

FINAL DRAFT

Conserving Fish and Wildlife Now and For the Future
Strategic Habitat Conservation Plan

FY2011-2013

Chesapeake Bay Field Office
Annapolis, Maryland

Chesapeake Bay Field Office

Our Vision

The Chesapeake Bay Field Office strives to efficiently conserve and restore priority fish and wildlife species and their habitats for the American people.

Our Mission

The Chesapeake Bay Field Office works to meet the mission of the U.S. Fish and Wildlife Service (FWS) through professional staff with diverse expertise, and to support National, regional, and Chesapeake Bay watershed conservation and restoration needs.

Core Principles

We continuously improve our ability to efficiently work across programs, establish strong and long-lasting partnerships, leverage funds and other resources, and use strategic, science-driven landscape level knowledge base and expertise to meet the Service priorities:

- Protect, restore, and manage migratory bird populations;
- Recover and prevent the extinction of threatened and endangered species;
- Protect, restore, and enhance the Nation's fish and aquatic communities
- Work with other partners to conserve trust species and their habitats;
- Conserve the lands and resources within the National Wildlife Refuge System; and
- Ensure the future of conservation by connecting people with nature.

The Chesapeake Bay Field Office's organizational structure reflects our goal of meeting these priorities. The Chesapeake Bay Field Office currently has 34 staff that includes both the traditional Ecological Services as well as the Chesapeake Bay Coastal Program. The Chesapeake Bay Field Office is comprised of three divisions:

Division of Strategic Resource Conservation

By using the Service's regulatory tools and authorities, the Division of Strategic Resource Conservation works on a cross programmatic way to develop conservation plans for species/habitat types based on biological outcomes, objectives; and incorporates landscape level analysis using Geographic Information Systems (GIS) to conserve, protect and recover priority species and their habitats.

Division of Habitat Restoration

Based on the strategic planning documents developed by the CBFO the Division of Habitat Restoration works with other programs and partners to implement habitat restoration actions for priority species; conducts monitoring and research to evaluate those actions; and provides leadership and training on habitat assessment and restoration techniques with the goal of influencing other resource management agencies and partners responsible for developing and implementing natural resource policies.

Division of Habitat Conservation

Based on the strategic planning documents developed by the CBFO the Division of Habitat Conservation works with other programs and partners to strategically implement land

conservation actions for priority species and their habitats; provides technical expertise on local, regional and national issues affecting federal trust species and their habitats; and conducts assessments and research on contaminant related issues affecting these trust species.

The Chesapeake Bay

The Chesapeake Bay is the largest estuary in the United States. The watershed encompasses 64,000 square miles and parts of six states – Maryland, Virginia, Delaware, District of Columbia, Pennsylvania, New York, and West Virginia. The watershed is home to over 16.6 million people, and restoration efforts that began 20 years ago to improve Bay conditions are being hampered by the effects of development associated with a growing population. The environmental and economic vitality of the watershed is dependent upon the ecological health of the Bay, including the important aquatic, wetland, and forest habitats that support migratory birds, interjurisdictional fisheries, threatened, and endangered species, and many recreational and commercially important species. Conserving these resources is key to meeting the Service mission.

Responsibilities

The Chesapeake Bay Field Office is actively involved in conservation and restoration activities in the Chesapeake Bay watershed with most of these activities occurring in Maryland, Delaware, and the District of Columbia. However, our close proximity to the Environmental Protection Agency's (EPA) Chesapeake Bay Program involves us taking a lead role in dealing with watershed wide issues. We have been actively engaged in the Environmental Protection Agency's (EPA) Chesapeake Bay Program since its inception in 1983. Over the years we have provided leadership on fish passage, oysters, stream restoration, toxics, invasive species, wetlands, and SAV. Most recently, we are providing leadership on the Habitat Goal Implementation Team, and have provided substantial input to develop a renewed federal strategy for restoring the Chesapeake Bay as part of the Chesapeake Bay Executive Order that President Obama signed in May 2009. We will be responsible for implementing many of the actions identified in the Habitat and Living Resource 202(g) report.

Challenges We Face

The Chesapeake Bay Field Office is responsible for the conservation of trust species over a large geographic area. Nutrient and sediment pollution, environmental contaminants, air pollution, overharvest, climate change, and invasive species are the main stressors of living resources in the Chesapeake Bay watershed. Continuous population growth and development in the watershed result in the adverse modification or destruction of waterways, forests, and wetlands that our trust resources depend upon. Additionally, we are dealing with large scale renewable energy projects, some which are newer technologies in which trust species impacts are not always known. Due to these factors, and limited staff and resources, it is important that we prioritize species and habitats, to better determine where our restoration, conservation and policy efforts should be focused. We are committed to work at a landscape level scale based on clearly defined biological based outcomes. Further, it is important that we have strong support for research and monitoring for priority species to effectively implement Strategic Habitat Conservation (SHC). It is also important that we have the science support to determine potential effects of emerging energy technologies such as land based and offshore wind power, Marcellus shale, and oil and

gas drilling so that we can proactively determine conservation measures that can be implemented to minimize potential adverse affects.

Strategic Planning Process

Focal geographic areas were chosen based on key species of concern, stakeholder needs, Chesapeake Bay Program goals and actions identified in the 202 reports, and grant and leveraging opportunities.

The following is the strategic planning process developed by CBFO to identify focus areas:

1. Identify the geographic areas of responsibility.
2. Develop refined focus area maps based on various combinations of objectives and screening criteria
3. Identify potential project areas from the refined focus area maps
4. Use the strategic plan to develop a draft FY 2011 Workplan and priorities over the next 1-3 years using the Strategic Habitat Conservation (SHC) model.

Focus Area Identification

The Chesapeake Bay Field Office first used the presence of Service priorities (i.e., endangered species, refuges, migratory birds, and fisheries) to identify potential focal areas. We then evaluated other important factors and realities to refine these focal areas. These included, but were not limited to: stakeholder priorities; State Comprehensive Plans; Chesapeake Bay Program goals; funding availability, applicability, and affordability; resource needs, threats, current condition, and opportunities; contribution to the health of downstream priority trust species and priority habitats; and cross-programmatic opportunities. Based on all of this information, the Chesapeake Bay Field Office identified 17 focus areas, mostly within the states of Maryland and Delaware.

Priority Species Action Plans

Priority species also were identified for each focus area utilizing a variety of criteria including wildlife species which: are federally-listed as threatened and endangered species; require a high level of conservation effort; represent a broader group of species sharing similar conservation needs; have been identified As an important species in relation to the Chesapeake Bay Protection and Restoration Executive Order (EO 13508); or have the potential to promote long term landscape scale management with partners.

To conserve or restore these priority species to healthy and sustainable levels, a Species Action Plan was developed for each of the selected wildlife species. Each Species Action Plan contains:

- Biological Planning: identifies clear goals and objectives and the necessary information needed to achieve them
- Conservation Design: brings together the results of biological planning into an on the ground strategy for achieving the objectives
- Conservation Delivery: implements on-the-ground actions guided by biological foundations
- Monitoring: evaluates the assumptions, response of habitats and populations to conservation actions and progress towards conservation objectives
- Outreach: identifies and targets audiences, messages and products to promote and report conservation needs and goals.

Innovative Solutions: *the most important species we work for are people!*

While the Chesapeake Bay Field office works under an array of statutory authorities and programs to meet its mandates to conserve fish, wildlife and their habitats, we realize that the most important species we work for are people. People value and conserve what they care about and they care about what they have directly experienced. To ensure the future of conservation, Chesapeake Bay Field Office uses a variety of tools to increase opportunities for Americans to connect directly with nature.

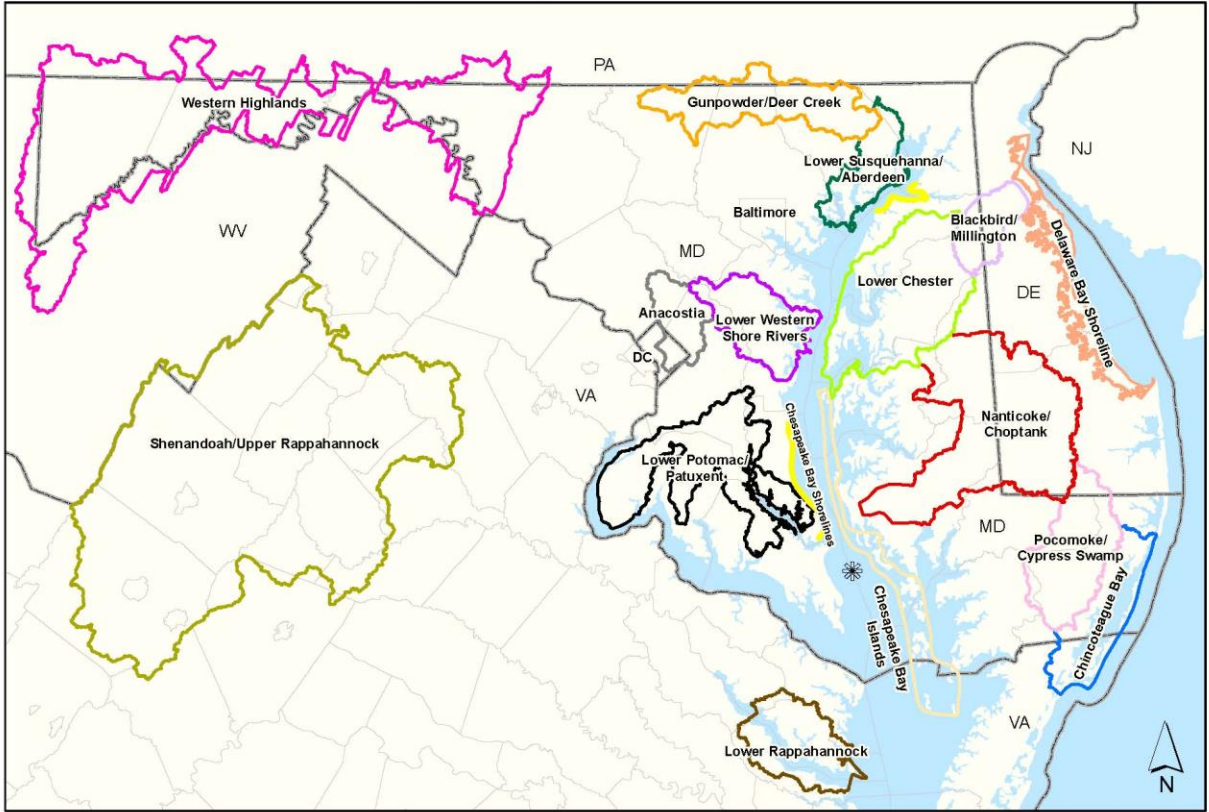
Our approach is to engage willing partners, through non-regulatory incentives, to conserve and protect valuable fish and wildlife habitat on their property and in their communities. We do this by sharing expertise, offering technical assistance, and identifying funding opportunities for citizens, private landowners, farmers, businesses and corporations to conserve wetlands, streams and rivers, marshes and estuaries, and upland grasslands and forests.

By working with schools, landowners, land trusts, watershed associations, conservation organizations, and local, state, and federal agencies we can leverage funds to make on-the-ground conservation affordable, feasible, and effective in the Chesapeake Bay watershed and in Mid-Atlantic region.

We work with schools and school systems to create, maintain and study native wildlife habitat on school grounds. These schoolyard projects not only improve the wildlife habitat they also provide students and the larger community the opportunity to observe and connect with nature every day. By promoting the use of native plants for landscaping, homeowners become active stewards for the environmental health of their own community, nearby waterways and local wildlife.

Reaching out and establishing trusting relationships with partners fosters a shared sense of stewardship necessary for successful collaboration. These voluntary and innovative approaches are critical to the managing fish and wildlife resources now and for the future.

Chesapeake Bay Field Office Focus Areas



Map Created February 2011

* Eastern oyster focus area not mapped - see focus area description



Anacostia Watershed Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata*), bald eagle (*Haliaeetus leucocephalus*), blueback herring (*Alosa aestivalis*), Kentucky warbler (*Oporornis formosus*), prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Anacostia River watershed, home to over 860,000 people, covers approximately 176 square miles, extends into two physiographic provinces, and contains free-flowing and freshwater tidal segments. It consists of three major drainage areas: the Northwest Branch, the Northeast Branch, and the tidal drainage; and 14 primary subwatersheds. Residential development is the single largest land use, comprising more than 43 percent of the watershed and impervious surface representing 23 percent of the watershed.

Forested areas represent 30 percent of the watershed. Deciduous stands constitute the largest type of forest by area, followed by mixed stands, regenerating scrub/shrub, and coniferous forest. Within the Anacostia watershed, 62 percent of the stream length is buffered by a riparian forest that is at least 35 feet wide.

Wetlands represent three percent of the watershed. Palustrine wetlands make up more than three-quarters of the total wetlands, with the remainder as riverine (20 percent) and lacustrine (4 percent) of the watershed. Most wetlands are located in the Coastal Plain.

Eighty percent of the land in this focus area is in private ownership. The remaining 20% is a combination of local, state and federal ownership. A significant portion of the public lands are linear, forested parks that follow the stream network. Some large to moderate sized terrestrial and wetland habitats are located adjacent to stream systems and are scattered throughout the watershed.

Benefits to Trust Resources: Forest wetland species that will benefit from targeted habitat protection and restoration include the Kentucky warbler, Acadian flycatcher, willow flycatcher, American woodcock, and prothonotary warbler. Other neotropical migratory and forest interior dwelling birds that will benefit include the wood thrush, red-eyed vireo, northern parula, and yellow warbler. Cooper's hawk, red-shouldered hawk, and barred owl are found here. Great blue heron, green heron, wood duck, marsh wren, and mallard are found in wetland areas.

The federally-listed endangered shortnose sturgeon, moves past the mouth of the Anacostia towards spawning grounds in the Potomac River. Bald eagles are also known to occur in the watershed. The watershed historically provided important spawning and nursery habitat for alewife, American eel, American shad, Atlantic sturgeon, striped bass, and blueback herring, all identified as fish species of conservation concern in the Northeast Region. Kenk's amphipod, listed as rare in the upper portion of the watershed.

Conservation Objectives:

- Restore riparian corridors
- Restore stream habitat to improve water quality
- Address toxic chemical issues

- Improve aquatic habitat
- Reduce sediment, nutrient, and trash loads
- Facilitate fish passage through the removal of barriers
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: The Anacostia River has been identified by American Rivers as one of the 10 most contaminated rivers in the country and also one of three areas of concern identified by the Chesapeake Bay Program.

The state of Maryland and District of Columbia have listed the Anacostia River as not meeting water quality standards according to section 303 (d) of the Federal Clean Water Act, and thus is considered impaired. The listings include toxic chemicals (both organics and metals), fecal coliform bacteria, suspended sediments, nutrients including nitrogen and phosphorous, biochemical oxygen demand, and trash. Two of the key contaminant stressors are polychlorinated biphenyls (PCBs) in fish tissue resulting in advisories to avoid bottom feeding fish, and polynuclear aromatic hydrocarbons (PAHs) which are responsible in part for the high prevalence of liver and skin tumors in brown bullhead. Raw sewage continues to enter the river through leaking sanitary pipes in the upper watershed and combined sewer overflows in the tidal area. Current and planned efforts by the Washington Suburban Sanitation Commission and District of Columbia Water and Sewer Authority (DCWASA), including the Long-Term Control Plan will drastically reduce the input of raw sewage.

The river's decline began as settlers cleared fields for agriculture (leading to heavy erosion and sedimentation). Urbanization claimed forest and wetland habitat, altered stream flows, and fed ever-increasing flows of sewage and polluted runoff into the Anacostia. More than 4,000 acres of nontidal wetlands and 2,500 acres of tidal wetlands have been lost in the past five decades. There has been an eight percent decline in forest cover between 1936 and 2000. Nearly 38 percent of the stream miles have little to no riparian buffers. Large amounts of pollutants (i.e. sediment, excess nutrients, toxic chemicals, and trash/debris) enter streams as a result of uncontrolled stormwater runoff from impervious surfaces, as well as combined sewer and stormwater overflows.

Current climate models predict a 2 to 6 °C increase in annual mean temperature in the mid-Atlantic by 2010. This would result in the advancement of spring fish spawning and could lead to a mismatch between the timing of phytoplankton availability and fish larvae. The current climate models also predict an increased volume and intensity of precipitation in the winter and spring in the mid-Atlantic. This will lead to increased stream flow resulting in greater stream bank erosion and higher sediment and nutrient loading into the tidal river. Increased turbidity and nutrient loading may lead to a decrease in submerged aquatic vegetation (SAV) and an increase of anoxia, a result of this loading, would threaten benthic resources, which are the base of the food chain for fish and piscivorous wildlife. The number of short, medium, and long-term droughts is expected to increase in the northeast U.S. This would increase the susceptibility of forests within the watershed to disease and insect damage.

These severe impacts have resulted in large-scale, collaborative, multi-agency restoration initiatives. The District of Columbia, the State of Maryland, Montgomery and Prince George's counties, Maryland, the U.S. Army Corps of Engineers (COE), Environmental Protection Agency and National Park Service jointly signed the Anacostia Watershed Restoration Agreement agreeing to restore stream and wetland habitats within the Anacostia. The Anacostia Watershed Toxics Alliance was formed to address the problem of toxic sediments in the tidal Anacostia River. In 2006, the Anacostia Watershed Restoration Partnership was formed, including federal agencies and local, state, and regional government, local industry and environmental groups.

In 2010 The U.S. Army Corps of Engineers, in concert with local, state, and federal agencies, completed the Anacostia River Watershed Restoration Plan and Report to direct future restoration efforts as well as to assist the Anacostia Watershed Restoration partnership achieve its six restoration goals: dramatically reduce pollutant loads; protect and restore ecological integrity; improve fish passage; increase wetland acreage; expand forest cover; and increase public and private participation.

The Chesapeake Bay Field Office has been an active member and will continue as an active member in the multi-agency initiatives to address toxic contaminants through sediment remediation and source control and restore stream habitat to reduce erosion, sedimentation, and stormwater runoff. Service resources and grants such EPA's Targeted Watershed grant, National Fish and Wildlife Federation grants, National Oceanic and Atmospheric Administration's Habitat Restoration Program grants will be used within the multi-agency groups to accomplish the Service's targeted restoration activities for this focus area. Secretary Salazar has made the Anacostia cleanup a priority in urban restoration efforts.

The Chesapeake Bay Field Office has conducted watershed level assessments on three tributaries in the Anacostia River Watershed (Hickey Run, Oxon Run, and Watt's Branch). Bank and bed erosion were identified as a major source of sediment in each of those watersheds, and similar conditions exist throughout much of the Anacostia Watershed. A 1.8-mile stream restoration project underway in Watt's Branch will reduce bank erosion by approximately 1,200 tons per year. Stream and riparian restoration projects in the watershed would significantly reduce the volume of sediment being carried downstream to the Anacostia River and provide a significant benefit to trust species.

Supporting Documentation:

Anacostia Watershed Forest Management and Protection Strategy
http://www.mwcog.org/store/item.asp?PUBLICATION_ID=237

Anacostia Watershed Restoration Indicators and Targets for Period 2001-2010
http://www.anacostia.net/restoration/progress_reports.html

Anacostia Watershed Restoration Plan
<http://www.anacostia.net/>

Atlantic Coast Joint Venture Waterfowl Implementation Plan

<http://www.acjv.org/resources.htm>

Chesapeake Bay Program – Chesapeake 2000 Agreement
http://www.chesapeakebay.net/content/publications/cbp_12081.pdf

Climate Change and the Chesapeake Bay. State of the Science Review and Recommendations
<http://www.chesapeake.org/stac/>

Maryland Fish Passage Prioritization Strategy

Maryland Green Infrastructure Program
<http://www.dnr.state.md.us/greenways/gi/overview/overview.html>

Maryland Wildlife Conservation Plan
http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

North American Waterfowl Management Plan
<http://www.fws.gov/birdhabitat/nawmp/index.shtm>

Partners in Flight Bird Conservation Plan
http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Responding to Climate Change in the Chesapeake Bay Watershed. A draft report fulfilling Section 202(d) of Executive Order 13508
[http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202\(d\)+Climate+Change+Draft+Report+Executive+Summary.pdf](http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202(d)+Climate+Change+Draft+Report+Executive+Summary.pdf)

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Blackbird Millington Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata*), blueback herring (*Alosa aestivalis*), Delmarva fox squirrel (*Sciurus niger cinereus*), Kentucky warbler (*Oporornis formosus*), prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*), yellow perch (*Perca flavescens*)

Habitat Description: The Blackbird Millington Focus Area lies on the Delmarva Peninsula and spans both Delaware and Maryland, around the towns of Blackbird Delaware and Millington Maryland. Eighty percent of the focus area is privately-owned. There are three major tributaries in the focus area, the Sassafras and Chester Rivers which drain to the Chesapeake Bay and Blackbird Creek which drains to the Delaware Bay. There is a total of 199 miles of streams in the focus area, 21 miles which are protected.

Located in the Eastern Coastal Plain Province, the Blackbird Millington focus area contains the greatest number of Delmarva Bays, a special type of isolated vernal pool wetland. The Blackbird Millington area has a large amount (40%) of forested areas because the high concentration of isolated wetlands made the land difficult to timber and unsuitable for agriculture. The forests are dominated by oak–hickory stands and sweet gum and red maple in the wetter areas.

Benefits to Trust Resources: The Blackbird Millington Focus Area is located in the Partners in Flight Bird Conservation Plan for The Mid-Atlantic Coastal Plain (Physiographic Area 44). The wet forests support breeding neotropical migrants such as Kentucky warbler and prothonotary warbler. Mixed upland forests support wood thrush, worm-eating warbler, and red-shouldered hawks. The agriculture landscape provides habitat for grassland nesting species, including grasshopper and vesper sparrows. All of these species are priority species in the Partners in Flight Plan. Federally-listed endangered or threatened species occurring in the focus area include Canby's dropwort, swamp pink, and small whorled pagonia. The focus area is within the 3-mile buffer of a Delmarva fox squirrel location, another federally-listed endangered species. This area also supports key wildlife habitats, such as Coastal Plain ponds (Delmarva bays), upland depressional swamps and dry oak pine forests, identified in the Maryland Wildlife Diversity Conservation Plan and the Delaware Wildlife Action Plan. The Blackbird Millington area contains populations of tiger salamanders and barking treefrogs, both listed as endangered by the states of Delaware and Maryland.

Conservation Objectives:

- Protect and restore large forest blocks and vernal pool wetlands, especially the unique Delmarva Bays, in order to maintain or increase the current distribution of forest interior bird species and state listed amphibians
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands.

Threats and Opportunities: The Blackbird Millington Focus Area contains a mixture of urban areas, farmland, woodland, wetlands, and fallow fields. Conversion of agricultural lands and forests to residential developments is a great threat because of the proximity to Wilmington, DE and Philadelphia, PA. Also, lacking in Delaware is protection of isolated wetlands particularly

Delmarva Bays and other vernal pools which can be drained and converted to cropland. The Gap Analysis Project report by the Delaware Bay and Estuary Program (2006) identified areas with high biological diversity for protection and areas for forest and wetland restoration.

Chesapeake Bay Field Office's Partners for Fish and Wildlife Program will work with private landowners and the Natural Resources Conservation Service's Wetland Reserve Program to restore and protect degraded Coastal Plain ponds and expand large forest blocks. We will work with Maryland Department of Natural Resources, Delaware Department of Natural Resources and Environmental Control, and The Nature Conservancy to protect habitats of conservation concern.

Supporting Documentation:

Maryland Wildlife Diversity Conservation Plan

http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

Delaware Wildlife Action Plan

<http://www.fw.delaware.gov/dwap/Pages/DEWAPlan.aspx>

Maryland DNR Focus Area

TNC Blackbird Millington focus area

http://www.nature.org/media/delaware/bmc_exec_report.pdf

Delaware Green Infrastructure area

http://www.dnrec.state.de.us/nhp/information/17_App_A.pdf

Delaware Forest Service forest legacy area

<http://dda.delaware.gov/forestry/conser.shtml#ForestLegacy>

Partners in Flight Bird Conservation Plan for The Mid-Atlantic

Coastal Plain (Physiographic Area 44) http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Chesapeake Bay Islands Focus Area

Priority Species: American black duck (*Anas rubripes*), common tern (*Sterna hirundo*), Eastern oyster (*Crassostrea virginica*), snowy egret (*Egretta thula*)

Habitat Description: Chesapeake Bay Island habitat is a subtle continuum of habitats that move from upland forest dominated by woody species such as loblolly pine (*Pinus taeda*), sweetbay magnolia (*Magnolia virginiana*), and red maple (*Acer rubrum*) at the highest elevations. As the elevation begins to slowly decline to the upland/ marsh boundary, woody shrub species such as marsh elder (*Iva frutescens*) and groundsel tree (*Baccharis hamifolia*) may occur. As the island farther declines in elevation, saltmarsh plant species become the dominate herbaceous vegetation type and are characterized by species such as saltmarsh cordgrass (*Spartina alterniflora*), salt marsh hay (*Spartina patens*), salt grass (*Distichlis spicata*), black needlerush (*Juncus romerianus*) and threesquare (*Scirpus olnei*). With further declines in elevation the marsh may give way to shallow water habitats that may include submerged aquatic vegetation beds and oyster reefs. The transition between the upland, woody upland, saltmarsh, and subtidal habitat is often measured in centimeters and is directly influenced by tide.

Benefits to Trust Resources: Remote island habitat is essential for successful breeding for many colonial waterbirds such as common and least terns, black skimmer, snowy egrets, and brown pelicans. Waterfowl, such as the American black duck, are easily disturbed by human activity and require isolated areas such as remote islands to reproduce successfully. The Maryland breeding population of the peregrine falcon is very small, totaling approximately 20 nesting pairs throughout the State. Fifty percent of the pairs are found on Maryland's Eastern Shore within several islands located in Somerset and Dorchester Counties

Conservation Objectives:

- Maintain current island habitats in the Chesapeake and Coastal Bays and protect and restore trust species inhabiting these islands, particularly colonial waterbirds, American black duck and peregrine falcon
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Remote island habitats in the Chesapeake Bay are slowly being lost to the physical forces of sea level rise, erosion and subsidence. New island formation is also not taking place through these processes due to shoreline armoring. Protection and enhancement of remote islands is critical if natural resource managers are to sustain local populations of the above nesting species. Wildlife management for remote islands will use the best possible strategies and tools including habitat creation, restoration and enhancement, nuisance species and predator control and documentation, disease response, wildlife surveys and monitoring, and education.

The need to dispose of dredged material from navigation projects offers an excellent opportunity to help sustain and improve island habitats. Dredged material can be used to restore and protect islands from erosion. It can also be utilized to increase the elevation of low islands to help offset sea level rise and/or accomplish specific habitat development objectives (e.g., waterbird nesting). The Army Corps of Engineers is responsible for the larger projects that have the most potential

for benefitting island habitats. The Service has previously collaborated with the Corps in using dredged material to improve island habitats including placement projects at Barren Island and Eastern Neck Island (units of the Blackwater National Wildlife Refuge) as well as projects at Poplar Island, Hart/Miller Island, Smith Island, Fair Island, and Tar Island.

Island Prioritization:

1. Undeveloped and naturalized islands
2. Actively supporting nesting water birds
3. Free of manmade connections to the mainland
4. Potential to support nesting colonial waterbirds
5. Potential to support nesting American black ducks
6. Potential to support nesting peregrine falcons

Top Priority Islands:

- Skimmer Island and other coastal bay islands - large nesting area of colonial waterbirds.
- Watts Island - 91 acres near Tangier and Pocomoke Sound, part of Martin National Wildlife Refuge
- Bloodsworth Island - owned by the Navy and used as a bombing station, much of the island is marsh and has a heron rookery, and a few great egret and yellow crowned night heron nesting sites.
- Barren Island - owned by the Service it now encompasses 118 acres, down from its original size of 582 acres. The island once supported a large number of nesting least terns, but numbers of the birds here have dwindled. The island supports a large great blue heron rookery and is home to many waterfowl using its shallow bays such as American black duck, canvasbacks and redheads.
- James Island - located in the mouth of the Little Choptank River, once totaling 1,350 acres it has now eroded down to three separate islands totaling 85 acres with average erosion rates of 8 acres a year. It provides nesting habitat to many water birds.
- Poplar Island - owned by the state of Maryland, it receives dredge spoil to restore the 1,500 eroded acres. It is home to many birds such as ospreys, eagles, terns, herons, and egrets.
- Disappearing Islands of Tangier Sound - these islands are of high priority due to their small size, existing nesting habitat and high erosion rates.
- Holland Island – a small private island eroded down to 121 acres of which mostly is marsh, home to an array of nesting song birds and other natives.
- Martin National Wildlife Refuge - 4,400 acres of undeveloped marsh land and refuge, located next to Smith Island.
- Cedar Island - 3,000 acre wildlife management area that is open to the public and provides excellent American black duck nesting habitat, located in Tangier Sound.

Supporting Documentation:

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Chesapeake Bay Shorelines Focus Area

Priority Species: Puritan tiger beetle (*Cicindela puritana*)

Habitat Description: The Chesapeake Bay shorelines include high energy shorelines along the main stem of the Chesapeake Bay where beach habitats are adjacent to high cliffs, and medium to high energy shorelines that maintain a more moderate beach area adjacent to marshes or upland areas. This focus area does not include the very low energy areas where the coast line is a convoluted area of saltmarsh and open water. The shorelines in this focus area are mainly the higher energy shorelines that maintain some beach habitat and are used by a variety of trust species.

Benefits to Trust Resources: The natural dynamic shorelines of the Chesapeake Bay provide unique habitats for two federally-listed tiger beetles; the Puritan tiger beetle (*Cicindela puritana*) and northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). The Puritan tiger beetle inhabits the tall eroding cliffs and adjacent beaches of Calvert County and the Sassafras River Area. These cliffs have been eroding for centuries and the beetle has evolved to occupy this dynamic system. The northeastern tiger beetle does not require cliffs, but spends its life cycle on the lower and upper portions of sand beaches. The shorelines where beach habitat is adjacent to marshes can be very productive for shorebirds on migration, as well as horseshoe crabs and diamondback terrapins.

Conservation Objectives:

- To maintain “Chesapeake Bay Shoreline Sanctuaries,” shorelines that are protected from hardening and erosion control structures and are allowed to function naturally
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threat and Opportunities: Protection of natural shorelines occupied by Puritan tiger beetles is one of the Recovery Criteria in the Puritan Tiger Beetle Recovery Plan. These actions can eventually lead to possible recovery of this species. The northeastern beach tiger also benefits from areas where it is protected from revetments and disturbance.

All of these shorelines are becoming increasingly armored using bulkheads and revetments of wood, concrete and stone. The proximity of houses, marinas, and other private properties that are understandably trying to prevent erosion has resulted in a loss of natural shorelines of both high energy beach and lower energy areas. Some of these areas have lost their beach habitat and are now eroding banks.

High energy beaches are also under pressure for erosion control and in these areas, rock and concrete are the major techniques. Once a stretch of shoreline has been armored in this way, the habitat is eliminated, and the dynamics of the Chesapeake Bay currents and sand budgets are also affected.

In the lower energy portions of the Chesapeake Bay and its riverine areas, alternative erosion control methods such as living shorelines are being developed. These techniques can protect

important areas such as National Wildlife Refuges and replace eroding banks with shoreline marsh and beach habitat. The state of Maryland now has policies that insist that these approaches be considered first in erosion control efforts.

Virginia, through its Coastal Zone Management Program, developed a Shoreline Management Strategy to promote the use of living shorelines and to improve shoreline management. Included in this strategy were the following: a “Living Shoreline Summit,” to advance the use of this technique; revision of “Wetlands Guidelines” used to guide decisions about shoreline and tidal wetlands management; guidance for local governments in shoreline management planning; and a training program for contractors and local government staff on living shoreline practices.

Supporting Documentation:

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<http://www.fws.gov/chesapeakebay/EndSppWeb/BEETLE/PDFs/FensterKnisleyReed2006.pdf>

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<http://www.fws.gov/chesapeakebay/EndSppWeb/BEETLE/PDFs/Federal%20register.pdf>

U.S. Fish and Wildlife Service. 1993. Puritan Tiger Beetle Recovery Plan.

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Chesapeake Oyster Reef Focus Area

Priority Species: Eastern oyster (*Crassostrea virginica*), long-tailed duck (*Clangula hyemalis*)

Benefits to Trust Resources: Many Service trust fish species, such as striped bass (*Morone saxatilis*) and Atlantic sturgeon (*Acipenser oxyrinchus*) use oyster reefs as vital habitat for feeding and refuge (Chesapeake Bay Program, 2007). Migratory waterfowl, such as scoters (*Melanitta sp.*) and long tailed ducks (*Clangula hyemalis*) directly benefit from oyster reefs. For example, black, surf and white-winged scoters directly benefit from oyster reefs with 50%, 22%, and 28% respectively of their winter diet of hooked mussels (*Ischadium recurvum*), a species closely associated with oyster reefs in the Chesapeake Bay (Perry et al. 2007). Rodney and Paynter (2006) found that the restored oyster reefs are colonized by large densities of hooked mussels and many other species.

