

# *RIVER VALUES*

## *The Value of a Clean and Healthy Delaware River*



Delaware RIVERKEEPER® Network

April 2010



# *RIVER VALUES*

## *The Value of a Clean and Healthy Delaware River*

Delaware RIVERKEEPER® Network

April 2010

Printed on Recycled Paper

# Delaware RIVERKEEPER® Network



The Delaware Riverkeeper is an individual who is the lead voice for the Delaware River, championing the rights of the Delaware River and its streams as members of our community.

The Delaware Riverkeeper is assisted by seasoned professionals and a network of members, volunteers and supporters. Together they are the Delaware Riverkeeper Network, and together they stand as vigilant protectors and defenders of the River, its tributaries and watershed.

Established in 1988 upon the appointment of the Delaware Riverkeeper, the Delaware

Riverkeeper Network (DRN) is the only advocacy organization working throughout the entire Delaware River Watershed. DRN is committed to restoring the watershed's natural balance where it has been lost and ensuring its preservation where it still exists.

The Delaware Riverkeeper Network's focus is the ecological health and integrity of the river ecosystem recognizing we best protect ourselves only when we best protect our River.

The Delaware Riverkeeper Network works to:

- ✓ Protect and defend the Delaware River through advocacy and enforcement;
- ✓ Inform, organize, activate and strengthen citizens and communities that appreciate and rely upon the River, its tributaries and watershed and want to get involved for their protection and restoration;
- ✓ Monitor the health of the River and tributary streams – gathering reliable data that is then used to bring about meaningful change;
- ✓ Secure and enforce strong legal protections for waterways and associated ecosystems;
- ✓ Restore damaged streams and ecosystems; and
- ✓ Ensure that the voice of the River is heard and its needs are given highest priority in all decision making.

To learn more about the Delaware Riverkeeper Network, to support our work, and/or to become an active member visit our website or contact our office.

**Delaware RIVERKEEPER Network**  
**Bristol, PA 19007**  
**(215) 369-1188**  
**[www.delawareriverkeeper.org](http://www.delawareriverkeeper.org)**



# Table of Contents

## Table of Contents

Forward by Maya K. van Rossum, the Delaware Riverkeeper.....	v
Property Values .....	1
Clean Rivers Increase Property Values.....	1
Healthy Environments Protect Our Communities.....	2
Businesses Benefit from Attractive Waterfronts.....	9
River Recreation .....	12
The Broad Array of Recreation on the Delaware River .....	12
Diverse Boating for Recreation and Sport.....	14
Swimming and Biking Along the Delaware.....	21
Leisure Fishing.....	22
Birding and Wildlife Watching.....	27
Parks and Wildlife Refuges.....	35
Community Attractions Focused on Enticing Ecotourism .....	43
The River as an Employer.....	45
Commercial Fisheries as Employers.....	45
Agriculture and the River.....	49
Where our Drinking Water Comes From.....	52
Industry on the Delaware.....	56
Water and Commercial Use.....	59
Delaware River Ports.....	59
Cultural and Historic Values.....	62
Native Americans.....	62
European movement and American Independence.....	63
Historical Sites and Reenactments.....	64
The Importance of Clean Water.....	65
We Need Your Help.....	67
Special Thanks .....	67
List of Figures	
Figure 1 Hotel Prices with and without a River View .....	11
Figure 2 Water Recreation Revenue in PA, NY, & NJ .....	13
Figure 3 Canoe Liveryes along the Delaware River main stem .....	18
Figure 4 Number of Fishing Licenses Sold in 2003 in Basin States .....	26
Figure 5 Delaware River Significant Species List .....	34
Figure 6 Nationally Significant Parks in the Watershed .....	36
Figure 7 Campgrounds Bordering the Delaware River .....	42
Figure 8 Sectors that Consume Delaware River Surface Water .....	56
Figure 9 Biggest Water Consumers on the Delaware .....	57
Figure 10 Historical Sites and Public Reenactments .....	64
Cited Sources.....	69



## Forward Maya K. van Rossum the Delaware Riverkeeper

The Delaware River is the last major free-flowing River in the eastern United States. It flows for 330 miles through 4 states, 42 counties and 838 municipalities. Rather than serving as a dividing line among these communities, the Delaware River is a unifying element in the landscape. Throughout history and today, communities within the region regardless of political boundaries have been drawn together by this River, recognizing it as a living resource that supports their lives.

Recreationally, there is no off-season for the Delaware. In the warmer months you can find folks enjoying the River at all hours of the day or night -- fishing, boating, swimming, birding or just idly sitting on its banks and watching it flow by. Even in the coldest winter months kayakers and die-hard anglers are out there enjoying the River and its Bay. Preserving and enhancing the health of the River is critical for sustaining these recreational uses and protecting the local economies that rely on them.



The rich ecological history of the river region, still evidenced today, has not only been critical to the success of the recreational uses and associated eco-tourism, but has been the foundation upon which the region's culture and sense of identity has evolved. Historic and ongoing community vigilance has preserved unique cliff formations overlooking the River; natural islands, rapids, a remarkably well-established green riparian buffer including wetlands, and magnificent and unparalleled ecological phenomena including the arrival of hundreds of thousands of migratory shorebirds coming to feast on the eggs of the Horseshoe Crab, a species that has lived and spawned in our Delaware Bay since before the dinosaurs.



Many reaches of the River are still graced with the presence and history of the Native Americans. It is well documented that the Lenape and Minisink lived, fished, travelled and traded along the banks of the Delaware River.

Additionally, the Delaware River holds a special place in the European history of this country and is viewed by many as the place where America was born. Washington crossed the Delaware River and fought the Battle of Trenton on the banks of the Delaware. It was this battle which was the turning point for the American Revolution and the birth of our nation.

The sense of community created by the Delaware River has harmonized otherwise diverse and disparate voices in support of the River's protection and restoration. Still, more needs to be done.

There was a time in the mid-20<sup>th</sup> century when the Delaware River had become so polluted that it prevented migration of the historically important Shad upriver to spawn. Implementation of environmental laws and concerted action by concerned citizens and communities restored the River's water quality and ecosystems and supported the return of the Shad to the Delaware River.

While the pollution-induced fish block is now gone, the Delaware River today suffers different problems than in the past. Toxic and other legal and illegal pollution discharges to the River continue; damaging development that floods our communities, pollutes our waterways, and destroys sensitive and important ecosystems continue and are on the rise; the funding of structural flood control options and allowing communities to build, remain and grow in floodplains and in the path of dangerous floods are still the norm; the use of outdated technologies that degrade our clean water or needlessly kill billions of fish is still accepted; the proliferation of industrial activities such as natural gas extraction threatens water resources; overharvesting species, spoiling habitats, and scouring river bottoms continue – all this to accomplish goals that could be better achieved in other ways without such irrevocable harm. In short, many continue to treat our River and its ecological communities as though they are disposable.

***But our River is not disposable, it is priceless and irreplaceable.***



Access to pure, life-sustaining water that supports diverse and healthy aquatic communities is an inalienable right of all beings, and of the Delaware River itself. The Delaware River and the watershed it supports is our opportunity to receive the benefits of this inalienable right. No one entity, person, corporation, industry, town, county or state, has the right to use the Delaware River or any of the streams that feed it in a way that harms others or infringes on this right.

Protecting, respecting and restoring a clean, healthy and free flowing Delaware River provides the greatest level of protection, healthy growth and quality of life to our communities. A healthy Delaware River including floodplains, flows, tributaries, aquifers and habitats protects our communities from flood damages and drought, provides clean and abundant drinking water at a sustainable level to our communities, supports growing businesses of all types, supports healthy commerce, encourages both commercial and recreational fisheries providing safe food, creates vibrant recreation, encourages growing ecotourism, increases the marketability and market value of our homes, and makes our communities more desirable places to live and be.

This report is designed to document and demonstrate many of the unrecognized values and benefits that a healthy Delaware River brings to our communities, to help people make River protection among their highest priorities, and to expand and enhance appreciation for the beauty and the power of a healthy Delaware River.

***The most important take-away from this report is that the Delaware River is a living ecosystem rich in beauty, culture, and community that needs to be protected and, where necessary, restored to continue to be the vibrant and contributing member of our community we all desire and need.***

***Thank you for your role in appreciating, protecting and restoring the Delaware River, its streams and watershed. It is your care, your voice and your action to Remember the River every day and in all you do that will make the difference.***

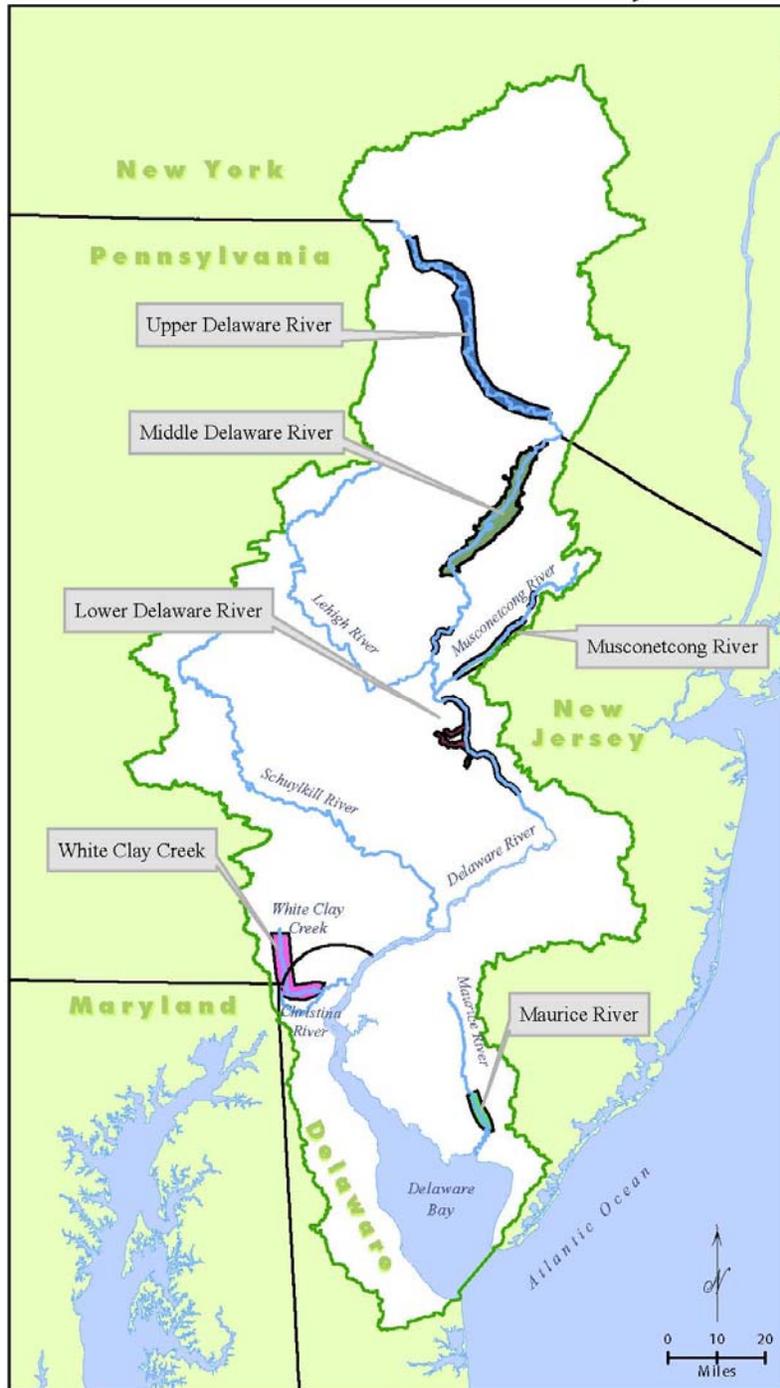
---

***Maya K. van Rossum  
the Delaware Riverkeeper***

***River Values: The Value of a Clean and Healthy Delaware River***

***Delaware Riverkeeper Network***

## Stretches of the Delaware River and its Tributaries Included in the National Wild and Scenic Rivers System



WWW.DRBC.NET  
 P.O. BOX 7360  
 WEST TRENTON, NJ 08628  
 (609) 883-9500



# Property Values Property Values

- ❖ Clean Rivers Increase Property Values
- ❖ Healthy Environments Protect Our Communities
- ❖ Businesses Benefit from Attractive Waterfronts

## ❖ Clean Rivers Increase Property Values

***A healthy River, free flowing and free from pollution, enhances the economic value of homes, businesses and communities by and through which it flows. An injured system does the opposite. It creates damage and decreases values. River communities need to grow and thrive in a way that protects and maintains healthy river systems to ensure maximum economic and personal benefit.***

From the late 16th century throughout the early 20th century, decades of industrial and residential waste dumped directly into the Delaware River began taking its toll on the population. Water pollution in the Delaware River caused outbreaks of dangerous and deadly diseases including cholera and yellow fever.<sup>1</sup> The pollution became unsightly causing pungent and sickening odors. The many cities and towns lining the Delaware misused the River by using it as their personal and commercial sewer line.<sup>2</sup>

Because of this River abuse, people who could afford it began building country estates and vacationing spots outside of populated cities. Communities such as Washington Crossing, Pennsylvania and Riverton, New Jersey began as summer retreat villages founded by city dwellers from Philadelphia, Trenton, Camden, and New York who wanted to have a Delaware River summer home partially to avoid the risk of waterborne illness which was at its highest in the summer months.<sup>3</sup> Some of the oldest and more glamorous 19<sup>th</sup> century homes along the Delaware River have become privately owned Inns and restaurants that are still used today.<sup>4</sup>

In recent years, as the pollution in the Delaware has declined, communities are starting to turn back to the River for its beauty, recognizing that life by a clean river is not only desirable but can be economically valuable. Maintaining natural areas, trees, wildlife, and a healthy streamside helps to increase property values by reducing pollution, lessening the threats and impacts of flooding and by increasing property and community aesthetics.



**RIVERTON, NJ HISTORIC MANSIONS WERE BUILT FACING THE RIVER RATHER THAN THE STREET. MOST OF THESE STATELY HOMES ARE STILL INHABITED OR HAVE BECOME INNS AND RESTAURANTS TAKING ADVANTAGE OF THE RIVER VIEW.**

While the property value of a home or business is dependent upon several factors, it is largely influenced by the features either on or nearby the site. A *Money* magazine survey found that clean water and clean air are two of the most important factors Americans consider in choosing a place to live.<sup>5</sup> Living near a stream, creek or river increases property value. "Ocean, lake, and riverfront properties often sell or rent for several times the value of similar properties located inland."<sup>6</sup> A case study from the Maine Agricultural and Forest Experiment Station compared property values for homes facing clean water versus water

considered dirty or unclean. The study shows that property located near a high quality water body has a higher market value than if the water body has lower water quality and that in some cases the entire market value premium (increase) resulting from the waterfront location can be lost as the result of declining water quality.<sup>7</sup>

Many waterfront properties have benefited from measures to clean up the Delaware River and its tributaries including the tidal stretch. For example, the Residences at Dockside in Philadelphia and Christiana Landing in Wilmington are selling condominiums featuring a waterfront view for up to \$1.5 million.<sup>8</sup> In downtown Wilmington, the waterfront has been completely modernized with new town homes, restaurants, museums, and shopping in an effort to stimulate a city renaissance providing access to the River.<sup>9</sup> These are big changes in cities where only a few decades ago the River was blocked off and primarily used by industries and port operations. Aesthetically appealing and clean rivers are an asset to property values along the Delaware.

## ❖ Healthy Environments Protect Our Communities

***Trees, shrubs and naturalized lands, whether along a water body or inland, provide a number of benefits in addition to increased market value and marketability of properties. They provide critical protections to the health of our streams and rivers as well as to our communities through pollution filtering, flooding and natural disaster protection, and erosion prevention.***

### **Healthy Environments are Pollution Filters**

Vegetation such as trees, shrubs, and deep rooted plants, filter pollution out of water runoff, protecting our streams from potential contamination and our communities from the cost of cleanup. Sediment and pollutants are trapped by the structure of a forest floor and by plant communities. The natural vegetation slows the flow of runoff, allowing a greater opportunity for sediment and pollutants to settle and/or be absorbed by plants and soils, before the runoff enters a stream, wetlands or other waterway. At the same time, plants via their root systems take up pollutants.<sup>10</sup> Nitrogen, phosphorous, pesticides, sediment, sulfates, calcium, magnesium, and herbicides are among the many contaminants that healthy plant communities can remove from runoff before it is allowed to pollute our streams and water supplies.<sup>11</sup> Trees absorb air pollution and help maintain air quality. The shade provided by trees reduces heat, which reduces cooling costs for property owners and protects aquatic life.



**BUFFER. VEGETATED STREAMS PROVIDE POLLUTION FILTERS, FLOOD PROTECTION, AND EROSION PROTECTION TO MAINTAIN STABLE BANKS**

#### **VEGETATED BUFFER**

Vegetated buffers are the banks and adjacent lands of waterways and wetlands with trees, shrubs, and deep rooted plants that act to prevent erosion and trap sediment, while providing habitat, food, and shade for aquatic life and animals, acting as natural filters for pollutants, absorbing floodwaters and providing distance needed to protect communities from flooding

Whether you live along a body of water or inland, naturalizing your property to receive all of these benefits also increases the value of your home and property. In a survey conducted by the National Association of Home Builders, 43% of home buyers paid a premium of up to \$3,000, 30% paid premiums of \$3,000 to \$5,000, and 27% paid premiums of over \$5,000 for homes with trees.<sup>12</sup> "Two regional economic surveys documented that conserving forests on residential and commercial sites enhanced property values by an average of 6 to 15% and increased the rate at which units were sold or leased."<sup>13</sup>

Living nearby healthy plant ecosystems also increases property values. One study found that homes within 1,500 feet of a park sold for \$1,600 more than properties further away from naturalized areas.<sup>14</sup> Similarly, the study found that property values go up for homes within 1,500 feet of a wetland by an average of \$37 per acre.<sup>15</sup> "Pennypack Park in Philadelphia is credited with a 38% increase in the value of a nearby property."<sup>16</sup>

Not only are homeowners economically benefitted when they plant trees on their properties, but the host communities are too. "It has been conservatively estimated that over \$1.5 billion per year is generated in tax revenue for communities in the U.S. due to the value of privately-owned trees on residential property."<sup>17</sup>

## **Healthy Environments Protect Us from Natural Disasters**

Flooding in the watershed causes significant damage to public property, private property, and measurable economic injury for towns and cities. Hurricanes, severe thunderstorms, heavy rains, and snowstorms affect the Delaware River watershed and its residents. In areas lacking proper floodplain protection and riparian buffers, high water levels can create dangerous situations that are devastating emotionally, physically and financially, while resulting in damage to residents, communities, the River and all who rely upon it.

Vegetated areas encourage the infiltration of rainfall, protecting the region from the impacts of flooding and drought. The infiltrated water replenishes groundwater, which in turn provides healthy base flow to streams and the River, and feeds drinking water aquifers. Soaking this water into the ground also means it does not turn into non-natural stormwater runoff that contributes to flooding. Using manmade structures to try to prevent stormwater runoff and flooding is costly and much less effective than supporting the same action by nature.



**NEW HOPE, PA CONDOMINIUMS INUNDATED DURING THE JUNE 2006 FLOOD. THESE RESIDENCES WERE BUILT BETWEEN THE DELAWARE CANAL AND RIVER, IN A FRAGILE ENVIRONMENT SURROUNDED BY WATER WITH NO RIPARIAN BUFFERS OR PROTECTION FROM OR FOR THE RIVER.**

***"Floods have been, and continue to be, the most destructive natural hazard in terms of economic loss to the nation, as well as the cause of hundreds of deaths in communities across the nation"***

***..... testimony from William O. Jenkins, Director of Homeland Security and Justice, 2004***

Flood response and emergency services costs are of increasing concern to our region and nation. In its long history, Delaware River flooding has not only cost homeowners and municipalities millions of dollars, but the taxpayers of the entire state and nation pay the price. Responding to a flood requires a variety of emergency service operations and personnel including police and fire departments, local and county municipal services, and cleanup efforts. After a flood, communities must be provided temporary housing, food, and water. There must also be an investment of time and resources in providing ongoing information and assistance to flooded communities. Clean up after a flood often requires "hundreds of workers to renovate and repair, or tear down and dispose of, damaged or destroyed structures and materials."<sup>18</sup> Flooding destroys public and private utilities. Repairing damaged power lines, roads and bridges, gas pipelines, water treatment and storage facilities, and heating and cooling systems can make the cost of clean-up insupportable.



NOT ONLY DOES PROPERTY SUFFER DURING FLOOD EVENTS, BUT THE RIVER SUFFERS AS WELL. ALTHOUGH FLOODS ARE A NATURALLY OCCURRING PROCESS FOR RIVERS, NON NATURAL STRUCTURES, LITTER, AND ANYTHING THAT FLOOD WATERS COME IN CONTACT WITH IS CARRIED INTO THE RIVER, POLLUTING IT.

Other often unrealized expenses include health threats, and the cost of lost food and polluted drinking water. Repair, renovation and demolition operations that must occur in the wake of a flood often generate airborne asbestos mineral fiber that can cause chronic lung diseases or cancer.<sup>19</sup> Inhalation of asbestos can cause lung disease that can be fatal.<sup>20</sup> Lead is another dangerous toxin that can be released during repair, renovation or demolition operations. If inhaled or ingested, lead can cause damage to the nervous system, to the kidneys, to blood forming organs and to the reproductive system.<sup>21</sup>

After a flood, it is recommended that foods that came into contact with flood waters be discarded, and that all water should be considered unsafe until communities have been notified otherwise. These can be costly hardships for communities recovering from a flood.<sup>22</sup> Flooding can result in the growth and

transmission of fungi such as mildew, mold, rusts and yeasts which can cause illnesses.<sup>23</sup> Some forms of the fungi can cause skin, respiratory and other disorders.<sup>24</sup> Waterborne illnesses caused by bacteria, viruses and protozoa in drinking water are additional concerns in the wake of a flood.<sup>25</sup>

Flooding pollutes rivers with accumulated chemicals and debris from roadways and cities. Thunderstorms and hurricanes often lead to “Boil Water Advisories” as the result of sewage overflows at water treatment facilities. It is recommended that people boil all water for at least three minutes before consuming, making ice, feeding pets, washing dishes, brushing teeth, or rinsing food. These advisories can be expensive, as well as the added cost of having to buy treated/filtered water. When flooding occurs, recreation is halted and ecotourism harmed. The loss of business to a community or region can be significant.

In developed areas, rainwater rushes off impervious surfaces such as parking lots, roads, rooftops, hard-packed and chemically treated turf lawns, playing fields, golf courses and unstable farm fields into detention basins and storm systems that dump it, generally untreated, directly into streams, wetlands, lakes, and rivers and onto downstream communities. As development increases, the volume of stormwater increases and flooding worsens.

In natural forests and meadows, rainwater is absorbed into vegetated soils, feeding plant life, recharging aquifers and wetlands and maintaining stream base flow and waterway health. The volume of stormwater runoff is reduced. Naturally vegetated areas protect communities from increasing flood damages, the need for flood response services, and the need for flood damage payouts.

### HIDDEN COSTS OF FLOODING

Floods bring serious emotional harm to affected homeowners and communities in crisis. Following a flood disaster, people are engaged in the response and helping one another to cope. Later, feelings of panic, anger, anxiety, disorientation, and despair emerge. The full force of emotions often hit after the flood waters have receded. Exhaustion, grief, desperation and depression can then set in.

The prolonged stress caused in the wake of a flood can lead to difficulty sleeping, irritability and outbursts of anger, difficulty concentrating, painful emotions, or post traumatic stress disorder.

Children can be more deeply affected than adults, experiencing nightmares, fear, anxiety, increased physical pain such as headaches and stomach aches, a decline in their academic performance, difficulty sleeping, even suicidal tendencies.

Accessed June 9, 2008 West Virginia Division of Homeland Security and Emergency Management [www.wvdhsem.gov](http://www.wvdhsem.gov)



TINICUM, PA DRN RECEIVED FUNDING TO DEVELOP RESTORATION AND MANAGEMENT PLANS FOR 2 MILES OF TINICUM AND RAPP CREEK. THE PLANS WILL ADDRESS INCREASES IN STORMWATER RUNOFF, FLOODING, STREAM BANK EROSION AND THE LOSS OF RIPARIAN BUFFERS. TREES AND WOODY SHRUBS NATURALLY PROVIDE FLOOD FLOW REDUCTION.

A loss of tree cover over a 15 year period (1985 to 2000) in Bucks, Montgomery, Delaware, and Chester Counties, Pennsylvania and Mercer, Burlington, Camden and Gloucester Counties, New Jersey, reduced the ability of the Delaware watershed region's urban forests to "detain almost 53 million cubic feet of stormwater, a service valued at \$105 million."<sup>26</sup> Despite that diminishment, this same region "stored 2.9 billion cubic feet of stormwater in 2000, valued at \$5.9 billion."<sup>27</sup>

Existing tree cover was found to prevent 65 million cubic feet of stormwater runoff in the Big Timber Creek watershed (New Jersey) saving the community \$3.3 billion in stormwater infrastructure. In the Cobbs Creek watershed (Pennsylvania) existing tree cover prevented 20 billion cubic feet of stormwater runoff saving the community \$1 billion in stormwater infrastructure.<sup>28</sup>

In the Mill Creek watershed (New Jersey) existing tree cover prevented 6.7 billion cubic feet of stormwater runoff saving the community \$350 million in stormwater infrastructure. And in the Frankford-Tacony watershed (Pennsylvania) existing tree cover prevented 38 billion cubic feet of stormwater runoff saving the community \$2 billion in stormwater infrastructure. This tremendous savings translates into \$176,052,455 per year of benefit/savings for this part of the Delaware River watershed community.<sup>29</sup>



VALLEY CREEK, CHESTER COUNTY, DRN ASSISTED OPEN LAND CONSERVANCY AND RESTORED THIS STREAM REACH WHICH HAD BEEN DEVASTATED BY EROSION.

## FLOODPLAIN

The floodplain is the low, flat, periodically flooded area adjacent to rivers, lakes, and oceans. Natural floodplains absorb water, filter it, and help it to infiltrate the soil rejuvenating groundwater aquifers for drinking water.

Calculating the benefits of trees on a site-by-site basis further demonstrates that healthy, vegetated watersheds can provide dramatic cost savings for communities. A 3.41 acre commercial site in the Tacony watershed (Pennsylvania) with 2% tree cover and 97% impervious cover provides no stormwater benefits. By comparison, a single family site, 3.19 acres, with a 30% tree cover “provides \$5,454 in stormwater savings”.<sup>30</sup> In communities serviced by combined sewer and stormwater systems, where the cost to build additional stormwater infrastructure storage costs approximately \$52 per cubic foot (as compared to areas served by separate stormwater systems where the cost ranges at \$2 per cubic foot for stormwater construction), a 30% tree canopy on a 5 acre residential development site can save over \$308,000.<sup>31</sup>

To reap the benefits of living near a water way, it is important not to encroach on it. While locating homes and certain businesses (such as restaurants, hotels, etc.) with a water view enhances their value, placing them too close to the water does the opposite. Buildings and other structures located too close to our waterways are at risk of flooding and resulting flood damages.

Houses located within the floodplain have lower market values than equivalent houses located outside the floodplain.<sup>32</sup> The reduction in value between the two can be as much as 4 to 12% with an average 5.8% reduction in value.<sup>33</sup> Recent flooding creates an even greater reduction in property values.<sup>34</sup>

A location in the floodplain reduces the value of the home for the seller, and also increases the costs for the buyer. Homeowners located in the floodplain are required to purchase flood insurance. They are also responsible for uncovered expenses associated with cleanup after a flood, and the costs of having to relocate after a flood, temporarily or long term.

