IDENTIFICATION & CONSERVATION OF VERNAL POOLS IN PENNSYLVANIA

Pennsylvania Natural Heritage Program

208 Airport Drive, Middletown, PA 17057

Phone: 717-948-3839

WHAT IS A VERNAL POOL?

- A wetland that dries up every year or every few years
- Lacks a permanent inlet or outlet
- Relatively small in size / shallow in depth
- Supports a distinctive biological community of plants and animals
- But does not support fish!!

Definitely NOT one size fits all!

- Vernal pools come in many different shapes and sizes
- The pool basin may contain varying amounts of marshy plants, shrubs, and trees.
- The basin bottom may be covered with a thick layer of decomposing tree leaves with no plants or trees at all!
- Variability in names for vernal pools as well!
  - -Seasonal / temporary / ephemeral / spring / autumnal pool
  - -Frog or salamander pond

Let's take a look at some different types of vernal pools in PA....

Unvegetated (black leaf) pool – wet phase

Small dog shows scale, this is a small pool!

Unvegetated pool – drying phase

Unvegetated pool – drying phase

Marsh pool, wet phase

Marsh pool, wet phase

Marsh pool, wet phase

Shrub-marsh pool, wet phase

Shrub-marsh pool, wet phase

Shrub-marsh pool, muddied from deer traffic

Shrub pool, wet phase

How do you recognize a dry vernal pool?

You can walk through it without getting all wet!

Look for a shallow depression often without any trees in it.

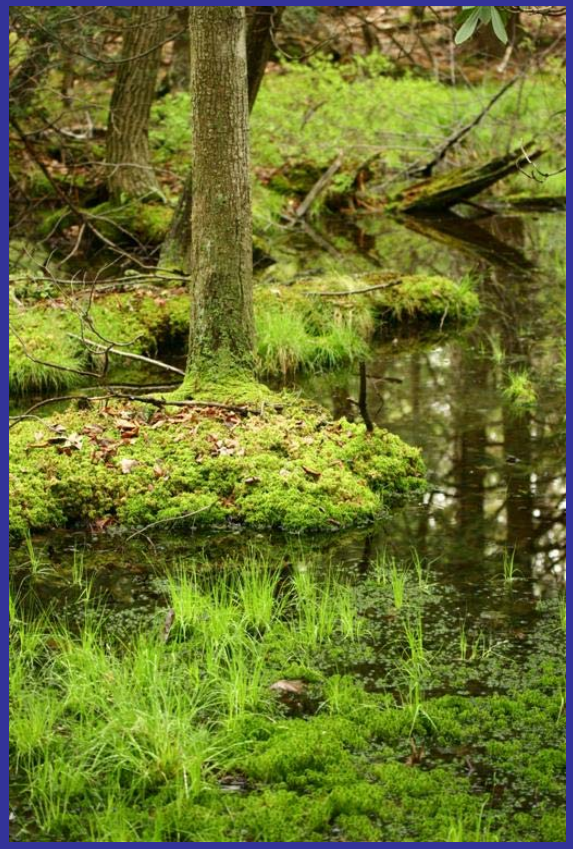
Look for grayed, water-stained leaves

Mosses often mark the shallowest waters of the pool perimeter>>

More signs...look for dry shallow basins with...

Marsh or other herbaceous plants

Flood resistant trees (e.g. pin oaks) with ‘high water’ marks



Trees growing on hummocks, mounds of sphagnum moss

Wetland plants in areas with little or no standing water

Look for wetland soils under water-stained leaves…

…and evidence of aquatic life such as:
remnants of amphibian egg masses, caddisfly cases, snail or fingernail clam shells

Unvegetated pool, dry phase

Marsh pool, dry phase

Marsh pool, dry phase, years after a forest fire

Shrub pool, dry phase

Swamp forest pool, dry phase

Recognizing a vernal pool - recap

- Ephemeral with cyclical wet and dry phases
- Relatively small size and shallow depth
- No permanent in-flow or out-flow
- No fish
- Presence of indicator animals
- Presence of wetland plants (though as we have just seen many pools are completely unvegetated)

EPHEMERAL = WET and DRY PHASES

Vernal pools exhibit great variability in hydroperiod (duration and frequency of flooding):

–Some pools hold water for a month or two and then dry up. Others hold water years at a time and only dry down completely during extended droughts.

–Some pools fill and dry once a year, others fill and dry multiple times a year.

