TOPIC: *RESEARCH, EXPLORATION AND MONITORING*

KEY ISSUE: *Setting Research Requirements*

ISSUES RAISED

- The advantage of centralizing within an agency is if the right person is running it, to maintain the interest of the people and the money so it does not have temptation to go elsewhere to other things. If you put it in an agency like NASA or NOAA, there would constantly be battles of where the money would go. We need a system that has the right feedback to encourage appropriate behavior. One model to lessen the territorialism is to take the heads of four agencies and rotate them every two years to the next agency. The Navy does this all the time. The idea of the president's panel was that 75 million dollars should be money that was coordinated to do these major ocean explorations. (McNutt)
- Whatever research is now being done by U.S. agencies—NSF, NOAA, and NASA—is not coordinated, and is not part of an integrated observation plan. (Spindel)
- The Arctic Ocean is split by national jurisdictional claims, making research access difficult, and the trend is towards even more claimants. (Spindel)
- There is an NSF, Arctic support section. Some think it works well and others do not. In the context of logistic capabilities it has worked well. They are highly developed for the Antarctic. (Spindel)
- The Arctic Research Commission was established in part to make sure that we didn't wind up in the situation that we're in right now. They would not do as the vehicle to increase our active research efforts. (Spindel)
- The ocean scientists are part of the problem, because we each have our own agendas. (Spindel)
- There is a need for more scientific research on our oceans and the wildlife and organisms they support. (Gaydos)
- Sill lack the knowledge needed to sustain and restore ocean ecosystems. (Revell)
- The National Ocean Research Leadership Council (NORLC) can identify those areas in which agencies can leverage efforts of common interest, through coordination and collaboration. (Colwell)
- We are concerned about the ocean research into carbon cycling over the next few decades. The role of carbon dioxide and green house gases on the warming of the earth and the importance that the role of the ocean has in mitigating the release of carbon dioxide, is very important. The carbon dioxide releases in the air have influenced 35% of this industrial area. The ocean has taken up 30% of the carbon dioxide. If the ocean had not been such an efficient absorber, the current concentrations in the atmosphere would be double what it is today. That is why we are so concerned with planning research on this issue of carbon cycling in the oceans. (Quay)
- The comprehensive mapping of marine ecosystems and habitats is fundamental to understanding the marine environment and appropriately managing underwater habitats. (Durand)
- The advances that have been made in biology have been extraordinary. It is the era of biology. But it is important to recognize that biology is built, on physicists, chemists, mathematicians, even social and behavioral scientists who understand the data about our living world. It is an interdisciplinary era with a focus on understanding ourselves and the organisms around us. (Colwell)
- NOPP can serve as a mechanism for making strategic investments for programs of high national priority that serve to advance those areas of shared interest. (Colwell)

- The NOPP model is supported on the national level for coordination of research, industry and management entities and partnership activities and coordination of all the relevant agencies. GoMOOS is trying to be a regional version of the NOPP in the sense of fostering regional partnerships. (Bogden)
- NOPP is a coordinating body, an interagency organization representing the Federal agencies which fund the majority of ocean related research and education in this country. (Gagosian)
- It is hard to have an organized method when working in the environment because every time you tug on something in nature, you find that it's connected to everything else. So, it's a matter of being in the 21st century with 21st century tools and not just looking at the catch limit, for example, but the focus is on the effect that is has on the rest of the biota on the human aspect of it, and on the environment. A holistic approach is critical. (Colwell)
- Ocean.US currently has an important role at NOPP, however, it is mostly a coordinating role for the various programs. (Gagosian)
- Yes, a science plan can be built for the next five to ten years—a visionary approach as opposed to the disconnected individual approach. A reason for the difficulty in the past is that "ocean sciences" is really a misnomer. It is really a set of sciences that work on the ocean and consequently, it's all of science. This country has not done a very good job of prioritizing within disciplines, or in cross-disciplines. Your example of success in funding the Cold War was true. It worked because there was one issue: The Cold War and there was a societal imperative. The major ocean issues are coastal ocean, deep-sea exploration, ocean life, and ocean and climate change. If these focused umbrellas were prioritized, there would be fewer, more crosscutting, projects. (Gargosian)
- Our members observe that more and more of marine science funding is being oriented in a top-down fashion with very complicated strict rules for what must be in a proposal. (Jumars)
- The coordination of ecosystem and fisheries research is not well integrated either culturally or structurally. (Jumars)
- In Alaska and the Arctic, when we think of ocean research and of ocean policy, human dimensions are central to all our deliberations and our objectives must be to protect and sustain economy and culture as well as the ocean environment itself. [discussion provided] (Dorman)
- Virtually all of the global climate models seem to indicate the magnitude and effects of warming and other changes will be largest in the Arctic. Real human concerns are not just about 'climate' but also about the other elements of environmental change, such as the ecosystem changes in the Gulf and the Bering, Beaufort, and Chukchi seas—most notably weather. (Dorman)
- Connectivity—of Alaska to other areas and to other programs—is critical. [discussion provided] (Dorman)
- There is interested and capable research talent in Alaska. (Dorman)
- We are at the point where one starts with a physical model of the oceans. In a variety of cases, we are at the stage where they can be reasonably reliably committed and done; the computational capacity is there. There are already integrated efforts to attempt to at least model the physical environment. [discussion provided] (Dorman)
- The modeling centers we have such as the GDFL, and those in the Navy, NOAA, and NASA, are fundamentally adequate. This is the case thanks to the high performance computing programs that have been stimulated on the Federal level. So, the computational capacity is there. There is great interest in the climate and climate change and extending the weather processes. So the fundamental structural capacity is there but we do need some reform in the operational perspective in our thinking process. (Dorman)

