# Bay Barometer

## A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2010

Executive Summary

Chesapeake Bay Program
SCIENCE • RESTORATION • PARTNERSHIP

# The New Way Forward: What We Are Seeing and Where are We Headed

## About this report

While reading the *2010 Bay Barometer*, CBP's annual report on the Bay's health and ongoing restoration efforts, I am amazed by the quantity and quality of scientific know-how that we have in this watershed-wide partnership—an alliance of scientists and state and federal policy-makers—that has almost as many different parts to it as the Bay itself.

Evaluating and reporting on the health of the Bay and its 64,000 square mile watershed is no small task. This intricate ecosystem includes a diversity of people living in a variety of ways, on lands as dissimilar as mountains and coastal plains, and near waterways ranging in size from a mere trickle of fresh water to the open salty waters where the Bay meets the Atlantic Ocean. It is appropriate, then, that the science of the Bay reflects that complexity and adapts over time, as any good field of science must do.

Answering the question, "How is the watershed doing?" is complex, too, and requires some context. The section called "Factors Impacting the Bay" offers this, presenting information on population as well as flow of freshwater runoff into waterways. As dynamic as these trends and natural conditions are from year to year, we all should remember that the actions we take to reduce pollution coming from the land can continue to reduce pollution in our waterways, even in the wettest years.

With that context in mind, the 2010 Bay Health and Watershed Health sections show us several signs of hope, and reminders of the ways this system is interdependent. These sections tell us "what we are seeing" in terms of scientific data and trends. Key highlights include:

- Significantly less nitrogen and phosphorus entering non-tidal creeks and rivers when we remove the effects of annual flows of runoff—a positive sign of improved health in these parts of the watershed.
- Continued strength in the abundance of adult blue crabs, arguably the Bay's most hardy and reproductively prolific creatures. The crab population grew by 92 million last year—an increase that can likely be attributed to the bi-state harvest regulations put in place in 2009.
- Optimism for a returning shad population in the Potomac River; although the marginal return of shad to three other waterways suggest that continued improvements in water quality, habitat and installation of fish passageways is still needed.

In the Bay Restoration and Protection section, we highlight "what we are doing" to bring balance to the system by reducing pollution, protecting critical habitat, conserving lands and ensuring sustainable populations of fish and shellfish. Highlights here include:

- Restoration of over 1,000 acres of wetlands;
- Increases in forest buffers planted, enough so that the state of Pennsylvania exceeded its goal;
- Preservation of 102,888 acres of lands, for a total of 7.3 million acres throughout the basin as of 2010 (an amount that exceeds the goal);
- Significant moves forward in the protection of oyster habitat by Maryland and continued reef management by Virginia; and,
- Ongoing, successful management of the crab harvest across state lines.

It also is important to remember that while the figures on buffers and wetlands show accomplishments and represent progress, they do not reflect the numbers of acres or habitats lost to development or other pressures, a figure that continues to challenge our restoration efforts. So in some sense, the message on the Bay continues to be: We're working hard, but there is much more work to be done.

There is a new message, however, about the path forward, or "where we are going": the creation of the first-ever, Bay-wide "pollution diet" known as the Chesapeake Bay TMDL (Total Maximum Daily Load), issued in December 2010. This "diet" for reducing nitrogen, phosphorus and sediment sets a goal of having all actions to reduce pollution in place by 2025. It is based largely on implementation plans, developed by the states and the District of Columbia, which show the "how and when" for meeting the TMDL goals. We are hopeful that this important effort will make a difference in changing the "same old message" and stem the incoming tide of pressures on the Bay ecosystem.

Finally, each and every economic sector can do more and each individual who lives within this watershed can do better. The CBP partnership is no exception. We are now facing the challenges of shifting from a largely voluntary program to one that employs a mix of voluntary and mandatory tools. This new way forward will come right down to the local level, too, asking you and your communities to make the decision: What are you willing to do or change to keep your local creek healthy? What are you willing to do to help restore the Chesapeake Bay?

I invite you to visit www.chesapeakebay.net to find Bay facts and history, expanded scientific data and information, and ways that you, too, can get involved and do your part. Restoration of the Bay and our quality of life depend on it.

*Nick DiPasquale, Director, Chesapeake Bay Program*

# Introduction

The Chesapeake Bay region is one of the most extraordinary places in America. This unique estuary and its network of streams, creeks and rivers have tremendous ecological, cultural, economic, historic and recreational value to local communities and the entire country.

For more than 25 years, the Chesapeake Bay Program (CBP) has worked to protect and restore the Bay and its 64,000-square-mile watershed—the system of land and local waterways from New York to Virginia that drain into the main Bay. *Bay Barometer* is the annual assessment of the Bay Program partnership's progress toward meeting its health and restoration goals.

## The Year in Review

### Bay and Watershed Health

The health of the Bay and specific areas of the watershed saw some improvements in 2010, however conditions remained poor overall.

We estimate that:

- The adult blue crab population continued to grow to an estimated 315 million, a record high since 1993;
- The health of the Bay's bottom-dwelling species fell from 56 percent of the goal in 2009 to 49 percent in 2010;
- Underwater bay grasses decreased from 85,914 acres of the Bay's shallows in 2009 to 79,675 acres in 2010;
- 18 percent of tidal waters met or exceeded guidelines for water clarity, an 8 percent decrease from 2009;
- 38 percent of the Bay and its tidal tributaries met Clean Water Act standards for dissolved oxygen, which is decrease of 1 percent from 2009[1];
- Less than half (45%) of stream health scores at monitoring sites were fair, good or excellent;
- There was long-term improvement in nitrogen and phosphorus levels at two-thirds of the sites in the watershed.

### Restoration and Protection Efforts

The Bay Program partnership implemented many efforts in 2010 to restore habitats, manage fisheries, protect watersheds and foster stewardship. Last year:

- 337 miles of forest buffers were planted along the Bay watershed's streams and rivers, providing a 3 percent increase toward the goal. The bulk of these—279—were planted in Pennsylvania, exceeding the state's forest buffer restoration goal;
- The blue crab fishery was successfully managed at sustainable levels for the second year in a row;
- Over 1,000 acres of wetlands were restored;
- Over 100,000 acres of land were preserved in Maryland, Virginia, and Pennsylvania;
- During the 2009–10 school year, NOAA grants supported Meaningful Watershed Educational Experiences (MWEEs) for more than 46,000 students and training opportunities for roughly 2,000 teachers;

[1] In 2009-10, as part of the development of the Total Maximum Daily Load (TMDL), CBP scientists reviewed the methodology for assessing dissolved oxygen levels and found instances where the science behind these tools had advanced. The methodology was updated to incorporate these advances. This had the effect of modifying the reference against which large open water areas are measured. As a result, some areas that were previously thought to have unacceptably low oxygen levels are now understood to have dissolved oxygen levels that met the standards for the given time period. The technical description of the methodological changes is available online.

# Factors Affecting the Bay and Watershed

**or what we have to consider**

## Land Use

The Bay's decline is directly linked to the rise in the number of people in the watershed; since 1950, the number of residents has more than doubled. As of 2010, 17.2 million people were estimated to live in the Bay watershed (up from 16.9 million in 2008). Projections through 2030 show the watershed's population climbing above 20 million.

The way people use the land has the greatest impact on the health of the Bay and local waterways. Natural areas like forests and wetlands generally have a positive effect on Bay and watershed health, while lands that have been developed generally have a negative effect.

There are multiple ways that increasing population and the development that comes with it can harm the health of the Bay and its watershed. When forests, farms, and natural areas are converted to homes, shopping centers and parking lots, water cannot soak into the ground. Instead, it runs off the hard surfaces, picking up pollution as it goes. Most of this runoff is not treated in any way. As it moves downhill and through stormdrains, it flows into local waterways at high speeds that scour out streambanks, muddying the waters and sending loose dirt downstream.

Agriculture can contribute to the Bay's pollution issues as well. While fertilizers, pesticides, manure and tilled soil are beneficial to crops, they become pollutants when water from irrigation and precipitation washes excess amounts of them into local waterways or they seep into ground water. Proper management by farmers of their animal, grain and vegetable operations is essential for good water quality in nearby creeks and rivers.