An ephemeral hydroperiod is important because it eliminates fish; variations in hydroperiod influences what other plants and animals will use the pool too.

NO FLOW

Vernal pools are mainly filled by

Precipitation

Runoff

Snow Melt

…therefore they are ‘isolated’ – meaning they are not continually connected to other water bodies via a stream

BUT

Many vernal pools intersect the water table, especially those located on floodplains, at the headwaters of streams, or on the sides or bases of hill slopes.

Many vernal pools will have temporary inlets and outlets when they overflow as a result of heavy rains & snow melt.

Some pools located on floodplains will get flooded by streams overflowing their banks during high water events

RELATIVELY SMALL & SHALLOW

The maximum area of many vernal pools is less than

0.25 acres (0.1 ha)

and depth less than

3 feet (~1 m)

DISTINCTIVE BIOLOGICAL COMMUNITY

•The dry phase of a vernal pool prevents fish from becoming established. Fish are a top predator in permanent ponds…when they are missing from the food chain there is less predation and competition pressure.

•Animals whose young develop in vernal pools must have special adaptations to survive the dry phase. Two common strategies:

1) The young mature into terrestrial-living adults that leave the pool before it dries

2) The animal completes an egg-to adult-to egg again cycle while the pool is wet. These animals must have a drought and freeze resistant egg that can lie dormant in the dry pool bed until it floods again.

MEET THE INDICATORS

Vernal pool indicator species are specialists that reproduce most successfully in fishless waters.

In Pennsylvania, there are **five** species of amphibians and a type of crustacean that use seasonal pools almost exclusively for breeding and larval development.

wood frog tadpole

1: MARBLED SALAMANDER (*Ambystoma opacum*)

-Chunky black & white mole salamander 4-5” long

-Female lays eggs in a dry pool basin in autumn;
she guards them until the pool floods again

2: JEFFERSON SALAMANDER (*Ambystoma jeffersonianum*)

- Slender, dark, long (4-7”) mole salamander with blue flecking on sides and very long toes.

-First salamander to arrive in the spring, often crossing snow & ice

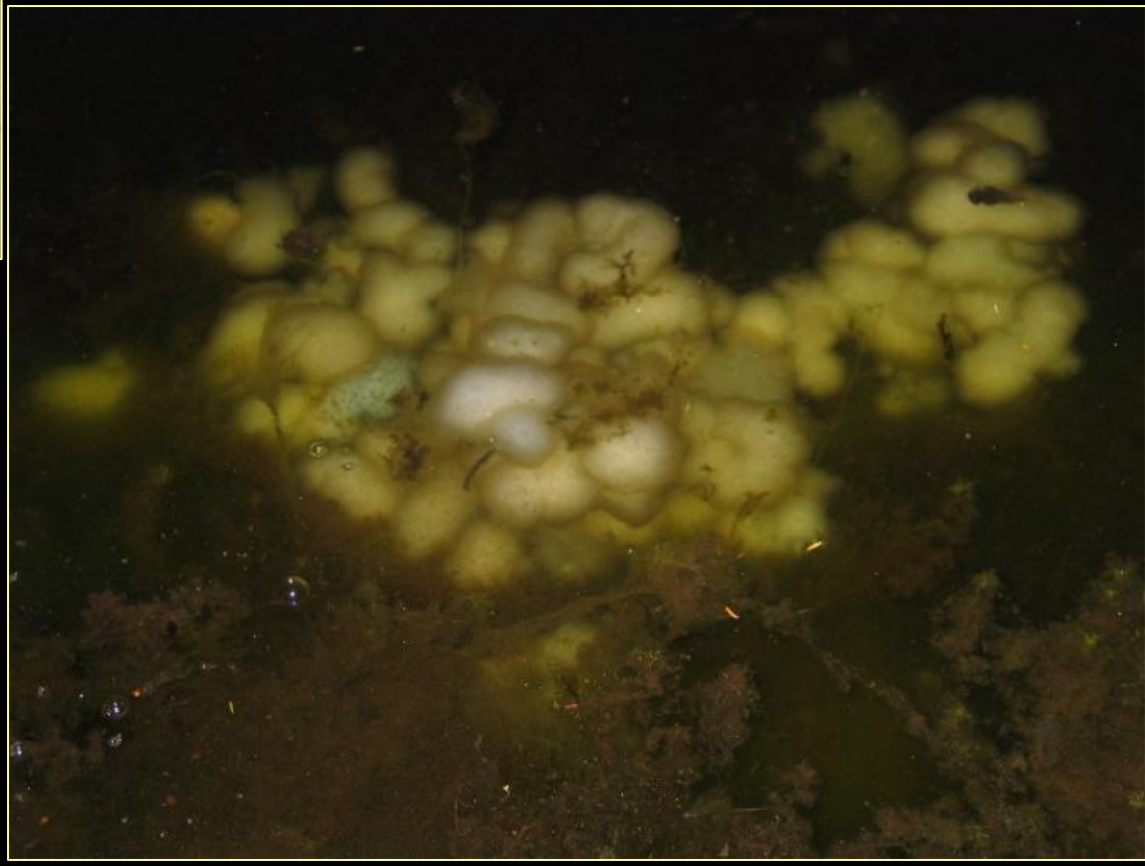
- May be confused with leadback (*Plethodon cinereus*) and dusky (*Desmognathus spp*) salamanders

