

# A Report to the Citizens of the Bay Region

[www.chesapeakebay.net](http://www.chesapeakebay.net)



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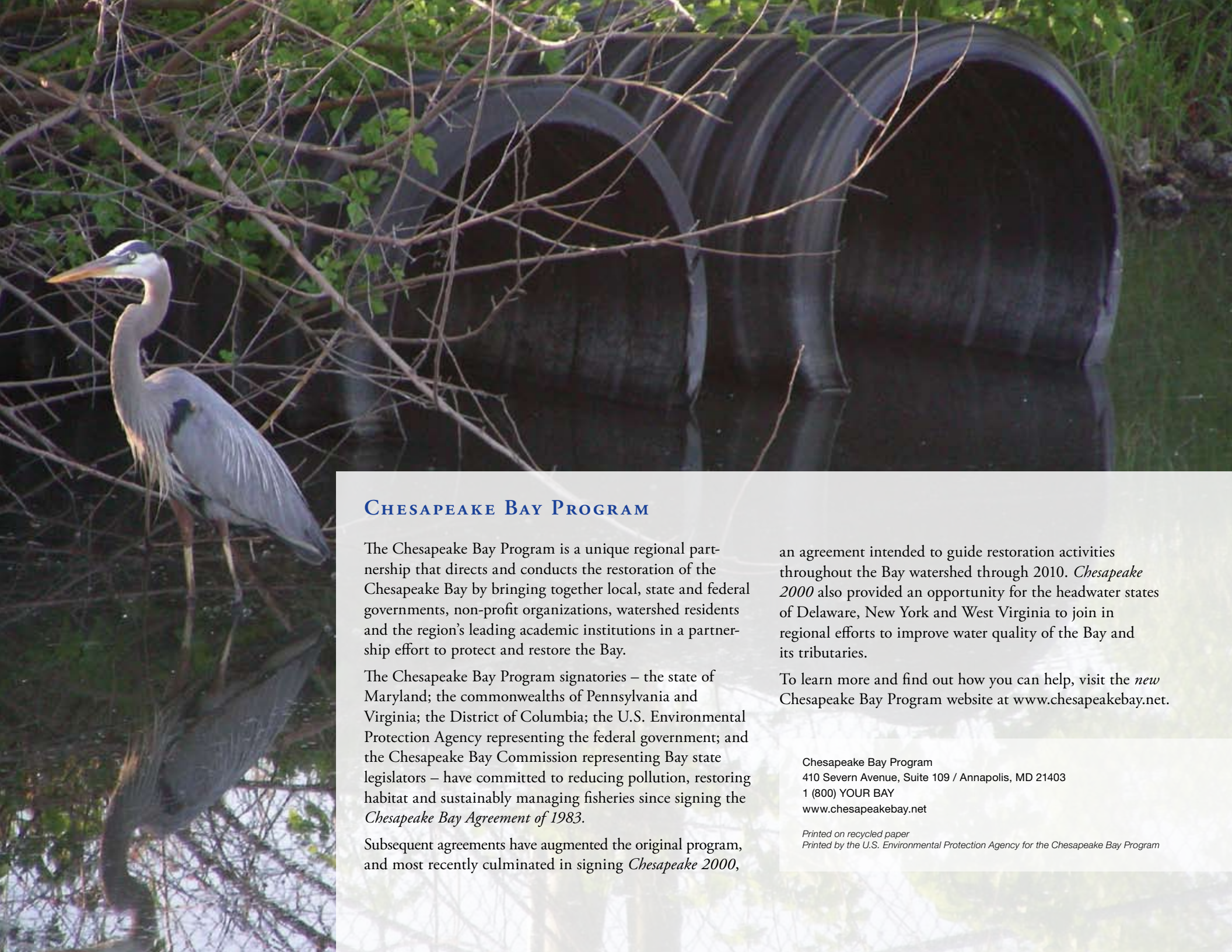
## CHESAPEAKE BAY

2007

*Health & Restoration Assessment*







## CHESAPEAKE BAY PROGRAM

The Chesapeake Bay Program is a unique regional partnership that directs and conducts the restoration of the Chesapeake Bay by bringing together local, state and federal governments, non-profit organizations, watershed residents and the region's leading academic institutions in a partnership effort to protect and restore the Bay.

The Chesapeake Bay Program signatories – the state of Maryland; the commonwealths of Pennsylvania and Virginia; the District of Columbia; the U.S. Environmental Protection Agency representing the federal government; and the Chesapeake Bay Commission representing Bay state legislators – have committed to reducing pollution, restoring habitat and sustainably managing fisheries since signing the *Chesapeake Bay Agreement of 1983*.

Subsequent agreements have augmented the original program, and most recently culminated in signing *Chesapeake 2000*,

an agreement intended to guide restoration activities throughout the Bay watershed through 2010. *Chesapeake 2000* also provided an opportunity for the headwater states of Delaware, New York and West Virginia to join in regional efforts to improve water quality of the Bay and its tributaries.

To learn more and find out how you can help, visit the *new* Chesapeake Bay Program website at [www.chesapeakebay.net](http://www.chesapeakebay.net).

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## About This Report

Chesapeake Bay is the largest and still the most productive estuary in North America, home to more than 3,700 species of plants and animals. The Bay has sustained the region's economy and defined its traditions and culture since Captain John Smith sailed its waters 400 years ago. But the Chesapeake is in trouble.

A healthy Bay requires balancing the needs of the region's people and economy with the needs of the Bay for clean waters and ample habitat for aquatic life. The goal of Bay restoration is to restore this balance by reducing pollution, protecting critical habitat and ensuring sustainable populations of fish and shellfish.

Although there are a number of smaller-scale success stories, the overall ecosystem health of the Chesapeake Bay remains degraded. For more than twenty years, restoration efforts have managed to offset the impact of the region's growing population while making modest ecological gains in some areas. Major pollution reduction, habitat restoration, fisheries management and watershed protection actions taken to date have not yet been sufficient to restore the health of the Bay.

In December 2007, the Chesapeake Executive Council met to chart a new course to accelerate efforts to reduce nutrient and sediment pollution throughout the Bay watershed. The principals attending the meeting each agreed to "champion" an issue or issues that are vital to restore our streams, rivers and the Bay, intending that the outcomes of the various projects or programs be models that are transferable to other states and local communities.

Each leader found that there were specific issues they could focus on using the expertise available to them. Some chose to focus on future impacts, such as the expanding use and impacts of biofuels on the Bay. Others are focusing on continuing issues, such as agriculture or assisting local governments to increase their capacity to reduce pollution from growth and development and to maintain clean water. As each "champion" makes progress, they will report back to the partnership and then encourage others to consider these individual models, modifying them for their respective uses.

We are very excited about this new direction and look forward to sharing our collective successes with you during the year. We encourage you to visit our new website at [www.chesapeakebay.net](http://www.chesapeakebay.net) to keep abreast of Bay Program news and happenings, Executive Council updates and most important, ways that the over 16 million watershed residents can work together to clean up the rivers, streams and waterways of the Chesapeake Bay watershed.

The *Chesapeake Bay 2007 Health and Restoration Assessment* is presented this year as one document with four chapters, stressing the health of the Bay, the stressors to our environment, restoration efforts and, new this year, a summary of local water quality assessments which will help you learn about the health of the streams and rivers in your portion of the Bay watershed. We hope that, by presenting data in this manner, watershed residents can better understand the health of the Bay relative to what is needed for a balanced ecosystem.

Jeffrey Lape, *Director*, Chesapeake Bay Program



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An electronic version of the *Chesapeake Bay 2007 Health and Restoration Assessment* can be found at [www.chesapeakebay.net/indicatorshome.aspx](http://www.chesapeakebay.net/indicatorshome.aspx).

Detailed information about each indicator, including expanded analysis and interpretation of data as well as the methods used to compile the graphs in this publication can be found at [www.chesapeakebay.net/indicatorshome.aspx](http://www.chesapeakebay.net/indicatorshome.aspx).



### CHAPTER ONE 8

#### Ecosystem Health

Progress toward a restored Bay is tracked with 13 indicators grouped in three priority areas that represent major components of the Bay ecosystem. Quantitative restoration goals have been set for most of these indicators. For each indicator, a chart shows, as a percent of the goal, current status and a history of progress toward achieving the goal. A summary bar chart shows the current status of each indicator with respect to its restoration goal.

### CHAPTER TWO 16

#### Factors Impacting Bay and Watershed Health

What are the factors that impact the health of our local waters, the Bay and the landscape throughout the watershed? This chapter gives some perspective on population, land use, river flow and pollution loads, all of which impact the ecosystem.

### CHAPTER THREE 20

#### Restoration Efforts

In this chapter, 20 indicators are grouped into five priority areas described in the landmark Chesapeake 2000 agreement that represent major elements of the Bay restoration effort. Quantitative goals have been set for most of these indicators. For each, a chart shows the current status and a history of percent of progress toward achieving the goal.

### CHAPTER FOUR 32

#### Health of Freshwater Streams and Rivers

This chapter provides a summary of pertinent local water quality assessments developed by Chesapeake Bay Program state partners as part of their federal 305b/303d reporting requirements. This chapter also directs citizens to the webpage with links to each state's assessment reports.



The Chesapeake Bay is an estuary – a place of transition between the land and the sea, where incoming fresh water mixes with salty ocean water. The Chesapeake Bay is a productive ecosystem and is the largest estuary in North America, home to more than 3,700 species of plants and animals. The Bay *watershed spreads over 64,000 square miles*, creating some of the most special land and water areas in our country. The Chesapeake's future depends on the choices made every day by the millions of people who live within the Bay watershed. *What each of us does* on the land – including the use of vehicles, fertilizers, pesticides, electricity and water – *affects* our streams, rivers and ultimately *the Bay*.

For more than twenty years, restoration efforts have managed to offset a variety of destructive environmental impacts, while making modest ecological gains in some areas. Recently this imbalance has intensified because of *rapid population growth* and land use conversion in parts of the watershed; thus major pollution reduction, habitat restoration, fisheries management and watershed protection actions taken to date have not yielded a significant Bay ecosystem response.

Although there are a number of smaller-scale success stories, the overall ecosystem health of the *Chesapeake Bay remains degraded*.

It is important to note that progress cannot be calculated on a day-to-day basis. By using detailed scientific data that have been carefully analyzed and interpreted, we can see changes in the health of the Bay over time. Change is occurring, but slowly.



*The way nearly 17 million watershed residents live and use natural resources greatly influences Bay and watershed health.*

### Chesapeake Bay Health

**Water Quality** – Most of the Bay’s waters are degraded. Algal blooms fed by nutrient pollution block sunlight from reaching underwater bay grasses and lead to low oxygen levels in the water. 2007 saw fish kills in a number of rivers leading to the Bay. Suspended sediment from urban development and agricultural lands, as well as some natural sources, is carried into the Bay and clouds its waters. Portions of Chesapeake Bay and its tidal tributaries are contaminated with chemical pollutants that can be found in fish tissue. In 2007, we were 21 percent of the way toward meeting Bay water quality goals, a drop from 23 percent in 2006.

**Habitats and Lower Food Web** – The Bay’s critical habitats and food web continue to be at risk.

Nutrient and sediment runoff have harmed bay grasses and bottom habitat, while disproportionate algae growth has pushed the Bay food web out of balance. Currently, the Bay’s habitats and lower food web are at 44 percent of desired levels, up from 40 percent in 2006.

**Fish and Shellfish** – Many of the Bay’s fish and shellfish populations are below historic levels.

- Blue crab abundance continues to be low and the stock is not rebuilding as had been anticipated.
- Oyster restoration efforts are hampered by disease and the stock remains at low levels.
- American shad abundance continues to be at depressed levels.
- The striped bass stock returned to high levels of abundance, but now there are concerns about disease and nutrition.
- Menhaden populations along the Atlantic Coast are healthy, but some scientists are concerned about low abundance in Chesapeake Bay.

Currently, the Bay’s fish and shellfish are at 52 percent of desired levels, up from 48 percent in 2006.

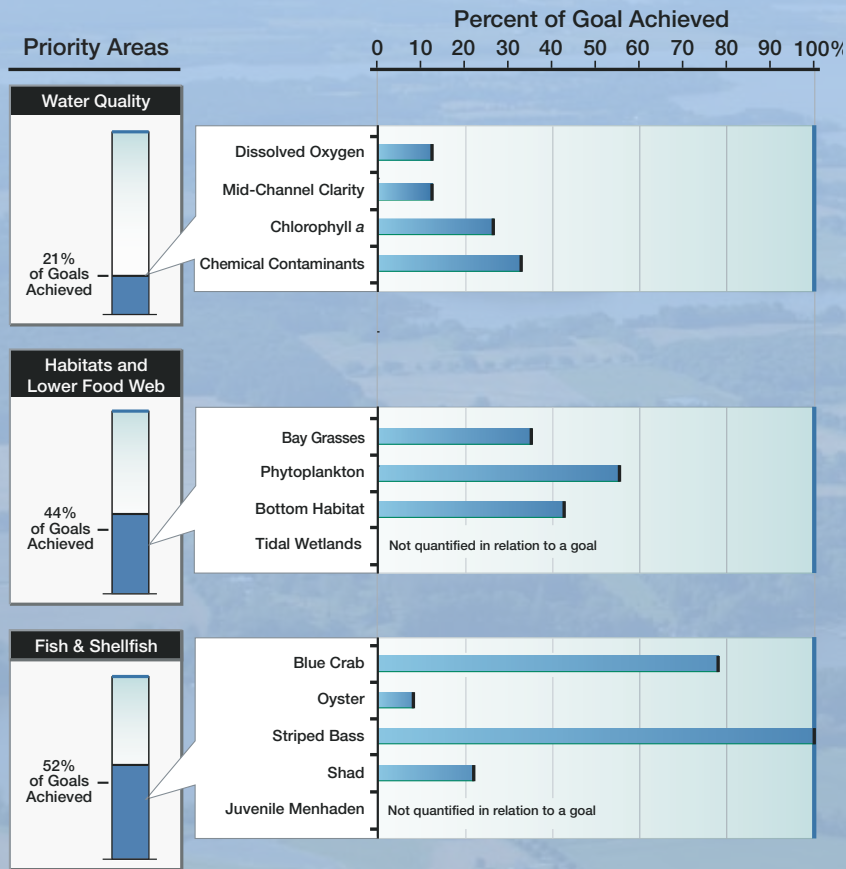
### Factors Impacting Bay and Watershed Health

The way nearly 17 million watershed residents live and use natural resources greatly influences Bay and watershed health, which includes hundreds of local creeks, streams and rivers. The population in the Bay watershed is now growing by about 130,000 residents annually and 100 acres of forestland are lost each day. Pollutant loads continue to exceed target levels established to restore the Bay’s water quality.

