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American Society of Limnology and Oceanography

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Public Comment for the Record  
U.S. Commission on Ocean Policy  
1120 20th Street, NW  
Suite 200 North  
Washington, D.C. 20036

Dear Commissioners:

On behalf of the American Society of Limnology and Oceanography (ASLO), I am pleased to submit the appended comments prepared by our Public Policy Committee. These comments should be viewed not as a consensus of our roughly 3800 members, but rather as the opinion of a panel of experts chosen from our membership analogous to an NRC report. The report's preparers are listed on its cover page, but the preparers have interviewed a much wider spectrum of our membership, and the report has also been reviewed and approved by ASLO's Board of Directors.

Should you find it useful, I could arrange to present or discuss this material at your Northeast Regional Meeting next week. I would be happy to address comments or questions by e-mail as well.

Sincerely yours,

A handwritten signature in blue ink that reads 'Peter A. Jumars'. The signature is fluid and cursive, with a prominent underline for the last name.

Peter A. Jumars

**Report to the United States Commission on Ocean Policy**

**Submitted by the  
American Society of Limnology and Oceanography Public Policy Committee  
Commission on Ocean Policy Working Group**

Bess Ward, Princeton University  
Denise Breitburg, The Academy of Natural Sciences  
Samantha Joye, University of Georgia  
Hans Paerl, University of North Carolina-Chapel Hill  
Margie Mulholland, Old Dominion University  
Jim Ammerman, Rutgers University  
Adrienne Froelich, ASLO Director of Public Policy

July 15, 2002

# ASLO Executive Summary

## I. Research Programs and Research Funding

### *1. Ocean Observing Systems*

**Summary:** While funding of new instruments is essential, support for analysis of long term data sets derived from past and future research is equally important. Scientists do not have adequate methods to turn the fire-hose volume of incoming data into a useful information stream.

**Recommendation:** Establish a synthesis program to support efforts to analyze large, long-term data sets with the goal of producing overview papers and to aid in identifying "data gaps" in the data-sets.

### *2. Land-Ocean Connections*

**Summary:** Interactions and feedbacks among freshwater flow, water quality and coastal ecosystem dynamics must be better understood in order to predict the response of these systems to future changes in landward forcing functions (e.g. changes in freshwater flow and nutrient loading, rising sea level).

**Recommendation:** A cross-agency initiative modeled after the Climate Change Research Initiative, or a single-agency grant competition for studying these interactions, would be the first step in fostering collaboration between terrestrial, freshwater and marine scientists.

### *3. Marine Science Funding*

**Summary:** 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. We question the assumption that top-down direction of questions and approaches is the fastest, most productive or efficient way to solve the basic research questions that will lead to the greatest advances in understanding or the greatest societal benefits.

**Recommendation:** While we see the value and need for mission-oriented research, a greater proportion of marine science funding should be available for innovative research in the marine sciences, allowing advances in the science and technology used in marine research to act as a guide.

## II. Use of Marine Resources and Pollution

### *1. Impact Assessment of Marine Resource Use*

**Summary:** The oceans are a planetary resource and are important in planetary-scale processes (e.g., regulating climate). However, there are many gaps in knowledge about how removal or exploitation of marine resources cascade through marine ecosystems.

**Recommendation:** 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.

### *2. Coordination and Integration of Ecosystem and Fisheries Research and Management.*

**Summary:** Because commercial and recreational fishing activities have impacts on entire ecosystems, the NMFS should employ an ecosystem-based approach to fisheries management. Unfortunately, the scientific knowledge required to do so is incomplete, due in large part to the fractionation of research funding sources and the partitioning of responsibilities among management agencies. Basic research on marine ecosystems and fisheries-related studies are typically funded by different agencies.

**Recommendation:** Encourage a more thoroughly integrated management structure that allows for a more tightly coordinated approach to habitat and fisheries management, and research funding that rewards efforts to merge ecological and fisheries-oriented studies.

