
SECTION 17 – SEASONAL WETLANDS (VERNAL POOLS)

(adapted from Zimmerman 2004, Maret 2005, and Appendix 2)

Seasonal pool wetland ecosystems, known commonly as “vernal ponds,” are isolated from streams, rivers, and other bodies of water and characterized by a seasonally fluctuating water level, often drying out completely for some part of the year. Vernal ponds are often small, seemingly “minor” waterbodies that are particularly important to amphibian populations.

These habitats provide breeding sites for wetland wildlife that are not populated by predatory fish or other major predators. The lack of predatory fish allows greater productivity and thus, these pools are critical habitat for an assortment of wetland species. The periodic drying of these pools keeps fish and other aquatic predators at bay, allowing for great productivity of amphibian populations. Forested or herbaceous cover around the pools also provides cover amid the leaf litter for adults traveling to and from the breeding pools, and keeps water temperature moderated.

Vernal ponds dry up in summer and only contain water during wetter months of the year. As a result of this periodic drying, species requiring water year-round are not able to survive. These ecosystems are a significant component of Pennsylvania's natural heritage and provide critical habitat for a unique set of species adapted to seasonal wet and dry periods such as salamanders, frogs, and fairy shrimp.

Seasonal pools are beginning to gain recognition as important habitats because of their unique role in the landscape, their valuable wetland function, and the critical habitat they provide for plants and animals of special concern.

17.1 Location and Condition of Seasonal Wetlands

In Pennsylvania, acid precipitation (Rowe *et al.* 1992), chemical contamination (Semlitsch 2003), forest management activities (DeMaynadier and Hunter 1999, Naughton *et al.* 2000), and outright destruction affect both the quality and quantity of seasonal wetlands. Vernal ponds are further threatened by disturbance of habitats surrounding them. Fragmentation of forests and isolation of riparian areas from woodland areas restricts the access of terrestrial amphibians to these important habitats. Water quantity is also a particular concern for these important amphibian habitats because they are ephemeral by nature, with many occurring in upland areas where water bodies are limited. Because vernal pools are periodically wet/dry, they are more vulnerable to falling water tables than many other water bodies.

There is limited information available on the statewide location and occurrence of seasonal pools. In order to contribute to the protection of seasonal pool ecosystems, we need to know where they are, learn more about their ecology, and identify the types of seasonal pools most critical for biodiversity conservation. These wetland systems represent some of the more poorly-studied wetland community types in eastern North America. Resource managers and

regulators throughout the region are in great need of information to protect and manage these systems. An effort to map and classify vernal ponds throughout the state would be a useful step in identifying important habitats. (As an outcome of WAP development, such a program was selected to receive SWG '04 funding).

17.2 Threats to Seasonal Wetlands and Associated Species

(adapted from Maret 2005)

The primary threat facing seasonal wetlands and associated species is habitat loss/destruction. Many seasonal pool wetlands are in danger of being destroyed because it's easy to overlook them, given their temporary status as inundated wetlands. Additionally, a recent U.S. Supreme Court decision greatly reduced the protections afforded to wetlands "isolated" from navigable waters, elimination federal protection of these sites under the Clean Water Act (Gibbons 2003) [Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (No. 99-1178; SWANCC)].

In Pennsylvania, vernal pools are regulated as wetlands under Chapter 105 of the PA Code (PA Code, DEP 2000), but permits can be acquired for pond alteration or destruction. Loss of isolated wetlands not only causes immediate loss of habitat, but also changes the spatial configuration of, and distance between, remaining ponds, thereby affecting movements and recolonization processes of dependent species (Semlitsch 2003).

Water quantity is an emerging issue in managing aquatic resources. Surface and groundwater withdrawals affect stream flows, vernal pool occurrence and wetland hydrology. Currently, regulatory authority is very weak relative to such impacts. For example, Delaware River Basic Commission regulations do not address impacts of groundwater or surface water withdrawals on the biota of southeastern Pennsylvania – a heavily-impacted region. Even where such authority exists, vernal pool impacts have not been assessed. Groundwater regulations are based on the lowest annual quantity of groundwater available once every 25 years, regardless of the impact of this level of withdrawal on biota and aquatic habitat. Withdrawal levels may have significant impacts, particularly during low flow conditions. Evaluation of groundwater withdrawal impacts on priority sites and systems is a conservation and management priority.

Another potential threat to species associated with seasonal wetlands is habitat disturbance and mortality associated with timber harvest. Several studies have documented negative effects of timber harvest on ambystomatid salamanders (e.g. DeMaynadier and Hunter 1999, Naughton *et al.* 2000). Chazal and Niewiarowski (1998) found no difference in survival of recently metamorphosed mole salamanders placed in forested and clearcut habitats, suggesting that is the process of timber harvest itself, rather than the associated habitat change, that is detrimental to salamanders. Therefore, attention to adequate buffer widths around seasonal wetlands during timber harvests should help minimize mortality of these species.

Other potential threats to associated and obligate species include road mortality and reduced dispersal associated with increased development (Gibbs 1998), acid precipitation (Rowe *et al.* 1992), chemical contamination (Semlitsch 2003), infectious diseases (Carey *et al.* 2003), and habitat changes associated with global warming (Brooks 2004).

