THE POCOMOKE RIVER AND CHESAPEAKE BAY

Presentation to the House Subcommittee on Fisheries Conservation, Wildlife and Oceans

May 18, 2004

Report prepared and presented by

Pocomoke High School

Pocomoke, Maryland

Thomas Gladding

Amber Mason

Leslie Miller

Kenneth Nugent

Steven Payne

Maurice Waters

Mrs. Amy Lines (advisor)

INTRODUCTION

The Chesapeake Bay is a unique and diverse ecosystem. It is the largest estuary in the United States. About half of the Bay's water comes from 150 rivers, streams and creeks. The Bay's watershed expands through six states including Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia. The Chesapeake Bay contains approximate 11,600 miles of shoreline, nearly 200 miles long and 25 miles wide at its widest point. The Bay's water capacity is approximately 18 trillion gallons of water.

One of the rivers included in the Chesapeake Bay's watershed is the Pocomoke River. "Pocomoke" is an Algonquin word meaning "dark water." The dark water of the Pocomoke is the result of tannic acid from falling cypress leaves, which results in a pH of 5 – 6 throughout the river. The river is nearly seventy-three miles in length and originates in the Great Cypress Swamp on the Delaware-Maryland border and flows approximately sixty miles through Maryland into the Pocomoke Sound at the Chesapeake Bay.

The Pocomoke River watershed is a large area; it spans over 170,000 acres of farmland, which consists mainly of a large poultry industry. The Pocomoke River is relatively narrow and very deep until it reaches Shelltown, Maryland where it opens rapidly into the broad and shallow Pocomoke Sound. The National Oceanic and Atmospheric Administration has recognized the Pocomoke Sound as one of the largest shellfish producing areas in the Chesapeake Bay The Pocomoke Sound is considered to be the mouth of the river and is bordered by both Virginia and Maryland.

A unique habitat of the area is the Pocomoke River Swamp, which is thirty miles long and two miles wide. It contains the northern most cypress swamp in the United States. There are more than 27 species of mammals, 29 reptiles, 14 amphibians and 172 birds identified in the wetlands bordering the river. Pileated woodpeckers and bald eagles are not uncommon.
In the 1700's and 1800's, the Pocomoke River was a trade and shipping route. Shellfish, tobacco, fish, cypress trees and pelts were harvested and shipped as far as the Orient from Worcester County's largest city. Over time, the forest was cut away, agriculture expanded. In the 1930's the government sponsored the draining of the swamp because of the limited amount of high ground suitable for agriculture. Channels and ditches were carved into the landscape. Changes in agricultural practices including plowing, followed due to an increasing demand for

grain to feed the nation. Soil erosion has increased ever since. These changes to the landscape and harvesting of timber resulted in an erosion of the river's banks and a deepening of the river. Both of these still impact on the health of the river today.

The National Park Service, U.S. Department of the Interior and the Nationwide Rivers Inventory as a "Great River of America" list the Pocomoke. The periodical "Field and Stream" called the Pocomoke River one of the "last undiscovered rivers" of the nation.

Today, the Pocomoke River is challenged and threatened by faulty wastewater treatment, failing septic systems, the poultry industry, agriculture, sedimentation and channelization. In 1998, the Pocomoke River was named the third most endangered river in the United States by the American Rivers 13th annual report on America's Most Endangered Rivers, due mostly to nutrient problems associated with chicken manure and the outbreak of Pfiesteria that killed tens of thousands of fish and sickened watermen and boaters.

THE IMPACT OF THE POULTRY INDUSTRY ON THE POCOMOKE RIVER

The main industry located in the Pocomoke River's watershed is the poultry industry. Over 600 million chickens are produced annually on the Eastern Shore. One- fifth of the chickens raised are located in Worcester and Somerset Counties, both located in the Pocomoke River's watershed. The chicken industry is a powerful $1.6 billion continually growing business. Over 14,000 people are presently employed by the poultry industry. The birds are raised in poultry houses owned and operated by small farmers who are responsible for disposing of 750,000 tons of chicken waste per year. One method of disposal is the use of the chicken litter as fertilizer. However, recent studies have found that many areas on the Delmarva Peninsula posses two to three times more manure than needed to fertilize local crops.