### *3. Criteria for Evaluating Marine Pollution*

**Summary:** Coastal eutrophication is widespread in the US and around the world, resulting in increased frequency and extent of hypoxic and anoxic waters, and the alteration of coastal ocean food webs. More information on the effects of coastal pollution on marine systems, as well as criteria for evaluating marine pollution, is needed to better understand the causes and consequences of these events.

**Recommendation:** Fund research and interdisciplinary scientific endeavors to address these areas. A goal of such research would be to develop broadly-applicable, regional and global-scale indicators of changing ocean conditions in response to pollutants.

### *4. Coastal Development*

**Summary:** Despite growing appreciation for the vulnerability of coastlines to both short-term (e.g., storms) and long-term (e.g., sea level rise associated with global warming) dangers, development and building continue, without adequate recognition of real total costs involved.

**Recommendation:** More consistent regulations and enforcement of regulations on ownership and development of coastal properties to prevent future losses should be implemented. Real costs of development (both short and long term) should be included in plans for coastal development.

## **III. Education**

**Summary:** Many of society's most pressing problems are related to the coastal and ocean environments. Scientifically trained individuals with knowledge of these environments are needed to provide managers and policy-makers with the information necessary to make decisions.

**Recommendations:** Undergraduate research internships are effective and important for minority and other students who may not be exposed to aquatic sciences in their undergraduate curricula; funding for such programs is highly encouraged. Another means of "bridging the gap" between science and management is to allow and encourage federal marine resource managers to attend annual conferences of scientific societies.

## **ASLO Report to the United States Commission on Ocean Policy**

The American Society of Limnology and Oceanography is a nonprofit, professional society whose goals are: "To promote the interests of limnology and oceanography and related sciences, to foster the exchange of information across the range of aquatic science, to further investigations dealing with these subjects, and to link knowledge and understanding in the aquatic sciences to the identification and solution of problems generated by human interactions with and impacts on the environment." We would like to provide the input in the following areas for consideration by the Oceans Commission:

### **I. Research Programs and Research Funding**

### **II. Use of Marine Resources and Pollution**

### **III. Education**

#### **I. Research Programs and Research Funding**

*1. Ocean Observing Systems:* Ocean observing systems using recently developed and evolving technologies now make it possible to conduct real time monitoring of key environmental parameters in coastal and open ocean waters. Automated measurements coupled to continuous data-recording and -transmitting capabilities will greatly facilitate the establishment of baseline data and detection of trends in light of human-induced and natural (e.g., climatic) change in many regions of the world ocean. Whether moored in coastal areas or operating on navigable vessels (e.g., ferries and commercial ships), or autonomous vehicles that roam the deep sea, measurement platforms are proving highly useful and as such are proliferating. While these platforms can measure a suite of standard physical variables, they are also becoming increasingly capable of collecting chemically, geologically and biologically useful data. Such observatories are obviously useful to the research community, and in climate prediction and national security, and for the public as well (e.g., for real time red tide warnings). Although the observatories offer tremendous logistic and technical advantages in terms of massive data collection in remote and hard-to-access waters, they still require major capital investment to deploy, operate and maintain.

Several such systems already have been justified, and some have been implemented in prototype mode. The next question for the research and policy communities is how advances in this area should be supported. NSF can support them only at the expense of single-investigator grants. Are other agencies involved? Should ONR, EPA, NOAA, DOE, NASA and NSF be encouraged to devote new sources of funds to observatory projects in order to support them without drastic cuts to the core investigator programs? Support needs extend not just to collection of data and maintenance of facilities, but to data analysis and access by scientific and management communities, as well as the public, much like the weather service now operates.

Along the same lines, the massive data sets collected by WOCE, JGOFS, satellite missions, and these new observatories will require resources for their maintenance and continued access to the scientific community. While funding of new instruments is essential, support for analysis of long term data sets derived from past and future research is equally important. We note that the transition from analysis and archival of small data sets to large data sets has been rapid and that the information technological and human resources to facilitate this transition are in short supply. In general, the scientists now collecting these large volumes of data do not have methods to turn the fire-hose volume of incoming data into a useful information stream.