There are several factors that may have caused the decline of seasonal wetland-associated salamanders in Pennsylvania: 1.) The destruction of vernal pools, ponds and wetlands has reduced and destroyed the amount of breeding habitat; 2.) Pollution of wetlands, ponds, lakes and vernal pools from contaminants such as acid mine drainage, road salt, storm-water run-off, phosphates and nitrates; 3.) Aerial spraying of pesticides and herbicides, especially near breeding wetlands, can contribute to population declines; 4.) The destruction and removal of vegetation along the margins of swamps, bogs, ponds and lakes and; 5.) Excessive timber harvesting adjacent to breeding wetlands leads to premature wetland drying and warming of the forest floor (Koval 2005).

Given that the Pennsylvania endangered spadefoot toad occurs in floodplains and valleys, they are threatened by habitat destruction from residential and industrial development, as well as habitat alteration and changes in water chemistry from agricultural practices (Jansen *et al.* 2001, Wildlife in Connecticut 1999). The eastern spadefoot was recently listed as a state endangered species because of heavy habitat alteration throughout its range and its limited presence in Pennsylvania. The waters they breed in can be temporary pools, which are not necessarily delineated wetlands. Consequently, wetland regulations cannot be relied upon to provide sufficient protection for this species.

17.3 Seasonal Wetland-Associated Species

Table 17.1: WAP-Priority species associated with seasonal wetlands in Pennsylvania.

SPECIES	SPECIFIC HABITAT ASSOCIATION
IMMEDIATE CONCERN	
Mountain Chorus Frog – R <i>Pseudacris brachyphona</i>	vernal pools and spring seeps within wooded slopes of deciduous forests. Slow-moving streams and ditches with abundant vegetation along edges
Spotted Turtle – R <i>Clemmys guttata</i>	soft-bottomed aquatic habitats, including small streams, marshes, swamps, and vernal pools with upland forests or open habitats
HIGH LEVEL CONCERN	
Eastern Spadefoot <i>Scaphiopus holbrookii</i>	temporary/ephemeral pools in depression areas in agricultural settings with sandy to loamy soils

New Jersey Chorus Frog <i>Pseudacris triseriata kalmi</i>	permanent and temporarily inundated habitats including forested swamp, marshes, wet meadows, floodplains, riparian corridors, ditches, and canals
Northern Cricket Frog <i>Acris crepitans</i>	lakes, bogs, ponds, vernal pools and large open water marsh with vegetated shores and edges
RESPONSIBILITY SPECIES	
Jefferson Salamander –R <i>Ambystoma jeffersonianum</i>	vernal pools in mixed deciduous forests - primarily upland sites
PENNSYLVANIA VULNERABLE	
Upland Chorus Frog <i>Pseudacris feriarum</i>	open palustrine emergent wetlands mixed with small, shallow areas of temporary standing water in forested areas
Western Chorus Frog <i>Pseudacris triseriata</i>	open palustrine emergent wetlands mixed with small, shallow areas of temporary standing water in forested areas
MAINTENANCE CONCERN	
Four-Toed Salamander <i>Hemidactylium scutatum</i>	forest with adjacent wetlands containing sphagnum hummocks (such as bogs, swamps, fens, wet meadows, vernal pools and the edges of lakes and ponds)
Marbled Salamander <i>Ambystoma opacum</i>	vernal pools in mixed deciduous forests - both upland and floodplain sites
Northern Leopard Frog <i>Rana pipiens</i>	temporary pools and wet meadows for breeding, with adjacent grass/old field foraging areas

17.4 Conservation and Management Needs for Seasonal Wetlands

There is a growing body of research-based literature regarding seasonal pool ecology and fauna of seasonal pool ecosystems. The Pennsylvania Natural Heritage Program has previously conducted preliminary studies of seasonal pools in the Central Appalachian Forest Ecoregion aimed at deriving significant invertebrate indicator species. Current research at Shippensburg University is looking at genetic flow in amphibians in and between seasonal pool clusters. Other studies, including some conducted in Pennsylvania, have examined the effects of various environmental variables such as pH, hydroperiod and clear-cutting on seasonal pool amphibians and proposed buffer sizes.

Most vernal pool studies have been focused primarily on one or a few species groups, took place in a small geographic area, or were based upon just a few sites. A need remains for a more comprehensive study that incorporates a larger-scale approach and larger sampling intensity across different ecoregions in the state. More work is needed to determine differences in ecosystem structure, geological and landform differences, and the effects of forest management activities on seasonal wetland systems. Additional research needs include: 1.) Examination of the effects of habitat loss and fragmentation on population viability and dispersal, particularly in relation to metapopulation dynamics, and 2.)

Determination of the effects of chronic acidification of aquatic and terrestrial habitats on survivorship and population viability.

Beyond research, conservation of associated species requires protection of vernal ponds and spring seeps, as well as appropriate management of surrounding forested habitats. With the loss of federal protection provided previously by the Clean Water Act, increased state and local protections for isolated wetlands are necessary. Although isolated wetlands in Pennsylvania receive some protection under Chapter 105 of the PA Code, permits often can be acquired for wetland alteration or destruction (Pennsylvania Code 2005). Remaining high-quality complexes should be given high priority for protection.

Because of their complicated lifecycle, most associated species require unobstructed access to both terrestrial and aquatic environments. Adequate terrestrial habitat around vernal ponds and spring seeps is required for adult salamanders (Semlitsch 1998, Gibbons 2003). For ambystomatid salamanders, it has been recommended that a protected area or buffer zone extend 164 meters (Semlitsch 1998) to 175 meters (Faccio 2003) from vernal ponds. Because some salamanders (such as the Jefferson salamander) appear to move farther from ponds, occasionally in excess of 600 meters (Petranka 1998), these recommendations may be conservative.