3: SPOTTED SALAMANDER (*Ambystoma maculatum*)

Large (6-8” long) with unmistakable yellow spots

The most commonly encountered mole salamander in PA vernal pools

Spotted Salamander Egg Masses



Only the spotted salamander lays cloudy, opaque egg masses,

BUT, they will lay clear egg masses too!

Spotted versus Jefferson Salamander Egg Masses

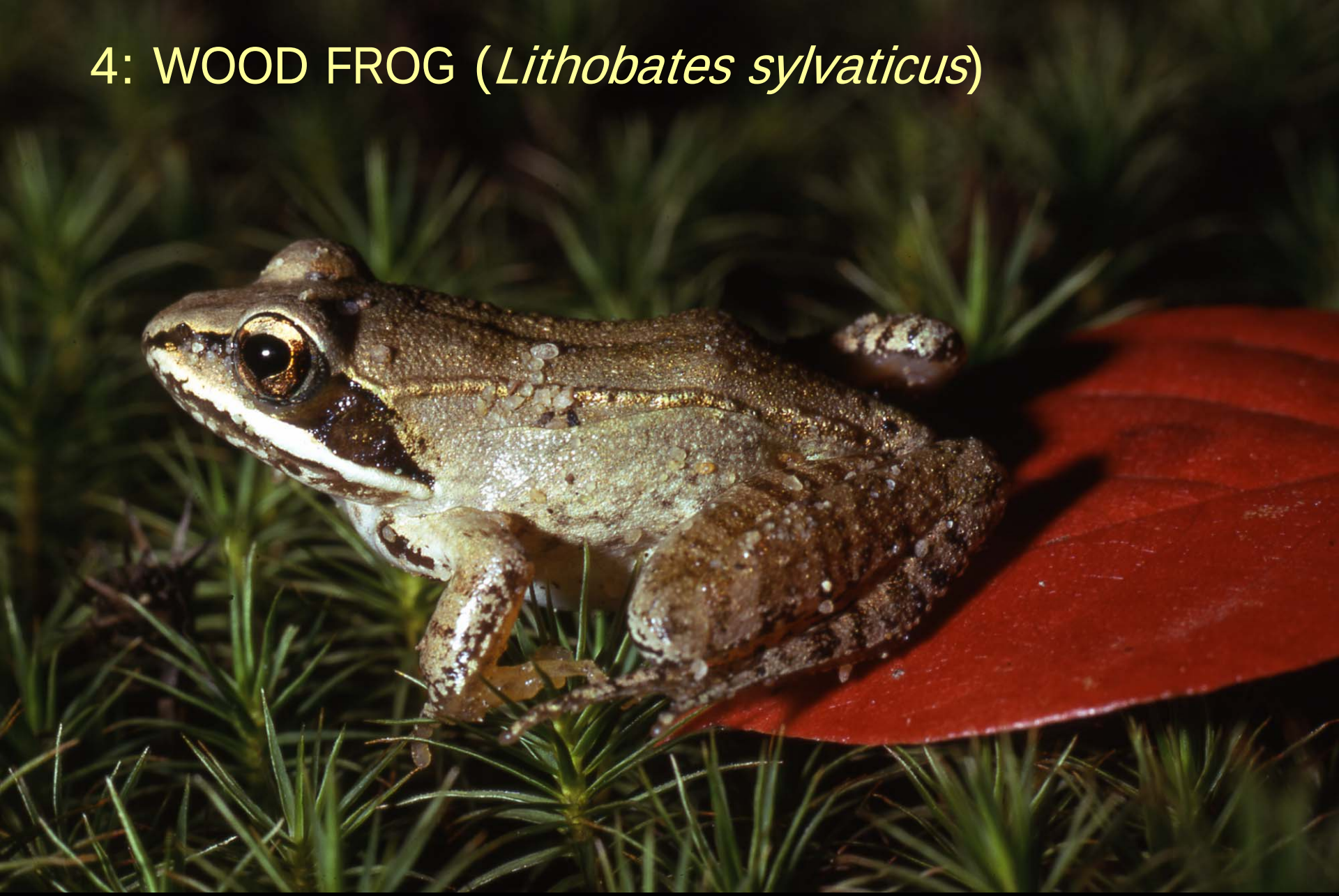
Jefferson egg mass

Jefferson egg masses are always clear with a softer jelly than spotteds; overall smaller & more linear in shape. Individual embryos encircled with a thin milky white ring.

Spotted egg masses can be clear or opaque white, and have a very firm jelly that is ‘blob-shaped’. In clear egg masses, look for a thick milky white ring encircling individual embryos.

