Saving the Chesapeake

Cooperation among government officials, scientists, conservationists, and the public is helping to restore the Chesapeake Bay.

BY GEOFF OXNAM AND JOHN PAGE WILLIAMS

As she looked out over the marsh, across Hooper Strait to Bloodsworth Island, Ann Swanson said, "I'm proud and troubled all at once." Swanson—who is executive director of the Chesapeake Bay Commission, a legislative body established in 1980 to advise the legislators of Maryland, Pennsylvania, and Virginia—was talking to a group of state environmental officials, scientists, and conservationists about the future of the bay.

It was a Friday morning in October 2000. We had gathered on the second-story porch of the Chesapeake Bay Foundation's Karen Noonan Environmental Education Center, at the southern tip of the Dorchester County mainland on Maryland's Eastern Shore. We had caught our dinner the night before and had begun the morning early by bird watching and canoeing the marshes. Now it was time for some serious talk about the health of the Chesapeake Bay and the Susquehanna River, and about the provisions of *Chesapeake 2000*, the new Chesapeake Bay Agreement.

This voluntary pledge between the governors of Maryland, Pennsylvania, and Virginia, the mayor of Washington, D.C., the Chesapeake Bay Commission, and the administrator of the U.S. Environmental Protection Agency recognizes that piecemeal efforts differing from state-to-state will never protect and restore an ecosystem this large. The original agreement—which is now nearly 20 years old, although it was updated in 1987—set common goals and a framework for achieving them. Though not enforceable by law, it has been the centerpiece of a remarkable environmental turnaround.

Swanson was the perfect leader for such a discussion. She headed the team that drafted the new agreement, shepherding it carefully over two years through public hearings and tough negotiations. She played key roles in several initiatives of earlier Chesapeake Bay agreements, including a ban on phosphate detergents. Her pride is justified, but she has a right to be troubled, too. The long drafting process, which included exhaustive public input, clearly highlighted the Chesapeake's problems. The bay's health is on a plateau, with progress slowing down after 15 years of modest improvements.

This is a critical year for the agreement, Swanson emphasized. Many of the bay improvements made to date have been the low-hanging fruit. Solutions to complex and politically charged issues, such as further reducing nutrient pollution and curtailing suburban sprawl's devastating impacts, are still elusive.

A Bay of Significance

Protecting and restoring the Chesapeake Bay is a massive undertaking. It is North America's largest estuary and the third largest in the world. The bay's watershed spans 64,000-square miles (166,000-square kilometers) across six states and the District of Columbia. The headwaters fill Lake Otsego at Cooperstown, New York. Flowing downhill, the waters meet the Atlantic in southeastern Virginia.

The Chesapeake Bay is actually the valley of the lower Susquehanna River, an estuary drowned by the Atlantic as sea level rose over the past 15,000 years. The result is a shallow, tidal settling basin with an average depth of 21 feet (6.5 meters).

The Susquehanna/Chesapeake system is about four times larger than the next largest Atlantic Coast river system, the Connecticut. Its largest tributaries, the Potomac and the James, are major rivers in their own right. All told, 19 rivers and 400 smaller tributaries feed the Chesapeake. This sprawling complex of tidal rivers provides a major source of seafood, transportation, and recreational opportunities. The main stem runs 180 miles (290 kilometers) from the mouth of the Susquehanna to Cape Charles and Cape Henry in Virginia, including more than 4,600 miles of shoreline. More than 15 million people live within the bay watershed. One can get to a stream, creek, river, or stretch of bay shore in 10 minutes from virtually any spot in the watershed.

The Chesapeake Bay is a system of remarkable biological productivity. It supports more than 2,400 species of plants and animals, including 200 species of fish. Chesapeake waters and wetlands are important stopovers for many species of migratory birds.

The bay has long been important to its human population. A 1989 report by the Maryland Department of Economic and Employment Development put a $678 billion price tag (in 1987 dollars) on the economic importance of the bay to the economies of Maryland and Virginia. It has long been a focal point of both regional and national culture, from the first permanent English settlement at Jamestown to the surrender of General Cornwallis at Yorktown and the penning of the "Star Spangled Banner" by Francis Scott Key in Baltimore's Harbor. Since 1800, the nation's capitol has been in the Chesapeake watershed.