- With regard to the potential for significant impact from methane release and permafrost, this is something that has been widely debated, not proven. But certainly given the greenhouse gas potential of methane, this is a very significant issue and the potential feedback, positive feedback processes should this occur, are quite scary. With regard to research about methane release, the U.S. is led significantly by a number of European nations as well as by the Japanese. We have limited programs particularly associated with the clathrates of methane hydrates at the Universities. One of the things we are looking at is sequestration of carbon dioxide as a replacement as we extract the methane. (Dorman)
- The Arctic Ocean has profound effects on the world's climate and, in turn, is profoundly affected by climate change. The presence of sea ice and the changes in its abundance and distribution make the Arctic Ocean a unique and powerful indicator of climate change. (Newton)
- Arctic Ocean sea ice is decreasing its summer extent by as much as 3.5% per decade, while average thickness of sea ice has decreased over the last 30-40 years by as much as 2.6 meters per decade. (Newton)
- Changes in the location of the edge of sea ice have important biological, physical, and chemical effects of both regional and global significance. [Further description provided.] (Newton)
- The principal climate change research program currently underway in the Arctic is the interagency Study of Environmental Arctic Change (SEARCH), established to coordinate the research of several institutions and programs on questions pertaining to natural vs. human-induced climate change. [Further description provided.] (Newton)
- The principal funding agencies for research in the Arctic Ocean are the National Science Foundation, the Office of Naval Research, and NOAA. (Newton)
- If warming in the Arctic leads to opportunities for trans-Arctic shipping (e.g., for Japanese automobile cargoes), then we can expect a large increase in ship traffic through the region. (Newton)
- We expect the Senate will eventually ratify the UNCLOS. From the date of our accession to the Convention, we will have ten years to submit our claim to the sea floor beyond our 200 mile EEZ under Article 76. However, the U.S. currently has virtually no data in the Arctic Ocean Basin on which to base an Article 76 claim. (Newton)
- Other people must be convinced of the very vital importance of the Arctic Ocean. If we don't choose to be a dominant player then somebody else is going to take it from us. We, therefore, must generate the interest within the Executive Branch to make special exceptions, and to take advantage of unique opportunities, such as the Mendell Rivers decommissioning two years ago. We need a large resource, like a submarine, like the USS Hawkeville, to solve and answer some very vital questions. [discussion provided] (Newton)
- We are seeing the decline of permafrost and sub sea permafrost because of global warming, causing a receding ice line, and an increase in storms and their severity along the coast of Alaska. It is going to mandate that we understand permafrost better. (Newton)
- Sub-regional, often referred to as bioregional scale, is a tool to do ecosystem information gathering. A workshop took place last July and there's a report that's forthcoming on ecosystem approaches around the U.S. and it will be submitted to the Commission as soon as it's completed. (Thomas)
- The Arctic Ocean is on the frontier of global climate change – a serious concern to Alaskans. (Miller)

- There is a need to improve our understanding of the Great Lakes basin's hydrology, particularly the interaction of groundwater and surface water. There is also a need to undertake the research needed to determine how decisions regarding withdrawals can impact the Great Lakes ecosystem. The primary federal research institutions such as the National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory and the United States Geological Survey, along with other federal agencies such as the Corps of Engineers and the U.S. Fish and Wildlife Service, need to be tasked and funded to develop the data bases and to perform the analyses needed to assist the States and Provinces in their efforts to "manage for sustainable water use" in the Great Lakes basin. (Vonnahme)
- Basic research on the large lakes of the world lags far behind similar research on the oceans. Basic research on the world's large lakes provides more than the wonder of discovery, however; it serves as the basis for assessing human impact on large-lake ecosystems, and for developing sound policy for managing and protecting these invaluable bodies of fresh water as our global environment evolves. (Johnson)
- There appears to be a major mismatch between the importance of the nation's freshwater inland seas and the level of support they are receiving from NSF. The current level of NSF funding for basic research on them is extremely low, typically less than 1% of what is spent on ocean sciences in any given year. (Johnson)
- Regardless of the degree to which climate variability and change result from anthropogenic influences, coping with both will be easier if we can predict what is coming, over a broad spectrum of time scales ranging from tomorrow's weather through the next season to as far in advance as science will permit. (McPherson)
- Useful prediction of the Earth's fluid envelope involves three components: observations, modeling, and provision of services. Education and institutional arrangements are necessary to ensure that services are effective, dependable, and subject to continuous improvement. (McPherson)
- Improvements for climate prediction rely critically on the establishment and maintenance of quality observing networks, particularly in the global oceans. Also crucial for improved climate prediction capability are increased computational and human resources and more coordinated management of current resources for model development. (Goddard)
- The current state-of-the-art in climate prediction employs a two-tiered dynamical prediction system; sea surface temperatures (SSTs) are predicted first, which then serve as the lower boundary forcing to atmospheric general circulation models (AGCMs). (Goddard)
- Unfortunately the skill of AGCMs in reproducing seasonal climate has not increased much in the last 10 years. Model results are especially sensitive to differing parameterizations of convection and cloud processes, which have implications for both local thermodynamics related to local radiation and global thermodynamics related to the global hydrological cycle and the global heat budget. (Goddard)
- The future of seasonal-to-interannual climate prediction is coupled ocean-atmosphere models. In this "one-tier" prediction methodology, SST anomalies are generated by anomalies of the overlying atmospheric circulation instead of being imposed. (Goddard)
- Considerable research and development is still required for coupled models. Most coupled models have large systematic errors in reproducing the mean state and seasonal cycle as well as the interannual variability of the tropical oceans. (Goddard)
- Our ideas about "climate" have been changing, in part due to the recent success in prediction of El Niño in the Equatorial Pacific Ocean. Thinking is centered around slow changes to our climate and how they will affect humans and the habitability of our planet. Yet this thinking is flawed: it ignores the well-established fact that Earth's climate has changed rapidly in the past and could change rapidly in the future. Presently, there is only one viable mechanism identified that may play a major role in determining the stable states of our climate and what causes transitions between them: it involves ocean dynamics. (Joyce)

