

THE NATIONAL OCEAN SERVICE:

PROTECTING OCEAN AND HUMAN HEALTH



SIGNIFICANCE: Ocean, coastal, and Great Lakes ecosystems maintain human quality of life and sustain the tourism, marine transportation, and fisheries linchpins of coastal economies which, in turn, provide 60 percent of the nation's gross domestic product. Yet, the crucial abilities of these ecosystems to continue to provide essential services are seriously compromised due to the combined pressures from increased pollution, poorly planned/implemented coastal development and land use, destructive fishing, major storms and other natural and human-induced extreme events, and global climate change. Associated with the degradation of coastal ecosystems are escalating threats to the health and well-being of humans and marine organisms. Spreading blooms of toxic algae, expanding occurrences of microbes that cause infectious diseases, and increasing chemical pollution in our coastal waters are putting hundreds of millions of people, thousands of communities, and the coastal economic engine at risk. The oceans also provide a virtual treasure trove of medicines and beneficial food and health products, but this too is threatened by habitat degradation, declines in general environmental and water quality, and loss of marine biodiversity.

BACKGROUND: Blooms of toxic algae are increasing in frequency, duration, intensity, and extent globally and along all coasts of the United States, including the Great Lakes. These harmful algal blooms (HABs) produce potent toxins that kill fish, marine mammals, and invertebrates; contaminate waters, shellfish, and fish; and cause a variety of illnesses in animals and humans, ranging from gastroenteritis ("stomach flu") to seizures, memory loss, respiratory problems, partial and temporary paralysis, and even death. Human exposure even to airborne forms of some of these toxins at and near beaches can cause respiratory distress and probably other health effects that may lead to serious diseases later in life.

In addition, coastal residents and visitors are also increasingly being exposed to bacteria and viruses that cause infectious diseases. According to some estimates, as many as one in 10 beachgoers may contract gastrointestinal illness. Some pathogenic microbes result from sewage and runoff pollution, but others occur naturally in coastal waters. Both may affect people via contact with contaminated water or seafood. In addition, marine organisms may serve as hosts or reservoirs of diseases that may affect humans and may pass diseases directly to people. Finally, there are growing concerns about the spread of antibiotic resistance in bacteria in marine waters, suggesting that some exposures to diseases in coastal environments may result in infections difficult to treat.

Also, a huge range of chemical contaminants is reaching coastal environments from industrial and agricultural processes, runoff, and direct release. These contaminants are either well known (e.g., DDT) or newly identified and include antibiotics and drugs for humans and animals, endocrine-disrupting chemicals, fire retardants, stain- and stick-resistant materials, new pesticides, and many others. Most are not monitored and many pass little changed through sewage and water treatment plants. Alarming trends in accumulation of some of these in marine animals (and in some cases in humans), along with observed environmental effects, raise serious concerns regarding unintended exposures and impacts through recreation, drinking water, and seafood consumption.

On the positive side, the potential benefits from the sea include pharmaceuticals such as new antibiotics, cancer treatments, pain medications, and a host of other natural products derived from sustainably harvested resources and even from some toxic species. Also of enormous potential health benefits are efforts to enhance the quality of food from the sea through improved aquaculture techniques and improved water quality. We have only scratched the surface of the huge potential for new products and business opportunities from the sea.

STATUS: NOAA has the authority, responsibility, capabilities, and programmatic structure to build a robust effort in oceans and human health. Relevant statutes include the Oceans and Human Health Act which specifically authorized an Oceans and Human Health Initiative (OHHI) within NOAA, established its functions, and tasked it to work collaboratively to “advance scientific understanding of the connections between the oceans and human health, provide usable information for the prediction of marine-related public health problems.” The Harmful Algal Bloom and Hypoxia Research and Control Act requires NOAA to research, monitor, and mitigate the impacts of these phenomenon. The Marine Mammal Protection Act, Coral Reef Conservation Act, and Endangered Species Act require that NOAA evaluate the causes of die-offs or disease outbreaks in marine animals. From an interagency perspective, Ecosystem Health and Enhancing Human Health are two of the six themes of the Joint Subcommittee on Ocean Science and Technology (JSOST) Ocean Research Priorities Plan (ORPP), and Sensors for Marine Ecosystems is one of the ORPP near-term priorities. A NOAA focus on oceans and human health is called for in the JSOST Interagency OHH Research Implementation Plan and supports the goals of the NOAA Five-year Research Plan.

CHALLENGES: NOAA has existing basic, but disparate, oceans and human health capabilities in all Goals and Line offices, and robust partnerships with many federal, state, and local agencies, including marine animal, protected species, coastal zone, and public health managers. Many partners are already working collaboratively but are critically limited because of resource constraints. The challenge is for NOAA to recognize this urgent opportunity, embrace its role, provide the leadership and support necessary to participate fully in the scientific discovery, new partnerships, institutional change, and public education necessary to achieve a new integrated approach to protect and enhance the health and well being of people, marine species, and economies which depend on healthy ocean and coastal ecosystems.

OUTLOOK: At present resources for most of the ocean and health-related programs in NOAA are at an all-time low; however, the partnerships remain with other agencies (e.g., the National Science Foundation, Environmental Protection Agency, NASA, U.S. Geological Survey) and with the academic community. Our oceans and coasts are suffering from a myriad of human and environmental stressors—with alarming health consequences and enormous potential benefits. The outlook, however, is excellent if we act now. The core internal and external capacity building begun over the past several years can be re-invigorated and can provide the research, partnership, and operational capabilities to build a robust NOAA Oceans and Human Health effort.