Four Centuries of Decline

The features that make the bay and its watershed such a rich ecosystem have attracted a burgeoning human population. In 1635, the watershed's European population is estimated to have been 5,300. By 1700, it reached 88,000. Between 1900 and 2000, it rose from 6 million to over 15 million. By 2020, nearly 18 million people are expected to live in the region.

Today's population adds more pollutants than ever before, even as we reduce the bay's capacity to deal with pollutants through degradation of natural treatment systems like wetlands, underwater grass beds, forested buffers along streambanks, and oyster reefs.

Gauging the health of a complex system like the Chesapeake means bringing together a number of key indicators. In 1998, the Chesapeake Bay Foundation developed an index based on the best available historical and current information for twelve factors grouped into three categories:

- pollution—toxics, nutrients, dissolved oxygen, water clarity;
- habitat—wetlands, forest buffers, resource lands, underwater grasses;
- fisheries—blue crabs, striped bass, American shad, oysters.

The index measures today's bay against the healthiest Chesapeake we know, the one that Captain John Smith described in his exploration narratives of the early 1600s. Modern science confirms many of Smith's observations and sets the bay's benchmark at 100, compared with a 28 in the Chesapeake Bay Foundation's *2000 State of the Bay Report*. While that score marks a modest increase from an estimated 23 in 1983, it also represents a plateau over the past three years.

Pollution

During the past 400 years, the quality of bay waters has declined significantly. For 350 of those years, people saw the water not only as a provider of food, but also a vast waste receptacle. The most obvious problem was human sewage. During the 1800s, growing cities like Baltimore, Norfolk, Richmond, and Washington, D.C., built central waste collection systems and installed rudimentary treatment plants. The systems greatly reduced the threat of diseases like cholera, but the discharge pipes from the plants poured nearly raw sewage into those cities' rivers.

The nitrogen and phosphorus from these discharges fertilized blooms of algae that clouded the waters, killed underwater grasses, damaged fisheries, and drove away vacationers and recreationists. As the algae cells died and sank to the bottom, they caused explosive blooms of decay bacteria that sucked dissolved oxygen out of the water, stressing fish and shellfish. The problem repeated itself in smaller cities and towns all over the bay.

Meanwhile, the Industrial Revolution was gaining momentum, adding fossil fuels to steam and water power. Manufacturing plants poured wastewater into the rivers, contributing even more

damage. By the mid-20th century, the Elizabeth, James, Patapsco, and Potomac Rivers were downright nasty waterways, serving as beasts of burden for their cities.

Gradually though, people began to realize that doing business didn't have to preclude healthy waterways. Major changes came with the passage of the Clean Water Act in 1972. Wastewater treatment became mandatory under the National Pollution Discharge Elimination System, in which the U.S. Environmental Protection Agency delegated authority to the states to regulate sewage and industrial wastewater discharges. The Potomac showed the most dramatic turnaround, as Washington's massive Blue Plains sewage treatment plant changed from the river's worst foe to its best friend. The Hampton Roads Sanitation District made important improvements as well. Gradually, the rivers returned to the point where they now have some healthy fisheries, though human population pressures still take their toll.

Contaminated Runoff

The flow from industrial plant discharges was obvious. What we didn't realize for many years was how much damage stormwater runoff does to the Chesapeake. Three and a half centuries of clearing land for agriculture and timber throughout the Chesapeake watershed, with little attention to soil conservation, had already led to the silting-in of large harbors like Joppa on the Gunpowder River north of Baltimore and Dumfries on the Potomac, as well as countless steamboat wharves and creeks. From Princess Anne on the Eastern Shore of Maryland's Manokin River to Hillsboro on Virginia's Mattaponi River, marshes grew up in what had been the big boats' turning basins.

As rainwater runs off land, it dissolves much of the material it encounters and carries even more in suspension. The faster it moves, the more material it carries.