In addition there are many indirect benefits associated with restoring oyster reef habitat including improved water quality, shoreline stabilization, and carbon sequestration. Oysters filter water improving its quality around the oyster reef. The high densities of mussels colonizing these reefs are additional biofilters. This water quality improvement has a direct positive effect on submerged aquatic vegetation beds (NRC 2004). The submerged aquatic vegetation in turn serve as refuge and nursery habitat for many other Trust fish species and feeding grounds for migratory waterfowl. Oyster reefs can also play a vital role in helping to mitigate the effects of climate change in the Bay. The reefs themselves help to stabilize shorelines and mitigate some of the impacts of sea level rise. Oyster reefs also work as a carbon sink thereby improving the Chesapeake Bay's capacity to absorb excess CO₂ from the atmosphere (Peterson et al. 2003).

Conservation Objectives:

- Conserve, enhance and restore the function of oyster reef communities to benefit several Service's Trust species
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Historically, the oyster has been the cornerstone of the natural reef ecosystem in the Chesapeake Bay. Decades of overharvest, habitat destruction, disease, and poor water quality have reduced the population of oysters in the Chesapeake Bay to less than 1 percent of its historic levels (NRC 2004). The "Final Programmatic Environmental Impact Statement for Oyster Restoration in the Chesapeake Bay" (U.S. ACOE 2009) estimates that as much as 70 percent of the 450,000 acres of historic oyster bar habitat in the Chesapeake Bay has been lost to siltation during the last 100 years and less than 1% is classified as clean.

President Obama issued Executive Order 13508, recognizing the Chesapeake Bay as a national treasure and calling on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. The strategy developed to carry out the Executive Order calls on Federal agencies to coordinate with the states in a multijurisdictional effort to restore oyster reefs and establish self sustaining oyster reef sanctuaries. As part of our support of this Executive Order, the Service will implement native oyster reef restoration in the Chesapeake Bay. There are many key players involved in a comprehensive Bay-wide strategy to restore

native oysters. It is our intention to strongly support those efforts focusing on sites and oyster reef habitat restoration projects that will maximize benefits to fish and wildlife resources.

Oysters tend to recruit best on living oyster shell. Unfortunately, oyster shell availability for habitat restoration is extremely limited. Because oyster shell is so limited, creative solutions for restoring oyster reef function are necessary. Restoration using artificial materials like reef balls or granite has shown promise in recent years. We expect diverse communities established on artificial materials can serve as reasonable and functional surrogate for traditional oyster restoration.

Focus Areas Identification Strategy:

The U.S. Fish and Wildlife Service views oyster (*Crassostrea virginica*) reef restoration as essential to restoring ecosystem function in the Chesapeake Bay. The oyster is a keystone species for the Chesapeake Bay because of its unique ability to continuously build extensive three-dimensional reef habitat that supports a diverse and productive community of fish, wintering waterfowl, crabs, mussels and other invertebrates. Although degraded and in need of conservation and restoration, oyster reefs remain critical wintering feeding grounds for long-tailed duck and scoters. They also provide important feeding and/or nursery grounds for striped bass and sturgeon

The geographic focus for oyster reef restoration is based on the historic range of oysters in the Chesapeake Bay prioritized by the two critical criteria and the five supporting criteria. A three-tier system has been established. Tier I focus areas are those areas that meet the two critical criteria and all five supporting criteria. Tier II focus area are those areas that meet two critical criteria and between two and five supporting criteria. Tier III focus areas are all other areas within the historic oyster range in the Chesapeake Bay.

Critical Criteria:

1. Areas that are used or will have the potential to be used by Trust Resources (long-tailed duck, scoter species, Sturgeon, and striped Bass).
2. Areas where salinity and general water quality will support active reproduction and recruitment of oysters.

Supporting Criteria:

1. Historic oyster habitat in Maryland and Virginia
2. Sub-watersheds or areas associated with National Wildlife Refuges
3. Sub-watersheds or areas associated with Federal lands
4. Areas that are in designated oyster sanctuaries
5. Areas that can be protected from poaching

Oyster Focus Area Descriptions:

Tier I Oyster Focus Area: Choptank River, Little Choptank River Tangier Sound and tributaries including the Nanticoke River, Lower Chester River, Coastal Bays, Rappahannock River including the Great Wicomico and the Piankatank River. Tier I focus areas meet all the critical criteria and all of the supporting criteria. These areas provide conditions with the best chance of success in oyster restoration.

Tier II Oyster Focus Area: Patuxent River, Herring Bay, Eastern Bay, Elizabeth River and Lynnhaven River. Tier II focus areas are similar to Tier I but lack one or more of the supporting criteria listed above. With limited resources available, the Tier II sites will opportunity-driven, most likely by one of our partners.

Tier III Oyster Focus Area: all remaining oyster habitat in the Chesapeake Bay. Tier III focus areas meet the critical criteria, and may meet some of the supporting criteria These are all areas within the historical oyster range in the Chesapeake Bay not covered by Tier I or II. Tier III focus areas are areas where the Service will not likely spend resources without considerable justification.

Supporting Documentation:

Chesapeake Bay Program 2007. Ecocheck: Assessing and forecasting ecosystem status, Benthic Index of Biotic Integrity http://www.eco-check.org/reportcard/chesapeake/2007/indicators/benthic_index/.

Executive Order 13508 (2009). Chesapeake Bay Protection and Restoration http://www.whitehouse.gov/the_press_office/Executive-Order-Chesapeake-Bay-Protection-and-Restoration/

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Haramis, M. C. Perry, and K. A. Hobson (eds.). Waterbirds of the Chesapeake Bay and vicinity: harbingers of change? Waterbirds 30 (special publication 1).

Rodney, W. S., and K. T. Paynter. 2006. Comparisons of macrofaunal assemblages on restored and non-restored oyster reefs in mesohaline regions of Chesapeake Bay in Maryland. *Journal of Experimental Marine Biology* 335: 39-51.

U.S. ACOE 2009. Final Programmatic Environmental Impact Statement for Oyster Restoration in the Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster. http://www.nao.usace.army.mil/OysterEIS/FINAL_PEIS/homepage.asp

Chincoteague Bay Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), American black duck (*Anas rubripes*), American eel (*Anguilla rostrata*), blueback herring (*Alosa aestivalis*), prothonotary warbler (*Protonotaria citrea*), saltmarsh sparrow (*Ammodramus caudacutus*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Chincoteague Bay watershed is in the Atlantic Ocean drainage area, which includes portions of Maryland and Virginia. The Chincoteague Bay Focus Area is about 500 square miles in size and consists of approximately 48 percent upland and wetland and 52 percent open water. The majority of these wetlands are estuarine. Of the palustrine wetlands, most are forested. Forest and brush lands account for about 40 percent of the watershed and wetlands cover about 23 percent. Active land uses encompass about 35 percent of the watershed, including agriculture (33 percent) and developed land (2 percent).

Chincoteague Bay consists of shallow lagoons located landward of Assateague Island in Maryland and Virginia. This estuarine bay supports complex ecosystems that provide habitat for a wide range of fish and wildlife. Chincoteague Bay supports 115 fish species, more than 400 bird species, a variety of wetland plants, about 150 species of crabs, shellfish, and other aquatic invertebrates, and 108 rare species. There are 7,000 acres of submerged aquatic vegetation in Chincoteague Bay, composed of two species. Due to this great diversity, the Maryland Coastal Bays portion of Chincoteague Bay was included in the National Estuary Program. However, water and habitat quality continues to be degraded by a combination of urban, residential, and agricultural sources.

Benefits to Trust Resources: According to the Atlantic Coast Joint Venture Implementation Plan, the Atlantic Coastal Bays Focus Area, which includes the Chincoteague Bay watershed, is an important area for breeding and wintering waterfowl. The bays and associated wetlands within the focus area support American black duck, American wigeon, Atlantic brant, bufflehead, Canada goose, canvasback, gadwall, scaup, greater snow goose, mallard, Northern pintail, and red-breasted merganser.

Two Service priority species identified in the Northern Atlantic Regional Shorebird Plan breed within or near the forested and coastal wetlands in the watershed. These species include American oystercatcher and American woodcock. The Forster's tern, identified as a species of moderate concern in the North American Waterbird Conservation Plan breeds within coastal wetlands in the watershed.

This watershed is located in the Partners in Flight Bird Conservation Region (BCR) 44. Riparian forests support breeding neotropical migratory birds such as the wood thrush and prothonotary warbler. Coastal salt marshes support black rail, clapper rail, saltmarsh sparrow, seaside sparrow, and American black duck. All of these species are priority species in the Partners in Flight Plan. Other important birds found in the watershed include the black skimmer, a Bird of Conservation Concern in the Northeast Region, the willet, and various terns, herons and egrets.

Federally-listed threatened species occurring here include piping plover, swamp pink and sea beach amaranth. Tributaries in the watershed provide important spawning and nursery habitat for American eel, American shad, striped bass, alewife, and blueback herring. Chincoteague National Wildlife Refuge is located in the watershed.

Conservation Objectives:

- Improve habitat conditions for forest interior dwelling and saltmarsh bird species
- Protect and restore large contiguous blocks of wetlands and wetland associated uplands, including oak, hickory, and pine upland forests, and tidal emergent coastal salt marshes extending from Isle of Wight in Maryland south to Wallops Island and the southern tip of Assateague Island at Chincoteague National Wildlife Refuge in Virginia to allow for wetland habitat migration as sea level rises
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: The Maryland Wildlife Diversity Conservation Plan identified extensive tracts of tidal brackish marsh in the Maryland portion of Chincoteague Bay requiring protection and restoration. This includes protection of upland buffers, restoration of hydrology in ditched marshes, and invasive species control. Despite large state and federal holdings, including Chincoteague National Wildlife Refuge and Assateague National Seashore, this watershed is dominated (95%) by private ownership. Protection and restoration efforts will require a significant private land component. There are large expanses of unfragmented habitat that are just beginning to be threatened by development. Water quality is degraded due to poor flushing and large inputs of agricultural and urban run-off. Protection and restoration of emergent and forested wetland will assist in improving water quality in Chincoteague Bay.

Opportunities exist to leverage resources and submit North American Wetland Conservation Act and National Coastal Wetland Grant proposals to protect and restore ecologically important habitat through wetland restoration, mosquito ditch modification, purchase of conservation easements, fee-simple acquisition, and other means. Partners include the Maryland Department of Natural Resources, Maryland Department of Agriculture, Maryland Department of the Environment, Virginia Division of Game and Inland Fisheries, Assateague Island National Seashore, and Chincoteague National Wildlife Refuge, U.S. Department of Agriculture, The Nature Conservancy, The Conservation Fund, local land trusts, and local governments. Habitat targets are identified by rare species occurrences, proximity to Chincoteague Bay, and by consulting sources such as Maryland's Green Infrastructure Program, which identifies ecologically important habitat hubs and corridors.

Chincoteague National Wildlife Refuge is developing a plan to expand the refuge acquisition boundary onto the mainland. The current concept targets the Coastal Bays and Pocomoke River watersheds in Virginia and Maryland. Chesapeake Bay Field Office will assist the refuge with targeting projects and identifying funding sources to aid in purchasing land and conservation easements within the refuge's expanded acquisition boundary.

Since 2006, a partnership consisting of the U.S. Fish and Wildlife Service Maryland Department of Natural Resources Worcester County, and Natural Resources Conservation Service has

protected 1,200 acres of coastal habitat adjacent on the shores of the Chincoteague Bay. Through Service grants and Natural Resources Conservation Service programs, 450 acres of salt marsh has been restored with several hundred acres of additional wetland restoration planned for the future. In addition, grassland buffers are being planted along agricultural ditches.

Supporting Documentation:

Partners in Flight North American Landbird Conservation Plan

http://www.partnersinflight.org/cont_plan/

Partners in Flight Mid-Atlantic Coastal Plain Bird Conservation Plan

http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Atlantic Coast Joint Venture Waterfowl Implementation Plan

<http://www.acjv.org/resources.htm>

North Atlantic Regional Shorebird Plan

<http://www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.pdf>

Maryland Wildlife Diversity Conservation Plan

http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

Maryland Coastal Bays Comprehensive Conservation Management Plan

http://www.dnr.state.md.us/coastalbays/res_protect/ccmp.html

Worcester County Comprehensive Plan

<http://www.co.worcester.md.us/2005%20comp%20plan/2005%20comp%20plan%20page.htm>

Delaware Bay Shoreline Focus Area

Priority Species: American black duck (*Anas rubripes*), red knot (*Calidris canutus*), saltmarsh sparrow (*Ammodramus caudacutus*)

Habitat Description: The geographic location of the Delaware Bay Shoreline Focus Area is defined as a 300 foot buffer from the Delaware Coastal Program's predicted sea level rise of 1.5 meters (4.92 feet) by the year 2100. The prediction was derived from the SLAMM model and is based on the local Mean Higher High Water which is the average highest high tide line in tidal areas. Inundation is assumed to occur at a constant elevation based on tidal elevation and no other factors like erosion, subsidence, or future construction are used to determine water levels (Delaware Coastal Program). The 300 foot buffer allows for inland migration of coastal marshes and associated upland habitat.

The Delaware Bay Shoreline Focus Area is dominated by a broad band of tidal marsh extending from Lewes, Delaware to the Chesapeake and Delaware Canal. The character of the marsh changes as the salinity drops from approximately 25-30 psu at Lewes to approximately 1-10 psu at the canal. Development within this band is generally limited to several isolated residential communities that occupy linear parcels of upland along the shore. From Lewes to Pickering Beach, the marsh is fronted by a sand beach. On the landward side of the tidal marsh, agriculture is the dominant land use, followed by forest, and suburban/residential development.

The Delaware Bay shoreline zone (in Delaware and New Jersey) is the largest spring staging area for shorebirds in eastern North America. One of the main attractions for the birds is the abundant food supply of horseshoe crab eggs which are deposited in clusters on the beaches during the crab's spring spawning. Red knot, semipalmated sandpiper, ruddy turnstone and sanderling are among the most abundant species. The red knot is currently of particular interest. Most red knots use Delaware Bay as a stopover location during their northern migration from their wintering area in Tierra del Fuego to their breeding area in the central Canadian Arctic. Over the last two decades these birds have experienced a dramatic decline in abundance. As a result, in 2006 the *rufa* subspecies was designated as a candidate for protection under the Endangered Species Act.

The extensive tidal marsh areas provide important feeding and/or breeding habitat for a wide variety of migratory birds including wading birds (herons and egrets), rails (clapper and Virginia rails), shorebirds (willet and yellowlegs), waterfowl (American black duck and snow goose), raptors (northern harrier), and some passerines (seaside sparrow, saltmarsh sparrow and marsh wren). The adjacent forested habitats are favored habitat for neotropical migratory birds, apparently due to the coastal location. There are numerous riverine corridors that pass through this area and many of them contain high quality wetland and riparian wildlife habitat. Some examples include: Cedar Creek (Atlantic white cedar community), Primehook Creek (breeding wood ducks and wintering waterfowl), and Murderkill River/Browns Branch (wood ducks, wading birds and songbirds).

A large proportion of the tidal marshes and some of the adjacent terrestrial habitat is owned and managed by state or federal governments, or conservation organizations such as The Nature Conservancy. There are two national wildlife refuges (Bombay Hook National Wildlife Refuge

and Prime Hook National Wildlife Refuge) and several state wildlife management areas. Numerous impoundments have been successful in improving the marshes' carrying capacity for wintering waterfowl and migrating shorebirds. To reduce some of the adverse ecological effects (e.g., water quality problems and diminished estuarine trophic relationships), the current water management practices generally try to promote greater water exchange between the impoundments and the adjacent estuary. The projected rise in sea level and the resulting progressive erosion will likely pose a major threat to the integrity of the impoundment dike systems. By projecting the location of lost shoreline habitats due to sea level rise, we can prepare for the migration of wetlands farther inland and preserve adequate upland buffer for these habitats and the species utilizing these areas.

Conservation Objectives:

- To restore and protect shoreline and adjacent marsh habitat and provide adequate food supplies for waterfowl, shorebirds, and neo-tropical migratory birds, especially red knot and salt marsh sparrow
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: The focus area, including beaches, coastal marshes, impoundments, and upland buffers, has been modified dramatically by people over the past 300 years. Much of Delaware's wetlands have been filled and drained to create farmland

During the 1930s, coastal wetlands were grid-ditched to drain the marshes to control mosquito populations. Today, mosquito populations are controlled by the Delaware Division of Fish and Wildlife who apply several pesticides. Working with partners, we are implementing a Best Management Practice (BMP) by plugging the ditches and creating shallow pools and channels to reconnect these areas to tidal exchange. This allows fish that consume mosquito larvae to reach these areas, reducing the amount of pesticides. Increasing tidal exchange also discourages the growth of *Phragmites*, an invasive plant species that grows aggressively and dominates a wetland. The Service and other agencies control *Phragmites* using an herbicide/burning regime over several years. This technique allows native plant species, such as *Spartina*, to gain a foothold and colonize the area.

The Delaware Bay is the largest nesting area for the Atlantic horseshoe crab (*Limulus polyphemus*). The Delaware Bay is the second largest stopover location for northern bound migrating shorebirds in the Western Hemisphere. The spring migration of red knots is timed perfectly to take advantage of the superabundant supply of horseshoe crab eggs deposited on the beaches of Delaware Bay during the spring spawning period. Unfortunately, horseshoe crab populations in Delaware Bay are in decline due to harvesting as bait for eel pots and for the biomedical industry. The red knot population has been at a very low level since the mid-2000s.

Delaware has a long industrial history. Today, there are numerous chemical plants, oil refineries, and industrial facilities along the Delaware River and its tributaries. The contaminants of concern in the Delaware River include metals, organics (dioxin, PCBs, PAHs), and pesticides. The State recommends against consuming any finfish caught in the Delaware River between the state border and the C&D canal because of PCBs, dioxin, mercury, and chlorinated pesticides. There is also a fish advisory for the lower Delaware River and Bay for PCBs and mercury.

Although these contaminants are persistent in the environment, we are working with federal and state agencies on setting stricter water quality standards, implementing hazardous waste cleanup actions, and restoring injured natural resources in the Delaware River watershed.

The Delaware estuary is home to the sixth largest port and third largest petrochemical port in the United States. Since the Delaware River is too shallow to enable large oil tankers to reach the refineries, the lower Delaware Bay is one of the world's largest lightering areas. Here oil is transferred from large ocean oil tankers to smaller barges. Occasionally spills occur as a result of this process. The Service continues to prepare for and respond to oil spills that occur in this area. We work closely with response agencies and participate as a natural resource trustee in the damage assessment and restoration process.

Wind power is a growing significant threat to migratory bird populations along the Atlantic coast flyway corridor. The service is working with private companies and governmental agencies to minimize the impacts from wind power activities on migrating birds and bats.

Supporting Documentation:

Crockett, D. Updated 1998. Real Birds – Shorebird Crisis: The Horseshoe Crabs of the Delaware Bay. Shorebird Migration and the Delaware Bay. Virtual Birder, copyright Great Blue Media Works. 1996-2003.

<http://www.virtualbirder.com/vbirder/realbirds/dbhsc/SBMigration.html>.

Delaware Wildlife Action Plan

<http://www.fw.delaware.gov/dwap/Pages/DEWAPlan.aspx>

Delaware Green Infrastructure area

http://www.dnrec.state.de.us/nhp/information/17_App_A.pdf

Delaware Coastal Management Program

<http://www.swc.dnrec.delaware.gov/Pages/CoastalMgt.aspx>

Delaware Bay Estuary Project

<http://www.fws.gov/delawarebay/>

Great Blue Heron Productions 1997. Real Birds – Horseshoe Crabs of the Delaware Bay. Harvesting Horseshoe Crabs.

<http://www.virtualbirder.com/vbirder/realbirds/dbhsc/HSCSurvey.html>

Partners in Flight Bird Conservation Plan for The Mid-Atlantic Coastal Plain (Physiographic Area 44)

http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

USFWS 2010. Red Knot (*Calidris canutus rufa*) Spotlight Species Action Plan. Prepared by: New Jersey Field Office, Pleasantville, NJ.

http://ecos.fws.gov/docs/action_plans/doc3265.pdf

Gunpowder River Deer Creek Focus Area

Priority Species: bog turtle (*Clemmys muhlenbergii*), brook trout (*Salvelinus fontinalis*)

Habitat Description: The Gunpowder River Deer Creek Focus Area lies in the northern portions of Harford, Baltimore, and Carroll counties in Maryland and includes Loch Raven Reservoir, Prettyboy Reservoir, Deer Creek, Broad Creek, and Codorus Creek subwatersheds.

Unique spring fed wetlands such as bogs, fens, wet meadows, sedge marshes and pastures with soft muddy areas provide the habitat bog turtles require for feeding, breeding and hibernation. These spring-fed wetlands occur in seepage slopes or terraces along headwaters of small to moderate sized streams.

Benefits to Trust Resources: The primary focus is on the restoration of spring-fed sedge meadow habitat and riparian travel corridors for bog turtle. To breed successfully, bog turtles require sedge dominated, wet meadows with little or no canopies. Historically, this open canopy was maintained by grazing animals, beaver activity, fire, and floods. Much of the disturbance, especially by grazing animals, has declined over time. Invasive woody and exotic vegetation has colonized many bog turtle sites eliminating the open canopy nesting habitat. The restoration activities include the removal of woody vegetation and control of non-native herbaceous vegetation, restoring hydrology by plugging ditches and connecting streams with their floodplain through stream restoration.

There are recent records of summer roosting sites in Carroll County, Maryland. Summering Indiana bats roost in trees in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bats to roost between the bark and bole of the tree. Cavities and crevices in trees also may be used for roosting. Sassafras and maple, hickory, ash, elm and oak species may be used for roosts. Structure is probably more important than the species. Tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites.

There is quite a bit of greatly reduced habitat for brook trout in this focus area, which could be enhanced through riparian planting projects, which would also help Indiana bat. Chesapeake Bay Field office will work with Maryland Department of Natural Resources and Natural Resources Conservation Service to prioritize sites for brook trout restoration. Once the analysis is completed we will know how important this area may be for brook trout.

Restoration and protection these riparian habitats will also provide habitat for early successional birds such as American woodcock.

Conservation Objectives:

- Conserve and restore habitat for the bog turtle
- Restore riparian forest buffers for bog turtle, brook trout and Indiana bat
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Threats to bog turtle habitat include: fragmentation from developments and roads; conversion of wetlands to agriculture and ponds; shrub and tree succession; invasive plants; hydrologic changes from residential development, agriculture, ditching, water withdrawal, and pond construction..

Another major threat to riparian wetlands is the loss of hydrology by the downcutting of the adjacent stream. Unstable streams can degrade vertically until they abandon their floodplains. Once this occurs, the water table will drop and adjacent wetlands will lose their hydrology. Stream restoration opportunities exist in this focus area to restore streams and reestablish floodplain connectivity. This, in turn, would conserve habitat for bog turtles and other trust species

Bog turtle restoration is a priority for the Service and some funds are available for restoration projects. The Natural Resources Conservation Service's Wetland Reserve Program can provide permanent easements where all the restoration costs are paid for or management costs are mostly covered through a 10-year restoration cost share agreement. Riparian areas between permanently protected areas can also be enrolled in Wetland Reserve Program and could also benefit brook trout and Indiana bat.

Supporting Documentation:

Maryland Department of Natural Resources. 2005. Maryland wildlife diversity conservation plan. Maryland Department of Natural Resources , Annapolis, Maryland.

U.S. Fish and Wildlife Service. 2001. Bog Turtle (*Clemmys muhlenbergii*), Northern Population, Recovery Plan. Hadley, Massachusetts. 103 pp.

Lower Chester River Focus Area

Priority Species: American black duck (*Anas rubripes*), American eel (*Anguilla rostrata*), Delmarva fox squirrel (*Sciurus niger cinereus*), dwarf wedge mussel (*Alasmidonta heterodon*), Eastern oyster (*Crassostrea virginica*), Kentucky warbler (*Oporornis formosus*), long-tailed duck (*Clangula hyemalis*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The lower Chester River watershed is located within three Maryland counties. Three tributaries drain in this watershed: Langford Creek, Southeast Creek, and Corsica River. The Chester River was historically one of the most valued watersheds in Maryland for its bountiful natural resources, deep water access and fertile soils for agriculture. This focus area currently contains a mixture of is primarily farmland with some woodland, fallow fields and urban areas. Important habitat types include upland forest, tidal and non-tidal wetlands, forested wetlands, and Delmarva Bays.

Benefits to Trust Resources: According to the Atlantic Coast Joint Venture Waterfowl Implementation Plan, the Chester River and Kent County Bayshore Focus Area supports important beds of submerged aquatic vegetation that are critical to breeding and wintering waterfowl in the Atlantic Flyway. Approximately one third of Maryland's population of American black duck utilizes the focus area. Other waterfowl that winter in the area include Canada goose, snow goose, scaup, canvasback, mallard, ruddy duck, merganser, tundra swan, bufflehead, ring-necked duck, and common goldeneye, in addition to small numbers of scoters, redhead, long-tailed duck, American wigeon, gadwall, and Northern pintail. A recent radar study of the Delmarva Peninsula identifies the Chester River and Eastern Bay as high concentration areas for birds (Stroeh email 11/5/10).

This watershed is located near the Partners in Flight Bird Conservation Region (BCR) 44. Remaining riparian forests support breeding neotropical migrants such as cerulean warbler, prothonotary warbler, and Acadian flycatcher. Mixed upland forests support wood thrush, worm-eating warbler, and Kentucky warbler. The agriculture landscape provides habitat for grassland nesting species, including grasshopper and vesper sparrow. All of these species are listed as priority species in the Partners in Flight Plan.

Federally listed endangered species occurring in the watershed include Delmarva fox squirrel, shortnose sturgeon, and dwarf wedge mussel. Tributaries in the watershed provide important spawning and nursery habitat for American eel, American shad, striped bass, alewife, and blueback herring. Eastern Neck National Wildlife is located in the lower watershed.

This focus area also supports key wildlife habitats identified in the Maryland Wildlife Diversity Conservation Plan, such as the dry oak-pine forest. The canopy of the dry oak-pine forest is typically semi-open and dominated by a mix of loblolly pine, shortleaf pine, pitch pine, sand hickory, southern red oak, and black jack oak. Dry oak-pine forests also include several types of dry calcareous woodlands and forests. They are nearly restricted to the upper Eastern Shore where they occur on steep, convex, south-facing slopes of deep ravines and stream-fronting bluffs that have downcut into Tertiary shell deposits

Conservation Objectives:

- To protect and restore Service lands, threatened and endangered species habitat, waterfowl and shorebird habitat, reopen fish habitat to diadromous fish, and reestablish reef ecosystems
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: The lack of vegetated agricultural field buffers and especially the conversion of agricultural lands to residential developments are the greatest threats on land. In the river, the lack of shallow water reef habitat exacerbates the shoreline erosion problem leading to poor water quality and listing on the Environmental Protection Agency's impaired rivers list.

The Natural Resources Conservation Service has identified the upper Chester River as a Maryland Chesapeake Bay Showcase Watershed. The majority of the land is farmland, poultry facilities, horse farms, nurseries and cattle farms can also be found in the watershed. A variety of agricultural opportunities will enable the Natural Resources Conservation Service and U.S. Fish and Wildlife Service to demonstrate a wide variety of conservation methods.

Protection of large acreages in this watershed is needed to mitigate the effects of sea level rise and improve water quality for our trust species. Opportunities exist for both small and large restoration and protection projects to benefit threatened and endangered species and provide fish passage. Shoreline and oyster reef projects are likely to have the greatest shallow water habitat benefits. Funding can be acquired through FWS Section 6 Recovery Land Acquisition Grants, and Coastal Program Grants, Natural Resources Conservation Service, private stewardship grants, National Fish and Wildlife Foundation Grants, Chesapeake Bay Trust Grants, and through partnerships.

Living shoreline and oyster reef demonstration projects have shown early success in protecting and restoring fish and wildlife habitat.

Supporting Documentation:

Atlantic Coast Joint Venture's New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Plan

<http://www.acjv.org/bcr30.htm>

Partners in Flight Bird Conservation Plan for The Mid-Atlantic Coastal Plain (Physiographic Area 44) http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Maryland Wildlife Diversity Conservation Plan

http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

Lower Potomac Patuxent Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), American black duck (*Anas rubripes*), bald eagle (*Haliaeetus leucocephalus*), blueback herring (*Alosa aestivalis*), dwarf wedge mussel (*Alasmidonta heterodon*), Kentucky warbler (*Oporornis formosus*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*), yellow perch (*Perca flavescens*)

Habitat Description: The Lower Potomac/Patuxent Focus Area includes five sub-watersheds, portions of the Lower Potomac River and Patuxent River watersheds. These are the lower Patuxent River, from Jug Bay to the mouth of the river, and the lower Potomac River watersheds of Mattawoman Creek, Nanjemoy Creek, Zekiah Swamp, and McIntosh Run.

At the mid-point of the Patuxent River is a large 8,500-acre complex of protected state and local government lands, known Jug Bay Wetlands Sanctuary, a part of the National Estuarine Research Reserve System. The emergent wetlands and rich waters provide habitat for wintering waterfowl and breeding song birds. Designated as an IBA by Audubon, the Jug Bay area supports 120 breeding bird species. The Smithsonian Institution considers Jug Bay to be one of Maryland's ten most unique ecological communities. There are 15 state-listed plants and animals in the Sanctuary and its tidal hardwood swamp community is considered to be globally vulnerable, with only 100 known occurrences worldwide (Friends of Jug Bay 2010)

The emergent wetlands of Jug Bay attract the greatest number of migrating rails in North America, including the state-listed sora rail (National Audubon Society 2010). An average of 12,000 migratory waterfowl, including Canada geese, mallard, American black duck, pintail, and green-winged teal, winter in the area. Extending south from Jug Bay to the Chesapeake Bay is the Atlantic Coast Joint Venture's (ACJV) Patuxent River Waterfowl Focus Area, with its extensive freshwater marshes.

The Mattawoman Creek watershed is a hotspot for terrestrial and aquatic biodiversity and productivity, supported by significant tidal and non-tidal wetlands, extensive forest cover, and high quality streams. A gap analysis report (USFWS 2006) assigned high value to the riparian forested areas in the Mattawoman Creek area. The Mattawoman Creek watershed also has two magnolia bogs, which are considered globally imperiled habitat endemic to the mid-Atlantic (Nature Serve).

A 48,000-acre block of contiguous forestland in the Nanjemoy Creek watershed was identified by The Nature Conservancy as a priority for land protection and restoration. Approximately 80% of the watershed is forested, with over 5,400 total acres protected as part of TNC's Nanjemoy Creek Preserve and the Nanjemoy Creek Natural Resources Management Area. Most of the forests in the watershed consist of mature trees with small pockets of young pine and oak-pine woodlands. Much of the mature forest is comprised of deciduous trees including oak and hickory. Tidal emergent and forested wetlands, scattered along the Nanjemoy Creek mainstem and tributaries, support numerous rare plant species

Zekiah Swamp is the largest hardwood swamp in Maryland. This extensive complex of swamp forest, shrub swamps, grass and sedge savannahs, snag-filled pockets of emergent wetlands, and beaver ponds has received the designation of Wetlands of Special State Concern (Maryland Natural Heritage Program 1996). The Smithsonian Institution also has identified the 20-mile braided swamp as one of the most ecologically important wetlands on the East Coast.

McIntosh Run and its tributaries have healthy riparian zones and forested buffers along most of their length. McIntosh Run watershed is currently one of the most ecologically intact watersheds remaining in Maryland, containing large blocks of contiguous forest, which provide habitat for forest interior dwelling bird species and other wildlife and are critical to insuring that water quality is adequate to support the federally-listed endangered dwarf wedge mussel and other aquatic life.

Benefits to Trust Resources: The Patuxent River received special recognition from the ACJV primarily due to its importance to migrating sora rails and wintering ruddy ducks. Maryland supports one-fourth of the North American ruddy duck population, a large percentage of which winter on the Patuxent River (ACJV 2005). Other species supported in the Patuxent River Focus Area include wintering American black duck, bufflehead, Canada goose, scaup, and tundra swan, as well as breeding least bittern, American bittern, Virginia rail, and king rail (ACJV 2005). The extensive and relatively intact riparian corridor along the river supports large numbers of breeding and migrating songbirds.

The lower Potomac River is a significant, year-round bald eagle foraging and concentration area. The bald eagle is a Chesapeake Bay trust species and overall, a species of national importance. Eagles are attracted to these areas due to the abundance and availability of food in proximity to undeveloped forested shoreline habitats. Protection of concentration areas like Lower Potomac River is deemed necessary for survivability of juvenile and sub-adult recruitment in order to sustain a long-term breeding population.

