The Delaware Estuary: Join in its Rediscovery

2002

State of the Delaware Estuary Report

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The Delaware Estuary: Join in its Rediscovery

Dear Residents of the Delaware Estuary,

Across our region, people are rediscovering the Delaware Estuary – the portion of the Delaware River that is influenced by the high and low tides. Large, empty warehouses are being renovated into waterfront offices and homes. Brownfield sites are being converted into waterfront parks. Fish ladders are being built, stream banks are being stabilized, and wetlands are being protected. Fifty years ago, who would have thought that our environment could have made such a successful recovery. Our waterways and wildlife are being cared for… and it shows.

The Delaware Estuary is still one of the most heavily used ecosystems in the nation. It is a source of drinking water for millions of people. It houses one of the world's greatest concentrations of heavy industry and contains one of the largest shipping ports. It is also home to many rare and endangered species of wildlife, and is known for its vast wetlands, important fisheries, beauty, and recreational opportunities.

The ***State of the Estuary Report*** highlights our current knowledge of the Delaware Estuary – what we know about its land and the quality of its water. The report explains the status of the bald eagle population; how the Eastern oyster is recovering from disease; and how the American shad is making a comeback. It also offers some suggestions for conserving our water resources and preventing pollution from stormwater runoff. Lastly, this report introduces you to a couple of the Estuary's watersheds and their unique features.

While it is impossible to report on every issue affecting the Estuary, it is our hope that this report will encourage you to participate in the effort to restore and protect this valuable resource. Read on, learn more, and join us in rediscovering the Delaware Estuary.

Delaware Estuary Program

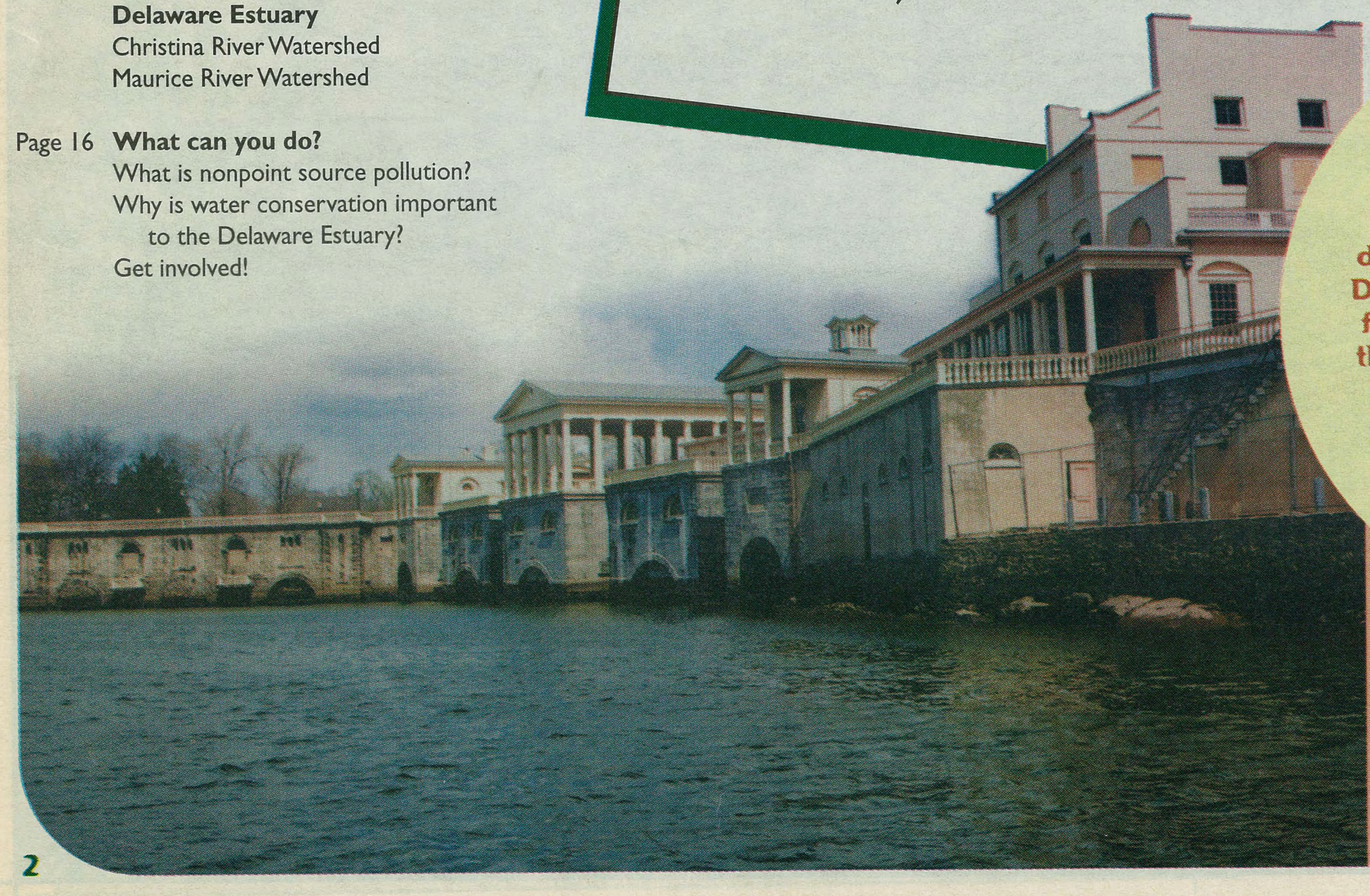

Photo by Kathy Klein

Fact:
Over 17 million people rely on the waters of the Delaware River Basin for drinking and industrial use. The Delaware Bay is only a day's drive for approximately 40 percent of the United States population, yet the Basin drains only four-tenths of one percent of the total nation's continental land area.

Source: DRBC

The Delaware Estuary: Join in its Rediscovery
2002 State of the Estuary Report

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Edited by Joe Matassino, et al.
Designed and illustrated by Frank McShane
Map artwork by Joel Dubin

What is the Delaware Estuary?

Why is it Important?

*The **Delaware Estuary** is part of the Delaware River Basin. The Delaware River is the longest undammed river east of the Mississippi, extending 330 miles from the confluence of its east and west branches at Hancock, New York to the mouth of the Delaware Bay. The River is fed by 216 tributaries - the largest being the Schuylkill and Lehigh Rivers in Pennsylvania.*

An estuary is a tidal body of water where salt water from an ocean mixes with fresh water from a river. The Delaware Estuary is located in the Mid-Atlantic Region of the United States, and includes portions of Pennsylvania, New Jersey and Delaware, through which the Delaware River and its tributaries flow. It covers approximately 6,747 square miles of watersheds that drain into 134 miles of the Delaware River and Bay, from the falls of the Delaware River at Trenton, New Jersey and Morrisville, Pennsylvania, south to the mouth of the Delaware Bay between Cape May, New Jersey, and Cape Henlopen, Delaware.

The transition from land to sea, and from fresh to salt water creates one of the most productive habitats on Earth. It provides vital spawning, nursery, and feeding grounds for fish, shellfish, and marine mammals. The Estuary is home to the largest population of horseshoe crabs in the world, and is an important stopover in the migration path for millions of birds. The wetlands surrounding the waters of the Estuary filter pollutants and sediments from the land, and act as a buffer that provides protection from flooding and erosion.

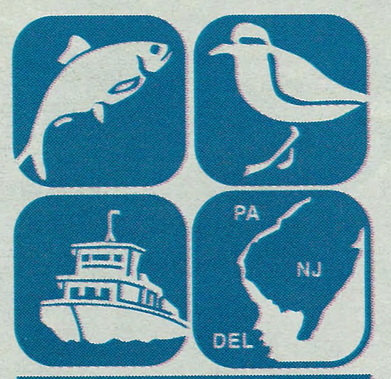
The Delaware Estuary also contributes significantly to the economic, recreational, and cultural resources of our region. The Estuary serves as a source of drinking water, is a shipping route for the food we purchase at the grocery store, and has one of the world's largest concentrations of heavy industry, which provides many of us with employment. We also use the Estuary for fishing, boating, and other forms of recreation. These many diverse uses of the Estuary require us to balance how we take advantage of the Estuary's resources and how we choose to protect those resources.

*The **Delaware River Basin** is 13,539 square miles, draining parts of Pennsylvania (6,422 square miles or 50.3% of the Basin's total land area); New Jersey (2,969 square miles, or 23.3%); New York (2,362 square miles, 18.5%); and Delaware (1,002 square miles, 7.9%).*

Photo of rowers by Pennsylvania Environmental Council

What is the Delaware Estuary Program?

The **Delaware Estuary Program** (DELEP) is one of 28 National Estuary Programs in the United States. DELEP is a partnership of the U. S. Environmental Protection Agency, the states of Delaware, New Jersey and Pennsylvania, the Delaware River Basin Commission, the Partnership for the Delaware Estuary, other non-profit organizations and governmental agencies, the private sector, and citizens, working together to restore and protect the Delaware Estuary. It was established in 1988 to develop a Comprehensive Conservation and Management Plan to protect and enhance the natural resources of the Estuary. DELEP is now in its sixth year of implementing the plan's 77 Action Items. Organizationally, DELEP is comprised of implementation teams and advisory committees that meet on a regular basis to address DELEP priorities.



Is water quality improving in the Delaware Estuary?

Photo by Bill Buchanan

Why protect water quality?

- Clean water is an essential requirement for life and for a healthy and sustainable future.
- Drinking water for most of the residents and businesses in the region comes from the Delaware River and its tributaries.
- Chemical pollutants that are accidentally discharged - even in small amounts - can damage the habitats where beneficial and beautiful wildlife live and breed.
- Clean water in a clean environment enhances the quality of our lives.

Yes! Today's water quality standards and tighter controls have resulted in a much cleaner Estuary as compared to a few decades ago. New techniques allow us to locate sources of pollution and find ways to prevent pollution from entering our rivers and streams. Enforcement of the Clean Water Act, which was passed by Congress in 1972, and the construction of wastewater treatment facilities, have both gone a long way toward improving water quality.

Water quality is an important issue in the Delaware Estuary because of the heavy demands for drinking water, industrial water use, and recreational and commercial fisheries. An excellent indicator of water quality is fish population. We know the quality of the water is improving because the types and variety of fish species that can be found in the Delaware Estuary are increasing. One such indicator species is the striped bass.

As early as the 1700s, water quality in the Estuary was recognized as a problem. In its darkest days, the Delaware Estuary was so badly polluted that little or no oxygen remained in the water to support fish populations. Untreated municipal sewage and industrial waste led to low dissolved oxygen levels in the more industrialized areas of the Estuary. Gaseous odors, released from sewage in the water, tarnished ships, sickened sailors, and turned nearby houses yellow in color.

Our water has greatly improved due to the success of the Clean Water Act, which regulates point sources of pollution. Point source pollution is pollution known to come from a distinct source, such as an industrial discharge pipe.

Yet, despite our great strides in improving water quality, challenges still remain. The Estuary faces threats from toxics, oil spills, and human development. One of the greatest threats to water quality in the Delaware Estuary is from "nonpoint source," or stormwater runoff pollution.

Fact:
The Delaware Bay was named after Lord de la Warr, who was appointed as the first Governor of Virginia in 1609.

How does water quality affect fish and wildlife populations in the Estuary?

Every living organism needs clean water to survive. Thanks to effective regulatory programs and upgrades to treatment plants, we have limited the amount and types of waste that can be discharged into waterways. In fact, the Estuary has seen dramatic declines in fecal coliform levels and significant increases in dissolved oxygen levels, meaning certain fish populations have returned to the River.

Striped Bass

(Morone saxatilis)

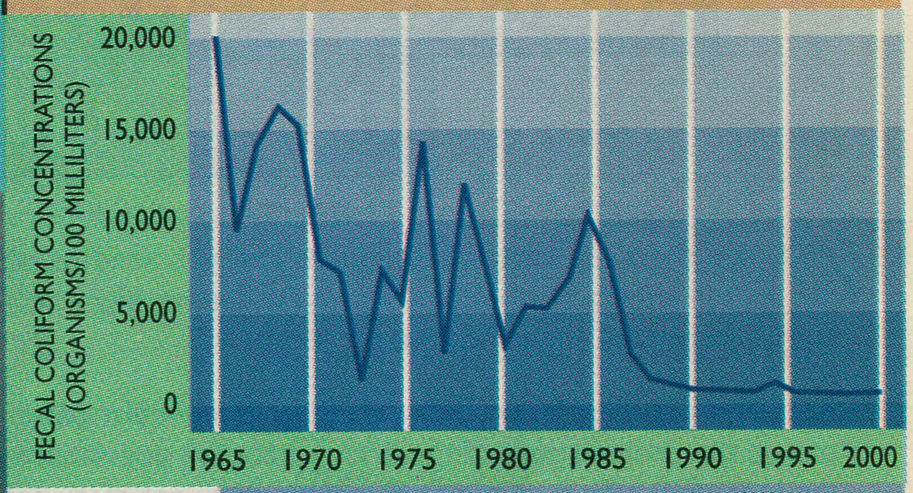
One fish that has been directly impacted by the presence of low dissolved oxygen levels is striped bass. The striped bass is an anadromous species, which means it lives most of its life in salt water but returns to fresh water to spawn. The striped bass has long been of commercial and recreational importance in the Delaware Estuary.