Running off clear-cut timberland and farm fields, with furrows plowed straight uphill, rainwater in the past carried massive amounts of topsoil, which smothered oysters and clouded out light needed by underwater grasses.

In growing urban areas, sediment poured off bare construction sites. As motor vehicles replaced horses, rainwater on pavement picked up toxics like crankcase oil and antifreeze. Where wetlands and forests once trapped and partially filtered rainwater then slowly released it into tributaries and underwater aquifers, now concrete storm drains accelerated runoff, turning waters to which they flowed into collecting basins. Washington's still-dirty Anacostia River, which once had some of the finest wild rice marshes and herring runs on the Chesapeake, is a testimony to how much damage urban stormwater can do.

As the 20th century wore on, runoff problems that no one foresaw began to surface. The exhaust pipes of motor vehicles and power plant stacks gave off oxides of nitrogen that fell to the ground. Rainwater dissolved them and swept them overboard, adding to already heavy loads of nitrates. In areas of heavy commuter traffic, such as the Washington, D.C., and Hampton Roads metropolitan areas, these oxides of nitrogen became major contributors to the overfertilization of bay waters.

Meanwhile, as agriculture became more intensive, more silt and nutrients flowed from the fields plowed close to the edges. Concentrated animal husbandry wastes, especially of poultry on the lower Eastern Shore and in the Shenandoah Valley, and of cattle in central Pennsylvania's Lancaster County, led to concentrations of nitrogen and phosphorus in areas where manure was spread repeatedly on land as fertilizer in concentrations higher than what crops could take up.

Habitat

Reducing the pollutants flowing to the bay, of course, won't solve all the problems. Of equal importance is restoring the natural systems that filter those pollutants—forest buffers, resource lands, wetlands, and underwater grasses. Trees slow the fall of rain to the ground, and the thick, spongy soil of mature woodlands soaks up the water, releasing it slowly to adjacent streams. The trees' root systems take up nutrients for growth and hold soil around them. The Chesapeake Bay watershed evolved during the past 20,000 years with virgin forests that filtered most of the rain that fell. During the past 400 years, as we have cleared land, cut timber, and covered soils with pavement and rooftops, we have radically altered the way water runs off these lands.

The past century, however, has seen improvements in forest cover. Lands that were stripped of their trees in the 19th century have grown back, often with the help of timber companies. The bay watershed today is about 60-percent forested, an increase of 10 percent since 1830. Today, however, the watershed's timber stands are under pressure again, mostly from

development. Clearing mature trees to build houses and replacing them with young trees does not solve the problem. In addition, sprawling development fragments forests, and clearing land along waterways reduces their capacity to treat runoff.

The Chesapeake watershed has lost 43 percent of another of its great natural filters since 1600—wetlands. It's easy to understand why some of these losses occurred. With mounting loads of sewage and polluted runoff, some wetlands held legitimate threats of diseases, like cholera and malaria, until development of modern medicines. Farmers drained low, wet spots in fields to convert them to arable land, often with the encouragement of government agencies. Developers filled tidal wetlands to build land for houses.

Most of this destruction was based in ignorance. We didn't understand the roles that wetlands played in the Chesapeake system, providing habitat for wildlife, nurseries for fish and crabs, and water treatment systems that we now refer to as the "kidneys of the bay." Destruction of tidal wetlands has been much arrested since passage of protective laws in Maryland in 1970 and Virginia in 1972. Even so, losses of nontidal wetland have continued even to this day.

Similar declines have plagued underwater grasses. The bay's 16 or so species of these plants provide essential habitat for fish and shellfish, especially our beloved blue crab. They trap suspended sediment and turn nutrients into building blocks for growth. These grasses require clear water to grow and flower, however.

We don't have hard data, but extensive anecdotal evidence indicates that the Chesapeake held about 600,000 acres (240,000 hectares) of underwater grass in Captain John Smith's time, growing out to depths of 12 to 15 feet. Maps from 1916 on the upper tidal Potomac indicate vast coverage, as do aerial photographs of Tangier Sound in the 1950s.

