

1 Chesapeake Bay

Overview

The Chesapeake Bay is the largest of 130 estuaries in the United States. It is located on the east coast of the U.S., stretching 322 km from Maryland to Virginia. The Bay's width varies between 5.5 km, near Aberdeen in Maryland, to 56 km, near the mouth of the Potomac River. The main channel of the Chesapeake Bay is approximately 304 km long.

< <http://geology.er.usgs.gov/> >
< <http://www.chesapeakebay.net/> >

Location



Basic information

Surface area : 18,130 km²

Volume : 0.068 km³

Average depth : 6.4 m

Maximum depth : 53 m

Nature

< Background >

The Bay receives about half of its water volume from the Atlantic Ocean. The rest drains into the Bay from a 166,000 km² catchment area, which includes parts of six states - New York, Pennsylvania, Delaware, Maryland, Virginia and West Virginia. It also includes all of the District of Columbia.

Climate

Because of its mid-latitude location, the Chesapeake Bay enjoys a rather moderate climate, with an average temperature of 13 °C. The Chesapeake Bay also has a moderating effect on the area, keeping summer and winter temperatures from reaching extremes. The average annual rainfall is 1,067 mm, which occurs mainly during the spring and late fall.

Topography

The Bay is generally shaped like a shallow tray. Its average depth, including all tidal tributaries, is about 6.4 m but a few deep troughs, which form a deep channel along much of its length, reach 53 m deep. This channel allows the passage of large commercial vessels.

< <http://www.chesapeakebay.net/> >

Hydrology

Fifty major tributaries pour freshwater into the Chesapeake Bay. Eighty to 90 per cent of this water comes from the northern and western sides, and the remaining 10 to 20 per cent comes from the eastern shore. About the same volume of saltwater enters the Bay from the ocean through tidal movement. Also, the upper Bay receives water from Delaware Bay via the Chesapeake and Delaware canals.

There are two kinds of tidal cycles in the Bay. In the southern Bay, the tides and tidal currents are semidiurnal, while in the central and northern Bay they are classified as mixed.

The Bay's salinity ranges from freshwater (0 - 0.5) at the Bay's head, to water of nearly oceanic salinity (30 - 35) at the Bay's mouth.

Because the Bay is so shallow, its capacity to store heat is relatively small. As a result, water temperature fluctuates throughout the year, ranging from 1 to 29 °C, dramatically changing the rate of chemical and biological reactions within the water.

< <http://www.chesapeakebay.net/> >

< <http://www.bayswim.com/weather.html> >

< Surrounding environment >

The Bay supports more than 3,600 species of plants, fish and animals, including 348 species of finfish, 173 species of shellfish and over 2,700 plant species.

The Chesapeake Bay region is home to 29 species of waterfowl and is a major resting ground along the Atlantic Migratory Bird Flyway. Every year, one million waterfowl winter in the Bay's basin.

Wetlands

Approximately 6,000 km² of wetlands remain in the Bay's catchment, which is less than half of the wetlands that were present during colonial times. Of the remaining wetlands, 13 per cent are tidal and 87 per cent are non tidal.

SAV (Sub Aquatic Vegetation)

Fourteen species of SAV are commonly found in the Bay or nearby rivers. Historically, more than 810 km² of grasses grew along the shoreline of the Bay. By 1984, a survey of SAV documented only 150 km² in the Bay and its tidal tributaries. Bay grasses have rebounded steadily since then, and 257 km² of grasses were documented in 1998.

Fish life

During the spawning season, yellow and white perch travel short distances from the brackish water of the middle of the Bay to the freshwater areas of the upper Bay or tributaries. Striped bass also spawn in the tidal freshwater areas of the Bay and major tributaries. Some remain in the Bay to feed while others migrate to ocean waters. Shad and herring are truly anadromous, traveling from the ocean to freshwater to spawn and returning to the ocean to feed. Eels are the only catadromous species in the Bay. Although eels live in the Bay for long periods, they eventually migrate to the Sargasso Sea in the central North Atlantic to spawn.

Other fish utilize the Bay strictly for feeding. Croaker, drum, menhaden, weakfish and spot journey into the Bay while still in their larval stage to take advantage of the rich supply of food. The abundance of menhaden supports a commercial fishing industry and provides food for predatory fish and birds. Bluefish enter the Bay only as young adults or mature fish.

Besides fish, crustaceans and invertebrates may be part of the nekton community. Larger animals such as sharks, rays, sea turtles and the occasional dolphin and whale enter the Bay.

Protected Areas

There are two nationally protected areas in the region, one in Maryland and one in Virginia, and both are called the Chesapeake Bay National Estuarine Research Reserve. They are designed to protect the diversity of estuarine habitats found within the Chesapeake Bay.

