Committee on Resources

Subcommittee on Fisheries Conservation, Wildlife and Oceans

Statement

Written Testimony

Jane Lubchenco

Distinguished Professor of Zoology

and Wayne & Gladys Valley Professor of Marine Biology

Oregon State University

Before the

Subcommittee on
Fisheries Conservation, Wildlife & Oceans

Committee on Resources

U.S. House of Representatives

May 6, 1999

Good morning, Mr. Chairman and distinguished members of the Subcommittee. My name is Jane Lubchenco. I am a marine scientist and a professor at Oregon State University. I appear before you today as an independent scientist with expertise on coastal ocean issues and special interest in H.R. 1243, The National Marine Sanctuaries Enhancement Act of 1999. I have extensive experience doing research on the ecology of rocky shores of Oregon, Washington and California over three decades. My Harvard University Ph.D. dissertation research focused on the coasts of New England. I've also studied coastal ecosystems in countries around the world.

I have a passion for science and for oceans and am delighted to have the opportunity to speak about them both. One of the most important roles of science is to inform the deliberations and decisions of individuals and of society. It is in this spirit of sharing new scientific information and understanding that I am here today.

I think I can be most helpful in putting the consideration of National Marine Sanctuaries legislation in the broader context of the state of oceans today. How we think about our Sanctuaries should be informed by knowledge about how oceans are changing.

A number of recent polls indicate strong awareness and concern expressed by the American public about our oceans. I find that much of this concern is focused on discrete disasters such as oil spills. The reality is far different. The discrete disasters are merely the tips of the icebergs. A broad array of land-based and ocean-based activities is inadvertently resulting in invisible, incremental, sometimes irreversible and altogether insidious changes to our oceans.

What do we actually know about the state of the oceans? How are ocean ecosystems changing and at what rate? Can we separate the anthropogenic from the non-anthropogenic components? What are the likely consequences of these changes? Which ones are most important for us to address immediately? Answering these questions for oceans presents special challenges. We lack basic information and baseline data for most oceanic systems.

Nonetheless, we can assess some very important aspects of oceans. I've chosen to focus specifically on a suite of indicators of change where we can document the magnitude and in some cases the rates of change. I highlight today the changes that have been quantified with a high degree of confidence. These indicators do not include everything we might wish to know or many changes we suspect. Rather they are limited to alterations that are reported and quantified in the peer-reviewed scientific literature.

Some indicators focus on land-based activities, highlighting the reality that oceans are affected both by land-based and ocean-based activities. Land use practices have far greater impact on ocean ecosystems than is generally appreciated.

Seven global-scale indicators of change in oceans include:

1. Two-thirds of the major marine fisheries are fully exploited, over exploited or depleted. Just over 40 years ago, this figure stood at less than 5%. In some cases, over-exploited species may recover; in others, e.g. the white abalone, extinction appears virtually certain. Much of the legislation your subcommittee has considered has focused on ways to help ensure that fisheries are sustainable.

2. The concentration of carbon dioxide in the atmosphere has increased by 30% since the beginning of the Industrial Revolution. Because we can "fingerprint" this heat-trapping, greenhouse gas, we are certain that the increase is a direct result of human activities, primarily the burning of fossil fuels. The consensus within the scientific community is that the increases in CO_2 and other greenhouse gases have probably already affected climate. The average global temperature of Earth has risen by about 1° F over the last century; sea level has risen by 4 - 10 inches. There is uncertainty about how fast the planet will continue to warm and how this and other climate-related changes will affect the land and oceans. The best (and cautious) predictions forecast an increase of between 2 and 6° F and a rise in sea level of 6 inches to 3 feet over the next century.

3. Humanity currently utilizes over half the available surface freshwater of the planet. About 70% of that amount is used in agriculture. Above and beyond the ramifications of these numbers for an explosively growing human population, this figure has critical implications for water flow through estuaries and bays, and therefore habitat quality, e.g., for salmon.

4. Between one-third and one-half of the land surface of Earth has now been transformed by human action. Examples include the conversion of wetlands and forests to urban and industrial areas or of grasslands to pastures and agricultural fields. The resulting alterations in biogeochemical cycles, precipitation patterns, and habitat availability affect ocean ecosystems directly and indirectly. The recent listing of nine salmon and steelhead populations in the Pacific Northwest highlight some of the consequences to marine species of land transformation due to logging, grazing, hydroelectric power generation, agriculture and urbanization. Habitat transformation is more difficult to quantify in oceans. Our best information comes from the more easily accessible shorelines. Mangroves, for example, line tropical and subtropical shorelines.

Fully 50% of the mangroves of the world have been lost in recent years, due to coastal development and conversion to shrimp-farming ponds. These ecosystems provide valuable services including the provision of nursery and spawning areas for numerous economically important species, retention of sediments, stabilization of coastlines against erosion and purification of water flowing through them. Their loss thus has significant ramifications for water quality, fisheries, coral reef functioning and coastline stability.