- Evidence and processes of abrupt climate change related to the oceans is discussed in detail. (Joyce)
- Global climate is moving in a direction that makes abrupt climate change more probable, that these dynamics lie beyond the capability of many of the models used in IPCC reports, and the consequences of ignoring this may be large. (Joyce)
- Scientific research is often impaired by inadequate interdisciplinary communication. (Johnston)
- The Northeastern Association of Marine and Great Lakes Laboratories (NEAMGL). NEAMGL is a regional association of the National Association of Marine Laboratories (NAML), a nonprofit organization of approximately 120 member institutions that encompass a variety of academic, research, and public service programs. (Frasier)
- Despite the importance of the lakes to the people in the basin and to the United States and Canada as a whole, we understand only a small part of how the lakes function as an ecosystem. (Fraser)
- Areas of future attention: Great Lakes fisheries; future climate change; watershed hydrology and biogeochemistry; social science and the concept of sustainability in the Great Lakes; food web dynamics; health issues in Great Lakes Area of Concern (AOC's); and chemical, hydrodynamic and ecosystem models. (Fraser)
- Critical research objectives include development of multi-media models to link air, water, and land processes, basin-wide models to compute the transport and fate of pollutants of concern in the lakes as a connected hydrologic system, aquatic ecosystem models to address such issues as nutrients, trophic transfer of chemical contaminants, toxics cycling and bioaccumulation, exotic species, and fisheries production and dynamics, and models to assess impacts of global warming and water level control on lakes. Critical needs to accomplish these objectives include computer hardware and software, training for modelers, and funding for development of large, coordinated, multi-disciplinary, multi-institutional, research programs that have policy and management value. (Fraser)
- Field Labs and facilities play important roles and need continued support. (Bushek)
- July science workshop report will outline how $10 million per year should be spent in the NSF budget. (Johnson)
- Input of coastal and ocean scientific advice for our decisions tends to come from other Federal agencies. (Knight)
- Ocean circulation, together with the atmosphere, constitutes the mechanism by which solar energy is re-distributed from the tropics to the entire planet. Therefore, improved understanding of this interaction is critical to improved weather and climate prediction. (Asrar)
- Understanding the dynamics of ocean circulation requires systematic measurements of the velocity field at a frequency of at least weekly, but also spanning decades. Only global satellite observations can meet these needs. Our efforts in the past decade have resulted in a wealth of observations, but NASA could not have been successful had we worked alone. Our collaboration with other Federal Agencies and international partners was a critical element in this success. (Asrar)
- NASA's research in oceanography is all extramural, in partnership with academia and other Federal laboratories around the nation and its focus is on utilization of space-based observations. (Asrar)
- An increasing fraction of basic research funding is tied to very strict rules set out in broad agency announcements with short lead times and rapidly changing rules. (Jumars)
- The oceans are a planetary resource and are important in planetary-scale process. However, there are many gaps in knowledge about how removal or exploitation of marine resources cascade through marine ecosystems. (Jumars)
- More information on the effects of coastal pollution on marine systems, as well as criteria for evaluating marine pollution is needed to better understand causes and consequences of eutrophication events. (Jumars)

- A comprehensive national ocean policy must speak to numerous pressing national needs. Among the most immediate are understanding global climate change, sustaining the marine environment, managing living and nonliving marine resources, preserving our coastal areas, and enhancing our national defense at sea are among the most immediate. Effective and enduring solutions to these issues require a renewed and strengthened commitment to oceanographic research. (West)
- Findings, goals and objectives for coastal and ocean research. (CSO)
- Public health in Pacific Islands is sensitive to climate variability and change largely through effects on infectious disease vectors and pathogens, fresh water resources and food supplies. Pacific Assessment focused on exploration of climate "vulnerability" in order to understand climate exposure and sensitivity (impacts) and opportunities to enhance resilience (adaptive capacity). Effects of climate variability and change on marine and coastal resources categorized in two ways: effects on human populations and effects on natural resources upon which coastal communities depend. (Lewis)
- The oceans role in climate, and oceanic impacts of climate variability and change. [detailed discussions provided] (Lucas)
- Impediments to better understanding of oceans role in climate and applications:
  1) Inadequate numbers of long multivariate time series;
  2) Ignorance of connections between spatial structures and temporal variability;
  3) Ignorance of marine ecosystem dynamics and inability to observe key elements;
  4) Gaps between research programs;
  5) Logistics and political barriers. (Lucas)
- Marine organisms offer promising source of novel compounds with therapeutic potential.
- Technical difficulties and lack of knowledge of marine environment prevent scientists from more fully exploring use of marine life. [3 obstacles provided] (Dearry)
- Just now recognizing role of oceans in future of human treatment. Major opportunities exist for fundamental scientific discovery and commercial development. Multidisciplinary programs are needed which facilitate this activity. National Institutes of Environmental Health Services and National Science Foundation collaborative program "The Oceans and Human Health." (Fenical)
- Funding has been flat for ocean research. (Knox)
- "Biodiscovery" encompasses all types of scientific work on marine invertebrates, from taxonomic census to materials of use for agriculture, aquaculture, veterinary and human-directed pharmaceuticals and food. One of the major sources for funding in U.S. for biodiscovery related to human diseases is National Institute of Health, National Cancer Institute; others are National Science Foundation and Sea Grant. (Newman)
- USACOE Coastal Field Data Collection Program:
  1) Field research facility, Duck, N.C.
  2) Wave hindcasting program
  3) Coastal Data Information Program (Thompson)
- Critical need to invest in infrastructure of nation's coastal and Great Lakes labs. (Fletcher)
- Microorganisms rule the earth. Critical that scientists be supported in their search for new and novel microbes in ocean. (Grimes)
- Recently authored report recommends support for interdisciplinary studies of marine diseases, focus on better molecular and computational tools and on understanding mechanisms of disease resistance in marine organisms. Understanding comes from basic research; mitigation capability from applied research and technology development. (Grimes)

