TESTIMONY OF
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Field Hearing on Progress Made in Safeguarding Chesapeake Bay

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Mr. Chairman and Members of the Committee, I am Lowell Bahner, Director of the National Oceanic and Atmospheric Administration (NOAA) Chesapeake Bay Office. Thank you for inviting me to testify on NOAA's role in supporting the Chesapeake Bay Program and the issue of modeling versus monitoring to evaluate progress in the restoration effort.

NOAA has been a partner in the Chesapeake Bay Program since 1984, when the Northeast Regional Office of the National Marine Fisheries Service (NOAA Fisheries) first entered into a Memorandum of Understanding with the Environmental Protection Agency (EPA), establishing the participation of NOAA in the Chesapeake Bay Program. Between 1984 and 1991, NOAA Fisheries administered fisheries research and assessment grants, serving as chair of the Chesapeake Bay Stock Assessment Committee. The NOAA Chesapeake Bay Office was established through congressional authorization in 1992, beginning a new era of strengthened NOAA Bay Program involvement, including co-location of the new office and staff with the EPA-led Chesapeake Bay Program in Annapolis, Maryland. The NOAA Chesapeake Bay Office was reauthorized in 2002.

I am particularly pleased to be here representing NOAA. We in the NOAA Chesapeake Bay Office are proud not only of the programs we administer, but also of the broad range of science, service and stewardship activities represented by our agency at large. NOAA's missions in ecosystem management, weather and water, commerce and transportation, and climate all have applications in the context of Chesapeake Bay. We are continually looking for ways to improve our capabilities to meet the needs of the Bay and the region.

My testimony today will focus on the issues you requested in the letter of invitation: (1) NOAA's role in support of the Chesapeake Bay Program in its mission to clean up the Bay (particularly as it pertains to the Chesapeake 2000 Agreement) and (2) the issue of modeling

versus monitoring as it relates to accurately reporting on progress. I will conclude with some remarks on emerging NOAA capabilities and programs that could further assist in restoring Chesapeake Bay.

NOAA's Role in the Chesapeake Bay Program

NOAA's role in the Chesapeake Bay Program derives from NOAA's mission as an agency, the statutory mandate for the NOAA Chesapeake Bay Program, and the Chesapeake 2000 (C2K) Agreement, whereby EPA is the signatory on behalf of the Federal partnership that includes NOAA. I will describe the specific programs and activities of the NOAA Chesapeake Bay Office as they relate to the C2K Agreement and briefly mention NOAA-wide programs that support overall Chesapeake Bay protection, restoration, and management.

As a partner in the Chesapeake Bay Program, NOAA works towards specific commitments of the C2K Agreement:

- By 2010, achieve, at a minimum, a 10-fold increase in native oysters
- Address exotic and invasive species, ballast water
- By 2003, revise fishery management plans for migratory fish
- By 2004, assess menhaden, oysters and clams
- By 2005, develop multi-species management plans
- By 2007, implement multi-species management plans
- For blue crabs, establish targets and manage species
- For submerged aquatic vegetation (SAV), accelerate protection and restoration
- For toxics, understand effects and impacts
- By 2003, assess effects of airborne nitrogen compounds
- For education, provide a meaningful Bay or stream experience for all students in the watershed, beginning with the class of 2005
- For community engagement, provide small watershed grants

The Chesapeake Bay Program recently established a set of "keystone commitments" for Bay restoration. NOAA is the lead for four of these keystones:

- By 2010, achieve, at a minimum, a 10-fold increase in native oysters
- By 2005, develop multi-species management plans
- For SAV, accelerate protection and restoration
- Provide a meaningful Bay or stream experience for all students in the watershed, beginning with the class of 2005

I will focus on these "keystone commitments" in describing the programs of the NOAA Chesapeake Bay Office.

Oyster Restoration/Non-native Oyster Research (By 2010, achieve, at a minimum, a 10-fold increase in native oysters)

NOAA is the lead federal agency for Chesapeake Bay oyster restoration, providing funding and technical assistance to large-scale restoration and community efforts, hatchery infrastructure, and applied disease research. Oyster restoration activities supported by the NOAA Chesapeake Bay Office are Bay-wide. The strategy for native oyster restoration continues to be refined based on evaluation of projects implemented to date. NOAA-sponsored oyster restoration in Virginia began in 1999, with approximately 350 acres of oyster grounds restored as of July 2004 in the Yeocomico, Coan River, Great Wicomico, Rappahannock, Corrotoman and Piankatank Rivers, and Tangier Sound. NOAA divers provide monitoring and assessment expertise to validate project results, and NOAA ship-based charting technology is being used to determine appropriate planting areas, bottom substrate types, and areas for reclaiming buried shell.