5. The amount of nitrogen that enters the nitrogen cycle each year has more than doubled over the past century as a result of human activities. The making of fertilizers and burning of fossil fuels account for the bulk of this newly "fixed" nitrogen. The problem is that vast amounts of nitrogen in fertilizers are not used by crop, garden or lawn plants, but are washed away into streams, rivers and oceans. Additional wasted nitrogen is carried into the air and

transported elsewhere on land or into oceans. This excess nitrogen can disrupt downstream ecological systems. The chemistry of coastal areas around the world is changing, in part because of this influx of nitrogen into previously nitrogen-poor systems. The growth of many (though not all) species that cause red tides and other harmful algal blooms is often triggered by an influx of nitrogen and other nutrients. It has been suggested that the global-scale increase in harmful algal blooms is partly related to the increased amounts of nitrogen in coastal waters around the world.

6. A number of scientific experts have stated that Earth is in the early states of the sixth mass extinction event in the history of the planet. This is the first mass extinction that is due directly to human activities. Major drivers include habitat destruction or alteration, introduced and invasive species, and overfishing. It is difficult to quantify the changes in the rate at which all species are being lost, primarily because we do not know how many species are present on Earth. This is particularly true in oceans. However, we do have reliable information about certain more obvious, well-known and well-preserved taxa. We know, for example, that **one-fourth of the bird species on the planet have gone extinct**, due primarily to human actions (hunting and habitat destruction).

7. There are now some fifty "dead zones" or areas with low to no oxygen, in the coastal areas around the world, most of which have appeared within the last fifty years. Globally, dead zones have tripled in number in the last thirty years. The dead zone in the Gulf of Mexico, for example, has doubled in size since 1993, and at 1600 square miles is the largest in the Western Hemisphere. Excessive nutrient influx, especially nitrogen and phosphorus compounds from agricultural, livestock and poultry enterprises in upstream watersheds, are the suspected causal agents.

These seven global-scale indicators of change - in fisheries, atmospheric gases, water, land transformation, nitrogen, biodiversity and dead zones -- as fundamental and important as they are, do not provide us with a complete picture of ways in which oceans are changing. Nonetheless they give us a firm position from which to draw some conclusions.

- It is clear that human activities are changing the chemistry, the physical structure, and the biology of the oceans, especially along coastal margins.

- It is clear that the rates, scales and kinds of changes happening now are fundamentally different from before.

- It follows that bold action is needed to safeguard our ocean ecosystems.

The oceans are changing dramatically. In general, we are ignorant about many of these changes, in denial about some and generally complacent about the likely consequences. It is indeed time to take concrete action to protect ocean ecosystems in stronger and more effective ways. Two particular actions relate to the Committee's current deliberations.

1. The National Marine Sanctuaries have played a vital role in protecting coastal resources. They could and should be more effective. Significantly more resources would enable stronger protection of existing sanctuaries. Enforcement, monitoring, research and education are all vitally important to the sanctuary program, but all have been severely underfunded. Adequate resources are urgently needed for the 12 existing sanctuaries. In addition, and in view of the fast pace of changes along our shores, the sanctuary system should be expanded significantly to protect more of our national heritage. The planning process for expansion could proceed in parallel to addressing extant needs.

2. Within the context of the sanctuaries, a powerful and effective vehicle for helping to ensure conservation of vital ocean resources would be a network of strategically sited and fully protected marine reserves. Fully protected, also known as "no-take," reserves can conserve vital ocean habitats, serve as "recharge zones" for fishery production, protect biodiversity, provide sites for education and enjoyment, and facilitate research. Establishing this network in conjunction with expansion of the National Marine Sanctuaries would be a powerful advance and a fitting legacy.

Information is rapidly accumulating about the multiple benefits arising from fully protected reserves. Sufficient information is in hand that a strong consensus exists within the scientific community about the benefits. I recently served on the National Academy of Science's National Research Council's committee that produced the report "Sustaining Marine Fisheries." This report - just out in its final form and available on the Academy's website at www.nap.edu - strongly endorses fully protected marine reserves as a powerful and essential fishery management tool.

In summary, marine ecosystems provide important goods and services to people. They are under multiple assault from a wide variety of ocean- and land-based activities. Protecting, using and managing them sustainably should be one of our highest priorities. Strengthening and expanding the National Marine Sanctuaries is an excellent step toward these goals.

I append the following scientific documents that provide additional information and documentation for the indicator cited above.

1. Vitousek, P. M., H.A. Mooney, J. Lubchenco and J. M. Melillo. 1997. Human domination of earth's ecosystems. **Science** 277:494-499. (Covers indicators 1-6)

2. Malakoff, D. 1998. Death by suffocation in the Gulf of Mexico. **Science** 28: 190-192. (Indicator 7)

3. Diaz, R. J. and R. Rosenberg. 1995. Marine benthic hypoxia: a review of its ecological effects and the behavioural responses of benthic macrofauna. **Oceanography and Marine Biology: An Annual Review** 33: 245-303. (Indicator 7).

4. National Research Council. 1999. Sustaining Marine Fisheries. National Academy Press, Washington DC. (fully protected marine reserves): available on line at http://www.nap.org

# # # # #