In Pennsylvania, some protection of habitats during timber harvest is provided on State Forests by regulations requiring a 30-meter buffer of "no disturbance" habitat and an additional 30-meter buffer of partial-cut habitat (retaining 50 percent canopy cover) around vernal pools. However, based upon information on salamander movements, these buffer widths may not be adequate to ensure protection. No buffer protection is presently required for habitats in privately-owned forests, a high percentage of which are maturing to commercially-valuable stages.

Similar to the situation with rock habitats, small emergent wetlands, and other isolated, disjunct habitats, species associated with seasonal wetlands often demonstrate a metapopulation demographic structure. Therefore the best strategy is to protect small wetlands and conserve them in groups rather than as isolated entities (Johnson *et al.* 2000, Wright and Butchkoski 2005).

Based on the outcome of surveys, an effort should be made to identify exemplary seasonal wetland complexes, as well as areas of the state where habitat destruction/degradation is seriously impacting seasonal wetland systems and the populations of associated species. Within these areas, efforts should be made to reduce/reverse negative impacts through a combination of landowner outreach and technical assistance to public and private land managers, enhancements to public lands management policies and practices, and public education. Multi-species management guidelines should be developed that provide information on protective measures/management of these habitats. In light of the recent

elimination of federal protection for these sites, state-level legislative action could be taken to provide permanent protection to existing vernal ponds.

Because of the extensive use of upland habitat by many species associated with small wetlands, terrestrial buffer zones should be maintained and managed around priority wetland sites. Because many wetland-associated species (spotted turtles and other high-priority species) travel considerable distances on land, destruction of terrestrial habitats can dramatically affect target populations, particularly if these habitats serve as corridors between wetland habitats. The loss of proper reproductive habitat compounds this problem by causing breeding individuals to travel further overland in search of suitable conditions, thereby putting them at greater risk. Gibbs and Shriver (2002) created a model of the effects of road mortality on turtle populations, and concluded that persistence of semi-terrestrial turtles such as those of the genus *Clemmys* are jeopardized by road densities characteristic of much of the eastern United States.

Additionally, effort should be directed toward implementing best-management conservation practices in the uplands surrounding high-priority seasonal wetlands. Such targeted management could include Farm Bill incentives and programs (CREP, EQIP, WHIP, etc.), stream-bank fencing, riparian overstory restoration, and idling highly erosive cropland. In one study in southwest Wisconsin, as land use changed from row crop to CRP, fish communities in local streams shifted from populations dominated by eurythermal tolerant species to coldwater communities. These changes included greater brown trout abundance and improved coldwater Index of Biotic Integrity scores. Biological data suggests that water quality improved and favorable cold-water temperatures were restored in the streams. Intensive water chemical sampling was not performed but phosphorus export coefficients and unit area runoff rates were derived from similar land uses in nearby watersheds. Predicted phosphorus loads declined by approximately 84 percent and surface runoff water declined by about 70 percent from CRP lands. It is likely that such findings also pertain to seasonal wetlands and associated uplands. Therefore, continued support for conservation provisions under the Farm Bill, USDA, and other relevant programs should be a priority for all stakeholders involved with conservation of seasonal wetlands and wetland-dependent species.

Creation and observance of protective buffers surrounding wetlands is a vital strategy for their long-term conservation. However, different buffer widths are likely required by different species. Several studies have recognized the importance of upland habitats surrounding wetlands to spotted turtles and have made recommendations for their preservation (e.g., Perillo 1997, Joyal *et al.* 2001, Milam and Melvin 2001, Semlitsch and Bodie 2003). Buffer widths of 150-275 meters have been recommended for a variety of aquatic and semi-aquatic turtle species (Burke and Gibbons 1995, Buhlmann and Gibbons 2001, Bodie 2001). Perillo (1997) and Milam and Melvin (2001) recommend buffer widths of 200 meters and 400 meters, respectively, specifically for spotted turtles.

Finally, long term monitoring of seasonal wetland quality and abundance will be a necessary effort in conserving WAP-Priority species that depend on such habitats. After an initial statewide inventory of vernal pools is completed (funded with SWG '04), this information should provide a baseline for long term monitoring efforts. Monitoring of vernal pools and other shallow wetlands would provide much-needed information on habitat availability and trends for WAP-priority species including spotted turtles, Jefferson salamanders, marbled salamanders, chorus frogs, cricket frogs, and leopard frogs.

17.5 STATEWIDE PRIORITY CONSERVATION ACTIONS – SEASONAL WETLANDS

Level 1 Needs – highest priority over the next 1-5 years

- **Inventory Seasonal Wetlands**

Target: To develop a seasonal pools registry and research program that will increase interest in identifying, locating and studying seasonal pools in Pennsylvania.

Measure: Project initiated (SWG '04 project)

Issue: Seasonal wetland systems represent some of the more poorly studied wetland community types in eastern North America and resource managers and regulators throughout the region are in great need of information to protect and manage these systems. There is limited information available on the composition or location of seasonal pools.