The water quality of most rivers on the east coast of the United States has improved since 1980 but the Pocomoke River's condition seems to have worsened. Many feel the increase in the poultry industry continue to affect the River. Many citizens work in the poultry industry and rely on this industry for their livelihood. The industry helps to support bankers who finance chicken houses, farmers who grow chickens, grain farmers, truck drivers and plant workers to support the chicken industry. It has been estimated that a 4 percent decrease in the chicken industry would wipe out thousands of jobs and up to $74 million in economic output necessary for our area.

The chicken industry grew by one-third from 1982 to 1997. Cropland was reduced by 15%. Some estimates include the doubling of chickens on the Lower Eastern Shore, including the Pocomoke River watershed. An increased demand for chicken has resulted in an increase in the number and size of chicken houses being built and are being built in thicker clusters. The chicken houses are being built closer to the slaughterhouses to reduce trucking distance and time. There is a slaughterhouse 15 miles south of Pocomoke City.

Weather has an effect on the amount of pollutants produced by the production of chickens. An increase in storms sends more waste related materials into the Pocomoke River and its watershed. Droughts decrease the amount of pollutants entering the river.

Chicken manure has higher quantities of nutrients than manure produced from other livestock grown on the Eastern Shore of Maryland. Chicken manure contains more phosphorus than nitrogen. This waste contains approximately 13 million pounds of phosphorous and 48 million pounds of nitrogen. The watershed area of the Pocomoke River houses over 100 million chickens and 60,000 hogs, producing close to 250 million pounds of manure each year, along with bedding litter and the remains of chickens killed in production. Phosphorus concentrations in the Pocomoke Sound have increased more than 25% since 1985 according to EPA data. When a farmer applies enough manure to deliver the nitrogen needed by a specific crop, a surplus of phosphorus goes with it. More than 90% of soil samples tested by the University of Maryland Eastern Shore in 1997 showed elevated qualities of phosphorus.

Air pollution directly relates to the pollution of nearby waterways. All chicken manure must be removed in one of three ways, released into the air, put it into the water or spread on the land. Fans are used in chicken houses to remove excess ammonia. Ammonia gas, which is a form of nitrogen, floats off piles of manure. It then settles into nearby ditches and creeks.

Nutrient pollution also affects groundwater. Nitrates contaminate one-third of all groundwater in Delmarva's agricultural areas according to the U. S, Geological Survey. Samples taken by the USGS indicate nitrate levels in ground water are three to four times as much as the EPA considers safe. Contaminated groundwater adds to the nutrient pollution problem reaching the Pocomoke River and Chesapeake Bay. The USGS estimates that as much as 80% of freshwater that flows into Delmarva's rivers and streams originates from groundwater sources. Irrigation also plays a role in increased air pollution eventually settling as water pollution. Millions of gallons of treated water are sprayed onto fields. It then seeps into the groundwater.

Some chicken plants spray wastewater close to the slaughterhouses and the wells inside the slaughterhouses have been contaminated. In some areas, this spraying practice has stopped but nitrate levels continue to rise due to the long-term movement of water.

There is massive regulations and legislation regarding the production of chicken. The Delmarva Peninsula consists of three states. Often chicken farmers in one state find less regulation in a neighboring state. For example, trucks from Perdue transport millions of gallons of waste a year from its Delaware slaughterhouses into Maryland where the manure is used on farms due to a lack of regulation on the dumping of manure in Maryland's fields.

The chicken industry has a very powerful lobby. Money is spent to back candidates who are supportive of the chicken industry. Poultry corporations hire lobbyists who lobby for legislation decreasing regulations. Advertisement, scholarships, baseball fields, support of Salisbury University are just some of the ways the chicken industry attempts to improve the image of chicken production.

An issue related to nutrient management is the question of who is responsible for the massive quantities of chicken waste produced. Some feel the large four brand name companies (Allen Family Foods, Mountaire Farms, Inc., Perdue Farms, Inc, Tyson Foods, Inc.) that own and market the birds and earn $1.6 billion a year should be responsible for the waste. Others feel the local farmer, who is under contract with the large companies and raises the chickens, is ultimately responsible for dealing with the manure. At this point, the growers own the waste and must deal with it. They must deal with chickens that die before they reach maturity. As a result of this decision, chicken manure is scattered on thousands of farms throughout the watershed and monitoring is almost impossible.

