Pennsylvania Ecological Services Field Office

Priority Planning Strategy FY 2011-2013

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SECTION I – OVERVIEW

Introduction and Purpose

The Pennsylvania Ecological Services Field Office (PAFO) of the U.S. Fish and Wildlife Service (FWS) has developed this Priority Planning Strategy to guide its work over the next three fiscal years. This Strategy will be shared with other conservation partners, both within the FWS (e.g. other field stations in Pennsylvania, as well as neighboring Field Offices), and outside of the FWS (state wildlife agencies, federal agencies, conservation organizations, and others). Based on conversations with partners at all levels, and depending upon changing resources, information, or rates of progress, the Strategy will be subject to ongoing review and revision.

Nonetheless, the PAFO intends this Priority Planning Strategy to guide its work, especially to achieve the following purposes:

- Influence Discretionary Opportunities: Establish priorities to guide use of office staff time and funding, to the extent flexibility exists to make discretionary decisions.
- Target Resource Needs: Target opportunities to increase staff time or funding, by clearly identifying priority needs.
- Improve Communication: Articulate priorities to our partners, to allow for better communication and to give partners the opportunity to influence future priority revisions.
- Learn and Adapt: Create a more intentional outline of PAFO priorities and how we intend to achieve them, so that we can aim for consistent improvement on an iterative basis.

To achieve each of these purposes, but especially as it relates the iterative goal described in the last bullet, this Priority Planning Strategy is organized using the model of Strategic Habitat Conservation. Strategic Habitat Conservation is an adaptive resource management framework describing the way FWS intends to do business: setting biological goals, making strategic decisions, and constantly reassessing and improving our actions. For this document, we have identified focal species for the PAFO, and addressed each focal species in a Species Action Plan using the primary components of Strategic Habitat Conservation.

- *Biological Planning (setting targets):* This identifies threats and limiting factors, determines current population status, and establishes population goals.
- *Conservation Design (developing a plan to meet the goals):* This articulates the conservation methods and strategies we believe will achieve desired population goals, and ideally will include models predicting how types of actions relate to population response.
- *Conservation Delivery (implementing the plan):* These are the conservation actions we intend to implement through programs and partnerships. They include on-the-ground conservation, as well as any actions implementing the conservation design strategies intended to achieve biological objectives.

- *Monitoring and Research (measuring success and increasing our understanding):* These are information needs to evaluate the effectiveness of conservation actions, and test assumptions in – or provide the basis for -- Biological Planning and Conservation Design. While Strategic Habitat Conservation ideally divides these into separate needs for "Outcome-Based Monitoring" and "Assumption-Driven Research," they are combined in this document.

For each PAFO focal species, the Species Action Plan addresses where we currently stand in achieving the goals for each of these four components of Strategic Habitat Conservation, and then identifies priority needs within that component. For example, under Biological Planning, the Species Action Plan will describe known threats and limiting factors, existing conservation goals, and then describe needs to improve our biological planning. By comparison, under Conservation Delivery we describe existing actions, and then identify priority actions we intend to implement. Research and Monitoring describes needs which should be tied to information required to conduct Biological Planning, Conservation Design, or to monitor Conservation Delivery.

It is important to note that this Priority Planning Strategy does not presume to speak for the priorities of any entity other than the PAFO. That is, we recognize that state wildlife agencies, conservation organizations, other federal agencies, and even other programs and offices within the FWS may identify different focal species and different priority needs for the same focal species. This document intends only to specify the focal species and priority needs that the PAFO itself expects to target over the next three years. By doing so, we hope to more effectively cooperate with our partners where our priorities align, to better communicate and understand one another when our priorities do not align, and to better inform future decisions concerning the PAFO's priorities based on input and review from our partners.

Focal Species

The PAFO focal species were selected using a number of criteria. None of these factors was individually controlling. A broad range of potential focal species was identified, and then each potential species was evaluated in regard to each factor. Species that were evaluated most strongly in the most factors were then selected as focal species.

Criteria used were as follows (not in any priority order):

- Ability for the PAFO to deliver projects and conservation actions – defined broadly -- benefitting the species. (Is there something we can be doing?)
- Ability to influence the conservation status of the species. (Are we likely to make a difference?)
- Extent to which the species is believed to be a priority for other conservation partners (both within and outside of FWS).
- Whether it is a "spotlight" species for the FWS.
- Whether it is a federally listed or candidate species.
- Proportion of the species' range within Pennsylvania.

- Degree of threat or population decline concerning the species (especially regarding non-listed species).
- Extent to which there may be "umbrella" benefits from actions to conserve the species (i.e. use of it as a "keystone" species for a declining species guild or habitat).

Using these criteria, the PAFO identified the following focal species for priority planning purposes, for the next three years.

American shad
American woodcock
Bog turtle
Brook trout
Cerulean warbler
Dwarf wedgemussel
Eastern massasauga rattlesnake
Golden-winged warbler
Indiana bat
Ohio River mussels (a suite of species)
Piping plover – Great Lakes population

Once again, it merits emphasizing that this list does not represent all species for which the PAFO is responsible and may undertake conservation actions. For example, the list does not include all federally listed species in Pennsylvania, much less all migratory birds who use Pennsylvania habitat. Rather, the species are those for which the PAFO intends to target its work when and where possible, in the belief that this targeted effort would maximize benefit for our trust species, based on the criteria used for selection. Nonetheless, additional species, or suites of species, may be considered for addition during the three years of this Priority Planning Strategy.

Species Action Plans for each focal species are included as sections within the Priority Planning Strategy.

Focal Areas

This Priority Planning Strategy also identifies Focal Areas, linked to the priorities identified in the Species Action Plans. The Focal Areas are critical to understanding how the PAFO intends to implement the priority needs for each species, for each component of Strategic Habitat Conservation. These are intended to improved internal and external communication concerning what sort of proactive conservation actions, and responsive regulatory actions, are of most interest in various parts of the state.

Each Focal Area definition incorporates the Focal Area habitat, purpose, and location.

- Habitat: The type of habitat relevant to identified focal species, which may signal that the habitat currently exists, or that it has the promise to exist in the Focal Area.

- Purpose: The type of conservation action, conservation strategy, or limiting factor making the focal area relevant as a priority for identified focal species.
- Location: The geographic location where the habitat and purpose will exist as a focal area.

With each of these three facets part of the definition, it is possible for a single Focal Area to exist in multiple locations, if locations with common habitat and purpose are defined and designated. (For example, the Indiana Bat Zones of Concern Focal Area occurs in multiple zones, frequently disconnected from each other.) On the other hand, different Focal Areas may overlap, if different habitat types serving different species purposes are identified in the same basic location. (For example, at a mapping scale, the Central PA Headwaters Focal Area and the Early Successional Focal Area may exist in the same mapping location, although they are considered different Focal Areas due to the different habitats and purpose that make up their definitions.)

The PAFO recognizes and expects that it will continue to address conservation responsibilities and opportunities outside of designated Focal Areas. Nonetheless, the Focal Areas will affect management decisions, consistent with the purposes of this Priority Planning Strategy. As stated above, that means Focal Areas will:

- Influence Discretionary Opportunities
- Target Resource Needs
- Improve Communication
- Learn and Adapt

Each PAFO Focal Area is included as an Attachment to this Priority Planning Strategy, with a definition of the Focal Area addressing its habitat, purpose, and a map showing its location. PAFO Focal Areas are as follows:

Susquehanna River Mainstem
Early Successional Forest Habitat
Headwater Wetlands of SE PA
Central PA Headwaters
Mature Forest Ridgetops and Bottomlands
Upper Delaware River
Indiana Bat Zones of Concern
Ohio River and Allegheny River
Presque Isle

SECTION II – Focal Species Action Plans

Each Focal Species Action Plan consists of the following:

Introduction

- Justification
- Information Sources
- Focal Area

Section I – Biological Planning

- Threats
- Conservation Goals
- Partners
- Needs

Section II – Conservation Design

- Conservation Strategies
- Partners
- Needs

Section III – Conservation Delivery

- Existing Actions
- Partners
- Needs

Section IV – Monitoring and Research

- Key Data Gaps
- Partners
- Needs

American Shad (***Alosa sapidissima***)

Introduction: American shad (*Alosa sapidissima*) are an anadromous, pelagic, highly migratory, schooling species (Colette and Klein-MacPhee 2002). American shad spend most of their lives in marine waters, with adults migrating into coastal rivers and tributaries to spawn (Greene et.al. 2009). On average, American shad spend four to five years at sea, and some individuals from the southernmost range may travel over 20,000 km during this time period (Dadswell et al. 1987). Researchers believe that the historical spawning range of American shad included all accessible rivers and tributaries along the Atlantic coast (MacKenzie et al. 1985). Over the past 170 years, declines in American shad stocks have been attributed to overfishing, pollution, and habitat loss due to dams, upland development, and other factors (Limburg et al. 2003). Specifically, declines in Susquehanna River shad can be attributed to poor efficiency of fish passage measures and facilities; low hatchery production in recent years; low numbers of spawning fish accessing quality upstream habitat: poor young-of-year recruitment upstream of Conowingo Dam; excessive ocean fishery mortality; and potentially high predation mortality (SRFAFRC 2010).

Justification: In the past 45 years, State and Federal resource agencies, utilities, and citizen interest groups have committed over $75 million and many man-hours to rebuilding fish populations in the Susquehanna River and constructing fish passage at the four most downstream dams. The shad restoration program goal is to reestablish an annual spawning population of 2 million shad and 20 million herring by 2025 (USFWS 2005). Migratory fish restoration in the Susquehanna River Basin has been largely a cooperative effort. Resource agencies have been working together with hydropower companies and others to establish shad passage, shad culture, and shad stocking programs to more effectively manage migratory fish resources in Pennsylvania.

Focus on the American shad would have umbrella benefits to other species as well including

- anadromous species
    - herring family (Clupeidae):
        - Hickory shad (*Alosa mediocris*)
        - alewife (*Alosa pseudoharengus*)
        - Blueback herring (*Alosa aestivalis*)
    - striped bass (*Morone saxatilis*)
- catadromous species
    - American eel (*Anguilla rostrata*)
- potadromous species
    - gizzard shad (*Dorosoma cepedianum)*
- resident riverine fish species
    - smallmouth bass
    - walleye
    - muskellunge
    - pike
    - catfish

Other organisms benefiting from a focus on shad would include aquatic macroinvertebrates such as insects and mussels (Dillon 2000). Each mussel species is very specific in fish host selection

(*i.e.*, Eastern Elliptio (*Elliptio complenata*) and American eel). Some use a number of different hosts, while others only use one to two hosts. Barriers, such as dams, that impede the up-and downstream movements of fish hosts, constrain the distribution of mussels that rely on specific fish hosts.

Information Sources:

Note, see end of document for a complete listing of references.
Greene, K.E., J.L. Zimmerman, R.W. Laney, and J.C Thomas-Blate. 2009. Atlantic Coast Diadromous Fish Habitat: A Review of Utilization, Threats, Recommendations for Conservation, and Research Needs. ASMFC Habitat Management Series #9.

SRAFRC. 2010. Migratory Fish Management and Restoration Plan for the Susquehanna River Basin. Cooperators: U.S. Fish and Wildlife Service, National Marine Fisheries Service, Susquehanna River Basin Commission, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, and New York State Department of Environmental Conservation.

SRAFRC. 2008. Restoration of American Shad to the Susquehanna River: Annaul Progress Report, 2006. Cooperators: Maryland Department of Natural Resources: New York Div. of Fish, Wildlife & Marine Resources; Pennsylvania Fish and Boat Commission; Susquehanna River Basin Commission; United States Fish and Wildlife Service; National Marine Fisheries Service.

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Focal Area:

Susquehanna River Mainstem
The Susquehanna River Mainstem Focal Area consists of the portion of the Upper Susquehanna River located in Pennsylvania and the mainstem of its major tributaries. It is defined as follows:

- Habitat: Mainstem rivers within the banks
- Purpose: Address river passage, water withdrawal, and flow issues, especially as these issues affect American shad and related umbrella species.
- Location: See maps in Focal Area Section.

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats:
1. Barriers to migration (dams and other stream obstacles)
2. Upland development (increased sediment loading)
3. Poor efficiency of fish passage measures and facilities
4. Low hatchery production in recent years

5. Low numbers of spawning fish accessing quality upstream habitat
6. Poor young-of-year recruitment upstream of Conowingo Dam
7. Excessive ocean fishery mortality (overfishing)
8. Potentially high predation mortality
9. Competition for introduced species
10. Emerging contaminants (water quality)
11. Consumptive water uses (water quantity)

Conservation Goals:

1. Reestablish an annual spawning population of 2 million shad and 20 million herring by 2025 (USFWS 2005).
2. Return migratory fishes to historic spawning and nursery habitat upstream of dams in the Susquehanna River (SRAFRC 2008)
3. Restore self-sustaining, robust, and productive stocks of migratory fish capable of producing sustainable fisheries, to the Susquehanna River Basin throughout their historic ranges in Maryland, Pennsylvania, and New York. The numeric goals are 2 million American shad and 5 million river herring spawning upstream of the York Haven Dam (SRAFRC 2010)
    a. Restore access to historic habitats for juvenile and adult migratory fish
    b. Maintain or improve existing migratory fish habitat quality
    c. Enhance migratory fish spawning stock biomass and maximize juvenile recruitment
    d. Evaluate the migratory fish restoration effort periodically and adjust programs or processes as needed
    e. Ensure cooperation among all restoration partners while generating support for the restoration of migratory fish among the general public and potential funding sources (SRAFRC 2010)

Partners: U.S. Fish and Wildlife Service (Fishery Division), National Marine Fisheries Service, Susquehanna River Basin Commission, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, New York State Department of Environmental Conservation, SRAFRAC, PPL Holtwood, Excelon, York Haven, Safe Harbor, PA Department of Conservation and Natural Resources, PA Department Of Environmental Protection, NYFO, CBFO, American Rivers, PA Department of Environmental Protection.

Needs:

1. Periodic review to ensure the population goals are feasible and accurate

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategies:

Strategies for addressing threats. Actions for 2011 are indicated with an asterisk/blue.

1. Barriers to Migration

a. *Provide technical expertise to permitting agencies, discouraging new barriers to fish passage in the Susquehanna River Basin and encouraging fish passage provisions for existing barriers (*i.e.*, the proposed permanent causeway at Sunbury, transportation projects involving bridge replacements/temporary causeways across the Susquehanna River, etc.).
   b. Provide adequate upstream and downstream passage (safe, timely, effective, and efficient) for migratory fish at all dams.
      i. Provide technical assistance with regard to improved fish passage facilities on the Conowingo Dam, Holtwood Dam, York Haven Dam, and Sunbury Fabridam
      ii. *Coordinate with the Susquehanna River Coordinator on all FERC relicensing actions for the Conowingo, Holtwood and York Haven Dams to provide better fish passage facilities.
2. Upland development (increased sediment loading)
   a. Improve existing habitat quality
      i. Reduce non-point sediment source pollution by developing best management practices
   b. Reduce sediment loading
3. Poor efficiency of fish passage measures and facilities
   a. Work with partner organizations in the relicensing process of York Haven Dam, Conowingo Dam, Holtwood Dam, and Muddy Run Pumped Storage Facility to improve existing, or gain new, fish passage facilities.
4. Low hatchery production in recent years
   a. Supplement wild production with hatchery culture and stocking of larval American shad in order to re-establish and rebuild mainstem and tributary stocks. Stock 10 million, or more, hatchery-reared American shad larvae annually. Distribute those larvae in mainstem and tributary areas according to available habitat.
5. Low numbers of spawning fish accessing quality upstream habitat
   a. *Work with partner organizations to prioritize barriers on Susquehanna River tributaries to be targeted for removal
6. Competition from introduced species
   a. Reduce invasive species by developing and implementing best management practices
7. Emerging contaminants (*i.e.* Marcellus shale frac water/frac chemicals)
   a. Conduct fish sampling within the Susquehanna watershed to evaluate emerging contaminants and their sources
8. Consumptive water uses (water quantity)
   a. No work identified at this time

Partners: U.S. Fish and Wildlife Service (Fishery Division), National Marine Fisheries Service, Susquehanna River Basin Commission, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, New York State Department of Environmental Conservation, SRAFRAC, PPL Holtwood, Excelon, York Haven, Safe Harbor, PA Department of Conservation and Natural Resources, PA Department Of Environmental Protection, NYFO, CBFO, American Rivers, PA Department of Environmental Protection.