We see no ready solution to this growing problem at present. A synthesis program to support efforts to analyze large, long-term data sets with the goal of producing overview papers (published in the peer-reviewed literature) is a commendable goal. Such a program could be operated (and perhaps managed) through the National Center for Ecological Synthesis (NCES) in Santa Barbara. This program would not only support data-synthesis but would also aid in identifying “data gaps” in the data sets.

2. *Land-Ocean Connections*: The commission's work is focused on the ocean itself, but we urge the commission to also take note of critical land-ocean connections because a concerted scientific effort is needed to link the landscape (and changes in the landscape) with the seascape (and changes in the seascape). The interface between surface, rain and ground waters and the ocean is an increasingly important one, and one to which limnologists and hydrologists as well as oceanographers can contribute. The amount, quality and fate of freshwater input to the coastal zone is important, and similarly, the degree of salinization of aquifers caused by exploitation of ground waters is a major issue in coastal regions. Interactions and feedbacks between freshwater flow and water quality and coastal ecosystem dynamics must be better understood in order to predict the response of these systems to future changes in landward forcing functions (e.g. changes in freshwater flow, rising sea level, changes in nutrient loading).

3. *Marine Science Funding*: Just as these last issues of land-sea exchanges fall uneasily within the purview of the Ocean Commission, natural aggregations and subdivisions of marine science cross agency jurisdictions in the increasingly complex web of agencies and programs that deal with the oceans. It is striking how differently basic research in fish ecology is treated from basic research in oceanography, for example, despite the fact that decades of research shows the importance of top-down effects on communities and ecosystems from fish predation. This difference is strikingly apparent to ASLO members when they hold meetings in Canada and Europe, where basic research on fish ecology is not so artificially separated from basic research on other aspects of the marine environment. An inability to decide target agencies for enhanced marine sciences funding within the federal government has now made ocean research more and not less Byzantine through the formation of conglomerates such as NOPP. An increasing fraction of basic research funding is tied to very strict rules set out in broad agency announcements with short lead times, and the rules change rapidly with subsequent announcements even from the same agency. We question the assumption that top-down dictation of questions and approaches is the fastest, most productive or efficient way to solve the basic research questions that will lead to the greatest advances in understanding or the greatest societal benefits.

## **II. Use of Marine Resources and Pollution:**

1. *Impact Assessment of Marine Resource Use*: The oceans as a planetary resource: Because the ocean is largely a commons (with the exception of exclusive economic zones), there will be some difficulty in coordinating any US Ocean Policy outside of an international framework. Policy with regard to pollution and large-scale uncontrolled manipulations will be difficult to implement without international support. The London Convention on the Prevention of Marine Pollution should help with guiding policy on delivery of materials into the oceans. The US, as a major player in oceanographic research could play a strong leadership role in setting the standard for how the open ocean is “used” for attempted manipulations such as carbon sequestration.

The oceans are a planetary resource and important in a variety of planetary-scale processes (e.g., regulating climate) and therefore, any policy regarding ocean use should contain provisions (or impact assessment) on how its use will alter ocean function both in

the short and long term (e.g., on appropriate spatial and temporal scales). This requires scientific expertise. There are many gaps in knowledge about how removal of or impacts on marine resources cascade through marine ecosystems. Long- and short-term (and large- and small-scale) impacts should be considered PRIOR to permitting resource use to the ocean commons. Research is needed to determine how extractive industries impact ocean ecosystems. Regulations should be proactive and include impact statements with the best available information on how removal affects biological, chemical and physical systems and their interactions.

## *2. Coordination and Integration of Ecosystem and Fisheries Research and Management:*

Improved coordination and integration of ecosystem and fisheries research and management: It has become increasingly apparent that the characteristics of coastal and marine ecosystems [referred to collectively as marine ecosystems] both affect and can be affected by commercial and recreational fisheries. The quality, quantity and spatial arrangement of habitats within marine ecosystems affect both their basic functioning and their value to fisheries production. Factors such as nutrient loading and the abundance of species that create complex 3-dimensional structure alter biogeochemical cycles, diversity and habitat available to fishes. In addition, degraded habitat can make species more susceptible to fishing pressure, both by increasing the susceptibility of individuals to fishing gear, and by reducing the productivity and resilience of populations. In recognition of the importance of the multitude of anthropogenic and natural factors potentially affecting aquatic systems in which finfish and shellfish are taken, a National Academy of Sciences panel has recommended a move towards ecosystem-based fisheries management. Fisheries management regulations in the United States made an important stride towards incorporating habitat considerations into fisheries management with the enactment of the 1996 Sustainable Fisheries Act, which added Essential Fish Habitat (EFH) provisions to the Magnuson-Stevens Fishery Conservation and Management Act.