Historic over-harvest, compounded by the impacts of poor water quality, disease and blocked access to historic spawning grounds, has resulted in low abundances of oysters, crabs and shad.

Natural factors, such as temperature and wind, as well as rainfall which affects the volume of water flowing into the Bay, also have a great impact on water quality, habitat and fish and shellfish populations.

## SUMMARY: 2007 BAY HEALTH ASSESSMENT



Data and Methods: [www.chesapeakebay.net/status\\_bayhealth.aspx](http://www.chesapeakebay.net/status_bayhealth.aspx)





### Restoration Efforts

The Chesapeake Bay Program partners have developed science-based plans to improve the waters, habitats and fisheries of the Chesapeake. On-the-ground efforts are taking place throughout the 64,000-square-mile watershed and new initiatives are being implemented to accelerate progress. While there are many notable individual accomplishments relating to Chesapeake Bay restoration, *Chapter One: Ecosystem Health* makes clear that the Bay Program partners need to accelerate the pace of water quality improvement efforts.

Restoration of a complex ecosystem requires a multi-pronged approach. The Chesapeake Bay Program has divided its restoration efforts into five broad areas: Reducing Pollution, Restoring Habitats, Managing Fisheries, Protecting Watersheds and Fostering Stewardship.

**Reducing Pollution** – These efforts are the most far-reaching. The goal is to take the actions necessary to remove the Bay and its tidal tributaries from EPA's list of "impaired waters" by 2010. Overall, based on available data, Bay Program scientists project that little more than half of the pollution reduction efforts needed to achieve the nutrient goals have been undertaken since 1985.

**Restoring Habitats** – Progress toward water habitat restoration is measured against a series of goals established by the Program. Most of the goals have a 2010 deadline. Overall, habitat restoration efforts are collectively 48 percent to Program goals, up from 45 percent in 2006; however, there is concern about the overall quality of habitats that remain.

**Managing Fisheries** – These efforts focus on promoting a shift from a traditional management approach that looks solely at single species to one that recognizes interactions between multiple species and environmental stressors such as low dissolved oxygen levels (ecosystem-based). Success is measured by milestones necessary to achieve that shift, not by an assessment of fishing stocks (which can be found

in *Chapter One: Ecosystem Health*). Progress toward this new approach ranges from 37 to 63 percent for five key species, unchanged from 2006.

**Protecting Watersheds** – These efforts are also measured against Program goals. Many of these efforts help slow the rate of new pollution associated with population increases in the watershed as well as reduce current pollution levels. Overall, watershed protection efforts show good progress and are 71 percent of the way toward meeting current Program goals, up from 69 percent in 2006.

**Fostering Stewardship** – Stewardship efforts include a broad range of actions from expanding opportunities for residents to experience the Chesapeake, to formal outdoor environmental education experiences for school-age children, to engaging communities and helping move them to action. Overall the Program has reached 68 percent of its fostering stewardship goals, a rise of one percent from 2006.

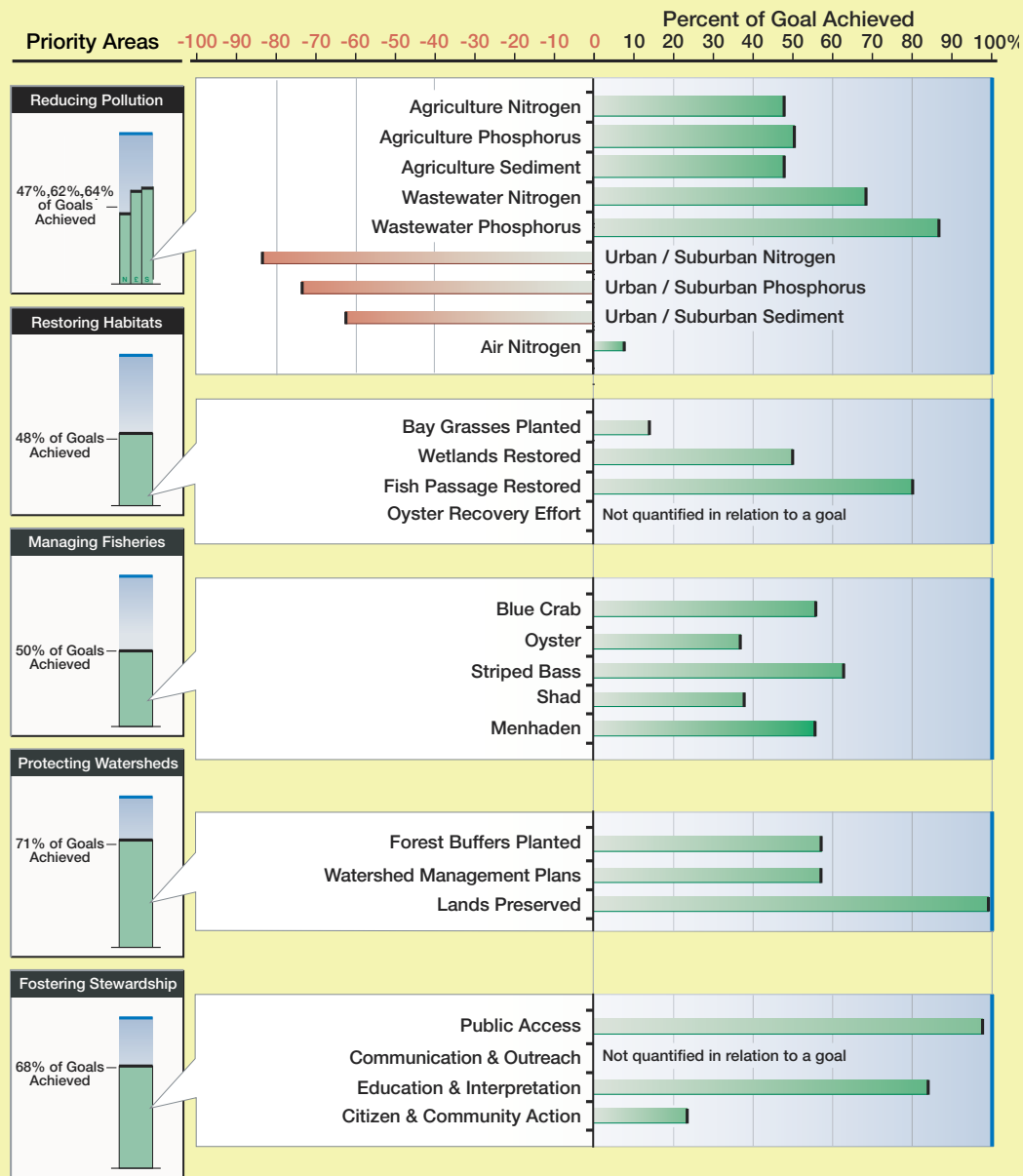
### Health of Freshwater Streams & Rivers

The presence and diversity of snails, mussels, insects and other freshwater benthic macroinvertebrate communities are good indicators of stream health because of their limited mobility and their known responses to environmental pollutants and stressors. Consequently, these communities are often used as indicators of the attainment or nonattainment of aquatic life uses protected by state water quality standards. Benthic macroinvertebrate communities in rivers and streams throughout the Bay watershed suffer with increases in pollution, sedimentation and decreasing oxygen levels.

Each state in the watershed conducts benthic macroinvertebrate assessments as part of its biennial water quality assessment report mandated by the Clean Water Act. Where assessed benthic macroinvertebrate communities are degraded, states must designate those stream segments as impaired and add them to the list of impaired waters in need of cleanup.



## SUMMARY: 2007 BAY RESTORATION EFFORTS



Data and Methods: [www.chesapeakebay.net/status\\_restoration.aspx](http://www.chesapeakebay.net/status_restoration.aspx)



The overall ecosystem health of the Bay remains degraded.

### Water Quality

To support a vibrant Chesapeake Bay ecosystem, waters must become clearer, oxygen levels higher, and the amount of algae and chemical contaminants in its waters must be reduced. Water quality goals in this section are based on published water quality criteria designed to protect aquatic life and human health in the Bay. Runoff from winter and spring rains deliver loads of sediment and nutrient pollutants to the Bay that drive summer water quality conditions in the Bay. Past observations reveal that summer weather conditions also contribute to summer water quality when intense storms increase erosion, which contributes to poor water clarity and adds to the existing nutrient load in the Bay. The health of the Bay in the critical summer season will improve as actions are taken year-round to reduce the level of pollutants in the watershed.

#### DISSOLVED OXYGEN

Like terrestrial animals, the Bay's fish and shellfish need oxygen to survive. State water quality standards have been adopted to reflect the dissolved oxygen needs of the Bay's aquatic life. The standards vary with depth, season and duration of exposure. Dissolved oxygen concentrations need to be high enough to support life in aquatic systems and different aquatic species have different requirements. Generally speaking, oxygen-rich shallow waters are most essential in the spring during spawning season. Slightly lower dissolved oxygen levels are acceptable at other times of the year, particularly in deeper waters.

When assessing the Bay's tidal water quality, federal and state regulators examine conditions over the most recent three years to help remove annual weather-driven fluctuations. Water quality data gathered between 2005 and 2007 indicate that about 12 percent of the combined volume of open-water, deep-water and deep-channel water of the Bay and its tidal tributaries met dissolved oxygen standards during the

summer months. This is a sharp decrease from 28 percent in 2004 through 2006.

Some scientists believe this is due to the inclusion of data from the summer of 2007, when dissolved oxygen concentrations did not meet the needs of aquatic life for long periods of time in open water portions of the middle Bay (from the Bay Bridge south to the mouth of the Potomac River).

The historic data featured in this indicator changed due to the inclusion of additional data and the publication of a new bio-reference curve, as described in Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and Its Tidal Tributaries, 2007 Addendum (EPA 2007).

#### WATER CLARITY

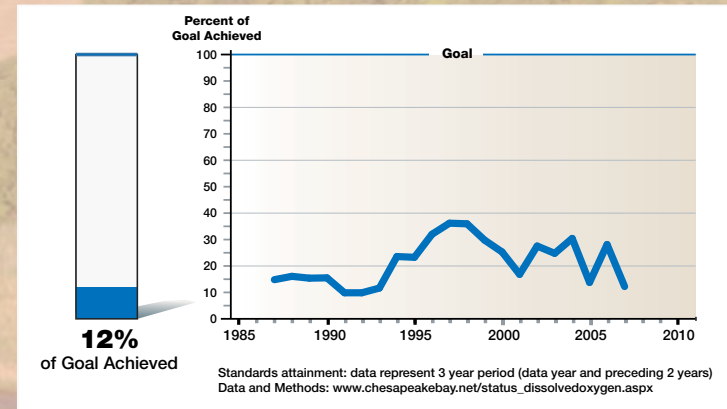
Clear waters are indicative of a healthier Bay, with acceptable levels of nitrogen, phosphorus, sediment and microscopic life in the water column. Clear waters allow sunlight to reach underwater plants and fish to see their prey and avoid their predators.

Good water clarity is one of the most critical factors determining growth and survival rates of underwater bay grasses, which are rooted in shallow areas fringing the bay. Also known as submerged aquatic vegetation or SAV, they provide vital habitat for a number of living resources. When light is inhibited from penetrating through the water to the plants' leaves and stems, the plants are not able to produce enough food and energy to grow.

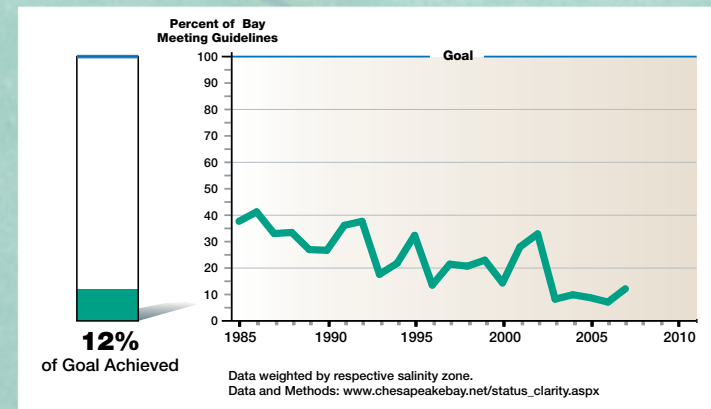
Unfortunately, systematic monitoring of water clarity in shallow water areas has been underway for only the past few years and there are not yet sufficient data to provide a bay-wide assessment. In order to provide a baywide assessment, water clarity data from deeper, mid-channel areas are used to indicate general conditions and trends. Based on these data, scientists estimate that only 12 percent of the Bay's waters had acceptable water clarity in 2007.



## DISSOLVED OXYGEN STANDARDS ATTAINMENT



## MID-CHANNEL WATER CLARITY



*Underwater bay  
grasses are one of  
the most important  
habitats in the  
Chesapeake Bay.*

### CHLOROPHYLL A

Scientists measure the amount of chlorophyll *a* in the Bay's waters to assess the amount of algae present. The Bay needs the right amount of phytoplankton, or algae, to maintain a balanced food web. Algae are microscopic and usually live suspended in open waters. They are the base of food chains that support most living resources in the bay, including oysters and fish.

Excess nutrients can cause large-scale algal blooms that block sunlight from reaching bay grasses, reducing available habitat for Bay life. Lower algal levels support improved water quality and habitat and result in fewer harmful blooms.

Every year harmful algal blooms cover a portion of the Bay and its tributaries.

In 2007, scientists estimate that about 26 percent of the Bay's waters had acceptable concentrations of chlorophyll *a*.

### CHEMICAL CONTAMINANTS

Currently less than 33 percent of the monitored tidal waters contain no impairment for chemical contaminants. The remaining 67 percent are impaired or partly impaired due to chemical contaminants. Nearly all impairments – 95 percent – identify polychlorinated biphenyls (PCBs) as the source of impairment.