## River Flow and Pollutant Loads

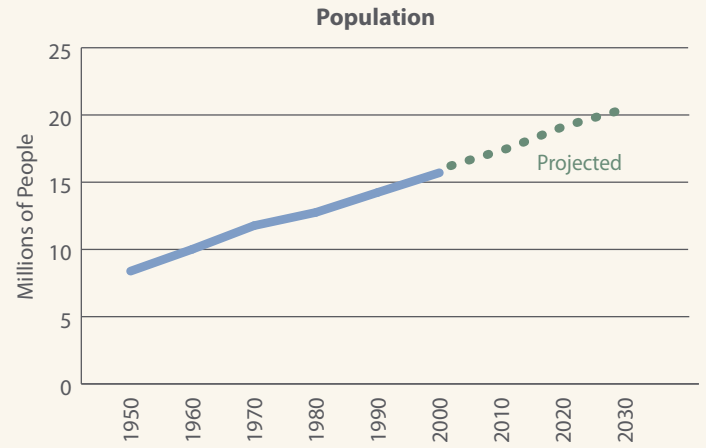
Annual rain and snowfall influence the amount of water in rivers that eventually flow into the Bay. In years of higher river flow, more pollution enters the Bay, while during dry years, fewer pollutants are washed downstream. Therefore, fresh water river flow is a fundamentally important force that shapes conditions in the Bay and the salinity levels that can affect oysters, crabs, and fish. Compared to 2009, 2010 saw increases in river flow levels that resulted in more nitrogen, phosphorus and sediment reaching the Bay.

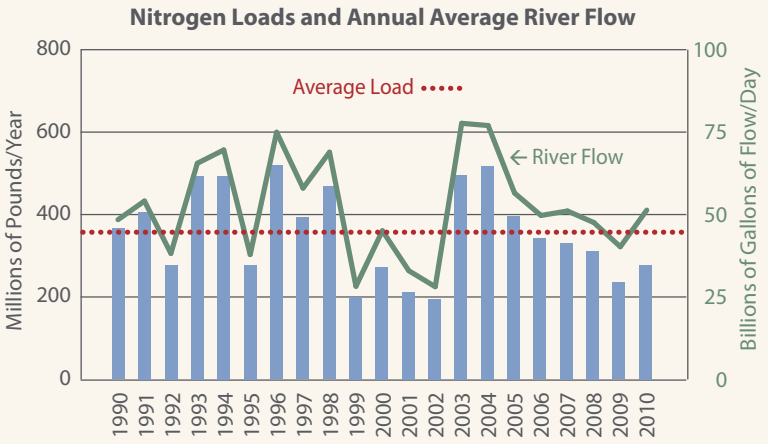
**River Flow:** The annual average river flow to the Bay during the 2010 water year (October 2009-September 2010) was 52 billion gallons per day (BGD). This is 11 BGD more than the previous year and close to the 53 BGD average from 1990-2010.

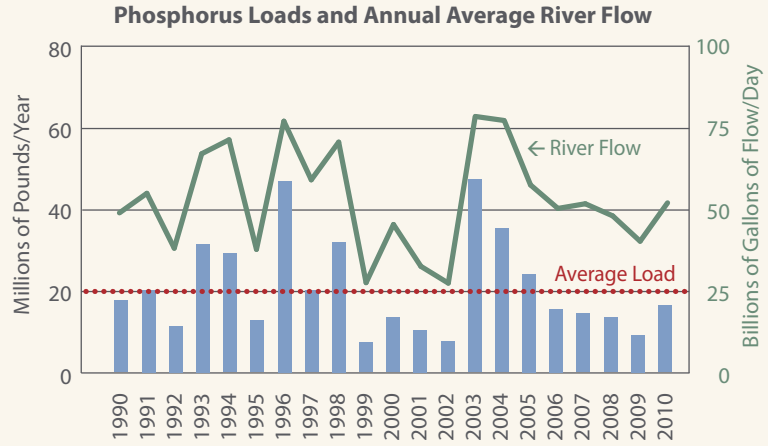
**Nitrogen:** Preliminary estimates show that 278 million pounds of nitrogen reached the Bay during the 2010 water year. This is 43 million pounds more than the loads in 2009 and 78 million pounds less than the 356 million pound average load from 1990-2010.

**Phosphorus:** Preliminary estimates show that 16 million pounds of phosphorus reached the Bay during the 2010 water year. This is 7 million pounds more than the loads in 2009 and 4 million pounds less than the 20 million pound average load from 1990-2010.

**Sediment:** Preliminary estimates show that 9 million tons of sediment reached the Bay from non-tidal rivers in 2010 water year. This is a 7 million ton increase from 2009 and more than the 4 million ton average load from 1990-2010. Initial results indicate that two high runoff events in the Potomac River basin in January and March 2010 combined to generate this load, which is one of the highest sediment loads in the last twenty years.




### LOOKING FOR MORE DETAIL?

Visit www.chesapeakebay.net/status_factorsimpacting.aspx for more information about these indicators, including data and methods.

# Bay Health
## or what we are seeing

Overall in 2010, the Bay continued to have poor water quality, degraded habitats, and low populations of some fish and shellfish species. The most notable gain was a continued increase in the adult blue crab population.

## Water Quality

In 2010, amounts of rainfall and snowfall were well above average. Water quality is affected by these events since they result in runoff containing nitrogen, phosphorus and sediment washing off the land and into the waterways. These pollutants harm aquatic life by clouding the water and fueling the growth of algae blooms that reduce oxygen needed by the Bay's creatures. To improve quality, actions must continue to be taken to reduce pollution loads and chemical contamination.

### Dissolved Oxygen[1]

**Goal: 100 percent of the tidal tributaries and the Chesapeake Bay to meet water quality standards for dissolved oxygen.**

When oxygen is in water, it is in a dissolved form. Like animals on land, the Bay's fish and shellfish need it to survive. The necessary amount of dissolved oxygen varies by species, season and location in the Bay.

In 2010: Data gathered from 2008 to 2010 indicate that 38 percent of the combined water volume of the Bay and its tidal tributaries met dissolved oxygen standards during the summer months. This is one percent less than the 2009 assessment.

### Mid-Channel Clarity

**Goal: 100 percent of the Chesapeake Bay to meet thresholds for water clarity. In general, visibility to a depth greater than .65–2 meters (depending on salinity of waterway) meets the goal.**

Water clarity measures the depth to which light can penetrate into the water. It is routinely hindered by the amount of fine sediment, plankton and other debris suspended in the water. Greater water clarity generally leads to a healthier Bay.

In 2010: Of tidal waters, 18 percent met or exceeded goals for water clarity. This was a decrease from 2009, when 26 percent met the goals.

### Chlorophyll *a*

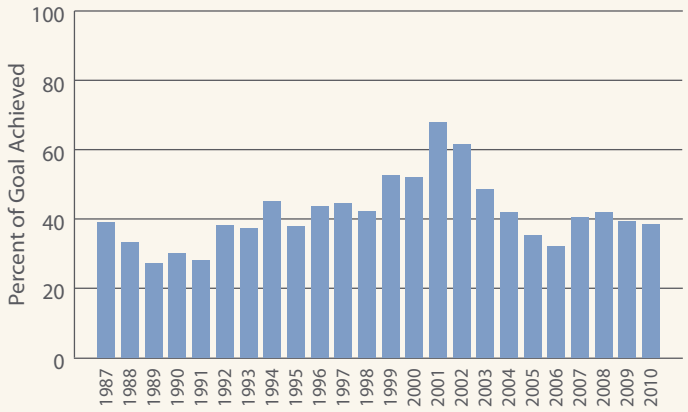
**Goal: 100 percent of Chesapeake Bay tidal waters to be below specific threshold concentrations of chlorophyll *a* that are acceptable to underwater bay grasses.**

Scientists study chlorophyll *a* to determine the amount of algae present in the Bay. Algae are the foundation of the food web and are a necessary part of a balanced ecosystem. However, too much algae can block sunlight from reaching underwater grasses, reducing the habitat and oxygen that underwater life need to survive. The range of acceptable chlorophyll *a* concentrations varies by season and salinity.

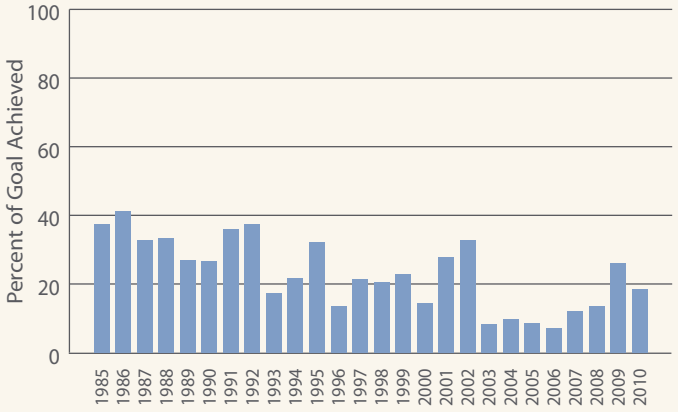
In 2010: Twenty-two percent of tidal waters had chlorophyll *a* concentrations that achieved the goal. This is a decrease of 7 percent from 2009.

[1]Refer to footnote 1 on page 1.