In addition to restoration support, oyster disease research funding from NOAA Sea Grant continues to address disease vector and management strategies, including development of disease diagnostic tools, development of potentially disease-resistant strains of native oysters, and evaluation of the possible introduction of alternative oyster species. Since 2002, the NOAA Chesapeake Bay Office has funded research on the non-native Asian oyster, *Crassostrea ariakensis*, proposed for introduction into Chesapeake Bay by the states of Maryland and Virginia. NOAA is a cooperating agency on the Environmental Impact Statement, led by the U.S. Army Corps of Engineers, to evaluate risks associated with potential *ariakensis* introduction. The NOAA Chesapeake Bay Office is also providing data management and geographic information system (GIS) support to provide comprehensive tracking and mapping of state and federal oyster restoration sites in the Bay.

Fisheries/Multi-species Management (By 2005, develop multi-species management plans)

Fisheries in Chesapeake Bay contribute significantly to U.S. catches at the national and regional levels. Recent statistics indicate that an average of about 670 million pounds of fish and shellfish are commercially harvested annually from Chesapeake Bay waters (1993-2003 average), with an average dockside value of more than $165 million per year. Maintaining the health of these fisheries is an important but difficult task given the inter-annual variability of each species, changes in ecosystem health, predator-prey interactions, and the multiple authorities responsible for fisheries management in the Chesapeake Bay region. Both federal and state agencies have responsibility for managing fisheries within the Bay. Maryland, Virginia, and the Potomac River Fisheries Commission are responsible for regulation of fisheries within their respective waters. However, a majority of stocks of individual species span all of these jurisdictions. Furthermore, migratory species that spend a portion of their life in coastal or oceanic waters are subject to Federal jurisdiction through either the Atlantic States Marine Fisheries Commission (within 3 miles of the coast) or the Mid-Atlantic Fishery Management Council (3 – 200 miles offshore).

The NOAA Chesapeake Bay Office chairs a Fisheries Steering Committee for Chesapeake Bay, composed of members from each of the Bay fishery management agencies in Maryland, Virginia, and Pennsylvania, the District of Columbia, the Potomac River Fisheries Commission, the Atlantic States Marine Fisheries Commission, the U.S. Fish and Wildlife Service, and the Chesapeake Bay Program. To meet the 2005 and 2007 goals for establishing multi-species fishery management plans, NOAA recently released a guidance document entitled "Fishery Ecosystem Planning for Chesapeake Bay" to provide state and regional managers with improved tools and technical advice for ecosystem approaches to fishery management. The NOAA Chesapeake Bay Office is also developing an ecosystem-based fisheries model to support fishery management decision making in the development of these new plans.

Submerged Aquatic Vegetation (SAV) Protection and Restoration (For SAV, accelerate protection and restoration)

In accordance with Congressional appropriations language, the NOAA Chesapeake Bay Office began large-scale SAV planting and research in 2003. NOAA awarded grants totaling $550,000 in fiscal year (FY) 2003 and $800,000 in FY 2004 to establish pilot and large-scale planting and restoration techniques for underwater seeds, shoots, and roots of grasses native to the various salinity regimes of Chesapeake Bay and tidal tributaries in Virginia and Maryland. Submerged aquatic vegetation is particularly sensitive to light conditions, with improved grass growth following periods when water clarity is greatest. Therefore, success of restoration efforts is contingent upon water quality in the Bay. As a result of being one of the wettest years on record, 2003 was a relatively poor year for water clarity, leading to a reported loss of nearly 30,000 acres of SAV bay-wide.

NOAA-funded research has identified techniques for large-scale seed harvest and successful storage, with the goal that SAV seeds for some species can be handled much like standard agricultural processes, with the difference that SAV seeds must be kept moist. Broadcasting of seeds has provided the best recent success for large-scale planting. Alternative planting techniques, such as mechanized planting from boats, have been less successful. Small-scale commercial operations are testing woven mats with SAV seeds in the weave. SAV restoration is a key component of successful shoreline restoration, providing a barrier to reduce wave action and trap sediment. SAV provide critical habitat for fish and shellfish, particularly for blue crabs during mating and molting.

Education (Provide a meaningful Bay or stream experience for all students in the watershed, beginning with the class of 2005)

As the lead federal agency for education in the Chesapeake Bay Program, NOAA coordinates the activities of the Education Workgroup. Much of the effort to meet the C2K commitment is supported through the NOAA Bay Watershed Education and Training (B-WET) Program, established in 2002. The B-WET Program provides hands-on watershed education to students and teachers to foster stewardship of Chesapeake Bay. NOAA recognizes that environmentally

aware citizens with the skills and knowledge to make well-informed environmental choices are key to sustaining the Nation's ocean and coastal environments.