The prevalence of toxic contamination in fish tissue, sediment and the water column has both an ecosystem and human health connection. Due to bioaccumulation, contaminants monitored in fish tissue give an indication of the overall presence of these substances in the Bay ecosystem. Also, as these contaminants bioaccumulate in predatory species, they can potentially affect humans that consume these fish.

This indicator is different from the one featured in the 2006 Assessment, as it provides a more complete depiction of the extent of impairments due to chemical contaminants.

## Habitats and Lower Food Web

Life in the Bay needs high-quality food and habitat to thrive. From the clams and worms that live within sediments at the bottom of the Bay, to the rockfish that prowl its open waters, to the juvenile fish and crabs darting among underwater grasses and wetlands, healthy and abundant habitat is critical for supporting the Bay's aquatic life. When healthy habitat is supported by a balanced food web, healthy aquatic communities can flourish. As both of these key environmental elements improve, the ecosystem's potential to support larger and more diverse populations of aquatic life expands as well.

### BAY GRASSES

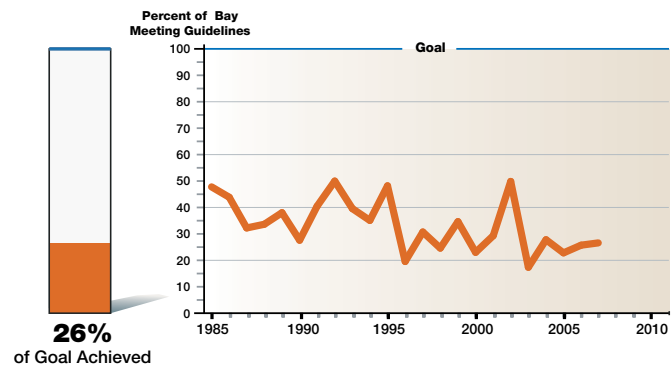
Aside from the water itself, underwater bay grasses are one of the most important habitats in the Chesapeake Bay. As their health is closely related to the quality of local waters, grasses serve as an excellent barometer for the overall health of the estuary. Bay grass abundance has a profound effect on the Bay and its aquatic life, as it provides critical habitat to key species such as striped bass and blue crabs while improving the clarity of local waters.

The most recent baywide data from 2007 show bay grasses covering nearly 65,000 acres – or about 35 percent of the 185,000-acre restoration goal. Although an increase from 59,000 acres in 2006, grasses have not yet recovered to the recent high level of 90,000 acres in 2002.

The total Bay grass abundance goal has also been broken down by three zones. Bay grasses in the Upper Bay in 2007 covered about 19,000 acres or 80 percent of the 23,630-acre goal. For 2007, Middle Bay grasses covered roughly 30,000 acres or 26 percent of the 115,229-acre goal, while grasses in the Lower Bay covered 16,000 acres or 35 percent of the 46,030-acre goal.

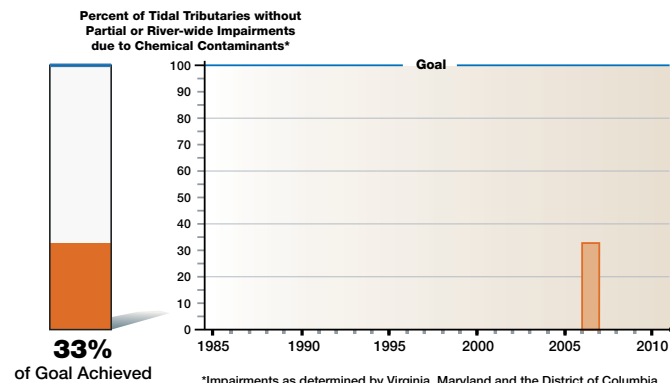


## CHLOROPHYLL A



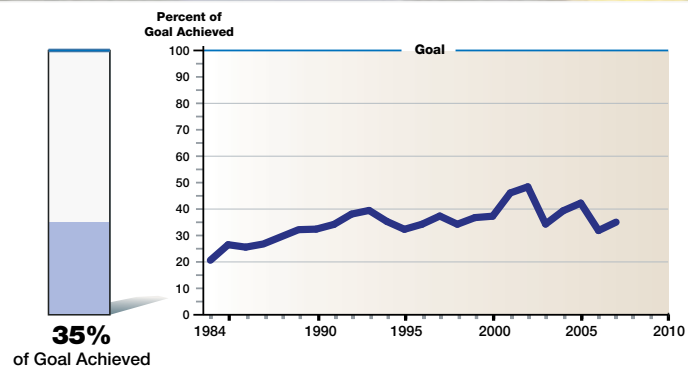
Data and Methods: [www.chesapeakebay.net/status\\_chlorophylla.aspx](http://www.chesapeakebay.net/status_chlorophylla.aspx)

## CHEMICAL CONTAMINANTS



\*Impairments as determined by Virginia, Maryland and the District of Columbia under Clean Water Act requirements.  
Data and Methods: [www.chesapeakebay.net/status\\_chemicalcontaminants.aspx](http://www.chesapeakebay.net/status_chemicalcontaminants.aspx)

## BAY GRASS ABUNDANCE



Data and Methods: [www.chesapeakebay.net/status\\_baygrasses.aspx](http://www.chesapeakebay.net/status_baygrasses.aspx)

*Blue crab abundance continues to be low and the stock is not rebuilding as had been anticipated.*

### BOTTOM HABITAT

The health of the Bay's bottom-dwelling – or benthic – communities is greatly reduced when pollution levels increase and oxygen levels drop. Benthic habitats serve as a good indicator of long-term environmental conditions, as the inhabiting worms and clams are long-lived, have limited mobility and their responses to stress are well documented.

In 2007, about 43 percent of the Bay's benthic habitat was considered healthy as measured by the composite Benthic Index of Biotic Integrity. Reduced amounts of nutrients, sediment and chemical contaminants flowing into the Bay will help these bottom dwelling communities improve.

### PHYTOPLANKTON

Phytoplankton, or algae, are an excellent indicator of the health of the Bay's surface waters, as they have shown to be especially sensitive to changes in nutrient levels, water clarity, temperature, salinity and grazer communities (i.e., organisms that feed on phytoplankton). Phytoplankton form the base of the food web in the Bay ecosystem. While increased populations provide more food to organisms further up the food web, too much or the wrong type of algae can harm the overall health of the Bay. In some cases, harmful algal blooms can impact human health as well.

Scientists assess algal community health with a Phytoplankton Index of Biotic Integrity. Data from Spring 2007 show that about 55 percent of the Bay's phytoplankton communities were considered healthy.

The historic data featured in this indicator changed from the 2006 assessment due to the inclusion of additional data from Virginia.

### WETLANDS

Wetlands link land to the water. In both tidal and non-tidal parts of the Bay, they serve as critical habitat to terrestrial and aquatic life, and act as sponges and natural filters by absorb-

ing runoff and removing pollutants from water before they can reach local streams and the Bay. Many researchers believe Chesapeake Bay tidal wetlands are threatened by sea level rise, storms, shoreline development and invasive species.

As of 2005, there were approximately 283,946 acres of tidal wetlands in the Bay. Assessment of the long-term data show that there is a declining trend in tidal wetland abundance in the Chesapeake Bay. According to the land change statistics there was a 2,600 acre loss between 1996 and 2005. However, this change is not statistically significant at the baywide scale due to limitations of the data.

While the changes are not significant on a baywide scale, there are some significant changes on a local scale. Aerial photography in specific locations around the Bay, such as Blackwater National Wildlife Refuge on Maryland's Eastern Shore, has been used to visually document significant loss of wetlands.

This indicator is not intended to speak to the quality or health of the wetlands being analyzed; it is simply a quantitative tool. For more information about wetland improvement efforts, see *Chapter Three: Restoration Efforts*.

## Fish and Shellfish

The long-term health and sustainability of the Bay's fish and shellfish is critical to restoring the ecosystem. Ample aquatic habitat, clean water and well-managed fisheries are key components for abundant fish and shellfish populations in the Bay.

### BLUE CRAB

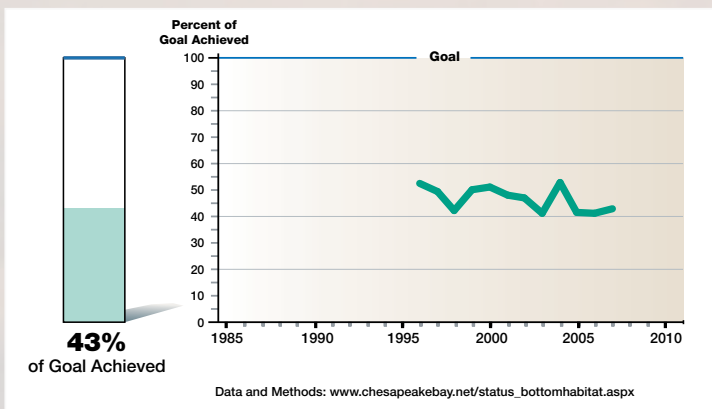
It is estimated that about one-third of the nation's blue crab catch comes from the Chesapeake Bay.

Scientists estimate that the population of blue crabs in the Chesapeake Bay in 2007 is about 78 percent of the 200 million blue crab interim target. However, blue crab abundance continues to be low and the stock is not rebuilding as had been anticipated.



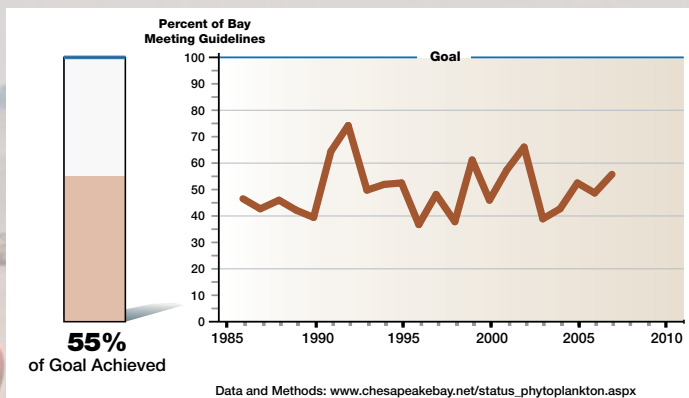
## BOTTOM HABITAT

Benthic Index of Biotic Integrity

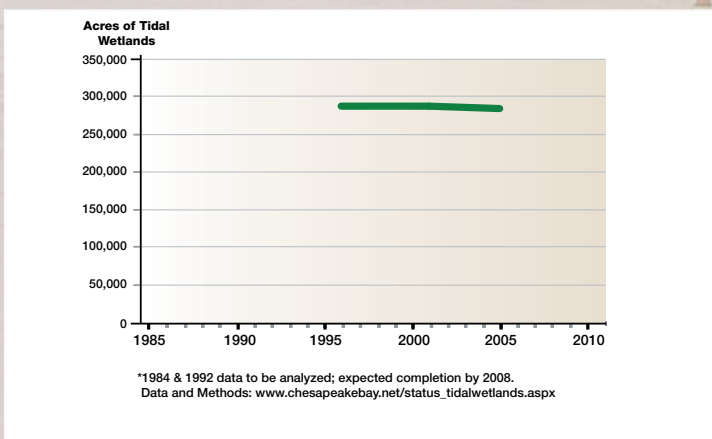


## PHYTOPLANKTON

Index of Biotic Integrity

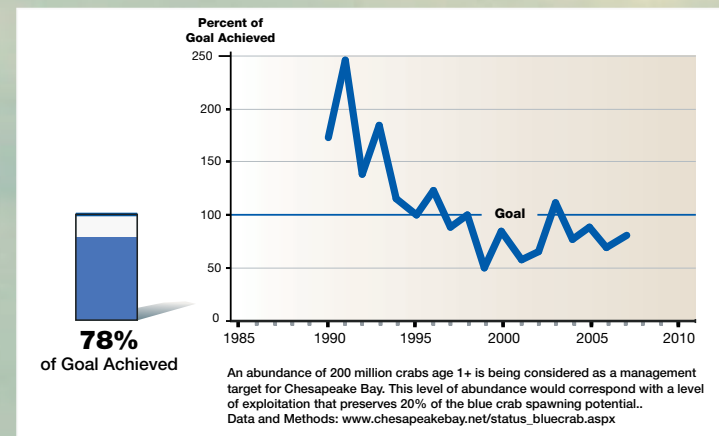


## TIDAL WETLANDS ABUNDANCE



## BLUE CRAB ABUNDANCE

(age 1 and Older)



*Scientists estimate that the population of native oysters in the Chesapeake Bay in 2006 was about 8 percent of current restoration goals.*

These blue crab population estimates are made through a winter dredge survey. Currently, the blue crab fishery remains vulnerable to overexploitation; therefore, harvest restrictions will continue to remain in place. Proper management of the blue crab harvest, improved water quality and habitat restoration efforts will help improve the Bay's blue crab populations.

The historic data featured in this indicator in the 2006 Assessment changed because Bay fisheries scientists made a revision to the interim target population changing it from 232 to 200 million blue crabs.

### STRIPED BASS

Striped bass support one of the most important commercial and recreational fisheries on the Atlantic seaboard. The Chesapeake Bay is the primary spawning and nursery habitat for striped bass on the Atlantic Coast. Over-harvesting during the 1970s and 1980s contributed to the decline of the spawning stock in Chesapeake Bay and along the Atlantic Coast. There was a fishing moratorium in the Bay in the late 1980s and there have been commercial quotas and recreational harvest limits since the fishery was reopened in 1990.

Striped bass are also one of the top predators in the Chesapeake Bay food web and prey availability may be an important factor affecting abundance and growth. In 1995, the population had increased to the point where the stock was considered restored. While striped bass biomass remains high, scientists are particularly concerned with the high prevalence of disease (mycobacteriosis) and the abundance of prey, including menhaden, small crabs and other food, to adequately support the nutritional needs of the population.

Research is underway to better understand the disease's impact on the Bay's striped bass population. The current status of Bay striped bass – high abundance but uncertain health – illustrates the need for an ecosystem-based fisheries management approach in Chesapeake Bay.

The historic data featured in this indicator changed from the 2006 Assessment due to a planned update in 2007 of the models used by the Atlantic States Marine Fisheries Commission (ASMFC) to assess the status of the stock.