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:

1. Barriers to Migration
    a. *Provide technical expertise to permitting agencies, discouraging new barriers to fish passage in the Susquehanna River Basin.
    b. *Promote fish passage provisions for existing barriers (*i.e.*, the proposed permanent causeway at Sunbury, transportation projects involving bridge replacements/temporary causeways across the Susquehanna River, etc.).
    c. *Coordinate with State, Federal, and NGOs (*i.e.*, American Rivers) to identify and prioritize stream barriers targeted for removal or fishway retrofit to increase fish passage (Partners – PADEP, American Rivers, Partners for Fish and Wildlife)
    d. *Complete fish passage facilities at both the east and west sides of the inflatable dam (Fabri-dam) at Shikellamy State Park in Sunbury, PA or
    e. *Advocate removal of, the Fabridam at Sunbury
2. Upland development (increased sediment loading)
    a. Improve existing habitat quality
        i. Reduce non-point sediment source pollution by developing best management practices
        ii. *Provide technical assistance on stream restoration projects in the Susquehanna River watershed
        iii. Provide stream and wetland protection guidelines via CPA permit and project review
        iv. *Wetland restoration within the Susquehanna River Basin (Parners for Fish and Wildlife Program projects)
        v. *Riparian restoration/conservation/preservation within the Susquehanna River Basin
    b. Reduce sediment loading
        i. *Provide stream and wetland protection guidelines via the Conservation Planning Assistance (CPA) permit and project review process, including best management practices (BMPs) technical assistance
        ii. *Assist regulatory agencies and public in providing recommendations for reducing non-point source sediment pollution through best management strategies in priority watersheds (CPA)
        iii. *Participate in State and Federal technical committees, subcommittees, and task groups to provide technical assistance on programs and projects, which minimize sediment loads in streams, or establish riparian buffers (using plant species that are native to Pennsylvania).
        iv. *Natural stream channel design for stream restoration projects (Roaring Brach Stream Restoration Project – Tioga County, instream habitat enhancements – Lancaster (2 projects) and Lebenon (one project) Counties via Partners for Fish and Wildlife Program)

v. *Provide technical assistance on stream restoration projects in the Susquehanna River Basin
vi. *Streambank fencing projects (Union County and others via Partners for Fish and Wildlife Program)

3. Poor efficiency of fish passage measures and facilities
    a. *Coordinate with the Susquehanna River Coordinator on all FERC relicensing actions for the Conowingo, Holtwood and York Haven Dams to provide better fish passage facilities.
    b. *Work with partner organizations to prioritize barriers to be targeted for removal
    c. *Work with Susquehanna River Coordinator, PADEP, and American Rivers to fund removal of stream barriers to increase fish passage
4. Low hatchery production in recent years
    a. No work identified at this time
5. Low numbers of spawning fish accessing quality upstream habitat
    a. *Work with partner organizations to prioritize barriers to be targeted for removal
    b. *Work with Susquehanna River Coordinator, PADEP, and American Rivers to fund removal of stream barriers to increase fish passage
6. Poor young-of-year recruitment upstream of Conowingo Dam
    a. No work identified at this time
7. Excessive ocean fishery mortality (overfishing)
    a. No work identified at this time
8. Potentially high predation mortality
    a. No work identified at this time
9. Competition from introduced species
    a. *Coordinate with the PA Fish and Boat Commission on the rusty crawfish infestation in the lower Susquehanna River
10. Emerging contaminants
    a. No work identified at this time
11. Consumptive water uses (water quantity)
    a. *Support the Susquehanna River Basin Commission in their effort to develop a water use model depicting consumptive water uses and their effects on the Susquehanna River basin
    b. *Provide support to the Susquehanna River Coordinator in interpretation of the model results.

Partners: U.S. Fish and Wildlife Service (Fishery Division), National Marine Fisheries Service, Susquehanna River Basin Commission, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, New York State Department of Environmental Conservation, SRAFRAC, PPL Holtwood, Excelon, York Haven, Safe Harbor, PA Department of Conservation and Natural Resources, PA Department Of Environmental Protection, NYFO, CBFO, American Rivers, PA Department of Environmental Protection.

Needs/Actions:

1. Full CPA staffing compliment
2. Barriers to migration (dams and other stream obstacles)
    a. PA dams database

   b. *Obtain a source of funding for dam removal
   c. *Work with Susquehanna River Coordinator, PADEP, and American Rivers to fund removal of stream barriers to increase fish passage
3. Upland development (increased sediment loading)
   a. *Obtain a source of funding for stream restoration
   b. *Participate in State and Federal technical committees, subcommittees, and task groups to provide technical assistance on programs and projects, which minimize sediment loads in streams, or establish riparian buffers (using plant species that are native to Pennsylvania).
   c. *Wetland restoration within the Susquehanna River Basin
   d. *Provide technical assistance on stream restoration projects in the Susquehanna River watershed
   e. *Riparian restoration/conservation/preservation within the Susquehanna River Basin
   f. *Provide stream and wetland protection guidelines via the Conservation Planning Assistance (CPA) permit and project review process, including best management practices (BMPs) technical assistance
   g. *Assist regulatory agencies and public in providing recommendations for reducing non-point source sediment pollution through best management strategies in priority watersheds (CPA)
   h. *Natural stream channel design recommendations for stream restoration projects
   i. *Protect and enhance streambank riparian buffers by streambank fencing
   j. *Provide technical assistance on stream restoration projects in the Susquehanna River Basin
4. Low hatchery production in recent years
   a. No work identified at this time
5. Low numbers of spawning fish accessing quality upstream habitat
   a. See barriers to migration
6. Poor young-of-year recruitment upstream of Conowingo Dam
   a. Support PA Fish and Boat Commission studies and review Excelon and Conowingo studies
   b. Develop a reliable source of Susquehanna River American shad eggs to replace out-of-basin sources and to enhance genetic integrity of the program.
7. Excessive ocean fishery mortality (overfishing)
   a. Support SRAFRC efforts and National Marine Fishery Service (NMFS) and Atlantic States Marine Fisheries Commission (ASMFC) efforts and regulations
   b. Maintain closure or restrictions on commercial and recreational fisheries, for American shad in those waters of the Susquehanna River Basin and Chesapeake Bay, which could take Susquehanna fish until or unless it is shown that approved harvests would not impair Susquehanna River restoration.
   c. Manage the existing or developing commercial and recreational fisheries for migratory fish through regulation of use and harvest.
8. Potentially high predation mortality
   a. Support SRAFRC efforts and National Marine Fishery Service (NMFS) and Atlantic States Marine Fisheries Commission (ASMFC) efforts and regulations
9. Competition for introduced species
   a. Reduce rusty crawfish infestation in the lower Susquehanna River

        i. Eradication
        ii. Wise use of
10. Emerging contaminants (water quality)
    a. *Coordinate with SRBC and PADEP regarding Marcellus shale activities within the basin.
    b. Provide guidance regarding Marcellus shale activities within the basin.
11. Consumptive water uses (water quantity)
    a. Voluntary cooperative agreements with private landowners
        i. Develop a water use model depicting consumptive water uses and their effects on the Susquehanna River basin

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:

1. Understanding of emerging contaminants and their effects upon migratory fish in the Susquehanna
2. Radio telemetry – movement patterns
3. Beneficial relationships with other organisms (*i.e*. are shad host fish for specific mussel species in the Susquehanna River system?)
4. Understanding the effects of raw Marcellus shale frac water spills and leaks, and treated frac water disposal, and discharge on Susquehanna River water quality and migratory fish survival
5. Understanding the swimming mechanics (power/leaping power) of shad as they migrate (*i.e*. what constitutes a barrier in terms of height, and water velocity.
6. Analyze fish migration and behavior using fish passage counts, PIT tagging, telemetry, and other appropriate techniques.
7. Determine hatchery- and wild-stock composition of pre-spawn adult American shad returning to Conowingo Dam annually.
8. Monitor the use of migratory fish spawning habitats in the mainstem Susquehanna River and tributaries.
9. Monitor juvenile *Alosa* including relative abundance, growth, and outmigration timing and maintain or improve existing juvenile surveys.
10. Understanding the effects of the exotic, invasive rusty crawfish on the life cycle of the American shad
11. Understanding the rusty crawfish and its effects on native flora and fauna

Partners: U.S. Fish and Wildlife Service (Fishery Division), National Marine Fisheries Service, Susquehanna River Basin Commission, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, New York State Department of Environmental Conservation, SRAFRAC, PPL Holtwood, Excelon, York Haven, Safe Harbor, PA Department of Conservation and Natural Resources, PA Department Of Environmental Protection, NYFO, CBFO, American Rivers, PA Department of Environmental Protection.

Needs:

1. Research into impact of Marcellus shale production (frac water and frac chemicals – water quality and quantity issue)
2. Evaluate fish passage efficiency
3. Evaluate fish passage improvement measures
4. Low hatchery production in recent years
    a. Study hatchery production trends
    b. Evaluate broodstock sources

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U.S. Fish and Wildlife Service. 2005. Fact Sheet, *Susquehanna River Coordinator*. U.S. Fish and Wildlife Service, 1800/344-WILD, http://www.fws.gov.

American Woodcock (*Scolopax minor*)

Introduction:
This shorebird species, also known as timberdoodle, is a popular migratory game bird. It nests in young forests and old fields with courtship displays and nesting spanning a six month period beginning in mid-winter in the south and extending into June in the north (Keppie & Whiting 1994). Across its northern range, woodcock appear to be the earliest migrant species to breed. It is strongly associated with both upland and wetland habitat types. Woodcock are most abundant where available habitats include a mix of fields or openings, forests of different ages, and feeding habitat with moist soils and high shrub cover.

Justification:
Since woodcock surveys began in 1966, it is estimated that woodcock numbers have declined 1-2% annually within their geographic range. Land-use changes such as wetland drainage and land conversion from early succession to mature forest are likely causes of population declines (Case and Associates 2010). As a result, national and international bird conservation organizations consider the American woodcock a species of continental concern, and protecting the woodcock is a high priority in its habitat ranges. It is ranked "High" (H) on the BCR 13 and BCR 28 list of "Priority Bird Species in Bird Conservation Regions partially or wholly within the Atlantic Coast Joint Venture". It is ranked as highly imperiled in the Northern Atlantic Regional Shorebird Plan, and is identified as a "Bird in Trouble" in the Eastern Forest in the North American Bird Conservation Initiative's 2009 report, "The State of the Birds, United States of America."
The population estimate for this species for the US and Canada is 5,000 (Rich et al. 2004).
There has been a loss of over 829,000 singing male woodcock since the early 1970s (Kelley et al. 2008).

The suite of early successional dependent species that will directly benefit from this strategy are: American black duck, mallard, Canada warbler, willow flycatcher, wood duck, brown thrasher, field sparrow, golden-winged warbler, blue-winged warbler, northern oriole, northern flicker, prairie warbler, ruffed grouse, red-headed woodpecker, song sparrow, wood turtle, bog turtle, black bear, bobcat, snowshoe hare, and the Appalachian cottontail.

Focal Area(s):
BCR 28 encompasses approximately 80% of the Pennsylvania landscape, including most of the prime woodcock areas in northern and central regions of the Commonwealth. The Upper Susquehanna Focus area constitutes the best woodcock habitat in the Commonwealth.

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats:

1. **Loss of habitat and habitat function.** The woodcock's decline is mostly attributed to loss of upland and wetland habitat. In particular, the loss of young forest (early successional) due to forest and farmland maturation, and a lack of adequate rotational cutting, especially in riparian areas (critical for breeding & migrating). In BCR 28 there has been a net loss of 2.3 million acres

of early-successional habitats since the 1970s, resulting in declines in bird species such as American woodcock that utilize this habitat type (NAS 2009).

2. **Decline in food supply** (i.e. earthworms). It is suggested that decreased changes in soil pH due to acid deposition has resulted in decreasing numbers of earthworms (NAS 2009).

3. **Climate change**: Climate change effects could include modification of water levels in river, lakes, and wetlands, resulting in direct habitat alterations. Changes in seasonal climate regimes could shift migration patterns of birds such as woodcock, and result in indirect adverse effects because of changes in food availability and/or reproductive success.

Conservation Goals:

Woodcock are managed on the basis of two regions or populations, Eastern and Central (Cooper 2008), with PA in the Eastern population. Singing-ground survey data for the Eastern Region for 1998-2008 indicate a 1.6% population decline per year Regionwide, with a 3.3% annual decline for Pennsylvania (Palmer 2010). Annual spring surveys of their breeding grounds show that woodcock numbers in Pennsylvania have been reduced by 32% over the last 40 years (Palmer 2010).

The ultimate conservation goal is to halt the decline of woodcock populations and to return them to densities which provide adequate opportunity for utilization of the woodcock resource. In BCR 28, there is a deficit of 88,186 males that would be needed to restore the population to 1970s levels, of which 30,414 (35%) would need to be in Pennsylvania.

The Habitat management objectives to achieve the goal is as follows:

- Halt decline of early successional habitat by 2012 (includes creation of 4.7 million acres of new habitat per year).
- Increase early successional habitat by 2022.

Partners:
Several key partners are involved in the biological planning for this species, including The Pennsylvania Game Commission, Pennsylvania Department of Conservation and Natural Resources, Wildlife Management Institute, Ruffed Grouse Society, American Bird Conservancy, Woodcock Unlimited, and a host of Colleges and Universities.

Needs: None

FY11 Actions: None

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategy
In 2001, Federal and State wildlife agencies, along with NGOs including The Wildlife Management Institute, the Association of Fish and Wildlife Agencies, and the Ruffed Grouse Society, formed the Woodcock Task Force. Since then, using funding from the National Fish and Wildlife Foundation and administered by the Wildlife Management Institute, biologists and land managers have developed a Woodcock Conservation Plan. Three regional initiatives, under the direction of the Wildlife Management Institute, were then formed to begin implementing the habitat goals of the plan (Cooper 2008).
To restore woodcock densities in BCR 28 to those observed during the early 1970s, as described above in Section I, a total of nearly 3.0 million acres of new woodcock habitat needs to be created, of which 1 million acres needs to be in Pennsylvania. It is estimated that to attain a full recovery of the 1970 population density, nearly 140,000 acres of early successional habitat will need to be established in Pennsylvania on an annual basis for the next 20 years (WMI 2010). In BCR 28, the majority of timberland is under private ownership; however, millions of acres of mature forest are also owned and undermanaged by State agencies. Therefore, state and federal resource agencies will need to communicate well, and enlist the help of individual and commercial private forestland owners in order to achieve habitat-management goals. This is a tremendous amount of acreage to manage and will require a monumental undertaking and cooperation from a diverse group of parties, as well as considerable monetary investment. (Kelley et al. 2008).

Partners: PA Game Commission, PA DCNR, PA Fish and Boat Commission, Ruffed Grouse Society, Wildlife Management Institute, USGS, NRCS, National Park Service, U.S. Forest Service, County CCDs, TNC, and large private landowners, various colleges and universities.

Needs:
1. Assess the accuracy of the assumption that there is a direct and unbiased correlation between acres of quality habitat and numbers of birds. All of the estimates provided in Cooper (2008) are based on the assumption that 33.98 acres of habitat equals one singing male woodcock.

2. Better utilize all PAFO resources to increase creation of early successional habitat.

3. Establish GIS database to:
    a. Analyze existing areas of habitat to determine potential breeding areas
    b. Analyze breeding bird survey data to confirm above and focus efforts; and,
    c. Create maps for possible woodcock sites of concern and focus areas for restoration

4. Establish Best Management Practices, including sustainable forest methods and techniques, to share with landowners and promote early successional habitat.

- Develop best management practices from results of monitoring to inform future American woodcock population restoration activities.

FY11 Actions:

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:
The Wildlife Management Institute and partnering agencies have launched four regional habitat initiatives in the primary breeding range of the Woodcock. BCR 28 encompasses approximately 80% of the Pennsylvania landscape and is home to that Appalachian Mountain Woodcock initiative. WMI has initiated 6 project demonstration areas in Pennsylvania and has restored and managed several thousand acres to date (WMI 2010). The PCG creates thousands of acres of early successional habitat through timber sales on State Game Lands and habitat projects on private lands through their Farm Game Program (PGC 2005). The FWS PFFW program works closely with various partners and restores approximately 100 acres of private lands annually to early successional habitat.

Partners: PA Game Commission, PA DCNR, PA Fish and Boat Commission, Ruffed Grouse Society, Wildlife Management Institute, USGS, NRCS, National Park Service, U.S. Forest Service, County CCDs, TNC, and large private landowners, various colleges and universities.

Needs:

1. Increase communication and coordination among partners to asssit each other with on-the-ground implementation.
2. Develop and outreach strategy to identify willing landowners.
3. Expand partnerships, especially those with access to large parcels and deep pockets.
4. Prepare to address the technical assistance bottleneck (i.e, not having sufficient personnel and resources to coordinate restoration planning among a variety of agencies, obtain permits, and write management plans).

FY11 Actions:

1. Provide substantive Federal agency comments on proposed Federal agency actions with potential adverse impacts to woodcock and/or their habitat.

2. Prioritize and streamline permit review in early successional habitat types or areas that have the potential for restoration.

3. Develop Fact Sheets with best management practices (BMPs) to minimize impacts to woodcock, and use these to influence landowners regarding habitat needs of this species. In developing BMPs consider the management recommendation of the NAS 2009 (appended to the end of this document).

4. Utilize the PAFO web site to illustrate ideas for minimizing impacts to woodcock and to highlight projects that support the creation of early successional habitat.

5. Provide technical assistance to NRCS to maximize opportunity for WHIP, EQIP, WRP restoration and conservation of habitat that would also be suitable for woodcock.

6. Work with partners (RGS, WMI, PA DCNR, PA Game Commission, NWRS, etc.) to better coordinate actions and create early successional habitat within focus areas.

    a. Complete 100 acres of early successional habitat projects (PFW) within the the Upper Susquehanna Focal Area. Cost would depend on type of equipment used and who would complete work. A rough cost estimate would be $400-$1000/ac.

7. Influence regulatory agency decisions regarding proposed development, agricultural practices, etc. that result in loss of habitat and habitat functions for this species.

8. Work to promote large block forest cutting on State, federal and private land.

9. Target Service habitat creation, restoration and enhancement projects to benefit woodcock.

    a. Use NRDAR, PFFW, and Bog Turtle restoration funds to accomplish early successional habitat restoration and protection using guidance found in Woodcock Conservation Plan.
    b. Work with land trusts to target woodcock conservation
    c. Work with large private timber landowners to create plans to manage woodcock habitat.

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:

1. Work to solidfy the assumption the decrease in early successional habitat is the primary factor in declining woodcock densities. It may be as simple as "build them habitat and they will come," but we must evaluate our projects for success to be certain.

Partners: USGS, WMI, various Colleges and Universities.

Needs:
1. McAuley et al. (2005) specified research that was needed to evaluate if low recruitment observed on Northeast sites is caused by contaminants, habitat fragmentation, habitat degradation, or diminishing food supply.
2. Research is needed to determine the effects of climate change on this species.
3. Monitoring is needed to determine success at project sites. The following is needed:
    - Develop protocols to measure success of conservation delivery activities
    - Work with Partners to identify leads for accomplishing monitoring activities

FY11 Actions:
1. Develop protocols to measure success of conservation delivery activities

2. Work with Partners to identify leads for accomplishing monitoring activities

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Wildlife Management Institute. 2010. Implementing the American Woodcock Conservation Plan. Progress to Date. 40pp.

