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OCEAN SCIENCE AND DATA LIMITS IN A TIME OF CRISIS: DO NOAA AND FISH AND WILDLIFE SERVICE HAVE THE RESOURCES TO RESPOND?

BEFORE THE
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Thank you, Chairwoman Bordallo and Members of the Subcommittee, for the opportunity to testify on the Department of Commerce's National Oceanic and Atmospheric Administration's (NOAA) role in the response to the Deepwater Horizon oil spill.

My name is David Kennedy and I am the Acting Assistant Administrator for Ocean Services and Coastal Zone Management at NOAA. I appreciate the opportunity to discuss the critical roles NOAA serves during oil spills and the importance of our contributions to protect and restore the natural resources, communities, and economies affected by this tragic event. Before I move on to discuss NOAA's efforts, I would first like to express my condolences to the families of the eleven people who lost their lives in the explosion and sinking of the Deepwater Horizon platform.

NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs. NOAA is also a natural resource trustee and is one of the federal agencies responsible for protecting, assessing, and restoring the public's coastal natural resources when they are impacted by oil spills, hazardous substance releases, and impacts from vessel groundings on corals and seagrass beds. As such, the entire agency is deeply concerned about the immediate and long-term environmental, economic, and social impacts to the Gulf Coast and the Nation as a whole from this spill. NOAA is fully mobilized and working tirelessly to lessen impacts on the Gulf Coast and will continue to do so until the spill is controlled, oil is cleaned up, natural resource injuries are assessed, and restoration is complete.

My testimony today will discuss NOAA's role in the Deepwater Horizon response and natural resource damage assessment process, observations related to the Gulf of Mexico, and future activities to improve response and resource assessment efforts.

NOAA'S RESPONSE AND DAMAGE ASSESSMENT EFFORTS

NOAA has three critical roles mandated by the Oil Pollution Act of 1990 and the National Contingency Plan:

1. During the emergency response, NOAA serves as a conduit for scientific information to the Federal On-Scene Coordinator. NOAA provides trajectory predictions for spilled oil, conducts overflight observations of oil on water, identifies highly valued or sensitive environmental areas, and conducts shoreline surveys to determine clean-up priorities.
2. As a natural resource trustee, NOAA conducts a joint Natural Resource Damage Assessment (NRDA) with co-trustees to assess and restore natural resources injured by the oil spill. NRDA also assesses the lost uses of those resources, such as recreational fishing, canoeing, and swimming, with the goal of implementing restoration projects to address these injuries.
3. Finally, NOAA represents the Department of Commerce in spill response decision-making activities through the National Response Team.

NOAA's experts have been assisting with the response to the Deepwater Horizon oil spill from the beginning, providing coordinated scientific services when and where they are needed most. Support from NOAA has not stopped since the first requests for information by the U.S. Coast Guard (USCG). Over the past eight weeks, NOAA has provided scientific support, both on-scene and through our headquarters and regional offices. NOAA's support includes daily trajectories of the spilled oil, weather data to support short- and long-range forecasts, and hourly localized 'spot' forecasts to determine the use of weather-dependent mitigation techniques such as oil burns and chemical dispersant applications. We develop custom navigation products and updated charts to help keep mariners out of oiled areas. NOAA uses satellite imagery and real-time observational data on the tides and currents to predict and verify oil spill location and movement. To ensure the safety of fishermen and consumer seafood safety, NOAA has closed oil-impacted areas to commercial fishing. NOAA scientists are in the spill area taking water and seafood samples to determine which areas are safe for commercial fishing. NOAA will reopen these areas only if it is assured that fish products within the closed area meet the Food and Drug Administration (FDA) standards for public health and wholesomeness. To that end, NOAA, in conjunction with FDA, is continuing to refine a reopening protocol based on both chemical and sensory analysis of seafood within the closed area. In addition, NOAA's marine animal health experts are providing expertise and assistance with stranded sea turtles and marine mammals.

