

**CHARTING THE COURSE FOR OCEAN SCIENCE IN THE  
UNITED STATES:  
RESEARCH PRIORITIES FOR THE NEXT DECADE**

**Public Review Collation  
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## **General Comments**

I am writing on behalf of American Bird Conservancy (ABC) to offer comments on the draft plan “Charting the course of ocean science in the United States: Research priorities for the next decade”. This plan developed by the NSTC Joint Subcommittee on Ocean Science and Technology is designed to outline the national ocean research priorities and provide a basis for the Ocean Research Priorities Plan and Implementation Strategy to be released in December of 2006. The draft plan outlines and describes 21 research priorities under six societal themes.

American Bird Conservancy is the only 501(c)(3) organization that works solely to conserve native wild birds and their habitats throughout the Americas. ABC acts to safeguard the rarest bird species, restore habitats, and reduce threats, while building capacity in the conservation movement. ABC is the voice for birds, ensuring that they are adequately protected; that sufficient funding is available for bird conservation; and that land is protected and properly managed to maintain viable habitat. ABC counts among its staff some of the foremost experts in bird conservation in the United States, and partners with many others throughout the Americas. ABC is a membership organization that is consistently awarded a top, four-star rating by the independent group, Charity Navigator.

As an advocate for seabirds, ABC is committed to ensuring that ocean resource priorities are developed in such a way that promotes strong, science-based management and conservation for this species group.

### ***Comments***

#### ***General:***

We strongly support the efforts of National Science and Technology Council’s Joint Subcommittee on Ocean Science and Technology to prepare an Ocean Research Priorities Plan and Implementation Policy. However, we are concerned that the current draft document is too broad to result in clear and concise research activities that directly contribute to improved understanding of the ocean ecosystem. We appreciate the ecosystem approach taken in the draft document, but would like to see some mention of specific, yet broad-spanning, issues in the marine environment (e.g., marine debris, fisheries impacts, energy development), as well as taxon- or discipline-specific recommendations. In the current document, only climate change and natural hazards are addressed under their own specific theme and individual taxa are only alluded to. We understand that the goal of the document is to paint a broad picture, but in its current state it is weak as a guidance document.

A prioritization of ocean research needs is warranted and an ecosystem level approach is useful. However, the research priorities listed in the draft document do not adequately describe this approach. In many areas more detail is needed on the specific research needs and data gaps. Specific research recommendations and discussion of data gaps should be provided under each of the six themes outlined in the draft document. Understanding data gaps is a critical step towards developing the proper research priorities to improve our ability to manage the ocean’s resources. To address this issue and outline a strong plan for approaching national ocean research needs, the JSOST needs to develop assessments in conjunction with experts in all ocean taxa, and disciplines. This could be accomplished through a federal advisory committee, *ad hoc* groups, or some other mechanisms, and would

require discipline-specific assessments followed by interdisciplinary assessments to avoid overlap.

The draft document places too much emphasis on large ocean processes, human use, and impacts to humans from changes in the ocean environment, and not enough emphasis on protecting the ocean flora and fauna for which the government acts as a trustee. We realize that one of the goals of the document is to place an emphasis on understanding the relationship between society and the environment, but focusing on broad oceanographic processes and ignoring the organisms and biotic interactions that are an integral part of the marine ecosystem does not fully explore the nature of the relationship. In addition, it is important to recognize the role of the government to protect natural resources. We would like to see more specific discussion of biotic resources, particularly middle and upper trophic levels (e.g., fish, seabirds, marine mammals). If we, as a country, have the goal to "...protect, based on the best scientific information available, ocean and coastal ecosystems while facilitating access to them so that these ecosystems will be available for future generations to enjoy..." we must improve our understanding of ocean processes and the effects of human and environmental impacts at all levels. We suggest that research priorities be designed to clearly include the study of human/species, species/species, and species/habitat interactions at all levels.

[Section specific comments inserted in table]

In conclusion, we support the development of a strategic plan for ocean research and believe that while the draft document constitutes a good start for such a plan, to be effective it must specifically outline research priorities, more clearly recognize the role of the government as a trustee for natural resources, include a clear assessment of data gaps, and integrate studies of ocean processes as well as all trophic levels of biota. To accomplish these goals consultation with experts in the various ocean research and management disciplines will be absolutely necessary.

In addition to our own recommendations, we support comments submitted by the Pacific Seabird Group and the Ornithological Council. We further emphasize that studies of demography (recruitment, survival, etc.) are in many instances of equal importance to seabird conservation as studies aimed at understanding broad oceanographic process. We also acknowledge that much well-designed, basic research is needed to assist natural resource managers, but innovative methods used by managers are also important.

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**American Bird Conservancy-Fenwick**

Thank you for the opportunity to provide comments on the August 2006 draft report, "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade." The American Institute of Biological Sciences (AIBS) is a nonprofit scientific association dedicated to advancing biological research and education for the welfare of society. AIBS counts among its members roughly 5,000 biologists and 200 professional

societies and scientific organizations; the combined individual membership of the latter exceeds 250,000.

The draft report focuses needed attention on a number of important research topics. For example, a concerted national research effort addressing the stewardship of our natural and cultural ocean resources, better understanding system resilience to natural events, improving ecosystem health, and better understanding the link between ocean, lake and coastal systems and human health are all timely research arenas that warrant a robust and sustained federal investment. However, a number of significant issues do not, at the surface, appear to have been addressed in the report. Thus, these comments are intended to raise these issues for the future consideration of the Joint Subcommittee on Ocean Science and Technology (JSOST).

A significant concern with the draft report is that it fails to articulate the funding that will be sought to achieve the proposed goals. A number of the research activities proposed are already initiatives at various federal agencies, yet progress has been slow due to what some consider inadequate and unpredictable funding. A realistic budget request and multi-year commitment to federal research program managers would seem to be a central element necessary for the ultimate success of the JSOST research plan.

Another concern with the draft report is the lack of attention given to international collaboration. Effective and high-impact research on deep-ocean systems, the Great Lakes, or coastal ecosystems requires effective and strategic international collaboration. The final report would be greatly improved if it included a framework for supporting international research partnerships and collaborative agreements.

Additionally, significant research questions about ocean, Great Lakes, and coastal ecosystem biodiversity remain unanswered. It is important that the final report fully reflect these research questions and needs. Scientists must be able to access and utilize state-of-the-art infrastructure and equipment. In addition to new tools, such as the ocean observing system, the report should ensure that existing components of our research infrastructure are appropriately addressed. Research vessels, marine laboratories and field stations, natural science collections, and the human capital that utilize these facilities are all necessary to address the research agenda proposed in the draft report. In many cases, however, these science facilities require new investments to maintain their physical structures and construct the infrastructure, such as cyber infrastructure, that will make it possible to serve scientific research into the future. In each of the past two years, the research and development priorities memorandum from the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP) has articulated the need to prioritize federal object-based scientific collections.

Once again, thank you for the opportunity to comment on the draft report and for your continuing efforts to ensure a robust ocean, Great Lakes, and costal ecosystems research action plan. If you have any questions, please contact AIBS director of public policy Dr. Robert Gropp.

**American Institute of Biological Sciences-O'Grady**

This draft represents a dramatic improvement over the materials reviewed at the April 18-20, 2006, workshop in Denver. Greatly appreciated is the attempt to have the applied scientific priorities reflect the needs of coastal managers. This is reflected in the refinement of categories, particularly the enhanced scientific support of ecosystem-based management. However, the draft still falls short of capturing the true need of those who conduct scientific and management programs in the coastal zone. Four areas are identified for emphasis in the near term (3-5 years), hazards, sensor development, climate change, and comparing ecosystem organization. The ecology of our oceans and coasts does not warrant such a small portion of the proposed national research emphasis.

The research listed is weighted too far toward large-scale ocean and atmospheric circulation and ocean observing. These are very important but offer little short-term rewards to ocean health, particularly in the hard-hit coastal areas. The areas contained in this plan are well thought out and valuable, but the result could well be a plan that does great things for the world's oceans, but little for the critical first few miles of water along the U.S. coasts.

It is unclear how or to what degree the elements in this draft plan will be prioritized for actual implementation. Pg 3 References the U.S. Ocean Action Plan commitment to an open and transparent process for the development of the Ocean Research Priorities Plan and Implementation Strategy. The full language in the U.S. Ocean Action Plan, page 12 of that document, states that the *“Ocean Research Priorities Plan and Implementation Strategy will be prepared in an open and transparent manner with advice from the ocean research community (government, academic, industry and other non-government entities. The Implementation Strategy will identify how the various ocean science sectors (government, academic, industry, and other non-government entities) can and should be engaged, individually or through partnerships. The Implementation Strategy will evaluate performance and research needs and identify areas of greatest priority and opportunity.”*

This comment period only provides an opportunity for transparent review of the Ocean Research Priorities Plan. In statements made at the Denver workshop and as reflected in this draft, the public will not have an opportunity to help shape or provide comments on the Implementation Strategy. This contradicts the commitment made in the U.S. Ocean Action Plan. The best way to identify how the various ocean science sectors can and should be engaged is to directly engage them. State programs are in a unique position to help evaluate performance and research needs of actual on-the-ground science and management programs. We are also in a unique position to help the JSOST identify the areas of greatest priority and opportunity for coastal science and management at the scale at which this data and products will be utilized. As one of the near-term priorities is scientific support to improve ecosystem-based management, it is absolutely essential to engage management and science practitioners to understand true programmatic priorities and the sort of data and data products that can be used by a program as that is often defined through statute, regulation, or policy.

**Bailenson, Florida Department of Environmental Protection**

The one comment I have regarding the document is that I felt the importance of remote sensing is substantially understated. I do not see that the ambitious science objective outlined for ocean research in this document can possibly be achieved without a strong and advanced remote sensing program. This should include advanced global polar orbiting sensors (expanded observation spectral range and resolution) focused on biological/carbon cycle products and improved spatial resolution sensors for very near-shore regions. NASA's Ocean Biology and Biogeochemistry program has developed a planning document outlining details on necessary new sensors and I think it would be very appropriate to reference that plan in the current document. My big fear here is that without enough emphasis on a strong remote sensing component, it will get overlooked and defaulted to reliance on the VIIRS sensor series, which will fall far short of our observational requirements and undermine the success of the ocean plan developed by your group.

Finally, I would like to thank you all for your efforts in developing this plan. I know very well the amount of work that goes into such an endeavor. I hope that a coherent and consistent set of recommendations for future ocean research will result from the diverse planning efforts that are taking place.

**Behrenfeld, Oregon State University**

The Great Lakes are a unique and extraordinary resource that has provided vast amounts of freshwater to nourish the history, culture, economy and well-being in this part of the country. The Great Lakes are the single largest source of fresh surface water in the Western hemisphere. During the early 1900's, the Great lakes region was the industrial backbone of America. Physical changes to the Great Lakes ecosystem as a result of the heavy industry, agriculture and urban development has endangered the future of the Lakes.

The "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade" appears to be broad based and generic in addressing ocean/Great Lakes issues. In fact, reference to the Great Lakes appears to be an after thought. Due to the lack of detail, it is difficult to tell which areas of research (if any) identified in the document, appearing to be germane to the Great Lakes, will indeed be considered within the context the Great Lakes. In general, this document discusses research priorities seeming to assist in understanding and/or identifying problems or concerns or dealing with forecasting. While the development of an understanding processes and problems is important there does not appear to be an obvious focus on protection, restoration or methods to address least cost (effective) measures to address problems identified in prior research efforts.

Executive Order 11334 established the Great Lakes Regional Collaboration (GLRC), consisting of a Federal, State, local government, tribal interests and additional stakeholders. The GLRC released a report in December 2005 describing a strategy to restore and protect the Great Lakes. Research identified in the GLRC report should be included in the overall plan for R&D priorities for Ocean Science in the next decade. The research identified in the GLRC strategy report should form the basis for assessing research priorities within the Great Lakes basin.

It is my opinion that particular areas of concern for the Great Lakes include (but are not limited to):

## Aquatic Invasive Species

### Introduction through ballast water

- Needed promulgation of environmentally protective standards for ballast water and implementation of effective ship-board treatment and management measures. Ballast water management practices for ships operating within the Great Lakes needs modification.
- Research on best \ least cost measures to stop introduction of new AIS via ballast water
- Research on how to stop proliferation once they are in the Great Lakes.

### Ensure canals and waterways are not vector for AIS

- Research to control and stop invasion of invasive species through canals and waterways

## Dredge Material Management –

### Contaminated sediments

- Research to develop alternative and innovative technologies to treat contaminated material (separation, immobilization, neutralization or destruction with out creation of new contaminants.
- Contaminated sediment remediation at AOC – no specific federal authorization prior to GL Legacy Act. Should fully fund.
- Beneficial use - Mining CDF – encourage locals facilitate use of beneficial material – creating more space in existing facilities.

## Regional Sediment Management

### Consider Sand as a resource

Beneficial use of dredged material – construction, landfill cap

### Sediment Transport

Soil Conservation Practices - (contaminated sediment management)

## Wet Weather Discharge

Control combined and sanitary sewer discharges

Research for improved waste water treatment facilities and technologies

## Ecosystem Restoration

### Indicators

- SOLEC – developed for GL – continued research needed to expand

## Regional Observation Systems

### GLOS

Tools – gages, wind measurements on lake (inclusion to WIS), directional wave measurements

## Climate Effects

Regional Effects – Lake effect snow, rain, precipitation.

Lake Level – historic, trends, evaporation due to no freezing conditions.

## Predictive Models

Model development by multiple agencies – research to use (or expand) existing models through collaboration between agencies. Duplication of efforts wastes time, money and energy.

Lake Level – historic (meteorological) and geologic forcing (isostatic rebound)

Wave Information Study (WIS) – wave hindcasting based on historic data

## Recreation

Beaches – use, contamination (see wet weather flow)

Harbors – 1/3 of registered recreation boat owners in Great lakes region

Drinking Water – near shore pollution

### **Benziger, USACE**

The Massachusetts Office of Coastal Zone Management fully supports the priorities proposed by the Joint Subcommittee on Ocean Science and Technology for ocean research in the next decade. We are particularly supportive of:

- The need for an expanded and integrated observing system;
- Improved communication among researchers, managers, and the public; and
- The use of ecosystem-based management.

We recognize that this will necessitate a renewed stewardship ethic toward the oceans as well as institutional support for the development of new technologies and predictive models. The list of priorities rightly proposes a multi-dimensional approach to viewing our oceans, their risks, and uses through socio-economic, ecological, and technological lenses. We look forward to working with Congress and our partners in fulfilling these research priorities.

### **Carlisle, Commonwealth of Massachusetts**

Having read the draft document and attended a recent town hall meeting in Baton Rouge, given by Dr. Rick Spinrad, my main question regarding the document is “to whom is it aimed?” If it is aimed at Congress as an answer to the OAP, then I guess it fulfills its aims of setting out how we can restructure U.S. ocean research to enhance those portions that are directly concerned with the economic side of oceanography (which includes, among other things, fisheries and human health aspects). If it is aimed at the research community, however, as a way of setting out where future funding is to go, or to the public at large, I feel that this is a rather discouraging document. Where is the vision and the “Wow!” factor that brings many people initially to oceanography? NASA managed to encapsulate this perfectly following President Kennedy’s announcement that the U.S. would put a man on the Moon within a decade, and still manages to supply this excitement even though the manned space program has no real economic value to the country and is being pushed at the expense of NASA’s science program at a cost far higher than the funding received by the ocean research community.

In our local town hall meeting, we were told that this document is designed to elicit extra funding for oceanography from Congress, but nowhere in the document is there any mention of the likely funds required, nor that this is supposed to be funding over and above what is presently available. Why doesn’t it at least support the statements in other recent documents from the Pew Commission or the U.S. Commission on Ocean Policy that support the idea of increasing funding for marine research by some multiple of the present amount? Many researchers reading it are likely to assume that future funding will be channeled ONLY to those areas of research highlighted in the draft document. There is a statement in passing in the second paragraph on p.18 that points to the need for continued funding for “blue seas” research, but I do not get the sense from anything else in the document that this is considered particularly important.

## **Chapman, LSU**

On behalf of the Coastal States Organization (CSO), I am writing to submit comments on the national priorities plan titled *Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade* (commonly referred to as the Ocean Research Priorities Plan, ORPP, dated 8-30-06).

First and foremost, CSO wants to thank the Co-Chairs of the Joint Subcommittee on Ocean Science and Technology (JSOST) for conducting a transparent and input-driven process in developing the ORPP. CSO also thanks Drs. Spinrad and Walker for traveling to CSO meetings to meet with the states and Shelby Walker for keeping CSO informed on the Plan's progress. I appreciate the enormity and challenge in drafting a national research priorities plan and support many of the changes the JSOST made to the ORPP.

### **Translating Science into Management**

The states believe to successfully manage the coasts, management decisions must be based upon the best available science. At the Denver workshop, CSO and the states urged the JSOST to revise the draft plan to recognize the need for improved communication between the coastal management and science community. We also called upon the JSOST to place greater emphasis on translating research and data into useful information products and tools for decision-making. In addition, CSO conveyed the need for applied research and science translation via written comments and presentations to the JSOST, the Ocean Research Advisory Panel, and others.

In reviewing this iteration of the ORPP, CSO appreciates that the JSOST took note and revised the plan. While basic research is a critical component, the pressing need for applied research, models, assessments, and information products and tools for decision-making is now integrated into each theme of the Plan and the research priorities. In addition, it is aptly included in a section titled "Making a Difference." CSO applauds the ORPP's call for a strong investment in these activities and looks forward to working with the JSOST to implement this recommendation.

The JSOST accepted two other recommendations made by CSO. In our comments, CSO called upon the JSOST to stress the importance of interactions between humans and ocean ecosystems and focus on economic, social, and cultural studies to better understand and quantify the value and use of coastal and ocean resources. The ORPP has addressed both these requests.

As the JSOST moves to finalize the ORPP, CSO urges you to retain the science translation, social science, or human dimension aspects of the Plan. CSO also asks the JSOST to further strengthen the role of science translation in the final version particularly in the priorities related to ocean observations and ecosystem-based management. Lastly, CSO requests adding language to the ES and "Making a Difference" to emphasize the vital role of science translation and wise management to the success of the ORPP, the 21 research priorities, and the health of our oceans and coasts.

### **Near-Shore and Watershed Science**

CSO recommends the ORPP "bring the science closer to shore" and increase the report's focus on near-shore, estuarine, and watershed science. It is in the near-shore environment where

human impacts are concentrated, causing resource managers often to think in terms of ten feet of water, not 1,000 feet.

Science must also be conducted at the appropriate scale. If managers, for example, are working at the estuary level, the science must be applicable at that scale. If the research is too broad (global climate change patterns) or too narrow (the mortality rate of snails in an upland river), managers are unable to extrapolate the implications of that research to their estuary and it can be difficult politically to implement change. CSO asks the ORPP to be amended to emphasize the need to conduct science at the appropriate scale.

### **Integrated Ocean Observation System**

The ORPP places great importance on the need for ocean observations and the development of a comprehensive observing system. In addition, the near-term priorities focus almost exclusively on enhancing observation data or related sensor capabilities. If the intention of the ORPP is to select ocean observations as the top priority for the next 2-5 years, CSO encourages the Plan openly state it. If this is not the intent, then clarifying the goals and tasks of the near-terms priorities may be warranted.

In implementing an integrated ocean observations system and in the section “Developing the Tools,” CSO recommends the JSOST affirm the need to turn certain ocean observations into forecasts and products that are accessible and useful to resource managers. Many states and end-users lack the capacity and technology to use raw data, so simply distributing the data widely is not enough to ensure it will be used. In addition, CSO believes the observing system will be most relevant when it is able to receive and respond to the current and emerging problems that are confronting resource managers.

Lastly, CSO recommends the JSOST look to the IOOS Regional Associations as an integral component of implementing the ORPP’s recommendations concerning ocean observations. Ocean observing is not just models, satellites, and buoys. A successful system is also comprised of end-users. At this time, the best access point for end-users and resource managers is the Regional Associations. The Regional Associations are dedicating considerable time to building relationships within the regions and identifying end-users needs. The potential of this goodwill and the ability to leverage efforts should be fostered. CSO hopes the JSOST will renew the federal agencies’ commitment to the Regional Association framework.

### **Implementation Strategy**

Drafting the ORPP is a momentous step towards focusing the nation’s future science efforts; however, the most crucial step is yet to come – implementation. The potential for success or failure lies in whether and how the ORPP is implemented.

In the coming weeks, the JSOST will draft the Implementation Strategy. While this strategy is viewed as a set of operational principles and guidelines for federal agencies, the JSOST should recognize that the states and other constituents are keenly interested in this strategy. Simply providing the strategy in its final form in December does not align with the spirit of input, transparency, and partnership that has defined the development of the ORPP to date. As

partners in this national plan, CSO recommends the JSOST work with coastal states and CSO to develop the implementation strategy and provide an appropriate comment period.

Of the issues listed to be addressed in the Implementation Strategy, CSO is particularly interested in assisting with the following:

- Roles and responsibilities of each constituent sector (including federal and state agencies);
- Use of existing mechanisms for collaboration among federal agencies and their partners; and
- Enhancing coordination between the resource management and ocean science communities.

CSO also recommends the JSOST add principles and guidance on these important issues:

- Need to include science translation as an integral component of the Implementation Strategy;
- Financial and budget implications of the ORPP;
- Potential opportunities for the ORPP to align with the regional priorities being set forth by Governors;
- Ensuring an on-going dialogue between states and federal agencies; and
- A coordinated outreach effort by the federal agencies and their programs to avoid duplication of effort and piecemeal approaches.

### **A Vision for the ORPP**

It has been said the ORPP does not articulate an exciting vision for the future of science. CSO offers that there is a vision in the ORPP, but it needs to be brought out and clearly expressed in the Plan. There are several opportunities in the paper where a vision could be derived. For example, on page 13, a potential vision could be culled from the need to understand and manage our oceans to “protect lives, enhance livelihoods, and improve quality of life.” Another option is found on page 15, where a vision for the ORPP could “promote discovery, impart greater understanding, and apply knowledge.” Paring the ORPP vision down from 67 pages to a short and simple summary would help clearly communicate to stakeholders and the public the purpose and potential of this Plan.

### **Layout of the ORPP**

The ORPP puts forth six societal themes, twenty-one research priorities, three “Patterns of Opportunity,” three “Opportunities for Progress,” four near-term priorities, and three components of the research enterprise. As currently written, it is unclear to CSO how the priorities and opportunities may fit together or overlap. To demonstrate those relationships, it may be helpful to provide a chart or visual framework.

### **ORPP Specific Comments**

CSO has attached a one-page document detailing specific language changes to be addressed in the Plan.

[Section specific comments included in table]

### **Conclusion**

In conclusion, CSO thanks you for the opportunity to comment on the ORPP. We look forward to working with you on the to promote a better understanding of our oceans and the use of science in wise decision-making. Please feel free to contact me at 202-508-3860 or [kandrews@coastalstates.org](mailto:kandrews@coastalstates.org) if you have any questions.

Thank you for this opportunity to submit comments on your Ocean Sciences Planning Document.

**Coastal States Organization-Andrews**

On behalf of the 86 members of the Consortium for Oceanographic Research and Education (CORE), we are writing to provide comments on the Ocean Research Priorities Plan (ORPP) entitled “*Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.*” CORE commends the Joint Subcommittee on Ocean Science and Technology (JSOST) for its work in developing this strategy and for its consultations with the ocean research and education community and the National Research Council.

In general both the Planning Document and ORPP are scientifically sound, but we find the Planning Document format and narrative much more readable and appropriate for the lay-person. In our comments we offer recommendations for ways to improve the ORPP to ensure that all parties fully understand national priorities for ocean research the steps necessary to make progress on those priorities.

We believe that the final document must clearly chart the research priorities and expected results for the next decade. Furthermore, it is essential that the final document is free of scientific jargon so that the general public can read and clearly understand the plan. Therefore, we strongly urge that the final ORPP clearly describes a strategy to perform the research necessary to better protect, conserve and manage our marine resources.

CORE believes that the plan should include research priorities that promote the guiding principles of sustainability, ecosystem-based management, preservation of marine biodiversity, and adaptive management. We also believe that the plan must identify two or three high-priority, highly-visible initiatives that hold the greatest potential for communicating a compelling vision, generating public and political support, while also providing the greatest benefits.

The strategy appears to focus primarily upon the federal agencies. To ensure the ORPP’s effective implementation and success, we believe that the strategy should highlight opportunities for partnerships with the States and academic and private research and development sectors. Integration of all the stakeholders in ocean research, conservation, and management is paramount for successful implementation of this plan

Finally, while the JSOST has refrained from any discussion or recognition of limited resources being both a major challenge and potential impediment to successful implementation of this strategy, it must tackle this issues and provide clear cost estimates to accompany either the final ORPP or the subsequent implementation strategy that are both grounded in reality and not constrained by the current budget climate. A realistic assessment of the costs associated with meeting the challenges identified in the plan is essential to educating Congress and the public about the limitation of current efforts and the commitment of resources that will be necessary to achieve the objectives identified in the plan.

CORE recognizes the importance of this document and is strongly committed to its success. We stand ready to work with JSOST to improve the document and firmly believe that all of the necessary elements exist between the Planning Document and this draft of the ORPP to produce a clear blueprint that all federal agencies, the Administration, Congress, and the academic research community can embrace and fully support.

### **General Comments**

Between the Planning Document and the ORPP, the authors have changed the format under the research priorities section of each theme from bulleted text to identify research priorities to narratives that are framed as “understand” or “apply”. By using this approach, proposed research priorities are obscure become somewhat lost in the narrative. In most cases, the language in the Planning Document is more prescriptive and precise, enabling the lay-reader to clearly understand the research need. In the ORPP, the examples are often more illuminating than the text and provide a better basis or rationale for a particular research recommendation. JSOST should expand these examples as they provide concrete circumstances with which the reader can relate. Moreover, the ORPP narrative often provides the rationale for a particular research recommendation, rather than clearly stating the recommendation. The ORPP’s broad research priorities each seem to contain subsets of research needs--many of which are in the Planning Document. These subsets should be more clearly articulated and supported through a combination of a bulleted statement of need followed by a rationale—so the format would be a broad research priority, bulleted research need, followed by a rationale for the research need. CORE is not advocating for a laundry list of research priorities and needs, rather we suggest that JSOST revert to the format used in the Planning Document that clearly articulated and highlighted research needs.

In addition, the ORPP places great emphasis on application and model development, while not clearly making the link between the models and the data necessary to populate and drive the models. CORE appreciates and supports the application of scientific data and believes it is critical in order for federal agencies to meet their mission mandates. We also believe that forecasting and risk assessment models are important tools in the development and implementation of sound marine policy and management; nevertheless, we believe a national research plan must balance application with the need for investment

in the acquisition of basic and applied research that will increase our understanding of the ocean and its processes.

### **Conclusion**

CORE strives for a national consensus where citizens and decision-makers recognize the importance of reliable science-based ocean data upon which to base our ocean policy decisions. This requires a sound science plan with strong investment in physical, biological, social, and economic research of our oceans, coasts and Great Lakes. The ocean research community believes that JSOST can produce a focused set of priorities and an implementation strategy that will allow our collective interests to further ocean research and education be recognized and acted upon at the highest levels of government and industry. We must come together to support one common research plan. To that end, there is room for improvement and the two documents (ORPP and Planning Document) provide a solid foundation from which to devise a clear, concise, and readable blueprint. CORE commends the JSOST for its work thus far on the ORPP, appreciates the opportunity to provide our input on this important plan, and stands ready to help throughout out the process to ensure the successful completion of this plan.

### **CORE-West**

We've reviewed it and have no specific comments. The general comment is that the Institute of Nautical Archaeology fully supports the initiative, and finds the goals laudable and pertinent. We stand ready to assist in whatever way we can to assist and to participate in the achievement of those goals as they relate to our expertise and involvement in documenting and assessing the record of human activity on the seas and inland waters as represented by archaeological remains

### **Delgado, Institute of Nautical Archaeology, Texas A&M**

I feel that the current draft report is an improvement over the earlier version. I especially like the idea of combining natural sciences with socioeconomic sciences, since we manage people and their activities in order to conserve living marine resources, protected resources and natural trust resources. I concur with the importance of communicating the scientific results to both managers in order to support an Ecosystems Approach to Management and to the general public in order to promote a stewardship ethic for the ocean. Since scientists focus on producing peer-reviewed publications, it is important for somebody to synthesize the scientific results in terms of management issues and have science translators produce products accessible to the general public. I feel that this areas needs more emphasis if we are to avoid the problem of "being data rich, but information poor". There is a lot of discussion of ocean observing systems (OOS), making greater use of of remotely sensed data and combining information from biological, chemical, physical, geological and socioeconomic sciences in order to meet societal information needs. To accomplish this requires more than developing new computer technologies and database storage methods. Synthesis of products is crucial to this effort.

The major concern that I have is that the proposed resources (\$30 KK per year) is inadequate to meet the near term goals over a 2-5 year time horizon. At the briefing that I attended at the Woods Hole Oceanographic Institution (WHOI), scientists in the

audience suggested that the re-programmed funds be targeted to developing the backbone of an OOS; supplying new research platforms from research vessels to AUVs/ROVs/gliders; and supporting seabed or coastal research sampling stations. Given the limited amount of funding available, I am not in favor of focusing the funds on such infrastructure, since money would not be available for other useful endeavors (modelling; developing computer networks and synthesizing products; developing educational outreach programs; funding peer-reviewed research; etc.). The federal agencies that will fund the ocean research plan need to develop a balanced portfolio for the near term period and not spend it all on infrastructure. Presumably this issue will be addressed in the December 2006 release of the Ocean Research Priorities Plan and Implementation Strategy.

### **Dow, NMFS/NEFSC**

The draft report presents a compelling set of priorities for U.S. ocean research for the next decade that begin to address the challenges and needs identified in the U.S. Commission on Ocean Policy report, *An Ocean Blueprint for the 21<sup>st</sup> Century*. These priorities are appropriately focused and developed within six societal themes that provide long missing guidance for the federal research enterprise across the agencies. These priorities would ensure societal relevance while allowing ample room for scientific innovation and discovery. ERF is pleased to see that the plan recognizes that fundamental research and risk taking are critical to the success of the national scientific enterprise. The six socially responsive themes are suitably broad and encompassing, allowing latitude for further development of specific research efforts that appropriately respond to the themes. In addition to being comprehensive, the report makes a compelling case for the need to do a much better job of tackling these interconnected issues now. The Estuarine Research Federation agrees with the content and descriptions of the framing, opportunities, and strategic and near-term priorities, and commends the JSOST for its effort.

### **The Land-Ocean Margin Transition**

Because of the Federation's focus on estuarine and coastal environments, ERF is particularly interested in the treatment within the *Charting the Course* report of the broad, land-margin transition, from watersheds draining into U.S. territorial water to the continental margins. All six societal themes address intersecting issues within this transition zone where the bulk of the nation's natural and cultural resources, exposure to natural hazards and human health risks, marine operations, and unhealthy marine ecosystems occur. It is the region in which there is an urgent need for ecosystem-based management that is called for in the Commission on Ocean Policy Report. This transition zone also represents a critical focal point for research priorities identified in the present report. Furthermore, some of the more important consequences of climate variability and change are experienced in the land-ocean margin transition.

ERF is pleased to see that "ocean" is used here to refer to a broad set of environments, including open ocean, coasts and estuaries, and coastal watersheds and, in particular, the need to incorporate watersheds in plans for fundamental science and research addressing stewardship of natural resources, climate change, and ecosystem health. We recommend

that the research priorities plan more explicitly mention the integration of watershed and ocean science and fully address this in the implementation strategy to ensure that the science gaps across the land-ocean transition are effectively bridged. Examples of issues that require research across the land-ocean transition include assessment of changing fluxes of fresh water, sediments, nutrients, carbon and contaminants, as well as migrations and larval recruitment processes of fishery species that transcend ocean, estuarine and riverine environments. Science programs that address terrestrial and freshwater environments are often organized in different agencies (e.g. Departments of Interior and Agriculture versus the National Oceanic and Atmospheric Administration) or divisions within agencies (e.g., in the National Science Foundation). How, then, will the federal ocean research plan engage and integrate with critical research on the continent?

### **Estuarine Research Federation-Boesch**

First, the committee is to be commended for their work in addressing the wide range of scientific issues related to the health of our oceans. Those of us in the Oceans and Human Health scientific community are pleased that the committee recognizes the importance of protecting ocean health to ensure we are “protecting lives, enhancing livelihoods and improving quality life” (page 13). This is the essence of what we strive for through our multi-disciplinary Centers for Oceans and Human Health. The committee wisely defined human health not as the absence of disease, but as the overall health and well being of individuals, families and communities.

### **Faustman, UW**

I am writing as the Director of the NSF NIEHS Oceans and Human Health Center at the University of Miami, as well as a researcher actively involved in oceans and human health research and as a concerned citizen.

I was impressed with the depth and breadth of discussion of important ocean research issues throughout the Report. However, I was distressed to find that after an indepth chapter devoted to Oceans and Human Health, as well as multiple references to human health throughout the document, that there was ultimately very little in the Recommendations of the Final Chapter directly related to human and public health.

In particular, oceans and human health (OHH) is a new scientific discipline which is trans-disciplinary (simplistically OHH tries to bridge the ocean and biomedical sciences) which needs specific funding for the training and research, emergency response, and outreach/education to educate scientists and the public about the effects of the humans on oceans and the oceans on human health. Without this directed funding, there will be no new generation of scientists and managers truly ready to take on the complex issues associated with oceans and human health.

Furthermore, although I agree that the proposed Integrated Oceans Observing System (IOOS) is an important area of ocean research worthy of future funding and resources, the IOOS needs to be more tied into public health. Although we have an excellent example of the potential of IOOS to protect human health in the Hurricane Forecasting

and Warning System, there need to be more direct applications and integrations between IOOS and public health. A concrete suggestion would be to fund some Demonstration/Pilot Projects of IOOS with Public Health to show that it can be done, to explore some of the issues, and to inspire other researchers to go further in the future.

I would be happy to provide additional detail to “flesh out” these recommendations if requested

**Fleming, University of Miami School of Medicine and Rosenstiel School of Marine and Atmospheric Sciences**

A large factor in the ecological health of the Northern Gulf Coast is the nutrient load delivered down the Mississippi River watershed. An overload of nutrients can result in an anoxic "dead zone" along the coast. A far reaching educational and, if necessary, regulatory program for farmers that live within the watershed would greatly help to reduce this nutrient load and improve the health of the Gulf. This program would simply require farmers to apply fertilizers at times when high amounts of precipitation are less likely. This would benefit the farmers, as well, because less of their fertilizers would be "lost" to runoff.

**Gibson, USM**

The document is very well put together and does an excellent job covering many of the Washington State Department of Ecology’s needs for ocean research as we move into the future. It stresses the need for an integrated ocean observing system (long term monitoring), the development of effective systems for managing and sharing the information, and the importance of developing large-scale, regional, and local models to understand and address problems ranging from the effects of climate change to assessing the impacts of management strategies on resources and human communities. (Brian Grantham, Ecology) The general priority areas capture the main ocean issues and related research, monitoring, and observing needs. (Jennifer Hennessey, Ecology)

The research priorities and background focus more on the use of monitoring and research to develop mitigation strategies and technologies, rather than on preventing problems in the first place. Numerous locations indicate the importance of understanding impacts and how to mitigate them, but fewer discussions in the document identify obtaining the knowledge needed to prevent the impacts. This document should tie more explicitly to research priorities related to issues such as preventing erosion or the pollution of our waters in the first place. (Brian Grantham, Ecology)

The document lacks sufficient emphasis on providing the research and monitoring data and data products needed to address regulatory needs. Clearly these are part of the package, but they should be spelled out more explicitly. Our ability to meet many of the U.S. Commission on Ocean Policy recommendations related to ecosystem health depends on effective regulation. (Brian Grantham, Ecology)

It would be helpful if more detail were included on how the proposed large-scale research program would be developed and administered in a way that would effectively move multiple, diverse interests toward common goals. (Brian Grantham, Ecology)

Although the document discusses the importance of involving and coordinating the efforts of government, academia, industry, and non-governmental organizations, there is no indication of how this might be achieved. For example, if funding becomes available for substantial development of an integrated ocean observing system, then important questions are: who will administer the funding, what will each state's role be in development of the system, and how will adequate representation of various interests be ensured? (Brian Grantham, Ecology)

A common complaint in developing the Integrated Ocean Observing System (IOOS) has been that its focus is largely on physical measurements. Although the document addresses the need to develop biological and chemical sensors, this should be emphasized more. A lack of sensors for *in situ* monitoring of things like Harmful Algal Blooms (HABs), pathogens, and fecal coliform bacteria are major impediments to the effective management of water quality and ecosystem health in general (Brian Grantham, Ecology)  
**Grantham and Hennessey, WA State Dept of Ecology**

On behalf of the Great Lakes Commission (GLC), the Great Lakes Observing System (GLOS) and the Council of Great Lakes Research Managers, we are pleased to offer comments on the final draft of the document entitled: ***Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade***, which outlines U.S. national research priorities which would affect the Great Lakes – St. Lawrence River system for the next ten years.

The GLC is an interstate compact agency, serving the Great Lakes states and provinces, dedicated to the use, management and protection of the water, land and other natural resources of the Great Lakes - St. Lawrence system. The GLC coordinates consensus building between our ten jurisdictions on issues of resource management, environmental protection, transportation and sustainable development and advocates for necessary resources. The GLC also coordinates information standardization and exchange across the region and has spearheaded development of the Great Lakes Observing System (GLOS) as the region's component of the Integrated Ocean Observing System (IOOS). The Council of Great Lakes Research Managers is operated by the International Joint Commission (IJC) and has served as the IJC's principal advisor on research programs and research needs for more than twenty years. The Council's purpose is to enhance the ability of the Commission to provide effective leadership, guidance, support and evaluation of Great Lakes research as it applies to the provisions of the Great Lakes Water Quality Agreement of 1978.

The Great Lakes – St. Lawrence River system and its drainage basin spans portions of eight states and to Canadian provinces. Nearly 40 million people inhabit this watershed. The Great Lakes—totaling nearly 100,000 square miles in surface area—are a central

economic, cultural and recreational resource with important implications for the region's health and well-being.

The comments that we provide below are highly influenced through a similar visioning process that has recently occurred within the Great Lakes region under the auspices of the President's Interagency Great Lakes Task Force. This activity, known as the Great Lakes Regional Collaboration (GLRC), engaged nearly 1500 stakeholders to develop short-term strategic approaches for restoring and protecting natural resources across the region. Among the nations aquatic resources, the Great Lakes are truly unique, representing by far the largest freshwater ecosystem and containing one fifth of the earth's freshwater. Unlike the U.S.'s ocean coastline, the Great Lakes system is a relatively closed system. This ecosystem, its users and its challenges are unique. We feel that the Ocean Research Priority Plan (ORPP) should provide additional emphasis on the following Great Lakes issue areas:

**Drinking Water:** The ORPP does not address research needs affecting the use of Great Lakes waters as the primary source of drinking water for nearly 40 million North Americans. Research needs include the development of monitoring and modeling technologies and tools to rapidly identify threats to water supplies and to predict and track sources of contaminants, either intentional or inadvertent.

**Aquatic Invasive Species:** Among the major threats to the sustainability of the ocean and Great Lakes ecosystems are the continual introduction of aquatic invasive species. The Great Lakes in particular have struggled to prevent and to ameliorate the harm from such organisms entering the system. Scientific and technological advances are needed to improve technologies preventing introduction (e.g., ballast water treatment), improve detection and response capabilities, to better understand food web and economic impacts, and improve abilities to adaptively manage altered ecosystems.

**Global Cycling of Pollutants:** Many of today's pollution challenges are of a global nature, with contaminants dispersing around the earth, depositing to and cycling within oceans and lakes. Just as toxic substances in the ocean are often a reflection of worldwide uses and releases, the Great Lakes also receive considerable toxic inputs from global emissions dispersed through the atmosphere. Controlling pollutants on the global scale will require advances in characterization of global emissions and transport processes and development of more robust predictive models of chemical fate and exposure.

**Terrestrial Impacts and Interactions:** Many of the threats to coastal aquatic ecosystem health—and threats to human health through coastal processes—are a direct result of human activities within the coastal zone. Inputs of nutrients, pollutants and sedimentation from coastal land use patterns are a major cause of coastal environmental problems. In addition, development of wetlands and estuaries continue to destroy important buffers between the terrestrial and aquatic environments. These issues are particularly acute in the Great Lakes, where the aquatic ecosystem is surrounded by a drainage basin containing nearly 40 million people and many large urbanized areas, industries, agricultural operations, and rapids development. Better scientific tools are needed to

characterize the impacts of terrestrial areas on the adjacent nearshore aquatic ecosystems, with an aim toward promoting better management practices.

**Interconnecting Waterways:** In addition to tens of thousands of square miles of open water, the Great Lakes also contain key interconnecting waterways between the lakes, including the St. Marys, St. Clair, Detroit, Niagara and St. Lawrence rivers and Lake St. Clair. Navigation on these interconnecting waterways presents unique challenges that are not present within the nation's other oceanic navigation corridors. Research on hydrodynamic characteristics of these waterways is important to protect municipal water intakes, improve safety at public bathing beaches and enhance safe and efficient commercial navigation throughout these corridors.

**Geomorphologic and Anthropogenic Changes:** While the Great Lakes physical characteristics have been comprehensively measured, much of these endeavors were completed many decades ago. There is credible evidence of significant physical changes that have occurred due to differential isostatic rebound of the lake floor or anthropogenic changes in the interconnecting waterways including at outlets from each of the Great Lakes. In a system such as the Great Lakes, there is potential for substantial impacts as this young geologic and ecological system continues to evolve in structure.

**Climate Change:** While the report has a commendable focus on global climate change, it lacks specific recognition of the associated impacts on the physical environment, fauna, and human uses of the Great Lakes system. For example, the Great Lakes could be included as a region of focus within the climate change section and investigating impacts of climate change on unique aquatic habitats like the Great Lakes could be made a priority research need.

**Water Quantity:** While it may seem unusual to express concern over the quantity of water in the nation's ocean resources, this is a significant concern within the Great Lakes, where consumptive demand, physical alterations and climatic change pose threats to this aquatic resource. The Great Lakes – St. Lawrence River system contains nearly 95% of the nation's available surface freshwater reserves. There is currently a lack of certainty about the sustainability of these resources and how human and/or natural alterations would affect aquatic life, human health, commerce and hemispheric climate.

**Data Compatibility and Access:** The ORPP places significant emphasis on the acquisition and utilization of oceanic data and information. However, a significant step in the process leading from data acquisition to decision making is largely skipped. It is essential to ensure that data are broadly available, well documented and of usable quality and formatting. Within the "Observations / Infrastructure" section, additional focus might be given to the themes of expanded data availability, standardized data formats and compliant metadata, both among federal agencies and their non-federal partners.

**Great Lakes Regional Collaboration – Indicators and Information Strategy Team:**

During the 2005 calendar year, over 100 stakeholders of various backgrounds worked together to develop an Indicators and Information (I&I) strategy for the Great Lakes as part of the GLRC and in response to a May 2004 Presidential Executive Order ([www.glrc.us](http://www.glrc.us)). The I&I Strategy Team chapter of the GLRC report outlines key steps needed to improve information collection, information management and integration, assessment and reporting of indicators, and public outreach and educational activities. In most aspects, the findings of the I&I Strategy Team and the draft ORPP are in significant agreement.

Within the Great Lakes community, a significant emphasis has been placed on the development of a concise set of well-defined and measurable indicators to inform policy makers and the public on the changing state of the physical, chemical and biological components of the system. Implementation and reporting on this indicator suite presents considerable challenges and demands for improved science, observations and modeling. The ORPP could benefit from incorporation of oceanic indicators on a national level. While this topic is broached in the Improving Ecosystem Health section, it would be beneficial to emphasize indicators also within the human health, natural resources, climate and quality of life sections.

**Research Priorities:** As the ORPP moves toward completion, additional work will be required to delineate specific research priorities over the short and long term. As ORPP implementation planning proceeds, the I&I Strategy Team appendix to the GLRC report should be used as a resource for identifying research priorities for the Great Lakes. Another valuable resource would be to consult with the Council of Great Lakes Research Managers of the International Joint Commission. We would be happy to provide contacts and references to those groups.

**Great Lakes Commission, Council of Great Lakes Research Managers, Great Lakes Observing System-Dettling**

Please find enclosed comments regarding the National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST) draft report, "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade." It is my privilege to submit these on behalf of the Gulf of Mexico Alliance Environmental Education Network.

For reference, the Gulf of Mexico Alliance has identified five priority issues:

- Water quality for healthy beaches and shellfish beds.
- Wetland and coastal conservation and restoration.
- Environmental education.
- Identification and characterization of Gulf habitats.
- Reductions in nutrient inputs to coastal ecosystems.

These issues are expressed in 11 priority actions for the Gulf region in the *Governors' Action Plan for Healthy and Resilient Coasts*<sup>1</sup> approved in March 2006 by the five U.S.

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<sup>1</sup> Document can be obtained by going to website <http://www.dep.state.fl.us/gulf/>.

Gulf State Governors. This *Plan* was developed by professionals in their respective fields, as well as through community workshops held throughout the U.S Gulf coast. An overarching thread is highly visible in the fabric of all five issues, i.e., the need for improved environmental education and communication at all levels, to all audiences.

With the premise that we are advocating environmental education and the understanding that the current JSOST draft report reflects, “Research Priorities for the Next Decade,” we submit the following comments. In light of the JSOST approach to research, the Gulf of Mexico Alliance Environmental Education Network (GOMA-EEN) encourages you to expand this vision to include education and outreach practices.

While it was noted in the briefing presentation that this effort reflects a change in approach toward ocean sciences research, we recognize that some intrinsic research needs are identified. It is in this arena where often the creative successes lead toward more practical approaches to questions posed within the scientific community. Equally, we applaud that applied science has been expanded to contain a broader, more collaborative connection between “hard” and “soft” sciences, thereby creating a synergy for applied sciences that will work more effectively. To that end, the GOMA-EEN has observed on nearly every page of the document phrases, such as the following

“Wise stewardship and sensible management ...”

“Societal well-being, quality of life, and economy ...”

“... develop the information and tools necessary to carry out ...”

“... change how society takes action ...”

“... management and government systems that are informed by scientific understanding ...”

“... use by policy and decision makers.”

To manage the environment and promote stewardship, one must first understand what should be fostered. In order for the audiences implied in the previous phrases to utilize new information, a connection to these groups must be made. Research knowledge gained must go hand in hand with those for whom the information is intended. To make a difference and establish an ocean literate nation, the GOMA-EEN believes and suggests that education and communication must be included in the broader scope across all disciplines

To truly change the manner in which research is approached, one must also engage in education, hand in hand, with that change in order to sustain the technology and advances being sought throughout the various components of society. Actions of education are often generational. Society does not see the full effects of change until a full cycle of child to adult is realized in the workforce. If improved ocean literacy is to become a reality, education must be elevated to a higher level of importance within research opportunities.