- Also part of National Research Council committee reviewing impacts of ocean on human health with recommendations:
  1) Elucidate connections between oceans and human health;
  2) Evaluate present state of knowledge about these connections;
  3) Suggest how current and future efforts may be directed to anticipate and respond to future health needs and threats. (Grimes)
- Energy industry concerned about future talent and leadership in ocean and energy sciences:
  1) Decline in interest, and school enrollment, is rooted in dated perceptions of oil industry;
  2) Campus recruiting and partnerships with academic institutions beginning to turn trend around. (West, JR)
- Certain degree of research competition among federal agencies likely to always be there. Need a coordinated plan for agencies to work with and get funding for. (Palmer)
- Research relating to advancements in energy resource technology is critical to our long-term economic strength and environmental responsibilities. Such research also imperative in providing good stewardship for the environment and accessing various new non-conventional energy sources. (Woolsey)
- Division of research between industry and government: energy industry in-house research relates to proprietary interests, improving operational efficiencies; government sponsored research successful in addressing long term and high risk areas. Example of appropriate government sponsored research is DOE and DOI gas hydrate research in U.S. EEZ. [description of CMRET research on hydrate stability zone provided] (Woolsey)
- Effective management requires a wealth of intellectual resources with intimate understanding of the dynamics of the Gulf of Mexico who are in constant touch with Gulf habitats and resources from its shorelines to its abyssal depths. Texas A&M Corpus Christi prepared to contribute. (Tunnell)
- Developing knowledge base required to address pressing marine issues must include:
  1) Consistent internal and external investments;
  2) Objective prioritization of needs;
  3) Coordination to avoid duplication;
  4) Technological improvements to acquire and deliver data. (Bodman)
- NOAA science and development funding breakdown. (Bodman)
- NOAA responsibility for in-house research relative to academic entities. (Bodman)
- Global ocean ecosystem dynamics program demonstrates utility of basic science linked to commercially harvested species. (Colwell)
- U.S. lacks basic ecological and oceanographic knowledge to successfully implement “ecosystem-based” fisheries management. New observing systems and other platforms will help provide data for new approach. (Colwell)
- Connection between oceans and human health becoming clearer. Recent research is developing potential for pharmaceutical applications of novel marine products. [example provided] NSF is presently developing a collaborative research initiative on oceans and human health. (Colwell)
- NOPP is an important development in coordinating and funding ocean research. (Colwell)
- Linkage of NSF Ocean Observing Initiative with broader systems; steady state requirements for oceangoing fleet/facilities and agency support of research; NSF plan for under-ice research; value of MEDEA and defense/intelligence data source products; design/development of more robust data archive and distribution system; understanding open ocean vs. continental and coastal zones in controlling climate change; pathways to incorporate NSF results into national/local policy; understanding how climate change affects marine resources; better integration of interdisciplinary research; integration of NGOs and industry with science funding and proposal selection. (Colwell)

- The U.S, leads the world in public sector funding of gas hydrate research. (Fry)
- The situation in ocean sciences: federal funding cannot and does not provide continuity; there is an excellent chance to establish scientific and financial linkages with commercial, civic, state, and industry groups. [list provided] (Betzer)
- Ocean research and development directed budgets are approximately what they were 30 years ago. (Brown)
- There is a cornucopia of needs and unprecedented opportunity, but no clear strategy for investment or implementation. Why? Ocean science has relied on governmental funding rather than commercial marketplace and has become "soft" science. Ocean science has high cost associated with it. (Brown)
- Structural problems are characterized as: end-to-end responsibility, agency-to-agency coordination, programs at the agency and/or discipline interface, linking research to applications to operations, and congressional review and oversight. (Brown)

PRESENTER RECOMMENDATIONS

- Support regional marine research by recommending increased resources and National focus on fisheries and marine habitat activities. [details provided] (Shultz)
- NSF's grants should be for longer term support but should also be open to new answers and new attitudes as they become apparent. (McNutt)
- Establish an interagency authority for Arctic Ocean research. The National Ocean Research Leadership Council might be the right vehicle. (Spindel)
- Include a high level diplomatic component in our plans for future arctic research to assure research access. (Spindel)
- Change the NSF's attitude and its bias so that the Commission will support an increase in Arctic support. (Spindel)
- The Arctic component should be a major priority and receive emphasis in any integrated marine system plan. It pays a large role as an indicator of the climate. We have to have a global observing system and the Arctic must be a part of it. (Spindel)
- Must balance the funding between the Antarctic and the Arctic. We maintain our presence in the Antarctic to maintain national presence so that essentially we establish some ownership to the continent. Certainly what is happening in the Arctic Ocean is quite different. In fact, maybe one reason the Russians are attempting to occupy the EEZ is to just establish a larger presence. (Spindel)
- We need to get our act together and put forward a coherent agenda. Two mechanisms may be appropriate: the NORLC, the newly formed Ocean Research Leadership Council. The other is the core of institutions. (Spindel)
- There is a need for basic understanding of large-scale ecosystem functions. This need to understand physical and biological processes extends far beyond salmon and the Endangered Species Act. (Lashever)
- The Commission should focus on our nation's need for the understanding of ocean processes and how to collect and disseminate information in a manner that can inform, rather than hinder decision making, and that fairly spreads the burden. (Lashever)
- The Commission should recommend the creation of a dedicated program that supplies long-term funding for independent researchers to study our oceans and its resources. This ocean-specific Federal grants program could be modeled after grant programs administered by the U.S. Dept. of Health and Human Services' National Institutes of Health or the Federal Government's National Science Foundation. (Gaydos)

- Recommend additional funding and support for scientific research, and to engage local experts, surfers, ocean recreational users, and fishermen to understand their intimate knowledge of the ocean. Until we have the appropriate science, management decisions need to apply the precautionary principle and be conservative. Think long term. (Revell)
- Commission should recommend a research focus on understanding the relationships between pollutants, water quality testing indicators, and human and marine species health. (Revell)
- Expand an existing research program established to study Equatorial climatic variations. Establish a buoy array spaced 100 km apart along the West Coast of the U.S. covering coastal waters and waters of the EEZ to help oceanographers and atmospheric scientists create models for ocean and atmospheric conditions. They would also establish a baseline of information to aid in monitoring global warming and natural ocean and climatic oscillations. (Scranton)
- The NORLC is nicely positioned to provide leadership for the broad research endeavor and to lead the necessary interagency cooperation. [discussion provided] (Colwell)
- If we are going to improve our predictions of future carbon dioxide levels in the atmosphere, we must encourage government support for research of carbon cycling in the ocean. (Quay)
- One of the major goals of NSF should be to extend their remaining awards from the current two years, to five years. That is, copy not just what the DOD has done, but also the NIH model where the rewards are for five years, and an automatic renewal is subject to satisfactory progress. Otherwise we are just looking at the short-term management of science, rather than the long-term investment. (Norwell)
- We urge you to support the ratification of the treaty to ban the use or production of persistent organic pollutants (POPs), and funding research with regard to POPs. (Ayers)
- The Commission is urged to support mapping and exploration of all our ocean areas. The goal should be to develop information by the year 2012 on our ocean areas comparable to terrestrial maps that currently guide management efforts on land. (Durand)
- Three specific roles for the NOPP should be:
  1) To provide a valuable forum for addressing shared needs of importance to the ocean science community, including oceanographic facilities and ocean education
  2) To facilitate and coordinate the transfer of research results into applications that meet societal needs
  3) To provide a mechanism for identifying and developing oceanographic research directions that cut across agency missions. (Colwell)
- Expand NOPP's function by creating a major ocean initiative for this country under an umbrella organization that will initiate it, manage it, and coordinate the major needs for the ocean Federal agencies. Most importantly, it would be responsible for making sure that the highest level of intellectual content is reached. (Gagosian)
- One initiative under one umbrella—could call it the Planet Ocean Initiative—could encompass all these elements. Under this Initiative, a coherent, logical sequence of programs and requests can be coordinated. (Gagosian)
- NOPP would be made up of the Federal agencies, and would be the mechanism by which the agencies could get the resources to accomplish what they want for their mission. Yes, it would mean "new" money, or actually "more" money. The money could flow into the agency but there would have to be firewalls so the money is targeted and does not get directed elsewhere. (Gagosian)
- One possibility of combining research-oriented scientists with policy makers is to have one major organization that deals with the science, but have members of that organization be in another organization that had policy makers involved. The science would be translated and transitioned to another group. A second possibility would to have a large coordinating office for the science folks to have frequent meetings with the "board" of that group, and get the policy makers' input from the very beginning. (Gagosian)