Mattawoman Creek is considered to be the Chesapeake's most productive anadromous fish nursery with high overall productivity for American shad, hickory shad, white perch, blueback herring and alewife (Carmichael et al. 1992). The headwaters of Mattawoman Creek are important for reptile and amphibian species richness. Riparian corridors of Mattawoman Creek are important for rare amphibian species and also for rare bird species due to the large blocks of unbroken forest.

Maryland- DC Audubon (2009) identified Mattawoman Creek as an Important Bird Area and supports a high diversity of forest interior dwelling bird species with 18 recorded out of 24 possible on the Maryland's Coastal Plain. Bald eagle, red-headed woodpecker, wood thrush, prairie warbler, and Kentucky warbler, birds on the 2008 Birds of Conservation Concern list (USFWS 2008), were observed in the Mattawoman Creek watershed. Additionally, prairie warbler, American black duck, prothonotary warbler, Acadian flycatcher, and Kentucky warbler were identified as priority bird populations needing conservation efforts in the Partners in Flight Mid-Atlantic Coastal Plain plan (Rich et al. 2004). The watershed also supports a large breeding population of wood ducks.

The high quality waters of Nanjemoy Creek support one of the two most viable populations of the federally-listed endangered dwarf wedge mussel. Audubon Maryland-DC identified six at-risk bird species in the watershed, including the bald eagle, whip-poor-will, wood thrush, prairie warbler, prothonotary warbler and worm-eating warbler, one of the state's most area sensitive species (Audubon Maryland-DC 2009). An Audubon Important Bird Area, the Nanjemoy Creek watershed supports 20 of 24 forest interior dwelling bird species known to nest in Maryland. In its analysis of freshwater stream and river biodiversity, the Maryland Department of Natural Resources identified Zekiah Swamp as the highest ranking watershed in the state. Zekiah Swamp has been designated a stronghold watershed for five fish species of greatest conservation need, including ironcolor shiner (state-endangered), flier (state-threatened), bluespotted sunfish, swamp darter, and warmouth. The watershed also supports five reptile and amphibian species of greatest conservation need. One small tributary to Zekiah Swamp, Piney Branch Bog, supports nine state-listed plant species, including the state-endangered and globally-rare New Jersey rush. Audubon Maryland-DC (2009) recorded breeding populations of seven at-risk bird species in Zekiah Swamp, including the prothonotary warbler, Kentucky warbler, Louisiana waterthrush, prairie warbler, wood thrush, red-headed woodpecker, and bald eagle. The watershed also was found to have a high breeding FIDS biodiversity, with 17 out of 24 potential Maryland coastal plain nesters recorded.

Key to the recovery of the dwarf wedge mussel is the preservation of mussel populations and occupied habitats in McIntosh Run (USFWS 1993). In addition to the mussel, wetland herbaceous communities associated with forested bottomlands along McIntosh Run and tributaries contain twelve state-listed species, including a flier, the eastern narrow-mouthed toad, and ten rare plant species (Motivans 1999).

Conservation Objectives:

- Restore forest and riparian connectivity, aquatic habitats, riparian lands and associated wetlands
- Purchase conservation easements and fee ownership on key tracts identified as important for the protection of migratory birds, federally-listed species, candidate species, state-listed species and rare communities
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: At the beginning of European colonization, the Maryland landscape was 95% forest and 5% tidal wetland (MDNR 2005). By 1993, the state's forests and wetlands were reduced by half. From 1972 to 2002 urban land use in Maryland nearly doubled. If current trends continue, the acreage of urban land is predicted to increase by 25% by 2020 with an estimated 9% decrease in forest cover over the same timeframe.

The human population of the Chesapeake Bay watershed is expected to increase to 20 million people by 2030 (USDOJ 2009). The magnitude of land development to accommodate increased human populations has far exceeded requirements for space. The Chesapeake Bay watershed's population grew by 8.2% between 1990 and 2000. The acreage of forest and farms lost to development increased by 25%. The impervious cover associated with this development increased by 42% resulting in increases of polluted runoff flowing into the Chesapeake Bay and its rivers. Forests continue to be lost at a rate of 100 acres per day, while farmland is lost to

development at a rate of almost 250 acres per day. If the current trends continue, most of the western shore of the Chesapeake Bay in Maryland is expected to be dominated by urban and suburban development by 2020.

Climate driven sea level rise will pose an increased threat to Chesapeake Bay fish and wildlife habitat over time by submerging low level islands, forests, beaches and wetlands. Other potential impacts from climate change include changes in temperature and precipitation that could lead to changes in habitat composition and species ranges. The land protection efforts outlined here would help to reduce impacts of climate change by increasing the extent of protected areas, improving representation and replication within a protected-area network, and protecting movement corridors, stepping stones, and refugia. Other threats include exotic invasive species and incompatible forestry and agriculture practices (MDNR 2005).

In his 2009 Executive Order 13508 for the Chesapeake Bay, President Obama recognized the Chesapeake Bay watershed as a national treasure that must be protected and restored. The Executive Order established a Federal Leadership Committee to develop and implement a new strategy for the protection and restoration of the Chesapeake Bay. The *Strategy for Protecting and Restoring the Chesapeake Bay* (Federal Leadership Committee for the Chesapeake Bay 2010) outlines several environmental goals including conserving land and increasing public access.

Under the land conservation goal is the protection of an additional two million acres of lands identified as high conservation priorities by 2025. This includes 695,000 acres of forestland having the maximum value for maintaining water quality. This goal also includes a requirement for 300 new public access sites in the watershed by 2025.

The Executive Order offers an unprecedented opportunity to expand and restore conservation lands in the Lower Potomac/Patuxent focus area through the use of North American Wetlands Conservation Act Grants, National Coastal Wetlands Grants, and Section 6 Recovery Land Acquisition Grants. Other important Federal funding sources to be pursued include Farm Bill programs such as the Wetland Reserve Program, NOAA's Coastal and Estuarine Land Conservation Program, the Defense Department's National Readiness and Environmental Protection Initiative Conservation Buffer Program, and the National Park Service's Chesapeake Bay Gateways Initiative. State and private funds and in-kind support will be supplied by the Maryland Department of Natural Resources, Chesapeake Conservancy, The Nature Conservancy, The Conservation Fund, and the Trust for Public Lands, and local land trusts such as the Patuxent Tidewater Land Trust and the Scenic Rivers Land Trust.

Supporting Documentation:

Partners in Flight North American Landbird Conservation Plan

http://www.partnersinflight.org/cont_plan/

Partners in Flight Mid-Atlantic Coastal Plain Bird Conservation Plan

http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Atlantic Coast Joint Venture Waterfowl Implementation Plan

<http://www.acjv.org/resources.htm>

North Atlantic Regional Shorebird Plan

<http://www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.pdf>

Maryland Wildlife Diversity Conservation Plan

http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

Maryland Coastal Bays Comprehensive Conservation Management Plan

http://www.dnr.state.md.us/coastalbays/res_protect/ccmp.html

Atlantic Coast Joint Venture Focus Area Report (2005)

http://www.acjv.org/wip/acjv_wip_midatlantic.pdf

Atlantic Coast Joint Venture New England/Mid-Atlantic Coast Bird Conservation Region 30
Draft Implementation Plan (2007)

<http://www.acjv.org/bcr30.htm>

Atlantic Coast Joint Venture Strategic Plan (2009)

http://www.acjv.org/documents/ACJV_StrategicPlan_2009update_final.pdf

Audubon Maryland – DC Important Bird Areas Program (2010)

<http://mddc.audubon.org/birds-science-education/important-bird-areas>

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tributaries during the summers of 1989-1991: a data report. MDNR (1992)

Chesapeake Bay Program Chesapeake 2000 Agreement (2000)

http://www.chesapeakebay.net/content/publications/cbp_12081.pdf

Federal Leadership Committee for the Chesapeake Bay Strategy for Protecting and Restoring the
Chesapeake Bay Watershed. Executive Order 13508 (2010)

<http://executiveorder.chesapeakebay.net/file.axd?file=2010%2f9%2fChesapeake+EO+Action+Plan+FY2011.pdf>

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unnamed tributaries draining Chapman Forest, and Reeder Run (2000)

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Management Plan: 2008 – 2012 (2008)

http://www.nerrs.noaa.gov/Doc/PDF/Reserve/CBM_MgmtPlan.pdf

MD Natural Heritage Program. Ecologically significant areas in Zekiah Swamp, nontidal
wetland of special state concern: sites newly identified or updated in 1995 (1996)

Mattawoman Creek Watershed Plan. U.S. Army Corps of Engineers (2003)
<http://www.charlescounty.org/PGM/planning/plans/environmental/mattawoman/plan/plan.pdf>

Motivans. Site Conservation Plan McIntosh Run Watershed Including Miski Run and Burnt Mill Creek Tributaries. TNC. (1999)

NatureServe (2007)

O'Dell. Survey of anadromous fish spawning areas-Completion Report, Fisheries Administration. MDNR. (1975)

The Nature Conservancy. Chesapeake Bay Lowlands Ecoregional Plan (2002)
<http://www.conservationgateway.org/content/ecoregional-reports>

Ramsar. 2004. www.ramsarcommittee.us/documents/USNRC-US-Site-contact-List.doc

Robbins and Blom Atlas of Breeding Birds of Maryland and the District of Columbia (1996)

Uphoff. Identifying priority areas for protection and restoration: Chesapeake Bay striped bass spawning and larval nursery areas as a model, Fisheries Technical Report (2008)
<http://www.dnr.state.md.us/irc/docs/00010669.pdf>

U.S. Department of the Interior. Landscape Conservation and Public Access in the Chesapeake Bay Region. Report Fullfilling Section 202(e) of Executive Order 13508 (2009)
[http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202\(e\)+Access+%26+Landscapes+Draft+Report+Executive+Summary.pdf](http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202(e)+Access+%26+Landscapes+Draft+Report+Executive+Summary.pdf)

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<http://www.fws.gov/northeast/nyfo/es/dwm.pdf>

U.S. Fish and Wildlife Service. Gap Analysis of Animal Species Distributions in Maryland, Delaware, and New Jersey (2006)
<http://www.fws.gov/delawarebay/Pdfs/finalreport.pdf>

U.S. Fish and Wildlife Service Birds of Conservation Concern (2008)
<http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf>

Lower Rappahannock River Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), American black duck (*Anas rubripes*), American eel (*Anguilla rostrata*), bald eagle (*Haliaeetus leucocephalus*), blueback herring (*Alosa aestivalis*), Eastern oyster (*Crassostrea virginica*), Kentucky warbler (*Oporornis formosus*), long-tailed duck (*Clangula hyemalis*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Rappahannock River supports extensive forested wetlands and pristine shorelines embedded within a rural landscape of row crops and idle grasslands. Forested wetlands are composed predominantly of red maple while forest uplands are a mix of loblolly pine, oaks, red maple, ashes, and hickories. Uplands have a wide range of topographic features that result in a high diversity of habitats within a relatively small area. These natural habitats are embedded in a rural landscape. Tidal fresh marshes contain primarily arrow arum and wild rice.

The Lower Rappahannock was nominated as an Important Bird Area not only due to the high concentration of bald eagles foraging and roosting during the summer and winter months, but also because of other rare species or species of conservation concern such as Coastal Plain swamp sparrow, Northern bobwhite, or American black duck using the shoreline up to 3 kilometers inland. In 2008, the Lower Rappahannock Important Bird Area was elevated to Global Importance status.

The refuge provides habitat 18 species of waterfowl of conservation concern. Two of the species are common breeders here: wood duck and mallard. This area is important to migrating and wintering waterfowl including redhead, ring-neck duck, blue-winged teal, gadwall and northern shoveler according to the Atlantic Coast Joint Venture Focus Area Report (draft 2005) for the Rappahannock River.

Spawning areas for herring, shad and alewife, are confirmed and probable in the Rappahannock River as far back as 1970 in an Annual Progress Report. Today, the fish stocks of herring and shad are rebounding due to dam removal and habitat restoration projects in the lower river.

Benefits to Trust Resources: A federally-listed threatened species, sensitive joint-vetch, is found within the refuge boundary. Sensitive joint-vetch is a rare plant found only in freshwater tidal marshes. Bald eagles nest and roost in significant numbers throughout the refuge boundary area. In fact, Virginia's largest wintering bald eagle roost is within the refuge boundary. The watershed is home to a diverse fish and benthic community and provides spawning, nursery and rearing habitats.

Shorebirds, neotropical migratory songbirds, raptors, and marsh birds rely on the Rappahannock River's corridors during the spring and fall migration periods. Species groups targeted for management include bald eagles, forest-interior dwelling birds such as wood thrush and Acadian flycatcher, and grassland nesting birds such as grasshopper sparrow and northern bobwhite.

Conservation Objectives:

- Protect wetlands and associated uplands along the Rappahannock River, its major tributaries and within the acquisition area of the Rappahannock River Valley National Wildlife Refuge for migratory birds, threatened or endangered species and diadromous fish
- Restore prior-converted crop fields and farmed wet pastures to wetlands to provide excellent waterfowl habitat for wintering and staging waterfowl populations.
- Protect uplands adjacent to coastal wetlands to provide space for these habitats to migrate in the face of sea level rise

Threats and Opportunities: Four primary threats to the focus area and its resources include: conversion of open land to residential; loss of aquatic habitats from impacts such as sea level rise; contaminants within the fishery used by piscivorous birds; and continued expansion of phragmites into sensitive marsh habitats. In addition, the urban centers of Fredericksburg and Tappahannock are expanding and expected to place pressure on the rural lands within this area in the future.

Waterfront property is particularly vulnerable to future development. Since many of the species that depend on this area are sensitive to development, further development remains a concern. The reach of the river between Tappahannock and Port Royal supports one of the largest winter and summer concentrations of migrant bald eagles in eastern North America. These birds have been shown to be very sensitive to boating activity. Increases in boating activity and the number of boat access points within this stretch will negatively impact migrant eagles. Because of the position of these birds within the food web, they will always be vulnerable to new contaminants entering the system. Dispersal of the invasive plant phragmites from the large source population on Hoskins Creek threatens the integrity of pristine marshes throughout the system.

The goal of the Rappahannock River Valley National Wildlife Refuge is to protect 20,000 acres of wetlands and associated uplands. As of September 2008, 8,191 acres have been purchased from willing sellers or donated by Refuge partners, including 1,660 acres of conservation easements. With help from conservation partners, including Chesapeake Bay Foundation, The Conservation Fund, The Nature Conservancy, and Trust for Public Land, we are well on our way toward achieving our land protections goal. Partners, volunteers and refuge staff continue to restore native grasslands and riparian forests along the river and tributary streams. Funding is acquired through U.S. Fish and Wildlife Service's Section 6 Recovery Land Acquisition Grants and Coastal Program Grants, private stewardship grants, National Fish and Wildlife Foundation Grants, Chesapeake Bay Trust Grants, Natural Resources Conservation Service's Wetlands Reserve Program and through partnerships.

Supporting Documentation:

Rappahannock River Valley National Wildlife Refuge: Comprehensive Conservation Plan-December 2009

library.fws.gov/ccps/rappahannockrivervalley_final09.pdf

Atlantic Coast Joint Venture – Virginia Waterfowl Focus Area Report
www.dgif.virginia.gov/waterfowlstampgrants/virginiafocusareas.pdf

National Oceanic and Atmospheric Administration Chesapeake Bay Oyster Restoration
<http://chesapeakebay.noaa.gov/oysters/oyster-restoration>

Virginia Coastal and Estuarine Land Conservation Program Plan
www.deq.state.va.us/coastal/documents/vacelcpplandraft.pdf

Lower Susquehanna Aberdeen Focus Area

Priority Species: American eel (*Anguilla rostrata*), bald eagle (*Haliaeetus leucocephalus*)

Habitat Description: A majority of the Lower Susquehanna River/Aberdeen Focus Area lies within the Piedmont and Atlantic Coastal Plain physiographic provinces. The upper boundary (Conowingo Dam) to the mouth of the Susquehanna River is underlain by metamorphic rocks (mainly schist, gneiss, and quartzite) and is characterized by rolling uplands with broad hills and steep-sided valleys that are mostly forested. Several freshwater streams drain into the lower Susquehanna River below Conowingo Dam, and include Deer Creek, Rock Run, Herring Run, and Ocatararo Creek.

The Susquehanna Flats and Aberdeen region of the focus area lies within the Atlantic Coastal Plain region is characterized by predominantly fine-grained unconsolidated sediments, consisting of clay silt, sand, and gravel deposited by streams, rivers, and seas, and form a wedge-shaped body that dips southeastward. Alluvial deposits occur adjacent to and within drainage ways and topographic lows. Freshwater and brackish water marshes are characteristic of the areas bordering the Chesapeake Bay, with extensive forested areas and open fields characterizing the adjacent uplands. The shallow water of the Susquehanna Flats support extensive submerged aquatic vegetation beds that provide nursery areas for numerous invertebrate and fish species. In addition, the submerged aquatic vegetation beds provide food for several waterfowl species.

Aberdeen Proving Ground, comprising a large area of the focus area, is an active U.S. Army Garrison that includes 72,000 acres in Harford and Baltimore counties. Aberdeen Proving Ground is composed of three large land masses; Spesutie Island to the north, the main body of Aberdeen Proving Ground and Monk's Island to the south. Carroll Island and Poole's Island are located on the outermost land segments of the Army property. The Chesapeake Bay and several large tributaries (Susquehanna River, Bush River, Gunpowder River, Mosquito Creek, and Romney Creek) border the military base and provides approximately 150 miles of shoreline habitat for a variety of fish and wildlife species. These areas have an exceptional appeal to the bald eagle where undisturbed forested shorelines provide perching, foraging, and roosting opportunities close to open water. Interconnecting marshes, tidal wetlands, and shallow water systems provide additional foraging and nesting habitat for other species of fish, waterfowl, and wading birds during spring and winter months. A 200 meter restriction for public recreation along Aberdeen Proving Ground's shoreline may indirectly attribute protection to a diversity of fish species and other aquatic organisms. This too, may be one of the reasons for the attraction of the largest great-blue heron rookery in the northern Chesapeake Bay region (3,000 nesting pairs) which annually occupies Poole's Island.

Benefits to Trust Resources: The bald eagle (*Haliaeetus leucocephalus*) is a Chesapeake Bay trust resource and overall, a species of national importance. Recently removed from the Endangered Species Act (2007), the bald eagle continues to receive federal protection under the Bald and Golden Eagle Protection Act. The Service mandates post-delisting monitoring for a period of 20 years. The Chesapeake Bay regional eagle population is comprised of 1,600 pairs nesting pairs. Equally important, the Chesapeake Bay also supports more than 10 major bald eagle concentration areas. Collectively, these areas are known to support over several thousand

non-breeding adult and sub-adult individuals during summer and winter months. Eagles are attracted to these areas due to abundance and availability of food in proximity to undeveloped forested shoreline habitats.

The northern Chesapeake Bay/Susquehanna River has been determined to be a highly significant, year round bald eagle foraging and concentration area. Eagles from 3 separate populations (New England, Chesapeake, and Florida) are found to congregate there, with over 250 eagles documented at one time. This density of eagles is the highest found east of the Mississippi River. Recent studies have documented a high use corridor between the Aberdeen Proving Ground peninsula and the Conowingo Dam on the lower Susquehanna River.

American eel plays a key role in the aquatic ecosystem of the Lower Susquehanna-Aberdeen Focus Area. Recent research conducted by the USGS, Northern Appalachian Research Laboratory, indicates that American eel is the primary fish host for the freshwater mussel, eastern elliptio (*Elliptio complanata*) in the Susquehanna River (Lellis et al. 2001). However, in comparison with other rivers such as the Delaware River where the eastern elliptio population is estimated to be in the millions, biologists have noticed a distinct absence of eastern elliptio and lack of recent recruitment to the Susquehanna River (personal communication, William Lellis, USGS, Wellsboro, PA). Low recruitment of eastern elliptio to the Susquehanna River could be linked to the lack of eel passage over the 4 mainstem dams in the Susquehanna River.

If American eels are essential to the reproduction of eastern elliptio or other freshwater mussel species, the implications of providing eel passage to freshwater mussel populations and in turn, ecosystem function could be significant. Similar to oysters in the Chesapeake Bay, freshwater mussels provide the service of natural filtration to the rivers and streams where they live. A healthy reproducing population of eastern elliptio could remove algae, sediment, and micronutrients from billions of gallons of Susquehanna River water each day. Restoring the upstream distribution of American eels and eastern elliptio mussels could improve water quality of the Susquehanna River and subsequently the Chesapeake Bay.

Conservation Objectives:

- Protect the largest concentration area of nesting and roosting bald eagles (> 250 eagles) on the East Coast
- Coordinate with partners to improve management of Susquehanna River fisheries and upstream/downstream passage issues around dams
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Aberdeen Proving Ground was originally used to test ordinance and weapons. It was also used to test chemical weapons, conduct chemical research, and store and dispose of chemicals. . On-site surface waters contain pesticides, metals, phosphorous and volatile organic compounds. In addition to these contaminants, the groundwater also contains chemical warfare degradation products. Soils are contaminated with pesticides, metals, polychlorinated biphenyls, volatile organic compounds, and unexploded ordinance. Thirteen disposal pits, found on Carroll Island containing chemical weapon agents, were excavated, but land use controls have been instituted The shoreline has been armored to prevent further erosion of the unstable banks which contain debris. The Service is working with the Environmental

Protection Agency and Department of Defense to cleanup these contaminated areas and to limit impacts to natural resources

In 1996, the lower Susquehanna River basin was placed on Maryland's Water Quality Limited Segment (WQLS) list for nutrients, sediments, cadmium (Cd) and PCBs tissue (Water Quality Analysis of Eutrophication for the Tidal Lower Susquehanna River, Harford and Cecil Counties, Maryland). Although there are historic data related to health, contaminant exposure and associated hazards for fish in Chesapeake Bay (Pinkney et al. 2001 and 2004; Blazer et al. 2007), considerably less is known about waterbirds particularly in northern tributaries. Rattner and McGowan (2007) suggest that the Susquehanna River warrants further investigation since contaminant data for wildlife is limited along this major tributary.

To gain a greater understanding of the effects contaminants may be having on bird species, the U.S. Geological Survey and Service has proposed a large scale study to investigate the effects contaminants may have on ospreys nesting in several areas of the Chesapeake Bay including the lower Susquehanna River. Ospreys are strictly piscivorous and feed at a high trophic level which makes them ideal for monitoring bioaccumulation and transfer of contaminants through their food source.

Under the Restoring Water Quality Goal, the Chesapeake Bay Executive Order states that portions of the 2011 enhancement of Chesapeake Bay activities support information requirements to reduce the occurrence of toxic contaminants impacting the health of fish, wildlife and people in the watershed by 2025. This is to be accomplished by conducting assessments and developing toxics control strategies for three major basins in the Chesapeake Bay watershed. Data collected from osprey study, as discussed above, will aid in meeting the Restoring Water Quality goal of the Executive Order. Data from the study will be ultimately provided to federal and state natural resource management agencies, the U.S. Department of Agriculture, the U.S. Environmental Protection Agency and state municipalities to develop management actions for agriculture, industrial pollution control measures, and water quality standards that mitigate toxic inputs into the Chesapeake Bay. Results will be used by these agencies to prioritize toxics of concern to establish a pro-active approach to contaminant monitoring and identification of threats to Chesapeake Bay wildlife in the future. These data will document spatial and temporal trends in fish and wildlife and have implications for human health. Ultimately findings will contribute towards creating a sustainable ecosystem and improving environmental quality.

Climate change will produce many different effects in this focus area. Higher water elevations will erode shorelines and transport unidentified explosive ordinances in the water column and nearshore habitats. As these rust out and degrade, contaminants are released into the water column and sediments. Tides move unidentified explosive ordinances around the nearshore habitats, requiring additional daily sweeps of areas prior to their being able to be used for maneuvers by the military or other users.

Higher water levels would also contribute to a loss of marsh area in Aberdeen, as the marshes have fewer suitable elevations into which they may migrate. Heavier levels of storm activity associated with climate change would wash additional contaminants off of upland sources.

If climate change produces a greater number of tropical storms, as predicted, the accumulated sediment behind Conowingo Dam on the Susquehanna River may be mobilized in one large transport event, as occurred with Tropical Storm Agnes in 1972. The resulting smothering of submerged aquatic vegetation beds and poor water quality had long term effects on the health of the Upper Bay and mainstem Chesapeake for many years afterward.

Supporting Documentation:

Aberdeen Proving Ground, Bald Eagle Management Plan, 2008

Atlantic Flyway Mute Swan Management Plan 2003-2013

www.portal.state.pa.us/portal/server.pt/document/.../mute_swan_plan_pdf

Chesapeake Bay Mute Swan Management Plan, 2004

http://www.dnr.state.md.us/wildlife/Plants_Wildlife/pdfs/Mute_Swan_Cheseapeake_Bay_Plan_2005.pdf

Blazer VS, Iwanowicz LR, Iwanowica DD, Smith DR, Young JA, Hedrick JD, Foster SW, Reeser SJ. 2007. Intersex (testicular oocytes) in Smallmouth Bass *Micropterus dolomieu* from the Potomac River and selected nearby drainages. *J Aquat Anim Health* 19: 242-253.

Executive Order 13508, Chesapeake Bay Protection and Restoration

http://www.whitehouse.gov/the_press_office/Executive-Order-Chesapeake-Bay-Protection-and-Restoration/

Lower Western Shore Rivers Focus Area

Priority Species: alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), Kentucky warbler (*Oporornis formosus*), prairie warbler (*Dendroica discolor*), wood thrush (*Hylocichla mustelina*), yellow perch (*Perca flavescens*)

Habitat Description: The Lower Western Shore Rivers Focus Area contains high integrity forest hubs and corridors and Chesapeake Bay tributaries in the Baltimore-Annapolis-Washington DC metropolitan area. Within the focus area, Patuxent Research Refuge supports a wide diversity of wildlife in forest, meadow, and wetland habitats. Consisting of predominantly forest land surrounding the Patuxent and Little Patuxent Rivers, the refuge encompasses over 12,800 acres.

The South River Greenway includes undeveloped forests covering 10,000 acres (6,000 acres identified by Maryland Department of Natural Resources as natural resource forest hubs and corridors). Four watersheds with 100 miles of streams flow through the greenway into the South River. Extensive wetlands and several thousand acres of undisturbed forests provide vital protection to the South River, and ultimately the Chesapeake Bay. Identified as an Important Bird Area by Maryland/District of Columbia Audubon, the greenway supports at least 18 nesting species of forest interior dwelling birds. This is also a regionally important area for reptiles and birds according to the Gap Analysis Report of biodiversity in the Mid Atlantic region and contains a high priority forest block identified by Maryland Department of Natural Resources' Green Print Program and the Chesapeake Bay Program's Resource Lands Assessment Report. The focus area is a historical spawning area for yellow perch and river herring.

Benefits to Trust Resources: Birds of Conservation Concern (BCC) that will benefit from permanent protection of upland and wetland forests include the wood thrush, worm-eating warbler, and Kentucky warbler. Fifteen other forest interior dwelling bird species will benefit from permanent habitat protection. The prairie warbler (BCC) and several other shrubland bird species will benefit from habitat management of a five mile stretch of powerline right-of-way. Forest habitat quality will be restored and maintained for many of the already mentioned species through control of invasive plants. Restoring stream habitat by stabilizing headcuts will reduce sediment runoff to second/third order streams and tidal rivers. Reduced sediment and improved water clarity benefit striped bass, river herring, yellow perch, submerged aquatic vegetation (and the waterfowl that feeds on that vegetation), Eastern oyster, and many other species that need clean water.

Conservation Objectives:

- Examine factors affecting fish health, reproduction, and contamination
- Protect existing upland and wetland forests
- Restore stream habitat (headcut stabilization) and improve water quality
- Control spread of invasive plants
- Promote management of shrubland bird habitat
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands
- Connect people with nature

Threats and Opportunities: Innovative approaches to conservation in this area serve our habitat preservation and restoration missions, while offering the ability to connect people with nature on a larger scale. Pilot work in this focus area has far reaching applications for other conservation lands and waters throughout the Mid Atlantic region.

Future Refuge acquisition boundaries being considered may allow for greater protection of these wildlife corridors along the Patuxent River.

The Maryland Department of the Environment (MDE) has listed both the Severn and South River watersheds as impaired for the following use categories: aquatic life in first to fourth order streams; benthic resources in the estuarine habitats; fishing due to PCB contamination resulting in part from contaminated sediments; and the health of fish and shellfish due to nutrient loading. In addition, the South River is listed for impaired submerged aquatic vegetation due to total suspended solid concentrations. Both rivers have an approved Total Maximum Daily Load (TMDL) report that attributes the bulk of fecal coliform contamination to loadings from pet waste. MDE lists several fish tissue advisories for the rivers. Limits are advised for the consumption of American eel and spot in the South River and white perch in both the South and Severn rivers.

Impairments to portions of the Patuxent identified by MDE as Upper Patuxent River Tidal Fresh, Patuxent River Upper, Little Patuxent River, Western Branch, and Cash Lake are for total suspended solids, phosphorus, nitrogen, fecal coliform, and aquatic life in first through fourth order streams. In addition, several impairments in the rivers cannot be currently addressed with a TMDL including nitrogen loading affecting the use of the tidal fresh portion of the Patuxent for fish spawning and a nursery area and a low score for benthos due to unknown causes. A TMDL has been approved for Western Branch to address biochemical oxygen demand released from a municipal waste water treatment plant. Cash Lake, located on Patuxent Research Refuge, is impaired because of high mercury concentrations in fish tissue. The Refuge does not allow bass species to be kept and limits another predator species, chain pickerel, to one fish per day.

According to Maryland Department of Natural Resources, the human population in the lower western shore increased by 96% between 1970 and 2000 and is projected to grow another 13% by 2020. Impervious surfaces in the watersheds have increased as these watersheds became more urbanized and now account for 15.0% of land use in the Severn and 8.8% in the South. With increased imperviousness, nutrients and contaminants run off into the streams and mainstem rather than percolating through soil and ground water.

Many of the problems facing all of these rivers arise from excessive sediment loading into the streams and mainstem. Sediment loading as well as nutrients and contaminants may be factors affecting the poor reproductive success of yellow perch in the South and Severn watersheds. Hatchery stocking by Maryland Department of natural Resources has not improved recruitment. It is uncertain whether the reproductive problems result primarily from adults producing poor gametes or early life stage mortality.

A major problem in the Severn and South rivers is a large zone of low oxygen (hypoxic) waters. Both Riverkeeper organizations have highlighted this threat to the aquatic life of the rivers, giving low scores on their river report cards. The low oxygen zones reduce the available habitat for species such as blue crabs and striped bass and are reflected in the benthic impairments.

The South River attracted widespread attention in 2005, when the USFWS reported a 53% prevalence of skin tumors in brown bullhead. Follow-up studies are in progress aimed at determining trends over time, comparing prevalence in the Severn River versus the South River, and evaluating possible associations between tumor prevalence and classes of chemicals such as polynuclear aromatic hydrocarbons (PAHs). Ongoing studies on yellow perch are focused on evaluating eggs and sperm for evidence of pathology and testing the effects of exposure to higher salinity waters and suspended sediments on hatching of eggs and survival of larvae.

Current climate models predict a 2 to 6 °C increase in annual mean temperature in the mid-Atlantic by the year 2100. This would result in the advancement of spring fish spawning and could lead to a mismatch between the timing of phytoplankton availability and fish larvae. The current climate prediction models also state that there will be an increased volume and intensity of precipitation in the winter and spring in the mid-Atlantic. This will lead to increased streamflow resulting in greater stream bank erosion. This in turn will result in higher sediment and nutrient loading from the streams into the tidal river. Increased turbidity and nutrient loading may lead to a further decrease in submerged aquatic vegetation (SAV). An increase of anoxia, a result of this loading, would also threaten the recovery of benthic resources, which are the base of the food chain for fish and piscivorous wildlife. The number of short, medium, and long-term droughts is expected to increase in the northeast U.S. This would increase the susceptibility of forests within the watershed to disease and insect damage.

Forested tracts in the South River Greenway are under intense development pressure. Seventy-five percent of the undeveloped forests have highly erodible soils, meaning small disturbances to the land result in large impacts to streams that transport sediment to the South River and eventually Chesapeake Bay. Despite the extensive forest buffers, 21 miles of streams are listed as in poor condition as a result of land use changes (roads and subdivisions).

A major portion of the Greenway, the Bacon Ridge Natural Area, is in the process of becoming a natural area park for citizens of the county and state. The Greenway is located in the center of Anne Arundel County, ten minutes from the state capital. A network of trails could be developed connecting Over 2,500 acres of this land is owned by local, state or city government. Many more acres are precluded from development due to Forest Conservation Act easements and building restrictions on wetlands and steep slopes.