The GOMA-EEN recommends:

- At a minimum, *Making A Difference* should be moved to a more forward position within the document.
- A component of communication and education be included in near term priorities.

- Elevating education, outreach, and communication to an Overarching Opportunity.

On behalf the GOMA-EEN, it is my pleasure to submit these comments. I would like to thank the Joint Subcommittee on Ocean Science and Technology for this opportunity to express our views and recommendations for the further development of a comprehensive research priorities plan.

**Gulf of Mexico Alliance Environmental Education Network-Yokel**

**Much of the important material in this document is not included in the societal themes or near-term priority bullets (hereafter referred to as the 21+4 priorities).** It is our strong belief that funding agencies and researchers who adopt this document will do so based primarily on what they glean from these heavily emphasized bullet points. Therefore, we feel that whatever is not *explicitly* given a “bulleted priority” will not emerge as a clear directive when this document is actually implemented. This view is reflected in many of our other comments, as well.

**The disconnect between research and policy is not adequately addressed.** This is one of the greatest obstacles to the implementation of sound natural and human resources management strategies and programs. As it relates to “Framing the Approach” (pp. 15-16), one of the most valuable *applications* of scientific *understanding* is through swift, decisive policy change. That directive is only briefly mentioned in this document (pp. 12, 13, 14, 53).

**The term “human-use”, in most cases, should be replaced by “human-impact”, as there is too much overall emphasis on sustaining consumption rather than mitigating impact.** For example, Priority #3 “Understand *human-use patterns* that may influence resource stability and sustainability” (p.23), should be re-phrased to “human-impact”.

**Harbor Branch Oceanographic Institution- Frey**

This document does refer in several places (nine that I counted) to the general issue of sea-level change. In the section ‘The Path Forward’ (page 57) the end of the first paragraph ends with the statement” “Just how much will sea level rise affect southern Florida, and by when?”. POSSIBLY the largest single impact of climate change may be the rise in sea-level associated with the melting of the polar ice sheets (i.e., the land glaciers and not the sea ice). By contrast, due to ocean thermal expansion effects, the likely change would be quite modest. The current observed global sea-level rise is about 3 mm/year. This current, small rate places little threat on southern Florida during the next few decades. However, due to a possible collapse of marine-based ice sheets, for example the six meters of global sea-level rise that sits latent in the West Antarctic Ice Sheet, there could be a very large threat facing southern Florida, and DC, and NYC, and others that would make such locations effectively become new ocean area.

A key point is that the climate and ocean modeling community presently possesses no capability of predicting future sea-level rise due to warm ocean waters melting away marine-based ice sheets. There is no ocean science plan in place to correct this shortcoming. There is plenty of media hype on catastrophic change in sea level, and lots of folks have opinions on this, but the level of scientific knowledge in this area is nowhere near the level of the hype. So in this document raising questions like “Just how much will sea level rise affect southern Florida” is somehow disingenuous because this document offers no real hope of being able to answer this question or of even setting a path to do so anytime soon. I believe the comments or implications that relate to sea level which are used as a kind of motivation need to be deleted from the document because they set a false sense (to me anyway) of comfort that we are going to do sea-level related research, but in fact we are not. Otherwise, leave in such comments but provide a plan to address the question of future sea-level rise. This will require first and foremost an extensive development or extension of existing observational technology that we as an oceanographic community would have to commit to the polar oceans. Alongside this effort we would need to develop ocean models that are capable of predicting sea-level changes due to ocean-glacier interaction and embed these models into full climate models. The ocean modeling community has not developed such models and is not making any detectable strides in this direction.

As a final comment, I re-iterate that unless we plan on doing ocean research in and around and under marine-based ice sheets, predicting future sea-level rise is a hopeless exercise.

**Holland, New York University**

As a scientist doing applied science and sustainable management, I have much to say and to contribute about the ocean, but I am unclear how I can make my voice heard.

For a start, I guess three things matter from my 10 years of experience dealing with the issues.:

- We need open access and free digital data for all aspects of the ocean
- We need transparent administrative structures so that vested commercial interests have no real influence in the ocean management
- We need a high detail data inventory of the ocean, and related processed, e.g. watersheds and adjacent countries, international waters included.

**Huettmann, University of Alaska**

There is virtually no mention of the status of the UNOLS fleet. There is a sentence on page 24 that states, "Current estimates indicate that the fleet of ships available is only about one-third of the capacity needed to provide essential information on the status of managed populations and ecosystem effects of human activities." This follows a

sentence about rapid, efficient, and synoptic assessment of ocean resources, and I think what we are talking about is fisheries management, not basic research. In the section on improving ecosystem health there is a statement (p. 43), "Collection of such data will require extensive infrastructure, including research vessels, . . ." On page 58 there is a statement, "A robust observing system that can describe the actual state of the ocean will fundamentally alter society's view of the ocean environment. As outlined in the societal themes, observations underpin fundamental knowledge of the open ocean, coasts, coastal watersheds, and Great Lakes. . . . Deploying the priority elements of that observing system will allow researchers to enable the promise of ocean forecasting and ecosystem-based management during the next decade." The priority elements of the observing system are not identified.

Money. There is no mention of the cost of the plan. The closest thing I could find was a statement on page 64 under the "next steps" category, where we are told the implementation strategy will place particular emphasis on, inter alia, budgeting and execution of the priorities. I think one obvious question is whether implementing the plan will require new money. I think the answer is almost certainly yes. Assuming that to be the case, it would be unfortunate if the ORPP left the impression that what we are talking about is a rebudgeting of existing funds.

**Laws, Louisiana State University**

Overall the research priorities reflect a balanced set of priorities that addresses key needs of the nation in several areas.

The ocean is a key component of this global climate system, and the ocean changes in response to global climate variability. Global climate variability is reflected in altered marine ecosystems, rising global sea level, frequency and nature of extreme events such as hurricanes, and shifts in storm tracks that impact precipitation runoff into coastal regions as well as maritime safety. The Plan rightfully indicates that the global climate system plays an important role in each of its six themes. So it is fitting and critical that Climate not only be one of the major themes of the plan, and that one of the near-term priorities addresses the meridional overturning circulation, a key ocean feature of the global climate system.

**Legler, US CLIVAR**

Overall, the drafters have done a good job of identifying key areas that require investment in the near future. The three key areas identified ("developing the understanding and capability to forecast ocean processes; collecting the scientific information needed to support ecosystem-based management of resources, especially those found in coastal and near shore ecosystems; and accelerating deployment of an ocean observing system that will, in turn, advance forecasting and management") are appropriate and necessary. The discussion of models and their use (pg 51-52) is especially pertinent.

The report could have done a better job in acknowledging that, although many of the priorities are national in scope, much of the implementation of ecosystem-based management and ocean observing systems happens at a regional level. This was also brought out by the Commission on Ocean Policy report, and that report had several recommendations dealing with ocean governance at a regional level, which are being pursued under SIMOR. The Ocean Research Priorities report could have made much better linkages to these efforts. It could be that some of the priorities identified in this report will rise to a higher level in certain regions, and other priorities will be dominant in other regions. While there is value in having a national framework to guide ocean research, ultimately the implementation of ecosystem-based management, and the observations to support it, will have to address regional needs and be carried out on a regional basis. Some mention of this should be made in the ES, perhaps after line (24) on page (7).

**Magnien, Center for Sponsored Coastal Ocean Research, National Centers for Coastal Ocean Science, NOAA/National Ocean Service**

As a professional society dedicated to the advancement of marine technology we support the ongoing efforts to chart the course for future ocean science in acknowledging the role of – and facilitating the development and application of -- the technological (advanced and emerging) requirements necessary to support goal-directed research efforts.

Therefore, we recommend that:

- The document should include the critical question [used to identify the most compelling research priorities for each theme] "Is the technology required for this theme available, or can it be available in the foreseeable future? What is the level of [technology] development effort required for research determined to be high risk? See page 20, draft document.

US technology/technology transfer can not provide or ensure success if operating in a political/societal or policy vacuum. “Forward thinking innovative basic and applied scientific research, coupled with technological advances, will permit marine operations to meet challenging requirements for increased levels of transportation and commerce in the maritime domain...” (page 31) and “There is a need to integrate natural resource requirements, data products, technological advances and operations in a manner that will facilitate safe, efficient, and sound current and future marine operations” (page 32) are meaningless if it is not acknowledged that marine/maritime operations as well as marine/maritime security can only occur in a climate that is both supportive and encourages the development and application of essential enabling technologies.

Therefore, we recommend that:

- The document should include the critical statement “Legal and political obstacles to technology transfer, freedom of the seas; mineral rights; among other things, must be adequately addressed if technology is to be implemented and successful (pages 31 and 32).

On a final note, the Marine Technology Society applauds the efforts of the document's authors in recognizing that technology is an integral component-- and in some cases, driver – of research endeavors.

**Marine Technology Society- Krauthamer**

Sensors on satellites and other remotely located observatories should go beyond “ocean color” and phytoplankton to be more process oriented, should encourage further development of refined ocean color sensors in coastal regions and polar regions where current technology (good for oceanic regions in temperate latitudes) has severe limitations.

**Matrai, Bigelow Laboratory for Ocean Sciences**

We greatly appreciate the prominence in the plan of establishing an integrated ocean observing system and agree that in order to achieve many –if not most – of the research priorities identified, such a system must be established with strong regional components. Research has clearly documented the value of long-term observations, and with increased use of our marine environment, the importance of integration, collaboration and coordination is greater than ever.

We are concerned however, that the plan does not discuss the issue of funding. It is critical that IOOS be fully funded with new money – and not at the expense of increasing funding for additional ocean research priorities. AOOS is currently operating with a \$1.7 million earmark. It is not possible to develop and sustain an integrated system at this funding level for a state with 43,000 miles of coastline, the nation's most valuable commercial fishery resources, untold offshore oil and gas resources, critical points for homeland security (Bering Strait, North Slope oil fields, Trans-Alaska pipeline terminal and shipping lanes, Stryker Brigade home port, Great Circle Shipping Route), and dramatically changing ecosystems due to climate change.

The plan needs a bold, compelling vision for ocean science research – and stated upfront. This should be followed by a series of scientific challenges that would excite the public, as well as the ocean research community.

The hierarchy among research priorities, the 3 overarching opportunities, and the near-term priorities is confusing. Consider re-organizing the plan and bringing the 3 overarching opportunities to the front of the plan – they get lost where they are. Unclear how these are to be weighted. Are they “super-priorities”?

Priorities are uneven in scope: in many cases too broad, in others, overly prescriptive. Some don't even appear to be actual research priorities, but rather, operational activities. The criteria for developing these were identified, but it is unclear how these priorities were developed using these criteria.

**AOOS-McCammon.**

Overall, we are impressed with the focus on an interdisciplinary approach, the recognition of important connections between humans and ocean ecosystems, and the identification of the science underlying ecosystem-based management as one of the overarching priorities. The Communication Partnership for Science and the Sea (COMPASS) developed a scientific consensus statement on ecosystem-based management, referenced in this draft report, which presents a framework for developing and applying science toward this end. However, the research priorities currently tend to rely heavily on the monitoring of abiotic parameters and theoretical modeling. We believe that an increased emphasis on enhancing our empirical understanding of ecosystem functioning, the provision of ecosystem services, and the impacts of human activities is warranted. We also believe that these research priorities must emphasize the effective application of knowledge to address the current and future challenges faced by US coasts and oceans. As pointed out under Framing the Approach (pp. 15-16), application must be an essential and integral part of the national strategy.

**McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup>**

Please accept these personal comments on the report, “*Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.*” As you are aware, I have also submitted comments on behalf of the National Association of Marine Laboratories (NAML), an organization that I am honored to lead as the current President. Those comments reflect the consensus views of the many Marine Laboratory Directors that actively contribute to our public policy discussions. The comments presented here are my own thoughts on a few additional issues that I strongly feel should be reflected in the report.

Overall, I am very impressed by the current document and see it as a great improvement over the earlier drafts. You have obviously worked long and hard to incorporate the views of the community through the previous public comments and your outreach at meetings. You have chosen priorities that are generally good and defensible on both the long and short term time-scales. If I had to point out areas that could still be improved overall, I would suggest that the language could be enhanced to both tighten the text and to make it more elegant. There is some real value in a document that has both style and content and that can still be done. I also think that the document can be further improved by better pointing out the improved linkages among topics, more regularly showing the value of basic science to some of the more applied topical areas and through a real integration of research, education and outreach. I am very pleased, as is NAML, with the expansion of the focus to include quality of life as a central theme and to expand the scope to cover the oceans, coasts and Great Lakes.

Below, I discuss some areas that I feel are important additions or modification to the text. Although I present them as whole ideas, I do think that many of them fit nicely into existing homes within the document as written and these ideas can be incorporated without major changes in the overall document. Many are perspectives that can be inserted once and then reinforced by reference in other locations.

In coming up with these ideas, I do this from two perspectives that may help you understand why these may differ from other comments you receive and point you in directions where you can look for additional guidance should you desire to build on these perspectives. I direct a marine and environmental program at the University of Southern California that has been around for 103 years and, for that entire time, has been fully immersed within the rich intellectual community of a research university. This leads me to value the connections to areas of scholarship that are outside the traditional bounds of our field and to more strongly value the unique contributions that marine science has made to academia at large. Second, our marine programs are now fully and purposely embedding in a larger environmental institute a choice that has led to important synergies. I am also the founding President of the Council of Environmental Deans and Directors (CEDD). These environmental perspectives have taught me the value of the rich approaches that characterize environmental scholarship in other environments than the ocean. I hope that my comments from these perspectives are a useful contribution to your valuable deliberations.

#### **The Research-Education Connection:**

I would like to strongly advocate for the integration of education and training into this plan throughout the document. I understand that this is a research plan, but research and education are intimately linked and that linkage is growing in a way that provides both immediate and long-term benefits to the research enterprise and the nation. Across our universities, the central role of research in the learning process is growing into a major focus, a development that this document should reflect. Inquiry-based and student-centered learning are coupled to the re-structuring of the undergraduate curriculum to allow students to create new knowledge and to reinvent themselves multiple times through their lives. I see this also moving into the middle and high school science education curriculum. Here, the ocean sciences are already leading the way, not to create legions of marine scientists, but to have a more science-literate public who can be knowledge-creators in their own right. I think that in the future, the making and development of this link between research and education will become normal in most fields and the oceans are a prime place to start. Perhaps even more important, the education-research linkage is the ONLY way that we are going to increase the diversity of scholars in our field. We know that we have done a poor job historically in the participation of many ethnic minorities and we have only recently made appropriate strides in the participation of women. Our field needs these individuals, their skills, their perspectives, and their participation. Education alone will help them be more science literate citizens; however, coupling education and research is required to get them to join our field. Broadening and embedding an education focus in this plan is important. It will be good for the oceans, good for ocean science and good for science education in general. I think that this perspective should be a part of the leadership role that this plan provides to our field.

One key point is that the federal government is not a big player in education. This is both a limitation and an opportunity. Across the nation, State, Local Government and Private Entities, from school districts through universities, are already earning and spending a

very large amount of non-Federal money on both research and education. The enormous investments in education at the state and local levels and by private entities are something that can provide a leverage opportunity for federal funds. A little federal leadership for the “nation” can steer a much larger ship. That is exactly what a **national** plan would and should do. In almost every other aspect, this plan is still largely a federal plan and I think that that is basically fine – having a plan is an enormous advance. However, it is in education, at the interface with research and in the training of the workforce of the future, that we really have something where this plan can rise to play one specific national role. Please grab that opportunity and provide vision for how federal investments at the interface between research and education can stimulate this larger enterprise to grow in areas that benefit our field and our nation’s future. Please recognize the educational opportunities that enhance research as they are already contained within the plan and make the modest changes to the text to bring them more clearly to our attention.

**Emerging Fields Outside of Marine Science:**

I see one major weakness in the document overall. In my opinion, the document does not do justice to the great opportunity to advance research in our field through connections with emerging fields that are outside of ocean science. The marine sciences have suffered over the decades by our relative isolation from large parts of the academic community. So much of our work has been done by research faculty in stand-alone oceanographic institutions and, for many years, in response to the funding interests of the Navy and other important mission agencies. While we have done better than many fields in how we conduct certain kinds of interdisciplinary scholarship, we have also missed many other areas of research in the natural and social sciences that blossom in our universities. I think that our future as a field and our ability to conduct the kinds of research contemplated in this plan absolutely require that we more intimately connect ourselves into the great discoveries happening in other parts of the university. I see a few brief references to this point in your plan. I think that you should make a much bigger deal about this and point to these areas regularly where appropriate to the plan. In particular, below are some specific areas where I think that more attention is appropriate in general and where the topic could also show up in many of your thematic and priority sections:

***Prediction of Complex Dynamical Systems.*** I applaud the focus throughout the document on prediction – this is a wonderful decision and absolutely correct. There is a large, distributed community of scholarly research in many different fields that study “complex” systems at everything from the theoretical, through basic experimental research to simulation, modeling and application. This scholarship is critical to predicting the dynamics of most ecosystems, social systems, aspects of climate, and many other areas where forecasting is key to management and to research itself. However, in many parts of the plan, the connection between data and models seems driven by simple correlations or by an imperfectly defined “understanding.” However, unless we move away from data-fitting correlations and comparative approaches towards a deep understanding based on the dynamical behavior of the system, I think that we miss the real ability to forecast. This is particularly true of non-linear and adaptive systems, something you recognize occasionally but that should be found throughout. In fact, the

entire sections on ecosystem based management, living resources and even the discussion of the role of basic research should stress a complex systems reality and approach. Your short term goal on ecosystems should move away from a comparative language to a dynamical systems language. We can't finesse the road to effective prediction; we must describe it and plan for how to do it correctly. You have laid out laudable goals and set appropriate priorities. I feel that you should populate the sections on prediction with the language that clearly describes what it will take to get there.

***The Genomics Revolution.*** There is a growing set of tools that arise from the enormous investment in genomics. Some of these tools are being applied to environmental systems and questions with some excellent results. Some of the genomic applications have been transforming discoveries, everything from new modes of metabolism to revisions of the tree of life. I think that most of us can see that these tools can really open our eyes to the composition of biological communities, the metabolic potential and realized metabolism of those communities and many aspects of their dynamics and controls. However, their use is still extremely limited, mostly because of limitations on the training and experience of the scientists in marine science and the inability to gain access to the infrastructure and funding that these approaches require.

Environmental Genomics and all of its sister "...omics" are not a magic bullet, but they are a huge new tool and world-view. The use of genomics requires new infrastructure unlike anything that you mention in this report (enormous sequencing centers, computational resources at the cutting edge of bioinformatics, etc). The appropriate training of biologists in the mathematics of bioinformatics is critical to the intellectual infrastructure and, interestingly enough, is very much the kind of applied math training that will be required more widely to create a competitive workforce in many STEM areas beyond ocean science. However, without a clear description of the opportunity and the needs, this will never happen and our field will continue to dabble around the edges of what these tools make possible.

***Nano-technology and Advanced Robotics.*** These are two enormous revolutions in the academic engineering community that our field only weakly engages. We have very nice centers of ocean engineering within our field, but they are exploring innovation in a quite traditional range of questions. These may be obvious to us in their value, but the obvious rarely transforms. I see great opportunities for the use of these technologies as they are explored by the best in their own fields when applied to such questions as ocean observing, exploration, materials science, the tracking and manipulations of ecological systems and the technologies of resource use in mining, energy and aquaculture. I suggest that you describe a future at the interface of engineering research, ocean science needs and the opportunities to improve the quality of life for humanity. In particular, observing systems do not have to be the simple propagation of existing technologies into the sea, but can gain from the inventive richness of these other communities as they bring their tools to bear on our questions.

***Social Sciences.*** Too often, "ocean policy," "ocean economics" and "nature's services" are the sum total of our interest in the social dimensions of the sea. The plan does

actually touch on more topics than just these. However, it doesn't seem to me that it really points out the full benefits that ocean research can gain from a deeper interaction with the full range of social sciences. Conversely, the oceans have a number of key questions, particularly in international relations, common resources, market mechanisms, human behavior, that may be excellent research topics in a variety of social science fields. We need to bring this richness into the field, not as an adjunct to our desire to improve quality of life, but as a rich area of basic scholarship that **also** improves our ability to link natural science research to the needs of humanity.

**Infrastructure:**

The section on infrastructure has been greatly improved by broadening the definition beyond ships and observing systems to many of the other components of the marine science research enterprise that must be brought to bear to fully attain your goals. I concur with the NAML comments on the unique value that our marine labs bring to ocean research and encourage you to even expand on our role. To me, this goes beyond the value of the physical infrastructure, instruments and facilities. These sites are embedded within communities and they create many of the connections between research and improving the quality of life. We are the face of marine science to many under-represented groups. We touch community leaders, local businesses and students of all ages. Marine Laboratories must be nurtured both for their value to the research enterprise and for how they make real the promise of our scholarship to communities.

However, as implied above, I also feel that infrastructure must go well beyond the recognition of the current abilities and needs. We will need sequencing centers beyond the scale of those that currently exist if we are going to tackle the questions of the diversity and function of ecosystems at all scales. Many individual marine organisms have genomes that dwarf the size of the human genome, and there are literally thousands of species in a drop of water or gram of sediment. Clever approaches will let us start to tackle these problems now, but they still require sequencing at a scale we have never seen in our field. At the same time, the computational requirements for assembling shot-gun sequence data or querying the enormous datasets that result from more targeted approaches will require computational resources at a new scale. The simulation of some ocean systems that require individual-based approaches already show us that the largest computers of today barely get us to ecosystems at the liter scale. Climate and ocean physics researchers are often limited by computational resources for resolution of the very problems you pose. We need to engage the communities that are developing peta-scale and grid computing and build the computational infrastructure that lets us do credible models at the scale you propose. These are but two obvious examples where borrowing the expertise of other fields is transformative, but it will be our job to create our own versions of the infrastructure required by these approaches or we will be forced to wait at the back of the line for our turn. Our academic revolutions would then wait as well.

**Aquaculture:**

I recommend that more attention be placed on marine aquaculture in the research priorities plan. You have the numbers on its growing role in the seafood supply. It is

clear that there is no way to get more food out of the ocean without it. Although we know that there are issues with many types of aquaculture practice, most are things that research can improve and in other parts of the world, countries are making those investments. Yet, the plan mentions it weakly and it is almost entirely silent about a research agenda for aquaculture. If this is already 40% of the scale of wild fisheries and growing, it should have proportional attention. I would argue that it must have more attention as it will undoubtedly grow in scale over the next decades. I understand the strong antipathy towards aquaculture that exists in the environmental community and in many of our federal and state agencies. I do not think that this antipathy is in the best interests of our country. Since the only way to find out is to do research on the topic, I think that it deserves more of us at this visionary stage.

### **Transforming Fields Through Education and Training:**

We must fully recognize and expand the special role that marine labs have in interdisciplinary training and in the creation of the interdisciplinary communities that are required to meet your research goals. In fact, some of the key fields in ocean science started as unique summer courses at marine labs where communities of scholars gathered to teach and, in the process, they invented new fields. The marine microbiology course at the Marine Biology Laboratory, the Geophysical Fluid Dynamics course at Woods Hole Oceanographic, the Geobiology Summer Course at our Wrigley Marine Science Center on Catalina Island, the Antarctic Research Course at McMurdo, and the Biomechanics Course and the Biogeochemical Modeling Course, both at Friday Harbor are but a few examples. Each of these brought together diverse scholars and even more diverse students for an intensive experience, enriched by the unique location and, in the process, created whole new interdisciplinary research programs that are now embedded in our larger field. Hard, interdisciplinary problems are not magically solved because we identify the parts, they require communities of people who know and trust each other enough to take the most important part of their professional lives and entrust part of it to someone with a totally different background. The friendships and trust built up by the unique coupling of education and research in these courses is one of the distinguishing reasons for our current success in interdisciplinary scholarship and we should explicitly build on this model to tackle the hard problems that you so correctly pose for us in the future.

In closing, I thank you again for your leadership in creating this plan and for engaging so much of our community in its content and design. If I can be of further assistance, please feel free to contact me directly ([tony@usc.edu](mailto:tony@usc.edu)).

**Michaels, USC**

The Draft Report: Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade goes far to meet the Ocean Action Plan's call for an outline of national ocean research priorities. The excellence of this report rests in the extent to which the transparent process that included input for the ocean research community is presented. The report goes further than stating succinctly the six theme areas and twenty-one priorities that came out of the Denver workshops to describe the necessary tools that

will make research even more effective, and perhaps transformative. I was particularly gratified to see this because I requested near the end of our meetings in Denver to see the rationale explained. Thank you for also presenting the contexts that drive the importance of each theme area. While this may be obvious to the researchers, the rationale in this report explains why this research is so necessary and worthy of government and society support.

At least in the minds of the scientists who participated in Denver, the report would have even more legitimacy if it could include, perhaps as an appendage, the "raw priorities" stated by individual participants. Seeing their statements recognized in print help scientists to justify their time away from work in Denver. This would make more clear that their concerns were heard even when the final wording of priorities may differ. Presenting the breadth of priorities raised by participants should also give more weight to the three or four resulting composite priorities of each theme area. Seeing the breadth and depth of complexity to ocean science research as spoken by individuals is valuable and will go farther than the twenty-one priorities alone to demonstrate the enormous extent of opportunities for future scientists and citizen stewards.

**Moir, Ocean River Institute**

NOTE: I had numerous copy edits to offer, but this comment procedure is too awkward given the time I have available for such things. --- However, I think the document is remarkably farsighted and refreshing, especially in embracing "ocean stewardship" and "ocean forecasting" concepts.--- My major thought is: There needs to be a stronger emphasis on identifying the underpinning basic and applied research issues that must be addressed to ensure robust approaches to societal applications. In particular, there needs to be a national scientific agenda developed on regional-scale, coastal ocean environmental and ecological processes that will be newly enabled by the coastal ocean component of IOOS and by OOI/ORION, and that will underlie the needed societal applications to be made through IOOS observing and modeling subsystems.

**Mooers, OPEL/AMP/RSMAS, University of Miami**

The Northeast Region of the U.S. Fish and Wildlife Service (FWS) has reviewed the draft report entitled "Charting the Course for Ocean Science in the United States; Research Priorities for the Next Decade." Like the companion Management Plan developed by the Subcommittee on Integration Management of Ocean Resources, this Plan, by its very nature, must be somewhat general. We applaud the multi-discipline approach advocated in the document along with its ecosystem focus. However, we see what we consider to be several significant omissions in the document.

In numerous locations within the document, mention is made of watersheds, coastal watersheds and terrestrial linkages (page 19, line 12). However, in our view, it is never clearly stated that both the terrestrial and oceanic systems are inexorably linked and that there is a movement of productivity between these two components of the environment via biological mechanisms like anadromous fish and the distribution of nutrients within

estuaries and coastal waters. The document also appears to focus on the aquatic side of the resource issue, and not provide adequate coverage of the large pelagic bird community that also act to link marine and terrestrial systems. The FWS is especially interested in the distribution and abundance of the bird community within the areas potentially subject to the development of alternative energy such as wind and tidal power. Finally, the document notes in many places (page 13, line 29) that educating the public is an important component designed to enable the public to make informed decisions and engender a stewardship ethic. While an educated public is important, one must also recognize the need to change the way we attempt to provide this education. Social Marketing, a relatively new approach to education, works to determine the root cause behind the public's failure to take the desired action even when provided with all the necessary information. Based on research undertaken in this field, the traditional approach of providing information and assuming the public will take the correct action is very unlikely to generate the desired action. These deficiencies should be corrected in the final document.

[Specific comments inserted in table]

We appreciate the opportunity to comment on this document and look forward to working with the Joint Subcommittee on Ocean Science and Technology during the development of the implementation plan. If you should have any questions, please contact Dr. Edward Christoffers, Special Assistant to the Regional Director, at 413-253-8305

**Moriarty, US FWS**

There were a number of instances where waffle words like “may” were used. Sometimes this is appropriate, but I have flagged several places (see below) where we have no need to waffle on a topic. E.g. the ocean **does** exert a strong control over hurricane strength and trajectory; it’s inaccurate to say that it **can** exert such a control, and needlessly belittles the point. I’ve no reason to believe this of the document in question, but there have been far too many cases recently of our federal administration exerting control in an attempt to diminish the significance of climate change.

While I can’t offer obvious alternatives, the expressions “Charting the Course” and “The Path Forward” have been used *ad nauseum* for planning documents such as this, and something different would have been refreshing. If you do insist on the former, then at least replace the latter with “The Future Course”. Mariners use “course”, not “path”. Perhaps try a thesaurus – I don’t mean to dictate changes here, rather, to suggest that other terms may be more appropriate.

Please do not use the politically coined term “Homeland” in this document. The U.S. is, and has always been, a Nation. By the same token, please remove any references to “Homeland Security”, which is also a politically coined term and has come to represent anything but “security”. Politics has no place in a document such as this. (Though I guess I’ve made clear my own political views!)

## **Muench, ESR**

This is an excellent start for defining our nation's ocean research priorities. I provide specific comments that address some factual errors and also provide additional context for research priorities, linkages between research and operations, and better coordination of the national research infrastructure that exists within and outside of government entities.

Ensure that the introduction and as needed each chapter highlights the fact that one area of resource use, research, and operations may have an impact on another. This is critical in moving toward Ecosystem-Based Management.

The report needs some emphasis on international dimensions of the nation's research priorities – some text to consider is provided in comments below.

**Muller-Karger, University of South Florida**

On behalf of the National Association of Marine Laboratories (NAML), I am pleased to submit our comments to the National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST) on the report, "*Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.*"

NAML believes the development and execution of a research priorities plan for the oceans, coasts and Great Lakes is important for the health, security and quality of life of the nation, and will also play a vital role in protecting, restoring and enhancing the resources embodied in these waters. NAML believes the JSOST priority setting exercise represents a unique opportunity to influence the continued development of U.S. ocean policy to more adequately support vital research, infrastructure, and education activities important to the ocean, coastal, and Great Lakes research and education community. We applaud you for your efforts in this process thus far.

The current draft interagency ocean research priorities plan (August 2006) represents a significant improvement to the original that was released in April 2006, both in content and in structure. In addition, the new draft reflects many of the points that were raised at the Denver workshop last spring and incorporates several of the recommendations made by NAML in its official comment to the JSOST in May. We believe the new format, with both near term and longer term research priorities, will provide effective guidance for those entities tasked with implementing the national priorities and policies.

NAML has a number of comments, both general and specific, that we offer for consideration for the final plan slated for completion in December 2006. NAML believes the plan should clearly link research into both natural systems and processes and human-induced alterations to the oceans. This draft has made great strides to call for research to better understand the human dimension of ocean issues, as well as increase our understanding of ecosystem dynamics and interactions. An ecosystem based approach to

management of the oceans, coasts and Great Lakes will only be effective if humans are considered as a component of the ocean ecosystem and vice versa. NAML believes that this current draft recognizes this interface and addresses it throughout the report.

Equally important, however, is the need for strong and interwoven connections between research and education. In fact, ocean education was identified as a cross-cutting theme in the April draft. Education, outreach, the blend of basic science to decision-making, the nestling of scholarship in communities, and the need to reach out and engage the full strength and diversity of our society are each complemented and strengthened by the other. Education and workforce training are also enormous enterprises at the state and local levels and within private institutions and industries. They also contribute to securing this nation's competitive edge over other countries in terms of science and technological advancement. A national plan should provide inspirational guidance on the value of education about the oceans and using the oceans as a model, even if the federal investment is relatively small. NAML strongly recommends that the final document increase its emphasis on the importance of ocean education and literacy, as it is inextricably linked to issues related to human/ecosystem health, national security, competitiveness, and the economy.

We also note that a number of themes from the April draft appear to be reordered in the August draft. For example, the April draft opened with themes related to ecosystem and human health. In the new report, however, the issue of enhancing human health was the last of the six themes to be listed. Similarly, the discussion of Improving Ecosystem Health has also been moved from the top of the order to the bottom. NAML applauds the JSOST for including increased emphasis on understanding the interactions that are occurring between terrestrial and aquatic ecosystems at the land/water interface; however, we are concerned that its new place in the report signifies a lessening of its priority. If so, we hope JSOST will rethink this issue for the final report.

In addition, the issue of seafood science and technology is not mentioned in any significant detail in the new draft. We continue to recommend that research be focused on the potential positive health effects of seafood consumption and the promise of new and emerging seafood technologies – particularly including aquaculture. The new draft seems to point exclusively to the potential threats of seafood consumption to humans. We would recommend the final plan take a more balanced position on seafood consumption and technology by highlighting the already proven and potential benefits of seafood *in addition to* addressing concerns about seafood safety (by way of contamination, pollution, invasive species, etc.).

Within the ocean sciences, the report has a reasonable balance of topics and makes good, defensible decisions about the priorities for the future. In one area, the report could be strengthened by drawing a much more visionary connection between traditional areas of research and non-marine research that has the potential to transform our research on the sea. Areas like the study of complex systems, genomics, robotics, nanotechnology, modern approaches to a variety of social sciences and many more are areas where very large investments and extraordinary discoveries are occurring throughout universities,

corporate research centers and government laboratories. These areas of research will revolutionize many of the research topics you identify in the plan if they can be brought into our community. Further, they will provide synergies that leverage ocean research investments into greater results than the same investment in more traditional areas. They also broaden the definition of ocean research infrastructure to include facilities like sequencing centers, supercomputers and grid computing. We recognize that incorporating these discoveries into our field will be difficult for many parts of our academic community, both federal and national. However, this is critical for the scale of transformative research that should be the goal of this plan.

Finally, the JSOST has clearly broadened the scope of “infrastructure” in this new draft. Many of the most important ocean and coastal related discoveries and education activities are provided or supported by shore-based marine labs and use specialized versions of the types of physical, analytical, and intellectual infrastructure found in universities. In addition, marine labs have a unique capability to connect to human needs and to communities through education and outreach, making them a particularly critical part of the ocean research and education infrastructure. Recognizing all types of infrastructure – including shore-based facilities as well as other technological and engineering developments that enhance marine labs’ ability to conduct marine science – is crucial if the plan is to be truly comprehensive and effective. Though there are still places within the report where the role of marine labs could be more prominently recognized, NAML is encouraged that the new draft has in fact increased its emphasis and recognition of marine labs as crucial infrastructure.

On behalf of NAML, I would like to thank the Joint Subcommittee on Ocean Science and Technology for this opportunity to express our views and recommendations for the further development of a comprehensive ocean, coastal, and Great Lakes research priorities plan. If you have any questions or would like to follow up in anyway regarding our comments please do not hesitate to contact me or NAML’s Washington Representative Joel Widder (contact information is located in the left-hand margin on the first page). NAML looks forward to continuing to work with the Subcommittee as the research priorities plan develops and its implementation moves forward.

**National Association of Marine Laboratories-Michaels**

We strongly support the recognition of the need to establish an integrated ocean observing system and agree that the development of a robust system with dynamic regional systems is key to achieving many of the priorities described in the draft plan.

The plan only focuses on one element of IOOS – the observations. In fact, IOOS is an end-to-end system (meaning it starts with the needs of users and ends with the information products and decision-making tools for users) that has 3 subsystems: 1) a data acquisition subsystem, 2) a data management and communication system, and 3) a modeling and product development subsystem. The plan should reflect all the elements of the IOOS.

The document postpones discussion of funding or discussion on how the plan will be implemented. The plan would be stronger if these were addressed in the document itself.

While the plan covers most of the major topics, it is not an inspirational document. As Daniel Burnham said at the 1890 World Fair “Make no little plans ...for they lack the magic to stir man’s blood.” Given the state of ocean research today, we need a plan to stir the nation’s blood.

### **National Federation of Regional Associations-Quintrell**

On behalf of the National Marine Educators Association (NMEA), we appreciate the opportunity to comment on the National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST) draft report, “Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.”

It is a pleasure to note the strong recognition in this document that sound well-planned ocean science requires the support of an “ocean literate” society to bring it to fruition. Additionally, there are references throughout the document (especially pages 53-56) regarding education, stewardship, and outreach as critical components of a strategy to move ocean science forward in a manner consistent with the goals of the U.S. Commission on Ocean Policy and the U.S. Ocean Action Plan.

As an organization that brings together those interested in the study and enjoyment of the world of water--both fresh and salt, and includes professionals in: education, science, business, government, museums, aquariums, and marine research, NMEA applauds this recognition of the importance of education leading to ocean literacy. NMEA members are dedicated to increasing ocean literacy in their own regions and across the country by actively engaging in education, outreach and the promotion of stewardship of the marine and aquatic environment with a broad range of diverse audiences. We suggest that to make a difference and establish an ocean literate nation, education and communication must be included in the broader scope across all disciplines. We also strongly support the steps outlined in the “Making a Difference’ section.

Specifically we would recommend the following:

- 1) The section “Making a Difference” should be moved to a more forward position in the document and given more prominence.
- 2) Near term priorities should include and emphasize a component of education and communication.
- 3) Education, Outreach, and Communication should be elevated to an “Overarching Opportunity.”
- 4) Funding for education should be increased and sustained in order to realistically make a significant impact on creating an ‘ocean literate” society.

NMEA recognizes the focus of the document is on research priorities, but we also recognize that strong support of education, outreach, and communication about ocean

science is imperative in order to truly achieve those priorities, so that ultimately they are embraced, supported, and understood by an ocean literate society.

Thank you for your efforts in soliciting input for this important document. If you have any questions or comments please feel free to contact me (or other officers of NMEA)  
**National Marine Educators Association- Whitley**

The National Marine Sanctuary Foundation supports the comments of Dr. Sharon Walker. We believe education is critical to the future success of efforts under the U.S. Ocean Action Plan and that this should be reflected in *Charting the Course for Ocean Science in the United States*. We commend the efforts of the Interagency Working Group for Ocean Education, which reports to the JSOST/SIMOR co-charis, to develop a plan of action that defines future steps for achieving ocean literacy, consistent with the U.S. Ocean Action Plan, the U.S. Commission on Ocean Policy, the recent Conference on Ocean Literacy and many other similar efforts that identify the importance of education.

The Foundation recommends:

- \* Giving Ocean Sciences Education and Outreach greater emphasis as a near-term priority;
- \* Moving Making a Difference to a more prominent position in the document;
- \* Elevating education, outreach and communications to an overarching opportunity;
- \* Working to improve sustained funding for education;
- \* Recognizing and endorsing IWG/OE efforts.

Thank you for the opportunity to comment.

**National Marine Sanctuary Foundation-Arguelles and Kaplan**

In *Charting the Course for Ocean Sciences in the United States: Research Priorities for the Next Decade* the Joint Subcommittee on Ocean Science and Technology (JSOST) lays out a series of major themes that define the priorities for ocean related research. *Charting the Course* grounds its recommendations by noting the critical economic importance of ocean and coastal resources to the nation and by “plac[ing] a high emphasis on understanding the interactions between humans and ocean ecosystems- the human dimensions of ocean issues.” (p. 12, lines 7-8)

The research priorities enumerated in *Charting the Course*, however, do not address in any detail the needs for research regarding the socioeconomic aspects of ocean systems. This omission could reduce significantly the ultimate value of JSOST’s recommendations. We suggest that JSOST consider including an explicit section on priorities for socio-economic research as part of its recommendations for ocean research priorities.

*Charting the Course* identifies two key tools that are needed to address societal needs regarding our understanding of the ocean: observing systems and models. These tools have their analogs in socioeconomic areas of research:

### **1. Data and Observations**

There are two major sources of socioeconomic data relative to the oceans. The first, secondary data, include a large amount of data already collected that requires adaptation to the specific issues involved in ocean and coastal resources. Examples of existing data include data from: 1) the Census on population and housing, 2) the Bureau of Labor Statistics on employment and wages, and 3) the Bureau of Economic Analysis for measures of income and output, as well as 4) data series from other federal and state agencies. There is a wide variety of data, which must be adapted to ocean-related issues through custom aggregations based on spatial location and on type of activity.

This task is being made easier as socioeconomic data are increasingly becoming available on a geocoded basis so that precise matching of geographic scale between socioeconomic and natural systems is possible. Transforming what is now possible into data sets that are usable for research and policy analysis will require significant cooperative efforts among social scientists, natural scientists, and data management specialists.

The second source of data, primary data, are not currently collected and need to be collected from scratch in order to adequately understand key aspects of socioeconomic values that are not routinely measured. Primary data collection is particularly important for data on “Non-Market values” for coasts and oceans. Non-Market values reflect the economic importance of natural resources and the services those resources provide that are not measured in market transactions. Non-Market values are particularly important in measuring, monitoring, and understanding the economic health of resources that support recreation, aesthetic values, and ecosystem services. Non-Market value data are highly fragmented both geographically and topically making studies of such values across time and space very difficult. The state of such data is analogous to the state of oceanographic data prior to the development of ocean observing systems and will require similar commitments in the design and regular use of standardized valuation procedures.

Primary data collection also will be essential for one of the most basic socioeconomic issues: the measurement of human populations in coastal and watershed areas. Because the decennial Census provides the large amount of detail it does and because population data are so frequently cited when making the connection between oceans and society, it is easy to lose sight of the fact that the Census population estimates are very limited. The Census counts only resident populations and not the transient populations that come to the coasts on a daily basis for employment or the seasonal populations that can swell a coastal region by an order of magnitude. Coastal regions may have among the most dynamic human populations on a daily and seasonal basis of any regions. Understanding these dynamics is critical to hazard planning and to understanding the role of the human populations in the coastal ecosystems.

Finally, data focused on consistent and comparable social and economic indicators need to be collected over time and across many sites in order to allow analysts to tease out the impacts of ocean policy on ocean-dependent economic activity. Too often, socio-economic studies are conducted as one-time snapshots of the Ocean Economy. Only rigorous data, collected consistently across many coastal areas and over many years, will provide the analytic power needed to evaluate the effectiveness of policy decisions.

The development of socioeconomic data time series, and improvements to the collection of Market and Non-Market values data, would form the critical foundation for addressing several of the other research priorities identified in *Charting the Course*:

- Understand human-use patterns that may influence resource stability and sustainability. (p. 4, lines 24-25)
- Apply understanding of ocean-related socio-economic activities to assess the ability of marine ecosystems to provide essential goods and services. (p. 5, lines 22-23)
- Understand how human use and valuation of ocean resources can be affected by ocean-borne human health threats and how human activities can influence these threats. (p. 6, lines 1-3)

The ultimate goal of these efforts on developing data to measure and track socioeconomic systems should be considered the same as enunciated by JSOST with respect to natural systems:

- A robust observing system that can describe the actual state of the ocean will revolutionize the view of the ocean environment and provide the data necessary to advance the research efforts outlined in this document. (p. 7, lines 14-17)

## **2. Models and Forecasting**

The collection of data are the foundation for research, but data must be transformed into usable information through analysis. *Charting the Course* identifies the need to develop models of ocean processes that both lead to understanding of those processes and to the ability to forecast future conditions. The challenge for socioeconomic data is similar.

The major priority will be developing understanding of the two-way interactions between socioeconomic change and natural system change. *Charting the Course* notes the importance of both types of interactions. On the one hand are the impacts of human systems on natural systems, and so a priority is noted for:

- Understand and predict the impact of natural and anthropogenic processes that govern the overall level of ecosystem productivity. (p. 5, lines 20-21)

On the other hand, the condition of natural systems also has important effects on humans, as indicated by the priority for:

- Understanding and predicting the relationship between social and economic drivers and human health threats will require integrating socioeconomic investigations with ecosystem-based studies of health threats, which will, in turn, help support management and mitigation efforts. (P. 47 lines 27-30.)

The major challenge is to integrate models of socioeconomic processes and change with models of natural systems change. This is a research field that is still at a very early stage, but for which the increase in data from both socioeconomic and ocean observing systems holds great promise. A major priority for research in this field will be finding the appropriate time and spatial scales within which to detect interactions between socioeconomic and natural systems. The development of forecasting models for socioeconomic change is a generally well-advanced field, but the incorporation of factors such as changing ocean and coastal conditions remains to be done.

In sum, the Subcommittee's goals for ocean research that will form the foundation of the "wise stewardship and sensible management" of the ocean (p. 3. line 8) cannot be met without research in the socioeconomic aspects of ocean and coastal regions. In some ways such research will be easier than in the natural systems. Much socioeconomic data are already collected on a routine basis. This "observing system" needs only adaptation and expansion to meet the particular needs of ocean and coastal areas.

In closing, both socioeconomic and natural systems are highly complex and no one can claim full understanding of either. The integration of our imperfect understandings of these two systems is thus both a very high priority and a major challenge.

This memorandum is signed and supported by The National Ocean Economics Program, its colleagues, and sponsors. Names are listed with permission.

**The National Ocean Economics Program- Lockwood, et.al.,**

Thank you for the opportunity to comment on the August 2006 draft report, "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade." The Natural Science Collections Alliance (NSC Alliance) is a nonprofit association that supports natural science collections, their human resources, the institutions that house them, and their research activities for the benefit of science and society.

Developing a comprehensive, long-range ocean science research plan certainly presents a challenge. Although the draft report includes a number of positive recommendations for the future, it is equally important that the research plan reflect the importance of a sustained investment in our established research infrastructure. As you know, the 2005 and 2006 joint Office of Management and Budget (OMB) and Office of Science and Technology Policy (OSTP) annual memoranda on federal research and development priorities identified our nation's natural science collections infrastructure as a priority.

Natural science collections, whether housed at a university, museum, or marine laboratory, are essential to any research effort that seeks to understand ocean processes. These scientific collections hold important genetic, tissue, organism and environmental samples. With these specimens, researchers are able to answer questions about the current and historic relationships among organisms and between organisms and their environment. Understanding these relationships is essential for the development of models that forecast future ecosystem responses to environmental change. Moreover, biological specimens provide scientists the capacity to understand the type and severity of diseases that might be present in ocean, coastal, or lake fisheries; research that can contribute to sound environmental and food safety regulations.

The Subcommittee's recognition of the importance of ocean education and outreach programs is important. Museums and other science centers are an important component of our nation's educational system. Often, these organizations are the only opportunity school children have to experience the awesome size of a whale or microscopic algae. Indeed, public attendance at museums remains at high levels. Natural science museums would welcome an opportunity to partner with federal ocean research agencies to ensure that the research findings that arise from the Subcommittee's plan are converted into education and outreach displays serving citizens across the nation.

For these and other reasons, the Joint Subcommittee on Ocean Science and Technology should work to ensure that the final ocean research plan includes appropriate policies and funding for natural science collections involved with the collection and curation of ocean, coastal and Great Lakes specimens and data. The Subcommittee should also consider working closely with national organizations that provide place-based, informal science education programs.

Once again, thank you for the opportunity to comment on the draft report. If you have any questions or require additional information, please do not hesitate to contact me or Dr. Robert Gropp, NSC Alliance director of public policy at [rgropp@aibs.org](mailto:rgropp@aibs.org) or 202-628-1500 x 250.