The only solution that may be feasible and ultimately good for the environment is to find alternative uses for chicken waste projects such as burning it as fuel or converting it into fertilizer pellets that can be economically trucked away as compared to heavy loads of manure. This process could be more feasibly accomplished if the large industries "owned" the manure and it was kept at a limited number of facilities. The industry has the resources necessary to develop alternative uses.

The most recent Maryland law, in effect as of 2004, forces all farmers to test their soils and apply no more manure than the crops need. A nutrient management plan must be developed and kept by each farmer. As a result some farmers who now rely on chicken manure will have to

replace it with commercial fertilizer to get the nitrogen needed without the excess phosphorus not needed.

One other helpful method to decrease phosphorus is adding an enzyme called phytase to chicken feed. The phytase helps chickens digest phosphorus limiting the amount of phosphorus that ends up in the chicken manure. Due to the expense of adding this extra component to chicken feed, the legislature reimburses half the costs of the phytase.

Tax benefits and grants could encourage research and development of alternate uses for manure. This is extremely complex issue. The bottom line is the chicken industry is an integral component of people living in the Pocomoke River watershed. Discussions result in hot debates on both sides.

AGRICULTURE

One of the leading causes of pollution in the Pocomoke River and the Chesapeake Bay is the result of agricultural practices. Water carries pollutants long distances, and once pollutants get in water, they are very hard to remove. Nutrients, pesticides, sediments and pathogens used in agriculture move from the land and into the watersheds of tributaries, including the Pocomoke River, and from there they find their way into the Chesapeake Bay.

Agriculture contributes about 44 percent of the nitrogen and about 56 percent of the phosphorus entering the Chesapeake, according to Bay Program figures. In Maryland, agriculture contributes about 38 percent of the nitrogen and 55 percent of the phosphorus. Yet more than half of the fertilizer applied by farmers is never used by plants and percolates into groundwater, nearby ditches and ultimately into the Pocomoke River.

Fertilizers are used to promote plant growth. Nitrogen and phosphorus are common ingredients. When fertilizers are applied improperly and the plant cannot use them, they leach into the soil. When the plant cannot use all the fertilizer applied, the result is runoff. These chemicals support algae growth leading to eutrophication.

According to the Chesapeake Bay Foundation, nitrogen pollution is the most serious pollution problem for the Bay because it causes algae blooms that consume oxygen, which lowers dissolved oxygen levels so severely that fish and shellfish die. The majority of nitrogen pollution comes from sewage treatment plants, large-scale animal operations and agriculture.

There are many different sources of fertilizer used to supplement the nitrogen contained in soil. The most common soil fertilizers can be categorized as either inorganic or organic

fertilizers. Inorganic nitrogen fertilizers often have the advantage of being concentrated sources of nitrogen and, therefore, a smaller amount is needed and transportation costs are lower. Nitrogen fertilizers are also mixed with fertilizer materials containing phosphorus and potassium to produce a fertilizer blend. Common disadvantages of inorganic fertilizers are often associated with poor management such as applying too much nitrogen fertilizer.

Organic nitrogen fertilizers often have a relatively low nitrogen content and, therefore, they are often applied to the soil in large quantities. They have the advantages of adding organic matter to the soil thereby improving soil physical, biological and chemical properties for plant growth.

Nitrogen is applied by farmers in the Pocomoke watershed in two forms, as both organic and inorganic fertilizers and as chicken manure. Over application of fertilizers poses a threat to the environment by increasing the risk of surface runoff of nitrogen into the Pocomoke River and there is also the risk of nitrogen leaching into the groundwater.

More funds for research and adjustments made to agricultural practices may help lead to some methods of decreasing nitrogen. Losses to the environment can be minimized by crop rotation, planting cover crops, soil testing and ploughing in crop residues.

Excess phosphorus is much more difficult to deal with than nitrogen. Phosphorus is vital to root growth, seed formation, and increases disease resistance. Phosphorus is added to the soil to help plants absorb nutrients. Without it, more nutrients are lost to the environment. For most effective use of phosphorus, the fertilizer needs to be placed to ensure quick contact by growing roots and minimal contact with the soil. On agricultural land when annual application of phosphorus exceeds its removal by crops, then phosphorus will accumulate in soils.