Homes and businesses located in the floodplain increase polluted runoff because of this proximity to the waterway. The removal of native vegetation and the creation of impervious surfaces increases runoff that carries into the water every contaminant found there. For instance, homes that meet the minimum standards for floodplain construction can still place an unoccupied garage, driveway, and parking lot in the floodplain. Every time it rains, grease, oil, and any chemicals stored or used in a garage are washed into the river. And in floods, motor vehicles, lawn mowers, and other typical equipment kept in a garage or shed are swept in the floodwaters, sometimes taking the shed along as well.

Infringement on the floodplain reduces river values. Downstream and neighboring communities and businesses lose the enjoyment of beautiful, healthy and clean streams and their risk of flood damage is increased.

While avoiding construction in the floodplain will reduce flood damages and while reducing development impact through effective stormwater management and less impervious surface will reduce the volume of runoff, rivers and streams will always flood their floodplains. As part of the river system natural flood plains provide immense value by allowing river flooding to occur as part of the normal life cycle of a waterway.



BUCKS COUNTY, PA. BANK EROSION FROM EXCESSIVE RUNOFF IN TINICUM CREEK. THE SEDIMENT FROM THIS BANK RUNS DOWNSTREAM MUDDYING THE WATER, SMOTHERING STREAM BOTTOM HABITAT, AND SUFFOCATING FISH, MUSSELS AND OTHER AQUATIC LIFE.

## Flood damage claims for three major flood events in the Delaware River Watershed

September 2004: 1,313 claims totaling \$46 million

April 2005: 1,977 claims totaling \$73 million

June 2006: 3,045 claims totaling \$107 million

[http://www.state.nj.us/drbc/Flood\\_Website/floodclaims\\_home.htm](http://www.state.nj.us/drbc/Flood_Website/floodclaims_home.htm)

### Healthy Environments Prevent Erosion

Naturalized areas along a water body help prevent the erosion of public and private lands, including the undermining of bridges and roadways. Protection of our streams is much more cost effective than having to restore them once damage is done.

Streams are formed over time by the forces of nature. A stream's physical structure shifts naturally over time but often is forced to change more dramatically or unnaturally due to human intrusion such as increased water runoff, roads, dams, levees, or floodplain disturbance. A vegetated buffer along a waterway protects and supports the banks and other critical parts of a stream's make-up, allowing it to resist erosive forces and remain stable. Forested buffers are the glue that holds together nature's design. The roots hold the riparian lands in place, maintaining the hydraulic roughness of the bank, slowing flow velocities in the stream near the bank.<sup>35</sup> Also, the absorption ability of a vegetated buffer, especially when it contains a mix of woody shrubs and trees, slows down the water in high stream flows and soaks up water, reducing in-stream channel velocity and volume during storm events thereby reducing damage to the stream and preventing non-natural erosion.<sup>36</sup>

In Ohio, the Department of Transportation found that on average it costs between \$3-\$10 per linear foot to preserve a stream, while it costs almost \$300 per linear foot to restore it.<sup>37</sup> Protecting our floodplains and buffer areas keeps people from building in the floodplain where they are vulnerable to floods and flood damages while at the same time protecting our public and private lands from being literally washed away.



WETLANDS ARE FILTERS AND BUFFERS FOR RISING WATER LEVELS. THIS AREA IS ALONG BEAVER CREEK, A TRIBUTARY OF OLDMANS CREEK, A NEW JERSEY TRIBUTARY OF THE DELAWARE RIVER.

### Protection from the Effects of Global Climate Change

Global climate change is a major threat to our region, nation, and earth. A recent report entitled "Confronting Climate Change in the U.S. Northeast" and an associated New Jersey specific *Executive Summary* found that under one conservative emissions scenario, by the end of the century New Jersey is expected to lose virtually all of its snow cover; that "the frequency and severity of heavy rainfall events is expected to rise"; and that the frequency of short term drought (one to three months) is projected to increase.<sup>38</sup> In addition, global climate change is expected to dramatically increase the number of days over 100 degrees communities in our region experience. In the coming decades, communities nearby Philadelphia will begin to experience in the range of 10 days to 30 days that are over 100°.<sup>39</sup>

Scientists have determined that carbon dioxide, a major greenhouse gas, contributes significantly to global climate change.<sup>40</sup> Trees are an important part of the solution. Trees store carbon in their leaves, stems, branches, and roots.<sup>41</sup> Other plants, dead plant material, and the organic matter found on the forest floor and in forest soils also store carbon.<sup>42</sup> Protecting our forests to protect our rivers also helps protect us from global climate change.

A forest which has not been previously logged and has a closed canopy, stores about 250 tons of carbon per hectare in its vegetation and soil.<sup>43</sup> Rather than acting as a sink for carbon, this same area if converted to agriculture becomes a source of carbon, releasing about 200 tons of carbon per hectare.<sup>44</sup> Forests with an open canopy store about 115 tons of carbon per hectare. The same forests release about 29 to 39 tons per hectare if converted to agriculture.<sup>45</sup> The social costs of emitting carbon (calculated as damage avoided) is about \$34 per ton.<sup>46</sup> The US Forest Service Northeastern Research Station estimated that forest carbon storage in New Jersey at approximately 38.3 tons per hectare. This means that the 126,606 hectares of NJ State Parks and Forests store 4,849,009 tons of carbon<sup>47</sup> which would, at the \$34 per ton figure, provide over \$164 million in damage avoidance.

Restoring our floodplains by creating forested buffers along our rivers and streams protects communities from the expected increase in flooding that will accompany changing weather patterns and increased rise of sea level that will result from global climate change. At the same time it provides the quality of vegetation that can be part of the solution for reducing the advance of global climate change by sequestering carbon and filtering air pollution.



**NATIVE RIPARIAN PLANTS, GRASSES, AND TREES HELP TO RESTORE DAMAGED STREAMS STRENGTHENING THE BANKS AND CREATING ROOT SYSTEMS.**

## ❖ Businesses Benefit from Attractive Waterfronts

*A clean and healthy Delaware River increases the appeal of commercial properties and businesses that benefit from the River as an attraction. On a nice day, people are drawn to the River; riverfront businesses gain an increase in customers and foot traffic based on their location. Riverfront restaurants, art galleries, inns, Bed and Breakfasts, charter fishing boats, coffee shops, and retail shops all benefit from a proximity to the River and parks when they are clean and attractive.*

### **Restaurants**

At the riverfront in downtown Philadelphia, Moshulu has transformed a historic four masted sailing ship from the early 20<sup>th</sup> century into a fine dining restaurant docked at Penn's Landing. The restaurant is one of many fine dining experiences that may be enjoyed along the Delaware River. The Spirit of Philadelphia is a riverboat cruise that combines the beauty of the River, the spirit of the City, and a buffet dinner and a show for around \$65 per person. River cruises like this one are not uncommon to the Delaware River.<sup>48</sup> The Liberty Belle docked in the Navy Yard offers a similar experience and can be rented out for weddings or other large events for up to 600 people; people pay more than \$6,000 for this Mississippi style riverboat to enjoy their evening on the River.<sup>49</sup>



NEW HOPE, PA. THE LANDING RESTAURANT FEATURES RIVERSIDE DINING WITH VIEWS OF LAMBERTVILLE, N.J AND THE DELAWARE RIVER.



NEW HOPE-LAMBERTVILLE BRIDGE. PEDESTRIANS CAN WALK OVER THE DELAWARE RIVER FOR SHOPPING AND DINING ON EITHER SIDE OF THE RIVER. GOURMET RESTAURANTS, ANTIQUE SHOPS, CRAFT GALLERIES, SALON BOUTIQUES, AND UNIQUE JEWELRY STORES BENEFIT FROM A STEADY FLOW OF CUSTOMERS.

Along the lower Delaware the Bucks Bounty, Bridge Café, Landing Restaurant, Indian Rock Inn, and Center Bridge Inn are all restaurants that people drive to from miles away to enjoy the views of the River, the sounds of the water, and the aesthetics of nature and history.<sup>50</sup> Restaurants along the Delaware River in Lambertville and New Hope are able to attract visitors throughout the region for the scenic river views, walkable bridge, and historic towns.

Rojo's Roastery in Lambertville brews organic and fair trade coffee for pedestrians that stroll in from walking along the River and through town. The River Horse Brewery in Lambertville uses water directly from the Lambertville Reservoir of Swan Creek, a tributary of the Delaware River. The microbrewery has been located along the banks of the Delaware River since 1996 and distributes all natural beer throughout the northeast, Delaware, and Maryland.<sup>51</sup>



### Case Study: The Delaware River Art Gallery Yardley, PA

The Delaware River Art Gallery holds exclusive and historic pieces of artwork that focus on the life and beauty of the Delaware River, mostly by local artists. Located in historic Yardley, Pennsylvania the Gallery celebrates life on the Delaware as well as the beauty of the River itself.

Dale Woodward, owner of the Delaware River Art Gallery says that although much of the business comes from people strolling along the River through Yardley who decide they want to

remember the view of the Delaware through art, even more business comes from the people who actually live in the area. Residents of Yardley enjoy daily views of the Delaware, a River many of them have grown up on, and artwork of the River is a prized possession.

## Inns and Hotels

The Black Bass Inn was one of the first taverns in Bucks County. It is located in the river town of Lumberville.<sup>52</sup> Currently, the Black Bass resides as an upscale restaurant and inn.<sup>53</sup> Situated close to the Delaware, people come to the restaurant for the views of the River below. The Lumberville footbridge connects the town to Bulls Island State Park for an after dinner stroll or as a take out for kayakers and canoeists wanting a good meal.<sup>54</sup>

Chestnut Hill Inn on the Delaware consists of two romantic Victorian houses overlooking the scenic river in Milford, Hunterdon County, NJ.<sup>55</sup> The guest rooms exude a sense of warmth and romance no matter what season you visit. All rooms have access to the beautiful riverfront terraced gardens, deck, and dock. River access is nearby so guests can bring their boat, canoe, kayak or tube. Many guests enjoy bringing their lunch or dinner back to the Inn to dine along the River's edge.



CHESTNUT HILL INN ALONG THE DELAWARE RIVER IN MILFORD, NJ INNS LIKE CHESTNUT HILL ARE APPEALING BECAUSE OF THEIR PROXIMITY TO THE RIVER AND THE BEAUTY AND ACTIVITIES THE RIVER PROVIDE. PHOTO

The Bucks County Bed and Breakfast Association of Pennsylvania is supported by many Delaware River bed and breakfasts throughout Bucks County. Most of the inns and restaurants are restored homes built in the 19<sup>th</sup> century and contain the river charm people seek for getaways, retreats, and important events.<sup>56</sup>

The Lambertville Station Inn located along the Delaware River in Lambertville, New Jersey offers waterfront lodging, dining, activities, and a ballroom ideal for weddings and receptions.<sup>57</sup> Every room located at the Inn has a scenic waterfront view. The ballroom is made of three glass walls offering river observation from every angle, giving the inside an impression of the outdoors.

Among the many hotels, lodges, and inns throughout the watershed, accommodations along the River with a waterfront view are priced higher than hotels without. (see figure: 1)



Figure 1: Hotel Room Prices With and Without a River View

**Figure 1** shows a range of hotels along the Delaware River that offer both views of the riverfront and rooms without views of the riverfront. The range between the two demonstrates that people are willing to pay more for a view of the River. At the Cape May Grand Hotel located near the mouth of the Delaware Bay, a room with a waterfront view costs \$227 per night, while a view on the opposite side of the same hotel costs only \$192 for the same night.<sup>58</sup> The Hyatt Regency in Philadelphia also increases the price on rooms with a view, charging \$247 for a king size bedroom without a River view as compared to \$282 for a king size bedroom on the waterfront.<sup>59</sup> Up river at the Bridgeton House in Upper Black Eddy, prices can be found for nearly \$100 more with a Delaware River view.<sup>60</sup> And the historic Penn's View hotel in Philadelphia charges \$289 for its rooms with a Delaware River view, which are also suite style rooms; the lower level rooms can be purchased for as low as \$145 per night; a difference of \$144.<sup>61</sup>

# River Recreation

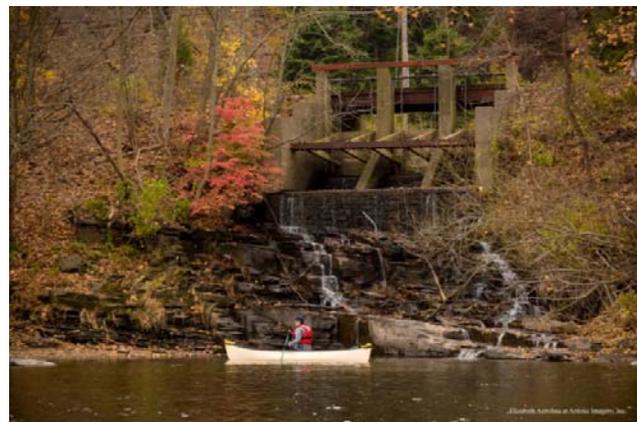
## River Recreation

- ❖ The Broad Array of Recreation on the Delaware River
  - ❖ Diverse Boating for Recreation and Sport
  - ❖ Swimming and Biking Along the Delaware
    - ❖ Leisure Fishing
  - ❖ Birding and Wildlife Watching
    - ❖ Parks and Wildlife Refuges
- ❖ Community Attractions Focused on Enticing Ecotourism

### ❖ The Broad Array of Recreation on the Delaware River

*Recreation is fundamental to individual, family and community quality of life. Recreation provides jobs, stimulates and supports the economy, brings tourists and outside revenue into the region, and it enhances the quality of life of those enjoying it.*

On the Delaware River recreational possibilities abound and include all types of boating, fishing, bird watching, hiking, biking, tubing, jogging, swimming, camping, and wildlife viewing. Keeping the river healthy, and restoring health where it has been lost, will allow these recreational activities to prosper.



PADDLER CROSSING A DELAWARE RIVER CANAL OVERFLOW IN SMITHFIELD, PA ON THE DELAWARE RIVERKEEPER NETWORK'S NOVEMBER 2008 BUSINESSMAN'S CANOE TRIP. PHOTO CREDIT: ELIZABETH AZZOLINA 2007

Outdoor recreation keeps people physically and mentally healthy and productive, enhancing the body and the mind. In a survey of Delaware River Valley visitors,<sup>62</sup> almost all recreationists stated that the River provided a source of mental and physical refreshment.

#### RECREATION

Recreation along the Delaware River includes boating, fishing, bird watching, hiking, biking, tubing, jogging, swimming, camping, and wildlife viewing.

Many rural river towns are supported by seasonal tourist revenue.<sup>63</sup> Recreation is a \$730 billion annual contribution to the United States economy.<sup>64</sup> In New York, New Jersey, and Pennsylvania alone, the total economic contribution of outdoor recreation exceeds \$38 million annually, generating over 350 thousand jobs and adding additional economic sales and tax revenues of more than \$32 million.<sup>65</sup>



CANOING THE DELAWARE RIVER AT FRENCHTOWN, NJ DRN HOLDS AN ANNUAL BUSINESSMAN'S CANOE TRIP IN THE FALL FOR MEMBERS AND STAFF TO ENJOY THE RIVER BEFORE WINTER AND WHILE THE LEAVES ARE BRIGHT AND COLORFUL. PHOTO CREDIT: ELIZABETH AZZOLINA 2007

According to the Outdoor Industry Foundation, “more Americans paddle (canoe, kayak, raft) than play soccer”, and “more Americans camp than play basketball”.<sup>66</sup> The U.S. Fish & Wildlife Service reports that in 2006 fishing was the “favorite recreational activity in the United States” with 13% of the population 16 and older (29.9 million anglers) spending an average of 17 days fishing in that year alone.<sup>67</sup> As a result, in 2006, “anglers spent more than \$40 billion on trips, equipment, licenses and other items to support their fishing activities.”<sup>68</sup> Of this, 44% (\$17.8 billion) was spent on items related to their trips, including food, lodging and transportation.<sup>69</sup>

These national trends and figures are consistent in the Delaware Valley. According to the New Jersey Department of Fish and Wildlife, New Jersey state parks received 12 million visits in one year (1994) statewide, with wildlife recreation, fishing and hunting responsible for 75,000 jobs and generating \$5 billion in retail sales.<sup>70</sup> Valley Forge Historical Park, through which the Schuylkill River and tributary streams flow, created 1.23 million recreation visits in 2001 with park visitors spending “\$33.3 million dollars within an hour’s driving distance of the park, generating \$10.4 million in direct personal income (wages and salaries) for local residents and supporting 713 jobs in the area.”<sup>71</sup>



Figure 2 Water Recreation Revenue in PA, NY, & NJ

For many, the Delaware River evokes a “strong feeling of affection, loyalty, and attachment”.<sup>72</sup> Visitors are attracted to the Delaware River for recreation because of its vicinity to major eastern metropolitan areas as well as its “clean river water, exceptional trout, shad, and eel fisheries, and wildlife to observe.”<sup>73</sup>

The most popular River activities include boating, fishing, and bird watching. The total economic contribution of fishing in Pennsylvania, New York, and New Jersey exceeds \$3 million.<sup>74</sup> Another \$2.5 million is supplied from paddle based boating.<sup>75</sup> Nearly \$2 million is spent on the gear to support these industries with another \$3 million generated from related travel.<sup>76</sup> In addition, nearly \$750,000 is generated in state and federal taxes on all of these water recreation income streams.<sup>77</sup> **Figure 2** shows how the amount of money spent on recreation purposes breaks down specifically in the tri-state area.

## ❖ Diverse Boating for Recreation and Sport

- ***The Delaware is the longest un-dammed 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 where it meets the Atlantic Ocean. Because the Delaware is undammed, it is ideal for popular recreational activities such as canoeing and kayaking. The River is fed by 216 tributaries, the largest being the Schuylkill and Lehigh Rivers in Pennsylvania and the Musconetcong in New Jersey. Boating options throughout the watershed include canoeing, kayaking, rafting, jet skiing, motorboats, paddleboats, different types of historic riverboats and sailing. Even in urban areas, such as the Philadelphia and Camden waterfronts, the popularity of paddle sports is increasing as evidenced by the recent creation of the Tidal Water Trail maps series, public access points, and points of interest.***

### Rowing on the Schuylkill

Boating recreation has a recognized history in the watershed. For example, the Schuylkill River traces its rowing culture as far back as the 1830's.<sup>78</sup> Each year the Schuylkill Navy hosts numerous regattas along the Schuylkill including the Dad Vail, the largest collegiate rowing event in the nation.<sup>79</sup> In response to the atmosphere of professional rowing of the 19th century, and the gambling and corruption that plagued the sport, the Schuylkill Navy was formed in 1858 to promote amateur rowing and establish rules of behavior.

Today, the Schuylkill Navy is the oldest amateur athletic governing body in the United States and is made up of ten clubs on Boathouse Row as well as high school and college rowing programs.<sup>80</sup> In 1938, Philadelphia Girls' Rowing Club, the first boat club on the Schuylkill for women, was organized.<sup>81</sup> The first Schuylkill men's club to organize a women's rowing team was Vesper in 1970.<sup>82</sup>



DINGMANS FERRY, PA AMERICAN CANOE ASSOCIATION HELPING DRN ORGANIZE THE ANNUAL UNITED NATIONS INTERNATIONAL SCHOOL FRESHMAN CLASS CANOE AND CAMPING TRIP ON THE DELAWARE.



PHILADELPHIA, PA ST. JOSEPH UNIVERSITY WOMEN'S ROW TEAM SCHUYLKILL RIVER. ROWING HAS A LONG HISTORY ON THE MAIN STEM SCHUYLKILL RIVER. PHOTO CREDIT: PATRICK CONOLLY 2007

The presence of the Schuylkill Navy and the clubs along Boathouse Row nurtured excellence in amateur rowing for decades. Vesper Boat club, organized in 1865, won gold medals in the eight-oared shell event at the 1900, 1904 and 1964 Olympics.<sup>83</sup>

Elite level rowers and world class coaches continue to be attracted to the Schuylkill to train. Rowers training in Philadelphia are earning spots on national and Olympic teams including the 5 Philadelphia-area rowers who represented the United States at the 2008 Olympics in Beijing.<sup>84</sup>

In addition to dual competitions among local college crews, more than 20 regattas are held on the Schuylkill each year from April through November.<sup>85</sup> These regattas include the

Independence Day Regatta, the largest summer club regatta in the United States (over 1,400 competitors in 2008)<sup>86</sup>; the Dad Vail, the largest collegiate rowing event in the nation (over 3,000 competitors in 2008)<sup>87</sup>; and the Stotesbury Cup, the largest high school regatta in the world (over 5,000 competitors from 177 high school teams in the United States and Canada in 2008).<sup>88</sup> With thousands of competitors coming to the region for multiple day visits, these regattas result in a significant economic impact for the Philadelphia area. Rowing has become such a strong force in the region that clubs and competitions have expanded to other Delaware River tributaries with regattas now being held on the Cooper River in New Jersey and the Christina River in Delaware.



PHILADELPHIA, PA BOATHOUSE ROW THE SCHUYLKILL REMAINS HEAVILY USED FOR COMPETITIONS INCLUDING NATIONAL REGATTAS AND OTHER ROWING EVENTS. PHOTO CREDIT: GREGORY MELLE

The boat clubs that comprise Boathouse Row have been registered as a National Historic Landmark since 1987.<sup>89</sup> Boathouse Row has become an iconic image for the City of Philadelphia and tours offering a glimpse into the competitive world of Philadelphia rowing have become an important component of Philadelphia tourism.<sup>90</sup>

## **Whitewater Kayaking**

Those who enjoy whitewater particularly enjoy the Delaware River's upper reaches. In 1986 the Upper Delaware attracted 232,000 whitewater paddlers who spent \$13.3 million, adding \$6.2 million to the local economy and supporting 291 jobs.<sup>91</sup> The Water Gap is a tremendous resource for whitewater paddlers. In 1986 this reach of the River was responsible for attracting 135,400 whitewater paddlers who spent \$6,929,000, contributing \$3,695,200 of local economic value and supporting 156 jobs.<sup>92</sup>



BUCKS COUNTY, PA TWICE A YEAR RELEASES FROM NOCKAMIXON LAKE TO TOHICKON CREEK CREATES A GREAT WHITEWATER EXPERIENCE THAT IS A FAVORITE AMONG WHITEWATER PADDLERS AND CANOEISTS.

## **Canoeing on the Delaware**

There are more than 20 canoe liveries along the Delaware River, some of which employ over 200 people and have annual attendances of around 60,000-70,000 people.<sup>93</sup> The liveries offer a variety of options including canoeing, kayaking, tubing, and rafting. Tubing at Bucks County River Country costs \$18 a trip and whole families can go rafting for \$40-\$50 a day (2006).<sup>94</sup> With an annual attendance of 60,000 people,<sup>95</sup> this creates estimated gross revenue of between \$648,000 and \$3 million.

Canoe liveries throughout the watershed cater to family fun. There are few other full day activities that families may experience together for as little as \$50. These activities allow for education and appreciation of the River while relaxing, fishing, reading, and sunbathing.

Clean and healthy water is essential for the survival of canoeing businesses. The threat of pollution or contaminated water turns many families away for health and safety reasons. When it was learned that the Village of Deposit was discharging 450,000 gallons per day of chlorinated raw sewage into the Delaware River during the summer months (July-August), 2006, it was recognized immediately as a threat to recreation along the River. An alert about the discharge from the Delaware Riverkeeper Network inspired numerous calls for immediate action. Calls to regulatory agencies, letters from the community, and news

articles about the discharge and its threat to the community and recreation prompted swift action from the agencies to stop the discharge. This type of pollution incident can damage the river's reputation even after the event is abated.

Flooding along the Delaware River in recent years has closed down canoe and boating liveries for weeks at a time. Peak livery operations last only 3 months out of the year, so summer flooding threatens these small businesses with relatively small profit margins.<sup>96</sup> High waters can be dangerous for boaters and swimmers by causing rapid water flow and adding obstacles and debris to the current.

Keeping the riversides and a campgrounds clean are important in attracting tourists to the region. Recognizing this Kittatinny Canoes near the Delaware Water Gap National Recreation Area hosts an annual river litter clean up that brings in people from all over the watershed to pull tires, paper, plastic bottles, and roadway trash from the River.



DELAWARE WATERGAP FOR THE PAST 18 YEARS, DELAWARE RIVERKEEPER NETWORK HAS ORGANIZED A 3 DAY CANOE AND CAMPING TRIP FOR THE FRESHMAN CLASS OF THE UNITED NATIONS INTERNATIONAL SCHOOL FROM NYC. FOR MANY IN THE GROUP OF 100+, IT IS THEIR FIRST TIME IN A CANOE OR CAMPING IN THE WOODS.

Location	Canoe Liveries
<b>Pennsylvania</b>	Adventure Sports Canoe & Raft Trips Bucks County River Country Chamberlain Canoes Kittatinny Canoes Pack Shack Adventures Portland Outfitters River Country Shawnee Canoe Trips Shohola Campground Soaring Eagle Campgrounds Sylvania Tree Farm Camping Two River Junction
<b>New Jersey</b>	Delaware River Rafting & Canoeing Delaware River Tubing GreenWave Paddling Lazy River Outpost Paint Island Canoe & Kayak Phillipsburg River Outpost
<b>New York</b>	Ascalona Campground Catskill Mountain Canoe and Jon Boat Rentals Cedar Rapids Kayak & Canoe Outfitters Inc Deer Run Rustic Campground Delaware River Trips Indian Head Canoes & Rafts Jerry's Three River Campground and Canoes Landers River Trips Red Barn Family Campground Silver Canoe Rentals Upper Delaware Campgrounds, Inc. Whitewater Willies Raft & Canoe Rentals, Inc. Wild & Scenic River Tours & Rentals

Figure 3: Canoe Liveries Along the Delaware River Main Stem<sup>97</sup>

Whitewater clubs and paddling clubs throughout New York take advantage of the nearby river attractions. The Canoe and Kayak Club of New York plans trips almost every weekend of the fall, spring and summer through Upper Delaware tributaries and headwater streams.<sup>97</sup> The Mongaup and Lehigh Rivers are favorites for clubs that frequent both the Delaware and Hudson River watersheds.<sup>98</sup>

To the delight of Whitewater enthusiasts, Lake Nockamixon makes 2 whitewater releases each year into the Tohickon Creek at Ralph Stover State Park in Bucks County, Pennsylvania.<sup>99</sup> The course can be challenging for even the most avid kayakers. The creek contains several drop-offs, high rock cliffs, class III and IV rapids, and some of the most beautiful landscapes in southeastern Pennsylvania.<sup>100</sup> Boundless Philadelphia, a Philadelphia based tourism website warns, “don’t be surprised to find the water somewhat crowded.” “This is a favorite among paddlers all over the Northeastern US.”<sup>101</sup>

Kayakers and paddlers take advantage of the still water reservoirs in New York and the upper Delaware. The Swinging Bridge reservoir and Mongaup Falls reservoir together span almost 1000 acres.<sup>102</sup> These recreational hot spots are free to paddlers and hikers; anglers can catch Largemouth Bass, Chain Pickerel, and Panfish.<sup>103</sup> The Mongaup Falls reservoir is trout stocked.<sup>104</sup> The Mongaup Falls Reservoir Park is known as a prime location for Bald Eagle watching and contains designated bird observation areas.<sup>105</sup>

Boating of all types is important for residents of the watershed and tourists. Tourists are attracted to the region; historic attractions are maintained; jobs are created; and valued recreation, vacation, environmental education and family interactions are nurtured along the River.



### Case Study: Canoe Designer and Photographer Harold Deal

Harold Deal's ancestors have been residents of the Delaware River for centuries. One of those ancestors, Daniel Bray, collected Durham boats for General Washington's army allowing them to cross the Delaware River aiding in our country's independence. Harold has grown up on the Delaware and knows its ebbs and flows in all seasons. He once continuously paddled the 200 miles from Hancock to Trenton without any sleep or rest. This intimate knowledge gained from the flow of the Delaware River and its tributaries enabled him to become a semi-professional paddler, designing and building prototype models for performance canoes and paddles used for recreational paddling and racing. Harold's whitewater skills led to 24 first-place finishes at Whitewater Open Canoe National Championship events held around the United States.