Existing strategies for American woodcock restoration:
Please refer to the following document for existing strategies:

- Bird Conservation Plan for BCR28 (Atlantic Coast Joint Venture 2007) http://www.acjv.org/bcr28_plan.htm
- American Woodcock Conservation Plan (Kelley et al. 2008) http://www.timberdoodle.org/sites/default/files/woodcockPlan_0.pdf
- Partners in Flight Landbird Conservation Plan (Rich et al. 2004) http://www.partnersinflight.org/cont_plan/default.htm
- Pennsylvania's Wildlife Action Plan (PGC 2005)

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

Woodcock Management Recommendations (NAS 2009):
• Create or maintain the various types of habitat required for feeding, display, roosting, and nesting. Habitats types need to be in close proximity (e.g., within 1/2 mile)
• Maintain at least 0.5 acres of open habitat for singing displays through plowing, mowing, or prescribed burns. Suggestion of one patch per 20-25 acres. The goal is for fields to appear "patchy," rather than uniform in structure. Moderate use of livestock grazing can also accomplish this. Mow every 2-4 years.
• Encourage native trees and shrubs.
• Maintain larger areas, 3-5 acres, of open habitat for nighttime roosts. Suggestion of one patch per 100 acres. Plant shrubs in open fields and around the perimeter of cultivated fields to provide roosting and escape cover.
• Maintain young, dense forest of at least 5 acres for nesting and feeding.
• Maintain grassy areas near water sources for feeding and display grounds.

Bog Turtle *(Clemmys [=Glyptemys] muhlenbergii)*

Introduction: The northern population of the bog turtle was listed as a threatened species on November 4, 1997. The bog turtle has experienced a least a 50 percent reduction of range and numbers over the last 30 years. The greatest threats to its survival include the loss, degradation, and fragmentation of its habitat and poaching.

Justification: The bog turtle is federally listed as threatened and State listed as endangered. It is also is a USFWS spotlight species. Pennsylvania has the largest portion of the range within its borders. This species is a priority for many of our partners such as, National Fish and Wildlife Foundation, Environmental Defense, The Nature Conservancy, Natural Lands Trust, many local watershed groups and more recently the Natural Resources Conservation Service who have started a Bog Turtle Initiative. With the assistance of our partners, the USFWS has the ability to recover the bog turtle.

Information Sources: The Bog Turtle Recovery Plan, Bog Turtle 5-Year Review, Bog Turtle Spotlight Species Action Plan

Focal Area(s): Pennsylvania has as portions of 3 of the 5 Recovery Units (Prairie Peninsula/ Lake Plain (PP/LP), Susquehanna/Potomac (S/P), Delaware).

Bog turtles have not been found in the PP/LP RU since the early 1900's and is not considered a focal area. A recent study entitled Survey for Bog Turtle in the Pymatuning Area (Prairie Peninsula/Lake Plain Recovery Unit) of Pennsylvania, shows that very little, if any bog turtle habitat still exists in this recovery unit within Pennsylvania.

Both the S/P (62) and Delaware (152) Recovery Units have a large number of extant bog turtle sites. It is suspected that Pennsylvania has the most number of undiscovered bog turtle populations within the entire range.

SECTION I – BIOLOGICAL PLANNING:

Threats:

1. **Factor A. The present or threatened destruction, modification, or curtailment of its habitat or range:**

- Residential and commercial development continues to be a leading cause of habitat loss and degradation. Most direct effects to bog turtles and their habitat are now avoided. Indirect effects to wetlands remain.

2. **Factor B. Overutilization for commercial, recreational, scientific, or educational purposes:**

- Collection is an ongoing threat.

3. **Factor C. Disease or predation:**

- New concerns about potential disease

- Predation is a threat to nesting, breeding, and feeding bog turtles.

4. **Factor D. The inadequacy of existing regulatory mechanisms:**

- Continues to pose a threat.

5. **Factor E. Other natural or manmade factors affecting its continued existence:**

- Invasive plant species and succession
- Climate Change may or may not be a threat to the species.

Goals: Recovery targets for each recovery unit in Pennsylvania is as follows:

- Prairie Peninsula/Lake Plain Recovery Unit is to ensure long-term protection of 0 PAS (Population Analysis Sites)
- Susquehanna/Potomac Recovery Unit is to ensure long-term protection of 40 PAS (Population Analysis Sites)
- Delaware Recovery Unit is to ensure long-term protection of 48 PAS (Population Analysis Sites)

Partners: Natural Resources Conservation Service, PA Fish and Boat Commission, local watershed groups, Mid-Atlantic Center for Herpetology & Conservation, National Fish and Wildlife Foundation, Natural Lands Trust, The Nature Conservancy

SECTION II – CONSERVATION DESIGN

The Service will work with partners to take a strategic approach in identifying the priorities for bog turtle conservation, develop a conservation or action plan, and implement habitat conservation and restoration activities. This approach has been identified in the Bog Turtle Spotlight Species Plan.

Section III: CONSERVATION DELIVERY

On the ground actions using strategies to address threats:

1. **Factor A. The present or threatened destruction, modification, or curtailment of its habitat or range:**

    A. Protect bog turtle sites through purchase and conservation easements (Recovery Action 2.3)
        1. Continue to provide technical assistance to partners that may be able to protect sites
        2. Continue to coordinate with land trusts
        3. Continue to provide technical assistance to NRCS on WRP projects
        4. Seek money to conduct essential bog turtle work in PA
        5. Work closely with NRCS to ensure maximum enrolled under the WRP Bog Turtle Initiative (Recovery Action 2.3)
        e. Gather new information on location of bog turtle sites in PA

f. Habitat management in perpetuity – Cost covered by NRCS

g. Visit all known bog turtle locations and rank the habitat and delineate the wetland boundaries (Recovery Action 1.1.2)

h. Identify potential bog turtle habitat in key areas (York & Bucks Counties)

i. Survey potential bog turtle habitat for the presence of bog turtles

j. Survey for new and historical bog turtle sites (Recovery Actions 3.3.2 & 3.4)

2. **Factor B. Overutilization for commercial, recreational, scientific, or educational purposes:**

1. No work planned

3. **Factor C. Disease or predation:**

1. Conduct study on nest predation
2. Continue to monitor bog turtles for disease

B. **Factor D. The inadequacy of existing regulatory mechanisms:** Improve the effectiveness of regulatory reviews in protecting bog turtles and their habitats, and avoid and minimize direct and indirect adverse effects to bog turtles and their habitat (Recovery Action 1.3)

Develop standardized avoidance, minimization and compensation measures:

A. PennDOT
B. Residential/Commercial Development
C. Pipelines/Powerlines

4. **Factor E. Other natural or manmade factors affecting its continued existence:** Control invasive species, esp. *Phragmites australis*, monotypic stands of *Typha spp*., *Lytrum salicaria (*purple loosestrife*)* and *Phalaris arundinacea (reed canary grass)*. Manage succession of bog turtle habitat

A. Manage, restore, and maintain bog turtle habitat, as appropriate (Recovery Action 6.4) and control succession and invasive exotic plants (Recovery Action 6.3.1)

Section IV – Monitoring and Research

Data gaps include undetected populations, contaminant/exposure effects on bog turtles and their life stages, population size, predation , invasive plant species control and indirect effects of development.

Partners: Natural Resources Conservation Service, PA Fish and Boat Commission, local watershed groups, Mid-Atlantic Center for Herpetology & Conservation, National Fish and Wildlife Foundation, Natural Lands Trust, The Nature Conservancy

a. Juvenile bog turtle habitat use study
b. Consider plan for heading starting bog turtles
c. Conduct predation and bog turtle range studies
d. Gather information on the Knoxville Zoo's bog turtle propagation project
e. Conduct research on nesting predation (
f. Conduct research on juvenile bog turtle movements
g. Conduct research on effects on reed canary grass and bog turtle movements
h. Develop compatible use guidelines and practices to avoid and reduce the indirect effects of development
i. Understand the effects of predation and how to mitigate it
j. Understand how bog turtles use invasive species and how to manage for it
k. Understand poaching as an issue
l. Study: How many turtles is considered a population?

Brook Trout (*Salvelinus fontinalis*)

Introduction: The brook trout is a native salmonid that prefers cold, clean streams in eastern North America. This species prefers clear waters of high purity and a narrow pH range in lakes, rivers, and streams. It is sensitive to poor oxygenation, pollution, and changes in pH caused by environmental effects such as acid rain, and therefore can be an indicator of water quality and the effects of climate change. Its diet includes crustaceans, frogs and other amphibians, insects, mollusks, smaller fish, and small aquatic mammals such as voles. It is a short-lived species, rarely surviving beyond four or five years in the wild.

Justification: Brook trout are distributed over a broad range of PA. Wild brook trout populations have been documented in 1,524 stream sections covering a total of 5,044 miles of stream. The largest populations occur within the West Branch Susquehanna River basin, the upper Allegheny River basin, and the North Branch Susquehanna River basin. Collectively, these three major drainage basins support 74.4% of the documented miles of wild brook trout streams in the state.

Urbanization, agriculture, and mining pollution have greatly reduced native brook trout habitat across Pennsylvania. An assessment by Hudy et al. (2005) revealed that wild brook trout populations in the eastern US are impaired. Present and intact populations were found in only 5% of all subwatersheds assessed from Maine to Georgia. Among the North Atlantic states of NY, NJ, and PA, Pennsylvania had the greatest number of subwatersheds with reduced, severely reduced, extirpated, and unknown populations.

There is great potential for improving habitat that could result in increasing populations of brook trout in the state. Activities that would improve habitat, such as reducing sediment input into streams, creating or increasing riparian buffers, and building habitat structures, are relatively low cost strategies that could have a significant impact. Potential partners, such as PA Fish and Boat Commission, PA Game Commission, and Trout Unlimited, view brook trout habitat improvement as a priority in their programs, and would therefore be willing to participate in and contribute to restoration projects. As brook trout is a highly prized native sportfish, projects which would improve their habitat would have wide public interest and support.

Information Sources: Eastern Brook Trout Joint Venture Conservation Strategies, USFWS NY Field Office, USFWS WV Field Office, PA Wildlife Action Plan, Chesapeake Bay 2011 Action Plan, Carline, et al. (1992), Hudy, et al. (2005).

Focal Area: The primary areas of intact populations in PA consist of headwater areas of the Northern Tier. The largest of these areas is in the north-central part of the state, centered around the Allegheny National Forest and the forested areas of the Ridge and Valley Province. Other areas consist of patches of present or reduced populations, surrounded by areas of greatly reduced habitat
Refer to map for specific locations.

SECTION I – BIOLOGICAL PLANNING:

Threats:

1. **Loss of habitat**:

a. Increased water temp.- often a result of thermal pollution from removal of riparian vegetation, removal of canopy, or excessive clear-cutting within the watershed. This is also an increasing factor with current climate change models which predict both higher air and water temperatures. Brook trout thrive in water temperatures <65°F. Optimum growth occurs between 55° and 65°F. Exposure to water temps of 75°F for only a few hours is usually lethal.

b. Land disturbances from agriculture, forestry, and development - result in increased sedimentation (results in the aggradation of pools, smothering eggs and embryos in redds), channelization of streams, increased runoff, removal of riparian vegetation, and increased nutrients, turbidity (brook trout are sight feeders), and low dissolved oxygen in streams.

c. Acid precipitation and acid mine drainage – particularly harmful to brook trout because they tend to occur in headwater streams and lakes that lack buffering capacity.

2. **Physical barriers:**

a. Dams and impassable culverts – prevent migration to suitable spawning habitat, to cool water refuges during warm periods during the summer, and to overwintering habitat.

3. **Presence of non-native fish species**:

a. Invasive species - brook trout are extremely vulnerable to the effects of predation and competition, especially in the first years of life.

b. Stocking hatchery-reared trout – results in genetic alteration due to interbreeding, altered selection pressures, displacement, and introduction of diseases.

Conservation Goals:

1. To bring watersheds of Present (50-90% of habitat contained wild, reproducing brook trout) to the status of Intact (>90% of habitat contained wild, reproducing brook trout), especially where located near other Present or Intact areas.
2. To bring watershed classified as Reduced (<50% of habitat contained wild, reproducing brook trout) to that of Present, especially where located near other Present or Intact areas.

Partners:

- Eastern Brook Trout Joint Venture (comprised of several state and federal agencies)
- USFWS: NY and WV Field Offices
- PA Fish and Boat Commission
- PA Game Commission
- Trout Unlimited

Needs:

1. *Get population numbers from Fish and Boat Commission or Lamar Fishery*.
2. Set specific goals for sub-watersheds based on current populations.
3. Establish baseline benchmarks for success.
4. Identify climate change-related impacts to brook trout and future threats.

SECTION II – CONSERVATION DESIGN:

Conservation Strategies:

1. **Habitat Protection**:
   - **a)** Target USFWS habitat restoration and enhancement projects to benefit brook trout:
     - Add enhancements to natural stream channel design projects (incl. planting trees and shrubs to provide shade for water temp. control).
     - Promote habitat restoration projects which also control sediment entering streams.
     - Provide technical assistance on stream restoration projects via natural stream design in the watershed.
     - Preserve, restore, and/or enhance streams known to support heritage strains of brook trout.

   GOAL: Each project completed should upgrade the sub-watershed to a higher category of trout habitat.

   - **b)** Seek to minimize loss of habitat by influencing regulatory agency decisions regarding stream relocation and modifications, including operation of hydroelectric power-producing facilities and unnatural erosion mitigation practices; and practices that diminish stream and wetland values for wildlife, i.e., dredging, and placement of fill in streams and wetlands.

   GOAL: Fewer projects negatively impacting brook trout habitat.

2. **Barriers to Migration:**
   - **a)** Remove barriers that negatively influence or limit brook trout habitat.

   GOAL: For each barrier removed, the sub-watershed would be upgraded to at least the next higher category of trout habitat.

3. **Competition from non-native salmonids:**
   - **a)** Target natural stream design restoration projects for smaller streams most likely to support only one or two salmonid species.
   - **b)** Support the cessation of stocking exotic salmonids.

Partners:

- PA Fish and Boat Commission
- PA Game Commission
- PENNDOT
- USFWS Lamar Fish Hatchery
- Trout Unlimited
- Conservation Districts
- Watershed Groups
- Township Supervisors
- City/County Planners
- NRCS
- DCNR

- US Forest Service
- Sportsmen's groups

Needs

1. Develop a prioritized list of streams for brook trout protection, restoration, and enhancement projects.

2. Identify subwatersheds likely to be refugia for cold water fish in the future.

3. Investigate and map habitat needs such as substrate, water temp/quality, riparian cover, etc.

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:

1. PFW Stream Restoration Program:
   a) Uses Natural Stream Channel Design in stream restoration projects.
   b) Targets large streams which sometimes contribute many tons of sediment into the aquatic community. These projects have the potential to drastically improve brook trout habitat.
   c) Habitat projects in small streams around the state which result in improved BT habitat.
   b) Partnership with PENNDOT brings stream projects associated with bridges to reduce aggradation and erosion around bridge structures, aiding fish passage and overall habitat.
2. Permit reviewer who is educated in Natural Channel Design practices and has access to Hydrologist for consultation on outside projects.
3. Hydrologist available for consultation and technical assistance to other agencies and NGO's.
4. Outreach:
   a) PSU stream restoration workshop, offered to regulatory agencies, students, and the public.
   b) Natural Stream Channel Design presentations to Conservation Districts, watershed associations and Stream Team.
   c) Articles to WFEEF newsletter outlining project accomplishments.
5. Intern program which educates students in stream restoration practices and policies, which will be an important knowledge base for their future careers.

Partners:

- PA Fish and Boat Commission
- PA Game Commission
- PENNDOT
- Trout Unlimited
- Conservation Districts
- Watershed Groups
- Township Supervisors
- City/County Planners
- NRCS
- DCNR

- US Forest Service
- Sportsmen's groups
- Dept. of Environmental Protection
- US Army Corps of Engineers
- Penn State University
- Wildlife For Everyone Endowment Foundation
- Private landowners

Needs:

1. Protect habitat in areas where brook trout populations are thriving, and restore habitat to areas where populations have been reduced, especially where there is connectivity to other existing populations.

2. Implement conservation practices to protect wild brook trout habitat on public lands.

3. Protect or restore habitat for brook trout in those watersheds that are likely to be refugia for cold water fish in the future.

4. Work with Dept. of Transportation to develop criteria for designation of culverts, the modification of which would improve brook trout passage.

5. Work with Dept. of Transportation to correct bridge abutments from being undermined by stream erosion; design and construct natural stream design features that will change stream bottom elevation and facilitate fish passage.

6. Remove fish passage barriers that influence brook trout distribution (at least 1 per year)

7. Facilitate habitat preservation through coordination with land trusts and encourage conservation easements on private land.

8. Develop and bolster partnerships with groups such as Trout Unlimited under the Coldwater Heritage Partnership.

9. Create list of BMP's and post on website.

10. Outreach to general public about brook trout and the importance of protecting, enhancing and restoring wild brook trout populations.

11. Outreach to regulatory agencies to educate about Natural Stream Channel Design practices.

SECTION IV – MONITORING AND RESEARCH:

Key Data Gaps:

Locations of existing, declining, and extirpated populations.
Locations of barriers and likelihood/cost of removal.

Partners:

- PSU Graduate students
- Keystone College
- Lycoming Creek Watershed Association

Needs:

1. Quantify and locate specific populations of brook trout in impaired watersheds.

2. Identify specific populations in watersheds that are assessed as intact.
3. Identify those watersheds impaired by factors that are more easily corrected (i.e., through natural stream channel design, etc.)
4. Investigate and map habitat needs such as substrate, water temp/quality, riparian cover, etc.
5. Identify effects from acid precipitation and drainage on historical populations and habitats.
6. Identify fish passage barriers that have an influence on brook trout distribution.
7. Assess importance of isolating heritage populations vs. providing passage for stocked brook trout and other salmonids.
8. Assess impact of competition from stocked and/or naturally reproducing non-native salmonids (steelhead, rainbow trout, brown trout)
9. Determine genetic diversity of brook trout in the watersheds to assess the effects of interbreeding
10. Identify climate change-related impacts to brook trout and future threats.
11. Partner with researchers to characterize the genetic identity of PA's wild brook trout resource.
12. Identify small streams that support only one or two salmonid species.

