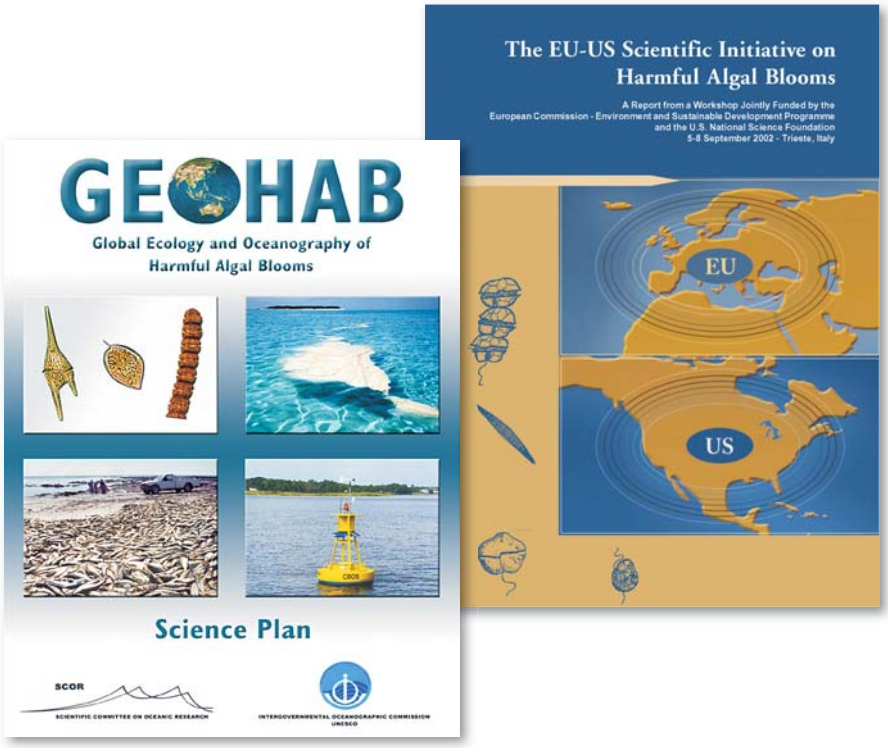
Special Issue on Harmful Algal Blooms

Harmful algal blooms (HABs) are growing in frequency around the world and their effects are being recognized by ecosystems managers, scientists, and the public alike. From the serious threat to public health created by seafood tainted with algal toxins; to human respiratory and skin irritations from exposure to aerosols along beaches with red tides; to headlines of stranded whales, manatees, and dolphins; to economically devastating fish kills, these events are serious threats to the viability of our coastal systems. While it is certainly true that scientists have developed new tools for monitoring such events—and have been able to recognize new events that previously were undetectable, not all of the "new" awareness is due to new and better science. Indeed, there are more HAB events, more often, and of longer duration than decades ago. Human activities have been contributing to the problem through increased nutrient inputs, through the translocation of harmful species, through human-induced climate change, and through overfishing. Recent reports such as that produced by the U.S. Commission on Ocean Policy have recognized that the coasts are in peril and will require a new approach to their management in the future (report is available online at http://www.oceancommission.gov). Efforts to build an Integrated Ocean Observing System are underway (see http://www.ocean.us for more information) and will be central in the continued effort to understand HABs and to determine the importance of factors such as eutrophication on their development, and to build operational models and forecasts.

When asked to edit this special issue of *Oceanography* on HABs, we hailed the opportunity for several reasons. The last decade has seen an enormous advancement in the study of HABs—but far more than can be encapsulated in a brief issue such as this. From identification of species, to techniques for their rapid enumeration, to our ability to monitor physical dynamics of properties on scales relevant to organismal dynamics and to model these processes, the advancement has been large, in part due to national and multi-national programs such as ECOHAB, MERHAB, EUROHAB and others around the world. Perhaps more relevant here is that we are now at a time when new programs are being launched for global cooperation of HAB research, and when new priorities from U.S. HAB research are being announced. This issue provides the opportunity to highlight some of the recent progress in our understanding of the factors driving the formation of specific HABs as well as some of the new approaches being taken to monitor them and the processes that regulate them.

New international cooperation on HAB research is emerging through the development of the Global Ecology and Oceanography of Harmful Algal Blooms Program (GEOHAB), an initiative of the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO). GEOHAB is based on the premise that enhanced understanding will come from international cooperation and a comparative approach to the study of HAB species and their regulating factors. In 2001, the GEOHAB Science Plan was published (available online at http://ioc.unesco.org/hab/final.pdf), and in the following years a series of workshops and Open Science Meetings have been held around the world aimed at implementing multinational comparative research activities. Assessment of the extent to which HAB species respond similarly within comparable ecosystems will lead to new insight into the oceanographic processes that influence HAB population dynamics, the role of external factors such as eutrophication and climate variability, and the importance of community interactions in controlling HAB dynamics. The first step towards formalized international comparisons on HAB research was launched in 2003 with the EU-US Scientific Initiative on Harmful Algal Blooms; the first projects of this initiative are now underway.

In the United States, research has been guided for the past



decade by a National Plan on Marine Biotoxins and HABs. A new National Plan, Harmful Algal Research and Response-A National Environmental Science Strategy 2005-2015, HARRNESS, has been developed based on broad scientific and management input. The new Plan underscores the complex and multidimensional nature of the HAB problem. It places priorities on improved understanding of bloom ecology and dynamics, of toxins and their effects, of the public health and socioeconomic impacts of HABs, and of the relationships between HABs and food webs and HABs and fisheries.

We hope through the papers in this issue to convey a sense of the depth and breadth of understanding of the global HAB problem, and the tremendous advancements that are being made in both our understanding of the controlling factors and dynamics of HABs and the new approaches that have advanced this understanding. We also hope to emphasize the importance of multinational and multidisciplinary comparative approaches. Lastly, we introduce the evolution of the new U.S. National Plan on HABs. We illustrate how much we have learned in the past several decades, and discuss the many remaining unknowns. We show how new tools have aided advancements in knowledge and highlight a few of those that show great promise for future studies. We hope that some of the excitement we feel will be conveyed in this issue.

We wish to thank the many authors who contributed to this issue, some on very short time lines. We thank Ellen Kappel and the rest of the editorial staff of *Oceanography* for launching this effort and for the outstanding job they have done of presenting these papers. We also wish to thank the National Science Foundation (NSF) for making this issue possible, the National Oceanic and Atmospheric Administration (NOAA) and NSF for their continued support of HAB research, and the many funding agencies around the world that are contributing to the study of this important problem.

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