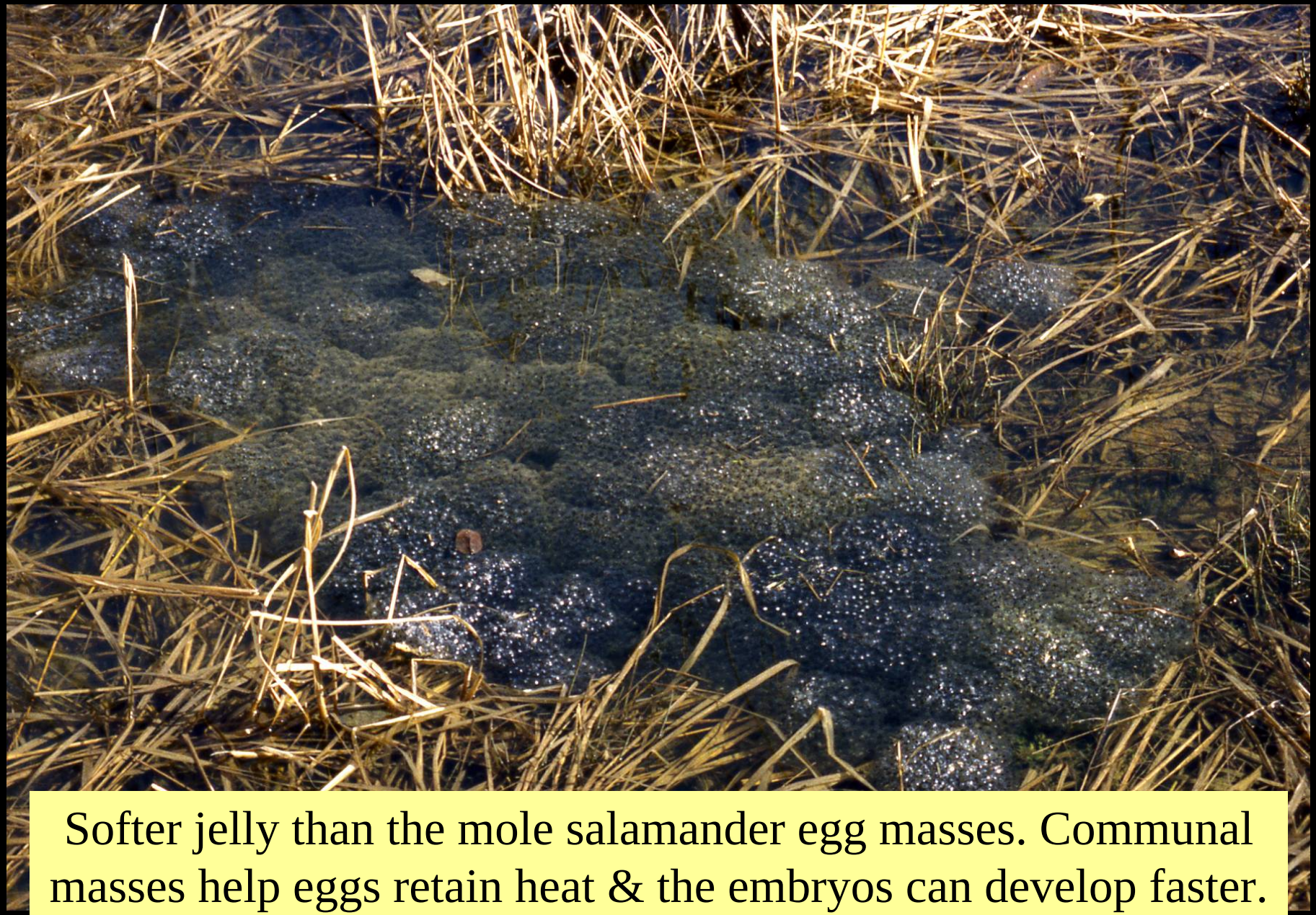
Spotted egg mass left, Jefferson right

4: WOOD FROG (*Lithobates sylvaticus*)



-Distinctive dark mask through eye and white ‘upper lip’
-Distinctive quacking call

Wood Frog Egg Masses



Softer jelly than the mole salamander egg masses. Communal masses help eggs retain heat & the embryos can develop faster.

5: EASTERN SPADEFOOT (*Scaphiopus holbrookii*)

-Small stout primitive species of frog; greenish-gold protruding eyes. A hard projection on webbed hind feet functions like a digging spade.

-Rarely encountered. Unpredictable breeding events take place after heavy rainstorms, uses quick-drying vernal pools in sandy areas

FAIRY SHRIMP are small crustaceans only found in seasonal pools. Springtime Fairy Shrimp (*Eubranchipus vernalis*) (above) are the most common shrimp species encountered in PA pools.

Springtime Fairy Shrimp (*Eubranchipus vernalis*)

Male with ‘trunks’ or claspers on their head; used to grab hold of a female>>

<<Female with eggs in a small pouch; eggs are agitated like clothing in a washing machine

MEET THE ASSOCIATES

Vernal pool facultative species are commonly found breeding in vernal pools but can also reproduce successfully in permanent waters.

A few examples: spring peepers, American toads, gray tree frogs, green frogs, dragonflies and damselflies, predaceous diving beetles, back swimmers, water boatmen, water striders, caddisflies, mosquitoes, phantom midges, aquatic worms, amphibious snails, and fingernail clams

SPRING PEEPER (*Pseudacris crucifer)*

A tiny frog ~1” in length
with diagnostic X on its back

AMERICAN TOAD (*Anaxyrus americanus*)

American Toad

Shown at right typically has one or two large warts per dark spot on its back & spots on its chest & belly