Fertilizers containing phosphorus are not only used by farmers but are used as feed for livestock as part of poultry and hog feed. The digestive tracts of pigs and chickens do not adequately absorb phosphorus so phosphorus is added to the diet of chickens and hogs increasing the phosphorus in their manure.

Scientists at the University of Maryland Eastern Shore are studying methods to reduce runoff resulting from phosphorus used in fertilizers. One new control method being studied is the use of gypsum. Gypsum is a combustion by-product, which means that it is formed when coal is burned. Most phosphorus initially added to land through fertilizer or manure reacts with soil components, converting to an insoluble form or attaching to soil particles. Studies at

University of Maryland Eastern Shore show gypsum, when spread on the soil, significantly impairs the vertical movement of phosphorus into the water table. Another advantage to use of gypsum is its cost; it is very cheap. Scientists at UMES only had to pay for the truck to deliver this by-product.

One of the main crops grown on farms on agricultural lands near the Pocomoke is soybeans. This crop is used for forage for livestock. On local farms, the new soybeans could be grown to produce forage that could be baled or cubed for shipping to other areas. There are three new "giant soybeans" which may actually pull more phosphorus out of soils than conventional soybeans usually grown for grain. The exceptional growth of these giant soybeans could make them useful in our area as well as decrease phosphorus in nearby waters.

Farmers in low lying, flat agricultural areas around the Pocomoke River use ditches to drain excess water off the fields. These ditches usually have very few if any buffer zones to assist in the absorption of fertilizers and nutrients. As a result, the level of fertilizers are concentrated in these drainage ditches which flow unobstructed directly into the Pocomoke River. A proposed solution is to reexamine drainage ponds. In the past farmers mishandled the drainage pond by using them for aquaculture and the fish. The fish often died, fouling the ponds and creating more problems. Drainage ponds act as storage units and allow the nutrients to settle before they flow into the river. Scientists are then examining the possibilities of dredging the bottom of the ponds and reusing the nutrients built up on the bottom. SAV's planted in these ponds also absorb nutrients and prevent them from flowing into the River.

Sedimentation in the Pocomoke River and Chesapeake Bay

Over the past 100 years, the net deposition of sediment entering the Chesapeake Bay from the Maryland portion has been estimated to be approximately 155 million metric tons. Scientists believe that sedimentation rates have continued to increase since colonial time due to an increase in population, logging, agriculture and different land uses.

The term "sediments" refers to any loose particles of clay, silt, sand and other substances that are suspended in the water and eventually settle to the bottom of a body of water. Sediments pose a serious threat for bodies of water including the Pocomoke River and ultimately the Chesapeake Bay. Sedimentation in the Pocomoke River is mainly derived from nonpoint sources including construction sites, dirt roadways, and agriculture

Massive quantities of sedimentation in the Pocomoke may cause problems ranging from clouding the water a bit, to smothering plants and animals at the bottom of the river. The clouding of the water may presents problems by blocking the sunlight to submerged aquatic vegetation necessary for photosynthesis. Sedimentation may not be as apparent in the Pocomoke River as it is in the Chesapeake Bay because the Pocomoke River is one of the Eastern Shore's "black rivers." Its tea color, characteristic of cypress swamps, comes from tannic acid in the roots and decaying leaves of trees and plants that line its banks. This darkened color means that light has never penetrated very deep and it is unlikely there was ever sufficient deep light penetration that would have permitted the presence of submerged aquatic vegetation. The natural dark color of the river makes it appear sedimentation is not a problem because it is not as apparent.

In the Pocomoke River, the size of each sediment particle is complicated by the fact that the individual sediment particles have a large surface area. These sediments act as chemical sinks and absorb fertilizers and pesticides from nearby farms. The pesticides cling to the particle and slowly release high concentrations of nutrients over an extended period of time. As a result of the size factor of the particles, sedimentation increases the nutrient content in the Pocomoke River.

The release of sediments into the environment is the result of a variety of activities. Sedimentation from natural sources accounts for 30% of sedimentation production from man induced activities accounts for 70% of sedimentation production. One of the main causes of this form of erosion is due to farmer's fields lying next to the river. The increase in development on the river itself and the lack of sufficient buffers result in an increase in sedimentation.

Weather conditions increase sedimentation. Weather conditions including temperature, storms and humidity may increase the rate of sedimentation. Precipitation moves soil great distances and ultimately these particles end up in the waterways. Once the sediments arrive in the Chesapeake Bay there are few ways to filter the amount and size of the particles out of the water.