**Natural Science Collections Alliance-Yates**

We are pleased to have the opportunity to comment on the Draft document: Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade. We applaud the National Science and Technology Council's Joint Subcommittee on Ocean Science and Technology (JSOST) for its transparent and inclusive process while developing these research priorities.

We are especially pleased to see the emphasis on cross-disciplinary research approaches as we believe interdisciplinary research will be indispensable in addressing challenges related to management of ocean resources. Moreover, we fully support the research framework of *discovery*, *understanding*, and *application* as simultaneous attention to these three pillars of research will be vital. We believe that large-scale ocean observing

systems, especially those that rigorously monitor *both* biological and physical attributes, are the necessary foundation for these three pillars, and we are pleased to see emphasis in the Draft on ocean observing systems. It is particularly important for such observing systems to cross the land-sea boundary, including the important land-based and coastal components of ocean ecosystems. As part of these systems we do think there is a role for “citizen-science” initiatives that can contribute significant resources at very low cost towards such activities as (for example) water-quality monitoring, censuses of marine mammal and sea bird mortality, and marine debris monitoring. These citizen efforts can be greatly aided through federal agency support, including marine program agencies collaborating with the Americorps program, and this should be added to the report.

In general, we hope that some of the language is tightened up to reduce ambiguity between what is actually known about ocean management and what has merely been proposed as potential solutions. For example, on page 7 the statement, “*Ecosystem-based management is now widely recognized as the one of the most effective ways to cope with a variety of increasing natural and human-induced pressures*” is misleading. Although the *principle* of ecosystem-based management (EBM) is becoming increasingly well-understood, the *application and effectiveness* of EBM have simply not been evaluated in any rigorous way, especially since there are currently few ocean management schemes operating for any substantial period of time based on the EBM principles.

Beyond this, we wish to raise here three specific areas that we feel are not fully emphasized or clarified in the Draft.

First, the role of the social sciences and the need for better assessments of economic and social drivers and impacts of marine policy and environmental change is not given strong emphasis in the Draft. As an example problem, social, economic and environmental drivers are altering coastal development patterns. This development in turn has profound impacts on both the coastal environment as well as the coastal human communities that directly depend on ocean resources. Especially when advocating an EBM approach to ocean management, we cannot ignore the social and economic components and feedback loops within the ocean ecosystem. The report discusses competing uses of the marine environment in several places, but acknowledging the existence of competing uses is not enough to guide policy. We would like to stress that quantitative assessments are an important part of making tradeoffs systematically. These assessments must incorporate the dynamic feedbacks of human interactions with natural systems and how existing or proposed policies affect these feedbacks. We understand that there may be uncertainty as to whether social considerations should be infused throughout the research priorities or be considered separately as their own research priority, but nonetheless they should be given adequate attention.

Second, the role of connectivity between inland watersheds and the ocean needs to be given greater emphasis. The devastation of Hurricane Katrina and the persistent dead zone in the Gulf of Mexico are two dramatic examples of how physical, chemical and biological processes that begin in watersheds far from the ocean greatly impact coastal and ocean ecosystems. We note here that ongoing large-scale research projects such as

the NSF-funded Santa Barbara LTER program are already explicitly exploring the linkages between watersheds, human population centers and ocean ecosystems. Proper emphasis on land-ocean connectivity in this draft will help support and replicate such efforts.

Third, we would like to see a more enterprising approach toward “adaptive management” in the research plan. Too often, adaptive management becomes a hedge against the failure of policies that were not designed correctly or were not fully implemented. A more rigorous approach to adaptive management would encourage the design of true management experiments with appropriate controls. In this way, ecosystem responses could be assessed against benchmarks and linked to particular management actions. Moreover future management actions could be modified appropriately based on empirical evidence, rather than pursued as another unreplicated trial. Even though it may raise concerns from some quarters, adaptive management should essentially be viewed as a series of experiments, and designed with the rigor of a proper experiment.

Finally, as researchers with a range of interests in marine affairs, we are truly energized to be in this field at this time. We see a tremendous need for more and better marine research given the enormity of the challenges facing the world’s oceans. At the same time we are excited about new technologies that allow us to study marine systems from the molecular level to the level of whole oceans and the globe. We think that the Draft document may better express this excitement and urgency to policy makers and the public by moving the intriguing questions posed in the “The Path Forward” section to the beginning of the document.

We look forward to continuing to work with JSOST as priorities for ocean research are developed and refined.

**Nicholas School at Duke University-Sagarin et al**

The Council appreciates the opportunity to review the recently issued report, *Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade*. Many of the ocean research priorities identified in the report reflect the Council’s needs for managing fisheries in the North Pacific, including:

- Understanding the status and trends of resource abundance and distribution,
- Understanding interspecies and habitat/species relationships,
- Understanding the impact of natural and anthropogenic processes that govern overall ecosystem productivity, and
- Understanding the impact of climate variability and change on the ocean.

The Council relies heavily on a scientific understanding of these and other research questions to effect sustainable management. The contribution of NOAA and National Marine Fisheries Service to implementation of the ocean research plan is critical. NOAA research provides both standard observations, through its survey efforts, as well as an understanding of the processes. Both of these efforts require extensive field efforts, and such field research is critical to implementing two of the near-term priorities identified in

the report: understanding and forecasting changing ocean conditions, and understanding marine organization.

The report identifies that an implementation strategy is the next step for furthering ocean research priorities. The Council hopes that such a strategy will recognize the importance of NOAA's field research program, and will support maintaining or increasing funding for NOAA research vessel time. NOAA surveys are important to understanding and predicting the production of economically important species, and helping Council understand how other species and the environment are impacted from fisheries. Even at the present time, NOAA has insufficient vessel time to carry out many of the kinds of activities that the Council would use in fishery management, such as expanded hydroacoustic surveys of commercially important species, or marine mammal/fishery interaction studies. For example, until we gain a better understanding of the relative roles of climate and human influences on Steller sea lions and their prey, fisheries will be impacted. It is also important to research small scale interactions, how fish respond to local oceanographic features and prey distribution, and how that might impact protected species such as Steller sea lions. We also need to enhance our basic understanding of lower trophic level productivity and fish recruitment processes.

In the Bering Sea, climate variability is very important. In recent years, there have been declines in sea ice, which have resulted in possible changes to the distribution of commercial fish resources and productivity. We need to better understand how those resources will distribute themselves under future changes in climate and sea ice, and what the implications are for fisheries in the future. To forecast what will happen in ecosystems as a result of climate variability, and how ecosystems will respond, we will need to continue and enhance current observations.

We look forward to seeing the implementation strategy, and hope that it will strongly endorse continued field research in the North Pacific. We encourage the Subcommittee's continuing work on this important issue.

**North Pacific Fishery Management Council-Oliver**

Building on a primary recommendation of the U.S. Commission on Ocean Policy, the report accurately supports the development of scientific information to facilitate ecosystem-based management of ocean resources.

**The Ocean Conservancy-Heinemann**

The Offshore Operators Committee, an organization of companies engaged in drilling and production of oil and gas in the Gulf of Mexico and in providing services in support of these activities, has reviewed the document "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade" and would like to offer the following comment. We believe the document gives insufficient emphasis to the importance of research on predicting and modeling extreme weather events in ocean and coastal environments. Improvements in the accuracy of our modeling tools will require both basic and applied research. Everyone who works or lives in coastal areas is

impacted by predictions and models of weather events. Success in this endeavor will improve the effectiveness of preparations for severe weather and reduce the cost of false alarms. Because the benefits of advances in this area are clear to essentially every stakeholder in the coastal areas of our country, progress in this area will also bolster public support for ocean research in other important areas.

Comments concerning how this issue is addressed in specific places in the document are listed by page and line number below

**Offshore Operators Committee, c/o ExxonMobil Upstream Research Company-Smith**

The Ornithological Council is a consortium of eleven scientific societies of ornithologists in the Western Hemisphere. Among them are seven societies based in the United States: American Ornithologists' Union, Association of Field Ornithologists, Cooper Ornithological Society, Pacific Seabird Group, Raptor Research Foundation, Waterbird Society, and Wilson Ornithological Society. Most of their members study birds in the wild, and a significant number – particularly those belonging to the Pacific Seabird Group and the Waterbird Society - study seabirds and shorebirds. We appreciate the opportunity to comment on the Joint Subcommittee's recommended priorities for ocean science for the next decade.

The template provided by the JSOST is not suitable for our comments, which are general in nature, though we refer to page and line numbers where appropriate to illustrate our points.

*The approach taken to a given question should be appropriate to the question or problem addressed by the researcher. The JSOST should reconsider its preference for or emphasis on interdisciplinary, theoretical, and “transformative” research, as it could lead to a further decline in funding for wildlife research or to the development of research projects that are unnecessarily complex and expensive.*

We are keenly concerned about the diminishing resources for fundamental, taxon-based research in favor of models, theoretical or “transformative” science, and interdisciplinary research. These approaches have great value, but rarely result in the biological knowledge needed to understand wildlife issues or develop the more immediate, short-term solutions that are needed. Deeper understanding is a laudable goal, but not necessarily where the emphasis should be placed for some questions. For instance, knowing how or why ocean currents change location, direction, or depth is important, and these changes certainly affect the fish stocks upon which seabirds rely, but a more immediate need – particularly for long-lived bird species – is to study the relationship between nesting success, fledgling quality and survival, and recruitment into the adult population. Populations may appear stable if adult survival is high, even if recruitment is relatively low. And if reproductive success is declining, what are the causes? It may be climate change (Meehan *et al.* 1998), driving changes in nesting dates or resource availability, or it may be increased predation, contaminants, or a combination of factors.

The kind of research needed to make these determinations, and to devise corrective action – if such action is possible – generally is not considered “transformative” and may not require an interdisciplinary approach, which could increase the cost and complexity of the study without a commensurate benefit in understanding of the primary question. It is increasingly difficult to come by funding for this kind of research. The impact of fishing methods on seabirds and sea ducks is another example of the need for ordinary, everyday research. Longlining fishing methods and near-shore gillnets cause significant mortality; in the case of some seabird species, the high level of mortality is sufficient to pose a threat of extinction. Solving these problems does not call for interdisciplinary studies that open frontiers; such research would be costly and unlikely to lead to solutions.

And, of course, model validation requires field-collected data. Though the JSOST may assume that modeling exercises will encompass the collection of field data, it is sufficiently important that it should be stated explicitly.

Similarly, climate change is among the drivers of the development of alternatives to fossil fuel energy. These new technologies include near-shore wave energy. When agencies such as the Minerals Management Service prepare environmental impact statements to evaluate the potential environmental consequences of these technologies, they have little or no information about the real or potential impact on wildlife, because funding is not available for these studies. The EIS is thus at best speculative, and is of little or no use in informing decision-makers. The JSOST recognizes as that application of knowledge is one of the three foundational elements of the research enterprise (Page 15, line 29 *et seq.*). Without the knowledge, there is nothing to apply. This kind of knowledge is not likely to be generated adequately by the research approaches advocated by the JSOST.

The report suggests as one of eight prioritization criteria, “Does the research address high priority needs of resource managers?” (Page 20, Line 8). The list of workshop participants is not available on the JSOST website, but if resource managers participated, it is not evident from the outcome. None of the JSOST members are recognizable by their titles as resource managers; for that matter few can be identified as biologists or wildlife biologists. Resource managers of biological resources, lands with significant biological resources, and wildlife managers, in our experience, will rarely use the words “transformative” “innovative” “cross-cutting” or “frontier” to describe the research they need to manage those resources. Though in some cases, they may be too focused on the here-and-now and on immediate solutions, it is the case that the kind of research that the JSOST clearly prefers is unlikely to address the high priority needs of those who manage wildlife and wildlife habitat.

*We encourage the JSOST to include a recommendation that research agendas and funding levels in all agencies be developed through ongoing dialogue between resource managers and researchers. The imbalance in research funding along the spectrum of basic versus applied research, especially given the emphasis on cutting-edge, interdisciplinary, and transformative science, is such that there is simply not enough of the kind of research needed for natural resource management. To redress this imbalance,*

*intramural and extramural agencies should reach out to resource managers to identify high-priority research needs and attempt to balance their funding portfolios within and among agencies so as to avoid neglecting this type of research.*

Although the JSOST recommendations recognize the need for both types of research, too much emphasis is placed on large-scale, theoretical, long-term, interdisciplinary research. Specific examples of the overemphasis include:

Page 8, Line 24 (and following paragraph): Ecosystem studies are large, expensive, and generally long-term. Recognizing the inherent nature of this kind of study, the NSF has established an entire program devoted to long-term ecological research. The need to understand all the links in the chain (or all the threads in the web) is critical, but answers to specific questions or problems can be derived from much smaller-scale and even observational studies and, in turn, contribute to the understanding of the ecosystem. Forecasting or other forms of modeling tends to be expensive, and the models must be validated or refined with data, which can be collected in the context of shorter, smaller-scale studies.

Ecosystem approaches are valuable, but should be redefined to include investigations of individual components of the ecosystem and the interactions of those components, including those of individual species. There is much we don't know about the basic biology and ecology of many bird species, including life history traits, behavior, energetics, intra- and interspecific interactions, nesting requirements...in the case of the Marbled Murrelet, for instance, we learned only four decades ago that the species breeds inland. A lack of knowledge or understanding of these small components of ecosystems weakens ecosystem studies. The JSOST could address this concern by recommending that ecosystem studies encompass suite of studies at various biological and temporal scales, including species-specific studies.

Page 12, Lines 13-17: *“The nation’s ocean research portfolio is, in essence, being re-balanced to take advantage of new interdisciplinary research approaches, sophisticated research and computational tools, and the availability of shared assets such as personnel and research platforms. An appropriately balanced research portfolio will provide insight into ocean processes that will enable better policy and resource management decisions.”*

In fact, the recommendations in this report will lead to an imbalance. At the least, the report should make clear that it recommends the *addition* of these approaches, but not the loss or replacement of more traditional approaches, particularly where those approaches are better-suited to the questions being studied. Integrating knowledge into a scaffold that supports a better understanding of the system is a valuable goal, but scaffolds will fail if parts are missing. Our understanding of the biological components of coastal and ocean ecosystems is not strong enough to support the scaffold.

Page 17, Lines 3-25: “a critical aspect of understanding the ocean environment is expanding the scientific horizon through innovative research that does not directly

respond to specific products or societal requirements, but addresses key, underlying science questions and poorly understood processes;” “Fundamental research that expands the scientific frontier will provide a deeper and more comprehensive understanding of the ocean and its role in the Earth system;”

Page 20, Lines 4-6: It is telling that the first question asked is whether the proposed research is transformational. The parenthetical questions suggest that the JSOST is not using this term in the manner in which it is generally understood by the research community as defined by the National Science Board in its December 2004 charge to the Committee on Transformative Research: “research that has the potential to revolutionize an existing discipline through a paradigm shift or create a new one.” < <http://www.nsf.gov/nsb/committees/cpptrcharge.htm>>. Instead, the JSOST asks if the research that it characterizes as transformative will enable significant advances for insight and application. All research should be conducted with the goal of enabling significant advances for insight and application. At the very least, the JSOST should define terms *as used in this document* to avoid misinterpretation of the recommendations.

Assuming that the JSOST intended this term to be understood in the more common sense – despite the parenthetical questions that suggest otherwise – the JSOST places too much value on this kind of science. Emphasizing or recommending certain approaches over others is likely to result in a distortion of the research agenda and a continuing decline in funds available for much wildlife research. Or, to meet these standards in order to compete successfully for funding, wildlife researchers may be forced to propose research projects that are needlessly complex and expensive.

*Wildlife research is completely overlooked*

The word “wildlife” does not appear once in the document. Is this kind of research unimportant? Is it to be conducted only around the margins? Is it valuable only if the context of these large, ecosystem, transformative studies that expand frontiers? Of course, wildlife can and often should be studied in the ecosystem context, but this is not always the best approach and may be unnecessarily costly. Moreover, the discussion of ecosystem research (Page 41, Lines 11-25) fails to mention the biotic components of the marine ecosystem – except as food products and seems to regard the study of the biotic components as having value only as bioindicators (Page 43, Lines 9-20).

Traditional wildlife research may not have these characteristics, but it is important and should not be overlooked. This report, if used by funders as guidance, will lead to the further erosion of funding for wildlife research – at a great cost to wildlife and to the country.

*The report provides little useful guidance to research funders.*

Page 18, Lines 17-23: *Attempting to prioritize research efforts driven by new ideas and the desire for discovery would constrain these fundamental and critical activities. By definition, unforeseen breakthroughs and paradigm shifts cannot be*

*planned nor should they be, as such planning would be inherently limited by current understanding. Therefore, this document focuses on underscoring – rather than defining and enumerating - the fundamental research efforts that provide the foundation for understanding the ocean.*

The document should not be limited to research efforts that provide the foundation for understanding oceanographic processes. The Oceans Commission, though it devoted relatively scant attention to wildlife (apart from fisheries as a resource), considered coastal and oceanic wildlife, and the scope of a report on the research needed to implement the Ocean Commission report should be commensurate with the scope of the report. This may be a matter of defining terms; many readers may interpret the word “ocean” to mean the physical components and actions of the bodies of water termed oceans, rather than all the biotic and abiotic aspects of oceans and coastal environments.

Even given this statement regarding the focus of the document, the report is so broad and inclusive that it functions as little more than a re-organized list of the questions about oceans and coasts and the associated natural resources – and all in the context of how humans impact those resources and, conversely, how the oceans (and the harm humans do) impact humans. If the intent is to increase the overall level of funding, i.e., to persuade the Administration and Congress to increase funding to grantmaking and intramural research agencies, or to direct additional funding to the relevant programs of those agencies, this document should suffice, subject to the concerns voiced above regarding an unwise emphasis on certain approaches and the omission of an important research category.

Regardless of overall funding levels, agencies will likely use this document as guidance. These agencies would be well-served by the advice of discipline-specific experts and interdisciplinary teams as to funding priorities along the entire research spectrum – from broad, transformative, interdisciplinary science to smaller-scale and discipline-specific work, such as wildlife research. They might also be aided by a discussion of the relative mix of research approaches, and should be cautioned not to neglect some kinds of research in favor of others without a compelling reason to do so.

However, the JSOST should not – and probably cannot – develop the more specific, detailed priorities that would be helpful in directing whatever resources are available to them. For that purpose, the JSOST (or the NSTC) should ask NSF, NOAA, or other relevant agencies to commission or solicit proposals from established or ad hoc groups of experts for discipline-specific and interdisciplinary reports outlining research priorities for the next decade. These exercises can be difficult, in that they generally require that participating researchers objectively consider the entire field, and forego assigning priority to their own research interest. The directive to bidders must make clear that comprehensive lists of all possible research questions, or broad categories of research topics that could encompass all or nearly all research questions, are not useful for the intended purpose and that proposals should detail the procedures that will be employed to avoid such results.

Alternatively, the NSTC could establish a federal advisory committee with suitable subcommittees, though as it often takes a year or more to establish a federal advisory committee and these committees tend to take a minimum of two years to produce a full report, this is probably not efficient. Moreover, the relatively small size of these committees would preclude participation by most experts in the relevant fields. Existing NSF panels, enhanced by resource managers and wildlife biologists – both from academia and other federal research agencies – might be able to address these discipline-specific and interdisciplinary research agendas.

*Ocean and coastal science is international, these resources are mostly international, and our efforts to achieve a sufficient scientific understanding of ocean and coastal science should be international*

At page 11, line 30, the document states, “Addressing the national and global challenges outlined in this document also requires the collaboration and coordination of national research efforts with international initiatives.” There is virtually no other mention of international collaboration. The research questions are as vast and deep as the oceans themselves. No one nation can achieve the level of knowledge that is needed to address the myriad and difficult questions and issues pertaining to the biotic and abiotic facets of oceans and coasts. More emphasis should be given to the need for international collaboration.

*Concurrence with views submitted by American Bird Conservancy and the Pacific Seabird Group*

In addition to our own recommendations, we strongly support comments submitted by the Pacific Seabird Group and the American Bird Conservancy, which express many of the same view points.

#### Citations

Meehan, R., V. Byrd, G. Divoky, and J. Piatt. Implications of Climate Change for Alaska’s Seabirds. Available online at <http://www.besis.uaf.edu/besis-oct98-report/Seabirds.pdf>

#### **Ornithological Council-Paul**

On behalf of the Pacific Seabird Group (PSG), we offer the following comments on the draft plan "**Charting The Course For Ocean Science In The United States: Research Priorities For The Next Decade**" that was issued in August 2006. In addition to our general overview, we have attached editorial comments that refer to specific pages. PSG also supports the comments of the Ornithological Council and the American Bird Conservancy. The Draft Research Priorities constitutes a needs assessment and outlines a strategic action plan aimed at outlining national ocean research priorities in the U.S. over the coming decade. We understand that this document will be a foundation for the Ocean Research Priorities Plan and Implementation Strategy, which is to be released in December 2006.

PSG is an international, non-profit organization that was founded in 1972 to promote the knowledge, study, and conservation of Pacific seabirds. It has a membership drawn from the entire Pacific basin, including Canada, Mexico, Peru, Chile, Russia, Japan, South Korea, China, Australia, New Zealand, and the USA. Among PSG's members are biologists who have research interests in Pacific seabirds, government officials who manage seabird refuges and populations, and individuals who are interested in marine and seabird conservation. Since PSG began it has been a strong and vocal advocate of ocean research, including ecosystem-based research on all aspects of the marine and near-shore environment, of which seabirds are an integral part. Our interest in this topic is keen, and our comments are as a primary "stakeholder."

We applaud this effort by NSTC Joint Subcommittee on Ocean Science and Technology to provide U.S. institutions and government agencies a template that will guide ocean research for the next decade. In general, we believe that this draft represents a good beginning. The final report should provide a strategy and concrete plan of action plan.

The plan should acknowledge and incorporate the increasingly important role of seabirds and other apex predators as indicators of ecosystem function and health. Seabirds are secondary and tertiary consumers, the same trophic level as commercially exploited fish. Seabird prey include the juveniles of many commercial species and may in some cases compete with fish for the same prey. Thus, seabirds can be excellent samplers and predictors of fisheries stocks. Because seabirds are conspicuous, accessible, and are sensitive to physical and biological fluctuations in the marine environment, they can provide early warning of toxins and contaminate accumulation, and signal natural or human-caused changes in the ocean environment. Indeed, upper trophic level predators have been found to be more sensitive indicators of environmental shifts than most physical barometers. For example, in the Pacific Ocean, changes in seabird productivity and survival rates were among the first reported indications of large-scale impacts associated with El Niño and La Niña. This valuable source of information should be incorporated into any comprehensive research plan.

Editorially, this document could be improved by streamlining it, as there are repetitions among sections, and even repetitive paragraphs in the same section. In addition, some of the statements are so general or non-contentious that they provide little guidance. Parts of the introduction read more like conclusions, and thus are repeated later in the document. The findings could be clarified by numbering sections and priorities. For example, on page 7 and elsewhere, the document refers to 21 research priorities, but it is not clear which are the 21 priorities.

Our substantive concern is that, while the document purports to be inclusive of all aspects of ocean research, there is an overriding emphasis on human use of ocean resources or impacts on humans due to changes in the oceans. Even if this human-centered approach is necessary, it will not be possible to understand the marine ecosystem and the issues you propose, without attention to middle and upper trophic levels. Furthermore, there is little (or no) attention to the government's role as a trustee for these natural resources,

and the government's responsibility for issues ranging from the regulation of contaminants, to the harvest of fishes, to the maintenance of healthy populations of seabirds and marine mammals.

Throughout, the document makes giant leaps from physical oceanography to humans, with occasional, minimal attention to things such as 'productivity, coral reef systems, pathogens, invasives', etc. The intermediate and upper ecosystem components (fishes, birds, mammals) only appear to be implied. This approach could lead to inefficient operations and flawed programs. For example, the research plan ignores the potential, at least under certain conditions, for 'top-down' impacts on ecosystems and ocean regimes, and appears to assume 'bottom-up' control, which has not always been supported. One example is the potential 'top-down' force on the recruitment and abundance of commercially important fish species by larger fish, seabirds, and marine mammals. Higher trophic levels are mentioned within the context of large-scale ecosystem models (p. 23), but fully understanding interactions among trophic levels will require additional approaches. The outline should be more specific about the inclusion of such basics as population trends and abundances of major taxa, as well as more complex interactions among species and their changing environment.

Among the six themes selected (which 'represent key areas of human interaction with the ocean'), most have in common the issues of acquiring and managing up-to-date data, the communication and availability of the databases, GIS applications, and modeling. In addition, the document notes the need to train and maintain the technical and scientific expertise to maintain the necessary infrastructure. All of these are important goals that we support. We would add, however, that the plan needs to recognize the existence of many valuable data sets that, for lack of support, are not currently fully integrated into accessible databases. These data sources could prove valuable in evaluating long-term changes, as well as the validation of new models.

We are pleased to see the plan address the necessity of improving marine operations, as the lack of safety standards, resources, and accountability continue to endanger seabirds at sea and near their breeding areas. However, the plan does not appear to address the safety issues from foreign registered vessels. It is not clear if 'industry' (p.32) includes foreign-based ships, but if so, this should be clearly stated. U.S. waters host many international routes, yet (for example) there is no mention of the 'great circle' route through Alaska's waters, where 85% of U.S. seabirds occur. While we agree with the need to 'increase understanding of environmental impacts and conditions affecting marine transportation' (p.32), there is also a need to understand and protect the environment from the anticipated increase in marine transportation.

Finally, we strongly support the suggestion for sharing of research platforms among different aspects of ocean science research. We also strongly support the emphasis on long-term observing systems. To be successful, a program will approach both of these goals by fully incorporating the middle and upper trophic levels in its conception and operation. For example, land-based and at-sea monitoring programs for seabirds already provide platforms for collection of physical and biological data. With improved database

management and accessibility, these operations could provide useful additions to larger databases. Because seabirds are long-lived and are among the most conspicuous and easily studied of marine organisms, they can play an important role as monitors, sensors, and indicators of marine ecosystem health and dynamics.

Could be reduced – much repetition. A few examples (page, sentence number(s)):

p. 8.11-30: last 2 paragraphs seem repetition of previous 2 pages.

p. 14.7-8., p. 37.22-23 – repeats from first paragraph of section (p.36.4-5).

Many statements so general as to be meaningless (a bit like mom & apple pie). Parts of introduction read more like conclusions, thus are repeated later in document  
Overriding emphasis on human use or impacts on humans due to ocean changes. Need more focus on understanding/maintaining health of ocean's ecosystems.

Throughout, document makes a giant leap from physical oceanography to humans, with minimal mention in a few places of 'productivity, coral reef systems, pathogens, invasives, etc. Intermediate/upper connections are skipped over (fishes, birds, mammals). Ignores the potential, for 'top-down' impacts on ecosystems and regimes; its not always 'bottom-up' control.

p.7 – notes 21 research priorities identified. Later in document, not clear which these are (due to subsections and repetitions). Number sections and priorities for easier reference.

Agree with need for sharing of research platforms, and information management/distribution.

Agree with emphasis on long-term observing systems. (but incorporate all trophic levels).

Much talk of 'multidisciplinary research', but document primarily focuses on physical oceanography or humans (or impact of physical/climate changes on humans). 'Higher trophic levels' are mentioned on p23.14 ('incorporate feedback mechanisms among higher trophic levels' within large-scale ecosystem models.

Among six themes that 'represent key areas of human interaction with ocean': most have common issues – requiring up-to-date data, database management & communication/availability, GIS applications, and modeling (whole approach is very heavy on modeling component).

### **Pacific Seabird Group-O'Reilly**

On behalf of the Sea Grant Association (SGA), I am pleased to submit our comments on the report entitled, "*Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.*"

The SGA applauds the efforts of the Joint Subcommittee on Ocean Science and Technology (JSOST) to identify the most pressing research needs related to the ocean sciences. The research priorities set forth in this draft document are far-reaching and

focus appropriately on some of the nation's most important short and long term research requirements. The current draft addresses many of the recommendations made by the community at the Denver workshop in April and elsewhere. We are encouraged by the level of attention given to ocean, coastal and Great Lakes issues via this plan and look forward to an opportunity to support and assist in the implementation of the plan's recommendations.

As you know, the National Sea Grant College Program (NSGCP) is the premier university-based research, outreach and education program at NOAA in support of coastal resource use and conservation. The thirty-one Sea Grant Programs are located in every coastal, Great Lakes, and Gulf Coast state and work to address the urgent and immediate needs of coastal managers through "place-based" science. It is the goal of the NSGCP to strengthen decision-making by providing credible science-based information, and in accomplishing this acts as a link between government, scientists, academia, industry, and the American public. The Sea Grant Association is a non-profit organization dedicated to furthering the Sea Grant Program concept and its membership includes the academic institutions that participate in the NSGCP.

Integrated research, outreach, and education make up the basis of the Sea Grant concept. Likewise, the draft plan seeks to utilize these same concepts to accomplish the goals set forth in the twenty-one identified priorities. Everyday, Sea Grant supported research is fostering healthy marine ecosystems, seafood safety, sustainable living marine resources, economically viable and safe coastal communities, new technologies for ocean development, coastal observatories, and education and human resources development. In addition, its education and outreach activities, via its teams of extension agents, educators, and communicators, put research results to use by providing local leaders and the public with the information needed to make wise management decisions. As a result, Sea Grant is uniquely positioned to play an integral role in helping the nation address many of the priorities identified in the draft plan. Below are three examples of how Sea Grant can contribute to the implementation of the priorities in the draft plan.

First, Sea Grant supports research that addresses the needs of coastal communities, especially urban coasts. The coasts are attractive areas for business, recreation, and residential development. We are encouraged that the draft plan highlights the need for research to understand more fully the interface between human activity and the ocean. An ecosystem-based approach to management cannot be successful without incorporating humans into the definition of ocean ecosystem and vice versa. In addition, the urbanization of America's coasts and watersheds threatens these vital resources with pollution and other problems, such as harmful algal blooms (HABs), hypoxia/anoxia and aquatic invasive species. Sea Grant provides the research, education and outreach structure needed to foster a safer, well-informed, and aware populace able to make better choices in responding to these and other pressing challenges.

Secondly, Sea Grant plays a very active role in enhancing community resilience to natural disasters. Building strong and safe coastal communities involves developing sustainable linkages to stakeholders at many levels and providing them with the basic

knowledge and understanding of the relationship between their lives and their coastal environment. Building community capacity to recognize problems, improve local planning and management practices, and devise sustainable solutions is central to the mission of Sea Grant Programs nationwide. The 2005 hurricane season underscored the need for greatly improved information transfer to enable and empower communities to better prepare, respond and rebuild. Sea Grant research and related efforts help to enhance preparedness and reduce loss of life, property, and natural resources at the hand of naturally-occurring coastal hazards. The draft JSOST plan addresses the need for thorough hazard assessment, translation of research into results, and enhanced communication and education. Sea Grant, with its experience in hazard planning, mitigation and restoration can play a vital role in implementing this aspect of the Subcommittee's draft plan.

Finally, the section of the draft report entitled, "Opportunities for Progress – Making a Difference," which discusses "Information to Support Decision-Making," is a textbook example of how many of the report's priorities dovetail with the strengths of the Sea Grant Program. The individual Sea Grant Programs tailor their activities to the specific research needs of the coastal communities, state or region in which they operate. This continually provides local resource managers, national, regional and local governments, and citizens on-the-ground support and expertise on a regular basis and especially in times of need. Communication and collaboration among Sea Grant Programs facilitates coordination across these scales. With its science-based focus, Sea Grant is usually viewed as an honest broker among a wide range of constituencies – including state and local government, academia, business, industry, and private citizens. As the JSOST considers how best to translate research into action, Sea Grant is prepared to use its considerable experience and expertise to assist in this effort.

SGA is largely supportive of the current draft. There are, however, two issues we believe could use more explicit attention. Enhanced ocean education and literacy for students at all levels (K-grade) is needed to ensure that the citizenry is aware of their impacts on the sea as well as the sea's impacts on them, to better understand the potential dangers as well as benefits derived from the sea, and to help local managers make wise decisions regarding the use of the oceans and its resources. Ocean literacy and education has implications for national security, economic development, and quality of life. As such, we believe it should be more prominently highlighted in the final JSOST report. Second, while we appreciate that this document is not an implementation plan, it is important to recognize that extant programs (like Sea Grant) represent a strong capacity that can be put to use in short order to address the critical issues and opportunities raised in the report. Building upon this national capacity in new and innovative ways can only strengthen our ability to make progress in the near term.

On behalf of the Sea Grant Association, I would like to thank you for the opportunity to provide these views. As the JSOST moves forward with its planning and implementation of these priorities, we hope you will call on the National Sea Grant College Program as a resource and partner. If the SGA can provide you with additional information, please do not hesitate to contact me at (301) 405-7500 or [Kramer@mdsg.umd.edu](mailto:Kramer@mdsg.umd.edu).

## **Sea Grant Association- Kramer**

On behalf of the Sea Grant Education Network (SGEN), I welcome the opportunity to comment on the document, “Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade,” prepared by the Joint Subcommittee on Ocean Science and Technology. As a scientist who has worked for nearly thirty years as an educator, I am most pleased to see the strong recognition in this document that sound, well-planned ocean science requires the support of an “ocean-literate” society to bring it to fruition. References to education, outreach, and stewardship were very evident throughout the document as critical components of a strategy to move ocean science forward in a manner consistent with the U.S. Commission on Ocean Policy and the U.S. Ocean Action Plan.

Sea Grant programs throughout the country have personnel devoted to education, outreach and communication focused on improving ocean literacy to a diverse audience and the SGEN strongly supports the steps outlined in the “Making A Difference” section of the document. We know firsthand the importance of a knowledgeable and engaged citizenry in the understanding of scientific research and of the need for continued stewardship of ocean resources. SGEN applauds the emphasis given to education in the document, but would strongly suggest and support the following steps to further highlight this important aspect of the document.

- 1) Education and outreach about the oceans and ocean science research should be given even greater emphasis by elevating it to a near-term priority;
- 2) The “Making a Difference” section of the document should be given a more prominent place in the document;
- 3) Education, outreach and communications should be considered “an overarching opportunity;”
- 4) More emphasis should be placed on the need for sustained funding for education at a level that will realistically have a significant impact on the development of a society that is truly “ocean literate.”

SGEN recognizes that the document is focused on research priorities, rather than specifically on education and outreach. However, we feel strongly that ocean research must be accomplished with a view to fostering ocean literacy across all levels of society. Strong support for education and outreach as an essential component of research priorities will ensure that the needed resources will be provided.

Thanks you for the opportunity to comment. Please feel free to contact me with questions or for clarification.

**Sea Grant Education Network-Lubner**

We, at Sea Studios Foundation, would like to take this opportunity to make an overall comment on the draft document: Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade

One element we feel worth adding into the draft is the powerful role **citizen science initiatives** can play in engaging and connecting coastal and landlocked citizens with the ocean and their adjoining watersheds. Such initiatives can simultaneously create extensive and valuable datasets. Citizen scientists can contribute significant resources at very low cost with such activities as watershed/water-quality monitoring, censuses of marine mammals and sea birds, and marine debris monitoring. Many state funded and community grassroots groups are currently attempting such volunteer monitoring programs e.g. Minnesota Pollution Control Agency, the Great North American Secchi Dip-in, Monterey Bay Sanctuary Citizen Watershed Monitoring Network. Such efforts could be greatly aided through additional federal agency support.

#### **Sea Studios Foundation-Thys**

The Shell E&P Company is pleased to provide these comments on the draft Ocean Research Priorities Plan (ORPP) developed by the National Science and Technology Council's Joint Subcommittee on Ocean Science and Technology. Shell is well aware of the importance of the oceans both for our nation's vitality, as well as for our business of bringing energy to market. We hope that the hard work of the committee will be rewarded by an unprecedented coordination between governmental, academic, and private sectors. A better understanding of the oceans will be a benefit to us all.

For Shell, our overarching priority is to make our offshore operations safe for people and the environment. If hurricanes and tropical storms threaten, evacuations must start days in advance in order to keep our people safe. Our facilities must also be shut in consistent with regulatory requirements. The offshore industry has maintained a strong environmental record even while enduring the destruction of hurricanes Katrina and Rita, but the potential exists for pollution events with these kinds of episodes.

With this in mind, we offer this list of ocean research topics that have critical importance for us:

#### **1) Real-time ocean observations of hurricanes/tropical storms in the Gulf of Mexico**

Our nation requires a better understanding of forces generated during extreme weather events. Observing equipment must be designed to remain operational and continue to transmit information during extreme events. Such knowledge would be invaluable for both storm forecasting and structural engineering for infrastructure in harms way. Increased ability to forecast storms and their paths helps to protect our people offshore.

#### **2) Ocean observations in sparsely covered areas including the Bering Sea, the Chukchi Sea, and the Beaufort Sea surrounding Alaska**

These areas contain valuable fossil fuels and other natural resources for our nation. For example, the value of commercial fisheries within the Bering Sea is monumental and in

order to explore these regions for energy resources with the highest environmental performance, we require the best possible environmental information to ensure mitigation of any impact identified by the scientific community. By implementing real-time ocean observing systems in these regions, we are assured of high quality information that captures the spectra of conditions, from average to unusual.

### **3) Real-time ocean observations in the Gulf of Mexico**

Current measurements are taken by the oil and gas industry as part of Minerals Management Service's Notice to Leasees for Deepwater Current Monitoring. Shell is proud of our role in the implementation of this system, which freely provides important information to all. Additional measurement of oceanic currents in shallower waters would benefit oil spill response, ecological processes such as dead zone phenomena associated with the Mississippi River's discharge into the Gulf of Mexico, larvae dispersion and recruitment, and dynamics for important Gulf Coast fisheries.

### **4) Deep-sea benthic ecosystem stressors**

As industry moves into deeper waters to find oil and gas, we would like additional baseline information on ecosystem variability and heterogeneity in these remote environments. Further understanding of these ecosystems can improve our understanding of the effects of our operations.

### **5) Maintain and expand national satellite network for remote sensing**

We agree wholeheartedly with the draft ORPP that our nation's network of remote-sensing satellites continues to be invaluable. As we understand, the satellite constellation will be shrinking in years to come rather than growing. We hope that this situation can be rectified and sufficient funding found to continue and expand this important mission. The satellite-obtained data is a tremendous resource for all types of oceanography.

### **6) Monitoring of ice conditions and ice-generated forces in the Arctic**

Industry has looked to the Arctic for oil and gas, and increased understanding of the role that ice plays in shaping this environment is welcome. Real-time monitoring of ice conditions along with models to predict the forces applied by ice benefit operational activities. While satellites have historically been used to monitor ice, perhaps new technologies can be developed that integrate with existing ocean observing systems. Particularly timely with the onset of International Polar Year 2007-2008, Shell hopes to work with government and academia to address ice issues.

We strongly support the deployment of a national ocean observing system that can describe the state of the ocean in near real time. As a company with diverse operations in our oceans, we strongly value such information.

As the ORPP enters the implementation phase, we encourage all constituent sectors to look beyond historical partnerships, for example, between government and academia, to the potential for new paths of cooperation.

Please call Ian Voparil at (281) 544-6906 if there are any questions regarding these comments.

## Shell Exploration & Production Company-Satterlee

The State of Alaska has reviewed the draft national Ocean Research Priorities Plan entitled *Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade* (draft ORPP) as released on the President's Council on Environmental Quality website on September 1, 2006. These comments represent the consolidated views of the State of Alaska. We are disappointed that states have not been an integral part of writing this plan, that gubernatorial comments were not expressly sought, and that this public comment period substitutes for a thorough survey of state research priorities and needs. The State of Alaska and the National Governors' Association commented on the U.S. Commission on Ocean Policy (USCOP) Report, and we are disappointed to see that those comments were not addressed during the development of this draft ORPP.

While the draft ORPP lists questions used to prioritize national ocean research, it is not clear how JSOST ascertained the "high priority needs of resources managers," the "mandates of governing entities," or the answers to any of the other prioritization criteria. More importantly, JSOST must engage states in drafting the implementation strategy, which is the heart of the ORPP, and the subsequent new budgeting processes. We are dismayed to learn that the implementation portion of the ORPP will not undergo public review, but this should not prevent partnering with states on the implementation strategy. Please remember that your contact with regional associations, regional research organizations, and universities is no substitute for direct contact with state officials.

In addition to the flawed process underlying the draft ORPP, the State of Alaska is concerned about the following major deficiencies, further articulated below:

- The draft emphasizes observation, monitoring, modeling and forecasting, rather than **applied research** for improved resource management and regulation.
- The draft recognizes the collection of more data; but does not adequately address the massive task of **data interpretation** – without which, raw data are useless.
- The USCOP Report targets **improved coordination** among agencies and other research entities; but the draft ORPP fails to recognize this as a "**cross-cutting theme**" or an overarching opportunity.

### **Applied Research**

Each theme of the draft ORPP has several bullets describing what needs to be accomplished, such as "understand the status and trends," "understand relationships," and "understand patterns." While we agree that better understanding of interactions and environments is a basic and necessary research function, the manner in which that basic research is applied will dictate its value to society. The draft ORPP describes only limited ways that basic research would be applied – assess vulnerability, conduct risk assessments, create models, predict conditions, project future changes, and develop products and ecosystem indicators. Most applications of research do not facilitate or

improve the capability of resource managers and regulators, sustain or enhance ecosystem production for wild resource harvest, or ensure the health safety of the general populace by helping public officials do their jobs more effectively. New technology, more data, and new models will be of limited value without a realistic and clear vision of what managers and regulators need to do their jobs more effectively. We therefore strongly recommend re-tooling the 21 ORPP research priorities to emphasize real world management needs.

### **Data Interpretation**

While the collection of raw data (e.g. water temperature, salinity, stream flow) can be useful, the utility of that data to decisions is revealed through analysis and interpretation. The draft ORPP proposes new technology for seemingly unconstrained data collection to fulfill a general need to understand the ocean better. Unfortunately, the broad goal of increasing the amount of data collected and academic research performed is not targeted enough to affect positive change on the level of local and regional management and decision making. Data interpretation is a massive task that must be funded and emphasized to a greater extent. Raw data are useless to shellfish growers, shipping captains, bush pilots, and city planners. To be more effective, the draft ORPP should de-emphasize crude observation, monitoring, and other raw data collection technologies and elevate the importance of end users' needs and securing the man-power necessary to provide focused data analysis.

### **Improved Coordination**

The draft ORPP lists two cross-cutting themes that are not necessarily traditional "research" but are nonetheless important to supporting improved research in the next decade: 1) Information to Support Decision Making, and 2) Establishing an Ocean Literate Nation. While these two themes are highly appropriate, a third essential theme is lacking: the need for enhanced communication and coordination. Improved coordination among state and federal agencies and other research entities – such as universities, research boards, councils, and commissions – was the unifying theme throughout the U.S. Commission on Ocean Policy Report.

Effective coordination is a difficult concept to articulate because there are so many levels that could benefit from increased coordination. Beyond the basic concept of the coordination of data collection, there is a need for improved colleague-to-colleague relationships and more effective coordination and collaboration among agencies. Little emphasis is placed on better communication in government corporate culture; therefore, coordination work falls under "other duties as assigned" for individual employees and an unfunded mandate for agencies. Public research dollars could be spent more efficiently, research needs could be assessed more globally, and research could be completed more cooperatively if better communication and coordination were an explicit and funded priority within federal agencies. While the President's Ocean Action Plan and its subsequent committees give lip service to improved coordination, these words are not backed with new dollars. The necessary level of coordination will not be achieved by merely re-shuffling existing agency resources.

The state and federal agencies in Alaska have attempted to remedy this coordination deficit by creating the Alaska Marine Ecosystem Forum (AMEF), a regional ocean partnership intended to provide a platform for discussing high priority issues in a given marine ecosystem and for sharing current and future research needs among agencies with jurisdiction. Like the Gulf of Mexico Alliance, the AMEF was created in the region, by the people who live and work in Alaska, to address issues on an ecosystem-wide basis. But unlike the Gulf of Mexico Alliance, the AMEF was not listed in the President's Ocean Action Plan, and therefore has received little support from the administration. We specifically request the ORPP implementation plan recognize regional ocean partnerships around the country and expressly describe how each federal agency will provide new support at both their headquarters and regional office levels.

### **ORPP Research Themes**

At the request of the JSOST, the following paragraphs are aligned with the draft ORPP societal themes; although we do not agree that these themes necessarily reflect the most pressing needs of management agencies. The following comments will recommend implementation and application of research within each theme.

[Section comments are in table]

In summary, states have not been included in the development of the draft ORPP to any consequential extent. We have attempted to give input to the Sub-committee on Integrated Management of Ocean Resources' (SIMOR) Federal-State Task Team; however, the process and timeline for the Federal-State Task Team to contribute in a meaningful way to the draft ORPP has been unclear, rushed, and lacking rigor. States have been treated like a stakeholder group, rather than a partner in resource management. This is a fundamental flaw in the approach of the draft ORPP and can only be remedied by going back to the drawing board with states as partners. JSOST should work closely with states in developing the implementation plan and devising a federal budgeting strategy.

Thank you for your consideration of these comments. Please contact Heather Brandon, the state's ocean policy coordinator, at (907) 465-5871 as JSOST goes forward with developing the implementation strategy.

**State of Alaska-Murkowski**

Thank you for the opportunity to comment on the draft Joint Subcommittee on Ocean Science and Technology (JSOST) research priorities plan entitled *Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade*. I would like to take this opportunity to submit the State of California's comments regarding this draft plan and the process for developing the implementation strategy. The JSOST has taken an important step in producing this document intended to help guide the nation's science and management needs into the future. We are pleased with the progress on this plan and hope to continue working closely with you in finalizing both this plan and the implementation strategy.

**Continued Involvement of Coastal States** I would like to express our gratitude for JSOST's work to include coastal states in the development of this draft plan and encourage continued close collaboration during its completion and the formation of the implementation strategy. Below, I describe briefly the State of California's involvement in the priorities plan development to lay the groundwork for our continued collaboration.

The State of California has been actively engaged in the development of this plan since its inception. The California Ocean Protection Council, which I chair, adopted a research priorities plan entitled *California Ocean and Coastal Information, Research, and Outreach Strategy* in September 2005. In November 2005, I submitted this strategy to Committee on Ocean Policy, the Subcommittee on Integrated Management of Ocean Resources (SIMOR), and JSOST requesting that these priorities be included in the national plan. In addition, Admiral James Watkins and Leon Panetta from the Joint Ocean Commission Initiative commended our plan and urged the Committee on Ocean Policy to pay close attention to this strategy and the commitment of the State of California during the implementation of the President's Ocean Action Plan.