Algae blooms from sewage and sediment pollution from development reduced water clarity on the Potomac during most of the century. The grasses crashed. The story is much the same throughout the system. By 1984, coverage of the bay's underwater grasses declined to about 37,000 acres, or a loss of about 94 percent. They rebounded to about 70,000 acres in 1993, with greatest gains in the tidal Potomac, as a result of good sewage treatment. Since then, however, the trend has flattened.

Oysters

The greatest decline of the 20th century and, paradoxically, the strongest potential for restoration, lies with the Chesapeake's oysters. Before 1870, the bay's oysters grew in reefs so high that they were hazards to navigation. They were so abundant that they removed 25 to 40 percent of algae blooms in warm weather.

But then we began harvesting them faster that they could reproduce. Between 1890 and 1905, baywide harvests dropped from 15 million to 5 million bushels per year as dredgers scraped the reefs flat. Despite the declining harvests, oysters were still abundant enough that most people scoffed at the notion that they were being overharvested.

Overharvesting was not the only problem, however. The oysters growing on the bottom were increasingly hampered by poor water quality. They had to expend more energy pumping sediment out of their gills. And, too, the concentrations of food—phytoplankton, which need sunlight for photosynthesis—and dissolved oxygen are lower at depth. Oyster growth and reproduction slowed. During the next 50 years, oyster harvests trailed off to a couple of million bushels a year.

In the 1960s, the disease MSX struck the high-salinity beds of the lower bay, decimating much of Virginia's public oyster grounds. In the drought years of the 1970s and 1980s, the disease worked its way into Maryland as well. In the 1980s and 1990s, another disease, Dermo, also began to affect the stocks. The baywide harvest declined to fewer than 100,000 bushels in 1993, the final step in a 99-percent drop over 100 years.

The decline was devastating to the communities of watermen who depend on oysters for income to carry families though the winters. In addition, the loss removed the most effective natural water treatment system even as the region's growing human population added more sediments and algae-growing nutrients to the system.

The early 1990s were a time of great pessimism about the future of the Chesapeake's oysters, but the seeds of recovery were sown even then. People began to recognize the vital ecological roles that oysters play in the bay, providing live-bottom habitat for fish and other shellfish, filtering sediment, and converting sunlight-blocking algae into tasty meat.

An oyster research and hatchery program at the Virginia Institute of Marine Science developed a technique for growing oysters in

floats, which led to an explosion of oyster gardening by private citizens. In the floats, the oysters grew fat and fast, reaching a harvestable size of 3 inches (8 centimeters) in 16 to 18 months instead of the three years that it takes in the wild. These fast-growing commercial oysters can easily outrun MSX and Dermo, which require 24 to 36 months to kill their hosts. Clearly, the Chesapeake can still grow top-quality oysters.

Also in the early 1990s, Jim Wesson, shellfish repletion officer at the Virginia Marine Resources Commission and a former waterman, began experimenting with high reefs built of shell and seeded with large oysters. These reefs mimicked the shape of those seen in the prints of the bay from the 17th century, the way oysters grew naturally before we began harvesting them intensively. To date, he has built 20 reefs in Virginia waters, with at least 10 more planned for the next two years. Planted with large oysters as broodstock, the reefs show greatly increased reproduction, which is spreading to nearby bottoms planted with shell.

Increasingly, broodstock oysters grown from disease-resistant strains—developed at the Virginia Institute of Marine Science and the University of Maryland's hatchery on the Eastern Shore—are being raised by students and private citizen gardeners who want to help in the effort. The Chesapeake Bay Foundation is taking the lead in organizing citizen growers in both states.

Some of the broodstock includes large wild oysters with disease resistance, harvested by watermen and bought for the reefs by the Virginia Marine Resources Commission and the Chesapeake Bay Foundation.

Save the Bay

These stories of pollution, habitat, and oysters tell not only of decline, but also of a subtle shift in attitudes toward the bay and its natural systems. By the 1960s, a few voices in the watershed started to call for change. In 1964, a group of Baltimore businessmen—all sailors, waterfowl hunters, and fishermen—had lunch with Rogers C.B. Morton, then a congressman from Maryland's Eastern Shore. They wanted his help with problems they saw looming on the Chesapeake: more boats, more people, more houses, poor sewage treatment, dirty industrial discharges.