- What is needed is an IPO, an Integrated Program Office, which has both the responsibility and the authority, via funding, to coordinate the development of the system. In terms of the grand concept of establishing research priorities in the context of some grand strategy, clearly, military research is driven by mission requirements. Research is prioritized based on the mission requirements of the particular agencies involved. (Malone)
- There is a debate right now about whether science and the management process should be separated. When good science is available, it should be used, not be lost because the focus is on funding issues and other resource issues. (Malone)
- Urge the Commission to help Alaska get more knowledgeable about climate change and to convince the national government that this is something that is not just for Alaska, but that it's of national interest. (Stevens)
- A national backbone is needed to support the regional programs Alaska already has underway, such as the Gulf of Alaska Ecosystem Monitoring and Research Program (GEM), and the North Pacific Research Board (NPRB). (Penney)
- Restart the SCICEX dedicated cruises either as part of the above or as essential research activities on their own merits. (Newton)
- Integrate Arctic Ocean research in the National Ocean Research Plan and the Integrated Ocean Observing System. Integrate Arctic Ocean planning in planning by all ocean research agencies. (Newton)
- Include Arctic Ocean studies in planning for the President's Climate Change initiative. (Newton)
- Restore the funding for the Office of Naval Research High Latitude Program to the $10-15 million per year range. (Newton)
- Follow the Federal Oceanographic Fleet Coordinating Committee (FOFCC) Plan and build the Alaska Area Research Vessel (AARV). (Newton)
- We must include local indigenous knowledge to complement that of scientific understanding. (Blatchford)
- One or two jobs in the coastal community in marine research are a measurable percentage in the workplace. As jobs move out of fisheries it is important that there is recognition that marine research is a career field. (Pawlowski)
- Subsistence is the way of life for our Unangan people, and our tribe needs to direct research to ensure that we have healthy environments to provide adequate subsistence resources. (Pletnikoff)
- We need a smarter science. Sometimes the way the U.S. does science doesn't get us to where we need to go. Science has to be connected to the management questions and the value, the sustainability issue that needs to be addressed. (Marcy)
- Urge this Commission to incorporate the proven science developed by Alaska Natives in ecosystem management that has been theorized. (Snyder)
- There is a need to accelerate efforts to conduct detailed seafloor mapping. (Estabrook)
- The large lakes community needs sustained funding for: investigator-driven, individual research projects on the biology, chemistry, geology and physics of large lakes; multi-investigator, large research initiatives, some involving sustained (multi-year) time-series measurements of key environmental parameters; research vessel operations; new instrumentation, including "ocean" observatories and autonomous underwater vehicles; fellowship support for graduate students who will comprise the next generation of scientists and government managers of large lakes ecosystems. (Johnson)
- Establish a separate budget of $10M per year in the Geosciences Directorate at NSF for large lakes research. (Johnson)

- All Sea Grant Funding should be based on merit. Currently, the National Sea Grant College Program awards about 2/3 of its total support to the 30 individual state programs in a fashion that is not based on merit. (Reutter)
- It appears that earmarking within the National Undersea Research Program is hindering the program's ability to address issues in the Great Lakes. Currently NURP has 6 regional centers, but half the funding must go to the two centers on the west coast. Furthermore, the Great Lakes are lumped with the Northeast Regional Center in New England making it very difficult for dollars to reach the region. This support could be very helpful in documenting the expansion of mussels onto soft substrates. (Reutter)
- Support for equipment and facilities at marine laboratories within NSF is woefully inadequate. (Reutter)
- Policies that affect monitoring, prediction, and/or modifying the components of this coupled system should recognize that it is coupled. Comprehensive numerical models of the coupled system must also be coupled. Prediction and other environmental information services, when provided as a "public good" return on the public investment, should also be organized according to the notion that the system is coupled. (McPherson)
- The AMS is supportive of an integrated global observing system for monitoring the state of the coupled ocean-atmosphere-land system on a continuing basis. Such a system should be built by extending the existing system of in situ and remotely sensed observations of the oceans, atmosphere, rivers, streams, and lakes, ice-covered areas, and land surfaces, to be more comprehensive than at present. This integrated global observing system should be designed and operated with full recognition that the information that it will produce will have multiple uses. (McPherson)
- Organizing the national effort to routinely observe the coupled Earth system, managing the information flow, modeling the coupled system, and providing services suggests that care should be taken to reflect the coupled characteristics of the system. (McPherson)
- Encourage enduring and comprehensive observational networks. (Goddard)
- Bridge gap between optimal design of observing networks and their ultimate value in forecast systems. (Goddard)
- Encourage national coordination of efforts and resource investments toward development and improvement of climate modeling and climate prediction tools. (Goddard)
- From an economic as well as an environmental point of view an essential thrust of the Commission must be to emphasize the ocean's effects on the weather and climate. (White)
- The operational and user communities must be involved at all stages of planning, from mission formulation, to technology development and infusion, and finally to applications development. We must also continue to plan for research satellites to fill the gaps in critical datasets. (Asrar)
- Research needs to translate into action. (Stupak)
- Field Labs and facilities play important roles and need continued support. (Bushek)
- Although there is value and need in mission-oriented research, a greater proportion of marine science funding should be available for innovative research in the marine sciences. (Jumars)
- Regulations should be proactive and include impact statements with the best available information on how resource use affects biological, chemical and physical systems and their interactions. (Jumars)
- Fund research and interdisciplinary scientific endeavors to understand the effects of coastal pollution on marine systems, as well as criteria for evaluating marine pollution. (Jumars)
- Develop national programs to study ocean and estuarine processes. (Wellenberger)
- Regularly develop synthesis reports of Federally supported research and monitoring. (Wellenberger)