Prioritized Implementation Actions:

Level 1

- Develop criteria for the identification of seasonal wetlands
- Develop list of indicator species
- Map and classify vernal ponds
- Build an inventory and database to manage location information

Level 2

- Propose practical field techniques to enable land managers to recognize and identify seasonal wetlands
- Encourage public and private land managers to enter locations of seasonal wetlands in statewide database(s)

Coordination:

Pennsylvania Game Commission
 Pennsylvania Fish and Boat Commission
 Department of Conservation and Natural Resources
 Western Pennsylvania Conservancy

- **Technical Assistance to Private Landowners**

Target: Target PGC's PLAP outreach and other forms of landowner outreach to priority seasonal wetlands, seasonal wetland complexes and priority species occurrences.

Measure: Public contacts; materials developed; attendance, and volume of request for educational materials.

Issue: Public land holdings are not sufficient for the long-term conservation and management of priority species. Private landowners control the majority of seasonal wetlands in Pennsylvania. Consequently, management practices on private lands will define the distribution and condition of seasonal wetland habitats in much of Pennsylvania. Technical assistance to private landowners should focus on educating landowners about the sustainable management practices and providing incentives to landowners of priority sites and habitats.

Prioritized Implementation Actions:

Level 1

- Use landowner outreach to help ensure that highest-priority sites and complexes are not inadvertently destroyed.
- Disseminate management guidelines to relevant businesses and landowners.
- Continue the PGC's Private Landowners Assistance Program.
- Provide technical assistance/management recommendations from PGC Regional Wildlife Diversity Biologists to high-priority landowners/sites.
- Encourage the implementation of best-management conservation practices in the uplands surrounding high-priority seasonal wetlands.
- Encourage landowners to consider enhancing existing sites if conditions warrant.
- If there is no alternative but to destroy a high-priority site, encourage landowners to delay the work until the end of vulnerable periods (e.g. reproductive, hibernation periods).

Level 2

- Support and develop programs that engage private landowners in sharing information about the benefits of practicing sustainable management.
- Support and develop tax and other incentives that encourage private landowners of forestlands and farmlands to employ proper management practices on their lands.
- Develop multi-species management guidelines on the maintenance and management of seasonal wetlands as part of ongoing forest/farm management procedures.
- Support and implement existing and future habitat conservation funding programs included in the Farm Bill and other state and federal legislation (WRP, GRP, CSP, etc.).

Coordination:

Pennsylvania Game Commission Private Landowner Assistance Program
 Pennsylvania Game Commission Public Access Cooperators
 Pennsylvania Department of Conservation and Natural Resource Service Foresters
 Pennsylvania Biological Survey-Herpetological Technical Committee
 The Nature Conservancy
 Western Pennsylvania Conservancy
 Private landowners
 Industrial stakeholders

Level 2 – priority over the next 5-10 years

• **Ensure Adequate State-Level Protection of Seasonal Wetlands**

Target: Adequate statewide protection of seasonal wetlands

Measure: Efforts initiated

Issue: Protection of wetland habitat is critical for the survival of this and many other species of amphibians. Vernal pools are particularly important breeding habitat and currently have little protection as wetlands at the federal or state level.

Prioritized Implementation Actions:

- Develop public outreach efforts that encourage citizens to identify and protect seasonal wetlands.
- Review guidelines used in Massachusetts Vernal Pool Program (Kenney and Burne 2000) and assess feasibility for use in Pennsylvania.
- Conduct in-depth studies of current habitats that support breeding populations to identify priority sites and determine causes of declines.
- Ensure protection of highest-priority sites and seasonal wetland complexes.
- Ensure protection of adjacent wetlands, meadows and forested habitat at high priority sites.

Coordination:

Pennsylvania Game Commission

Pennsylvania Fish and Boat Commission

Department of Conservation and Natural Resources, Bureau of Forestry, State Parks

Public/private research institutions

Conservation partners

Conservation and economic stakeholders

• **Monitoring and Adaptive Management of Seasonal Wetlands**

Target: Develop a standardized protocol to periodically assess seasonal wetlands in order to identify trends and detect changes in condition and abundance of seasonal wetland habitats.

Target species that would benefit from monitoring of seasonal wetlands include: spotted turtles, Jefferson salamander, marbled salamander, chorus frogs, cricket frogs, and leopard frogs.

Measure: Seasonal wetland quantity and quality indices

Issue: Because many seasonal wetlands are undergoing direct and indirect degradation that could have significant impacts on wetland-associated species, we must have reliable information on the changing availability and quality of these habitats. The statewide inventory of seasonal wetlands currently being developed (with SWG '04 funding) could provide a baseline of information to begin long term monitoring of sites. Synthesis of this product and other potential sources of habitat information should provide a background for consideration of population trends and conservation actions targeting priority species associated with seasonal wetlands.

Prioritized Implementation Actions:

Level 1

- Produce a preliminary inventory of seasonal wetlands in the Commonwealth based upon SWG'04 project information
 - Identify the condition of wetland and waterbody buffers
- Level 2
- Periodically assess seasonal wetland quantity and quality throughout the state or priority regions
 - Use GIS in conjunction with field studies to produce a more fine-scale definition of suitable habitat for high-priority vernal pool species and assess temporal changes in habitat availability
 - Assess habitat quality by examining reproductive output of wetland-associated species targets in different habitats, perhaps by intensive studies located in various sites (IBAs, IMAs, (IHAs), etc).