Supporting Documents

Partners in Flight Bird Conservation Plan for The Mid-Atlantic Coastal Plain (Physiographic Area 44)

http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Atlantic Coast Joint Venture Waterfowl Implementation Plan

<http://www.acjv.org/resources.htm>

Gap Analysis Biodiversity Report
Chesapeake Bay Program – Chesapeake 2000 Agreement
http://www.chesapeakebay.net/content/publications/cbp_12081.pdf

Maryland Green Infrastructure Program
<http://www.dnr.state.md.us/greenways/gi/gi.html>

Maryland Wildlife Conservation Plan
<http://www.wildlifeactionplans.org/maryland.html>

Maryland/DC Audubon Important Bird Area Program
<http://mddc.audubon.org/birds-science-education/important-bird-areas/what-important-bird-areas-program>

Maryland Department of the Environment: The 2010 (Draft) Integrated Report of Surface Water Quality in Maryland
<http://www.mde.state.md.us/programs/Water/TMDL/TMDLHome/Pages/programs/waterprograms/tmdl/maryland%20303%20dlist/index.aspx>

Maryland Department of Natural Resources, Lower Western Shore Basin Overview (2003)
http://www.dnr.state.md.us/BAY/TRIBSTRAT/low_west/low_west_shore.pdf

Severn Riverkeeper, 2008 Severn River Report Card
<http://www.severnriverkeeper.org/pdf/SevernReportCard2008.pdf>

South River Federation, Annual Scorecard (2010)
<http://www.southriverfederation.net/index.php/river-health/asc>

Responding to Climate Change in the Chesapeake Bay Watershed. A draft report fulfilling Section 202(d) of Executive Order 13508
[http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202\(d\)+Climate+Change+Draft+Report+Executive+Summary.pdf](http://executiveorder.chesapeakebay.net/file.axd?file=2009%2F9%2F202(d)+Climate+Change+Draft+Report+Executive+Summary.pdf)

Climate Change and the Chesapeake Bay. State of the Science Review and Recommendations
<http://www.chesapeake.org/stac/Pubs/climchangereport.pdf>

Nanticoke Choptank Focus Area

Priority Species: American black duck (*Anas rubripes*), American eel (*Anguilla rostrata*), Delmarva fox squirrel (*Sciurus niger cinereus*), Eastern oyster (*Crassostrea virginica*), Kentucky warbler (*Oporornis formosus*), prothonotary warbler (*Protonotaria citrea*), saltmarsh sparrow (*Ammodramus caudacutus*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The headwaters of the Nanticoke River and the Choptank River occupy a large section of western Kent County and Sussex counties in Delaware, and Caroline and Dorchester counties in Maryland. This focus area is important breeding and wintering habitat for a myriad of migratory birds.

Important habitat types include upland forest, tidal and non-tidal wetlands, forested and scrub-shrub wetlands, ancient sand dunes, and Delmarva Bays. Forested wetlands in these headwater areas are comprised primarily of red maple, green ash, pumpkin ash, blackgum, and sweetbay with scrub-shrub species of smaller ash, gum, maple, alders and dogwood. Emergent marshes are dominated by spatterdock, wild rice, arrow arum, and bulrush. Upland forest is characterized by native coastal plain species including white oak, southern red oak, and scarlet oak, hickory, poplar, and red maples mixed with loblolly pine. A unique intact ancient sand dune system occurs along the eastern shoreline of Marshyhope Creek, is a tributary of the Nanticoke River. This type of sand dune natural community, dominated by Virginia pine and oaks, is thought to occur nowhere else except on the Delmarva Peninsula. The headwaters region of the Choptank River watershed is approximately 60 percent row crop agriculture, 30 percent forested, and 8 percent developed.

Benefits to Trust Resources: The Nanticoke River and the Choptank River watersheds are extremely important areas for the Service's trust species. Land acquisition strategies and boundaries for the Blackwater National Wildlife Refuge include a large portion of the lower and mid Nanticoke River watershed. These watersheds are located in the Partners in Flight Bird Conservation Region (BCR) 44 and provide significant breeding and winter stop over habitat for forest interior dwelling species such as the Kentucky warbler and other species listed as priority species in the Partners in Flight Plan and the states of Maryland and Delaware's Wildlife Action Plans. Federally-listed threatened and endangered species such as Delmarva fox squirrels and swamp pink occupy forested habitats within this focus area. Tributaries in these headwater areas also provide important spawning and nursery habitat for American eel.

Conservation Objectives:

- Protect and restore large contiguous blocks of forested wetlands, riparian forest corridors and associated upland forests in the headwater portions of the Nanticoke and Choptank River watersheds
- Conduct stream habitat restoration to improve water quality, improve aquatic habitat, and reduce sediment loads
- Reconnect floodplains to perennial tributaries through the removal of side cast berms
- Continue to eradicate nutria from the Nanticoke River watershed
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Continued forest fragmentation due to agriculture and residential development represent the greatest threats to habitat connectivity in these watersheds. Silvicultural practices which convert deciduous forests into loblolly pine plantations through suppression of broadleaf hardwood species using herbicides continues to degrade the biodiversity of the headwater forest communities. Drainage for agriculture and silviculture also reduces the ability of the forested wetlands and riparian forests to remove nutrient loads from surface waters and ground water that discharge to the Chesapeake Bay.

Additional challenges include the reluctance of landowners to convert cropland to forests due to rising farm commodity prices. Residential development pressures have eased due to diminished land values in the past three years but will be a potential threat in the future. Invasive exotic plant and animal species also represent a current and future threat.

Reconnecting floodplains to perennial tributaries through the removal of side cast berms is a major objective in the focus area. Farm Bill programs such as the Wetland Reserve program and Conservation Reserve Program will be the primary tools to restore and protect these targeted habits. A habitat based strategy will serve to reduce nutrient runoff, reduce forest fragmentation and restore lost biodiversity in the headwaters of two major tributaries of the Chesapeake Bay. Extensive nutria eradication efforts have been and continue to be employed in the Nanticoke River watershed.

Supporting Documentation:

Partners in Flight Bird Conservation Plan for The Mid-Atlantic Coastal Plain (Physiographic Area 44) http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf

Delaware Wildlife Action Plan
<http://www.fw.delaware.gov/dwap/Pages/DEWAPlan.aspx>

Maryland Wildlife Diversity Conservation Plan
http://www.wildlifeactionplans.org/pdfs/action_plans/md_action_plan.pdf

Pocomoke River Cypress Swamp Focus Area

Priority Species: American black duck (*Anas rubripes*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Pocomoke River originates in Cypress Swamp of Delaware and flows 49 miles south through Wicomico, Worcester, and Somerset Counties in Maryland prior to reaching Virginia and the Pocomoke Sound. Pleistocene age mineral flats and sand dunes form an undulating landscape with a wide diversity of important habitat types. Some of the most important habitats for migratory birds in this focus area include: remnants of globally rare Atlantic white cedar swamps; bald cypress-black gum swamps, palustrine forested wetlands and oak-hickory upland forests.

Pocomoke Sound, including Cedar Island Wildlife Management Area and Pocomoke Sound Wildlife Management Area, is famous for waterfowl and rail hunting. It supports some of the best remaining submerged aquatic vegetation (SAV) beds in Maryland. Due to its 3,000 acres of tidal marsh, ponds and creeks, Cedar Island is legendary for its ability to attract large numbers of American black duck

Benefits to Trust Resources: Due to its importance to neotropical migratory birds and forest interior dwelling birds, the focus area is included in the Atlantic Coast Joint Venture's New England/Mid-Atlantic Coast Bird Conservation Region (BCR) 30. Forest interior dwelling birds as well as water birds will benefit from protection and restoration of forest habitats targeted in this focus area. The focus species prothonotary warbler, American black duck, and wood thrush are included on the U.S. Fish and Wildlife Service's Birds of Conservation Concern list for the Northeast Region. Other bird species that will benefit include: Swainson's warbler which occurs only in the Pocomoke watershed and the Dismal Swamp in Virginia; northern parula, yellow warbler, yellow-throated warbler, pine warbler, prairie warbler, black and white warbler, American redstart, worm-eating warbler, ovenbird, Louisiana waterthrush, common yellowthroat, hooded warbler, yellow breasted chat, wood-peewee, and red-headed woodpecker. Partners in Flight also identified the entire upper Pocomoke River watershed as a shorebird focus area, due to its importance to the American woodcock. In addition, the Atlantic Coast Joint Venture Waterfowl Implementation Plan identifies the forested wetlands in the Pocomoke River watershed as important wintering grounds for American black duck.

Conservation Objectives:

- Protect, restore and enhance large contiguous blocks of forests, including wetlands and uplands, for breeding and wintering migratory birds
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and opportunities: The primary threats to the target species in this focus area are loss of habitat connectivity and diversity. Forest fragmentation from agricultural operations, residential development, intensive silviculture and stream channelization represent the greatest threats. Forested wetlands adjacent to channelized sections of the Pocomoke River and Dividing Creek are the primary targets for hydrology restoration. Hydrology will be restored through the

partial removal of side-cast berms. Restoring out of bank flow regimes to these wetlands will reduce sediment loads to the Chesapeake Bay and increase biodiversity of the forested wetlands. Partnerships with the Maryland Department of Natural Resources, U.S. Department of Agriculture's Natural Resources Conservation Service, the Nature Conservancy and other private non-government organizations such as Ducks Unlimited, Inc. will be an imperative for the restoration and protection of this focus area

Supporting Documentation:

Atlantic Coast Joint Venture's New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Plan

<http://www.acjv.org/bcr30.htm>

U.S. Fish and Wildlife Service Birds of Conservation Concern 2008

<http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf>

Atlantic Coast Joint Venture Waterfowl Implementation Plan

<http://www.acjv.org/resources.htm>

Shenandoah Upper Rappahannock Focus Area

Priority Species: brook trout (*Salvelinus fontinalis*), prairie warbler (*Dendroica discolor*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Shenandoah River Upper Rappahannock Focus Area is located in northwestern Virginia. The Shenandoah River lies in the Valley and Ridge physiographic province, while the Rappahannock River starts at the Blue Ridge and continues eastward through the Piedmont and Coastal Plain.

Benefits to Trust Resources: Brook trout were historically located throughout the Shenandoah and upper Rappahannock watersheds. The species is not only a recreationally important species, but is an indicator of high water quality. Today those populations have been reduced in number and limited in their geographical range. Stream restoration, riparian restoration, and barrier removal will benefit brook trout by improving water quality, in-stream habitat, and increasing available habitat.

The improved water quality will provide benefits to freshwater mussels and many other aquatic species.

The restoration of riparian habitat will benefit numerous bird species. These watersheds are located in the Partners in Flight Physiographic Region 12. Restoration and protection of riparian habitat will benefit early successional birds such as golden-winged warbler, prairie warbler, American woodcock, whip-poor-will, Northern bobwhite, field sparrow, Eastern towhee, blue-winged warbler, and willow flycatcher. Restoration and protection of mature deciduous forest will benefit cerulean warbler, worm-eating warbler, Louisiana waterthrush, and woodthrush. Restoration of grasslands will benefit the Henslow's sparrow. Restoration and protection of northern hardwood and spruce-fir forests will benefit black-throated blue warbler and blackburnian warbler.

The Indiana bat and Virginia big-eared bat are federally-listed endangered species that occur in the watershed and may also benefit from the riparian restoration.

Conservation Objectives:

- Protect and restore riparian corridors
- Conduct stream habitat restoration to improve water quality, aquatic habitat and reduce sediment loads
- Facilitate fish passage through the removal of barriers

Threats and Opportunities: In 2006 American Rivers named the Shenandoah River as one of the most endangered rivers. The river is threatened by polluted runoff from agricultural land and new suburban/urban development. Land use practices are significantly affecting the natural resources in the two watersheds. Impacts resulting from agriculture, urbanization, mining, non-native fish introductions, and invasive species are the major stressors to the Shenandoah River and upper Rappahannock watersheds.

Executive Order 13508 - Strategy for Protecting and Restoring the Chesapeake Bay Watershed includes goals for brook trout restoration in the Chesapeake Bay watershed. The goal is to restore naturally reproducing brook trout populations in headwaters streams by improving 58 sub-watersheds from “reduced” classification (10-50 percent of habitat lost) to “healthy” (less than 10 percent of habitat lost) by 2025. Executive Order funding will be available for project implementation.

The Eastern Brook Trout Joint Venture was formed by public and private entities to address the regional and range wide threat of the species. Since that time, the group has overseen a range wide assessment of brook trout population and threats. Eastern Brook Trout Joint Venture is currently revising population data down to the catchment level to provide greater detail for protection and restoration measures. They are also studying the potential impact of global warming on the brook trout population using climate modeling. In addition to the research, Eastern Brook Trout Joint Venture is providing project funding to assist with stream and riparian restoration projects.

The National Fish and Wildlife Foundation developed a Keystone Initiative to help address the decline of the brook trout population in the mid-Atlantic region. One focus area of initiative is the headwaters of the Shenandoah River. These headwaters are priority locations for enhancement and restoration of brook trout habitat. The National Fish and Wildlife Foundation is planning on providing approximately \$500,000 annually for the next ten years for project implementation.

The U.S. Fish and Wildlife Service, Natural Resources Conservation Service, Trout Unlimited, and Virginia Inland Game and Fish are currently working together to identify priority watersheds for restoration within the focus area. One program that the partners are using is the Cooperative Conservation Partnership Initiative (CCPI). Natural Resources Conservation Service administers the CCPI, which allows them to enter into multi-year agreements with partners to implement natural resources practices on agricultural and private forest lands.

In Maryland a number of federal and states agencies are developing a fish passage blockage matrix to prioritize blockage removal. The Maryland tool is currently being field tested and revised. Once that tool is complete, the partners in the focus area plan to create a similar tool for use in the focus area.

The Service will refine the geographic boundaries of the focus area using the outcomes of CCPI, development of the Virginia fish passage blockage matrix, and revision of the Eastern Brook Trout Joint Venture population data.

Supporting Documentation:

Conserving the Eastern Brook Trout: An Overview of Status, Threats, and Trends – EBTJV
http://www.state.nj.us/dep/fgw/pdf/tic_cons_eastern_bkt.pdf

Virginia Brook Trout Conservation Strategies – EBTJV
http://www.easternbrooktrout.org/docs/EBTJV_Virginia_CS.pdf

Partners in Flight Bird Conservation Plan

http://www.partnersinflight.org/bcps/pl_12sum.htm

Business Plan – Eastern Brook Trout – NFWF

http://www.nfwf.org/Content/ContentFolders/NationalFishandWildlifeFoundation/GrantPrograms/Keystones/FishConservation/E_Brook_Trout_Biz_Plan.pdf

Executive Summary - Eastern Brook Trout – NFWF

http://www.nfwf.org/Content/ContentFolders/NationalFishandWildlifeFoundation/GrantPrograms/Keystones/FishConservation/E_Brook_Trout_Exec_Summ.pdf

Executive Order 13508 – Strategy for Protecting and Restoring the Chesapeake Bay Watershed

http://www.whitehouse.gov/the_press_office/Executive-Order-Chesapeake-Bay-Protection-and-Restoration/

Western Highlands Focus Area

Priority Species: American black duck (*Anas rubripes*), American eel (*Anguilla rostrata*), brook trout (*Salvelinus fontinalis*), prairie warbler (*Dendroica discolor*), wood thrush (*Hylocichla mustelina*)

Habitat Description: The Western Highlands Focus Area covers approximately 1,500 square feet and includes Garrett, Allegany, and Washington counties in Maryland, as well as portions of bordering counties in Pennsylvania and West Virginia. Elevations in this area range from 250 feet above sea level in Washington County, MD to over 3,300 feet above sea level in Garrett County, MD. The Western Highlands includes the Allegheny Plateau, Valley and Ridge, and Blue Ridge physiographic provinces, as well as the Youghiogeny, North Branch Potomac, and Upper Potomac watersheds. Because of the unique habitats and multiple physiographic regions, the Western Highlands focus area hosts some of the most diverse and globally important ecological resources on Earth (Canaan Valley Institute, July 2002).

The Western Highlands contains the most extensive interior hardwood forest in the world at the temperate latitudes. The Garrett and Allegany County regions of the Western Highlands are over 70% forested. These non-fragmented, interior hardwood forests serve as corridors for species migration since they are an important part of the migratory flyway for geese, ducks, and songbirds (Canaan Valley Institute, July 2002). Development in this area is limited to areas around cities such as Hagerstown and Cumberland. The remainder of the Western Highlands is predominantly used for agriculture.

Stream habitat in the Western Highlands varies greatly due to the multiple physiographic regions. However, in general the streams tend to be silt free, spring-fed, riffle-run areas that contain mixed gravels, cobble and sand. The streams in the Western Highlands contain over 150 fish species, 75 mussel species and 20 crayfish species, several of which are endangered, threatened or of special concern. The Nature Conservancy identified the Mid-Atlantic Highlands as one of its top six priorities because of species diversity and richness and the presence of species not found anywhere else in the U.S. Although water quality tends to be good in this region, acid mine drainage and nutrient inputs from agriculture are threats. According to the Maryland Department of Natural Resources (Boward et al. 1999), only 40 percent of the streams in the Western Highlands have an adequate riparian buffer.

Although the current geographic area of the Western Highlands is large, subwatersheds will be strategically targeted based on the best available species and ecological data. In particular, a Brook Trout Project Prioritization matrix will be used to assist in the identification of high priority brook trout stream restoration and dam removal projects.

Benefits to Trust Resources: These watersheds are located in the Partners in Flight Physiographic Region 12. Restoration and protection of riparian habitat will benefit early successional birds such as golden-winged warbler, prairie warbler, American woodcock, whip-poor-will, Northern bobwhite, field sparrow, Eastern towhee, blue-winged warbler, and willow flycatcher. Restoration and protection of mature deciduous forest will benefit cerulean warbler, worm-eating warbler, Louisiana waterthrush, and wood thrush. Restoration of grasslands will

benefit the Henslow's sparrow. Restoration and protection of northern hardwood and spruce-fir forests will benefit black-throated blue warbler, and Blackburnian warbler. Stream restoration and dam removal will benefit brook trout.

The Atlantic Coast Joint Venture Implementation Plan identified Canaan Valley as an important wetland area. Canaan Valley contains the largest wetland area in West Virginia, making up 39 percent of the state's wetlands. It also contains one of the largest shrub swamp and bog complexes in the eastern United States. The area supports nesting and wintering American black duck, mallard, and wood duck, and is a stopover point for migrating American black duck, mallard, green-winged teal, blue-winged teal, ring-necked duck, hooded merganser, gadwall, American wigeon, northern shoveler, pintail, bufflehead, common goldeneye, and lesser scaup.

Federally listed species that occur in the watershed are Indiana bat and harperella. The rivers provide important spawning and nursery habitat for American eel, a fish species of conservation concern in Northeast region. Canaan National Wildlife Refuge is located in this area.

In the spring of 2009 Maryland/District of Columbia Audubon identified a series of man-made grasslands, mostly on reclaimed coal strip mines, as important for several grassland bird species. Most notably, 60 pairs of Henslow's sparrows, a Bird of Conservation Concern in the Northeast Region, were counted. Conservation and enhancement of the grasslands will protect important habitat for Henslow's sparrow and seven other species of grassland birds.

Excluding livestock from streams and restoring forest buffers will provide travel corridors for several species of forest interior birds and many other state trust resources. In addition a direct benefit to stream water quality will result. Aquatic habitat in the Potomac River and ultimately Chesapeake Bay will benefit from reduced sediment and nutrient input.

The action plan for implementing Executive Order 13508 - Chesapeake Bay Protection and Restoration includes goals for brook trout restoration in the Chesapeake Bay watershed. Stream restoration and blockage removal using natural channel design methodology will improve water quality and habitat for brook trout. These improvements will benefit numerous other aquatic species, and ultimately result in reduced sediment and nutrient inputs to downstream watersheds.

Conservation Objectives:

- To protect and restore riparian corridors
- Restore stream habitat to improve water quality, aquatic habitat and reduce sediment loads
- Facilitate fish passage through the removal of barriers
- Exclude livestock from streams
- Protect and enhance (through invasive plant management) certain man-made grasslands
- Promote land use policies and decisions which protect existing valuable habitat and ecosystem functions on undeveloped lands

Threats and Opportunities: Land use practices are significantly affecting the natural resources in the Western Highlands. Stream acidification and deposition, forest fragmentation, nutrient runoff, habitat alteration, riparian and aquatic habitat losses, fish-tissue contamination, watershed disturbance and non-native fish introductions are major stressors to the Western Highlands.

Almost 25 percent of streams (17,000 miles) have poor aquatic habitat and 40 percent (29,000 miles) have only fair aquatic habitat. Acid rain and acid mine drainage have affected over 10,000 miles of streams. Moreover, almost 47 percent of the landscape is considered to be in poor to fair habitat because of forest fragmentation.

The Environmental Protection Agency, recognizing the loss of significant natural resources in the Highlands, has undertaken several courses of actions. They have three major research efforts (Mid-Atlantic Highlands Environmental and Assessment Program, Regional Vulnerability Assessment, and Mid-Atlantic Integrated Assessment) and one major implementation effort (Mid-Atlantic Highlands Action Plan (HAP)). The HAP is a recent initiative where EPA seeks to establish a multi-agency program that trains locals to implement restoration projects. The ultimate goal is to have a grass-root based program to increase environmental stewardship awareness and contribute to the local economy through the restoration projects.

EPA has already established multi-agency partnerships at the federal, state, and local levels as well as with nongovernmental organizations. Four state liaison (PA, MD, VA, and WV) positions have been created to coordinate and initialize restoration efforts within their perspective states. The Chesapeake Bay Field Office has entered into a 5-year partnership with EPA and the state liaisons to assist in the establishment of the grass-root program and implement protection and restoration projects.

EPA has contributed over \$3 million as initial funding to establish the Highlands Program and has programmed for future funding to secure its existence. Along with EPA funding, other HAP partners are contributing matching funds and in-kind services.

In addition, the Eastern Brook Trout Joint Venture developed a memorandum of understanding with federal and state fishery resource agencies and interested non-government organizations to participate in and support a joint venture partnership to conserve brook trout and their habitats in the eastern portion of the United States. The Eastern Brook Trout Joint Venture accepts project proposals to restore and conserve habitat necessary to support existing populations of brook trout that are healthy and productive and that will restore habitat that has historically sustained brook trout populations. Funding is available under the National Fish Habitat Action Plan through the U.S. Fish and Wildlife Service. Proposals range from approximately \$10,000 to \$50,000 in grant request and must had a minimum of a 1:1 match from other sources. These funds can only be used for on-the-ground habitat conservation and improvement projects and related design and monitoring activities.

Supporting Documentation:

Atlantic Coast Joint Venture Implementation Plan

http://www.acjv.org/wip/acjv_wip_midatlantic.pdf

Eastern Brook Trout Joint Venture Conservation Strategy

http://easternbrooktrout.org/docs/EBTJV_Conservation_Strategy_July_08.pdf

Executive Order 13508, Chesapeake Bay Protection and Restoration

http://www.whitehouse.gov/the_press_office/Executive-Order-Chesapeake-Bay-Protection-and-Restoration/

Fiscal Year 2011 Action Plan Executive Order 13508, Strategy for Protecting and Restoring the Chesapeake Bay Watershed

<http://executiveorder.chesapeakebay.net/file.axd?file=2010%2f9%2fChesapeake+EO+Action+Plan+FY2011.pdf>

From the Mountains to the Sea: The State of Maryland's Freshwater Streams

<http://www.dnr.state.md.us/streams/pdfs/md-streams.pdf>

Mid-Atlantic Highlands Program Transforming a Legacy

<http://www.epa.gov/reg3esd1/pdf/highlandslegacy.pdf>

Partners in Flight Bird Physiographic Region 12

http://www.partnersinflight.org/bcps/pl_12sum.htm

U.S. Fish and Wildlife Service Birds of Conservation Concern 2008

<http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf>

Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*) Species Action Plan

Focus Areas: Anacostia Watershed, Blackbird Millington, Chincoteague Bay, Lower Potomac Patuxent, Lower Rappahannock River, Lower Western Shore Rivers

Other Species Benefitting:, American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), striped bass (*Morone saxatilis*), white perch (*Morone americana*), yellow perch (*Perca flavescens*)

BIOLOGICAL PLANNING

Species Information: Based on the Klauda et al. (1991), alewife range along the east coast of North America, from South Carolina to northeastern Newfoundland. The range extends to the west as far as the Great Lakes, several of the Finger Lakes in New York and other freshwater lakes, but is most dominant on the northeastern coast. Adults limit oceanic movement to within 130 km from land and stay close to their natal estuaries. Adult alewife feed on amphipods and mysids, however just after spawning, adults will feed on cases of caddis-fly *Brachycentrus* before returning to sea.

Blueback herring range along the east coast of North America from Cape Breton, Nova Scotia to northern Florida. The range extends to the Gulf of St. Lawrence and to freshwater lakes, but is most dominant on the southwestern coast. Adults live close to shore and move to fresh or brackish water to spawn. Juvenile blueback herring are mainly planktivorous and consume copepods, cladocerans, and larval dipterans. Both species are eaten by a variety of fish species including striped bass, yellow perch, and largemouth bass as well as piscivorous birds.

River herring are anadromous, with adults migrating from the ocean into their natal streams to spawn. Blueback herring prefer to spawn in swift water, while alewife favor slow streams. Upon reaching the spawning ground, males circle a lone female. As this mass of fish swirls around, the females releases her eggs and the males release their sperm. After spawning, the adults swim back downstream and return to the ocean. The eggs hatch in three to seven days. Swift flowing streams carry the larvae downstream. In Chesapeake Bay rivers, juveniles range throughout tidal and freshwater areas during the spring but move upstream during summer with the encroachment of saltier water. During the fall, the young move downstream, beginning their first seaward migration. Juvenile river herring remain at sea until reaching sexual maturity at 3 to 6 years.

Justification for Species Selection: River herring, as interjurisdictional anadromous fish are a U.S. Fish and Wildlife Service trust resource. Of all anadromous fish in the Chesapeake, herring have dropped most dramatically. Only a few rivers support healthy populations. The Atlantic States Marine Fisheries Commission (ASMFC 2009) prohibited commercial and recreational fisheries beginning on January 1, 2012 unless states develop management plans that establish the sustainability of its fisheries. In the District of Columbia, new regulations are being proposed for 2011 that will close the recreational harvest of river herring (DDOE 2009), based on the AFSMC requirement. There is no commercial fishing of any species in the District. New fishing regulations have not yet been proposed for Maryland.

The Lower Potomac includes Mattawoman Creek, considered to be one of the Chesapeake Bay's most productive anadromous fish nursery with high overall productivity for American shad, hickory shad, white perch, blueback herring and alewife (Carmichael et al. 1992)

In the District of Columbia, river herring are found in the Potomac and Anacostia drainages. Shad and river herring are the primary fish species targeted for restorations within the waters of the District of Columbia (D. Ryan, District Department of the Environment, personal communication).

Threats and Assessment: Commercial landings of herring in the Bay peaked in 1908 at nearly 66 million pounds. By the early 1970s herring stocks dropped dramatically and commercial harvests plummeted. From 1965-1985, harvests of herring in Maryland and Virginia declined by at least 80%. Maryland Department of Natural Resources reports commercial harvest of nearly 87,000 pounds in 2004 compared with over 2 million pounds in 1973 (<http://mddnr.chesapeakebay.net/mdcomfish/finfish/test2y1.cfm?Spcode=0010>). Recent depletion of river herring has been attributed:

- Overfishing
- Pollutants including nutrients that can lead to hypoxia, acid rain, sediments which can carry toxic chemicals such as metals, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), nutrients, and pesticides, and road salt
- Migration blockages including dams, road culverts, stream gauging stations, and debris
- Loss of spawning habitat due to urbanization and an increase in impervious surface
- Climate change may lead to more intense rainfall, increased soil erosion and therefore increased loading of sediments, nutrients, and contaminants into streams. Hypoxia will increase from the nutrient loading and, at higher temperatures, fish would have increased oxygen requirements. Such changes would adversely impact the critical habitat for early life stages of river herring.

Research/Actions Needed:

- Examine the effects of sediment, hypoxia, and contaminant loading on survival of early life stages of river herring.
- Evaluate how urbanization and increased impervious coverage are associated with river herring population trends. Included would be an analysis of whether elevated conductivity is a factor in the decreased number of spawning sites in the non-tidal portion of Mattawoman Creek.
- Evaluate the benefits of reopening blockages in rivers with severe contaminant issues.
- Blockages have eliminated nearly 1,000 miles of potential spawning habitat in Chesapeake Bay tributaries. Since 1989, almost 200 miles of spawning habitat has been restored and more rivers are slated for opening.
- In the Anacostia watershed, restoration activities that may benefit river herring include the removal of 120-130 stream blockages, the implementation of low impact development to reduce runoff, and stormwater retrofits (U.S Army Corps of Engineers 2010).
- Additional restoration efforts include restocking depleted streams with herring transferred from other river systems.

Potential Funding: Funding would be sought by developing partnerships with federal, state, and academic colleagues. Stream blockage removals are a high priority for federal, state, and local agencies and funding is available to some extent.

Population Goal: Restore stable populations to Chesapeake Bay tributaries.

CONSERVATION DESIGN

- Assemble multi-disciplinary teams on a project-specific basis to unravel the effects of multiple stressors, including climate change, on river herring populations in the Chesapeake Bay.
- Work with partners to assess the impacts of these stressors and advise on adaptations.

CONSERVATION DELIVERY

- Remove blockages and restore stream habitat.
- Engage in early project planning (e.g. rerouting highway expansions away from spawning areas).
- Increase/restore riparian buffers to benefit habitats utilized by anadromous fish.

OUTREACH

CBFO will develop an outreach strategy to communicate the threats to river herring habitat and transmit the results of the studies to the public. CBFO will produce new fact sheets and update the web site with information specific to the Chesapeake Bay watershed. CBFO will make presentations to local watershed groups that highlight the status of river herring within the watershed.

MONITORING

Population monitoring is continuing as funding permits by the Maryland Department of Natural Resources. In the District of Columbia, the Fisheries Research Branch of the Department of the Environment conducts several surveys to monitor all life stages of American shad and river herring in the Anacostia and Potomac rivers. Electrofishing and seining surveys are used to target both adult and juvenile American shad and river herring and determine abundance estimates and young of the year indices. A push net survey is conducted focusing exclusively on young of the year recruitment and abundance of American shad and river herring.

Partners

District of Columbia, Department of the Environment
Maryland Department of Natural Resources
U.S Army Corps of Engineers
U.S. Fish and Wildlife Service, Maryland Fisheries Resource Office

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American Black Duck (*Anas rubripes*) Species Action Plan

Focus Areas: Chesapeake Bay Islands, Chincoteague Bay, Delaware Bay Shoreline, Lower Chester River, Lower Potomac Patuxent, Lower Rappahannock River, Nanticoke Choptank, Pocomoke River Cypress Swamp, Western Highlands

Other Species Benefitting: black rail (*Laterallus jamaicensis*), saltmarsh sparrow (*Ammodramus caudacutus*), seaside sparrow (*Ammodramus maritimus*)

BIOLOGICAL PLANNING

Species Information: The American black duck (hereafter black duck) is a large dabbling duck that breeds in North American wetlands, including freshwater wetlands created by beaver; brooks lined by speckled alder; lakes, ponds, and bogs throughout mixed hardwood and boreal forests; and in salt marshes. Post molting males, females, and fledged young assemble near breeding areas in early September. Southward migration begins in September to early October with individuals reaching wintering sites in coastal marshes from Nova Scotia to the mid-Atlantic states.

Nesting begins in February in southern parts of its range, but often not until late May in northern areas. Nests are usually well concealed and on the ground, often in uplands. Only females incubate the eggs. Once the ducklings hatch females lead broods to rearing areas where food and cover can be found.

Black ducks are omnivorous. Ducklings feed almost exclusively on insects until 18 days post-hatch when ducklings begin feeding on plants including seeds and leafy material. (Longcore et al. 2000b). Migrants eat seeds, foliage, and tubers of aquatic plants and seeds and fruits of terrestrial species, a variety of invertebrates, agricultural grains, and occasionally fish and amphibians. Animal foods, including saltmarsh snail (*Melampus bidentatus*), blue mussels (*Mytilus edulis*) and small crustaceans are important fall and winter food items along the Atlantic coast.

Justification for Species Selection: The black duck population remains below the North American Waterfowl Management Plan (NAWMP) continental population goal and has been identified as a “Species of Greatest Conservation Need” by 23 states in the Mississippi and Atlantic Flyways. One measure of success for sustaining healthy populations of fish and wildlife contained within President Obama's Executive Order 13508 on Chesapeake Bay Protection and Restoration is the restoration of a three-year average wintering black duck population in the Chesapeake Bay watershed of 100,000 birds by 2025.