To facilitate on-the-ground understanding of the spill's impacts, NOAA is awarding grants for rapid response projects to monitor the impacts of the oil spill on Louisiana's coastal marshes and fishery species through the Sea Grant Program. To support the local communities as they deal with the economic, social, and environmental impacts of the spill, the Gulf Coast Sea Grant Programs are hosting a series of open forums across the Gulf where citizens have the opportunity to interact with industry, government, and university representatives. In addition, NOAA helped organized volunteer beach clean-ups to remove pre-spill debris from state beaches, which eliminates obstacles and improves access, thereby helping to facilitate the identification and cleanup of oil along the shoreline.

With multiple agencies supporting a diverse array of research projects in response to the Deepwater Horizon oil spill in the Gulf of Mexico, it is important to coordinate research activities to ensure the best use of limited resources. NOAA's Gulf Coast Sea Grant Programs are developing a website to serve as a central database listing ongoing research activities and identifying funding opportunities for oil-spill related research, whether conducted by government, academic, or privately-supported scientists. The database's intent is to provide a single, comprehensive view of research activities in the Gulf that are being undertaken in connection with the Deepwater Horizon oil spill and to foster coordination of these efforts.

At the onset of this oil spill, NOAA quickly mobilized staff from its Damage Assessment Remediation and Restoration Program to begin coordinating with federal and state co-trustees and the responsible parties to collect a variety of data that are critical to help inform the NRDA process. NOAA is coordinating the NRDA effort with the Department of the Interior (another federal co-trustee), as well as co-trustees in five states and representatives for at least one responsible party, BP.

While it is still too early in the process to know what the full scope of the damage assessment will be, NOAA and co-trustees continue to collect data in the Gulf and across the five states. These data will be used to determine what natural resources have been injured and what human uses have been lost due to the spill. Several technical working groups comprising NOAA, federal and state co-trustees, and representatives from one responsible party (BP) are gathering existing scientific information and developing and implementing baseline (pre-spill impact) and post-impact field studies for multiple resource categories. Hundreds of miles of coastal shoreline were surveyed by air and samples were taken to determine baseline conditions prior to the oil hitting land, to identify where the oil has made landfall to support clean-up activities. Resources being assessed include fish and shellfish, bottom-dwelling plant and animal life, birds, marine mammals, turtles, and sensitive habitats such as wetlands, submerged aquatic vegetation or seagrasses, beaches, mudflats, bottom sediments, deep and shallow corals, chemosynthetic organisms, and the water column. Some of these resources may be included within National Estuarine Research Reserves and National Marine Sanctuaries. In addition, NOAA and co-trustee field teams are determining how human uses, including cultural uses, and natural resource services are being impacted.

Needless to say, for both the response and the NRDA, offices throughout NOAA are mobilized and hundreds of NOAA personnel are dedicating themselves to assist with this unprecedented effort.

ACTIVITIES TO IMPROVE FUTURE RESPONSE AND RESOURCE ASSESSMENT EFFORTS

The Deepwater Horizon oil spill is a grave reminder that spills of national significance can occur despite the safeguards and improvements that have been put into place since the passage of Oil Pollution Act of 1990. Although the best option is to prevent oil spills, the risk of oil spills remains a concern given the offshore and onshore oil infrastructure, pipes, and vessels that move huge volumes of oil through our waterways. If a spill does occur, responders must be equipped with the appropriate tools and information. An effective response, based on solid science and

smart decision making reduces environmental and socioeconomic impacts, as well as clean-up costs. Research and development and technological innovation by the public or private sector in the following areas would greatly enhance the tools and technologies available in the event of a spill.

Surface Observations

Real-time data on currents, tides, and winds, as well as sustained observations of physical and chemical parameters of the whole water column, are important in driving the models that inform our understanding of the likely trajectory of the spilled oil. The usefulness of NOAA's trajectory model depends in part on the accuracy of its input data. Observational data play a critical role in ensuring the most accurate trajectory forecast is provided. These forecasts ensure that local communities have advance warning of potential impacts and, as a result, that plans can be put in place to protect sensitive natural resources. Government, academic, and commercial entities are working together to provide the data needed to support these forecasting efforts. For example, several ocean current models are contributing to the trajectory analysis for the Deepwater Horizon oil spill, including those from NOAA, the Navy, the Department of the Interior's Mineral Management Service, the State of Texas, and academic partners. These models use satellite analysis, real-time and near real-time ocean observations, and long-term data.