< <http://www.csc.noaa.gov/pagis/html/protect.htm> >

History and Culture

The Chesapeake Bay developed from natural occurrences during the last Ice Age. Around 9000 B.C., melting glaciers filled in the Susquehanna valley, and about 7000 years later, the Bay assumed its current shape. All along, Native Americans lived in the Bay region, beginning agricultural practices around 1000 B.C.

In 1607, the first permanent New World settlement was established in Virginia on the James River, and a member of the traveling group, John Smith, began extensive exploration of the Bay. Most of those original colonists died in the first year, but the New World’s population began to grow as more people and supplies came from England. Over the next 300 years of the Bay’s time line, people built homes, farmed, started businesses, and participated in a host of other activities that continue to affect the Bay today.

It has been suggested that the name "Chesapeake" comes from a Native American word meaning "Great Shellfish Bay," which is certainly an accurate description because of the tons of crab, oysters, clams, and fin fish it produced at its height. Native Americans thrived on the Bay’s bounty, using hand-hewn arrowheads for hunting and fishing from their dugout log canoes. These canoes became the basis for the commercial sailing fishing boats that continue to plough the Bay today.

The arrival of English colonists brought western farming techniques to the area and the systematic cultivation of tobacco. As throughout the history of the Bay, its lushness supported lucrative trading by bringing over European manufactured goods. Commercial activity brought with it attacks from enemies and pirates of every nationality. This resulted in a demand for warships, many of which were produced in St. Michaels.

Ten months after the Boston Tea Party, in October 1774, a similar event in Annapolis, Maryland ended in the burning of a Bay-built brig at the site where the U.S. Naval Academy is now located. The final British surrender of the war took place at Yorktown, Virginia on the Chesapeake Bay after the French fleet succeeded in preventing essential delivery of supplies and reinforcements to the British.

During the Civil War, the Chesapeake Bay was the scene of a momentous event in naval history - the first confrontation between iron-clad warships.

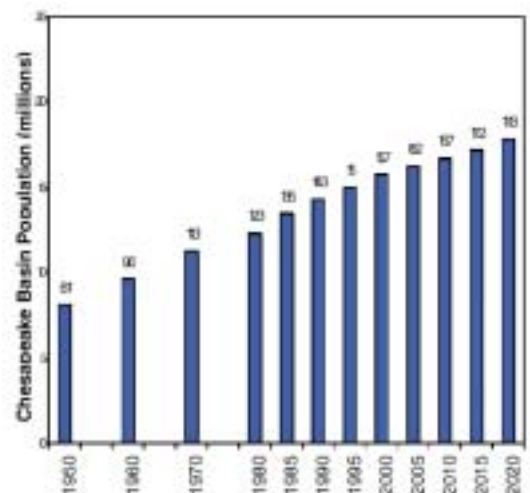
< <http://www.cbmm.org/cbmm.htm> >

< <http://www.mariner.org/baylink/index.html> >

Social Environment

< **Population** >

The population in the Bay catchment area has doubled since the 1950s. More than 15 million people live in the Bay catchment area, and about 10 million people live along its shores or close by. It is estimated that the region’s population will continue to grow at a rate of 300 new people each day, reaching 18 million people by 2020.¹



Population in the catchment of Chesapeake Bay

< <http://www.chesapeakebay.net/> >

< Land use >

Because of its large catchment, the Chesapeake Bay has an extremely high land-to-water ratio, making it especially sensitive to runoff.

The three dominant land-use categories are forest (58%, in 2000), agriculture (23%) and urban lands (9%). The Bay catchment contains two of the 10 most threatened farmland areas in the United States - the Piedmont region and the mid-Atlantic coastal plain. Between 1985 and 2000, 4,500 km³ of farmland were lost due to population growth.

A total of 1.7 million new homes are projected to be built in the catchment by 2020, potentially consuming more than an additional 2,400 km² of forest and farmland.²

< Industry >**Fisheries**

A study by the National Marine Fisheries Service ranked the Chesapeake Bay as third in the nation for fish catch. Only the Atlantic and Pacific oceans exceed the Bay in production. That is an impressive ranking, since the Bay is small compared to these other bodies of water.

More than half of the nation's soft-shelled clams also come from the Chesapeake Bay. An extensive finfish industry, primarily based on menhaden and striped bass, rounds out the Bay's commercial seafood production. In 1992, the dockside value of commercial shellfish and finfish harvests was close to US\$80 million.