“After so many years of paddling, I know how a canoe's shape will respond in the dynamics of a flowing river. My relationship with boating manufacturers from recreational paddling and whitewater racing over the years allowed me to develop and market my own concepts for canoes and paddles that are being produced today”, said Deal.

Deal lives along the Delaware River in Upper Mount Bethel Township with his wife Bets. He is able to keep an eye on the river and regularly frequents his favorite sections of the Delaware and its tributaries year round. “Living in close proximity to the river has allowed me to immerse myself in a way of life that is connected with the water. Bets and I have a deep appreciation for wildlife and the natural outdoors, and the importance of preserving a clean and healthy watershed system”.





BRISTOL, PA THE BRISTOL RIVERBOAT QUEEN DOCKED ALONGSIDE THE DELAWARE RIVERFRONT IS A REPLICA STEAMBOAT THAT TOURS THE MANSIONS OF BRISTOL AND BURLINGTON, NJ

## **Historic Riverboats**

Riverboats are a part of the Delaware River's history and offer another kind of boating attraction. Canal boat tours in New Hope and Easton, Pennsylvania keep that history alive. Wells Ferry in New Hope, Pennsylvania offers scenic, narrated tours of the Delaware River's history.<sup>106</sup> Coryell's Ferry, also in New Hope offers narrated tours on a boat with a paddlewheel that departs every 45 minutes in May through October.<sup>107</sup>

In Burlington, New Jersey, county officials have attempted to spark tourism through offering a historical riverboat tour on the Bristol Riverboat Queen, a replica steamboat.

What began as a one day event has transformed into a regular summertime weekend adventure. More than 1,500 people showed interest in the tour of the Burlington and Bristol mansions and factories that can only be viewed from the River itself.<sup>108</sup> The boat holds 100 people, and every trip is filled to capacity.<sup>109</sup>

The Bucks County Riverboat Company offers a 52-foot long pontoon boat for scenic and historic rides along the Delaware while serving dinner for more than 70 guests at a time. The pontoon boat can be chartered for special events at a cost of \$1,375 for four hours.<sup>110</sup> It is rented out regularly on weekends throughout the summertime months. This riverboat and the Delaware River Steamboat floating classroom offer environmental education seminars for local public and private schools, families, college students, and youth groups.<sup>111</sup>

## ❖ Swimming and Biking along the Delaware

*The Delaware is a safe and fun haven for swimmers and the canal towpaths create perfect biking trails. Swimmers enjoy Delaware River and tributary waters at a number of locations that may not be official access points, but community-made put-ins where kids and adults can appreciate the cool water during the hot summer.*



CAPE HENLOPEN, DE KIDS SWIMMING DURING DELAWARE RIVERKEEPER NETWORK'S ANNUAL MEMBERS DAY AT THE BAY DAY AT THE BEACH. THE BAY OFFERS MORE SECLUSION THAN THE JERSEY SHORE, WITH JUST AS MUCH FUN.

Some popular Delaware River swimming holes are located at Bulls Island just north of New Hope and Lambertville, Farview in Stroudsburg, Flatbrook and Milford swimming holes in Milford, and at the Trestle Bridge in Columbia, New Jersey.<sup>112</sup> Popular swimming lakes include Crater Lake and Highlands Natural Pool.<sup>113</sup> Creeks and brooks with reportedly good swimming spots are at the Devils Pool on Cresheim Creek in Mt. Airy Pennsylvania, the Brandywine in Chadd's Ford, and Otter Hole in the Posts Brook in New Jersey.<sup>114</sup> The Musconetcong Wild and Scenic River enters the Delaware at Riegelsville, New Jersey and plays host to popular swimming holes throughout its length. Some of these lakes and swimming holes are in the most beautiful secluded spots of the watershed. Many have warnings about jumping from high up into shallow water and watching out for dams or big rocks.<sup>115</sup> After

heavy rain, due to polluted runoff, many areas are better left off limits for swimming and other water contact recreation for approximately two days to allow water quality to clear up.

Besides swimming holes, there are also a few remaining Delaware River beaches where swimming continues. Historically, swimming in the River was a popular summertime activity. Smithfield Beach and Milford Beach in Milford, Pennsylvania maintains a lifeguard on duty during the summer months. In the Delaware Bay, Cape Henlopen, Dewey Beach, Cape May, and several other spots are popular for tidal salt water beaches without the crowds of the Jersey Shore or Delaware beach hotspots. To many towns, beaches are a vital part of the local economy.

Bicyclists have a number of scenic options that take them close to water. The Delaware and Raritan Canal trail is a perfect bicycling adventure. It travels along the historic Delaware River canal towpath for 27 miles from Frenchtown to Trenton, New Jersey.<sup>116</sup> The canal on the Pennsylvania side of the River offers a similar experience close to the water for over 60 miles from Easton to Bristol.<sup>117</sup> Bikers, runners, and families with strollers, appreciate the trails. The River to River scenic Bicycle tour from Montgomery County to Bucks County, Pennsylvania offers both recreational and professional cyclists with 25-, 50-, or 100-mile cycling routes along roads through scenic old towns, rivers, and parks.<sup>118</sup>

The Delaware River Scenic Byway is a scenic driving experience traveling along Route 29 between Trenton and Frenchtown, New Jersey, and along Route 32 that parallels the River through Bucks County in Pennsylvania. Motorcyclists and bicyclists also enjoy the scenic rides and views<sup>119</sup> and cycling opportunities continue to expand from the Poconos (the MacDade Trail) to the Camden City Waterfront (Camden Greenway Trails).

## ❖ Leisure Fishing

**The Delaware River is known for its world class fisheries. Both commercial and recreational fishing abound on the River and help support local economies. Fish commonly found in the Delaware River include Striped Bass, Trout, and Large and Smallmouth Bass. Other fish present in the River include Weakfish, American Shad, Sturgeon, Catfish, Pike, Bullhead, Perch, Walleye, and Sunfish. A 1996 survey found that 31,390 anglers spent 265,970 days fishing just the New York reaches of the Delaware River.**<sup>120</sup>

### Shad Fishing

The American Shad is deeply rooted in the foundation of the cities and towns throughout the Delaware River watershed. The Shad is a “major part of the river’s ecology and has played an important role in the river’s early commercialization, development, and tourism.”<sup>121</sup> American Shad are born in freshwater. After hatching in spring, they feed on plankton and aquatic insects before migrating towards the ocean.<sup>122</sup> After four to seven years in the ocean the Shad return to their place of birth to spawn in the fresh waters of the Delaware River and upriver tributaries.<sup>123</sup>



JUVENILE SHAD SEINING. PHOTO CREDIT: NJ DIV. OF FISH & WILDLIFE

The American Shad are celebrated in several cities throughout the watershed during their spring spawn including Fishtown in Philadelphia, Easton, Pennsylvania and Lambertville, New Jersey bringing in people from all over the basin. The annual Shad fishing tournament held each year following the Easton Shadfest charges a \$20 entry fee, and with over 1000 competitors in 2006, the tournament raised \$20,000 in proceeds.<sup>124</sup> Lambertville’s Shadfest has been an annual part of the community for 26 years, attracting 30,000 to 35,000 visitors during the two day event.<sup>125</sup> The Shad population has rebounded from decades ago because of renewed efforts to maintain water quality allowing the Shad to make the spawning journey up the Delaware.<sup>126</sup>



LAMBERTVILLE, NJ DELAWARE RIVERKEEPER NETWORK BOOTH FEATURING A REAL AMERICAN SHAD, MERCHANDISE, AND EDUCATIONAL MATERIAL . PHOTO CREDIT: A. WALSH

Shad enthusiasts express their passion for shad fishing through many avenues. The Delaware River Shad Fisherman’s Association actively supports “all things shad”, from tournaments to school education, advocacy and lots of fun events. Find them at <http://mgfx.com/fishing/assocs/drsfa/> or DRSFA, 3907 Boswell Court, Bethlehem, PA.

## **Trout Fishing**

Trout are a world class Delaware River recreational fishery. While there are no dams on the main stem of the Delaware River, there are significant dams on tributaries. Most notable are a series of three dams on headwater streams to the River. Cannonsville Reservoir Dam is on the West Branch of the Delaware, Pepacton Reservoir Dam is on the East Branch of the Delaware, and the Neversink Reservoir Dam is located on the Neversink River; an Upper Delaware tributary.

These reservoirs were constructed to provide drinking water to New York City (located in the Hudson River Watershed). The tailwaters ( the water just below the dam) receiving cold water from Cannonsville and Pepacton are widely known for their Brown and Rainbow Trout populations. While brook trout have been present on these headwater streams well before construction of the dams and historically were abundant on the East and West branches, tributaries and upper main stem Delaware River<sup>127</sup>, the trout fishery in the region regained attention in the 1980s “when improved water releases from the water supply reservoirs enhanced the fishery value of these waters.”<sup>128</sup> Today there is great debate over how to best manage the releases from the reservoirs in order to best support the trout, and while more can be done to benefit the trout, the fishery maintains its national reputation.

It has been determined that in the Upper Delaware, wild trout fishing resulted in \$17.69 million for local business revenue in 1996, that there was \$7.25 million of spending by anglers in Delaware County, New York alone, and that about 41% of this spending remained in the local communities surrounding the tail water fisheries area (Hancock, Deposit, Walton, and Village of Downsville).<sup>129</sup> The cycling of this 41% of angler expenditures in the region ultimately results in \$29.98 million in local economic activity.<sup>130</sup> Research has also shown that revenues generated by anglers in this region supported 348 jobs with total wages of \$3.65 million; and provided \$719,350 in local taxes.<sup>131</sup> Other research has shown that multiple towns in the New York reaches of the Delaware River Watershed are benefiting from the clean water and resulting healthy fish populations found in tributary streams.

The Beaverkill and Willowemoc Rivers are credited with providing towns such as Roscoe and Livingston Manor with \$10 million in annual expenditures from their sport fishery.<sup>132</sup> Friends of the Upper Delaware have reported that the world famous upper Delaware River is a dynamic tourism and economic engine that has not yet reached its potential.<sup>133</sup> They estimate that fly-fishing in the region could generate \$58 million per year in economic activity, creating new jobs with virtually no infrastructure or environmental threat, for which there is already a trained work force and where control would remain local.<sup>134</sup>



VALLEY CREEK, PA DRN RESTORATION STAFF COME ACROSS BROOK TROUT AND OTHER WILDLIFE WHILE ASSESSING STREAMS AND CONDUCTING RESTORATION PROJECTS. PHOTO CREDIT: DAVE WILLIAMS

## IMPORTANT SPECIES HIGHLIGHT

### Dwarf Wedge Mussel (federal endangered)

The mussel is an interesting species. Mussels are *mini filters* cleaning our rivers as the water travels ovetop of the rocks and riffles where they hide. The Dwarf Wedge Mussel is special in particular, because it is now *endangered* due to *poor water quality* and *dams* throughout the eastern US. It can only live in *very clean* streams with little *sediment*, *chemicals*, and a good supply of *coldwater flows* to keep the temperature low even in summer months. The *largest remaining population* of Dwarf Wedge Mussels exists in the Upper Delaware watershed which is good news for *trout anglers*. Not only does mussel presence indicate clean healthy water, but their status as endangered helped remove a dam along the Neversink that threatened their population and continues to protect the waterways from future threats where both species coexist.



## Delaware Estuary and Bay Fishing

Fishing in the lower reaches of the Delaware River and Bay is an important aspect of the River and its connection with the community. Children along the docks go crabbing and fish for Herring during the Herring run. Recreational fishermen catch Mackerel, Drumfish, Weakfish, Flounder, Sea Bass, and Striped Bass seasonally in the Delaware Bay.

Urban fishing throughout Philadelphia, Camden, Wilmington and Trenton is a common sight along the River because of available public access and desire from community residents. In 2006, Ron Swegman authored *Philadelphia on the Fly: Tales of an Urban Angler*, a book about the popularity of fly fishing in the Philadelphia area.<sup>135</sup> In it, Swegman tells stories of different rivers and tributaries where he has successfully been fly fishing. Swegman continues to write about urban fishing spots throughout Pennsylvania in his personal blog and Pennsylvania angler forums.<sup>136</sup>

Urban anglers use spots like naturalized piers and docks throughout Philadelphia, as well as urban parks and bridges to go fishing on both the Delaware and its major tributary there, the Schuylkill. Greenways along major roadways and new parks in urban areas like Trenton attract anglers providing them with a relatively inexpensive meal each trip. (see "FISH ADVISORIES" box)



DELAWARE BAY, DE THESE ROCKY OUTCROPS JUTTING INTO THE BAY MAKE A PERFECT FISHING PLATFORM FOR KIDS AND ADULTS WANTING TO CATCH SOME FISH FOR DINNER OR JUST HAVE SOME FUN.

**Figure 4** shows the revenue generated from the sale of state fishing licenses within each of the four basin states. In Delaware, the state with the lowest price for a fishing license, revenue of nearly \$200,000 was generated in 2003. In Pennsylvania, the state earned nearly \$19 million in fishing license revenue from resident and non-resident purchases of fishing licenses. This is not counting all of the 1, 3, and 7 day-passes, or any of the passes simply given away to children at local parks and events. (In Pennsylvania, fishing activities are credited with generating \$4.7 billion per year in revenue and supporting 43,000 jobs.<sup>137</sup>) New Jersey brought in almost \$4 million in revenue statewide from fishing license sales, and New York, with the highest number of out of state fishing licenses sold, brought in almost \$32 million in state revenue.

## FISH ADVISORIES

State and National agencies put fish advisories in place in response to contamination found in the fish tissue, generally accumulated from the waters where they live. Because the various responsible agencies do not coordinate or join forces in crafting and releasing fish advisories, in several reaches of the Delaware one side of the River is under advisory for a species while the other is not. Fish advisories impact the perceptions of our River and region and as a result can affect tourism, recreation, and associated commercial activities like dining, overnight stays, and the purchase of associated goods and services. Advisories should be consistent from state to state to both better protect public health and the economies the fish advisories impact. For further rating on fish consumption and the best and worst choices of fish considering environmental factors go to

<http://www.edf.org/home.cfm>



PHILADELPHIA, PA URBAN FISHERMAN OUTSIDE OF VACANT PHILADELPHIA ELECTRIC COMPANY ON DELAWARE AVE AT PENN TREATY PARK. FISHERMAN CAN ALMOST ALWAYS BE FOUND AT THIS SPOT.

STATE	# Fishing Licenses Sold in 2003	Resident Cost	Non-Resident Cost	Total Revenue (Million)
Delaware 138	R: 17,233 NR: 3,331	\$8.50	\$15.00	\$196,445
Pennsylvania 139	R: 777,089 NR: 49,957 O: 67,992	\$21.00	\$51.00	\$18,866,676 (w/o O sales)
New Jersey 140	R: 155,764 NR: 6,763 O: 4,181	\$22.50	\$34.50	\$ 3,738,013 (w/o O sales)
New York 141	R: 842,966 NR: 156,726	\$19.00	\$40.00	\$ 31,882,588

R: Resident NR: Non-Resident O: Other, including lifetime, 3-day, 7-day, and free fishing licenses.

Figure 4: Number of Fishing Licenses Sold in 2003 in Delaware River Basin States

## Clean Water for our Food Supply

Fishing the Delaware River is valuable commercially, recreationally and for those families that simply need it to eat. Clean water is critical for supporting the life cycle of fish. But also, it is critical for ensuring that the fish caught from our Rivers are safely edible. Pollutants accumulate in the fat and/or tissue of fish, in some cases building up and increasing in concentration over time. Persistent pollution problems can and do contaminate fish, in some cases making them unsafe to eat.

On the main stem Delaware River there are advisories on more than 9 species of fish.<sup>142</sup> In some sections of the River all fish are subject to advisories.<sup>143</sup> Fish advisories set limits on the amount of contaminated fish species that should be eaten in order to protect individual and community health. Often elderly persons, children and pregnant women are subject to more stringent limits because of their increased vulnerability to contamination. Exposure to the toxins contained in fish tissue, including methyl mercury, PCB's, chlorinated pesticides and dioxins are colorless, odorless, and can not be revealed through appearance of the fish – therefore knowledge and compliance with fish advisories is critical.<sup>144</sup> Before consuming fish from the Delaware River and Bay, it is important to be aware of the current fish consumption advisories for each state. Many fish in the River are unsafe for pregnant women and the elderly because of contaminants that are still making their way into our streams and rivers. Contact your state's environmental protection agency for the most current advisories and warnings.

### **"United for The River"**



The Delaware River Fisherman's Association is an active, fish-loving membership organization for both NJ and PA fisherman. For their many activities and great reports go to:  
[www.drfishermen.com/](http://www.drfishermen.com/)

Or

To learn about some popular fishing spots in the Delaware River Watershed go to  
[www.delawariver.net/fishing](http://www.delawariver.net/fishing).

If we were able to eliminate pollution to the level that there were no advisories on the Delaware, not only would we be protecting the health of our communities, but we would be enhancing the fisheries of the Delaware and all who rely on them. It is important to note, the issue isn't just reality, it is also perception. Multiple fish advisories create the perception that the Delaware is not clean or safe – the result could be to impact the desirability of the Delaware as a tourism, recreation or home buying destination, and can affect associated commercial activities like dining, overnight stays, and the purchase of associated goods and services.

## ❖ Birding and Wildlife Watching

***The Delaware River and Bay are home to populations of birds, mammals, reptiles, amphibians, fish, insects, and shellfish surviving and thriving in the functioning ecosystems of the region. The plants and animals within the River and its corridor are a major draw bringing tourists from near and far to vacation and experience the beauty of our River and its natural communities. Many Delaware River plants and animals are nationally significant for health, historical, and economic reasons. All of the species within the River deserve to be respected, protected and preserved if they are to continue to exist for future generations.***

Because of the River's free flows, its captivating beauty, its vast natural resources, historical significance, high water quality, premier recreation, and natural open space, in 1978 a majority of the non-tidal Delaware River (73 miles extending from Hancock, New York to Milford, Pennsylvania and 40 miles from just south of Port Jervis, New York to the Delaware Water Gap) was Congressionally designated a National Wild and Scenic River of the United States.<sup>145</sup> In 2000, the Lower Delaware from the Water Gap to Washington Crossing, a stretch of 76 miles, was also granted Wild and Scenic designation due to its extraordinary beauty and health. The abundant wildlife and bird watching opportunities within this nationally significant corridor generate a tremendous volume of ecotourism and related business. Many of the species inhabiting the Lower and Upper Delaware are designated as threatened or endangered, demonstrating the fragility and vulnerability of the ecosystems and ecological communities dependent upon the area. **Figure 5** lists some of the diverse species found here. This table is just a sampling of the interesting and valuable species that can be found in the Delaware River Watershed. (Figure is at the end of this section)

In 2006, over 71 million Americans participated in wildlife watching including photography and observation, spending nearly \$45 billion dollars on travel, equipment, food, and lodging.<sup>146</sup> Twenty-three million of the 71 million traveled away from home (more than a mile) to engage in wildlife watching activities.<sup>147</sup> In New Jersey, it has been determined that watchable wildlife attracted 1.9 million participants in a single year.<sup>148</sup>

Wildlife viewing creates nearly 500 thousand jobs nationally, and generates \$2.7 billion in federal and state taxes.<sup>149</sup> In Pennsylvania, New York and New Jersey, 31% of the population participates in some form of wildlife viewing.<sup>150</sup> These activities generated an estimated \$1 million in retail supply sales, \$623 million in trip related sales, \$217 million in federal and state taxes, and supported 35,000 jobs.<sup>151</sup>



**KEMPTON, PA BIRD WATCHING FROM WITHIN THE HAWK MOUNTAIN SANCTURAY. BIRD WATCHING IS ONE OF THE FASTEST GROWING FORMS OF RECREATION. PHOTO CREDIT: HAWK MOUNTAIN SANCTUARY**

The total economic contribution of wildlife viewing in the tri-state area exceeded \$3 million in the year 2002.<sup>152</sup> The Outdoor Recreation Alliance estimates that New Jersey alone generated nearly \$4 billion from wildlife-related recreation in 2006, and reports that New Jersey ranks number six in the amount of economic activity created by in-state wildlife viewing activities.<sup>153</sup>

### **Celebrating Birds is a Lucrative Business**

Bird watching has become one of the most lucrative forms of recreation in the watershed because of the avian diversity and wealth of attractive viewing areas. Bald Eagles, Ospreys, Red-Tailed Hawks, and migrating shorebirds such as Sanderlings and the Red Knot *rufa* can all be viewed within the watershed. In addition to being among the most lucrative activities for our region, birding is also among the fastest growing. The Center for Rural Pennsylvania issued a report on nature-based tourism in 2003 which listed bird watching up 155% in Pennsylvania; a greater percentage increase than every other form of recreation measured.<sup>154</sup>



ONE OF MANY RAPTORS THAT CAN BE SEEN FROM HAWK MOUNTAIN AND OTHER LOCATIONS IN THE DELAWARE VALLEY. RAPTOR POPULATION DECLINES ARE OFTEN DUE TO HABITAT FRAGMENTATION, OR BUILDING HOMES, ROADS, AND RETAIL SPACES ON FORMERLY FORESTED LAND. PHOTO CREDIT: GEORGE WILLIAMS

Hawk Mountain in Kempton, Pennsylvania is a wildlife sanctuary for raptors in the Delaware River Watershed (Lehigh River) eastern Pennsylvania. The preserve is the largest protected tract of contiguous forest in Pennsylvania with 13,000 acres of private and public lands.<sup>155</sup> Mountaintop vistas, hiking trails, and over 25,000 Hawks, Eagles, and Falcons bring visitors year round.<sup>156</sup> The Hawk Mountain sanctuary brought in over \$850,000 in 2005 from visitor fees, memberships, and retail.<sup>157</sup>



HAWK MOUNTAIN SANCTUARY KEMPTON, PA NOW HAS 13,000 ACRES OF CONTIGUOUS FOREST PROTECTED FOR RAPTORS AND OTHER WILDLIFE. PHOTO CREDIT: HAWK MOUNTAIN SANCTUARY



## Case Study: Nature Photographer Mike Hogan

Michael Hogan,  
Professional Nature  
Photographer, has  
spent decades taking

pictures of the Delaware Bay and Pinelands region. His pictures help in tracking invasive species; producing photographic natural resource inventories for counties and municipalities; and using Geographic Integrated Systems (GIS) technology to document where endangered species exist such as Swamp Pink, a gorgeous flowering wetland plant that remains in only a few remote locations throughout New Jersey. Working with the South Jersey Land and Water Trust and the Rutgers Water Resources Program, and using the USDA Stream Visual Assessment Protocol, Michael has visually assessed 300 stream segments in southern New Jersey for stream health and quality.

Nature photography in the region has led Hogan to become an advocate and active environmentalist for preserving open space in New Jersey. "The habitats and ecosystems within New Jersey are keeping my career afloat. If I wasn't helping to preserve land and wildlife in New Jersey through education, book illustrations, visual stream assessments, and art, I don't know what I'd be doing right now," said Hogan.

Michael's large format, landscape photographs are in public, private, and corporate art collections. In addition, Michael has donated his work to various local nonprofit organizations including the Delaware Riverkeeper Network to help them in their fundraising. In 2005, Michael Hogan partnered with author Robert Peterson to create an illustrated book called "The Natural Wonders of Jersey Pine and Shore." "This book combines years of photographs and prose into one source so that people from all over can see what I see when I'm hiking in the Pinelands or relaxing on the Bay shore" says Hogan. The book was the last from author Robert Peterson who passed away in 2003 just after viewing the final text of the book.

When asked how important southern New Jersey is to him Michael Hogan replied "It's where I live, it's what I care about, and it's my livelihood".

There are many careers supported by the nature and wildlife of the Delaware River Valley. Michael's work can be viewed on his website [www.hoganphoto.com](http://www.hoganphoto.com).

The Bald Eagle, an emblem of American freedom, spirit, and pursuit of excellence, currently lives and thrives along the protected Upper Delaware River. Explicit Bald and Golden Eagle protection laws, conservation of Eagle habitat, and the banning of DDT and other poisons have been successful in protecting Upper Delaware Eagles.<sup>158</sup> In the United States, Bald Eagle populations have increased from less than 500 nesting pairs in the 1960's to more than 5,000 currently.<sup>159</sup>

To celebrate the remarkable comeback of the Bald Eagle, Eagle Fest is an annual winter festival held in Narrowsburg, New York along the scenic Upper Delaware River. The festival draws between 1,500 and 2,500 people from around the region, including residents from New York, Pennsylvania and New Jersey. The local fire Department uses the festival as a successful fundraiser, selling hot dogs and hamburgers; local churches and the Chamber of Commerce help run the event and set up tables for fundraising.

For many local businesses, Eagle Fest brings tourists and visitors to the region in the middle of winter when tourism is relatively low. Festival attendees learn about Bald Eagles and their recovery while they try and catch a glimpse of one flying over the often frozen Delaware River. To broaden appeal, Eagle Fest holds multiple events including lectures, art shows, a live raptor show, Eagle educational exhibits, food, and environmental films. Conservation groups are also invited to participate and share information about their organizational mission and efforts. Ice carvers, wood carvers and other artists are able to exhibit their handy work. Local shops featuring gifts, clothing, antiques, art stores, and even furniture stores not only see greater sales during the event, but see return visitors throughout the year who first came during Eagle Fest. For many local businesses, Eagle Fest brings the best or second best sales day of the year.<sup>160</sup>

In New Jersey, the Cape May Bird Observatory holds a Spring Weekend every year offering guided walks, boat rides, nature tours, book signings, movies, speakers, and birding. At the end of the three-day weekend they hold a World Series of birding to discover how many birds each person has counted over the weekend. More than 200 birds have been spotted flying throughout the nature center's premises.<sup>161</sup> Bird watchers wishing to enter as a single person or team obtain sponsorships where they receive money for every bird they view and proceeds go to the conservation fund of their choice. The event raises more than \$500,000 annually to support bird conservation efforts and attracts bird enthusiasts from all over the world.<sup>162</sup>



THE AMERICAN EAGLE THE UNITED STATES EMBLEM WAS NEARLY EXTINCT AFTER THE DECADES OF HEAVY PESTICIDE USE AND DECREASING WATER QUALITY IN WATERWAYS LIKE THE DELAWARE RIVER. ITS REMARKABLE RECOVERY IS AN IMPORTANT SUCCESS; ONE THAT SHOULD BE REPLICATED FOR THE MANY OTHER BIRD SPECIES CURRENTLY IN PERIL THROUGHOUT THE US. PHOTO CREDIT: DOUGLAS NORTON 2007



BOWERS BEACH, DE DELAWARE BAY IS HOME TO THE WORLDS LARGEST SPAWNING POPULATION OF HORSESHOE CRABS IN THE WORLD. THE HORSESHOE CRAB IS AN ANCIENT SPECIES DATING BACK OVER 350 MILLION YEARS.



RED KNOT PHOTO TAKEN DURING THE 2008 RED KNOT MIGRATION. RED KNOTS WERE BEING BANDED SO THAT SCIENTISTS COULD TRACK THEIR QUALITY OF HEALTH AND WEIGHT TO BETTER UNDERSTAND THEIR SURVIVAL.

### **Protecting Birds, Food and Habitats**

Delaware Bay is home to the largest spawning population of Horseshoe Crabs in the world. The Horseshoe Crab is an ancient species, dating back over 350 million years. Delaware Bay is also critical habitat to more than 400 species of birds and migrating shore birds.<sup>163</sup> Each spring, at least 11 species of birds stop over on the Delaware Bay shore to feed on the eggs of the Horseshoe Crab and thereby fuel their annual spring migration, including the Sanderling, Sandpiper, Red Knot, and Ruddy Turnstone.<sup>164</sup>

It is estimated that between 425,000 and 1,000,000 birds stop in the Delaware Bay as part of their 3,000 to 4,000 mile migratory journey from their wintering grounds in

South America to their breeding grounds in the Arctic.<sup>165</sup> The bird stop over is ecologically timed to coincide with the spawning of the Horseshoe Crabs, their eggs being a critical food source.<sup>166</sup> The eggs of the Horseshoe Crab are so critical that recent declines in their abundance threaten the survival of the Red Knot (*Calidris canutus*).