Spawning populations of the species were nearly eliminated by industrial and municipal waste discharges, particularly between Wilmington, Delaware and Philadelphia, Pennsylvania. In this stretch of the River, dissolved oxygen levels were so low, that the adult fish couldn't migrate past this area into fresh water to spawn. In tributaries to the Delaware River, obstructions such as dams prevented striped bass from reaching their spawning grounds. Not being able to reach their spawning grounds caused population levels of striped bass in the Estuary to decline dramatically.

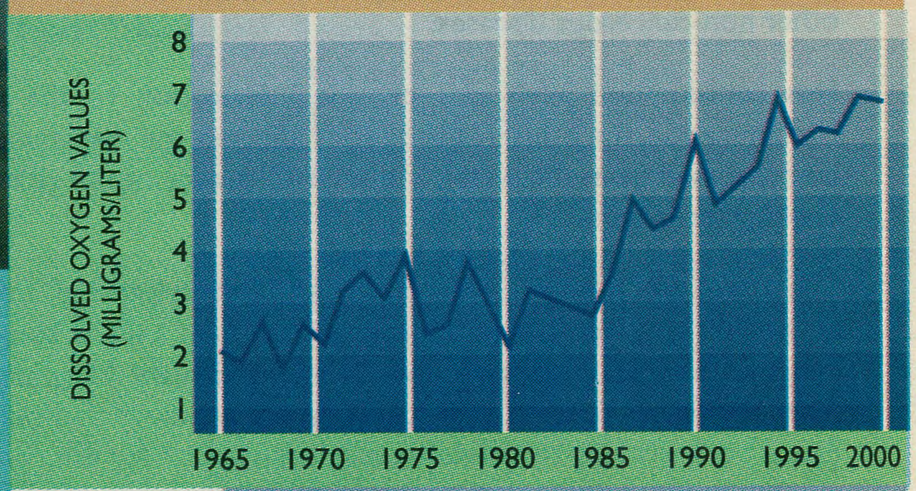
In the last 25 years, with the implementation of pollution control measures and protective management, the striped bass has made a successful comeback throughout the Estuary. Stocks of striped bass that have spawned in the lower Delaware River now contribute to coastal migration populations. The Delaware Estuary is once again reclaiming its place as one of the major striped bass-producing areas on the East Coast.

A Water Quality Success Story

DECLINING FECAL COLIFORM CONCENTRATIONS



INCREASING DISSOLVED OXYGEN LEVELS

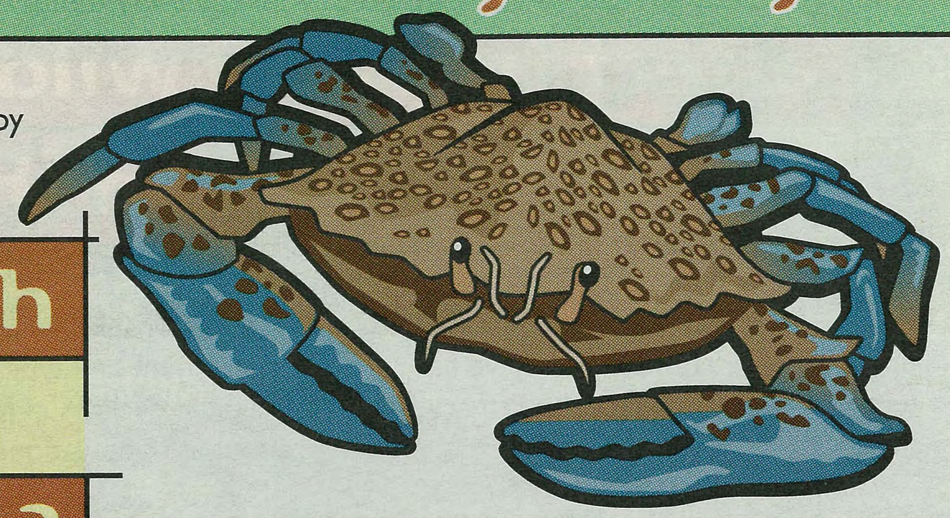


Aquatic organisms, like humans, need oxygen to survive. Their oxygen intake comes from dissolved oxygen that is found in water. The Delaware River Basin Commission's wasteload allocation program and upgrades at riverbank wastewater treatment plants have resulted in dramatic declines in fecal coliform levels and significant increases in dissolved oxygen levels in the Delaware Estuary. High levels of fecal coliform indicate the possible presence of harmful bacteria in a water body. The data in the charts above were generated during the summer months, from sampling water quality in the Philadelphia reach of the Delaware River.

Source: DRBC

How does water quality in the Delaware Estuary affect you?

The presence of water pollution in the Delaware Estuary means that you may not be able to enjoy the water for swimming and fishing as much as you may like.



Can you eat the fish and shellfish that come from the Delaware Estuary?

Yes, but there are certain precautions that you need to take. The states in our region have issued fish consumption advisories to assist you in determining which fish are safe to eat and at what quantity and frequency you should eat them.

Recreational fishing in the Delaware River is a popular pastime for many residents. This is especially true in the tidal portions of the River where fish populations have rebounded. Unfortunately, due to the long-term effects of toxic substances, there are many species of fish carrying unhealthy levels of pollutants in their bodies. While the consumption of non-contaminated fish is part of a healthy diet, the potential effects of ignoring fish consumption advisories include an increased risk of cancer and other non-cancerous diseases.

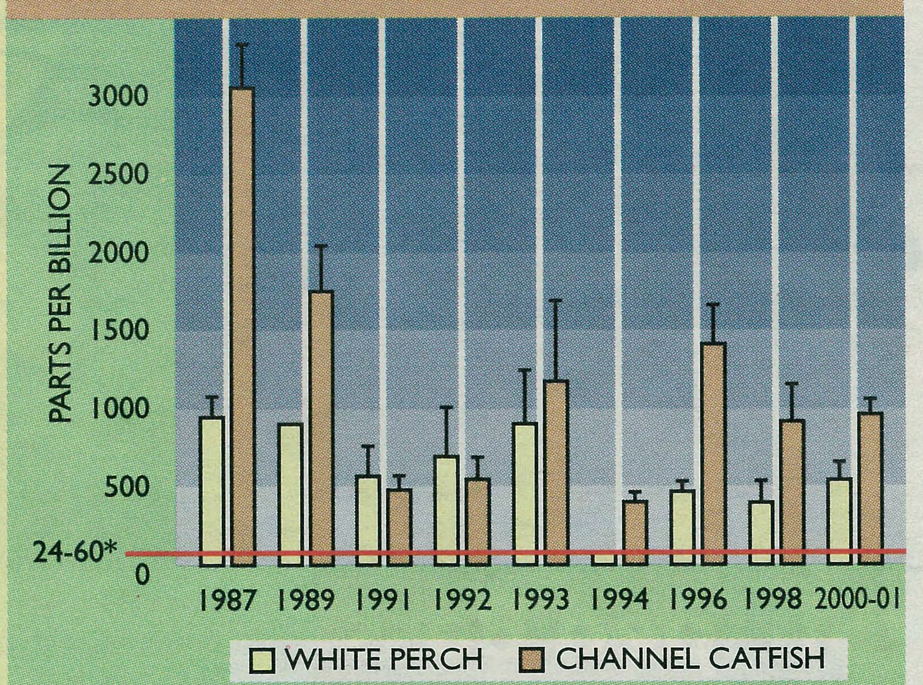
Fish consumption advisories provide information to the public concerning the extent of fish contamination, the fish/shellfish species affected, the maximum number of fish/shellfish that can safely be consumed from the water, and ways to reduce health risks through proper meal preparation and cooking techniques.

The states of Delaware, New Jersey, and Pennsylvania all issue fish consumption advisories. These advisories, however, are not consistent and that can be somewhat confusing for the public. In an effort to address this issue, the Delaware Estuary Program has established a Fish Consumption Advisory Team. Experts in fields of fisheries biology and public health from all three states in the Estuary are working to develop a uniform message for fish consumption.

The graph to the right shows specific information on the synthetic chemical known as Polychlorinated Biphenyls (PCBs). PCBs are a toxic of concern in the Delaware Estuary and in many other waterways throughout the United States and the world. There are currently fish consumption advisories in each of the Delaware Estuary states for PCBs. Based on historical records, the concentrations of PCBs in fish from the Delaware Estuary fell significantly during the 1970s and 1980s. This decline is attributable, in large part, to a ban on the production of new PCBs in the late 1970s, and much closer control and cleanup of sources of PCBs since that time. Despite the long-term improvements, results of fish tissue testing over the last decade show that PCBs continue to persist in the environment at levels of concern. The graph indicates that PCBs continue to exceed the recommended levels for consumption, thus justifying the current fish consumption advisories. A cooperative process is being carried out by numerous stakeholders in the Estuary to identify steps that can be taken to address the remaining PCB problem, with a goal of eventually eliminating fish consumption advisories all together.

The bottom line is that we have come a long way in reducing the magnitude of PCB contamination in the Estuary, but we still have a long way to go.

PCB CONCENTRATION IN DELAWARE ESTUARY FISH



* 24-60 parts per billion (ppb) range, as of August 1, 2002 above which the states of Delaware, New Jersey, and Pennsylvania would recommend consumption of no more than one meal per week.

Source: DNREC

Historic data with respect to PCB concentrations in fish tissue was collected as far back as the 1960s and 1970s. However, this data cannot be compared to current data due to differences in species and locations tested, as well as laboratory methods used. The above information reflects the most recent data available. The bars represent mean PCB concentration over the area from the head of tide at Trenton down to the Chesapeake and Delaware Canal. Standard error is indicated by the error t-bars.

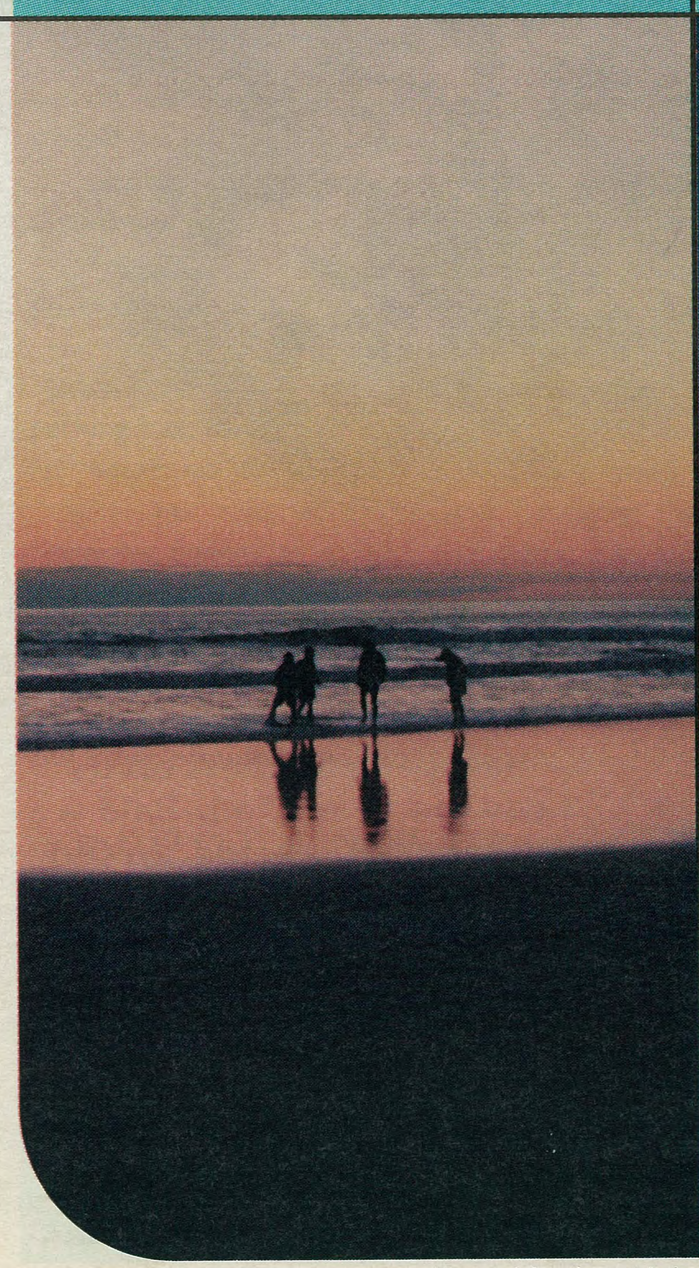
For information on current fish advisories visit:
Delaware: www.dnrec.state.de.us/fw/advisory.htm
New Jersey: www.nj.gov/dep/dsr/njmainfish.htm
Pennsylvania: www.dep.state.pa.us
(directLINK - Fish Advisories)

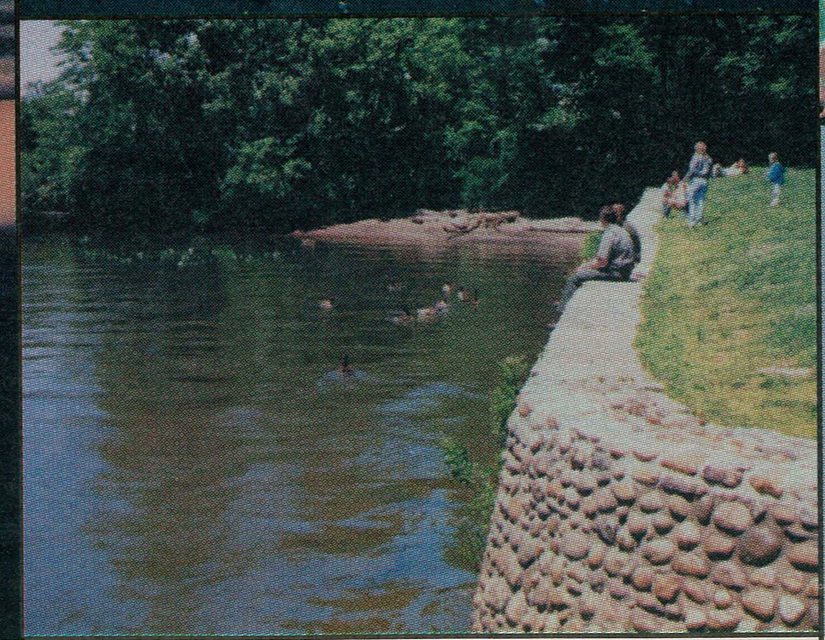
Can you swim in the water?

