

PREFACE

Algae are the most abundant photosynthetic organisms in marine and freshwater ecosystems and are essential, energy-producing components of aquatic food webs. Harmful algal bloom or "HAB" species are a small subset of algal species that produce toxins and/or bloom to excess, thus creating harm to humans and ecosystems. Humans, domestic animals, and wildlife, including endangered species, can be exposed to algal toxins through their food, drinking water, the water in which they swim, or aerosols. It is widely believed that the frequency and geographic distribution of HABs have been increasing worldwide. All U.S. coastal states have experienced HABs over the last decade, and new species have emerged in some locations that were not previously known to cause problems. The authors of this book analyze and discuss the most recent research done in this field. This book consists of public documents which have been located, gathered, combined, reformatted, and enhanced with a subject index, selectively edited and bound to provide easy access.

Chapter 1 - Algae are the most abundant photosynthetic organisms in marine and freshwater ecosystems and are essential, energy-producing components of aquatic food webs. Harmful algal bloom or "HAB" species are a small subset of algal species that produce toxins and/or bloom to excess, thus creating harm to humans and ecosystems. Humans, domestic animals, and wildlife, including endangered species, can be exposed to algal toxins through their food, drinking water, the water in which they swim, or aerosols.

Symptoms from toxin exposure range from neurological impairment to gastrointestinal upset to respiratory irritation, in some cases resulting in severe illness and even death. Other HAB species cause problems by generating excessive biomass which can result in water discoloration, oxygen-depleted bottom waters devoid of animal life, shading of submerged aquatic vegetation, damage to coral reefs, or other adverse ecosystem effects. It has been estimated that the economic effects of HABs in U.S. communities amount to at least \$82 million per year including lost income for fisheries, lost recreational opportunities, decreased business in tourism industries, public health costs of illness, and expenses for monitoring and management. The sociocultural impacts of HABs may be significant, but remain mostly undocumented.

It is widely believed that the frequency and geographic distribution of HABs have been increasing worldwide. All U.S. coastal states have experienced HABs over the last decade, and new species have emerged in some locations that were not previously known to cause problems. HAB frequency is also thought to be increasing in freshwater systems.

Chapter 2 - This chapter is edited and excerpted testimony by Dr. Donald M. Anderson, before the Committee on Science and Technology, Subcommittee on Energy and Environment, U.S. House of Representatives on July 10, 2008.

Chapter 3 - This chapter is edited and excerpted testimony by Robert E. Magnien before the Committee on Science and Technology, Subcommittee on Energy and Environment, U.S. House of Representatives on July 10, 2008.

Chapter 4 - The marine and freshwaters of many countries are increasingly impacted by the environmental and socioeconomic problem of harmful algal blooms (HABs). HABs are proliferations of marine and freshwater algae that can produce toxins or accumulate in sufficient numbers to alter ecosystems in detrimental ways. These blooms are often referred to as "red tides," but it is now recognized that they may also be green, yellow, brown, or even without visible color, depending on the type and number of organisms present.

In U.S. waters, HABs are found in expanding numbers of locations and are also increasing in duration and severity. Further, HAB species or impacts have emerged that pose new threats to human and ecosystem health in particular regions. The expansion in HABs has led to increased awareness of impacts such as poisonous seafood, toxin-contaminated drinking water, and mortality of fish and other animals (including protected and endangered species), public health and economic impacts in coastal and lakeside communities, losses to aquaculture enterprises, and long-term aquatic ecosystem changes.

The 1998 Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA 1998) established research programs to address the U.S. HAB problem. When HABHRCA was reauthorized and expanded to include freshwater HABs in 2004 (HABHRCA 2004), it required four interagency reports and plans to assess U.S. HAB problems and update priorities for Federal research and response programs. The first report, the *National Assessment of Efforts to Predict and Respond to Harmful Algal Blooms in U.S. Waters* (Prediction and Response Report), assesses the extent of the HAB problem in the United States, details Federal, state, and tribal prediction and response programs, emphasizing Federal efforts, and highlights opportunities to improve HAB prediction and response efforts and associated infrastructure.

This Workshop Report provides a strategy in response to the needs outlined in the Prediction and Response Report. It also addresses priorities laid out in the *Harmful Algal Research and Response National Environmental Science Strategy 2005-2015* (HARRNESS), as well as other recent marine and freshwater HAB reports called for by HABHRCA 2004 or developed by the HAB management and research community. The *National Scientific Development, Demonstration, and Technology Transfer Plan on Reducing Impacts from Harmful Algal Blooms* (RDDTT Plan), called for by HABHRCA 2004, is derived from this Workshop Report, and appears as the final chapter in *Harmful Algal Bloom Management and Response: Assessment and Plan*.