In 1982, 95,530 Red Knot were counted on the shores of the Delaware Bay. In 2006 only 13,445 were observed during the same time period<sup>167</sup> and a more recent study continues to show declines and low weight gain for the birds that do arrive to feed on Horseshoe Crab eggs. The Red Knot is now predicted to go extinct because declines in the Horseshoe Crab and



MOORE'S BEACH NJ INTERESTED VOLUNTEERS AND AREA VISITORS WATCH THE ARRIVAL OF THE BIRDS WITH BINOCULARS.

their eggs.<sup>168</sup>

Other shorebirds that rely on Horseshoe Crab eggs, such as Ruddy Turnstone (*Arenaria interpres*), Semipalmated Sandpiper (*Calidris pusilla*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*) and Short-Billed Dowitcher (*Limnodromus griseus*), have also declined in numbers on the Delaware Bay migratory stop over. These species and Red Knot make up 99 percent of the shorebird concentration in the Delaware Bay and all are primarily dependent upon Horseshoe Crab eggs for their diet.<sup>169</sup>

The arrival, feasting and migration of the shorebirds supports a multi-million dollar ecotourism industry. Birding and outdoor enthusiasts from all over the world flock to the Delaware Bay shore to watch the spectacular

feeding frenzy. During their visit they buy recreational-related goods and services, stay in the region's hotels, and visit parks and patronize restaurants and local shops.<sup>170</sup> According to one report, Horseshoe Crab dependent ecotourism generates between approximately \$7 million and \$10 million of spending in Cape May, New Jersey alone, and creates 120 to 180 related jobs providing an additional \$3 million to \$4 million in social welfare value.<sup>171</sup> According to a New Jersey Department of Fish and Wildlife report, the economic value of the Horseshoe Crab and migratory bird phenomenon seasonally for the Delaware Bay shore area is over \$11.8 million with over \$15 million of economic value generated if other beneficiaries beyond New Jersey are included. Annually, it provides \$25 million in benefits to the Delaware Bay shore region and \$34 million regionally.<sup>172</sup> Because most of these expenditures occur in the "off-season", it is particularly valuable to local economies.

The fishery use of Horseshoe Crabs as bait for whelk, eel and conch, is highly controversial. Decades of overharvesting and abuse have resulted in a decline in the Horseshoe Crab population to such a level that the Red Knot is predicted to go extinct because of a lack of Horseshoe Crab eggs needed to fuel their annual migration.<sup>173</sup> Since 1989 Horseshoe Crabs in the Delaware Bay have shown a steady decline with the lowest counts taking place in most recent years.<sup>174</sup> To combat this ecological crisis, many are calling for a moratorium on the bait harvest of Horseshoe Crabs in order to allow the Crabs, the eggs and

the birds to replenish and restore so that all dependent industries can be supported in the future. New Jersey issued regulations that established a moratorium for 2006 and 2007; and in 2008 passed legislation to keep the moratorium in place until the Red Knot population is restored and stable.

### INDICATOR SPECIES

Protecting bird species throughout the basin is important for several reasons. Not only is bird watching one of the most popular and lucrative forms of recreation, bringing in tourists from all over the world, but birds are an *indicator species*. Indicator species represent the overall health status of an area through their population numbers and habitats. Healthy rivers are habitat for healthy bird populations. If bird populations begin declining, it can mean that the over all quality of life for an area may be declining as well. Abundance in bird species is a good sign that land condition and air quality are high enough to support ample birds and bird watchers alike.

The continuing existence of the Horseshoe Crab and migrating shorebird phenomenon are vital for the related ecotourism industry. Of those surveyed, only 6.6% said that the Horseshoe Crab and shorebird phenomenon was unimportant to their visitor satisfaction. On average those surveyed said they would be willing to pay as much as \$212.45 (in decreased annual household income) annually for a program to protect these resources; and that they would "be willing to tolerate no more than 50.7% decline in Horseshoe Crabs and migrant shorebirds

before they would cease visiting the Delaware Bay shore area.”<sup>175</sup>

## **Wildlife for Health Protection**

Protecting healthy wildlife and aquatic life populations that live in the River provides critical health protections to humans, protections that have economic and social value. A good example is the Horseshoe Crab. The Horseshoe Crabs in Delaware Bay are irreplaceably important to the biomedical industry. In the late 1960's, researchers at Johns Hopkins University demonstrated that special blood properties from Horseshoe Crabs could be used to detect endotoxins.<sup>176</sup> As a result, the U.S. Food and Drug Administration now requires that many intravenous drugs and medical implants be tested for endotoxins using Limulus Amebocyte Lysate (LAL), found exclusively in the blood of Horseshoe Crabs.<sup>177</sup> In addition, LAL is used for detecting diseases including spinal meningitis.<sup>178</sup> No artificial alternatives to the LAL test currently exist.<sup>179</sup> To obtain the blood the Horseshoe Crabs are bled non-lethally,<sup>180</sup> although it has been estimated that between 10 and 15% may die once the Crabs have been returned to their natural environment.<sup>181</sup>

The U.S. Fish and Wildlife Service valued annual revenues associated with the LAL industry at \$60 million with the social welfare value at \$150 million. One pint of Horseshoe Crab blood is worth \$15,000 to the bio-medical industry,<sup>182</sup> and the industry creates between 145 and 195 jobs in each of the regions it operates (Falmouth, Massachusetts, Walkersville, Maryland and Charleston, South Carolina), contributing \$73 million to \$96 million total to these local economies.<sup>183</sup> Furthermore, the industry is expected to grow between 8-10% annually.<sup>184</sup> The ecotourism and biomedical benefits of Horseshoe Crabs dwarfs their value as bait in the fishing industry in dollars and number of jobs.



**BOWERS BEACH, DE. FEMALE HORSESHOE CRAB MAKING ITS WAY BACK TO THE SHORE FROM THE OCEAN. FEMALE HORSESHOE CRABS ARE LARGER THAN MALES BECAUSE THEIR BODIES HAVE GROWN OVER TIME ALLOWING THEM TO CAPTURE MORE SPERM DURING MATING SEASON. HORSESHOE CRAB EGGS ARE THE PRIMARY FOOD SOURCE FOR MANY MIGRATING SHOREBIRDS IN THE DELAWARE BAY.**

## SPECIAL SPECIES HIGHLIGHT

### *American Eel meets the Elliptio companata mussel*

The American eel deserves recognition for the journey it makes and the impact it has on the Upper Delaware River. Born in the Sargasso Sea (northern Caribbean-Bermuda region), the American eel travels across the Atlantic Ocean, into the Delaware Bay, and up the undammed Delaware River, which retains one of the largest eel populations in the nation.

Not only does the eel perform this epic journey, but it also supports one of the largest mussel populations in the Upper Delaware, the *Elliptio companata*, mussel which relies on the eel for particular components of reproduction. The *Elliptio* can be found in the millions in the Upper Delaware because of the presence of the American eel.

These mussels have an enormous filtration capacity and are able to filter six times the Delaware's average daily summer flow. With almost 2 million mussels per mile, the clean water benefits we receive from this species interaction are invaluable.



SWAMP PINK IS AN ENDANGERED AND SIGNIFICANT SPECIES IN THE DELAWARE VALLEY. IT CAN BE FOUND IN THE SWAMPS AND MARSHES OF THE PINELANDS REGION OF NEW JERSEY. PHOTO CREDIT: MIKE HOGAN [WWW.HOGANPHOTO.COM](http://WWW.HOGANPHOTO.COM)



JUVENILE AMERICAN EEL MAKE THE JOURNEY TO THE UPPER DELAWARE RIVER FROM THE SARGASSO SEA AND BECOME THE HOST SPECIES ENABLING THE *ELLIPTIO* MUSSEL TO SURVIVE. MUSSELS IN THE UPPER DELAWARE FILTER 6 TIMES THE AVERAGE FLOW PER DAY. PHOTO CREDIT: DOUG AND TIM WATTS [WWW.GLOOSKAPANDTHEFROG.COM](http://WWW.GLOOSKAPANDTHEFROG.COM)

<b>Amphibians and Reptiles</b>	<p>Bog turtle (E)  Coastal plain leopard frog (E)  Eastern mud turtles  Loggerhead sea turtle (E)  Long-tailed salamander (T)  Map turtle  Marbled salamander  New Jersey chorus frogs (E)  Northern diamondback terrapin  Red-bellied turtle (T)  Timber rattlesnake (E)  Wood turtle</p>	<b>Invertebrates and Insects</b>	<p>American Oyster  Blue Crab  Brook Floater (E)  Dwarf Wedgemussel (E)  Eastern Pearlshell  Eastern Pondmussel (E)  Horseshoe Crab  Mottled Duskywing  Northeastern beach tiger beetle (T)  Regal fritillary  Tawny crescent</p>
<b>Birds</b>	<p>American Bittern (T)  Bald Eagle  Barred Owl (T)  Bobolink (T)  Cerulean warbler  Cliff Swallow (T)  Common Snipe (T)  Common nighthawk  Coopers Hawk (E)  Grasshopper Sparrow (T)  Great Blue Heron (T)  Least Bittern (T)  Louisiana Waterthrush  Northern Harrier (T)  Northern Goshawk (E)  Osprey (E)  Peregrine Falcon (E)  Red Headed Woodpecker (T)  Red Shouldered Hawk (T)  Savannah Sparrow (T)  Short Eared Owls  Upland Sandpiper (T)  Yellow-bellied Flycatcher (T)  Prairie Warbler  Ruffed Grouse  Marsh Wren</p>	<b>Plants</b>	<p>American Purple Vetch  Atlantic Sedge (T)  Basil Bee-Balm  Basil Mountain Mint  Bog bluegrass (T)  Bush's sedge  Eared false-foxglove (E)  Grass of parnassus  Great St. John's-wart  Hemlock  Lobelia  Lowland brittle fern  Missouri goosefoot  Nebraska sedge  Northern pondweed (E)  Pale Indian plantain  Prickly pear cactus  Rhododendron  Serpentine aster (T)  Shadblow serviceberry  Spreading globeflower (E)  Skunk currant (E)  Spring coral root  Swamp pink (E)  Variable sedge (E)  Wood aster</p>
<b>Fish</b>	<p>American Shad (T)  Alewife  American Eel  Atlantic Sturgeon (T)  Banded Sunfish (E)  Bridle Shiner (E)  Hickory Shad (E)  Ironcolor Shiner (E)  Largemouth Bass  Muskellunge  River Herring  Slimy Sculpin  Sheild darter  Shortnose Sturgeon (E)  Smallmouth Bass  Striped Bass  Tadpole Madtom (E)  Threespine Stickleback (E)  Trout  Walleye Pike  White Perch</p>	<b>Mammals</b>	<p>Beaver  Blackbear  Blue whale  Bobcat  Canada lynx (E)  Delmarva fox squirrel (E)  Eastern red bat  Eastern woodrat (E)  Fin whale  Harbor porpoise  Hoary bat  Humpback whale  Indiana bat (E)  Keen's bat (E)  Least shrew (E)  Marsh rat  Northern long-eared bat (E)  Northern right whale  River otter  Small-footed bat (E)  Sperm whale</p>

(T) Federal or State (PA, DE, NJ, NY) Threatened Species (E) Federal or State Endangered Species

Figure 5: Delaware River Significant Species List<sup>186</sup>

## ❖ Parks and Wildlife Refuges

*The Delaware River spans four states. In order to maintain animal habitat, recreational access, and special or significant pieces of land, federal, state and local governments operate and maintain a spectacular array of parks, forests, and wildlife refuges. The national, state, county and local park systems are key elements in the ecotourism businesses and attractions that grace the Delaware River Watershed. The parks provide a public place to view wildlife, canoe, fish, hike, and much more -- they enhance the quality of life for the community, providing job opportunities, and recreational and family activities.*

### **National Parks**

Dozens of parks line the banks of the Delaware, with the region's largest federal parks known all over the world. **Figure 6** lists the parks within the Delaware River watershed designated as nationally significant. This includes the nationally recognized Appalachian Trail which stretches from Georgia to Maine, and crosses the Delaware River at the Delaware Water Gap National Recreational Area (DWGNRA.) This crossing of the Delaware River is a "favorite" among the hundreds of people each year who hike the trail from start to finish.<sup>185</sup> The watershed is also home to four national historic sites and two national historic parks and memorials.<sup>186</sup> The United States Department of Agriculture's (USDA) Forest Service has determined that water enhances the value of National Forest Lands nationwide by more than \$3.7 billion a year, not including a number of key economic benefits including maintaining the value of fish species or the savings to municipalities with reduced filtration costs as a result of the protected lands.<sup>187</sup>

The Delaware Water Gap National Recreation Area is 67,000 acres and was first acquired by the U.S. Army Corps of Engineers in the 1950's to support construction of the Tocks Island Dam.<sup>188</sup> The dam proposal was defeated after decades of protest and analysis.<sup>189</sup> The land was then transformed into a national recreation area which contains waterfalls, ponds, mountains, river bends, and animals such as Bald Eagles, Black Bears, Timber Rattlesnakes, and Peregrine Falcons.<sup>190</sup> There are a variety of plant species present including Hemlock, Rhododendron, Andropogon gerardii (big bluestem grass) and Prickly Pear Cactus. Water quality in the Delaware River as it flows through the DWGNRA is exceptional, encouraging swimming, fishing, boating, hunting, and hiking.<sup>191</sup>



THE WILD AND SCENIC DELAWARE RIVER. THE DELAWARE RIVER HAS BEEN AWARDED SPECIAL PROTECTION WATERS STATUS BY THE DELAWARE RIVER BASIN COMMISSION. THE HIGHEST LEVEL OF PROTECTION FOR BEING A CLEAN AND VALUABLE RIVER FROM ITS HEADWATERS THROUGH THE WATER GAP AND BELOW FOR 176 MILES. NO OTHER RIVER IN THE U.S. HAS THIS DESIGNATION FOR A LONGER STRETCH. PHOTO CREDIT: PAUL CARLUCCIO

National Park	Park Type	Location
Delaware Water Gap National Recreation Area	National Recreation Area	Bushkill, PA and New Jersey
Independence National Historic Park	National Historic Park	Philadelphia, PA
Valley Forge National Historic Park	National Historic Park	Valley Forge, PA
Upper Delaware Scenic and Recreational River	Scenic and Recreational River	Pike and Wayne, PA Delaware, Orange, and Sullivan, NY
Thaddeus Kosciuszko National Memorial	National Memorial	Philadelphia, PA
Appalachian National Scenic Trail	National Scenic Trail	GA, CT, MA, MD, ME, NC, NH, NJ, NY, PA, TN, VA, VT, WV
Hopewell Furnace National Historic Site	National Historic Site	Elverson, PA
Gloria Dei Church National Historic Site	National Historic Site	Philadelphia, PA
Deshler-Morris House	National Historic Site	Philadelphia, PA
Edgar Allen Poe National Historic Site	National Historic Site	Philadelphia, PA

Figure 6: Nationally Significant Parks in the Delaware River Watershed<sup>192</sup>

The Delaware Water Gap National Recreation Area is one of the most heavily used parks on the East Coast visited by more than 3 million annually.<sup>193</sup> Shared by Pennsylvania and New Jersey, DWGNRA has been home to native people for centuries prior to European settlement. Since about 1988 more than 113,000 historical and aboriginal artifacts have been uncovered.<sup>194</sup> Archaeological sites currently located within DWGNRA help today's archaeologists learn more about the culture and history of the Minisink and other native people as well as the natural history of the region.



CANOING AT THE DELAWARE WATER GAP. THE WATER IS CLEAN, THE AIR IS FRESH, AND CLIFFS APPEAR THROUGHOUT THE LANDSCAPE. WILDLIFE IS ABUNDANT THROUGHOUT THIS STRETCH MAKING IT THE PERFECT OUTDOOR EXPERIENCE FOR PEOPLE FROM NEW YORK, PHILADELPHIA, AND BEYOND.

In 2007, in recognition of the beauty of the DWGNRA and its 40.6 mile water trail, the Delaware Water Gap National Recreation Area was designated a National Recreation Trail by the Secretary of the Interior.<sup>195</sup> The trail is valued for connecting people with the beauty and values of nature, introducing them to geological formations and a diverse set of wildlife habitats. It is the largest recreation area in the eastern U.S. bringing in revenue to local communities and economies in both Pennsylvania and New Jersey.<sup>196</sup>

National Wildlife Refuges are a special class of parkland set aside specifically to protect animal and plant habitats. Several wildlife refuges exist throughout the watershed. Just south of Philadelphia, the John Heinz National Wildlife Refuge at Tinicum has been set aside to protect the last 200 acres of freshwater tidal marsh in Pennsylvania. It is currently home to over 280

species of birds and is the only place where the “state endangered Red-Bellied Turtle and Southern Leopard Frog can be found”.<sup>197</sup> A great amount of effort has been invested in preserving and restoring this natural area which is located in a densely populated region of the watershed.<sup>198</sup> The wildlife preserve allows urban communities to access native plants, wetlands, and aquatic habitats. It also connects urban residents with their natural community. The marshes of the John Heinz Wildlife Refuge capture rainfall and stormwater while filtering out pollution, absorbing flood waters, helping to defend against drought, and providing water quality benefits to the River.<sup>199</sup>

The Cape May National Wildlife Refuge, Delaware Bay Division, protects a large variety of habitat including “salt marsh, forested uplands, forested wetland and vernal pools, shrub/scrub, and grassland”<sup>200</sup> Supawna Meadows National Wildlife Refuge in Pennsville, NJ is part of the Cape May Refuge. It includes 3,000 acres of protected wetlands, mainly for shorebirds, warblers and other migrating birds which use the upland area as valuable resting and feeding habitat.<sup>201</sup>

Bombay Hook is a National Wildlife Refuge in Delaware encompassing 15,000 acres in the Delaware estuary.<sup>202</sup> This refuge connects parts of the Atlantic Flyway, an avian migratory route of global ecological importance. It provides an important resting point and breeding ground for a variety of species including migrating waterfowl, Bald Eagles, Canada Geese, and several species of duck.<sup>203</sup> Bombay Hook is an important home to White-Tailed deer, Woodchucks, Horseshoe Crabs, Bullfrogs, and Tulip Trees.<sup>204</sup> Prime Hook National Wildlife Refuge, located near the western shore of the Delaware Bay, is a 10,000 acre sanctuary for migrating birds. Outstanding wetlands provide rare habitat for many species of birds and other wildlife, including threatened and endangered species.<sup>205</sup>

The Delaware Estuary’s Pea Patch Island is a refuge ideal for wading bird populations and waterfowl, including 2,300 nesting pairs of Heron.<sup>206</sup> The Delaware Bay as a whole is the second largest stopover for migratory birds in the western hemisphere, visited each year by over one million birds.<sup>207</sup>



WORTHINGTON STATE FOREST, NJ WATERFALL ON A TRIBUTARY TO THE MIDDLE DELAWARE WILD AND SCENIC RIVER. PHOTO CREDIT: PAUL CARLUCCIO

## State and County Parks

State and county managed parks are also prominent in the watershed. State parks and campgrounds are used regularly by tourists and local residents and are home to a variety of wildlife, trees and plants. “A walk along the 60-mile towpath of the Delaware Canal is a stroll into American History. The Delaware Canal is the only remaining continuously intact canal of the great towpath canal building era of the early and mid-19th century.”<sup>208</sup> Before railroads, the canal was a means of transporting people and goods from Pennsylvania to New York and back.<sup>209</sup> Today, 60 miles of the canal has been restored and converted into a nature trail for joggers, bikers, birders and historians.<sup>210</sup> The Delaware Canal State Park, stretching from Easton to Bristol, PA, has protected the riverfront for everyone to enjoy. The Pennsylvania Canal State Park attracts on average nearly 835,000 visitors annually.<sup>211</sup>

On the New Jersey side, the Delaware and Raritan Canal State Park begins at Bulls Island Recreation Area and travels through Washington Crossing State Park linking Frenchtown with New Brunswick.<sup>212</sup> “The 70-mile Delaware and Raritan Canal State Park is one of central New Jersey’s most popular recreational corridors for canoeing, camping, jogging, hiking, bicycling, fishing and horseback riding. The canal and the park are part of the National Recreation Trail System. This linear park is also a valuable wildlife corridor connecting fields and forests. A recent bird survey conducted in the park revealed 160 species of birds, almost 90 of which nested in the park.”<sup>213</sup>

## INTRINSIC VALUE

Intrinsic value is the value of something for more than its measurable qualities. Instead of valuing fish for their ability to be caught or eaten, intrinsic value is the value of the fish simply for existing and not for its services to humans. Intrinsic values and existence values are important to keep in mind when thinking about the importance of biodiversity throughout the watershed. Biodiversity not only has a dollar sign attached to the term, but is important to maintain intrinsically, simply because nature has a right to exist.



FISHTOWN, PA PENN TREATY PARK IS A HAVEN IN CENTRAL PHILADELPHIA. A NATURAL RIVER'S EDGE, VIEWS OF THE BEN FRANKLIN BRIDGE AND PETTY'S ISLAND, EASY ACCESSIBILITY FOR PEDESTRIANS AND MASS TRANSIT, MEANS THAT THE PARK IS ALWAYS BUSY.

New Jersey State Parks and Forests attract 15 million visitors each year. It is estimated that New Jersey's Parks and Forests generate \$807 million a year with park fees accounting for \$6 million. Stokes State Forest is located within the New Jersey Sky lands and includes over 15,000 acres of mountains, streams, trails and wildflowers; and is home to a variety of fish, birds, and wildlife.<sup>214</sup> New Jersey Worthington State Park is situated along the Delaware River at the Delaware Water Gap National Recreational Area and has widespread appeal with camping, canoe and boat launches, waterfalls, and forested river refuges.<sup>215</sup>

In Philadelphia, it is estimated that annually, parks provide the city with revenue of \$23.3 million for the residents and government of Philadelphia.<sup>216</sup> This methodology for valuing the city parks includes the value of property value, tourism, direct use, health, community cohesion, clean water, and clean air.<sup>217</sup>

Some of the most visited parks in Philadelphia include Fairmount Park, home of Philadelphia's first water treatment reserve.<sup>218</sup> Philadelphia's yellow fever epidemic of the 1790's left City Hall with a need to protect its water supply by purchasing land and setting aside public areas that would protect the Schuylkill River and surrounding land from development.<sup>219</sup> The park is now 92,000 acres providing drinking water protection, as well as an enhanced opportunity for events, public recreation, and environmental education.<sup>220</sup> Historical records indicate that Penn Treaty Park along the Delaware River in Philadelphia is the site where William Penn may have signed a peace treaty with the Lenape Indians, but where we know they met in a peaceful and respectful way in the 17<sup>th</sup> century.<sup>221</sup> The Park remains today reminding us of the peaceful relationship between the two peoples at that time.

Numerous small city parks throughout Philadelphia provide naturally green areas that benefit the urban community in a variety of ways. Some have become city gardens, teaching kids how to plant, nurture and cultivate the earth. Others are just a nice place to rest, play with your pets, or enjoy time with the family. These small urban parks are vital for communities to retain a connection with nature that enhances quality of life amidst the city land.

*Native plants, like wildlife, are themselves an attraction to our parks and region generating interest and visitors. The Prickly Pear cactus is a notable Delaware River species. It is most often found in desert ecosystems like the Mojave; however it can also be found on some of the south facing cliffs in the Delaware River region, while the northern face of the same cliff can be covered in flora and fauna typically found in arctic-alpine climates. The differences in landscape between the northern and southern sections of the same cliff are an attraction bringing visitors to local parks on foot and by boat.*



PRICKLY PEAR CACTUS IN BLOOM IN NEW JERSEY. THE CACTUS CAN BE FOUND THROUGHOUT THE DELAWARE RIVER WATERSHED FROM THE PINES BARRENS TO THE JOHN HEINZ WILDLIFE NATIONAL REFUGE TO CLIFFS ALONG THE UPPER REACHES OF THE RIVER.



DEPUE ISLAND IN THE DELAWARE WATER GAP, RIVER MILE 215. OVER 100 ISLANDS EXIST IN THE DELAWARE, SOME DEVELOPED AS GOLF COURSES, ONE AS A BOY SCOUT CAMP, BUT MOST ARE UNDEVELOPED FORESTS AND HABITAT PERFECT FOR A LUNCH BREAK STOP DURING A PADDLE.

### **“GIMME SOME SPACE”**

The value of open space from a wildlife, recreation and quality of life perspective has fueled local efforts to purchase and protect natural lands from development. From 1961 to 1995, the New Jersey Green Acres program set aside \$1.4 billion for land acquisition and park development for open space and wildlife. Since 1998, funding was guaranteed for the program, set aside by the Garden State Preservation Trust Act. The Trust was depleted in 2009, but a new Bond or other stable source of funding is being developed in the state. NJ officials have also recognized the importance of protecting riparian lands for ecosystem services including water quality and flood protection. The state has approved a Blue Acres program which would invest funds in protecting open space along the Delaware and other river systems.

In Bucks County Pennsylvania, voters overwhelmingly approved spending \$59 million towards preserving open space throughout the county in 1997. Since then, more than 15,000 acres have been protected establishing new parks, preserving agricultural land, providing natural habitat for wildlife, improving historical buildings and grounds, and rejuvenating the Delaware River waterfront.

Other public land preservation programs are active in all the River's Watershed States. In addition, private non-profit conservation organizations dedicate millions towards preserving land from development.

For more information on the benefit of open space go to:

The Benefit of State Investments in Preservation Programs, April 15, 2009.

<http://njkeepitgreen.org/resources.htm>

Community Benefits of Open Space, The Trust for Public Land <http://www.njkeepitgreen.org/>

Economic Benefits of Conserved Rivers: An Annotated Bibliography, National Park Service June, 2001



CAPE HENLOPEN STATE PARK DELAWARE BAY AT SUNSET. VISITORS CAN CAMP ON THE BEACH AND WATCH WATERFOWL WHILE THE SUN SETS.

The State of Delaware is home to 18 parks including historical parks, nature preserves, state forests, and scenic vistas.<sup>222</sup> Delaware is known for its unmatched wading bird populations. Marshes, wetlands, and the Delaware River estuary provide habitat to rare bird species specific to the Delaware region.<sup>223</sup> Delaware visitors can experience beaches, rivers, nature trails, greenways, and farms. State parks in Delaware include activities such as whale and dolphin watching.<sup>224</sup> Cape Henlopen State Park, which borders the Delaware Bay, allows visitors to camp on its beaches and visit the nature center which provides activities year round.<sup>225</sup> Each year Delaware's Cape Henlopen attracts over 1 million visitors.<sup>226</sup>

Catskill State Park is a vast 300,000 acres spanning Sullivan, Ulster, Delaware, and Greene Counties in New York.<sup>227</sup> Its size has grown considerably since its founding in 1894 at 30,000 acres.<sup>228</sup> The park contains ponds, waterfalls, meadows, streams, cliffs, and 98 mountain peaks over 3,000 feet high forming an "impressive skyline."<sup>229</sup> Catskill State Park is a great place to visit for hiking with hundreds of miles of trails and abandoned roads. "Today, it serves as watershed, recreation area, and ecological scenic reserve."<sup>230</sup>

The Catskill Mountains in New York are the headwaters of the Delaware River. Catskill

Campgrounds along the Delaware River provide access to river resources and recreation including rafting, canoeing, kayaking, fishing and wildlife viewing. Natural, low impact campgrounds retain the atmosphere and essence of nature that many campers seek. Campgrounds throughout the watershed range in size and amenities, and are an important part of the ecotourism experience. RV campsites generally have hook ups to electricity, increasing the amount of amenities campers have while enjoying the outdoors. For example, Lander's River Trips and Campground has four different campgrounds to choose from, allowing for all types of campers. Some enjoy the peaceful quiet sounds by the campfire, while others want restaurants and amenities after a long day on the River. Dingmans and Kittatinny campgrounds both offer whitewater rapids within their stretch of the River ideal for kayakers. Sylvania Tree Farm is a secluded 1,200 acre estate in the Upper Delaware Wild and Scenic stretch of the River,<sup>231</sup> and within the Wild & Scenic River corridor. It offers a nature campsite right on the River where one can enjoy the peaceful flowing water all night and come across interesting wildlife including bears. There are also secluded cabins set back in the woods away from the River's edge.<sup>232</sup> Bull's Island Recreation Area, located on Route 29 (River Road) in Hunterdon County, NJ, and within the Delaware and Raritan State Park, offers 43 rustic campsites on the Island, each with a fire ring and picnic table open April 11–October 31. With a boat ramp on the Island, the site is perfect for overnight canoe-campers.<sup>233</sup>



DELAWARE RIVER CAMPSITE ALONG THE DELAWARE. THE NATIONAL PARK SERVICE HAS CREATED FIRST COME FIRST SERVE CAMSITES THROUGHOUT MANY OF THEIR PARKS FOR HIKERS AND BOATERS TO REST.