Fowler's Toad (*Anaxyrus fowleri*) usually has three or more large warts per dark spot & an unmarked chest & belly

American toad eggs are laid in long ropy strands

GRAY TREE FROG (*Hyla versicolor*)

Perfectly patterned to blend in on a tree trunk...a good strategy because it lives in trees most of the year

Calls like an old-fashion telephone

Diagnostic yellow coloration on legs and sides of belly

DRAGONFLIES & DAMSELFLIES
Order Odonata

Present in the vernal pool as nymphs

Pictured: Skimmer dragonfly nymph (Family Libellulidae)

Look for adults patrolling or laying eggs in wet or dry pool basins.

PREDACEOUS DIVING BEETLES

Order: Coleoptera
Family: Dytiscidae

Present in the pool as adults (pictured) and as larvae known as ‘toe-biters’

BACKSWIMMERS

Order: Hemiptera
Family: Notonectidae

CADDISFLIES (Order Trichoptera)

Cigar tube Caddisfly
(Family Phryganeidae)

Log Cabin Caddisfly
(Family Limnephilidae)

WHY ARE VERNAL POOLS IMPORTANT?

Vernal pools are often the only wetlands found in an otherwise dry landscape.

They increase the abundance and variety of food, water, and habitat available to wildlife in the forest.

ECOLOGICAL SERVICES

Vernal pools do all this for FREE!…

- Slow Flooding & Erosion by trapping RUNOFF
- Remove Pollutants & Sediments by slowly FILTERING water through plants and soils
- Improve the Quality & Quantity of our DRINKING WATER
- Improve the Health of our STREAMS

WILDLIFE

Vernal pools are good for

- Amphibians
- Turtles
- Bats
- Insects
- Wetland plants
- Deer
- Bears
- Turkeys
- Wood ducks
- Songbirds

In the winter look for deer and turkey tracks in the snow around pools as they seek fresh water.