California has continued to participate in the opportunities the JSOST provided for input. I took part in the Denver workshop on the draft plan and my Assistant Secretary for Ocean and Coastal Policy, Brian Baird, served on the Federal-State Task Team (FSTT) that SIMOR established to incorporate the advice of coastal states in its development. Through the FSTT process, we developed regional priorities and submitted them to JSOST in the document entitled *Pacific Coast Regional Priorities for Ocean and Coastal Research: Preliminary Consensus for California, Oregon, and Washington*. We hope to continue this dialog with you as you move forward with this process.

### **Implementation Strategy**

The research priorities plan, when finalized, should serve as a critical roadmap for near- and long-term funding opportunities. However, as with most government plans, the potential for success or failure lies with its implementation. I would like to take this opportunity to offer comments on the development of the implementation strategy before it is released.

The current funding levels for ocean science are insufficient to meet the nation's needs for information about our oceans and coasts. As detailed in the report of the U.S. Commission on Ocean Policy, funding levels for ocean sciences have remained flat for too long, causing the nation to lose its international prominence in these fields. The State of California supports the Commission's recommendation that the federal ocean science budget be doubled, at least, over the next several years as part of the implementation of this JSOST plan.

We urge the JSOST to work with coastal states in developing the implementation strategy and to provide a comment period for the strategy as it is has for the priorities plan. Sound priorities will not result in essential science and monitoring if not funded and executed correctly; therefore, input from states and universities is necessary to provide the on-the-

ground expertise to ensure that our scientific resources are applied most efficiently toward the most critical projects. The State of California strongly encourages the JSOST to work closely with the Coastal States Organization (CSO) to prepare an implementation strategy that meets the needs of all coastal states. Assistant Secretary Brian Baird currently serves as the chair of CSO, and we are ready and willing to help mobilize coastal states in this effort. The Strategic Plan adopted by the CSO in September 2006 places a high priority on the need for ocean and coastal research that can be applied to on-the-ground management issues.

### **Comments on Draft Priorities Plan**

Specific to this draft plan, we would like to emphasize three major research priorities for California: i). Application to Management and Policy; ii). Ecosystem-based Management; iii). Ocean Observing. We were happy to see that the draft plan includes these priorities and we would like to reinforce their importance and provide suggestions on how to strengthen discussion of these priorities below.

*Application to Management and Policy.* California is facing many difficult management decisions regarding our ocean and coastal resources—future success will depend on our knowledge of ever-changing ecosystems and how these systems’ respond to different impacts. As a state and a region, we strive to fund research that addresses pressing management and policy decisions, but more must be done. We are happy to see applied research emphasized in this draft plan and encourage you to maintain it as a high priority in the final plan and implementation strategy. Furthermore, data must be accessible and translated into useful products if it is to be useful to managers and policymakers.

**Recommendation:** Data sharing and communication of research results should receive greater emphasis in the final plan. Many of the answers to our management questions may exist within existing scientific studies, but lack of adequate data sharing or communication of this information may preclude its application to pressing ocean and coastal management problems.

*Ecosystem-based Management.* We are pleased that the draft plan includes critical information needs that would support ecosystem-based management approaches, including the need to gain a greater understanding of how all components of the ecosystem interact. The draft plan highlights improved ecosystem modeling as one of the most important priorities. While we agree that this should be the end goal, the science needed to support these models should not be overlooked. In many systems, the empirical data on how species interact with each other and the physical environment are not known and more basic information is needed to populate the data fields of ecosystem models.

**Recommendation:** The final plan should provide explicit support for additional investments for direct experimentation and monitoring so that the information needed to build realistic models is collected. Again, the need for modeling is important, but such models must be based on the best achievable information.

*Ocean Observing.* We support the draft plan’s focus on the development of an integrated

ocean observing system. California is dedicating significant resources to the construction and integration of its regional associations. It is critical that comprehensive biological monitoring be incorporated into an integrated ocean observing system. It should be our goal to provide real-time biological and physical data to citizens to protect their health and property, and to managers responsible for the long-term viability of our ocean and coastal resources.

**Recommendation:** The biological and ecological components of ocean observing deserve greater emphasis in the final plan. California, and other states, are dealing with complex issues with water quality, management of our fisheries, and design of marine protected areas off our coastline. The biological and ecological components of these ocean observing systems, if properly designed, could provide important information for our efforts in these areas.

### **Moving Forward**

California is currently working with the four West Coast Sea Grant programs (California, Oregon, and Washington) to develop a regional research plan with the assistance of a \$500,000 grant from the National Sea Grant Program. Public workshops will be held in each state to help determine the highest priority projects. This regional process is being designed to build upon the categories presented in the JSOST plan, so that this West Coast regional approach can provide a more focused assessment of research needs. In that sense, we view the West Coast effort as a pilot approach in the implementation of the national priorities plan being prepared by JSOST. We hope to work closely with you as we develop this plan.

Furthermore, California continues to fund cutting-edge research at our world-class system of universities and research institutions, and we are making a significant commitment to ecosystem monitoring, ocean observing, and habitat and bathymetry mapping. We look forward to the opportunity to coordinate these actions with those of the federal agencies. We foresee many opportunities to leveraging joint funds to achieve shared goals set forth in this draft research priorities plan.

Again, thank you for the opportunity to comment on your document and we look forward to future opportunities to work with you to promote a better understanding of our oceans and coasts for the benefit of all citizens. Please contact Assistant Secretary Brian Baird or Ocean Policy Analyst Leah Akins at (916) 653-9416 if you have questions about these comments.

### **State of California-Chrisman**

The mission of the California Department of Boating and Waterways is to enhance safe boating access for recreational boaters. As an advocate for boating access, I would like to submit the following comments related to the draft document, "Charting the course for Ocean Science in the United States: Research Priorities for the Next Decade."

The document is unique because it recognizes the important relationship between society and the ocean, and emphasizes human understanding of ocean resources. For example, page 47 states: “Understanding the predicting the relationship between social and economic drivers and human health will require integrating socio-economic investigations with ecosystem-based studies of health threats, which will, in turn, help support management and mitigation efforts.”

As the State’s boating agency, we believe that decisions made by federal agencies should reflect a careful evaluation of the consequences the decision will have on economic and social interests.

Specifically, we believe that a more careful assessment is needed for appropriate resource and planning management for recreation, especially for coastal power boating. Coastal power boating provides opportunities for fishing, cruising, and tourism/transient boating, which, in turn, provide substantial economic benefits to California cities and counties. Additional limitations on where boaters can recreate will have a deleterious economic and social impact on coastal communities, recreational boating, and boating-related businesses.

As you move forward in developing necessary protections for our valuable aquatic resources, please be aware of the needs and importance of all aspects of recreational boating on the California coast.

If you have any questions, please contact Mr. David Johnson, at 916-263-0780 or by email: [djohnson@dbw.c.gov](mailto:djohnson@dbw.c.gov)

**Tsuneyoshi, Department of Boating and Waterways, California**

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the draft Ocean Research Priorities Plan, as announced in the 12 September 2006 Federal Register, and offers the following general comments. Thank you for the opportunity to comment.

The Commission believes that the draft Ocean Research Priorities Plan represents a significant achievement in ocean science and management. Among other things, the plan

- provides a broad perspective on research needed to manage the nation's marine ecosystems;
- integrates a multitude of marine topics into six main themes that span the nation's diverse interests;
- describes many benefits that we derive from marine ecosystems;
- recognizes real and potential effects of human activities that pose risk to marine ecosystems;
- recognizes the value of basic science and discovery for building our knowledge and understanding of the oceans;
- recognizes the value of applied science for addressing existing and anticipated challenges in maintaining ocean health and productivity;

- emphasizes an ecosystem-based approach to research and management;
- emphasizes the need for a transition to multi-disciplinary ocean science;
- identifies key tools and methods for support of ocean science; and
- provides a basis for integrating multiple research and management efforts at the federal, state, regional, and local levels.

If implemented effectively, the Ocean Research Priorities Plan will provide a milestone in our nation's efforts to develop a sustainable relationship with our natural marine environment. We commend the Joint Subcommittee on Ocean Science and Technology for preparing the plan. We suggest the following three areas for further consideration by the Joint Subcommittee to strengthen the plan.

### **Human population studies and activities**

We see no mention of human demographics in the plan. With regard to the oceans, our nation's fundamental challenge is to derive long-term benefits from them without depleting their many resources or significantly diminishing the ecological character of the affected ecosystems. Much of the plan focuses on research aimed at understanding our marine ecosystems, but considerably less attention is focused on understanding the human activities that may affect them. Human abundance in the United States has reached 300,000,000, and is projected to reach 420,000,000 by 2050. The majority of the population is concentrated in coastal areas, where they impact the oceans through coastal development, construction, recreation, disposal of human and industrial wastes, and runoff from urban and suburban areas. Dead zones, harmful algal blooms, and accumulating debris all are consequences of human activities occurring in the oceans or on land and transported by riverine or atmospheric systems. Worldwide fisheries catch from wild population appears to have peaked at about 80-85 million tons and aquaculture, which appears to be the only means for meeting the increasing demand for fish protein, will bring its own suite of risks to marine ecosystems (pollution, disease, competition with wild populations). Commercial shipping is projected to double in the next few decades, which will mean more and larger ships in coastal waters, dredging and enlargement of coastal ports, and increased transport of invasive species. Demand for energy is expected to increase by 50 percent by 2030 and may lead to increased oil and gas drilling in both coastal and offshore waters and development of nearshore "wind farms." Climate change may have profound effects on the oceans through changes in sea level, alteration of major currents, and acidification. Although the Ocean Research Priorities Plan recognizes and is based, at least partially, on concerns about the effects of human activities, the plan could be strengthened by explicitly calling for more concerted research efforts aimed at understanding human demography and socioeconomic activities and the risks they pose to the oceans. To understand the cause-and-effect relationships that underlie our concern about human effects on the oceans, we must study the causes as well as the effects. In 2003 the Marine Mammal Commission consulted with marine mammal scientists from the United States and six other countries to identify future directions for research on marine mammals in view of these kinds of concerns. The results were recently published in *Marine Mammal Research: Conservation Beyond Crisis* and, among other things, call for long-term research on the human activities that are at the center of many conservation issues.

### **International research**

The plan does not mention international coordination and cooperation. In most respects, the oceans are an international domain. Not only do they cover 70 percent of the earth, but they are in constant motion, interacting with land, ice, and atmosphere. We need only track the movements of highly migratory species, map the great circle routes used for commercial shipping, or link polar pollutants to their industrial sources to appreciate the oceans as international commons. The United States rightly supports a wide range of international research activities, and such activities are and should continue to be a critical part of our ocean research efforts. The inattention to international research is an oversight with potentially significant consequences, that it unnecessarily limits U.S. research efforts, and that it undermines the collection and sharing of information vital to achieving a sustainable global relationship between human activities and healthy marine ecosystems. The United States cannot play a leading role in ocean research if it fails to engage other nations in this important endeavor. For these and other reasons, the Marine Mammal Commission urges the Joint Subcommittee on Ocean Science and Technology to expand the breadth of its plan to incorporate research cooperation and coordination with other nations.

### **Temporal scale and the importance of long-term goals**

The major themes described in the Ocean Research Priorities Plan, and the research subjects embedded within them, will require long periods of dedicated research. Climate change and oceanographic regime shifts, ocean productivity and biodiversity, hurricanes and tsunamis, coastal development and dead zones, pollution, anthropogenic sound, fishing, marine pathogens, and similar topics are all subjects of ongoing research that will continue for decades, if not indefinitely. Maximizing the benefits of such research over time will require a long-term perspective in planning and implementation to address not only our information needs, but also those of future generations. Short-term objectives are useful for measuring progress, but the value of the Ocean Research Priorities Plan stems more from the long-term direction it provides. We understand that an implementation strategy is under development. We urge the Joint Subcommittee on Ocean Science and Technology to ensure that long-term goals are not compromised by excessive focus on short-term results.

### **Connectivity between watersheds and coastal environments**

Pollutants, harmful algal blooms, and dead zones are all reminders of the linkages between on-land activities and the marine environment. Although these matters are discussed in the plan, we believe they warrant greater attention because they reflect the connectedness of ecosystems and the diffuse nature of human impacts on the marine environment. Each of the above phenomena are increasing rapidly and pose a growing threat to our vital coastal regions.

### **Adaptive management**

Finally, the plan gives insufficient attention to adaptive, experimental approaches to ocean research and management. Risks posed by our marine activities will be virtually impossible to assess without adaptive experimentation that integrates research into our

social and economic activities to test underlying assumptions about their effects. The current fishing strategy, for example, is based on the assumption that 60 percent or more of the biomass of target species can be removed from the oceans without significant consequences on the affected ecosystems. Such assumptions require adaptive, experimental evaluation if we are to sustain our marine ecosystems in a healthy state.

**U.S. Marine Mammals Commission-Reynolds**

As a member of the Science Advisory Panel for the U.S. Commission on Ocean Policy concerning the document, *Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade*, which outlines the national ocean research priorities for the United States for the next ten years, I applaud the fact that some aspect of education, outreach, and stewardship is located on nearly every page of the document and the focus for education is found on pages 53 - 56.

However, I would like to suggest specifically **that Ocean Sciences Education and Outreach be elevated to a near-term priority; that the *Making a Difference* section be elevated to a more prominent position within the JSOST document; that education, outreach, and communication be elevated to an overarching opportunity; and that increased and sustained funding be made available for implementing the actions required to achieve an ocean literate citizenry within this country.** I believe we "must continue being proactive" in pushing and raising the bar concerning ocean sciences education. Lastly, I also realize there are no singular simplistic solutions and only through incremental and focused efforts will this country collectively achieve ocean literacy by and for its citizens.

**Walker, University of Southern Mississippi**

General comment: Overall the document is well organized and accurately represents a broad overview of ocean science research needs. However in part because it is so broad, it does not contain enough discussion of priorities to efficiently guide any actual research programs or initiatives. For example, one priority under the "Stewardship" theme is to understand the status and trends of resource abundance and distribution through more accurate, timely and synoptic assessments. Obviously there are thousands (if not millions) of marine species and resources. Without further direction as to appropriate research foci (e.g. major commercial stocks, coral reefs, marine mammals etc.) research on virtually any species will fit within this priority. Although virtually all scientific endeavors advance our understanding, some issues are clearly more pressing than others. We suggest that the final draft include detailed discussions of research needs and priorities within each theme that will allow researchers and research managers to address our nation's marine science needs in a well-coordinated and cost-effective manner. We also suggest and request that such priorities (whether in another iteration of this plan or in the upcoming Ocean Research Priorities and Implementation Strategy) be subject to a public review and comment period prior to their adoption. Marine science and resources are a national concern and as such public input will be required to determine our national

priorities. Finally, we offer our assistance in drafting such priorities as they might apply to the Western Pacific Region.

**Western Pacific Regional Fishery Management Council-Hamilton**

As an active marine educator, President Elect of the National Marine Educators Association, and former Chair of the Sea Grant Education Network, I am very concerned with the status of marine science education and ocean literacy in our country. Therefore, I would like to comment on the National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST) draft report, "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade."

As noted in the document "The ocean research priorities outlined in this document must be addressed to improve society's interaction with the ocean and improve the health of the ocean. For these research efforts to be effective, they must be accompanied by a strong investment communicating the results so society can understand and effectively use this information." The document also refers to "Establishing an Ocean Literate Nation and states that support of the ocean research priorities in the broadest sense requires a society that appreciates the importance of a healthy ocean to life on Earth." This requires citizens who are good stewards of the ocean, and who possess the knowledge to make informed decisions about their interactions with it. Furthermore, it notes, "this goal can only be attained through improved education efforts for the entire spectrum ("K-Gray")---encompassing ocean literacy for the general public, formal and informal education, proactive workforce development and effective communication."

I totally agree, and I offer the following comments and suggestions:

- \* At a minimum, the "Making A Difference" section should be moved to a more forward and prominent position within the document.
- \* A component of communication and education should be included in near term priorities.
- \* Elevate education, outreach, and communication to an Overarching Opportunity
- \* Funding for ocean science education and outreach should be increased and sustained.

I applaud the efforts of the commission to engage the public's input regarding this draft report, "Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade" and thank you for the opportunity to comment.

**Whitley, USC**

The JSOST is to be commended on its work to synthesize the USCOP recommendations and subsequent input into scalable and timely action items. One question posed at the Seattle briefing was "How do we convince people that [ocean] science is important?" The comments offered here refer to areas in which research recommendations might be strengthened to address that question, particularly related to the human dimensions contributions.

Numerous references are made to the need to encourage interdisciplinarity (e.g. p.12 line 3-11; p.19 line 17-18; p. 43, line 5-7; p. 55 line 19-27). It was noted that few concrete suggestions appear for the explicit involvement of social scientists beginning at the planning and research stages, and continuing throughout the process. Since interdisciplinarity involves not only combining knowledge, but new and mixed methods of research, a suggestion is to develop this “connective tissue” of interdisciplinarity among scientific disciplines including policy and other social sciences to improve how science is used in policy processes. Segregating disciplines and later aggregating research is subject to the concern that the results may have conflicting premises, measures, or use conflicting methods unless multiple frameworks and methods were considered in an interdisciplinary original research design.

Several references are made to the “translation” of science as a primary purpose of human dimensions efforts (i.e. p. 15-16 line 31-3; p. 31, line 1; p. 53 line 8-23). Perhaps a more useful approach would be to go beyond translation to “incorporate” science. While translating complex concepts for decision makers is the most basic level of communicating information, inserting an additional level of hybridized “experts” into the process may not change the communications process in such a way that achieves one major purpose of this report as stated at the briefing: getting the attention of OMB and others in the federal process to ensure allocation beyond authorization in this tight budgetary environment. What could change the process is to incorporate the human dimensions component in tangible ways through collaborative efforts among the various natural scientists and social scientific disciplines in ways that address the hierarchy of expertise which has paved the way for conflicts among competing scientific inputs at the policy discussion level. In addition, involving the public not only as targets of study but as contributors to early discussion has the added benefit of incorporating expertise from the people who live and work on or near the ocean. The collaborative rather than expert model could also encompass the methods and approaches that encourage appropriate dynamic communication rather than the controlled input or alternative, non discursive approaches that have proven largely ineffective in getting the best science appropriately incorporated into the decision-making process.

Although included in every section of this report as vital to the overall success, the human dimensions elements are not nearly as fully developed or explicitly explained as are the requirements for the listed physical and natural science priorities. Most are listed in general terms such as “develop and use indicators;” or “address social and economic issues.” Detailed priorities for human dimensions research need to be connected to the JSOST research priorities for the next decade. While this document has excellent specific requirements, for example, for ocean observation systems (considered to have “mature plans’ on p.58 line 17) or climate modeling, a similar level of rigor is lacking for the inclusion of social sciences. More effectively developing this aspect throughout of the report would speak to the policy and budgetary audiences who compare these requests for ocean resources to other requests, and who focus heavily on the social and political aspects of the issues brought before them.

**Wilson, SeaTrust Institute**

## Key to Table

<b>Chapter Number</b>	<b>Chapter Heading</b>
ES	Executive Summary
01	Introduction
02	Focusing the Nation's Ocean Research Enterprise
03	Stewardship of Our Natural and Cultural Resources
04	Increasing Resilience to Natural Hazards
05	Enabling Marine Operations
06	The Ocean's Role in Climate
07	Improving Ecosystem Health
08	Enhancing Human Health
09	Opportunities for Progress
10	The Path Forward
11	Next Steps

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
ES	0				The report needs to recognize both IOOS and OOI as priorities. <b>Raytheon-Moran</b>
ES	0				An important topic that is missing from the report is Systems Research. Understanding, modeling, and visualizing the complex interactions of physical, chemical and biological ocean processes and the human policy and management decisions that impact them, will not only advance our scientific understanding of the ocean system and how to manage it, but will foster greater public understanding of the importance of ocean research. System-level modeling will also be important to understanding societal benefits, setting appropriate metrics, and measuring progress. <b>Raytheon-Moran</b>
ES	0	0			National and Homeland Security is not mentioned in the ES, although there is a disconnected reference to it in the chapter on Maritime Operations. <b>Raytheon-Moran</b>
ES	0	0			While the <i>Charting the Course</i> report is about the right length and level of detail, the ES, at seven pages, may strain the limits of attention for the true executive-level reader. Although the ES is faithful to the body of the report, it may benefit from some condensation. Because of the potential for confusion regarding the broad definition of “ocean” as explained later in the footnote on page 10 and its more commonly understood and narrower meaning, it would be helpful to refer to “ocean, coastal zone and Great Lakes” in the opening sentence of the ES. <b>Estuarine Research Foundation-Boesch</b>
ES	01	01	9	22	In several sub-sections, the challenges and scope of the knowledge gap are identified. This should be done for all sections. The ES ought to highlight the fact that most (95% is commonly used) of the ocean, including the US EEZ, has not been visited, characterized or studied. The reader ought to have this frame of reference from the start. The scope of the knowledge gap is enormous. <b>Beach, NOAA</b>
ES	3		9		The concept of “enhancing human health” features prominently in the narrative and executive summary; it is named as one of the societal themes and research priorities. However, it is not explicitly included in the three key areas of science and technology (referred to as “overarching

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<p>opportunities”). The four near term science priorities incorporate aspects of the “overarching opportunities” and therefore human health issues are not adequately addressed in the near-term priorities. For these ambitious near term goals to satisfy longer-term research needs, it is important that issues of human health are fully integrated into the design and implementation of the near-term science priorities.</p> <p>To fully integrate human health science, it must be understood that public health disciplines encompass a wide range of studies and extend beyond disease surveillance. Human health scientists, including those engaged in toxicology, biology, risk assessment, epidemiology and related disciplines, are conducting research to look at the impact of human activities on the oceans and the impact of the oceans on human health and well being. Such studies span the continuum from the cellular to population level. Human health is at risk from ocean events such as harmful algal blooms, microbial and anthropogenic pollution, severe weather and other disasters, as well as global changes. Humans benefit from the oceans through high quality food sources, recreation, biodiversity, pharmaceuticals derived from the seas and marine models of human disease. An example of an important research need is to improve our understanding of biomarkers of exposure and early biological response for ocean toxicants and pathogens.</p> <p>It is very important that those scientists involved in oceans and human health research are fully integrated into the planning and implementation strategies of the near-term research goals related to forecasting, resource management and deployment of ocean observing systems.</p> <p><b>E. Faustman, UW</b></p>
ES	3		9		<p>Needs to be rewritten to capture more of the essence of plan. Not all recommendations have to be included in this, but not certain all the right ones were in this draft.</p> <p><b>AOOS-McCammon.</b></p>
ES	03	08	3	8	<p>This cannot be met without research in the socioeconomic aspects of ocean and coastal regions. In some ways such research will be easier than in the natural systems. Much socioeconomic data are already collected on a routine basis. This “observing system” needs only adaptation and expansion to</p>

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					meet the particular needs of ocean and coastal areas. <b>National Ocean Economics Program-Lockwood, et al.</b>
ES	3	8	3	8	<RPLC>sensible management. Scientific <WITH> sensible management. Understanding society’s impact on the ocean, and its impact on us forms the basis ensuring a clean, healthy and stable ocean environment that can be responsibly used and enjoyed for generations to come. Scientific <END> ; <b>Zlotnicki, JPL</b>
ES	04	14			Having 21 priorities is like having no priorities. Suggest moving the 3 key areas of research and 4 near-term priorities up front. <b>Raytheon-Moran</b>
ES	04	19	4	27	Make it explicit that this includes energy resources (e.g., wind, wave, ocean-thermal). <b>Raytheon-Moran</b>
ES	04	19			Add: Apply understanding to improve stewardship strategies, including conservation and health of coastal and marine environments. <b>Muller-Karger, University of South Florida</b>
ES	04	28	5	4	Should be “Increasing Resilience to Natural <i><u>and Human-Induced</u></i> Hazards.” <b>Raytheon-Moran</b>
ES	4	29	4	29	The importance of research on the forecasting of extreme events reflected in this research priority but it gets lost in the discussion that follows. <b>Offshore Operators Committee-Smith</b>
ES	5				The sequence in which these research priorities are introduced automatically implies priority. If that is not the intention, there should be some reference about how the report is organized. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	5	6			Add: Understand impacts of marine operations on the environment, and apply understanding to improve stewardship strategies including conservation and health of coastal and marine environments. <b>Muller-Karger, University of South Florida</b>
ES	05	13	5	13	Should be “The Ocean’s Role in Climate <i><u>and Weather.</u></i> ” <b>Raytheon-Moran</b>

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
ES	5	13			Add: Apply understanding to develop policies that help reduce the threats of major projected climate changes prior to their occurrence. <b>Muller-Karger, University of South Florida</b>
ES	05	14	5	14	Should be “Understand ocean-climate <u>and ocean-weather</u> interactions across regions.” <b>Raytheon-Moran</b>
ES	05	16	5	17	Insert “ <u>Understand ocean-atmosphere coupling and its impact on near- and long-term weather.</u> ” <b>Raytheon-Moran</b>
ES	05	17	5	18	Should be “Apply understanding of the ocean to help project <u>near-term and long-term weather</u> and future climate changes and their impacts <u>to guide mitigation strategies and actions and future policy decisions.</u> ” <b>Raytheon-Moran</b>
ES	05	19			Add: develop appropriate measures to improve ecosystem health based on understanding of impacts of resource use. <b>Muller-Karger, University of South Florida</b>
ES	05	20	05	21	The major challenge is to integrate models of socioeconomic processes and change with models of natural systems change. This is a research field that is still at a very early stage, but for which the increase in data from both socioeconomic and ocean observing systems holds great promise. A major priority for research in this field will be finding the appropriate time and spatial scales within which to detect interactions between socioeconomic and natural systems. The development of forecasting models for socioeconomic change is a generally well-advanced field, but the incorporation of factors such as changing ocean and coastal conditions remains to be done. <b>(Also repeated in Chapter 08, Enhancing Human Health, Page 47)</b> <b>National Ocean Economics Program-Lockwood, et al.</b>
ES	5	24	5	24	I would suggest adding the word “goals” before “indicators” to emphasize the importance of having meaningful science-based goals that can be used to drive “effective management”. The use of “indicators” and “metrics” are more suggestive of measurement techniques rather than drivers of a management effort. <b>Magnien, Center for Sponsored Coastal Ocean Research, National Centers for Coastal Ocean</b>

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<b>Science, NOAA/National Ocean Service</b>
ES	06	04			Append to end of line: “, strategies,” . <b>Muller-Karger, University of South Florida</b>
ES	6	7	6	14	Advancements in ocean science did not happen by identifying "some common scientific and technical threads" that "can be leveraged to achieve advances across the breadth of the enterprise." Instead, Americans become the enterprise themselves, the entire effort from silver-nitrate-stained hands casting cocked Nansen bottles over the sides of ships to satellites in outer space. We understand that the ocean is immense, rich of life, unpredictable and full of surprises. The sea is much more than a metaphorical clock of cogs, springs and levers with only a few keyholes to crank. <b>Moir, Ocean River Institute</b>
ES	6	7	6	14	The logic of lines 7 to 12 is very opaque. From 21 research priorities in 6 theme areas are some priorities that repeat in two or more themes. These priorities are referred to as “common threads.” How many of the 21 priorities are threads in common are not told. The few threads form a pattern that can be “seized” in a few areas and leveraged to achieve advance across the breadth of the enterprise. Threads are generally not apt to be good levers for when placed on fulcrum points threads tend to drape. Talk of threads and levers to lift “the breadth of the enterprise” sounds to me more like smoke and mirrors and at complete odds to careful deliberative and transparent work that characterizes this document. Cut it out, lines 7 to 12, please.  Recommend you commence the paragraph by defining the relationship alluded to as “that relationship”. For example: For the United States relationship with the ocean to change for the better, advances in three key areas of science technology must be pursued: <b>Moir, Ocean River Institute</b>
ES	06	12			Suggest adding something on competitiveness, like “...over the next decade, <b><i>maintain U.S. leadership in ocean science, and enhance U.S. competitiveness.</i></b> ” <b>Raytheon-Moran</b>
ES	06	14	6	15	Should be “...forecast ocean <b><i>and coupled ocean-atmosphere</i></b> processes;”

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<b>Raytheon-Moran</b>
ES	06	14	6	18	The advances 1 and 3 look very much the same except that ocean observing technologies is specifically listed in the 3 <sup>rd</sup> . This list does not identify any human health activity except what might be inferred as improved storm forecasting and seafood safety. These could be written as: 1. increasing understanding and capacity to collect relevant ocean data and forecast ocean processes, 2. –this could stay as written–, 3. increasing understanding of the impact of the oceans on human health. <b>Backer, Centers for Disease Control &amp; Prevention</b>
ES	6	14	6	18	Advances #1 and 3 look very much the same except that ocean observing technologies are specifically listed in #3. This list does not identify any human health activity except what might be inferred from improved storm forecasting and seafood safety. These could be re-written as: 2. increasing understanding and capacity to collect relevant ocean data and forecast ocean processes, 2. –this could stay as written–, 3. increasing understanding of the impact of the oceans on human health. <b>National HAB Committee-Anderson and Glibert</b>
ES	06	17	6	18	Should be “..(3) deploying <b><i>and integrating</i></b> ocean observing technologies...” <b>Raytheon-Moran</b>
ES	06	17			<i>(3) deploying ocean observing technologies that will, in turn, accelerate forecasting and management capabilities.</i> The common technical thread here is the need for <b>increased access to the sea</b> . The country/world is ocean-access limited. Current methods are very expensive. We need technology that increases the pace, efficiency and scope of oceanic investigations and monitoring, to accelerate new knowledge and forecasting. The current statement (3) doesn’t go far enough. <b>Beach, NOAA</b>
ES	06	18			Add: In addition, it will be important to develop and implement new strategies to educate and instill a sense of stewardship in the public, adjust resource use patterns, and review governance structures that use the scientific knowledge and new technologies to ensure conservation of resources, enhance the health of ocean and coastal ecosystems, and provide a path for the sustainable future of industries that

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					depend on the ocean. <b>Muller-Karger, University of South Florida</b>
ES	06	20			Should be “Understanding and Capability to Forecast Ocean <u><i>and Ocean-Atmosphere Coupling</i></u> Processes <u><i>and Their Impacts on Weather and Climate</i></u> ” <b>Raytheon-Moran</b>
ES	6	20	7	24	Development of an ocean observing system should be the first priority on this list, since the first two priorities currently listed are highly dependent its implementation. This fact should be strongly stressed throughout the document. (Brian Grantham and Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
ES	7		9		My primary comment has to do with the near term priorities. The JSOST has said over and over that they need to present these priorities in a way that the tax paying public and our legislators understand their importance and buys into supporting them. When I read some of the “titles” for the near term priorities all I can think is...what does that mean? For example, I think it probably does take a “rocket scientist” (or maybe a climatologist?) to understand what ”Assessing Meridional overturning Circulation variability; Implications for rapid Climate Change” actually is. I’m sure the average tax payer is just saying- tax me more I can’t get enough meridional overturning circulation.....how many congress people/senators do you estimate know what meridional overturning circulation is? Microsoft Word doesn’t even recognize meridional as a word..... I suggest you consider using laymen’s terms- there HAS to be a way to do that. Maybe Ocean effects on rapid climate change or ...something a bit easier to understand. Let the implementation plan be filled with big words- make this simpler for those of us who haven’t a clue what you are talking about. Minimize jargon.  Also I have heard that the near term priorities were in part set because there is currently funding for these efforts and therefore they can be accomplished in the near term. I would suggest that there has been significant funding at the national level through appropriations for the Centers on Oceans and Human Health (both NOAA and NSF/NIEHS Centers exist- so there is a multi-agency activity already active) and that these programs are programs for which the benefits are easily understandable to pretty much everyone (it doesn’t take a meridional climatology specialist to understand what you

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					are trying to accomplish when you say you are trying to find treatments for cancer or prevent toxic, stinky algae blooms). Continued support of these Centers; Creation of additional Centers; integration with the NIH Roadmap screening labs (MLSCN) as well as continued support of the NOAA Oceans and Human Health extramural grant program which funds a variety of research at universities and non-profits on HABs, pathogens, seafood safety, and new bioproducts with therapeutic and other health benefits all provide to the US tax payer a real human benefit in improved human (and ecosystem) health. I strongly feel that the Oceans and Human health concept should be emphasized in the Near Term Priorities capitalizing on the existing legislation supporting the Oceans and Human Health initiative and the Ocean exploration initiative. There has also been significant funding for HABs through NOAA and EPA and this can be capitalized on as well. The funding is there, the benefit is there and I believe the results are there so capitalize on these current successes- add some aspect of human health to the near term priorities. <b>Wright, Harbor Branch Oceanographic Institution</b>
ES	7				<b><i>“Enhanced Scientific Support for Ecosystem-Based Management</i></b> Implementing ecosystem-based management requires determining which interactions are most critical, as well as the natural and human factors affecting those interactions, and the way those factors will change in the future.” This leaves out a key aspect, the ability to identify and measure indicators of these most-critical interactions. Without means to monitor and assess the interactions, having only the understanding of them limits their utility to resource users and managers. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	7				<b><i>“Targeted Deployment of an ocean observing system:”</i></b> As described, the benefits of this will be limited. While there are certainly important benefits that result from a more complete implementation of the present ocean observing system, the greatest potential for benefit results from implementing OOS technologies within estuaries and near the coasts, where the greatest density of management activities occur. These areas are the most difficult to understand hydrodynamically, yet present observing systems focus on the simpler offshore and freshwater systems, avoiding the coastline because of the complexity caused by the mixing of the two systems. This complexity is exactly why observing systems in them will provide the greatest benefit. This fresh/salt and

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					land/water interface is not only the most complex, it is also the location of the greatest and most widespread impacts of present human activities. Most complicated and greatest impacts means this is where the greatest benefits result from increased understanding and is where a substantial portion of the research resources should be targeted. Specific reference to the role of the Regional Associations in determining the deployment targets should be made. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	7				Mention is made of targeted deployment of an ocean observing system. While this system is an important component of the strategy to gather data/information on the ocean environment, it should be noted that it is also necessary to maintain and expand the terrestrial observing network to provide the companion data necessary to fully understand the relationships between the two components. Unfortunately, the U.S. Geological Survey's Stream Gauging Network has been shrinking in size, resulting in the loss of important stream flow and water quality data. <b>Moriarty, USFWS</b>
ES	07	01			Instead of “to name a few” this paragraph should help set priorities and state clearly which priorities should be pursued in parallel over the short term and which over the long term. <b>Muller-Karger, University of South Florida</b>
ES	07	01			Include: linkages between land use and land use change and coastal and marine environmental health, including strategies to minimize or avoid negative impacts on coastal and marine environments and resource use. <b>Muller-Karger, University of South Florida</b>
ES	7	4	7	12	This section on scientific support for Ecosystem-Based Management is very good but lacks the mention of ecological modeling or predictive capabilities that are critical in almost all cases to synthesizing the science and providing meaningful advice to support an ecosystem-based management approach. <b>Magnien, Center for Sponsored Coastal Ocean Research, National Centers for Coastal Ocean Science, NOAA/National Ocean Service</b>
ES	7	4	7	12	“ <i>Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade</i> accurately identifies the need for enhanced scientific support for Ecosystem-Based

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					Management as a key ocean research priority. <b>Ocean Research &amp; Conservation Association-Widder</b>
ES	7	4	7	4	“The initial use of the term Ecosystem-Based Management in the Executive Summary may be enhanced with a footnote referring readers to a succinct definition of what ecosystem-based management is, especially as applied to marine environments. The first page of the <i>Scientific Consensus Statement on Marine Ecosystem-Based Management</i> contains an answer to the question, “What is Ecosystem Based Management for the Oceans?” Proposed footnote: Scientific Consensus Statement on Marine Ecosystem-Based Management. March 21, 2005, p. 1 <a href="http://compassonline.org/files/inline/EBM%20Consensus%20Statement_FINAL_July%2012_v12.pdf">http://compassonline.org/files/inline/EBM%20Consensus%20Statement_FINAL_July%2012_v12.pdf</a> <b>Ocean Research &amp; Conservation Association-Widder</b>
ES	7	8	7	8	<RPLC> as the one of the most<WITH> as one of the most <END> ; <b>Zlotnicki, JPL</b>
ES	7	10	7	12	Enhanced scientific support for ecosystem-based management should also include research on management techniques and tools. Collection and analysis of data on effectiveness, for example, of coastal restoration techniques are needed to move beyond efforts with low to moderate success rates. Research on innovative management practices and technologies would provide the information program managers need to make meaningful improvements in our stewardship of ocean and coastal resources. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	07	12			Include: Ecosystem-based management will also require careful review of governance jurisdictions, and implementing mechanisms that facilitate management across existing jurisdictional boundaries, including mechanisms to address impacts that originate far inland or act over large spatial scales such as atmospheric deposition of pollutants. <b>Muller-Karger, University of South Florida</b>
ES	07	14			Given the current focus of OOS on measuring physical and chemical parameters, equal attention needs to be given to other biological accounts beyond plankton. This would include living marine resources (fish and shellfish) , protected resources (marine mammals and sea turtles) and natural trust resources (seabirds).

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<b>Dow, NMFS/NEFSC</b>
ES	07	14			Should be “Targeted Deployment of an <i>Integrated</i> Ocean Observing System” <b>Raytheon-Moran</b>
ES	07	18			Insert after “coasts,”: “critical shallow habitats such as coral reefs,” . <b>Muller-Karger, University of South Florida</b>
ES	07	21			What ARE the priority elements of the observing system? Is DMAC #1? How are Observations, Models, and Decision Support Tools inter-related so as to break down the stovepipes that exist today? <b>Raytheon-Moran</b>
ES	8				The first and third ‘overarching opportunities’ are virtually identical. It puts forth the case that ocean observing systems and the atmospheric and ocean circulation understanding they support are the most important things to help the U.S. and world oceans. While they are indeed important, as described they offer few or no short-term benefits to the health of our coastal/ocean biological communities or the quality of those waters and should not, therefore, dominate the U.S. ocean research plan. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	8				<b>“Comparative Analysis of Marine Ecosystem Organization” Management of marine ecosystems can be improved by elucidating their underlying dynamics at a variety of scales.”</b> This makes an important point. The ability to compare outcomes of multiple management options with reasonable accuracy would go a long way toward helping minimize effects of and guide coastal development. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	08	07	8	8	Statement implies that the other 21 priorities only require “a modest effort over 10 years,” which is not a real priority. <b>Raytheon-Moran</b>
ES	08	08	8	9	Remove “and” now in line 8 and add the following in present line 9: “and results (i.e., will the effort result in improved coastal and ocean health, and improved sustainable use of the resource)” . <b>Muller-Karger, University of South Florida</b>
ES	08	08			Modify phrase in parenthesis to: “will the effort capitalize on the human capacity and the research and management infrastructure distributed across sectors throughout the country, to enable a new

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					governance and management paradigm under which collaborations and partnerships among sectors is maximized” . <b>Muller-Karger, University of South Florida</b>
ES	08	11	9	22	The writeups under these “near-term priorities” are weak, non-specific, and don’t convey either their impacts, urgency or partnership opportunities. <b>Raytheon-Moran</b>
ES	08	11	8	22	While this paragraph identifies a potential group who may be interested in using the data generated by forecasting, there is no mention of including end-users in the development of the systems. It is critical that end-users be an integral part of any effort to collect oceans data. <b>Backer, Centers for Disease Control &amp; Prevention</b>
ES	8	11	8	22	While this paragraph identifies a potential group who may be interested in using the data generated by forecasting, there is no mention of including end-users in the development of the systems. It is critical that end-users be an integral part of any effort to collect oceans data. <b>National HAB Committee-Anderson and Glibert</b>
ES	8	16			<RPLC> environment. This effort <WITH> environment. The combination of relatively slow sea level rise from ocean thermal expansion and ice melt, together with fast episodic inundation associated with high tides, storm surges, and in extreme cases hurricanes, poses increasing dangers to coastal communities and to the port facilities through which international commerce is carried out. It is necessary to monitor and model both the slow regional variations in sea level, and the episodic events better to predict, for example, the number of times in 50 years that a coastal region will become inundated, how high, and what forces will be applied to structures. It is necessary to plan accordingly. Hurricane Katrina was the most recent and most devastating reminder, but storms washing away homes in California and Florida also occur in a statistically predictable manner in any one decade. This problem has high impact, urgency in order to prepare plans of action for the next few decades based on data and understanding obtained over the next 2-5 years, and partnerships among the data collecting and science agencies, the emergency response agencies, the insurance industry, the marine transportation industry, etc. This effort <END> ; <b>Zlotnicki, JPL</b>

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ES	8	19			CSO would like to amend the sentence “data will be made widely available to diverse end-users” to say “data and information products.” Many states lack the capacity and technology to access or interpret raw data and will require information products to make management decisions. <b>CSO-Andrews</b>
ES	08	19	8	20	<b><u><i>IOOS is clearly a national priority, yet you refrain from using the term in this report – Why?</i></u></b> <b>Raytheon-Moran</b>
ES	08	24	8	30	This doesn’t say anything about what you’re actually proposing to do. Suggest looking at other similar efforts to understand impacts of technology, policy and management decisions in complex systems – e.g., NIH Digital Human, FAA’s Next Generation Air Transportation System, and DoD Wargaming. Wargaming exercises might be particularly effective as it includes human-in-the-loop decision-making in complex and realistic scenarios. <b>Raytheon-Moran</b>
ES	8	24	8	30	The title “Comparative Analysis of Marine Ecosystem Organization” does not fit well with the content of this paragraph. I would suggest “Predictive Tools to Support Ecosystem-Based Management”. <b>Magnien, Center for Sponsored Coastal Ocean Research, National Centers for Coastal Ocean Science, NOAA/National Ocean Service</b>
ES	8	28	8	29	CSO encourages whoever is tasked with developing the “practical tools” to consult with end-users and resource managers in developing the evaluation tools. <b>CSO-Andrews</b>
ES	9				< COMMENT TO EDITORS > The summary of what is worth doing in less than 5 years is blatantly out of wack with the rest of the doc. It is not necessary to put everything here, but there must be SOMETHING that addresses Enable Marine Operations, or Coastal Hazards (my offering in the line above)<END> ; <b>Zlotnicki, JPL</b>
ES	9				<b>“Sensors for Marine Ecosystems”</b> Concur with the benefits of this, but would emphasize the importance of employing them along coasts and in estuaries along with the present offshore locations. Use of improved in-situ sensors along the coasts and in estuaries to calibrate satellite imagery offers

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					tremendous potential of real and near-time monitoring of coastal waters, allowing timely management decisions. Areas of focus for sensor development and deployment should be determined in close coordination with state governments and local stakeholders to ensure that priorities are met. <b>Bailenson, Florida Department of Environmental Protection</b>
ES	09	02	9	11	Both Congress and the Administration are sending strong messages that deployment of an Integrated Ocean Observing System is a high priority, but the focus of this particular “near-term priority” is on Sensors! By not focusing on IOOS you are sending conflicting messages! <b>Raytheon-Moran</b>
ES	09	02	9	11	While this paragraph attempts to make a case for the need for new, improved sensor capabilities, it does not define how the data will be used. Some examples of products, end-users, how the data will be applied is needed. <b>Backer, Centers for Disease Control &amp; Prevention</b>
ES	9	2	9	11	While this paragraph attempts to make a case for the need for new, improved sensor capabilities, it does not define how the data will be used. Some examples of products, end-users, how the data will be applied are needed. <b>National HAB Committee-Anderson and Glibert</b>
ES	09	07			Insert: "These include sensors such as an advanced space-based Landsat-class imaging capability, enhanced to observe global littoral zones. This would provide a unique capability to monitor coastal water quality and estuarine and shallow submerged habitats, such as sand and gravel deposits, sea grasses and coral reefs, in a synoptic manner." . <b>Muller-Karger, University of South Florida</b>
ES	09	17	9	22	Hansen et al. (Hansen, J., M. Sato, R. Ruedy, K. Lo, D.W. Leam and M. Medina-Elizade, 2006: Global temperature change. <i>Proc. Natl. Acad. Sci. of the United States of America</i> , 103, 14288-14293) note that the upper layers of the Pacific Ocean play a pivotal role in the global scale interactions involving El Nino/ENSO, and that climate change appears likely to impact these interactions with potentially significant consequences. I don't mean to underrate the importance of the Atlantic Ocean MOC, but singling it out here might give the impression that it is the <i>only</i> major ocean process likely to be impacted by climate change. The Atlantic gets huge research attention because of

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					justified European concerns, and it doesn't need to be pumped up here through specific mention. <b>Muench, ESR</b>
ES	09	21			Spelling of "conveyor" (misspelled as "conveyer"). <b>Muller-Karger, University of South Florida</b>
ES	9	21	9	23	<RPLC>ocean conveyer ... changes in climate<WITH> ocean conveyor belt would help better understand this key process. Developing and deploying the necessary sensors, together with improved understanding, will help forecast its evolution <END> ; <b>Zlotnicki, JPL</b>
ES	09	23			Insert a brief section highlighting the importance of international partnerships and developing a strategy for U.S. leadership in international partnerships to transfer technologies, build capacity, and conduct joint research.  Insert something like (text based on USCOP final report): <b><i>Building on the Bases of International Partnerships</i></b> - It is in America's interest to work with the international community to preserve the productivity and health of the oceans and to secure cooperation among nations everywhere in managing marine assets wisely. Aspects of living marine resources, coral reefs, pollution abatement, marine debris, vessel safety, invasive species, habitat loss, science and observations, and conflict resolution among competing users require a broader international strategy to address these research and management priorities.  The Administration will make continuing efforts toward accession to the United Nations Convention on the Law of the Seas. <b>Muller-Karger, University of South Florida</b>
01	10		12		The overarching goal of ORPP should be to make the ocean compelling to our citizens, establish the connection between human activity and the oceans, and create an ocean literate citizenry. The introduction must capture the readers attention, convey the awe, wonder, and importance of the oceans and make a strong case for increased support for ocean research and education. As CORE has stated in our earlier comments, JSOST should consider placing a sidebar box that contains compelling

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					<p>information about the ocean and how it impacts our daily lives.</p> <p>The introduction should also frame the national investment in the oceans. For example, only 0.0003% of the United States federal budget is spent on understanding our oceans and an annual investment of \$1.5 billion (or .0005% of the annual federal budget) would double the ocean research and development capability of the United States, thus increasing our competitiveness.</p> <p>The introduction should also highlight why the oceans are critical to the well-being of the nation and its people. It must also address how greater investment in ocean science and education is necessary to reverse the degradation the oceans are currently sustaining. It must compel readers to support the plan and understand that if our oceans are to sustain the nation we must invest in scientific tools and technologies, including well-equipped research vessels, remote ocean sensing, and an integrated ocean observing system.</p> <p><b>CORE-West</b></p>
01	10		12		<p>Not very inspiring. Needs to capture some of the language from the Commission on Ocean Policy and PEW reports to capture the public imagination/concern about the ocean.</p> <p><b>AOOS-McCammon.</b></p>
01	10	2	10	3	<p>President Andrew Jackson’s called for large scale ocean science to challenge Britain's assumed superiority over the seas and to thwart UK ambitions for acquiring Oregon and California. President Jackson charted two courses for ocean science, navigation (marine operations) and natural science. Four ships and two schooners were outfitted for the Great U.S. Exploring Expedition (1838-1842) in the greatest naval venture up to that time. The U.S. Navy with civilian scientists carried out fifteen ocean expeditions between 1837 and 1860.</p> <p><b>Moir, Ocean River Institute</b></p>
01	10	8	10	9	<p>While the Magnuson-Stevens Fisheries Act did extend jurisdiction of fisheries conservation and management to 200 nautical miles, I believe that an EEZ was not established under that name until Reagan had a presidential proclamation to that effect in 1983 – please verify and change language if needed (see USCOP report pages 51 and bottom of p 53) .</p>