State Contribution to Overall Species Population: Black ducks occur in both the Mississippi and Atlantic Flyways but the majority of birds winter on the Atlantic coast. The Mid-winter Waterfowl Survey conducted each January in most Atlantic Flyway states reported that for the years 2001 to 2005 Maryland, Delaware, and Virginia wintered about 25 percent of the Atlantic Flyway total count and the Chesapeake Bay watershed accounted for about 12 % of the Flyway's black ducks. In 2010 Maryland, Delaware, and Virginia wintered about 30 percent of the

Atlantic Flyway total count and the Chesapeake Bay Watershed accounted for about 15 % of the Flyway's black ducks

There are two populations of black ducks that inhabit the mid-Atlantic Region, resident breeding birds and a wintering population that migrates from Quebec, Ontario, and the maritime provinces.

In the Chesapeake Bay marshes, black ducks were once an abundant breeder throughout tidal marshes with the largest numbers nesting along the eastern shore from the Chester River to the Saxis marshes in VA, including all of the islands. The breeding population has steadily declined since the 1960's due to the loss of submerged aquatic vegetation, competition with millions of farm-raised mallards released at Regulated Shooting Areas (RSAs), competition and interbreeding with mallards (*Anas platyrhynchos*), development of shorelines, disturbance, predators, loss of coastal islands and brackish marshes, overharvest at RSAs and poaching. All of the factors have contributed to their demise to where there are probably less than 1000 breeding pairs remaining in the Chesapeake Bay.

The migratory population faces many of the same problems including overharvest, competition and hybridization with mallards, decrease in quality and quantity of wintering and breeding habitat, and environmental contaminants (Conroy et al. 1989, Rusch et al. 1989, Longcore et al. 2000 *a,b*, Merendino et al. 1993, Nudds et al. 1996, Conroy et al. 2002, McAuley et al. 2004, Zimpfer and Conroy 2006).

Threats and Assessment:

Causes of black duck mortality and habitat loss are numerous and complex and include:

- Over harvest and poaching
- Predators including black-backed gulls, herring gulls, crows, bald eagle, raccoons, exotic red fox, and skunks
- Loss of high salt marsh breeding habitat due to sea level rise, damage caused by nutria, human intrusion, and development
- Encroachment of non-native invasive plants such as common reed (*Phragmites australis*)
- Competition and interbreeding with mallards

Conservation Goal: To conserve and protect American black duck population, ensuring its long term sustainability in the wild.

Research/Actions Needed:

- Recent research suggests that black duck food sources may be limited in coastal salt marshes. Research should expand to determine if this is an issue of low or reduced productivity or competition with other animals.
- Support research for a biological control of common reed by federal, state and non-governmental programs.
- Research the impact of native and nonnative predators on various life stages of black ducks, and seek methods to reduce predation if it is substantial.
- Estimate the take of black ducks in legal hunting, poaching and incidental take at Regulated Shooting Areas (RSA).

- Study the effectiveness of mosquito control especially spraying of larva ives and insecticides in marshes and its reduction of black duck foods. Do cost/benefit analysis of damage to marsh and birds to need for mosquito control.
- Evaluate bycatch in legal and illegal fishing gear such as fyke nets, pound nets, and gillnets.

CONSERVATION DESIGN

- Permanently protect salt marsh habitats from development and pollution through fee simple purchases, conservation easements, and private donations
- Restore wetlands from prior –converted crop fields and farmed wetland pastures
- Continue restoring Poplar Island and other Chesapeake Bay islands to provide nesting habitat for black duck
- Control invasion of common reed (*Phragmites australis*) to prevent encroachment into black duck high salt marsh habitats
- Reduce mute swan population to in order to reduce its detrimental effect on submerged aquatic vegetation, an important black duck food source
- Continue nutria eradications efforts and reconstruct wetlands at Blackwater National Wildlife Refuge and adjacent habitats on private lands
- Restore natural ponds degraded by mosquito control actions
- Control predators especially the exotic red fox, but attempt to reduce predations of other invasive species through control or habitat manipulations
- Increase law enforcement to reduce illegal take of birds

CONSERVATION DELIVERY

- Through the National Coastal Wetlands Conservation grant program properties within the breeding range of the black duck can be protected under conservation easements to allow for potential marsh migration
- Work with the state of Maryland's Rural Legacy Program to protect large, contiguous tracts of black duck breeding and wintering habitat through cooperative efforts among state and local governments and land trusts.
- Utilize the North American Wetlands Conservation Act (NAWCA) to provide funding for Black duck habitat conservation or restoration in conjunction with partner organizations like National Audubon, Maryland-DC.

OUTREACH

Outreach is extensive through the Flyways, and the Black Duck Joint Venture. We will partner with other federal agencies in outreach connected with the black duck restoration in the Chesapeake Bay.

MONITORING

Current monitoring by U.S. Fish and Wildlife Service Division of Migratory Bird Management and the states are sufficient to determine the status of black ducks in the watershed.

Monitoring of common reed stands adjacent to black duck nesting habitat is important to ensure that the extensive grassy high marsh habitats required by the black duck aren't lost to invasion by this non-native plant species.

Partners

Appalachian Mountain Joint Venture (AMJV)
Atlantic Coast Joint Venture (ACJV)
Central Hardwoods Joint Venture (CHJV)
Delaware and Maryland Coastal Bays Program
Ducks Unlimited
Eastern Habitat Joint Venture (EHJV)
Environment Canada's Canadian Wildlife Service (CWS),
Maryland Department of Natural Resources
State and provincial conservation agencies of the Atlantic and Mississippi Flyways
Upper Mississippi River and Great Lakes Joint Venture (UMRGLJV)
U.S. Fish and Wildlife Service, Division of Migratory Bird
U. S. Fish and Wildlife Service, National Wildlife Refuge System (Regions 5, 3,4)
U. S. Fish and Wildlife Service, Regional Migratory Bird Programs (Regions 5, 3,4)

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American Eel (*Anguilla rostrata*) Species Action Plan

Focal Areas: Anacostia Watershed, Blackbird Millington, Lower Chester River, Lower Rappahannock River, Lower Susquehanna Aberdeen, Nanticoke Choptank, Western Highlands

Other Species Benefitting: freshwater mussel (*Elliptio complanata*)

BIOLOGICAL PLANNING

Species Information: American eel occupy a significant and unique niche in coastal rivers and tributaries. Historically, American eel were very abundant in the Chesapeake Bay rivers, comprising more than 25 percent of the total fish biomass. The abundance of this species has declined from the historic high levels and now remains relatively stable at historic low levels. Resource managers and scientists are warning that future declines in abundance may come from greater harvest and other impacts. In an effort to address the decline in abundance, a working group was established by the Atlantic States Marine Fisheries Commission to develop a Fishery Management Plan (FMP) for the American eel in order to protect and restore the species. The document outlines the conservation measures to take for the species. The U.S. Fish and Wildlife Service is in full support of the measures to attain the goals of the FMP.

Justification for Species Selection: Proposed as a Federally-listed threatened species, the American eel has a unique life history and uses a variety of aquatic habitats. The American eel was selected as a priority species because it is an indicator of good water quality in aquatic habitats that range from the coastal estuary to the highland streams. Eels are highly adaptive to various food sources and undergo long migrations upstream and downstream in the watershed. This occurs even in rivers with small dams. The successful migration of American eels is essential to the full restoration of a river ecosystem due to the fact that eel typically provide for freshwater mussel distribution upstream in a watershed. This relationship between the eel and mussel is short lived, but it is essential for mussel distribution and survival in a watershed.

On May 12, 2009, the President issued Executive Order 13508, recognizing the Chesapeake Bay as a national treasure and calling on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. Among one of the goals set forth by the Executive order is to restore historical fish migratory routes by opening 1,000 additional stream miles by 2025, with restoration success indicated by the presence of American eel, American shad and river herring.

State Contribution to Overall Species Population: American eel are found in all Chesapeake Bay rivers and streams that are free of blockages.

Threats and Assessment: American eel assessments are conducted annually in Maryland with some fishery dependent and independent methods. Eel abundance may be adversely impacted by:

- Habitat loss
- Water quality impairment
- Commercial fishing

- Recreational bait fishing
- Hydroelectric turbines
- Drinking water intakes

Conservation Goals: The goal is to conserve and protect the American eel ensuring its continued role in the ecosystems, while providing the opportunity for its commercial, recreational, scientific, and educational use.

Specifically:

- Protect and enhance the abundance of American eel in the watershed and contribute to the viability of the American eel spawning population
- Provide for sustainable commercial and recreational eel fisheries by preventing overharvest of any life stage.

Research/Actions Needed

The American eel needs considerably more research conducted on migration, biology, habitat use and aquaculture (see attachment).

CONSERVATION DESIGN

- Lead the Potomac River Dams 4 and 5 eelway projects
- Develop eel passage monitoring on the Potomac River
- Develop and support eel passage and monitoring on the Shenandoah River
- Plan to open Potomac and Shenandoah Rivers to eel passage, with a vision to open the entire Potomac Watershed
- Improve knowledge of eel utilization at all life stages through mandatory reporting of harvest and effort by commercial fishers and dealers, and enhanced recreational fisheries monitoring.
- Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring.
- Protect and enhance American eel abundance in all subwatersheds where eel now occur.
- Where practical, restore American eel to those waters where they had historical abundance but may now be absent by providing access to inland waters for and adequate escapement to the ocean for pre-spawning adult eel.
- Investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure.

CONSERVATION DELIVERY

- Open access on the Potomac River at dams 4 and 5
- Open upstream and downstream eel passage on the Shenandoah River
- Reduce downstream passage mortality at hydroelectric stations with nighttime shutdowns on the Shenandoah and Potomac Rivers
- Coordinate and support dam removals and other eel passage projects in the Chesapeake Bay watershed

OUTREACH

- All completed dam removal and eelway projects include a media and environmental education day
- Volunteer and education opportunities exist for children and adults during eelway monitoring
- The Potomac River Dams 4 and 5 eelway projects will have environmental education kiosks or signage
- The National Park Service will assist with education and outreach on the Potomac River watershed projects

MONITORING

The Chesapeake Bay Field Office is the lead for American eel restoration and protection in the Shenandoah River since 1986 and through the process of regulatory actions of the hydroelectric relicensing. A partnership with the Allegheny Energy Supply Company, University of West Virginia, Fish and Wildlife Cooperative Unit, the Service's Maryland Fisheries Resource Office and other federal and state resource agencies to monitor upstream and downstream eel passage including:

- Downstream out-migration of silver eels within the Shenandoah River relative to Luray, Warren, and Millville hydroelectric dams
- Downstream outmigration of silver eels at a larger geographic scale from Luray to the mouth of the Potomac River
- Effectiveness of the eel ladders at Millville, Warren, and Luray Dams for upstream migration of yellow eels
- Timing, periodicity, and environmental correlates of upstream movements of yellow eels between the dams and age-length relationships of yellow eels to assess relative growth rates
- Infection rates of swimbladder nematodes in eels of the lower Shenandoah River.

Management actions (such as periods of shut down or methods to assist eel passage) could be refined with additional understanding of seasonal variation in downstream migration, environmental fluctuations on downstream migration, the timing and daily periodicity of downstream migration, and the locations (spillway vs. turbines) of where eels pass the dam.

Partners

Allegheny Energy Supply
Interstate Commission on the Potomac River Basin
Maryland Department of Natural Resources
National Park Service
The Nature Conservancy
U. S. Army Corps of Engineers, Baltimore District
U.S. Fish and Wildlife Service, Maryland Fisheries Assistance Office
West Virginia Department of Natural Resources
West Virginia University Cooperative Fish and Wildlife Unit, U.S. Geological Survey

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Attachments

American eel research needs recommended in the Atlantic States Marine Fisheries Commission FMP.

Assessment and determination of fishing mortality rates (F) to develop sustainable harvest rates
Economic studies are necessary to determine the value of the fishery and the impact of regulatory management.

Investigate: mechanism of sex determination; growth rates for males and females throughout their range; habitat preferences of males and females; predator-prey relationships; behavior and movement of American eel during their freshwater residency; oceanic behavior, movement and spawning location of mature adult American eel; and all information on the leptocephalus stage of the American eel.

Evaluate contaminant effects on American eel and the effects of bioaccumulation with respect to impacts by age on survival and growth and effect on maturation and reproductive success.

Study the nutrition of American eel leptocephali larvae in the ocean.

Determine growth rates of male and female American eel in different habitats.

Determine if geographic sub-populations exist, which may have implications for management.

Investigate larval and juvenile survival and mortality to assist in the assessment of annual recruitment

Determine food habits of glass eel while at sea

Investigate location and triggering mechanism for metamorphosis from leptocephalus to glass eel

Investigate mechanisms of exit from the Sargasso Sea and of transport across the continental shelf

Evaluate the impact, both upstream and downstream, of barriers on American eel with respect to population and distribution affects. Determine areas of extirpation and historical distribution

Investigate, develop, and improve technologies for American eel passage upstream and downstream

Evaluate the ecosystem importance of American eels as prey, predators, and mechanisms of transporting freshwater biomass to marine systems

Determine fecundity-length and fecundity-weight relations for female American eel from various parts of its geographic range

Determine mortality rates at different life history stages (leptocephalus, glass eel, yellow eel, and silver eel) and mortality rates with size within the yellow eel stage

Investigate mechanism of sex determination in American eel

Determine age at entry of glass eel into estuaries and fresh waters

Investigate migratory routes and guidance mechanisms for silver eel in the ocean

Investigate mechanisms of recognition of the spawning area by silver eel

Investigate mate location in the Sargasso Sea

Conduct studies on spawning behavior

Determine gonadal development in maturation

Conduct workshop on aging techniques

Sustainable fishing mortality rates (F) for American eel have not been examined.

Researchers and fishery managers have not determined the best means to ensure the stability of the American eel populations

Identification and understanding of American eel habitat needs for all life stages

Model the effect of increased habitat availability and reductions in mortality at various freshwater life stages on escapement

Research the impacts of elver fishing on the abundance and distribution of later life stages within a watershed and what, if any, impacts there are on sexual determination and upstream migration.

Research techniques (physical and behavioral) for providing upstream and downstream passage around dams

Research the feasibility and ecological/genetic impacts of trap and truck programs for elvers

Quantify and assess male eel habitat and male eel abundance

Quantify and estimate the impact of the bait fishery for juvenile/bootstrap eels.

Bald Eagle (*Haliaeetus leucocephalus*) Species Action Plan

Focus Areas: Anacostia Watershed, Lower Potomac Patuxent, Lower Rappahannock River, Lower Susquehanna Aberdeen

Other Species Benefitting: Delmarva fox squirrel (*Sciurus niger cinereus*)

BIOLOGICAL PLANNING

Species Information: Bald eagles are large birds of prey (raptors) of North America, weighing between 10 -14 pounds and have an average wingspan of 6 feet. Bald eagles live near rivers, lakes, marshes and estuaries where they forage for fish, their predominant year round food source. Bald eagles will also feed on waterfowl, turtles, rabbits, snakes, and other small animals including carrion, especially during the winter months. The Chesapeake Bay has the distinction of hosting a large breeding population and an equally important non-breeding and migrant population. In winter, bald eagles congregate in forested areas near open water for foraging, loafing, sheltering and overnight roosting.

The regulated nesting season begins December 15 and ends June 15 of each year. Bald eagles in the Chesapeake Bay region prefer nesting in mature loblolly pines, tulip poplars and oaks near undisturbed shorelines. Nest heights average 90 feet above the ground. The massive nests are often used year after year, growing to 6-8 feet in width and averaging 4 feet deep. By late January to early February, bald eagles will lay one to three eggs which hatch after 35 days of incubation. The young fledge between 11 and 12 weeks of age.

Historical records show that in the early 1900s several thousand pairs of eagles nested around the Chesapeake Bay each year. However, just prior to the 1940s, bald eagles began to decline due to the direct killing, loss of habitat and the introduction of the pesticide DDT. The near demise of the population prompted the federal government to list the species in 1967 for regulatory protection. In 1978, the species was listed as endangered under the Endangered Species Act throughout the lower 48 states.

During the past 25 years of recovery, eagles have made a significant rebound. Bald eagles have responded to the absence of DDT in the environment in addition to landowner compliance of the Endangered Species Act. The species was removed from the ESA in 2007 but remains protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act (MBTA). The Service also developed the *National Bald Eagle Management Guidelines* in 2007, to inform the public of measures to avoid disturbance to bald eagles.

Justification for Species Selection: The Chesapeake Bay encompasses one of the largest concentrations of bald eagles in the lower 48 states. In addition to the breeding population, the Chesapeake Bay supports winter migrants from as far north as Canada and northern states and summer migrants from Florida and the Carolinas. State and federal monitoring programs have documented only a limited number of communal and concentration areas throughout the Chesapeake Bay and its tributaries in Maryland and Virginia. These areas are deemed significant not only to protect recruitment levels for the Chesapeake Bay nesting population but also winter

and summer eagles from the northern and southern bald eagle populations. The level of importance the Chesapeake Bay has on the migrant population has yet to be determined.

In 2009, the Service promulgated new permit regulations under the Bald and Golden Eagle Protection Act, including a regulatory definition of disturb. Two new take permits under CFR 50, 22.26 (disturbance) and CFR 50 22.27 (nest removal) were established for development projects which comply with the permit issuance criteria for take.

State Contribution to Overall Species Population: Maryland and Virginia support approximately 1,600 nesting pairs to the overall national nesting population of 10,000 (+) breeding pairs. The Chesapeake Bay area supports no less than 10 recognized concentration areas which collectively sustain several thousand non-breeding aged adult, sub-adult and juvenile individuals during the summer and winter months. Known locations in Maryland include areas of the Conowingo Dam on the lower Susquehanna River, Aberdeen Proving Ground in northern Chesapeake Bay, lower Potomac River (Maryland and Virginia shoreline) and Blackwater National Wildlife Refuge. In Virginia, sites include a significant portion of the James and Rappahannock Rivers.

Threats and Assessment:

- Cumulative impacts (direct effects) from habitat loss due to shoreline development projects including new construction of private and community boat ramps and marinas. Recreational water activities (indirect effects) will have increased negative impacts to communal and concentration areas over time which may substantially fragment or completely eliminate these important areas.
- Mortality (line strike collision with electrical utilities and wind turbines, environmental contaminants such as ingested lead; mercury)
- Noise disturbance (human activity)

Management Actions Needed: The *National Bald Eagle Management Guidelines* provides criteria to avoid and minimize disturbance to nests, foraging and roost areas. In addition, new federal regulatory documents have been developed which provide the framework for authorizing eagle take through a permit process. The majority of permits will likely involve disturbance of nests. The number of permits issued will not exceed the Regional Take Allocation per given year. The Endangered Species Act established a requirement for monitoring a species once removed from Threatened and Endangered Species List. Post-Delisting Monitoring for nest occupancy was initiated in 2009 and will continue every 5 years for a 20 year period. The state of Maryland recently removed their designation of threatened status and therefore no longer allocate funding or resources to protect the species. All inquiries are directed to the Service due to the federal status designation. A serious problem persists however, for potential take/disturbance of eagles at concentration areas. The Service has an incomplete inventory of communal and concentration areas, especially in Maryland, and currently lack necessary funds for conducting shoreline roost surveys. These data gaps will result in the Services inability to address potential take which may result in projects moving forward without receiving mitigation or compensation for the species.

Potential Funding: Funding priorities do not include bald eagle communal roost and concentration surveys at this time. The Service must recognize this need in order to be able to assess the local population dynamics which would then enable field offices (Eagle Coordinators) and the Regional Endangered Species and Migratory Bird Programs to set annual take thresholds for eagles that may be disturbed within these areas. The Service's Eagle Management Team has a strategy to initiate a National Eagle Compensation Fund as a mitigation component within the permit framework for disturbance, which could possibly be used to fund actions such as communal roost surveys.

Research/Monitoring Actions Needed: As cited earlier, current monitoring is an extension of the Endangered Species Act which requires implementation of a Post-Delisting Monitoring Plan. Aerial nesting surveys are conducted for a sub-set of the population once every 5 years for 20 years to ascertain any declines in the population level that may dip below the baseline threshold. In April/May 2009, the Service conducted the first of five aerial monitoring for nest occupancy.

Population Goals: The national breeding population (and Chesapeake Bay Eagle Region) has been stable or steadily increasing since delisting in 2007. Chesapeake Bay Bald Eagle Recovery Plan objectives of 300-400 nesting pairs, productivity of 1.1 young and long term, adequately protected habitat continue to be met or exceeded. Results of the first Post-Delisting Monitoring indicated an increasing eagle population, above the baseline threshold (20 % population decline). Thus far, the Regional permit allocation number has not been exceeded (based on limitation of 5% of the annual nest productivity). However, the population goal is based on the number of nesting pairs and productivity. There is no accounting for eagles within the concentration areas which must be addressed.

CONSERVATION DESIGN

- The Bald Eagle Coordinator at Chesapeake Bay Field Office, in coordination with the Service's Eagle Management Team and Region 5 Endangered Species and Migratory Bird Permit Office and Virginia Field Office, will develop a strategy to quantify the parameters necessary to sustain long term protection for bald eagles at communal roost/concentration areas. Take threshold levels will be addressed which may be inclusive of the entire local Chesapeake Bay communal roosting areas or determined individually, based on watershed or tributary unit.

CONSERVATION DELIVERY

- Continue to actively provide technical assistance to Aberdeen Proving Grounds and other Department of Defense facilities

OUTREACH

Continue to work with the Service's Eagle Management Team and sub-teams and provide updates for posting on at Chesapeake Bay Field Office and Region 5 Endangered Species and Migratory Bird Permit Office web sites as new information becomes available.

MONITORING

Other than an Endangered Species Act requirement to implement post-delisting monitoring ever 5 years, annual monitoring for nesting territories is no longer conducted by the state of

Maryland. Efforts have begun internally with the Service to address these needs but with an added emphasis to monitor eagle concentration areas.

Partners

Maryland Department of Natural Resources
College of William and Mary-Center for Conservation Biology

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Bog Turtle (*Clemmys muhlenbergii*) Species Action Plan

Focus Area: Gunpowder River Deer Creek

Other Species Benefitting: American woodcock (*Scolopax minor*), brook trout (*Salvelinus fontinalis*), Indiana bat (*Myotis sodalis*)

BIOLOGICAL PLANNING

Species Information: The bog turtle is one of the smallest turtles in North America with a carapace between 7.5 – 11.4 centimeters in length. It is distinguished by a bright orange, yellow or red blotch on each side of the head and neck. The shell is a light brown to ebony and is weakly keeled. The limbs and head are dark brown to black. The plastron is yellow with black patches.

The northern population of the bog turtle extends from western Massachusetts to northern Maryland and Delaware. The geographic distribution of the bog turtle is fairly extensive but its habitat requirements limit it to spring fed emergent wetlands with thick mucky organic soils (Smith 2000). These wetland types are very rare in its distribution range. These wetlands are dominated by low grasses and sedges with a mix of shrub species. Common emergent species include rice cut-grass (*Leersia oryzoides*), tearthumbs (*Polygonum* spp.), tussock sedge (*Carex stricta*), skunk cabbage (*Symplocarpus foetidus*), soft rush (*Juncus effuses*), sensitive fern (*Onoclea sensibilis*), jewelweed (*Impatiens* spp.), arrowheads (*Sagittaria* spp.), and a variety of other sedges (*Carex* spp.). Common scrub species include alder (*Alnus* spp.), viburnum (*Viburnum* spp.) and poison sumac (*Toxicodendron vernix*) (Lee and Norden 1996).

Research is needed on the affects of predation on bog turtle populations and reproduction. Wildlife cameras will be deployed at several sites to observe the species of predators, duration of visits, and numbers of each species moving through these wetlands. Depending on the results, a stomach analysis study may be recommended on the most common predators frequenting the sites.

Confer with institutions breeding bog turtles and other endangered turtles to determine the practicality of developing captive breeding programs at two or three zoos. Presently, there are several isolated bog turtle wetlands in Maryland with populations of fewer than 10 individuals. These turtles will never generate self-sustaining populations and should be bred in zoos. Young turtles could be kept in the zoo for a year or two or until they reach a size that makes them less vulnerable to predation and then released in Population Analysis Sites (PAS) with more than one wetland to reestablish populations in these priority sub-watersheds.

Justification for Species Selection: The bog turtle was listed as threatened under the Endangered Species Act in 1997 because it was being excessively collected for the pet trade and was limited to wetland habitat types that are rare throughout its northern range. The collection of turtles for the pet trade has been diminished because of its listing. Its low population numbers also makes the turtle very hard to find. However, the loss of bog turtle wetlands and Population Analysis Sites (PAS) is continuing because of land development and habitat succession. The Chesapeake Bay Field Office has the responsibility of developing recovery plans for bog turtles located in Baltimore, Carroll, Cecil, and Harford counties in Maryland; New Castle County in Delaware; and Adams, Cumberland, Franklin, and York counties in Pennsylvania. These counties encompass portions of two major watersheds that are separated into two bog turtle recovery units. The recovery units are listed as the Delaware and Susquehanna/Potomac Recovery Units

and include the Delaware Bay, Susquehanna River, and Potomac River watershed regions that are occupied by the bog turtle.

State Contribution to Overall Species Population: The Maryland Department of Natural Resources (MDNR) conducted three bog turtle surveys between 1976 and 2004 and provided detailed data on 177 wetlands and 91 bog turtle populations (U.S. Fish and Wildlife Service 2005).

Threats and Assessment:

- Habitat loss and segmentation of Population Analysis Sites (PAS)
- Habitat succession and nutrient inputs
- Low reproduction, low population numbers and unknown predation impacts
- Barriers to migration

Management Actions Needed:

Habitat Loss and Segmentation of Population Analysis Sites

In 2001, there were approximately 350 Population Analysis Sites (PAS) throughout the northern population of the bog turtle (U.S. Fish and Wildlife Service 2001). A PAS consists of one or more emergent wetlands that are close enough to each other and support or could potentially support bog turtles. These wetlands are located in small sub-watersheds consisting of first and second order streams and are not blocked from each other by roads, or by residential, office, or industrial development. Turtles should be able to travel easily between each wetland for it to be considered a habitat unit in the same PAS. Ongoing road construction and land development continually threaten bog turtle wetlands and PAS's.

The situation of wetland and PAS destruction can be illustrated by two bog turtle surveys conducted by the Maryland Department of Natural Resources (MDNR) in 1976 -1978 and 1992-1993 (Smith 1994). In 1976, the MDNR found 177 wetlands comprising 94 PAS's inhabited by bog turtles. By 1993, only 91 sites of the 159 sites surveyed contained bog turtles and only 56 PAS's remained. Bog turtles were missing from 68 sites and 38 PAS's that contained bog turtles in the late 1970's. This represents a 43% reduction in wetlands and a 40% in PAS's in 16 years. Protecting bog turtle wetlands and preventing fragmentation of Population Analysis Sites (PAS) is critical to the recovery of this species.

Habitat Succession and Nutrient Inputs

Another problem affecting bog turtles concerns invasive native and exotic plant species overwhelming the emergent and shrub species needed for viable bog turtle habitat. Bog turtles need wetlands dominated by a diverse community of emergent vegetation. Over 50% of the remaining bog turtle wetlands are being overrun by red maple (*Acer rubrum*), multiflora rose (*Rosa multiflora*), cattail (*Typha latifolia*), and reed canary grass (*Phalaris arundinacea*) which engulf and shade out the emergent vegetation utilized by bog turtles. To prevent succession of bog turtle wetlands into forested wetlands and reduce nutrients from croplands we recommend:

- Control invasive woody and herbaceous vegetation with glyphosate and imazapyr. The glyphosate will be applied to the cut stump of red maple, willow, and alder and to the leaves of reed canary grass, cattails, and multiflora rose. Imazapyr will be injected in the trunks of red maple and willow.

- Fence bog turtle wetlands and allow goats, sheep, or cattle to graze on the invasive wetland vegetation.
- Identify potential nutrient sources and place the wetland and a 300-foot wide upland buffer into a conservation easement. The vegetation in the buffer incorporates the nutrients into plant tissue.

Low reproduction, low population numbers, and unknown predation impacts

We recommend that a captive breeding program be initiated in three to four zoos in the Northeast. These bog turtles can be removed from small populations that are in isolated PAS's with only one or two wetlands. Since there is little variation in the genetics of bog turtles (Rosenbaum et al. 2006), all the turtles collected can be interchanged between the zoos involved with this program. A captive breeding program can no longer be dismissed as too problematic due to the high rate of loss.

Increased predation may be having a significant effect on bog turtle populations and reproductive success. To determine the predator species and determine the frequency of predator travel through the bog turtle wetlands, wildlife cameras should be placed in some of these wetlands.

Barriers to migration

Where subdivision of the land base is imminent, continue to work NRCS and landowners to promote the purchase of conservation easements. Buffer if part of the conservation easement, would also minimize the impacts of new developments on wetland hydrology. Because of past land uses many of the streams adjacent to bog turtle wetlands have steep banks which prevent bog turtles from accessing adjacent wetlands. Stream restoration should be implemented on the highest priority PAS's.

Research Actions Needed:

Deploy wildlife cameras at several sites to observe predation on bog turtle populations and identify the species of predators, duration of visits, and numbers of each species moving through these wetlands. Depending on the results, a stomach analysis study may be recommended on the most common predators frequenting the sites.

Confer with institutions breeding bog turtles and other endangered turtles to determine the practicality of developing captive breeding programs at two or three zoos. Young turtles could be kept in the zoo until they reach a size that makes them less vulnerable to predation and then released in PAS's to reestablish populations in these priority sub-watersheds.

CONSERVATION DESIGN

- Prioritize Maryland bog turtle wetlands according to reproduction/no reproduction, population size, and number of wetlands in each PAS.
- Place each Maryland wetland on an aerial photo to determine the spatial relationship between wetlands rated as to value.
- Place traps in newly discovered bog turtle wetlands to estimate turtle population sizes.
- Conduct bog turtle walk through surveys in Maryland.
- Hire crews to fence bog turtle wetlands that will utilize goats, sheep, or cattle to control invasive vegetation.

- Hire crews to spray vegetation that needs to be controlled in bog turtle wetlands.
- Assist the Natural Resources Conservation Service in identifying properties with bog turtle wetlands.
- Conduct stream and riparian restoration to increase floodplain connectivity, and restore wetland hydrology.
- Work with the Corps of Engineers to ensure no permits are issued for alterations to bog turtle wetlands.
- Visit facilities that are breeding endangered and threatened turtles. If captive breeding seems feasible, meet with zoo officials to try to initiate two or three breeding programs.

CONSERVATION DELIVERY

- Develop location maps for the top 110 priority wetlands in the state of Maryland
- Control invasive woody and herbaceous vegetation with glyphosate and imazapyr. The glyphosate will be applied to the cut stump of red maple, willow, and alder and to the leaves of reed canary grass, cattails, and multiflora rose. Imazapyr will be injected in the trunks of red maple and willow.
- Control invasive plant species in 10 to 15 bog turtle wetland each year. Spray ten to twenty bog turtle sites each year.
- Conduct 10 bog turtle surveys in Maryland per year.
- Fence bog turtle wetlands and allow goats, sheep, or cattle to graze on the invasive wetland vegetation. Fence four bog turtle sites each year.
- Work with identified landowners to encourage them to place their wetlands in a conservation easement that allows the Service to restore or enhance the wetland for bog turtles.
- Work with the U.S. Army Corps of Engineers to ensure that property owners are not given permits to fill or alter the hydrology of known jurisdictional bog turtle wetlands.
- Work with the U.S. Army Corps of Engineers and the regulatory branches in Chesapeake Bay Field Office and Pennsylvania Field Office on permit applications that may impact bog turtle wetlands.
- If feasible, establish two bog turtle captive breeding programs by 2015.

OUTREACH

- Work with Natural Resources Conservation Service to organize meetings to discuss the various funding opportunities to promote wetland and buffer easements, fencing, and construction of stream crossings.
- Provide this information through brochures, websites and social networks to landowners.
- Contact a minimum of 50% of the landowners at least once a year to ask how we can assist them in the maintenance of their wetlands.

Partners

Landowners

Maryland Department of Natural Resources

Natural Resources Conservation Service

U.S. Army Corps of Engineers

U.S. Fish and Wildlife Service, Pennsylvania Field Office

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Brook Trout (*Salvelinus fontinalis*) Species Action Plan

Focus Areas: Gunpowder River Deer Creek, Shenandoah Upper Rappahannock, Western Highlands

Other Species Benefitting: American eel (*Anguilla rostrata*), freshwater mussels

BIOLOGICAL PLANNING

Species Information: Brook trout range from Maine to Georgia in the eastern portion of the United States. Although self-sustaining populations are found in lakes and ponds in Maine, New York, and Vermont (Hudy et al., 2005), they are typically found in silt-free, spring-fed headwater streams with mixed gravels, cobble and sand substrate (Maryland Department of Natural Resources, 2006). Spawning occurs from mid-October to late November or early December when the trout migrate upstream to gravel-bottomed areas in cold, spring-fed tributaries. Aquatic insect larvae and other terrestrial invertebrates make up much of their diet. Due to their feeding habits, brook trout can be negatively impacted by persistent water turbidity (Maryland Department of Natural Resources, 2006).