Campground	Location	Price	Nearby Attraction	Amenities
<b>Dingman's Campground</b>	Dingman's Ferry, PA	\$28/ Night	Waterfalls, Appalachian Trail	Hiking, Nature and Biking Trails, Fishing, Canoeing <sup>234</sup>
<b>Worthington State Forest</b>	Warren County, Old Mine Road Delaware Water Gap	\$15/ Night	6,000 acres within the DWGNRA, Sunfish Pond, Old Copper Mine Trail	Fishing and Boating, Hiking the Appalachian Trail, Picnicking <sup>235</sup>
<b>Lander's River Trips and Campground</b>	Narrowsburg, NY	\$16/ Night	4 campgrounds with River Views, Fort Delaware, Skinner's Falls (waterfalls)	Boating, Fishing, Hiking, Kayaking, Rafting, Playgrounds <sup>236</sup>
<b>Kittatinny Campground</b>	Barryville, NY	\$10/ Night	Mountains, Delaware River Whitewater	Whitewater Rafting, Kayaking, Trout Fishing, Hiking, Horseshoes, Volleyball <sup>237</sup>
<b>Cape Henlopen</b>	Lewes, DE	\$31/ Night	Six miles of beach, WWII Observation Tower, Lewes Ferry	Beach Camping, Bike Trails, Bird Watching, Swimming, Disc Golf, Ferry Service <sup>238</sup>
<b>Sylvania Tree Farm</b>	Lackawaxen, PA	\$25/ Night	Skiing, Horseback riding, Balloon rides, Delaware River Whitewater	Fishing, Hiking, Camping, Swimming <sup>239</sup>
<b>Bull's Island Recreation Area</b>	Stockton, NJ	\$20/ Night	Borders river and canal, lush vegetation on the Island. Nearby towns Lambertville, NJ and New Hope, PA	Fishing, River and Canal access, Swimming, Historic foot bridge to PA

Figure 7: Campgrounds bordering the Delaware River

## ❖ Community Attractions and Ecotourism

**Enhancing the natural assets of a community to increase ecotourism can be a low-cost, high-benefit solution for bringing in extra people and dollars to an area. Several communities in the watershed have already been successful in this endeavor, while others are just beginning.**

In Pennsylvania, Bucks County is distinguishing itself as an ecotourism destination. Wineries, breweries, local coffee houses, nature parks, historic hotels, museums, bed and breakfasts and Delaware River access points all bring visitors to the area.<sup>240</sup> Places like the Bowman's Hill Wildflower Preserve, 1000 acres with over 134 native plant species near New Hope provide opportunities for day trips as well as complementing longer stays.<sup>241</sup> Visitors to the area supply revenue to local businesses and keep the importance of preservation and conservation of resources at the forefront of county planning.<sup>242</sup>

The State of Delaware has attracted tourists through creative activities such as the "Biking Inn to Inn" – an excursion that combines recreation, wildlife viewing, exercise, and Delaware's history on a 30-45 mile biking tour.<sup>243</sup> The trip stops at three different historic Delaware Bed and Breakfasts along countryside back roads. Other Delaware ecotourist adventures include bird-watching along the Atlantic Flyway, sport-fishing, horseback riding, antique shopping, arts and culture, fine dining, shopping, and visits to historic locations.<sup>244</sup>



**BLUE TORTILLA RESTAURANT IN NEW HOPE, PA THE HISTORIC BUILDINGS, PEDESTRIAN FRIENDLY WALKWAYS, AND RIVERFRONT ACCESS ALL BRING TOURISTS TO THE AREA FOR SHOPPING, DINING, AND RECREATION.**

Small river towns throughout the watershed bring in visitors each year to celebrate the river. In Frenchtown New Jersey, "River Fest" first started to commemorate the role of the Delaware River in local history, and to support the preservation of the river and the surrounding environment.<sup>245</sup> River Fest, sponsored by the Frenchtown Business and Professional Association is considered Frenchtown's largest annual event.<sup>246</sup> In Knowlton, New Jersey, River Fest is "an annual Musical Event that celebrates music and nature next to the

Delaware River."<sup>247</sup> In Narrowsburg, New York, River Fest is about promoting the Arts and Environment, featuring speakers that promote river conservation education. Lambertville's Shad Fest brings 30,000-35,000 visitors each year to the small historic river town. In Easton, Pennsylvania the Annual Forks of the Delaware Shad Fishing Tournament and Festival is held every year in Scott Park, attracting enthusiastic shad lovers from all around.

Peters Valley, a small village tucked away in Sussex County, is an art retreat for artisans and crafters.<sup>248</sup> The Peters Valley Craft Center has 8 art studios which include blacksmithing, ceramics, structural fibers, metals, photography, and woodworking.<sup>249</sup> Once a year they hold an annual craft fair in September featuring local crafters using inspiration from the Valley's surroundings.<sup>250</sup>

### ECOTOURISM

Ecotourism is responsible travel to natural areas that helps conserve the environment and improve the welfare of local residents. Ecotourism is a major component of each of the basin states economy. Ecotourism supports local economies through retail sales, restaurants, lodging, and services provided. Ecotourism is the fastest growing sector of the travel industry, and therefore countries all over the world and states throughout the U.S. are quickly changing marketing systems to promote their remaining natural and historical areas.

The Delaware County Riverfront Ramble is a weekend long festival featuring music, canoe racing, environmental education, and pirate and fishing shows for families and people of all ages.<sup>251</sup> Riverfront Ramble promotes the Delaware River as a destination location. In 2007, after only 3 years, the event attracted approximately 22,000 people and was expanded to cover 2 days in order to attract overnight visitors and therefore increased proceeds for participating communities.<sup>252</sup> In 2008 the Riverfront Ramble had events in 6 locations lining the Delaware shore including Market Square Memorial Park in Marcus Hook, Delaware, John Heinz National Wildlife Refuge, and the Governor Printz Park in Tinicum, Pennsylvania and several other Delaware River shore stops. Ferry and free boat rides connect the 6 locations with shuttle services to get you back to your start.

Big cities benefit from the draw and beauty of a clean and healthy Delaware River. Philadelphia is home to a variety of events that boast its river areas as an attraction. Boating events include the Philadelphia Canoe Club's 'Philadelphia Fall Classic', a 10,000 meter canoe, kayak, outrigger and surf ski race<sup>253</sup> and the Philadelphia International Dragon Boat Festival featuring more than 100 teams racing fiberglass dragon boats on the Schuylkill River.<sup>254</sup>

Maintaining the nature and history of towns along the Delaware River makes them tourist locations that bring in additional revenue for the entire community. This idea is what led to Cumberland County New Jersey publishing a "Vision & Implementation Strategy for Economic Development & Conservation" in 1996. The report "was born out of a need to find a common agenda; one that would provide both economic development opportunities and preserve the County's natural heritage. Eco-tourism is here. It is happening today in Cumberland County. It is one way to expand the economy, create jobs, and protect



WASHINGTON CROSSING STATE PARK. PA. ECOTOURISM, SUCH AS WILDLIFE OBSERVATION INCLUDING THIS EASTERN TIGER SWALLOWTAIL BUTTERFLY. BRING ECOTOURISTS INTO A REGION REQUIRING MASSIVE INFRASTRUCTURE, ROAD BUILDING, OR HIGH RISE HOTELS. THE KEY IS PROPERLY MARKETING THE UNIQUE AND VALUABLE NATURAL RESOURCES AN AREA ALREADY CONTAINS.

## THREATS TO ECOTOURISM

Improper handling and treatment of sewage, inappropriate and uncontrolled development, industrial air pollution, and water pollution from all sources including industry, roads, farms, cities, and neighborhoods threaten regional ecotourism opportunities for small towns and counties. A recent university study found that illnesses associated with swimming in contaminated water costs the public more than \$3 million per year through the loss of tourism dollars as well as health care related costs, legal fees, and cleanup. Poor environments diminish the public's ability to fish, swim, bird watch, canoe, and experience our public parks and reserves.

the natural resource base that is so important to the area's quality of life."<sup>255</sup> Other communities have published similar reports, created brochures, or are developing strategies to enhance the natural and cultural assets already existing within their borders.

Recognizing the value of recreation to our communities, and its dependence on clean water, beautiful and scenic vistas, and natural areas, it is important that we take action to protect the quality of our river water, our river corridors, and the natural areas in the watershed. Clean water increases park attendance and recreation revenue. Every type of river recreation is diminished if the health of the Delaware River diminishes. With the jobs and economy supported by recreation and ecotourism, it is vital that the community place a high value on the protection and restoration of the River and its surroundings.

# The River as an Employer

## The River as an Employer

- ❖ Commercial Fisheries as Employers
  - ❖ Agriculture and the River
- ❖ Where our Drinking Water Comes From
  - ❖ Industry on the Delaware
  - ❖ Water and Commercial Use
    - ❖ Delaware River Ports

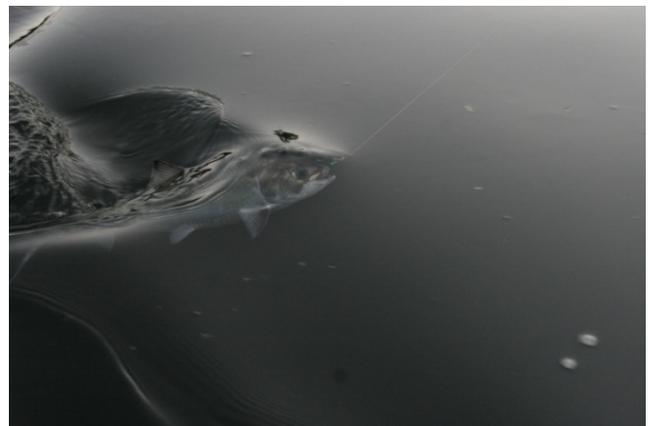
### ❖ Commercial Fisheries as Employers

***The Delaware River watershed supports diverse interests and purposes. A clean and healthy Delaware River creates and supports. To support the diversity and quality of jobs the Delaware needs to be clean, healthy and free-flowing.***

"In 1991, over 9 billion pounds of fish and shellfish with a value of over \$3 billion were harvested by commercial fishermen in the United States."<sup>256</sup> This commercial catch includes freshwater species as well as ocean catches, but it is estimated that nearly three-quarters of all commercially harvested fish and shellfish depend directly on coastal estuaries and river basins for spawning grounds or nurseries. The Delaware River and Bay provide temporary home and spawning ground for species that are later harvested for use all over the eastern U.S. In the late 19<sup>th</sup> century, the Delaware River had the largest annual commercial fish catch of any river on the Atlantic coast. But over-fishing and/or pollution has often threatened the fish of the Delaware River including Shortnose Sturgeon, Atlantic Sturgeon, River Herring (including Blueback and Alewife), Striped Bass, and American Shad.<sup>257</sup>

Early European settlers wrote letters home telling their families and friends about the bounties of fish within the Delaware River and tributaries, at sizes often much larger than typically found in Europe.<sup>258</sup> Tales of almost effortless fishing and brush netting fish into crates became well known in the Delaware River Valley.<sup>259</sup>

By the mid-20<sup>th</sup> century, a combination of an increasing human population, loss of natural forest wetlands, and inadequate sewage and industrial waste treatment created an ecological barrier, a 20-mile oxygen dead zone that impeded the ability of fish to migrate upriver to spawn in the Philadelphia/Camden portion of the River.<sup>260</sup> Improved technologies and laws that required their use, including the Federal Clean Water Act of 1972, forced the cleanup of a variety of pollution sources to the River. As a result, the nutrient pollution which was the primary cause of the River's oxygen problem was largely abated, allowing fish to once again migrate upstream from the ocean and lower stretches of the estuary.



SHAD ARE MAKING THEIR WAY BACK UP THE DELAWARE AND ITS TRIBUTARIES AGAIN BECAUSE CLEAN WATER IS ALLOWING THEM TO RETURN TO THEIR SPAWNING GROUNDS AFTER A LIFE IN THE ATLANTIC OCEAN. PHOTO CREDIT: ART EASTON 2008



SHAD FISHING: LUMBERVILLE, PA  
PHOTO CREDIT: ART EASTON 2008

Today, a viable commercial fishery is still maintained along the Delaware River and Bay. In 1998, statewide, New Jersey's commercial fisheries harvested 196 million pounds at a value of \$90.9 million statewide; New York harvested 57.5 million pounds at a value of \$84.3 million; and Delaware harvested 7.8 million pounds at a value of \$5.6 million.<sup>261</sup> According to New Jersey's Department of Fish and Wildlife, efforts to clean up rivers and reservoirs have created the best trout fishery New Jersey has ever had.<sup>262</sup> Striped Bass has been declared recovered in the Delaware River by the Atlantic States Marine Fisheries

Commission compared to historic levels.<sup>263</sup> American Shad have also recovered enough to support commercial fishing in the Delaware River, although not enough to supply the current demand.<sup>264</sup> Other species commercially caught from the Bay and tributary waters include Alewife, Atlantic Croaker, Blueback Herring, Carp, Spot, Striped Bass, White Perch and Blue Crab.<sup>265</sup>

### **Lewis Shad Commercial Fishery**

The Lewis Shad commercial fishery has survived in the Delaware River for over 108 years. A family run business located above the head of tide in Lambertville, NJ, the Lewis Shad fishery is the oldest commercial shad fishery on the Delaware River.<sup>266</sup> Although its annual shad catches no longer support commercial demand in the Philadelphia and New York markets, this family fishery remains in operation, still using the same fishing methods and practices it used when it first began.<sup>267</sup> The Shad catch is very low, but the family continues their traditions to keep Shad fishermen trained and ready for when the Shad return in greater numbers.<sup>268</sup> The traditional practices used by the Lewis Shad fishery are demonstrated every year at the Lambertville Shad Fest and are a big draw for those in attendance. Each year Shad make the journey up river from the ocean with the fishery improving as water quality and obstacles to migration improve in the Delaware River.<sup>269</sup>

Lewis' approach to the shad market demonstrates a strong conservation ethic. "We don't try to catch enough even to sell to the markets of Philadelphia and New York," said Lewis. "We try not to catch more than we can sell right here. For the price you get in the markets, the fish are more valuable going up the river. A shad roe that you might get 50 cents a pound for in the market, might spawn 150,000 eggs; big difference in value there."<sup>270</sup>

### **Shellfisheries**

Shellfish are also part of the economy sustained by the Delaware River. In 1880, the Delaware Bay brought in a harvest of 2.4 million bushels of oysters. In the 1930's, more than 1 million bushels were harvested. Numbers decreased as natural surfaces in the Bay were reduced, limiting the places where oysters can attach and grow. In the late 1950's, MSX (Multinucleated Sphere unknown affinity X), a deadly shellfish disease, depleted 90-95% of the oyster population in the Bay.<sup>271</sup> After minimal recovery and decades of building resistance to the disease, Dermo (Perkinsus marinus), a second shellfish parasitic disease, again decimated the oyster population in 1980.<sup>272</sup>

While Dermo continues to plague the adult oyster population, the Delaware Bay Oyster Restoration Task Force (a total of 12 public and private agencies from NJ and DE including representatives from Rutgers University, the New Jersey Department of Environmental Protection, the Delaware Department of Natural Resources and Environmental Control, the Delaware River Basin Commission, and the Delaware River Bay Authority) have invested heavily in efforts to restore the Bay's oyster populations and the oyster industry. Since 2005, as much as \$5 million of federal funds have been invested to restore the oyster beds of the Delaware Bay.<sup>273</sup> In 2004, \$1.55 million worth of oysters were landed on the New Jersey side

of the Bay.<sup>274</sup> In 2006 it was reported that oyster harvesting generated \$535,000 of income for harvesters, and a total \$3 million of economic benefit locally.<sup>275</sup> Numbers of oysters and successful shell placement and economic benefits continue to markedly increase. The estimated overall economic impact to the industry for 2007 is estimated at \$80 million.



OYSTER LARVAE REQUIRE A CLEAN, HARD SURFACE UPON WHICH THEY CAN ATTACH OR "RECRUIT." DUE TO A STORAGE OF THESE NATURAL RESOURCES, THE DELAWARE BAY OYSTER RESTORATION TASK FORCE HAS "PLANTED" SURF CLAM, OCEAN QUAHOG, AND MARYLAND OYSTER SHELL IN AN EFFORT TO REVITALIZE THE DELAWARE BAY OYSTER POLLUTION. PHOTO CREDIT: BAYSHORE DISCOVERY PROJECT.

## Case Study: Backwoods Angler Fishing Guides

Blaine Mengel Jr. and Associate Guide Chris Gorsuch know the Delaware River up and down. Both are Delaware River fishing guides for a company called The Backwoods Angler, a fishing guide service owned and operated by Blaine. In operation since 2000, this guide service is based on a healthy catch & release smallmouth bass fishery. Their range spans from Belvidere, NJ north and south.

People come from Pennsylvania, New Jersey, New York, and all over the U.S. to experience the Delaware River. "People are amazed to find such a clean and scenic valuable resource within such a close distance to a metropolis like NYC" said Chris Gorsuch, Associate Guide. The Backwater Angler offers both kayaking trips and jet boat trips from 4-8 hours long for groups of 1-2 people. "We regularly see a variety of turtles, beaver, deer, eagles, osprey, great blue heron and other water fowl; we have even had a number of black bear sightings in the past few years along the banks of the Delaware," Gorsuch reports.

As Gorsuch explains, "Our business is truly sustained by the River and its ecosystem. It is a delicate balance, the aquatic plants, insects and invertebrates all thrive in clean water. These insects and other minnows such as darters, provide the forage that sustains a healthy smallmouth bass population. Without a healthy fish population, there are no eagles, no osprey, no blue heron, and without a quality fishery there are no fishing guides. We have to be able to take people to where the fish are, and understand what parts of the river offer the best fishing opportunities depending on the time of year and the water flow. A healthy Delaware is vital to our being able to do this. Without clean water, we don't have jobs".

There are only a handful of fishing guides along the Delaware; most are trout guides in the West Branch Delaware River. Backwoods Angler operates 7 days a week 12 months out of the year, and successfully gets about 500-600 people out on the River annually. To learn more about the Backwoods Angler Fishing Guide Service, visit their website at [www.backwoodsangler.com](http://www.backwoodsangler.com)



*Dylan Hechendorf and his father Darin booked the Backwoods Angler guide service in early August. This was Dylan's first Delaware River Smallmouth. His dad says; "Dylan's hooked for life!"*

## Additional Commercial Businesses

Many businesses throughout the watershed are supported by the River, but aren't directly along its banks. The Crab Connection in Little Creek, Delaware sells fresh seasonal seafood as well as bait for Delaware Bay fishermen.<sup>277</sup> In Easton, Pennsylvania Lani Abraham has created a Pocket Guide to tourism in the area and along the River, and runs a tourist shop in the downtown district providing information to recreationists and visitors to the River and City of Easton from throughout the region.<sup>278</sup>



BOWERS BEACH, DE RUSSELL'S CHARTER FISHING BOAT MISS SHYANNE TAKES A GROUP OUT ON A FISHING TOUR ON THE DELAWARE.

Charter boats and charter fishing companies thrive in all seasons along the Delaware Bay. Russell's Charter Fishing, Inc. in Bowers Beach, Delaware takes tourists and locals out into the Bay to fish for whatever is in season. Captain Sonny Sullivan owns a bait and tackle shop in Bowers Beach supplying the necessities to Charter fishing boats while also using his own boat to catch bait for sale at his shop.



BOWERS BEACH, DE CAPTAIN SONNY SULLIVAN CUTTING BAIT FOR SONNY'S BAIT AND TACKLE SHOP THAT CATERES TO RECREATIONAL AND COMMERCIAL FISHERIES.

The Philadelphia seafood market, located in the Italian Market at 9<sup>th</sup> and Washington, is "the oldest and largest working outdoor market in the United States". The outdoor market supplies seasonal fresh fish and shellfish from the Delaware River and Bay, as well as from other waterways around the world.<sup>279</sup> Similarly the Reading Terminal Market in downtown

Philadelphia brings thousands out each weekend to buy locally grown produce, fresh meats, and fish from the Delaware River.<sup>280</sup>

The Delaware's commercial fishery doesn't just provide jobs, it supports a way of life. It is a historic and present day culture that is unique unto itself and worthy of respect and protection, not only for the dollars it generates, but for the culture it brings.

## ❖ Agriculture and the River

*Agriculture has a long history in the Delaware River Valley. Pennsylvania is known for its dairy; New Jersey for its peaches, tomatoes, cranberries and blueberries; New York homesteads for their maple syrup, sheep, eggs, and dairy cows; and Delaware State for its poultry.*

### Farming Culture

There are thousands of farms throughout the basin providing local restaurants and farm markets with an abundance of local produce, vegetables, grass-fed meat, eggs, dairy products, and more. In New Jersey, "Jersey Fresh" has become emblematic of family farming and marketing throughout the state. Water



BEDMINSTER, BUCKS COUNTY, PA PRESERVED FARMSTEAD, ONE OF 917 FARMS IN BUCKS COUNTY PRESERVED TO ENSURE THE RURAL HERITAGE AND FARMING TRADITIONS OF THE REGION.

provided by the Delaware River system and the unique river valley soils throughout the basin have supported the farming tradition in each of the basin states producing a wide variety of foods, goods, and jobs.

In 2006, the Bucks County Open Space Task Force celebrated preserving its 100<sup>th</sup> farm. Today, Bucks County, Pennsylvania, has over 917 farms containing more than 76,000 acres and generating over \$60 million in agricultural products.<sup>281</sup> Preserving farmland provides a sense of identity for the county. Historic barns and outbuildings, grazing livestock, and open fields continue to define the character of the county while, when managed appropriately, helps to maintain meadowlands, streambeds, and forests for natural habitat.<sup>282</sup>

Monmouth County, New Jersey recently preserved its 10,000<sup>th</sup> acre of farmland, and is the seventh county in the state to do so. The Gerald Rottkamp Farm in Cumberland County, New Jersey produces sweet corn, tomatoes, peppers, melons, and blueberries, and uses 2,200 gallons of water per day from the Delaware River. Likewise, other farms throughout the state and the basin rely on the Delaware River its tributaries and agriculture to provide irrigation and to sustain farming traditions.<sup>283</sup>



NEW JERSEY FARM MARKET RT 48 SALEM COUNTY. "JERSEY FRESH" HAS BECOME EMBLEMATIC OF NEW JERSEY AGRICULTURE THROUGHOUT THE STATE.

## Buying Local

Agriculture close to or within urban areas is also uniquely valuable and important. It creates green spaces for trees and water filtration, while providing a local food supply to urban residents. Local farms provide educational opportunities for children and decrease the amount of transportation needed to supply homes, local groceries, restaurants, stores and markets with fresh produce.

In agriculture, contamination of water sources could lead to sickness and infection of both humans who consume the food and to livestock that use the water for drinking. Pre-treating irrigation water is a costly endeavor.

Current methods of irrigation take in water from the River and apply it directly onto agricultural fields. Many agricultural fields use ground water wells for irrigation rather than direct surface water intakes, but contamination can still happen. The importance of clean water in irrigation was proven in the fall of 2006 when over one hundred people became sick after consuming spinach that was irrigated with contaminated water in California. The irrigation sources were infected from fertilizer runoff and animal waste.<sup>284</sup>



JERSEY FRESH RED POTATOES SOLD IN SALEM COUNTY FOR \$2.50 A BOX

For a great guide to New Jersey food, see [Edible Jersey](http://www.ediblejersey.com), a quarterly magazine that celebrates "local foods from the Garden State, Season by Season." ([www.ediblejersey.com](http://www.ediblejersey.com))

## **Livestock and Factory Farming**

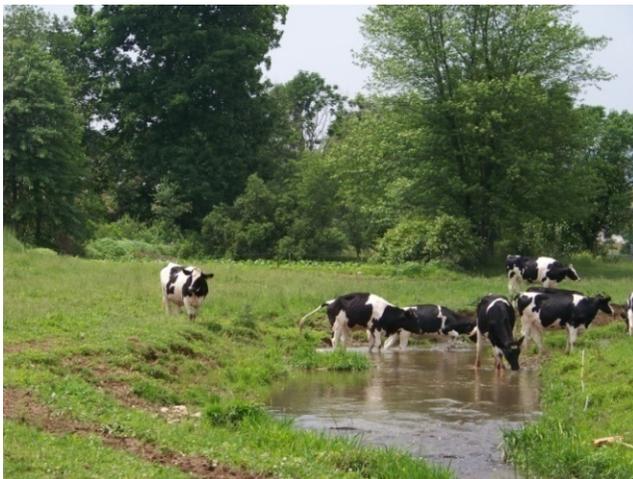
Agriculture is a significant part of the Delaware River watershed economy and culture. While watershed farmers need to do their part to protect the streams and rivers of the watershed; the watershed community needs to do its part to support local farmers with clean water and community support.

Many livestock and farm animals drink from the water provided by the Delaware River and its tributaries. Clean water is needed in order for them to stay healthy and sanitary. "High levels of sulfates in drinking water can contribute to decreased egg production in chickens."<sup>285</sup> "Many species of animals are susceptible to nitrate poisoning, especially cattle", which has been associated with miscarriage and other reproductive problems, anorexia, lower blood pressure, and reduced lactation for dairy cattle."<sup>286</sup>



**CONFINED ANIMAL FACTORY FARM BEING INUNDATED WITH FLOOD WATERS. THE FARM'S LAGOONS CONTAIN MANURE AND CONTAMINANTS THAT, WHEN FLOODED OR OVERTOPPED, POLLUTE THE NEARBY WATERWAY.**

And agriculture must take due care to ensure that it does not itself become a source of pollution to waterways in the watershed. Animal agriculture produces byproducts like manure and chemical waste that should be properly treated, recycled as fertilizer or compost and kept away from waterways. Rain washes livestock waste containing bacteria and pathogens into water sources. Excessive nutrients from animal byproducts destroy river habitats by creating excessive algal blooms resulting in reduced oxygen levels that suffocate fish and impact wildlife. Livestock should always be kept away from streams and rivers.



**WITHOUT FENCING, EVEN SMALL ANIMAL OPERATIONS CAN DEGRADE STREAM QUALITY.**

Every effort should be made to avoid the operation of confined animal feeding operations (CAFO's) or factory farms in our watershed and communities. Factory farms introduce a variety of chemicals, pharmaceuticals, growth hormones, antibiotics, bacteria and contaminants onto the land and into the nearest waterway.<sup>287</sup> Factory farms create water, noise and odor pollution, and they inflict morally reprehensible abuse on the animals they house. Preventing the construction and operation of factory farms is one important strategy for protecting drinking water supplies, the environment and communities.