It depends upon where you swim. Even though we have seen improvements in water quality, there are still many parts of the Delaware Estuary where swimming is not advisable due to physical safety concerns, dangerous currents, floating debris, ship traffic, and pollution from heavy stormwater runoff.

As the demands for recreational, residential, and commercial opportunities along the banks of the River and its tributaries expand, improving water quality to attain swimmable status has become imperative. Monitoring programs conducted at the state and federal level evaluate water quality to determine if bacterial indicators are at levels that would cause infection or disease. The data that are used to judge the suitability of ambient water for swimming include fecal coliform, total coliform, and enterococcus bacteria. Each state that borders the Estuary, as well as the Delaware River Basin Commission, has water quality standards for swimming. These standards are based on bacterial counts of fecal coliform and enterococcus colonies. Counts below a certain level are interpreted as being of no concern, while those exceeding the level indicate a certain risk to human health. As the levels rise and criteria are exceeded, the probability of human illness increases.

Public swimming beaches such as Cape Henlopen State Park in Lewes, Delaware and Higbee Wildlife Management Area in Cape May, New Jersey are monitored for bacterial contamination. However, swimming also takes place in areas that are not monitored. The urbanized region of the Estuary shows improved water quality with most of the samples showing bacteria counts below any level of concern. Even still, many of the Estuary's tributaries show levels of bacteria that indicate swimming is unadvisable. In the headwaters, the quality of the streams vary. Use some judgment, do some research, and ask around to determine if your local waterway is safe for swimming.





Photos: left and top right by Frank McShane, lower right by Kathy Klein

SUITABILITY OF THE DELAWARE ESTUARY WATERS FOR SWIMMING

Source: DRBC Boat Run Program, DNREC, NJDEP, PADEP

Are fish and wildlife populations improving?

Yes! A number of the Delaware Estuary's living resources have seen significant improvements in population. The abundance and diversity of living resources that can be found are indicators of an ecosystem's health. Living resources like eagles, oysters, and shad respond to environmental conditions, habitat availability, and disease. There is, however, still a great deal of work to be done to continue improving the quality of life for our living resources.

Bald Eagles

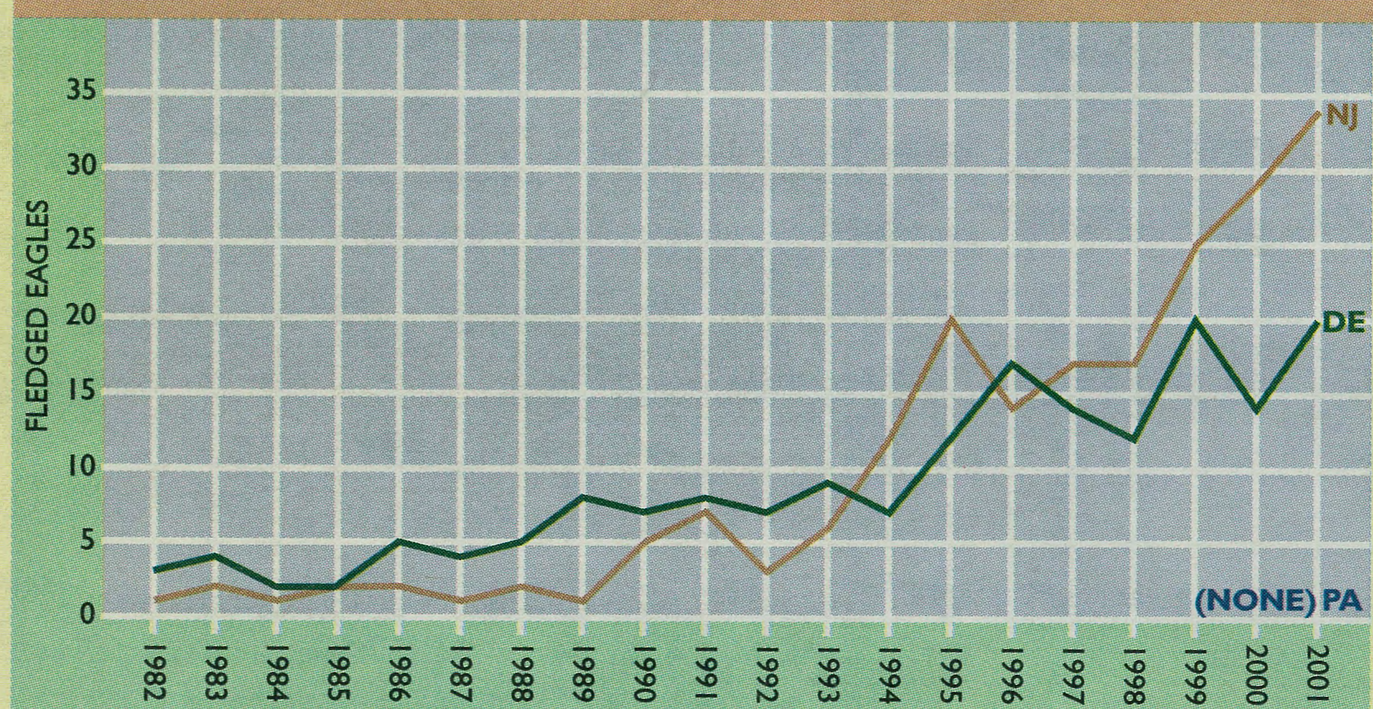
(Haliaeetus leucocephalus)

In 1782, the bald eagle was chosen as the emblem of the United States because of its longevity, strength, and majestic appearance. It was also believed to exist only on this continent. For the past four decades the bald eagle has been a symbol, or an indicator, of our environmental health.

Eagles sit at the top of the food chain. Since each link in the food chain tends to concentrate chemicals from the lower link upward, a process known as bioaccumulation, eagles are more vulnerable to toxic chemicals in the environment.

As a result of the use of the pesticide dichlorodiphenyltrichloroethane, more commonly known as DDT, the number of nesting pairs of bald eagles in the Delaware Estuary declined. The use of DDT was banned in the United States in 1972. Thanks to aggressive management and public education, the eagle population in the Delaware Estuary has rebounded. Any major changes in contamination or habitat destruction would likely adversely affect the Estuary's population of eagles.

NUMBER OF BALD EAGLES THAT HAVE FLEDGED* THEIR NESTS



Source: New Jersey Fish and Wildlife Service, Delaware Division of Fish and Wildlife, and Pennsylvania Game Commission

*The graph shows the number of eagle chicks in New Jersey and Delaware that have successfully fledged their nests from 1982 to 2001. * To* **fledge** *means that the birds have grown the feathers needed for them to take flight. While there are eagles nests within the Delaware Estuary portion of Pennsylvania, none have successfully produced any young to date.*

Fact:
The bald eagle is not really bald; it actually has white feathers on its head, neck, and tail. Bald is a derivation of balde, an Old English word meaning white. The eagle was named for its white feathers instead of for a lack of feathers.

To learn more about opportunities for viewing the bald eagle in your state, search: www.audubon.org

Eastern Oysters

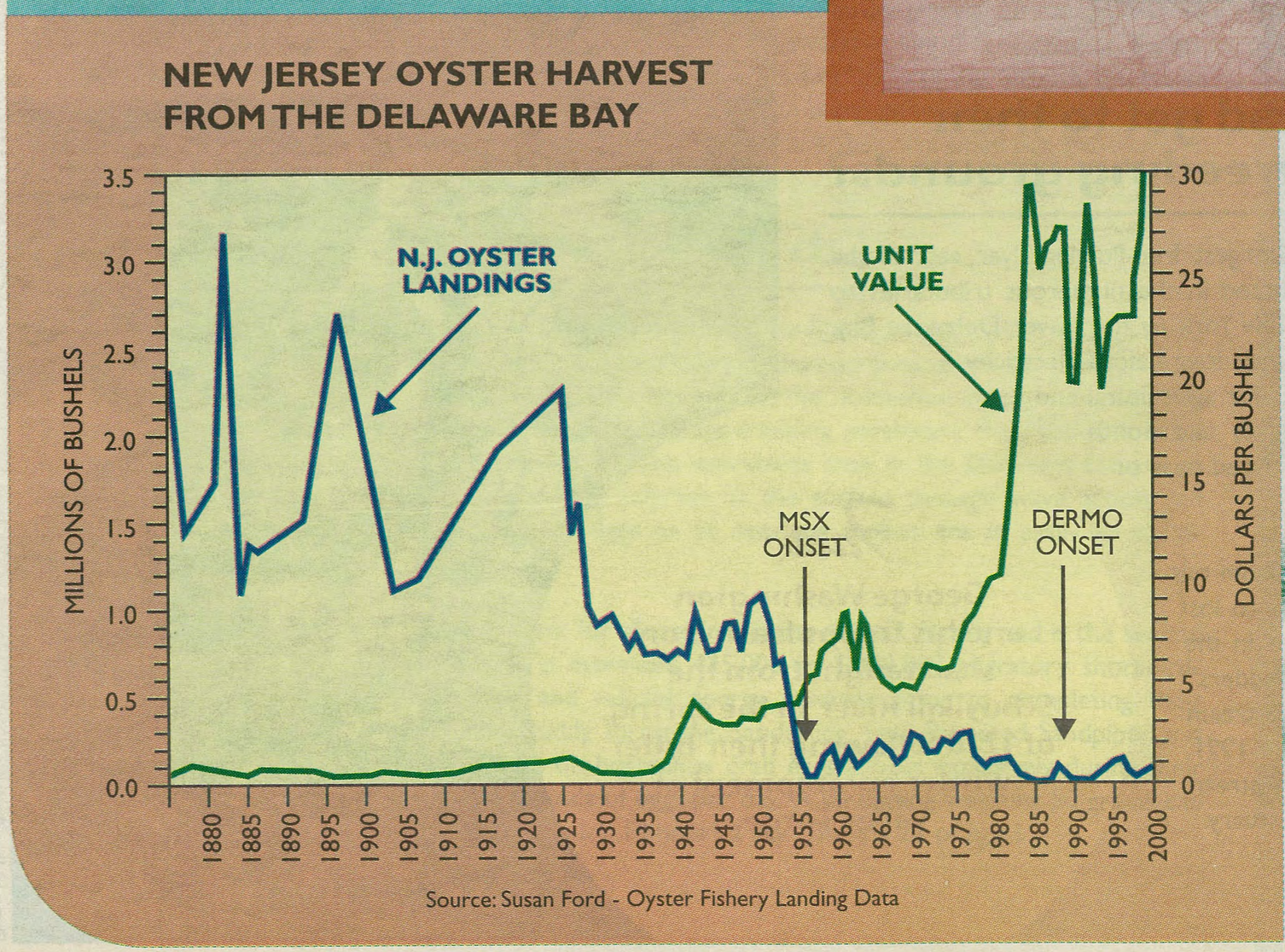
(*Crassostrea virginica*)

The Eastern oyster has a long history as being a commercially and ecologically important species in the Delaware Estuary. As far back as the early 1800s, Eastern oysters found in the Delaware Bay were known for their unique taste and high quality meat. They were extremely popular on the oyster market, and had a significant economic importance to the bayshore communities of Delaware and New Jersey.