Construction sites expose large amounts of sediments as a result of the movement of land. On a construction site, the first thing that takes place is the removal of all vegetation in the area. With this removing process, the roots that usually hold the soil in place are torn out of the land and the soil becomes loose and easier to move. During periods of construction, unprotected soil is usually left uncovered for long periods allowing the wind to lift the exposed sediments and

carry them to the river. Runoff from construction sites can be 2,000 times greater than erosion occurring in woodland. The term “run-off” is used to describe sand and loose soil left on the land surface which can easily able to be washed by rain and water into the near by waterways.
A possible solution may be a training course for builders and construction site workers in sedimentation reduction followed by a certification presented for completion of the course. This practice has already been implemented by the Coastal Bays program and has participation in the training has shown to be successful.

Agriculture is a major contributor of artificial sedimentation similar to construction sites. Fields are harvested or cleared, exposing the soil and making the soil susceptible to run-off. Cover crops may not be planted immediately. Run-off from farmlands near the river usually runs into channels and then run straight into the river, carrying fertilizers and pesticides with it. Therefore, sediments are carried to the river along with toxins.

Limits need to be set on how long land may be exposed for construction and farming. Recently,(March 2004) sediment goals have been set. The first step of these goals is reducing from 5.05 million tons of sediment to 4.15 million tons of sediment that annually washes into the bay from major tributaries. The second step of these goals involves shoreline erosion where reductions are being set on a case-by-case basis to help restore historic levels of grass beds, (Bay journal Marc 2004, pg. 16).

WASTEWATER TREATMENT

The Pocomoke City water treatment plant treats 1.2 million gallons of wastewater. The treatment plant has recently been upgraded from a 1C class to a 5A class plant. This means wastewater will now receive the third stage of treatment. The tertiary stage used in Pocomoke’s water treatment includes the implementation of a Biological Nutrient Removal (BNR) system. The goal of the plant is to decrease the total annual nitrogen discharge to an average of no more than 8 mg/L. That is a reduction of 55 percent of the nitrogen and 33 perent of the phosphorus. It is expected to be up and running by June 2004. Wastewater accounts for 30% of the nutrient flow into the Chesapeake Bay

The Pocomoke City storm drains, like many other towns in the Chesapeake watershed, flows directly into the Pocomoke River. There are catch basins that collect debris and trash, and then the water goes into the river untreated. This filtered water still has liquidated toxins including fertilizers and pesticides used by homeowners. From these fertilizers, comes large

amounts of nitrogen and phosphorus, nutrients associated with problems in the Pocomoke watershed. Solutions to the storm drain problem should include sending storm water to the water treatment plant to eliminate toxins, metals, and chemicals still present in the water

Pocomoke River State Park is located on the River and has approximately 250,000 visitors annually. The wastewater is treated through a septic system that is not checked annually. Therefore, this wastewater has may seep into the ground water and eventually run into the river. This septic system has 14 tanks allowing for drainage, one tank for each building according to the building's square footage. The drainage fields are only a few acres in size and are within several hundred feet of the Pocomoke River. The septic system at Pocomoke River State Park needs to be examined to meet the growing needs of the Park and the effect of the wastewater on the river. This treatment should include an updated plant sized to accommodate the sewage flow. If a modern wastewater treatment is not built the drainage fields should be relocated further from the River to prevent any seepage.

Snow Hill is located on the banks of the Pocomoke River with a population of approximately 2, 400. The town manager has requested a grant of six million dollars to help update wastewater treatment. Snow Hill has cracked sewage pipes, and sewage is drained right into the river. The treatment plant needs to be updated in order to reduce nutrient problems. If the town of Snow Hill receives money for the sewage treatment plant, nutrient overload Pocomoke River would be greatly reduced.

Oysters

A little known fact is the common oysters may be another possible solution for the problems of the Chesapeake Bay. In the past, the Pocomoke Sound was a major supplier of oysters. Oysters serve many important purposes in the Bay. Not only are they beneficial to the economy surrounding the Bay, but they also serve many important ecological purposes. For over 100 years, Chesapeake Bay watermen have made their living fishing and harvesting oysters. Until the mid-1980's, oystering was the most valuable commercial business in the Bay. Despite their economical importance, oysters are most beneficial in the ecology.

