director, NOAA CMSP Program.

\***Paul Sandifer:** Senior Science Advisor to the NOAA Administrator, NOAA.

**Charles Wahle:** Senior Scientist (acting), NOAA Coastal and Marine Spatial Planning Program.

### A.2. Unable to attend due to last minute travel complications

**Laura Cantral:** Program Director, Meridian Institute.

**Sarah Chasis:** Director, Ocean Initiative, Natural Resources Defense Council.

**Simon Cripps:** Chief Executive, Dorset Wildlife Trust.

**Jane Lubchenco:** Administrator, National Oceanic and Atmospheric Administration.

**Kathryn Mengerink:** Director of Ocean Program, Environmental Law Institute.

**David Stein:** Marine Cadastre, Coastal Services Center, NOAA.

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