Cerulean Warbler (*Dendroica cerulea*)

Introduction:

The Cerulean Warbler is a small neotropical migrant songbird that breeds in eastern North American and winters in middle elevations of the Andes Mountains in northern South America. This species has specific habitat preferences on both the breeding and wintering grounds, largely associated with mature forests having structurally diverse canopies with multiple vegetation layers. The species occupies two habitat types: river valleys and ridge slopes. Common tree species in bottomlands are sycamore, cottonwood, and elm, while in uplands they use oaks, maples, and black locust. This species is a canopy insectivore eating primarily caterpillars, beetles, wasps, and bees.

Justification:

Cerulean Warbler was once a common species of eastern North America, particularly in the Mississippi River and Ohio River valleys (Hamel 2000a, b). Cerulean Warbler numbers have declined at the steepest rate of any North American warbler species monitored by the North American Breeding Bird Survey (BBS) [Sauer et al. 2005]. Analyses of BBS data demonstrates an average rate of -3.2%/year over the past 40 years, from 1966-2005 (J. Sauer, *unpublished data)*. It now is common only in the "core" of the range in the central portions of the Appalachian Mountains, particularly the Ohio Hills and Allegheny Plateau regions. This long-term, steep decline is one of the primary reasons for a high level of concern for this species (USFWS 2007) with listings as Partners in Flight priority I species requiring immediate management, a Pennsylvania Watch List species, and a High Level Concern Species (PGC and PFBC 2005). The core breeding habitat of this species coincides with a major natural gas deposit currently being developed. Creation of the extraction infrastructure results in permanent loss of woodlots and fragmentation of forests on ridgetops and riparian corridors.

Other forest species that will benefit from Cerulean Warbler habitat conservation and enhancement include Kentucky warbler, Canada warbler, yellow-throated warbler, worm-eating warbler, black-throated blue warbler, Louisiana waterthrush, yellow-throated vireo, scarlet tanager, northern goshawk, red-shouldered hawk, broad-winged hawk, Indiana bat, northern myotis, and small-footed bat (PGC and PFBC).

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Focal Area(s):

The majority of the population occurs within the Appalachian Mountains Bird Conservation Region (USFWS 2007). Pennsylvania has high responsibility for species, providing core populations in the Northeast with focal areas in Ohio Hills, Lower Great Lakes, and the North (Allegheny) Plateau (PGC and PFBC 2005). Nesting in Pennsylvania occurs in both bottomland and upland habitats: in the Delaware River riparian corridor and adjacent dry slopes, in Moraine State Park on dry slopes, in the Juniata River riparian corridor, at Peter's Mountain on dry slopes, on dry slopes at Brady's Run and Forbes State Forest, and on dry slopes and in the riparian corridor at Ten Mile Creek and Duff and Boyce Parks (Rosenberg et al. 2002).

Cerulean Warblers have specific habitat preferences within mature forests: tall, large diameter trees and a structurally diverse canopy with multiple vegetation layers (Oliarnyk and Robertson 1996, Jones and Robertson 2001, Nicholson 2003). Throughout much of their breeding range, they exhibit a preference for nesting within large forest patches (Hamel 2000a, b; Rosenberg et al. 2000). Cerulean Warblers avoid abrupt edges between forests and large areas of open land (Perkins 2006).

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats:

According to USFWS (2007), three aspects of change to breeding habitat represent threats to Cerulean Warblers:
1) outright loss of mature deciduous forest,
2) forest fragmentation, and
3) loss of diverse, multi-layer vegetation within mature deciduous forest.

In Pennsylvania, potential non-habitat threats include: potential effects from climate change such as shifts in location of suitable forest types and timing of emergence of insects in the spring, risks from collisions with towers (including gas drilling rigs, wind farms, communications towers), mercury contamination, and acid deposition (USFWS 2007). In addition to suppressing the regeneration of acid sensitive plants within forest habitat, acid deposition could be a threat to the cerulean warbler and other priority birds through reductions in available calcium and increases in the availability of toxic metals (PGC and PFBC 2005). Air emissions, excessive noise, and light pollution from gas compressor stations and drill pads throughout the breeding habitat could affect habitat use and nest abandonment.

Conservation Goals:

The Cerulean Warbler Technical Group selected a goal of doubling the current population within 50 years and restoring it to 1980s levels within that time period (UFWS 2007). With the majority of the population occurring within the northern half of the Appalachian Mountains Bird Conservation Region, Pennsylvania has high responsibility for this species. Partners in Flight lists Ohio Hills and Allegheny Plateau as critical areas with these objectives:

Ohio Hills: 150,000 ha to support 150,000 breeding pairs
Allegheny Plateau: 12,000 ha to support 12,000 breeding pairs

Partners:

1. Cerulean Warbler Technical Group (CWTG): formed in 2001 to develop a broad-based, scientific and technically sound approach to cerulean warbler conservation. Composed of private, state, and federal natural resource managers and species experts, the CWTG is developing strategies to meet monitoring, research, and conservation needs.
2. FWS Migratory Bird Program
3. FWS Refuges
4. Appalachian Mountains Joint Venture
5. Appalachian Landscape Conservation Cooperative
6. National Park Service
7. US Forest Service
8. US Geological Service
9. Office of Surface Mining: Appalachian Regional Reforestation Initiative

Needs:

1. Refine population goals for Cerulean Warblers; develop habitat conservation objectives and identify focus areas for habitat conservation efforts to support population goals.

FY11 Actions:

SECTION II – CONSERVATION DESIGN: Conservation Strategies

1. Reduce forest fragmentation and prevent major forest loss on the breeding grounds.

2. Identify and protect large blocks of core forest in upland and bottomland.

3. Protect forest habitats within large forest tracts with high structural diversity and multiple vegetation layers (e.g., canopy, sub-canopy, and understory).

4. Create conservation plans with possible subsequent protection for priority areas identified as cerulean warbler occurrences from the Cerulean Warbler Atlas Project (CWAP) including post fledging habitat.

5. Work with industry representatives to reduce/mitigate risks from collisions with gas drilling rigs, wind farms, and communication towers.

6. Maintain and regenerate forests with high structural diversity through both landscape level efforts (state/agency planning) and ownership level efforts (technical outreach/incentives to private landowners).

Partners:

1. Pennsylvania Game Commission
2. Pennsylvania Department of Conservation and Natural Resources
3. Pennsylvania Department of Environmental Protection- Bureau of Mining and Reclamation and Bureau of Oil and Gas Management
4. Pennsylvania Department of Transportation
5. Pennsylvania State University Cooperative Extension
6. Susquehanna River Basin Commission
7. Delaware River Basin Commission
8. National Park Service (individual parks, corridors, and historic sites)
9. Department of Energy
10. Western Pennsylvania Conservancy
11. The Nature Conservancy
12. County Land Conservancies
13. Industry (coal, gas, pipeline, wind, forestry)

Needs:

Conservation strategies are well defined; no current needs were identified.

FY11 Actions:

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions

No specific actions for this species are currently underway. However, forest conservation efforts for other species are likely benefit Cerulean warbler.

Partners:

1. Pennsylvania Game Commission
2. Pennsylvania Department of Conservation and Natural Resources
3. Pennsylvania Department of Environmental Protection- Bureau of Mining and Reclamation and Bureau of Oil and Gas Management
4. Pennsylvania Department of Transportation
5. Pennsylvania State University (Cooperative Extension and School of Forest Resources)
6. Susquehanna River Basin Commission
7. Delaware River Basin Commission
8. National Park Service (individual parks, corridors, and historic sites)
9. Department of Energy
10. Western Pennsylvania Conservancy
11. The Nature Conservancy
12. County Land Conservancies
13. Industry (coal, gas, pipeline, wind, forestry)

Needs:

1. Develop forest management recommendations for Cerulean Warblers that can be incorporated into management plans for public and private forestlands to improve habitat within the breeding range.

2. Develop surface coal mining recommendations for Cerulean Warblers that can be incorporated into federal and state mine regulatory agency permitting processes within the breeding range.

3. Establish education and outreach programs for regional and local development planners.

4. Join national and/or regional partnerships working on Cerulean Warbler.

5. Assist partners in development of recommendations.

6. Identify forest blocks > 10,000 ha with > 80percent forest in a 10 km radius and ≥ 100 ha patches with ≥ 30 percent forest in the surrounding landscape.
7. Work with private landowners, land managers, and real estate developers to identify, protect, and maintain suitable large forest tracts. Maintain ≥ 100 ha patches with ≥ 30 percent forest in the surrounding landscape. Roads and trails should be planned around the edges of forests to conserve core area and minimize breaks in canopy cover.
8. Maintain forests with high structural diversity through both landscape level efforts (state/agency planning) and ownership level efforts (technical outreach/incentives to private landowners).

FY11 Actions:

Not likely to implement on the ground actions tailored to this species until recommendations and location prioritization have been completed.

1. Work with DOE and Pennsylvania state agencies to identify BMPs for activities in forested habitats and minimize risks associated with gas drilling.
2. Join national and/or regional partnerships working on Cerulean Warbler.

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:

1. Study intrinsic limits to fecundity and differences in habitat selection between sex and age groups to target better management
2. Investigate factors affecting post-fledging survival
3. Identify high quality post-fledging habitat.
4. Increase knowledge about dispersal patterns (juvenile and adult) and factors affecting dispersal, including strength of site fidelity, responses to habitat loss, and sensitivity to habitat fragmentation
5. Identify foraging constraints of migratory fattening
6. Establish extent and pattern of migratory connectivity
7. Develop annual stage-specific life history model
8. Improve ability to monitor population trends and estimate population size on the breeding grounds at appropriate spatial scales
9. Develop models of how markets and levels of demand for wood products and energy products are likely to influence habitat availability and suitability for Cerulean Warblers
10. Investigate correlations between climate change and forest availability as a potential tool for predicting future changes in Cerulean Warbler distribution and management needs
11. Investigate correlations between climate change, timing of spring arrival of Cerulean Warblers on breeding grounds, and timing of emergence of insect prey populations
12. Investigate the potential effects of mercury contamination and acid deposition

Partners:

1. Cerulean Warbler Technical Group (CWTG): formed in 2001 to develop a broad-based, scientific and technically sound approach to cerulean warbler conservation. Composed of private, state, and federal natural resource managers and species experts, the CWTG is developing strategies to meet monitoring, research, and conservation needs.
2. FWS Migratory Bird Program
3. Appalachian Mountains Joint Venture
4. Appalachian Landscape Conservation Cooperative
5. National Park Service
6. US Geological Survey
7. Office of Surface Mining: Appalachian Regional Reforestation Initiative
8. Universities (PSU, OSU, private colleges)

Needs:

1. Participate in efforts to improve monitoring of population trends and estimating of population size on the breeding grounds at appropriate spatial scales
2. Collect data on forestry and gas practices that are likely to influence habitat availability and suitability for Cerulean Warblers
3. Participate in studies investigating correlations between climate change and forest availability as a potential tool for predicting future changes in Cerulean Warbler distribution and management needs
4. Participate in studies investigating correlations between climate change, timing of spring arrival of Cerulean Warblers on breeding grounds, and timing of emergence of insect prey populations
5. Investigate the potential effects of mercury contamination and acid deposition

FY11 Actions:

Dependent upon monitoring and research projects already being implemented by partners.

1. Identify additional research needs in conjunction with DOE and USGS (WVU Coop Unit) regarding gas drilling effects on breeding birds.

Dwarf Wedgemussel (*Alasmidonta heterodon*)

Introduction: Freshwater mussels include abundant species that are vital for ecosystem function. These are also the most imperiled of all animals and plants in the Delaware River Basin, as elsewhere in North America (Williams et al. 1993.) The federal endangered dwarf wedgemussel (Alasmidonta heterodon) is sensitive to many of the same threats described above for other native species of freshwater mussels. Siltation, hydrologic changes, and contaminants are among the threats to the species survival cited at the time it was listed in 1990 (55 FR 9447 9451; U.S. Fish and Wildlife Service 1993).

Dwarf wedgemussels have characteristics that likely increase their susceptibility to these factors. First, the species is small compared to most other freshwater mussel species, (in the range of about an inch in length); therefore, relatively minor siltation events can deposit a smothering silt layer that reaches a depth that animals cannot push above.

Second, although they require flowing water and occur in a diversity of habitats from small streams to large rivers, dwarf wedgemussel are a thin shelled species that could be easily transported during a scour event. Like many freshwater mussels, dwarf wedgemussel populations tend to occur in areas protected from high-flow events, such as side channels of larger rivers and lower gradient streams. These low to medium velocity areas tend to have finer particle size substrates. Infiltration of relatively smaller amounts of silt between sands and smaller gravel particles can quickly hinder interstitial flow.

In the Delaware River this microhabitat preferred by dwarf wedgemussels tends to be away from the main channel, and therefore it is very susceptible to low flow exposure and associated changes in temperature. The seasonality of low flow and temperature rise may also be critical for dwarf wedgemussel reproduction and nutrition since freshwater mussels require specific food conditions for reproductive conditioning.

Justification: The dwarf wedgemussel is state and federally listed as endangered. This mussel was once found at 70 locations in 15 major Atlantic Coast drainages. In Pennsylvania, extant DWM's are only known to occur in the Delaware River; however, additional surveys are needed. For example, tributaries to the Delaware River in New York and New Jersey are known to support this species and the Delaware River downstream of the Delaware River Water Gap National Park is largely unsurveyed for mussel.

Information Sources:

- Federal recovery plan (1993) http://ecos.fws.gov/docs/recovery_plan/930208b.pdf
- 5-year review completed (USFWS, 2007) http://ecos.fws.gov/docs/five_year_review/doc1098.pdf

Note that the 5-year review recommended a revision of the recovery plan.

Focal Area(s): Delaware River and tributaries

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats: The 1993 Recovery Plan identified four primary factors responsible for the decline of the dwarf wedgemussel: impoundments, pollution, riverbank alteration, and siltation (USFWS 1993). All of these factors continue to impact DWM populations.

1. *Inadequacy of existing regulatory mechanisms:* Overall, the protections provided by the Endangered Species Act of 1973, as amended, are adequate to prevent a rangewide decline of DWM populations, although the ESA allows for incidental take that has resulted in declines of local populations, particularly in the southern portion of the range. Regulations other than the ESA are not adequate to protect the species from decline, but this does not pose a threat as long as the species is listed.

2. *Other natural or manmade factors affecting its continued existence:* Recently, severe flooding in the Delaware River in Pennsylvania and New York, resulted in the destruction of occupied habitat and loss of dwarf wedgemussels. Severe flooding in the spring of 2005 scoured the river channel and deposited cobble in at least one of the sites previously surveyed.

Conservation Goals:. The contribution of dwarf wedgemussel in Pennsylvania toward species recovery was not specifically addressed in the 1993 recovery plan because the Delaware River population was not rediscovered until 2001. However, n order to reclassify the DWM as threatened from endangered, this criterion must be met:

1. The following populations of the DWM must be shown to be viable (a population containing a sufficient number of reproducing adults to maintain genetic variability, and annual recruitment is adequate to maintain a stable population): Mainstem Connecticut River (NH/VT), Ashuelot River (NH), Neversink River (NY), Upper Tar River (NC), Little River (NC), Swift Creek (NC), Turkey Creek (NC), and six other rivers/creeks representative of the species' range.

2. At least 10 of the rivers/creeks in Criterion 1 must support a widely dispersed viable population so that a single catastrophic event in a given river will be unlikely to result in the total loss of that river's population.

3. The rivers in Criterion 2 should be distributed throughout the species' current range with at least two in New England (NH,VT,MA,CT), one in New York, and four south of Pennsylvania.

4. All populations referred to in Criteria 1 through 3 must be protected from present and foreseeable anthropogenic and natural threats that could interfere with their survival.

Partners: DRBC, NPS, USGS, New York City

Needs: Since an additional viable occurrences was discovered in Pennsylvania which should be taken into consideration in revised recovery plan criteria. Furthermore, the criteria are vague in quantifying how large or inclusive the viable populations need to be, how separate from other

populations (in order to ameliorate catastrophic events), and what constitutes protection of the habitat and populations from present and foreseeable threats.

1. Establishing specific population goals for Delaware River that meet the recovery plan intent of a viable site.
2. Locate additional Delaware River populations.

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategies: A significant amount of life history and population distribution and status information has been collected since the release of the 1993 Recovery Plan for the DWM. Much of the information is unavailable to the general public, since it is found in reports to the Service or state agencies and in other gray literature (presentation abstracts, personal communications). A revised recovery plan will be the nexus for releasing current information, and it may be used to update state fact sheets and assist in developing future pertinent research.

Maintain and increase the area of suitable DWM habitat in the Delaware River by enhance habitat through the manipulated flow regime. Preserve existing water quality

Partners: NPS, DRBC, New England Field Office

Needs: Since the dwarf wedgemussel was listed in 1990, and the recovery plan was completed, new and significantly large populations in the Delaware River watershed was been discovered. Consequently, this population was not considered in the existing recovery plan.

1. Revise recovery plan to include conservation strategies for the Delaware River that the Service and partners can implement to enhance and recovery this populations.
2. Develop habitat protection strategies for the Delaware River

Actions:

1. Assist with recovery plan revision to include consideration and conservation planning for the Delaware River.

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:

1. Assist DRBC with developing instream flow target protective of DWM

Partners: NPS, DRBC, Corps, USGS, PAFBC

Needs:
Assist the New England Field Office with revision of recovery plan when initiated, as recommended by NEFO's 5-year review.

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps: Continue to monitor the distribution and habitat needs of DWM in the Delaware River.

Partners: USGS, NPS

Needs: Understand the relationship between DWM habitat (and host fish) and regulated flow in the Delaware River.

Actions:

1. Resurvey Delaware River to assess impacts from severe flooding in 2005 and 2006 and establish new baselines for future comparison.

Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*)

Introduction: The eastern massasauga is a medium-sized venomous snake that reaches lengths of 24 to 30 inches. It has a grayish body color with a series of dark-brown, irregularly shaped blotches along the top of the back. These blotches are the sources of the Latin species name "catenatus", which means "chain-like". Along the sides of the body are two to three rows of smaller, more rounded spots. Massasaugas are pit vipers with heat-sensing pits on the side of the head between the eye and nostril. These snakes have vertically elliptical pupils and a single row of scales on the underside of the tail. The body is very stout compared to the length and its head is covered with nine large, scale plates typical of Pennsylvania's non-venomous snake species. Male massasaugas find their mates by following scent trails of other massasaugas. Mating peaks in May and June, but can occur throughout the warm season. Female massasaugas give birth to litters of up to 20 live young encased in a membrane. The young are venomous at the time of birth (1).

Justification: The eastern massasauga, a Pennsylvania endangered species, is rare throughout its range in the U.S. and is on the endangered, threatened or rare list in each state where it is found. The U.S. Fish & Wildlife Service is reviewing this species for federal Endangered Species Act listing because of its declining populations range-wide (1). The presence of this snake species has been documented in western counties of PA since the early 1900s. The disjunctive distribution throughout the state, small size, secretive habitats, and preference for wetland habitats of this species may contribute to its existence to be overlooked (3). Historically dam and highway construction led to the decrease in massasauga populations, but recent investigations have indicated that the continued decline in populations can be attributed to habitat deterioration caused by natural succession of woody vegetation (3). The eastern massasauga is a candidate indicator species used to warn conservation groups of declining wetland and upland habitats. These habitats, when conserved can provide support for health populations of many species of plants and animals (4).

Information Sources:

(1) Shiels, Andrew L. 2007. *Pennsylvania Amphibians & Reptiles: The Massasauga Rattlesnake*. Pennsylvania Angler & Boat. November-December 2007. PA Fish & Boat Commission. Harrisburg, PA.

(2) U.S. Fish & Wildlife Service. Endangered Species Program. http://www.fws.gov/endangered/species/spotlight-species.html

(3) Reinert, Howard K. and Lauretta M. Buskar. *The Massasauga Rattlesnake in Pennsylvania: Continuing Habitat Loss and Population Isolation*. Rattlesnake Symposium. Metro Toronto Zoo.

(4) U.S. Fish & Wildlife Service. 1999. *Eastern Massasauga Rattlesnake*. USFWS. Minnesota.

Information Sources:

(5) Kowalski, Matt. 2007. *Conservation and Planning for the Eastern Massasauga in Pennsylvania*. Pennsylvania Natural Heritage Program. Western Pennsylvania Conservancy.

(6) U.S. Fish & Wildlife Service. 2010. Massasauga Rattlesnake Priority Planning Report. *Focal Area: Finger Lakes/Onondaga*, NY. USFWS New York Field Office.

(7) Franklin, I. R. 1980. *Evolutionary changes in small populations*. In: Conservation Biology, an Evolutionary-Ecological Perspective, M.E. Soule and B.A.Wilcox (eds.). Sinauer, Sunderland, MA, pp.135-149.

Focal Area(s): Geographic range of the massasauga in Pennsylvania has always been limited to the extreme western portion of the state. Literature reports and museum records define a historic distribution that included 19 separate localities in six western Pennsylvania counties (3). This species of snake is strongly associated with relict prairie habitat in Crawford, Mercer, Butler, and Vanango counties (1). Crawford, Mercer, and Vanango counties would be focal areas due to documented extant populations (3). The focal area definition would therefore consist of these three counties in Northwestern Pennsylvania, and further defined as wetlands and relict prairie lands habitat, for the purpose of collecting data on extant massasauga populations and their habitat in focal area to determine immediate conservation needs.

SECTION I – BIOLOGICAL PLANNING:

Threats: (6)

1. The present or threatened destruction, modification, or curtailment of its habitat or range.
2. Over utilization for commercial, recreational, scientific, or educational purposes.
3. Disease and/or predation.
4. Inadequacy of existing regulatory mechanisms.
5. Other natural or manmade factors affecting its continued existence.
6. Genetic viability, loss of genetic diversity due to isolation.
7. Invasive species encroachment.
8. Illegal collecting.

Conservation Goals: It has been proposed that a minimum effective population size of 500 individuals is necessary to maintain genetic vigor, and thereby long-term viability of a local population. This quantitative value only considers the breeding members of the population (7). The goal is to provide suitable habitat for the maintenance of the minimum population size.

Partners: Western Pennsylvania Conservancy, Carnegie Museum of Natural History, Department of Natural Resources, Clarion University, Pennsylvania Wild Resource

Conservation Fund, Pennsylvania Fish & Boat Commission, Pennsylvania Natural Heritage Program, U.S. Fish & Wildlife Service.

Needs:

1. Determine values for stable mating populations within northwestern Pennsylvania.

2. Quantify habitats suitable for healthy massasauga populations throughout Pennsylvania.

3. Review PAFO biological surveys and conservation plans to quantify suitable habitats.

SECTION II – CONSERVATION DESIGN:

Conservation Strategies: [Refer to report titled *Recommendations for Land Management in Pennsylvania Specific to the Protection of Eastern Massasauga Habitats and Populations*. *June 30, 2007* submitted to the Pennsylvania Fish & Boat Commission.]

1. Prioritize potential habitat restoration projects in occupied habitat and unoccupied but suitable habitat where invasive species encroachment limits habitat availability (6)

2. Prioritize potential habitat restoration projects in occupied habitat and unoccupied but suitable habitat.

3. Seek to minimize loss of habitat by influencing regulatory agency decisions regarding wetland draining, agricultural practices that diminish wetland values for wildlife, dredging and placement of fill in wetlands with a focus on wetlands that have suitable habitat (6).

4. Develop plans for captive rearing and enhanced protection of existing populations (6).

Partners: Department of Natural Resources, Pennsylvania Fish & Boat Commission, U.S. Fish & Wildlife Service, Partners for Fish & Wildlife.

Needs:

1. Qualify habitats where healthy populations have been documented.

2. Compile comprehensive list of PAFO habitat restoration projects with suitable habitat.

SECTION III – CONSERVATION DELIVERY:

Existing Actions:

1. The present or threatened destruction, modification, or curtailment of its habitat or range.
2. Over utilization for commercial, recreational, scientific, or educational purposes.
3. Disease and/or predation.
4. Inadequacy of existing regulatory mechanisms.
5. Other natural or manmade factors affecting its continued existence.
6. Genetic viability, loss of genetic diversity due to isolation.
8. Illegal collecting.

Partners: Department of Natural Resources, Pennsylvania Fish & Boat Commission, U.S. Fish & Wildlife Service, Partners for Fish & Wildlife, Habitat Forever, Ruffed Grouse Society.

Needs:

1. Secure agency and private source funding to support massasauga habitat restoration efforts.
2. Increase public interest in this endangered species candidate through informative publications and on-site educational programs.
3. Generate a comprehensive list of restoration projects where there is suitable habitat for massasauga populations and where invasive species have been documented.
5. Publish educational material regarding the current state of massasauga populations within the state of Pennsylvania.
6. Cultivate relationships with agencies and private entities interested in the protection of this species and/or its suitable habitat.
7. Prioritize potential habitat restoration projects in occupied habitat and unoccupied but suitable habitat where invasive species encroachment limits habitat availability (6)
8. Develop plans for captive rearing and enhanced protection of existing populations (6).
9. Minimize loss of habitat by influencing regulatory agency decisions regarding wetland draining, agricultural practices that diminish wetland values for wildlife, dredging and placement of fill in wetlands with a focus on wetlands that have suitable habitat (6)

SECTION IV – MONITORING AND RESEARCH:

Key Data Gaps:

1. Comprehensive data on the range of massasauga throughout the state of Pennsylvania.
2. Effect burrowing animal populations, such as the crawfish, have on the successful hibernation of massasauga.
3. Long-term population data on existing massasauga populations in eastern Pennsylvania.

Partners: Department of Natural Resources, Pennsylvania Fish & Boat Commission, U.S. Fish & Wildlife Service, Partners for Fish & Wildlife, Habitat Forever, Ruffed Grouse Society.

Needs:

1. Collect data of current Pennsylvania massasauga populations including locality, density, mating pairs, and physical condition of species sampled.
2. Long-term monitoring of existing massasauga populations in eastern Pennsylvania.
3. Study of influence burrowing animal populations has on the successful hibernation of healthy massasauga populations.
4. Scientific documentation describing methods for the successful breeding of captive massasauga populations.
5. Review case studies and methods documenting successful management of existing populations.
6. Compile a comprehensive list of PAFO restoration projects, including site values for invasive species, exhibiting suitable habitat for massasauga populations.
7. Cultivate relationships with agencies and private entities interested in the protection of massasauga populations and/or its suitable habitat.
8. Determine cost basis to implement a long-term monitoring program for existing massasauga populations in several localities of eastern Pennsylvania.
9. Review literature documenting recent conservation efforts to establish suitable massasauga habitat in PA.

Golden-winged warbler (*Vemivora chysoptera*)

Introduction: The Golden-winged Warbler is a small, neo-tropical migrant songbird that breeds in the United States in the Northeastern and Great Lakes regions and in the higher elevations in Southeastern Canada and the southern Appalachians (Larkin 2008). Males are slate gray in color with a white chest, black cheek and throat patches, and yellow patches on their crown, forehead, and wings. Females have grey cheek and throat patches and their back is generally olive in color with some yellow markings. Golden-winged Warblers nest in uplands, marshes and bogs, power line right-of-ways, and other areas with sparse tree cover and patches of shrubs. In uplands, they prefer areas in the early stages of succession, similar to the woodcock. These birds nest on the ground in a field or marsh generally at the base of ferns or briars. They are widely distributed throughout Pennsylvania but are rare in the northern tiers and absent in the southeast regions of the state (Confer 1992).

Justification: According to the Breeding Bird Atlas, Pennsylvania has seen a 7.2% annual decline of Golden-winged warbler populations. Likewise, populations throughout Region 5 show an annual decline of 7.5% (Sauer et al. 2007). The primary factors that are driving this trend include loss of breeding and wintering habitat, parasitism by brown-headed cowbirds and hybridization with Blue-winged Warblers (Buehler et al. 2007). There is a high probability that if immediate action is not taken, the Golden-winged Warbler will require protection under the Endangered Species Act (Larkin 2008). In Pennsylvania, the Golden-winged warbler was chosen as a priority species because of the degree of population decline, its priority status among our conservation partners, and our ability to deliver early-successional habitat restoration projects.

Information Sources: [List the key sources used to compile this documents information, such as Recovery Plan, State Wildlife Action Plan, etc.]

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Focal Area(s): Dr. Jeff Larkin of Indiana University of Pennsylvania (IUP) has undertaken a multi-year study in northcentral Pennsylvania to:
"1) determine the extent to which Golden-winged Warbler breed in this portion of the Commonwealth;
2) quantify characteristics of Golden-winged Warbler breeding habitat and, in particular, the habitat that is most favorable for Golden-winged Warbler while excluding Blue-winged Warbler; and
3) collect baseline data in order to examine the response of Golden-winged Warbler to future experimental habitat manipulation (Larkin 2008)."

Because of the Pennsylvania Field Office's location in northcentral Pennsylvania, the Partners for Fish and Wildlife program has made two sites, as identified in the study, a priority for our Golden-winged Warbler habitat restoration work. The first site is located at Bald Eagle State Park in northern Centre County and is part of an ongoing, multi-year early-successional habitat restoration project. The second site is located in Sproul State Forest in northern Centre and western Clinton Counties and is included in habitat studies undertaken by IUP.

Likewise, Dr. Larkin has identified statewide focal areas (as outlined on the attached map entitled ***"Golden-winged Warbler Habitat, Pennsylvania's Focal Areas.")***

Using this information, PAFO conservation work for Golden-winged warblers will concentrate on the Early Successional Focal Area (see Section III – Focal Areas).

SECTION I – BIOLOGICAL PLANNING: *Identify clear goals and objectives and compile information necessary to achieve them.*

Threats:
1. Habitat loss in breeding and wintering range
2. Hybridization with the Blue-winged Warbler
3. Parasitism by Brown-headed Cowbirds

Conservation Goals: While population goals have not been published for Pennsylvania, the Partners in Flight Landbird Conservation Plan does make recommendations for three regions that encompass approximately 90% of Pennsylvania.

<u>Partners in Flight Area 24, Allegheny Plateau</u>

The Allegheny Plateau covers much of west-central Pennsylvania, the southern tier of New York to the base of the Adirondack Mt., and a portion of northeast Ohio.
In this area, it is recommended that 18,000 ha of disturbed or shrubby habitat is needed to support 8,500 pairs of Golden-winged Warblers (Robertson and Rosenberg 2003).

Partners in Flight Area 17, Northern Ridge and Valley
The Northern Ridge and Valley extends from southeastern Pennsylvania, through northwestern New Jersey and southeastern New York nearly to the base of the Adirondack Mts. It includes portions of several major river valleys, including the Hudson, Delaware, and Susquehanna Rivers. In this area, it is recommended that 7,000 ha be protected or managed at high elevations to support 3,500 pairs of Golden-winged Warblers (Rosenberg and Robertson 2003).

Partners in Flight Area 22, Ohio Hills
The Ohio Hills physiographic area encompasses much of southwestern Pennsylvania, western West Virginia, and southeastern Ohio. In this area, it is recommended that 8,000 ha be managed to support 3,200 pairs of Golden-winged Warblers (Rosenberg and Dettmers 2004).

Partners:
Indiana University of Pennsylvania
Wildlife Management Institute (WMI)
Ruffed Grouse Society (RGS)
Foundation for California University of Pennsylvania (Foundation for CalU)
Habitat Forever/Pheasants Forever (HF/PF)
Pennsylvania Department of Conservation and Natural Resources (DCNR)
Pennsylvania Game Commission (PGC)
Woodcock Limited of Pennsylvania (WLPA)
Wildlife for Everyone Endowment Foundation (WFEEF)

Needs:
1. Develop specific population goals on a statewide basis
2. Develop specific habitat restoration goals on a statewide basis

FY11 Actions:
1. Work with IUP, WMI, PGC and other partners to develop specific population goals on a statewide basis based on field data collected by these partners and Pennsylvania's portion of the Breeding Bird Survey.
2. Work with IUP, WMI, PGC and other partners to develop specific habitat restoration goals on a statewide basis based on field data collected by these partners and Pennsylvania's portion of the Breeding Bird Survey.
3. Continue coordination and work with our partners within existing plans for Bald Eagle State Park and Sproul State Forest.

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategies:
1. Remove exotic vegetation and restore early successional habitat in breeding areas with the anticipation of use by one breeding pair for every 2 hectares treated.
2. Continue to work on long-term habitat restoration goals in areas for which we have management plans as at Bald Eagle State Park and at Sproul State Forest and continue to review and modify plan
3. Continue to work on long-term habitat restoration goals in Pennsylvania's Golden-winged Warbler focal areas

Partners:
Indiana University of Pennsylvania
Wildlife Management Institute
Ruffed Grouse Society
Foundation for California University of Pennsylvania
Habitat Forever/Pheasants Forever
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Game Commission
Woodcock Limited of Pennsylvania
Wildlife for Everyone Endowment Foundation

Needs:
1. Continue to update and develop our habitat restoration demonstration area at Bald Eagle State Park including reviewing the effectiveness of our habitat restoration techniques
2. Work with partners within existing local plans for early-successional habitat restoration projects
3. Develop plans that address nest parasitism and hybridization

FY11 Actions:
1. Continue to facilitate biological planning by providing study areas at our habitat restoration projects as outlined in the Golden-winged Warbler Conservation Initiative - Pennsylvania
2. Continue to facilitate biological planning as outlined in the "*Bald Eagle State Park Native Plant and Early-Successional Stage Habitat Restoration Project Report*"

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:

1. Working with our partners at IUP, RGS, Pennsylvania Bureau of Forestry, and DCNR to restore a minimum of 50 acres of suitable habitat annually to support 10 pairs of Golden-winged Warblers – estimated annual cost $25,000
2. Working with our partners at WMI, IUP, and RGS to develop best management practices for use by landowners and industry
3. Working with the timber industry to encourage early-successional habitat restoration
4. Working with our partners to deliver USDA-funded (WHIP, WRP, CREP etc.) projects that benefit Golden-winged Warbler and others in the habitat suite
5. Working with our partners to implement habitat projects that promote segregation between Golden-winged Warblers and Blue-winged Warblers
6. Using varied techniques to restore habitat for evaluation by monitoring and research partners
7. Restoring habitat in varying location for comparisons of differing vegetation and vegetative structure

Partners: Habitat Forever, Indiana University of Pennsylvania, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Game Commission

Needs:
To continue work on existing actions as outlined above.

FY11 Actions:
We will continue implementing existing actions as outlined above.

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:
Determine the role of beaver in creating habitat. Identify community types and management strategies that promote segregation between Golden-winged and Blue-winged Warblers.

Partners:
IUP, WMI, Golden-winged Warbler Working Group, RGS

Needs:
Per the Golden-winged Warbler Working Group:
1. Identify areas of high population concentrations using surveys and regional habitat models.
2. Evaluate forest harvest and burning prescriptions that promote quality habitat.
3. Evaluate strip-cutting of lowland shrub communities or mechanical cutting strategies.
4. Compare habitat quality across community types used by Golden-winged Warblers in each region.
5. Identify community types and management strategies that promote segregation between Golden-winged warblers and Blue-winged Warblers
6. Determine role and significance of beaver in creating habitat
7. Evaluate significance and quality of breeding habitat for post breeding and migratory needs.

FY11 Actions:
1. Work with partners (IUP, PGC, RGS) to evaluate strip-cutting and mechanical treatments on projects we implement

Indiana bat (*Myotis sodalis*)

Introduction: The Indiana bat winters in caves and mines from November through March, and spends the spring, summer and fall in forest habitat. The distance between winter and summer habitat may range from a few miles to over 200 miles. Indiana bats are highly colonial, as evidenced by their dense clustering behavior during hibernation and their formation of maternity colonies in the summer.