DISTINCTIVE BIOLOGICAL COMMUNITY

•Vernal pool indicator species depend on vernal pools for successful development and survival of their young.

•In the mid-Atlantic region, 26% of all threatened & endangered amphibians depend upon vernal pools (Colburn, 2004).

Spotted Salamander (*Ambystoma maculatum*)

SEASONAL POOL CONSERVATION

Vernal pools are sensitive habitats that consist of the vernal pool wetland & the surrounding uplands.

Multiple tiers of habitat need protection (Brown & Jung 2005):

- Seasonal pool depression
- Seasonal pool envelope (100 ft)
- Seasonal pool terrestrial habitat (1000 ft)

Why is so much upland habitat needed?

Each new generation needs somewhere to live

Young aquatic animals must develop into terrestrial adults & leave the pool before it disappears or else they will dry out and perish. They need to find an upland home.

Adult habitat

During the many months that a vernal pool is dry, adult amphibians find food and shelter in the surrounding upland forest.

They live under rocks, rotting logs, and the moist layer of leaves on the forest floor. Mole salamanders and spadefoot toads move into underground burrows.

The EPA recommends managing a **1000 ft radius area** beyond the edge of a vernal pool basin as forested upland habitat. This distance will **protect 95% of a vernal pool's amphibians** in the uplands where they spend most of the year (Brown & Jung 2005).

Blue line shows the pool basin perimeter;
Purple line encompasses the terrestrial habitat (1000 m)

1000 ft distance is based on scientific studies of animal movement

Amphibian movement between upland and breeding pool habitats

(Brown & Jung 2005 and Colburn 2004)

Four-toed salamanders move a maximum of 650 feet

Wood frogs commonly move 1,200-1,600 feet

Spotted salamanders average over 500 feet but will move up to 2700 feet

Jefferson salamanders average around 820 feet but will move up to 2050 feet

Marbled salamanders average about 635 feet but will travel up to 1475 feet

FRAGMENTATION

The smaller the forest patch around a pool, the less food and shelter is available.

Roads and other barriers located between pools and uplands increase the odds of mortality during migration to and from a pool.

Water Quality

Buffers are critical to protecting vernal pool water quality. This pool is degraded by the run-off it receives from a nearby road.

ARE VERNAL POOLS PROTECTED BY LAW?

YES!

Vernal pool habitats and vernal pool plants and animals are protected under a number of state and federal laws.

US Army Corps of Engineers

Vernal pools can receive protection under section 404 of the Federal Clean Water Act, administered by the U.S. Army Corps of Engineers (ACOE). Section 404 can be viewed at http://www.wetlands.com/regs/sec404fc.htm

The ACOE cannot regulate "isolated wetlands" that lack a connection to a stream or waterway

However, indirect wetland connections may count, such as if the vernal pool is:

- connected to another wetland which drains into a stream
- located in the floodplain of a stream

PA Department of Environmental Protection

DEP requires a permit to directly impact a body of water under 25 Pa. Code Chapter 105, Dam Safety and Waterway Management. Code viewable at http://pacode.com/secure/data/025/chapter105/chap105toc.html

Permits are necessary to directly impact ANY vernal pool by fill or excavation, regardless of the size.

Mitigation (wetland replacement) is only required for alteration of pools *over 0.05 acres* in size (a 46 ft x 46 ft square is ~0.05 acres).

- Minimum 1 to 1 acreage replacement with a wetland of equal function & value
- Minimum 2 to 1 acreage replacement with a wetland of different function & value.

Many vernal pools in PA are smaller than 0.05 acres and do not require mitigation. But their acreage is added to the total acreage of wetlands lost. PA has a 'no-net wetland loss' policy and has programs to create wetlands that offset all lost acreage.
(http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/WWEC/GENERAL/WETLANDS/NetGain.htm)

PA Fish and Boat Commission

The Pennsylvania Fish and Boat Commission (http://www.fish.state.pa.us/) is responsible for regulations concerning game and non-game fish, reptiles, amphibians, and aquatic invertebrates.

Current regulations prohibit the collection or possession of the following species associated with seasonal pools:

- Four-toed salamanders (*Hemidactylium scutatum)*
- Jefferson salamanders (*Ambystoma jeffersonianum*)
- Marbled salamanders (*Ambystoma opacum*)
- Spotted turtles (*Clemmys guttata*)

PA Endangered Species Protection

Additional protection for some seasonal pool species is provided under the Endangered Species section of the Pennsylvania Code (58 Pa. Code Chapter 75).