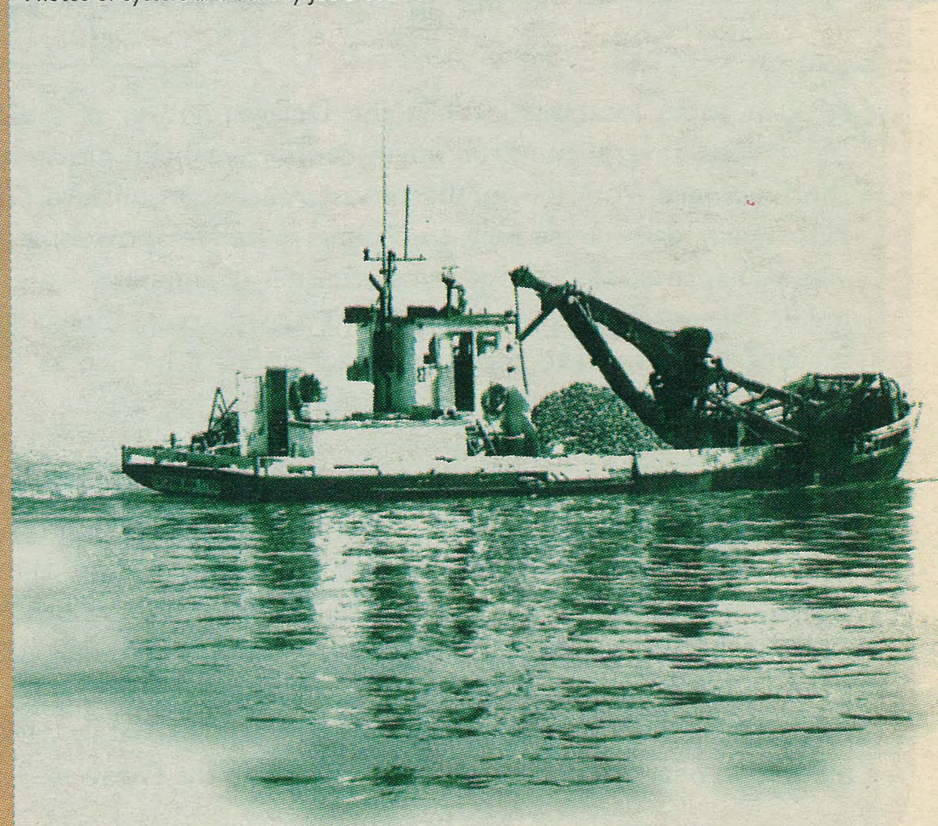
Throughout the early 1900s, annual oyster landings ranged from one million to two million bushels. In the 1950s, however, oyster production was dramatically reduced due to a parasite called MSX. By 1960, only 49,000 bushels were harvested in the Delaware Bay. Gradually, the industry rebounded as the seedbeds recovered in the late 1960s and early 1970s and native oysters developed some resistance to the disease. Unfortunately, in 1990, a new problem surfaced in several locations on the New Jersey side of the Delaware Bay. A new parasite, known as Dermo, spread over much of the Eastern bay causing heavy losses of planted and seeded oysters. Today, there is one shucking house and one packinghouse operating in the town of Bivalve on the Maurice River in New Jersey. They process mostly out-of-state oysters. Researchers are currently working to develop a disease resistant oyster, and management efforts are also under way to bolster populations and develop strategies to better harvest and market the Eastern oyster.

NOAA chart of the Delaware Bay, showing oyster seedbeds and planting grounds

Photos of oysters and boat by Joe Dobarro



Source: Susan Ford - Oyster Fishery Landing Data

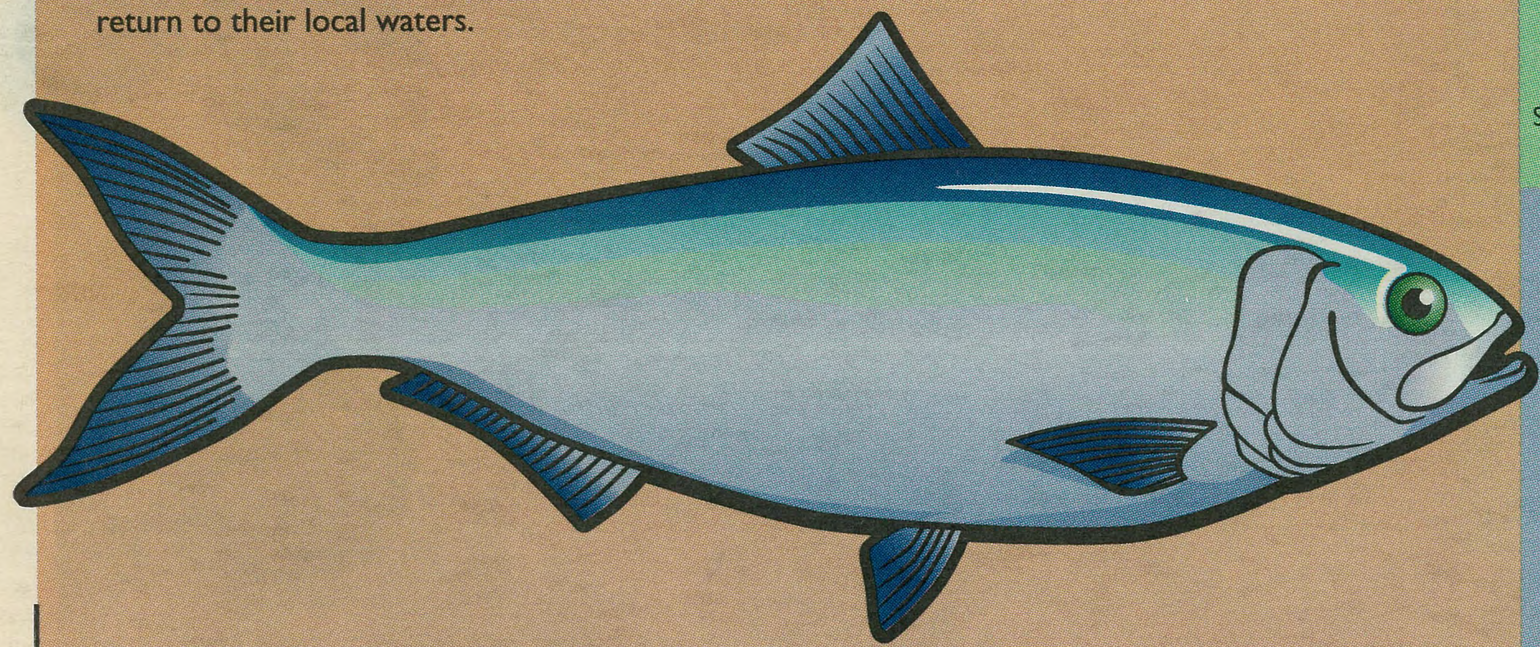


American Shad

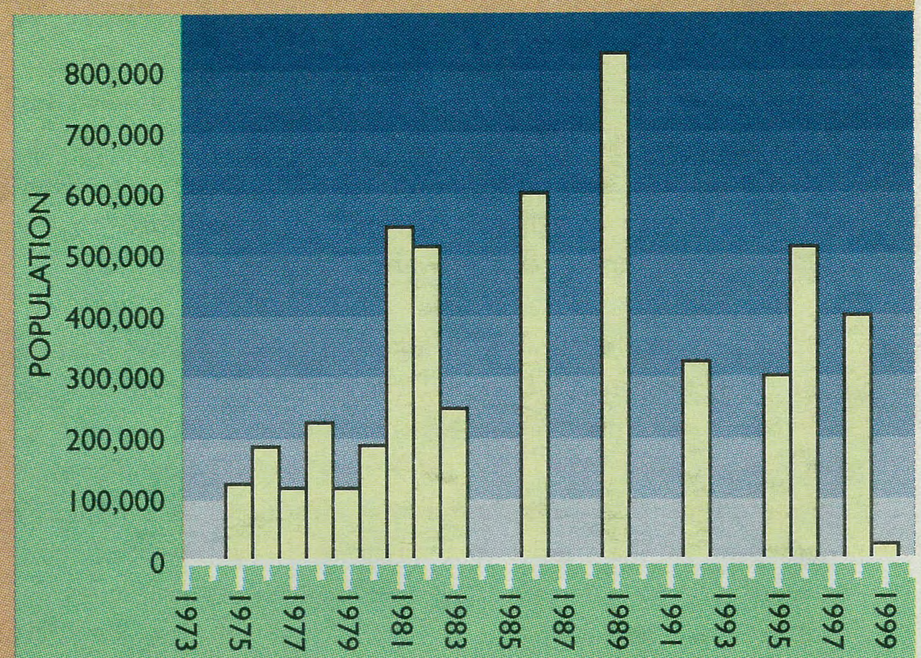
(Alosa sapidissima)

The American shad is the largest member of the herring family. As a native species of the Atlantic Ocean, the American shad, like the striped bass, is an anadromous species that migrates annually from the Atlantic into the Delaware River for the purpose of spawning.

The Delaware River once supported immense populations of shad. Around 1900, their numbers began to decline rapidly, and by 1920 shad populations were so low that productive shad fisheries were no longer a viable economic industry. Degradation in water quality was the principal factor in the decline of the shad population. In addition, a number of the tributaries had been dammed, obstructing spawning habitats. Cooperative efforts in water quality management among state and federal agencies have been primarily responsible for the return of shad to the area. Today, the Delaware River supports a valuable commercial and sport fishery. Shad is recognized as one of the most popular springtime fisheries on the Delaware River and is among the strongest and hardest-fighting of all fish found in freshwater. Delaware River Basin communities, such as Lambertville, New Jersey and Easton, Pennsylvania, now hold annual shad festivals in the spring to celebrate the shad's return to their local waters.



ESTIMATED POPULATION OF ADULT SHAD



Source: NJDEP (1979-2000), Delaware River Basin Fish and Wildlife Cooperative, Delaware Estuary Program (Living Resources and Characterization)

It is difficult to assess the progress with regard to recovery of this resource. The data on juvenile shad shows significant swings in apparent abundance; adult shad numbers have shown an increase, but variability is also apparent from the graph. One theory that may explain these results is that, with water quality improving spawning is able to occur in the lower reaches of the river, resulting in fewer shad in the upper reaches where sampling has been undertaken.

Can fish such as American shad get to their breeding grounds?

Yes, in some locations. While the Delaware River is the longest free-flowing river east of the Mississippi, several hundred small dams have been constructed in the numerous tributaries to the Delaware from its northernmost reaches in upstate New York to the lower Delaware Bay. Historically, dams were built to channel water for powering mills long before electricity was widely available. Today, dams are built to impound water for agricultural and municipal water supply uses and to create recreational lakes and ponds. Building dams, however, prevents anadromous fish, such as striped bass or shad, from completing their upstream spawning migrations.

There is currently a national effort to remove obsolete dams from our waterways, which would allow migratory fish to regain access to lost habitat. While there are few current removal plans for dams in the Delaware Watershed, in recent years, fish passages or "fish ladders" have been built to bypass these dams, thereby opening upstream ponds and stream habitats for use by anadromous fish. Since 1991, through the construction of fish ladders, approximately 165 stream miles have been reopened for fish migration in the Delaware Estuary.

Fact:

George Washington and his troops feasted on shad caught from the Schuylkill River in the spring of 1778 following their bitter winter encampment at Valley Forge.