Coordination:

Pennsylvania Department of Conservation and Natural Resources- state parks, forests
 Pennsylvania Department of Environmental Protection
 Pennsylvania Game Commission- state game lands
 US Fish and Wildlife Service – wetlands monitoring inventory data update
 US Army Corps of Engineers- wetlands protection
 US Department of Agriculture, US Forest Service- Allegheny National Forest
 US Department of Agriculture, Natural Resources Conservation Service- CREP
 Counties and Municipalities- comprehensive planning
 The Nature Conservancy – easements and research
 Audubon Pennsylvania- Important Bird Areas Program
 Environmental Resources Research Institute, Pennsylvania State University
 GIS and Remote Sensing Center, Wilkes University
 Pennsylvania State Cooperative Wetlands Center, Pennsylvania State University
 U.S. Fish and Wildlife Service Regional Wetland Coordinator

17.6 STATEWIDE PRIORITY CONSERVATION ACTIONS – SEASONAL WETLAND-ASSOCIATED SPECIES

Level 1 Needs – highest priority over the next 1-5 years

- **Presence/Absence Surveys of Priority Species**

Target: Determine whether mountain chorus frog is still extant in Pennsylvania and identify extent of occurrence of New Jersey chorus frog and eastern spadefoot

Measure: Surveys initiated/completed

Issue: One of the difficulties in formulating a conservation plan for the mountain chorus frog, which was historically a Responsibility Species for Pennsylvania, is that no frogs have been reported in more than 25 years. In order to initiate any program designed to protect the mountain chorus frog, we must first document its presence in the state. Species targets: mountain chorus frog, New Jersey chorus frog, and eastern spadefoot.

Prioritized Implementation Actions:

Level 1

- Focus surveys within species’ historic ranges to determine if the target species still occurs in Pennsylvania.
- Survey and identify extant and historical sites throughout species’ ranges.

Level 2.

- Survey other sites of potential habitat throughout their ranges to detect new population occurrences.
- When populations are found, gather information on habitat requirements, non-breeding and hibernation habitats, migration corridors, home ranges, etc.
- Survey areas between known sites to assess for suitability as dispersal corridors.
- Develop a monitoring protocol to record breeding and evaluate population changes at known sites.
- Conduct basic research on all facets of the biology and ecology of target species.
- Monitor historical sites during the breeding season when the males are calling.
- Carefully examine potential breeding sites for the presence of tadpoles.

Coordination:

Pennsylvania Fish and Boat Commission
 Pennsylvania Biological Survey - Herpetological Technical Committee
 Colleges and universities
 Conservation partners

- **Status Assessments of Priority Species**

Target: Establish basic information regarding Pennsylvania population size, structure, viability and management/recovery needs of WAP-Priority species

Measure: Surveys initiated

Issue: The present status of many species associated with seasonal wetlands remains largely unknown, though declines are suspected. Target species to include:

IMMEDIATE CONCERN	HIGH-LEVEL CONCERN	PENNSYLVANIA VULNERABLE	MAINTENANCE CONCERN
SPOTTED TURTLE-R	EASTERN SPADEFOOT	UPLAND CHORUS FROG	JEFFERSON SALAMANDER-R
	NORTHERN CRICKET FROG	WESTERN CHORUS FROG	FOUR-TOED SALAMANDER
			MARBLED SALAMANDER
			NORTHERN LEOPARD FROG

Prioritized Implementation Actions:

Level 1

- Survey and identify extant and historical sites throughout species' ranges.
- Survey other sites of potential habitat throughout their ranges to detect new population occurrences.
- Estimate population size and age structure and assess population health.

Level 2

- Identify life history requirements and optimum habitat characteristics.
- Identify key characteristics of successfully breeding populations.
- Identify extant threats that may jeopardize remaining populations.
- Implement management and recovery actions.
- Survey areas between known sites to assess for suitability as dispersal corridors.
- Develop a monitoring protocol to record breeding and evaluate population changes at known sites.
- Initiate monitoring activities at selected sites to detect changes in population numbers and distribution of priority species.

Coordination:

Pennsylvania Game Commission

Pennsylvania Fish and Boat Commission

Department of Conservation and Natural Resources, Bureau of Forestry

Pennsylvania Biological Survey

Public/private research institutions

Conservation partners

- **Monitoring and Adaptive Management**

Target: Monitor populations that are still relatively abundant to determine trends at the state or regional scale, and gather long-term information on population demographics, status, distribution and abundance to measure population trends in a timely manner and proactively manage target species and habitats.

Measure: Regular monitoring efforts initiated/ongoing

Issue: The most pressing conservation need for many Maintenance Concern Species is to implement a long-term, regular monitoring program. Intensive surveys are needed to determine present distribution and status, particularly in areas of the state with historic records of occurrence but no recent sightings, as well as areas that have not been adequately surveyed. These surveys should be followed up with monitoring activities at selected sites to detect changes in numbers. Target species would include:

IMMEDIATE CONCERN	HIGH-LEVEL CONCERN	PENNSYLVANIA VULNERABLE	MAINTENANCE CONCERN
SPOTTED TURTLE-R	EASTERN SPADEFOOT	UPLAND CHORUS FROG	JEFFERSON SALAMANDER-R
	NORTHERN CRICKET FROG	WESTERN CHORUS FROG	FOUR-TOED SALAMANDER
			MARBLED SALAMANDER
			NORTHERN LEOPARD FROG

Prioritized Implementation Actions:

Level 1

- The sites designated for long-term monitoring should, whenever possible, be situated on public lands.
- Continue and expand the Pennsylvania Herpetological Atlas or similar atlas efforts to include an intensive, statewide frog and toad call survey.
- Assess the feasibility of modeling statewide surveys after the Wisconsin Frog and Toad Survey.
- Conduct surveys of ponds in the spring to assess success of reproduction (adult amphibians in the terrestrial habitat are seldom seen and difficult to monitor).
- Appropriate resource managers should be made aware of the existence of populations at all sites where they are discovered. Whenever possible, management for Immediate Concern Species should be incorporated into appropriate resource management plans for the site(s).
- Support the continuation and participation of public involvement/citizen science projects (such as the PA Herpetological Atlas, USGS Frogwatch Project, and/or the Wisconsin Frog and Toad Survey) that provide data on distribution, abundance and location of seasonal wetlands and associated species.