### OYSTERS

For more than a century, oysters constituted one of the Bay's most valuable commercial fisheries. Over-harvesting, pollution and the diseases Dermo and MSX have caused a severe decline in their numbers throughout the Chesapeake Bay. Scientists estimate that the population of native oysters in the Chesapeake Bay in 2006 was about 8 percent of current restoration goals.

### SHAD

This new indicator of shad abundance adds assessments of shad in the Potomac, York and James rivers to the assessment of Susquehanna River shad featured in the 2006 Assessment. In the last two years, some tributaries have shown signs of recovery (Potomac and York rivers), while other areas have exhibited a decline (James and Susquehanna rivers); overall, shad abundance continues to be at depressed levels. Based on the most recent data from four Bay rivers, the baywide shad abundance index is 22 percent of goal achieved.

### MENHADEN

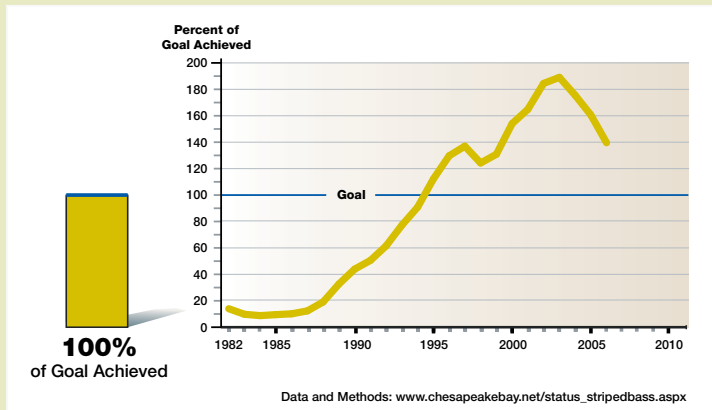
Menhaden play a key ecological role in the Bay as an important prey species for top predators such as striped bass, and for their ability to filter the water. The menhaden fishery is one of the most important and productive on the Atlantic Coast, providing fish meal, fish oil and bait for the blue crab and other fisheries.

Atlantic menhaden that inhabit the Chesapeake Bay are a part of a coastal Atlantic stock. Populations along the Atlantic Coast are healthy, but some scientists are concerned about low abundance in Chesapeake Bay. The number of juvenile menhaden in Chesapeake Bay are significantly lower than numbers present in the mid-1970s through the mid-1980s, and have remained at fairly stable, but low, levels for the last 14 years.

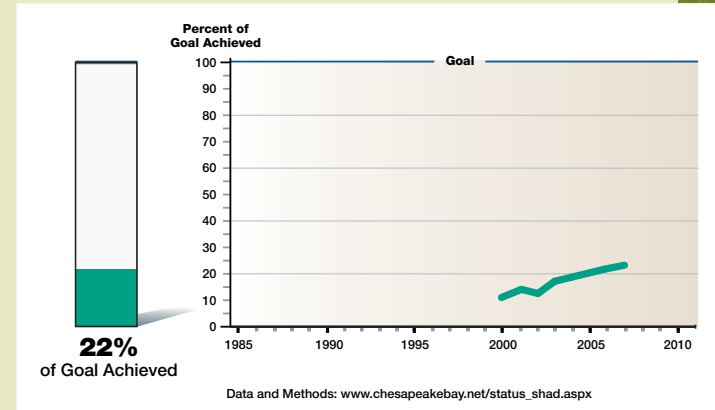


## STRIPED BASS ABUNDANCE

(Spawning Female Biomass)

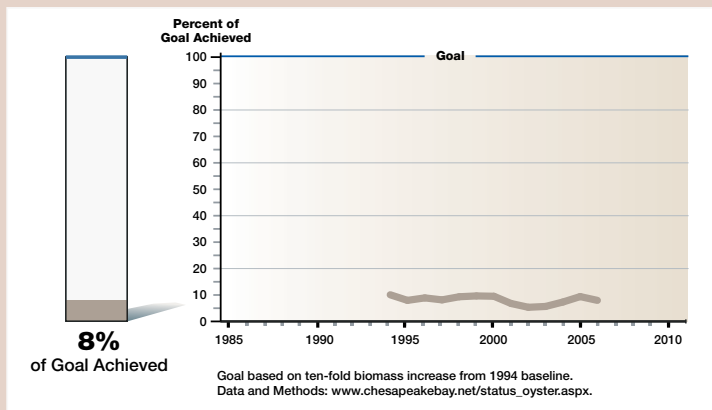


## SHAD RETURNING TO CHESAPEAKE BAY

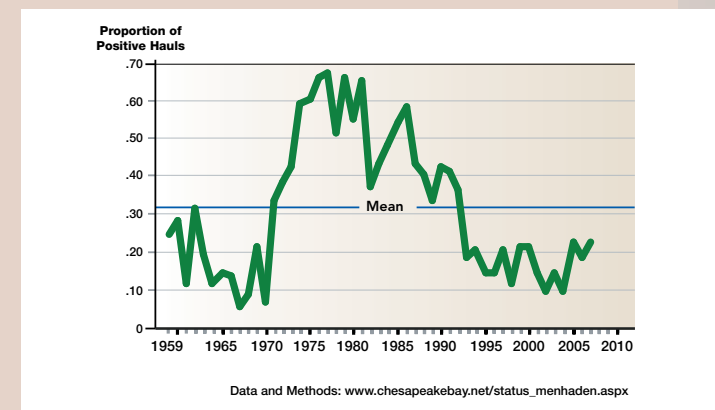


## NATIVE OYSTER ABUNDANCE

(Biomass)



## JUVENILE MENHADEN ABUNDANCE IN MARYLAND



The Chesapeake Bay is affected by multiple factors, ranging from population growth to climate variability, which will challenge the recovery of this important ecosystem.

Population growth and agricultural lands have contributed to an overabundance of nutrients, sediment and contaminants entering the Bay, and loss of habitats that can retain these pollutants. Climate change and variability have caused water temperatures in the Bay to exhibit greater extremes during the 20th century than the previous 2,000 years. Sea level rise related to climate change is contributing to the loss of vital coastal wetlands.

Historic over-harvest, compounded by the impacts of poor water quality, disease and blocked access to historic spawning grounds, has resulted in low abundances of oysters, crabs and shad. The cumulative impact of pollutants, habitat loss, over-harvesting, invasive species, climate change and disease has affected the health of fish and bird populations in the Bay and its watershed.

The U.S. Geological Survey, a Bay Program partner, recently released a report that provides a comprehensive five-year summary of science about the multiple factors affecting the degradation of the Chesapeake Bay ecosystem. Among the key findings on land use and its relation to water quality and habitats:

- Impervious surfaces increased 41 percent during the 1990s compared to an 8 percent increase in population. The rate of increase of impervious surface implies there will be more rapid delivery of nutrients to streams and an increase in sediment erosion.
- There has been a decrease in nitrogen and phosphorus concentrations at a majority of the river water quality monitoring sites throughout the watershed. However, concentrations are not decreasing at a rate that would sufficiently reduce nutrient loads to the Bay to meet water quality standards by 2010.
- Sediment continues to have an adverse impact on water clarity and underwater grasses in the Bay and stream quality in the watershed.

- The travel time of nutrients and sediment through the watershed ranges from weeks to centuries. This can result in a “lag time” between implementing management actions and improvements in water quality.
- Synthetic organic pesticides and their degradation products have been widely detected at low levels in the watershed, including emerging contaminants such as pharmaceuticals and hormones.

Among the key findings on the fish and bird populations:

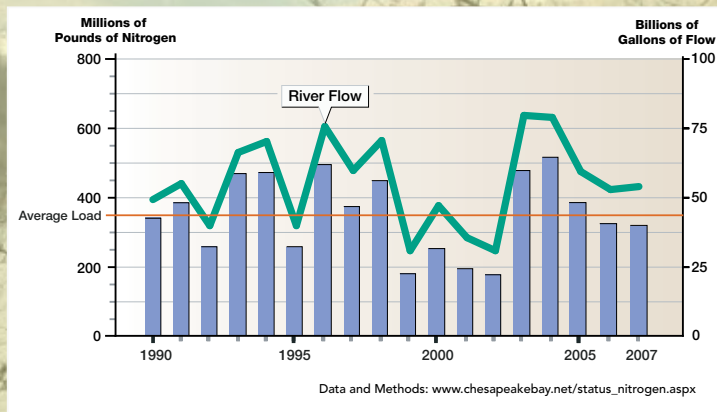
- The health of fish populations in the Bay is affected by multiple factors including degraded water quality, pathogens, and disease.
- Fish (principally male bass) in the Potomac watershed have testicular oocytes – female eggs growing in their testes – a form of intersex. Reproductive abnormalities in fish have been strongly linked with a variety of contaminants that affect the endocrine systems of fish.
- Habitat loss, invasive species and poor water quality have affected the food sources and habitat for seaduck populations, which have declined over the past several decades.

Among the key findings related to climate change:

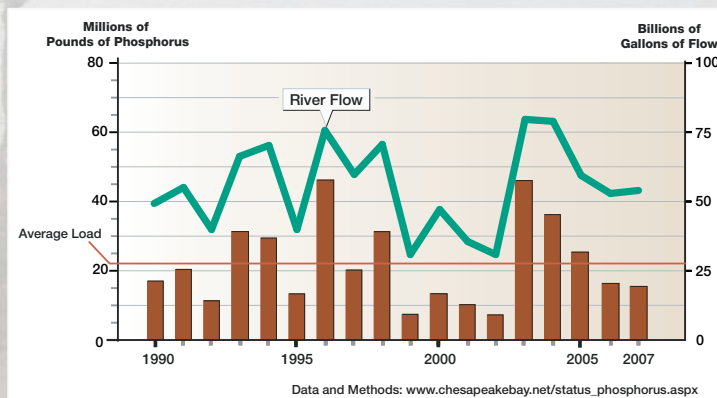
- Low dissolved oxygen conditions have been much more extensive and severe during the past four decades than at any time in the past 2,500 years. These conditions are influenced both by climate change and population growth in the watershed.
- Sea level rise due to climate change and land subsidence will continue to cause losses and landward migration of tidal wetlands during the coming century. Sea level rise is also causing sediment erosion in low-lying shoreline areas which has an adverse effect on water clarity in the Bay.



## RIVER FLOW AND NITROGEN LOADS REACHING CHESAPEAKE BAY



## RIVER FLOW AND PHOSPHORUS LOADS REACHING CHESAPEAKE BAY



*Provisional estimates indicate that approximately 318 million pounds of nitrogen reached the Bay during the 2007 water year.*

### River Flow and the Pollutant Loads Reaching the Bay

Annual Bay water quality conditions are largely determined by a combination of the amount of pollution deposited on the land and the amount of water flowing into the Bay. Rainfall affects the volume of water flowing into the Bay from its many freshwater streams and rivers. The amount of freshwater flowing to the Bay impacts the saltiness (salinity) of Bay waters. River flow is generally fast-moving and turbulent, mixing the Bay's waters and capturing oxygen from the air. Total river flow to the Bay during the 2007 water year (October 2006-September 2007) was very close to the long-term average despite several months of extremes.

As river flow increases, its potential to carry additional amounts of pollutants increases as well. Scientists estimate annual pollutant loads to the Bay through a combination of monitored water samples and modeled information.

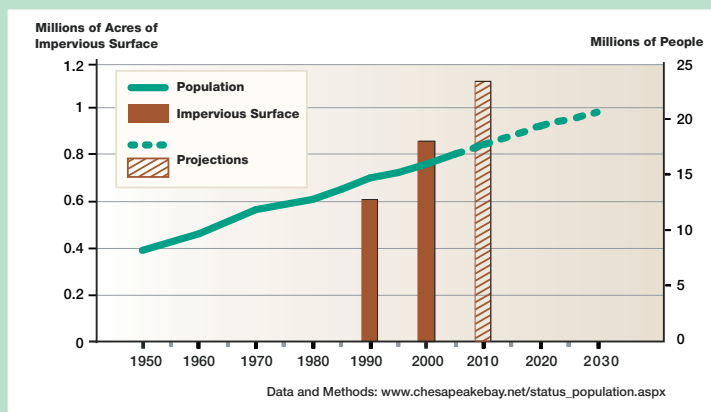
Whenever practical, scientists measure pollution levels in water samples from the rivers and wastewater pipes that flow into the Bay. Model-generated estimates are used where monitoring is not practical, when no data are available or data do not meet specific requirements and/or are outdated. By capturing water samples at the point where large, free-flowing rivers meet tidal waters, scientists can calculate pollution loads from 78 percent of the watershed land area. For the remaining area, loads from wastewater and model-generated estimates are used. This combination of monitoring and modeling data allows scientists to provide the most practical accounting of the amount of pollution reaching the Bay.

Provisional estimates indicate that approximately 318 million pounds of nitrogen reached the Bay during the 2007 water year, which is similar to the average load for 1990-2007. This amount is almost double the restoration target of 175 million pounds of nitrogen.

Provisional estimates indicate that approximately 15 million pounds of phosphorus reached the Bay during the 2007 water year, which is below the 1990-2007 average. This amount is above the target level of 12.8 million pounds of phosphorus to reach the Bay. Additional pollution-fighting measures are being put in place throughout the watershed to reduce total pollution loads in the future.

Based on water samples collected at the point where large, free flowing rivers meet tidal waters, 2.8 million tons of sediment were delivered to the Bay in the 2007 water year. This is below the average load for 1990-2007. The sediment load estimates do not account for sediment from the coastal plain areas of the watershed. Scientists are currently developing methods to quantify the total loads of sediment to the Bay.

#### BAY WATERSHED POPULATION AND IMPERVIOUS SURFACE





## Land Use

The human population in the Chesapeake Bay watershed has more than doubled since 1950 from 8 to over 16.7 million, intensifying the stresses that affect the Bay and its tidal tributaries. Between 1990 and 2000, impervious surfaces increased at nearly five times the rate of population growth, from 611,017 to 860,004 acres. At that rate of increase, it is estimated that an additional 250,000 acres will become impervious between 2000 and 2010.