Traditionally, the value of brook trout has been linked to recreational and economic benefits. In addition to this, however, brook trout are very significant biologically. They require pristine, stable habitat and high water quality conditions to survive, and are indicators of high biological integrity in streams. These requirements make this species a very good candidate when planning biological and conservation actions for the entire ecosystem they live in.

Justification for Species Selection: Brook trout populations are declining throughout the native range. Currently 388 of 1,294 sub-watersheds in the Chesapeake Bay are classified as “reduced” for brook trout. May 12, 2009, President Barak Obama signed the Chesapeake Bay Protection and Restoration Executive Order (EO) 13508 requiring a renewed commitment from Federal Agencies to protect and restore the Chesapeake Bay. A brook trout outcome was included in the “Sustain Fish and Wildlife” goal under this EO. Brook trout are listed as a “Species of Greatest Need of Conservation” in the Maryland Department of Natural Resources Wildlife Diversity Conservation Plan (Maryland Department of Natural Resources, 2005). The recognition of the significance and uniqueness of brook trout habitat, and the widespread detrimental effects of its decline, has also resulted in the creation of various alliances, such as the multi-state Eastern Brook Trout Joint Venture and the Maryland Brook Trout Alliance.

State Contribution to Overall Species Population: Hudy, et al. (2005) show that brook trout are extirpated from 26% of their native subwatersheds in Maryland, West Virginia and Virginia. In Maryland specifically, brook trout have been extirpated from 62% of their native habitat and 82% of the remaining populations are classified as “greatly reduced” (Hudy et al. 2005).

Threats and Assessment:

- Climate change, increases in water temperature - Research indicates that water temperature is the single most important factor limiting the geographic distribution of brook trout (Maryland Department of Natural Resources, 2006).

- Habitat degradation and alteration - Brook trout populations become extirpated and its habitat declines when human land use in a subwatershed is greater than 18% (Hudy et al. 2005).

Hudy et al. (2005) identified urbanization as a high or medium impact in 100 of 145 subwatersheds in Maryland. Urbanization typically effects brook trout through loss of riparian buffer, loss of stream shading, change in surface and sub-surface hydrological regimes, increased sedimentation, reduced flow, increased high flow events, changes in channel morphology, changes in the physical makeup of streambeds, and increased impervious surface (Maryland Department of Natural Resources, 2006).

Hudy et al. (2005) identified agriculture as the most widely distributed factor in the decline of brook trout across its eastern range. The impacts to brook trout populations are similar as in urbanization (i.e. increased water temperature, increased sedimentation, hydrological changes, loss of riparian vegetation etc.). Additionally, livestock in agricultural areas can increase problems by damaging stream banks and contributing nutrients.

- Mining activities impact brook trout populations through acid mine drainage (AMD), hydrological changes and physical habitat degradation.
- Non-native fish species, such as brown trout, have negative impacts on brook trout populations due to competition for resources.
- Population fragmentation due to physical and chemical barriers - Hilderbrand and Morgan (2009) indicate that isolation of populations due to connectivity loss will decrease genetic diversity, and therefore increase the risk of extirpation.

Rangewide Recovery Goals: Conserve, enhance or restore naturally reproducing brook trout populations.

Rangewide Recovery Objectives: Improve 58 sub-watersheds from “reduced” classification to “healthy.”

Research/Actions Needed:

Maryland Department of Natural Resources (2006) identified the need to:

- Determine brook trout life history parameters
- Investigate brook trout movement patterns
- Investigate the impact of non-native trout and other exotic species
- Determine the extent of streams impacted by acid rain and acid mine drainage

Hudy et al. (2005) identified the need for:

- Increased quantitative population monitoring where there are data gaps.
- Continued quantitative population monitoring to document trends.

The U.S. Fish and Wildlife Service, Chesapeake Bay Field Office and Maryland Fisheries Resource Office identified the need for continued inventory of fish passage barriers, particularly in the western portion of Maryland.

Potential Funding Sources: National Fish Habitat Action Plan, Mid-Atlantic Highlands Action Plan, Wildlife Habitat Initiative Program (WHIP), Conservation Reserve Enhancement Program (CREP), Eastern Brook Trout Joint Venture

CONSERVATION DESIGN

Existing Strategies

- The Eastern Brook Trout Joint Venture 2008 Action Strategies
- The 2006 Maryland Brook Trout Fisheries Management Plan
- The Chesapeake Bay Summit 2010 outcomes from the Wetland Restoration and Enhancement and Stream Restoration Maryland Action Teams.

Other Strategies for Addressing Threats

- Conduct stream restoration using a natural channel design methodology (NCD). NCD uses the rivers natural tendencies to design a channel that will maintain its dimension, pattern, and profile overtime. Projects will range in scope from bank stabilization using native materials to full channel reconfiguration with the installation of bank stabilization and in-stream structures, while increasing floodplain connectivity. The Service will use native grasses, trees, and shrubs for bank stabilization and riparian plantings. Construction of in-stream structures will utilize logs and rocks, with preference given to log structures when their use is possible.
- Design and implement fish passage using a natural channel design methodology (NCD). NCD uses the rivers natural tendencies to design a channel that will maintain its dimension, pattern, and profile overtime. Projects will range in scope from removing the blockage with a small amount of bank stabilization using native materials to full channel reconfiguration with the installation of bank stabilization and in-stream structures, while increasing floodplain connectivity. The Service will use native grasses, trees, and shrubs for bank stabilization and riparian plantings. Construction of in-stream structures will utilize logs and rocks, with preference given to log structures when their use is possible.
- Conserve or enhance existing riparian habitat
- Conduct riparian plantings and livestock fencing
- Develop a Brook Trout Project Prioritization matrix to assist in the strategic identification of high priority brook trout stream restoration and dam removal projects

CONSERVATION DELIVERY

To address climate change, increases in water temperature, habitat degradation and alteration, and mining, the following actions are recommended:

- Assess and design 3 miles of stream for brook trout
- Restore 1 mile of stream for brook trout
- Enhance, restore, or conserve 2 miles of riparian habitat
- Work with federal, state, local, and non-governmental organization partners to develop a database and framework to identify and prioritize brook trout restoration and conservation projects.

To address population fragmentation due to physical and chemical barriers, the following actions are recommended:

- Assess and design 2 fish passage projects

- Implement 1 fish passage project
- Identify data gaps and collect data on additional blockages

OUTREACH

- Develop informational and educational resources describing recovery actions. Examples include signage at restoration sites and fact sheets.
- Produce a GIS based information source describing potential and successful projects.

MONITORING

- Work with Maryland Department of Natural Resources, and the U.S. Fish and Wildlife Service, Maryland Fisheries Resource Office to monitor brook trout populations after restoration is complete. Monitoring activities will include electroshocking the restored site to determine if brook trout are successfully using the site.
- Conduct stream stability assessments to determine the lateral and vertical stability of a restoration site.
- Conduct as-built surveys as needed to document success of any structures installed during restoration.

Partners

American Rivers
 Eastern Brook Trout Joint Venture
 Environmental Protection Agency
 Maryland Department of Natural Resources
 Maryland Brook Trout Alliance
 Mid-Atlantic Highlands Action Plan
 Natural Resources Conservation Service
 Soil Conservation Districts
 Trout Unlimited
 U.S. Fish and Wildlife Service, Maryland Fisheries Resource Office
 Virginia Department of Game and Inland Fisheries

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Common Tern (*Sterna hirundo*) Species Action Plan

Focus Areas: Chesapeake Bay Islands

Other Species Benefitting: least tern (*Sterna antillarum*), American oystercatcher (*Haematopus palliatus*), black skimmer (*Rynchops niger*), gull-billed tern (*Sterna nilotica*), Forster's tern (*Sterna forsteri*)

BIOLOGICAL PLANNING

Species Information: The common tern is the most widespread and recognizable tern in North America. Its breeding range is from central to eastern Canada at inland lakes and along the Atlantic Coast from the Canadian Maritimes south to South Carolina where it typically nests on islands or barrier beaches. They prefer nesting areas with sand, gravel, or shell with sparse vegetation, but along the Atlantic are often found using small marsh islands where they nest on wrack or on small shell ridges (rakes). Along barrier islands, colony sites are often at overwash sites with little or no vegetation; here they may associate with gull-billed terns, black skimmers, American oystercatchers and/or piping plovers (*Charadrius melodus*). Two to three eggs per nest is common with hatching taking place between 21-23 days without predator interference. Most common avian predators are great horned owls (*Bubo virginianus*) herring gulls (*Larus argentatus*) and greater black-backed gulls (*Larus marinus*); terrestrial predators include red fox (*Vulpes vulpes*) and raccoons (*Procyon lotor*). Feeding usually occurs near (several km) the breeding site on the Atlantic Coast where they take small fish (up to 150 mm long). Occasionally they feed on small crustaceans and insects (Erwin 1977, Nisbet 2002).

Justification for Species Selection: Common tern populations within the Chesapeake Bay region are undergoing significant declines. From 1977-2003, common tern populations in the Chesapeake Bay region declined by approximately 39 percent; however more striking is the 60 percent decline they experienced from 1993-2003 (Brinker et al. 2007). At present, the Paul S. Sarbanes Environmental Restoration Project at Poplar Island supports the only nesting colony of common terns in the Maryland portion of the Chesapeake Bay (Brinker et al. 2007; Erwin 2010).

State Contribution to Overall Species Population: Maryland is one of the Atlantic Coast states with nesting populations of common terns. A recent population survey (2003) conducted in the Chesapeake Bay region indicated that 3,236 nesting pairs were present and were distributed among 45 colonies (Brinker et al. 2007). Most colonies exist in Virginia and along the coast of Maryland and Virginia.

Threats and Assessment:

- Human development, building, and recreation
- Erosion of island habitat and sea level rise
- Avian and mammalian predators reduce the number of suitable nesting and roosting sites
- Displacement from nesting sites by herring and greater black-backed gulls
- Continued use of pesticides in the Caribbean, Central America and South America (winter range) as well as sporadic trapping for food in some countries there

Rangewide Recovery Goal: To establish long-term sustainability of the species in the wild.

Rangewide Recovery Objective: Interim - improve nesting success of common terns on Poplar Island; increase number of potential nesting sites along coastal bays and in Chesapeake; reduce gull predation at key colony sites (e.g. Hampton Roads Bridge Tunnel). Long term - increase the number of predator-free nesting sites in Maryland and Virginia.

Conservation Goal for Maryland: Same as rangewide goals.

Research/Actions Needed:

Erwin (personal communication) of the U.S. Geological Survey/Patuxent Wildlife Research Center identified these additional research needs:

- Document movement patterns by nesting individuals within colonies on a local and regional scale
- Gain greater understanding of mortality types (i.e. percent of mortality due to predation, weather, and disturbance)

CONSERVATION DESIGN

- Coordinate with Maryland Department of Natural Resources, U.S. Army Corps of Engineers, and Virginia Department of Game and Inland Fisheries to develop island restoration plans for both bay and oceanside
- Develop land management plans which incorporate conservation measures into the local planning processes
- Initiate measures to protect, maintain, and improve all species habitats and populations through coordinated efforts with various programs within state, federal and non-governmental organizations.
- Utilize coastal zone management programs
- Conduct an inventory of islands with habitat capable of supporting nesting colonies and determine current use
- Conduct quantitative surveys identifying all populations, habitats, and critical resources, followed by long-term research on population trends and assessments of mortality factors

CONSERVATION DELIVERY

- Use more aggressive enforcement of area restrictions (with additional sign postings) at sites used by nesting or roosting terns. Increase fines imposed by law enforcement where violations occur.
- Stabilize island shorelines and use dredge material and/or other materials to replenish eroding islands.
- Look for signs of mammalian predators and remove if necessary
- Establish avian and mammalian predator control on the islands where common terns nest
- Monitor avian species such as great horned owls and herring and black-backed gulls and remove if necessary..
- Trap and remove gulls in cases where they are usurping common tern prime nesting habitat.
- Oil gull nests to decrease the number of hatchlings and slow population growth.

OUTREACH

- Produce a fact sheet to be distributed by the Chesapeake Bay Field Office.
- Develop a video that shows the habitat and life cycle of a common tern to be posted on Chesapeake Bay Field Office website as well as social media sites.

MONITORING

- Monitoring common tern populations at restored or habitat enhanced island sites within the Chesapeake Bay would be conducted using similar protocols used by Maryland Department of Natural Resources and U.S Geological Survey biologists that currently conduct colonial waterbird surveys within the Chesapeake Bay (Erwin 2010). In Maryland and Virginia, coordinated surveys are conducted on a five-year basis.
- Establish coordinated habitat and population monitoring programs on a regional level using standardized surveying techniques designed to have minimal impacts on populations
- Continue nesting monitoring and reproduction success at Poplar Island

Partners

U.S. Geological Survey/Patuxent Wildlife Research Center
 Maryland Department of Natural Resources
 Virginia Department of Game and Inland Fisheries
 U.S Department of Agriculture APHIS
 U.S. Army Corps of Engineers – Baltimore and Norfolk Districts

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Delmarva Fox Squirrel (*Sciurus niger cinereus*) Species Action Plan

Focus Areas: Blackbird Millington, Lower Chester River, Nanticoke Choptank

Other Species Benefitting: Kentucky warbler (*Oporonis formosus*), pileated woodpecker (*Dryocopus pileatus*)

BIOLOGICAL PLANNING

Species Information: The Delmarva fox squirrel (DFS) is a subspecies of the eastern fox squirrel and is only found on the Delmarva Peninsula. It inhabits mature, mixed pine/hardwood forests that have a closed canopy and relatively open understory. Habitat models for this species indicate that variables associated with forest maturity (e.g. percent of trees over 12" dbh, percent of canopy closure, and height of trees) are the most significant variables (Dueser 2000, Morris 2006). DFS inhabit forests that range from 100% hardwoods to 100% pine, but a mix of both conifers and hardwoods with a diversity of species is probably preferred. Mature forest provides large trees for den sites and leaf nests. Larger trees also produce more food for DFS such as hard mast (e.g. acorns and walnuts) and soft mast (maple flowers and samaras, pine cones). This species has been expanding into new forest blocks on the Eastern Shore and often uses riparian forests as well as the forest/agricultural edges of these riparian forests. These forests are likely providing corridors for DFS movement and expansion.

Justification for Species Selection: Since forest habitat maturity is strongly correlated to the presence of Delmarva fox squirrels, the species functions as a great indicator of this habitat type. Restoring and maintaining large mature forest blocks connected to each other has been identified as one of the most important conservation actions for the Delmarva Peninsula. In addition, this subspecies was listed as federally endangered by the U.S. Fish and Wildlife Service in 1968 because its range had diminished to only 10% of the Delmarva Peninsula. Since that time, translocations have been conducted to expand its range, and additional sightings have occurred in new areas. A 2007 Status Review for this species summarized that the larger range, and its persistence within the range, indicated this species was close to recovery and concluded that the appropriate status for this animal was threatened until new information could help evaluate the possible threat from timber harvest (USFWS 2007).

State Contribution to Overall Species Population: Approximately 97% of the DFS distribution is in Maryland (USFWS 2007) and 2% and 1% are in Delaware and Virginia respectively. Even historically, the DFS distribution was limited in Delaware and its historic occurrence in Virginia was certainly limited as it was never documented to occur there but assumed to occur because of its presence in Maryland counties on the Virginia border. Thus most of the DFS occurrence is in eight Maryland counties of the Delmarva Peninsula.

Threats and Assessment: Loss of habitat from short-term pine management, development, and over-hunting were the original threats to this species. While these threats are no longer considered to threaten this species with extinction, additional protections of habitat that are expected to occur in the future, will also benefit this species. In addition, development pressure

(commercial, urban and infrastructure), forest fragmentation, and habitat loss due to sea level rise are emerging challenges that could affect the conservation of this species.

Conservation Goal: The current goal is primarily insuring persistence and continued growth of the population within its existing range, especially in the northern counties where DFS are not as abundant. The 2007 Status Review estimated the total DFS population to be a little less than 20,000. This is over 150 times the estimated minimum viable population (Hilderbrand et al. 2007).

Research/Monitoring Actions Needed: The species is doing relatively well and expanding, and its most important needs are conserving mature forests tracks and the connectivity between them. Monitoring needs will continue into post-delisting for this species and the Service has obligations for a post-delisting monitoring plan. Monitoring will include the use of camera surveys in some areas, but reports of DFS sightings are still the best source of information on the range. Widening the network of individuals who report DFS sightings will be important. Post-delisting may also improve the monitoring as reluctance of individuals to report endangered species can be problematic for documenting presence in some areas.

Management Actions Needed: Maintaining a network of relatively connected forests in the northern portion of the Delmarva Peninsula (Lower Chester River Focus Area) would also be helpful and there may be some areas where riparian forest protection from logging or development would be beneficial. The northern counties have less forested area than the southern counties, and, in the north, riparian forests form the best network that connect many forest tracks. For example, DFS have been using the Tuckahoe River corridor and other corridors in Queen Anne's County to expand. Actions that protect riparian forests from logging, prevent losses from development, or enhance areas where riparian forests are very limited could be beneficial to the DFS. Forest connectivity is also important to the south (Nanticoke Choptank Focus Area). It is important to maintain large forested corridors intact.

Potential Funding: Maryland Department of Natural Resources, Natural Resources Conservation Service

CONSERVATION DESIGN

- Conduct a GIS analysis of riparian forest areas in the Lower Chester River Focus Area to identify riparian forests that have mature forest habitat; the proportion that is currently protected from development; the logging frequency of these riparian forests; and stream areas that currently do not have riparian forests.
- The GIS analysis will be used to prioritize areas where riparian forests can be improved for the DFS and other species, specifically the dwarf wedge mussel, another endangered species in the area. Conservation delivery will range from protecting sites with easements, or working with local foresters to minimize impacts from logging.

CONSERVATION DELIVERY

- Focus upland and forested wetland habitat protection efforts to conserve forest corridors and expand the size of forest blocks.

- Work with the Natural Resources Conservation Service and other partners on restoring connectivity of forest tracts by restoring riparian corridors.

OUTREACH

- Develop awareness of DFS through more information on the Chesapeake Bay Field Office website and Maryland Delaware websites. Postings should include: photographs of DFS from remote cameras; photographs distinguishing DFS from gray squirrels; instructions for reporting sightings of DFS (possible Google Earth platform)
- Develop a hunter survey form for reporting DFS sightings

MONITORING

A DFS Monitoring Plan has been drafted and currently involves a combination of camera surveys at some sites, and use of the network of volunteer observers to report sightings of DFS in individual woodlots. This network of volunteers are the most cost-effective way to document the range, but these volunteers have to be kept informed and interested to keep this monitoring going. These sightings can be reported at the scale of Atlas blocks, however, since we currently have DFS presence/absence at the level of woodlots for much of the range, we will try and continue monitoring DFS occurrence at this scale.

Initial work towards an Atlas or mapping approach has found that we need to access the hunting community more thoroughly as hunters, sitting still in hunting stands, have the best opportunity for seeing DFS. Accessing private lands is difficult. We will be work with the state of Maryland in identifying ways to better access the hunting community. Hunting clubs lease Maryland Department of Natural Resources. There are 58,000 acres of these lands scattered throughout the lower Eastern Shore. DFS sighting cards on these properties would provide additional information about a large area. Sighting cards provided to other hunt-clubs could help in other areas (Queen Anne's County).

Partners

Maryland Department of Natural Resources
 Maryland Environmental Trust
 Eastern Shore Land Conservancy
 Natural Resource Conservation Service
 Queen Anne's County.

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Dwarf Wedge Mussel (*Alasmidonta heterodon*) Species Action Plan

Focus Areas: Lower Chester River, Lower Potomac Patuxent

Other Species Benefitting: American black duck (*Anas rubripes*), Acadian flycatcher (*Empidonax virescens*), cerulean warbler (*Dendroica cerulean*), common elliptio mussel (*Elliptio complanata*), Eastern narrow-mouthed toad (*Gastrophryne carolinensis*), flier (*Centrarchus macropterus*), Kentucky warbler (*Oporornis formosus*), Louisiana waterthrush (*Seiurus motacilla*), mallard (*Anas platyrhynchos*) Northern pintail (*Anas acuta*) redbreast sunfish (*Lepomis auritis*), wood duck (*Aix sponsa*), wood thrush (*Hylocichla mustelina*), yellow-throated vireo (*Vireo flavifrons*)

BIOLOGICAL PLANNING

Species Information: The dwarf wedge mussel is a small (~ 145 mm long) mussel that lives on muddy sand, sand, and gravel bottoms, in creeks and rivers of varying sizes, in areas of slow to moderate current, good water quality, and little silt deposition.

Little is known about the reproductive biology of the dwarf wedge mussel; however, the reproductive biology of freshwater mussels appears to be similar among nearly all mussel species. During the spawning period, males discharge sperm into the water column, and the sperm are taken in by females during siphoning. Eggs are fertilized in the gills, which also serve as a place for larval development. Clarke (1981b) indicates that the dwarf wedge mussel is a long-term brooder. Fertilization typically occurs in mid-summer and fall, and larvae are released the following spring and summer. Larvae release for some long-term brooders also has been observed during fall and winter (Zale 1980). Upon release into the water column, mature larvae of the genus *Alasmidonta* attach to the fins and soft tissue of the mouth of host fishes to encyst and eventually metamorphose to the juvenile mussel stage. When metamorphosis is complete, they drop to the streambed as juvenile mussels.

Justification for Species Selection: The dwarf wedge mussel was listed as endangered under the Endangered Species Act on March 14, 1990. The species' dramatic decline, as well as the small size and extent of most of its remaining populations, indicate that individual populations remain highly vulnerable to extirpation.

Historically, the dwarf wedge mussel was widely but discontinuously distributed in Atlantic drainages from the Petitcodiac River in New Brunswick, Canada, south to the Neuse River in North Carolina. The species was known from at least 74 locations in 11 states and one Canadian province. Master (1986) reported that an extensive status survey of historical and potential sites turned up only eight extant populations. Since then, 12 additional extant populations have been found in Maryland, North Carolina, Virginia, and New York. Although a few additional populations may still be discovered, a clear pattern has emerged -- relatively small, scattered relict populations remain from a once extensive distribution.

State Contribution to Overall Species Population: The following are locations of three (3) extant populations of the dwarf wedge mussel in the Potomac River drainage in Maryland and

Virginia: McIntosh Run in St. Mary's County, Maryland, Nanjemoy Creek in Charles County, Maryland and Aquia Creek in Stafford County, Virginia. In addition, the species occurs in two tributaries, the Corsica River and Southeast Creek, within the lower Chester River drainage in Maryland.

Threats and Assessment:

- The damming and channelization of rivers has resulted in the elimination of formerly occupied habitat. Discharge rate modifications from dams can also affect the dwarf wedge mussel.
- Siltation generated by road construction, agriculture, forestry activities, and removal of streambank vegetation is considered to be an important factor in the decline of many freshwater mussel species, including the dwarf wedge mussel.
- Sedimentation from forestry operations and agriculture
- The continuing decline and ultimate loss of the dwarf wedge mussel from most of its historical sites can best be explained by agricultural, domestic, and industrial pollution of its aquatic habitat.
- Residential, highway, or industrial development
- Removal of streambank vegetation affects both the physical and biological processes of the waterways. Tree removal alters the amount of organic material and light reaching the stream, impacting both temperature and dissolved oxygen, which are critical factors for both fish and mussels. The floodplain biomass can also help buffer the stream from pollutants.
- The invasion of the Asian clam (*Corbicula fluminea*) and the zebra mussel (*Dreissena polymorpha*) may be a significant threat to the dwarf wedge mussel.
- Mussel die-offs, the cause of which remains unknown, may be a threat to the dwarf wedge mussel.
- Most of the dwarf wedge mussel populations are small, and all are geographically isolated from each other. This isolation restricts the natural interchange of genetic material between populations. The small population size also reduces the reservoir of genetic variability within populations.

Research/Actions Needed:

- Conduct life history research on the species to include reproduction, food habits, age and growth, and mortality factors. Characterize the species' habitat requirements (physical, biological, and chemical components) for all life history stages.

Potential Funding: Section 6 Recovery Land Acquisition Grants, National Coastal Wetland Grants, Farm Bill Wetland Reserve Program, National Park Service, Chesapeake Gateways Initiative.

CONSERVATION DESIGN

- Conduct additional population and habitat surveys for dwarf wedge to identify essential habitat and key areas in need of protection.
- Identify and determine significance of specific threats faced by the species such as pesticide contamination, siltation, acidification, and municipal and industrial effluents.

- Use data from GIS layers to determine if properties that contain dwarf wedge mussels can be purchased or have easements placed on the banks of the waterways to improve water quality for the dwarf wedge mussel.

CONSERVATION DELIVERY

- Protect populations of the dwarf wedge mussel (Corsica River, Southeast Creek tributaries, McIntosh Run and Nanjemoy Creek in Maryland and Aquia Creek in Virginia) from impacts upstream and along the stream banks.
- Protect the hydrology and ground water quality and quantity in the vicinity of river reaches known to be occupied by dwarf wedge mussels
- Protect riparian buffers along and upstream of occupied reaches of the Corsica River and Southeast Creek tributaries in the Lower Choptank focus area, and Nanjemoy Creek and McIntosh Run in the Lower Potomac/Patuxent focus area.
- Develop a successful technique for re-establishing and augmenting populations. Where appropriate, reintroduce the species within its historical range and evaluate success.

OUTREACH

- Develop and distribute informational and educational materials, such as power point presentations and brochures to school children, civic groups, and the general public.
- Develop and distribute informational and educational materials in the priority watersheds identified above.
- Continue to facilitate the initiation of River Watch Programs in dwarf wedge mussel rivers.
- Continue to provide information through updating dwarf wedge mussel website

MONITORING

- Develop a program to monitor the three existing populations of the dwarf wedge mussel (McIntosh Run and Nanjemoy Creek in Maryland and Aquia Creek in Virginia).
- Monitor population levels and habitat conditions of presently established and introduced populations

Partners

Charles County, MD
 Maryland Department of Natural Resources
 North American Land Trust and other non-governmental organizations
 Stafford County in Virginia
 St. Mary's County MD
 U.S. Geological Survey
 Virginia Department of Game and Inland Fisheries

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Eastern Oyster (*Crassostrea virginica*) Species Action Plan

Focus Areas: Chesapeake Bay Islands, Chesapeake Oyster Reef, Lower Chester River, Lower Rappahannock River, Nanticoke Choptank

Other Species Benefitting: long-tailed duck (*Clangula hyemalis*), scoters (*Melanitta sp.*) striped bass (*Morone saxatilis*), sturgeon (*Acipenser sp.*)

BIOLOGICAL PLANNING

Species Information: The oyster is a keystone species for the Chesapeake Bay because of its unique ability to continuously build extensive three-dimensional reef habitat that supports a diverse and productive community of fish, wintering waterfowl, as well as, crabs, mussels and other invertebrates. Many Service Trust fish species, such as striped bass and Atlantic sturgeon use oyster reefs as vital habitat for feeding and refuge (Chesapeake Bay Program, 2007). Migratory waterfowl, such as scoters and long tailed ducks directly benefit from oyster reefs. For example, black, surf and white-winged scoters directly benefit from oyster reefs with 50%, 22%, and 28% respectively of their winter diet of hooked mussels (*Ischadium recurvum*), a species closely associated with oyster reefs in the Chesapeake Bay (Perry et al. 2007). Rodney and Paynter (2006) found that the restored oyster reefs are colonized by large densities of hooked mussels and many other species.

In addition to the direct benefits to Service Trust species, there are many indirect benefits associated with restoring oyster reef habitat including improved water quality, shoreline stabilization, and carbon sequestration. Oysters filter water improving its quality around the oyster reef. The high densities of mussels colonizing these reefs are additional biofilters. This water quality improvement can have a direct positive effect on submerged aquatic vegetation (SAV) beds (NRC 2004). The SAV beds in turn serve as refuge and nursery habitat for many other fish species and feeding grounds for migratory waterfowl. Oyster reefs can also play a vital role in helping to mitigate the effects of climate change in the Chesapeake Bay by stabilizing shorelines and mitigating some of the impacts of sea level rise.

Justification for Species Selection: On May 12, 2009, the President issued Executive Order 13508, recognizing the Chesapeake Bay as a national treasure and calling on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. The strategy developed to carry out the Executive Order calls on Federal agencies to coordinate with the states in a multijurisdictional effort to restore oyster reefs and establish self sustaining oyster reef sanctuaries. As part of our support of this Executive Order, the Service will implement native oyster reef restoration in the Chesapeake Bay.

State Contribution to Overall Species Population: The oyster is a keystone species for the Maryland and Virginia portion of the Chesapeake Bay watershed. While the Eastern oyster's natural range is from the Gulf of Mexico to Nova Scotia Canada, historically the densest and most productive reefs occurred in the Chesapeake Bay (NRC 2004).

Threats and Assessment: Decades of overharvest, habitat destruction, disease, and poor water quality have reduced the population of oysters in the Chesapeake Bay to less than 1 percent of its

historic levels (NRC 2004). The “Final Programmatic Environmental Impact Statement for Oyster Restoration in the Chesapeake Bay” (U.S. ACOE 2009) estimates that as much as 70 percent of the 450,000 acres of historic oyster bar habitat in the Chesapeake Bay has been lost to siltation during the last 100 years and less than 1% is classified as clean. Although degraded and in need of conservation and restoration, oyster reefs remain critical wintering feeding grounds for long-tailed duck and scoters. They also provide important feeding and/or nursery grounds for striped bass and sturgeon.

Research/Actions Needed:

- Develop bay-wide restoration goals (success/performance metrics) for sustainable oyster populations that include specific, compatible and quantitative goals for ecological function and ecosystem services from restored oyster populations.
- Develop and identify support for a bay-wide complementary survey, monitoring and assessment program of oyster abundance and other key physical, chemical, and ecological parameters that will allow consistent evaluation of progress toward the oyster restoration goals.
- Gather and evaluate available data sets of Chesapeake Bay benthic habitats and sea duck wintering distributions.
- Map these distributions using GIS software for a visual and empirical correlation between the benthic habitats and wintering sea duck distributions.
- Create trophic model that quantifies the ecological linkages between oyster reefs and wintering sea duck utilization.
- Evaluate model integrity, determine if any data gaps exist, and create a plan to ground truth these gaps to better inform the trophic model.

Potential Funding: There are many key players involved in a comprehensive Bay-wide strategy to restore native oysters to the Bay. It is our intention to strongly support those efforts focusing on sites and oyster reef habitat restoration projects that will maximize benefits to fish and wildlife resources.

Population Goals: Restoring oyster reef habitat is essential to restoring ecosystem function. Oysters tend to recruit best on living oyster shell. Unfortunately, oyster shell availability for habitat restoration is extremely limited. Restoration using artificial materials like reef balls or granite has shown promise in recent years. Diverse communities established on artificial materials can serve as reasonable and functional surrogate for traditional oyster restoration.

CONSERVATION DESIGN

There are many key players involved in a comprehensive Bay-wide strategy to restore native oysters to the Bay. Achieving this goal, requires a new strategy anchored by substantial collaboration among oyster restoration partners bay wide, guided by the best available science, and targeted in areas most likely to succeed. The Maryland Oyster Restoration and Aquaculture Development Plan and the U.S. Army Corps of Engineers Native Oyster Restoration Master Plan are integral components to this effort. The Sustainable Fisheries Goal Implementation Team (Fisheries GIT) has agreed to serve as the coordinating body to provide guidance and oversight in aligning oyster restoration efforts and ensure bay-wide scientific and technical capabilities are leveraged to address challenges. It is our intention to strongly support those efforts focusing on

sites and oyster reef habitat restoration projects that will maximize benefits to fish and wildlife resources.

CONSERVATION DELIVERY

The conservation objective is to enhance and restore the function of oyster reef communities to benefit several of the Service's Trust resources. Our approach will be to work with partners to restore and conserve reef habitats that are used by long-tailed ducks and scoters. We also expect to achieve a substantial improvement in the foraging habitat available for shortnose sturgeon, Atlantic sturgeon and other anadromous fish.

OUTREACH

- Develop an outreach strategy to engage the public in the importance of reef ecology and reef habitat restoration in the Chesapeake Bay.

MONITORING

- Develop bay-wide restoration goals (success/performance metrics) for sustainable oyster populations that include specific, compatible and quantitative goals for ecological function and ecosystem services from restored oyster populations.
- Develop and identify support for a bay-wide complementary survey and monitoring and assessment program of oyster abundance and other key physical, chemical, and ecological parameters that will allow consistent evaluation of progress toward the oyster restoration goals.