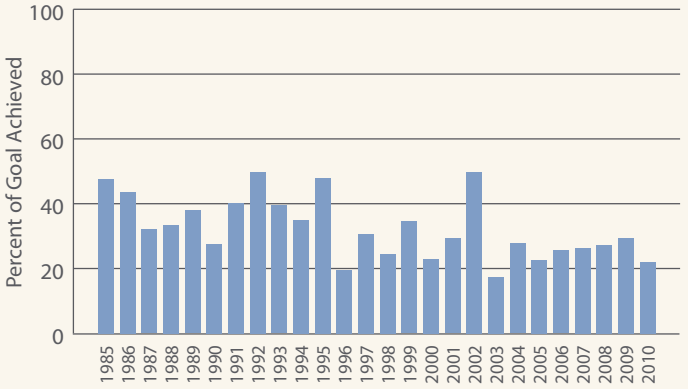
**Dissolved Oxygen**
Goal: 100% of Tidal Waters Meet Water Quality Standards




**Mid-Channel Water Clarity**
Goal: 100% of Tidal Waters Exceed Threshold Depths




**Chlorophyll *a***
Goal: 100% of Tidal Waters with Concentrations Less Than Thresholds



# Bay Health
## or what we are seeing

### Chemical Contaminants

**Goal: 100 percent of Bay and tidal segments considered to contain no impairments due to toxic chemicals.**

Chemical contaminants such as metals and polychlorinated biphenyls (PCBs) can be found in Bay sediments and the tissues of fish. By analyzing specific fish tissues scientists can estimate overall presence of contaminants in the ecosystem. Toxins tend to accumulate in predatory species at the top of the food web and potentially reach humans who eat contaminated fish.

In 2010: Based on last year's assessments of the ninety tidal waterways analyzed, 28 percent had no impairment for chemical contaminants. A majority of impaired waterways (72 percent) have persistent problems with PCBs in fish tissues.

## Habitats and Lower Food Web

The health of the Bay's critical habitats and lower food web declined overall in 2010. By any measure, they remain far below what is needed to support thriving populations of underwater life. Bay grasses declined by 6,239 acres from 2009 and bottom habitat health dropped by 7 percent of the goal achievement.

### Bay Grasses

**Goal: 185,000 acres of underwater bay grasses in the Chesapeake Bay.**

Underwater bay grasses serve many essential ecological functions and are among the most closely monitored habitats in the Bay. They provide critical shelter to many key species, add oxygen to the water and reduce shoreline erosion. Their abundance is an excellent indicator of Bay health because grasses depend on good, local water quality.

In 2010: There were 79,675 acres of bay grasses throughout the Bay, which is 43 percent of the goal and a decrease of 6,239 acres from 2009.

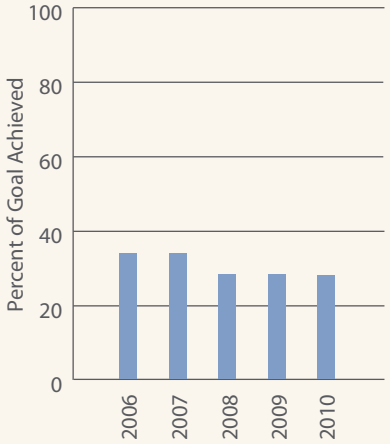
### Phytoplankton

**Goal: The health of phytoplankton is measured on a scale of 1 (very degraded) to 5 (least impaired). The goal is for all scores to be at least a 3.**

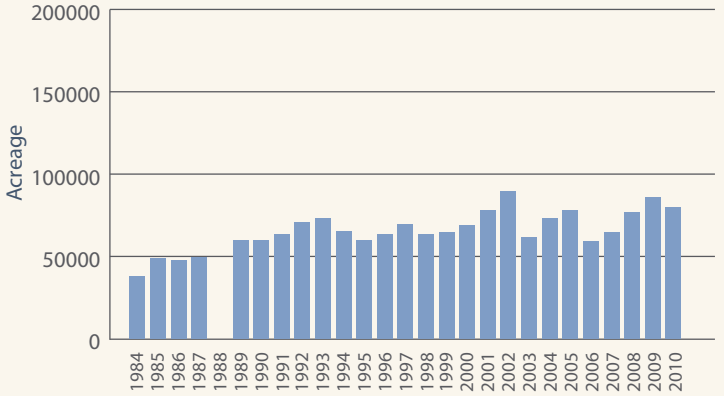
Phytoplankton are the critical base of most Chesapeake food webs. Moderate, stable levels are needed for healthy bottom-dwelling species which form the foundation of the food web that supports larger species such as fish and birds. However, too much or the wrong type of algae can be detrimental to the overall health of the Bay. Phytoplankton are especially sensitive to changes in pollution levels, water clarity, temperature and salinity, and therefore serve as an excellent indicator of the health of the Bay's surface waters.

In 2010: Of the Bay's surface waters, fifty-five percent met the goal, a slight improvement from 2009.

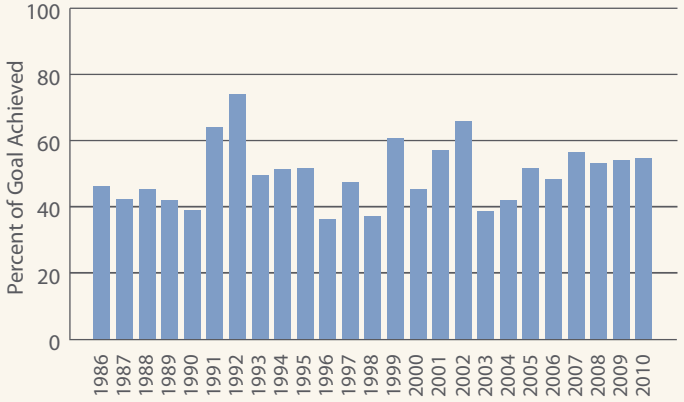
**Chemical Contaminants**
Goal: 100% of Bay Tidal Segments Not Impaired




**Underwater Bay Grass Abundance**
Goal: 185,000 Acres




**Phytoplankton**
Goal: 100% of Sites with Score of at Least 3 (on a scale of 1-5)

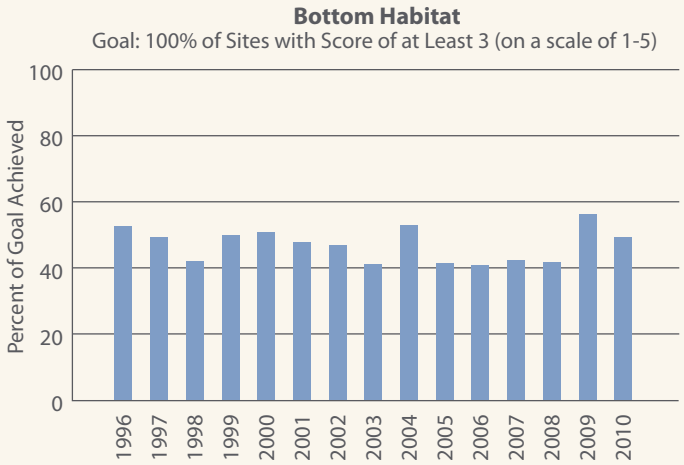


## Bottom Habitat

**Goal: The health of the Bay's bottom habitat is measured on a scale of 1 (very degraded) to 5 (least impaired). The goal is for all scores to be at least a 3.**

The Bay's bottom is home to many species of small creatures such worms, clams, and tiny crustaceans. These creatures (called benthic macroinvertebrates) live on or in the bottom sediments and are especially sensitive to increases in chemical contaminants and decreases in oxygen. Since they cannot move to avoid poor environmental conditions, their health is an excellent indicator of the Bay's health.

In 2010: Forty-nine percent of the bottom habitat of the Bay and its tidal tributaries met the restoration goals, which is a 7 percent decrease from the previous year. The main Bay declined in health while a few rivers saw some improvements.

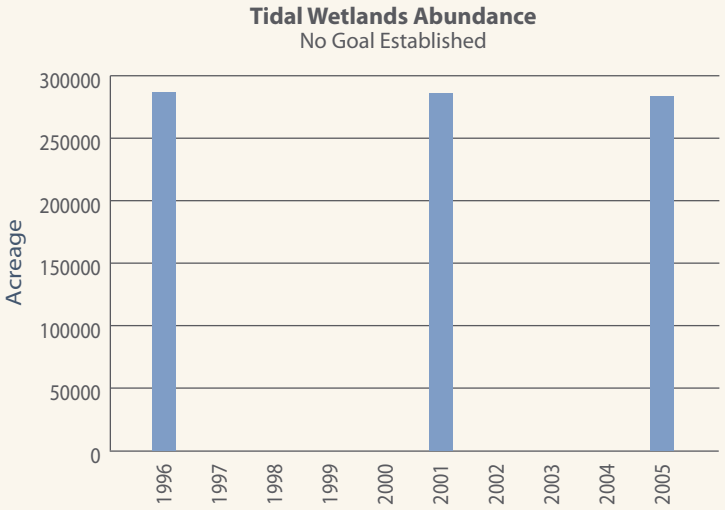



## Tidal Wetlands

**Goal: This indicator is used to measure how many acres of tidal wetlands are in the Bay and identify trends, not to track CBP's progress toward a goal.**

Wetlands are areas of transition between land and water that provide unique habitats for a rich diversity of land animals and aquatic life. They also act as sponges and natural filters by absorbing runoff and removing pollution from water before it enters streams, creeks, rivers and the Bay. Finally, wetlands provide natural flood protection.

