Largest and richest of all U.S. estuaries, Chesapeake Bay is an example of the importance of aquatic ecosystems and the effects of water pollution. Like all estuaries, Chesapeake Bay is a drowned river valley. Its drainage basin covers more than 166,000 sq km (64,000 sq mi) in six states, while its main stem stretches some 300 km (190 mi) from the tidal flats in Maryland to its mouth in the Tidewater area of Virginia. Fresh water and nutrients from more than 150 tributary streams mix with saltwater in its broad, shallow basin, creating complex ecological gradients. Salinity ranges from near zero in the Susquehanna River at the Bay's upper end, to thirty parts per thousand (near that of seawater) in its lower reaches. Fresh water generally flows south in the Bay's upper layers, while saltier water flows north (up the bay) in the lower layers. Tides and currents mix the waters, distributing nutrients and flushing out wastes. Shoals and salt marshes provide food, shelter, and living space for myriad plants and animals. Some 2,700 different species spend all or part of their lives in, on, or beside the Bay.

Oysters, blue crabs, rockfish, white perch, shad, sturgeon, flounder, eel, menhaden, alewives, and soft-shell clams once created bountiful harvests for tidewater residents. Even with overharvesting of some species and the effects of pollution, the annual shellfish and finfish catch has averaged over 20,000 metric tons in recent years. But some important species have declined severely. Shad and striped bass, which once came into the Bay to spawn in astronomical numbers, now are much less abundant. Sturgeon are rarely caught anymore. The oyster harvest, estimated at 15 to 18 million bushels per year in the 1890s, was not even 1 million bushels in 1986.

Suspected agents in the decline of this productive fishery include sewage, silt from soil erosion, heavy metals, toxic chemicals and heat from industry, pesticides and herbicides from agricultural runoff, oil spills, and destruction of habitat by dredging and filling. About 10 million people live in the Chesapeake drainage basin. A variety of chemical plants, shipyards, oil refineries, steel mills, and power plants are located on the Bay or its tributaries, discharging wastes into its waters.

The most serious pollutant in the Bay is sewage. Filter feeders, such as shellfish, concentrate pathogenic viruses and bacteria. Contaminated seafoods transmit hepatitis and other dangerous diseases. The nutrients introduced by sewage and treated sewage effluent stimulate growth of phytoplankton in the Bay's broad shallow waters. As these innumerable tiny creatures die and settle to the bottom, they decompose, using up all the oxygen in bottom layers of the Bay, killing oysters and other bottom dwellers. This oxygen-poor water is trapped within the lower strata of the Bay by infiltration of coastal saline waters and lack of mixing currents.

Other human-caused pollutants also threaten aquatic life and water quality in the Bay. One of the more infamous incidents of insecticide pollution occurred on the James River near the southern end of the Bay. In 1975 it was discovered that workers at a chemical plant in Hopewell, Virginia, had been poisoned by Kepone, a potent insecticide. Kepone also had leaked or been dumped into the river and had spread downstream. Like most organic chemicals, Kepone has an affinity for sediments in the bottom where it persists for many years. Toxic levels have built up in the food chain through bioaccumulation so that harvesting of some species of fish and shellfish is forbidden in sections of the estuary.

In the early 1980s, over $500 million in state and federal funds were spent on cleanup programs in and around the Bay. New sewage plants were built and old ones were upgraded. Areas such as the Baltimore harbor that had been essentially devoid of life for decades began to have fish and crabs again. There has been a controversy about how to reduce the algal blooms that discolor the water and deplete oxygen levels. In most aquatic systems, algae are limited by phosphorus concentrations, making it the most crucial element to control. Phosphorus levels do control algal populations in the Bay during the summer when growth rates are high. In the winter, however, phosphorus is released from bottom sediments and nitrogen becomes the limiting factor. Few sewage treatment plants are equipped to...
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remove nitrogen from effluents. New biological treatments utilizing artificial marshes or floating aquatic plants may help to solve this problem.

In 1987, the EPA signed an agreement with the governors of Maryland, Pennsylvania, Virginia, and the mayor of Washington, D.C., pledging improved water quality, regulated coastal zone development, and the rebuilding of fish and oyster stocks. The goal was to remove 40 percent of the nitrogen and phosphorus flowing into Chesapeake Bay by the year 2000. Farmers throughout the drainage basin are being encouraged to practice conservation tillage and to use precisely measured amounts of fertilizer to reduce runoff into tributary streams. Much research is being carried out to determine the best way to manage this complex resource. The flushing action of the tidal currents and rivers still brings clean water into the Bay, and natural systems are resilient. Perhaps with care and attention, seafood again will be harvested in abundance and the Bay will resume its value for sailing, swimming, observing nature, or just watching the sunrise over a salt marsh or a quiet cove.