Level 2

- After several years of initial surveys are completed throughout the state, develop more intensive monitoring for critical breeding habitats and high-priority sites.
- Long-term studies should include mark-recapture procedures and should specifically target population size and structure, as well as reproductive activity and success within the populations.
- Once the locations of populations of Immediate/High-Level Concern species are established through surveys, the populations should be subjected to intensive long-term monitoring.

- Investigation of the various causes of mortality to all life stages of turtles (i.e., predation, road mortality, collecting) to determine the relative impact of each, including determination of methods to reduce mortality during critical life stages.
- Examination of the effects of habitat loss and fragmentation on population viability and dispersal, particularly in relation to metapopulation dynamics.

Coordination:

Pennsylvania Game Commission
 Pennsylvania Fish and Boat Commission
 Department of Conservation and Natural Resources, Bureau of Forestry
 Pennsylvania Biological Survey
 Public/private research institutions
 Conservation partners

Level 2 Needs – highest priority over the next 5-10 years

- **Clarification of Genetic Issues**

Target: Build capacity to identify genetically-distinct populations in order to prioritize conservation efforts most efficiently.

Measure: Effort initiated. This was announced as a PGC SWG Program '05 Priority, and a pilot project is being funded by PGC/PFBC with SWG'05 funds

Issue: It is difficult to appropriately prioritize conservation and recovery efforts for species at the edge of their range, because of questions about Pennsylvania's responsibility role for the species. Efforts will be aimed primarily at WAP-Priority species that are identified as Pennsylvania Vulnerable – i.e., are rare/peripheral in Pennsylvania but not in trouble in the rest of their range. Emphasis on Immediate Concern and High Level Concern species also may be appropriate. Target species would include eastern spadefoot (peripheral species) and Jefferson salamander (hybridization issues in northern Pennsylvania).

Prioritized Implementation Actions:

Level 1

- Identify genetic issues and species targets for which resolution of genetics issues are relevant to species management in Pennsylvania.
- Design genetic research protocols for target species/issues.
- Employ practical methods for assessing genetic diversity of target populations/species using DNA sequence data.
- Refine protocols for interpretation of genetic data.
- Assess the genetic status of disjunct, isolated, fragmented, and peripheral populations of high-priority species.

Level 2

- Develop management recommendations that integrate information on genetic diversity with data on population density and distribution.
- Develop/document “Best Practices” for genetics field research and laboratory analysis of target species

Coordination:

Pennsylvania Game Commission
 Pennsylvania Fish and Boat Commission
 Pennsylvania Biological Survey, Herpetological Technical Committee
 Carnegie Museum of Natural History
 Colleges and universities

• **Research Effects of Habitat Management Activities on Priority Species**

Target: To understand the effects of farmland and forestland management activities on priority species associated with seasonal wetlands

Measure: Research efforts initiated

Issue: There is evidence that salamanders associated with seasonal wetlands are impacted more by the *process* of timber harvest rather than long-lasting habitat effects resulting from timber harvest. This would indicate that careful attention to forest management activities could be an effective conservation tool for these species. The Pennsylvania endangered eastern spadefoot is only found on private land in agricultural settings. Therefore an understanding of farm management activity effects on the species is essential.

Prioritized Implementation Actions:

- Investigate the effect of habitat disturbance from logging on mortality and movements of adult salamanders.
- Assess salamander use of disturbed habitats following the cessation of logging activities.
- Examine the effects of habitat loss and fragmentation on population viability and dispersal, particularly in relation to metapopulation dynamics.

Coordination:

Pennsylvania Game Commission
 Pennsylvania Fish and Boat Commission
 Department of Conservation and Natural Resources, Bureau of Forestry
 Public/private research institutions
 Conservation partners

• **Ensure Adequate State-Level Protection of Priority Species**

Target: Ensure that state-level protection is adequate based upon current information.

Measure: Protection, public education efforts

Issue: Many WAP-Priority reptiles and amphibians are threatened by either commercial and/or private collection or persecution. Most of these species receive no legal protection other than current PFBC regulations allowing individuals with a fishing license to remove from the wild and possess two individuals at any given time. Target species are presented in the following table, however once threats assessments and habitat assessments are completed, other species may be identified that require enhanced state-level protection.