The wintering population in Pennsylvania numbers around 1000 bats, which is a small proportion of the population in the Appalachian Recovery Unit (27,458 bats in 2009). However, Pennsylvania makes up about 30% of the species' range within the subject RU. The populations in Pennsylvania and the RU are expected to decline precipitously over the next few years due to white-nose syndrome (WNS), which has been documented throughout most of the RU.

Justification: The Indiana bat was identified as a priority species due to 1) its federal listing as endangered under the Endangered Species Act; 2) a high degree of threat and substantial population decline due to white-nose syndrome and human activities affecting the species and its habitat (*e.g.*, wind power, coal mining, oil and gas development); 3) the ability of PAFO to influence the species' status (*e.g.*, through consultations and work with partners); 4) umbrella benefits to other bat species that will result from Indiana bat conservation; and 5) the degree to which other partners (*e.g.*, PGC, BCI, PNHP, mining interests) consider this species a high conservation priority.

Information Sources: 1) Indiana bat (*Myotis sodalis*) draft recovery plan: first revision, 2) Indiana bat (*Myotis sodalis*) 5-year review, 3) 2009 rangewide population estimate for the Indiana bat, 4) Indiana bat mitigation guidance for Pennsylvania.

Focal Areas:

1. Indiana bat hibernating populations and the associated hibernacula and swarming habitat. There are currently 18 known Indiana bat hibernacula in 10 counties, including Armstrong, Beaver, Blair, Centre, Fayette, Huntingdon, Lawrence, Luzerne, Mifflin and Somerset. These hibernacula include limestone caves, mines (limestone, anthracite coal), and an abandoned railroad tunnel. The total known Indiana bat hibernating population in Pennsylvania was estimated to be 1,038 bats in 2007, with the largest concentration being found in the J.D. Hartman Mine (a.k.a. Canoe Creek hibernaculum) in Blair County. This is the State's only Priority 2 hibernaculum, with Indiana bat population counts ranging from approximately 600 to 800 over the past decade. There are three Priority 3 hibernacula in Pennsylvania with extant populations, but only two of them (*i.e.*, South Penn Railroad Tunnel and Long Run Mine) currently support Indiana bat populations exceeding 100 bats. Recovery Focus Areas include the following hibernacula and their associated swarming habitat: Hartman Mine, South Penn Tunnel, Long Run Mine, and CS&M Mine. Hibernacula focal areas are defined by a 10-mile radius around the hibernaculum.
2. Maternity colonies and the associated habitat. Eleven Indiana bat maternity colonies have been identified in nine counties, including Adams, Armstrong, Bedford, Berks, Blair, Greene, Somerset, Washington and York. Maternity colony focal areas are

defined by a 2.5-mile radius around the identified maternity roost tree(s). Where no roost trees have been identified, the focal area is defined by a 5.0-mile radius around a summer capture location for a reproductive female or a juvenile bat.

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats:

1. White-nose syndrome
2. Wind turbine operation in focal areas
3. Resource extraction activities (coal mining, oil and gas, non-coal minerals) that affect forest habitat in focal areas
4. Land development activities (residential and commercial development) that affect forest habitat in focal areas
5. Entrapment or exclusion from suitable hibernacula via the closure of abandoned mine portals
6. Disturbance of hibernating bats

Conservation Goals:

Within the Appalachian Mountains RU, there are two P1, five P2, 21 P3, and 31 P4 hibernacula that have extant Indiana bat populations. In Pennsylvania, there are one P2, three P3, and 14 P4 hibernacula. To reclassify the Indiana bat as "threatened" would require the protection of both P1 hibernacula, a positive population growth rate in important hibernacula within the RU, and a rangewide population of at least 457,000 bats. Delisting would require permanent protection of at least 50% of the P2 hibernacula within the RU, a positive population growth rate within the RU, and a rangewide population of at least 457,000 bats (USFWS 2007).

The conservation of P2 and P3 hibernacula and their hibernating populations in Pennsylvania is a priority due to the contribution these hibernacula have in meeting RU goals for reclassifying and delisting the species. In addition, the conservation of Indiana bat maternity colonies and their associated habitat is a priority due to the contribution these population units have in supporting the associated hibernating populations.

Partners: Pennsylvania Game Commission, USFWS – R5 WNS coordinator

Needs:

1. Determine whether range-wide recovery objectives for the Indiana bat are still appropriate. (Lead: Region 3)

FY11 Actions: No actions are anticipated for FY11

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategies:

1. Reduce the threat of WNS
2. Protect and manage Priority 2 (P2) and Priority 3 (P3) Indiana bat hibernacula and their associated hibernating populations. (There are no Priority 1 hibernacula in Pennsylvania.) Stabilize or increase population size by reducing mortality and/or increasing survival rates. Within the Appalachian Mountains RU, there are two P1, five P2, 21 P3, and 31 P4 hibernacula that have extant Indiana bat populations. In Pennsylvania, there are one P2, three P3, and 14 P4 hibernacula.
3. Protect Indiana bat maternity colonies. Stabilize or increase population size by reducing mortality, increasing survival rates, and /or increasing recruitment.
4. Protect suitable habitat (forests) within 10 miles of P2 and P3 hibernacula.
5. Protect summer habitat, particularly known maternity habitat.
6. Protect and manage Priority 4 (P4) Indiana bat hibernacula.
7. Protect suitable habitat (forests) within 10 miles of P4 hibernacula.
8. Where forest cover has been or is likely to be significantly reduced (*e.g.*, due to development pressure, mineral extraction, *etc.*), restore suitable habitat within 10 miles of Indiana bat hibernacula and 3 miles of maternity roosts.

Partners: Pennsylvania Game Commission, Pennsylvania Natural Heritage Program, WNS researchers

Needs:

1. Develop a map depicting forest habitat associated with hibernacula and maternity sites. Include layers depicting land under conservation ownership (e.g., PGC, DCNR). This will facilitate project reviews and the identification of potential conservation lands. (Lead: PGC)
2. Identify lands to be conserved using Indiana Bat Conservation Fund (IBCF) monies. (Lead: PGC)
3. Determine if Indiana bat habitat management guidelines used by NRCS in the Healthy Forest Initiative are sufficient to provide for suitable foraging and roosting habitat. Modify in cooperation with NRCS, as necessary.
4. Revise Indiana bat polygons in the online environmental review tool to ensure hibernacula, swarming habitat, maternity colonies, and maternity habitat are adequately protected. (Lead PAFO. Partners: PGC and PNHP)
5. Develop a model to estimate the effect of Indiana bat take on hibernating populations when wind turbines are operated in swarming habitat.

6. Develop a survey protocol for conducting post-construction mortality monitoring (for bats) at wind farms.
7. Develop a protocol for assessing the size, health and distribution of an Indiana bat maternity colony over time.
8. Develop a strategy to mitigate the loss of Indiana bat habitat due to resource extraction activities in focal areas (priorities include oil and gas, and non-coal minerals).
9. Develop a map of Indiana bat focal areas (i.e., swarming radii and maternity site radii) that can be posted on the PAFO website.

FY11 Actions:

1. Revise Indiana bat polygons in the online environmental review tool to ensure hibernacula, swarming habitat, maternity colonies, and maternity habitat are adequately protected. (Lead PAFO. Partners: PGC and PNHP)
2. Develop a map of Indiana bat focal areas (i.e., swarming radii and maternity site radii) that can be posted on the PAFO website.

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions:

1. Rely upon the PNHP online environmental review tool to provide automated USFWS technical assistance and consultation regarding Indiana bat to the extent possible. This frees PAFO to devote more time to Indiana bat recovery and the review of projects with complex or substantial effects on Indiana bats.
2. Consult and provide technical assistance on coal mining projects to ensure effects on Indiana bats and their habitat are minimized, and forest habitat loss is compensated in accordance with the protection and enhancement plan guidelines for Pennsylvania. (PAFO: 0.25 FTE)
3. Consult and provide technical assistance on wind projects to reduce Indiana bat mortality (*e.g.*, via appropriate siting of turbines, use of measures to reduce mortality). (PAFO: 0.5 FTE)

Partners: Pennsylvania Game Commission, Pennsylvania Natural Heritage Program

Needs:

1. Reduce the threat of WNS. This is currently precluded by insufficient knowledge about the transmission, effects, and treatment of WNS (see **Section IV – Research**). Until further information is gained, support USFWS and PGC efforts to reduce the risk of transmission through cave/mine closures, disinfection protocols, mist-netting protocols, monitoring, reporting, and public outreach.
2. Assist with WNS investigations as needed.

3. Participate in WNS calls to keep up-to-date on the effects and spread of WNS, and the research and mitigation strategies related to WNS.
4. Coordinate with PGC to obtain up-to-date information regarding the movement of WNS across PA, and the effects of WNS on Indiana bat populations.
5. Develop an agreement with PGC to govern the establishment and implementation of a fund for WNS research and monitoring.
6. Consult and provide technical assistance on development and resource extraction activities affecting Indiana bat habitat to ensure the risk of Indiana bat mortality is reduced by implementing seasonal restrictions on tree-cutting and by implementing measures to reduce adverse effects on forest habitat. (PAFO: 0.25 FTE)
7. Provide additional Indiana bat guidance and resources on the PAFO website (e.g., industry-specific avoidance and minimization measures, updated surveyor list, updated survey guidelines).
8. Post map on PAFO website depicting Indiana bat focal areas (i.e., swarming radii and maternity site radii) to encourage development outside these sensitive areas and allow for early project planning that considers the needs of Indiana bats.
9. Conserve Indiana bat habitat using Indiana Bat Conservation Fund (IBCF) monies. (Lead: PGC)
10. Conserve Indiana bat swarming and maternity habitat by assisting NRCS with implementation of its Healthy Forests Initiative. (Lead PAFO. 0.25 FTE needed for 1 year)
11. Protect Indiana bat hibernating populations by working with OSM and PGC to develop and implement abandoned mine portal assessment, closure, and gating procedures to ensure bats are not trapped in or excluded from suitable hibernacula.
12. Consult and provide technical assistance to PGC and DCNR on forest management activities to reduce the risk of Indiana bat mortality and retain habitat in a condition that is suitable for the roosting and foraging needs of Indiana bats.
13. Network with biologists from R3, R4 and R5 regarding measures to reduce and monitor Indiana bat mortality due to wind turbine operation.
14. Identify the location and amount of forest habitat in focal areas. Determine which forest habitat is in conservation ownership within focal areas.
15. Determine which focal areas are threatened by large-scale habitat alteration (*e.g.*, coal mining, oil and gas development, non-coal minerals development, wind development).
16. Determine which hibernating populations are at risk of disturbance and which hibernacula are in need of gating.
17. Update PAFO endangered species records to ensure project reviews are accurate and complete.
18. Revise the online environmental review tool project matrix to incorporate different avoidance measures for swarming vs. maternity habitat.

19. Revise the online environmental review tool project matrix to provide links to the PAFO website for industry-specific guidance on avoiding and minimizing adverse effects on Indiana bats and their habitat.
20. Develop an HCP to address impacts to Indiana bats and their habitat from resource extraction activities other than coal mining. (PAFO: 1.0 FTE for 2 years)
21. Review and revise Indiana bat information in IPAC to ensure species' range information is correct.

FY11 Actions:

1. Consult and provide technical assistance on coal mining projects to ensure effects on Indiana bats and their habitat are minimized, and forest habitat loss is compensated in accordance with the protection and enhancement plan guidelines for Pennsylvania. (PAFO: 0.25 FTE)
2. Consult and provide technical assistance on wind projects to reduce Indiana bat mortality (*e.g.*, via appropriate siting of turbines, use of measures to reduce mortality). (PAFO: 0.5 FTE)
3. Assist with WNS investigations as needed.
4. Participate in WNS calls to keep up-to-date on the effects and spread of WNS, and the research and mitigation strategies related to WNS.
5. Coordinate with PGC to obtain up-to-date information regarding the movement of WNS across PA, and the effects of WNS on Indiana bat populations.
6. Develop an agreement with PGC to govern the establishment and implementation of a fund for WNS research and monitoring.
7. Provide additional Indiana bat guidance and resources on the PAFO website (e.g., industry-specific avoidance and minimization measures, updated surveyor list, updated survey guidelines).
8. Post map on PAFO website depicting Indiana bat focal areas (i.e., swarming radii and maternity site radii) to encourage development outside these sensitive areas and allow for early project planning that considers the needs of Indiana bats.
9. Conserve Indiana bat swarming and maternity habitat by assisting NRCS with implementation of its Healthy Forests Initiative. (Lead PAFO. 0.25 FTE needed for 1 year)
10. Protect Indiana bat hibernating populations by working with OSM and PGC to develop and implement abandoned mine portal assessment, closure, and gating procedures to ensure bats are not trapped in or excluded from suitable hibernacula.
11. Network with biologists from R3, R4 and R5 regarding measures to reduce and monitor Indiana bat mortality due to wind turbine operation.
12. Update PAFO endangered species records to ensure project reviews are accurate and complete.

13. Revise the online environmental review tool project matrix to incorporate different avoidance measures for swarming vs. maternity habitat.
14. Revise the online environmental review tool project matrix to provide links to the PAFO website for industry-specific guidance on avoiding and minimizing adverse effects on Indiana bats and their habitat.
15. Review and revise Indiana bat information in IPAC to ensure species' range information is correct.

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:

1. Effect of WNS on Indiana bat survival and reproductive rates
2. Degree to which resistance to WNS may develop in Indiana bats, type of resistance (behavioral, genetic, physiological), and the degree to which environmental and biological factors affect resistance (*e.g.*, cave microclimate, population density).
3. Effect of WNS-related attrition on colonial aspects of the Indiana bat's life history (*e.g.*, clustering during hibernation, aggregation into maternity colonies in summer)
4. Effectiveness of take minimization measures on reducing turbine-related bat mortality to Indiana bats and myotis species.
5. Effectiveness of the PEP guidelines in restoring suitable forest habitat for Indiana bats.
6. Effectiveness of the PEP guidelines in retaining reforested habitat to meet the long-term habitat needs of Indiana bats
7. Location and distribution of Indiana bat maternity colonies in PA.
8. Extent of swarming habitat use for hibernacula of various population sizes.
9. Effect of hibernaculum microclimate on bat mortality levels due to WNS.
10. Safe and effective treatments for WNS.
11. Effect of WNS on the brain, sinuses, and nasal passages of bats.
12. Degree to which WNS is harbored and transmitted during the spring and summer.
13. Effect of turbines on Indiana bats when turbines are situated within maternity colony habitat.
14. Effect of turbines on Indiana bats when turbines are situated within swarming habitat.

Partners: Pennsylvania Game Commission, WNS researchers, R5 WNS Coordinator

Needs:

1. Monitor the effect of WNS on Indiana bat hibernating populations in PA over time.
2. Monitor the effect of WNS on Indiana bat maternity colonies in PA over time.

3. Determine the level and type of resistance of Indiana bat populations to WNS over time.
4. Determine the effectiveness of take minimization measures on reducing turbine-related bat mortality to Indiana bats and/or myotis species.
5. Determine the effectiveness of the PEP guidelines in restoring suitable forest habitat for Indiana bats.
6. Determine the effectiveness of the PEP guidelines in retaining reforested habitat over time.
7. Determine the location and distribution of Indiana bat maternity colonies in PA by conducting telemetry studies to track bats during spring migration.
8. Determine the extent of swarming habitat use by conducting additional fall telemetry studies, particularly at P3 and P4 hibernacula.
9. Monitor the response of maternity colonies to attrition due to WNS by conducting long-term monitoring of one or more colonies. In doing so, determine threshold maternity colony size.
10. Determine the effect of hibernaculum microhabitat on bat mortality levels due to WNS.
11. Identify a safe and effective treatment(s) for WNS.
12. Determine the effect of WNS on the brain, sinuses, and nasal passages of bats.
13. Monitor Indiana bat hibernacula to determine the extent to which WNS has affected hibernating populations (Lead: PGC)
14. Monitor the Greene County maternity colony to determine its status over time. (Lead: Consol)
15. Monitor bat mortality at wind farms that have received incidental take authorization to determine the effectiveness of take minimization measures. (Lead: project proponents)
16. In cooperation with PGC and bat researchers, identify WNS research needs that can be funded using the WNS escrow account.

FY11 Actions:

1. Monitor the Greene County maternity colony to determine its status over time. (Lead: Consol)
2. Monitor bat mortality at wind farms that have received incidental take authorization to determine the effectiveness of take minimization measures. (Lead: project proponents)
3. In cooperation with PGC and bat researchers, identify WNS research needs that can be funded using the WNS escrow account.

Ohio River Mussels (Suite of species)

Species: **Clubshell (*Pleurobema clava*), Endangered**
Northern riffleshell (*Epioblasma torulosa rangiana*), Endangered
Rayed bean (*Villosa fabalis*), Proposed endangered
Snuffbox (*Epioblasma triquetra*), Proposed endangered
Sheepnose (Plethobasis cyphyus), Proposed*
Rabbitsfoot (*Quadrula cylindrica cylindrica*), Candidate

Introduction: The Ohio River basin in Pennsylvania supports a diverse aquatic community that includes fish and freshwater mussel species that have become rare elsewhere in North America. These including populations vital to the continued existence and recovery of two federally listed endangered mussels, clubshell and northern riffleshell, and significant, reproducing populations of three proposed endangered mussels, rayed bean, snuffbox, sheepnose.

Justification: Conservation of federally listed, proposed and candidate species falls under the jurisdiction of the U.S. Fish and Wildlife Service (Service) under authority of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.). PAFO is the National Lead for clubshell and northern riffleshell. In addition, the Service is responsible for ensuring the conservation of aquatic resources via its advisory role under the Fish and Wildlife Coordination Act (48 Stat. 401, 16 U.S.C. 661 *et seq*.). At the State level, conservation of living aquatic resources falls under the jurisdiction of the Pennsylvania Fish and Boat Commission.