In 2010: No data for 2010 were available. The most recent data, offered here, are based on a specific multi-year survey of wetlands completed in 2005. That survey found approximately 283,946 acres of tidal wetlands around the main Bay.




# Bay Health
## or what we are seeing

## Fish and Shellfish Abundance

The Bay's fish and shellfish abundance shows the health of these resources. It tells a mixed story in 2010. While striped bass and blue crab populations appear to have been stable or on the rise, returning American shad numbers remained low in the James, Susquehanna and York Rivers. Oyster populations also remained very low; however, high numbers of spat recorded in Maryland and low frequency and intensity of disease were positive signs for restoration. Blue crab population soared last year to 315 million adult crabs, the highest population recorded since 1993. Oyster and shad populations remained relatively unchanged at low levels. Striped bass information will be updated in 2011, when the next survey of this fish population is analyzed.

### Blue Crabs

**Goal: The interim target of 200 million blue crabs that are one year old and older in the Bay. A new benchmark assessment will be completed and reviewed in 2011 and results may lead to establishing a new target level for the future.**

It is estimated that one-third of the nation's blue crab catch comes from the Chesapeake. Because they reproduce by the millions and eat virtually anything, crabs are one of the Bay's most hardy species. Good water quality and adequate habitat are important for the crab's continued health.

In 2010: The population of adult (one year and older) blue crabs in the Bay continued to climb, from 223 million in 2009 to 315 million and has exceeded the interim target for the past two years. Regulatory actions from 2008 through 2010 are thought to be the primary factor in the crab's recent recovery.

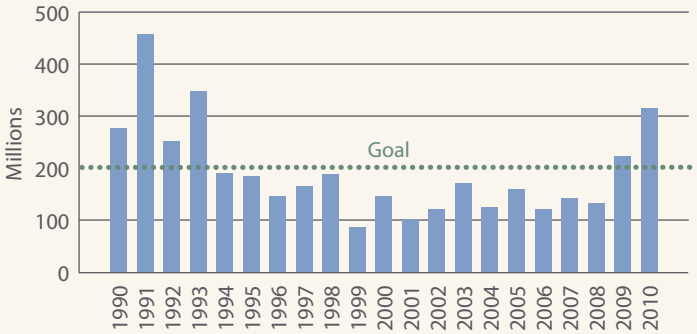
### Oysters

**Goal: Based on 1994 levels, the goal is to achieve an oyster biomass of 31.6 billion grams, which would represent a tenfold increase in native oysters.**

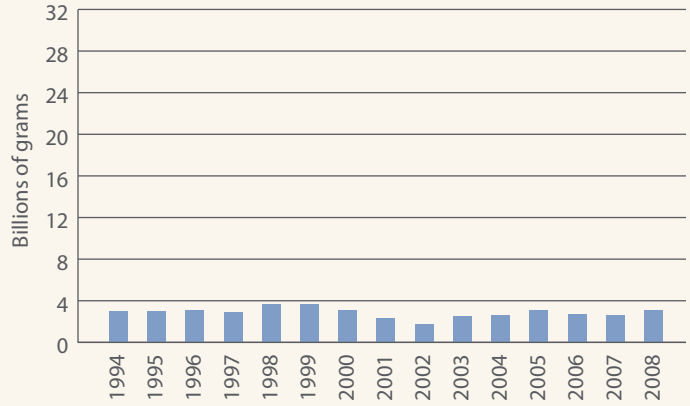
Oysters are a valuable Bay species since they feed by filtering Bay water and thereby increase water clarity. It has been estimated that at their historic population peak, oysters filtered all of the Bay's water in less than one week; it takes about one year for the current population to do so.

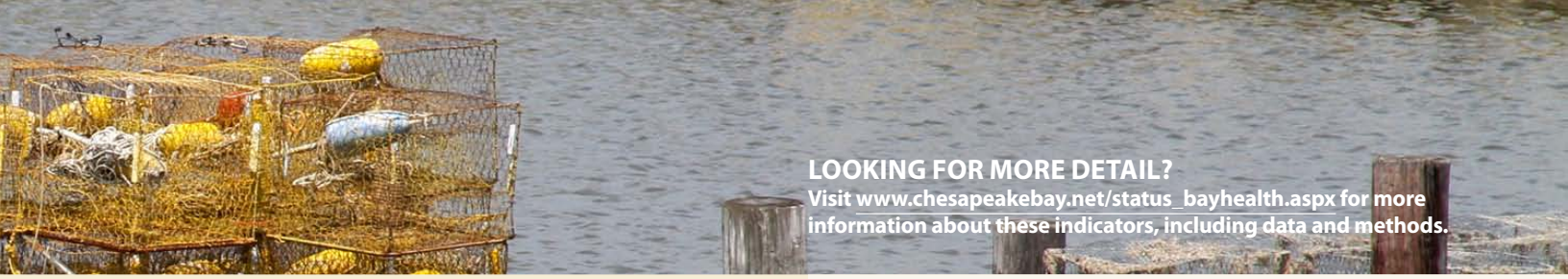
In 2010: Based on data from 2008, there were an estimated 3 billion grams of oyster biomass. These are the most current data available at the time of publication.

**Blue Crab Abundance**
Goal: 200 Million Adult (age 1+) Crabs




**Oyster Biomass**
Goal: 31.6 Billion Grams



**LOOKING FOR MORE DETAIL?**
**Visit www.chesapeakebay.net/status_bayhealth.aspx for more information about these indicators, including data and methods.**

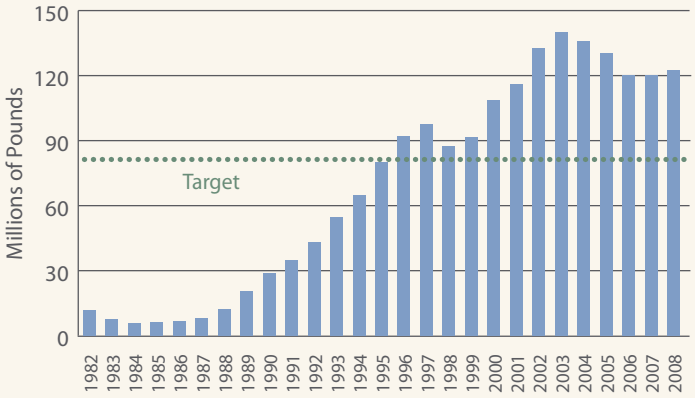
## Striped Bass

**Goal: The target level is a spawning stock biomass (SSB) equal to the average from 1960 to 1971, which is 82.7 million pounds of females.**

Striped bass populations rebounded from historic lows in the mid-1980s to highs that exceed the population target. A multi-state fishing moratorium in the 1980s, commercial quotas and recreational harvest limits set in the 1990s were successful at rebuilding the striped bass stock. However, scientists today are concerned about the high prevalence of disease (mycobacteriosis) and whether there is enough prey available to adequately support this predatory fish.

In 2010: Female striped bass SSB has exceeded the target since 1995. In 2008, striped bass abundance measured 122 million pounds. The stock is not overfished and overfishing is not occurring.

**Striped Bass Abundance**
Goal: 82.7 Million Pounds of Spawning-Age Females



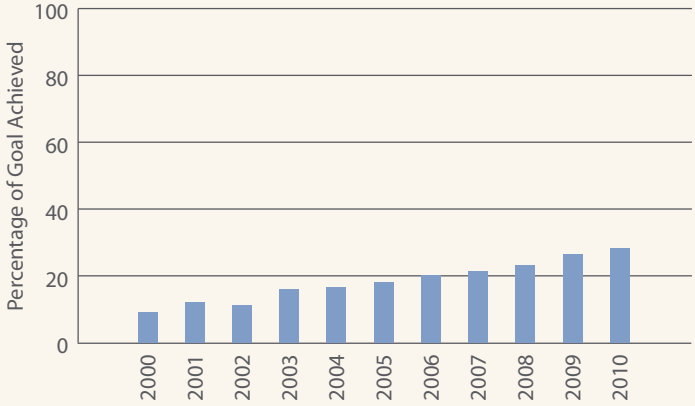

## American Shad

**Goal: Four major river systems in the Bay, two with fish passage systems in place to bypass existing blockages by dams and other barriers, are tracked for spawning shad stock. Each river system has its own numeric target.**

American shad form an important link in the Bay food web. Shad feed on zooplankton and are preyed upon by larger fish, including bluefish, weakfish and striped bass.

In 2010: Based on the most recent data from the James, Potomac, Susquehanna and York rivers, the estimates of Bay-wide shad abundance increased slightly to 28 percent of the goal. The Potomac River saw the most consistent increase of returning shad, reaching 97 percent of that river's target. The York River's shad abundance was at 20 percent while the James and Susquehanna River remained at less than 1 percent.