Recreation

The hospitable climate, lush vegetation and natural beauty of the Chesapeake Bay has made it an increasingly popular recreational area. Boating, crabbing, swimming, hunting and camping are major attractions. The use of power and sail boats has grown dramatically. In 1993, more than 175,000 pleasure craft were registered.

Sportfishing is another major recreational activity in the Chesapeake Bay. The National Marine Fisheries Service reported that close to 1 million anglers from Maryland and Virginia took almost 600,000 fishing trips in 1991. The recreational fishing industry in the states of Maryland and Virginia is estimated to be worth more than \$1 billion per year.

Shipping

The Chesapeake Bay is a key commercial waterway, with two of the nation's five major North Atlantic ports located there. The Hampton Roads Complex, which includes Portsmouth, Norfolk, Hampton and Newport News, dominates the mouth of the Bay. Hampton Roads ranks third in tonnage of foreign water-borne commerce. At the northern end, the Port of Baltimore is ranked ninth in the nation. Baltimore is the leading exporter of trucks and cars in the nation. More than 90 million tons of cargo was shipped via the Chesapeake Bay during 1992. Baltimore and Hampton Roads are near the coal-producing regions of Appalachia, making them essential for exporting U.S. coal abroad. The Hampton Roads Complex already leads the nation in exporting coal and lignite. Shipbuilding and other related industries also depend on the Bay.

< <http://geochange.er.usgs.gov/pub/info/facts/chesapeake/> >

Environmental Problems**< Current status >**

The Chesapeake Bay has experienced serious environmental degradation over the past century. Symptoms of degradation include large declines in seagrass acreage and finfish and shellfish (oysters and crab) populations, seasonal depletions in dissolved oxygen and increases in sedimentation.

Water Quality

Chesapeake Bay water quality problems are evidenced by the following indicators, which reveal the effects of excessive amounts of nutrients and sediments in the water column.

1. Dissolved Oxygen (DO)

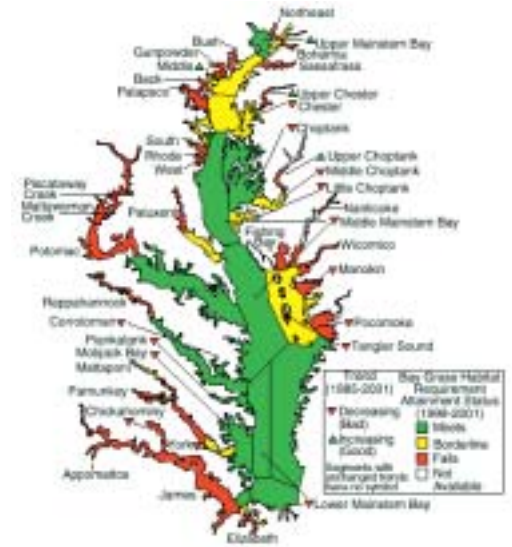
There are recent indications of an improving trend in DO since 1985. However, in 2001, half of the Bay's lower-layer waters were hypoxic.

2. Chlorophyll

The Elk, Middle and Back rivers, and the Chesapeake and Delaware canals showed improvements. Most areas showed no significant change, although in Tangier Sound a number of tributaries show degrading trends. While most areas meet the habitat requirements for SAV (Sub Aquatic Vegetation), the upper reaches of large tributaries and most upper Bay tributaries are borderline or are failing.

3. Water Clarity

While most of the main stem of the Bay, larger embayments and lower regions of large tributaries, meet the minimum light requirement for SAV, the upper regions of the large tributaries and many minor tributaries are not satisfactory. Water clarity is improving in parts of the upper Bay, Middle River and upper regions of the Chester and Choptank rivers.



Secchi Depth in the Mainstem Bay and Tidal Tributaries

< <http://www.chesapeakebay.net/> >

< <http://www.epa.gov/r3chespk/> >

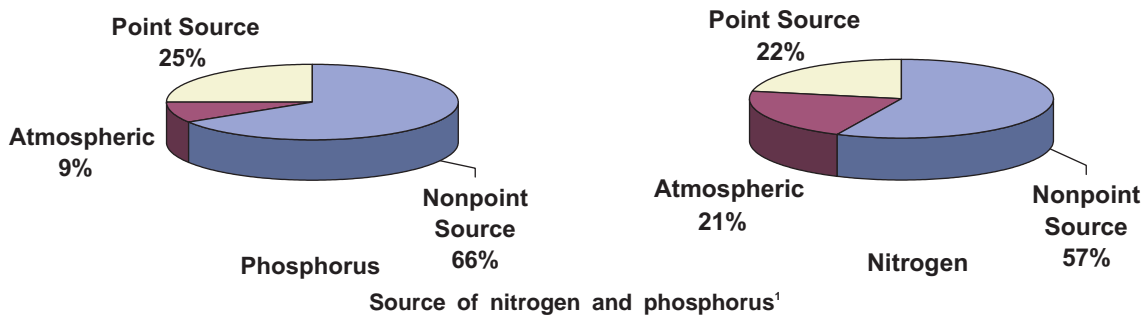
Sedimentation

Another critical problem in the Chesapeake Bay is sedimentation. Sediment can cloud the water so much that SAV cannot survive. Over the last 100 years, the net deposition of sediment that entered the Maryland portion of the bay was 155 million metric tons. Scientists believe that sedimentation rates have increased since colonial times due to land-use changes that have been disruptive to the health of the Bay.