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					<b>Muller-Karger, University of South Florida</b>
01	10	22	10	29	I don't understand part of this sentence: how does the research "now cover...a large number of regulatory responsibilities" [please clarify] . <b>Muller-Karger, University of South Florida</b>
01	11	26	11	28	Amend the sentence to "...a collaborative effort involving all federal, <b>state, tribal, and local government agencies</b> with interests and responsibilities linked to the ocean...". (Brian Grantham and Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
01	11	28			Please add "states and local governments" to the list of those who participated in the development of the ORPP. <b>CSO-Andrews</b>
01	12				<b>"The ocean research priorities presented in this document are national in scope yet reflect the need to provide benefits at the local, state, regional, and national levels, while involving all parties in the enterprise."</b> Without an increased emphasis on nearshore research and active engagement in the actual setting of priorities for implementation, this document and the Implementation Strategy will not reflect the benefits at these varied scales nor truly involve all parties in the enterprise. <b>Bailenson, Florida Department of Environmental Protection</b>
01	12	2			Add "or for example" after last comma. <b>Muller-Karger, University of South Florida</b>
01	12	5			Insert: research must also address the critical issue of resource conservation and help find ways to improve the health of coastal and marine ecosystems, and help develop methods to sustain the use of marine resources. <b>Muller-Karger, University of South Florida</b>
01	12	16	12	17	From my viewpoint the focus of the ocean research plan leans too heavily on basic research with too little emphasis on applied research if the goal is to support public policy and make better resource management decisions. <b>Dow, NMFS/NEFSC</b>

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01	12	21			Add tribal governments to the list of coordination among government agencies: “among state, regional, <b>tribal</b> , and local government agencies...” In Washington State, many tribal governments conduct important ocean and coastal resource research and monitoring. Acknowledging coordination needs with these governments is critical. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
01	16				Use of ‘discovery, understanding, application’ framework is very effective. <b>Bailenson, Florida Department of Environmental Protection</b>
01	17				This section noted the need for fundamental science even if it does not directly respond to specific products or social requirements. While the FWS understands the need to conduct this type of research, this document is part of the Administration's Plan and, as such, research conducted as part of this effort should be linked to an identified management need. In addition, the questions used to identify research priorities on page 20 (lines 8 and 18) clearly indicate the need for a management focus. <b>Moriarty, USFWS</b>
01	20				“ <b>Does the research address mandates of governing entities (federal agencies, state, tribal and local governments)?</b> ” This should not be the last of the factors considered. Appropriate emphasis should be placed on research that enables us to meet goals or conduct management activities that are <i>mandated</i> . <b>Bailenson, Florida Department of Environmental Protection</b>
02	0				This transitional section of the report is very important, not only for setting the stage for what follows, but for establishing principles for further planning and implementation of research priorities. The first subsection does a good job in presenting the societal drivers for the research priorities, while the third subsection clearly establishes the need for fundamental science as an essential part of the nation’s ocean research investments. The second section, addressing framing the approach, will be particularly important in implementing the research priorities developed under the six themes identified in the concluding subsection.  Emphasis on and linkage among discovery, understanding and application are as important as the

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					strategic investments in research for achieving the societal relevance that is the basis for the plan. These three components are essentially the same as those articulated by Ernest Boyer in his seminal book <i>Scholarship Reconsidered: Priorities of the Professorate</i> (Carnegie Foundation for the Advancement of Teaching, 1990, re-released in 1997) that has been used by some universities to transform the work of faculty. In addition to teaching, Boyer argues that the responsibilities of scholarship include discovery, integration and application. In fact, “integration,” which Boyer describes as “making connections across the disciplines, placing the specialties in larger context, illuminating data in a revealing way” that "seeks to interpret, draw together, and bring new insight to bear on original research," may be a better term than “understanding” as used here. <b>Estuarine Research Foundation-Boesch</b>
02	13		14		CORE asserts that this section is redundant and should be deleted. Many of these points were made or could be made in the Introduction. <b>CORE-West</b>
02	13	6			Replace “functioning” with “functioning and healthy” . <b>Muller-Karger, University of South Florida</b>
02	13	15			Append: “, and improve the health of ecosystems within them” . <b>Muller-Karger, University of South Florida</b>
02	13	29	13	31	In support of the statement of need for “wide public access to information that will enable informed public discourse and decision-making,” this report has the opportunity to recommend specific ways to involve the public (and professional policy actors at all levels) much as the technical OOS requirements are spelled out in the document rather than perpetuating the appearance of the public as policy targets. <b>Wilson, SeaTrust Institute</b>
02	14	5	14	8	Replace “challenge is” with “challenges are” and reword paragraph to include this concept: “and coordinating the human capacity and research and management infrastructure that exists in the nation across all sectors to enable this vision” . <b>Muller-Karger, University of South Florida</b>
02	14	5	14	8	Perhaps the biggest challenge is for government to fulfill its guardian leadership legacy of America’s

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					stewardship ethic to value and protect, based on the best scientific research available, ocean and coastal ecosystems while facilitating responsible public access to healthy oceans for both today's and future generations to enjoy. <b>Moir, Ocean River Institute</b>
02	15		16		Appreciate the approach of discovery, understanding, application, but the approach does not seem to be carried through in selection and then development of research priorities. <b>McCammom, AOOS</b>
02	15		16		Discussion encompassed under "Discovery" and "Understanding" is more aptly placed in the section "The Need for Fundamental Science." <b>CORE-West</b>
02	15	2	15	3	The scope of this effort is to promote exploration and discovery that will provide new insights and perspectives of greater clarity on the ocean environment; impact greater understanding . . <b>Moir, Ocean River Institute</b>
02	15	2	15	31	Suggest including discovery through social and political discourse (a social science research aspect intertwined with fundamental science questions) as part of how "society builds comprehension of life" (line 13) and "serving the public interest" (line 31). <b>Wilson, SeaTrust Institute</b>
02	15	9	15	15	Exploration and Discovery Exploration is the pursuit of the unconstrained fundamental science questions that drive the imagination including the exploration of new phenomena and terrain, remote geographies, and unique marine system. Science exploration may also be a process of making the known and familiar strange that may result in discoveries of more thorough and better grounded knowledge. Discovery provides the foundation upon which society builds comprehension of life and complex systems. Discovery, for example the finding of deep thermal vent communities, has the potential to fundamentally shift our understanding of the ocean and even humanity's place in the system. <b>Moir, Ocean River Institute</b>
02	15	31			Add after Public interest": "including the conservation and sustainable uses of natural resources, particularly those which are entrusted to governments to manage on behalf of humankind" [intent is

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					to highlight the “public trust doctrine”- see USCOP final report p 61, 71, etc.] . <b>Muller-Karger, University of South Florida</b>
02	16	01		04	In order to convert scientific data into information useful to managers and the general public, one needs to have a framework in place for an ecosystems approach to management (EAM); managing the impacts from climate change; addressing coastal hazards; etc. The Ocean Commissions recommended Regional Ocean Councils as one way to coordinate state/federal activities in pursuit of multisectoral EAM. The Canadian experience in establishing the Eastern Scotian Shelf Integrated Management (ESSIM) program suggests that establishing such regional entities is a time consuming endeavor. In our region the Gulf of Maine Council for the Marine Environment (GOMC) provides a mechanism for coordinating federal/state/provincial activities for a shared body of water (Gulf of Maine). The International Joint Commission (IJC) serves a similar function in the Great Lakes region. Since the framework for such regional entities differs from that of groups of federal agencies focused at the national level, it would be useful to seek input from some of the existing regional organizations on the types of data integration/synthesis and product development required to meet their information needs (including those of their constituents). Presumably at some future point in time the U.S. government will establish regional councils to support EAM coordination. The Ocean Research Plan should have the flexibility to meet these future needs. <b>Dow, NMFS/NEFSC</b>
02	17		18		<b><u>Separation of fundamental science from the more-emphasized societal themes, downgrades the need for such endeavors.</u></b> The document states “The path ahead as presented in this document necessarily includes room for creative individuals to pursue the kind of fundamental scientific research that can lead to unforeseen breakthroughs” (p.17). The separation of fundamental science from the strictly defined 10-year priorities does not lend to its funding or public support. Furthermore, the phrase “ <i>includes room for ...</i> ” is by no means a clear endorsement for any funding agency to support such activities. <b>Harbor Branch Oceanographic Institution-Frey</b>
02	17		18		CORE strongly supports this section of the ORPP. Science should be the foundation of ocean and coastal conservation, management and policy. Increased scientific knowledge and better

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					dissemination of information is needed to improve the management of our nation's ocean and coastal resources and its biological diversity. Science-based management and policy is critical to making informed decisions that balance human needs with the protection of ocean and coastal resources and move toward an ecosystem-based management approach. We must build a strong vibrant case for and excite the public about ocean research and new research initiatives that have the potential to produce breakthroughs to improve our understanding the ocean and great societal benefits. This section should emphasize the need for a renewed investment in ocean exploration and greater commitment to significantly increase the federal ocean and coastal research budget and this funding should be used to support a balance of basic and applied research and public outreach and education should be integral components of a national plan. <b>CORE-West</b>
02	17	4	17	5	Change second sentence in paragraph to read:” In the past and at present, society frequently manages its actions by reacting to crises, without preventing or addressing problems based on knowledge and understanding of the ocean.” . <b>Muller-Karger, University of South Florida</b>
02	17	08		11	I have a specific suggestion for fundamental research that would improve our understanding of marine food webs and the flow of energy/carbon to the higher trophic levels (fish, shellfish, marine mammals, etc.) that is managed by the federal/state governments. This involves the role of the microbial loop in coupling dissolved organic carbon in the pelagic zone of continental shelves to the grazing food chain (based on phytoplankton and detritus) that supports higher trophic levels. Microbial ecologists and biological oceanographers focus their research on the lower levels of the marine food web (microbial loop and plankton), while fisheries scientists concentrate on the linkage between zooplankton and the benthos in supporting living marine resources (LMRs) and protected resources (PRs). There is a large uncertainty on whether the microbial loop is a sink for non-living DOC and POC (particulate organic carbon) or provides a link through zooplankton and macroplankton to the grazing food chain that supports LMRs and PRs. Since the relative concentrations of DOC:POC:Phytoplankton in the water column are 75:5:1, answering the question of whether the microbial loop is a link or sink has practical implications for an ecosystems approach

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					to fisheries management (EAF). <b>Dow, NMFS/NEFSC</b>
02	17	17	18	11	I agree that temporal-spatial observations must be increased in density through real infrastructure investment that supports regular, consistent, and continual progress of in situ measurement paradigms. One example referred to obliquely throughout the text is the need for benthic mapping, yet no specific plan for developing the requisite infrastructure is stated. <b>Noll, NOAA Ship Rainier</b>
02	18	4	18	9	<RPLC>In addition to platforms that enable ever-expanding temporal and spatial access to the ocean, such as in situ and remote global, national, and regional observing systems and a robust research fleet (including manned submersibles), land-based marine laboratories enable multidisciplinary research programs and support specialized equipment and instrumentation <WITH> Observing and understanding ocean processes that operate in different space and time scales, in different regions, and are the object of attention of different disciplines, requires a balanced combination of in-situ platforms, remotely operated autonomous in-water vehicles, a robust fleet of research ships, orbiting satellites, and land-based marine laboratories, organized as global, national, and regional observing systems. <END> ; <b>Zlotnicki, JPL</b>
02	18	9	18	11	How will the workforce be developed? This is potentially a significant budget item. <b>Wilson, SeaTrust Institute</b>
02	19	1	19	9	<i>“Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade</i> (hereafter referred to as The Report) correctly identifies urgent ocean research priorities that address the six most compelling societal questions. Furthermore, The Report does an excellent job of focusing on the essential research that must be undertaken in the coming decade. The Ocean Research & Conservation Association applauds the first research priority (“Stewardship of Our Natural and Cultural Ocean Resources.”) <b>Ocean Research &amp; Conservation Association-Widder</b>
02	20				Does the proposed research contribute to a significant understanding of management issues affecting high priority resource issues (e.g., fisheries bycatch of non-target fish and seabirds).

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					<b>Moriarty, USFWS</b>
03	0				<b><u>Stability, sustainability, and effective management of marine resources (Societal themes 1 &amp; 5) should include an equal focus on development of technologies and techniques that remove the need to extract natural resources in the first place</u></b> (e.g. aquaculture, alternative energy sources, recycling of ocean-derived materials). With decreased human demand on natural resources, ensuring stability and sustainability of such resources is much simpler. <b>Harbor Branch Oceanographic Institution-Frey</b>
03	0				This section appropriately recognizes the substantial role that healthy ocean and coastal resources have in the coastal tourism and recreation industry. In addition, the section calls attention to the fact that coastal resources are intrinsically linked to the nation's cultural heritage. This section also properly acknowledges the need for advanced technological developments and data integration that will improve resource management, including regional sediment management. <b>American Shore and Beach Preservation Association-Ordal.</b>
03	0				We offer the following comments on this section:  <ol style="list-style-type: none"> <li>1. The section begins by discussing the cumulative effects of human activities. While these might be considered as habitat/species interactions, some modification of this wording would make the inclusion of these factors clearer. Furthermore, this section and the others under this theme do not specifically address one of the more important human activities that affect the ecosystems supporting living resources, resource extraction itself (bottom habitat disturbances, bycatch, top-down cascading effects on the ecosystem, etc.). The consequences of resource extraction deserve more explicit consideration in the research priorities.</li> <li>2. As written the second research priority implies that interspecies and habitat/species relationships completely control resource sustainability. Surely, climatologic and stochastic processes also affect resource recruitment and should be addressed in research and modeling.</li> <li>3. The third research priority, concerning human-use patterns, could be improved with an</li> </ol>

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					<p>explicit statement about research needed to evaluate the success of different management strategies (e.g., marine protected areas vs. closure vs. gear size restrictions).</p> <p>4. The last research priority, applying advanced technologies, should be reworded. Here, we are really talking about the application of advanced technologies “to reduce the impact of human uses of the oceans and Great Lakes on natural resources.” It is important to make the distinction between minimizing the adverse impact of human activities such as resource extraction and aquaculture on wild population from activities which might enhance natural resources like restoration.</p> <p>5. In the necessary tools section, other important areas in which stewardship could be enhanced, such as habitat and resource restoration activities and controlling the introduction of exotics, might be mentioned. Also, the requirements and opportunities for international cooperation in research on open-ocean species and [shared fishery stocks] should be mentioned.</p> <p><b>Estuarine Research Foundation-Boesch</b></p>
03	21				<p>Reaching a consensus on the value of area-based management tools (e.g. Marine Protected Areas) for fisheries management will require research on key biological and sociological processes, especially connectivity (with links to larval dispersal), spillover (based on adult movement patterns), density-dependent processes (reserve effect), settlement processes, effort displacement and redistribution, and fisher responses to reserve effects such as spillover.</p> <p><b>The Ocean Conservancy-Heinemann</b></p>
03	21				<p>Integrated research on the implementation of current efforts towards ecosystem-based management is needed immediately; this will require natural scientists, social scientists, economists and policy experts to work together in specific locations.</p> <p><b>The Ocean Conservancy-Heinemann</b></p>
03	21		25		<p>Many of the items under this theme could go under the ecosystem health theme. Should consider revising those themes. Where are issues of ocean mining, offshore oil and gas development, etc. to be included? These seem to be missing</p>

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					<b>AOOS-McCammon.</b>
03	21		25		In this theme, cultural resources are mentioned but not adequately addressed. It would be helpful to integrate the conservation of cultural resources more directly into some of the specific strategies. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
03	21		25		We suggest that you also consider the use of scenarios. Unlike predictions and forecasts, scenarios are powerful planning tools for decision-making over long time frames in systems that are incompletely understood and subject to change. In other words, scenarios are a useful means of dealing with uncertainty and preparing for surprises – both of which are crucial for managing impacts to ocean ecosystems in this era of climate change. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
03	21		25		As a trustee for natural resources, it is the government’s responsibility to protect the ocean ecosystem including all related flora and fauna. While this section potentially alludes to trustee resources such as seabirds and marine mammals, the absence of clear and direct discussion of the need for research marine organisms is of concern. Our ability to protect our natural resources is limited by our ability to assess impacts based on current scientific knowledge. For example, efforts to develop sustainable energy sources in an ecosystem- friendly manner will require information on ocean use patterns of many seabird species (much of which is currently unavailable). Research developed under this theme should address such data gaps. We also stress that this first research theme should include understanding the population-level impacts of environmental and anthropogenic stressors on individual species. <b>American Bird Conservancy-Fenwick</b>
03	21		25		<b>Theme 1: Stewardship of Our Natural and Cultural Ocean Resources</b> <ul style="list-style-type: none"> <li>▪ Understand the status and trends of resource abundance</li> <li>▪ Understand interspecies and habitat relationships in order to forecast sustainability</li> <li>▪ Understand human use patterns that influence stability/sustainability</li> <li>▪ Apply technology to enhance benefits of various natural resources</li> </ul> <p>Gathering basic information, such as where natural resources are located, is an important factor in</p>

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					management decisions and a steady federal financial commitment to such applied research should be the hallmark of the national Ocean Research Priorities Plan. For example, NOAA and the Environmental Protection Agency (EPA) issue a National Coastal Assessment (NCA) report purported to be a comprehensive survey of the nation’s coastline. Yet Alaska, a coastal state containing over 40 percent of the nation’s coastline, has not received adequate fiscal support to complete even the first baseline survey, while other states are starting to assess trends and are on their third or fourth NCA survey. We already have scientifically rigorous methods for understanding human use patterns and assessing the status of resources, but the federal will to complete the NCA for the entire country must be bolstered. A re-commitment by federal agencies to essential and basic research for management – such as mapping bottom habitats, fish population assessments, marine mammal distribution, bycatch reduction, assessment of coastal aquatic resources, and species’ life cycle patterns – is the appropriate focus for the stewardship theme. <b>State of Alaska-Murkowski</b>
03	21	4	21	14	CORE believes that the introduction does not sufficiently recognize the problems that currently plague many of our natural resources and the discussion focuses too much on utilization rather than achieving recovery and sustainability. <b>CORE-West</b>
03	21	4			On line 4, the term “Coastal Watershed” is used. In other parts of the document, different terms are used to refer to this component of the ecosystem. It would be helpful if the terms could be standardized and a list of terms defined for clarity. On line 12, change “...habitat destruction, and competition with invasive species.” to “...habitat destruction, competition with invasive species, and fisheries bycatch causing seabird population declines.” <b>Moriarty, USFWS</b>
03	21	9	21	9	“neutralize toxins” should be changed to read “neutralize <b>some</b> toxins”. The ocean has no capability to neutralize many man-made toxins, witness for example the accumulation of pesticides in farmed Atlantic salmon and the presence of plastic-derived toxins virtually throughout the ocean. We can only <i>wish</i> it neutralized all the stuff we’ve dumped into it. <b>Muench, ESR</b>

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03	21	20			Replace “recreational” with “recreational fishery” to make this sentence/sector very clear
03	21	28			notes they want to provide ‘foundation for huge coastal tourism and recreation industry that is the fastest growing area of the ocean economy’. This could impact seabirds in particular. <b>Pacific Seabird Group-O’Reilly</b>
03	21	29			Add: “The density of coastal populations continues to increase, and coastal zones represent the areas of our nation that are being developed the fastest, frequently impacting the very factors that attract people to live in coastal areas in the first place.” . <b>Muller-Karger, University of South Florida</b>
03	22				<b>“The scale and diversity of ocean resources is immense, however, resource use and development sometimes compete with other societal needs and values. Balancing environmental impacts of resource use and extraction with the economics of resource development can help mitigate some of the pressures being placed on coastal ecosystems, enable restoration of degraded habitats, and ultimately, support robust and coordinated ecosystem-based managementxiii and governance strategies for sustainable resource use.”</b> We need to balance resource use with sustainability, and plan development accordingly. Balancing resource use and development may not yield the necessary sustainability. <b>Bailenson, Florida Department of Environmental Protection</b>
03	22				<b>“Central to the effective management of natural and cultural resources is the ability to accurately assess the current condition of these resources, and to determine the likely impacts of various management alternatives.”</b> This is a very important—probably the most important—research priority. However: <b>“Measuring the abundance and distribution of biota and non-living resources in the open ocean, coasts, coastal watersheds, and Great Lakes is challenging, particularly for living resources, because of their complex movement patterns.”</b> Movement alone is not the cause of the difficulties in measuring abundance and distribution of many living resources. We are no more able to measure and, as importantly, assess the condition of non-mobile resources than we are mobile ones. This is a statement aimed at species, not at the ecosystems within which they exist.

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					<b>Bailenson, Florida Department of Environmental Protection</b>
03	22				<p><b>“Capabilities necessary for these measurements include the ability to: ... assess the spatial and temporal variability (both natural and use-induced) of resources (biota, energy, minerals, and pharmaceuticals, among others), particularly in deep-water settings;...”</b></p> <p>The need for these capabilities is widespread, but there does not exist a greater need in deep water than in the rest of the oceans. The bulk of biota are not in deep-water settings and we can’t presently fully assess them. Deep water abilities should also be developed but not with a higher priority than those of shallow areas.</p> <p><b>Bailenson, Florida Department of Environmental Protection</b></p>
03	22	2			<p>The Rationale section should include an overarching paragraph that creates a sense of urgency and frames the problems related to natural resource management. In general, CORE prefers the rationale in the Planning Document to that in this version of the ORPP. CORE suggests the following addition.</p> <p>Insert: “Over the last thirty years, our ocean resources have suffered--overexploitation of many fish stocks and degradation of habitats have had negative consequences for too many ecosystems and fishing communities. Recent reports regarding the world’s fish populations suggest that commercially and recreationally important creatures, such as tuna, marlin, and swordfish, have decline by as much as 90%. Globally, fisheries discard 8 percent of the total catch—that’s 7.3 million tons of marine life thrown back into the sea dead or dying. Worldwide, 25 to 30 percent of the world’s major fish stocks are overexploited. To ensure the long-term sustainability of U.S. fisheries, maximize social and economic benefits, and conserve ecosystem integrity and marine biodiversity, fishery management must be improved. Fisheries management must move toward an ecosystem-based approach that will require better information about the ecosystem and its various components, and will require the integration of ecosystem data in an improved collection and processing system.”</p> <p><b>CORE-West</b></p>
03	22	2	22	3	Suggest you delete this sentence as it is vague and not entirely correct—resource use and development “often” not “sometimes” compete with society’s economic desires.

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					<b>CORE-West</b>
03	22	9	24	20	<p>For living marine resources, ocean research priorities should foster a policy that allows decision-makers to meet the needs of the present generation without compromising the ability of future generations to meet their needs. As part of an ecosystem-based management regime, marine biodiversity is a priority and downward trends in marine biodiversity should be reversed where they exist, with a desired end of maintaining or recovering natural levels of biological diversity and ecosystem services. Overall the various federal agencies responsible for resource management should move toward comprehensive synoptic ecological biodiversity surveys to augment or transition from strictly individual stock assessments for fish and marine mammals. Research must better elucidate the cumulative impacts of human use of ocean resources.</p> <p>Again, the ORPP now contains a few, very broad categories of research priorities and an over-reliance on models rather than collection of the data need drive the models. The narrative rambles and lacks prescription, leaving the reader unclear as to the exact research actions necessary to make progress in this area. The Planning Document contained clear, bulleted recommendations for research actions/needs, some of which are discussed and supported in the ORPP. CORE recommends that JSOST return to the priorities highlighted in that document and use the current text in the ORPP to support those priorities that the agencies and the community have identified as critically important.</p>
03	22	10		12	<p><u>Areas where ‘seabirds as indicators’ applies</u> to assess condition of resources &amp; determine impacts of management alternatives.</p> <p><b>Pacific Seabird Group-O’Reilly</b></p>
03	22	10	22	16	<p><i>“Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade</i> (hereafter referred to as The Report) correctly identifies the top research priority for effective management of natural &amp; cultural resources as (1) Assessment (“the ability to accurately assess the condition of these resources) and subsequently (2) Determine appropriate management alternatives (“and to determine the likely impacts of various management alternatives.”)</p>

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					<p>The <i>Scientific Consensus Statement on Marine Ecosystem-Based Management</i> calls this technique “adaptive management” which is defined as “an approach to learning from management actions that allows for scientifically based evaluation, testing of alternative management approaches, and the adjustment as new information becomes available from carefully designed monitoring systems.” (p. 5)</p> <p>However, missing from The Report is the <i>Scientific Consensus Statement on Marine Ecosystem-Based Management’s</i> (SCSME-BM report) recommendation to initiate regional zoning of the ocean. While it is absent from the Report (due perhaps to a lack of consensus among stakeholders regarding the appropriateness of zoning as the way to achieve the stated objectives), it appears we cannot implement the use of adaptive management approaches without “networks of fully protected marine reserves and other types of marine protected areas.” (SCSME-BM, p. 5) (“[N]etworks of marine reserves are uniquely capable of protecting biodiversity and habitats, producing the large-bodied individuals who contributed disproportionately to reproductive output, providing insurance against management uncertainties, and providing a benchmark for evaluating the effects of activities outside of reserves.” (SCSME-BM report, p. 5) Stewardship of ocean resources, using ecosystem based management tools, will require scientists to provide a benchmark for evaluating effects—both inside and outside of reserves. Therefore, it may be helpful if The Report discussed the potentially important role Marine Protected Areas may have in achieving the stated objectives.</p> <p><b>Ocean Research &amp; Conservation Association-Widder</b></p>
03	22	18	22	30	<p>Research priority 1, page 22, “understanding the status and trends of resource abundance through more accurate, timely, and synoptic assessments” is very broadly stated, indicating a need to monitor all biotic and abiotic resources. This is important, but we caution against the development of research plans that focus on monitoring broad ocean processes and lower trophic levels and merely imply impacts to fish, seabirds, and marine mammals. Information on trends at all trophic levels and integration of that knowledge is critical to the understanding of factors driving those trends. Additionally, monitoring must be developed with a clear tie to management needs. Without clearly defining this connection, monitoring efforts may be wasted by collecting data in such a way that it is</p>

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					not useful to address critical management questions or incorrectly prioritizes monitoring programs. <b>American Bird Conservancy-Fenwick</b>
03	22	19	22	22	The research considerations for measuring the abundance and distribution of <i>living</i> and <i>non-living</i> resources are fundamentally different. We suggest separate research priorities to address them with more specificity. <b>The Ocean Conservancy-Heinemann</b>
03	23				<b>“Understand interspecies and habitat/species relationships as a basis for forecasting resource stability and sustainability...There is a need to invest in data collection, experimentation, and advanced modeling to help identify crucial data and process-understanding gaps so that the proper resource management techniques can be developed and implemented.”</b> This section is well stated and with appropriate emphasis on its importance and the potential benefits. <b>Bailenson, Florida Department of Environmental Protection</b>
03	23				<b>“Understand human-use patterns that may influence resource stability and sustainability. Determining the “worth” (i.e., consumptive and non-consumptive valuation) of natural and cultural resources and evaluating effects of alternative management scenarios requires considering economic, sociological and cultural factors, and potential competing uses.”</b> This needs to include the value of ecological functions when making these types of calculations. It is the calculations as described that have resulted in a failure to appreciate the value and benefits of functional ecosystems and the widespread need (at great expense) for ‘restoration’. <b>Bailenson, Florida Department of Environmental Protection</b>
03	23	1	23	21	Research is needed to better understand the significance of sound and sonar for ocean wildlife. <b>The Ocean Conservancy-Heinemann</b>
03	23	1	23	21	We agree that a better understanding of cumulative impacts is crucial to implementing EBM. In addition to the modeling approaches suggested here, there is a need to develop the analytical tools and knowledge base for understanding cumulative impacts to the marine environment. We need to better understand how individual threats interact, the cumulative impacts of these threats over space and time, and the processes by which threats ultimately affect the delivery of ecosystem services. With respect to the suggested modeling priorities, there is a pressing need for models that <i>integrate</i>

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					our understanding of feedbacks between natural processes occurring at large scales, smaller (local and regional) scales, human impacts, ecosystem services, and the implications of various management alternatives. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
03	23	1	23	21	Research priority 2, page 23, “understanding interspecies or habitat/species relationships as a basis for forecasting resource stability and sustainability,” is also an important priority. There is an obvious need to invest in data collection, experimentation, and advanced modeling to understand interspecies and habitat species interactions; however, the prioritization of this work must be based on addressing the most urgent data needs. This section states, “There is a need to invest in data collection, experimentation, and advanced modeling to help identify crucial data and process-understanding gaps so that the proper resource management techniques can be developed and implemented”. This seems to skip a step in the process, before investing additional funds and energy into these areas, a thorough assessment of data needs should be conducted. This will begin the iterative process of developing of priority projects, reassessing data needs, and developing new projects. The text in this section leads quickly into modeling as a tool for developing management plans. While modeling is a powerful tool for such analysis, the need to invest in data collection through observation and experimental techniques should not be over looked, as the ability of models to accurately predict outcomes is often limited by the availability of data to develop the model. <b>American Bird Conservancy-Fenwick</b>
03	23	3	23	3	substitute 'use' for 'development' <b>National HAB Committee-Anderson and Glibert</b>
03	23	12	23	18	These research priorities are an important step to move towards ecosystem-based fisheries management. <b>The Ocean Conservancy-Heinemann</b>
03	23	14	23	14	delete 'higher' <b>National HAB Committee-Anderson and Glibert</b> Contact information: Biology Department, MS #32, WHOI, Woods Hole, MA 02543, 508-289-2351, <a href="mailto:danderson@whoi.edu">danderson@whoi.edu</a> ; <a href="mailto:glibert@hpl.umces.edu">glibert@hpl.umces.edu</a>

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03	23	17	23	17	insert "increasingly frequent signs of eutrophication like harmful algal blooms or hypoxia/anoxia" after 'watershed discharge' <b>National HAB Committee-Anderson and Glibert</b>
03	23	23	24	3	Additionally, research is needed into options for altering existing sociopolitical and economic institutions and processes that continue to allow, and even foster, persistent overfishing. <b>The Ocean Conservancy-Heinemann</b>
03	23	23	24	3	Increased value would be received if this research explores what is used to include more interpretive methods together with survey and other quantifiable data for investigating the “how” and “why” questions of human behavior on ocean resources use. <b>Wilson, SeaTrust Institute</b>
03	23	27	24	3	An additional means of creating a “better-engaged public” would be to engage the public in understanding the link between ecosystems and their own well-being. In particular, beyond the typical focus on the value of or impacts to provisioning services (also known as “goods”), it is particularly important to draw attention to / increase our understanding of how socio-economic factors impact regulating, cultural, and supporting services (as described in the Millennium Ecosystem Assessment). <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
03	24				<b>“Enhanced information technology and data support infrastructure is essential.”</b> There is a substantial need for investment in large scale data handling, accessibility, and storage. This overarching need should be a priority in the implementation strategy. <b>Bailenson, Florida Department of Environmental Protection</b>
03	24	5	24	20	Research priority 4, page 24, “Applying advanced technologies to enhance the benefits of various natural resources from the open ocean, coasts, and Great Lakes,” represents one way we, as a nation, can protect our trustee resources. ABC agrees that one such technology must be the development of bycatch reduction technologies for fisheries and protected resources. We would extend that to implementation as well as development. <b>American Bird Conservancy-Fenwick</b>
03	24	13			Add: “understanding the input, storage (sequestration) and transfer of various elements within the

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					ocean, including carbon, nitrogen, and phosphorus, and how these are linked to ocean, land and atmosphere processes; ” . <b>Muller-Karger, University of South Florida</b>
03	24	17	25	12	Mapping US EEZ is stated as a requirement, yet mapping capability is not sufficiently addressed; methodologies and research leadership should not be left to market or political forces, as there are significant differences in accuracy, resolution, and metadata from various approaches possible using both commercially-available and other equipment, and the viability of data acquired may suffer without federal leadership integral to international standardization development. <b>Noll, NOAA Ship Rainier</b>
03	24	17			On line 17, change “...fisheries and protected resources...” to read “fisheries, pelagic birds, and protected resources...” <b>Moriarty, USFWS</b>
03	24	20			CORE would also recommend adding the following new bullets: <ul style="list-style-type: none"> <li>• improve information on fish stock status and health, socioeconomic impacts of management measures, sustainability of fishing practices, identify essential fish habitats and important habitats in such a way as to define optimum-sized areas to protect vulnerable life-history stages of commercially and recreationally important species;</li> <li>• acquire data on all bycatch of species captured by commercial and recreational fisheries, assess the broad ecosystem impacts of bycatch, and conduct research into technology and conservation engineering systems that will help reduce the impacts of fishing on ecosystems, reduce bycatch in fisheries, and interaction with endangered species;</li> <li>• conduct research, monitoring, and assessments to better understand the basic biology, physiology, life history, and population dynamics of marine mammals, sea turtles, and other endangered or vulnerable marine species and improve our response to and understanding of the causes of strandings and unusual mortality events of marine mammals and sea turtles to better understand how disease, contaminants, harmful algal blooms, ocean acoustics and noise, human activities and other stressors impact these animals; and</li> </ul>

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					<ul style="list-style-type: none"> <li>understand the impact of aquaculture on natural ecosystems, including the release of genetically-modified organisms into the ocean as well as the impacts of fish hatcheries in modifying the genetic diversity of natural populations</li> </ul> <b>CORE-West</b>
03	24	28	24	28	after "(e.g., biomass" insert ", toxins"  <b>National HAB Committee-Anderson and Glibert</b>
03	25	3			Add paragraph: "The extensive infrastructure and human capacity that exists across the country within academic research and commercial institutions can effectively support national research requirements relevant to the government's mission. This infrastructure and capacity need to be better coordinated and nurtured, as some of it is in danger of collapse. Neglect of this infrastructure will continue to erode the capacity of the U.S. to remain in an international position of scientific leadership. Developing a new paradigm of coordinating these resources to advance the nation's research priorities is an important challenge." . <b>Muller-Karger, University of South Florida</b>
03	25	4	25	12	Need to discuss importance of IOOS. <b>Raytheon-Moran</b>
03	25	4		10	emphasizes need to enhance information technology and data support infrastructure. Agree, but need to recognize many valuable data that are not integrated into useable databases. <b>Pacific Seabird Group-O'Reilly</b>
03	25	08		12	In order to understand the interactions between the physical environment, ecosystems and human activities, dynamic models will need to be developed to augment the static views generated from geographic information systems (GIS) and network models. <b>Dow, NMFS/NEFSC</b>
03	25	12			Append: "It will be critical to establish more effective linkages between existing national, regional, and global databases, and ensure the efficiency of systems such as the National Oceanographic Data Center to entrain the nation's observations. The ultimate objective of enhanced information systems needs to be the development of knowledge to support management decisions and policy." .

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					<b>Muller-Karger, University of South Florida</b>
03	25	13	25	14	Insert new paragraph between lines 13 and 14: “Innovative approaches to predict and manage critical resource issues to ensure adequate agency response and action is a priority. The Department of the Interior Offshore Alternative Energy Roundtable is one example of multiple agencies collaborating to develop the necessary regulations, implement research priorities, and provide relevant information to decision-makers. This approach can be modeled for other similar priority marine issues.” <b>Moriarty, USFWS</b>
03	25	14		17	also notes emphasis on GIS, modeling, databases. And, esp, investment in training and maintaining this workforce. Agree this is important to long-term maintenance, success. <b>Pacific Seabird Group-O’Reilly</b>
04	0				This section properly seeks to produce an integrated approach to improving hazard mitigation and assessment of hazard potential. <b>American Shore and Beach Preservation Association-Ordal.</b>
04	0				The plan focuses heavily on forecasting hazards and less on research needed to mitigate hazards. Although long-term changes such as sea-level rise are occasionally mentioned, the emphasis is on being able to predict storms, extreme events, and changes in regimes such as El Niño. Forecasting these events is very useful, but the growing hazards posed by secular changes (e.g. climate change or over development) should also be considered. As the report nicely explains, the economic value of forecasting regime changes and the ability to predict or forewarn extreme events is critical to marine operations and for preventing the loss of human life. However, over the long term forecasts alone will not prevent economic loss or habitat destruction. ERF suggests that more emphasis should be placed on research to: (1) understand (so we can eventually modify) the social and economic drivers of land use in the coastal zone and (2) evaluate the short and long-term successes and failures of [protection systems] that might minimize the adverse affect of storm surges and waves. Such research should explicitly include long-term strategies to deal with potentially large dislocations of people due to rising sea level and to enhance the protective role of wetlands and reefs. Research is also needed to evaluate the advantages and disadvantages of engineered systems (such as hurricane barriers and levees). Page 28 (lines 7-8) mentions the fact that hazards can impact coastal features

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					such as wetlands and shorelines with cascading impacts but does not acknowledge that these features can also amplify or mitigate hazards. <b>Estuarine Research Foundation-Boesch</b>
04	26		30		<b><u>The section “Increasing Resilience to Natural Hazards” (p.26) should include ecologically-produced hazards, OR clearly state that its focus is on physical hazards only.</u></b> For example, algal blooms, water-borne pathogens, and invasive species all pose potential natural hazards to humans and can have well-defined peak events. If it is the intention of the JSOST to separate physical and biological hazards by placing the latter in Theme 6, this is fine, but the term “physical hazards” should be used in Theme 2. Also, a clear statement that biological threat events constitute “natural hazards” should be added. In this way, the investigation and mitigation of such events can be included under the umbrella of “natural hazard resilience”. <b>Harbor Branch Oceanographic Institution-Frey</b>
04	26		30		<b><u>The section "Increasing Resilience to Natural Hazards" (p.26) should include an examination of the role natural processes play in enhancing resilience.</u></b> Examples: <ul style="list-style-type: none"> <li>a. Coastal wetlands store and filter stormwater runoff - improving downstream water quality and reducing local flooding - and mitigate the effects of storm surge by acting as physical barriers.</li> <li>b. Loss of wetlands and dunes to development and subsidence resulting from interruption of natural, seasonal, river basin flood-plain inundation and alluvial sediment deposition cycles, may reduce coastal resilience to storm events.</li> <li>c. Carbonate barrier reef systems (such as coral reefs in Florida) are important coastal storm buffers, and also produce sands that renourish the beaches they protect. Loss of these reefs - due to eutrophication, ocean acidification, and physical destruction (groundings, overuse, anchor damage, etc.) - may also reduce coastal resilience to natural hazards.</li> </ul> <b>Harbor Branch Oceanographic Institution-Frey</b>
04	26				Comment refers to Chapter “Increasing Resilience to Natural Disasters”, but may well be applicable to several other areas of the document: Experience with the responses to hurricanes has taught

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					valuable lessons regarding the importance of having cooperative working relationships and coordination with many other stakeholder and regulatory groups. NOAA can only optimize success of their missions when these other groups are effectively engaged and working with NOAA-and NOAA with them. NOAA may want to list a line item to broadly address the importance and need to identify other stakeholders and build the necessary working relationships with them to be better prepared to address response activities that will have to be handled in a joint and hopefully unified manner. This sounds straight forward, but often is not when some agencies with important roles become involved and have not been routine members of the response culture and community. <b>Benggio, NOAA</b>
04	26		30		Enhancing our scientific understanding of ecosystem restoration should also be a priority. As more and more environments are impacted by human activities, restoring the natural functioning to degraded ecosystems, such as many of the nation’s estuaries, wetlands and nearshore environments must be a research priority. Poorly conducted restoration efforts fail to produce needed ecosystem services and waste valuable monetary and labor resources. It is critical that we strive to enhance our understanding of how to successfully restore ecosystem functioning to degraded systems through careful experimentation and monitoring of ongoing restoration efforts. New ecological models are also necessary to predict the long-term trajectory of different restoration pathways. It is also critical to understand exactly what and how much can be restored, as restoration is unlikely to simply reverse the track of degradation. For example, what level of exploited stock abundance can we expect to restore? <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
04	26		30		This section, which currently has a strong emphasis on forecasting, should more clearly address the need to approach human development in a manner that increases hazard resistance and reduces the potential impacts to ecosystems and human infrastructure from natural disasters. While the third research priority in this theme (page 28), mentions the development of “more effective and affordable systems, materials, and technologies for hazard-resilient and resistant communities”, it focus on building structures and ignores the need for development approaches that will also minimize ecosystem damage in the face of natural disasters. An example of an approach that will protect both

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					human structural development and ecosystems is maintaining and re-establishing natural wetland buffers. Such buffers not only have value in terms of reducing hazard impacts, but also function to protect the ocean ecosystem from human impacts by acting (to some extent) as natural filters. Another example is focusing development pressure away from hazardous coastlines; thus, protecting human structures and allowing natural ecosystem processes to occur. <b>American Bird Conservancy-Fenwick</b>
04	26				The section beginning on this page deals with increasing resilience to natural hazards. Clearly we need to devote substantial effort to this task; however, the most important thing we can do in the short-term is to protect, preserve and restore the existing natural buffer systems like dunes, barrier islands, wetlands and coral reefs. Smart growth is a part of this process, but it must also include study and analysis to determine areas where we might relocate people and structures from the hazard zones. <b>Moriarty, USFWS</b>
04	26		30		CORE generally supports the provisions as drafted but believes the research needs, identified in the Planning Document, are more focused and appropriate to make significant progress in mitigating the impact of natural hazards; whereas the narrative in the ORPP provides supporting language or the rationale for the research needs that were articulated in the Planning Document. CORE strongly supports activities that will significantly improve the quality and timeliness of weather-related warnings, increasing the lead time for protective measures and evacuations. CORE believes that the nation, as a matter of urgency, needs the full development and implementation of the Integrated Ocean Observing System (IOOS). IOOS would improve weather-related warnings and provide additional predictive capabilities for floods, coastal erosion, hurricanes, tsunamis, and for chemical and biological hazards, such as sudden pollutant loadings, harmful algal blooms, and pathogens. CORE also believes that it is important to understand (so we can eventually modify) the social and economic drivers of land use in the coastal zone and evaluate the short and long-term successes and failures of protection systems used to minimize the adverse affect of storm surges and waves. It is also vitality important that research begin to investigate and develop strategies to deal with potentially large dislocations of people due to rising sea level and to enhance the protective role of wetlands and reefs. Finally, the ORPP should encourage research that will evaluate the advantages and

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					disadvantages of engineered systems (such as hurricane barriers and levees) to society and to the coastal and marine ecosystem. <b>CORE-West</b>
04	26		30		<p><b>Theme 2: Increasing Resilience to Natural Hazards</b></p> <ul style="list-style-type: none"> <li>▪ Understand hazard events and apply to forecasts</li> <li>▪ Understand system response to natural hazards and assess vulnerability</li> <li>▪ Develop multi-risk assessments, models, policies, and strategies for hazard mitigation</li> </ul> <p>Storm events, coastal erosion, and natural hazards – such as floods, earthquakes, and tsunamis – have the most impact on coastal communities and city/county/borough governments. The implementation of this theme will have to incorporate a very strong commitment to partner with state coastal zone management programs, local governments, and affected communities if any progress will be made. Forecasting, understanding vulnerability, and how systems respond to hazards is just the very first piece of information that communities will need to prepare for hazards and to mount appropriate emergency responses. Beyond the risk assessments, the models and the proposed strategies is where the real work needs to get done. Homes and whole towns need to be moved to higher ground, alternatives to shoreline armoring and other alternative techniques need to be tested and funded on a massive scale, and federal agencies need to work with insurance companies and local governments to provide incentives for appropriate, long-term coastal development.</p> <p><b>State of Alaska-Murkowski</b></p>
04	26	1	30	3	<p><b>Suggestion:</b> Include harmful algal blooms (HABs) as an example of a hazard addressed by the “Increasing Resilience to Natural Hazards” theme.</p> <p><b>Rationale:</b> By confining discussion of HABs to the “Enhancing Human Health” theme, “Charting the Course” ignores profound sociocultural and economic impacts of this coastal hazard. In the past, NOAA has recognized HABs as natural hazards, akin to hurricanes, tsunamis, etc. The sociocultural impacts of HABs remain undocumented, although not unobserved. Studies are needed to determine the extent to which HABs and management responses (such as fisheries closures) directly or</p>

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					<p>indirectly result in family disruption, community conflict, disruption to or shifts in livelihoods, threats to subsistence, increased reliance on social services, degradation of cultural practices and values, loss of recreational opportunities, and other sociocultural impacts. It is important to understand these impacts so that appropriate mitigation strategies can be planned, funded, and implemented. <i>Harmful Algal Research and Response: A Human Dimensions Strategy</i>, a 2006 report published by the National Office for Marine Biotoxins and Harmful Algal Blooms (HARR-HD), provides general research priorities, specific research objectives, and example projects to understand and reduce sociocultural and economic impacts of harmful algal blooms.</p> <p>(HARR-HD: <a href="http://www.nccos.noaa.gov/stressors/extremeevents/hab/HDstrategy.pdf">http://www.nccos.noaa.gov/stressors/extremeevents/hab/HDstrategy.pdf</a>)  <b>National HAB Committee-Anderson and Glibert</b></p>
04	26	1	30	3	<p><b>Suggested Research Priority for “Increasing Resilience to Natural Hazards:”</b> Apply understanding of human perceptions to develop hazard products and communications that promote risk-wise behavior.</p> <p><b>Rationale:</b> The National Science and Technology Council report, <i>Grand Challenges for Disaster Reduction</i>, puts forth “promoting risk-wise behavior” as a priority for sustained Federal investment in science and technology to improve America’s capacity to prevent and recover from disasters. Individual behaviors and social practices are “risk-wise” so long as they reduce vulnerability and promote resilience to hazards. For example, risk-wise behaviors in relation to harmful algal blooms include participating in volunteer phytoplankton monitoring efforts, complying with beach closures, and heeding fish consumption advisories. As <i>Grand Challenges</i> explains, “to be effective, hazard information (e.g., forecasts and warnings) must be communicated to a population that understands and trusts the messages. The at-risk population must then respond appropriately to the information” to avoid and respond to undesirable environmental, sociocultural, and economic consequences. The report concludes that “this is a challenge that can only be met by effectively leveraging the findings from social science research” (NSTC 2005, 11).</p>