## ❖ Where our Drinking Water Comes From

***A clean and healthy Delaware River, including the River's corridor, provide for our basic human needs: water, food, safety and health. About 5 percent of the U.S. population or 15 million people rely on the Delaware River for their drinking water supply. Major cities and small communities alike drink from the River.***



NEVERSINK RIVER, NY THE NORTHERN REACHES OF THE DELAWARE RIVER WATERSHED HELP TO SUPPLY MILLIONS OF NEW YORKERS. PHOTO CREDIT: DAN L. PERLMAN/ECOLIBRARY.ORG

The Philadelphia Water Department has three drinking water treatment plants that draw water from the Delaware and Schuylkill Rivers. The Baxter plant, which draws an average of 200 million gallons a day from the mainstream Delaware, provides drinking water to 60% of Philadelphia's population, as well as serving a portion of lower Bucks County. The Belmont and Queen Lane treatment plants together draw an average of 110 million gallons per day (40 MGD and 70 MGD respectively) from the Schuylkill River to support the other 40% of Philadelphia's drinking water needs.<sup>288</sup> Not all of the 15 million people drinking Delaware River water live in the watershed, in fact a large portion live in other River basins. Residents of central New Jersey reside in the Raritan River Basin, and New York City residents are in the Hudson River Basin – yet both drink water supplied by the Delaware River.

## Clean Drinking Water

Clean Delaware River water, free from toxins, bacteria, pathogens, mercury, PCB's, and various other known and unknown chemicals is critical for supporting a healthy drinking water supply for residents throughout the watershed as well as business and commercial uses. The health impacts of water contamination for both humans and wildlife range from acute illness, to diseases such as cancer and metabolic disorders. Waterborne diseases are a major problem in surface water. Gastroenteritis, acute respiratory symptoms, and dermatitis are among the acute illnesses that can result from contaminated drinking water.<sup>289</sup> Both ground and surface water can become polluted with pesticides, petrochemicals, bacteria, nutrients, synthetic organics, acidification, heavy metals, chemicals (manmade and naturally occurring), and waste products. Toxins and contaminants have serious health consequences when consumed. Accidental pollution releases, legally permitted pollution discharges, illegal discharges, as well as pollution washed from the land during rain events are all potential sources of contamination of our drinking water supply.

In 2008, The Associated Press reported that 56 pharmaceuticals or byproducts have been found in Philadelphia's drinking water supply.<sup>290</sup> According to authorities this issue may not be a major issue now, but over time and without fully understanding where the byproducts are originating, it could be a substantial threat.<sup>291</sup>

## Cleaning Dirty Water: Water Treatment

The cost of water treatment is high. Maintaining our drinking water supplies to the highest specifications of water safety and cleanliness not only provides health and quality of life benefits but it also ensures a more cost effective source of drinking water. In New York, residents have long enjoyed the untreated, high quality waters from the upper Delaware River system. In 1996, New York City faced the choice of building a water filtration plant to filter its water supply, or of protecting the watershed that drains to the City's drinking water reservoirs in order to maintain its high quality drinking water. Economically, the decision was an easy one. The cost of building and operating a water filtration plant would cost the City \$6 to \$8 billion at that time.<sup>292</sup> Rather than invest in a water filtration facility, New York City, with the support of the U.S. Environmental Protection Agency (EPA), entered into its Watershed Memorandum of



NEW YORK CITY DECIDED TO PRESERVE RIPARIAN LAND IN THE UPPER DELAWARE TO MAINTAIN CLEAN WATER VS. BUILDING A MULT- BILLION WATER FILTRATION PLANT. PHOTO CREDIT: JON NAIL

Agreement in 2007. The Watershed Plan that was created invested in protecting riparian buffer zones and watershed lands around their City's reservoirs in order to help protect their water source from non-point source pollution, including nutrients and pesticides resulting from stormwater runoff, septic tanks and agriculture.<sup>293</sup> The City invested in repairing and installing community sewage treatment plants throughout the counties that drain to their reservoirs. Protecting the watershed was estimated to only cost the City around \$1 to \$1.5 billion dollars with \$250 million invested in acquiring land and setting aside special protection areas.<sup>294</sup> This land purchase has been complemented by regulatory protections (New York City's Rules and Regulations for the Protection from Contamination, Degradation, and Pollution of the NYC Water Supply and its sources Chapter 18 and landowner incentives for land protection.<sup>295</sup>

The watershed program choice has not only provided New York City with some of the cleanest and best tasting water nationwide, but it has provided tremendous benefits to the Delaware River as a whole, reducing the level of pollution that is dumped into the system from deforestation and development.

Today it is estimated that building a water filtration plant could total as much as \$10-20 Billion; New York City residents' annual water bills would increase by at least 11.5%. This would make the average water bill \$699, annually.<sup>296</sup> Protecting the watershed is still the most cost effective and attractive solution for the City.

***"...clean water is the fuel  
that powers the nation's  
economic engine."***



Researchers in other communities recognize the benefits of watershed protection from a community water supply and pollution prevention perspective, finding that every \$1 invested in watershed protection could save between \$7.50 and \$200 in costs for new filtration and water treatment facilities.<sup>297</sup> “In 1991, the cost of treating contaminated water was estimated to be \$10-\$15 per month for a family of three.”<sup>298</sup> Communities in Washington D.C. spend as much as \$3 to \$5 per pound to remove nitrogen from wastewater, a process that forested buffers provide naturally.<sup>299</sup>



NEW YORK CITY'S WATER SUPPLY SYSTEM



The map above shows some of the water storage reservoirs along the Delaware. These reservoirs hold the public supply of water used for drinking, cleaning, lawn care, and for industries such as food production and automobile manufacturing. Several communities manage their own water supply through reservoir operations including Wilmington and Newark in Delaware, Bethlehem, Pennsylvania, and the largest water user from our basin, New York City, which exports water from the headwaters of the Delaware River. Other communities in addition to Philadelphia take in water directly from the River including: Morrisville, Trenton, Burlington, and Bristol.

## ❖ Industry on the River

***Although industry has changed along the Delaware River over the years, the River has always been a fundamental resource for the economy that spurred the growth of Philadelphia, Camden, Wilmington, Trenton, and even New York City. Industries throughout the watershed continue to bring young talented professionals and families into the region, but the River is what keeps that industry viable and its employees' quality of life high.***

### **Industrial Beginnings**

Starting in the 1760's, timber rafting was a way of transporting thousands of harvested trees from the Upper Delaware forests of New York, Pennsylvania, and New Jersey into Philadelphia and Camden. Timber from the valley fueled shipbuilding, one of the first major Delaware River industries.<sup>300</sup> Other historical Delaware River industries include lumber and paper mills, tanneries, stone quarries, especially bluestone, cement-making, iron, and rubber. Many of these industries relied primarily on the River and estuary for transportation, including coal which traveled down the Lehigh into the Port of Richmond just north of Philadelphia.<sup>301</sup> The anthracite coal industry began in the early 19<sup>th</sup> century in the headwaters of the Schuylkill River to fuel the industrial revolution.

Many historic Delaware River industries played a large part in the demise of water quality between Trenton and Philadelphia, the decline reached its peak in the 1940's and 50's.

In the Mid to late 1800's upper Delaware River timber harvesting and tanneries that stripped tannic acid from the bark of the region's mature trees devastated the River. What was once an idyllic intact forest brimming with trout-filled streams was transformed into a logged wasteland with a river polluted by acid and choked with sediment. Many tributary streams were utterly destroyed.

Declining quality made the River an unreliable source of water. Federal laws and a greater appreciation of the River for multiple purposes resulted in the cleaning up of the Delaware River, which revived industrial reliance for water supply on the Delaware, leading to greater job security and better health for its many workers. The industries that dominate the River's edges have changed over the decades.

**Sectors that Consume Delaware River Surface Water**



Figure 8: Sectors that Consume Delaware River Surface Water

## Today's River Industries

Today, water is an essential factor in industrial production, productivity and transport. The largest water consumers on the Delaware today are electricity generation facilities, or the power industry. The power industry takes in three times more water than all other major water consumers combined, including public water supply, agriculture, and commercial businesses. **Figure 8** lists the four sectors of commercial Delaware River surface water consumers.<sup>302</sup>

The power industry consumes approximately 5.674 billion gallons per day of Delaware River surface water,<sup>303</sup> primarily used for cooling purposes. Because most power generating facilities along the Delaware River intake water through underwater pipes, it is important that the water remain clean and clear of unnatural debris.

In April of 2007, a cooling water intake at PSE&G was forced to shut down after screens on its water intake system became clogged with assorted River debris.<sup>304</sup>

PSE&G is a native New Jersey electric service provider that supplies electricity for over 75% of New Jersey from Bergen, to Gloucester Counties. PSE&G employs over 10,500 people throughout its state wide service area, providing jobs for highly skilled engineers and nuclear technicians as well as hourly positions of all kinds.<sup>305</sup> PSE&G takes in more than three billion gallons of water per day from the Delaware River for cooling purposes.<sup>306</sup>

Exelon takes in over one billion gallons per day from the Delaware River and employs thousands of men and women throughout the region.<sup>307</sup> Power companies strategically locate themselves along bodies of water. A dependable flow of water is essential for power plants to remain viable.

**Figure 9** shows the five largest Delaware River consumers; four of which are power companies.<sup>308</sup> Connectiv, Exelon, PSE&G, and Reliant are all power companies with a combined water intake of more than 55 billion gallons of water per day.<sup>309</sup> Premcor is an oil refining facility that takes in 355 million gallons per day of Delaware River surface water.<sup>310</sup>

Every year the Salem Nuclear Generating Station kills over 3 billion Delaware River fish including:

- Over 59 million Blueback Herring
- Over 77 million Weakfish
- Over 134 million Atlantic Croaker
- Over 412 million White Perch
- Over 448 million Striped Bass
- Over 2 billion Bay Anchovy

The US Fish and Wildlife Service, in a letter dated January 10, 2001, characterizes the loss of aquatic organisms at Salem as "ecologically significant. In addition, conditional mortality rates for some Representative Important Species (RIS) are high enough to be of serious concern."

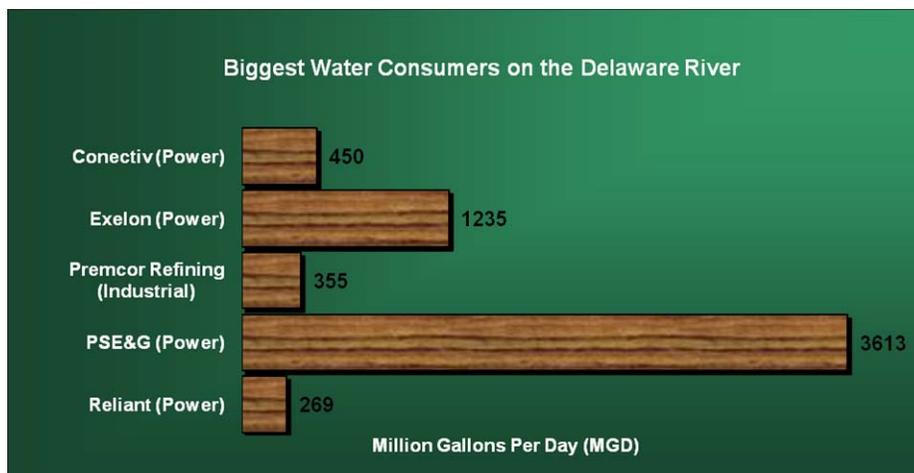


Figure 9: Five Largest Delaware River Consumers

Being the biggest water consumers on the Delaware brings with it a high level of responsibility, ensuring that their use of the River water is done so as to minimize any adverse impacts they might have on the ecosystem or others who rely on the River. PSE&G's Salem facility kills over 3 billion Delaware River fish a year including Weakfish, Bay Anchovy, Shad, and more. If PSE&G were to change the cooling water technology at the facility it could reduce those fish kills by over 95% and use 95% less Delaware River water. In addition to the ecological impacts, the commercial and recreational fishing industries and workers are forced to compete with electric generating stations for their livelihood — a day's catch. Fishing industries are dependent on a healthy and growing fish population in the Delaware Estuary and Bay and it is incumbent on PSE&G, Exelon and all other power companies to respect the right and need of others who mutually rely on the River.

Other industries that today rely on Delaware River surface water include steel manufacturing, chemical companies, paper mills, cement production facilities, and oil refineries. Chemicals are manufactured at DuPont with locations in New Jersey and Delaware. Although clean water is an essential component of DuPont's operations, DuPont's Chamber Works facility in Deepwater New Jersey is the single largest discharger of hazardous waste effluent in New Jersey.<sup>311</sup> Industries like this do not help the River or region, but actually hurt the long term growth of the environment and economy. Rohm and Haas (now Dow Chemical) is a chemical company based out of Philadelphia. According to the industry, chemical manufacturing and research requires a reliable water source: "Water is the single most important chemical compound".<sup>312</sup> The higher the level of initial contamination of the water, the more effort that must be applied before research and production can begin.



INDUSTRIAL TOWERS IN THE BACKGROUND OF A SCENIC RIVER VIEW.

Water is a basic and essential component to the local production of paper towels, tissues, copy paper and notepads. Companies such as Scott paper operating on the Delaware River since the mid 1800's rely on plentiful, good quality water.

### **Why Industry Needs Clean Water**

"Contaminated water can increase industrial expenses as it causes steam electric power plants to operate less efficiently, clogs cooling equipment, corrodes pipes, and increases the rate at which pumps and other equipment wear out".<sup>313</sup> In November of 2008, industries along the Monongahela River flowing through Pittsburgh, Pennsylvania noticed "significantly higher water treatment costs" after microscopic contaminants, Total Dissolved Solids (TDS), were found at high levels.<sup>314</sup> The Pennsylvania Department of Environmental Protection said it

received several reports from industries about equipment problems and increased filtering costs to protect expensive steam boilers and turbines as well as drinking water filtration plant problems that led to water so high in TDS that it couldn't be effectively filtered. 325,000 consumers were advised to switch to bottled water for weeks and again for a period in 2009. A power industry spokesman said utility treatment costs increased because very clean water is needed for power generating facilities.

Many industries and businesses depend on the River for transportation today. Approximately 3000 cargo vessels travel the River annually.<sup>315</sup> About 85% of the east coast oil imports come up through the Delaware Bay and River<sup>316</sup>. Debris impairs the ability of ships for these and other industries located along the river to safely transport and deliver their cargo, making it important to keep damaging debris out of the water.

In Philadelphia and South Jersey, the Delaware River Port Authority (DRPA) launched a “Green Ports” program with South Jersey Port Corporation (SJPC) and the Philadelphia Regional Port Authority (PRPA). The DRPA is a regional transportation and development agency that owns and operates the Benjamin Franklin, Walt Whitman, Commodore Barry and Betsy Ross bridges, PATCO, the Philadelphia Cruise Terminal and the RiverLink Ferry.<sup>317</sup> Initiatives to “green the ports” in several U. S. port cities have led to success economically and environmentally. Los Angeles, Mayor Antonio Villaraigosa and the mayor of neighboring Long Beach, launched a campaign to clean up port activities and reduce air emissions and water pollution. “We believe the only way to grow the port is to green the port,” says Villaraigosa. “And the only way to green the port is to grow the port....”<sup>318</sup>

## ❖ Water and Commercial Use

***Other commercial users of Delaware River surface water include the small businesses of the watershed like restaurants and hotels.***

Hotels, restaurants, small businesses, and real estate operations rely on the Delaware River for their drinking water, wash water, maintaining their landscaping and grounds and to support onsite recreational uses including filling and maintaining swimming pools. Clean water is also fundamentally important for real estate in order to sell properties. Either real or perceived contamination, litter, garbage, or murky river conditions can influence buyer interest and the final selling price of property.

Some of the largest private consumers of Delaware River water are Waterworks Condominiums in Philadelphia, USS Real Estate owned by U.S. Steel, and River Winds in West Deptford Township, New Jersey.<sup>319</sup> Even the Philadelphia Airport takes in water to maintain the grounds, keep runways and airplanes clean, provide bathroom facilities for thousands of people moving throughout the airport each day, and to run the many restaurants and kitchens located within the facility.

As with all users of the River, it is important that commercial sources that benefit from a clean and healthy Delaware River do their part to protect and restore that same clean water. Their ability to do so is all about the choices they make for their day to day operations.

## ❖ Delaware River Ports

***The ports of Philadelphia and Camden make up the busiest freshwater port in the world with annual revenue of \$19 billion.<sup>320</sup> Over 70 million tons of cargo per year move through the ports at Philadelphia, PA; Camden, Gloucester City, and Salem, NJ; and Wilmington, DE Historically, cities such as Philadelphia and Trenton were created and supported by the products supplied through the ports. Raw timber and coal went out, and processed goods came in.***

“Delaware River ports employ 4,056 workers who earn \$326 million.”<sup>321</sup> When one looks at the additional jobs and worker spending associated with these jobs the Delaware River ports are said to support “12,121 jobs and \$772 million in labor income, generating \$2.4 billion in economic output.”<sup>322</sup> The ports are well known for staple products like fruits, cashews, and cocoa beans, and contain the number one perishables port on the east coast. Oil comes in from the Middle East and meat comes in from Chile, Argentina, and Australia. Delaware River ports make up the largest North American port for steel, paper, and meat imports as well as the largest importer of cocoa and fruit on the east coast.<sup>323</sup> The Port of Wilmington is one of the busiest container ports on the Delaware River handling Dole and Chiquita.<sup>324</sup>

A deepened main navigation channel is not needed to support this vibrant port, or new business. The success of the Delaware River ports lies in developing them as a strong niche port. In recent years record growth has been reported for the Delaware River ports, without the prospect of a deepened channel.<sup>325</sup> While deepening the Delaware is not needed for a vital and growing port, it would threaten the other uses of the River with contamination, losing jobs and income, as well as diminishing the health of the River for others, including the people who drink and eat from it.



VIEW OF THE NAVY SHIPYARD AT SUNSET. THE PORTS ARE SHIPPING AND RECEIVING CORRIDORS FOR INTERNATIONAL TRADE AND COMMERCE. MOSTLY OIL TANKERS, WE ALSO RECEIVE PERISHABLE FOODS AND CONSUMER GOODS.

## **Why it Needs to be Clean Water**

In the 1940's and 1950's the Delaware River was filled with sewage and garbage that clogged boat engines of incoming and outgoing ships peeling the paint from their sides, hindering traffic and port employment.<sup>326</sup> In 2004, a large oil tanker carrying thick Venezuelan crude oil hit two submerged objects lying on the River's bottom: an old anchor and pipe. The objects ripped two gashes in the tanker's hull resulting in an oil spill of 265,000 gallons. The Athos I oil spill forced the ports to completely shut down for a period of days. The Coast Guard and others were forced to invest more than \$84 million dollars to clean up the toxic crude which impacted 115 miles of River and 280 miles of shoreline with oil, as well as over 16,500 birds and other wildlife.<sup>327</sup>

Keeping the ports healthy and functioning is important to the region's economy. The supplies that come into the ports provide jobs for watershed residents, overseas manufacturers, ship captains and their workforce, port receiving and distribution, inland transportation like truckers and railroad personnel, and all of the local suppliers relying on the products like restaurants, Hershey's chocolate factory, steel manufacturers, and more. It is important that we keep our river clean so we do not jeopardize job security or the health of these workers. Accidents and fuel or cargo spills cause injuries, death, damage to public health and the environment, and serious economic harm. It is critical that all policies, procedures and steps be taken to avoid short term catastrophic events as well as long term degradation and harm. Maintaining our port as a source of reliable employment for hundreds of thousands of workers is a priority for the region and requires a clean and healthy River.

In Philadelphia and South Jersey, the Delaware River Port Authority (DRPA) launched a "Green Ports" program with South Jersey Port Corporation (SJPC) and the Philadelphia Regional Port Authority (PRPA). The DRPA is a regional transportation and development agency that owns and operates the Benjamin Franklin, Walt Whitman, Commodore Barry and Betsy Ross bridges, PATCO, the Philadelphia Cruise Terminal and the RiverLink Ferry.<sup>328</sup> Initiatives to "green the ports" in several U. S. port cities have

led to success economically and environmentally. Los Angeles, Mayor Antonio Villaraigosa and the mayor of neighboring Long Beach, launched a campaign to clean up port activities and reduce air emissions and water pollution. "We believe the only way to grow the port is to green the port," says Villaraigosa. "And the only way to green the port is to grow the port...."<sup>329</sup>



ABOVE LEFT: AFTER THE ATHOS 1 OIL SPILL TEAMS FROM ALL OVER THE REGION TOOK PART IN THE CLEAN UP EFFORTS TO WASH BIRDS AND STOP THE FLOW OF OIL FROM THE SPILL SITE. PHOTO CREDIT: DAVID SWANSON PHILADELPHIA INQUIRER: ABOVE RIGHT: ATHOS 1 PHOTO CREDIT: DANIELLE DEMARINO BOTTOM RIGHT: OIL SOAKED GOOSE FROM ATHOS 1 SPILL PHOTO CREDIT: DAN PRAN/THE NEW YORK TIMES

# Cultural & Historic Value

## Cultural & Historic Value

- ❖ Native Americans
- ❖ European Movement and American Independence
- ❖ Historical Sites and Reenactments

### ❖ Native Americans

*The Delaware River holds a spiritual and cultural significance to those living within the watershed and beyond. Native Americans from the valley continue to meet and spread their stories and history to the community.*

Pre-dating European settlement, Native Americans, the Lenape, inhabited the land along the Delaware River and Bay. Their “Lenapehoking” (land of the Lenape) encompassed southern Connecticut, New York, all of New Jersey, eastern Pennsylvania, and Delaware.<sup>330</sup> The Lenape made canoes and used the Delaware River for both transportation and sustenance.<sup>331</sup>

Today, archaeologists from American University’s Department of Anthropology have found more than 55,000 Lenape artifacts from 25% of what is believed to be the total site area in the upper Delaware River Valley region. Archeological evidence of the region’s native people and their settlements have been found up and down the River and its Watershed. There has even been some findings that may prove ancient cultures that pre-date the Lenape.



More recently, prehistoric Native American artifacts were found along the Delaware River in Philadelphia, at the site of the proposed Sugar House casino. Common artifacts found at Native American archaeological sites include arrowheads and other tools used during the time the Lenape inhabited the area.<sup>332</sup> Museums throughout the Basin describe Lenape history and culture. The Delaware River still holds a very spiritual and cultural connection to their descendents. The River is a link to the life and spirit cherished by the Lenape.

ED FELL SERVED AS PRESIDENT OF THE NATIVE AMERICAN ALLIANCE OF BUCKS COUNTY FOR MANY YEARS UNTIL HIS PASSING IN 2009. THE ALLIANCE CONTINUES TO HOLD REGULAR MEETINGS EDUCATING OUR YOUTH ABOUT NATIVE CULTURES OF THE PAST AND ENSURING NATIVE AMERICAN CULTURE LIVES ON IN THE DELAWARE VALLEY.

## ❖ European Movement and American Independence

*With such a long history, the Delaware River valley holds significant opportunities for people looking to rediscover events of the past. From the formation of the River to the first human settlement, its colonial history, the revolutionary war, and more recent accomplishments, several places of interest bring in visitors year round. Many historic sites are located along the Delaware River or one of its tributaries. Keeping the water clean as it flows past and through these sites entices people to continue visiting them. A bad smell, dirty water, or degraded streams detract from the historic presence of a site.*

Henry Hudson was the first European to discover the Delaware River when he and the crew of the Dutch Half Moon entered the mouth of Delaware Bay on August 28, 1609. They quickly ran aground in the Bay, making a u-turn that allowed Lenapes to enjoy a little more time before settlers intruded.<sup>333</sup> The English discovered the Delaware the following year, and Dutch, Swedish, Finnish, German and other settlers from Europe followed over the next 166 years.<sup>334</sup>



BATTLE OF TRENTON REENACTMENT. PHOTO CREDIT: PAUL CARLUCCIO

Today, the site where George Washington crossed the Delaware on December 25<sup>th</sup> 1776, is one of the most heavily visited locations on the River, particularly on Christmas Day when this event is reenacted. On the other side of the River in Trenton, NJ, there are annual reenactments of the Battle of Trenton which ensued on Christmas night, and the second Battle of Trenton that occurred seven days later. These reenactments and Revolutionary War reenactments attract reenactors and visitors from all over the country.

### **History Telling**

Valley Forge Park along the Schuylkill River is also a heavily visited site. Valley Forge housed Washington's army during the harsh winter of 1777.<sup>335</sup> Historic details mixed with recreational possibilities and nature centers, provide people of all ages and interests with an exciting day-long outing. People come from all over to visit many of the historic sites where reenactments occur, and where markers describe the event and its significance.



OLD BARRACKS MUSEUM, TRENTON N.J. BATTLE OF TRENTON REENACTMENT. PHOTO CREDIT: PAUL CARLUCCIO

In the Estuary portion of the River, Fort Delaware is a famous historic site located on Pea Patch Island claimed to have grown from a cargo of peas that was lost overboard by the Dutch. Pea Patch Island today offers historic reenactments from the days when it was used as a Union prison during the Civil War.<sup>336</sup> In addition, the Island offers ferry rides, hiking trails, and an observation platform from which to view nine different species of birds, including Herons, Egrets, and Ibis.

Historic Sites and Reenactments	Where	Details
<b>Minisink Archaeological Site</b>	Bushkill, PA	Archaeologists have been making discoveries at this site for decades. More than 55,000 artifacts have been found in only 25% of the total site area. Arrowheads, relics, and details of early people continue to bring out new questions about the area's history. <sup>337</sup>
<b>Valley Forge National Park</b>	Forge, PA	Visit the encampment where Washington's army rested through the winter of 1777 during the Revolutionary War <sup>338</sup>
<b>Washington Crossing the Delaware</b>	Washington Crossing, PA	This famous site hosts annual reenactments of General George Washington crossing the Delaware River toward Trenton during the Christmas holiday bringing thousands of visitors <sup>339</sup>
<b>Battle of Trenton</b>	Trenton, NJ	The Battle of Trenton reenactments feature soldiers dressed in Revolutionary War era uniforms and traditional weaponry marching along the streets of Trenton, New Jersey. <sup>340</sup>
<b>Pea Patch Island</b>	Fort Delaware, DE	This well known site holds reenactments of the days when the island was used as a prison during the Civil War. Today it is also home to a protected wildlife preserve for numerous waterfowl species <sup>341</sup>

Figure 10: Historic Sites and Public Reenactments along the Delaware River

### **Historic Figures from the Delaware Valley**

After becoming famous, Zane Grey, one of the nation's favorite Western authors from the early 20<sup>th</sup> century, moved with his wife Dolly to Lackawanna County, Pennsylvania from New York City.<sup>342</sup> The convergence of the Lackawanna and Delaware Rivers was one of Grey's favorite spots and is where he settled with his family around 1905.<sup>343</sup> The home and farmstead remain at this unique and gorgeous location as a museum for travelers and locals. The museum contains Grey's library and office full of the photos, writings, and books he used while authoring his more than 40 books and essays, the first being "A Day on the Delaware" published in *Recreation Magazine* in 1905.<sup>344</sup>

Another historic attraction in the same reach of the Delaware River is the Roebling Aqueduct. In 1847, John Roebling, future engineer of the Brooklyn Bridge, designed and helped to construct several aqueducts along the Delaware and Hudson canal.<sup>345</sup> The D&H Canal was vital in transporting coal from Pennsylvania mines to New York City, where it helped to fuel the industrial revolution.<sup>346</sup> The only remaining aqueduct of Roebling's is along the Delaware, because of its adaptation to a car bridge in the

early 20<sup>th</sup> Century.<sup>347</sup> Almost all of the original ironwork, cables, and structures, remain on the Delaware Aqueduct, and other characteristics of the time have been reconstructed so that visitors can see exactly how early transportation by mule labor and water gravity occurred.<sup>348</sup>

In order to maintain the region's history and keep visitors coming to these sites, it is important to keep the neighboring streams and rivers clean. The Delaware River Watershed is a part of America's history. Maintaining this history for future generations to experience is an important aspect in understanding our past and our country's foundation. Keeping the river clean, with a goal of restoring it to the conditions our prehistoric and long-ago ancestors experienced, and ensuring that it is a complement and enticement for viewing and experiencing the local economic historic and cultural offerings of our region is important for education, ecotourism, cultural values, and local economies.