**American Shad Abundance**
Goal: 100%



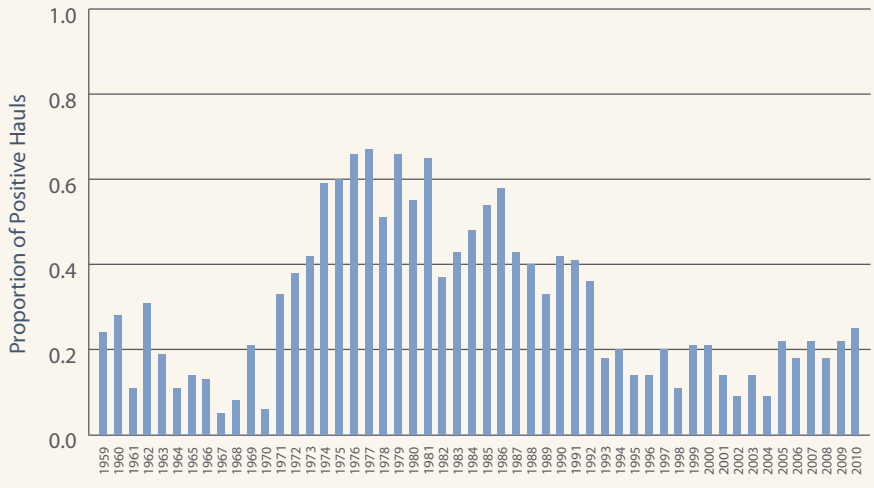

## Atlantic Menhaden

**Goal: There is no specific Chesapeake Bay target for menhaden because there is no estimate of the menhaden population in the Chesapeake Bay.**

Menhaden play a key ecological role in the Bay because they are food for top predators such as striped bass and they filter the water while feeding. The menhaden stock is managed under the Atlantic States Marine Fisheries Commission (ASMFC) using abundance targets and thresholds. In 2006 a cap of 109,020 metric tons was placed on the commercial harvest of menhaden from the bay. A coast-wide stock assessment was completed in 2009.

In 2010: Researchers in Maryland measured juvenile menhaden abundance by casting nets and recording the percentage of hauls in which menhaden were present (then called a "positive haul"). The 2010 data show that menhaden were caught in 25% of the hauls or the equivalent of menhaden being caught in 1 out of every 4 hauls.

**Juvenile Menhaden Abundance**
No Goal Established



# Watershed Health

**or more of what we are seeing**

## Health of Freshwater Streams

Between 2000 and 2008, over 10,000 sites were sampled and the average stream health scores in 7,886 of those sites indicated that 3,584 (45%) were in fair, good or excellent condition and 4,302 (55%) were in very poor or poor condition.

An effective way to measure the health of freshwater streams and rivers is to study the many tiny creatures that live in these waters. The abundance and diversity of snails, mussels, insects and other bottom-dwelling organisms are good indicators of the health of streams because these creatures can't move very far and they respond to pollution and environmental stresses.

Some generalizations can be made about the health of the watershed's streams:

Streams tend to be in very poor to fair condition around large urban areas, such as metropolitan Baltimore-Washington, D.C. Streams in heavily farmed or mined areas are also often in very poor to fair condition.

In contrast, streams tend to be in good to excellent condition in forested areas with ample natural habitat and low levels of pollution, such as in forested areas of the upper James and Potomac rivers and the West Branch of the Susquehanna River.

In general, it can be said that a healthy Bay watershed would have a majority of streams ranked as fair, good or excellent. Based on the location of streams sampled, those in forested areas tend to be in good to excellent condition and those in areas with more intensive land uses, including urban and some agricultural areas, tend to be in poor to fair condition.

Healthy freshwater streams are intrinsically linked to a healthy Chesapeake Bay. The watershed's streams, creeks and rivers eventually flow into the Bay, so their water quality has a direct effect on the entire Bay. Clean local waterways also support a diversity of fish and wildlife and are essential to residents who use them as a source of public drinking water, a place for family and recreational activities, and for business and other purposes.

## Flow-Adjusted Pollutant Trends

Concentrations of nitrogen, phosphorus and sediment are highly variable, depending on the amount of water flowing in streams and rivers throughout the Bay watershed. Therefore, scientists calculate flow-adjusted trends for these pollutants to determine whether concentrations have changed over time. By removing the effects of natural variations in stream flow, resource managers can evaluate the changes in stream health that may result from pollution reduction actions or other changes in the watershed.

Since the 1980s, Bay Program partners have collected data on stream flow and water quality at 32 locations throughout the non-tidal portions of the watershed. These watershed monitoring sites collectively represent 78 percent of the area of the Bay basin and range in size from the 100-square-mile Choptank River watershed to the Susquehanna River's 27,000 square mile watershed.

The goal is to observe downward trends in flow-adjusted nitrogen, phosphorus and sediment concentrations at monitoring sites across the Bay watershed. The majority of long-term stream monitoring sites show trends indicating decreasing flow-adjusted concentrations of nitrogen and phosphorus.

Between 1985 and 2009:

- 22 out of 32 sites showed downward flow-adjusted trends for nitrogen concentrations, while two sites showed upward trends.
- 22 out of 32 sites showed downward flow-adjusted trends for phosphorus concentrations, while four sites showed upward trends.
- 12 out of 32 sites showed downward flow-adjusted trends for suspended sediment concentrations, while four sites showed upward trends.
- The remaining sites show no or small trends that are not statistically significant.

At many monitored locations, long-term trends indicate that management actions, such as pollution controls for improved wastewater treatment plants, practices to reduce nutrients on farms and suburban lands, and efforts to curb erosion and runoff have reduced concentrations of nitrogen, phosphorus and sediment. While these reductions provide evidence of improving conditions in some upstream areas, additional reductions will be needed to have healthier streams and meet water-quality goals for the Bay.

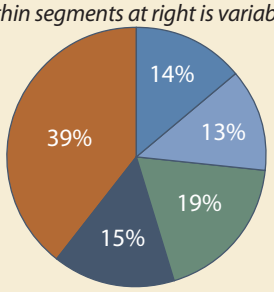
**LOOKING FOR MORE DETAIL?**
**Visit www.chesapeakebay.net/status_watershedhealth.aspx for more about these indicators and links to state assessments.**

## Average Benthic Index of Biotic Integrity Rating BY SEGMENT

*Note: Only data collected in a random design was used for this analysis. Benthic Index of Biotic Integrity scores are averaged over two scales of watersheds depending on data density.*

## Summary of Stream Health BY MONITORING SITES

*Note: Number of monitoring sites within segments at right is variable.*










Data Sources: 2000–2008 biological, chemical and physical habitat data for non-tidal, wadeable streams from various federal, state, local, and river basin commission monitoring programs throughout the Chesapeake Bay Watershed. For a list of data sources see analysis and methods link on www.chesapeakebay.net/status_streamhealth.aspx

Created by FMI, 03/07/2011

0 12.5 25 50 Kilometers
0 15 30 60 Miles
N

UTM Zone 18N, NAD 83

# Restoration and Protection Efforts

## or what we are doing

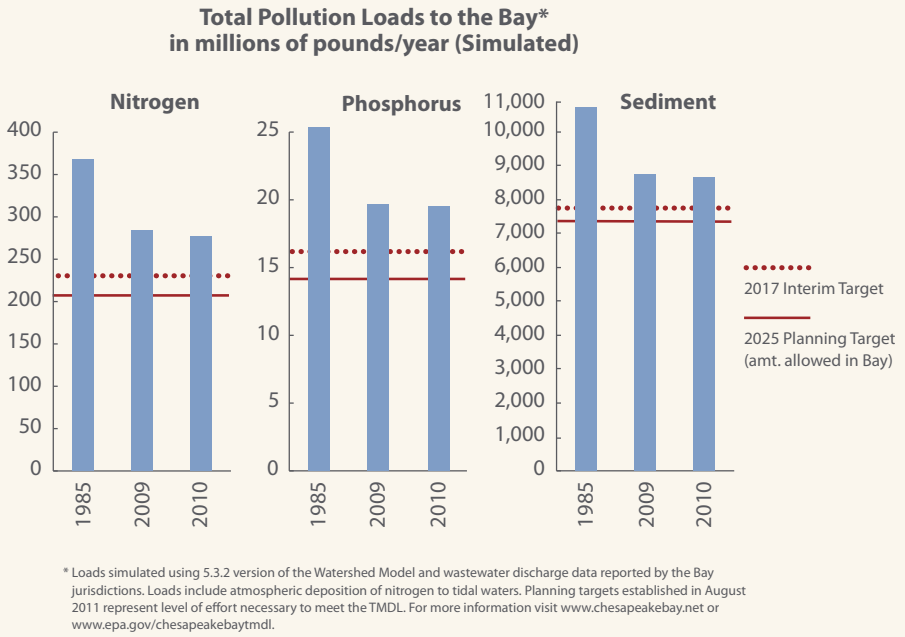
Chesapeake Bay Program partners continued efforts to restore and protect the Bay and its watershed in 2010 and showed notable success in the areas of blue crab management, land conservation, forest buffer and wetlands restoration, fish passage, watershed planning and the addition of many new public access sites.