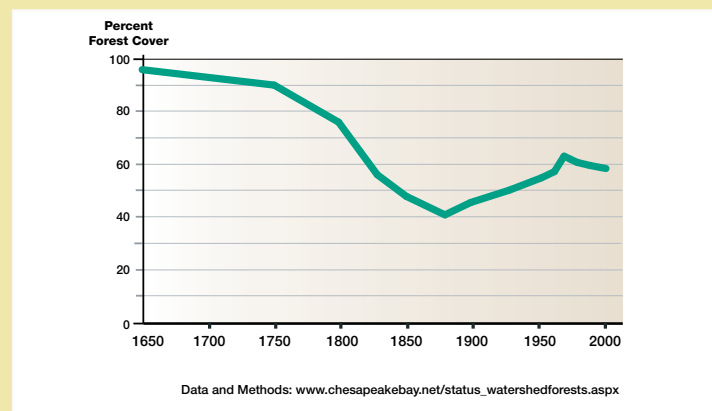
Impervious surface is defined as a surface or area that is hardened and does not allow water to pass through. Roads, rooftops, driveways, sidewalks, pools, patios and parking lots are all impervious surfaces.

While the overall population of the Bay watershed continues to grow, population changes vary from state to state and region to region. Some areas are gaining population at a high rate, while populations in other areas are leveling out or declining.

In the 1600s, about 95 percent of the Chesapeake Bay watershed was forested. Forests now cover only 58 percent, or 24 million acres. More than 750,000 acres – equivalent to 20 Washington, DCs – have been developed since the early 1980s, and the Bay watershed now loses forestland at the rate of 100 acres each day. If current trends continue, an additional 9.5 million acres of Chesapeake forests will be threatened by conversion to residential development by 2030.

Forests protect and filter drinking water for 75 percent of the Bay watershed's residents and provide valuable ecological services and economic benefits including carbon sequestration, flood control, wildlife habitat and forest products.

### BAY WATERSHED FOREST COVER



Retaining and expanding forests in the Chesapeake Bay watershed is critical to our success in restoring the Chesapeake Bay. Forests are the most beneficial land use for protecting water quality, due to their ability to capture, filter and retain water, as well as absorb pollution from the air. In fact, our watershed forests are excellent assimilators of air pollution, retaining up to 85 percent of the nitrogen they receive from air emission sources such as motor vehicles and electric utilities. Conversely, a reduction in forest area leads to a disproportionate increase in nitrogen loads to our waterways.



There are many notable individual accomplishments relating to Chesapeake Bay watershed restoration; however, Bay Program partners need to accelerate the pace of water quality improvement efforts.

### Reducing Pollution

Clearer, oxygen-rich waters are the foundation of Chesapeake Bay restoration. The Bay and its tidal rivers receive more nutrients and sediment than a healthy ecosystem can handle. Bay jurisdictions have developed river-specific cleanup strategies detailing activities that need to be implemented to reduce the amount of nutrients and sediment delivered to the Bay. Monitoring and tracking data and computer simulations are used to estimate the amount of pollution control efforts implemented in relation to the commitments made by the Bay jurisdictions in their cleanup strategies. The data featured in this section include efforts through only a portion of 2007.

The pollution control efforts are occurring in four major areas or “source sectors”: agriculture, wastewater, urban/suburban and air. The relative contributions of pollutant loads to the Bay from these four source sectors are detailed in the chart on page 21.

#### AGRICULTURE

Farmers employ dozens of conservation practices (also known as best management practices or BMPs) to reduce the amount of pollution reaching local waters and the Bay. Since 1985, the partners have achieved 48 percent and 51 percent of the goals for agricultural nitrogen and phosphorus pollution control efforts, respectively, and 48 percent of the goal for sediment pollution control efforts called for in the jurisdictions’ cleanup strategies. These estimates do not account for efforts that can not be tracked, such as BMPs installed voluntarily by private landowners without the use of public funds. While no pollution reduction can be attributed to these private efforts, they will still contribute to the overall improvement of water quality that is assessed in *Chapter One: Ecosystem Health*.

In part because they are so cost-effective, the Bay jurisdictions are relying on expanded implementation of BMPs on agricultural lands, such as planting winter cover crops, for

more than half of the remaining nutrient reductions needed to meet water quality restoration goals.

#### WASTEWATER

Decreases in the amount of nutrients discharged from wastewater treatment plants account for a large portion of the estimated nutrient reductions in the watershed to date. As the Chesapeake watershed’s population continues to grow, the volume of waste requiring treatment grows. In 2005, Bay jurisdictions began putting into place a new permitting approach that requires hundreds of wastewater treatment plants to install a new generation of nutrient reduction technology equipment. Bay jurisdictions are relying on additional reductions from wastewater treatment plants for achieving about 15 percent of their nutrient reduction goals. Since 1985, the partners have achieved 69 percent of their wastewater nitrogen reduction goal and 87 percent of their wastewater phosphorus reduction goal.

#### URBAN/SUBURBAN LANDS AND SEPTIC SYSTEMS

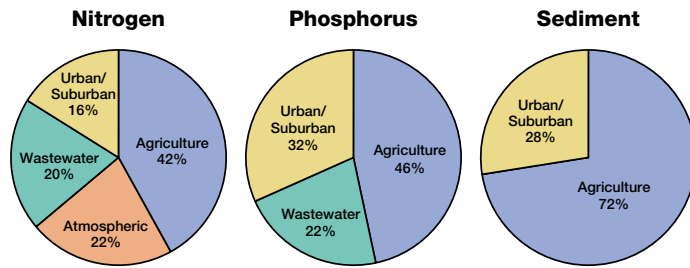
Stormwater that runs across roads, rooftops and other hardened surfaces carries harmful pollution to local streams and into the Chesapeake Bay. These pollutants include nitrogen, phosphorus, sediment and many chemical contaminants.

About one-quarter of the nutrient reductions called for in the jurisdictions’ cleanup strategies are expected to come from efforts to reduce, treat or prevent pollution from urban/suburban lands and septic systems. While improvements have been made in landscape design and stormwater management practices, significant challenges still exist in accounting for existing on-the-ground control practices.

That aside, to date, it is estimated that the pollution increases associated with land development (e.g., converting farms and forests to urban/suburban developments) have surpassed the gains achieved from improved landscape design and

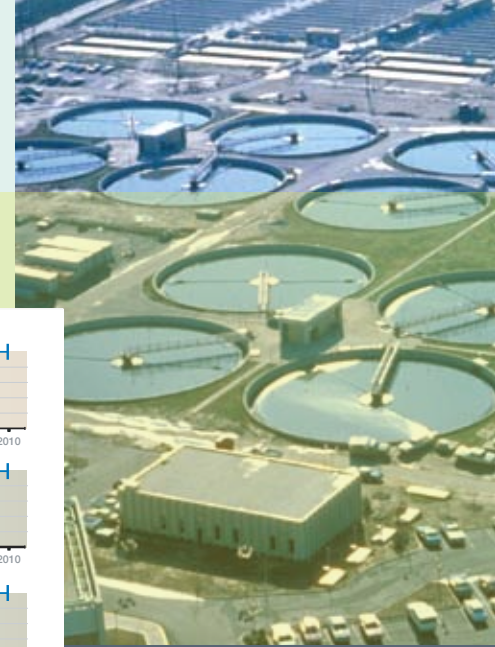
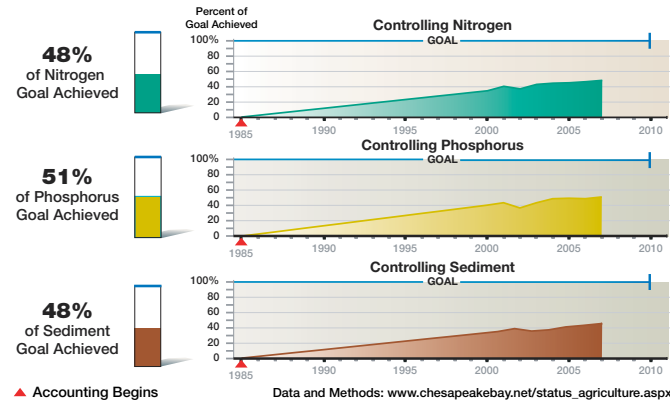


## RELATIVE RESPONSIBILITY FOR POLLUTION LOADS TO THE BAY (2007)

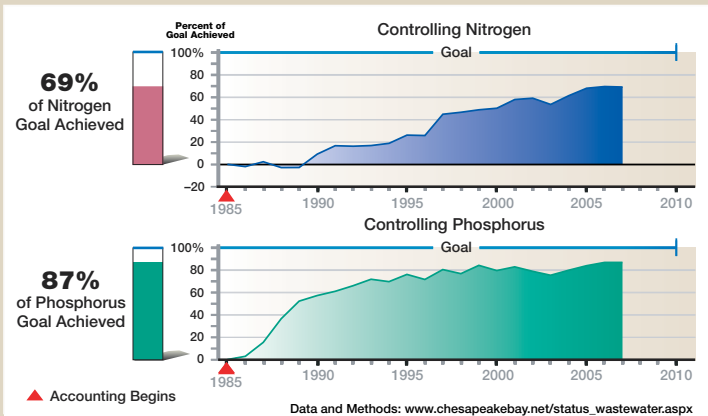


Wastewater loads based on measured discharges; the rest are based on an average-hydrology year. Does not include loads from direct deposition to tidal waters, tidal shoreline erosion or the ocean. Data and Methods: [www.chesapeakebay.net/status\\_reducingpollution.aspx](http://www.chesapeakebay.net/status_reducingpollution.aspx)

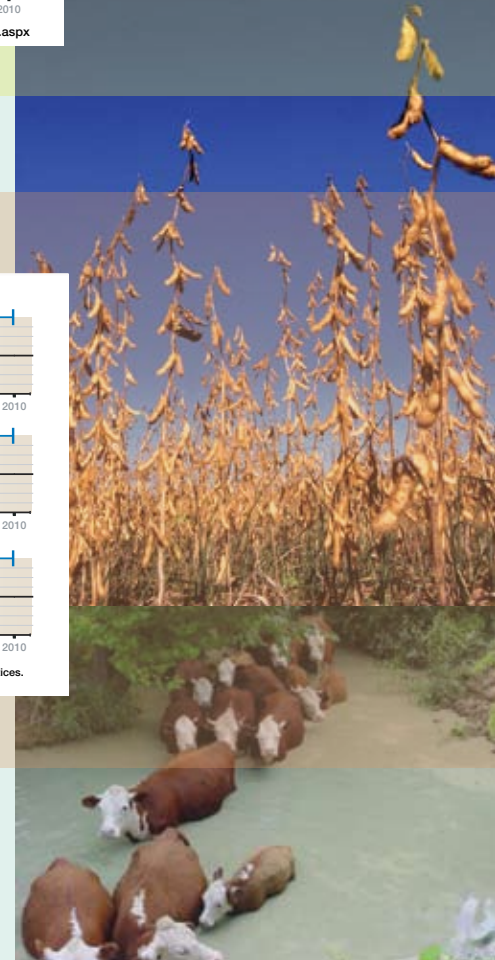
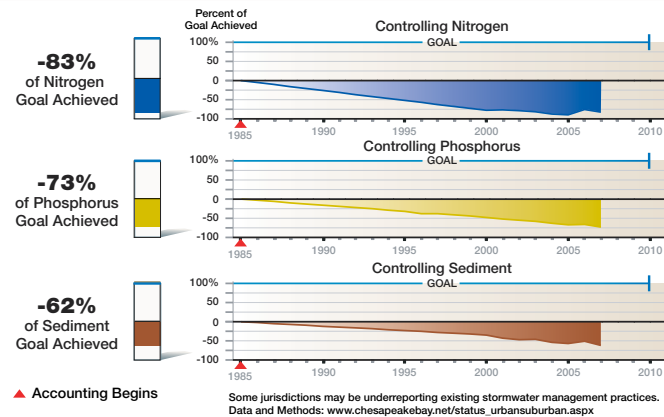
## AGRICULTURAL POLLUTION CONTROLS



## WASTEWATER POLLUTION CONTROLS



## URBAN/SUBURBAN POLLUTION CONTROLS



## Chapter Three: Restoration Efforts

*An estimated reduction of 8 million pounds of nitrogen delivered to the Bay will be achieved by 2010 through Clean Air Interstate Rule (CAIR) reductions.*

stormwater management practices. The rapid rate of population growth and related residential and commercial development coupled with the ongoing issues associated with accounting for the existing practices has made this pollution source sector the only one in the Bay watershed which continues to still be growing, and thus showing the overall “progress” as negative.

### AIR POLLUTION

Pollutants are emitted into the air primarily from vehicles, power plants, agriculture and other industries. These pollutants eventually fall onto water surfaces and the land where they can be washed into local waterways. Reducing the release of airborne nitrogen pollution is likely to have the additional benefit of reducing the release of toxic chemicals. The Bay jurisdictions are relying upon federal and state air pollution control programs to reduce airborne nitrogen emissions significantly by 2010. This is largely due to mandated air regulations on power plant point emissions of nitrogen oxides (NO<sub>x</sub>). An estimated reduction of 8 million pounds

of nitrogen delivered to the Bay will be achieved by 2010 through Clean Air Interstate Rule (CAIR) reductions.

## Restoring Habitats

Restoring high-quality habitat is critical to bringing the Bay ecosystem back into balance. Healthy habitats provide animals with access to food, shelter and safe areas to raise young.

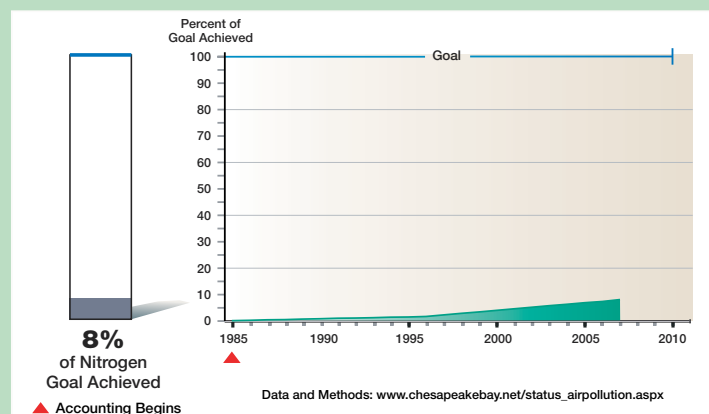
Restoration efforts have focused on increasing four habitat types. An effort to plant underwater grasses has seen mixed success in recent years, but the Program’s fish passage efforts are both long-standing and generally successful. Restoring wetlands is a major focus area, and in 2005 the partners agreed to expand their goal in this area. Oyster reefs were once a vital habitat for entire underwater communities. Oyster restoration efforts have focused on enhancing habitat through shell plantings and the use of alternate substrates. Efforts also include designating sanctuaries, protecting areas from harvest and using hatchery seed to increase the number of healthy oysters in the Bay.