IMMEDIATE CONCERN	HIGH-LEVEL CONCERN	PENNSYLVANIA VULNERABLE	MAINTENANCE CONCERN
SPOTTED TURTLE – R		EASTERN SPADEFOOT	FOUR-TOED SALAMANDER

Prioritized Implementation Actions:

- Review status of species and key threatening processes.
- Revise possession/take regulations, as appropriate, to limit collection and persecution of vulnerable species.
- Continue to revise legal status/listing as new information is available on species’ distribution, abundance, and threats.
- Incorporate knowledge gained from species surveys into regulatory listing/de-listing decisions.
- Incorporate knowledge gained from species surveys into environmental impact review.
- Ensure that new occurrence/species survey data is incorporated into the Pennsylvania Natural Diversity Inventory (PNDI) database in a timely manner.
- Protect occupied sites – determine site-specific threats, develop site management and monitoring plans for occupied habitats, including vegetation and soil management of temporary pools and surrounding upland buffers.
- Pursue conservation easements or direct acquisition of occupied sites.
- Support efforts of the Pennsylvania Fish and Boat Commission’s Non-Game and Endangered Species Division to prosecute individuals involved in commercial exploitation.
- Enter back-logged data on species of concern into the Pennsylvania Natural Diversity Inventory (PNDI) database.
- Track appropriate Immediate Concern, High-Level Concern, Pennsylvania Vulnerable species (in addition to the currently-tracked T&E species) occurrence through PNDI or other conservation planning tools/centralized databases of species’ occurrences.

Coordination:

Pennsylvania Fish and Boat Commission
 Pennsylvania Biological Survey, Herpetological Technical Committee
 Pennsylvania Natural Diversity Inventory
 College and universities
 Conservation partners

17.7 SPECIES OF GREATEST CONSERVATION NEED – SEASONAL WETLANDS

Significant effort was made in the course of WAP development to identify and emphasize the unique role of Pennsylvania in conserving species of concern. A guiding objective of WAP planning was to reach beyond ‘rarity,’ a reactive mode that forces managers to simply document the declines of a species. In order to achieve truly comprehensive, truly proactive

management, managers must begin to direct attention to those species and habitats for which Pennsylvania serves a responsibility role.

Considering species of concern through the dual lens of responsibility *and* imperilment quickly reveals where conservation actions should be directed under the State Wildlife Grants program. Focusing ‘endangered species prevention’ efforts and proactive management on the following species associated with seasonal wetland habitats will provide conservation results that will have the greatest impacts at the state, regional, national, and global levels (Table 17.2).

It is hoped that by careful attention to the habitat conservation needs outlined in Section 17.6, and targeted management of species of greatest conservation need (SGCN), other species will be conserved. Conservation needs of Immediate Concern and High Level Concern are presented at the end of this section. Detailed information on other WAP-Priority wetland species can be found in Appendix 3. Conservation summaries for all Species of Greatest Conservation Need can be found in section 23 of the WAP.

Table 17.2: Species of Greatest Conservation Need Associated with Seasonal Wetlands

	Ohio Hills	Lower Great Lakes	Northern Plateau	Pocono Plateau	Ridge and Valley	Piedmont	Coastal Plain
Mountain Chorus Frog -R	XX						
Spotted Turtle -R		xx		xx	XX	xx	
Jefferson Salamander -R	xx	xx	xx	xx	XX (non-hybrids)	XX (non-hybrids)	

XX – primary area of distribution
xx - secondary area of distribution
(xx) – likely extirpated from area

17.8 SOURCES

- Bodie, J. R. 2001. Stream and riparian management for freshwater turtles. *Journal of Environmental Management* 62(4):443-455.
- Brooks, R. T. 2004. Weather related effects on woodland vernal pond hydrology and hydroperiod. *Wetlands* 24:104-114.
- Buhlmann, K. A., and J. W. Gibbons. 2001. Terrestrial habitat use by aquatic turtles from a seasonally fluctuating wetland: implications for wetland conservation boundaries. *Chelonian Conservation Biology* 4:115-127.
- Burke, V. J., and J. W. Gibbons. 1995. Terrestrial buffer zones and wetland conservation: a case study of freshwater turtles in a Carolina Bay. *Conservation Biology* 9:1365-1369.
- Carey, C., A. P. Pessier, and A. D. Peace. 2003. Pathogens, infectious disease, and immune defenses. Pages 127-136 in R. D. Semlitsch, editor. *Amphibian Conservation*. Smithsonian, Washington, D.C.
- Chazal, A.C. and P. H. Niewiarowski. 1998. Responses of mole salamanders to clearcutting: Using field experiments in forest management. *Ecological Applications* 8:1133-1143
- DeMaynadier, P. G. and M. L. Hunter Jr. 1999. Forest canopy closure and juvenile emigration by pool-breeding amphibians in Maine. *Journal of Wildlife Management* 63:441-450.
- Faccio, S. D. 2003. Postbreeding emigration and habitat use by Jefferson and spotted salamanders in Vermont. *Journal of Herpetology* 37:479-489.
- Gibbs, J. P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. *Journal of Wildlife Management* 62:584-589.
- Gibbs, J. P. and W. G. Shriver. 2002. Estimating the effects of road mortality on turtle populations. *Conservation Biology* 16:1647-1652.
- Gibbons, J. W. 2003. Terrestrial habitat: A vital component for herpetofauna of isolated wetlands. *Wetlands* 23:630-635.
- Jansen, K. P., A. P. Summers, and P. R. Delis. 2001. Spadefoot toads (*Scaphiopus holbrookii holbrookii*) in an urban landscape: effects of nonnatural substrates on burrowing in adults and juveniles. *Journal of Herpetology*, 35(1): 141-145.