Partners

Army Corps of Engineers
Maryland Department of Natural Resources
National Oceanic and Atmospheric Administration
Potomac River Fisheries Commission
Smithsonian Environmental Research Center
The Nature Conservancy
University of Maryland
Virginia Institute of Marine Science
Virginia Marine Resources Commission

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Kentucky Warbler (*Oporornis formosus*) Species Action Plan

Focus Areas: Anacostia Watershed, Blackbird Millington, Lower Chester River, Lower Potomac Patuxent, Lower Rappahannock River, Lower Western Shore Rivers, Nanticoke Choptank

Other Species Benefitting: hooded warbler (*Wilsonia citrine*), Louisiana waterthrush (*Seiurus motacilla*), red-shouldered hawk (*Buteo lineatus*), wood thrush (*Hylocichla mustelina*)

BIOLOGICAL PLANNING

Species Information: The Kentucky warbler is a familiar sound of rich, moist, deciduous forests in the southeastern United States. This forest interior dweller is a skulking, ground-nesting bird that is more often heard than seen.

Nesting habitat includes bottomland hardwoods and riparian forests, often at low elevations. A well-developed ground cover and a thick understory are essential for successful nesting. Studies of forest fragmentation in Missouri indicate that blocks of suitable habitat of at least 500 ha are necessary for successful breeding.

Justification for Species Selection: The Kentucky warbler is listed on all three Bird Conservation Regions within Maryland/Delaware as a Bird of Conservation Concern and as a Bird of Conservation Concern in the Northeast region. Analysis of total Breeding Bird Survey data set found significant declines in continent wide population, both over long term (1966–1988: change of $-1.26\%/yr$) and over short term (1978–1988: change of $-1.95\%/yr$). However, local increases and expansion of range northward have been observed in BBS data.

Threats and Assessment:

- Forest fragmentation on breeding grounds
- Rapid deforestation on wintering grounds. Kentucky warblers are territorial even in the non-breeding season, so only small numbers of individuals can coexist even in the most suitable habitat.
- Recent Supreme Court decisions have removed federal protection from isolated forested wetlands. Delaware does not have a wetland protection law.
- Collisions with TV and cell towers, and with large glass windows
- Over abundant deer can denude forest understory and impact nesting habitat
- Nest predation and parasitism (brown-headed cowbird)

Research/Actions Needed: The most important research needs are those related to the monitoring and management of the species. Continuing annual surveys of suitable habitat and known populations using point counts and spot-mapping techniques are probably the most efficient ways to monitor this species. Unpublished data, however, suggest that even conscientious, season-long application of these techniques misses some breeding birds, and may also lead to erroneous conclusions about the suitability of the surveyed area to birds actually reproducing ([Gibbs and Faaborg 1990](#), [Gibbs and Wenny 1993](#)).

Management research priorities on the breeding grounds should be the assessment of minimum area requirements, and quantification of specific habitat requirements, especially of nest sites, as related to breeding success. In addition, research is needed to determine minimum viable population sizes and the impacts of forest fragmentation (including its effect on predation and cowbird parasitism). On the wintering grounds, all aspects of life need investigation, especially quantification of specific habitat requirements and minimum area requirements. Habitat requirements for post fledglings and migrating individuals should also be addressed.

Potential Funding: Wetland Reserve Program, Coastal Wetlands Grant, North America Wetlands Conservation Act

Population Goal for Maryland/Delaware: Maintain current population

CONSERVATION DESIGN

- Develop a ranking system of habitat which could include a matrix of variables and multiple species
- Rank habitats for their importance to migrating and nesting Kentucky warblers
- Using GIS, identify the most important site-specific areas to be protected and/or restore
- Work with Natural Resources Conservation Service to utilize this ranking to prioritize restoration and protection of forested wetlands meeting the needs of the Kentucky warbler.

CONSERVATION DELIVERY

Forest Fragmentation

- Restore hydrology to forested wetlands
- Permanently protect large blocks of forested wetland habitat.
- Restore, protect or manage riparian forests to provide migration corridors.
- Restore forested wetlands in open fields especially those adjacent to existing large blocks of forested wetland to increase suitable nesting habitat
- Provide agency comments on proposed federal actions that are likely to impact forest interior habitat
- Provide agency comments on wind power and other projects that could impact migrating birds

Forest Management Practices

Forest management practices that encourage a dense understory and well-developed ground cover should enhance forest stands for this species ([Bushman and Therres 1988](#)). Because Kentucky warblers are tolerant of openings in canopy, harvesting techniques such as group selection, small or narrow clear-cuts, thinning of “overmature” trees, and selection-cutting are acceptable practices ([Crawford et al. 1981](#)). Light timber stand improvement should also be acceptable to Kentucky warblers. Although species was thought to benefit from selective logging ([Whitcomb et al. 1977](#)), numbers actually declined after such practices in Indiana ([Adams and Barrett 1976](#)). Clear-cutting temporarily removes habitat for Kentucky warbler, but regenerating forest may be reoccupied after 6 to 7 years in Virginia ([Conner and Adkisson 1975](#)).

OUTREACH

Continue to contact and work with landowners on enrollment in land conservation programs, especially Natural Resources Conservation Service's' Wetland Reserve Program. Promote deer management to ensure understory vegetation is not denuded by high deer populations.

MONITORING

The North American Breeding Bird Survey, managed by U.S. Geological Survey, is a long term monitoring program that dates back to 1966. This is the most comprehensive long term monitoring for North American Birds and provides that basis for the trends of the Kentucky warbler. In addition, the Maryland Breeding Bird Atlas occurs every 10 years and provides more detailed distribution for breeding birds in Maryland. The second Atlas (2002-2006) was published in November 2010.

Partners

Natural Resource Conservation Service
Maryland Department of Natural Resources
Local land trusts

References

www.natureserve.org/explorer

Long-tailed Duck (*Clangula hyemalis*) and Scoter (*Melanitta sp.*) Species Action Plan

Focus Areas: Chesapeake Bay Islands, Chesapeake Oyster Reef, Chincoteague Bay, Delaware Bay Shoreline, Lower Chester River, Lower Rappahannock River

Other Species Benefitting: black scoter (*Melanitta americana*), surf scoter (*Melanitta perspicillata*), white-winged scoter (*Melanitta fusca*),

BIOLOGICAL PLANNING

Species Information: Long-tailed ducks breed in arctic and subarctic wetlands from the west coast of Alaska across most of northern Canada to the east coast of Labrador. The ducks migrate relatively late in fall and early in spring. Actual migration routes to the Chesapeake Bay are overland from the Great Lakes, and some moving down the coast from New England and the Canadian Maritimes. Southern Virginia is the maximum extent of most birds southern migration and the declining numbers in the Chesapeake Bay are probably the effect of warmer winters and that the Great Lakes and freshwater ponds are not freezing and no longer pushing the birds as far south.

Their winter diet is varied but chiefly animal matter, including bottom-dwelling crustaceans, clams, mussels, small fish, and snails. Most feeding is in water <9 m (30 ft) deep, but the long-tailed duck has been documented to dive to more than 60 m (200 ft), deeper than any other duck.

Long-tailed ducks have a very narrow bill as compared to scoters allowing them to extract small animals such as crustaceans in small crevices in three dimensional habitats such as oyster reefs. Both scoters and long-tailed ducks eat a large variety of bivalves and crustaceans. In Chesapeake Bay long-tailed ducks tend to eat a high percentage of gema clams and mussels while scoters tend to eat more mussels and surf clams (Perry et al. 2007).

Justification for Species Selection: The Breeding Population and Habitat Survey, conducted by the Canadian Wildlife Service and the U.S. Fish and Wildlife Service, shows that breeding populations of long-tailed ducks have declined about 80% since the survey started in 1957. Unfortunately, that survey covers only a small portion of Alaska and northwestern Canada, a tiny part of their overall breeding range. Causes for declines are unknown. Despite indications of long term declines, the long-tailed duck is the most abundant Arctic sea duck and, as such, is not considered a threatened or endangered species. Furthermore, the population seems to have stabilized since the early 1990's. All four seaducks are listed as birds of management concern by the U.S. Fish and Wildlife Service and all three species of scoters are believed to be declining.

State Contribution to Overall Species Population: Forsell estimated that at least 105,000 long-tailed ducks were present in Chesapeake Bay during the winter of 1992-93, making it the second most abundant duck in Chesapeake Bay after the surf scoter with an estimated population of 135,000 birds. While we do not have valid population estimates of sea ducks on the East Coast, a conservative estimate would be that Delaware Bay, Chesapeake Bay, and coastal areas of Delaware and Maryland winters about one third of the scoters on the East Coast and possibly 25 percent of long-tailed ducks.

Threats and Assessment: The magnitude of harvest and the role of hunting in regulating populations of long-tailed ducks is largely unknown. Long-tailed ducks are a small component of the sport harvest of waterfowl. They are generally considered poor table fare because of their strong taste. However, they are a major species in the subsistence harvest in some northern communities, and co-management of migratory birds with First Nation and Alaska Native groups should help ensure a sustainable use of long-tailed ducks.

Long-tailed ducks and scoters are vulnerable to oil spills, pollution, and disturbance by shipping vessels. Large numbers of these ducks are sometimes caught and killed in gillnets in both fresh and marine waters. Other potential threats include extensive habitat alterations, increased industrialization and development of traditional wintering grounds, including aquaculture, sand mining, over-fishing, clam dredging, and wind power development. Shellfish aquaculture in small amounts apparently does not affect scoter food availability, but an unknown amount of illegal take of seaducks occurs at aquaculture facilities. Contaminants such as lead, mercury, cadmium, and organochlorines (from pesticides) have been found at high levels in long-tailed ducks in both eastern Canada and Alaska.

Aquaculture that covers sandy and hard bottom reef substrates and excludes diving birds with nets can result in a loss of habitat for the birds. Dredging or filling of sandy substrates and hard bottom reef areas eliminates foraging habitat. Over harvest of bivalves, (clams, oysters, and mussels) removes or degrades important food resources. Dredging clams and other bivalves also destroys three dimensional habitats, silts in reefs, disturbs bottom substrate.

Research/Actions Needed: Reliable techniques for monitoring population size and trends of long-tailed ducks and scoters need to be developed and implemented. Satellite telemetry studies are currently underway that will help identify where birds from a particular breeding area spend the winter (and vice versa) as well as their migratory behavior and pathways.

Long-tailed ducks, scoters, and diving ducks are drowned in both legal and illegal gillnets in most coastal and freshwater areas. All fisheries should be assessed for their impact on waterbirds and mitigation techniques developed where possible. Illegal nets should be the center of active law enforcement effort and prosecutions and equipment confiscations should be pursued.

CONSERVATION DESIGN

- Per the Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, Federal agencies taking actions in coastal areas that reduce or impact bird habitat should mitigate their actions and enhance habitats.
- Long-tailed ducks, scoters, and diving ducks are drowned in both legal and illegal gillnets in most coastal and freshwater areas. Mitigation of fisheries impacts should be implemented where possible and could be funded by NRDA funds or mitigation from wind power development.
- Increase law enforcement of illegal gillnetting in Chesapeake Bay and coastal waters where long-taileds are drowned along with scoters, diving ducks, and loons. Illegal nets should be the center of active law enforcement effort including prosecutions and equipment confiscations.

CONSERVATION DELIVERY

- Conduct offshore surveys to determine distribution and abundance and to define current habitat preferences.
- Restore reef habitat with hard, three dimensional habitat that provides mobile invertebrates such as amphipods, worms, and isopods, plus bivalves such as mussels and clams.

OUTREACH

Engage the public, local bird clubs, and other non-profit organizations to join in the effort to report observations of illegal fishing activities through the state of Maryland's report a poacher program.

MONITORING

The only surveys that adequately assess long-tailed duck and scoter numbers in coastal waters are low level surveys that crisscross the Chesapeake Bay from shore to shore. The problem is they are very expensive and adequate sample size requires tens of thousands of dollars.

Because long-tailed ducks breed over a vast range and at low densities, there have been no comprehensive surveys of their abundance. Because they, like other sea ducks, inhabit offshore areas more than other waterfowl during winter, long-tailed ducks are also poorly monitored by mid-winter surveys for waterfowl. A crude estimate of the North American population is at least one million birds.

Partners

Chesapeake Bay Program
Delaware Department of Natural Resources and Environmental Control
Maryland Coastal Bays Program
Maryland Department of Natural Resources
Sea Duck Joint Venture
U.S. Fish and Wildlife Service, National Wildlife Refuges Program
U.S. Geological Survey, Patuxent Wildlife Research Center

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Prairie Warbler (*Dendroica discolor*) Species Action Plan

Focus Areas: Lower Potomac Patuxent, Lower Rappahannock River, Lower Western Shore Rivers, Pocomoke River Cypress Creek, Shenandoah Upper Rappahannock, Western Highlands

Other Species Benefitting: brown thrasher (*Toxostoma rufum*), Eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), yellow-breasted chat (*Icteria virens*)

BIOLOGICAL PLANNING

Species Information: The prairie warbler breeds in shrubby old fields, early-stage regenerating forests, dunes, mangroves, pine barrens, and other early successional habitats. It spends the winter in the Bahamas, on Caribbean islands, and in southern Florida. Before European settlement, the species was rare or absent in much of its present breeding range; following deforestation, it became widespread by the mid-twentieth century. Since about 1970, its numbers have declined in parts of the breeding range

Justification for Species Selection: Listed on all three Bird Conservation Regions (28,29,30) within Maryland/Delaware as a bird of Conservation Concern and listed as a U.S. Fish and Wildlife Service Region 5 Bird of Conservation Concern. Analysis of total Breeding Bird Survey data set found significant declines in Maryland, both over long term (1966–1988: change of –3.53%/yr) and over short term (1978–1988: change of –2.32%/yr).

Threats and Assessment:

- Old fields converted to housing developments and commercial development
- Suppression of fire which sets back later successional forest stages.
- Collisions with TV and cell towers, and with large glass windows
- Nest predation and parasitism (brown-headed cowbird)
- Effects of use of herbicides such as Arsenal used to eradicate deciduous trees/shrubs in forests regenerating after a timber harvest

Research/Actions Needed: For basic understanding of the species and its conservation, valuable additions can be expected from long-term study of winter populations, e.g., segregation of sex and age classes geographically, by habitat, or by feeding ecology. Future findings about winter ecology and population dynamics, complemented by breeding-season data should promote our understanding of the biology of migrant passerines (compare [Marra et al. 1998](#) and citations therein).

The prairie warbler appears to be a promising candidate for comparative experimental investigation of differences between a migratory generalist subspecies and a sedentary specialist subspecies. Examples might be studies of habitat selection and of genetic, developmental, and physiological bases for the expression of migratory behavior.

Potential Funding: utilities and Grassland Reserve Program

Population Goal for Maryland/Delaware: Increase current population

CONSERVATION DESIGN

- Work with power companies on adopting Integrated Vegetation Management (IVM) to maintain old field habitat.
- Identify and work with owners of abandoned strip mines to facilitate old field habitat management.
- Identify areas where the Grassland Reserve Program can be used to maintain open fields

CONSERVATION DELIVERY

- Work with Baltimore Gas and Electric on the South River Greenway IVM pilot project, Right-of-Way management and at Patuxent National Wildlife Refuge
- Provide federal agency comments on wind power and other projects that could impact migrating birds.
- Develop survey protocols to document breeding prairie warblers in Right-of-Ways where IVM is practiced.

OUTREACH

The Chesapeake Bay Field Office and its partners (Baltimore Gas and Electric, Integrated Vegetation Management partners, Scenic Rivers Land Trust) will continue to promote Integrated Vegetation Management as a beneficial tool for habitat management on utility rights-of-way through newsletters, social media, websites and factsheets.

MONITORING

The North American Breeding Bird Survey, managed by U.S. Geological Survey, is a long term monitoring program that dates back to 1966. This is the most comprehensive long term monitoring for North American Birds and provides that basis for the trends of the prairie warbler. In addition, the Maryland Breeding Bird Atlas occurs every 10 years and provides more detailed distribution for breeding birds in Maryland. The second Atlas (2002-2006) was published in November 2010. In addition to these monitoring programs, the Chesapeake Bay Field Office is working with the Anne Arundel County Bird Club to monitor breeding birds along a 5-mile stretch of utility right-of-way. The density of prairie warblers will be closely watched over time as Integrated Vegetation Management techniques are employed.

Partners

Baltimore Gas and Electric
Delmarva Power
Maryland Department of Natural Resources
Natural Resources Conservation Service

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Prothonotary Warbler (*Protonotaria citrea*) Species Action Plan

Focus Areas: Anacostia Watershed, Blackbird Millington, Chincoteague Bay, Lower Potomac Patuxent, Lower Rappahannock River, Nanticoke Choptank, Pocomoke River Cypress Swamp

Other Species Benefitting: American black duck (*Anas rubripes*), American eel (*Angilla rostrata*), hooded warbler (*Wilsonia citrine*), Louisiana waterthrush (*Seiurus motacilla*), red-shouldered hawk (*Buteo lineatus*), wood duck (*Aix sponsa*), wood thrush (*Hylocichla mustelina*)

BIOLOGICAL PLANNING

Species Information: The prothonotary warbler inhabits mature deciduous floodplain, riverine, and swamp forests (DeGraaf et al. 1980, Christman 1984, *Partners in Flight: Mid-Atlantic Coastal Plain Bird Conservation Plan (Physiographic Area #44) VERSION 1.0* April 1999). The center of abundance is the South Atlantic Coastal Plain physiographic area. Little is known of winter habitat on the Caribbean slope of Central America, Colombia, and northern Venezuela.

Essential habitat requirements are water, shade, and older trees that provide nesting holes. Habitat characteristics include a relatively low, open canopy with a high density of small stems (Kahl et al. 1985). Although this species will utilize the drier portion of the forested wetland gradient, flooded habitats have been shown elsewhere to be preferred and of higher quality (Petit and Petit 1996). Prothonotary warblers commonly breed in the southeastern U.S wherever there is suitable habitat: wooded wetlands, bottomland hardwood forests, and cypress swamps. They are secondary cavity nesters so cavity availability may serve as a constraint on habitat use. Prothonotary warblers are widespread and common throughout the extensive swamps and riverine forested wetlands within the Mid-Atlantic Coastal Plain physiographic region. The center of abundance is the South Atlantic Coastal Plain physiographic area. Little is known of winter habitat on the Caribbean slope of Central America, Colombia, and northern Venezuela.

The Mid-Atlantic Coastal Plain physiographic region extends from the Atlantic Ocean, south of Long Island, to the Fall Line, where the hilly Piedmont begins. The area was formed by shifting sea levels and alluvial deposition from rivers draining mountains to the west. Water continues to be a dominant feature of the landscape, creating forested wetlands and salt marsh and shaping barrier island and bay complexes. Upland forests on the remaining land graded in composition from pine dominated areas on the outer Coastal Plain (nearer the coast) to hardwood forests on the inner Coastal Plain. This was the site of the first successful English settlement in North America, and the natural landscape has been altered by European culture for nearly four centuries. The current human population approaches 11 million and is expected to continue to expand into the future, placing ever-increasing demands on the region's natural resources.

Justification for Species Selection: Most studies indicate a steady decline in populations of this neotropical migrant since the 1970s. The prothonotary warbler is listed as a species of high global priority in the *Partners in Flight* Bird Conservation plan for the Mid-Atlantic Physiographic region. This designation is indicative of population vulnerability for the species

throughout its range. The Maryland and Delaware Wildlife Action Plans also list the species as a “species of conservation concern” along with the habitats that the species inhabit.

Threats and Assessment: Forested wetlands have experienced dramatic reductions in area and changes in plant composition due to hydrology modifications over the past several decades. Nationwide, forested wetlands account for the greatest amount of wetland loss. Between the 1950's and 1970's, nearly 2.5 million ha of forested wetland were lost. Much of this loss was due to the harvest of wetland forests or to filling or draining of forested wetlands for conversion to agriculture or urban development. In 1991, the mid-Atlantic Coastal Plain contained more than 550,000 ha of forested wetlands or nearly 7.4% of the Nation's total (Field et al. 1991). As with upland forests, occupation of forested wetlands by birds is influenced by a number of factors including patch size, vegetation structure, and hydrology. Prothonotary warblers are neo-tropical migrants and are therefore also very vulnerable to habitat destruction issues outside of the breeding range of the mid-Atlantic. Some of the current threats to the species long-term survival are related to:

- Loss, degradation and fragmentation of habitat on breeding grounds as many wetlands are either permanently drained or flooded
- Rapid deforestation on wintering grounds
- Minimal or reduced federal protection of isolated forested wetlands in light of recent Supreme Court decisions.
- Conversion of broad-leafed deciduous forested wetlands into pine plantations.
- Nest predation and parasitism (brown-headed cowbird) exacerbated by forest fragmentation
- Competition with other species for nest sites

Research/Actions Needed:

- Priority monitoring action - Breeding Bird Survey (BBS) provides acceptable data at the continental level; however more localized monitoring data is needed
- Second priority monitoring action – improve the BBS
- Supplemental Surveys - more intensive survey work that penetrate this species' habitat to better understand population trends and patterns
- Determine factors contributing to forest and riparian bird population stability, including associations between landscape factors and indices of reproductive success and the effectiveness of the CWCA model in sustaining populations of high priority species including prothonotary warbler (Upper Great Lakes Plain); identify cost-effective methods for identifying bird population sources in forested habitats (Upper Great Lakes Plain)
- Identify/inventory suitable_ - identify large tracts of forest habitats in this region as a basis for conservation planning (Mid-Atlantic Coastal Plain Region)

Potential Funding: Wetland Reserve Program, Coastal Wetlands Grant, North American Wetlands Conservation Act

Population Goal for Maryland/Delaware: Maintain current population

CONSERVATION DESIGN

- Develop protocols to rank habitats for their importance to migrating and nesting Kentucky warblers
- Using GIS, identify the most important site-specific areas to be protected and/ or restore

CONSERVATION DELIVERY

- Permanently protect large blocks of forested wetlands
- Protect and restore riparian corridors
- Restore hydrology and native plant assemblages to degraded forested wetlands
- Restore forested wetlands on “prior converted” agricultural lands.

OUTREACH

Continue to contact and work with landowners on enrollment in land conservation programs, especially Natural Resources Conservation Service's Wetland Reserve Program.

MONITORING

The North American Breeding Bird Survey, managed by U.S. Geological Survey, is a long term monitoring program that dates back to 1966. This is the most comprehensive long term monitoring for North American Birds and provides that basis for the trends of the Kentucky warbler. In addition, the Maryland Breeding Bird Atlas occurs every 10 years and provides more detailed distribution for breeding birds in Maryland. The second Atlas (2002-2006) was published in November 2010.

Partners

Delaware Department of Natural Resources and Environmental Control
Land trusts
Maryland Department of Natural Resources
Natural Resources Conservation Service

References

www.natureserve.org/explorer

Puritan Tiger Beetle (*Cicindela puritana*) Action Plan

Focus Area: Chesapeake Bay Shorelines

Other Species Benefitting: bank swallows (*Riparia riparia*), belted kingfishers (*Megaceryle alcyon*), non-threatened tiger beetles (*Cicindela repanda*, *Cicindela hirticollis*, *Cicindela marginata*), northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*)

BIOLOGICAL PLANNING

Species Information: The Chesapeake Bay contains only two metapopulations of Puritan tiger beetles along its shorelines, both in Maryland, one on the western shore and one on the eastern shore. These beetles have very specific habitat requirements. The larvae occupy only naturally eroding cliffs, where they live in deep burrows after digging in sandy deposits on non-vegetated portions of the bluff face or at the base of the cliffs. They are most abundant at sites where the bluffs are long and high with little or no vegetation and composed in part of yellow or red sandy soil. Erosion results in the loss of some larval beetles, but is necessary to maintain the bare bluff faces they require.

Along the Chesapeake Bay, adult Puritan tiger beetles are first seen in June and July when they emerge to feed and mate along the beach area. After mating the females move up onto the cliffs to deposit their eggs. Newly hatched larvae construct burrows in the cliffs and pass through 3 larval stages before metamorphosing into the adult form. It takes two years for the Puritan tiger beetle to complete its life cycle.

Justification for Species Selection: This species was listed as federally threatened under the Endangered Species Act in 1990 primarily due to the threat to its habitat from shore erosion control projects. Since 1990 Puritan tiger beetles have declined in population size and distribution within their Chesapeake Bay range. The remaining Chesapeake Bay populations are highly susceptible to habitat loss or degradation.

A 2007 Status Review for this species indicated that its status had become more precarious and recommended uplisting to endangered status. Some improvement in population numbers has occurred since the 2007 status review and may be reflected in a new Status Review which is to begin in 2011.

State Contribution to Overall Species Population: Approximately 90% of the total Puritan tiger beetle population occurs in the state of Maryland (USFWS 2007). The remaining 10% is supported by the Connecticut River populations in Connecticut and Massachusetts.

Threats and Assessment:

- Shoreline development and bluff stabilization are the most serious threats. Shoreline structures have been found to destroy the larval habitat directly or by promoting vegetation on cliff faces making them unsuitable for the larvae. Natural threats include sea level rise, invasive vegetation, flooding, parasites and insect predators.

Research/Actions Needed:

- Protect as much undeveloped occupied habitat as possible through conservation easements or acquisition.
- Implement the current Project Review Process in concert with the Maryland Department of Natural Resources to provide off-setting habitat protection for all shoreline erosion control projects in Puritan tiger beetle habitat.
- Continue to control vegetation at locations which benefit the Puritan tiger beetle.
- Develop management strategies to improve habitat quality and quantity for this species. This includes refining methods to reverse vegetation encroachment on important cliff and beach habitat.
- Work with researchers to determine if an experiment can be designed to test man-made habitat containment structures placed in suboptimal cliff habitats. Studies might determine whether such structures would be used by ovipositing females and support larval development.
- Continue annual counts of tiger beetle populations to allow further analysis of population trends and effects of shoreline structures on the beetles.

Potential Funding: Section 6 of the Endangered Species Act, Maryland Department of Natural Resources

CONSERVATION DESIGN

- Refine GIS analysis of land ownership and lands available for conservation in areas supporting this species and develop a more accurate mapping of lands currently protected from development.
- Use the GIS analysis to identify and prioritize areas where easements or acquisition will benefit the Puritan tiger beetle. Coordinate with Maryland Department of Natural Resources and county personnel in this identification.
- Develop a Safe Harbor (or similar) Agreement with corporate landowners to proactively manage and protect Calvert Cliffs Nuclear Plant subpopulation.

CONSERVATION DELIVERY

- Conservation delivery will consist primarily in protecting sites with easements, but other tools may be used where appropriate. A high priority will be given to identifying private landowners who are willing to enter into conservation easements for the protection and management of their shoreline habitats supporting Puritan tiger beetles.
- Reverse vegetation encroachment on important cliff and beach habitat.
- Work with the state of Maryland, Federal Emergency Management Agency and Maryland Emergency Management Agency to develop a buyout program for homes in Puritan tiger beetle habitat most threatened by erosion.
- Develop a programmatic Habitat Conservation Plan for the species
- On a yearly basis, develop and submit Section 6 Land acquisition Grant proposals to protect the remaining 3 large subpopulations in the Chesapeake Bay.

OUTREACH

Develop awareness of the Puritan tiger beetle in the public through more info on the Chesapeake Bay Field Office website and Maryland websites. Postings already include:

- Scientific publications, including species recovery plan
- Survey and monitoring data

Partners

Army Corps of Engineers, Baltimore District
Calvert County, Maryland
Cecil County, Maryland
Eastern Shore Land Conservancy
Maryland Environmental Trust
Maryland Department of Natural Resources

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Red Knot (*Calidris canutus*) Species Action Plan

Focus Area: Delaware Bay Shoreline

Other Species Benefitting: diamondback terrapin (*Malaclemys terrapin*), horseshoe crab (*Limulus polyphemus*), ruddy turnstone (*Arenaria interpres*), semi-palmated sandpiper (*Calidris pusilla*)

BIOLOGICAL PLANNING

Species Information: The red knot is the largest of the beach sandpipers (9 inches long) and has a red belly and neck while in its breeding plumage. It migrates more than 9,300 miles from its wintering grounds along the coast of Patagonia and Tierra del Fuego in Argentina to its breeding habitat in the Canadian arctic and repeats this feat again in the fall. During its spring migration, it stops along the beaches of Delaware Bay to feed on the abundant horseshoe crab eggs. The migration is perfectly timed to coincide with the horseshoe crab nesting period. The red knot arrives emaciated and doubles its weight before continuing its migration north.

Justification for Species Selection: The red knot is a candidate species for listing under the Endangered Species Act (ESA) and is classified as threatened under the New Jersey Threatened Species Act and as a Species of Conservation Concern in Delaware and Maryland.

Threats and Assessment:

- Reduced availability of horseshoe crab eggs because of past harvesting of horseshoe crabs for bait in eel pots.
- Habitat loss from development, shoreline stabilization, erosion, and sea level rise
- Human disturbance to foraging and roosting birds.
- Vulnerability to site-specific threats because of small population size.
- Wind turbines
- Oil spill and other contaminants
- Climate change

Research/Actions Needed:

- Maintain and increase red knot population
- Maintain and increase horseshoe crab egg forage base
- Maintain, enhance, restore, and create Delaware Bay and Atlantic Coast foraging beaches
- Maintain, enhance, restore, and create coastal roost sites
- Reduce competition with gulls
- Minimize human disturbance on foraging areas and roosts during spring stopover

Potential Funding: National Fish and Wildlife Foundation and other grant programs.

Population Goal: The Manomet Shorebird Recovery Project received a grant from National Fish and Wildlife Foundation to double the size of the red knot population (from 30,000 to 60,000) within 10 years.

CONSERVATION DESIGN

- Coordinate with Atlantic States Marine Fisheries Commission and state fisheries managers to ensure horseshoe crab harvest levels do not result in insufficient horseshoe crab egg availability for red knot.
- Monitor red knot stopover population in Delaware Bay as key component in ongoing status review of red knot to determine priority for listing species under the Endangered Species Act.
- Work with conservation partners to implement the Red Knot Spotlight Species Action Plan and National Fish and Wildlife Foundation Red Knot Business Plan.
- Coordinate with existing partners to pursue regional efforts to maintain and enhance red knot habitat.
- Find additional partners through the Partners and Coastal Programs that are interested in habitat restoration and then assist with designing, funding, and constructing wetland habitat.
- Coordinate with state, federal, and local agencies to provide regulatory protection to red knot and its habitat.
- Address resource loss and restoration through the Natural Resource Damage Assessment and Restoration (NRDAR) program where appropriate.
- Develop Candidate Conservation Agreements/Candidate Conservation Agreements with Assurances, as appropriate.

CONSERVATION DELIVERY

- Through the Endangered Species Program, provide technical assistance to Atlantic States Marine Fisheries Commission and state fisheries managers in developing horseshoe crab harvest regulations.
- Through the Endangered Species Program, coordinate with state biologists, conservation groups, and land managers to identify and abate site-specific threats; seek funding opportunities through National Fish and Wildlife Foundation or other grant programs to support conservation actions.
- Continue to address coastal beach and wetland habitats in Conservation Planning Assistance reviews under authority of Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, and other authorities to minimize decisions resulting in shoreline hardening, coastal development, and filling of wetlands.
- Through the Partners Program, provide landowners, land trusts, municipalities, and counties with technical assistance, equipment, grant finding assistance, plant material, and construction for habitat restoration and enhancement projects; assist with reducing the populations of common reed and other invasives through herbicide use, manipulation of local hydrology, and biocontrol efforts.
- Through Conservation Planning Assistance reviews, continue to address potential adverse effects from communication towers and wind projects.

OUTREACH

Continue to educate public and stakeholders about the red knot and the importance of horseshoe crabs. Increase awareness of migration stopovers, wintering and nesting habitat requirements, and the threats to the red knot throughout its range.

MONITORING

Coordinate with state biologists and International Shorebird Team to monitor red knot numbers and body condition during migration stopover in Delaware Bay. Research is needed to understand and predict impacts to the red knot population from climate change (e.g. changes in habitat quality and quantity, prey availability, and plant community; changes in timing of shorebird stay vs. horseshoe crab spawning; and changes in the ranges of horseshoe crabs and/or prey species).

Partners

Atlantic Coast Joint Venture
Atlantic States Marine Fisheries Commission and state fisheries managers
National Fish and Wildlife Foundation
Natural Lands Trust
New Jersey Department of Environmental Protection
New Jersey Audubon Society
New Jersey Natural Lands Trust.
Partnership for the Delaware Estuary
U.S. Department of Agriculture
U.S. Fish and Wildlife Service, Delaware Bay Estuary Program
U.S. Fish and Wildlife Service, Migratory Bird and Fisheries Programs
U.S. Fish and Wildlife Service, National Wildlife Refuges

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Saltmarsh Sparrow (*Ammodramus caudacutus*) Species Action Plan

Focus Areas: Chincoteague Bay, Delaware Bay Shoreline, Nanticoke Choptank

Other Species Benefitting: black rail (*Laterallus jamaicensis*), seaside sparrow (*Ammodramus maritimus*)

BIOLOGICAL PLANNING

Species Information: The saltmarsh sparrow is a small, secretive, stocky sparrow with brownish upperparts, grey on the crown and nape, a cream-colored breast with dark streaks, and a white throat and belly. It has an orange face with grey cheeks and a short pointed tail.

