

The Coastal Ocean



At the coast—where air, sea, land, and people meet

We are all stewards of the coastal ocean. For some of us, the connection to the sea is clear and immediate; for others, it is subtle and distant. But whether you live on waterfront property or in a land-locked hamlet, your everyday activities affect this most sensitive and most threatened portion of the world's oceans.

Oil slicks in our harbors, sewage in our bays, and trash on our beaches provide obvious testimony to our links to the coast. So do the shrimp, salmon, and scallops on our dinner plates, and the money in the wallets of the millions of business owners and employees who make their living on the water's edge. Hundreds of thousands of buildings stand within reach of a storm surge from the ocean.

The subtle connections to the sea reach hundreds of miles inland. Air pollution from cars, trucks, and factories eventually precipitates into the ocean. Pesticides sprayed on lawns and golf courses run off into rivers, get ingested by fish downstream, and eventually poison shorebirds that never

fly near those lawns or golf courses.

Few farmers in Midwestern states think of how their activities affect the ocean, but they should. Ever since Fritz Haber discovered in 1908 how to remove nitrogen gas from the atmosphere and turn it into fertilizer, the amount of nutrients applied to farmlands has increased dramatically. Perhaps two-fifths of the world's population would not exist were it not for this affordable and inexhaustible supply.

The downside is that much of this nitrogen runs off the farms and finds its way into the coastal ocean. Nitrogen and other nutrients stimulate the growth of microscopic marine plants, which in turn feed marine animals. But sometimes the fertilizer promotes too much plant growth, crowding out many species and suffocating others. The headline from a recent series in *The Baltimore Sun* says it all: "Nitrogen's deadly harvest: feeding the world, but poisoning the oceans."

The coastal ocean is a precious, narrow strip of water extending from the edge of the continental shelf to the estuaries where

salt water and fresh water meet. It is the most biologically productive part of the ocean, and this wealth of activity influences, and gets influenced by, the cycles of carbon and other elements that govern climate and human life itself.

The growth of the human population—and the means used to achieve that growth—increasingly threaten nearshore waters. We have heard the statistics. Half of Earth's population lives within 50 miles of a coast. Coastal areas supply 90 percent of the world's fish catch and 25 percent of U.S. oil. More than 80 percent of U.S. global trade passes by ship through our harbors. Beaches and coastal waterways are fertile territory for tourism and recreation, the largest sector of the U.S. service industry.

Other statistics are less known but more worrisome:

- Eleven of the world's 15 most productive fishing grounds—and 70 percent of the major fish species in them—have been or will soon be overexploited.
- Within 60 years, one of every four

Institute



Chatham, Mass., photo by Steve Heaslip, *Cape Cod Times*

houses within 500 feet of the shoreline could be destroyed due to sea-level rise and inappropriate coastal development.

- The bottom of all the oceans' continental shelves are trawled by fishermen at least once every two years, with some areas scarred by nets and chains several times a season.

- At any given time, several thousand species are being carried from one location to another in ship ballast tanks, ready to invade and colonize distant habitats. In San Francisco Bay alone, 234 invasive species have become established, and a new species successfully invades every 14 weeks.

The news is not all bad. Coastal waters in some regions are cleaner than they've been for decades, thanks to efforts to reduce chemical and nutrient pollution. Marine aquaculture operations

are reducing the pressure on wild-capture fisheries. Some states are creating no-build zones in sensitive coastal areas, preventing development that is incompatible with the dynamic nature of the shoreline.

This issue of *Oceanus* provides background on many of these problems and promising developments. The articles that follow highlight the role that science must



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play in society's approach to everything from oil pollution and algal blooms to wind power and shifting shorelines.

New technologies, new approaches to coastal research, and new collaborations among scientists from different disciplines are setting the stage for scientifically based management of the coastal zone. Resource managers and elected leaders are desperate for ideas and guidance about how to manage our

relationship with the ocean. Many of the answers they need require new scientific inquiry, as well as better explanation of what we already know.

This is the mandate of the Coastal Ocean Institute (COI). Through research grants, scientific gatherings, and the development of state-of-the-art facilities, the Institute encourages innovative, interdisciplinary research and technology development that can improve our understanding of the processes at work along our shores. COI also fosters communication efforts to help civic leaders, students, and citizens become better informed about the complexities of this dynamic environment and the possibilities for sustaining and restoring it.

Coastal waters are the ocean's first line of defense, and that line is showing many signs of stress. The first step in promoting effective stewardship is to recognize and document the problems; as you will read, we are far along in that regard. The challenge now is to move our scientific understanding forward to a point where we can reduce or eliminate some of these problems.

—Donald M. Anderson