## Importance of Clean Water Importance of Clean Water



***“When we best protect and restore the Delaware River is when we best protect and restore ourselves.....”***

***Maya K. van Rossum, the Delaware Riverkeeper***

The Delaware River watershed is home to 8 million people and provides drinking water for approximately 15 million. It is a revered recreational resource to boaters, fishers, birdwatchers, nature hikers, swimmers, and sight-seers of all kinds. It is a means of transportation for port industry, and a steady reliable source of water for commercial and industrial operations. The riverbanks serve as

habitats for rare and endangered species. The River is an ecosystem to thousands of plant and animal species that have called it home for millions of years. When the River is healthy it helps to protect us from floods, droughts and illness.

A clean Delaware River reduces the cost of water treatment and increases property values for homes and businesses. By protecting and restoring our River we earn tremendous economic and ecological benefits while the quality of life for residents throughout the Delaware River watershed increases.

Once damage has been done to the natural ecosystems of the Delaware River it can be difficult and costly to undo. It has been estimated that restoring the ecosystems necessary to replace the billions of fish and aquatic organisms killed by the Pilgrim Nuclear Generating Station located in Massachusetts would cost at least \$140 million.<sup>349</sup>



It is often the case that the cost of the restoration is far less than the value of the natural resource to the community.<sup>350</sup> While the investment may be worth it, it would still have cost far less both in the direct cost of restoration and the opportunity costs during the period of harm, had the resource simply been protected in the first place.

The River is a resource and a member of our community which needs to be preserved for the children and grandchildren of the watershed. It is critical that the Delaware River remain valued so that the entire watershed may benefit ecologically, economically, culturally, and spiritually for decades to come.

One of the most important ways to protect all of the values of the streams and River discussed in this report is to protect the watershed in as natural a condition as possible. This includes protecting and restoring its floodplains in a forested state, protecting its upland forests and terrain, as well as its wetlands and soils. When we protect the watershed to protect the River we see the tremendous community-wide benefits that are received.

This report ends where it began. The most important take away from this report is that the Delaware River is a living ecosystem rich in beauty, culture, and community that needs to be protected and restored in order to continue to be the respected and contributing member of our community we all need and enjoy.



# We Need Your Help We Need Your Help

From its headwaters in the Catskills, the Delaware River flows 375 miles to the Delaware Bay. Its watershed encompasses over 13,539 square miles in the backyard of the most densely populated area of the country. When George Washington crossed the Delaware, he could not have imagined the insults this great river would suffer 200 years later - catastrophic oil and pollution spills, ongoing pollution inputs, the threat of dams and invasive dredging, and many species on the brink of extinction.

Rivers cannot defend themselves, but **the Delaware River does have a voice through the Delaware Riverkeeper and the Delaware Riverkeeper Network.** It is our responsibility and privilege to champion the Delaware River and its streams as members of our communities.

Led by the Delaware Riverkeeper, the Delaware Riverkeeper Network is **a dedicated team of staff and volunteers who defend the River and its tributaries.** For over 20 years, we've watched over the River and its tributaries, combating threats to its health and taking on challenges that endanger the environment our children will inherit. **We are the only river advocacy organization working throughout the Delaware River Valley, and we are making a difference.**

Members make up the backbone of the Delaware Riverkeeper Network, providing strength and resolve for all of our efforts and accomplishments. **Become a member and become part of our efforts to leave a legacy of healthy, vibrant rivers and the communities they support.**

As a member, you will have the satisfaction of knowing your donation is being put to work right here in the Delaware River watershed protecting local streams. You will receive email notices keeping you informed of breaking river protection news as well as opportunities to take action. You will also receive a special river keepsake, a 10% discount at our annual Native Plant Sale held the first weekend in May each year, and invitations to special members-only events.

As a citizen-supported and watershed-based organization, every membership has a profound impact on our ability to support our many successful programs. **Every member really does make a difference in ensuring that the voice of the River is heard.** Every dollar donated expands the number of threats to the River we are able to take on, so please join today. **By joining the Delaware Riverkeeper Network, you will be investing in a healthier future.**

Your membership strengthens us and ensures the voice of the Delaware River and its tributary streams is heard. To become part of the Delaware Riverkeeper Network, join online at [www.delawareriverkeeper.org](http://www.delawareriverkeeper.org) or by calling our office at 215-369-1188.

# Special Thanks Special Thanks

## Special Thanks to all who provided photos within the report

Elizabeth Azzolina  
Bristol Riverboat Queen  
Paul Carluccio  
Harold Deal  
Art Easton  
Mike Hogan  
Blaine Mengel Jr. and Chris Gorsuch  
Jon Nail  
Douglas Norton  
Dave Williams  
George Williams  
Richard Albert  
Ann Bidwell

## All Additional Photos provided by DRN Staff

Shannon Blankinship  
Elizabeth Koniers-Brown  
Tracy Carluccio  
Carole Glessner  
Emma Gutzler  
Fred Stine  
Maya van Rossum

## Contributing Authors

Maya K. van Rossum, the Delaware Riverkeeper  
Tracy Carluccio, Deputy Director, Delaware Riverkeeper Network  
Shannon Blankinship, Executive Assistant, Delaware Riverkeeper Network

## Technical Expertise & Editing

Richard Albert  
Mary Ellen Noble  
Chari Towne  
Faith Zerbe  
Stefanee Magill  
Fred Stine

## Sponsors of *The Value of a Clean and Healthy Delaware River*

Bucks County Riverboat and Trolley Company  
Delaware River Experience  
Kistlers Minuteman Press  
Zephyr Printing

# Cited Sources

- 
- <sup>1</sup> Albert, Richard C. "The Historical Context of Water Quality Management for the Delaware Estuary." *Estuaries* June 1988. Vol. 11, No. 2 p 99-107 citing (Webster et al 1914)
- <sup>2</sup> Ibid
- <sup>3</sup> Ibid
- <sup>4</sup> Ibid
- <sup>5</sup> Money. *Best Places to Live 2000*. Money Magazine: 2001.
- <sup>6</sup> EPA Office of Water. *EPA Liquid Assets 2000: America's Water Resources at a Turing Point*. US EPA, May 2000.
- <sup>7</sup> Bouchard, Roy, Kevin J. Boyle, Holly J. Michael. *How Water Quality Affects Property Prices: A Case study of Selected Maine Lakes*. Maine Agricultural and Forest Experiment Station. Misc Report 398. February 1996.
- <sup>8</sup> "The DePaul Grp.'s 242 unit condo extends program." NJPA Real Estate Journal. April 13-26 Vol.19 Issue 7
- <sup>9</sup> "Citizens Bank finances first housing development project along Wilmington, DE Riverfront: Townhouses will spur new housing and renaissance of city." *Citizens Bank Press*. 3 March 2004 <[www.citizensbank.com](http://www.citizensbank.com)> accessed 10 December 2006
- <sup>10</sup> DNREC and Brandywine Conservancy, *Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use*, September, 1997, pgs. 1-25
- <sup>11</sup> David Welsch, Forest Resources Management, USDA Forest Service, "Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources", NA-PR-07-91; NJAC 7:8 NJDEP Agency Proposal Document at NJAC 7:8-5.5(h) pg. 76
- <sup>12</sup> Kollin, Cheryl. "Designing with Nature and Showing the Benefits", *Land Development*, National Association of Home Builders, Winter, 1997.
- <sup>13</sup> Center for Watershed Protection, *Better Site Design: A Handbook for Changing Development Rules in Your Community*, August 1998 (citing two studies by Morales and Weyerhauser)
- <sup>14</sup> Lutzenhiser, M. and N.R. Netusil. "The Effect of Open Spaces on a Home's Sale Price" *Contemporary Economic Policy* 19.3 (2001): 291-298.
- <sup>15</sup> Ibid
- <sup>16</sup> Center for Watershed Protection, *Better Site Design: A Handbook for Changing Development Rules in Your Community*, August 1998, pg. 134
- <sup>17</sup> Ibid
- <sup>18</sup> US Dept of Labor: Occupational Safety and Health Administration. *Flood Cleanup Alert: How to Protect Yourself from Asbestos Hazards*, Bulletin 4. <[http://www.osha.gov/OshDoc/data\\_FloodFacts/Bulletin4.pdf](http://www.osha.gov/OshDoc/data_FloodFacts/Bulletin4.pdf)> accessed 20 June 2008
- <sup>19</sup> Ibid
- <sup>20</sup> Ibid
- <sup>21</sup> US Dept of Labor: Occupational Safety and Health Administration. *Flood Cleanup Alert: How to Protect Yourself from the Hazards of Lead Poisoning*, Bulletin 5. <[http://www.osha.gov/OshDoc/data\\_FloodFacts/Bulletin5.pdf](http://www.osha.gov/OshDoc/data_FloodFacts/Bulletin5.pdf)> accessed 20 June 2008
- <sup>22</sup> West Virginia Division of Homeland Security and Emergency Management. *Facts About Food and Floods* Disaster Resource. <[www.wvdhsem.gov](http://www.wvdhsem.gov)> accessed 9 June 2008
- <sup>23</sup> US Dept of Labor: Occupational Safety and Health Administration. *Flood Cleanup Alert: How to Protect Yourself from Fungal Disease*, Bulletin 3. <[http://www.osha.gov/OshDoc/data\\_FloodFacts/Bulletin3.pdf](http://www.osha.gov/OshDoc/data_FloodFacts/Bulletin3.pdf)> accessed 20 June 2008
- <sup>24</sup> Ibid
- <sup>25</sup> West Virginia Division of Homeland Security and Emergency Management. *Preventing Waterborne Illness*. Disaster Resource. [www.wvdhsem.gov](http://www.wvdhsem.gov) accessed 9 June 2008.
- <sup>26</sup> American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003 (The value attributed to these natural systems is based upon what it would have cost the region to construct basins and other solutions for intercepting the runoff.)
- <sup>27</sup> Ibid
- <sup>28</sup> Ibid
- <sup>29</sup> American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003.
- <sup>30</sup> Ibid (These are communities with separate stormwater sewer management systems.)
- <sup>31</sup> Ibid
- <sup>32</sup> Okmyung Bin & Stephen Polasky. 2003. "Effects of Flood Hazards on Property Values: Evidence Before and After Hurricane Floyd", August 2003.
- <sup>33</sup> Ibid
- <sup>34</sup> Ibid
- <sup>35</sup> Water, Science, and Technology Board, Board of Environmental Studies and Technology, "Riparian Areas: Functions and Strategies for Management" 2002 (citing Swanson, et al.)
- <sup>36</sup> J. Toby Tourbier, "Open Space Through Stormwater Management, Helping to Structure Growth on the Urban Fringe"
- <sup>37</sup> U.S. Department of Transportation Federal Highway Administration. Environment: Results of the FHWA Domestic Scan of Successful Wetland Mitigation Programs: Ohio.< <http://www.fhwa.dot.gov/environment/wetland/scanrpt/oh.htm>> accessed 23 June 2008
- <sup>38</sup> Union of Concerned Scientists, *New Jersey, Confront climate change in the U.S. Northeast*, 2007, a summary based on *Confronting Climate*

---

*Change in the U.S. Northeast: Science, Impacts and Solutions*, by the Northeast Climate Impacts Assessment, 2007.

<sup>39</sup> Ibid

<sup>40</sup> *The Economic Value of New Jersey State Parks and Forests*, NJDEP Division of Science, Research and Technology, June 2004 pg. 14

<sup>41</sup> Ibid

<sup>42</sup> Ibid

<sup>43</sup> Ibid

<sup>44</sup> Ibid

<sup>45</sup> Ibid

<sup>46</sup> Ibid

<sup>47</sup> New Jersey Department of Environmental Protection. Division of Science, Research, and Technology. *The Economic Value of New Jersey State Parks and Forests*. June 2004 pg. 15

<sup>48</sup> For more information go to: <<http://www.spiritofphiladelphia.com/ph/index.jsp>> 2007 rates quote

<sup>49</sup> For more information go to: <<http://www.libertybelle.com/>> 2007 rates used

<sup>50</sup> Ibid

<sup>51</sup> River Horse Brewery website. *About Us*. 2008 [http://www.riverhorse.com/about\\_us/index.html](http://www.riverhorse.com/about_us/index.html) accessed 6 August 2008

<sup>52</sup> Frenchtown.com. 2008. "Black Bass Inn Restaurant and Hotel Sold March 10, 2008." Frenchtown: A Collaborative Travel and Lifestyle Magazine. <<http://www.frenchtown.com/Black-Bass-Restaurant-and-Hotel-Sold-March-10-2008.html>> accessed 27 June 2008

<sup>53</sup> Ibid

<sup>54</sup> New Jersey Great Northwest Skylands. January 2008. "Bicycle Trails." <<http://www.njskylands.com/odbike.htm>> accessed 30 June 2008

<sup>55</sup> Chestnut Hill on the Delaware. Rob Castagna Phone Interview. July 2008.

<sup>56</sup> Bucks County Bed and Breakfast Association. "Restaurants." 2007. <[www.visitbucks.com/restaurant/](http://www.visitbucks.com/restaurant/)> accessed March 2007.

<sup>57</sup> Lambertville Station Inn. *Weddings*. 2007. <<http://www.lambertvillestation.com/>> accessed 5 June 2007.

<sup>58</sup> Cape May Grand Hotel. *Rates* 16 July 2007 <<http://www.grandhotelcapemay.com/rates/room1.htm>> accessed 10 August 2007

<sup>59</sup> Hyatt Corporation. 2007. *Reservations* <<http://pennslanding.hyatt.com/hyatt/reservations/flow6/propSelectedHotelRates.jsp>> accessed 10 August 2007

<sup>60</sup> Bridgeton House. 2007. *Lodging on the Delaware* <[bridgetonhouse.com/rates.htm](http://bridgetonhouse.com/rates.htm)> accessed 10 August 2007

<sup>61</sup> Penn's View Hotel. *Rates*. <[http://www.pennsviewhotel.com/hotel\\_accommodations/index.aspx](http://www.pennsviewhotel.com/hotel_accommodations/index.aspx)> accessed 26 July 2007

<sup>62</sup> Pawelko, K. E.B.; Drogin, A.R. Graefe; and D.P. Huden. 1995. "Examining the nature of river recreation visitors and their recreational experiences on the Delaware River." Pg. 46

<sup>63</sup> The Outdoor Industry Foundation. "The Active Outdoor Recreation Economy: A \$730 Billion Annual Contribution to the U.S. Economy." Fall 2006

<sup>64</sup> Ibid

<sup>65</sup> Ibid

<sup>66</sup> Ibid

<sup>67</sup> US Fish and Wildlife Service. "2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, National Overview." (Preliminary Findings) May 2007. Pg. 5

<sup>68</sup> Ibid

<sup>69</sup> Ibid

<sup>70</sup> Eubanks, Ted; Stoll, Paul Kerlinger. 2000 "Wildlife-associated Recreation on the New Jersey Delaware Bayshore, The Economic Impact of Tourism Based on the Horseshoe Crab-Shorebird Migration in New Jersey". 16 February 2000. Prepared for the New Jersey Department of Environmental Protection.

<sup>71</sup> Michigan State University. 2003. "Impacts of Visitor Spending on the Local Economy: Valley Forge National Historical Park, 2001." Prepared for National Park Service Social Science Program and Department of Parks, Recreation and Tourism Resources

<sup>72</sup> Pawelko, K. E.B. Drogin, A.R. Graefe, and D.P. Huden. 1995. "Examining the nature of river recreation visitors and their recreational experiences on the Delaware River." Pg. 45

<sup>73</sup> Pawelko, K. E.B. Drogin, A.R. Graefe, and D.P. Huden. 1995. "Examining the nature of river recreation visitors and their recreational experiences on the Delaware River." Pg. 46

<sup>74</sup> Ibid

<sup>75</sup> Ibid

<sup>76</sup> Ibid

<sup>77</sup> Ibid

<sup>78</sup> Schuylkill River National State & Heritage Area. "Philadelphia". <[www.schuylkillriver.org/philadelphia.aspx](http://www.schuylkillriver.org/philadelphia.aspx)> accessed 7 August 2007

<sup>79</sup> Ibid

<sup>80</sup> Living places by The Gombach Group. "Boathouse Row."

<[http://www.livingplaces.com/PA/Philadelphia\\_County/Philadelphia\\_City/Boathouse\\_Row.html](http://www.livingplaces.com/PA/Philadelphia_County/Philadelphia_City/Boathouse_Row.html)> accessed 29 July 2008

<sup>81</sup> Philadelphia Girls' Rowing Club. Club History. <<http://www.boathouserow.org/clubs/history.html>> accessed 29 July 2008

<sup>82</sup> Vesper Boat Club. "Vesper: A Brief History" <<http://www.vesperboatclub.org/AboutVesper.html>> accessed 29 July 2008

<sup>83</sup> Ibid

<sup>84</sup> Philadelphia Inquirer. Compiled By The Inquirer Staff. "U.S. Olympic rowing team has Philadelphia flavor"

<[http://www.philly.com/inquirer/sports/20080628\\_U\\_S\\_Olympic\\_rowing\\_team\\_has\\_Philadelphia\\_flavor.html](http://www.philly.com/inquirer/sports/20080628_U_S_Olympic_rowing_team_has_Philadelphia_flavor.html)> accessed 29 July 2008

<sup>85</sup> Schuylkill Navy. "Regattas" <<http://www.boathouserow.org/sked08.html>> accessed 29 July 2008

<sup>86</sup> Schuylkill Navy. "Independence Day Regatta" <<http://www.boathouserow.org/reg08/idr08.html>> accessed 29 July 2008

<sup>87</sup> Dad Vail Regatta. "News and Information" <<http://www.dadvail.org/?News>> accessed 29 July 2008

<sup>88</sup> Philadelphia Inquirer. Bill Iezzi, Inquirer Staff Writer. "Rowers off to fast start at Stotesbury"

<[http://www.philly.com/inquirer/home\\_top\\_left\\_story/7587402.html](http://www.philly.com/inquirer/home_top_left_story/7587402.html)> accessed 29 July 2008

<sup>89</sup> Living places by The Gombach Group. "Boathouse Row."

<[http://www.livingplaces.com/PA/Philadelphia\\_County/Philadelphia\\_City/Boathouse\\_Row.html](http://www.livingplaces.com/PA/Philadelphia_County/Philadelphia_City/Boathouse_Row.html)> accessed 29 July 2008

<sup>90</sup> Gophila.com, Official Visitor Site for Greater Philadelphia. "Rowing Adventures on Boathouse Row"

<[http://www.gophila.com/C/Your\\_Philadelphia/14/Family\\_friendly\\_Philadelphia/264/Family\\_friendly\\_Tours/286/U/Rowing\\_Adventures\\_on\\_Boathouse\\_Row/1951.html](http://www.gophila.com/C/Your_Philadelphia/14/Family_friendly_Philadelphia/264/Family_friendly_Tours/286/U/Rowing_Adventures_on_Boathouse_Row/1951.html)> accessed 29 July 2008

<sup>91</sup> American Whitewater. 2006. *River Stewardship Toolkit. "Paddlers Footprint: The Economic Impacts of River Recreation"* <[www.americanwhitewater.org](http://www.americanwhitewater.org)> accessed 16 June 2008 (summarizing data from Charles Simms 2002)

<sup>92</sup> Ibid

<sup>93</sup> Jones, Dave (Kittatinny Canoes). Telephone Interview. 14 November 2006

<sup>94</sup> Bucks County River Country. "Prices" <<http://www.rivercountry.net/index0.html>> accessed 31 July 2007

<sup>95</sup> Breen, Dan (Bucks County River Country). Telephone Interview. 21 February 2007

<sup>96</sup> Jones, Dave (Kittatinny Canoes). Telephone Interview. 14 November 2006.

<sup>97</sup> Canoe and Kayak club of New York. 2008 "Homepage". <<http://www.kccny.com/Default.aspx>> accessed 19 June 2008

<sup>98</sup> CanoeKayak.com. 2008 "Clubs" <<http://www.canoeKayak.com/paddlers-portal/clubs/>> accessed 19 June 2008

<sup>99</sup> Pennsylvania Department of Conservation and Natural Resources. Pennsylvania State Parks: Ralph Stover State Park.

<<http://www.dcnr.state.pa.us/stateparks/parks/ralphstover.aspx>> accessed 19 June 2008

<sup>100</sup> Greater Philadelphia Tourism and Marketing Corporation. 1998-2008. *Boundless Philadelphia: Lake Nockamixon Whitewater Release*. <[http://www.gophila.com/C/Countryside/382/Bucks\\_County/241/U/Lake\\_Nockamixon\\_Whitewater\\_Release/2134.html](http://www.gophila.com/C/Countryside/382/Bucks_County/241/U/Lake_Nockamixon_Whitewater_Release/2134.html)> accessed 19 June 2008

<sup>101</sup> Ibid

<sup>102</sup> Sportsman Connection. "Lake Info: Mongaup Falls Reservoir" <[http://www.sportsmansconnection.com/lakeinfo/11382-Mongaup\\_Falls\\_Reservoir/](http://www.sportsmansconnection.com/lakeinfo/11382-Mongaup_Falls_Reservoir/)> accessed 19 June 2008; Sportsman Connection. "Lake Info: Swinging Bridge Reservoir."

<[http://www.sportsmansconnection.com/lakeinfo/11425-Swinging\\_Bridge\\_Reservoir/](http://www.sportsmansconnection.com/lakeinfo/11425-Swinging_Bridge_Reservoir/)> accessed 19 June 2008

<sup>103</sup> Interactive GEO GuideBook Inc. 2007. "Swinging Bridge Reservoir: Description" <<http://www.activityguidebook.com/destination/3697>>

accessed 19 June 2008

<sup>104</sup> New York State Department of Environmental Conservation. 13 June 2008. Southeastern New York Fishing Hotline. Press Advisory.

<sup>105</sup> Eagle Institute. 2008. "Data Collection". <<http://www.eagleinstitute.org/datacollection/datacollection.php>> accessed 19 June 2008

<sup>106</sup> Wells Ferry. "Homepage" <<http://www.wellsferry.com/>> accessed 31 July 2007

<sup>107</sup> Gerenser, Robert. *Coryell's Ferry Boat Rides*. <<http://www.spiritof76.biz/ferry.html>> accessed 27 July 2007

<sup>108</sup> Laughlin, Jason. Courier-Post. "Burlco considers more riverboat tours". 30 July 2007

<sup>109</sup> Ibid

<sup>110</sup> Keller, David (Bucks County Riverboat Co.). Telephone Interview. 22 February 2007. 2007 Prices.

<sup>111</sup> Delaware River Steamboat Floating Classroom. <<http://steamboatclassroom.org/step2/>> accessed 19 June 2008

<sup>112</sup> SwimmingHoles.org. 2007. "Swimming Holes in NJ; Swimming Holes in PA; Swimming Holes in DE."

<<http://www.swimmingholes.org/nj.html>> accessed 19 June 2008

<sup>113</sup> Ibid

<sup>114</sup> Ibid

<sup>115</sup> Ibid

<sup>116</sup> New Jersey Department of Transportation. *D&R Canal Towpath Ride: A Tour Guide for Cyclists*. October 2002

<<http://www.state.nj.us/njcommuter/pdf/dr canal.pdf>> accessed 26 July 2007

<sup>117</sup> Pennsylvania State Parks. *Delaware Canal State Park*. <<http://www.dcnr.state.pa.us/stateparks/parks/delawarecanal.aspx>> accessed 31 July 2007

<sup>118</sup> Holmes, Kristen. Bucks County News In Brief: Bicycle Tour to Explore. Philadelphia Inquirer. 13 July 2008

<sup>119</sup> Delaware River Scenic Byway. *Delaware River Scenic Byway: Corridor Management Plan Update*. 2007

<[www.delawareriverscenicbyway.org/about.html](http://www.delawareriverscenicbyway.org/about.html)> accessed 28 March 2007

<sup>120</sup> Maharaj, Vishwanie, Joseph McGurrin and Janet Carpenter, *The Economic Impact of Trout Fishing on the Delaware River Tailwaters in New York*, Report prepared for American Sportfishing Association and Trout Unlimited, October 1998.

<sup>121</sup> Keller, David. *Delaware River Experience: Unique Educational Programs on the Delaware River*. 2006

22 February 2007 <<http://www.delawareriverexperience.org/DREPresentation.pdf>>

<sup>122</sup> Delaware River Basin Commission. *American Shad Fact Sheet*. 2007

<sup>123</sup> Ibid

<sup>124</sup> Forks of the Delaware Shad Fishing Tournament and Festival. 2007 <[http://shadtournament.com/Directions\\_Contacts.html](http://shadtournament.com/Directions_Contacts.html)> accessed June 2007

<sup>125</sup> Pineno, Ellen (Lambertville Chamber of Commerce). Shadfest Organizer. Telephone Interview. 18 September 2007

<sup>126</sup> The Shad Foundation. *Shad Journal*. Vol 1:1 Seattle, WA: November 1996

<sup>127</sup> Karas, Nick, "Brook Trout", Lyons Press, 1997, p.164.

<sup>128</sup> Maharaj, Vishwanie, Joseph McGurrin and Janet Carpenter, *The Economic Impact of Trout Fishing on the Delaware River Tailwaters in New York*, Report prepared for American Sportfishing Association and Trout Unlimited, October 1998.

<sup>129</sup> Ibid

<sup>130</sup> Ibid

<sup>131</sup> Ibid

<sup>132</sup> Ibid.

<sup>133</sup> Findley, Craig. Friends of the Upper Delaware River. "Adequate and Constant Releases - Equal's a Growing Economy." 8 April 2007

<sup>134</sup> Ibid

<sup>135</sup> Swegman, Ron P. 2005. Philadelphia on the Fly. Frank Amatto Publications: Portland, OR

<sup>136</sup> Ron p. Swegman blog. 2008. <<http://www.ronpswegman.com/>> accessed 6 August 2008

<sup>137</sup> PA Clean Water Campaign. *Who We Are*. 2007. 30 January 2007 <<http://www.pacleanwatercampaign.org>>

<sup>138</sup> Delaware Department of Fish and Wildlife. *License Statistics*. 2007. <<http://www.fw.delaware.gov/info/licensestats>> accessed 6 November 2006

<sup>139</sup> Pennsylvania Fish and Boat Commission. *Fishing Licenses*. 2007.