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					<p>Risk communication is an area of social science that is especially critical to develop effective hazard products. Risk communication specialists can help natural resource scientists and managers identify, understand, and collaborate with user groups (i.e., diverse audiences receiving hazard messages) to develop, test, operationalize, and evaluate products aiming to (1) ensure that various user groups understand the messages they receive, (2) persuade users to change their attitudes or behavior as appropriate to reduce risk and recover from impacts, (3) create the conditions for effective stakeholder participation in planning and decision making, and (4) achieve other goals of risk management agencies, other decision makers, and interested and affected parties (Ortwin Renn, 1998, <i>The Role of Risk Communication and Public Dialogue for Improving Risk Management, Risk Decision and Policy</i> 3 (1), 5-30).</p> <p><i>Harmful Algal Research and Response: A Human Dimensions Strategy</i>, a 2006 report published by the National Office for Marine Biotoxins and Harmful Algal Blooms (HARR-HD), provides general research priorities, specific research objectives, and example projects to apply understanding of human perceptions to promote risk-wise behavior in relation to harmful algal blooms.</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	26	1	30	3	<p><b>Suggested Research Priority for “Increasing Resilience to Natural Hazards:”</b> Apply understanding of institutions to develop and implement effective strategies for hazard preparedness, response, and recovery.</p> <p><b>Rationale:</b> From an institutional perspective, resilience is an endeavor in designing, managing, and maintaining networks of organizations (public, private, and non-profit) coordinated by formal and informal rules (e.g., laws and behavioral norms) that minimize transaction costs and promote desirable outcomes including a reasonable balance of societal objectives and other desirable outcomes such as efficiency, public accountability, and equity. The social scientific field of Institutional Analysis focuses on the role that the design of inter-organizational networks play in resource management, including mechanisms for stakeholder participation, strategies for handling scientific</p>

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					<p>uncertainty in decision making, conflict resolution measures, and translation of scientific information into policy change. For example, Leschine et al. (in prep, check accuracy, need ref) applied an Institutional Analysis framework to analyze Washington State’s management of recreational shellfish harvests utilizing scientific information related to domoic acid contamination. Research priorities and objectives for Institutional Analysis in the context of harmful algal bloom preparedness and response are put forth by <i>Harmful Algal Research and Response: A Human Dimensions Strategy</i>, a 2006 report published by the National Office for Marine Biotoxins and Harmful Algal Blooms (HARR-HD).</p> <p>(HARR-HD: <a href="http://www.nccos.noaa.gov/stressors/extremeevents/hab/HDstrategy.pdf">http://www.nccos.noaa.gov/stressors/extremeevents/hab/HDstrategy.pdf</a>)</p> <p>The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (<i>Protecting the Oceans from Land-Based Activities</i>, 2001, 97) recognizes that “Institutional Analysis provides a systematic way of obtaining an understanding of the nature, strengths and weaknesses of institutions within the context in which they are operating or which it is proposed they may operate in the future. It is, therefore, a key element in moving away from sectoral-based management of natural resources to an holistic approach that is likely to require modifications in the roles of different institutions.” In addition, the Subcommittee on Integrated Management of Ocean Resources recognizes the importance of institutional understanding by identifying several institutional research objectives as priority focal areas, including (1) “identify[ing] opportunities for improvements in the application of science in collaborative efforts;” (2) “analyz[ing] ways to improve efficiency and effectiveness of interagency ocean, coastal, and Great Lakes resource management activities;” and (3) “identify[ing] next steps to enhance interagency coordination on use and conservation of marine resources (e.g. energy, fisheries, recreation, and transportation)” (Priorities for the SIMOR, 2006, <a href="http://ocean.ceq.gov/about/docs/SIMOR_Priorities_050505.pdf">http://ocean.ceq.gov/about/docs/SIMOR_Priorities_050505.pdf</a>).</p> <p><i>Harmful Algal Research and Response: A Human Dimensions Strategy</i>, a 2006 report published by the National Office for Marine Biotoxins and Harmful Algal Blooms (HARR-HD), provides general research priorities, specific research objectives, and example projects to apply understanding of human institutions to increase resilience to harmful algal blooms.</p>

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					<b>National HAB Committee-Anderson and Glibert</b>
04	26	3	26	3	Altering the Natural Hazards section to include HABs after "tsunamis", insert "and to a lesser degree, ocean basin algal toxicity events, animal intoxications and mortalities" <b>National HAB Committee-Anderson and Glibert</b>
04	26	19	26	24	HABs should be added to the list of natural hazards. <b>National HAB Committee-Anderson and Glibert</b>
04	26	21			Add: "sea level rise" . <b>Muller-Karger, University of South Florida</b>
04	26	22	26	22	delete "and" <b>National HAB Committee-Anderson and Glibert</b>
04	26	24	26	24	insert 'and' after "tsunamis" <b>National HAB Committee-Anderson and Glibert</b>
04	26	25			Insert new bullet: "Harmful algal blooms" . <b>Muller-Karger, University of South Florida</b>
04	26	25	26	25	following bullet insert "basin-wide algal toxicity events threatening regional fisheries, shellfisheries, mammals, and coastal health and economics." <b>National HAB Committee-Anderson and Glibert</b>
04	26	25	26	27	<b>Suggested Modification to the "Rationale" section:</b> Clarify the notion of "human impacts" of hazards by providing examples of sociocultural impacts, e.g., family disruption, community conflict, disruption to or shifts in livelihoods, threats to subsistence, illness and death, increased reliance on social services, degradation of cultural practices and values, and loss of recreational opportunities. The existing text treats "human impacts" narrowly in terms of economic "costs," effectively obscuring these aspects of human well-being and the need to understand them in order to promote resilience. <b>National HAB Committee-Anderson and Glibert</b>

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04	26	30			increasing resilience to natural hazards: might address impact of human re-locations or locations on other wildlife. Emphasis here, again, is on reducing impacts to humans. Should also more completely address changes from human activities that increase damage vulnerability. <b>Pacific Seabird Group-O'Reilly</b>
04	27	1	27	3	A sound scientific and technical basis must also include identifying a range of policy responses or management measures that ameliorate the adverse effects of natural hazards and characterizing the costs of such responses or measures. <b>National HAB Committee-Anderson and Glibert</b>
04	27	6	27	19	Our entire attitude toward natural hazards, from assessments through prediction and response, have been dominated by national and local politics (think "Katrina", but if you look elsewhere you'll find similar patterns e.g. attempts by wealthy developers to grab lands inundated by the Indonesian tsunami). Depending on how constrained you feel to be politically correct, you might add a sentence noting that the entire hazards issue needs to be isolated as much as possible from political influence. Otherwise, science or technology will always be hamstrung to some degree in its usefulness. <b>Muench, ESR</b>
04	27	10			Insert: "Such assessments must also consider whether natural hazards are aggravated by human activities and their impacts on the land, the atmosphere, and the ocean." . <b>Muller-Karger, University of South Florida</b>
04	27	14	27	14	What is meant by the use of the term "broadest consideration" in this context? <b>National HAB Committee-Anderson and Glibert</b>
04	27	15	27	19	The public and policymakers must also be educated on the costs of decisions and responses. It is the combined costs of the damages due to natural hazards and the costs of responding to those damages that must be minimized. <b>National HAB Committee-Anderson and Glibert</b>
04	27	17			Insert: "Similarly, it is important to consider a range of options to mitigate the problem, if these hazards are accentuated by our activities." . <b>Muller-Karger, University of South Florida</b>
04	27	24			Insert after "flooding": "Harmful Algal Blooms, Clathrate outgassing".

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					<b>Muller-Karger, University of South Florida</b>
04	27	24	27	24	after "tsunami, flooding", insert ", algal blooms" <b>National HAB Committee-Anderson and Glibert</b>
04	27	27	29	22	Bathymetric modeling integrated to GIS decision tools is a foundation requirement to hazard assessment, and yet does not exist in the great majority of locations around the US at sufficient resolution to understand tsunami, storm surge, or other natural hazards because a majority of the underlying bathymetry is based on leadline measurements. <b>Noll, NOAA Ship Rainier</b>
04	28	1			Insert/append: "Coastal communities that are affected by Harmful Algal Blooms (HAB) need to understand the factors that lead to these recurrent and costly phenomena, as they affect aquaculture, fish resources, tourism and the health of coastal residents. The proper observation tools (in situ and remote sensing) and models are needed to help understand the movement and dispersal of the toxic blooms. These models will also be extremely valuable in understanding impacts on the habitat and other living marine resources in the affected regions." . <b>Muller-Karger, University of South Florida</b>
04	28	1	28	1	after "vulnerability." add "Forecasts of harmful algal bloom development, advection, and landfall should expand in “at-risk” areas, e.g., New England, Gulf of Mexico, and the Pacific NW." <b>National HAB Committee-Anderson and Glibert</b>
04	28	3	28	17	<b>Suggested Modification to Research Priority to “Understand the response of coastal and marine systems to natural hazards ... “:</b> Emphasize the need for <i>comprehensive</i> understanding of the response of coastal and marine systems to natural hazards (including harmful algal blooms) – i.e., understanding of societal response and adaptation in addition to infrastructure and landscape/coastal features. The need to account for the “full range of costs of coastal hazards” is explained in <i>The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation</i> , Heinz Center, 2000.  <b>Rationale:</b> Information on environmental impacts, while necessary, is not sufficient to support disaster resilience. In addition to environmental responses, coastal hazards can impact the built

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					<p>environment, business communities, and sociocultural dimensions, including public health and safety. Comprehensive assessment of the environmental and human responses of coastal hazards promotes “wise investment of limited mitigation dollars” (Heinz Center 2000, 99) to develop effective hazard mitigation strategies. “Ideally, everything that matters to society with respect to coastal hazards would be measured” when assessing impacts and these assessments “would serve as the basis for actions to reduce societal and environmental risk and vulnerability.” To the extent that assessments of impacts do not incorporate the full range of valued environmental, sociocultural, and economic attributes, “decision making in advance of future events could be less than optimal” (Heinz Center 2000, 105).</p> <p><i>Harmful Algal Research and Response: A Human Dimensions Strategy</i>, a 2006 report published by the National Office for Marine Biotoxins and Harmful Algal Blooms (HARR-HD), provides general research priorities, specific research objectives, and example projects to apply understanding of sociocultural and economic impacts to increase resilience to harmful algal blooms.</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	28	3	29	3	<p>It is critical that we increase our understanding of the resilience of <i>both</i> natural and social systems to “hazards” or perturbations, as it is often the feedbacks between these systems that lead to increased vulnerability. In addition to the listed research priorities, we need a better understanding of features that enhance resilience and develop better indicators for those features.</p> <p><b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b></p>
04	28	7	28	7	<p>add "and human illness" after "flooding"</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	28	16	28	16	<p>add "public health," after "coastal communities"</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	28	20	28	24	<p>Research efforts focused on ecosystem functions and infrastructure components should incorporate the efficacy of shore protection measures, including beach nourishment.</p> <p><b>American Shore and Beach Preservation Association-Ordal</b></p>

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04	28	23	28	24	<p>“Efficacy” with respect to what?</p> <p><b>National HAB Committee-Anderson and Glibert</b>  Contact information: Biology Department, MS #32, WHOI, Woods Hole, MA 02543, 508-289-2351, <a href="mailto:danderson@whoi.edu">danderson@whoi.edu</a>; <a href="mailto:glibert@hpl.umces.edu">glibert@hpl.umces.edu</a></p>
04	28	27	28	27	<p>insert "public health and safety, " after "coastal communities,"</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	28	28	28	30	<p>“Help guide the creation” sounds a little loose and vague. Maybe “optimize” would be better.</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	29		30		<p>We support the development of an “all hazards” geographic information system. One of the difficulties in translating new models and research into useful products is that managers use different information technologies than researchers. This translation is not always a simple problem.</p> <p><b>NFRA-Quintrell</b></p>
04	29	2	29	2	<p>It would help to be more specific about what is specifically being referred to with regard to “long – term and short-term public and policy response.”</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	29	9			<p>Insert: "Human land use and development patterns sometimes have poorly-understood feedbacks that increase the risk of larger impacts due to natural hazards." .</p> <p><b>Muller-Karger, University of South Florida</b></p>
04	29	11			<p>Insert sentence: "For example, satellite-based remote sensing with advanced technologies such as Fluorescence Line Height observations is required in coastal zones affected by Harmful Algal Blooms to enable discrimination between river plumes and the blooms. Appropriate tide gauge and meteorological networks in areas like the Caribbean Sea have to be linked and maintained to ensure proper alerts of phenomena like tsunamis and hurricanes."</p> <p><b>Muller-Karger, University of South Florida</b></p>
04	29	15	29	15	<p>change the line to read, "inundation, water quality, and toxicity. These deployments"</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
04	29	18	29	18	<p>insert "(or bloom)" after "and pre-storm"</p>

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					<b>National HAB Committee-Anderson and Glibert</b>
04	29	26			Replace "earth" with "land". <b>Muller-Karger, University of South Florida</b>
04	30	2	30	2	insert "for detecting and modeling" after "of tools" <b>National HAB Committee-Anderson and Glibert</b>
05	0				Marine operations, including shipping, fishing, recreation and energy and mineral extraction activities, are particularly concentrated in the land-ocean transition zone and demand concerted attention from the perspectives of both human safety and environmental health. Marine operations must also be considered in ecosystem-based management. In that regard ERF notes the many challenges related to our ports (navigation channels, ballast water and invasive species, dredged material placement, shoreline development, and safe operations) that merit further research. Also, marine operations constitute an important client for the integrated observing systems discussed elsewhere in the plan. We also note that the final two research priorities under this theme are close enough to combine them as one. <b>Estuarine Research Foundation-Boesch</b>
05	31		35		While the first two research priorities in this section touch on the need to develop marine operations in such a way that minimizes ecosystem impacts, the emphasis is placed on the need to avoid interruptions in marine operations. More emphasis needs to be placed on generating the necessary data to fully understand the impacts of marine operations on the ecosystem. For example, stronger observer programs and more research are needed to understand how fisheries impact seabirds and to develop and implement proper mitigation procedures. Also, with the proposed development of alternative energy sources in the ocean environment, more information is needed regarding the potential impacts of this development on the marine environment. We agree that the proper assessment of these impacts and the minimization of such impacts require improved collaboration among diverse stakeholders. <b>American Bird Conservancy-Fenwick</b>
05	31		35		<b>Theme 3: Enabling Marine Operations</b> <ul style="list-style-type: none"> <li>▪ Understand interactions between marine operations and environment</li> </ul>

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					<ul style="list-style-type: none"> <li>▪ Characterize and predict conditions for marine operations</li> <li>▪ Develop tools and information for safe and secure marine operations</li> <li>▪ Enhance the marine transportation system</li> </ul> <p>Approximately 3,000 ships each year traverse the Great Circle Route, which is the shortest shipping route from the U.S. West Coast ports to eastern Asia. Many of these vessels pass through the Aleutian Islands, and because of this passage there is an inherent risk to the environment due to potential accidents. One recent event was the <i>Selendang Ayu</i>, a soybean freighter which lost steering power near Unalaska Island and went aground, spilling fuel oil and soybeans on the shores of the Aleutian Islands. The U.S. Coast Guard (USCG) and the State of Alaska want to complete an Aleutian Islands Shipping Risk Assessment, and the Alaska Legislature has designated funds for this purpose. The Alaska Marine Ecosystem Forum, which includes many of the federal agencies on JSOST, has cited the shipping risk assessment as a collective priority, but no single federal agency has secured funds to go forward with the risk assessment. The responsibility of obtaining federal funding for the Aleutian Islands Risk Assessment should not fall entirely to the USCG, but also to Department of Interior and NOAA, since those agencies are partly responsible for the natural resources that could be impacted by a future spill. Show that “safe and secure marine operations” is truly a national priority by funding the Aleutian Islands Shipping Risk Assessment through multiple federal agencies, thereby vesting each agency in the process and outcome of the assessment.</p> <p><b>State of Alaska-Murkowski</b></p>
05	31	5			<p>Append: ", other forms of communication such as airborne transportation and submarine cables, and activities such as fishing, aquaculture, mining and beach renourishment, and other forms of management of coastal, estuarine and marine areas." .</p> <p><b>Muller-Karger, University of South Florida</b></p>
05	31	21			<p>Should include text about the importance of research focused on enabling a multimodal transportation system in key regions around the country, better linking maritime with land and airborne transportation systems. .</p> <p><b>Muller-Karger, University of South Florida</b></p>

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05	31	28	31	28	Who has decreed that shipping through an ice-free Arctic is a U.S. responsibility? We are surely players in a vast international effort to monitor this situation and contribute to the necessary environmental and engineering knowledge, but we may not even be major players in this given the more obvious Canadian and Siberian interests. Our research resources remain severely limited (NSF proposal funding success for ocean sciences hovers someplace around 10-15%!!), and we can't do everything. <b>Muench, ESR</b>
05	31	35			35 'Enabling Marine Operations' -Does not seem to address unsafe operations and the impacts from foreign registered vessels. (No mention of "great circle" routes through Alaska's waters). Mentions need for 'balancing sustainable use and protection of the environment'. <b>Pacific Seabird Group-O'Reilly</b>
05	32	5	32	5	insert 'including biological invasions,' after "ecosystem health, " <b>National HAB Committee-Anderson and Glibert</b>
05	32	17	34	13	Again, the ORPP now contains a few, very broad categories of research priorities with a seeming subset of research needs are that are less clearly articulated in the narrative but are more appropriately captured as bullets in the Planning Document. CORE recommends that the JSOST merge the appropriate (those priorities that have been supported by the agencies and community through this process) bulleted research needs identified in the Planning Document with those in the ORPP, highlight those research priorities in a bulleted format, and support those bullets with a rationale taken from the narrative in the ORPP. <b>CORE-West</b>
05	32	20			agree that need to "increase understanding of environmental impacts and conditions affecting marine transportation" is necessary. <u>But also</u> , need to understand and protect environment from the anticipated increase in marine transportation. <b>Pacific Seabird Group-O'Reilly</b>
05	32	27		28	notes need to improve communication & collaboration among stakeholders; foreign business/shipping interests not included in the list (of industry, local, state, federal government, and researchers). If 'industry' includes foreign-based ships, state this clearly.

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					<b>Pacific Seabird Group-O'Reilly</b>
05s	32	28			Add tribal governments to list of stakeholders involved in marine operations. "industry, local, state, tribal, and federal government, and researchers." Again, in Washington State, tribal communities rely on marine operations and oversee marine facilities. These governments should be recognized as key stakeholders in safe marine operations. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
05	32	30	33	15	Environmental interactions lead this section, a puzzling research priority given the requirement to map and chart the coastal ocean to facilitate the efficient movement of marine commerce otherwise described in this chapter. Research should focus not on the effects of marine commerce on the environment, but on how to make this marine commerce safer through fundamental measurements that meet international standards for data exchange, and simplify the visualization and decision process that mariners must achieve to maximize safety. Moving the research "upstream" in this way will create more opportunities for improved operations for a given amount of research effort. <b>Noll, NOAA Ship Rainier</b>
05	33	4	33	7	We already have a huge store of knowledge on this subject, and the problem has been enforcement as much as insufficient knowledge. Why not comment here on the issue? <b>Muench, ESR</b>
05	33	25	33	25	insert "meteorological and biophysical" after "real-time" <b>National HAB Committee-Anderson and Glibert</b>
05	33	29			Add to first sentence after "marine operations": "and effective and secure linkages to other modes of transportation and communication". <b>Muller-Karger, University of South Florida</b>
05	34		35		The development of a national database mentioned in this section seems to contradict the efforts of the IOOS and OOI. Both of these programs are investing in the development of a distributed data base system that builds on recent IT developments to achieve the same purpose. Currently, they are working on the standards and protocols required to do this. Large, centralized data systems have proven impractical. Distributed systems achieve the same result in a more flexible manner. <b>NFRA-Quintrell</b>

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05	34	4			Insert: "An important priority to enable research, management and other forms of operations is effective, high-speed linkages to and from the Internet from research vessels and other coastal and ocean research platforms such as buoys and unmanned vehicles." . <b>Muller-Karger, University of South Florida</b>
05	34	7			Add after "system": "and ensure effective multimodal transportation and global communications." . <b>Muller-Karger, University of South Florida</b>
05	34	12	34	12	insert "while not increasing invasions or environmental catastrophes (e.g., oil spills)" after "vessels)" <b>National HAB Committee-Anderson and Glibert</b>
05	34	16	35	5	CORE concurs with the recommendations and furthermore, suggests that JSOST include the following: <ul style="list-style-type: none"> <li>• Expand the national complement of oceanographic research vessels, satellites, autonomous underwater vehicles and unmanned aerial vehicles</li> <li>• Long-term observing systems that are transportable and easily relocated; that collect data anywhere on the globe as needed.</li> </ul> <p>Finally, within the marine operation section, JSOST should provide a specific section on the infrastructure needs for marine research. The future success of ocean and coastal research, management, enforcement, and observations in the United States will depend on the availability of modern ships, undersea vehicles, aircraft, satellites, laboratories, and observing systems, as well as the continuous development and integration of new technologies into these facilities. The nation needs a renewed commitment, a clear national strategy, and significant interagency coordination to plan for the acquisition, maintenance, and operation of our ocean infrastructure and technology. The IOOS, along with traditional expedition-based research, requires the support of a modern and capable research fleet. Currently, operating research vessels will be obsolete in less than 10 years, which leaves little time for planning, funding and building the next generation of research vessels. CORE recommends that the ORPP include in this section the following bullets:</p> <ul style="list-style-type: none"> <li>• a dedicated funding stream for critical ocean science infrastructure and technology needs</li> </ul>

CHAPTER	FROM PAGE	FROM LINE	TO PAGE	TO LINE	COMMENT
					<p>related to ocean and coastal research, conservation, management, operations, and enforcement—specifically the creation of a modernization fund in the NOAA, NSF, and DOD budgets that will support renewal of the University National Oceanographic Laboratory System (UNOLS), NOAA fleets, the international ocean drilling ship, and new manned and unmanned submergence vehicles;</p> <ul style="list-style-type: none"> <li>• a national ocean and coastal infrastructure and technology strategy that includes an assessment<sup>2</sup> of all U.S. federal, state, academic, and private ocean and coastal infrastructure and technology;</li> <li>• a detailed plan (that would be updated every five years) for funding and implementation to support science, resource management, assessments, enforcement, and education; and specific priorities for acquiring and upgrading ocean and coastal infrastructure, including vessels, facilities, instrumentation, equipment, and identification of emerging technologies that should be incorporated into agency operations</li> </ul> <p><b>CORE-West</b></p>
05	34	17	34	31	<p>This is the section that should lead the chapter. Basic mapping is fundamental to the other research in the coastal ocean. Using industry to perform this function can create proprietary and Homeland Security issues.</p> <p><b>Noll, NOAA Ship Rainier</b></p>
05	34	22			<p>Insert after "...radars);": "advancing high-speed linkages to and from the Internet from research vessels and other coastal and ocean research platforms, including connection from the high seas;" .</p> <p><b>Muller-Karger, University of South Florida</b></p>
05	34	22			<p>Insert: "advancing real-time or delayed information on environmental variables, cargo tracking, or logs on extraction of resources by and from fishing, cargo, and passenger ships, and make use of other ships that provide observation opportunities ("ships of opportunity")"</p>

<sup>2</sup> The assessment should include the location, ownership, availability, remaining service life, and replacement cost for a wide range of ocean infrastructure assets; maintenance and operational costs associated with these assets; associated human resource needs and the outcomes of past federal investments in ocean technology and infrastructure, with recommendations for improvements.

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					<b>Muller-Karger, University of South Florida</b>
05	35	7			(BOX: National and Homeland Security) Insert in second bullet: “including data from a robust, science-quality satellite-based global earth observation system)” . <b>Muller-Karger, University of South Florida</b>
05	35	7			Why if the National and Homeland Security box here? It is not mentioned anywhere in the text. <b>Raytheon-Moran</b>
06	0				This section underscores the need to develop and implement integrated ocean observing systems. Enhanced delivery of reliable information allows coastal officials to develop short and long-term response plans for severe weather and other climate-related issues. <b>American Shore and Beach Preservation Association-Ordal</b>
06	0				ERF strongly supports the research priorities under this theme. Understanding of the role of climate variability has progressed to the point of allowing forecasting in the land-ocean transition and integration into ecosystem-based management. Moreover, understanding climate change, including its consequences and necessary adaptations, is the grand challenge of our scientific generation. Overall, we believe this section captures important priorities well with some exceptions. Research into the controls on oceanic dimethylsulfide (DMS) emission and the role of dust as a control on oceanic productivity and carbon sequestration might also be mentioned. We are pleased to see paleoceanographic approaches mentioned, but for some of these parameters (dust and DMS) ice core data may be more useful and should not be overlooked. Finally, to be effective and efficient research and observations related to climate variability and change must involve other nations and international organizations.  The research priorities extend so far as to understand and project the impact of climate change, but they stop short of applying that knowledge to deal with these impacts. Although mitigation of and adaptation to climate change might be the subjects of other federal planning, how the ocean research plan will interface with these efforts deserves mention here. Such discussion could include mention of renewable energy alternatives involving the coastal ocean such as tidal and wind power, carbon sequestration, and adaptation of coastal land use and management.

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					<b>Estuarine Research Foundation-Boesch</b>
06	36		40		<p>This section leaves out a critical element of our nation’s ocean climate research needs, specifically the development of a mechanistic understanding of the processes (and the interactions between processes) that regulate the mean ocean state and govern its variability. Equally important for climate projections is the translation of that understanding into parameterizations that are appropriate in prognostic climate models. Unlike other ocean applications, where observations can be assimilated directly to ensure that a model’s agrees with the ocean’s state, long term climate projections are not primarily initial value problems. The greatest impacts observations can have on long-term ocean climate simulations are in increasing the physical consistency of the representation of processes in the models, and in the evaluation of the models as a whole. This is particularly critical for long-term climate forecasts, since they depend on projections of how the ocean will act in parts of parameter space that are inherently not observable.</p> <p>This section should include language explicitly calling for a systematic program to translate observationally and theoretically derived understanding of ocean processes into improved parameterizations and representations for use in ocean climate models. Such a high-level mandate is particularly important because it transcends the typical scope of most proposals, and the oceanographic community historically has not been particularly adept at making this happen.</p> <p><b>Hallberg, NOAA/GFDL</b></p>
06	36		38		<p>specifically p38 should include the link between underlying ocean and overlying atmosphere beyond physical parameters to also include exchange of chemical substances (deposition of eg dust, nutrients, Hg, pollutants, etc) (ventilation of eg gases other than CO2 with climatic implications, CCN/aerosols release, O3/UV/Hg in polar regions, etc) between these 2 reservoirs</p> <p><b>Matrai, Bigelow Laboratory for Ocean Sciences</b></p>
06	36		40		<p>The title seems 1-sided. The issue is not only the ocean’s role in climate, but also the role of climate change on the ocean and coasts, and on the people who use/depend on the marine environment.</p> <p><b>AOOS-McCammon.</b></p>
06	36		40		One of the critical research needs related to this topic is the impact of climate change on coastal

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					resources and communities. Bio-physical coupled models are needed to understand and predict how shifts in the ocean may affect fisheries, coastal habitats and other resources. <b>NFRA-Quintrell</b>
06	36		40		This section focuses on the ocean's role in climate as well as the potential impacts of climate change. In discussions of the impacts of climate change, this section largely focuses on physical changes in the ocean environment and impacts to humans, and merely implies potential impacts to other organisms. Understanding the impacts of climate change at all trophic levels is a critical step in addressing and coping with climate change. We encourage research on the impact of climate changes at all levels including how climate change will alter the physical characteristics of various ocean sectors, impacts of oceanographic changes on food chains, and impacts on breeding habitat for marine birds. In addition to developing research to understand the impacts of global climate change, efforts to combat its rapid progression and research to this aim must be a priority. <b>American Bird Conservancy-Fenwick</b>
06	36		40		The activities and programs catalyzed by the Plan need to be closely coordinated with activities under the federal U.S. Climate Change Science Program (CCSP). Moreover, the international CLIVAR (Climate Variability and Predictability) project (itself a part of the World Climate Research Program - WCRP) has a very strong US presence and could serve as a logical research home for the scientific development and coordination of many of the elements of this theme as well as the meridional overturning circulation near-term priority. <b>Legler, US CLIVAR</b>
06	36		40		<b>Theme 4: The Ocean's Role in Climate</b> <ul style="list-style-type: none"> <li>▪ Understand the ocean-climate interactions across regions</li> <li>▪ Understand impact of climate variability</li> <li>▪ Project future climate changes and their impacts</li> </ul> <p>The Bering and Chukchi ecosystems are experiencing ecological shifts that are probably due to climate change. Arctic and sub-arctic ecosystems are experiencing unprecedented variations due to climate change, including the warming of river water; melting of glaciers and increased fresh water</p>

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					output; loss of sea ice resulting in changes to marine mammal habitat availability, exposure of shorelines and increased off-shore wave action during seasonal storm fronts; changes in distribution of commercial and subsistence fish species; and decreased opportunity to move people and equipment on the tundra due to an ever shortening winter freeze period. Alaska, the only Arctic state in the nation, must deal with these changes now, and we have the most to lose of any state. We were hopeful that research and partnerships would be forged through the upcoming International Polar Year (IPY), but we have yet to be included to any meaningful extent by NSF – the lead U.S. agency for IPY. Again, states must be a partner to federal efforts, including those that are international in scope. <b>State of Alaska-Murkowski</b>
06	36	1	40	12	Need to include Ocean’s Role in Weather in this chapter, including ocean-atmosphere coupling. <b>Raytheon-Moran</b>
06	36	9			Add to text in parenthesis: “, changing weather patterns” . <b>Muller-Karger, University of South Florida</b>
06	36	15	36	17	Rewrite sentence to reflect fact that most sea-level rise in the time frame of concern is due to melting of land-fast ice – not due to warming of global ocean waters: “Because rising atmosphere and ocean temperatures lead to accelerated melting of glaciers, global sea level continues to rise. Warming ocean temperatures have other effects on organisms yet we don’t understand how coastal and marine habitats are changing.” . <b>Muller-Karger, University of South Florida</b>
06	36	17	36	19	<RPLC> The decision by human populations to live in low-lying coastal regions combined with rising sea level necessitates a more complete understanding of the rate of sea-level change, particularly at regional and local levels. <WITH> Humans continue to chose to live in low-lying coastal regions. Ports carrying billions of dollars in international commerce are similarly located. But sea levels encroach the land on slow time scales (sea level ‘rise’) and fast, episodic events, such as tides, storm surges, and at their most extreme, hurricanes. This requires a more complete understanding of the regional variations in these properties. Sea level does not rise equally in all regions. Hurricanes appear as ‘weather’ phenomena, but their intensification or weakening over

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					decades is part of climate. <END> ; <b>Zlotnicki, JPL</b>
06	36	19			Please add to “state” to regional and local levels. <b>CSO-Andrews</b>
06	36	21	36	21	replace “The ocean has an important influence ...” with “The ocean has a controlling influence on ...”. It’s not just an “important” influence. <b>Muench, ESR</b>
06	36	23	36	23	<RPLC> oscillations. Improved understanding <WITH> oscillations. For example, ‘tropical cyclone heat potential’ (TCHP), a proxy of heat content between the surface and 750m depth, has been shown to improve more the forecast of intensity of a hurricane than any other variable. Improved understanding <END> ; <b>Zlotnicki, JPL</b>
06	37	4	37	4	replace “ ... ocean circulation may influence ... “ with “ocean circulation <b>will</b> influence ...” The systems are interactive, and you can’t change one without having the other change as well. <b>Muench, ESR</b>
06	37	7		9	ocean regime shifts also affect seabirds and non-commercial fishes. <b>Pacific Seabird Group-O’Reilly</b>
06	37	9			Change line 9 from “commercial fisheries and coral...” to “commercial fisheries, changes in the distribution of seabird populations, and coral...” <b>Moriarty, USFWS</b>
06	37	16			At line 16, add new sentence after “protect vulnerable coastlines.”: “Ocean temperature changes or shifts in ocean currents can cause dramatic changes in the distribution of the prey base of a number of high priority pelagic birds species that can cause population declines and large die-offs due to starvation.” <b>Moriarty, USFWS</b>
06	37	21	46	??	Mention/reference of HARRNESS some where in the JSOST report. Just as the "Strategic Plan for the U.S. Climate Change Science Program" is referenced, it would seem reasonable for the national plan for research and response to harmful algal blooms to be reference similarly. Perhaps a reference

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					to HARRNESS would fit under the section titled "Understand, forecast and reduce ocean-related risks to human health from pathogens, biotoxins, and chemical contaminants." The full reference is:  <i>2005 Ramsdell, J.S., D.M. Anderson, and P.M. Glibert (Eds). HARRNESS. Harmful Algal Research and Response: A National Environmental Science Strategy 2005-2015. Ecological Society of America, Washington, DC, 96 pp.</i> <b>National HAB Committee-Anderson and Glibert</b>
06	37	21	38	20	The approach to understand the ocean-climate interactions across regions is consistent with the recognition that we must also consider variability of the ocean across a continuum of time scales, from seasonal-to-interannual through centennial and longer. For example, recent history has suggested that we can no longer improve our understanding and prediction of ENSO without understanding the longer multi-decadal variability of the tropical Pacific brought about perhaps through its connections to the extra-tropics and the polar regions. <b>Legler, US CLIVAR</b>
06	37	21	39	15	CORE recommends that the JSOST merge the research needs identified in the Planning Document with those in the ORPP and highlight research priorities in a bulleted format. It appears the narrative under this section provides the rationale for the bullets under research needs in the Planning Document. Some combination of both documents will provide a more robust and coherent framework to emphasize the research priorities to effectively investigate climate change. In addition, CORE recommends that the following research priorities be included in this section: <ul style="list-style-type: none"> <li>• develop a fundamental understanding of ocean circulation and its role in climate, and of sea level rise;</li> <li>• understand the role of chemical cycles in the bio-sphere in regulating and responding to climate and ocean circulation;</li> <li>• identify potential for abrupt change or "tipping points" (e.g., release of methane, biomass distribution, ecosystem regime shifts);</li> <li>• understand the Earth system to separate natural and anthropogenic effects on climate, and ocean climate effects on humans</li> </ul>

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					<ul style="list-style-type: none"> <li>conduct research into the controls on oceanic dimethylsulfide (DMS) emission and the role of dust as a control on oceanic productivity and carbon sequestration; and understand the role of ocean processes on the development and persistence of drought in western regions of North America</li> </ul> <b>CORE-West</b>
06	37	22	37	23	Reword to: “it is essential to improve understanding of the ocean’s role in past, present, and future climate, and educate the public about this role.”. <b>Muller-Karger, University of South Florida</b>
06	38	5			Reword “Regional ocean sectors” to “Ocean regions” . <b>Muller-Karger, University of South Florida</b>
06	38	5	38	20	Understanding changes to ocean biogeochemistry – particularly ocean acidification – is correctly identified as a research priority. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
06	38	6	38	6	replace “ ... have the potential to influence ... “ with “... will influence ...”. Surely we know enough now about t these systems to make definitive statements, even if they’re not politically palatable. <b>Muench, ESR</b>
06	38	6			Delete: “have the potential to” and replace “be influenced” with “are influenced” . <b>Muller-Karger, University of South Florida</b>
06	38	9			Delete “the” in front of “global tropical” . <b>Muller-Karger, University of South Florida</b>
06	38	11	38	14	<RPLC> ocean). Increasing global temperatures could lead to an ice-free Arctic Ocean in summer, with potentially widespread impacts, such as changes in polar albedo and ocean atmosphere heat exchange, alterations in sensitive Arctic ecosystems, and development of new shipping routes, which may lead to economic development. A warmer Artic will<WITH> Increasing global temperatures could lead to an ice-free Arctic Ocean in summer, with potentially widespread impacts, such as changes in polar albedo and ocean atmosphere heat exchange, alterations in sensitive Arctic ecosystems, and development of new shipping routes, which may lead to economic development.

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					Some 8200 years before present, ice cores in Greenland and similar evidence worldwide point to a sudden cooling event, probably triggered by a catastrophic meltwater release into the N. Atlantic followed by a slowdown in the formation of ‘North Atlantic Deep Water’. This and other evidence has spurred renewed scientific and eminently practical interest in the causes and consequences of sudden climate change. A warmer Arctic will <END><COMMENT TO EDITORS>Rapid Climate Change is in the < 5 year priority list without ever being mentioned in the body of the document<END> ; <b>Zlotnicki, JPL</b>
06	38	14	38	14	“Arctic” should be “Arctic” <b>Muench, ESR</b>
06	38	15	38	16	a warming Arctic is <i>already</i> contributing to sealevel rise (the melting Greenland ice cap) and will most assuredly interact with and influence climate change. As noted above, the systems are interactive. <b>Muench, ESR</b>
06	38	22	39	2	We must not only understand the impacts of climate variability and change on the ocean and its biogeochemistry and ecosystems, but also the impacts of the ecosystems and perhaps even the biogeochemistry on the physical characteristics of the ocean. For example, evidence suggests that the variability of biological characteristics in the eastern tropical Pacific impacts the attenuation and absorption of radiant energy by the ocean, which could impact the thermal structure and SST in this region that is so important for ENSO. Eventually, we will need a new generation of coupled physical-biological-chemical models and new coupled assimilative capabilities to provide us an integrated view of the ocean and how it integrates within the larger global earth system. <b>Legler, US CLIVAR</b>
06	38	26	38	26	insert "algal production" after "coral reefs, " <b>National HAB Committee-Anderson and Glibert</b>
06	38	26	38	31	insert "biophysical, chemical, and meteorological" after "and regional" <b>National HAB Committee-Anderson and Glibert</b>
06	38	30			At line 30, change “...ecosystem interactions) and modeling...” to “...ecosystem interaction, shifts in

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					seabird prey base) and modeling...” <b>Moriarty, USFWS</b>
06	39	2			Note that we don’t manage ecosystems, but people’s activities as they affect ecosystems – so replace line with: “effective management of human activities to ensure these ecosystems remain healthy and viable.” . <b>Muller-Karger, University of South Florida</b>
06	39	5			“Climate is always changing” is a vague and diverting phrase; you need to specify over which time scales climate is changing. In particular, the rate of current climate change is faster than most past changes. <b>Babson, UW Seattle</b>
06	39	7			Insert after “climate changes”: “due to such processes,” and Replace “they” with: “and how such changes” . <b>Muller-Karger, University of South Florida</b>
06	39	9	39	9	<RPLC>global ocean models. Integrating <WITH> global ocean models, constrained by observational data. Integrating <END> ; <b>Zlotnicki, JPL</b>
06	39	13	39	29	For the global GOOS to advance, we also need global cooperation which addresses ocean governance issues in US relationship to global issues e.g. the U.S. response to LOS. <b>Wilson, SeaTrust Institute</b>
06	39	15	39	15	insert "regional" before "policy- and" <b>National HAB Committee-Anderson and Glibert</b>
06	39	17	40	12	The section on Necessary Tools focuses exclusively on observations of the modern ocean and on modeling. In addition to these important steps, there is a need for an organized and integrated effort to examine paleoclimate records for evidence for coherent patterns of climate variability in the past. For example, just as the Pacific Decadal Oscillation and the North Atlantic Oscillation represent coherent patterns of variability in modern times, there may be coherent patterns of variability in paleoclimate records that provide critical information to elucidate the factors forcing rapid climate change in the past.

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					<p>This is intimately tied to my first comment above. Specifically, characterizing correlated changes in winds, precipitation, ocean currents, sea surface temperature, etc. that accompanied rapid climate change events in the past will lead to a better understanding of the processes responsible for those rapid climate changes (i.e., this strategy will enable scientists to discriminate between Atlantic meridional overturning circulation versus coherent patterns of surface-ocean and atmospheric circulation as drivers of rapid climate change). That improved understanding, in turn, will enable scientists to design appropriate monitoring systems to detect the first signs of rapid climate change today, and into the future.</p> <p>Today, most paleoclimate research involves individual scientists reconstructing at most a few parameters at a few sites. While that work must continue, what is needed is an organized effort to integrate those results into a framework that would permit climate scientists to identify coherent patterns of variability in the past. This would require a fundamental change in the way that paleoclimate research is carried out in the U. S., so it warrants a recommendation in this section of the JSOST document.</p> <p><b>Anderson, Lamont-Doherty Earth Observatory, Columbia University</b></p>
06	39	18		28	<p>Agree that we need continuous, sustained monitoring, database maintenance, integration among systems/databases, and modeling.</p> <p><b>Pacific Seabird Group-O'Reilly</b></p>
06	39	24	40	5	<p>Applying our increased understanding of the ocean to improve predictions of future climate change is a key activity required to realize the potential payoff of the research investment. Model improvement is more effective when the research community is partnered with the modeling community (this is a marriage not always easy to arrange!). There are several activities that need to be supported within these communities to make this process more efficient:</p> <ul style="list-style-type: none"> <li>• long-term development and maintenance of ocean models as well as providing model products to the research community and the public,</li> <li>• fundamental observations-based research to test the veracity of ocean models,</li> </ul>

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					<ul style="list-style-type: none"> <li>• building and testing of new low-level model parameterizations of important processes,</li> <li>• predictability studies to guide our prediction efforts,</li> <li>• prediction system evaluations and improvements, and</li> <li>• attribution studies to suggest the causes of observed or predicted changes</li> </ul> <p>Current levels of support for these activities by the US are not sufficient. Moreover, to bring diverse communities together, new approaches and frameworks such as the US CLIVAR Climate Process and Modeling Teams (CPTs) should be considered.  <b>Legler, US CLIVAR</b></p>
06	39	25			<p>Replace “observing systems” with “operational observing systems and scientific observatories” .  <b>Muller-Karger, University of South Florida</b></p>
06	39	26			<p>Replace “In addition to” with “As part of” .  <b>Muller-Karger, University of South Florida</b></p>
06	39	26	39	26	<p>delete "In addition to this global observing effort," , capitalize "Coastal", delete "should be developed" and insert "are integral to this effort."  <b>National HAB Committee-Anderson and Glibert</b></p>
06	39	29			<p>Add a sentence at the end that begins “Additionally, data systems should have the capability to develop climate data records for physical, biological, and biogeochemical data sets as well as the ability to reconstruct past states of the ocean, including the development and refinement of climate proxies.”  <b>CORE-West</b></p>
06	40	1	40	12	<p>Databases and operational systems require ongoing and long-term investments in personnel training and maintenance. A computer is a short-term investment that is only good for a certain number of years as a piece of the operational hardware. People should not be categorized as capital equipment under the same umbrella as sensors, communications gear and computers to be replaced by next year’s crop of graduates. This needs to be addressed as a part of the ocean policy strategy and planning for operational systems. A lack of critical mass in human resources is as equally debilitating to a performance goal as a lack of computers, sensors and ship time.  <b>Williams, University of Miami</b></p>

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06	40	7	40	12	Add the following sentence, which represents the opinion of the ocean modeling community and those who carry out field studies of ocean turbulence and mixing [IAPSO/SCOR Working Group on Ocean Mixing, 2006: Introduction to The Issue. <i>Deep-Sea Res. II</i> , 53, Ocean Mixing Issue, 2-4.] following line 8: "A primary difficulty with large scale ocean models is their present inability to adequately incorporate small-scale mixing, and process studies devoted to this issue is an essential prerequisite to successful predictive modeling of such global scale features as the meridional overturning circulation." <b>Muench, ESR</b>
06	40	7	40	7	after in situ insert "watershed, coastal and " <b>National HAB Committee-Anderson and Glibert</b>
06	40	8			Add sentences at end of line: "The present capability of global satellite ocean observations includes concurrent ocean color, sea surface temperature, sea surface height and vector winds. The nation faces a gap in the continuity of several of these critical observations, and it will be important to plan required satellite measurements to scope the nation's ocean observing system adequately." <b>Muller-Karger, University of South Florida</b>
06	40	8			At line 8, change "...such as currents, salinity, and sea-ice..." to "...such as currents, salinity, prey base, and sea-ice..." <b>Moriarty, USFWS</b>
06	40	9		10	<u>Areas where 'seabirds as indicators' applies</u> need for 'biological sensors that collect a variety of information, including data on sentinel organisms and habitats'. This paragraph could include upper trophic levels. <b>Pacific Seabird Group-O'Reilly</b>
06	40	10	40	10	insert ", toxicities, " after "on sentinel organisms" <b>National HAB Committee-Anderson and Glibert</b>
07	0				<b><u>Stability, sustainability, and effective management of marine resources (Societal themes 1 &amp; 5) should include an equal focus on development of technologies and techniques that remove the need to extract natural resources in the first place</u></b> (e.g. aquaculture, alternative energy sources, recycling of ocean-derived materials). With decreased human demand on natural resources, ensuring

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					stability and sustainability of such resources is much simpler. <b>Harbor Branch Oceanographic Institution-Frey</b>
07	0				<p>The research goals addressing this societal theme are very broad could be improved with more focus. For the first goal, the report mentions the importance of the terrestrial system but, as discussed above, how the research will make the connection between the watershed and the airshed needs to be stressed more. Also it seems to us that there are a number of pervasive problems that are national in scale and require a concerted federal research strategy. High among these would have to be the changes in the flux of key nutrients (e.g. nitrogen, phosphorus and silica) and contaminants from the land to the coastal ocean that underlie much of the ecosystem deterioration (dead zones, harmful algal blooms, etc.) seen around the country. These are the subjects of numerous regional management efforts, but presently are not subject of strategic research at a national level. There are other potential targets, e.g. coastal wetland loss, invasive species, etc., that would benefit from national strategies within this theme.</p> <p>Another theme mentioned here and elsewhere is the incorporation of new information and understanding into adaptive management practices. Adaptive management involves understanding expressed in models, but it also requires treating management efforts as experiments with a heavy reliance on monitoring of outcomes. Consequently, the federal research priorities and their implementation must provide new opportunities for research on ecosystem responses to management activities and for integration of research with the nation's extensive environmental monitoring programs.</p> <p><b>Estuarine Research Foundation-Boesch</b></p>
07	41				<p>Recommend research into the effectiveness of area-based management (e.g. Marine Protected Areas) as a tool to improve ecosystem health.</p> <p><b>The Ocean Conservancy-Heinemann</b></p>
07	41		44		We agree with the focus on natural and anthropogenic factors that impact the delivery of ecosystem services and the identification of indicators of ocean health for management. However, the proposed tools for addressing these priorities must go beyond ocean observing systems. Ocean observing