For modeling the surface movement of oil, ocean observations such as the high-frequency radar play a critical role. High-frequency radars deliver near real-time surface current data 24/7, covering thousands of square miles simultaneously. Surface currents of the ocean are key inputs to the models that generate estimates of the extent and trajectory of an oil spill. This information is provided from the Gulf of Mexico Coastal Ocean Observing System (GCOOS) and the Southeast Coastal Ocean Observing Regional Association (SECOORA). These regional associations are part of the U.S. Integrated Ocean Observing System (IOOS®), a federal, regional, and private-sector partnership working to enhance our ability to collect, deliver, and use ocean information. GCOOS and SECOORA each have three high-frequency radars that are contributing valuable information to the spill response. These radars are part of a national network high-frequency radar data delivery system funded and managed by the NOAA IOOS Program. Because we cannot predict where a spill will occur, data delivery from high-frequency radars is envisioned to be part of a seamless national system that will ensure information 24/7. As the Integrated Ocean Observing System generates more data from technological advances like high frequency radar, the prediction of oil location can be improved by pulling these observations into trajectory models in real time.

Efforts led by NOAA since 2007 to increase the coordination and interaction of various ocean observing centers of expertise into a cohesive community under the framework of the U.S. IOOS has built strong collaborative relationships across the community. As a result, the community has been able to quickly exchange information, identify assets and establish means of working together to meet the challenge the Nation faces with the Deepwater Horizon oil spill.

In addition to in-situ sensors, data collected by space-based synthetic aperture radar can be used to produce high-resolution images of the Earth's lands and oceans and can also be used in all types of weather, as it can "see through" clouds and darkness. Current use of NOAA-generated

experimental products suggests that data from space-based synthetic aperture radar can assist in detecting and refining the areal extent of oil, which would provide valuable information to help determine where response efforts and resources should be deployed.

Subsurface Observations

As the Deepwater Horizon oil spill is demonstrating, our Nation's existing capacity to deliver an accurate depiction of subsurface movement is limited; although, there is some capacity across the federal and non-federal oceanography community. Ocean currents, oil density and behavior, and oil droplet size are all significant contributors to whether oil rises to the ocean surface or remains below the surface. The subsurface concentration of dissolved oil or oil droplets is of significant concern to understanding how fisheries, marine mammals, and other species in the water column will be affected. To address these concerns, the federal response team established a formal Subsurface Monitoring Branch. In addition, the broad oceanographic community has responded in remarkable fashion and made available the best of their expertise and technology. In addition, federal agencies such as NOAA, U.S. Naval Oceanographic Office, and Environmental Protection Agency are all contributing capabilities to better inform our understanding of the subsurface movement of oil.

The emerging advancement in modeling three-dimensionally can greatly enhance response operations and mitigation efficacy. This year, NOAA started an effort to begin to enhance three-dimensional models, which will improve our ability to predict the movement of oil at depth and allow us to direct precious resources to validate the models' trajectory.

To detect the presence of subsurface oil and estimate its movement beneath the surface, one needs a suite of observing assets combined with three-dimensional ocean circulation models. In addition to the high-frequency radars to monitor the surface currents, one needs high-resolution circulation models informed by three-dimensional fields of temperature and salinity. While ship surveys have been the conventional method for observing three-dimensional fields of temperature, salinity, and other properties, such as chlorophyll and nutrients, this method is slow and costly. Three-dimensional circulation models require synoptic measurements at sufficient time intervals to adequately capture the changing conditions in the water column. A combination of profiling floats, moored buoys with profiling sensors, and gliders have the capability to deliver the information at the temporal and spatial parameters needed.

NOAA is currently involved in several sampling cruises to better characterize what is in the water column. A number of gliders, autonomous underwater vehicles (AUV), and other existing technologies are being applied in new ways, such as through the use of multi-beam echo sounders and fisheries echo sounders to help map the potential locations of oil that might be present in the water column.

Current hydrographic surveys carry out sustained observations of the whole water column in the Gulf of Mexico, Florida Bay, and the Florida Keys, and will be extended if the oil or dispersant spreads through the Strait of Florida and into the Gulf Stream. These surveys, along with satellite observations and numerical models, allow monitoring of currents and features responsible for the transport of oil and dispersants.