Oysters eat by filtering the nutrients they need out of the water. This not only gives the oysters food, but also cleans the water. Filtering takes excess nutrients out of water, settles sedimentation, and helps clear the water. Whatever the oysters don't consume gets deposited at the bottom of the body of water, where it is not harmful. According to the Chesapeake Bay

Foundation, an adult oyster can filter an average of 60 gallons a day. In fact, before oysters were fished, the population of oysters would be able to filter the volume of the whole Chesapeake Bay, about 19 trillion gallons, in a mere two or three days. Now because of over fishing and diseases, it would take the remaining oysters up to a year to filter the Bay.

Another way oysters help keep a healthy ecosystem is by providing a habitat for fish. Groups of oysters will form oyster beds, a favorite living area and hunting area for a variety of fish. The fish that live in these oyster beds sometimes feed on the nutrients and sediments that oysters miss, which further serves to clean the water in the Bay.

Despite being a very resilient species, the oyster population in the Bay is rapidly disappearing. One obvious reason for the decreasing population is the over harvesting and over fishing. During the twentieth century, oysters were the most harvested animal in the Bay. Loss of habitat is also making it harder and harder for oysters to find a place to live. The tremendous amount of pollution getting into the bay is just another element oysters have to fight. Parasites have been killing many oysters.

Two specific parasites have been the worst so far. These two microscopic predators are known as Dermo, *Perkinsus marinus*, and MSX, known as *multinucleted sphere x*. These diseases thrive in waters with high salinity and temperatures above 68 degrees Fahrenheit. These diseases have been documented as early as the 1950's, but really hit hard in the 1980's. These parasites are truly devastating to *Crassostrea virginica*, the oyster native to the Chesapeake Bay. However, oysters from different parts of the world have developed immunities. One such species is the Asian oyster, *Crassotrea ariakensis*. Some groups, including the Department of Natural Resources, Gov. Robert Ehrlich, and the Virginia Marine Resources Commission strongly support the proposal to artificially introduce this alien species to our ecosystem. They say that this new species will theoretically take the place of the old species if the old species can’t make it. The Asian oysters will thrive despite the parasites, and the population of oysters will increase. This will help keep the Bay clean because the oysters will once again be able to filter the water. This also helps the Bay ecosystem by replacing the habitats oysters provide. Government officials also hope that more oysters will help the economy.

There are also some groups fighting the introduction of this alien species. Many scientists and environmentalists are urging that it is too early to determine if this other species will actually help the environment. They want more tests to be completed before any actions are taken. They are afraid that artificially introducing a species may throw off the very sensitive balance of the ecosystem. These people are also afraid that the cost will be greater than the profits. There may be an economic benefit if these oysters do work, but it will cost millions to discover if these Asian oysters are compatible.

Pfiesteria and the Pocomoke River

Pfisteria piscicidea is a single-cell microorganism. It has a very complicated life cycle that includes at least 24 flagellated, amoeboid and encysted states or forms. They may live for years in a tiny, cyst-like shells buried in river bottom sediments. If many conditions come together, the cyst-like shells hatch. The conditions must include a water temperature of 70 degrees or above, elevated levels of phosphorus, ammonium and suspended solids, moderate to low salinity levels, increase rainfall or runoff, and the presence of fish in particularly large number. Pfisteria is very sensitive to elevated phosphorus enrichment. It seems to respond more to phosphorus at higher levels than it does to nitrates.

Excrement of fish, especially when they are found in large numbers, in an area where pfiesteria are present, trigger the encysted cells to emerge and become toxic. Fish excrement can also cause another stage of pfiesteria to develop. The small single cells swim toward fish prey and give off toxins in to the water. These toxins make the fish lethargic and often cause bleeding sores and hemorrhaging. Once the fish are sickened the pfiesteria feed on the epidermal tissue, blood and other substances that leak from the sores. Dead fish cause the flagellated stages to transfer to a different amoeboid stage, which feed, on the fish remains. If conditions become unfavorable or food supply diminishes, the pfiesteria develop a protective covering and sink back to a dormant cyst state in the bottom of the river. Pfiesteria may change forms in a matter of hours.