### PLANTING BAY GRASSES

Not only do Bay grasses help improve water quality, they also generate food and habitat for waterfowl, fish, shellfish and invertebrates. Restoring underwater Bay grasses to reach the healthy habitats goal of 185,000 acres relies overwhelmingly on the natural expansion of beds that is highly dependent on adequate water quality. Bay managers have begun to supplement pollution reduction efforts with experimental Bay grass plantings where predicted improvements in water quality would support Bay grasses where none currently exist. These newly planted grasses act as seed sources which in turn produce more grass beds as water quality improves.

In 2003, Bay Program partners adopted the “Strategy for the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay,” including a commitment to plant 1,000 acres by 2008. About 14 percent of the goal has been

### AIR POLLUTION CONTROLS





met, commensurate with the amount of funding received. Managers continue to evaluate the best and most cost-effective methods for planting Bay grasses. For more on the status of Bay grasses, please see *Chapter One: Ecosystem Health*.

### RESTORING OYSTER REEFS

Oyster reefs are an essential component of the Bay ecosystem, providing healthy habitat for other bottom-dwelling organisms as well as schools of fish. Reef restoration efforts include planting oyster shells and alternate substrate materials to rebuild habitat and planting hatchery-produced spat (juvenile) oysters on natural and man-made oyster habitats throughout the Bay. In 2007, 776 acres were treated, sometimes with multiple efforts on the same site.

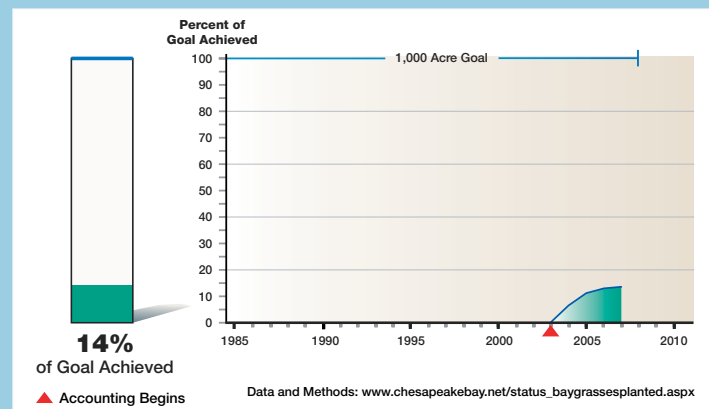
Restoring oyster reefs is an important component of the partners strategy for increasing native oyster populations. The success of these habitat restoration techniques has been limited by numerous factors including disease, fishing pressure and resulting habitat destruction, and poor water quality caused by human population growth and land use changes. For more information on oysters, please see *Chapter One: Ecosystem Health*.

### REOPENING FISH PASSAGE

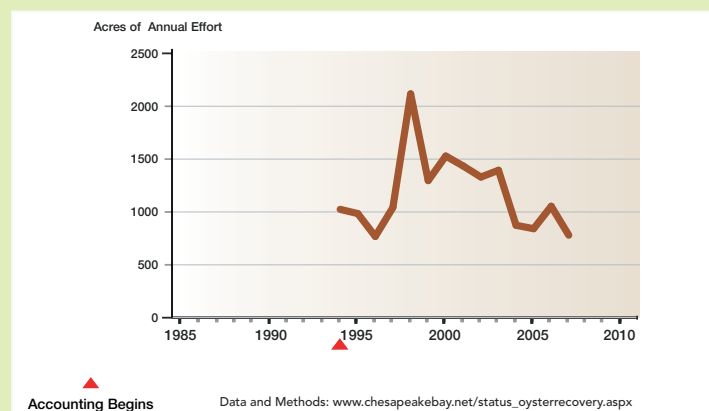
Dams, culverts and other obstructions block the movement of fish in many of the rivers and streams of the Bay watershed. By removing physical obstacles, key species like American shad are able to return to their native spawning grounds and increased habitat is available for resident fish. In addition to opening habitat to migratory fish, fish passage projects also restore flow, stream continuity, mediate sediment load and reduce habitat fragmentation.

From 1988 through 2005 the partners had opened 1,838 miles of fish passage, surpassing their original 1,357-mile restoration goal. In early 2005, the Bay Program partners committed to increasing the restoration goal to 2,807 miles by 2014. During 2006 and 2007 an additional 427 miles of

### BAY GRASSES PLANTED



### NATIVE OYSTER ANNUAL RESTORATION EFFORTS



## Chapter Three: Restoration Efforts

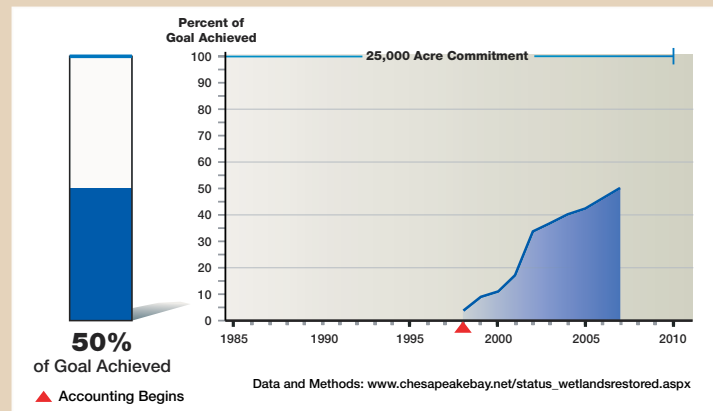
habitat were made available, bringing the cumulative total to 2,266 miles – achieving 81 percent of the 2014 goal.

### RESTORING WETLANDS

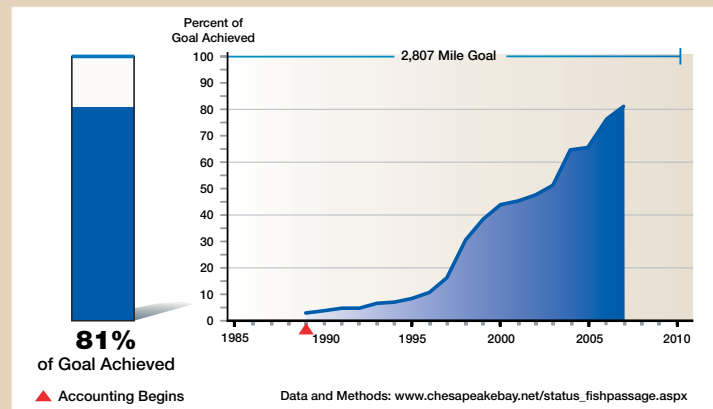
Wetlands serve multiple ecological functions. Restoring and enhancing wetlands throughout the watershed can provide critical wildlife habitat for many diverse species including finfish, shellfish, amphibians, birds and mammals. The Bay Program's current strategy commits partners to restoring 25,000 acres of wetlands by 2010, and as of 2007 they are 50 percent of the way toward achieving this goal.

In addition to habitat, wetlands also help clean the water by filtering excess nutrients and sediments. To improve water quality, the Bay watershed states call for the restoration of 200,000 acres of wetlands in their tributary cleanup plans. Progress toward this water quality goal is measured in part in the Reducing Pollution summary chart in the *Executive Summary*.

### WETLANDS RESTORATION EFFORTS



### OPENING RIVERS TO MIGRATORY FISH



## Managing Fisheries

### ECOSYSTEM-BASED FISHERIES PLANS

Chesapeake Bay ecosystem-based fishery management plans are being developed for five key species – oysters, blue crabs, American shad, striped bass and Atlantic menhaden. The index shows the three basic steps to expanding fishery management to include ecosystem considerations: actions that are species specific; actions that include multi-species interactions; and other actions that will broaden the management perspective to include ecosystem structure and function. Single species plans are already being implemented but ecosystem-based plans are more complex and will take time to fully develop and implement.

While some significant effort was undertaken to improve the management of Chesapeake Bay fisheries this year, very few of these efforts resulted in changes to fisheries management plans or the implementation of these plans. As a result, the index values for all the fisheries assessed remains unchanged from the 2006 Assessment. Progress toward fisheries management goals ranges from 37-63 percent for the five key Bay fisheries. Note: the index does not gauge the health of the fisheries which is covered in *Chapter One: Ecosystem Health*.

### OYSTERS

Oysters provide important ecological services to the Bay including important structural habitat for finfish and shellfish, filtering capabilities and sediment stabilization. The new ecosystem-based management approach will take these important ecological services into consideration. Oyster harvest is currently managed using minimum size limits, gear restrictions, seasonal and geographic closings and bushel limits. Fisheries targets and thresholds have not been established in the current plan. Restoration efforts include expanding the amount of clean, hard surfaces for oyster spat (juvenile oysters) to settle, increasing the number of breeding



adult oysters, establishing sanctuaries and combating oyster diseases.

While the effort score did not change this year, there was some notable progress on the research and management front, including the use of genetically modified strains of oysters, modeling the transport of larvae, modeling population fluctuations under different environmental circumstances, implementing new monitoring protocols and compiling a comprehensive baywide database of oyster information.

### BLUE CRABS

Blue crabs are currently managed as a single species using biological reference points, abundance and exploitation targets. The fishery is managed through minimum size limits, gear restrictions and seasonal limits on harvest to keep fishing pressure at acceptable levels. An annual review of the blue crab stock is conducted to determine the status of the stock. Currently, fishing pressure is set to levels that should allow for increased abundance. Blue crabs play an important role as both predator and prey in the Bay ecosystem. Interactions between blue crabs and striped bass, their predators, have been examined. In addition, some management recommendations have been implemented such as special openings in traps to allow the escape of non-targeted species.

While the effort score did not change this year, there were a host of research and monitoring activities in 2007, including investigations into the potential effects of ghost crab pots on blue crab mortality estimates, as well as improved growth rate estimates for stock assessment updates. However, none of these activities has at present led to change in the management plan.

### AMERICAN SHAD

By the mid-1970s, American shad stocks had been greatly diminished by overfishing, water pollution and spawning migration obstructions (dams). In 1980, Maryland implemented an American shad fishing moratorium and in 1994

Virginia followed, thus effectively banning direct harvest throughout the Bay.

Current management measures to promote the recovery of American shad in Chesapeake Bay include a moratorium on shad fishing with a limited bycatch allowance; the release of hatchery-raised fish; the removal of obstructions to migration; and the installation of fish passages. Over the last two decades shad stocks have been slowly rebuilding.

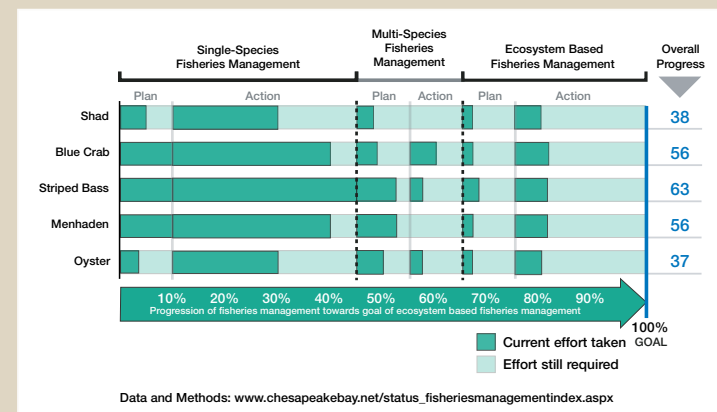
Before the fishery is reopened, catch limits (thresholds) and safe levels of harvest (targets) will need to be developed through the ecosystem-based fishery management process.

While some significant and important management and research has been conducted over the past year, including a coastal stock assessment report and the development of a new indicator of population health, no changes have been made to the fishery management plan, hence no increase in score.

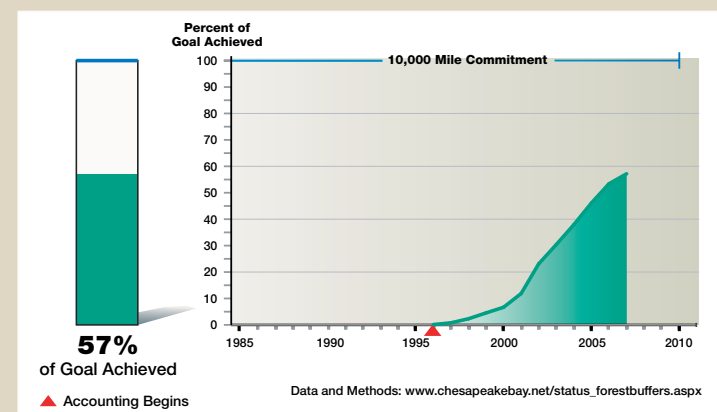
### STRIPED BASS

Maryland and Delaware instituted a moratorium on all striped bass fishing in 1985, following the collapse of the fishery during the early 1980s. Virginia and the Potomac River Fisheries Commission did so in 1989. Since the

## FISHERIES MANAGEMENT EFFORT INDEX



## RIPARIAN FOREST BUFFERS PLANTED



## Chapter Three: Restoration Efforts

moratorium was lifted in 1990, the stock has been rebuilt and maintained through an adaptive management approach, based upon constant monitoring and the use of catch quotas and seasonal closings. Currently the stock is at high levels of abundance. Striped bass are recognized as one of the top

predators in the Chesapeake Bay and impact forage species such as Atlantic menhaden. The recently proposed annual cap on the commercial harvest of Atlantic menhaden was adopted in part due to the dietary importance of menhaden to the striped bass population.

While some significant and important management and research has been conducted over the past year including the completion of tagging studies within the Bay leading to improved estimates of natural mortality rates, it has not led to any changes in the fishery management plans, hence no increase in score.

### ATLANTIC MENHADEN

Atlantic menhaden are managed as a coastal population under a single species approach. Atlantic menhaden that inhabit the Chesapeake Bay are a part of a coastal Atlantic stock. Populations along the Atlantic Coast are healthy, but some scientists are concerned about low abundance in Chesapeake Bay.

Menhaden are a significant part of the aquatic food chain and as such, multi-species management is critical. Currently, predator-prey and by-catch interactions are relatively well defined. Menhaden feed primarily on plankton and are prey for top predators such as striped bass and bluefish.

