Testimony of

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Mr. Chairman and members of the Subcommittee. My name is Don Anderson. I am a Senior Scientist at the Woods Hole Oceanographic Institution, where I have studied red tides and harmful algal blooms (HABs) for over 30 years. I have also been actively involved in the formulation of programs and legislation that support our national HAB program.

HABs are caused by algae – many of them microscopic (SLIDE). These species sometimes make their presence known through massive "blooms" of cells that discolor the water (SLIDE), sometimes through illness and death of humans who have consumed contaminated shellfish or fish (SLIDE), through mass mortalities of fish, seabirds, and marine mammals, and sometimes through irritating aerosolized toxins that drive tourists and coastal residents from beaches. Seaweeds can also cause harm as seen in these images from China where the sailing events in the Olympics are threatened by massive blooms (SLIDE).

Marine HABs affect every coastal state in the US (SLIDE). They are caused by a diverse range of algal species living in many different types of habitats, and therefore there are no simple generalizations about the scientific mechanisms underlying the blooms. Two brief examples demonstrate this diversity, and underscore the need for regionally based research programs.

Florida, Texas, and other states on the Gulf of Mexico are affected by HABs that make shellfish poisonous, kill fish by the millions, and release aerosolized toxins (SLIDE). The causative

organism can be found in the water year round and over wide areas. These cells proliferate in certain areas at certain times, often offshore, and are then transported to shore by wind events. Special features of the ocean bottom facilitate this transport and focus cell delivery to sites of recurrent blooms (SLIDE). Studies are ongoing to address the highly controversial issue of the potential link between red tides and nutrient inputs from land, including those associated with agriculture and other human activities.

In contrast, in the northeastern US, a different algal species produces toxins that accumulate in shellfish, but that does not cause massive fish kills or become aerosolized. These blooms show no obvious linkage to land-derived pollution and the organism is not present in the water year round. Instead, blooms are heavily reliant on a cyst or seed stage that lays dormant in bottom sediments for most of the year, and then germinates in the spring to inoculate surface waters. Blooms are thus highly seasonal. Here again, bloom transport pathways have been identified that are critical in carrying the toxic cells to both nearshore and offshore shellfish as shown in this SLIDE. Industry efforts to open a $50M a year sustainable offshore shellfish resource near Georges Bank are being severely constrained by the offshore component of these blooms.

In these and many other cases, research progress has been significant, and is providing tools to managers. For example, (SLIDE) a computer model of HAB dynamics in the Gulf of Maine has advanced to the level where we were able to issue a forecast this spring that successfully predicted a major red tide outbreak several months later – an outbreak that closed shellfish beds from Canada to Massachusetts (SLIDE). This is the first time a forecast of this type has ever been attempted anywhere. This model is also being used to provide weekly forecasts to managers and other stakeholders affected by toxic outbreaks in the region, and will be used by NOAA as the basis of an operational HAB forecasting system for the Gulf of Maine.

Research progress on HABs has been significant throughout the country, in part because the scientific and management communities worked together 15 years ago to formulate a National Plan or research agenda (SLIDE) that guided our efforts, and helped to foster research programs and interagency partnerships that Congress has supported.

The 1993 *National Plan* is outdated, however. Some of its recommendations have been fulfilled, while others remain unaddressed. We have therefore formulated a new plan called HARRNESS (SLIDE). This is the framework that will guide U.S. HAB research and monitoring well into the future, and is one that I enthusiastically support.

Under HARRNESS, several existing national research programs will continue, but new programs are needed. Prominent among these is a program on prevention, control, and mitigation of harmful algal blooms. Rob Magnien has already described this as the RDDTT program. I also endorse this program, and recommend that funds be provided for it that are separate from existing fundamental research programs such as ECOHAB. I have long maintained that we need a program of this type to direct fundamental scientific knowledge towards practical outcomes. There are a number of promising HAB mitigation and control strategies under development that are highlighted in my written testimony and that perhaps we can explore during the questions.

In conclusion, the diverse nature of HAB phenomena and the hydrodynamic and geographic variability associated with different outbreaks throughout the U.S. pose a significant constraint to a national HAB program. Nevertheless, the combination of planning, coordination, and a highly compelling topic of great societal importance has led to close cooperation between managers and scientists and the formulation of national science agendas. The rate and extent of progress from here will depend upon how well the relevant federal agencies can work together, and on how effectively the skills and expertise of government and academic scientists can be targeted on priority topics, with appropriate funding support.

Mr. Chairman, this concludes my oral statement. Thank you for the opportunity to present my views on this important and timely topic.