- Call for the development of a detailed biogeophysical assessment of the territorial sea and the Exclusive Economic Zone along the coasts of the U.S. and its territories. (DeVoe)
- Call for the development and implementation of a national coastal and ocean resource "audit." (DeVoe)
- Recommend the development of a national research and education plan for the nation's coasts, ocean, and Great Lakes to encourage the generation of high priority science-based information and educational materials for use by resource managers, decision makers, educators, and the public. (DeVoe)
- Foster some mechanism for encouraging interdisciplinary collaboration among institutions that monitor and assess environmental change, social change, and the interaction of the two. (NASULGC)
- Promote mechanisms for sustaining a strong, comprehensive program of research on all dimensions of the natural and social systems of the oceans through a consortium of university- and agency-based cooperative agreements and joint centers. (NASULGC)
- A means for integrating agency contributions to ocean research bridging agency missions and congressional committee responsibilities is essential. The National Oceanographic Partnership Program (NOPP) is one model, but there must be an incentive for agency contributions to and participation in the program - this is the biggest problem facing NOPP today. (West)
- Recommendation presented for coastal and ocean research. (CSO)
- Specific recommendations presented. (Allen)
- Increase NOAA supported research and monitoring in NERRS. (Wellenberger)
- Ways to enhance resilience of Pacific Island communities and resources:
  1) Adopt flexible, adaptive resource management;
  2) Reduce the risk of economic losses in the critical fisheries sector;
  3) Pursue integrated coastal zone management principles;
  4) Control the introduction of invasive and alien species;
  5) Enhance education and public awareness programs.
  6) Adopt principles [List provided] (Lewis)
- Data assimilation and modeling: work the interface between coasts and blue water, and between physics and biogeochemistry. Inter-program and inter-agency coordination/cooperation: Increase funding, target gaps. (Lucas)
- Develop centers of excellence in oceans and human health. (Dearry)
- Adequately fund research to better understand ocean ecosystem complexities. (Monroe)
- Most important thing for ocean sciences and academic fleet particularly; prod nation to unshackle ocean science from end of the soup line. (Knox)
- Biodiscovery—Marine reserves could become equivalent of "source country." Researchers who are recipients of competitively funded U.S. government grants would be permitted to remove small quantities (10g or less) of invertebrates and/or soil samples from marine reserve "plots." (Newman)
- Strengthen the role of science and shift burden of proof:
  1) Establish national science commission with regional arms;
  2) Shift perspective of management; assume new activity remains at pilot level until enough information gathered to show no harm. (Nothoff)
- Look into establishing a coordinating body of government agencies, academic representatives and industry to begin tackling complex logistical issues for cooperative research programs; NOPP may be such a body with sub-group (MMS lead). (Talbert)

- Develop a national coordinated research program for marine resources: national funding to enhance understanding of how estuarine and marine ecosystems function and how fishing activities interact with them; recognize ecological value not just economic value; watershed-level research of estuary function and effects development has on their health; integrating biological component of estuaries and marine communities with physical is important. (Reinert)
- Remind agencies and contractors who develop models that arid and less rainy parts of the country cannot use the tools if developed only by and for temperate zones. (Van Schoik)
- Universities need to change reward system; recognize that partnerships are the way to go and faculty should be given credit. (DeVoe)
- Urge ocean science funding be increased to support critical research and for sustained coastal and ocean observing system with long-term monitoring efforts of coastal and marine labs. (Fletcher)
- Encourage the expansion of both the scope and completeness of scientific information bases. (Allen, D)
- Expand ability to understand ocean resources and to respond to their needs. (Davis)
- MMS environmental studies needed: understanding oceanographic issues and data surrounding future deep water drilling. (Fury)
- Science: good examples exist of cooperation. [3 examples provided] (Oynes)
- To give "science underpinning" need to invest in studies and research. (Hollings)
- Increase funding for basic research in ocean sciences (should be 7% of federal research budget—$1.4 billion/yr). (Thoroughgood)
- Improve the scientific basis for decisions about use of marine resources and protection of marine ecosystems and public health. (Thoroughgood)
- Mechanisms for academic community to engage in science and understand problems:
  1) Provide public funding for competitive, peer-reviewed investigation. Strengthen basic research components of agency budgets (e.g., time-series observations and ocean observing system);
  2) Integrate agency contributions to ocean research (i.e., NOPPS). (Thoroughgood)
- Creation of an advisory council made up of oceanographers and representatives of prospective user groups that would be asked to consider the particular problems that oceanographers could become involved in addressing. (Betzer)
- Need to secure recurring state funding and small working group should develop framework for collaborative action. (Betzer)
- Improving current situation:
  1) Improve NOPP coordination; has a good start with increased inter-agency interactions and coordination; interagency partnership dimension should be enhanced; perhaps have budgetary dimension for each NOPP agency;
  2) Linking research and development to operations; NPOESS Joint Program Office is excellent example;
  3) More efforts like The Ocean Caucus, NOPP and CORE: full time staff for The Ocean Caucus would help. (Brown)
- Research Needs:
  1) Interaction between groundwaters and surface waters;
  2) Behavior of contaminants in the subsurface;
  3) Approaches to track sources of contaminants and groundwater discharge; molecular techniques; stable isotope tracing; natural/artificial tracers;
  4) Linkage of airsheds with watersheds;
  5) Determination of loading contaminant factors associated with agricultural activities. (Chanton)