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					<p>systems must be developed in such a way that they directly relate to management needs and opportunities, not just as a research tool or demonstration of technology. There is a need to accompany high-resolution ocean observation with much higher resolution and more timely data on the human activities that affect the ocean. We must determine how disturbances interact within an ecosystem and how their cumulative impacts alter critical ecosystem processes and the generation of ecosystem services. In addition, we must employ new ecological and economic tools for estimating the value of the multiple ecosystem services produced by ecosystems and generate frameworks for understanding and evaluating tradeoffs among these services in order to inform management and policy decisions.</p> <p><b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b></p>
07	41		44		<p>Here we stress the need to consider upper-trophic level species such as seabird and marine mammals in the assessment of ecosystem health. Such species can be used as indicators of the marine environment and offer a useful tool for assessing the overall state of the Ecosystem.</p> <p><b>American Bird Conservancy-Fenwick</b></p>
07	41		44		<p>U.S. ocean and coastal resources should be managed to reflect the relationships among all ecosystem components, including humans and nonhuman species and the environments in which they live.</p> <p><b>CORE-West</b></p>
07	41		44		<p><b>Theme 5: Improving Ecosystem Health</b></p> <ul style="list-style-type: none"> <li>▪ Understand and predict the impact of natural and anthropogenic processes on ecosystem productivity</li> <li>▪ Assess the ability of marine ecosystems to provide essential goods and services</li> <li>▪ Develop marine ecosystem indicators for sustainable and effective management</li> </ul> <p>Improving ecosystem health is a laudable goal, and ecosystem indicators may be one way to try to measure that health. Ecosystem indicators in the Bering Sea have been under development for several years, and a sub-area of the Bering Sea -- the Aleutian Islands -- is undergoing a regional research inventory and assessment by Alaska Sea Grant. The other three large marine ecosystems in Alaska (Gulf of Alaska, Chukchi Sea, and Beaufort Sea) are in various stages of comprehensive, large</p>

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					<p>scale examination. Because there is no single agency appointed as the keeper of an ecosystem, the big picture gets lost and individual management decisions are made without an understanding of the cumulative impacts of natural and anthropogenic activities. Coordination groups like the North Slope Science Initiative and the Alaska Marine Ecosystem Forum are the first step towards a more holistic management approach. Again, improved coordination should be a cross-cutting theme in the draft ORPP.</p> <p><b>State of Alaska-Murkowski</b></p>
07	41	1	44	15	<p><b>Suggested Research Priority for “Improving Ecosystem Health:”</b> Apply understanding of human values to democratically and rationally prioritize competing societal objectives as a basis for ecosystem-based management.</p> <p><b>Rationale:</b> The U.S. Commission on Ocean Policy (<i>An Ocean Blueprint for the 21<sup>st</sup> Century</i>, 2004, 66) recognizes that decision making in the face of conflict is characterized by intertwined scientific and normative (i.e., value-focused) dimensions. “Where multiple desirable but competing objectives exist, it is not possible to maximize each. For example, both recreational boating and marine aquaculture are potential uses of nearshore marine waters. Both provide benefits and costs to society, and both have impacts on the environment that can be lessened with proper planning. However, these activities can also conflict with each other: a large-scale aquaculture operation would prevent access by recreational boaters to certain waters.” In cases like this, social and natural science “can inform managers of the potential positive or negative impacts” of activities. Ultimately, however, as the U.S. Commission on Ocean Policy (2004, 66) emphasizes, “a community judgment must be made weighing the value of each activity against its potential impacts.” This judgment must not only evaluate the acceptability of diverse activities in view of likely impacts and their degree of uncertainty, but also rank their relative importance in the face of conflict.</p> <p>The National Research Council Panel on Social and Behavioral Science Research Priorities for Environmental Decision Making notes that “in most cases, the weighing or balancing of conflicting objectives, which is the essence of clarifying trade-offs, is either ignored or only partially addressed”</p>

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					<p>by environmental decision making (National Research Council 2005, 188). The theoretical traditions and skills of thought provided by Philosophical Ethics, especially a practically-oriented sub-discipline of the field, are uniquely useful to help scientists and decision makers richly clarify, critically examine, and rationally prioritize competing societal objectives (which must be empirically identified through sociocultural monitoring) as a basis for ecosystem-based monitoring and management. In addition, analysis can enhance critical examination of specific ethical issues raised in the context of studying, predicting, and managing the use of coastal and ocean ecosystems (e.g., environmental justice, the role of scientists in decision making and obligations to future generations) as well as issues concerning the relationship between science and society (e.g., the role of public groups in science, and the role of science and scientific uncertainty in policy formation). Finally, the sort of reasoned discourse fundamental to philosophical practice, and conceptual schemes of Environmental Ethics, can be useful as a framework for analytic-deliberative decision processes aiming to cooperatively adjudicate competing objectives to establish management priorities.</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
07	41	3	41	8	<p>The vision of “Improving Ecosystem Health” leaves the impression that the challenges are protecting what we have. Rather, a much more formidable challenge is restoring already degraded ecosystems and rebuilding already depleted living resources. That should be implicit in “improving,” yet restoration is not mentioned in this theme. In many ways restoration is quite a different challenge, both because the ocean research community does not have as much knowledge about “putting Humpty Dumpty” back together again as it does about what happened to him in the first place and also because it provides different opportunities for experimental learning. Likewise the text focuses exclusively on ecosystem productivity rather than the importance of ecosystem structure and function, CORE recommends that the JSOST address these issues in the final ORPP.</p> <p>Also, applying an ecosystem-based management principle will require coordinating the development of procedures for the practical application of the precautionary approach and adaptive management to preserve and restore marine biodiversity within well-defined relevant geographic management areas based on an ideal model for a healthy ocean and coastal ecosystem. The research priorities should</p>

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					further the development of regional, ecosystem-based research plans to help protect ocean ecosystems, guide agency research funding, and be incorporated into the design and implementation of the national monitoring network and the Integrated Ocean Observing System. <b>CORE-West</b>
07	41	5		8	Restoration (mentioned on p. 43) should be a more prominent part of <i>improving</i> ecosystem health. I would suggest the addition of “and restore ecosystems where past impacts have damaged ecosystem health” to this sentence. <b>Babson, UW Seattle</b>
07	41	14			Add after “watersheds”: “submarine groundwater discharges, and the atmosphere”. <b>Muller-Karger, University of South Florida</b>
07	41	14	41	14	delete 'riverine' <b>National HAB Committee-Anderson and Glibert</b>
07	41	14			Insert the following sentences: “Ocean and coastal habitats are spawning grounds, nurseries, shelter, and food for marine life, including a disproportionate number of endangered or commercially important species. Our ocean and coastal habitats are under increasing stress. According to the Ocean Commission “Over the past several decades the nation has lost millions of acres of wetlands, seen the destruction of seagrass and kelp beds, and faced a loss of significant mangrove forests.” <b>CORE-West</b>
07	41	22	41	25	I would reorder the sentence that starts with “Management and ...” to read something like “Adequate scientific understanding provides an essential basis for managerial systems to help ensure the sustained vitality ...” In otherwords, stress the scientific understanding more than the management. Recent experience has shown that no amount of scientific understanding will help unless management is inclined to use this understanding. <b>Muench, ESR</b>
07	41	22	41	22	delete 'in' <b>National HAB Committee-Anderson and Glibert</b>
07	41	28	43	20	CORE recommends that the JSOST merge the research needs identified in the Planning Document with those in the ORPP and highlight research priorities in a bulleted format. The research needs in

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					<p>the Planning Document are more comprehensive and clearer to the lay-reader—thus providing a clear and concise blueprint for improving ecosystem health.</p> <p>Federal, state, and local agencies must expand cost-effective conservation and restoration programs according to a national research strategy that sets goals and priorities, enhances the effectiveness and coordination of individual efforts, and periodically evaluates progress. The ORPP should also encourage research into problems that underlie much of the nation’s ecosystem deterioration (dead zones, harmful algal blooms, etc.) such as changes in the flux of key nutrients (e.g. nitrogen, phosphorus and silica), contaminants from the land to the coastal ocean, coastal wetland loss and invasive species. The ORPP must explore the impact of urban systems on oceans (runoff, non-point pollution etc.) and watershed processes and their interaction with coastal systems (critically important for anadromous species as well as eutrophication, etc.). Therefore, CORE recommends research in four areas—Marine Protected Areas, Sediment Management, Pollution Monitoring and Prevention, and Preventing the Spread of Invasive Species--that should be included in the ORPP to improve ecosystem health ocean through coastal habitat conservation and restoration.</p> <p><b>CORE-West</b></p>
07	42	3		4	<p><u>Areas where ‘seabirds as indicators’ applies</u> invest in ‘novel methods of investigating ecosystem mechanisms’.</p> <p><b>Pacific Seabird Group-O’Reilly</b></p>
07	42	7	42	25	<p><b><u>In the section “Improving Ecosystem Health”(p.42), the first two priorities emphasize “ecosystem productivity” rather than ecosystem health.</u></b> While productivity is often an indicator of a healthy ecosystem, the primary emphasis of all of the priorities in this theme should be on <i>ecosystem health</i>, not merely increasing yields of “essential goods and services”.</p> <p><b>Harbor Branch Oceanographic Institution-Frey</b></p>
07	42	7	42	24	<p>This research is very important, but seems vague as written. It does not directly address or prioritize the potential shifts in ecosystem structure to be researched. Sufficient information exists to begin prioritization and identification of imminent threats (e.g. overfishing).</p> <p><b>The Ocean Conservancy-Heinemann</b></p>

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07	42	9	42	9	Delete the word “often”. These systems are <i>always</i> complex and probably always nonlinear. <b>Muench, ESR</b>
07	42	10	42	10	insert 'event,' after "e.g.," <b>National HAB Committee-Anderson and Glibert</b>
07	42	12			Add after “incorporating”: “new and”. <b>Muller-Karger, University of South Florida</b>
07	42	16	42	24	<p>The text on p. 42 (lines 16-24) mentions several factors that influence the structure of marine ecosystems. These are all valid and important, but a factor that is at least as important as these is missing and should be added. Specifically, variability in the ratio of essential nutrients (both macro nutrients such as N, P and Si as well as micronutrients such as Fe, Zn, and Co) is believed to regulate the dominant organisms at the base of the food web and, therefore, the structure of the entire marine ecosystem. For example, it has long been recognized that the ratio of silicon to nitrogen influences the relative abundance of diatoms among phytoplankton taxa, and this in turn has an impact on fisheries. More recently, both the absolute and relative abundances of essential micronutrients (e.g., Fe, Co, Zn) are gaining increasing recognition as potential regulators of ecosystem structure and productivity.</p> <p>Nutrient ratios are sensitive to perturbation both by natural processes (e.g., changes in ocean circulation; denitrification) and by anthropogenic impacts (e.g., changes in land use and runoff; contaminant dispersal).</p> <p>The sensitivity of marine ecosystems to changes in the abundance and ratios of nutrients (both macro and micro) is sufficiently great that it can have as much impact on the structure and productivity of marine ecosystems as any of the other factors mentioned in the document. Therefore, the abundance and ratios of essential nutrients ought to be included in this section as one of the key areas in need of study.</p> <p><b>Anderson, Lamont-Doherty Earth Observatory, Columbia University</b></p>

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07	42	17	42	24	Research is needed to examine and understand the effects of pollution, including the increasing number of dead zones and the impacts of endocrine disruptors on marine wildlife. <b>The Ocean Conservancy-Heinemann</b>
07	42	17			At line 17, change "...via ocean acidification)..." to "...via ocean acidification, seabird prey base shifts)..." <b>Moriarty, USFWS</b>
07	42	18	42	18	insert "or" after 'activities' and then "leading to algal blooms and hypoxia" after "resource extraction" <b>National HAB Committee-Anderson and Glibert</b>
07	42	19		24	Since the modern view of marine systems emphasizes their dynamic nature in response to disturbances and the possibility of regime shifts related to natural or human forcing, I feel that the dynamic, nonlinear responses of system productivity to such disturbances may not be amenable to prediction. For example, the loss of eelgrass beds because of light limitation resulting from nutrient enrichment (disturbance that promotes the growth of phytoplankton or periphyton) does not follow the same pathway that recovery of the eelgrass beds will follow after the nutrient loading has been reduced. In order to develop workable mitigation plans or restoration programs requires better models to account for these different responses (loss pathway versus recovery pathway) to human stressors. <b>Dow, NMFS/NEFSC</b>
07	42	20		24	A 4 <sup>th</sup> requirement for forecasting is more data to calibrate and validate models. <b>Babson, UW Seattle</b>
07	42	21	42	21	insert "better watershed land use, coastal ocean models; (3)" immediately after (2) <b>National HAB Committee-Anderson and Glibert</b>
07	42	22		23	<u>Areas where 'seabirds as indicators' applies</u> 'development of next-generation trophic dynamics models'. <b>Pacific Seabird Group-O'Reilly</b>
07	42	22	42	22	change '(3)' to '(4)' <b>National HAB Committee-Anderson and Glibert</b>
07	42	26	43	7	The stated research needs are primarily for studying the impact of people on the environment. People also care about the impact of marine ecosystems on <i>them</i> , so investigating the impact <i>on</i> people and

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					their perceptions of that impact as well as <i>by</i> people on the ecosystems is important in order to promote human understanding and buy-in of the value of the ecosystem - a most-often cited problem in creating behavior change to benefit the marine environment. <b>Wilson, SeaTrust Institute</b>
07	43		44		The ocean community needs science-based synthesizing tools that can organize the plethora of ecosystem information into digestible and understandable formats. Terrestrial ecologists use landscape analysis to organize and synthesize such information. A similar approach is needed for the marine environment. <b>NFRA-Quintrell</b>
07	43				<b><i>“Apply understanding of marine ecosystems to develop appropriate indicators and metrics for their sustainable and effective management. A robust suite of indicators of ecosystem structure, function, products, and services must be developed, evaluated, and implemented at multiple scales (local, regional, basin-wide).”</i></b> This section is predicated upon the idea that one must first fully understand the ecosystem before developing indicators and metrics. Development of indicators and metrics is needed to provide a means of gaining that understanding. Useful indicators can be developed based upon human judgments of what constitutes a healthy system. Recognizing health does not require understanding of why that system is healthy. However, methods to assess health based on use of indicators provide a means to help understand ecosystem operation. As greater understanding is achieved, new indicators may be deemed more appropriate. <b>Bailenson, Florida Department of Environmental Protection</b>
07	43	5		7	an example of where discussion of ‘ecosystem-based management’ shifts more towards human benefits? <b>Pacific Seabird Group-O’Reilly</b>
07	43	9	43	10	Note again that we don’t manage ecosystems, but people’s activities as they affect ecosystems – so replace title (lines) with: “Apply understanding of marine ecosystems to develop appropriate indicators and metrics for the effective management of human activities, to ensure sustainable use of ecosystems.” .

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					<b>Muller-Karger, University of South Florida</b>
07	43	9		18	<u>Areas where 'seabirds as indicators' applies</u> 'Apply understanding of marine ecosystems to develop appropriate indicators...for sustainable and effective management.' No mention of upper trophic levels other than humans. <b>Pacific Seabird Group-O'Reilly</b>
07	43	10		20	Having been involved in developing indicators for fisheries and aquaculture for the Gulf of Maine Summit, we used the Pressure/State/Response paradigm for developing indicators. Among the lessons I learned from this experience was: the response should reflect the outcome from management measures, while the state should reflect the characteristics of the natural system subject to human stressors; that developing socioeconomic indicators is critical (4 out of 12 in our case), but difficult to do; it is critical to develop indicators for system structure/function attributes and not just that of the components; and that there has to be a cause/effect understanding that supports the indicators if one is to convert monitoring data to useful information for managers and the public. This will be a challenge for supporting an ecosystems approach to management (EAM) where indicators will likely supplement the single species reference points or water quality parameter approach currently in use. <b>Dow, NMFS/NEFSC</b>
07	43	14	43	14	insert "land use and " after "wetlands, " <b>National HAB Committee-Anderson and Glibert</b>
07	43	14			The development of indicators and metrics is mentioned on this page. Numerous programs across the nation either have or are developing indicators and metrics to help them track progress in meeting their objectives. What is needed is a comprehensive review of existing indicators and metrics and the development of unique indicators and metrics to fill the identified voids. This should produce a common set of nested indicators that would provide a picture of the health of the ecosystem from the headwaters to the oceanic abyss. At line 14, change "...wetlands, shoreline development,.... to "...wetlands, fisheries bycatch, shoreline...invasive species, seabird prey base shifts, introduction...." <b>Moriarty, USFWS</b>
07	43	17			Insert before "Additionally": "Research needs to be focused on developing means to use ecosystem resources sustainably and to restore degraded ecosystems. These methods need to be implemented in

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					new adaptive management strategies.” . <b>Muller-Karger, University of South Florida</b>
07	43	21			Insert the following new bullets: <ul style="list-style-type: none"> <li>• provide for a comprehensive research program for marine protected areas that results in the effective design, implementation, and evaluation of marine protected areas, to ensure that an area is appropriate for its intended purpose, including periodic assessment, monitoring, and modification to ensure continuing ecological and socioeconomic effectiveness of marine protected areas;</li> <li>• improve assessments, monitoring, research, and technology development to enhance sediment management and conduct coordinated strategies to better understand how contaminated sediment is created and transported;</li> <li>• mandate a comprehensive national risk assessment, biological survey, and monitoring program for early detection of invasive species that includes the gathering of baseline taxonomic information; performing of quantitative assessments of ecosystems; identifying invasive pathogens and vectors of introduction; and determining how invasive species disrupt ecosystem functions; and</li> <li>• a vigorous, coordinated research program on the fates and impacts of land based and vessel pollution, the results of which should be used to guide management priorities, develop new control technologies, determine best management practices, and create more effective regulatory regimes as needed to improve waste water treatment, U.S. ballast water technology, on-board ship-testing, and testing of experimental treatment systems.</li> </ul> <b>CORE-West</b>
07	43	22	43	31	The description of necessary tools focused mostly on in situ tools such as observing systems, which while important are not the only tools required. It is also critical that new laboratory based tools and innovative methods need to be developed that allow better understanding and interpretation of ecosystem processes and their interconnections. – <b>Landrum, GLERL</b>
07	43	27			Delete comma (“;”).

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					<b>Muller-Karger, University of South Florida</b>
07	43	30		31	<u>Areas where ‘seabirds as indicators’ applies</u> Agree with need for infrastructure and research vessels – don’t forget upper trophic levels in these plans. <b>Pacific Seabird Group-O’Reilly</b>
07	43	31	44	7	Cross-over opportunities for industrial mapping technology should be identified in applications for assessing physical oceanography. <b>Noll, NOAA Ship Rainier</b>
07	44	2			Replace "chemical" with "biogeochemical". <b>Muller-Karger, University of South Florida</b>
07	44	3			[NOTE: there seems to be little distinction throughout this document between observing system and observatory] Replace “ <i>in situ</i> observatories” with “integrated <i>in situ</i> and satellite-based scientific observatories and operational observing systems” . <b>Muller-Karger, University of South Florida</b>
07	44	4			<u>Areas where ‘seabirds as indicators’ applies</u> ‘shore-based facilities for sampling and observing system’ can include colony-based seabird work – past, present, and planned into future. <b>Pacific Seabird Group-O’Reilly</b>
07	44	5			Insert after “Improvements in”: “communications,” . <b>Muller-Karger, University of South Florida</b>
07	44	5			Insert: "An advanced Landsat-class imaging capability, enhanced to observe global littoral zones including estuarine and shallow submerged habitats, such as sand and gravel deposits, sea grasses and coral reefs, will revolutionize coastal zone management and research." . <b>Muller-Karger, University of South Florida</b>
07	44	12	44	15	The JSOST may want to add language about a workforce that is knowledgeable or capable of turning data into information products that meet end-users needs. <b>CSO-Andrews</b>

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07	44	12	44	12	insert "aquatic and terrestrial" between "natural" and "sciences" <b>National HAB Committee-Anderson and Glibert</b>
07	44	13			would include that we also need people knowledgeable in ecology/ecological relationships. This whole page is fairly general and states obvious. <b>Pacific Seabird Group-O'Reilly</b>
08	0				Here, again, the focus is more on forecasting than on mitigation of human health risks. ERF suggests that the research priorities would be strengthened with consideration of how understanding and forecasts can be applied to protect human health. Potential new topics include research on improved methods to treat storm water runoff and other sources of pathogen contamination in coastal waters, on ways to minimize mercury emissions, and on possible ways to predict and possibly terminate harmful algal blooms. Also, the consequences of climate variability and change on human health should be given attention as an integrative research focus. <b>Estuarine Research Foundation-Boesch</b>
08	45				<b>“Understanding the causes of health hazards and how they can be mitigated or managed will lead to fewer illnesses from contaminated seafood, polluted waters, known and emerging disease-causing microbes, and harmful algal blooms (HABs).”</b> It warrants mention somewhere that exploration into new areas of the oceans needs to be conducted differently to reduce the risk of spreading diseases of marine organisms. The spread of previously localized coral diseases and invasive species should serve as a warning as we move into exploration of new areas. <b>Bailenson, Florida Department of Environmental Protection</b>
08	45		49		CORE supports the U.S. Commission on Ocean Policy recommendation that "Significant investment must be put into developing a coordinated national research effort to better understand the links between the oceans and human health ...." We are just beginning to understand the numerous and complex ways in which humans can affect the oceans, and the oceans, in turn, can affect human health. However, while cases of human illness linked directly or indirectly to stressed estuarine and coastal environments are being documented with increasing frequency, the risks to human health from continued and expanded impairment of coastal and ocean environments remain very poorly

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					<p>understood. Therefore CORE urges JSOST to expand research and development efforts to encourage multidisciplinary studies of the evolution, ecology, chemistry, and molecular biology of marine species, discover potential marine bio-products, and develop practical compounds. The ORPP should include research on improved methods to treat storm water runoff and other sources of pathogen contamination in coastal waters, on ways to minimize mercury emissions, and on possible ways to predict and possibly terminate harmful algal blooms. Also, the ORPP should promote research that investigates the link between climate variability and change and human health.</p> <p><b>CORE-West</b></p>
08	45		49		<p><b>Theme 6: Enhancing Human Health</b></p> <ul style="list-style-type: none"> <li>▪ Understand, forecast and reduce ocean-related risks to human health from pathogens, biotoxins, and chemical contaminants</li> <li>▪ Understand human health risks associated with the ocean and potential benefits</li> <li>▪ Understand ocean-borne human health threats and human influence on this</li> <li>▪ Develop products and biological models to enhance human well-being</li> </ul> <p>A top research priority for Alaska is to understand and reduce the air-to-sea deposition of mercury, a leading threat to human health. We know far too little about mercury deposition and the danger it poses to consumers of Alaska’s commercial, recreational, and subsistence fisheries. EPA's modeling of mercury shows large mercury deposition rates along the entire Pacific coast up through Alaska; however, no organized mercury monitoring deposition network exists to reliably predict transport and deposition of mercury north of Washington state. Additionally, EPA acknowledges they know little about the mercury uptake chemistry in the marine environment.</p> <p>We <u>do</u> know that global weather patterns bring Asian air masses toward Alaska, and we know there are huge increases in the number of China’s coal-fired power plants, which have little, if any, pollution control (most U.S plants are tremendously cleaner). In the U.S., mercury pollution from coal power has a dominant cause and effect for fish tissue contaminations and subsequent fish consumption advisories. Consequently, our fears of mercury and other persistent organic pollutants</p>

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					(POPs) from Asian coal power is a very real threat to our relatively clean fish resources. The lack of research on global transport and uptake of mercury and other POPs must be addressed before it is too late to prevent a major contamination in Alaska’s wild fisheries (50 percent of the fish sold in the U.S.). <b>State of Alaska-Murkowski</b>
08	45	6	45	6	I would say “ocean-derived products”. <b>Muench, ESR</b>
08	45	16	45	16	NB my previous comment #2 concerning toxins in seawater. <i>This</i> sentence is accurate, although one might question how many chemical pollutants are not also toxic. You don’t want, in any way, to give the impression that the ocean will neutralize the stuff humans dump into it. <b>Muench, ESR</b>
08	45	19			Add: “Many coastal communities still have inadequate sewage treatment facilities, and discharges result in the repeated contamination and closure of beaches due to pathogen dispersal. Similarly, streets and marinas still are one of the largest sources of hydrocarbons (oil and gasoline) to our coastal waters and beaches. . <b>Muller-Karger, University of South Florida</b>
08	45	23	45	23	Replace “inaccurate” with “underestimated”. It’s not likely to be an overestimate. <b>Muench, ESR</b>
08	45	27		30	I would add endocrine disruptors to the list of anthropogenic contaminants. <b>Dow, NMFS/NEFSC</b>
08	45	27		29	<u>Areas where ‘seabirds as indicators’ applies</u> seabirds as indicators would be part of assessment of risks from contaminants (section is on ‘enhancing human health’). <b>Pacific Seabird Group-O’Reilly</b>
08	46	3	46	4	[State what communities have been newly discovered, and why they are unique biochemically as highlighted here] . <b>Muller-Karger, University of South Florida</b>
08	46	12	48	9	Existing national and regional monitoring and assessment programs have focused on the

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					measurement of persistent chemicals, particularly in estuarine and marine sediments. Much more attention should be paid to assessing known or potential human pathogens and contaminants and emerging contaminants of concern such as newly registered pesticides, pharmaceuticals, and fire retardants in shallow estuarine and marine waters, coastal retention ponds, continental shelf environments, and the open ocean. CORE recommends that the JSOST merge the more explicit research needs identified, and support in the public process, in the Planning Document with those in the ORPP. The JSOST should highlight research priorities in a bulleted format and use the narrative under this section to provide the rationale for the bullets under research needs in the Planning Document. Some combination of both documents will provide a well-reasoned framework to emphasize the research priorities to effectively investigate and enhance human health. <b>CORE-West</b>
08	46	16		17	<u>Areas where 'seabirds as indicators' applies</u> : would add wildlife health and contaminant load as indicators of ecosystem. <b>Pacific Seabird Group-O'Reilly</b>
08	46	26	46	26	insert "coastal and " before "ocean environments" <b>National HAB Committee-Anderson and Glibert</b>
08	47	12	47	12	delete 'and' before 'people' <b>National HAB Committee-Anderson and Glibert</b>
08	47	14	47	14	insert ", " after "fishers)" <b>National HAB Committee-Anderson and Glibert</b>
08	47	16	47	16	I would use the word "focus" rather than "refine" here. <b>Muench, ESR</b>
08	47	18	47	30	Research must incorporate the impacts that pathogens or other public health threats have on recreational opportunities, economic conditions (short and long-term), and other social conditions (i.e., public perceptions about the safety of ocean waters) throughout coastal regions. This section correctly emphasizes the importance of integrating socio-economic investigations with ecosystem-based studies of health threats. <b>American Shore and Beach Preservation Association-Ordal</b>

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08	47	26	47	26	Replace “can” with “have and will”. There can be no question that human coastal development contributes to offshore contamination. Another unpleasant truth. <b>Muench, ESR</b>
08	47	27	47	30	The major challenge is to integrate models of socioeconomic processes and change with models of natural systems change. This is a research field that is still at a very early stage, but for which the increase in data from both socioeconomic and ocean observing systems holds great promise. A major priority for research in this field will be finding the appropriate time and spatial scales within which to detect interactions between socioeconomic and natural systems. The development of forecasting models for socioeconomic change is a generally well-advanced field, but the incorporation of factors such as changing ocean and coastal conditions remains to be done. <b>(Also repeated in the ES, Page 5)</b> <b>National Ocean Economics Program-Lockwood, et al.</b>
08	47	28	47	28	The use of the term “social and economic drivers” is vague. What specifically are these drivers? <b>National HAB Committee-Anderson and Glibert</b>
08	48	6		8	<u>Areas where ‘seabirds as indicators’ applies</u> notes ‘use of marine species as models for study of diseases, toxicology, biochemical processes’ and use of ‘sentinel species’ to serve as early warning systems. <i>Seabirds as indicators here could include occurrence of seabird dieoffs, chick deformities, loss of productivity, etc.</i> <b>Pacific Seabird Group-O’Reilly</b>
08	48	10			Insert the following new bullets: <ul style="list-style-type: none"> <li>• “expand research and exploration efforts in marine microbiology and virology to discover, document, and describe new marine bacteria, algae, and viruses and determine their potential negative effects on the health of humans and marine organisms and the identify the inter-relations, pathways, and causal effects of marine pollution, harmful algal blooms, ecosystem degradation and alteration, emerging marine diseases, and climate change in disease events;</li> <li>• improve and develop accurate and cost-effective methods for detecting, monitoring, and identifying pathogens, contaminants, and chemical toxins in ocean and coastal waters and organisms.</li> </ul>

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					<b>CORE-West</b>
08	48	12	48	19	In order to enhance human well being, additional work documenting adverse human health effects from ocean-borne exposures is needed. We do not know enough about marine toxin-related illnesses to properly diagnose and treat patients, nor do we have a reliable estimate of the public health impact of these diseases. Also, we also do not know how changes in the oceans driven by global climate change will affect people living in coastal areas. If public health decision-makers are to use the data generated by ocean sensors, OOS programs, etc., the more fundamental research described above needs to be in place. <b>Backer, Centers for Disease Control &amp; Prevention</b>
08	48	22	48	22	insert 'toxins, ' after "species, " <b>National HAB Committee-Anderson and Glibert</b>
08	48	25			Insert after "...mechanistic)": and satellite-based synoptic observations such as phytoplankton fluorescence". <b>Muller-Karger, University of South Florida</b>
08	49	4			Insert a new sentence as follows: "Finally, new technologies will need to be developed to reduce concentrations of pharmaceuticals, personal care product ingredients, nutrients from animal wastes, and other biologically active contaminants in wastewater treatment plant discharges." <b>CORE-West</b>
09	0				This section contains two elements each of which is of great interest to the Estuarine Research Federation: developing tools and making a difference. The <i>Charting the Course</i> report places emphasis on observing systems as a critical tool, as does the Ocean Commission report. ERF supports the further development of observing systems and a national integrated ocean observing system, but raises some points for consideration in this research plan. First, observations are not necessarily scientific research. Research and observations feed on each other, and this feedback is critical for both. But support for operational activities should not come at the cost of support for scientific research. Second, while there is mention in the general statements about linkages to watersheds, the report should address how atmospheric, terrestrial, and freshwater observing systems will be sustained and integrated with those made in the open ocean and coastal ocean. It is a sad fact

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					<p>that we have lost many important capabilities over the last decade with cut backs to USGS water quantity and quality monitoring. Third, U.S. observing system activities must be explicitly integrated into international efforts in order to maximize their power and success. Finally, ocean observing systems require sustained implementation and operations and cannot provide the much needed data if they are reliant on annual congressional appropriations. Nonetheless, we have to be realistic about costs and focus on the most useful deployments and applications of observing systems, including not only computational capacity and sensor development, but also data management and analysis.</p> <p>We particularly endorse the recommendations concerning information to support decision-making. If the research priorities plan is going to be truly effective in addressing the societal themes, concerted efforts along the lines described here will be needed. While professional communicators often do a great job in translating research results into readily utilized products, research scientists themselves can be assisted in more effectively communicating to managers and decision makers. Furthermore, the level of scientific understanding within the management community can be enhanced. The plan should address ways to train both scientists and decision makers to communicate more effectively.</p> <p>The subsection on an ocean-literate nation focuses on ocean science education. While this is certainly desirable, the nation's fundamental educational needs in mathematics and science are so great that these efforts should be considered in the context of and as means of increasing math and science literacy. The public's understanding of the ocean would evolve naturally with better general science and math education. Conversely, developing literacy about the ocean and coastal zone where so many Americans live can be an effective means for developing basic science and mathematics skills. Among the informal education centers that deserve particular mention in the context of the ocean research priorities plan are marine laboratories. Most marine laboratories are already engaged in informal and formal education and provide the opportunity for research discoveries and understanding to transition directly to students and the public.</p> <p>The capacity to translate research results into information for decision support is correctly identified as a particular need under maintaining intellectual capacity. Targeted investments by federal agencies</p>

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					are required to support graduate training in this area. <b>Estuarine Research Foundation-Boesch</b>
09	50		52		I realize that this is a statement of intent and not an implementation document, but there seems to be a mismatch between what is requested in the text and the listing given under the “Opportunities for Progress” section. On p.24, it is stated that “...the fleet of ships available is only about one-third of the capacity needed to provide essential information on the status of managed populations and ecosystem effects of human activities.” However, pp. 50-51 talk only of improvements to observing systems (in the context of GOOS/IOOS) and modeling. What about the necessary fleet replacement program? This is particularly important in the Gulf of Mexico where we have already lost one ship (the Gyre), the Longhorn is either lost or about to be, and the sole remaining research vessel, the Pelican, is too small to accommodate the larger, diverse research teams that are required if we are to “...take an interdisciplinary approach to exploring and understanding the ocean’s role in many of society’s most pressing challenges.” (p. 12, top). <b>Chapman, LSU</b>
09	50		52		No specific mention of a research approach that can effectively create progress through collaboration at the industrial-academic-governmental is mentioned in this section. Recognition of programs such as the Center for Coastal & Ocean Mapping at the University of New Hampshire (CCOM/UNH) that relate industrial consortia to fast-track academic research under the sponsorship and partnership of federal programs is recommended here. <b>Noll, NOAA Ship Rainier</b>
09	50				(Personal Views) I attended a “town hall” meeting and later reviewed the document. Well done and I applaud the consensus building approach – the enormity of the task is daunting. I personally look forward to the implementation of the strategic course and present humble opinions.  “Making a Difference” is the crux for success and thus, the most important part of the document. The oceanography community knows how to do good science; those who choose to fund proposals have many from which to choose. In my opinion, the process of choice has historically been influenced by a vague understanding of a need (i.e., in the Navy, it may be “predict the ocean better” – a need

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					<p>through which one may drive the proverbial truck), the quality of the science, and the money available.</p> <p>“Making a difference” requires us to change. I propose that we need to “compete for attention” and deliver something that has a measurable impact upon society. In a classic systems engineering sense, this is where we oceanographer must become extroverts and interact with our customers to determine requirements, and later, to determine customer satisfaction or to deliver training. In a classic business sense, this is where we must become aware of our strengths (i.e., a cadre of great scientists working in great institutes), weaknesses (i.e., public indifference), opportunities (i.e., general awareness of harmful algae blooms), and threats (i.e., policy and funding decisions that relegate ocean research to the bottom of the heap). In a classic program management sense, this is where we track progress, deliverables, performance and metrics. In summation, we professionally prove our need and answer the call. The oceanography community, which most of us joined for pure love of the ocean, must change and either groom (or hire) ocean-savvy businessmen or business-savvy oceanographers to implement “Making a Difference”.</p> <p>This is a huge challenge! I do not know how to do it, but I offer observations on a few mechanisms I have observed.</p> <p>First, how do you prove that you “Make a difference”? We in NASA Applied Science are building a "bread board" and "sensitivity analysis tool", called in “D.C.-speak” the “Rapid Prototype Capability”. The tool is meant to give a quick look answer for "so what" that may lead to further, more robust study, transition, or even policy decision. From a NASA perspective, we are building the tool for analysis of NASA data and models, but it will be available for the community to use. It must be a community tool - accepted, managed, and improved by the "community". (All of this harkens back to my Institute for Naval Oceanography experience and our work on a tool that would quantify the impact of a new algorithm, model, or data assimilation scheme upon an operational modeling system - the tool worked, but in some cases researchers did not like independent review or review with operational data streams.)</p>

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					<p>When I use the term community, it is not solely the oceanography community! We work with many federal partners - NOAA, USDA, EPA, DOI, State, DHS, DOT, and HHS to name a few. Our communities are: agriculture, air quality, aviation (actually all of transportation), carbon management, coastal, disaster management, ecological forecasting, energy, homeland security, invasive species, public health, and water quality. There are common problems and some universal solutions and common tools within the spectrum; this spectrum provides a holistic or "ecosystem" view.</p> <p>To repeat, I personally look forward to the implementation of the strategic course.  <b>Johnson, NASA Stennis</b></p>
09	50		52		<p>Agree that establishment of an integrated ocean observing system is a key infrastructure need for addressing ocean research priorities. However, the plan as written differentiates the IOOS from models when in fact, IOOS is not just an observation system. It includes two other essential subsystems – data and information management and modeling. The 3 subsystems taken together are all essential elements to establishing an integrated system, and the plan should reflect that.  <b>AOOS-McCammon.</b></p>
09	50		52		<p><b>1. Observing Systems</b></p> <p>The most ambitious ocean research and monitoring initiative that the ORPP should strongly recommend is an integrated ocean observing system (IOOS). The IOOS is envisioned as a network of ocean sensors and instruments that will be deployed throughout U.S. waters and eventually linked to a global ocean observing system. The IOOS will connect coastal, ocean, and Great Lakes observing systems, which in turn will supply data to participating federal, state, academic and private research and operations entities. The IOOS is the realization of the confluence of advances in sensors, sensing platforms, as well as data transmission and management that can accelerate and deepen our understanding and management of large and complex systems. Furthermore, ecosystem-based management, which takes into account the relationships among all ecosystem components, will demand more timely and applicable ocean observing capabilities. The IOOS will be an integral component in tracing, understanding and addressing coastal pollution, natural hazards, climate</p>

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					<p>change, weather and storm prediction, coral reef degradation and fisheries depletion. CORE recommends that JSOST strongly support the development and implementation of a sustained, national IOOS within the ORPP.</p> <p style="text-align: center;">a. Ocean Data and Information Systems Needs</p> <p>Ocean and coastal research, observing, and monitoring activities are generating new data at ever-increasing rates—data that must eventually be analyzed, distributed, and stored. CORE concurs with the Ocean Commission that “the nation’s ocean and coastal data management systems should be modernized and integrated to promote interdisciplinary studies and provide useful information products for policy makers, resource managers, and the general public.” Agencies need to coordinate federal data management and develop an information management and communications program that will effectively store, access, integrate, and use a wide and disparate range of data needed to better understand the environment and to translate and deliver scientific results and information products in a timely way to national, regional, and local decision-makers. CORE recommends that the ORPP create a subsection under Opportunities for Progress to address the needs associated with modernizing ocean data and information systems.</p> <p><b>CORE-West</b></p>
09	50	5	50	5	<p>The real and purposeful interweaving of human dimensions research data and methods is part of this total “intellectual innovation.”</p> <p><b>Wilson, SeaTrust Institute</b></p>
09	50	9			<p>Insert: at end of line: “and science-quality satellite-based observations” .</p> <p><b>Muller-Karger, University of South Florida</b></p>
09	50	16			<p>Add after “Observing Systems”: “and Observatories” .</p> <p><b>Muller-Karger, University of South Florida</b></p>
09	50	17		19	<p>: Need to stress international aspect necessary for a global observing system. No mention is made of integrating other nations into research etc.</p> <p><b>Pacific Seabird Group-O’Reilly</b></p>

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09	50	18			Insert after “system”: “that includes tightly coupled operational and research components” . <b>Muller-Karger, University of South Florida</b>
09	50	21	50	21	remove the 'd' in 'integrated' <b>National HAB Committee-Anderson and Glibert</b>
09	50	22	50	22	insert 'terrestrial, coastal, and ocean" before 'observing systems)." <b>National HAB Committee-Anderson and Glibert</b>
09	50	24		26	Don’t forget ecological issues. Land-based and at-sea monitoring of marine birds can also be platforms to add to physical & biological data. These activities already take valuable data, but need better database management, maintenance, distribution, access. Put resources into using what’s already available, especially for looking back, or to validate models. <b>Pacific Seabird Group-O’Reilly</b>
09	50	25	50	25	insert 'coastal and' before 'ocean processes," <b>National HAB Committee-Anderson and Glibert</b>
09	51				<b>“Models—Questions about how the ocean will react to future conditions cannot be answered only by direct observation. Combining existing data sets with scientific and social theory and modeling will provide a window on conditions in the past and enable predictions of the future.”</b> Models usefulness is not limited to prediction of the past and future. Hydrodynamic models are also useful for assessing where different habitats and their associated biological communities are likely to be located, particularly in nearshore and estuarine areas. <b>Bailenson, Florida Department of Environmental Protection</b>
09	51	3			Add “as part of the Global Earth Observing System of Systems” . <b>Muller-Karger, University of South Florida</b>
09	51	4			Insert bullet: “Fully incorporate biological, chemical, and geological measurements into the Integrated Ocean Observing System and the Global Ocean Observing System. Of particular importance is to integrate new technologies for fish stock and biological productivity assessments”. <b>Muller-Karger, University of South Florida</b>
09	51	4	51	8	If the IOOS is to provide researchers with the quality data they require, then the IOOS must continually evolve. To do this, it will require a close and ongoing partnership with the research

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					community for technology development, process studies and model development. The regional systems offer the flexible environment to foster this partnership. <b>NFRA-Quintrell</b>
09	51	7	51	7	change the text to read "watershed-specific monitoring/observations and land-water fluxes;" <b>National HAB Committee-Anderson and Glibert</b>
09	51	8	51	11	Change the first sentence to read something like "Maintaining continuity of existing satellite missions and incorporating essential new capabilities into future missions." Make it clear that continued satellite coverage will be essential for the foreseeable future. Provide some ammunition for NASA, which is at present struggling to maintain satellite missions whilst also contributing to a number of man-in-space efforts. <b>Muench, ESR</b>
09	51	8	51	11	Maintaining our existing satellite capabilities is critically important. In addition, new sensors and satellite missions are needed to increase the temporal and spatial resolution of measurements in the near coastal zone to understand how coastal systems respond to extreme environmental events such as hurricanes. <b>NFRA-Quintrell</b>
09	51	9			Insert at beginning of line: "satellite-based" Insert after period: "This capability needs to be planned and scoped jointly with, and as an integral part of the nation's Integrated Ocean Observing System and complementary research observatories". <b>Muller-Karger, University of South Florida</b>
09	51	17	51	18	The need to expand sensor development for ecological, in addition to physical, parameters cannot be overemphasized. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
09	51	18			CSO believes the ocean observing system will not be fully implemented until the system provides useful and coordinated information to on-the-ground decision-makers. As such, we request a bullet be added that addresses the need to deliver information to end-users. This is consistent with the needs identified on page 50, line 16. <b>CSO-Andrews</b>

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09	51	19	52	18	<p>The section on models lacks a coherent message.</p> <p>A large part of the confusion and self-contradiction in the present text stems from the different of the word “model”. “Model” can be used to describe a specific model configuration, including all parameter settings, the specific domain, and the forcing fields. Alternately, “model” can be used to describe a modeling system, which is the software embodiment of a diverse array of algorithms from which the most appropriate combination can be selected for a particular application. The Modular Ocean Model (MOM) and the Regional Ocean Modeling System (ROMS) are well-known examples of modeling systems. The statement on p. 51, l. 30 through p. 52, l. 4 about the impossibility of a single model maximizing its generality, precision, and realism may be appropriate if describing a specific model configuration, but we do ourselves a great disservice if we do not think that modeling systems can be developed that are optimally configurable for a particular application. The text then describes community models (i.e. modeling systems) as a current and emerging capability without suggesting any actions. The text then reverts to describing global high resolution model configurations, noting the potentially broad utility of such configurations (although for specific technical reasons, no existing global high-resolution model configuration is simultaneously adiabatic enough for century scale integrations while also utilizing the data assimilation required for forecasts of days).</p> <p>The discussion here would be much clearer if the discussion of specific model configurations were separated from the discussion of modeling systems.</p> <p><b>Hallberg, NOAA/GFDL</b></p>
09	51	19	52	18	<p>The section on models identifies no action items, and makes no recommendations, either general or specific, for addressing the “key infrastructure needs” (see p. 50, lines 3-15) from ocean models.</p> <p>If I were to make a bullet-pointed list of required actions (akin to that for the observing systems on p. 50, l. 27 through p. 51, l. 18), I would suggest that key steps to the development of a maximally valuable national ocean modeling capability include:</p>

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					<ul style="list-style-type: none"> <li>• Consolidate existing modeling capabilities into a flexible and comprehensive unified ocean modeling software environment, building on the diverse existing community and developmental ocean models. These capabilities must include discretizations of resolved processes, parameterizations of unresolved processes, data assimilation and analysis techniques. Ease-of-use in operational, research, and pedagogical applications should be a primary consideration in designing the unified software environment.</li> <li>• Conduct systematic best-practice studies to provide clear guidance in the selection of the optimal set of algorithms and techniques for a particular modeling application.</li> <li>• Translate understanding derived from observations of oceanic processes and phenomena into improved representation of these processes in numerical models.</li> <li>• Develop high-resolution global ocean model configurations for use in real-time short-term forecasts out to days or months, reanalysis of the historical ocean state, and multi-century climate forecasts. To fulfill such a broad role and to minimize inherent biases, such configurations must be able to run for millennia with minimal drift in the ocean state when driven by steady forcing.</li> </ul> <p>This list assumes that, in addition to the few (very expensive) high-resolution global configurations, there will be a large number of application-specific model configurations. These will not require coordination on a national level, but should provide feedback and new techniques to the comprehensive software environment.</p> <p><b>Hallberg, NOAA/GFDL</b></p>
09	51	19	52	18	<p>Include large-scale Visualization in addition to Modeling and Simulation. Appropriate visualization tools will not only improve scientific understanding, but will also help convey this understanding to the general public.</p> <p><b>Raytheon-Moran</b></p>
09	51	21	51	21	<p>&lt;RPLC&gt;theory and modeling &lt;WITH&gt; theory and with numerical models constrained with observational data &lt;END&gt; ;</p>

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					<b>Zlotnicki, JPL</b>
09	52	9	52	9	delete 'called' <b>National HAB Committee-Anderson and Glibert</b>
09	52	10	52	10	<RPLC> <WITH> Current atmospheric models succeed at forecasting weather over the following few days because they combine the dynamics and thermodynamics embodied in the equations they represent, with ‘assimilation’ of actual data. So must numerical ocean models also assimilate data in order to correspond to reality as closely as possible. <END> ; <b>Zlotnicki, JPL</b>
09	52	14	52	14	insert "(and terrestrial)" after "the ocean" <b>National HAB Committee-Anderson and Glibert</b>
09	52	19	52	19	A whole section is missing from this section of the document. There is a need to develop innovative laboratory based approaches to determine the links and interactions of critical processes. This mix should include new experimental approaches to new tolls that permit more accurate and precise measures of organism response to multiple stressors. – <b>Landrum, GLERL</b>
09	52	19			Insert a new subsection entitled, “Ocean Data and Information Systems Needs” that include the following bullets: <ul style="list-style-type: none"> <li>• improve coordination between the existing data centers and integrate ocean and coastal data from different agencies, academic and private institutions, the goal of which would be the creation of a national ocean and coastal information management and communications partnership to generate information products relevant to national, regional, state, and local operational needs;</li> <li>• set priorities for archiving historical and nondigital data;</li> <li>• provide incentives to attract information technology expertise into the ocean sciences community; and</li> <li>• set common requirements, data certification procedures, and deadlines for investigators to submit data acquired during federally funded ocean research projects.</li> </ul> <b>CORE-West</b>
09	53		56		This section does an excellent job of highlighting the need to improve mechanisms for the translation