The three of the seven remaining reproducing clubshell populations are located in Pennsylvania in the Allegheny River, French Creek, and Shenango River basins. Similarly two of the three remaining reproducing populations of northern riffleshell occur in the Allegheny River and its tributary French Creek. The Allegheny River and French Creek also support globally important populations of the three proposed endangered or threatened species. Loss of these populations would significantly reduce the chance that these species will survive. The local abundance of all six species of endangered and proposed species allow for selective removal to conduct captive husbandry and may also serve as a source for augment/reintroduce efforts to increase the number of reproducing populations required to meet the species recovery objectives.

Clubshell and northern riffleshell, rayed bean and sheepnose, have been documented to occur in abundance at several locations, in Pennsylvania but these species exhibit discontinuous distributions (*i.e*., localized to areas of suitable habitat). The linear distribution means that these populations are vulnerable to single natural and anthropogenic catastrophic events (*e.g*., toxic spills or floods) and significant ongoing and new emerging threats have been identified.

Information Sources:
The clubshell and northern riffleshell were listed as endangered, without critical habitat, in 1993. The 1994 recovery plan identified four primary factors responsible for the decline of these species: siltation, impoundments, in-stream sand and gravel mining, and pollutants (USFWS 1994). Clubshell (*Pleurobema clava*) and Northern Riffleshell (*Epioblasma torulosa rangiana*) Recovery Plan, September 21, 1994 (http://ecos.fws.gov/docs/recovery_plan/940921.pdf).

Clubshell *(Pleurobema clava)* 5-Year Review: Summary and Evaluation (http://ecos.fws.gov/docs/five_year_review/doc2580.pdf); and Northern riffleshell (*Epioblasma torulosa rangiana*) -Year Review: Summary and Evaluation (http://ecos.fws.gov/docs/five_year_review/doc3284.pdf) considered additional threats that had emerged since 1994 including invasive species and energy extraction.

Recent proposed rules to add the rayed bean, snuffbox and sheepnose [Federal Register: November 2, 2010 (Volume 75, Number 211) http://www.gpo.gov/fdsys/search/citation.result.FR.action?federalRegister.volume=2010&federalRegister.page=67551&publication=FR] to the list of endangered and threatened species provide an analysis of the status and threats to these species.

Focal Area(s): Allegheny River Basin and Shenango River Basin.

SECTION I – BIOLOGICAL PLANNING: ***Identify clear goals and objectives and compile information necessary to achieve them.***

Threats: Threats to aquatic resources, including mussels, in the Allegheny River include water quality degradation (due to point and non-point source pollution); physical alteration of river substrate (*e.g.*, due commercial sand and gravel dredging, maintenance dredging, pipeline and bridge construction); construction and operation of dams; and the introduction and spread of invasive exotic species (*e.g.*, zebra mussels).

1. Habitat Loss and Fragmentation: Hydrologic and water quality alterations resulting from the operation of impoundments, point and non-point source water quality degradation from industrial and residential sources, and discharges from resource exploration and extraction have caused habitat loss and fragmentation of populations. Freshwater mussels, may be more sensitive to several components of treated sewage and other wastewater effluent (*e.g.*, ammonia, total dissolved solids, chlorine and copper) than are the typical organisms used to establish water quality criteria protective of aquatic life. In stream disturbance during sand and gravel dredging, gravel bar removal, bridge construction, and pipeline construction has resulted in both temporary and permanent habitat loss.

2. Inadequacy of existing regulatory mechanisms: Coal, oil, and gas resource extraction generally occurs away from the river, however, the extensive road networks frequently cross or occur near tributaries contributing sediment to the receiving waterway and discharge of treated and untreated brine waste may affect freshwater mussel populations. ESA does not provide for landuse regulation needed to maintain water quality. The cumulative effects of multiple activities have not been fully considered, particularly those based in tributaries that degrade clubshell habitat but may be physically distant from known populations. Climate change has not yet been considered in depth in the recovery of the clubshell or northern riffleshell.

3. Other natural or manmade factors: The genetic relationship between clubshell, *Pleurobema clava*, and Tennessee clubshell, *Pleurobema oviforme* in the Tennessee and Cumberland River basins is unclear. Some clubshell populations may not be correctly identified or protected. Similarly, the few remaining populations assumed to be northern riffleshell in the Green River, Kentucky and Elk River, West Virginia but which differ conchologically from those in the

Allegheny River basin and may represent different taxa. Augmenting these populations with individuals from the Allegheny River as Kentucky and West Virginia could result hybridization and loss of unique these taxa, which may be the presumed extinct tubercle-blossom pearly mussel (*Epioblasma torulosa torulosa*) or a currently unrecognized species.

Conservation Goals: *The immediate goal is to maintain the species status in Pennsylvania and control existing and potential threats*. These populations currently appear to be stable in most locations in these streams and they are vital to the continued survival of this species. Recovery goals are included in the recovery plan for clubshell and northern riffleshell, however, these may not be achievable as written. In order to ***reclassify*** the clubshell and northern riffleshell as threatened from endangered, this criterion must be met:

1. Viable populations must be documented in 10 separate drainages for this species. A viable population consists of sufficient numbers of reproducing individuals to maintain a stable or increasing population. These populations should include as many subpopulations as possible to maintain whatever fraction of the original genetic variability that remains.

The following drainages are identified as necessary to achieve recovery of the clubshell: Tippecanoe River (IN), East Fork West Branch St. Joseph River (MI/OH), Fish Creek (IN/OH), Green River (KY), Little Darby Creek (OH), Elk River (WV), French Creek (PA), Allegheny River (PA), and two additional drainages.

The following drainages are identified as necessary to achieve recovery: Tippecanoe River (IN), Detroit River (MI/Ontario – contingent on zebra mussel control), Fish Creek (OH), Green River (KY), Big Darby Creek (OH), Elk River (WV), French Creek (PA), Allegheny River (PA), and two additional as yet unidentified drainages.

In Pennsylvania, apparently reproducing populations of clubshell and northern riffleshell occur in French Creek (PA) and the Allegheny River (PA). A clubshell population has also been documented in the Shenango River (PA). Living clubshells and northern riffleshells are still occasionally found in several other streams that confluence with French Creek and the Allegheny River, but recent reproduction has not always been documented. The viability of remaining populations, including those showing some evidence of reproduction, is unknown. Northern riffleshells have been relocated from the Allegheny River to Big Darby Creek, Ohio and the Vermillion River, Illinois to establish reproductive populations to meet the recovery goals.

In order to ***remove*** the clubshell and northern riffleshell from the federal list of threatened and endangered species, the following additional criteria must be met:

2. Each of the 10 populations in Criterion 1 must be large enough to survive a single adverse ecological event. Most populations at this time are localized and susceptible to such impacts. Therefore, the extent of most populations must be increased, either naturally or through translocation.

3. The populations and their drainages from Criteria 1 and 2 must be permanently protected from all foreseeable and controllable threats, both natural and anthropogenic.

The recovery criteria have not been met; furthermore, they are vague in that: (1) population viability is not defined, (2) the separation distance (between sub-populations) necessary to ameliorate catastrophic events is not identified, (3) population protection is not well-defined, and (4) habitat protection is not well-defined. Several recovery tasks are intended to address habitat and population protection, but the needs of this species, including its environmental tolerances, are not well understood (see section 4.0).

Partners: Virtually all remaining habitat for these six species are dependent on instream flows managed by the Army Corps of Engineers, in French Creek with Union City Reservoir and Woodcock Creek Reservoir and in the Allegheny River by releases from Kinzua Dam and Seneca Pumped Storage Generating Station an in the Shenango River from Pymatuning Reservoir. The U.S. Geological Survey and Western Pennsylvania Conservancy have completed surveys of much of the Allegheny River, French Creek and the Shenango River.

Section 7 consultation actively works with Federal agencies (USCOE, FHWA, EPA) to minimize effects of federal actions and recommends conservation actions. Section 6 funding has been underutilized in Pennsylvania for mussel conservation but may be a funding source available to accomplish appropriate tasks with state partners. Partners for Wildlife program works with landowners to implement watershed management strategies.

The Service's Erie National Wildlife Refuge is involved in managing all of these (with the exception of sheepnose) populations in Muddy Creek and would likely be involved if additional land acquisition occurs along French Creek.

Needs:

1. Conduct a review of available literature regarding sensitivity of each life stage for major contaminants at known sites resulting from Marcellus shale production.
2. Identify and map activities or practices within the French Creek and Allegheny River watershed that may affect the clubshell and its host fish.

FY11 Actions:

1. Conduct a review of available literature regarding sensitivity of each life stage for major contaminants at known sites resulting from Marcellus shale production.
2. Identify and map activities or practices within the French Creek and Allegheny River watershed that may affect the clubshell and its host fish.

SECTION II – CONSERVATION DESIGN: ***Bring together results of biological planning into products that guide management and provide the on-the-ground strategy for achieving objectives.***

Conservation Strategies: Please go to these documents for existing strategies:

- Federal recovery plan (1994) http://www.fws.gov/northeast/nyfo/es/clubshell.pdf,
- 5-year review completed (USFWS, ECOS 2009) http://www.fws.gov/northeast/nyfo/es/clubshell.pdf

Partners: Region 3, USGS, PAFBC

Needs:

1. Habitat losses of candidate species (rayed bean, sheepnose, and snuffbox) have continued. Regulatory protection though section 7 and population monitoring will be improved with ESA listing.

FY11 Actions:

1. Coordinate an emergency response plan to address the most likely catastrophic events identified in Task 1.
2. Task 1.2. Develop instream flow recommendations for reservoir releases to protect and enhance downstream clubshell habitat.

SECTION III – CONSERVATION DELIVERY: ***Implement on-the-ground actions through partnerships guided by biological foundation.***

Existing Actions: Due to a locally robust population of northern riffleshell, clubshell and rayed bean, these species have been used a source population to augment or reintroduce populations to the Elk River in West Virginia (rayed bean); Duck River, Tennessee (rayed bean); Big Darby Creek, Ohio (northern riffleshell), Vermillion River, Illinois (northern riffleshell). Kentucky has requested 200 northern riffleshell to reintroduce to the Licking River in 2011. Clubshell have been taken to the Columbus Zoo/OSU Mussel Propagation Facility to study captive husbandry requirements of this species.

Partners: FWS Region 3 and Region 4, KY DFW, ODNR, Ohio State University, Columbus Zoo, IL DNR, WV DNR, PAFBC, Ohio River Islands National Wildlife Refuge

Needs:

1. Assist with augment and relocation activities to meet recovery goals of the northern riffleshell and clubshell.

1. Seeking funding to rewrite the northern riffleshell and clubshell recovery plan as indentified in the 5-year review
2. Complete the update of the 5-year review
3. Assist Region 3 with comment response to the proposed listing of the rayed bean, snuffbox, and sheepnose
4. Develop a Mussel Conservation Fund for use by project applicants seeking to mitigate effects of their action in a comprehensive, landscape-scale manner

FY11 Actions:

SECTION IV – MONITORING AND RESEARCH: ***Evaluate assumptions, response of habitats and populations to conservation actions, and progress toward objectives.***

Key Data Gaps:

1. Due to long life of most freshwater mussels, population trends may take several years to become evident. Adults can survey decades without successful recruitment masking eventual population failure. Long-term monitoring can assess for trends before populations collapse.
2. Water quality threats are significant in the Allegheny River basin but limited monitoring is being conducted at the most important mussel habitats.

Partners: DEP, PAFBC, USGS

Needs:

1. Establish at least two quantitative population monitoring sites on the Allegheny River and French Creek. Monitor populations at least every five years.
2. Promote continuous water quality and quantity monitoring stations along the Allegheny River and French Creek to monitor habitat conditions.

1. Clubshell and Tennessee clubshell are not readily distinguishable morphologically or by sequence data. Additional research is needed using fine-scale microsatellite markers to distinguish these species.
2. Utilize genetic material from preserved specimens to determine if riffleshell from the Green River KY and Elk River, WV are the same taxa as those in the Allegheny River.

FY11 Actions:

Piping plover (*Charadrius melodus*)

Introduction: The piping plover is a small shorebird that nests in the Great Plains states (Montana, Dakotas, Nebraska), on the shores of Lakes Michigan and Superior, and along the Atlantic coast. All populations winter along the Atlantic and Gulf coasts in the US, Central America, and the Carribean. The Great Lakes population is considered its own population and it is the population of most concern to PAFO. In 1991, the Great Lakes population was estimated to be 12 breeding pairs. In 2007, 63 breeding pairs were documented (http://www.fws.gov/midwest/endangered/pipingplover/pipl2007pop.html). Since the 1950s, piping plover has been extirpated in PA, but recently piping plover has been seen again along the coastline in Erie County at Presque Isle State Park. The population on Presque Isle State Park is part of the Great Lakes population.

Justification: The piping plover is a federally listed species that continues to lose essential habitat. There is an ability to deliver projects that would benefit the piping plover. There is a very small habitat and population in PA, but the degree of threat to population decline and the piping plover's status as a spotlight and federally listed species lead to the conclusion that this species is a priority to partners. The piping plover is also an umbrella species. Conservation efforts towards the piping plover will also benefit several other species.

Information Sources:

1. Agencies- USFW, Great Lakes Waterbird Research Program, University of Michigan- Biological Station- Piping Plover Research Program, University of Minnesota Great Lakes Piping Plover Research Program, PA Department of Conservation and Natural Resources, PA Game Commision.
2. Documents-
    a. Recovery Plan for the Great Lakes Piping Plover (Charadrius melodus), USFWS, 2003.
    b. http://www.birds.com/species/p-t/piping-plover/
    c. http://www.fws.gov/plover/facts.html
    d. Draft Recovery Plan for the Great Lakes Piping Plover (Charadrius melodus), USFWS, 2002.
    e. Great Lakes Piping Plover An Endangered Species pamphlet, USFWS & MIDNR, 2003.

Focal Area: Presque Isle State Park, Coastal beaches along Lake Erie

SECTION 1 – BIOLOGICAL PLANNING

Threats:

1. Loss of habitat- use of dams or other water control structures raise and lower the water. Too little water over a long period of time allows vegetation to grow on the prime nesting beaches making these sites unsuitable for nesting.

2. Elevated predator densities within plover habitat (gulls, raccoons, fox, dogs, feral cats).
3. Human disturbance- too much human disturbance can cause adults to abandon nest (example of disturbance include human presence, fireworks, and boating activities).

Conservation Goals: Specifically geared to Great Lakes population.

1. Restore and maintain a viable population (95% or greater chance of persisting 100 years) to the Great Lakes region.
2. Remove Great Lakes population from the list of Threatened and Endangered Species by 2020.
3. Reach at least 150 pairs with at least 100 breeding pairs in Michigan and 50 breeding pairs distributed amongst other Great Lake states.
4. Five year average fecundity within a range of 2.0 fledglings per pair per year.
5. Genetic diversity adequate for population to persist and be maintained long-term.
6. Essential breeding habitat in the Great Lakes and wintering habitat protected. * 1-6 ref: (http://ecos.fws.gov/docs/recovery_plans/2002/020805.pdf).
7. Establish a breeding population on Presque Island State Park (PA DCNR).

Partners: PA Department of Conservation & Natural Resources, University of Michigan, University of Minnesota, Great Lakes Waterbird Research Program

Needs: 1. Research for spatial requirements for piping plover breeding. 3.7 miles of shoreline have been preserved for migratory and coastal birds, but is it enough? 2. A large enough buffer from the beach to human disturbances on Presque Isle State Park?

SECTION II – CONSERVATION DESIGN

Conservation Strategies:

1. Use of enclosures and fencing to increase hatching, breeding, and survival of fledglings.
2. Habitat restoration by developing a sparse vegetation management plan and appropriate beach nourishment strategies.
3. Consider possible land acquisitions on Presque Isle State Park to increase habitat preservation, habitat restoration, or increase buffer areas from critical habitat to disturbance areas.

Partners: University of Michigan, University of Minnesota, PA Department of Conservation & Natural Resources, Michigan Department of Natural Resources, Alabama DNR, Florida DEP- Beaches and Coastal, Texas Parks and Wildlife Department

Needs: 1. Management plan for Presque Isle State Park that includes a plan to restrict access to critical habitat during breeding season.

SECTION III – CONSERVATION DELIVERY:

Existing Actions:

1. (2010) PA Game Commission was awarded a grant to restore 7 acres at Gull Pointe, Presque Isle State Park.
2. (2010) USFWS completed information Section 7 consultation for a project developed by USACE to remove several tombolos and reuse sand for shoreline nourishment. This would also increase sand deposition along the shoreline. This project would also increase monitoring to 5 times per week during peak breeding season, and more than twice a week pre and post breeding season.
3. USFWS has developed a partial recovery plan and has conducted 5 year reviews for Great Lakes population.

Partners: University of Michigan, University of Minnesota, PA Department of Conservation & Natural Resources, Michigan DNR, Michigan Department of Natural Resources, Alabama DNR, Florida DEP- Beaches and Coastal, Texas Parks and Wildlife Department, PA Game Commission, USACE

Needs:

1. Support grants that are specific to land acquisitions, like the Point Betsie Land Acquisition, which received $550,000 in funding.
2. Support grants that address land restoration of critical habitat, like the grant drafted by PA Game Commission in 2010, mentioned under existing actions in this section.
3. Combine data from all interested parties/partners to develop a common and agreeable management plan for piping plover at Presque Isle State Park.
4. Decrease predator populations on Presque Island (crab, raccoon, rats, fox, etc).
5. More stringent regulations regarding human disturbance along preserved lands on Presque Island State Park, including boat traffic.
6. Continue to fund and support fencing methods around nests as these methods have proven to be very successful (http://www.nps.gov/slbe/forteachers/upload/GLPloverdoc.pdf).
7. Boost public awareness at Presque Isle State Park regarding their population of piping plover.

SECTION IV: MONITORING AND RESEARCH:

Key Date Gaps: Information lacking in achieving the conservation of the piping plover within PA:

1. How many plovers were in Erie County before they were really impacted or extirpated in 1950s?

2. Where does the small population in Presque Island State Park overwinter now? Although this may not directly concern PAFO, it may help us identify pressures at the wintering location and lead to a partnership.