There is concern over the steady decline in the number of young menhaden produced in Chesapeake Bay. This decline, and other concerns with the fishery, prompted Virginia's adoption of a five-year cap on the commercial harvest of menhaden starting in 2006. Critical research will be performed while the harvest cap is in effect.

There has been no progress towards developing an ecosystem-based management plan in 2007. All management considerations have occurred at the coastal level.

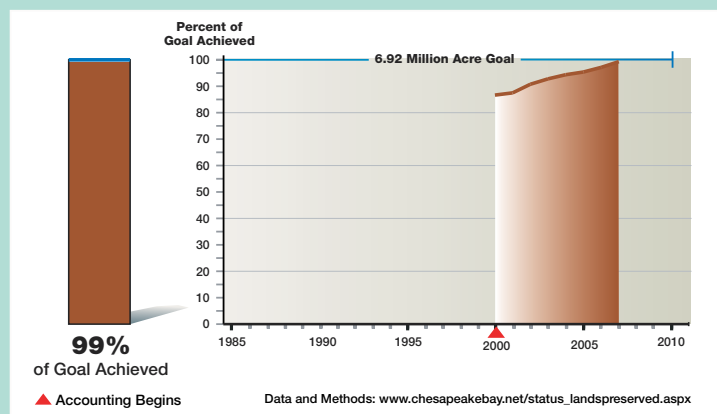
## Protecting Watersheds

The human population in the Chesapeake Bay watershed is now growing by about 130,000 residents annually. Planning for this growth is especially critical in this watershed because of the vast amount of land that drains into the relatively shallow Chesapeake. Restoration efforts center on reforesting streamside buffers and developing watershed management plans, as well as preserving open space and forests. Partners appear to be on track with many of their watershed protection efforts and are two-thirds of the way toward meeting current Bay Program goals, but these efforts appear to be inadequate in stemming the decline in water quality associated with population growth.

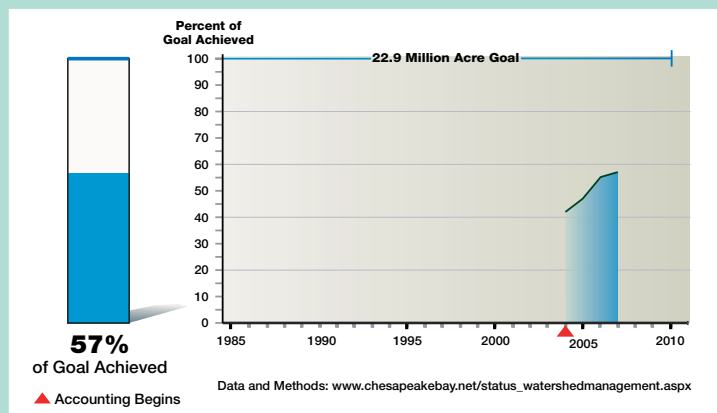
### CONSERVING FOREST BUFFERS

Streamside or riparian forest buffers provide habitat for wildlife, stabilize banks from erosion and keep river waters cool, an important factor for many fish. The Bay Program partners achieved their original 2010 buffer restoration goal of 2,010 miles well ahead of schedule and in 2003 raised that target to 10,000 miles. There have been 5,722 miles restored through

### WATERSHED LAND PRESERVATION



### WATERSHED MANAGEMENT PLANS DEVELOPED





2007, putting the Bay Program partners at 57 percent of goal achieved.

In addition to preserving the watershed, well-maintained forest buffers naturally absorb nutrients and sediments, thus improving water quality in neighboring streams. Riparian forest buffers also provide a source of large woody material input to streams that helps form and maintain important fish habitat and provides for channel stability. To improve water quality, the Bay watershed states call for the restoration of some 50,000 miles of riparian forest buffers in their tributary cleanup plans. Progress toward this water quality goal is measured in part in the Reducing Pollution summary chart in the *Executive Summary*.

#### **PRESERVING LANDS**

Maryland, Pennsylvania, Virginia and District of Columbia committed to permanently protect from development 20 percent of their combined 34.6 million acres by 2010. Parks, wildlife refuges and private lands protected through conservation easements are counted in this measure. By July 2007, a total of 6.88 million acres had been permanently preserved. With 99 percent of the goal achieved, the partners are very likely to meet the 2010 goal of 6.92 million acres preserved. The historic data featured in this indicator changed from the 2006 Assessment due to corrections by Virginia.

At its annual meeting in December 2007, the Chesapeake Executive Council signed the Forestry Conservation Initiative, committing the Bay states to permanently conserve an additional 695,000 acres of forested land throughout the watershed by 2020.

#### **DEVELOPING WATERSHED MANAGEMENT PLANS**

Watershed management plans address the protection, conservation and restoration of stream corridors, riparian forest buffers, wetlands, parklands and other open space for the purposes of preserving watershed health while enhancing

the quality of life in local communities. The Bay Program has a goal of developing and implementing locally supported watershed management plans in two-thirds of the Bay watershed. By the end of 2007 plans were in place for 13.1 million acres, more than half of the 22.9 million acres that should be covered under such plans by 2010. Translating these plans into action will be essential to restoring water quality (see *Chapter One: Ecosystem Health*).

## **Fostering Chesapeake Stewardship**

Accomplishing a comprehensive restoration plan for an ecosystem as complex as the Chesapeake Bay requires the full engagement of restoration leaders, citizens and all stakeholder groups throughout the watershed. All of the Bay's stakeholders require a base of information and motivation to take action. By providing an array of opportunities we optimize our chance to connect with people in the context of their interests, values and current level of understanding or motivation.

#### **PUBLIC ACCESS**

Personal interaction with the local rivers, streams and the Chesapeake Bay itself can help the public recognize the connection between the value of the Chesapeake and their individual interests. Local waterways that flow to the Chesapeake Bay, as well as the Chesapeake Bay itself, must matter to people in order to gain their support for restoration efforts. Since 2000, the Bay jurisdictions have acquired, developed or enhanced more than 100 public access points, and in 2007, Pennsylvania, Virginia and the District of Columbia added or enhanced 14 sites.

The Chesapeake Bay Gateways Network enhances place-based interpretation of Bay-related resources and stimulates volunteer involvement in resource restoration and conservation. Four new Gateway sites were added to the network in 2007, bringing the total to 156.



## Chapter Three: Restoration Efforts

*In 2007, 328 new water trail miles were developed, bringing the total to more than 2,000 miles.*

A mix of water trails managed by state, local and non-profit organizations has blossomed since 2000. The trails exist throughout the Bay and its tributaries and offer a variety of low-impact paddling experiences, connecting people to the natural, cultural and historic resources of the Bay. In 2007, 328 new water trail miles were developed, bringing the total to more than 2,000 miles.

In 2007, the National Park Service began the process to develop a comprehensive plan for managing and interpreting the nearly 3,000-mile-long Captain John Smith Chesapeake National Historic Trail. The Interpretive Plan will provide a vision for the future of interpretation and education for the trail and define long-term goals for meaningful connections between visitors and Bay resources.

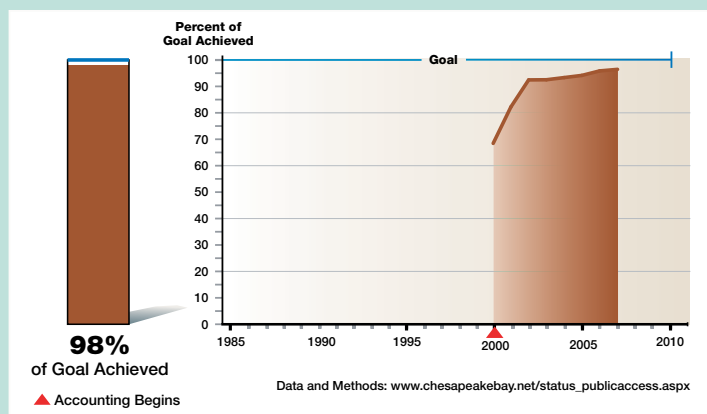
Overall, the partners have achieved 98 percent of established goals to enhance public access, create Gateways and establish water trails.

### COMMUNICATIONS AND OUTREACH

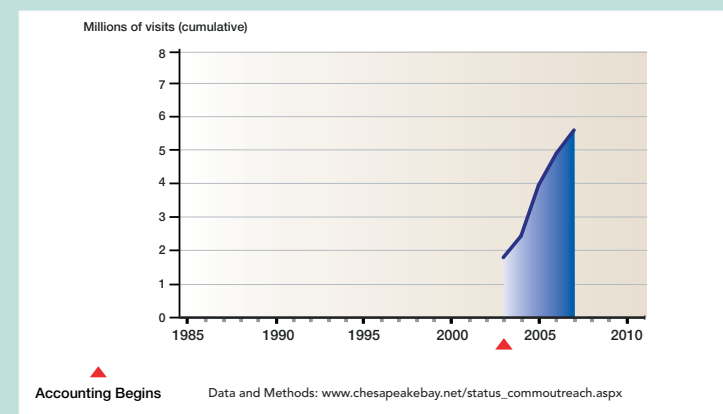
The partners believe that comprehensive and authoritative public information is essential to engage all stakeholders in the restoration effort. The Program has established a number of methods to meet this stewardship need. The *Bay Journal* newspaper reaches more than 50,000 print subscribers monthly, informing people about issues and events that affect the Chesapeake Bay. The monthly e-newsletter *Chesapeake Currents* is distributed to more than 1,000 subscribers, while the daily electronic *Bay News* service goes out to more than 1,100 users.

Publications, press releases, presentations, events and other communication and outreach efforts are also essential elements of the on-going effort to inform the public about the Bay and its watershed. The Bay Program's suite of websites was accessed by more than 5.6 million different users in 2007.

### PUBLIC ACCESS



### BAY PROGRAM WEBSITE VISITS





## EDUCATION AND INTERPRETATION

Formal environmental education opportunities allow for in-depth investigation and analysis that enhance a deeper understanding of ecological concepts, environmental inter-relationships and human implications. All signatory jurisdictions' school districts have incorporated curriculum that provides a meaningful outdoor watershed educational experience. Through 2007, the NOAA Bay Watershed Education & Training (B-WET) grants program has funded training opportunities for more than 15,000 teachers. More than 2.5 million Bay watershed students have participated in a field experience during their K-12 education.

The B-WET program, with support from the Chesapeake Bay Trust and the Keith Campbell Foundation for the Environment, recently completed an intensive multi-year evaluation that shows that students are more knowledgeable about the watershed and more likely to take action to protect the Bay after participating in B-WET supported programs. The study also showed that B-WET trained teachers are more

confident in their ability to use field experiences in teaching about the watershed and are more likely to do so.

Overall, the partners have achieved 84 percent of the current goal of providing a meaningful outdoor watershed educational experience to every student, starting with the class of 2005.

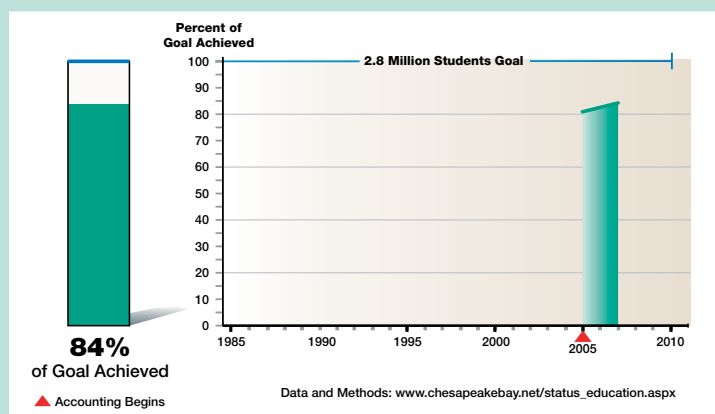
## CITIZEN AND COMMUNITY ACTION

Often, our ability to influence the public rests with the success we have connecting personal and local issues to the well-being of the Bay. By successfully making these connections, we can encourage people to take part in restoration programs as individuals or with their families; at home, at work and in their communities. An essential part of our work is to convert detailed technical information and teach skills to stakeholders groups who can implement best management practices in arenas such as watershed planning or habitat restoration.

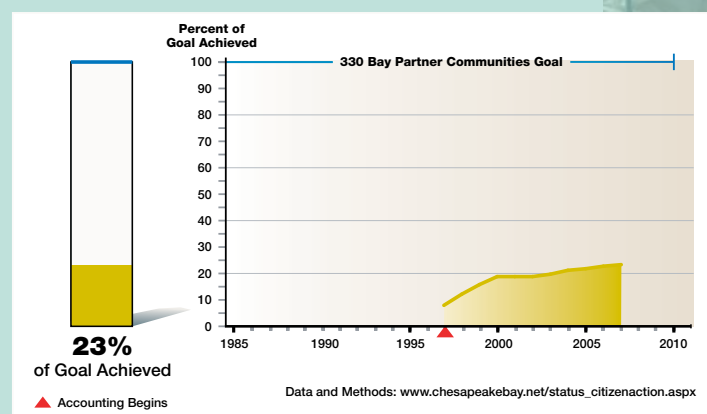
Businesses for the Bay is a voluntary effort by businesses committed to implementing pollution prevention in daily



### EDUCATIONAL FIELD EXPERIENCES PROVIDED



### BAY PARTNER COMMUNITIES



## Chapter Three: Restoration Efforts



operations and reducing releases of chemical contaminants and other wastes to the Chesapeake Bay.

Towns and cities are implementing Bay-friendly measures aimed at making their local communities as well as the Bay a better place to live, work and recreate. In 2007, two new local governments were awarded Bay Partner Community status, bringing the current total to 77.

Overall, the partners have achieved 23 percent of the existing goal to certify 330 Bay Partner Communities by 2005.

### 2007 Restoration Highlights

Through a series of Chesapeake Bay agreements, Bay Program signatories – the states of Maryland, the commonwealths of Pennsylvania and Virginia; the District of Columbia; the U.S. Environmental Protection Agency representing the federal government; and the Chesapeake Bay Commission representing Bay state legislators – have committed to reduce pollution, restore habitats and sustainably manage fisheries. Since 2000, the headwater states of Delaware, New York and West Virginia have joined regional efforts to improve water quality.