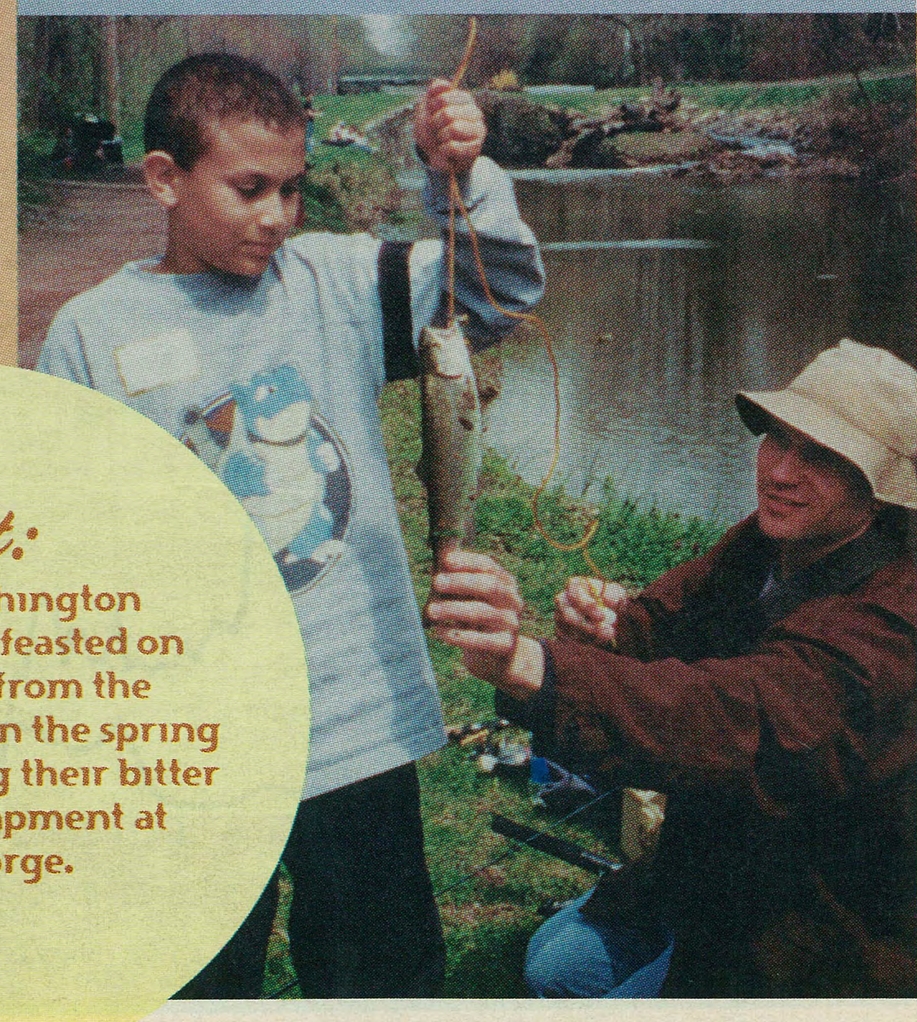


Photo by Jenn Porter

Horseshoe Crabs

(Limulus polyphemus)

The Delaware Estuary is home to thousands of animal species including the world's largest population of horseshoe crabs. The funny thing is…horseshoe crabs aren't really crabs at all! Although they are called "crabs" they are more closely related to spiders. To get technical, horseshoe crabs belong to the phylum of Arthropods, which consists of animals having an articulated body and limbs. The three major classes of Arthropods are Insects, Arachnids, and Crustaceans. The horseshoe crab belongs to its own class called Merostomata, which means "legs attached to the mouth."

Horseshoe crabs are saving lives, possibly yours! With their blood, the biomedical industry is able to produce a valuable substance known as limulus ameboeyte lysate or LAL. LAL is used around the world to test injectable drugs and biomedical devices for the presence of harmful endotoxins that could come in contact with human blood, mucus membranes, spinal fluids, and the lymphatic system. Once their blood is drawn in a medical lab, the horseshoe crabs are returned to the natural environment unharmed.

Horseshoe crabs are in jeopardy. Horseshoe crabs have been on the Earth since the days of the dinosaur. As a species, they are about 350 million years old. Despite their helmet-like shell and pointed tail, horseshoe crabs are gentle creatures. They have few natural enemies. In fact, it is human activities that pose the greatest threat to their survival. Because horseshoe crabs are used for bait in catching eel and conch, commercial harvesting pressure has taken its toll on the population. Loss of habitats due to development and shoreline retreat are also an issue. With concerns over the declining population of horseshoe crabs, biologists began a study in 1996 to determine how the horseshoe crabs use of spawning beaches varies. Their goal was to develop a method for monitoring the species to gain a better understanding of the horseshoe crab population and the impact that excessive harvesting and other human activities have had on the health of the population.

In 1998, the Atlantic States Marine Fisheries Commission implemented a management plan for the species along the Atlantic Coast. Adopted in October 2001, the plan calls for the collection of information necessary to manage the horseshoe crab fishery and to insure protection for the diverse animals that rely on horseshoe crabs and their eggs for food. Scientists at the U. S. Geological Survey designed a census in cooperation with researchers from the U. S. Fish and Wildlife Service, the states of Delaware and New Jersey, a biomedical company, and several universities, to determine the size and status of the Delaware Bay's horseshoe crab population. Regulations have also been put into place to control the harvesting of horseshoe crabs.

Horseshoe Crabs and Shorebirds

Each spring, adult horseshoe crabs journey from the depths of the Delaware Bay to the Bay's beaches to spawn. This journey occurs mostly during the high tides in May and June, especially near the new and full moons when daily tides are highest. At the same time, the horseshoe crabs are laying their eggs on the shore, hundreds of thousands of shorebirds are traveling northward from South America en route to their breeding grounds in the Arctic. The shorebirds stop in the Delaware Estuary to feed on the horseshoe crab eggs. Buried eggs migrate to the surface through wave action and repeated "digging" by other horseshoe crabs. Eggs on or near the surface are an easily accessible source of food for many birds.

The Delaware Estuary is the largest stop-over for shorebirds in the Atlantic Flyway and is the second largest staging site in North America. It is estimated 425,000 to 1,000,000 migratory shorebirds converge on the Delaware Bay to feed and rebuild energy reserves prior to completing their northward migration. Red Knot, Dunlin, Ruddy Turnstone, Sanderling, Semi-Palmated Sandpiper, and other species of migratory shorebirds feed on horseshoe crab eggs almost exclusively during their stopover. Each bird can (and will) eat thousands of eggs per day. A sanderling weighing 50 grams can eat one horseshoe crab egg every five seconds for 14 hours a day. That's a lot of eggs!

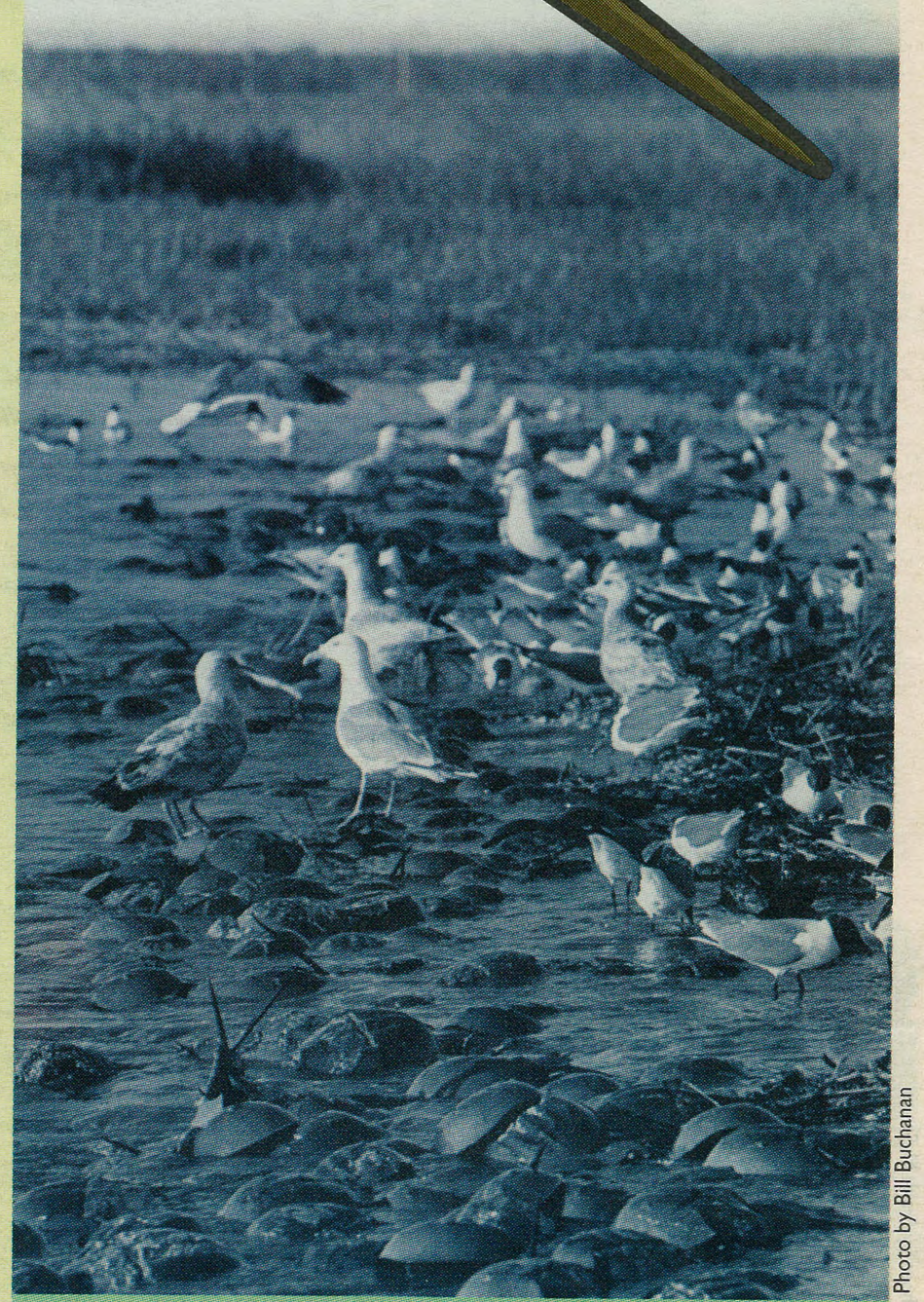
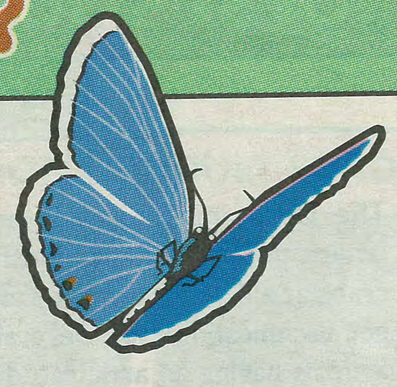


Photo by Bill Buchanan

For more information on the horseshoe crab visit: www.horseshoecrab.org

What do fish and wildlife need to survive?



Fish and wildlife need habitat to survive. Land development and the affects of sprawl or urbanization will determine the ultimate fate of habitat for fish and wildlife. The preservation and restoration of habitats such as wetlands, forests, riparian buffers, and contiguous open spaces are critical to the survival of fish and wildlife populations.

Wetlands

Wetlands are areas where water covers the soil, or where water is present either at or near the surface of the soil all year or for various times during the year, including the growing season. They are among the most productive ecosystems in the world. Their productivity is comparable to that of a rain forest or a coral reef. Wetlands were once thought of as a nuisance to be filled, drained, or dredged. As a result, over the course of 200 years, more than half of the nation's wetlands have disappeared. The loss of wetlands throughout the Delaware Estuary have been significant, particularly between 1954 and 1974. Possibly up to 21 percent to 24 percent of the originally existing wetlands of the Estuary region have been lost.

Today, we know that wetlands provide a host of environmental and economic benefits. They filter out pollutants, provide natural flood control, and recharge ground water supplies. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish, and mammals can be part of a wetlands ecosystem. The Delaware Estuary boasts prime tidal wetlands and 405,000 acres of some of North America's most critical habitat. More than 126,000 acres of these wetlands have been recognized as internationally important. The protection of these ecosystems is more important than ever.

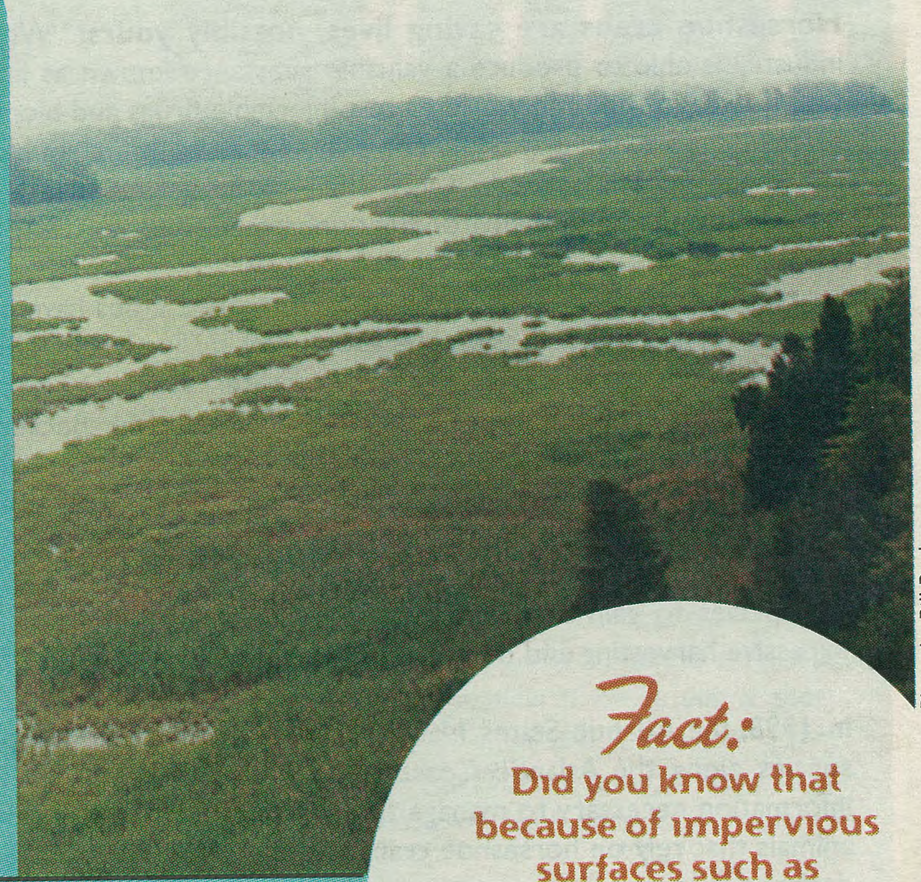


Photo by Bill Buchanan

Fact:
Did you know that because of impervious surfaces such as pavement and rooftops, a typical city block generates nine times as much runoff as a wooded area the same size?