Fishing practices affect not only fished populations, but the ecosystems they inhabit. A reduction in top predators or important herbivores alters basic trophic dynamics, the ability of systems to process nutrients, habitat available to both fished and non-fished species, and biogeochemical cycling. Fishing can also alter habitat. Trawling and dredging potentially reduce the value of habitat to fishes by reducing their abundance, and altering the composition of macroinvertebrate prey.

The interdependence of ecosystems and the fisheries they support provides strong rationale for improved coordination and integration of ecological and fisheries research and management, and strong support for both research and management efforts that attempt such integration. At present, efforts are fractionated by both research funding sources and the partitioning of responsibilities among management agencies. Different agencies typically fund research aimed at increasing the understanding of the basic organization and functioning of marine ecosystems and fisheries-related studies. Similarly, different federal agencies have responsibility for managing fisheries and for protecting the habitats on which they depend.

A more thoroughly integrated management structure that allows for a more tightly coordinated approach to habitat and fisheries management, and research funding that rewards efforts to merge ecological and fisheries-oriented studies would potentially benefit both the marine environment and the fisheries they support.

## *3. Criteria for Evaluating Marine Pollution:*

Whereas we can regulate in our own coastal areas (enforcement is another thing) we cannot regulate the open ocean. There are currently no good definitions or criteria for evaluating marine pollution. There is an

Ocean Dumping agreement that should be examined. We need more information on how coastal pollution (not only in US) affects marine systems and more policy work on mitigation and reduction of coastal pollution. Both science and policy in this area would benefit from international collaboration. Coastal eutrophication is widespread in the US and around the world. One of the most common symptoms of eutrophication is increased frequency and extent of hypoxic and anoxic waters and the alteration of coastal ocean food webs. Hypoxic-anoxic events may have serious repercussions on coastal fishery (both benthic and pelagic species) yields and sustainability. Understanding the causes and consequences of hypoxia-anoxia is critical, and research funds should be made available for such interdisciplinary scientific endeavors. Frequencies and composition of toxic algal blooms are also suspected to be linked to coastal eutrophication, and these events may impact coastal fisheries and recreation as well. We need to develop broadly-applicable, regional and global-scale indicators of changing ocean condition in response to pollutants.

*4. Coastal development:* Coastal real estate may also be considered an economic resource that is dependent upon on the ocean. Despite growing appreciation for the vulnerability of coastlines to both short-term (e.g., storms) and long-term (e.g., sea level rise associated with global warming) dangers, development and building continue. This issue might be addressed by more consistent regulations and enforcement of regulations on ownership and development of coastal properties to prevent future losses. Because much of the US and world population lives near coastal areas, impacts of development on ecosystem health might be an area where ASLO members can offer significant information. Real costs of development (including environmental costs) should be factored into any plan for coastal areas, and these costs should include long-term as well as short-term impacts.

### **III. Education**

Education is an integral part of ASLO's mission and is a major activity of many ASLO members. The society is involved in various education and outreach activities, but setting national education policy is not our focus. We have a diversity of dedicated individuals, however, who can contribute in many subject areas and at many levels. We have also had notable success in encouraging minority students to consider careers in limnology and oceanography. Undergraduate research internships are particular effective and important for minority and other students who may not be exposed to aquatic sciences in their undergraduate curricula. Education should continue at the level of science and science policy managers. An effective way to maintain and build scientific knowledge among government and agency scientists and managers is to encourage and support their attendance at national scientific meetings. This will have the additional advantage of building collegiate interactions among academic and agency scientists.