Whether provided by new technologies, or through re-examining the capabilities of current technologies, information on the locations of spilled oil is of significant benefit in spill response, such as the Deepwater Horizon oil spill. Timely understanding of the location of the spilled oil allows responders to position their activities and better utilize limited resources to maximize our contributions to protect and restore the resources, communities, and economies affected by this tragic event.

Activities to Improve Future Response and Resource Assessment Efforts

- ***Response capacity and capabilities***
  To mitigate environmental effects of future spills, responders must be equipped with sufficient capacity and capabilities to address the challenge. NOAA's Office of Response and Restoration is fully engaged in responding to the Deepwater Horizon oil spill. Although unlikely, if another large spill were to occur simultaneously in another location elsewhere in the United States, NOAA would have difficulty responding to its complete ability.

  - **Expertise -** A diverse team of experts in analytical chemistry, environmental chemistry, biology, oceanography, natural resource damage assessment, administrative functions, and information management helps NOAA plan and prepare activities between spills, including training, development of area plans and response protocols, drafting and reviewing response job aids, and coordinating with regional responders.
  - **Training -** Response training and exercises are essential to maintaining capabilities. Continuous training, improvement of our capabilities, maintenance of our capacity, and investments in high-priority, response-related research and development efforts help to ensure that the Nation's response to these events remains effective. Training and coordination with other federal, state, and local agencies with response and restoration responsibilities is critical to success in mitigating effects of future spills.

- ***Response tools and technologies***
  The continued development of tools and strategies can only increase the effectiveness of oil spill response. Specific activities that would increase response effectiveness include:
  - **Natural Resource Protection Tools –** Environmental Sensitivity Index (ESI) database and map products provide information that helps reduce the environmental, economic, and social impacts from oil and hazardous substance spills. ESI maps include critical information on biological resources (such as birds, shellfish beds, and endangered species), sensitive shorelines (such as marshes, tidal flats, and marine sanctuaries), and human-use resources (such as public beaches, parks, and drinking water intakes). Spill responders use NOAA's ESI maps — and maps prepared by other federal and state trustees, including the Department of the Interior (DOI) — as tools to identify priority areas to protect from the spreading oil, develop cleanup strategies to minimize impacts to the environment and coastal communities, and reduce overall cleanup costs.

NOAA's goal is to update ESI maps approximately every ten years so that responders have the most accurate information; other agencies update their maps according to their needs and schedules.

- **Data Management Tools for Decision Making** – The key to effective emergency response is efficiently integrating current science, information technology, and real-time observational data into response decision making. NOAA has developed the Emergency Response Management Application (ERMA), a web-based information management application, to facilitate preparedness and response and restoration decision making for oil spills and for other coastal hazards. ERMA integrates real-time observations (e.g., NOAA National Buoy Data Center data, weather data, shoreline data, vessel traffic information, etc.) with archived data sources (e.g., NOAA's National Oceanographic Data Center's historical data) in an easy to use, Google-based format to aid in evaluating resources at risk, visualizing oil trajectories, and planning rapid tactical response operations, injury assessments, and habitat restoration. Having access to retrospective data is critical to bringing value to real-time observational data being collected. NOAA is working with DOI and state trustees to assure that data management tools can be integrated.

  NOAA is currently using the Gulf of Mexico ERMA for the Deepwater Horizon oil spill response to help manage the common operational picture for all command posts. The Gulf of Mexico ERMA is updated daily to provide a dynamic and automated tool allowing for greater access, more layers of data, and high-resolution photography. ERMA allows users to navigate through different layers of information to reveal actual data and magnify areas of geographic interest – ultimately improving decision making. For example, ERMA could provide a picture of diverse shoreline development (e.g., industry, residential, protected habitats, tourist/ recreational use), information on routine shipments of oil and chemicals through the Gulf, and the proximity of wildlife management areas and conservation easements. In addition to the Gulf of Mexico, ERMA is operational in the U.S. Caribbean and New England.

