Statement to the United States Commission on Ocean Policy

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OCEANS AND HEALTH: UNDERSTANDING AND MITIGATING TRENDS AND LINKAGES

Admiral Watkins, distinguished members of the Commission, ladies and gentlemen; good morning. My name is Darrell Jay Grimes and I am Dean of Marine Sciences and Director of the Gulf Coast Research Laboratory at The University of Southern Mississippi. I am a marine microbiologist and I currently have the privilege of serving on the National Research Council's Ocean Studies Board and the Consortium for Oceanographic Research and Education as their Vice Chair.

Before I begin my testimony that focuses on my training and experience as a marine microbiologist, I want to reiterate key points made by the Ocean Studies Board and by CORE.

The OSB, in a letter from Dr. Ken Brink, emphasized the following eight issues which were specifically referenced in the purpose and objectives of the Oceans Act of 2000.

- Impacts of land-based activities on coastal areas
- Ocean pollution
- Management and governance of resources in U.S. waters
- Information to support decision making
- Infrastructure needs and the promotion of technological innovation
- Governance of activities outside national waters
- Improved coordination in ocean research, management, and policy
- Ocean education

In testimony presented by my colleague, Dr. Carolyn Thoroughgood, Chair of the Board of Governors of the Consortium for Oceanographic Research and Education, five key issues were highlighted, as was the need to improve interagency coordination and integration of basic ocean sciences.

- Increase the federal investment in basic research in ocean sciences
- Implement an integrated and sustained coastal and ocean observing system
- Enhance ocean science education support and human resource development
- Recapitalize scientific infrastructure and support systems
- Improve the scientific basis for decisions about the use of marine resources and the protection of marine ecosystems and public health

I fully support the importance of these issues and I will focus on several of them in my remarks this morning.

Microorganisms rule the biosphere. In the oceans and in the sea floor sediment under the oceans, microbes comprise a larger biodiversity and biomass than any other form of life on Earth. Microbes decompose dead plants and animals in the eternal cycles of nature, and they cause devastating diseases in all life forms. Some are the base of oceanic food chains, for example, methane utilizing bacteria that thrive in frozen gas hydrates on the floor of the Gulf of Mexico. Others produce methane from CO_2. Indeed, it has been said by many that bacteria can interact with every element listed on the periodic table. Because of this metabolic omnipotence, for the past two decades, microbes, including marine microbes, have been the foundation for biotechnology in the U.S. and worldwide.

Recent estimates based on sophisticated molecular tools strongly suggest that fewer than 0.1 % of the microbes that live on Earth have been discovered, isolated in pure culture, and described. This astounding revelation means that there are vast numbers of new microbial species yet to be discovered and it is anyone's guess as to what their role in nature is and what their potential for application will be. No doubt some will be identified as fish pathogens, some as producers of greenhouse gases, some as decomposers of toxic chemicals, and some as drivers of important biogeochemical processes common to the depths of the oceans and to aquifers of the deep subsurface. Whatever their role, it is critical that scientists be supported in their search for new and novel microbes in the ocean.

I co-authored a recent report in *Science* (Harvell et al., 1999), where it was shown that mass mortalities due to disease outbreaks have affected major life forms in the ocean. For relatively closely monitored groups like corals and marine mammals, reports on the frequency of epidemics and the number of new diseases have increased. Some of these diseases have been linked to climate change, because of climate-induced changes in both the agents and the hosts of specific diseases. Accordingly, this report recommended support for interdisciplinary studies of marine diseases, focused on the development of better molecular and computational tools and on understanding mechanisms of disease resistance in marine organisms. Such support would have the added advantage of providing for development of new tools to better detect, understand, and mitigate global waterborne disease agents (Rose and Grimes, 2001), as well as the recently emergent threat of bioterrorism.

In that same year, I was part of a National Research Council committee that reviewed the impacts of the ocean on human health (National Research Council, 1999). This NRC report made three recommendations: (1) elucidate connections between the ocean and human health, (2) evaluate the present state of knowledge about these connections, and (3) suggest how current and future efforts may be directed so that we can anticipate and respond to future health needs and threats. Because of acts of bioterrorism that occurred in 2001, these recommendations take on new and urgent meaning. Just exactly what are the health needs and threats of the future? I can no more answer that question today than I could when we panelists penned it in 1999. But I can assure you that all mechanisms of conveyance are being investigated by terrorists. In addition, there are reports of a new El Nino developing in the Pacific Ocean. If indeed this

periodic climate driver materializes, it will be interesting to look at new outbreaks of human disease caused by estuarine and marine microorganisms such as *Vibrio cholerae, V. parahaemolyticus,* and *V. vulnificus.*

The final point that I would like to make relates microbiology to fisheries, aquaculture, and seafood safety. We have all heard statistics about declining fisheries, our international trade deficit in fish and fish products and especially shrimp, the need to ramp up aquaculture in the United States, and the vulnerability of consumers to imported product. Clearly, capture fisheries cannot keep up and aquaculture is a promising alternative to meet demand. However, we must not overlook the many microbiological issues that affect the seafood we eat. These issues include health of the fishery, susceptibility of culture systems to disease, misuse of antibiotics in aquaculture, the potential for seafood to be used as devices for bioterrorism, nonindigenous species issues related to both fish and microorganisms, and concerns about environmental contamination.

In conclusion, permit me return to the title of my statement - **OCEANS AND HEALTH: UNDERSTANDING AND MITIGATING TRENDS AND LINKAGES**. If there is no understanding, there is no hope for mitigation. Understanding comes from basic research; mitigation capability comes from applied research and technology development. Trends and linkages are the products of long-term monitoring, observation, and interpretation. Clearly, the health of the oceans and the use of the oceans rely upon continued investment in the research enterprise. If we as a nation expect to understand and mitigate linkages between oceans and human health, there must be a reaffirmation of our commitment, as a nation, to fundamental research on the oceans and our aquatic resources. Our economic strength, social stability, and national security will require no less.

References

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