Photo by Frank McShane

Forests

Generally speaking, a forest is a large area, thickly covered with trees. Forests are distinguished by their species of trees and plants, their density, and soil type. They produce tremendous amounts of energy, nutrients, and oxygen, and affect regional weather and global climates. Forests benefit humans and wildlife species, providing wood fiber, outdoor recreation, wildlife habitat, and they also contribute to the natural water cycle.

The Mid-Atlantic Region is comprised of coniferous forests; pine-oak forests; oak-hickory forests; hardwood forests; bottomland and cove forests in the Appalachians; and riparian forests along the coast, which act as a transitional zone between aquatic and terrestrial environments. Despite their importance, our forests are disappearing or becoming fragmented as development continues to spread. Transforming the land from its natural state has consequences that not only affect water quality and quantity, but also the animals that make the forest their home. Forests are considered to be the world's most complex ecosystems supporting more species than all others combined.

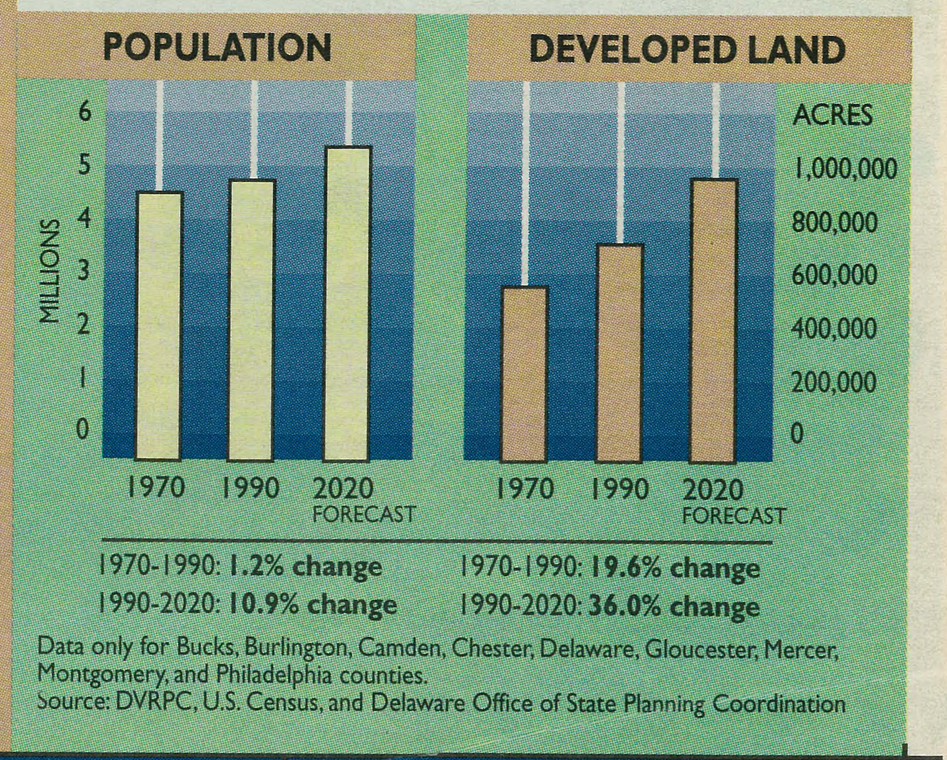
Currently, the U. S. Geological Survey in conjunction with the U. S. Forest Service is conducting a study of the Delaware River Basin to determine the extent of forest fragmentation. The results of this work are expected to be available for the next State of the Estuary Report.

Riparian Buffers

A riparian buffer is the swath of land adjacent to a river or stream. It is the transition area between the uplands and the river. The size of the riparian buffer can vary depending on the landscape. It may be a small corridor of vegetation hugging the river or a large network of wetlands stretching far into the flood plain.

A healthy riparian buffer is vital to the health and diversity of a wide variety of fish, birds, and wildlife. Riparian buffers are often the sole available habitat for amphibians and invertebrates that need moist conditions to survive. Although riparian buffers may occupy a relatively narrow band of territory, they are critical to maintaining the biodiversity of the more extensive, adjoining uplands.

The native plants and trees in the buffer also act as a filter that minimizes harmful sediment and contaminants, like fertilizers and pesticides, from washing into the river. Plants and trees growing in the riparian buffer help to stabilize the soil and reduce erosion. Shade provided by trees is important for controlling the water temperature along the shorelines of water bodies. Since many aquatic plant and animal species are sensitive to changes in water temperature, it is important to keep stream temperatures as close to natural levels as possible.



Data only for Bucks, Burlington, Camden, Chester, Delaware, Gloucester, Mercer, Montgomery, and Philadelphia counties.
Source: DVRPC, U.S. Census, and Delaware Office of State Planning Coordination

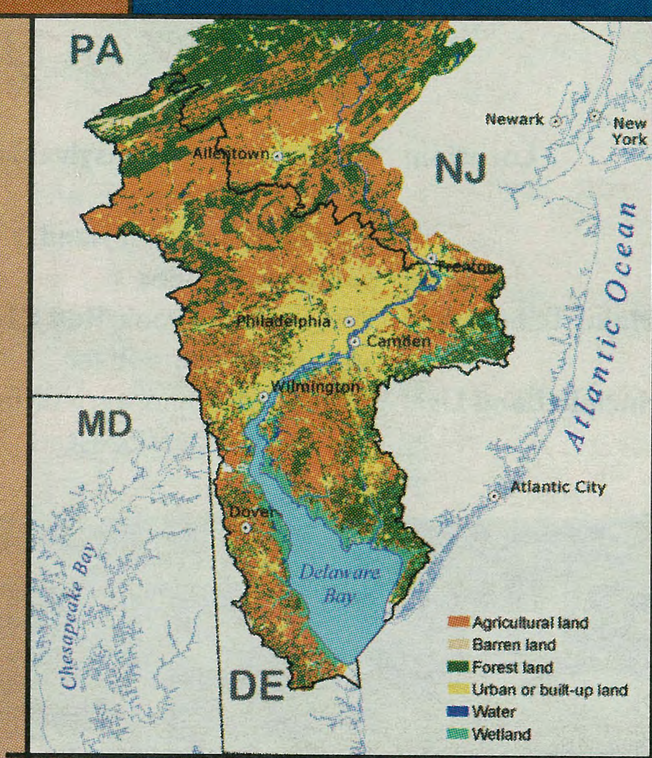
Open Space and Urbanization

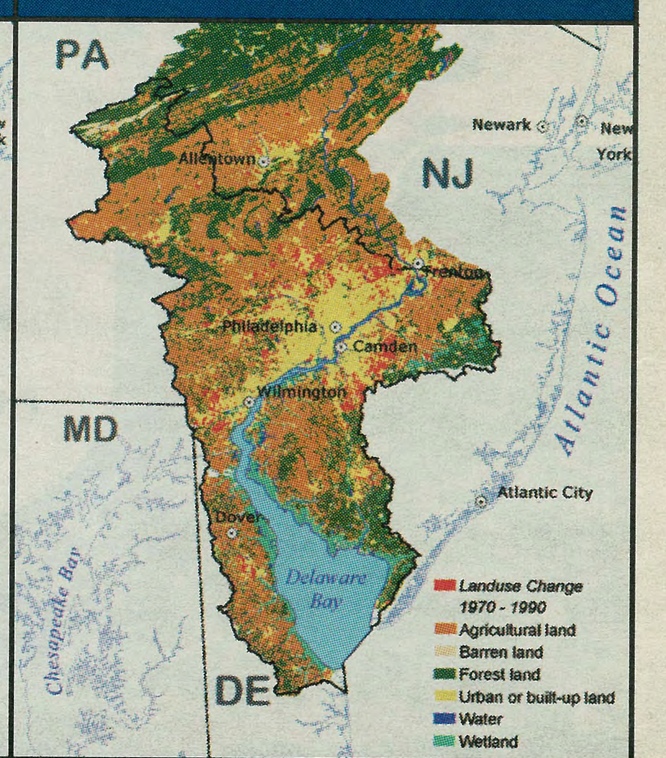
The impact of population growth and urbanization affect wetlands, forests, and riparian buffers which are all habitat for fish and wildlife.

Urbanization or "sprawl" consumes more land than is necessary. It is characterized by scattered, low-density, single-use residential and commercial development on former open space or farmland. Growth and sprawl are complicated issues. While it is important for the Estuary region to have growth and a healthy economy, we must learn to manage that growth to sustain an even healthier environment. The Delaware Estuary Program is not anti-growth, but encourages smart, environmentally-friendly development.

Sprawl leads to the construction of too many impervious surfaces such as parking lots, rooftops, and roads. This loss of pervious surface means that rainwater no longer soaks into the ground recharging groundwater supplies, but runs off of the land increasing the amount and velocity of rainwater flowing to streams and rivers. This increased speed and volume of water can have many negative impacts, including eroded stream banks, increased turbidity and pollution, and increased stream water temperature. With it, runoff carries sediment from construction sites, oil and gas leaked onto roads and parking lots, and fertilizers and pesticides improperly applied to lawns. All of these pollutants can have an adverse effect on the fish and other organisms living in the stream and the receiving waters.

From 1970 to 1990, the Estuary experienced minimal growth as compared to many other coastal metropolitan areas in the United States. The overall increase in population in the Delaware Estuary between 1970 and 1990 was 177,185 people. But forecasts have predicted an increase of 794,000 people between 1990 and 2020. While the population of the largest city in the Estuary, Philadelphia, is predicted to level off and stabilize during this time period, the suburban and rural communities on the fringe of urbanized areas are expected to experience the largest gains in population and development. Regional planners have forecasted that New Jersey municipalities will experience the fastest growth in the Estuary, followed by Delaware and Pennsylvania. (Source: DVRPC)





Maps Source: U.S. G. S. NAQWA Data

In order to gain a better understanding of where the development is occurring in the Estuary, the U. S. Geological Survey initiated a project through their National Water-Quality Assessment Program. Utilizing a geographical information system, U.S. Census population density data for 1990 was compared to 1970s digital land use data. Any area having a population density of 1,000 or more people per square mile was re-classified from a "rural" to an "urban" land use. (These areas are indicated in red in the 1990 map above.) This methodology when applied to the National Water-Quality Assessment program's study units provides us with a reasonable indication of where urbanization has occurred since the 1970s.

Source: U.S. G. S. Water-Resources Investigations Report 94-4250, K. J. Hitt

Rediscover these Watersheds in the Delaware Estuary

Christina River Watershed

Pennsylvania, Delaware, and Maryland

The Christina Watershed has been a hub of activity for the past four centuries. It was along the banks of the Christina, in present-day Wilmington, that the Swedes established the first permanent European settlement in the Delaware Estuary. Fort Christina Park commemorates that historical location. Since that time, the watershed has seen its share of changes in land use, human and wildlife population, and water quality. Today, more than half a million people in three states depend on the Christina River for their source of drinking water.

In an area with rapid population growth occurring, the Christina River Watershed is experiencing some water quality problems. Testing has revealed the presence of toxics and nutrients in the water, most likely a result of runoff from industrial and hazardous waste sites and from farms and suburban lawns. Yet despite these issues of population growth and nonpoint source pollution, the watershed still provides important wildlife habitat. It is home to the endangered or threatened bog turtle, cerulean warbler, longtailed salamander, and bald eagle. White Clay Creek State Park (Delaware) and Preserve (Pennsylvania) provide places of natural beauty and recreational opportunities for many to enjoy, and contain the White Clay Creek, a National Wild and Scenic River.

Watershed Facts:

Location:	**Southeastern Pennsylvania, Northern Delaware, and Northeastern Maryland**
Size:	**565 square miles**
Major Tributaries:	**White Clay Creek, Red Clay Creek, and Brandywine River**
Principle Land Use:	**Urban/suburban, agricultural, and open space/forested**

Photo by Joe Matassino

Who's doing what in the watershed?

The **Christina River Basin Water Quality Management Strategy**, begun in 1995, is a cooperative partnership among all levels of government, along with private groups and the academic community. It uses a coordinated, scientific approach to improving water quality and is meeting the water needs of the region. The sharing of federal funds, across state lines between Pennsylvania and Delaware, is just one example of this cooperation.