Pfisteria also affects humans. Dr.JoAnn Burkholder of North Carolina State University indicates symptoms associated with exposure include short term memory difficulties and respiratory problems. Nausea and vomiting, eye irritation, suppressed immune system are other symptoms may exposure to pfiesteria. In 1997, 20,000 – 30,000 fish were killed in the

Pocomoke River and 13 humans were sickened. As a result of the fish kill in 1997 and the possible risks to humans a seven mile stretch of the Pocomoke River was closed for five weeks.

The Pocomoke River has received considerable attention and study after the initial reports of pfiesteria. Temperature, salinity, precipitation, and water quality parameters including dissolved oxygen, nitrates, phosphates and turbidity are being monitored. In July of 2000, 9.6% of menhaden captured in the lower Pocomoke River showed ulcerative lesions. The majority of these fish were menhaden. Pfisteria has been found in the river but not in its toxic stage. The conclusions drawn from this study include the belief that fish lesions were not the result of pfiesteria.

The United States Geological Survey found high levels of arsenic and selenium present in the Pocomoke River and these two elements are known to stress fish and reduce their immunity to disease. It is hypothesized the fish are then more susceptible to fungus and bacterial invasions. Arsenic is added to chicken feed to kill parasites and promote growth and may be the source of the elevated levels of arsenic and selenium.

The only factor that humans can influence is nutrient levels. Nutrient levels in the Pocomoke during the summer of 1997 were high as compared to other areas in the Chesapeake's watershe

CONCLUSION

Over the past fifty years we have become aware of the deteriorating health of the Chesapeake Bay. The Bay went through a period of rapid deterioration between 1950 and 1980. The Bay has changed from an ecosystem with clear water and extensive fields of underwater grasses and vast expanses of oyster beds to its present condition. It had a sustained population of fish and wildlife. Poor water quality, overharvesting and disease has taken its toll on the Bay. For two decades there has been considerable effort to restore the Bay but there has been only moderate improvement.

In 2001, the Chesapeake Bay Foundation's State of the Bay Report concluded the health of the Bay is still on the decline. The more we study the Bay, the more we find the harm people have caused this estuary and how difficult it is to repair the damage.

The main problems facing the Bay must be addressed by the states in the watershed representing the different perspectives of the people who live there. Each group has a different approach to solving the problems. So what can be done to meet the needs of the Bay and still satisfy the diverse population? We cannot afford to lower the bar or give up.

In 1933, the first regional conference was held to address the overall health of the Chesapeake Bay. The second major push for Baywide management took place in 1965. At this time, the U.S. Army Corp of engineers did the first study of the present and future conditions of the Bay. Their report was completed in 1977 and led to further Bay Agreements. Since their final report, there have been three Bay Agreements, 1983, 1987 and 2000. The most recent Agreement has developed specific commitments and addresses living resources, habitat restoration, water quality, land use and community management. Further studies have been completed to project the state of the Bay to the year 2020. The goal of the Bay Agreements attempt to develop legislation and regulations that cross state boundaries. $282 million in federal monies has been used to fund restoration programs for the Bay. The federal government must also expect the states to develop programs. It has been estimated that Maryland will spend $6.30 million a year for Bay programs. Other states have not made the same commitment.

The Chesapeake Bay Foundation was established in 1967. This nonprofit group has stated that it will take at least $8.5 billion dollars to meet the goals set by the Chesapeake Bay Agreement by the 2010 deadline.

It seems to us that identifying the problems associated with the Chesapeake Bay and the Pocomoke River is the easiest part of the solution. We understand how difficult it is to ask farmers to change their practices. We understand how important the poultry industry is on our local economy. Our economy is strongly influenced by tourism. We all use and enjoy the Pocomoke River. It seems it is necessary to find alternative methods to make it feasible for each of the interest groups to improve their role in improving the quality of the Pocomoke River and the Chesapeake Bay.

Education of all people in the Bay's watershed is crucial. The Delmarva Discovery Center will be opening in 2005 in downtown Pocomoke. This Center has many different goals but its main objective is to educate the people in the Pocomoke watershed on their impacts on the river. This innovative program will include educational programs for local citizens, students and teachers. The Pocomoke River is one of the most beautiful rivers that flow into the Chesapeake Bay. The Discovery Center is an exciting program that will reach our citizens and hopefully the Pocomoke River will return to its place as one of America's most beautiful rivers.