Using the environment to help advance student learning and problem-solving abilities has been shown to increase academic performance, enthusiasm for learning, and environmental stewardship. The main component of B-WET is a financial assistance program. The program provides competitive grants and technical support, facilitating meaningful watershed experiences for students and related professional development for teachers. Funding for the program grew from $1.2 million in 2002 to $2.5 million in 2004. In 2004, B-WET will reach an estimated 14,500 students and 3,300 teachers through 34 grants ranging from $10,000 to $200,000.

NOAA-Wide Investments

In addition to the programs of the NOAA Chesapeake Bay Office, NOAA has several other investments in the Chesapeake Bay region:

- The NOAA Restoration Center, within NOAA Fisheries, provides funding for community-based restoration. Habitat restoration projects typically include oyster reefs, SAV, tidal wetlands, riparian habitat buffers, fish blockage removals, "soft" erosion control measures, and beneficial use of dredged materials. Since 1997, 35 projects have been awarded and completed in Virginia, with NOAA support totaling over $750K. Thus far in FY 2004, 5 new projects totaling an additional $150K have been awarded. Projects include a ½ acre 3-dimensional oyster sanctuary reef in the Elizabeth River (1997), the Alexandria Seaport Wetland Restoration (2000-02), rebuilding the Paradise Creek Wetland of the Elizabeth River (2002), Back Creek Eelgrass Restoration offshore of Langley Air Force Base (2000), and the Lynnhaven River Oyster Restoration and Plan (2001).
- NOAA's Ocean Service, including the Center for Operational Oceanographic Products and Services, National Geodetic Survey, National Centers for Coastal Ocean Science, Coastal Services Center, Office of Coast Survey, Office of Ocean and Coastal Resource Management, and Office of Response and Restoration invested over $11.8 million in FY 2003 towards provided funding for research, restoration, environmental monitoring, nautical charting, and coastal management activities.
- NOAA Research provides funding for air research, habitat and fisheries interactions, and ballast water and invasive species research, and supports the Maryland and Virginia Sea Grant programs.
- NOAA's National Weather Service provides weather forecasts, flood watches/warnings, and low-flow predictions.
- NOAA Satellites provides satellite remote sensing services, including information on sea surface temperatures.
- NOAA's Ships and Aircraft provide support for research, coastal mapping, and hydrographic surveys of Chesapeake Bay.

As illustrated by this investment portfolio, NOAA provides a number of valuable products and services to address a broad range of Bay user needs, ensuring safe navigation and marine commerce, restoring habitats, improving the management of coastal resources, providing citizens with forecasts of wind, weather, and water events, and protecting and restoring the Bay's fisheries. NOAA has also afforded benefits to Chesapeake Bay through strong partnerships with state and local government, academia, and private organizations.

Modeling vs. Monitoring in Reporting Progress

Regarding the issue of modeling versus monitoring in reporting on progress in the Bay restoration, NOAA believes that both are important. Modeling provides a valuable tool for examining the potential impact of a given management scheme (forecasting) and looking back (or hindcasting) to understand what happened. Monitoring provides an ongoing means of assessing the net result of management actions, taking into account the natural variability in the environment, and providing real-world data for input back into modeling efforts.

The individual measurements from monitoring give us a snapshot of the environment experienced by the living resources, a "point in time" basis for evaluating water quality at a given location. When these snapshots are combined spatially and temporally, we are able to identify trends and interpret the data, drawing inferences between management actions and water quality results. However, there are many factors to be taken into account in our analyses of the observed data to explain such results, and models provide a means to quantify these factors and then hind- and forecast observed conditions.

Modeling in the Bay is also important because the response to nutrient inputs observed in deep water (anoxia) is actually caused by phytoplankton production taking place in the shallows, which is transported to the deep water by various mechanisms. Research is adding a lot to our understanding of and modeling of these mechanisms, so that we can better interpret our observed data in terms of cause and effect and in terms of progress. We depend on models to translate current conditions and management actions into future conditions. But models are only as good as the information used to develop them – we are still short of understanding many processes and are lacking data on many of the current inputs. Therefore, it is important that we rely on both monitoring and modeling as we evaluate progress in the clean-up of Chesapeake Bay.