- Johnson, G., B. Kingsbury, R. King, C. Parent, R. A. Seigel, and J. A. Szymanski. 2000. The Eastern Massasauga rattlesnake: a handbook for land managers. U. S. Fish and Wildlife Service, Fort Snelling, MN
- Joyal, L. A., M. McCollough, and M. L. Hunter Jr. 2001. Landscape ecology approaches to wetland species conservation: a case study of two turtle species in southern Maine. *Conservation Biology* 15:1755-1762.
- Koval, R. 2005. WAP Species Assessment – Four-Toed Salamander, *Hemidactylum scutatum*. 10 pp. See Appendix 3 for complete species account.
- Maret, T. 2005. WAP Species Account – Marbled Salamander. Refer to Appendix 3 for complete account.
- Milam, J. C. and S. M. Melvin. 2001. Density, habitat use, movements, and conservation of spotted turtles (*Clemmys guttata*) in Massachusetts. *Journal of Herpetology* 35:418-427.
- Naughton, G. P., C. B. Henderson, K. R. Foresman and R. L. McGraw. 2000. Long-toed salamanders in harvested and intact Douglas fir forests of western Montana. *Ecological Applications* 10:1681-1689.
- Pennsylvania Code. 2005. Commonwealth of Pennsylvania, Harrisburg, Pennsylvania. Available <http://www.pacode.com/index.html> (Accessed March 11, 2005).
- Perillo, K. M. 1997. Seasonal movements of and habitat preferences of spotted turtles (*Clemmys guttata*) in north central Connecticut. *Chelonian Conservation and Biology* 2:445-447.
- Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.
- Rowe, C. L., W. J. Sadinski, and W. A. Dunson. 1992. Effects of acute and chronic acidifications on three larval amphibians that breed in temporary ponds. *Arch. Environ. Contam. Toxicol.* 23:339-350.
- Semlitsch, R. D. 2003. Conservation of pond-breeding amphibians. Pages 8-23 in, R. D. Semlitsch, editor. *Amphibian Conservation*. Smithsonian, Washington, D.C.
- Semlitsch, R. D. 1998. Biological delineation of terrestrial buffer zones for pond breeding salamanders. *Conservation Biology* 12:1113-1119.

Semlitsch, R. D. and J. R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. *Conservation Biology* 17:1219-1228.

Wildlife in Connecticut: Endangered and Threatened Species Series. 1999. "Eastern Spadefoot Toad".
<http://dep.state.ct.us/burnatr/wildlife/pdf/esptoad.pdf#search='Scaphiopus%20holbrookii%20endangered>.

Wright, J. and C. Butchkoski. 2005. WAP Species Account – Allegheny Woodrat. Refer to Appendix 3 for complete account.

Zimmerman, E. 2004. Web-based registry and study of seasonal pools in Pennsylvania. Western Pennsylvania Conservancy. Proposal submitted to the PGC for State Wildlife Grants FFY04 consideration.

Appendix 17.1 – Species/Habitat Associations for Seasonal Wetland Habitats

Clearly defining species-habitat associations is somewhat complicated. For each wildlife species, the particular habitat it uses is complex and is often comprised of several parts of a landscape and several land cover types or communities. Additionally, many species change their habitat use during various seasons and life stages. This also complicates the conservation of species and key habitats. Further complicating the effort of associating species with key habitats is that fact that a habitat’s quality and/or function may rely upon unknown and/or off-site mechanisms. In order for a species to be adequately conserved, all aspects of its key habitat(s) must be available in a quantity and quality sufficient for its survival.

Though complicated and fraught with incompleteness, it is nevertheless worthwhile to try to associate species with their key habitats to begin formulating conservation goals and objectives.

The following table contains summary information describing specific species/habitat associations relative to the habitat type covered in this section. This information is in DRAFT form and is in need of further refinement and additional input from technical experts to ensure its accuracy. Currently, Pennsylvania lacks a meaningful way to classify communities relative to terrestrial vertebrates. This is recognized as an ongoing priority by Pennsylvania’s natural resource agencies.

Species-specific information detailing specific habitat requirements, the location and relative condition of key habitats, threats and factors affecting habitat quality and population trends of target species can be found in Appendix 3: WAP-Priority Species Assessments.

Table 17.3. Specific species/habitat associations for seasonal wetland-associated, WAP-Priority species in Pennsylvania.

Category	Dominant Vegetation	Specific types	Micro-quality	WAP-Priority Species	Physiographic Area *
Vernal Pool	W/in deciduous forest		Vernal pool/emergent marsh complexes	Upland Chorus Frog	RV
			Vernal pool/emergent marsh complexes	Western Chorus Frog	LGL
		Upland sites	Ph > 4.5	Jefferson Salamander-R	RV, P (non-hybrids)

			With abundant vegetation along edge	Mountain Chorus Frog-R	OH
				Northern Cricket Frog	RV – Luzerne Co.
				Four-Toed Salamander	
		Upland and floodplain sites		Marbled Salamander	
				Spotted Turtle-R	
		Lowland sites			
				New Jersey Chorus Frog	CP
	W/in agricultural settings		With adjacent grassland/old field areas	Northern Leopard Frog	
			with sandy soils	Eastern Spadefoot	RV - Northumberland, Berks Counties

*** Species is largely or entirely restricted to a specific physiographic area (LGL – Lower Great Lakes, OH – Ohio Hills, NP – Northern Plateau, RV – Ridge and Valley, P – Piedmont, CP – Atlantic Coastal Plain**