In order to ensure that the streams of the Christina Basin meet their water quality standards, a broad partnership, including the U.S. Environmental Protection Agency and the U.S. Geological Survey, is developing the tools and strategies needed to take on the challenging issues of nutrient pollution (nitrogen and phosphorus), low dissolved oxygen, bacteria, and excessive sedimentation from a variety of point and nonpoint sources.

Agricultural Best Management Practices have been implemented in the watershed. They include approximately 15,000 feet of protected stream corridors, twelve farm nutrient management plans, five barnyard runoff control projects, and five systems to exclude livestock from streams. **Residents** are making use of over 200 rain barrels that have been purchased and distributed in the basin, capturing and using roof runoff that would otherwise contribute to excessive stormwater discharge. In addition, a "Smartyards" program in Delaware, run by the **Delaware Nature Society**, assists homeowners with ecologically beneficial landscaping practices on their properties, such as using native plants.

For more information on the Christina River Basin, see the University of Delaware Water Resources Agency's Christina Basin website: http://www.wr.udel.edu/cbl

Maurice River Watershed

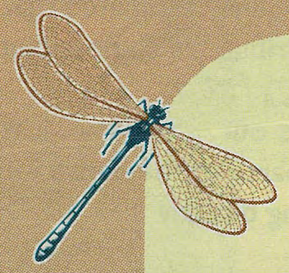
New Jersey

Photo by N.J. Dept. of Environmental Protection

The Maurice River Watershed (pronounced Morris) embodies much of what makes the Delaware Estuary so unique. This nationally recognized Wild and Scenic River was the hub of the Delaware Bay oyster industry. At its mouth, towns such as Port Norris and Bivalve once employed shuckers, watermen, and merchants hauling thousands of pounds of oysters to markets in New York and Philadelphia. Even today, the Maurice supports the more traditional industries such as commercial crabbing, oystering, eeling and net fishing. As a memorial to days gone by, the *A.J. Meerwald*, a 115-foot restored oyster schooner, sails out of Bivalve and serves as a floating classroom interpreting the life and history of the Delaware Estuary.

The Maurice Watershed possesses New Jersey's largest stand of wild rice. The rice attracts thousands of wintering waterfowl to the area every year and also supports nesting pairs of ospreys and bald eagles. With places such as the Manumuskin River Preserve, Union Lake, and the East Point Lighthouse, the watershed offers residents and visitors opportunities to paddle, hunt and fish, sightsee, bird watch, and learn about the Delaware Estuary's fascinating history.

Photo by Joe Dobarro



Watershed Facts:

Location:	**Southwestern New Jersey**
Size:	**386 square miles**
Major Tributaries:	**Scotland Run, Manantico Creek, Muskee Creek, Muddy Run, and the Manumuskin River**
Principle Land Use:	**Agricultural**

Who's doing what in the watershed?

The **Upper Maurice River Watershed Association** (www.sjwatersheds.org/watershedorgs/uppermaurice.htm) is part of the Federation of Gloucester County Watersheds. They concentrate their activities in the headwaters area of the Maurice River. Their focus is on land use and land development issues. The Association partners with the Gloucester County Department of Parks and Recreation in promoting clean waterways through community awareness and education. This partnership culminates in the annual Waterfest held each year in June at the Scotland Run Park in Clayton, New Jersey.

Citizens United to Protect the Maurice River and its Tributaries (www.cumauriceriver.org) is active in the lower and tidal portions of the Maurice River. Citizens United is committed to the preservation and protection of the natural and historic resources of the Maurice River watershed by promoting the virtues of open space. Citizens United was instrumental in securing the Wild and Scenic River designation by the National Park Service.

From the educational sailings of their restored oyster schooner, to their shore-based programs at the Delaware Bay Museum, the **Bayshore Discovery Project** (formerly the Delaware Bay Schooner Project) (www.ajmeerwald.org) has taken the lead in educating thousands about South Jersey's coastal waters. Their annual Bay Day celebrates the areas rich maritime history with fun-filled activities for the entire family, such as horseshoe crab mask-making and an oyster-shucking contest.

What can you do?

There are many ways that you can help the Delaware Estuary:
Help us to reduce nonpoint source pollution!
Take steps to conserve water!
Get involved!

What is nonpoint source pollution?

Nonpoint source pollution occurs when rainwater or melting snow washes over the land on its way to streams and rivers, collecting pollutants such as motor oil, fertilizers, pesticides, animal waste, and litter. Nonpoint source pollution is one of the leading causes of water degradation in the Delaware Estuary. In 1986, the U. S. Environmental Protection Agency estimated that 45 percent of all pollution impacts to estuarine ecosystems nationwide were attributable to nonpoint sources.

Because of the way nonpoint source pollution enters our waterways, it is sometimes referred to as stormwater runoff or "people pollution." In many parts of the Estuary region, these pollutants are carried into storm drains that have outfalls discharging directly into the Delaware River or one of its many tributaries.

Nonpoint source pollution comes in a variety of forms such as:

- Motor oil and antifreeze leaking from motor vehicles
- Nutrients present in lawn fertilizer and leaky septic systems
- Toxins found in pesticides used for gardening and farming
- Animal waste from both pets and farm animals
- Soil that erodes from unstable stream banks or construction sites
- Trash that is littered on the ground

Fact:
If one quart of oil were spilled into the Delaware Estuary, the resulting oil slick would cover two acres or 87,120 square feet of water surface.

Why is controlling nonpoint source pollution so important?

Nonpoint source pollution harms fish and aquatic vegetation, affects the productivity of oyster beds, decreases the water's level of dissolved oxygen, threatens our drinking water, and significantly increases the cost of treating water for human consumption. For example, sediment that erodes from unstable stream banks will accumulate in the bottom of our waterways, making stream water less suitable for the reproduction and survival of fish, macroinvertebrates, and aquatic vegetation. Also, lawn fertilizer contains nutrients, which will result in excess plant growth in streams causing oxygen levels in the water to decrease. This will in turn harm fish and other aquatic species.

Photos by Joe Matassino

What can you do to reduce nonpoint source pollution in the Delaware Estuary?

Because there are a variety of nonpoint source pollutants, there are also a variety of preventative solutions. These solutions are sometimes called Best Management Practices. By incorporating Best Management Practices into your everyday activities, we can all make a difference.

You can help prevent some forms of nonpoint source pollution in the following ways:

- Service your car regularly. A leaky vehicle can drip motor oil onto the streets and wash into our creeks and streams.
- Choose water-based paints.
- Bag or compost leaves to use as top-dressing in your garden.
- Minimize the use of toxic substances by purchasing products that say "all-natural", "earth-friendly," or "100% biodegradable" on their labels.
- Dispose of dog waste in the toilet or trash can.
- Limit your use of pesticides and lawn fertilizers.
- Use native plants because they have adapted to our environment and require less pesticides to survive.
- Keep litter in its place - a trash can.
- Use and maintain septic systems properly.
- Reduce. Reuse. Recycle.

Photo by a storm drain marking volunteer

Photo by Jenn Porter

Small Business owners - Become a Clean Water Partner!

Clean Water Partners is a voluntary, non-regulatory program designed to educate business owners about how they can help control stormwater runoff pollution.

For more information on this program contact: the Partnership for the Delaware Estuary at 1-800-445-4935.

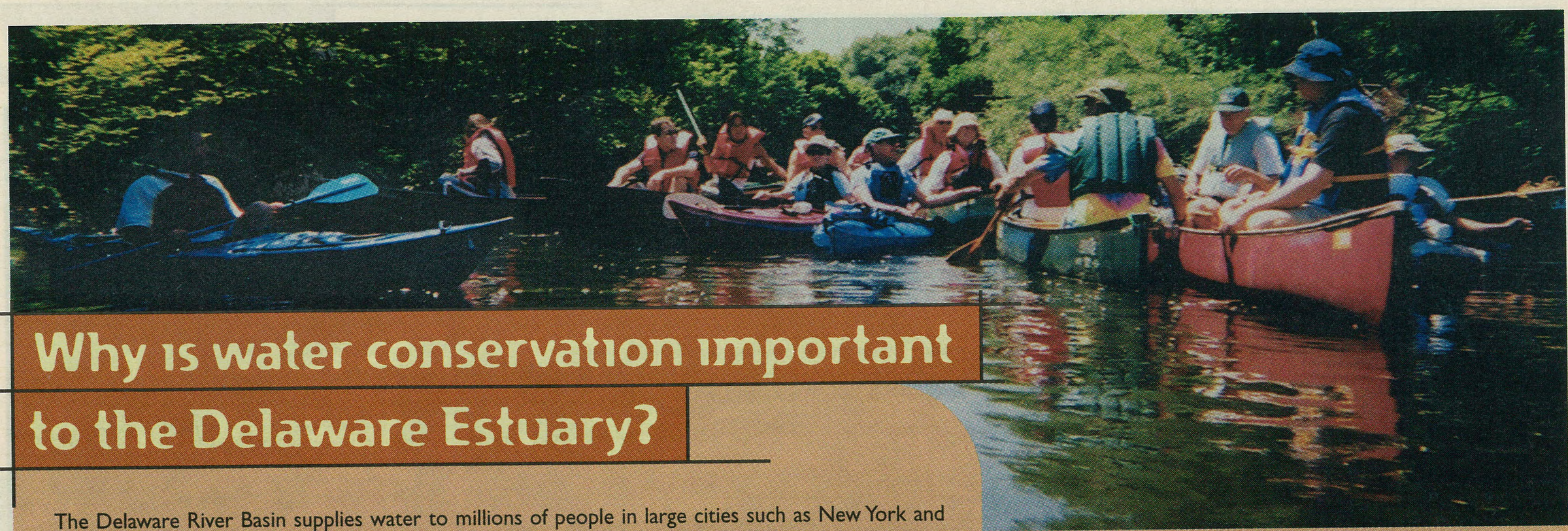


Photo by Jenn Porter

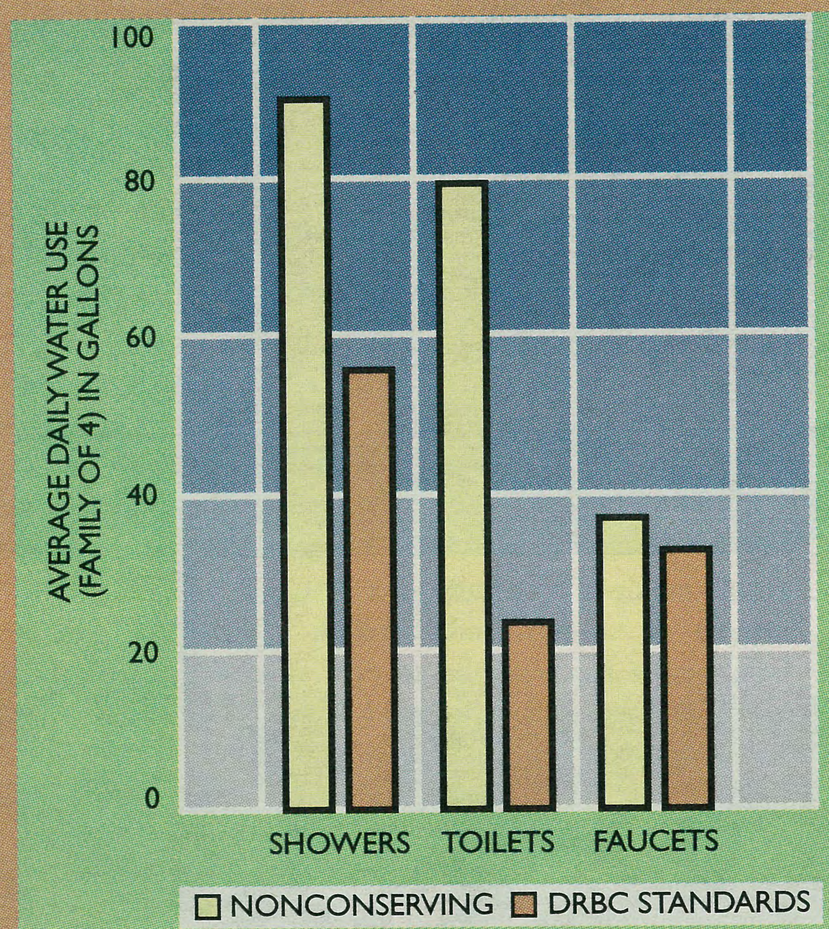
Why is water conservation important to the Delaware Estuary?

The Delaware River Basin supplies water to millions of people in large cities such as New York and Philadelphia, as well as hundreds of smaller communities located along the River and its tributaries. Industry uses water when manufacturing products, refining oil, and producing power. Some communities in the Estuary draw their drinking water straight from the Delaware River, while others draw water from underground aquifers. These communities depend on sufficient down river flows of fresh water to prevent the ocean's salty water from creeping upriver. When drought and water withdrawals create low river flows, the salt line moves north. When this happens, vital ground water supplies can be irreparably contaminated. Once saltwater enters an aquifer it may be impossible to remove. This, along with saltwater contamination of surface water intakes, puts drinking water supplies in the Estuary at risk.