  Recently NOAA has worked with the U.S. Fish and Wildlife Service to integrate their developing Information, Planning, and Conservation decision support system into ERMA. The result is the ability to transfer information allowing users to seamlessly move between the systems to obtain information about Fish and Wildlife Service trust resources and recommended best management practices. This system integration will result in users only having to visit one location to obtain information regarding both agencies' trust resources. The ability to obtain natural resource information in as few places as possible is vital to effective emergency response efforts

- ***Research***

  Strong science is critical to effective decision making to minimize the ecological and economic impacts from, and mitigate the effects of, oil spills on coastal and marine resources and associated communities. Existing research has resulted in the advancement

of some response technologies. More can be done, however, to strengthen our Nation's response capabilities.

- **Long-Term Effects on Species and Habitats** — Spilled oil can remain on the shoreline and in wetlands and other environments for years. More than twenty years later, there is still oil in the sediments of Prince William Sound from the Exxon Valdez spill. Continued research is needed to improve our understanding of the long-term effects of oil on sensitive and economically important species and habitats. Research is also needed to determine the effects of oil and dispersants that are suspended in the water column on mid-water and pelagic species, as well as on deep-water corals, chemosynthetic communities (animal communities living in the deep sea on dissolved gases), and benthic habitats. Such studies can provide valuable information on the sensitivity and/or resilience of these deepwater communities and can inform response actions and assessment work.
- **Research to Improve Tools for Assessment and Restoration —** As our understanding of complex ecosystems evolves, it is important that we continually update and refine our techniques to assess and restore injured natural resources. For example, research and tools to better assess and quantify natural resource services — such as water filtration and capture, flood protection, carbon sequestration, recreation, and education — across a range of habitat types, can help ensure that the public is fully compensated and that the environment is fully restored.
- **Research on behavior of surface and subsurface plumes —** The transport of chemical and biological substances, and dilution and transformation thereof is key to determining the concentrations that living marine resources will encounter. This, in turn, determines whether environmental impact will be significant or not. Research and development on observing systems and predictive models capable of characterizing plumes will provide much needed capability.
- **Air Quality Impacts —** In addition to its marine responsibilities, NOAA is also responsible for predicting the air-quality impacts from oil and hazardous substance spills in cooperation with the Environmental Protection Agency. The characteristics of pollution released from large areas of burning oil and the widespread evaporation of oil are significantly different from routine atmospheric-dispersion scenarios. Research and development of improved tools to estimate the characteristics of compounds entering the atmosphere, and integration of those tools with NOAA's existing atmospheric modeling capabilities, would significantly improve NOAA's ability to predict smoke and chemical concentrations in the atmosphere resulting from such incidents.
- **Oil in Arctic Environments —** Continued acceleration of sea-ice decline in the Arctic Ocean as a consequence of global warming may lead to increased Arctic maritime transportation and energy exploration that in turn may increase the potential for oil spills occurring in the Arctic. Recent studies, such as the Arctic Monitoring and Assessment Programme's Oil and Gas Assessment, place emphasis on improving our understanding of how oil will behave in icy environments or when it sinks below the surface. Acquiring a basic understanding of the current environmental conditions is important for conducting

injury assessments and developing restoration strategies. Research is needed to better understand the challenges of spill response in Arctic waters and the most effective tools and techniques to utilize in such environments. There is also a need to identify site-specific protocols for assessing injuries to the unique, high-value habitats found in the Arctic

- **Human Dimensions —** Research is needed on how to incorporate impacted communities into the preparedness and response processes to help address the human dimensions of spills. Such research would consider social issues, community effects, risk communication methods, and valuation of natural resources. Transparency and communications can be improved to share information with impacted communities on how and why decisions are made and the breadth of response and NRDA activities that have been and will be undertaken for the Deepwater Horizon oil spill.

CONCLUSION

I would like to assure you that NOAA will not relent in our efforts to protect the livelihoods of affected Gulf Coast residents and mitigate the environmental impacts of this spill. In the wake of such an event, we are reminded of the fragility of our coastal ecosystems and the dependence of coastal economies on the health and prosperity of our seas. Thank you for allowing me to testify on NOAA's response, damage assessment efforts, collaboration with other trustees, and areas for future research. I am happy to answer any questions you may have.