NOAA provides the EPA Chesapeake Bay Program Office with data used to run the Bay watershed (pollutant loading) model. Specifically, NOAA provides:

- Rainfall/precipitation data from NOAA's National Weather Service
- Winds and other meteorological products (temperature, humidity, solar radiation, etc) from National Weather Service stations
- Remotely sensed chlorophyll information from NOAA Satellites (NESDIS)
- Living resource data (quantities and locations)
- An air deposition model (developed by NOAA's Air Resources Laboratory at Research Triangle Park)

Over the last decade, the NOAA Air Resources Laboratory has led a multi-organizational effort to assess the role of atmospheric deposition on the water quality of Chesapeake Bay and its tributaries. The work has brought together studies by NOAA and EPA, with an emphasis on nitrogen and mercury. Atmospheric deposition of compounds of nitrogen, resulting from power production, automobiles, and a variety of other activities (including farming), amounts to more than 25 percent of the input of nitrogen nutrients into the Bay water body. Most of the mercury that affects the Bay is derived from atmospheric deposition. There are significant potential implications for human health as a result of the bioaccumulation of mercury in the flesh of edible fish. For this reason, NOAA scientists from several of the agency's line offices have joined forces to coordinate a NOAA-wide mercury program.

NOAA meteorology, rainfall, water level information, and living resources data (quantities and locations) are used in the Chesapeake Bay hydrodynamic and water quality model developed partly run by the U.S. Army Corps of Engineers and also run by a scientist from the University of Maryland, Center for Environmental Science, at the Chesapeake Bay Program Office.

The NOAA Chesapeake Bay Office is funding the Chesapeake Research Consortium (comprised of Bay academic institutions) to develop the next generation of a "community model" for Chesapeake Bay, engaging the expertise of the academic research community. A product under development from this effort is a hydrodynamic model that simulates the dispersion of oyster larvae to predict where the larvae might set as oysters. The tool is being designed to meet the oyster larvae tracking needs of stakeholders making oyster management decisions for Chesapeake Bay. It should also prove useful in support of the Environmental Impact Statement for potential introduction of *ariakensis*. The model may also provide improved prediction for movement of oil or contaminant spills.

As I previously stated, the NOAA Chesapeake Bay Office is developing and testing a food web model for the Chesapeake Bay ecosystem to help state resource managers evaluate proposed management alternatives. While not directly linked to the U.S. Corps of Engineers water quality model, this model provides capability to link nutrients to phytoplankton growth as a driver of fish populations. This model is also being developed to examine spatial considerations of fisheries management, including the feasibility and efficacy of spatially oriented management schemes, for example, reserves and sanctuaries. It can also be used to examine different fishery management scenarios and their associated economic, social, and ecological consequences.

Emerging NOAA Capabilities to Further Support Chesapeake Bay Restoration

In my introductory remarks, I indicated I would conclude with some remarks on emerging NOAA capabilities and programs that could further assist in restoring Chesapeake Bay. As you are likely aware, the Preliminary Report of the U.S. Commission on Ocean Policy outlines a number of recommendations for improving the stewardship of the Nation's coastal and ocean resources. The Preliminary Report concludes that implementation of an Integrated Ocean Observing System (IOOS) must be a priority, stating that *"High quality, accessible information*

is critical to making wise decisions about ocean and coastal resources and their uses to guarantee sustainable social, economic, and environmental benefits from the sea." [page xiii]

The tools and capabilities provided by IOOS will help us to address many needs, including the ability to:

1. Improve prediction of weather as well as climate change and variability and their impact on coastal communities and the nation;
2. Improve the safety and efficiency of marine operations;
3. More effectively mitigate the damaging effects of natural hazards;
4. Improve national and homeland security;
5. Reduce public health risks;
6. More effectively protect and restore healthy coastal marine ecosystems; and
7. Sustain use of marine resources.

The NOAA Chesapeake Bay Office began funding the deployment of remote sensing buoys and fixed sensor packages in Maryland and Virginia in 2003 for real-time monitoring of water quality and physical parameters as part of the development of the Chesapeake Bay Observing System (CBOS). One of NOAA's interests in monitoring is to install sensors in close proximity to restoration areas for submerged aquatic vegetation and oysters, to provide environmental data for evaluating the restoration program. Real-time sensors installed by NOAA's Ocean Service and National Weather Service provide data on tides, currents, winds, and waves that are widely used by recreational and commercial boaters. Predicted (model generated) winds and currents are used for gaining competitive advantage in sailboat races and for setting the starting times for the Great Bay Swim.

A second area of potential is improved application of NOAA's Coastal Zone Management Program and Estuarine Research Reserves System. In particular, these programs have developed communication tools that provide local decision makers with a better understanding of how their actions fit into the larger Bay watershed. An example is the Nonpoint Education for Municipal Officials (or NEMO) program, developed initially at the University of Connecticut as a collaboration between the Cooperative Extension System, the Natural Resources Management and Engineering Department, and the Connecticut Sea Grant College Program. NEMO is an educational program that links land use to water quality. It is built around GIS images of natural resources and remote sensing-derived images of land cover. Because the local land use decision-making process is complex, political, and widely varying, NEMO provides research-based, non-advocacy, outreach as a means to foster better land use decisions.

This concludes my testimony, Mr. Chairman. I will be happy to respond to any questions that you or members of the Subcommittee may have.