Morton responded by saying that they could not expect the government to fix all the bay's problems. "There is a great need," he said, "for a private-sector organization to represent the best interests of the Chesapeake Bay. It should build public concern, then encourage government and private citizens to deal with these problems together."

The words struck home. By 1967, the group, led by the late Arthur Sherwood, had formed and chartered the Chesapeake Bay Foundation to be that private-sector voice working on behalf of the bay. They recruited a board of trustees representing a variety of interests from throughout the Chesapeake watershed. To get out their message, they adopted SAVE THE BAY as the Chesapeake Bay Foundation's motto and printed the first run of the distinctive blue-and-white bumper stickers that are now so common throughout the watershed.

The Chesapeake Bay Foundation's beginnings were modest. Early in 1970, with membership at 2,000 and a staff of three, Arthur Sherwood took over as executive director and settled on two programs—environmental education and resource protection—with land conservation an integral part of the protection effort.

For the next 30 years, the Chesapeake Bay Foundation would represent the growing ranks of watershed citizens who demanded improvements in the bay's health. The Chesapeake Bay Foundation served as a vocal advocate in Annapolis, Harrisburg, Richmond, and Washington, D.C., while working with citizen volunteers to begin massive restoration and protection programs on the ground. At the same time, the organization taught growing numbers of students and adults about the bay and its watershed through on-the-water experience.

By the end of the century, the Chesapeake Bay Foundation would become the nation's largest regional environmental organization, with the largest field-based, on-the-water, environmental education program in the world.

The organization's success lies not only in its passion for its mission, but also in its ability to reach across divides of party politics, state lines, and socioeconomic status to tap into the public's tremendous love for the Chesapeake.

Shared Vision

In the early 1970s, bay protection and restoration on both federal and state levels started to take off. Maryland and Virginia had just enacted their tidal wetland protection acts. Within a couple of years, tidal wetland loss fell by more than 90 percent.

By 1976, the Chesapeake Bay

Foundation had sufficiently raised public concern about the future of the bay that Senator Charles "Mac" Mathias, Maryland Republican and a member of the Chesapeake Bay Foundation's board of trustees, pushed through Congress a seven-year EPA-sponsored Chesapeake Bay study. The study provided much of the scientific basis for the broad interstate effort that continues today.

In 1983, EPA issued its report, documenting systemic declines around the Chesapeake. The report focused, not on a single cause for the decline, but on the accumulation of insults that the bay was suffering as the result of human pressures.

William C. Baker, who had become president of the Chesapeake Bay Foundation in 1981, seized on the results of the bay study and, using all of the foundation's resources, entered vigorously into the planning processes then underway in Maryland and Virginia for programs to restore the bay.

In late 1983, the governors of Maryland, Virginia, and Pennsylvania and the mayor of the District of Columbia met at a major conference, along with staff from the Chesapeake Bay Foundation, other environmental organizations, and research laboratories. Their task was to hammer out what would become the first interstate Chesapeake Bay Agreement. A particularly important outgrowth of this agreement was Maryland's Critical Area Act, the first land-use legislation intended to minimize the effects of shoreline development on the bay ecosystem. Virginia added the Chesapeake Bay Preservation Act, the commonwealth's own land-use law. In Pennsylvania, the focus was on agricultural issues in the intensely farmed south-central counties along the Susquehanna River. Additional attention has been directed to wastewater treatment, urban stormwater runoff, and wetland protection. Meanwhile, the outpouring of public interest in cleaning up the Chesapeake grew tremendously.

In 1987, Virginia's Governor Gerald L. Baliles intensified the cleanup effort with a new Chesapeake Bay Agreement that called for a 40-percent reduction in the flow of the nutrients nitrogen and phosphorus into the bay, along with the specific goal of elimination of toxics from all controllable sources.