## Reducing Pollution

In December 2010, the Environmental Protection Agency (EPA) established a "pollution diet" known as the Chesapeake Bay Total Maximum Daily Load (TMDL). This "diet" sets limits on the amount of nitrogen, phosphorus and sediment that will be allowed to flow into the Bay each year. The TMDL is designed to ensure that all actions to control pollution entering tidal rivers and the Bay will be in place by 2025, with controls in place by 2017 that would achieve at least 60% of the reductions from 2009 necessary to meet the TMDL. When these measures are completed, the expectation is that the ecosystem's health will improve.

As part of this cleanup process, CBP partners are implementing and refining plans to reduce these pollutants over time. The total targeted amounts partners are striving for are: nitrogen, 207.27 million pounds; phosphorus, 14.55 million pounds; sediment, 7,341 million pounds*.

Computer simulations of the effects of pollution controls implemented between July 2009 and June 2010 indicate that nitrogen loads to the Bay would have decreased 5.81 million pounds to 276.85 million; phosphorus would have decreased 0.03 million pounds to 19.20 million; and sediment would have decreased 144 million pounds to 8,532 million.*



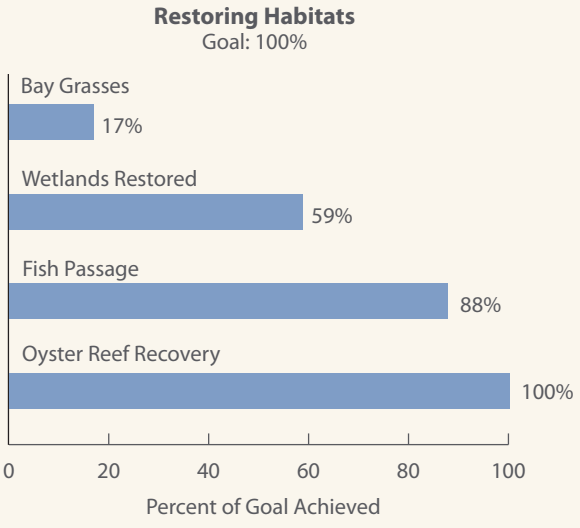

* Loads simulated using 5.3.2 version of the Watershed Model and wastewater discharge data reported by the Bay jurisdictions. Loads include atmospheric deposition of nitrogen to tidal waters. Planning targets established in August 2011 represent level of effort necessary to meet the TMDL. For more information visit www.chesapeakebay.net or www.epa.gov/chesapeakebaytmdl.

## Restoring Habitats

The restoration of critical wildlife habitats is an important component to a healthy Bay ecosystem overall. The following are goals for:

- Bay Grasses Planted: 1,000 acres planted by 2008.
- Wetlands Restored: 25,054 acres of wetlands restored in Maryland, Pennsylvania, Virginia and Washington, D.C. by 2010.
- Fish Passage Opened: By 2014, open 2,807 miles of habitat to migratory and resident fishes; complete 100 projects and open 1,000 miles of river and stream habitat.
- Oyster Reef Recovery: Implement restoration practices on 2,466 acres of oyster bar and reef habitat between 2007 and 2010.

In 2010: There were gains in planting bay grasses (12 acres), restoring wetlands (1,005 acres) and reopening fish passage (121 miles). The Bay Program partnership has surpassed its target of treating 2,466 acres of oyster reefs with habitat restoration techniques. Since 2007, partners have implemented reef restoration practices on 4,763 acres. While meeting this target is an important accomplishment, more work is needed to establish and maintain a sustainable oyster population in the Bay and its tributaries.



## Managing Fisheries

The Chesapeake Bay fishing industry holds tremendous commercial, cultural and historic value. Managing the fisheries for blue crabs, oysters, striped bass, shad and menhaden is also critical to restoring and protecting the population of these species and their important place in the ecosystem.

Goal (for blue crabs only): An interim target abundance level of 200 million adult (age 1+) crabs was adopted in 2008. The current overfishing threshold is just over half (53 percent) of the population and the target is 46 percent.

In 2010: Based on 2009-2010 winter dredge survey data and estimates of baywide harvest, the Chesapeake Bay blue crab population and numbers caught continued at sustainable levels, with the harvest remaining below the maximum number that can be taken (53 percent). A full assessment of blue crab stock is currently under development and managers are considering establishing a new, longer-term goal.

Indicators for the status of management effort for oysters, menhaden, striped bass, and shad are being re-evaluated. The Chesapeake Bay Program team on Sustainable Fisheries is looking at new methods for representing the health and management of these species to include ecosystem considerations. These metrics are expected to be used in future annual reports. In the mean time, steps to improve the protection and enhancement of the oyster resource have been implemented. Maryland has increased the protection of the remaining quality habitat for oysters from 9% to 25% through its Sanctuary Program.

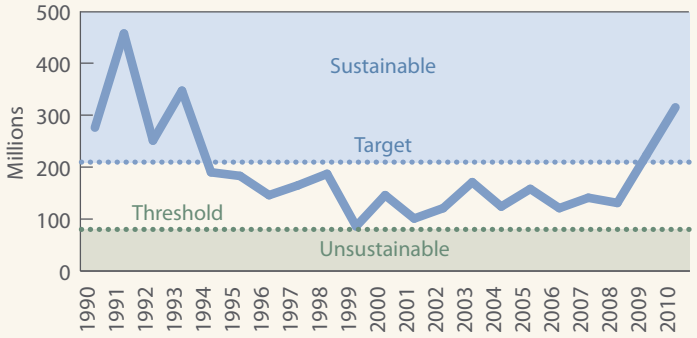
## Protecting Watersheds

The Bay region consists of thousands of local waterways. The health of these local streams and creeks depends on how the land around them is used, protected or preserved. The current goals for this section are:

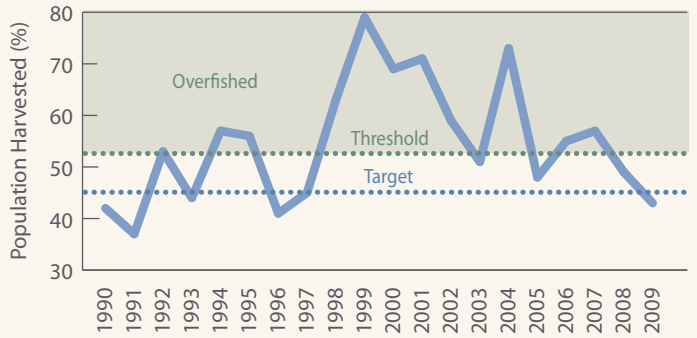
- Forest Buffers Planted: Conserve and restore forests along at least 70 percent of all streams and shoreline in the watershed with a near-term goal of at least 10,000 miles in the watershed portions of Maryland, Pennsylvania, Virginia and Washington, D.C. by 2010. (Note: Bay Program partners achieved their original 2010 restoration goal of 2,010 miles in 2002.)
- Watershed Management Plans: Develop and implement watershed management plans for two-thirds of the total watershed acreage in Maryland, Pennsylvania, Virginia and the District of Columbia, or 22.7 million acres, by 2010.
- Lands Preserved: Permanently preserve 20 percent of the total watershed acreage in Maryland, Pennsylvania, Virginia and the District of Columbia (or 6.8 million acres), from development by 2010.

In 2010: Bay Program partners planted 337 miles of forest buffers along local waterways in 2009-2010, achieving 72 percent of the near-term goal. Watershed plans were developed for 54,018 acres in Maryland for a total of 14 million acres with plans developed in all four jurisdictions or almost 62% of the goal. An additional 102,888 acres of land were protected this year, bringing the total amount of land preserved in the watershed portions of Maryland, Pennsylvania, Virginia and the District of Columbia to 7.3 million acres, which surpasses the goal of 6.8 million acres. (The total watershed acreage of Maryland, Pennsylvania, Virginia and the District of Columbia is estimated to be 34 million acres.)