< <http://geochange.er.usgs.gov/pub/info/facts/chesapeake/> >

Pollution source

The Chesapeake Bay's worst problems are caused by the overabundance of nitrogen and phosphorus, which come from air, land and water.



Estimates of phosphorus concentrations show that point-source loads were reduced by 2.3 million kg between 1985 and 1997. Most of this reduction was due to the implementation of phosphate detergent bans that went into effect in each of the states and in the District of Columbia between 1985 and 1990, as well as wastewater treatment plant upgrades and the implementation of effluent standards for phosphorus.

Bay managers also measured major reductions in point-source nitrogen loads. Between 1985 and 1997, nitrogen loads from point sources were reduced by approximately 7.3 million kg. Between 1985 and 1998, 43 major municipal wastewater-treatment facilities in the catchment were upgraded with biological nutrient-removal technology.

In 1990, 14 chemicals were identified in the regional program as those most harmful to the Bay's aquatic life. These chemicals were grouped together on the Toxics of Concern list. The chemicals are atrazine, benzantracene, benzopyrene, cadmium, chlordane, chromium, chrysene, copper, flouranthene, lead, mercury, naphthalene, PCBs and TBT. The program set a goal that called for a 75 per cent reduction in the release

of Toxics of Concern from point sources between 1988 and 2000.¹

< **Environmental Protection Measures** >

The highest priority in environmental protection measures in the Chesapeake Bay has been the restoration of the Bay's living resources - its finfish, shellfish, SAV and other aquatic life. The improvements needed include better fisheries management, habitat restoration, recovery of SAV, nutrient and toxin reductions and significant advances in estuarine science.

In the 1987 Chesapeake Bay Agreement, the Chesapeake Executive Council, whose membership consists of the governors of Maryland, Virginia and Pennsylvania, the mayor of the District of Columbia, the administrator of the U.S. Environmental Protection Agency and the chair of the Chesapeake Bay Commission set a goal to reduce the amount of nitrogen and phosphorous entering the Bay by 40 per cent by 2000. Achieving a 40 per cent nutrient reduction would ultimately improve the oxygen levels in Bay waters and encourage aquatic life to flourish.

Led by the Chesapeake Executive Council, the Chesapeake Bay Program, a regional partnership that has been directing and conducting the restoration of the Chesapeake Bay since the signing of the Chesapeake Bay Agreement, has been working to reduce nutrients at their source through various programs.

On June 28th, 2000, the Chesapeake Bay Program partners signed the new Chesapeake 2000 Agreement, which will guide the next decade of restoration and protection efforts throughout the Bay catchment. The agreement commits to protecting and restoring living resources, vital habitats and the water quality of the Bay and its catchment.

Monitoring program

The Chesapeake Bay Monitoring Program, begun in 1984 by the Chesapeake Bay Executive Council, is a Bay-wide EPA/state cooperative effort. The program combines the efforts of Maryland, Pennsylvania, Virginia, the District of Columbia, as well as several federal agencies, 10 institutions and over 30 scientists. Nineteen physical, chemical and biological characteristics are monitored 20 times a year in the mainstem and many tributaries. A volunteer citizen-monitoring program was started in 1985.

The following are monitored because they are key indicators of the Bay's health - nutrients, sediment, toxins, plankton, benthos, finfish, shellfish, SAV, freshwater flow, water temperature, salinity, circulation and oxygen.

< <http://www.chesapeakebay.net/> >

Related organizations and NGOs

- The Chesapeake Program < <http://www.chesapeakebay.net/> >
- United States Geological Survey, Chesapeake Bay Ecosystem Change and History Project
< <http://geology.er.usgs.gov/eespteam/ches/bayhome.html> >

References

1. Chesapeake Bay Program, Oct. 1999, The state of Chesapeake Bay, A report to the citizen of the Bay region, EPA 903-R99-013, CBP/TRS 222/108, pp. 24, 34.
2. The State of the Chesapeake Bay, 2002, A report to the citizen of the Bay region, pp. 45.