In 1991, to celebrate its 25th anniversary, the foundation commissioned the writing of the book *Turning the Tide: Saving the Chesapeake Bay* as its first *State of the Bay* report. Tom Horton, the book's principal author, concluded that the bay was dangerously out of balance and in need of a three-pronged approach to restoration: reduce pollution, protect and restore habitat, and replenish fisheries.

In 1993, the Chesapeake Bay Foundation began a long-term planning process designed to refocus its goals and to restructure itself for the 21st century. The planning resulted in development of the indicator benchmarks used in today's annual *State of the Bay* reports.

In 1997, a new threat arose from the fish-killing microorganism *Pfiesteria piscicida*. *Pfiesteria* had been associated with large fish kills in North Carolina's Pamlico Sound, whose waters were highly enriched by runoff of waste were from hog farms. The outbreaks in the bay began that summer on the Pocomoke River, which has tens of millions of chickens in its watershed. In late summer, kills also occurred on Kings Creek, a tributary of the Manokin River, and on the Chicamacomico River, both farther up Tangier Sound on the Eastern Shore. The kills were significant, both in loss of fish and in human illness suffered by watermen and state workers investigating the kills. Monitoring efforts by field staff in Virginia found *Pfiesteria* to be active there too, but at a much lower level.

Maryland Governor Parris N. Glendening responded by instituting a blue-ribbon commission to come up with recommendations for state spending and legislation to deal with the problem. *Pfiesteria* is a compelling reminder that the Chesapeake is not yet saved, that the cleanup is very much a work in progress. In both Maryland and Virginia, it has galvanized intensive efforts to strengthen nutrient reduction programs.

At the Crossroads

Chesapeake 2000, the third Chesapeake Bay Agreement, now raises the bar for bay restoration. Despite progress on many fronts, fundamental challenges to the Chesapeake's health remain. The central problem is that the bay watershed is growing fast, as anyone who drives our roadways knows all too well. Maintaining the status quo in bay restoration means losing ground.

The 1987 Chesapeake Bay Agreement mandated not only a 40-percent reduction of nitrogen and phosphorus, but also a permanent cap thereafter. We've missed the 40-percent goal, and current evidence suggests that restoring the system will require a

50-percent reduction. The most difficult challenge, however, may be maintaining the cap in the face of population growth. One of the watershed's sewage treatment plants, for example, is considering a 50-percent expansion to accommodate new houses and offices, while maintaining the same rate of nitrogen removal. That means a 50-percent increase in its effluent's nitrogen, which runs counter to everything we're striving for.

Even more worrisome is the way population growth currently gobbles up open land throughout the watershed at a rate of 10 acres every hour. In graphic terms, this means the watershed is losing an area of open land the size of Washington, D.C., every 10 weeks. Thus *Chesapeake 2000* includes a provision to reduce the rate of land conversion for harmful sprawl by 30 percent and to permanently preserve 20 percent of the land area of the watershed. The agreement includes a number of incentive-based tools like cost-share programs, easement purchases, and tax credits to achieve the 30-percent reduction.

This is the most specific Chesapeake Bay Agreement by far. Chesapeake Bay Commission's Ann Swanson notes that the agreement includes 97 explicit and interlocking commitments within five categories: living resource protection and restoration, vital habitat protection and restoration, water quality restoration and protection, sound land use, and stewardship and community engagement.

Back to the Future

After our conversation at the Noonan Center, we board a canoe fleet to explore underwater grass beds in nearby Hopkins Cove. In 1997, the cove's bottom was barren. A year later, it was half-covered with widgeon grass. Last year, it held a thick carpet. This year, it has a lot of bare spots again. Maybe the light-blocking effects of the mahogany tide algae bloom following last spring's rains thinned out the grass. Maybe the several dozen mute swans that live in the area overgrazed the beds during the summer—we shoo away 18 of the big birds as we approach. Maybe both factors are at work.

Earlier, Swanson had said she was both proud and troubled as she contemplated the Chesapeake's future. She was right on. We've made important progress, but much work remains. *Chesapeake 2000* gives us a strong, specific action plan. Now, we must get on with it.■

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