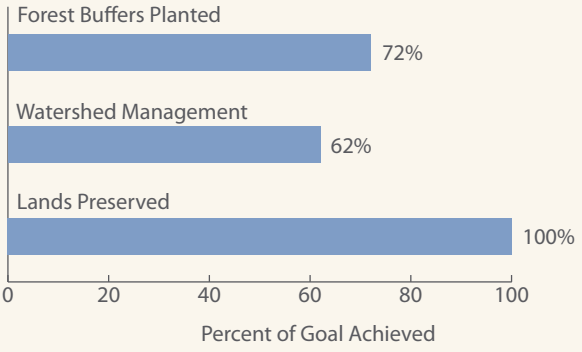
**Blue Crab Abundance**
Target: 200 Million Adult (age 1+) Crabs

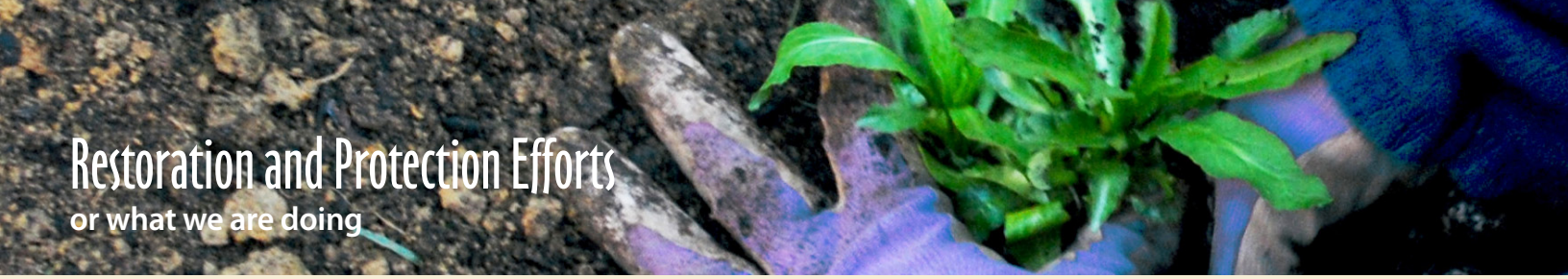



**Blue Crab Management**
Threshold: 53 Percent of Population




**Protecting Watersheds**
Goal: 100%





# Restoration and Protection Efforts

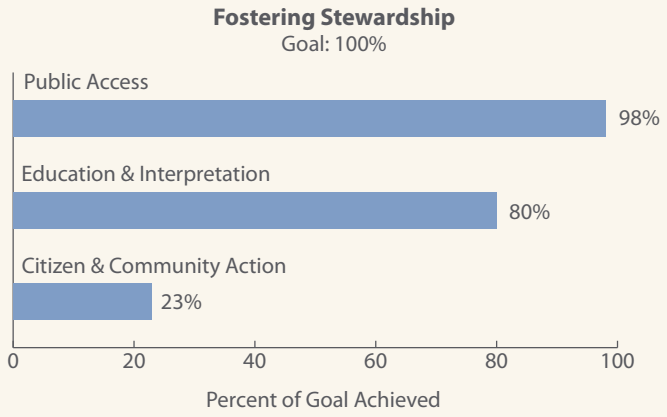
## or what we are doing

## Fostering Stewardship

Programs that foster public stewardship include education and interpretation for students (of all ages), increasing public access, and expanding actions by citizens and communities. Goals in this area are:

- **Public Access:** Expand the system of public access points in the watershed by 30 percent by 2010; develop partnerships with at least 30 sites to enhance place-based interpretation of Bay-related resources and themes (by 2003); increase the number of designated water trails in the Chesapeake Bay region by 500 miles (by 2005).
- **Education and Interpretation:** Provide three Meaningful Watershed Educational Experiences (MWEEs) for every student before high school graduation.
- **Citizen and Community Action:** Establish 330 local governments as Bay Partner Communities. No goal has been created for citizen action.

In 2010: Six public access sites were acquired, developed or enhanced (for a total of 767) and seven new Gateways sites were added (for a total of 173, exceeding the goal). The figures for water trails remained steady at 2,184 miles, exceeding the goal. During the 2009–10 school year, grant funding supported MWEEs for more than 46,000 students and training opportunities for more than 1,400 teachers. To date, 77 local governments have been awarded Bay Partner Community, which is 23 percent of the goal. However, the program is no longer funded. Finally, 22,846 volunteers participated in restoration activities in 2010.




**LOOKING FOR MORE DETAIL?**
Visit www.chesapeakebay.net/status_restoration.aspx for more information about these indicators, including data and methods.

# What You Can Do

No matter where you call home, you live in a "watershed"—an ecological system in which water that falls on the land runs downhill or soaks into the ground and ends up in a nearby river, creak, pond, or larger waterbody. As it travels, the flow of water carries whatever is on the land (ie: oil, loose soil, excess fertilizer) along with it. This is why we say that everything people do on the land affects their local waterways and the Chesapeake Bay.

Therefore, restoring the Chesapeake region means that the watershed's over 17.2 million —and growing—residents must become aware and get engaged in the effort to restore and protect it. The more involved we become, the more successful we will be in helping not only the Bay, but the creeks or stream in our neighborhoods, too.

## Where to start? Visit the "Get Involved" section of www.chesapeakebay.net to:

- Get ideas for bay places to visit and explore
- Volunteer at events where help is needed
- Find tips for how to help the bay: in your home, yard, on the road, on the water, at school
- Locate a watershed group near you that really knows the issues
- Uncover resources for teachers, schools, watershed groups, local governments and businesses

The Chesapeake Bay Program is a regional partnership that has coordinated and conducted the restoration of the Chesapeake Bay since 1983. Partners include the U.S. Environmental Protection Agency (representing the federal agencies); the states of Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; and advisory groups of citizens, scientists and local government officials.

Many federal and state agencies, local governments, academic institutions and non-governmental organizations contributed data and analysis to this report, including:

- Alliance for the Chesapeake Bay
- Anne Arundel Community College
- Chesapeake Bay Commission
- Chesapeake Research Consortium
- Delaware Department of Natural Resources and Environmental Control
- District of Columbia Department of the Environment
- District of Columbia Department of Health
- Fairfax County, Virginia
- Interstate Commission on the Potomac River Basin
- Maryland Department of Agriculture
- Maryland State Department of Education
- Maryland Department of the Environment
- Maryland Department of Natural Resources
- Montgomery County, Maryland
- Morgan State University Estuarine Research Laboratory
- National Aquarium in Baltimore
- National Park Service
- National Oceanic and Atmospheric Administration
- New York State Department of Environmental Conservation
- Old Dominion University
- Oyster Recovery Partnership
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Education
- Pennsylvania Department of Environmental Protection
- Pennsylvania Fish and Boat Commission
- Prince George's County, Maryland
- Susquehanna River Basin Commission
- University of Maryland Center for Environmental Science
- University of Maryland College Park
- Upper Susquehanna Coalition
- U.S. Army Corps of Engineers
- USDA Natural Resources Conservation Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- Versar, Inc.
- Virginia Department of Environmental Quality
- Virginia Department of Conservation and Recreation
- Virginia Department of Education
- Virginia Department of Forestry
- Virginia Department of Game and Inland Fisheries
- Virginia Institute of Marine Science
- Virginia Marine Resources Commission
- Virginia Polytechnic Institute and State University
- West Virginia Department of Agriculture
- West Virginia Department of Environmental Protection

# 2010 Partner Restoration Highlights

In 2010, Chesapeake Bay Program partners made continued progress on goals and commitments while also focusing on new efforts to restore and protect the Bay and its local waterways. The following are some notable accomplishments that Bay Program partners achieved.

## Chesapeake Bay Commission

With new ambitious land conservation goals set for the watershed, the Chesapeake Bay Commission partnered with Chesapeake Conservancy to publish *Conserving Chesapeake Landscapes: Protecting Our Investments, Securing Future Progress*. The report assessed the capacities and needs of the region's land conservation programs and built upon policy successes to present state-specific recommendations. Commission members successfully sponsored legislation to improve and protect the Bay's water quality, ranging from enhancing state land conservation efforts and incentivizing redevelopment of existing urban areas to increasing advanced biofuels production. Following release of the states' draft watershed implementation plans (WIP)s in the fall, the Commission identified potential legislative action items. In 2011 members sought to limit nitrogen and phosphorous in lawn maintenance fertilizers to reduce urban and suburban runoff pollution. View publications at www.chesbay.virginia.gov.

## Delaware

In 2010 Delaware made significant progress towards implementing the state's portion of the EPA's TMDL with the Chesapeake Bay Watershed Implementation Plan (Phase I), approved by the EPA. New Combined Animal Feeding Operation regulations and revised Nutrient Management Program Certification regulations took effect and required designated farms, livestock and poultry producers to take appropriate actions to manage manure, litter and wastewater to protect water quality. Other milestones to accelerate the Bay cleanup included: Enhanced nutrient removal (ENR) upgrades at the Delmar Wastewater Treatment plant that will reduce effluent loadings for total nitrogen by 84% and phosphorus by 94%; a new stormwater filtration system in Seaford which will reduce pollutants from entering the Nanticoke River; and the new Nanticoke Restoration Plan that targets enhancing and expanding headwater forests, restoring channelized streams, and establishing riparian buffers along streams and tidal wetlands.