How we use water in our homes, yards, and workplaces can really make a difference. Conservation practices need not be expensive, difficult, or inconvenient, but they do require making simple changes to everyday habitats. Try some of these suggested water conservation practices:

- Install water-saving toilets, showerheads and faucet aerators. They can cut your interior residential water use in half.
- Repair leaky faucets and turn taps off tightly. Slow drips can waste 15 to 20 gallons of water a day.
- View stormwater runoff as a resource, rather than a waste. Position your down spouts so rainwater runs onto the lawn or into the garden, not down the driveway where it is unable to replenish groundwater supplies.
- Plant drought-resistant trees and plants and use mulch to keep the soil moist.
- Use a self-closing nozzle on your garden hose to minimize water waste.
- Don't sprinkle lawns on hot summer days - up to 90 percent of the water can be lost through evaporation.
- Don't run water while shaving or brushing your teeth. Faucets use between two and three gallons of water per minute.
- Don't use the toilet as a wastebasket.
- When possible, install front-loading washing machines. They reduce water usage by 40 percent.

INVESTING FOR THE FUTURE



Source: DRBC

About two-thirds of interior residential water use is for bathing and toilet flushing. Savings realized through the installation of water-saving fixtures and fittings, like those required by the Delaware River Basin Commission, are depicted here. At the forefront of the national movement to cut down on the demand side of water supply, the Commission's conservation program is an integral component of its strategy to wisely manage the waters in the Basin. The program has resulted in significant cost savings, environmental protection, and improved drought preparedness.

Get involved!

Support organizations that work on Estuary issues. One such organization is the Partnership for the Delaware Estuary.

PARTNERSHIP FOR THE DELAWARE ESTUARY INC.

The Partnership for the Delaware Estuary, Inc. is a regional, non-profit organization, based in Wilmington, Delaware, that is dedicated to the promotion and conservation of the Delaware Estuary. It promotes education on the importance of the Estuary, both from within the formal school-based education structure and through hands-on educational initiatives directed toward the general public. It coordinates habitat restoration projects for corporations, and through several minigrant programs, is a source of funding and support for other non-profits. Collectively, their programs reach thousands of individuals in building stewardship for the Estuary and its natural resources.

For more information:

Partnership for the Delaware Estuary
400 West 9th Street, Suite 100
Wilmington, DE 19801
1-800-445-4935
E:mail: partners@udel.edu
Website: www.DelawareEstuary.org

Yes! I want to help protect, sustain, and enhance the Delaware Estuary. Enclosed is my contribution to the Partnership for the Delaware Estuary of:

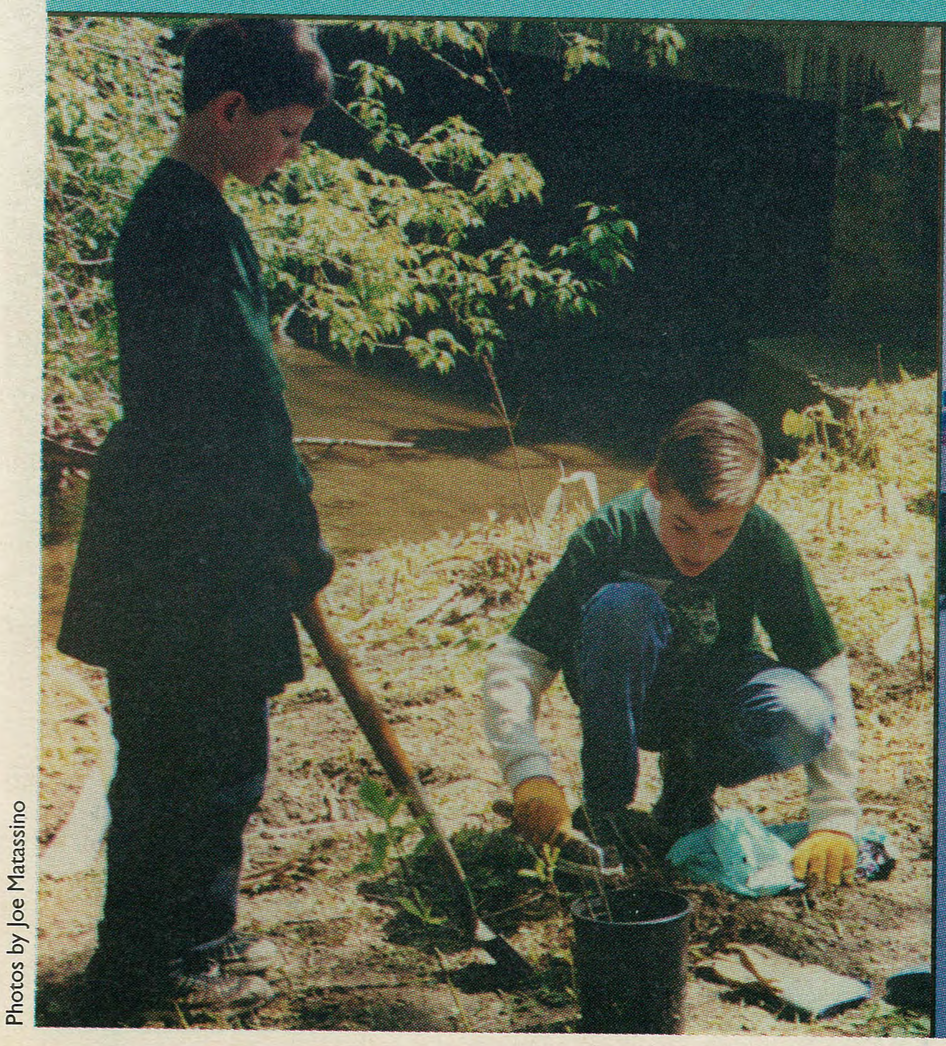
$25_____ $50_____ $75_____ $100_____ Other_____

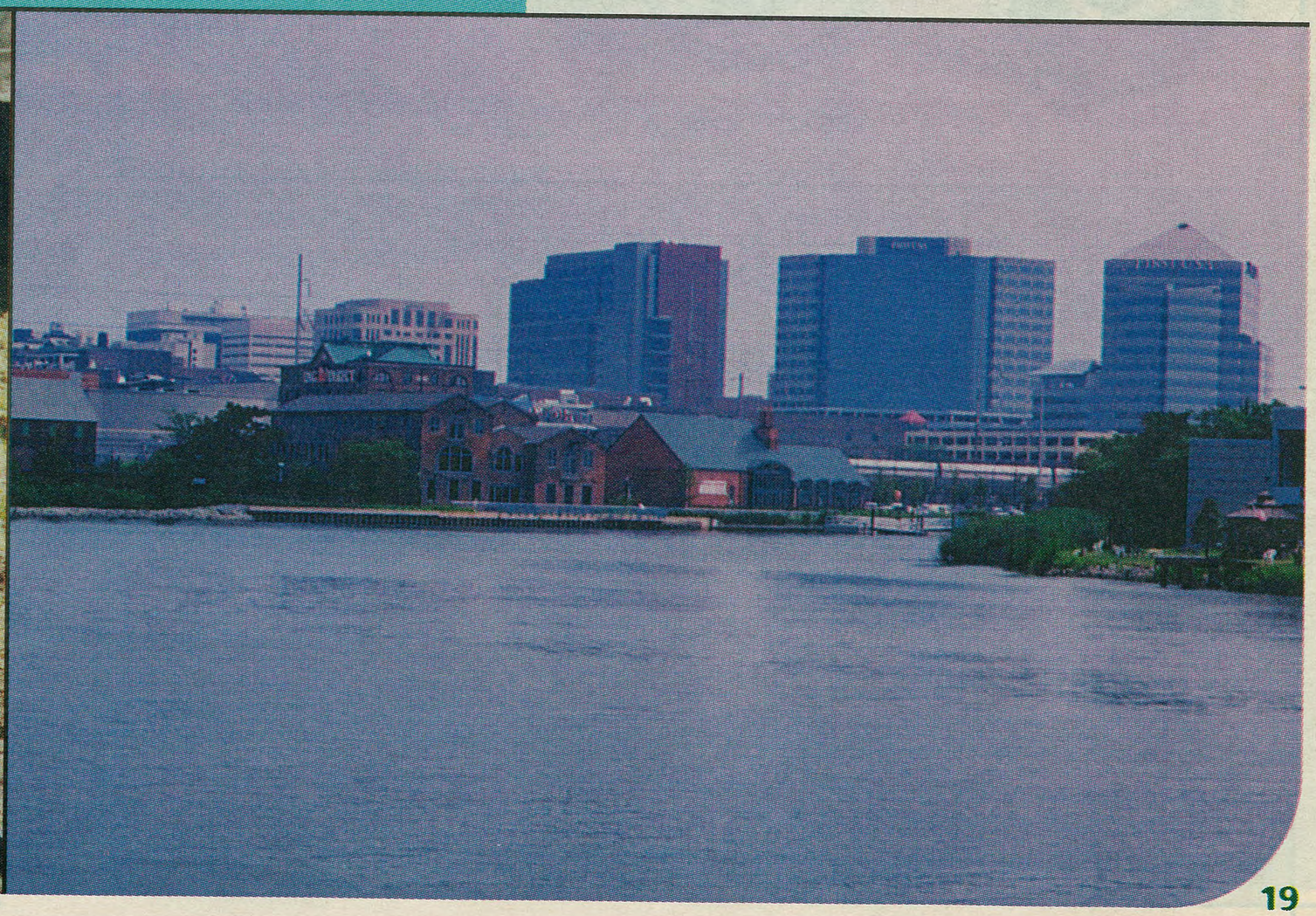
_____ I am contributing $75 or more and would like to receive a horseshoe crab stuffed animal.

Please make checks payable to the:
Partnership for the Delaware Estuary
400 West 9th Street, Suite 100
Wilmington, DE 19801
1-800-445-4935

Neither the United States Environmental Protection Agency nor any other federal agency provided funding for this page of the 2002 State of the Delaware Estuary Report.

The Partnership for the Delaware Estuary is a 501(c) 3 tax-exempt organization as provided by IRS regulations and is registered with the Commonwealth of Pennsylvania Bureau of Charitable Contributions and with the New Jersey Division of Consumer Affairs Charities Registration Section. The official registration and financial information of the Partnership for the Delaware Estuary may be obtained from the Pennsylvania Department of State by calling toll-free, within Pennsylvania, 1-800-732-0999. Registration does not imply endorsement. In New Jersey, information filed with the attorney general concerning this charitable solicitation may be obtained from the attorney general of the State of New Jersey by calling (973) 504-6215. Registration with the attorney general does not imply endorsement.





Photos by Joe Matassino

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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WM WASTE MANAGEMENT

BUCKS COUNTY Courier Times

Delaware State News
The Downstate Daily

Sources of Information

Atlantic States Marine Fisheries Commission
Delaware River Basin Commission
Delaware Department of Natural Resources and Environmental Control
Delaware Valley Regional Planning Commission
Ecological Research and Development Group
National Oceanic and Atmospheric Administration
New Jersey Department of Environmental Protection
New Jersey Fish and Wildlife Service
Partnership for the Delaware Estuary
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Coast to Coast...
Which Coast are you celebrating?

SOUTHEASTERN PENNSYLVANIA
Coast Day
SEPTEMBER 29, 2002

Pennsylvania Coast Day
Sunday, September 29, 11 a.m. to 5 p.m.
Fairmount Water Works, Philadelphia, Pennsylvania
Come discover the treasures of Pennsylvania's coast. This first-ever Coast Day celebration in Pennsylvania will feature family-oriented entertainment and hands-on activities by some of our region's most influential environmental organizations/agencies and artists, including found-object sculptor, Leo Sewell, and the mosaic artists of Philly's own NetworkArts. There will also be food and a craft show.
For more information, please call **1-800-445-4935**.

UNIVERSITY OF DELAWARE
2002
Coast Day
Sunday, October 6
11 a.m. to 5 p.m.
Hugh R. Sharp Campus
700 Pilottown Road ◆ Lewes, Delaware
Sponsored by University of Delaware Sea Grant College Program & Graduate College of Marine Studies

Coast Day Delaware
Sunday, October 6, 2002
University of Delaware College of Marine Studies
Lewes, Delaware
Discover the fascinating world of marine science in lectures, ship tours, marine critter touch tanks, children's activities, a nautical craft show, crab cake cook-off, seafood chowder challenge, and much more. For more information, please call **(302) 831-8083**.

Coast Day New Jersey
Sunday, October 13, 2002
Cape May and Point Pleasant Beach

Coast Day New Jersey
Sunday, October 13, 2002
Cape May and Point Pleasant Beach
This event, sponsored by the New Jersey Marine Sciences Consortium and its New Jersey Sea Grant Program, is dedicated to helping New Jerseyans better understand and appreciate their sea and shore. For more information, please call **(732) 872-1300 ext. 22.**