TOPIC: *RESEARCH, EXPLORATION AND MONITORING*

KEY ISSUE: *Ocean Exploration*

ISSUES RAISED

- The area the region knows least about but clearly has one of the major impacts on resources, including salmon resources, is the ocean. (Smitch)
- Very little is known about the oceans and we have only seen, let alone fully explored, 5% of the ocean. A whole century after the first national park was established, the National Marine Sanctuary Program was brought into being formally with legislation. It has taken a long time to get here. (Earle)
- The biggest problem facing us regarding the oceans is our ignorance, our lack of knowing. (Earle)
- Our nation would greatly benefit from a program in ocean exploration. Knowledge acquired through exploration is already, and will become even more, essential for policy makers, researchers, resource managers, and conservationists. Such a program should be conducted with full involvement of all relevant Federal agencies, the academic community, the private sector, and ideally, international partners. (McNutt)
- We cannot answer the most basic questions about why the Arctic has changed without sustained, continuous observations, and we have stopped making them. We are losing logistic capability. (Spindel)
- The Voyage of the Odyssey, a 5-year research program currently in its second year, is designed to quantify pollutant concentrations in the world's oceans. The Odyssey is now in the middle of the Indian Ocean. {Background and details of the Odyssey experiment provided]. (Payne)
- Scientific Ocean Drilling: NSF Integrated Ocean Drilling Program:
  1) Ocean drilling; [description of its importance]
  2) Present phase of Ocean Drilling Program will end in 2003;
  3) Planning for Integrated Ocean Drilling Program has been initiated [description provided];
  4) New ship required; modified from existing drill ships. (Leinen)
- A sea floor "base map" is essential as a foundation for seafloor issues: recent issue of MTS journal has collection of papers about new seafloor mapping technology. Urge this type of fundamental information be made available to fisheries resource managers quickly. (Wilson)
- There is need for exploration of unique regional habitats such as spawning banks and shelf-edge upwellings; additional mapping of habitats; additional oceanographic work and study of reproductive biology to determine sources and fates of larvae from spawning aggregates. (Sedberry)
- One of greatest areas for improvement in federal agency coordination and energy industry involvement is in ocean exploration and observation. (Talbert)
- Ocean exploration critical: Presidents Panel on Ocean Exploration excellent. (Farr)
- Selling Congress on need to explore the southern hemisphere is not easy, would start with Secretary Evans, Vice-President, and then to House members with good information why it is important. (Gilchrist)

PRESENTER RECOMMENDATIONS

- One candidate model for how to establish a program in exploration, is the Ocean Drilling Program (ODP). It is the premier example of a successful international program. [discussion provided]. (McNutt)

- The following Federal agencies should be involved in a program in ocean exploration: NSF, the Navy, NOAA, and NASA. The following agencies' participation must be encouraged: U.S. Geological Survey, the Minerals Management Service, the Environmental Protection Agency, and the Department of Energy. The program in ocean exploration must be discovery-based, have a vision and be conducted in an organized and systematic manner, and must be inclusive. (McNutt)
- Understand what is happening in the arctic, and why. Reinvigorate our Arctic Ocean research program.
- Prioritize construction of a UNOLS ice-capable vessel, and we need to support regular, continuous operations rather than sporadic forays. (Spindel)
- We need to invest in research about the oceans. (Ayers)
- To create an ocean exploration program for the U.S., an interagency group would need to sit down and actually look at the areas with the capability for the biggest advances. Exploration on the whole does not have a particular problem to solve so it would need to be broken down into segments of problems to solve. It should have a Federal structure such as in the Oil Drilling Program Initiative. It could be under the umbrella of something like the Planet Ocean Initiative and under something like a NOPP-type structure. When people go in to talk to their Senator about one of the many ocean-related issues, they would all say they are interested in the "Planet Ocean Initiative" and it all begins to come together in Congress' mind. (Gagosian)
- A national ocean policy is needed that supports work on the kind being done aboard the Odyssey and which also supports the kinds of programs Ocean Alliance is doing in partnership with educational institutions across the country. (Payne)
- Commence planning for the replacement of the Polar Class icebreakers and review their operating mode. (Newton)
- Funding should be provided for research on the sources and impacts of POPs in the subsistence diets of Indigenous people in the U.S. (Newton)
- Specific recommendations presented. (Allen)

TOPIC: *RESEARCH, EXPLORATION AND MONITORING*

KEY ISSUE: *Ocean and Coastal Monitoring*

ISSUES RAISED

- It is important to do monitoring and evaluation of whatever planning we do. Whether it is a marine protected area, or basin planning and recovery, there has to be a large-scale monitoring scheme to see how it is working. (Varanasi)
- Responding to the question 'is self-monitoring acceptable', Surfrider Foundation reports instances where permittee monitoring and independent monitoring produced major discrepancies, and for this reason mandatory independent monitoring of all waste water treatment plants should be considered. [Further description provided.]. (Evans, C)
- It is clear that the Arctic is more affected by climate change than Antarctica is. There are villages whose airports were inundated by seawater last year. Several of them may need to be moved back because of the ever-increasing water level. (Stevens)
- Monitoring systems are not well developed because of extreme costs. (Chandler)
- Findings, goals and objectives for environmental monitoring. (CSO)
- Coastal and estuarine monitoring—states' perspective on Ocean Observing Systems:
  1) Long-term status and trends monitoring is critical to manage the potential impacts to coastal and marine environments; also allows for determining if desired results of management actions are met or need adjustment;
  2) Monitoring may be perceived to be competing with investigative and process research funds when they are actually interdependent. Funds often provided for start up research and false start monitoring. (Haddad)
- Long-term monitoring and assessment programs by SCDNR have resulted from, and stimulated interest in, several state-federal partnerships (i.e., NOAA-NMFS) and provided data to management sections of SCDNR, ASMFC, NMSP, MMS, etc. [detailed description of, and results from, Marine Resources Monitoring, Assessment and Prediction (MARMAP)] (Sedberry)

PRESENTER RECOMMENDATIONS

- Support regional fisheries and marine habitat monitoring efforts. (Shultz)
- Develop and execute a plan for sustained, long-term observation in the Arctic. (Spindel)
- Continue to fund completely the BEACH Act to ensure that the program is fully implemented by all states and territories. Not only will the monitoring of ocean water quality for recreational health protect the health of the beach going public, it will provide an important tool in measuring water quality problems and will raise awareness about this important issue for coastal ecosystem health. (Evans, C)
- Make monitoring a requirement of any Federal grant that involves restoration. Some of our NOAA's Community Restoration Grants are very valuable for salt marsh restoration projects, but many times they don't include any money for monitoring. This would be one way to help solve that information gap that was discussed. A lot of restoration is being done but the managers are not being provided with information about the successes or how the projects and system should be revised to make sure they are being carried out right. (Buchsbaum)
- Recommendations presented for environmental monitoring. (CSO)
- Specific recommendations presented. (Allen)