## District of Columbia

The District of Columbia continued making significant progress on green infrastructure: we installed 550 rain barrels, expect to install another 1,000 in 2011, and provided fiscal incentives to residents for landscaping techniques like shade trees and porous pavers. A new impervious area-based stormwater fee is helping to reduce polluted runoff, and DDOE is developing a Discount Program to lower fees for properties installing stormwater retention practices. DDOE engaged residents in the design of 3 'green streets' and partnered with nonprofits to build community support for new environmental roadway design. The city worked to include low-impact treatments in road construction projects. It also initiated restoration in Watts Branch, a 1.7 mile project that will include over 10,000 new trees and shrubs and will reconnect the stream to its floodplain. DC Water's $101 million upgrade to reliably meet BNR (Biological Nutrient Reduction) standards of 7.5 mg/l was completed. To comply with ENR requirements, DC Water has a project underway that would capitalize on features constructed during the BNR phase. Completion of this ENR work is expected by June 2014, in time to meet new permit requirements by 2015. Under the Clean Rivers Project, construction of a storage tunnel to manage combined sewer overflows has begun and will be complete by 2018. Lastly, DC and its neighboring Maryland counties now have a Trash TMDL.

## Maryland

In 2010, Maryland farmers planted 400,000 acres of cover crops statewide. Doubling the acreage planted in cover crops is a prominent feature in Gov. Martin O'Malley's suite of 38 ambitious two-year milestones to accelerate Bay cleanup. Collectively, the 400,000 acres of cover crops planted will prevent an estimated 2.4 million pounds of nitrogen and 80,000 pounds of phosphorus from potentially impacting the Bay and its tributaries. Enhanced Nutrient Removal (ENR) retrofits were completed on 9 wastewater treatment plants, representing over 200,000 lb of N reduction. In addition, 5 plants started construction, and 9 plants began feasibility or design studies. By the end of 2010, Maryland had restored almost 40,000 acres of developed land with stormwater retrofits through the implementation of new MS4 permits. Maryland's poultry farmers transported 46,226 (FY10) tons of poultry litter out of the Bay watershed, exceeding the milestone goal by 168 percent. The state also fully funded Program Open Space for the fourth consecutive year and preserved more than 32,643 acres of vital natural landscape. The blue crab population rebounded with the enactment of new regulations, and Maryland took action to rebuild native oyster populations and expand oyster aquaculture opportunities.

## New York

The Dishwasher Detergent and Nutrient Runoff Law was signed into law by Governor Patterson on July 15, 2010. This law reduces phosphorus runoff into the State's waterbodies by prohibiting the sale of phosphorus-containing dishwasher detergents and limiting the use of phosphorus-containing lawn fertilizer. This will reduce costs to local governments and private entities required to remove phosphorus from stormwater and wastewater, while expanding recreational uses of the state's waters. The Upper Susquehanna Coalition, the Natural Resources Conservation Service, and land owners in New York also made great strides for cleaner water by: restoring 268 acres of wetlands; installing 80,274 feet of stream fencing; planting 273 acres of forest buffers; placing 5,239 acres under comprehensive nutrient management plans and 2,324 acres under prescribed grazing.

## Pennsylvania

Pennsylvania developed and worked to implement its Chesapeake Watershed Implementation Plan in 2010. Erosion and sedimentation (E&S) control regulations were strengthened. The revisions required E&S plans for all plowing and tilling activities as well as Animal Heavy Use Areas, and required additional vegetative cover or BMPs for fields within 100 feet of a stream. An extensive outreach effort began to inform all agricultural operations of these requirements. The revisions also established Riparian Buffer requirements for Special Protection watersheds. No earth disturbance is permitted within 150 feet of the intermittent stream,

perennial stream, lake, pond or reservoir and existing riparian buffers must be protected in perpetuity. For Special Protection waters failing to attain its designated use, a 150 foot wide Riparian Forest Buffer must be established and protected in perpetuity or an existing 150 foot wide Riparian Forest Buffer must be protected in perpetuity. Pennsylvania also adopted Nutrient Credit Trading regulations in 2010, and created a Nutrient Credit Clearinghouse.

## Virginia

During its 2011 Session, the Virginia General Assembly passed legislation that will contribute significantly to the state's effort in cleaning up the Chesapeake Bay. Governor McDonnell added $ 36.4 million to the Water Quality Improvement Fund, which will be used to help implement point and non-point source, best management practices and initiate the James River Chlorophyll study. Fertilizer legislation passed that prohibits the sale, distribution and use of lawn maintenance fertilizer containing phosphorus as of December 31, 2013. It also required golf courses to implement nutrient management plans by 2017. Finally, the legislation required the Virginia Department of Agriculture and Consumer Services to establish reporting requirements for contractor-applicators and licensees who apply lawn fertilizer to more than 100 acres of nonagricultural lands annually. The General Assembly also passed legislation allowing farmers who develop agriculture resource management plans to be deemed as being in full compliance with any load allocation contained in a TMDL.

## West Virginia

West Virginia's commitment to plant trees and shrubs along creeks kept agency staff and volunteers busy in 2010. In all, over 75,000 feet of buffers were planted in 2010 totaling nearly 175 acres (87% of the first 2-year milestone goal). This included 26 plantings done in the Potomac River watershed of West Virginia through the Conservation Reserve Enhancement Program (CREP) and other projects accomplished with diverse partners and funding sources. Cover crop implementation was another area of great success, boosted by a state-funded cost-share program initiated last year. Local government staff and other representatives of the developed lands sector met throughout the year to develop a model stormwater ordinance for the Eastern Panhandle. WV partners were also committed to assisting CBP staff with the development of the TMDL and finalizing a Phase I Watershed Implementation Plan (WIP). Partners worked to bring together stakeholders, to put the TMDL into language and numbers the public could understand, and to submit a WIP that was acceptable to EPA.

## EPA and Federal Agencies

In 2010, the U.S. Environmental Protection Agency (EPA) and numerous other federal agencies worked to develop and implement a new strategy (issued in May 2010) for the protection and restoration of the Chesapeake Bay Watershed. Since the issuance of President Obama's Executive Order 13508 in 2009 (http://executiveorder.chesapeakebay.net/), EPA and senior representatives from the Departments of Agriculture, Commerce, Defense, Homeland Security, Interior and Transportation have been sharing their respective expertise, in collaboration with state and local governments, to usher in a new era of federal leadership, action and accountability to protect the Bay. Some agency initiatives undertaken in 2010 include:

- **Department of Defense**
  Completion of the Navy's first "green" roof construction projects at the Legal Services Building.
- **National Oceanic and Atmospheric Administration (NOAA)**
  Worked with states and other partners to identify prime locations for oyster restoration by mapping and characterizing the bottom habitat in some tributaries. The survey data, combined with water quality and oyster harvest information, has been used to guide oyster reef building projects.
  http://chesapeakebay.noaa.gov/acoustic-seafloor-mapping-projects
- **Department of Agriculture (USDA)**
  Through the 2008 Farm Bill's Chesapeake Bay Watershed Initiative, USDA helped to provide an unprecedented $33,517,626 in 2010 to assist farmers in implementing conservation practices like cover crops, crop residue management, nutrient management, and vegetative buffers; in addition to assistance provided through other USDA programs. USDA and EPA also awarded $5.5 million in Conservation Innovation Grants and other grants for innovative agricultural conservation projects to help protect the Bay and local waterways.
  www.nrcs.usda.gov
- **U.S. Environmental Protection Agency (EPA)**
  Shaped by an extensive two-year long public and stakeholder involvement process, EPA released the Total Maximum Daily Load (TMDL) for the Chesapeake Bay and the region's streams, creeks and rivers in December 2010. This "pollution diet" calls for significant reductions in nitrogen, phosphorus and sediment loadings to the Bay by 2025, with at least 60 percent of the reductions achieved by 2017. EPA continues to work with the watershed jurisdictions as they create their Watershed Implementation Plans (WIP)s, providing them with resources (grants, technical assistance, contractor support, communication materials, etc.) to aid in implementation.
  www.epa.gov/chesapeakebaytmdl
- **U.S. Fish and Wildlife Service (FWS)**
  Working with federal partners, the FWS has targeted brook trout and black duck habitats for restoration; provided assistance to private landowners who want to restore habitat; identified shared priorities for land conservation; identified priority marshes and forests for restoration; and identified ways to encourage the use of Best Management Practices to help reduce nutrient and sediment flowing into waterways.
- **U.S Geologic Survey (USGS)**
  USGS helped to improve urban-land cover data; developed new techniques to assess improvements in nutrients and sediment in the watershed; and supplied information on sediment loads. With other federal agencies, it began to develop land-conservation prioritization tools and collaborate on areas for land conservation; continued sampling fish within the Potomac River basin; and studied factors affecting Bay sea-duck populations.
  http://chesapeake.usgs.gov

Chesapeake Bay Program
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410 Severn Avenue, Suite 112
Annapolis, Maryland 21403
**800-YOUR BAY | www.chesapeakebay.net**