Saltmarsh sparrows nest in grassy salt marsh habitats that are vulnerable to frequent high tides, which in turn can cause a high level of nest loss. Very high tides can occur every four weeks which corresponds to the same length of time it takes for the sparrow to raise a family. Hence if a nest is lost, re-nesting must occur almost immediately if the new set of young is to survive. This lack of time to re-nest causes the saltmarsh sparrow to have the highest documented rate of extra-pair mating (Hill et al. 2010).

Occupying a narrow region along the east coast of the United States, the saltmarsh sparrow breeds from Maine south to North Carolina. In the winter this species' range shifts southward, with its southern limit in Florida and northern limit in Maryland.

Justification for Species Selection: The saltmarsh sparrow is listed on the American Bird Conservancy and the National Audubon Society WatchLists in the highest "Red" category for conservation due to declining populations. It is listed as "HH", the highest category for conservation, in the priority species for bird conservation region (BCR 30) by the U.S. Fish and Wildlife Service. It is listed as globally vulnerable on the International Union of Conservation of Nature (IUCN) red list due to its breeding range being restricted to the northeast United States (the only bird species so restricted).

State Contribution to Overall Species population: The conservation status of the saltmarsh sparrow in Maryland is poorly known partly due to its secretive nature. The Atlas of Breeding Birds of Maryland (Robbins 1996) documents the loss of breeding populations from upper Chesapeake Bay and lower Potomac River. The saltmarsh sparrows' current range in Maryland is within the extensive salt and brackish marshes of southern Dorchester and western Somerset counties, and the coastal marshes of southern Worcester County.

Threats and Assessment:

- Saltmarsh sparrows breed only in extensive high salt marshes dominated with grasses. These habitats face a high rate of loss due to inundation resulting from climate change through sea level rise.
- Encroachment of non-native plant species such as common reed (*Phragmites australis*) into high marsh habitat areas have resulted in a loss of salt marsh habitat.

- Highly developed coastal areas have resulted in a loss of salt marsh habitat and created fragmentation among saltmarsh sparrow populations in the range.
- Commercial development in coastal areas has led to pollution of salt marsh habitats resulting in significant mercury levels in saltmarsh sparrows (Shriver 2006).

Research/Actions Needed:

Little population data has been collected on this maritime sparrow. Christmas Bird Counts from 1997 to 2005 record significant fluctuations. Thus, range-wide surveys for this secretive marsh bird are needed to get a better grasp on current population numbers.

Range-wide mapping of the saltmarsh sparrow's high salt marsh habitat is needed to determine availability of the extensive grassy high salt marsh areas necessary for nesting. Gap Analysis Program (GAP) land cover Geographic Information Systems (GIS) data layers are available for the multi-state range of the saltmarsh sparrow. However, the high marsh vegetation classification within this data set contains other high marsh plant species such as black needlerush which is not conducive for saltmarsh sparrow nesting. Thus, using the GAP land cover data may result in an inflated acreage value of nesting habitat availability. A more detailed species level salt marsh vegetation data set is needed to more accurately map only grassy salt marsh habitats to obtain the most accurate measure of habitat availability.

The affects of sea level rise on coastal marshes is complex and not fully understood in part due to the many variables of the accretionary process. The Sea Level Affecting Marshes Model (SLAMM) simulates sea level rise scenarios over time based on 30 meter resolution elevation data. Results from this model are appropriate to use for a regional perspective of estimating salt marsh loss but not at local levels. Modeling sea level rise using highly accurate light detection and ranging (LiDAR) elevation data will help yield results more suitable for calculating habitat loss for the saltmarsh sparrow at a population level.

CONSERVATION DESIGN

- Conduct secretive marsh bird surveys to obtain the most accurate population figures for saltmarsh sparrows to set benchmarks for comparison over time of population trends.
- Maryland's land protection program, Rural Legacy, has a focus area on the southern coast of Worcester county within the saltmarsh sparrows breeding range. The goal is to protect large, contiguous tracts of land from sprawl development and enhance natural resource, agricultural, forestry and environmental protection through cooperative efforts among state and local governments and land trusts.
- Another grant program with potential to protect salt marsh habitat paramount to the conservation of the saltmarsh sparrow is the North American Wetlands Conservation Act (NAWCA). The purpose of this program is to provide funding for wetlands conservation or restoration projects for the benefit of wetlands-associated migratory birds and other wildlife.
- Map the extent and condition of vegetation classes on tidal marsh at Blackwater National Wildlife Refuge and Fishing Bay Wildlife Management Area which will produce new aerial imagery and a classification of vegetation types including low emergent marsh, high emergent marsh, tidal shrublands, and *Phragmites australis* cover. Results of these detailed land cover classifications will provide a much more accurate acreage value for potential saltmarsh sparrow grassy high marsh habitat availability in these areas

- Audubon Maryland-DC will conduct marsh bird surveys in tidal marshes throughout Maryland and Virginia under contract from Maryland Department of Natural Resources, as part of a northeast regional marsh bird study funded by a State Wildlife Grant. The survey will use passive and broadcast surveys designed by the North American Secretive Marsh Bird Monitoring Program (2011-2012). The protocol and sampling framework will assess the distribution and abundance of four diurnal species that nest primarily in the high marsh zone, one of which is saltmarsh sparrow. The field protocol also includes a brief vegetation survey at each survey point which can be used to determine the validity of using the GAP land cover data for a range-wide estimate of grassy salt marsh habitat availability for saltmarsh sparrow.

CONSERVATION DELIVERY

- Permanently protect salt marsh habitats from development and pollution through fee simple purchases or conservation easements to allow for landward migration of salt marshes to compensate for habitat loss due to inundation from sea level rise.
- Control invasion of common reed (*Phragmites australis*) using chemical spraying and/or burning to prevent encroachment into saltmarsh sparrow high salt marsh habitats.
- Restore high marsh grassy wetlands to provide additional nesting habitat for saltmarsh sparrows
- In conjunction with partner organization, the National Audubon Society Maryland-DC, efforts to identify properties for a NAWCA grant proposal within the range of saltmarsh sparrow in southern Dorchester and western Somerset counties are planned for 2011.
- Using the results of the Audubon marsh bird survey for saltmarsh sparrow and the Service's *Phragmites* mapping, a GIS analysis can identify potential encroachment areas of *Phragmites* into saltmarsh sparrow habitat to target for *Phragmites* control.

OUTREACH

- Engage the public, local bird clubs, and other non-profit organizations to join in the effort to report observations of the secretive saltmarsh sparrow through a website known as eBird anytime, in the Great Backyard Bird Count in February, and promote participation in the Christmas Bird Count in December and early January (Audubon website 2010).
- With partner organizations, development of a secretive marsh bird fact sheet can bring forward the plight of lesser known birds like the saltmarsh sparrow to reach a broader audience of concerned citizens other than just the scientific community.

MONITORING

- Continuation of secretive marsh bird surveys, like the ones being conducted in 2011 by partner organizations, in all areas of Maryland where saltmarsh sparrows breed will allow biologists to monitor population trends. More frequent surveys will also lend knowledge to whether or not the land protection efforts undertaken in this species breeding habitat range have stabilized the decline in population numbers.
- Monitoring of *Phragmites* stands adjacent to saltmarsh sparrow nesting habitat is important to ensure that the extensive grassy high marsh habitats required by the saltmarsh sparrow aren't lost to invasion by this non-native plant species.

Partners

Maryland Coastal Bays Program
Maryland Department of Natural Resources
The National Audubon Society
U.S. Fish and Wildlife Service National Wildlife Refuges Program

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Saltmarsh Sparrow (*Ammodramus caudacutus*) Species Action Plan

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State Contribution to Overall Species population: The conservation status of the saltmarsh sparrow in Maryland is poorly known partly due to its secretive nature. The Atlas of Breeding Birds of Maryland (Robbins 1996) documents the loss of breeding populations from upper Chesapeake Bay and lower Potomac River. The saltmarsh sparrows’ current range in Maryland is within the extensive salt and brackish marshes of southern Dorchester and western Somerset counties, and the coastal marshes of southern Worcester County.

Threats and Assessment:

- Saltmarsh sparrows breed only in extensive high salt marshes dominated with grasses. These habitats face a high rate of loss due to inundation resulting from climate change through sea level rise.
- Encroachment of non-native plant species such as common reed (*Phragmites australis*) into high marsh habitat areas have resulted in a loss of salt marsh habitat.
- Highly developed coastal areas have resulted in a loss of salt marsh habitat and created fragmentation among saltmarsh sparrow populations in the range.
- Commercial development in coastal areas has led to pollution of salt marsh habitats resulting in significant mercury levels in saltmarsh sparrows (Shriver 2006).

Research/Actions Needed:

Little population data has been collected on this maritime sparrow. Christmas Bird Counts from 1997 to 2005 record significant fluctuations. Thus, range-wide surveys for this secretive marsh bird are needed to get a better grasp on current population numbers.

Range-wide mapping of the saltmarsh sparrow’s high salt marsh habitat is needed to determine availability of the extensive grassy high salt marsh areas necessary for nesting. Gap Analysis Program (GAP) land cover Geographic Information Systems (GIS) data layers are available for the multi-state range of the saltmarsh sparrow. However, the high marsh vegetation classification within this data set contains other high marsh plant species such as black needlerush which is not conducive for saltmarsh sparrow nesting. Thus, using the GAP land cover data may result in an inflated acreage value of nesting habitat availability. A more detailed species level salt marsh vegetation data set is needed to more accurately map only grassy salt marsh habitats to obtain the most accurate measure of habitat availability.

The affects of sea level rise on coastal marshes is complex and not fully understood in part due to the many variables of the accretionary process. The Sea Level Affecting Marshes Model (SLAMM) simulates sea level rise scenarios over time based on 30 meter resolution elevation data. Results from this model are appropriate to use for a regional perspective of estimating salt marsh loss but not at local levels. Modeling sea level rise using highly accurate light detection

and ranging (LiDAR) elevation data will help yield results more suitable for calculating habitat loss for the saltmarsh sparrow at a population level.

CONSERVATION DESIGN

- Conduct secretive marsh bird surveys to obtain the most accurate population figures for saltmarsh sparrows to set benchmarks for comparison over time of population trends.
- Maryland's land protection program, Rural Legacy, has a focus area on the southern coast of Worcester county within the saltmarsh sparrows breeding range. The goal is to protect large, contiguous tracts of land from sprawl development and enhance natural resource, agricultural, forestry and environmental protection through cooperative efforts among state and local governments and land trusts.
- Another grant program with potential to protect salt marsh habitat paramount to the conservation of the saltmarsh sparrow is the North American Wetlands Conservation Act (NAWCA). The purpose of this program is to provide funding for wetlands conservation or restoration projects for the benefit of wetlands-associated migratory birds and other wildlife.
- Map the extent and condition of vegetation classes on tidal marsh at Blackwater National Wildlife Refuge and Fishing Bay Wildlife Management Area which will produce new aerial imagery and a classification of vegetation types including low emergent marsh, high emergent marsh, tidal shrublands, and *Phragmites australis* cover. Results of these detailed land cover classifications will provide a much more accurate acreage value for potential saltmarsh sparrow grassy high marsh habitat availability in these areas
- Audubon Maryland-DC will conduct marsh bird surveys in tidal marshes throughout Maryland and Virginia under contract from Maryland Department of Natural Resources, as part of a northeast regional marsh bird study funded by a State Wildlife Grant. The survey will use passive and broadcast surveys designed by the North American Secretive Marsh Bird Monitoring Program (2011-2012). The protocol and sampling framework will assess the distribution and abundance of four diurnal species that nest primarily in the high marsh zone, one of which is saltmarsh sparrow. The field protocol also includes a brief vegetation survey at each survey point which can be used to determine the validity of using the GAP land cover data for a range-wide estimate of grassy salt marsh habitat availability for saltmarsh sparrow.

CONSERVATION DELIVERY

- Permanently protect salt marsh habitats from development and pollution through fee simple purchases or conservation easements to allow for landward migration of salt marshes to compensate for habitat loss due to inundation from sea level rise.
- Control invasion of common reed (*Phragmites australis*) using chemical spraying and/or burning to prevent encroachment into saltmarsh sparrow high salt marsh habitats.
- Restore high marsh grassy wetlands to provide additional nesting habitat for saltmarsh sparrows
- In conjunction with partner organization, the National Audubon Society Maryland-DC, efforts to identify properties for a NAWCA grant proposal within the range of saltmarsh sparrow in southern Dorchester and western Somerset counties are planned for 2011.
- Using the results of the Audubon marsh bird survey for saltmarsh sparrow and the Service's *Phragmites* mapping, a GIS analysis can identify potential encroachment areas of *Phragmites* into saltmarsh sparrow habitat to target for *Phragmites* control.

OUTREACH

- Engage the public, local bird clubs, and other non-profit organizations to join in the effort to report observations of the secretive saltmarsh sparrow through a website known as eBird anytime, in the Great Backyard Bird Count in February, and promote participation in the Christmas Bird Count in December and early January (Audubon website 2010).
- With partner organizations, development of a secretive marsh bird fact sheet can bring forward the plight of lesser known birds like the saltmarsh sparrow to reach a broader audience of concerned citizens other than just the scientific community.

MONITORING

- Continuation of secretive marsh bird surveys, like the ones being conducted in 2011 by partner organizations, in all areas of Maryland where saltmarsh sparrows breed will allow biologists to monitor population trends. More frequent surveys will also lend knowledge to whether or not the land protection efforts undertaken in this species breeding habitat range have stabilized the decline in population numbers.
- Monitoring of *Phragmites* stands adjacent to saltmarsh sparrow nesting habitat is important to ensure that the extensive grassy high marsh habitats required by the saltmarsh sparrow aren't lost to invasion by this non-native plant species.

Partners

Maryland Coastal Bays Program
Maryland Department of Natural Resources
The National Audubon Society
U.S. Fish and Wildlife Service National Wildlife Refuges Program

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Snowy Egret (*Egretta thula*) Species Action Plan

Focus Areas: Chesapeake Bay Islands, Chincoteague Bay

Other Species Benefitting: little blue heron (*Florida caerulea*), tricolored heron (*Hydranassa tricolor*)

BIOLOGICAL PLANNING

Species Information: The snowy egret is most commonly observed foraging along the water's edge of estuarine wetlands such as salt marshes. Within the Mid-Atlantic region, snowy egrets both breed and overwinter, with wintering occurring mostly along the coast. Preferred nesting habitats include isolated estuarine areas such as islands containing thick vegetation that includes shrubs such as bayberry (*Myrica pensylvanica*), wax myrtle (*Myrica cerifera*), high tide bush (*Iva frutescens*), and groundsel tree (*Baccharis hamifolia*). This species usually nests in mixed-species heronries that contain little blue herons, cattle egrets (*Bubulcus ibis*), tricolored herons, and/or great egrets (*Casmerodius albus*).

Justification for Species Selection: The species is listed as a U.S. Fish and Wildlife Service (USFWS) Bird of Conservation Concern (BCC) within Bird Conservation Region 30 (New England-Mid Atlantic coastal area; USFWS 2008). The snowy egret is also listed by Maryland Department of Natural Resources as a species of Greatest Conservation Need (GCN) in the Maryland Department of Natural Resources Maryland (MDNR) Wildlife Diversity Conservation Plan (MDNR 2005). Survey data within the Chesapeake Bay region has found that Snowy Egret populations are on the decline. In the 10-year period (1993-2003), the Chesapeake Bay snowy egret regional population had experienced a 28 percent decline (Williams et al. 2007), with little evidence of any recent recoveries.

State Contribution to Overall Species Population: The latest Bay-wide survey (2003) indicated the presence of approximately 3,236 nesting pairs of snowy egret distributed among 32 colonies, suggesting that there are more colonies than in the late 1970s, however they are much smaller (Williams et al. 2007).

Threats and Assessment:

- Loss of isolated nesting habitats such as estuarine islands
- Degradation of suitable habitat (i.e double-crested cormorant (*Phalacrocorax auritus*) and associated vegetation destruction)
- Colony disturbance (human) during nesting season
- Raccoon (*Procyon lotor*) populations in many areas of the Chesapeake Bay have expanded their range, resulting in greater exposure of snowy egrets to this predator.

Conservation Goals: Erwin (2010b) recommended using a population goal 4,176 nesting pairs, a value which based on data gathered during population surveys conducted in 1977 (Erwin and Korschgen 1979).

Research/Actions Needed:

As identified by Parsons and Masters (2000), future research should focus on:

- Colony-site dynamics; competitive interactions with other wading birds.
- Foraging requirements (area used, proximity requirements to nesting colonies)
- Use of aquaculture facilities as foraging areas
- Population genetics and wintering distribution

Erwin (2010a) of the USGS/PWRC identified these additional research needs:

- Documentation of movement patterns within colonies on a local and regional scale
- Gain greater understanding of mortality sources (i.e. percent of mortality due to predation, weather, and disturbance)
- Establish avian and mammalian predator control on selected islands

Overall, snowy egrets face accelerated threats to their existence throughout their range in the twenty-first century due to continued wetland degradation and loss, environmental contaminants, and control measures at aquaculture facilities. Scientists should provide resource managers with information on nesting- and foraging-site requirements for restoration efforts that may be warranted in the future. Similarly, conservation of the species may be improved with knowledge of population genetic (e.g. gene flow) factors likely to help determine reintroduction success (Parsons and Masters 2000).

Potential Funding: U.S Army Corps of Engineers

CONSERVATION DESIGN

- Identify island habitats that have the potential to support nesting snowy egrets
- Habitat enhancement of historic, active or potential snowy egret nesting sites.
- Attract nesting pairs to selected sites using decoys.

The latter two strategies have been very successful at the Paul S. Sarbanes Environmental Restoration Project at Poplar Island.

CONSERVATION DELIVERY

- Coordinate with Maryland Department of Natural Resources and U.S. Geological Survey personnel in identifying historic, current, and potential Snowy Egret nesting sites within the Chesapeake Bay.
- Coordination will include ground truthing of selected island sites to verify if sites could maintain nesting colonies.
- Enhancement of nesting habitat in active snowy egret nesting sites would be conducted by placement of additional nesting substrates into and surrounding areas of the current colonies as a measure to increase colony nesting size. Nesting substrates would include: used Christmas trees and other shrub species; snag a materials such as large sections of driftwood; possible planting of shrub species on larger island habitats.
- Sites that have the potential to support new nesting colonies would incorporate the above actions but on a larger scale.

- As an aid in attracting nesting pairs of snowy egret to selected nesting sites, plastic egret decoys will be placed in historic, current, and potential nesting sites. This approach has worked well at the Paul S. Sarbanes Environmental Restoration Project at Poplar Island, and island restoration project located in Chesapeake Bay (Erwin and Beck 2007; McGowan and Guy 2010).

OUTREACH

- Develop awareness of the importance of island habitats and species benefits to school age children by presenting at various schools from grades 5-12. Boy/Girl Scouts of America or similar groups could be used as volunteers in collection of used Christmas trees during the winter holiday break.
- Development of joint federal/state fact sheets on colonial waterbirds and islands

MONITORING

Monitoring Snowy Egret populations at restored or habitat enhanced island sites within the Chesapeake Bay would be conducted using similar protocols being used by Maryland Department of Natural Resources and U.S Geological Survey biologists that currently conduct colonial waterbird surveys within the Chesapeake Bay (Erwin 2010a). In Maryland and Virginia, coordinated surveys are conducted on a five-year basis.

Partners

Maryland Department of Natural Resources
U.S Geological Survey, Patuxent Wildlife Research Center
U.S Army Corps of Engineers

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Wood Thrush (*Hylocichla mustelina*) Species Action Plan

Focus Areas: Anacostia Watershed, Blackbird Millington, Chincoteague Bay, Lower Chester River, Lower Potomac Patuxent, Lower Rappahannock River, Lower Western Shore Rivers, Nanticoke Choptank, Pocomoke River Cypress Swamp, Shenandoah Upper Rappahannock, Western Highlands

Other Species Benefitting: black-billed cuckoo (*Coccyzus erythrophthalmus*), hooded warbler (*Wilsonia citrine*), red-shouldered hawk (*Buteo lineatus*)

BIOLOGICAL PLANNING

Species Information: The wood thrush is a common neotropical migrant found in deciduous and mixed forests throughout the eastern and mid-western United States and Canada during the spring and summer months.

Nesting occurs in deciduous or mixed forests with a dense canopy and a well-developed deciduous understory, especially in moist bottomlands and hardwood forests (Bertin 1977, Roth 1987, Roth et al. 1996). The wood thrush also nests in pine forests with a deciduous understory and well-wooded residential areas (Hamel et al. 1982). Bertin (1977) found wood thrushes require one or more trees at least 12 m tall, possibly for song perches and Morse (1971) reported nesting in stands of young white pine with a canopy under 9 m in height.

Justification for Species Selection: The wood thrush is listed as a U.S. Fish and Wildlife Service Region 5 Bird of Conservation Concern, as a priority bird species in three Bird Conservation Regions (28, 29, and 30), and as a Species of Conservation Need in Delaware and Maryland Wildlife Action Plans. The North American Breeding Bird Survey (BBS) data indicated a significant 1.9% annual decline (29% overall) in North America from 1966 to 1999, and the last half of this period (1980-1999) showed a significant 1.5% annual decrease (15.3% overall) (Nature Serve 2010).

Threats and Assessment:

- Forest fragmentation and deforestation on breeding grounds
- Deforestation of tropical wintering grounds and conversion shade coffee plantations to sun coffee plantations
- Over abundant deer denude forest understory and impact nesting habitat
- Nest predation and parasitism (brown-headed cowbird)

Research/Actions Needed: Annual surveys of suitable habitat and known populations using point count censusing techniques are probably the best way to monitor wood thrush populations. Long-term studies are preferred. Studies should monitor breeding productivity to provide critical information of factors affecting population recruitment and dynamics. It is imperative to determine why reproductive success may be low and why numbers of birds may be low. Minimum area requirements for source populations seem to be the least understood aspect of wood thrush management. Vegetation characteristics associated with nest-site selection and reproductive success needs to be quantified. Research is needed into the role of that tropical

deforestation and habitat fragmentation may have on the decline of regional thrush populations in temperate breeding grounds.

Potential Funding: Wetland Reserve Program, Coastal Wetlands Grant, North American Wetland Conservation Act grants, *Conservation Reserve Enhancement Program*, Wildlife Habitat Incentive Program, Forest Legacy Program

Population Goal for Delaware/Maryland: Maintain or increase current population

CONSERVATION DESIGN

- Permanently protect large blocks of forests and riparian corridors
- Restore hardwoods and mixed forest in open fields adjacent to large forest blocks to increase suitable nesting habitat
- Restore riparian corridors to facilitate dispersal between large forest blocks
- Reduce impacts to forest interior through the regulatory process
- Promote silviculture practices that minimize the impacts to the forest during logging operations

CONSERVATION DELIVERY

Forest Fragmentation – breeding and migration

- Permanently protect large blocks of forested upland and wetland habitat by the Partners and Coastal Programs using the Wetland Reserve Program, Coastal Wetlands Grant, and North American Wetland Conservation Act grants. Most of the work will be carried out on private land
- Restore or manage riparian forests to provide migration corridors
- Restore forest in open fields especially those adjacent to existing large blocks of forest
- Provide federal agency comments on proposed federal actions that are likely to impact forest interior habitat
- Provide federal agency comments on wind power and other projects that could impact migrating birds

Forestry

The effects of silvicultural practices such as clear cutting and selective logging on migratory songbirds may depend upon the landscape context (Robinson and Wilcove 1994). Preliminary evidence suggests that using low-volume selective logging as an alternative to clear cutting can have relatively little impact on wood thrushes (Robinson and Wilcove 1994). In addition to selective logging, logging roads should be closed and revegetated soon after harvest, and rotation times should be lengthened to permit regeneration of large, old trees (Robinson and Wilcove 1994).

OUTREACH

Continue to contact and work with landowners on enrollment in land conservation programs, especially Natural Resources Conservation Service's' Wetland Reserve Program. Promote deer management to ensure understory vegetation is not denuded by high deer populations.

MONITORING

The North American Breeding Bird Survey, managed by U.S. Geological Survey, is a long term monitoring program that dates back to 1966. This is the most comprehensive long term monitoring for North American Birds and provides that basis for the trends of the wood thrush. In addition, the Maryland Breeding Bird Atlas occurs every 10 years and provides more detailed distribution for breeding birds in Maryland. The second Atlas (2002-2006) was published in November 2010.

Partners

Delaware Division of Fish and Wildlife Land Trusts
Delaware Forest Service
Maryland Department of Natural Resources
Natural Resources Conservation Service

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Yellow Perch (*Perca flavescens*) Species Action Plan

Focus Areas: Blackbird Millington, Lower Potomac Patuxent, Lower Western Shore Rivers

Other Species Benefitting: alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), hickory shad (*Alosa mediocris*), striped bass (*Morone saxatilis*), white perch (*Morone americana*)

BIOLOGICAL PLANNING

Species Information: Along the east coast of North America, yellow perch range from South Carolina to Nova Scotia. The range extends to the west as far as Saskatchewan and to the northern half of the Mississippi drainage (Piavis 1991). The yellow perch is a treasured resource in the Chesapeake Bay. A semi-anadromous species, it lives in fresh to brackish waters of many Chesapeake Bay tributaries, and migrates upstream to fresher water habitats to spawn. According to Piavis (1991), adults remain in their natal tributaries. The primary movements are the upstream spawning migration of adults and the downstream dispersal of juveniles. Yellow perch is sought by recreational fishermen both for its excellent taste and as a harbinger of spring, since its spawning run in February and March is the earliest of the season. Historically, yellow perch have been a major commercial and recreational fishery in the Chesapeake Bay but populations in many tributaries have declined (see Threat and threat assessment). Yellow perch are eaten by top predators such as striped bass, largemouth bass (*Micropterus salmoides*), and piscivorous birds.

The habitat for yellow perch eggs and larvae overlaps with that for anadromous species such as alewife and blueback herring (Klauda *et al.* 1991). Juvenile and adult habitats also overlap with those for shad and striped bass. Thus, the approach and conclusions derived for yellow perch are applicable for the protection of these species. We consider yellow perch a better indicator of the effects of ecological stressors because of its more compressed spawning period.

Justification for Species Selection: On May 12, 2009, the President issued Executive Order 13508, recognizing the Chesapeake Bay as a national treasure and calling on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. Section 601 calls for the Departments of Commerce and Interior to conduct research to evaluate the effects of climate change on the Chesapeake Bay. The areas to be assessed include 1) evaluating the effects of changing rainfall levels and rainfall intensity on water quality and aquatic life; 2) the impacts of increasing temperature, acidity, and salinity levels; and 3) potential impacts of climate change on fish, wildlife and their habitats. Through long-term monitoring and modeling conducted by Maryland Department of Natural Resources, it is clear that reproduction in the Severn River and other western shore rivers is poor while that in the Choptank and Nanticoke is much more successful. Thus, the river specific yellow perch populations can serve as indicators to evaluate habitat quality for anadromous fish with regard to land use changes (i.e., increasing impervious surface due to urbanization) and sediment/contaminant loading.

Within CBFO's geographic region, yellow perch is a focal species for the Lower Western Shore and Lower Potomac areas. These areas include the most stressed populations, South and Severn Rivers (Uphoff *et al.* 2005, 2006, 2010) as well as an area threatened by development, Mattawoman Creek (American Rivers 2009).

Threats and Assessment:

Maryland's commercial fishery for yellow perch declined from over one million pounds per year around 1900 to 66,000 pounds in 1990 (Piavis 1991). Population declines resulted in commercial (Choptank, Magothy, Miles, Nanticoke, Patapsco, Severn, South, West, Wye rivers) and recreational (Magothy, Nanticoke, Patapsco, Severn, South, West rivers) closures in 1989. New regulations for the 2009 season reopened the Patapsco, Magothy, Severn, South, and Nanticoke rivers to recreational fishing. Portions of the Magothy and Severn rivers remain closed to recreational fishing to protect spawning habitat (<http://www.dnr.state.md.us/fisheries/management/yperch/ypmngindex.html>). Threats to yellow perch include:

- Nutrient loading leading to hypoxia
- Sediment loading - sediments carry toxic chemicals such as metals, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), nutrients, and pesticides (USGS 2005; U.S. EPA Chesapeake Bay Program 2009) sediment loading.
- Poor reproduction although it is not known whether this is due to an increased prevalence of abnormal gametes, possibly due to endocrine disrupting chemicals, hypoxia, or from the effects of stressors on early life stages
- Climate change - recent (2007-2009) collections of ripe (pre-spawning) adults indicates that spawning occurs over an approximately 3-5 day period, triggered by water temperatures reaching about 8-10 °C (S. Minkkinen, USFWS, personal communication). Climate change could result in an even more compressed spawning season due to a more rapid rise in temperature (S. Minkkinen, personal communication). Heavy rainfall can threaten hatching success by: dislodging egg chains, which are usually suspended from woody debris, and wash them downstream or destroy their integrity; increasing the concentrations of suspended sediment which will decrease yellow perch larval survival; and increasing loadings of contaminants off the impervious surfaces during winter storms.

Research/Actions Needed:

- Examine effects of hypoxia on the reproductive function of adult yellow perch. Hypoxia is a pervasive condition in the Severn River and is projected to increase as a result of climate change.
- Examine the effects of sediment and contaminant loading on survival of early life stages of yellow perch.
- Evaluate how urbanization and increased impervious coverage are associated with yellow perch population trends.

Potential Funding: Beginning in 2007, Chesapeake Bay Field Office and Maryland Fisheries Resource Office launched two yellow perch contaminant studies with two groups from U.S. Geological Survey, the National Fish Health Research Laboratory and the National Wetlands Research Center funded by the Mirant Power Company. The objective is to compare the reproductive status of yellow perch in five Chesapeake Bay tributaries – two of which (South

and Severn rivers) have experienced serious population declines. The study utilizes histopathology, hormone analyses, and sperm quality analyses as endpoints. A final report is expected in early 2011.

The current project, started in 2010, is a collaboration with Towson University and the University of Maryland Wye Research and Education Center to analyze the impacts of salinity (as altered by the addition of road salts) and exposure to suspended sediments on the survival of yellow perch eggs and larvae. Funding was received from the U.S. Fish Wildlife Service's Division of Environmental Quality as an Off-Refuge Proposal.

For both studies, Dr. Jim Uphoff, Maryland Department of Natural Resources, has served as an advisor and collaborator.

Population Goal: To increase the strength of the western shore populations as measured by the Maryland Department of Natural Resource's modeling effort. Before that can be achieved, studies are needed to identify stressors that adversely affect the populations.

CONSERVATION DESIGN

- Assemble multi-disciplinary teams on a project-specific basis to unraveling the effects of multiple stressors on yellow perch populations in the Chesapeake Bay. The teams are linked by collaborating on the proposal writing, working together on the projects, and co-authoring the reports. Financial arrangements are made through reimbursable agreements and Interagency Agreements.
- Assess the impacts of these stressors, including climate change, and advise on adaptations. A constant presence has been the long-term knowledge and advice provided by Dr. Jim Uphoff of Maryland Department of Natural Resources.

CONSERVATION DELIVERY

- Future actions may include total maximum daily limits (TMDLs) to limit sediment and nutrient inputs.
- Engage in early project planning (e.g. rerouting highway expansions away from spawning areas).
- Increase/restore riparian buffers to benefit the habitats that are utilized by anadromous fish.

OUTREACH

CBFO will develop an outreach strategy to communicate the threats to yellow perch habitat and transmit the results of the studies to the public. This will take the form of fact sheets, information on the CBFO web site, and presentations to watershed groups.

MONITORING

Population monitoring is continuing as funding permits by the Maryland Department of Natural Resources. These efforts could be supplemented by the Service so that long-term data sets are maintained. Some limited (and semi-quantitative) egg mass monitoring is currently conducted by the Maryland Coastal Conservation Association using volunteers. With funding, the Service could develop a more rigorous program. Future studies will revisit specific tributaries as part of

the multiple stressor assessments. One study we suggest is an analysis of the effects of hypoxia in the Severn River on yellow perch populations.

Partners

Maryland Department of Natural Resources
Mirant Power Company
Towson University, Chemistry Department
University of Maryland Wye Research and Education Center
U.S. Fish and Wildlife Service, Division of Environmental Quality
U.S. Fish and Wildlife Service, Maryland Fisheries Resource Office
U.S. Geological Survey, the National Fish Health Research Laboratory
U.S. Geological Survey, National Wetlands Research Center

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