- Develop consolidated federal initiative and policy for long-term monitoring with focus on integrating federal, state, and local programs that recognizes the resolution and types of information needed to evaluate resource management strategies. Should have a clear linkage to process oriented research but considered an operational management tool. (Haddad)
- Beaches Environmental Assessment and Coastal Health Act of 2000: continue to fund completely the Act to ensure the program is fully implemented by all states and territories. (Werny)
- Important to involve fishermen in development of monitoring plans or they won't buy in: create partnerships with them for sampling, etc. (Sedberry)
- Implement long-term, comprehensive inventory, monitoring, and assessment program to establish baseline to examine resource change. (Murley)
- Suggestions how best to integrate monitoring programs and recommendations the Commission should make in this area:
  1) Monitoring programs need to be integrated and coordinated so data collected for particular problem or fine scale can be merged into regional applications; EPA's EMAP and Florida's Watershed Monitoring Programs are good examples;
  2) Monitoring must be recognized and funded as a separate recurring expense;
  3) Consolidated independent federal initiative directed at long-term monitoring is needed. (Haddad)

TOPIC: *RESEARCH, EXPLORATION AND MONITORING*

KEY ISSUE: *Intellectual Property Concerns*

ISSUES RAISED

- The idea of real-time broad sharing of data from exploratory actions comes into play because it's important that all groups should know the same information rather than some groups being at a disadvantage. Data quality control would be immediately available over the Internet through web-based servers and anyone could call up this data and get access to it. There would have to be exceptions, if appropriate. (McNutt)
- On the subject of data policy and agencies being more open with their Federally funded data, it is already happening. Some of the funding already requires data to be open, almost immediately, to everyone. On the other hand, if our field is compared to the biomedical field, there is still a long way to go. (Gagosian)
- Existing data need to be more accessible. (Bushek)
- As our data acquisition platforms and sensors improve, our ability to collect environmental data increases at an exponential rate; as the capabilities of our customers grow, the performance of their systems is increasingly dependent on environmental data of even greater resolution and more rapid refresh rate. But our ability to assimilate and apply these data, and disseminate the associated products must keep pace with—and anticipate—these increased needs of the customers. (Spinrad)
- Offer that two overarching themes are relevant to the issue of ocean data management:
  1) The U.S. Navy uses a set of operational principles governing data management strategies. These principles emphasize that the Navy data management is part of a greater overall process where we address the customers' needs, effectively utilize the capabilities of data acquisition, analysis, and fusion centers, and maintain a strong link with the research and development community while robustly supporting our operational fleet at sea; and
  2) The U.S. Navy has mechanisms and infrastructure to meet current data management needs, and plans to exploit fully the continued growth in volume and diversity of data (especially remotely sensed data) in order to meet future operational needs. (Spinrad)
- If NOAA or the Navy gets data sets they are freely available. In the area of biology, fisheries, ecosystems, coastal data, those are more difficult and the restrictions more complicated. (Withee)
- Existing data need to be more accessible. (Bushek)
- People should realize that government data collection efforts benefit many sectors, ranging from the commercial to the non-profit. (Etnoyer)
- There is pressing need for better information about the marine environment; NORLC, 1999. (Seim)
- Energy industry already releases quite a bit of information but might be opportunities to do more. (Fury)
- Potential for an industry-wide program to offer a broad range of research and data gathering, as well as data sharing options with ocean research community:
  1) Industry is interested to do its part to advance accumulation of scientific understanding but primary role is production and marketing of energy;
  2) Extensive infrastructure throughout Gulf of Mexico example of the technological innovation and opportunity for cooperative progress in scientific arena;
  3) Industry not willing to shoulder financial or liability burden of non-industry related research;
  4) Industry vessels may be suitable platforms for instrumentation but safety, liability, maintenance issues must be resolved before industry can move forward with cooperative programs;

Some cooperative programs are underway [examples provided]. (Talbert)

- Design/implementation of NOAA data archive and distribution system. (Bodman)
- Industry willing to share some proprietary oceanographic data and environmental information voluntarily. (Caveney)
- Navy is attempting, and making progress, on releasing data and maps to oceanographic community, according to national security requirements. (West)

PRESENTER RECOMMENDATIONS

- Data acquisition and processing for natural hazard mitigation, marine operations, national security, public health and safety, and healthy ecosystems and living resources need not and should not be done in isolation. (Malone)
- The answer to sharing Federally funded data will be different whether you are talking about information for an operational system or information in a research program. For an operational program, the data has to be free access. For examples like XPT programs, XPTs should not be given to anybody unless they agreed to serve the XPT in real time. On the research side, there are good reasons that go all the way from quality control to the time it takes to analyze data and peer review to have a certain period of time in which someone else should have proprietary access to it. (Malone)
- We must deal effectively and efficiently with the increasing data flow that supports customer needs. (Spinrad)
- Need an effective data management governance framework. Authority for such a framework exists today in the National Oceanographic Partnership Program's National Ocean Research Leadership Council (NORLC). (Spinrad)
- Need a data management infrastructure that integrates all appropriate systems, platforms, and sensors. This coordinated national strategy for ocean observation integration should include expansion of NPOESS's and NOPP's authority. (Spinrad)
- Ocean data archive: Current levels and anticipated increases in the amount of ocean data dictates that the community work together to address data management and archiving. (Withee)
- Access to ocean data: Access to ocean data is of utmost importance. The Commission should endorse Ocean.US efforts to develop a national strategy for ocean data management. (Withee)
- Data assimilation and modeling are key to providing decision makers with information with economic and policy relevance. (Asrar)
- Continue to support and encourage data distribution efforts. (Etnoyer)
- A new Pacific Climate Information System could link climate science with decision making. (Lewis)
- Data and analysis should be made available on the Web to scientists and educators as envisioned through NSF-COSEE program. (Sedberry)
- Encourage Commission to improve access to and the use of existing scientific information for decision making. (Allen, D)
- Should examine how ever-increasing volumes of data should be managed. (Bodman)
- Develop protocols for data management that encourage integration and exchange through Web-based technology. (Murley)