#### LOOKING BACK AT 2007

While there are many notable individual accomplishments relating to Chesapeake Bay restoration, *Chapter One: Ecosystem Health* makes clear that the Bay Program partners need to accelerate the pace of water quality improvement efforts. To that end, a number of specific initiatives in 2007 are worth highlighting:

The **Chesapeake Bay Commission** focused on reducing agricultural and point source pollution. By working with Congress, pending versions of the Farm Bill provide up to \$100 million annually in new conservation funding Bay-wide. Pennsylvania Commission members created the Resource Enhancement and Protection Program, a statewide

agricultural tax credit to accelerate agricultural conservation. The Commission published a widely-praised biofuels report and helped the watershed's largest wastewater treatment plant, Blue Plains, receive a \$65 million authorization in the Water Resources Development Act.

The **Delaware** Department of Natural Resources and Environmental Control Division of Fish and Wildlife's Landowner Incentive Program, in cooperation with Ducks Unlimited and the U.S. Fish and Wildlife Service's Partners for Wildlife Program, recently restored 5 acres of Coastal Plain Ponds and established 42 acres of grassland habitat on a previously farmed field in New Castle County, Delaware. This restoration improved habitat for several threatened species of amphibians, enhanced nesting habitat for grassland birds, and improved ground and surface water quality.

In 2007, the **District of Columbia** pushed forward major stream restoration projects and continued to monitor successfully restored wetlands. In 2007, the District completed the designs, obtained permits and initiated pre-implementation monitoring for the 1.9 mile Watts Branch stream restoration project. The District initiated stream restoration designs on Pope Branch, where the District and DCWASA (Water and Sewer Authority) will restore the stream and replace an aging sanitary sewer line. District Department of the Environment (DDOE) monitored the River Fringe and Heritage wetland restorations, both of which continue to thrive.

Together with federal and state partners, **EPA** is helping to pick up the pace of Bay restoration by reducing sediment and nutrient pollution. In 2007, EPA and the District of Columbia began implementing a landmark green infrastructure agreement to curtail storm water runoff. The Navy enacted a low impact development policy that calls for no net increase in storm water volume, sediments and nutrients from construction projects. EPA provided \$6 million in funding to promote innovative solutions to reduce nutrients and sediments entering the Bay. EPA



Region 3 worked with jurisdictions in the watershed to implement a common permitting approach for more than 480 wastewater treatment facilities that unites both upstream and downstream jurisdictions in the enforcement of new water quality standards and allocations. To help accelerate the issuance of permits, the partners have utilized several innovative steps including general watershed permits consistent with the requirements of the nutrient permitting strategy. In fiscal year 2007, 150 permits were issued, for a total of 165 facilities in compliance with nutrient permits as of September 2007. A modification to the Washington, DC Blue Plains facility permit was issued by EPA Region 3 in April 2007. This modification to the single largest discharger in the Chesapeake Bay watershed included significant nutrient reductions – 4.6 million pounds from former limits.

Under the leadership of Governor Martin O'Malley, **Maryland** launched several innovative programs to accelerate Bay restoration. BayStat was created, a powerful new statistical tool being used to assess, coordinate and target programs and resources and inform citizens on progress. New land conservation criteria were adopted to identify acquisitions based on benefits to ecosystems, communities and the Bay. The 2010 Chesapeake Bay Trust Fund was established, providing \$50 million in new funding annually for implementation of non-point source nutrient reductions. Governor O'Malley also hosted the Chesapeake Executive Council meeting, leading partners to champion regional Bay issues.

In 2007, **Pennsylvania** enacted the Resource Enhancement and Protection Program, a \$10 million tax credit initiative encouraging farmers to implement conservation best management practices. The commonwealth also invested \$1.8 million to advance an innovative nutrient trading program in partnership with the state's agricultural community, and worked to establish nutrient limits in wastewater treatment plant permits. Since 1999, Pennsylvania has invested \$20 million in state funds and \$83 million in federal funds to build the nation's largest Conservation Reserve Enhancement Program.

**New York** targets implementation based on landowner interest and high potential for nutrient and sediment reduction and habitat improvement. The Upper Susquehanna Coalition and its partners restored 634 acres of wetlands, constructed 154 new vernal pools and initiated prescribed grazing on 4,892 acres of pasture and row crops. Grazing generates wall-to-wall buffers, reduces nutrient sources and runoff and helps sustain farms. New York also is evaluating road drainage systems as they are critical pathways for atmospheric nitrogen deposition and runoff.

Governor Kaine announced that **Virginia** expects to meet their point source nutrient reduction goals by the end of 2010 through aggressive state cost-share funding, pollution control technologies and efficient local government planning. Nonpoint source progress includes focusing 80 percent of available agricultural cost-share funding on five priority, cost-effective conservation practices. In addition, the Commonwealth has partnered with Virginia's poultry industry on several major initiatives including a litter transport program and maximizing the use of feed additives to reduce phosphorus in poultry litter.

**West Virginia** gained momentum in Tributary Strategy implementation by focusing work in priority watersheds. Successful projects such as a rain barrel workshop and a rain garden demonstration resulted from partnerships between volunteers, local governments and state agencies. These partners are now exploring ways to further promote such innovative stormwater practices in the quickly developing eastern panhandle. West Virginia's implementation team also worked with NRCS to encourage poultry litter transport and nutrient management plans and to promote the Conservation Reserve Enhancement Program.



## Chapter Four: Health of Freshwater Streams and Rivers

*Put simply, healthier waters throughout the watershed will contribute to a healthier Bay.*

The presence and diversity of snails, mussels, insects and other freshwater benthic macroinvertebrate communities are good indicators of stream health because of their limited mobility and their known responses to environmental pollutants and stressors. As a result, these communities are often used as indicators of the general health of freshwater streams and rivers.

The sources and causes of degraded streams and rivers are many and varied across the Chesapeake Bay watershed.



Causes of benthic community impairment are generally attributed to pollutants such as metals, acidity, sediment, pesticides and nutrients introduced into the water body by sources such as mining, agriculture, storm water and municipal or industrial wastewater treatment facilities. Such sources consequently result in water bodies with high bacteria counts, elevated nutrient levels, low pH (high acidity) and stressful dissolved oxygen levels.

These are important local water quality issues that also have implications for the water quality in the Bay itself. Put simply, healthier waters throughout the watershed will contribute to a healthier Bay; everyone living in the watershed benefits from having cleaner, healthier water locally and regionally.

Each state in the watershed conducts benthic macroinvertebrate assessments as part of its biennial water quality assessment report mandated by the Clean Water Act. Where assessed benthic macroinvertebrate communities are deemed the most degraded, states must designate those stream segments as impaired and add them to the list of impaired waters in need of cleanup.

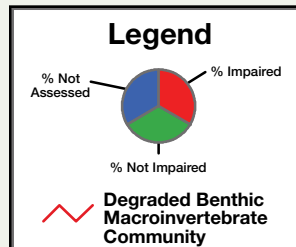
The Bay Program state partners – Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia – used the data and results from their 2006 water quality assessments to prepare summaries of stream conditions in each state. The methodologies for benthic macroinvertebrate assessment vary by state, therefore a synthesis of results across the entire watershed was not attempted at this time. The map presents a summary of each state's assessment results within the boundaries of the Chesapeake Bay watershed. The partners are examining other potential sources of information and approaches to develop a Chesapeake Bay watershed-specific indicator in the future.

For more information on individual states' water quality impairments go to [www.chesapeakebay.net/status\\_watershed\\_health.aspx](http://www.chesapeakebay.net/status_watershed_health.aspx).

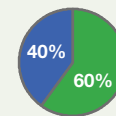
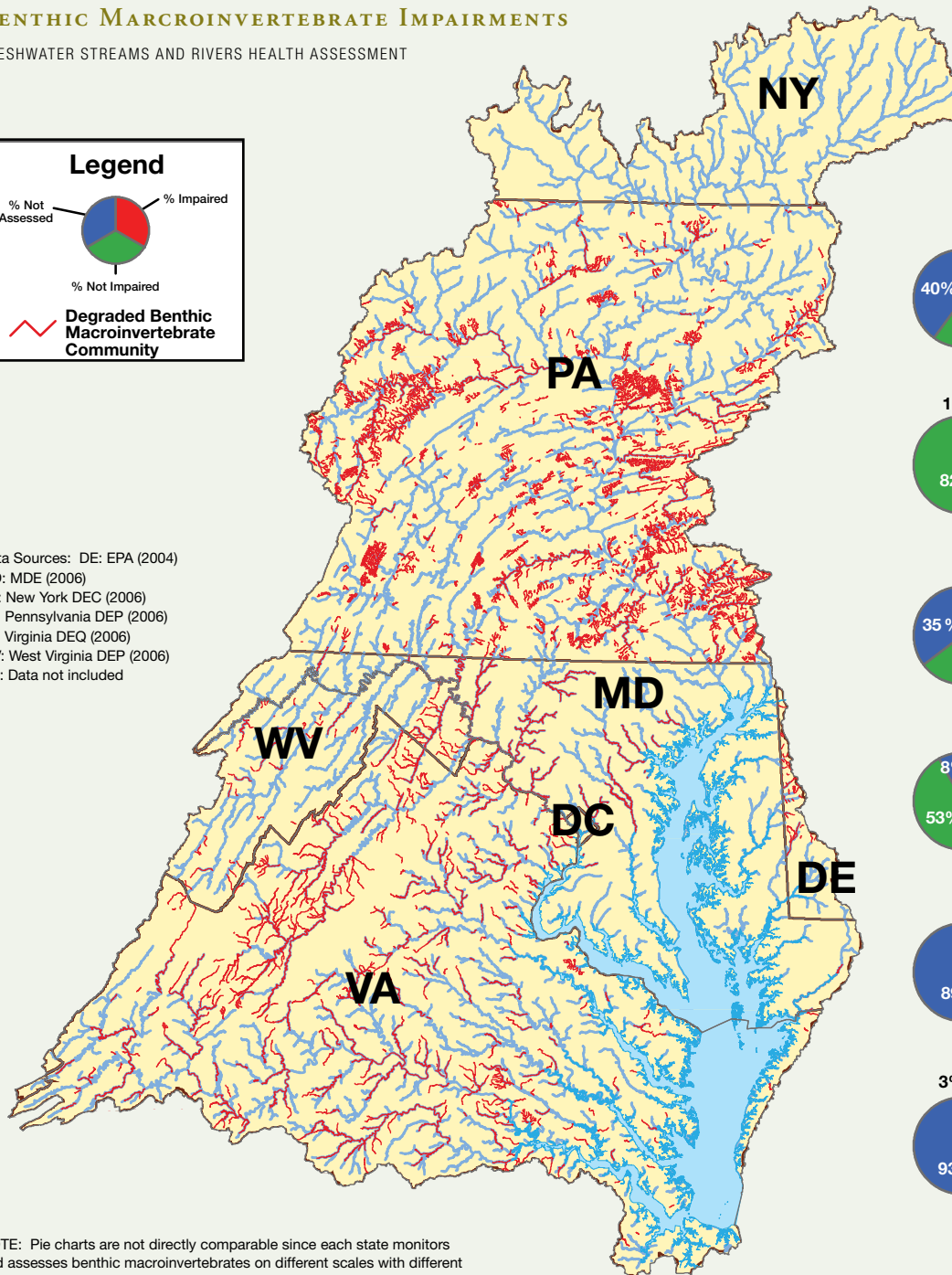


# BENTHIC MACROINVERTEBRATE IMPAIRMENTS

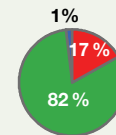
FRESHWATER STREAMS AND RIVERS HEALTH ASSESSMENT



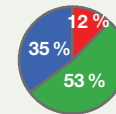
Data Sources: DE: EPA (2004)  
MD: MDE (2006)  
NY: New York DEC (2006)  
PA: Pennsylvania DEP (2006)  
VA: Virginia DEQ (2006)  
WV: West Virginia DEP (2006)  
DC: Data not included



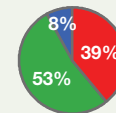
New York



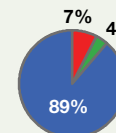
Pennsylvania



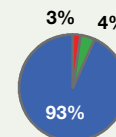
West Virginia



Maryland



Delaware



Virginia

NOTE: Pie charts are not directly comparable since each state monitors and assesses benthic macroinvertebrates on different scales with different methodologies and criterion. For more information on these differences, please refer to: [www.chesapeakebay.net/status\\_watershedhealth.aspx](http://www.chesapeakebay.net/status_watershedhealth.aspx).







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This report was developed by the Chesapeake Bay Program partnership to help inform watershed residents about the health of the Bay and efforts to restore it. Staff from a large number of state and federal agencies, academic institutions and non-governmental organizations contributed data and interpretation to the report, including The Alliance for the Chesapeake Bay, Chesapeake Bay Commission, Delaware Department of Natural Resources and Environmental Control, District of Columbia Department of the Environment, Interstate Commission on the Potomac River Basin, Maryland Department of Agriculture, Maryland Department of the Environment, Maryland Department of Natural Resources, National Park Service, National Oceanic and Atmospheric Administration, New York Department of Environmental Conservation, Old Dominion University, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Department of Environmental Protection, Pennsylvania Fish and Boat Commission, Susquehanna River Basin Commission, University of Maryland Center for Environmental Science, University of Maryland College Park, U.S. Army Corps of Engineers, USDA Natural Resource Conservation Service, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Game and Inland Fisheries, Virginia Institute of Marine Science, Virginia Tech, Versar, West Virginia Department of Agriculture and the West Virginia Department of Environmental Protection.

For a full list of contributing partners, visit [www.chesapeakebay.net/partnerorganizations.aspx](http://www.chesapeakebay.net/partnerorganizations.aspx).

**Images courtesy:** Scott Bauer; Anthony DePanise; Starke Jett; Mike Land; Russ Mader; Maryland Dept. of Natural Resources; NASA; NOAA Chesapeake Bay Office; Alicia Pimental; Kara Turner; U.S. Dept. of Agriculture; U.S. Fish & Wildlife Service; Virginia Institute of Marine Science; IAN Image Library: Jane Hawkey, Adrian Jones, Don Merritt, Jane Thomas and Joanna Woerner.

**Cover images courtesy:** IAN Image Library: Jane Hawkey and Jane Thomas; NOAA Chesapeake Bay Office.