Partners: PA Department of Conservation & Natural Resources, PA Game Commission, USACE

Needs:

1. Support monitoring actions conducted by Presque Isle State Park, USACE, PA Game Commission, PA DCNR, partners or any of their contractors. Like the monitoring actions proposed by the USACE in their 2010 project, mentioned previously in Section III, Existing Actions #2.
2. Consider and funding for a plan for abandoned eggs to be reared in captivity with the intent to release. This process has been successful for Dr. Francesca Cuthbert of USFWS in 1997-1998 (http://www.fws.gov/northeast/nyfo/es/GLplover03.pdf., pg 43).
3. Support studies specific to genetic diversity and conservation within the Great Lakes population, most concerned with the subpopulation inhabiting Presque Isle State Park. (?? $)
4. Research methods to maximize fecundity.
5. University of Michigan has two research projects ongoing:
    a. Erin Roche is studying the migratory route of the Great Lakes for the piping plover; and
    b. Francesca Cuthbert is on a project funded by Michigan DNR.

    *perhaps PA agencies/partners can assist wherever possible in research that would include piping plover on Presque Isle State Park.
6. Continual surveying and monitoring in Presque Isle State Park. Information gathered should then be placed into a GIS layer. A previous grant submittal estimated almost $230,000 to fund a project like this for 3 years.

FY11 Actions: Needs to further evaluated and finalized in group discussion.

SECTION III – FOCAL AREAS

Each PAFO Focal Area is defined by:

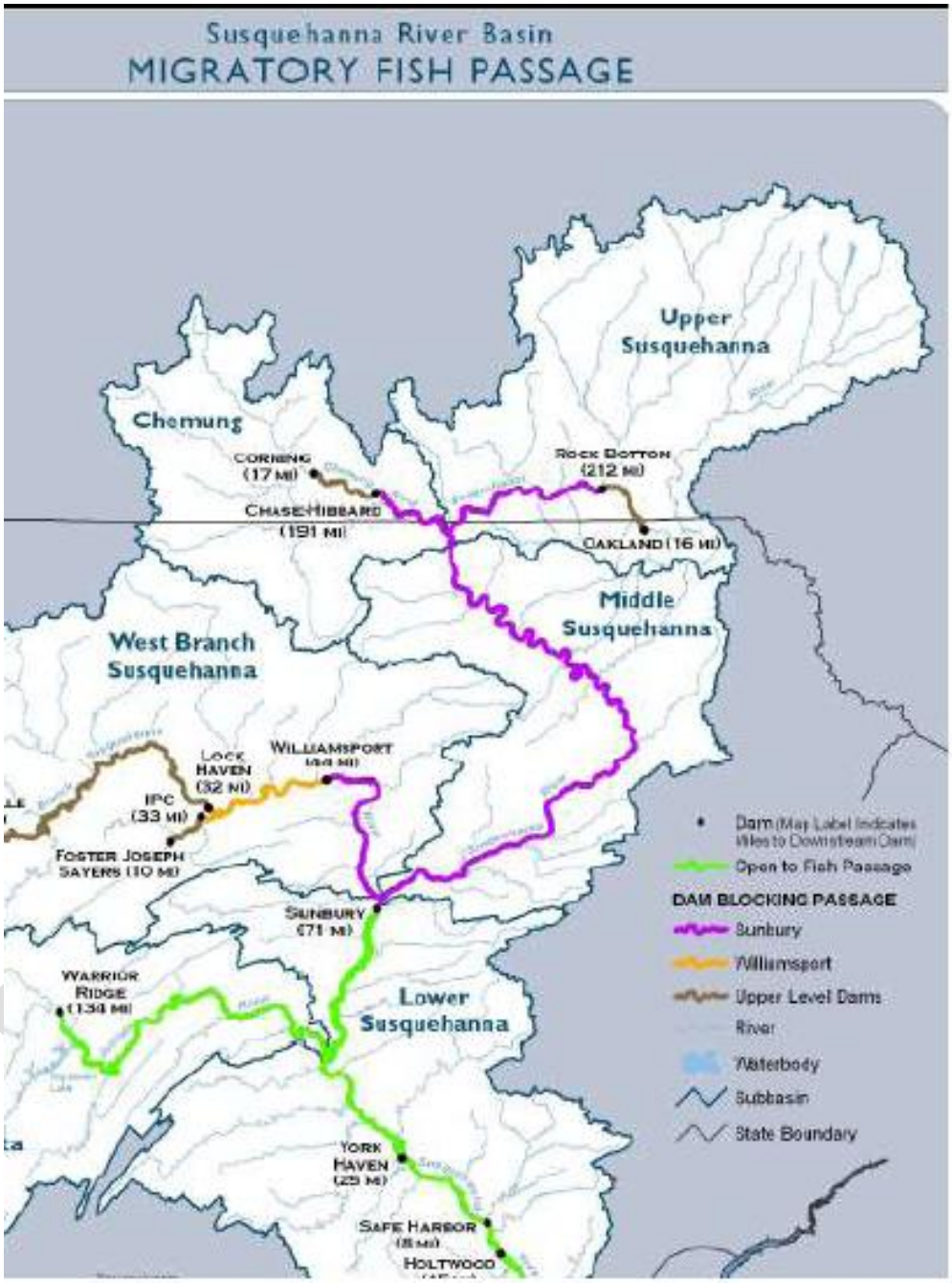
- Habitat
- Purpose
- Location

Susquehanna River Mainstem Focal Area

The Susquehanna River Mainstem Focal Area consists of the portion of the Upper Susquehanna River located in Pennsylvania and the mainstem of its major tributaries. It is defined as follows:

- Habitat: Mainstem rivers within the banks
- Purpose: Address river passage, water withdrawal, and flow issues, especially as these issues affect American shad and related umbrella species.
- Location: See maps


Susquehanna River Basin
SUBBASINS
Upper Susquehanna
Chemung
West Branch Susquehanna
Middle Susquehanna
Lower Susquehanna
Juniata
Cooperstown
Binghamton
Elmira
New York
Pennsylvania
Towanda
Wilkes-Barre
Nanticoke
Williamsport
Lock Haven
Berwick
Lewisburg
Northumberland
Sunbury
Mahaffey
Lewistown
Thompsontown
Huntingdon
Frankstown
Hollidaysburg
Vandyke
Duncannon
Harrisburg
Bedford
Columbia
Pennsylvania
Maryland
Havre de Grace
0 5 10 20 Miles
SRBC
Susquehanna River Basin Commission
Major Water Features: National Hydrography Dataset (NHD), USGS
Disclaimer: Intended for Educational Display Purposes Only
SRBC (1183c) 06-11-2009


Susquehanna River Basin
MIGRATORY FISH PASSAGE
Upper Susquehanna
Chemung
CORNING (17 MI)
ROCK BOTTOM (212 MI)
CHASE/HIBBARD (191 MI)
OAKLAND (16 MI)
Middle Susquehanna
West Branch Susquehanna
LOCK HAVEN (32 MI)
WILLIAMSPORT
IPC (33 MI)
FOSTER JOSEPH SAYERS (10 MI)
SUNBURY (71 MI)
WARRIOR RIDGE (134 MI)
Lower Susquehanna
YORK HAVEN (25 MI)
SAFE HARBOR (8 MI)
HOLTWOOD
Dam (Map Label Indicates Miles to Downstream Dam)
Open to Fish Passage
DAM BLOCKING PASSAGE
Sunbury
Williamsport
Upper Level Dams
River
Waterbody
Subbasin
State Boundary

Early Successional Forest Habitat Focal Area

The early successional forest habitat focal area consists primarily of the Appalachian Ridge and Valley section of Pennsylvania extending from Maryland to New York. It is defined as follows:

Habitat: Early successional forest with stem densities greater than 12,000 stems per acre. For benefit to golden-winged warbler an elevation range of 1,500 – 3,500 feet should be attained.

Purpose: Complete habitat restoration by either planting shrubs and trees to specified density or cutting of mature and pole-sized forest timber in large areas, on a rotational basis, and allow natural succession for maximum benefit.

Location: See map.

Headwater Wetlands of Southeastern PA Focal Area

The Headwater Wetlands of SE PA Focal Area consists generally of the bog turtle habitat in the 15 counties in the southeastern portion of Pennsylvania.

Habitat: Boggy wetlands appropriate to support nesting, foraging, and hibernating for bog turtle.

Purpose: Protecting, conserving, and restoring bog turtle habitat through easement, project review and technical assistance, and partnered-focused habitat restoration.

Location: See map.

Central PA Headwaters Focal Area

Habitat: Clean, cold streams, such as are found in the headwaters of north and central PA. These areas have dense forest cover and reduced areas of development.

Purpose: To protect the intact and present populations by influencing regulators to reduce damaging activities in these areas; and to improve or restore habitat in areas of reduced and greatly reduced populations by implementing restoration projects or removing fish passage barriers.

Location: See map.

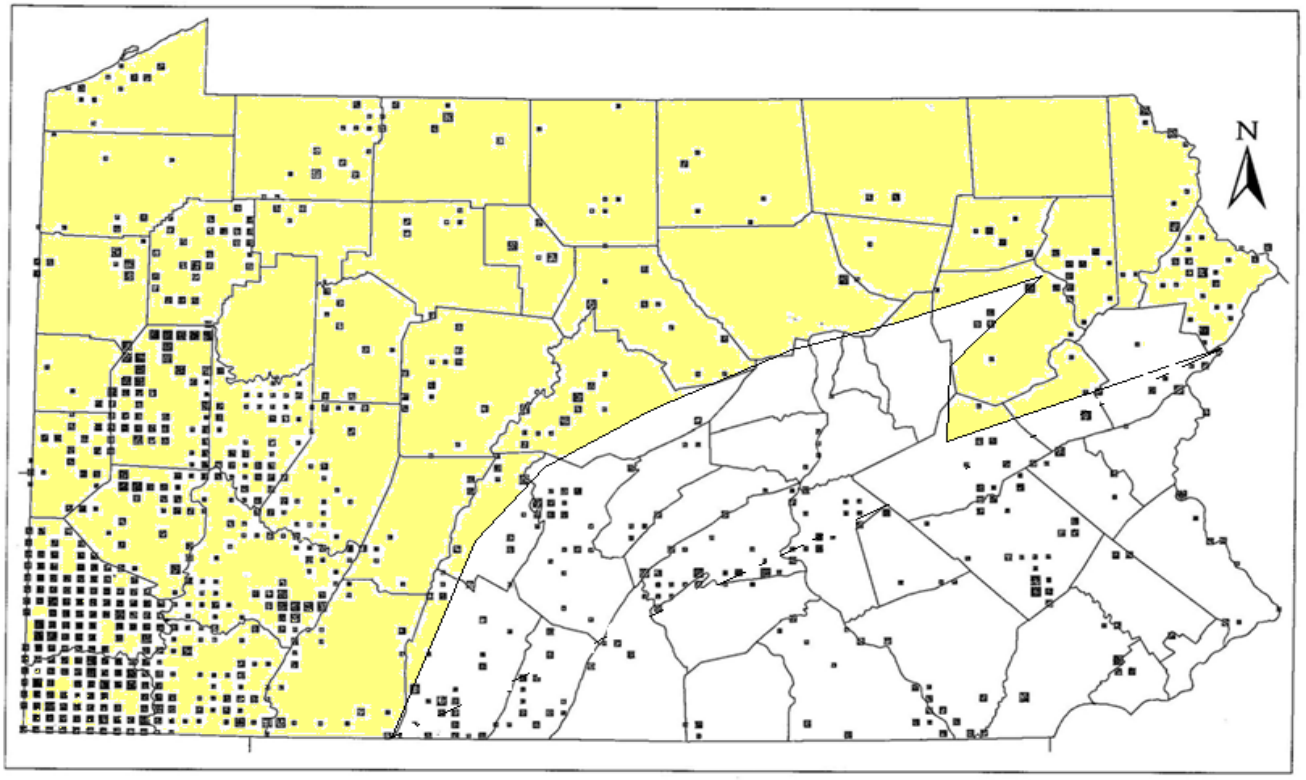
Mature Forest Ridgetops and Bottomlands Focal Area

This Focal Area addresses the forest habitat in Ohio Hills and Allegheny Plateau Physiographic Regions, by overlaying key habitat for Cerulean warblers and associated species with targeted natural gas development areas.

Habitat: Tall, broken canopy with very large oaks and hickories on ridge tops and tall sycamores in riparian bottomlands.

Purpose: Address threat of oil and gas development to the removal of forest habitat used by Cerulean warblers and associated species.

Location: See map.



Upper Delaware River Focal Area

Habitat: Mainstem river reaches, especially the slow-moving edges used by the Dwarf Wedgemussel.

Purpose: Develop flow regimes to benefit the Dwarfwedgemussel and related species.

Location: The Upper Delaware River reaches.

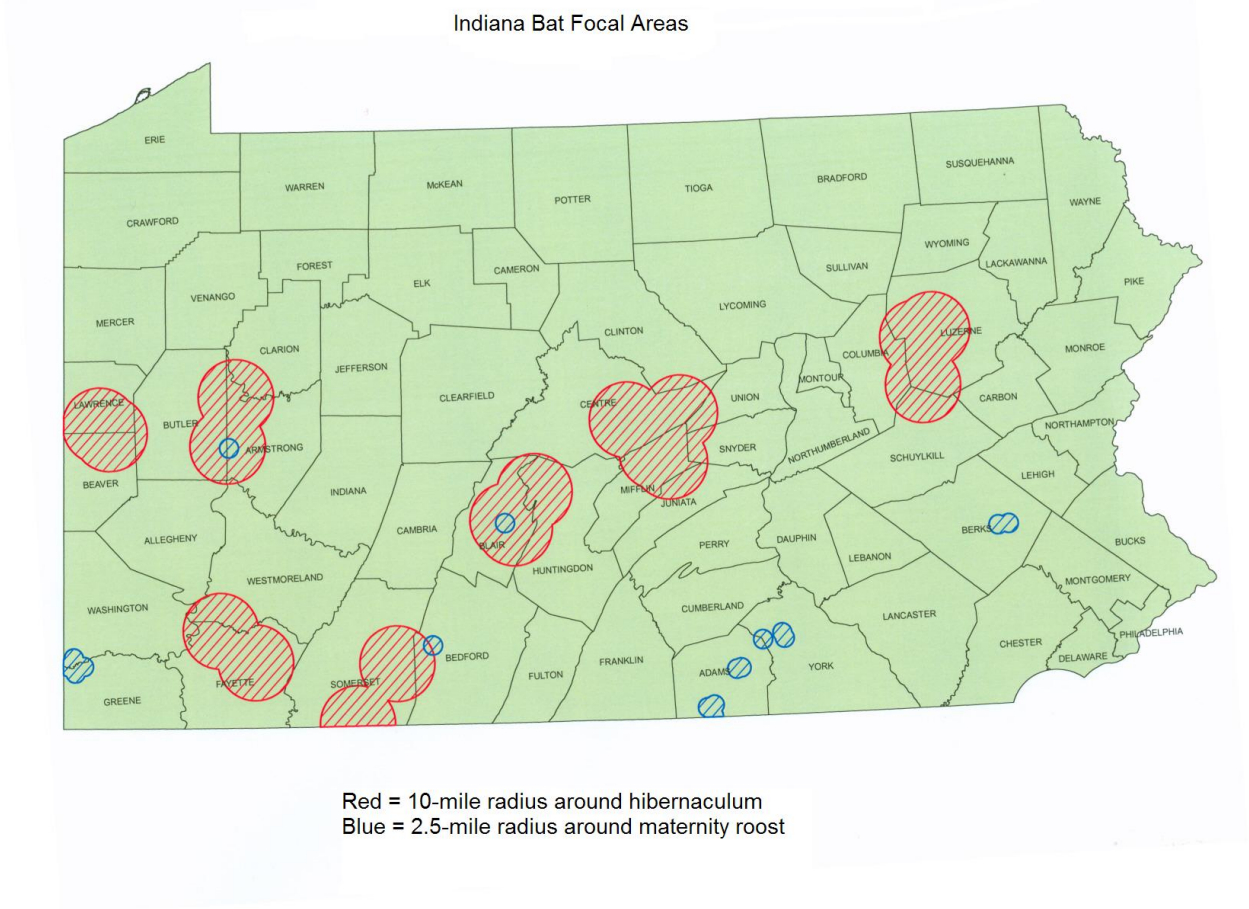
Indiana Bat Zones of Concern Focal Area

The Indiana bat focal area includes known hibernating, swarming, and maternity habitat.

Habitat: The habitat of concern includes hibernacula (caves and mines), and forests and woodlots within a 10-mile radius around each hibernaculum. Summer maternity habitat includes forests and woodlots within a 2.5-mile radius around identified maternity roost trees. Where no roost trees have been identified, summer maternity habitat is defined by a 5.0-mile radius around a summer capture location for a reproductive female or a juvenile bat.

Purpose: Conserve hibernating, swarming, and maternity habitat for known Indiana bat populations. Reduce threats to Indiana bats and their habitat within focal areas, particularly threats posed by mining, oil and gas development, timber harvesting, and residential and commercial development.

Location: See map.



Ohio River and Allegheny River Focal Area

The Ohio River and Allegheny River Focal Area consists of these two rivers in Pennsylvania, as well as certain Allegheny River tributaries, and watershed reaches affecting these rivers.

Habitat: The riverine areas used by mussels, and affected by water runoff that could impact water quality.

Purpose: Protect water quality necessary for listed and candidate mussel species.

Location: See map.

Presque Isle Focal Area

The Presque Isle Focal Area consists of the peninsula itself of the coast of Erie, PA. It is defined as follows:

Habitat: Presque Isle coastal areas and sandy beaches, including historic occurrence and future rehabilitation of those beaches.

Purpose: Nesting, breeding, and related foraging for the piping plover and similar shorebird umbrella species.

Location: See map.