<[http://sites.state.pa.us/PA\\_Exec/Fish\\_Boat/images/admin/lars/fishlice\\_county2003.htm](http://sites.state.pa.us/PA_Exec/Fish_Boat/images/admin/lars/fishlice_county2003.htm)> accessed 6 November 2006

<sup>140</sup> New Jersey Department of Fish and Game. 6 November 2006 *Calendar Year License Sales: 2001-2005*

- 
- <sup>141</sup> New York Department of Environmental Conservation. 19 December 2006 *Fishing License Sales 2000-2005*. Excel Spreadsheet.
- <sup>142</sup> Delaware Riverkeeper Network. "Eating Fish from the Delaware River Watershed: Know Which Fish Are Safe To Eat And How To Prepare Them." Data compiled from each state's 2003 fish advisories.
- <sup>143</sup> Ibid
- <sup>144</sup> Ibid
- <sup>145</sup> National Park Service. Lower Delaware River National Wild and Scenic Study Report, Section II: Description of the Study Area Resources. 2006. <<http://www.nps.gov/phso/sp/finalsect2.pdf>> accessed 30 March 2007; Delaware River Basin Commission web site, <<http://www.state.nj.us/drbc/>>, accessed March 2008
- <sup>146</sup> US Fish and Wildlife Service. "2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, National Overview." (Preliminary Findings) May 2007 pg. 5
- <sup>147</sup> Ibid
- <sup>148</sup> New Jersey Department of Environmental Protection. Division of Science, Research, and Technology. *The Economic Value of New Jersey State Parks and Forests*. June 2004 pg. 13
- <sup>149</sup> The Outdoor Industry Foundation. "The Active Outdoor Recreation Economy: A \$730 Billion Annual Contribution to the U.S. Economy." Fall 2006.
- <sup>150</sup> Ibid
- <sup>151</sup> Ibid
- <sup>152</sup> Ibid
- <sup>153</sup> Outdoor Recreation Alliance. *The Economic Impacts of Wildlife-Related Recreation in New Jersey*. Fact Sheet. <<http://www.outdoorrecreationalliance.com/pdf/economicbenefits.pdf>> accessed 26 July 2007
- <sup>154</sup> Shafer, E.L. and Youngsoo Choi. *Nature-Based Tourism Policy*. Center for Rural Pennsylvania. Harrisburg, PA: November 2003
- <sup>155</sup> Hawk Mountain Sanctuary. *Annual Report 2005*. April 2007 <[www.hawkmountain.org](http://www.hawkmountain.org)> accessed June 2007
- <sup>156</sup> Ibid
- <sup>157</sup> Ibid
- <sup>158</sup> American Eagle Foundation. *Bald Eagle: The U.S.A.'s National Symbol*. 2007. <<http://www.eagles.org/moreabout.html>> accessed 5 June 2007
- <sup>159</sup> Ibid
- <sup>160</sup> DiGiorgio, Yoke. (Eagle Fest organizer) Telephone Interview. 11 December 2007
- <sup>161</sup> New Jersey Audubon Society. 2007. Welcome to Birding's Premier Event: World Series of Birding, 2007 <<http://www.njaudubon.org/WSB/>> accessed 2 August 2007
- <sup>162</sup> World Series of Birding, Raising Funds for Bird Conservation, <[www.birds.cornell.edu/wsb/what-is-wsb](http://www.birds.cornell.edu/wsb/what-is-wsb)> accessed 12 September 2007
- <sup>163</sup> New Jersey Audubon Society. 2007 "Cape May Bird Observatory: Recreational Birding" <<http://www.njaudubon.org/Centers/CMBO/RecBird.html>> accessed 2 August
- <sup>164</sup> Walls, Berkson & Smith. "The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study" Reviews in Fisheries Science, 2002
- <sup>165</sup> Ibid
- <sup>166</sup> Ibid
- <sup>167</sup> New Jersey Department of Environmental Protection, *Status of the Red Knot (Calidris canutus rufa) in the Western Hemisphere*. Trenton: New Jersey, 2007, pg. 139
- <sup>168</sup> Niles et. al., Status of the Red Knot (*Calidris canutus rufa*) in the Western Hemisphere, prepared for US Fish and Wildlife Service, May 2007.
- <sup>169</sup> Dey, Amanda D., Niles, L.J., H Sitters. Report on Delaware Bay Shorebird Project 2008; Chandra, David. Director of NJ Division of Fish and Wildlife. From letter dated 27 December 2007.
- <sup>170</sup> Eubanks, Ted; Stoll, Paul Kerlinger. 2000 "Wildlife-associated Recreation on the New Jersey Delaware Bayshore, The Economic Impact of Tourism Based on the Horseshoe Crab-Shorebird Migration in New Jersey". 16 February 2000. Prepared for the NJ Dept of Environmental Protection.
- <sup>171</sup> Walls, Berkson & Smith, The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study, Reviews in Fisheries Science, 2002.
- <sup>172</sup> Eubanks, Ted; Stoll, Paul Kerlinger. 2000 "Wildlife-associated Recreation on the New Jersey Delaware Bayshore, The Economic Impact of Tourism Based on the Horseshoe Crab-Shorebird Migration in New Jersey". 16 February 2000. Prepared for the NJ Dept of Environmental Protection.
- <sup>173</sup> Niles et. al., Status of the Red Knot (*Calidris canutus rufa*) in the Western Hemisphere, prepared for US Fish and Wildlife Service, May 2007
- <sup>174</sup> Niles, Larry Ph.D., Amanda Dey, Ph.D, NJ Division of Fish and Wildlife; Humphrey Sitters, Ph.D International Wader Study Group, United Kingdom; Clive Minton, Ph.D, Victoria Water Study Group, Australia. Report on the Status of Red Knots on the Delaware Bay with Recommendations for the 2005 Field Season.
- <sup>175</sup> Eubanks, Ted; Stoll, Paul Kerlinger. 2000 "Wildlife-associated Recreation on the New Jersey Delaware Bayshore, The Economic Impact of Tourism Based on the Horseshoe Crab-Shorebird Migration in New Jersey". 16 February 2000. Prepared for the NJ Dept of Environmental Protection.
- <sup>176</sup> Sargent, William. Crab Wars: A Tale of Horseshoe Crabs, Bioterrorism, and Human Health. Lebanon, NH: University Press of New England, 2002.
- <sup>177</sup> Ibid
- <sup>178</sup> Ibid
- <sup>179</sup> Walls, Berkson & Smith, The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study, Reviews in Fisheries Science, 2002
- <sup>180</sup> Sargent, William. Crab Wars: A Tale of Horseshoe Crabs, Bioterrorism, and Human Health. Lebanon, NH: University Press of New England, 2002
- <sup>181</sup> Walls, Berkson & Smith, The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study, Reviews in Fisheries Science, 2002
- <sup>182</sup> Nature PBS Special. 2008. Crash: A Tale of Two Species
- <sup>183</sup> Ibid

- <sup>184</sup> Manion, M., R. West and R. Unsworth. 2000. Economic assessment of the Atlantic coast horseshoe crab fishery. Prepared for the Division of Economics, U.S. Fish and Wildlife Service, Arlington, VA, by Industrial Economics, Inc., Cambridge, MA.
- <sup>185</sup> Bryson, Bill. *A Walk in the Woods: Rediscovering America on the Appalachian Trail*. Black Swan, 1998
- <sup>186</sup> National Park Service. National Park Guide: Geographic Search; PA, NY, NJ, DE. <<http://home.nps.gov/applications/parksearch/state.cfm?st=pa>> accessed 26 July 2007
- <sup>187</sup> New Jersey Department of Environmental Protection. 2004 “*The Economic Value of New Jersey State Parks and Forests*”. NJDEP Division of Science, Research and Technology. June 2004 pg. 12
- <sup>188</sup> Albert, Richard C. *Damming The Delaware: The Rise and Fall of Tocks Island Dam*. University Park, PA: Pennsylvania State University Press, 1987.
- <sup>189</sup> Ibid
- <sup>190</sup> National Park Service. *Lower Delaware River National Wild and Scenic Study Report, Section II: Description of the Study Area Resources*. 2006. <<http://www.nps.gov/phso/sp/finalsect2.pdf>> accessed 30 March 2007
- <sup>191</sup> Ibid
- <sup>192</sup> National Park Service. National Park Guide: Geographic Search; PA, NY, NJ, DE.
- <sup>193</sup> Guest Services, Inc. 2008 New Jersey’s Great Northwest Skylands: Delaware Water Gap National Recreation Area. <<http://www.njskylands.com/pkdwgnra.htm>> accessed 8 August 2008
- <sup>194</sup> Ibid
- <sup>195</sup> *DWGNRA designation National Recreation Trail*, Pocono News.Net, June 4, 2007
- <sup>196</sup> Ibid
- <sup>197</sup> Fish and Wildlife Service. *John Heinz National Wildlife Refuge at Tinicum: Conserving the Nature of America*. 2007. <<http://www.fws.gov/northeast/heinz/>> accessed 09 February 2006
- <sup>198</sup> Delaware Riverkeeper Network. “*Restoration Plan for the Lower Darby Creek with Recommendations to the John Heinz National Wildlife Refuge*”. Washington’s Crossing, PA: May 2006
- <sup>199</sup> Ibid
- <sup>200</sup> [www.fws.gov/northeast/capemay/abouttherefuge](http://www.fws.gov/northeast/capemay/abouttherefuge)
- <sup>201</sup> <http://northeast.fws/nj/spm.htm>
- <sup>202</sup> U.S. Fish and Wildlife Service. *Bombay Hook National Wildlife Refuge: Welcome*. <<http://www.fws.gov/northeast/bombayhook/>> accessed 26 July 2007
- <sup>203</sup> Ibid
- <sup>204</sup> Ibid
- <sup>205</sup> [www.primehook.fws.gov](http://www.primehook.fws.gov)
- <sup>206</sup> Delaware Department of Natural Resources and Environmental Control. 2003. “*DNREC NEWS: Pea Patch Island Heronry is Off Limits to Everyone but the Birds*”. 1 April 2003
- <sup>207</sup> The Nature Conservancy. 2008. “*Delaware Bayshore: The Epicenter of Horseshoe Crab Habitat*.” <<http://www.nature.org/wherework/northamerica/states/delaware/preserves/art10713.html>> accessed 20 June 2008
- <sup>208</sup>
- <sup>209</sup> Pennsylvania State Parks. *Delaware Canal State Park*. <<http://www.dcnr.state.pa.us/stateparks/parks/delawarecanal.aspx>> accessed 31 July 2007
- <sup>210</sup> Ibid
- <sup>211</sup> DCNR park attendance figures 1956 – 2006.
- <sup>212</sup> Delaware and Raritan Canal State Park. 2008. “*General Information*.” <[http://www.dandrcanal.com/gen\\_info.html](http://www.dandrcanal.com/gen_info.html)> accessed 20 June 2008
- <sup>213</sup> Delaware and Raritan Canal Commission. “*General Information*”. 2009. <[http://www.dandrcanal.com/gen\\_info.html](http://www.dandrcanal.com/gen_info.html)> accessed 13 May 09
- <sup>214</sup> Johnson, Kent. “*Family Hiking in Stokes State Forest*.” New Jersey Skylands website. <<http://www.njskylands.com/pkstokes2.htm>> accessed 31 July 2007
- <sup>215</sup> StateParks.com. Worthington State Forest. USA- New Jersey. <<http://www.stateparks.com/worthington.html>> accessed 31 July 2007
- <sup>216</sup> The Trust for Public Lands and Philadelphia Parks Alliance. June 2008. “*How Much Value Does the City of Philadelphia Receive from Its Park and Recreation System?*”
- <sup>217</sup> The Trust for Public Lands and Philadelphia Parks Alliance, 2009. “*Measuring The Economic Value of a City Park System*”
- <sup>218</sup> Fairmount Park. “*Welcome to Fairmount Park: Philadelphia’s Park System*.” <<http://www.fairmountpark.org/HistoryMain.asp>> accessed 6 August 2008
- <sup>219</sup> Ibid
- <sup>220</sup> Ibid
- <sup>221</sup> Explore PAHistory.com. 2003. Penn Treaty Park. <<http://www.explorepahistory.com/hmarker.php?markerId=41>> accessed 8 August 2008
- <sup>222</sup> Delaware Division of Natural Resources and Environmental Conservation: Parks and Recreation. “*Overview of Delaware State Parks*”. <<http://www.destateparks.com/places/overview.htm>> accessed 31 July 2007
- <sup>223</sup> Ibid
- <sup>224</sup> Ibid
- <sup>225</sup> Ibid
- <sup>226</sup> Email communication with DNREC, July 27, 2007 (Actual figure provided 1,123,900)
- <sup>227</sup> State Parks.com. “*Catskill State Park*”. <<http://www.stateparks.com/catskill.html>> accessed 20 June 2008
- <sup>228</sup> Ibid
- <sup>229</sup> Ibid
- <sup>230</sup> Ibid
- <sup>231</sup> Sylvania Tree Farm. 2005. *About Us and Campsites*. <<http://www.sylvaniatreefarm.com/aboutus.htm>>
- <sup>232</sup> Ibid
- <sup>233</sup> [www.dandrcanal.com/camping.html](http://www.dandrcanal.com/camping.html)

- <sup>234</sup> Dingmans Choice Outdoors. *Dingmans Campground: "Welcome to Dingman's Campground 2007 Season."* <<http://www.dingmancampground.com/>> accessed 2 August 2007
- <sup>235</sup> StateParks.com. Worthington State Forest. USA- New Jersey. <<http://www.stateparks.com/worthington.html>> accessed 31 July 2007
- <sup>236</sup> Lander's River Trips. 2007. "Lander's River Trips: 2007 Rates" <<http://www.landersrivertrips.com/rates.htm>> accessed 2 August 2007
- <sup>237</sup> Kittatinny Canoes. 2004. *Camping Rates*. <[http://www.kittatinny.com/pages/camping\\_rates.php](http://www.kittatinny.com/pages/camping_rates.php)> accessed 2 August 2007
- <sup>238</sup> Delaware Division of Natural Resources and Environmental Conservation: Parks and Recreation. "Cape Henlopen" <<http://www.destateparks.com/chsp/chsp.htm>> accessed 31 July 2007
- <sup>239</sup> Sylvania Tree Farm. 2005. *About Us and Campsites*. <<http://www.sylvaniatreefarm.com/aboutus.htm>>
- <sup>240</sup> Bucks County Conference and Visitors Bureau, Inc. 2007 *Visitors Guide*. Bucks County Pennsylvania: 2007
- <sup>241</sup> Solebury Township, Bucks County, PA. 2005-2008. "Solebury: A natural choice to live. Community Organizations" <<http://www.soleburytpwp.org/page.aspx?p=33>> accessed 18 June 2009
- <sup>242</sup> Ibid
- <sup>243</sup> Southern Delaware Tourism. "Welcome to Southern Delaware: Discover our Treasures". <<http://www.visitsoutherndelaware.com/outdoors.htm>> accessed 2 August 2007
- <sup>244</sup> Southern Delaware Outdoor Guide. Georgetown, DE: Southern Delaware Tourism, 2001.
- <sup>245</sup> Frenchtown Website. Travel and Lifestyle Guide to Hunterdon & Bucks County and Beyond. *Festivals*. 2006 <<http://www.frenchtown.com/frenchtown-nj/river-fest-2006.html>> accessed 4 June 2007
- <sup>246</sup> Press Release, River Fest Sept 1-3, Frenchtown, NJ, Aug 2, 2007.
- <sup>247</sup> Knowlton-Fest Website. 2007 <<http://www.knowlton-fest.com/>> accessed 04 June 2007
- <sup>248</sup> Peters Valley Craft Center. 2008. "Peters Valley: About Us." <<http://www.petersvalley.org/about.htm>> accessed 20 June 2008
- <sup>249</sup> Ibid
- <sup>250</sup> Ibid
- <sup>251</sup> River Front Ramble website. "Home, Map, Activities" <<http://www.riverfrontramble.org/index.html>> accessed 28 July 2008
- <sup>252</sup> Mahon, Ed. *Riverfront Ramble expands to a two-day extravaganza*. Philadelphia Inquirer. August 12, 2007
- <sup>253</sup> For more information, go to [www.philacano.org](http://www.philacano.org)
- <sup>254</sup> For more information, go to [www.philadragonboatfestival.com](http://www.philadragonboatfestival.com)
- <sup>255</sup> Cumberland County. "Cumberland County Ecotourism Plan: A Vision & implementation Strategy For Economic Development & Conservation". February 1996
- <sup>256</sup> Klapproth, Julia C. and James E. Johnson. *Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners*. 2001. Virginia Cooperative Extension. Blacksburg, VA: pg. 6 (citing EPA 1995)
- <sup>257</sup> *Delaware Bay and Estuary Assessment Report*, DNREC and EPA, August 2005.
- <sup>258</sup> Scholl, Dennis. 1997. *History of Shad in the Lehigh River*. <<http://mgfx.com/fishing/assocs/drsfa/history.htm>> accessed 31 July 2008
- <sup>259</sup> Ibid
- <sup>260</sup> Delaware River Basin Commission. *American Shad Fact Sheet*. 2007
- <sup>261</sup> NOAA/National Marine Fisheries Service, Northeast Region, Press Release: *Commercial Fisheries and Mariculture Revenues for Northeast Coastal States Hit \$957 million in 1998*; July 8, 1999
- <sup>262</sup> Sciascia, Jim. "Trout Fishing in New Jersey- The Good 'Ole Days are Now." *New Jersey Outdoors*, Spring 2001
- <sup>263</sup> Beal, Robert. 2000. Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Atlantic Striped Bass (*Morone saxatilis*). 21 November 2000
- <sup>264</sup> The Shad Foundation. *Shad Journal*. Vol 1:1 Seattle, WA: November 1996
- <sup>265</sup> Ibid
- <sup>266</sup> Ibid
- <sup>267</sup> Ibid
- <sup>268</sup> Ibid
- <sup>269</sup> Ibid
- <sup>270</sup> The Shad Foundation. *Shad Journal*. Vol 1:1 Seattle, WA: November 1996
- <sup>271</sup> Army Corps of Engineers Philadelphia District. 2006 Delaware Bay Oyster Restoration Project: Delaware and New Jersey. Final Environmental Impact Statement. April 2006.
- <sup>272</sup> Ibid
- <sup>273</sup> News from The Delaware Department of Natural Resources and Environmental Control Vol. 39, No. 402, Oct. 8, 2009.
- <sup>274</sup> Moore, Kirk. "Delaware Bay Oysters Thrive on Clam Shells" Home News Tribune. 29 January 2006
- <sup>275</sup> Bauers, Sandy. "Clams Give Jersey Oysters a Leg Up." Philadelphia Inquirer. 29 January 2007
- <sup>276</sup> News from The Delaware Department of Natural Resources and Environmental Control Vol. 39, No. 402, Oct. 8, 2009.
- <sup>277</sup> Crab Connection. Personal Communication. July 2008
- <sup>278</sup> Laini's little pocket guide to Easton PA. Launch Party Invitation. July 16, 2007.
- <sup>279</sup> Philadelphia Italian Market website. <<http://www.phillyitalianmarket.com/market/9thstreet.htm>> 5 June 2007
- <sup>280</sup> Reading Terminal Market. *Welcome to the Reading Terminal Market*. January 2007 <[http://www.readingterminalmarket.org/pdf/RTM\\_dir\\_2007.pdf](http://www.readingterminalmarket.org/pdf/RTM_dir_2007.pdf)> accessed 5 June 2007
- <sup>281</sup> Bucks County Open Space Task Force. *Report of the Bucks County Open Space Task Force*. 20 June 2007 pg. 3
- <sup>282</sup> Ibid
- <sup>283</sup> Delaware River Basin Commission. *Surface Water Intakes Spreadsheet*. February 2007
- <sup>284</sup> Hood, James R. "Second Company Named in Contaminated Spinach Outbreak: Consumers warned to Avoid All Fresh Spinach." *ConsumerAffairs.com*. 19 September 2006
- <sup>285</sup> Klapproth, Julia C. and James E. Johnson. *Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners*. 2001. Virginia Cooperative Extension. Blacksburg,

- VA: pg. 6 (citing Veenhuizen and Shurson 1992)
- <sup>286</sup> Klapproth, Julia C. and James E. Johnson. Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners. 2001. Virginia Cooperative Extension. Blacksburg, VA: pg. 6 (citing Johnson 1994 and Overcash 1983)
- <sup>287</sup> U.S. EPA. Private Drinking Water Wells: Human Health. <<http://www.epa.gov/safewater/privatewells/health.html>> accessed 20 June 2008
- <sup>288</sup> City of Philadelphia. 2006. City of Philadelphia website <[www.phila.gov](http://www.phila.gov)> accessed 4 January 2008
- <sup>289</sup> US Waterborne Outbreaks 2003-2004, *Hresidენტealth Stream* the Public Health Newsletter of the Cooperative Research Center for Water Quality and Treatment, March 2007.
- <sup>290</sup> Mendoza, Martha. "Pharmawater-Secrecy, Water provides, researchers rarely release full test results". Metrowest Daily News. 11 March 2008
- <sup>291</sup> House, Khara. "Cotinine, Other Prescription Drugs, Found in U.S. Drinking Water". AC Associated Content, March 10, 2008
- <sup>292</sup> Barbier, Edward B. and Geoffrey M. Heal. "Valuing Ecosystem Services". The Berkeley Electronic Press, February 2006
- <sup>293</sup> Natural Resource Council: Committee on Assessing and Valuing the Services of Aquatic and related Terrestrial Ecosystems. 2004 Valuing Ecosystem Services: Toward Better Environmental Decision-making, The National Academies Press. pg. 157
- <sup>294</sup> Barbier, Edward B. and Geoffrey M. Heal. "Valuing Ecosystem Services". The Berkeley Electronic Press, February 2006. NY Department of Conservation land purchases have been of undeveloped land from willing sellers, as opposed to condemnation or eminent domain acquisition. Valuing Ecosystem Services, Toward Better Environmental Decision-making, National Research Academy, The National Academies Press, [www.nap.edu](http://www.nap.edu) (2004), p. 157.
- <sup>295</sup> Natural Resource Council: Committee on Assessing and Valuing the Services of Aquatic and related Terrestrial Ecosystems. 2004 Valuing Ecosystem Services: Toward Better Environmental Decision-making, The National Academies Press. pg. 158
- <sup>296</sup> DePalma, Anthony. "New York City Water Rates Expected to Rise 11.5 Percent." *New York Times*. 11 April 2007
- <sup>297</sup> New Jersey Department of Environmental Protection. Division of Science, Research, and Technology. 2004 "*The Economic Value of New Jersey State Parks and Forests*". June 2004
- <sup>298</sup> Klapproth, Julia C. and James E. Johnson. Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners. 2001. Virginia Cooperative Extension. Blacksburg, VA: Pg. 4 (citing Welsch 1991)
- <sup>299</sup> Klapproth, Julia C. and James E. Johnson. Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners. 2001. Virginia Cooperative Extension. Blacksburg, VA: Pg. 4 (citing Palone and Todd 1997)
- <sup>300</sup> Dale, Frank. Delaware Diary: Episodes in the Life of a River. New Brunswick, NJ: Rutgers University Press, 1996
- <sup>301</sup> Ibid
- <sup>302</sup> Delaware River Basin Commission. Surface Water Intakes Spreadsheet. February 2007
- <sup>303</sup> Ibid
- <sup>304</sup> "State's largest utility shut down nuclear plant." *Associated Press* 25 April 2007
- <sup>305</sup> Yahoo Finance. *Exelon Corp (PSEG): Direct Competitor Comparison*. <<http://finance.yahoo.com/q/co?s=PSEG>> accessed 5 July 2007
- <sup>306</sup> Delaware River Basin Commission. Surface Water Intakes Spreadsheet. February 2007
- <sup>307</sup> Yahoo Finance. *Exelon Corp (EXC): Direct Competitor Comparison*. <<http://finance.yahoo.com/q/co?s=EXC>> accessed 5 July 2007
- <sup>308</sup> Delaware River Basin Commission. Surface Water Intakes Spreadsheet. February 2007
- <sup>309</sup> Ibid
- <sup>310</sup> Ibid
- <sup>311</sup> <http://www.epa.gov/cgi-bin/broker?>
- <sup>312</sup> Dow Chemical. Dow News Center. 2006. <[www.news.dow.com/corporate/2006/200607250.htm](http://www.news.dow.com/corporate/2006/200607250.htm)> accessed 20 June 2008
- <sup>313</sup> Klapproth, Julia C. and James E. Johnson. Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowners. 2001. Virginia Cooperative Extension. Blacksburg, VA: Pg. 10 (citing Ribaldo 1986)
- <sup>314</sup> Hopey, Don. 17 November 2008 "*Monongahela River Solids and a Threat to Machinery but not Health*". Pittsburgh Post-Gazette. Pittsburgh: PA. <<http://www.ceoe.udel.edu/oilspill/shipping.html>>
- <sup>315</sup> Ibid
- <sup>316</sup> <http://www.drpa.org/projects/green.html>
- <sup>317</sup> Andrew Murr. PROJECT GREEN, Shipping News, "The 'greening' of America's two biggest ports", Newsweek Web Exclusive, Sep 9, 2008, <http://www.newsweek.com/id/158126>
- <sup>318</sup> <http://www.ceoe.udel.edu/oilspill/shipping.html>
- <sup>319</sup> Delaware River Basin Commission. Delaware River Basin Facts. <<http://www.state.nj.us/drbc/thedrb.htm>> accessed 30 November 2006
- <sup>320</sup> Maritime Commerce in Greater Philadelphia, Assessing Industry Trends and Growth Opportunities for Delaware River Ports, July 2008 p.3
- <sup>321</sup> Ibid
- <sup>322</sup> Delaware River Basin Commission. Delaware River Basin Facts. <<http://www.state.nj.us/drbc/thedrb.htm>>
- <sup>323</sup> 30 November 2006
- <sup>324</sup> Pappas, Leslie A. "Study: Growth coming if ports plan for it." *The News Journal*. 23 March 2007
- <sup>325</sup> For more detailed information see: Delaware Riverkeeper Network & National Wildlife Federation, Delaware River Deepening Dumped Again, March 2007; Delaware Riverkeeper Network & National Wildlife Federation, Strike Three ... The Corps Fails Again to Justify the Delaware River Deepening, July, 2003
- <sup>326</sup> Albert, Richard C. "The Historical Context of Water Quality Management for the Delaware Estuary." *Estuaries* June 1988. Vol 11, No. 2 pg 99-107
- <sup>327</sup> Coast Guard <[www.house.gov/transportation/cgmt/01-18-05/01-18-05memo.html](http://www.house.gov/transportation/cgmt/01-18-05/01-18-05memo.html)>
- <sup>328</sup> <http://www.drpa.org/projects/green.html>
- <sup>329</sup> Andrew Murr, PROJECT GREEN, Shipping News, "The 'greening' of America's two biggest ports", Newsweek Web Exclusive, Sep 9, 2008, <http://www.newsweek.com/id/158126>

- 
- <sup>330</sup> Lenape Lifeways. 2002. "Who were the Lenapes?" <<http://www.lenapelifeways.org/lenape1.htm#lenapes>> accessed 3 August 2007
- <sup>331</sup> Dale, Frank. *Delaware Diary: Episodes in the Life of a River*. New Brunswick, NJ: Rutgers University Press, 1996.
- <sup>332</sup> American University. Department of Anthropology. " *Shawnee Minisink: New Dates on the Paleoindian Component*" <[http://www.american.edu/cas/anthro/shawnee\\_minisink\\_2.html](http://www.american.edu/cas/anthro/shawnee_minisink_2.html)> accessed 2 August 2007
- <sup>333</sup> Albert, Richard C. *Damming The Delaware: The Rise and Fall of Tocks Island Dam*. University Park, PA: Pennsylvania State University Press, 1987.
- <sup>334</sup> Ibid
- <sup>335</sup> Ibid
- <sup>336</sup> Delaware River Basin Commission. *Pea Patch Island Fact Sheet*. 2007
- <sup>337</sup> American University. The Department of Anthropology. " *Shawnee Minisink: New Dates on the Paleoindian Component*" <[http://www.american.edu/cas/anthro/shawnee\\_minisink\\_2.html](http://www.american.edu/cas/anthro/shawnee_minisink_2.html)> accessed 2 August 2007
- <sup>338</sup> National Park Service. 2007. " *Valley Forge: History and Culture*". <<http://www.nps.gov/vafo/historyculture/index.htm>> accessed 2 August 2007
- <sup>339</sup> Pennsylvania Historical and Museum Commission. U.S. History.org. *Washington Crossing Historic Park*. <<http://www.ushistory.org/washingtoncrossing/>> accessed 31 July 2007
- <sup>340</sup> Pennsylvania Historical and Museum Commission. U.S. History.org. *Washington Crossing Historic Park: Timeline* <<http://www.ushistory.org/washingtoncrossing/history/timeline.htm> > accessed 2 August 2007
- <sup>341</sup> Delaware River Basin Commission. *Pea Patch Island Fact Sheet 2007*
- <sup>342</sup> National Park Service. 2006. *Upper Delaware Scenic and Recreational River: Zane Grey*. <<http://www.nps.gov/upde/historyculture/zanegrey.htm>> accessed 31 July 2008
- <sup>343</sup> Ibid
- <sup>344</sup> Ibid
- <sup>345</sup> National Park Service. 2006. Upper Delaware Scenic and Recreational River. Roebling's Delaware Aqueduct. <<http://www.nps.gov/upde/historyculture/roebingbridge.htm>> accessed 31 July 2008
- <sup>346</sup> Ibid
- <sup>347</sup> Ibid
- <sup>348</sup> Ibid
- <sup>349</sup> R. Bruins & M. Heberling, *Economics and Ecological Risk Assessment, Applications to Watershed Management*, Chapter 15, p. 415
- <sup>350</sup> R. Bruins & M. Heberling, *Economics and Ecological Risk Assessment, Applications to Watershed Management*, Chapter 15, p.