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					and application of research results. <b>Babson, UW Seattle</b>
09	53		54		This section describes translating scientific results into information products for the public and users. This is a critical component, but again, these are also part of the end-to-end system envisioned as IOOS. Therefore, the plan should reflect that developing an IOOS will in fact, result in these activities. <b>AOOS-McCammon.</b>
09	53		54		Ocean Sciences Education and Outreach should be elevated to a near-term priority. In addition, the ; Making a Difference section should be elevated to a more prominent position. Given the nature and importance of education, outreach and communication, they should be an overarching opportunity. <b>NFRA-Quintrell</b>
09	53		54		The development of techniques to integrate scientific data into decision making is in itself a science. Development of decision theoretical approaches and adaptive management approaches should be considered a priority. Such approaches not only assist in the development of informed decisions, but can provide a feedback system for setting new research priorities. <b>American Bird Conservancy-Fenwick</b>
09	53				<b>“Information To Support Decision-Making”</b> This section is nicely stated and captures a critical need. <b>Bailenson, Florida Department of Environmental Protection</b>
09	53		56		CORE strongly supports this section and specifically the need to strengthen ocean-related public education and outreach programs, to facilitate coordination of ocean-related education among federal agencies, and enhance collaboration among the research community, state and local education authorities, and the private sector. We agree that a primary objective of the ORPP should be to create an ocean literate public. This nation must enhance educational achievement in natural and social sciences and increase ocean awareness, including promotion of programs that transcend the traditional mission boundaries of individual agencies. The ORPP should include a recommendation that the nation must develop a medium-term (five-year) national ocean education plan for K–12 and informal education. Also the ORPP should include a series of specific and concrete

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					<p>recommendations that federal agencies, Congress, and the academic community can undertake within the next five to ten years to increase ocean literacy.</p> <p>Finally, CORE concurs with the recommendation to designate science translators to make the science education link and to translate scientific concepts and data into effective conservation and management measures.</p> <p><b>CORE-West</b></p>
09	53	8	53	23	<p>Page 53 line 15-16 refers to the “close coupling of problem formulation and data collection” which implies a methodological shift which may be appropriate. This section also refers to “communications between research and decision-makers will allow managers to acquire the information they need...” Problems with communications between researchers and decision-makers at all levels calls for specific research and communications plans to go far beyond hiring professional communicators to develop “more accessibly, derivative products.” Even if hiring these professionals was part of a broader plan to improve communications, then in addition to attunement to scientific objectives and management goals, they must also be sharply attuned to the larger social and policy issues if their work is to truly communicate concepts to the breadth of audiences implied in this section.</p> <p><b>Wilson, SeaTrust Institute</b></p>
09	53	12	53	23	<p>Both of these describe different aspects of the goals of boundary organizations such as COMPASS. COMPASS is a collaborative effort to advance marine conservation science and communicate scientific knowledge to policymakers, the public and the media. This organization works at the interface of science and policy, connecting researchers with policy-makers at both the regional and national level and helping scientists to create products that are more readily accessible to policymakers and the media.</p> <p><b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b></p>
09	53	17			<p>CSO requests that language be added that notes communication between researchers and decision-makers will also facilitate research that is relevant to specific management questions/needs.</p> <p><b>CSO-Andrews</b></p>
09	53	18	53	18	<p>add after processes "; scientists, in turn, can direct research to priority areas identified by managers."</p>

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					<b>National HAB Committee-Anderson and Glibert</b>
09	53	19			Establishing a mechanism to translate research into products usable by management is in our view a critical component of any strategy <b>Moriarty, USFWS</b>
09	53	20	53	20	We haven't near sufficient funding to carry out the basic research, so where will we find these "professional communicators"? This profession, if you want to call it that, simply doesn't exist at this time. I understand the problem ... scientists cover a complete range from extremely communicative and helpful with their results to completely obtuse. I would rather see an educational emphasis – for the scientists themselves – that would emphasize the subject communication aspects. The statement sounds as written like an overly simplistic solution to an eternally complex problem. Maybe just delete the reference to "communicators" and add a bit about training budding scientists in the art of communication. Maybe we should all take courses in journalism. <b>Muench, ESR</b>
09	53	23	53	23	<RPLC> <WITH> For example, in seeking a simple predictor of atmospheric conditions leading to famine in India, Sir Gilbert Walker proposed the now widely used Southern Oscillation Index (SOI). Modern researchers correlated the SOI and similar indices (temperature in the equatorial Pacific, for example) with precipitation and drought patterns worldwide. Other observations and numerical models have skill at forecasting the SOI, and thus the consequences it correlates with. Most end users may not be capable of using or understanding all the intermediate steps, or the complex dynamical interplay of ocean and atmosphere, but can use the final, simple correlation: the SOI is significantly above average, so this is what is likely to happen in my region, my crops, my fisheries. <END> <COMMENT TO EDITORS> Are you sure it is 'COMMUNICATORS' who do this? <END> ; <b>Zlotnicki, JPL</b>
09	54		56		<b><u>There is a noticeable absence of public education, outreach, and ocean literacy in the 21+4 priorities.</u></b> Even if <i>implied</i> in the expanded description of the individual priorities, in order for the JSOST-defined goals to “enable informed public discourse and decision-making” (p.13), and to “engender within society a stewardship ethic to value and protect ... ocean and coastal ecosystems” (p.14), education and outreach <i>must</i> be a clearly defined priority for the ocean research community

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					and their funding agencies. Without broader ocean literacy and increased interaction between the research sector and the public, support for such research and appreciation of its results will be significantly diminished. A good starting point would be to transform the recommendations from pp. 54-56: "Establishing an Ocean Literate Nation," into key bullet-points, and add them into the research priorities, perhaps as a completely new theme. <b>Harbor Branch Oceanographic Institution-Frey</b>
09	54		56		I appreciate the report you have provided on oceans. Regarding the section on establishing an ocean literate Nation I believe that you need to put more emphasis on education. All of the sections you list for research are very important but research also needs to be done on education. I have seen, over the years, more information become available on fisheries, seafood and ocean education but there is no one single effort to provide a variety of curricula to meet the needs of the fishing and seafood industries. The ocean plays a major role in the sustainability of these industries yet proposed solutions to many issues are often fragmented. For example, all of the research for observation of ocean activities, natural or otherwise, benefits the fishing and seafood industries but it seems industry seldom comes in contact with scientific research. Societal and economic issues regarding oceans have just recently become more prevalent in discussion circles. There are many resources available to develop world-class fisheries, seafood and ocean curricula but there is no concentrated collaborative effort. I believe through your process a system could be developed or a research effort could take place on what currently exists at all levels of education, elementary, secondary and post-secondary including Vocational and Technical education. This assessment would allow you to determine where we are and where we need to go to build a ocean literate nation. Thank you for allowing me to comment. <b>Herrmann, private citizen.</b>
09	54		56		We agree with the importance of establishing an ocean literate nation through increased education opportunities, but recommend that you increase its profile by making education a cross-cutting theme (as it was in an earlier draft) or overarching opportunity. It should receive more prominence in this plan. <b>AOOS-McCammon.</b>

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09	54	2			The JSOST may want to add that fostering communication will also result in creating synergies with existing data and tools. <b>CSO-Andrews</b>
09	54	2	54	2	insert after "effective development" the following, ", application, " <b>National HAB Committee-Anderson and Glibert</b>
09	54	10	54	10	Why not just say “improved education efforts for the general public.” This is probably one of the most difficult issues in the entire document because the US has, especially when compared to European countries like Germany and to Eastern countries like Japan, an essentially ascientific societal view of the world. (In how many other modern countries would a non-zero percentage of the population still maintain that the sun revolves around the earth?!!) <b>Muench, ESR</b>
09	54	14	54	14	after communication insert ", and management", <b>National HAB Committee-Anderson and Glibert</b>
09	54	18			Find it narrow to only consider ‘realizing the goal of sustainable use of ocean and its resources’. Is that really our goal? How about minimizing human impact on ecosystem health? A well-functioning ecosystem is necessary for humans, and we don’t yet understand it. <b>Pacific Seabird Group-O’Reilly</b>
09	54	21	54	21	after "ocean-literate public" insert ", scientifically knowledgeable managers, " and delete "and" before "a larger" <b>National HAB Committee-Anderson and Glibert</b>
09	54	23	55	3	I give this a loud “Yes!”. K-12 education absolutely should include courses on oceanography, and probably meteorology and geology as well. I’m uncertain to what degree this is already the case, but a much broader earth sciences education than at present is essential if we are to even begin to cultivate a scientifically aware public. <b>Muench, ESR</b>
09	54	24	54	25	Making ocean science a requirement in national science standards is crucial. <b>Wilson, SeaTrust Institute</b>
09	55				Maintaining the intellectual capacity of the workforce is another key component of this strategy. The

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					shift from single focus efforts to the interdisciplinary approach will require changes in the institutional and educational systems if we are to be successful in this effort. In addition, it will require the development of a process to integrate researchers who have traditionally worked in the marine environment with those from the terrestrial component. <b>Moriarty, USFWS</b>
09	55	1	55	1	insert ", managers and policy makers," before "and expanding" <b>National HAB Committee-Anderson and Glibert</b>
09	55	19	55	28	Given the historical contribution of graduate education at research universities to the present oceanographic-related workforce, I would be concerned if the implementation plan does not specifically address the present funding crisis in graduate education in the ocean sciences. The economic engine of graduate schools with an oceanographic focus has always been federally funded research. The workforce that is educated in this manner has traditionally not been required to fund their education and it could not be expected that, in the future, individuals would be willing to take on substantial student loan burdens for a profession that traditionally has much lower pay than other professions requiring equivalent investments in time and tuition. It is not enough to say that an educated and multi-disciplinary workforce is required. The implementation plan must go a step further in identifying the methodology and investments necessary for this to occur and it must be specific as to the educational track that will produce this workforce in addition to addressing the mechanics of funding the education for this workforce. <b>Williams, University of Miami</b>
09	55	19	56	8	In addition to proficiency with scientific methods and technical communications skills, a qualitative interpretive and evaluative understanding is required to address the needs listed in p. 55 line 25-27 to transcend natural science and to “possess the means to effectively communicate research results.” The report’s specific suggestions for developing certifications, incentives etc. are excellent p. 56 line 4-8. <b>Wilson, SeaTrust Institute</b>
09	55	26		28	Real goal appears to be to shift focus to a study of humans – their benefits, resource uses, recreation. This sets up every management action (or level of support for research) with respect to how humans can benefit; not necessarily a way to understand the ecosystems.

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					<b>Pacific Seabird Group-O'Reilly</b>
09	56	1	56	8	The present role that research universities hold in providing the future employees for these endeavors must be noted and their future roles should be explicitly addressed. It should not be assumed that research universities and their associated graduate education programs will produce the necessary numbers of future employees. I suggest that, as a key part of the plan, that a full report on the present state of the present ocean-related workforce, training and education at all levels and institutions in the US will be critical along with specific recommendations that will ensure the future workforce necessary to implement all aspects of the US Ocean Policies. . <b>Williams, University of Miami</b>
09	56	2	56	2	insert 'and absorb' after 'effectively communicate' <b>National HAB Committee-Anderson and Glibert</b>
09	56	9			[Insert text that addresses international outreach efforts.] <b>Muller-Karger, University of South Florida</b>  <i>Building on the Bases of International Partnerships</i> - It is in America's interest to work with the international community to preserve the productivity and health of the oceans and to secure cooperation among nations everywhere in managing marine assets wisely. The U.S. should help develop advanced ocean policy processes in partnership with the international community. Particularly important is to provide technical and financial assistance to build ocean science and management capacity in developing nations and small island states. The U.S. also needs to engage in partnerships with nongovernmental organizations, the scientific community, the private sector, regional institutions, and others to combine government and nongovernmental resources and expertise. <b>Muller-Karger, University of South Florida</b>
10	0				This section provides a sufficient set of near-term priorities. In particular, it is critical that the nation's coastal management and engineering communities have access to a centralized database of information that will foster collaboration, robust research, and integration across disciplines. <b>American Shore and Beach Preservation Association-Ordal</b>

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10	0				<p>ERF supports the three key science and technology efforts identified under overarching opportunities, namely developing understanding to support forecasts; collecting and synthesizing information needed to support ecosystem-based management, especially for coastal and nearshore ecosystems; and accelerating deployment of a national ocean observing system. Furthermore, we believe that, as recommended by the Ocean Commission, requirements for ecosystem-based management should dictate priorities for both forecasting and the development of the national observing system.</p> <p>ERF also supports the three near-term priorities as focal points for achieving significant advances over the next two to five years. However, we believe that broader activities that address the priorities identified under the six themes could begin during this time period. Forecasting the response of coastal ecosystems to persistent forcing and extreme events must go beyond integration of observations and models; these approaches should be complemented with appropriate experimental and theoretical studies. ERF also endorses comparative analysis of marine ecosystem organization as a near-term priority. We think that dismissal of experimental approaches to this end is perhaps overstated. In fact, the comparisons of the efficacy of ecosystem management strategies described as the second approach would benefit from experimental design and analysis. We also point out that closures are not the only kinds of ecosystem management strategies that should be compared. More comparisons of continental shelf and estuarine ecosystems around the United States can provide insights into geographic variations in ecosystem structure and function and region-specific strategies that might be useful elsewhere. Improved sensor capabilities are important near-term goals, but it is important that these developments should be driven by the needs of science and management and not by technology for its own sake.</p> <p>We underscore the importance of assessing meridional overturning circulation variability to understanding Earth’s climate system, but we recognize that this topic is generally considered to lie outside the realm of coastal science. This is an issue for which a concentrated effort in an observing system might really pay off. Although we are not convinced that two to five years is long enough to “accurately establish the true variability,” it is definitely a start. As coastal scientists, we point out that better measurements and understanding of the flow of fresh water into the Arctic Ocean,</p>

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					particularly from Asia, are required as part of this assessment. Related research should be incorporated into international science programs. <b>Estuarine Research Foundation-Boesch</b>
10	57		63		<p>[Repeated in Executive Summary] The concept of “enhancing human health” features prominently in the narrative and executive summary; it is named as one of the societal themes and research priorities. However, it is not explicitly included in the three key areas of science and technology (referred to as “overarching opportunities”). The four near term science priorities incorporate aspects of the “overarching opportunities” and therefore human health issues are not adequately addressed in the near-term priorities. For these ambitious near term goals to satisfy longer-term research needs, it is important that issues of human health are fully integrated into the design and implementation of the near-term science priorities.</p> <p>To fully integrate human health science, it must be understood that public health disciplines encompass a wide range of studies and extend beyond disease surveillance. Human health scientists, including those engaged in toxicology, biology, risk assessment, epidemiology and related disciplines, are conducting research to look at the impact of human activities on the oceans and the impact of the oceans on human health and well being. Such studies span the continuum from the cellular to population level. Human health is at risk from ocean events such as harmful algal blooms, microbial and anthropogenic pollution, severe weather and other disasters, as well as global changes. Humans benefit from the oceans through high quality food sources, recreation, biodiversity, pharmaceuticals derived from the seas and marine models of human disease. An example of an important research need is to improve our understanding of biomarkers of exposure and early biological response for ocean toxicants and pathogens.</p> <p>It is very important that those scientists involved in oceans and human health research are fully integrated into the planning and implementation strategies of the near-term research goals related to forecasting, resource management and deployment of ocean observing systems.</p> <p><b>E. Faustman, UW</b></p>

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10	57		58		The 3 opportunities identified here: developing the understanding and capability to forecast ocean processes; collecting the scientific information needed to support ecosystem-based management of resources; and accelerating deployment of an ocean observing system to advance forecasting and management capabilities; are all critically important priorities for the nation to advance its understanding and environmentally sound use of the ocean and coast. It is confusing to the reader to have these buried so deep in the document and not to clarify how they relate to the 21 research priorities and the 4 near-term priorities. We recommend that you consider a reorganization of the plan that would bring these 3 opportunities to the forefront and give them greater visibility. <b>AOOS-McCammon.</b>
10	57		63		The report meets the mandate of the Ocean Action Plan with twenty-one priorities from six theme areas. The report could stop there. Instead, the report writers go on to make additional recommendations, to further reduce the number of priorities by turning them into “overarching opportunities.’ We hope this is simply another way of restating the 21 priorities in lump form. More likely this a way to place greater emphasis on some priorities at the expense of other. This may even be a further prioritization and winnowing to justify decreased funding. The reader can not tell. In doing this, the report writers depart from the holistic and interconnected principles of ocean science. If one must take this course, clearer delineation should be made between reporting on what the research community wants (21 priorities across 6 themes) and subsequent winnowing to three key areas of science and technology to pursue. Frankly, the further reductionism of priorities in the latter portion of the drafted report is inappropriate for "a nation intrinsically connected to and the immensely reliant on the ocean" and is arguably un-American. When Great Britain got serious about ocean science research, they outfitted a three-masted corvette, one ship, the HMS Challenger in 1872. When the United States got serious about ocean science research, we outfitted the Great U.S. Exploring Expedition of 1838 with four ships and two schooners. The Navy commissioned their best qualified scientific men to chart the seas, charting fifteen hundred miles of the Antarctic coast in 1840. In 1843 an American “conchologist” made scientific observations of marine invertebrates that so thoroughly anticipated by more than a decade Darwin’s publication on the origin of species that he was wrongly accused of plagiarism until

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					his field notes were examined. <b>Moir, Ocean River Institute</b>
10	57		63		Better fish counts and population models are important and worthy of more research. This science, however, will be of little value to the nation if acidification from global warming or nutrient runoff from non point sources makes fish too slimy for consumption; or if bioaccumulation of fat-soluble toxins like mercury or biomagnification of endocrine-disruptor compounds makes fish detrimental to our health; or if invasive species disrupt populations and destroy fish habitats. As you know, there are no silver bullets for saving ocean ecosystems. A few directed actions will not amount to much because ocean ecosystems are a bit more complicated than is a target to aim at. The myriad of assaults humanity brings to oceans only increase marine complexities, complexities that make more difficult the challenges faced by ocean researchers. Given our many interactions and commerce with oceans, we need government support to ocean science more than ever before, most particularly if ebb tides are to be turned for the better. <b>Moir, Ocean River Institute</b>
10	57				<b>“OVERARCHING OPPORTUNITIES”</b> This reiterates the problem mentioned earlier in the Ex Summary. As truly useful and valuable a tool as ocean and remote observing are, they remain a tool, not a goal in themselves. Combined with the slim coastal research focus, the plan focuses too heavily on the long term advances needed without capturing the range of benefits that could be realized in 2-5 years. <b>Bailenson, Florida Department of Environmental Protection</b>
10	57		63		<b>Overarching Opportunities</b> <ul style="list-style-type: none"> <li>▪ Understanding and capability to forecast ocean processes</li> <li>▪ Enhanced scientific support of ecosystem-based management</li> <li>▪ Targeted deployment of an ocean observing system</li> </ul> <b>Near-term Priorities</b> <ul style="list-style-type: none"> <li>▪ Forecasting the response of coastal ecosystems to persistent forcing and extreme events</li> <li>▪ Comparative analysis of marine ecosystem organization (CAMEO)</li> </ul>

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					<ul style="list-style-type: none"> <li>▪ Sensors for marine ecosystems</li> <li>▪ Assessing meridional overturning circulation variability: implications for rapid climate change (Atlantic Ocean conveyor belt)</li> </ul> <p>It is difficult to comment on the overarching opportunities and the near-term priorities without an understanding of how these priorities were solicited from around the nation and ultimately decided upon as the country’s top priorities. There is no description of how these groupings were made, research selected for consideration, or prioritization criteria applied. If JSOST cannot demonstrate the evaluation methodology, then we cannot assess the value of the research prioritization choices made in the draft ORPP.</p> <p>For example, the “Assessing Meridional Overturning Circulation (MOC) Variability: Implications for Rapid Climate Change” priority is focused in the Atlantic Ocean. While understanding the Atlantic conveyor belt is important, it is not clear why it would be the highest priority research when it comes to rapid climate change. Perhaps the highest priority climate change research should be done in the Beaufort and Chukchi Seas or in the Pacific Islands, but we are unable to provide thoughtful critique of your decision because the draft ORPP does not provide a record, score sheet, or other justification.</p> <p><b>State of Alaska-Murkowski</b></p>
10	57	1	55	31	<p>It is important to educate the larger policy community about the process of scientific prediction, uncertainty and precaution, as well as its uses and limitations. Forecasting is frequently relied upon inappropriately (and in ways scientists never intended) because of the hunger for models of the future upon which to make all sorts of decisions. While this section outlines the “tremendous potential” it might equally stress the appropriate boundaries and cautions. Even excellent forecasting with today’s technologies often changes as events draw closer.</p> <p><b>Wilson, SeaTrust Institute</b></p>
10	57	9			<p>Append: “Why are coral reefs around the globe undergoing such rapid declines in health and cover?”</p> <p><b>Muller-Karger, University of South Florida</b></p>
10	57	9			<p>At line 9, insert new sentence at end of current sentence: “What if we knew the impacts to seabird</p>

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					populations before a wind farm is constructed?" <b>Moriarty, USFWS</b>
10	57	11	58	25	In our opinion this should be the first section after the introduction. The three overarching areas: “(1) developing the understanding and capability to forecast ocean processes; (2) collecting the scientific information needed to support ecosystem-based management of resources, especially those found in coastal and near shore ecosystems; and (3) accelerating deployment of an ocean observing system that will, in turn, advance forecasting and management capabilities;” hit the mark. Each should be developed further and the information on ocean observing from “Opportunities for Progress” should be placed in a discussion of item “3”. JSOST should then map how each of the themes relate to one or more of these three overarching areas. Finally, each overarching area should identify three to five near-term priorities that relate both to that area and several of the themes. By taking this approach, CORE believes that the clarity and utility of the ORPP will be greatly enhanced. <b>CORE-West</b>
10	57	12	57	20	I would add a fourth key effort: 4) ensuring a stable, skilled and educated workforce to execute the science and technology efforts . <b>Williams, University of Miami</b>
10	57	19	57	19	after, "that will" insert "through linkages to similar terrestrial and hydrological capacities," <b>National HAB Committee-Anderson and Glibert</b>
10	57	25			<u>Areas where ‘seabirds as indicators’ applies</u> note that seabirds were among first indicators of El Nino/LaNina impacts. <b>Pacific Seabird Group-O’Reilly</b>
10	58		63		Although the plan indicates these 4 near-term priorities were chosen based on the criteria for the 21 research priorities plus some additional criteria, it is not clear how those criteria were actually used to decide on these particular 4. Additional justification for these choices would enhance the plan. <b>AOOS-McCammon.</b>
10	58	1		2	another example of omitting everything inbetween oceans and human health (though do mention fish stocks (presumably as human food). <b>Pacific Seabird Group-O’Reilly</b>

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10	58	2	58	2	insert 'like harmful algal bloom toxins' after 'health hazards,' <b>National HAB Committee-Anderson and Glibert</b>
10	58	2			At line 2, change "...fish stocks, and human health hazards..." to "...fish stocks, seabird prey base, and human health hazards..." <b>Moriarty, USFWS</b>
10	58	6			Replace "Managing resources" with "Managing our approach to using resources" . <b>Muller-Karger, University of South Florida</b>
10	58	7			"resource" should be plural. <b>Muller-Karger, University of South Florida</b>
10	58	14			Replace "system" with: "system coupled with a process to synthesize information" . <b>Muller-Karger, University of South Florida</b>
10	58	20	58	20	insert 'with observations and modeled land inputs' before "will allow researchers" <b>National HAB Committee-Anderson and Glibert</b>
10	58	23			Insert after "areas": "(understanding and synthesis/forecasting, scientific support for ecosystem-based management, and deploying an ocean observing system)" . <b>Muller-Karger, University of South Florida</b>
10	58	28			What are the 21 research priorities? Provide a table and reference numbers. <b>Pacific Seabird Group-O'Reilly</b>
10	58	28	63	22	This is the first time these priorities appear in the draft ORPP. At first glance some of the priorities do not seem to flow out of the themes. To improve this section, the JSOST should clarify the criteria and process used to select these criteria and describe how these priorities specifically relate to the themes and the overarching opportunities. From the narrative it is difficult to ascertain exactly what type of research activity is being proposed, JSOST should provide specifics research activities that would be undertaken under each of these priorities and the costs of these activities. <b>CORE-West</b>
10	59		63		By definition, this document must prioritize certain research needs. The group chose to prioritize four specific areas that utilize aspects of the three overarching opportunities (understanding and capability for forecasting ocean processes, scientific support for ecosystem-based management, and targeted

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					deployment of elements of an ocean observing system). In particular, sensors for marine ecosystems are a critical to collecting better data and enhancing understanding for all research priority areas, not just those indicated for near-term prioritization. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
10	59		59		Again would benefit from including an atmospheric link between land and ocean for transport of nutrients and pollutants and ? across the coastal zone. Transport is not only land/river/runoff bound <b>Matrai, Bigelow Laboratory for Ocean Sciences</b>
10	59		60		We agree that this is an important near-term priority for the entire nation. In Alaska, we are already seeing rapid ecological changes in waters within the U.S. EEZ resulting in changing ocean conditions, loss of sea ice and coastal erosion <b>AOOS-McCammon.</b>
10	59				<b>“NEAR-TERM PRIORITIES Near-term (2-5 years) priorities</b> <b><i>Forecasting the Response of Coastal Ecosystems to Persistent Forcing and Extreme Events</i></b> Forecasting the responses of the ecosystem to persistent hypoxia (the only natural system ‘event’ mentioned), will not help managers fix this problem. To find a cost effective fix, requires research into methodologies and innovations that eliminate (or at least greatly reduce) the causes. This section is useful for helping human health and infrastructure responses to these events, but it would be better to portray it that way and not potentially misrepresent the outcome. <b>Bailenson, Florida Department of Environmental Protection</b>
10	59	9	59	10	Replace “...will the effort maximize collaborations among agencies and sectors” with: “will the effort capitalize on the human capacity and the research and management infrastructure distributed across sectors throughout the country, and maximize collaborations and partnerships among sectors” . <b>Muller-Karger, University of South Florida</b>
10	59	9	59	9	Partnerships are listed as one of 2 additional focus areas for short-term priorities. Incorporating specific available human dimensions research and results (e.g. collaboration, conflict, and partnerships) and defining specific research surrounding partnerships that furthers the goals of this document are underdeveloped concepts in this report.

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					<b>Wilson, SeaTrust Institute</b>
10	59	12			Add after "...Ecosystems to": "Human Pressures, ". <b>Muller-Karger, University of South Florida</b>
10	59	12	59	24	<b><u>Over-emphasis on forecasting and modeling of very complex ecological &amp; societal interactions, with little mention of the fact that large volumes of empirical scientific data already exist that show clear relationships between human activities and ocean health.</u></b> Sharing and integration of this data, as well as defining clear paths to application and action (e.g. policy change, technological solutions, and public outreach) would be arguably more valuable as a near-term priority, than investment in complex modeling efforts whose benefits would not be felt until well beyond the 2-5 year need to address rapid ocean degradation. <b>Harbor Branch Oceanographic Institution-Frey</b>
10	59	12	60	15	The section "forecasting the response of coastal ecosystems to persistent forcing and extreme events" indicates improving understanding of hazard events, natural disasters, and changing ocean conditions. Ocean observing was mentioned throughout the recommendations. It is not clear whether this priority includes the necessary expansion of ocean observing systems to facilitate better data gathering and therefore, improved forecasting. In Washington State, for example, lack of coastal weather Doppler RADAR, buoys, and other ocean observing sensors creates a gap in understanding for accurately predicting occurrence of these events and their impacts to coastal ecosystems. Clarify language in this priority to emphasize the need to enhance ocean observing systems and fill regional and state data gaps. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
10	59	12	59	12	The importance of research aimed at improving the forecasting of extreme events, which was cited on page 4 line 29, has been forgotten in the drafting of near term priorities. <b>Offshore Operators Committee-Smith</b>
10	59	14			Add after "...natural disasters": ", human activities, ". <b>Muller-Karger, University of South Florida</b>
10	59	15			Add after "hypoxia": "and coral reef bleaching". <b>Muller-Karger, University of South Florida</b>

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10	59	15	59	15	after "such as", insert 'algal blooms and' <b>National HAB Committee-Anderson and Glibert</b>
10	59	23	59	23	insert 'and public' after 'sustaining ecosystem' <b>National HAB Committee-Anderson and Glibert</b>
10	59	27	59	28	“...characterization of submerged and coastal landscapes...” means mapping the bathymetry. Keep it simply stated so this requirement is integrated with the rest of the document. <b>Noll, NOAA Ship Rainier</b>
10	59	31	62	2	“ <i>Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade</i> (hereafter referred to as The Report) correctly identifies the need for developing “coupled physical and biological models of ecosystem-level response to various stressors” and the critical need for new, improved sensors that “can revolutionize understanding of the ocean environment by providing information at temporal and spatial scales not currently available.” Because monitoring the short space and time scales of coastal events requires a dense distribution of potentially costly sensors, it might be valuable if The Report dealt with this economic reality by emphasizing the need for the development of low-cost sensors and installations. <b>Ocean Research &amp; Conservation Association-Widder</b>
10	60		60		This comparison between managed resources should include Arctic regions, not only sub-Arctic. It is melting of Arctic Ocean seaice that will allowed for increased radiation to reach the Arctic Ocean basin possibly affecting CO2 balance, O3 and Hg balance, food webs, etc <b>Matrai, Bigelow Laboratory for Ocean Sciences</b>
10	60		61		We found this section confusing. We agree with the importance of attempting to forecast marine ecosystem responses to management strategies, but the approach described seems overly prescriptive, and we’re not convinced this would provide the best near-term opportunity to advance knowledge on this issue. <b>AOOS-McCammon.</b>
10	60				“ <i>Comparative Analysis of Marine Ecosystem Organization – Management of marine ecosystems can be improved by elucidating their underlying dynamics at a variety of scales.</i> ” This section starts out well, but then it gets to the proposed approach:

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					<p><b>“Since marine ecosystems cannot be understood through classical controlled experimentation, two types of analyses will be undertaken. First, constructing and applying various classes of energy budget and dynamic models to managed marine ecosystems will enable greater understanding of the impacts of human activities by contrasting biomass changes by trophic level. The second approach will compare systems where ecosystem management strategies have been enacted.”</b></p> <p>This seems out of place. The entire document talks only in general terms until here where it dictates two specific approaches to a complex problem. These appear to have potential, but why lock this part into these two narrow avenues of investigation?</p> <p><b>Bailenson, Florida Department of Environmental Protection</b></p>
10	60	7	60	7	<p>after 'vectors' add ', toxins,'</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
10	60	12	60	12	<p>delete the first 'and' and after 'water quality' insert ', and watershed'</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
10	60	12	60	15	<p>Here is an opportunity to revisit decision-support models to include new research including re-examining the role of experts-</p> <p><b>Wilson, SeaTrust Institute</b></p>
10	60	17	60	18	<p>Replace “Management of marine ecosystems” with: “Management of human activities within marine ecosystems” .</p> <p>Replace “their underlying dynamics” with: “the underlying dynamics of these systems” .</p> <p><b>Muller-Karger, University of South Florida</b></p>
10	60	17	61	21	<p>The priority recommendation of “comparative analysis of marine ecosystem organization” has some merit. Both the broader comparative analysis and detailed ecosystem assessments are necessary for ecosystem-based management. Ecosystem-based management requires robust data sources and ecosystem assessments, which many areas currently lack. In addition, ecosystem types vary widely including the amount of degradation they have sustained, and how they have changed over time. A comparative analysis of a range of ecosystem types would provide less useful information to state and</p>

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					regional resource managers than detailed assessments. As a result, jumping to forecasting a handful of candidate ecosystems is a disservice to the needs for detailed regional ecosystem assessments including characterization, which can then support areas of needed research, observation, modeling, forecasting, and management. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
10	60	17	61	21	The suggested analyses are acceptable, but an understanding of marine ecosystems should be expanded to incorporate other elements such as (1) understanding the relationships between ecosystem components and the generation of ecosystem services in different ecosystem types on scales relevant to management, (2) understanding how ecosystem components contribute to resilience to both natural and anthropogenic disturbances, and (3) the development of models for EBM that deal explicitly with uncertainty. <b>McLeod<sup>1</sup>, Boesch<sup>2</sup>, Heiman<sup>1</sup>, Hixon<sup>1</sup>, Lubchenco<sup>1</sup>, and Rosenberg<sup>3</sup>; OSU<sup>1</sup>, UM<sup>2</sup>, UNH<sup>3</sup></b>
10	60	22	60	22	insert '(land-water)' after 'of local' <b>National HAB Committee-Anderson and Glibert</b>
10	60	25			Insert after “approaches”: “span political jurisdictional boundaries and” . <b>Muller-Karger, University of South Florida</b>
10	60	26	61	10	I feel that a critical data gap for an ecosystems approach to management is our inability to link the quality/quantity of pelagic and benthic habitat to the productivity of living marine resources (LMRs) and protected resources (PRs). Part of this stems from our lack of knowledge on the critical habitat requirements for LMRs/PRs and their prey. The other problem is that we lack maps of the benthic habitat (geological and biological structure) and the distribution of prey and invasive species in the pelagic realm. Solving this problem will require a combination of process-oriented research and mapping, both of which are expensive and time consuming. <b>Dow, NMFS/NEFSC</b>
10	60	28			Insert after “connectedness of”: “geographical regions and of” . <b>Muller-Karger, University of South Florida</b>
10	60	29	60	29	delete 'various' <b>National HAB Committee-Anderson and Glibert</b>

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10	61		62		We question whether this is one of the top 4 research priorities. Rather, this is R&D work that should become a major component of all research and operational programs for ocean research. <b>AOOS-McCammon.</b>
10	61		62		Transferring technologies from research to operations remains a problem and should be considered as part of any technology development program. <b>NFRA-Quintrell</b>
10	61	1	61	1	insert 'threatened or' before 'managed marine' <b>National HAB Committee-Anderson and Glibert</b>
10	61	4		5	Areas where 'seabirds as indicators' applies to compare systems where ecosystems management strategies have been enacted. <b>Pacific Seabird Group-O'Reilly</b>
10	61	12		20	This is only place where integration of higher trophic levels (other than humans) is really addressed, though still no mention of specific groups. <b>Pacific Seabird Group-O'Reilly</b>
10	61	12	61	21	This is a good list of potential local study areas that provide opportunities to discover unique requirements as well as generalizable concepts. Incorporating some of the human dimensions research as suggested in other comments could serve to broaden data capture possibilities. <b>Wilson, SeaTrust Institute</b>
10	61	13	61	13	Change as follows: "...continental shelves, coral reefs, estuaries, and Great Lakes." – <b>Landrum, GLERL</b>
10	61	18	61	18	modify text to read, 'human use patterns (e.g., alters the land use and estuarine responses, displacement of' <b>National HAB Committee-Anderson and Glibert</b>
10	61	23	62	24	<b><u>The third near-term priority “Sensors for Marine Ecosystems”(p.61) should read: “Sensors and Biomarkers for Marine Ecosystems”.</u></b> As pointed-out in the detailed description of this near-term priority, “new biological observations” are as important to improved ecosystem assessments as in-situ sensors and satellite observations. As stated previously, important points should be included in the

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					bulleted text. We therefore suggest rephrasing. <b>Harbor Branch Oceanographic Institution-Frey</b>
10	61	24	61	24	delete 'ocean' <b>National HAB Committee-Anderson and Glibert</b>
10	61	25	61	25	change 'marine' to 'aquatic'; insert 'and terrestrail' between 'ocean' and 'observing' <b>National HAB Committee-Anderson and Glibert</b>
10	61	29	61	29	delete 'the' before 'biological' <b>National HAB Committee-Anderson and Glibert</b>
10	61	31			Insert: "An advanced space-based Landsat-class imaging capability enhanced with the capability to observe global littoral zones would address critical needs of coastal zone resource managers, industry and researchers." . <b>Muller-Karger, University of South Florida</b>
10	61	31			Insert after "observations": ", for example to detect and track fish stocks." . <b>Muller-Karger, University of South Florida</b>
10	62		63		Agree that climate change should be a near-term priority. But disagree with focus on MOC Variability which is a significant international issue. Within the U.S. EEZ, the Bering Sea – home to the largest U.S. fishery – is experiencing rapid ecological change. What will be the impacts of these changes not only on U.S. fisheries, but since the Bering Sea/North Pacific is “upstream” of the Atlantic, what are the implications of warming ocean waters that pass through the Bering Strait to the Arctic and then to the Atlantic? These questions should form the basis of near-term climate change research for the U.S. <b>AOOS-McCammon.</b>
10	62	4		24	this paragraph is a ‘wish list’ of future advances, and suddenly rather specific regarding genetics, physical sensors, etc; is it really relevant for this document? <b>Pacific Seabird Group-O’Reilly</b>
10	62	04	62	06	Even though most of the biodiversity in the pelagic zone occurs in the microbial (viruses, bacteria, protozoa, etc.)size classes, many of these components exist in an inactive state and exhibit a "boom and bust" life history. I feel that the "genetic bar code" library approach needs to be supplemented

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					with approaches that examine to functional biodiversity in the water column (including the role of microbial consortia). <b>Dow, NMFS/NEFSC</b>
10	62	4	62	7	I agree that developing DNA-based biosensors for ocean observation systems is a high priority opportunity in the near term. It is implied that biosensor development may focus on harmful algae and pathogens. Application of biosensor technology should be broader. The same biosensor technology can be easily adapted for sensing vertebrate and invertebrate animal eggs, larvae and tissues in in situ sensing, AUVs, and shipboard field sensors. Application of biosensors for organisms at higher trophic levels can provide valuable data for understanding ocean ecosystems, managing marine resources and seafood safety and forensics. <b>Dickhoff, NOAA Fisheries</b>
10	62	17	62	17	insert 'from land use changes and harvests' after "human activities" <b>National HAB Committee-Anderson and Glibert</b>
10	62	22	62	22	line, insert 'links to land activities and load management,' after 'ecosystem productivity,' <b>National HAB Committee-Anderson and Glibert</b>
10	62	26	63	22	The recommendation to focus on the Meridional Overturning Circulation (MOC) of the Atlantic Ocean does not follow directly from the discussion of ocean processes related to climate change that is presented in the section on “The Ocean’s Role in Climate” (pp. 36-40). In fact, Atlantic MOC is not even mentioned in the section on The Ocean’s Role in Climate (pp. 36-40), so it comes as a surprise that Atlantic MOC is offered as a near-term research priority.  Furthermore, the degree to which Atlantic MOC serves as a driver of Rapid Climate Change is controversial. That is, variability of Atlantic MOC represents but one of several hypotheses related to the origin of rapid climate change that is being investigated by climate scientists. An alternative hypothesis is that Rapid Climate Change involves reorganization of coherent patterns of surface-ocean and atmospheric circulation, very roughly analogous to that related to the Pacific Decadal Oscillation and the North Atlantic Oscillation (PDO and NAO) discussed in the section on The Ocean’s Role in Climate Change. The heat budget of the tropical ocean and its impact on

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					<p>atmospheric circulation, rather than Atlantic MOC, is thought by some to be the primary driver of rapid climate change. For more information, see work by Richard Seager and Mark Cane, Columbia University, and by David Battisti, University of Washington.</p> <p>Therefore, it would be wise to resolve, as much as possible, the controversy concerning the factors responsible for rapid climate changes in the past BEFORE implementing a major research initiative to monitor Atlantic MOC. It would be a shame to invest heavily in a North Atlantic observing system if the principal driver of rapid climate change occurs in the tropical oceans, or elsewhere.</p> <p><b>Anderson, Lamont-Doherty Earth Observatory, Columbia University</b></p>
10	62	26	63	63	<p>The bottom of p. 62 and all of 63 are inserts specific for someone's project; this should not be encouraged as the wider community would need to identify the priority topic or topics, not the moc unless all of the community agrees; if the moc circulation is the topic for the community, then ok but otherwise this specific reference should be deleted</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
10	62	26	63	22	<p>If we are going to connect globally on issues like the MOC, we must collaborate globally.</p> <p><b>Wilson, SeaTrust Institute</b></p>
10	62	26	63	22	<p>This is an appropriate near-term priority for the Oceans Role in Climate theme. This priority has become an international priority, e.g. the substantial investment by the Europeans in observations and modeling. In addition to substantial international interest, new US capabilities in observations, predictive modeling, and data assimilation of the oceans, make the likelihood of a <i>payoff</i> for this near-term priority much higher.</p> <p><b>Legler, US CLIVAR</b></p>
10	62	30	62	31	<p>after 'climate system.' Deleted</p> <p><b>National HAB Committee-Anderson and Glibert</b></p>
10	63	2			<p>Add after "Understanding": "the role of the Gulf of Mexico and the Caribbean Sea in the MOC, and understanding...".</p> <p><b>Muller-Karger, University of South Florida</b></p>

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10	63	3			Spelling of “conveyor” (misspelled as “conveyer”) . <b>Muller-Karger, University of South Florida</b>
10	63	15			Add after “vector winds”: “sea surface temperature, salinity, and ocean color” . <b>Muller-Karger, University of South Florida</b>
10	63	23			<p>Insert a brief section highlighting the importance of international partnerships and developing a strategy for U.S. leadership in international partnerships to transfer technologies, build capacity, and conduct joint research.</p> <p>Insert something like (text based on USCOP final report):</p> <p><b><i>Building on the Bases of International Partnerships</i></b> - The Ocean Research Priorities Plan addresses aspects of living marine resources, coral reefs, pollution abatement, marine debris, vessel safety, invasive species, habitat loss, science and observations, and conflict resolution among competing users. The implementation plan will consider a broader international strategy to address these research and management priorities. Specifically, the approach will consider:</p> <ul style="list-style-type: none"> <li>• Use multilateral approaches, including participation in international forums, to achieve solutions to global ocean issues where coordinated action by many nations is required.</li> <li>• Use regional and bilateral approaches, with input from U.S. states, territories, and tribes in those regions, to address regional ecosystem-based ocean and coastal management problems.</li> <li>• Provide technical and financial assistance to build ocean science and management capacity in developing nations and small island states.</li> <li>• Engage in partnerships with nongovernmental organizations, the scientific community, the private sector, regional institutions, and others to combine government and nongovernmental resources and expertise.</li> </ul> <p>The Administration will make continuing efforts toward accession to the United Nations Convention on the Law of the Seas. <b>Muller-Karger, University of South Florida</b></p>

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11	0				The <i>Charting the Course</i> report is a very good start. The Estuarine Research Federation looks forward to the JSOST implementation strategy for these national ocean research priorities and stands ready to assist in any way appropriate. <b>Estuarine Research Foundation-Boesch</b>
11	64				Need for a near-term accounting of the present state of the workforce that will support these activities and recommendations for the long-term investments necessary to support these efforts in the future. I don't know that anyone can say for certainty that they have a very good understanding of this issue. Perhaps someone can and does. I have noticed the past 5 years a significant aging of the ocean science attendees at traditional workshops and meetings. It is possible that many of the present available skilled workforce may be retiring within the next 5-10 years. . <b>Williams, University of Miami</b>
11	64		65		It appears that the detailed implementation strategy is forthcoming. It is critical to spell out in the implementation document the process and roles for various regional, state, and local interests to partner and participate with federal research priorities. In particular, this process should be flexible enough to allow for regional, state, and local prioritization to fill research and monitoring gaps faced at these levels. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
11	64		65		This section describes how the Implementation Strategy to address these national research priorities will be developed. The process does not appear to provide for any public input, which is unfortunate since a plan is merely a wish until it becomes implemented and has the funding available to be implemented. Our major concern is that the federal agencies will be asked to re-program existing funds in order to accomplish these goals, when instead, the plan should reflect a major commitment of new funding to the ocean. The Wall Street Journal recently included this factoid in an article regarding the U.S. population now reaching 300 million: "The Center for Environment and Population, a nonpartisan research group in New Canaan, Conn., calculates that more than half the population (of 300 million) lives within 50 miles of the coasts. In the next decade, an additional 25 million people -- half the total population increase -- will join them there. The Ocean Research Priorities Plan provides an incredible opportunity to focus national attention – and funding – on

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					increased understanding and sustainability of our ocean and coastal resources. This must include a re-prioritization of funding to meet these challenges. <b>AOOS-McCammon.</b>
11	64		65		<p>The good news is that command-and-control expert-driven science is being complimented, if not replaced, by integrated adaptive ocean management science including conservation biology along with more participatory diverse knowledge groups. Government supported science is slow to change, for good reasons. However, out of a greater diversity of decision-makers come more robust actions and more indigenous situation-specific solutions than could have been mustered by just the "experts" acting on their own. Based on the coastal science practices of the 28 estuaries in the National Estuary Program, we now better recognize the role of science to assess ocean conditions, develop solution to problems, and to adapt management efforts.</p> <p>The report writers deserve kudos for hard work and applause for the recommended priorities identified by the Report: Charting the Course for Ocean Science in the United States. I hope these comments will help further the efforts of the report writers to bring greater clarity to the recommendations looking forward, and greater understanding, recognition and pride for the government-funded ocean research that is currently underway. For ocean research much needs to be done. Fortunately, in America much is being done. Informed by clear priorities of substance, with sustained government support, more definitely with increased support, we will do even more to meet the challenges of ocean science.</p> <p><b>Moir, Ocean River Institute</b></p>
11	64	8	64	9	<p>Add local and tribal governments to list of “roles and responsibilities of each constituent sector”. Tribes and local governments play an important role in providing local knowledge of research gaps and utilizing information provided by improved ocean research, monitoring and observing. These entities also need to play an appropriate role in planning, programming, budgeting and executing research priorities. (Jennifer Hennessey, Ecology)</p> <p><b>Grantham and Hennessey, WA State Dept of Ecology</b></p>
11	64	11	64	13	<p>While the existing mechanisms may be attractive, perhaps considering if these are the best collaborative mechanisms and institutions available is advised (e.g. consider studies that about</p>

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					characteristics of effective collaborations to assess whether the existing entities engender trust; have intractable conflict from past interactions; use experts appropriately; have sufficient diversity and power equalizations for credibility; etc. ) to make the process more attractive for federal investment <b>Wilson, SeaTrust Institute</b>
11	64	14			Append: “a prime objective will be to develop a paradigm that identifies and capitalizes on the human capacity and the research and management infrastructure distributed across sectors throughout the country, and maximizes collaborations and partnerships among sectors, to carry out the nation’s research priorities” . <b>Muller-Karger, University of South Florida</b>
11	64	15	64	16	Add local and tribal entities to the “enhanced coordination between resource management communities.” These entities play an important role in resource management. (Jennifer Hennessey, Ecology) <b>Grantham and Hennessey, WA State Dept of Ecology</b>
11	64	17			CSO asks that this bullet be expanded to also focus on the translation of ocean research for the purpose of resource decision-making. <b>CSO-Andrews</b>
11	64	19			Insert bullet: * Enhanced international partnerships to improve ocean and human health across the globe, enable global resource management efforts in coastal zones and in the high seas, and help improve the standard of living in developing nations. <b>Muller-Karger, University of South Florida</b>
11	65	1	65	1	delete 'and' after 'research priorities,' <b>National HAB Committee-Anderson and Glibert</b>
11	65	2	65	2	insert ", and link with similar approaches for land-watershed efforts that would with ocean-driven processes govern coastal ocean productivity and ecosystem change." <b>National HAB Committee-Anderson and Glibert</b>