Section 75.1 prohibits catching, taking, killing, possessing, importing, exporting, selling, or purchasing any of the Commonwealth's threatened or endangered species, alive or dead, without a special permit.

Currently the **Eastern Spadefoot Toad (*Scaphiopus holbrookii*)** is the only vernal pool species listed as Threatened or Endangered in PA (http://www.pacode.com/secure/data/058/chapter75/chap75toc.html)

IS THIS ENOUGH??

Federal and state laws only go so far. They regulate impacts to the pool basin but neglect the equally critical terrestrial upland habitat.

Additional State Legislation is needed to provide protection to the vernal pool envelope and upland terrestrial habitat.

Better protection can be achieved through greater communication and action of the scientific / conservation community and the public.

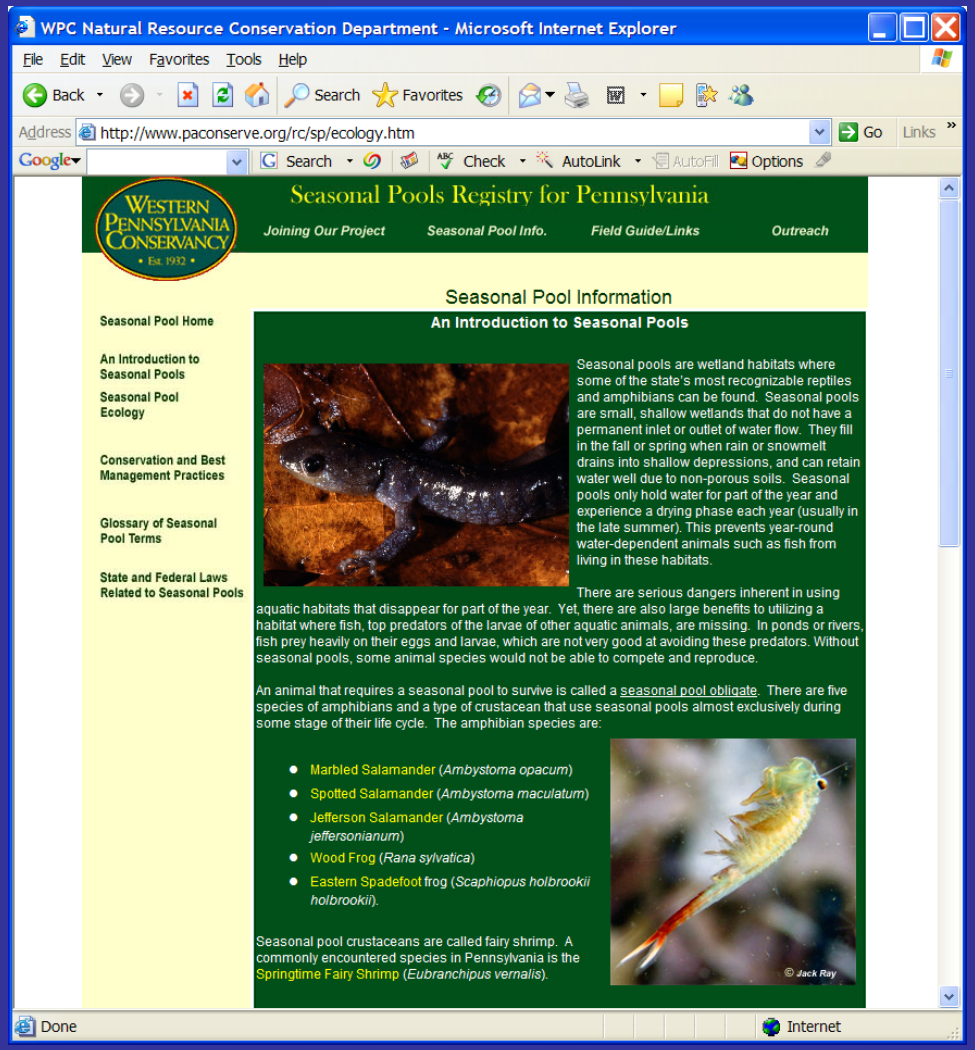
The **Seasonal Pool Registry** helps maximize existing regulations by documenting locations of seasonal pools and providing information on seasonal pool habitats, species, and recommendations for conservation and management.

SEASONAL POOLS REGISTRY FOR PENNSYLVANIA

http://www.waterlandlife.org/54

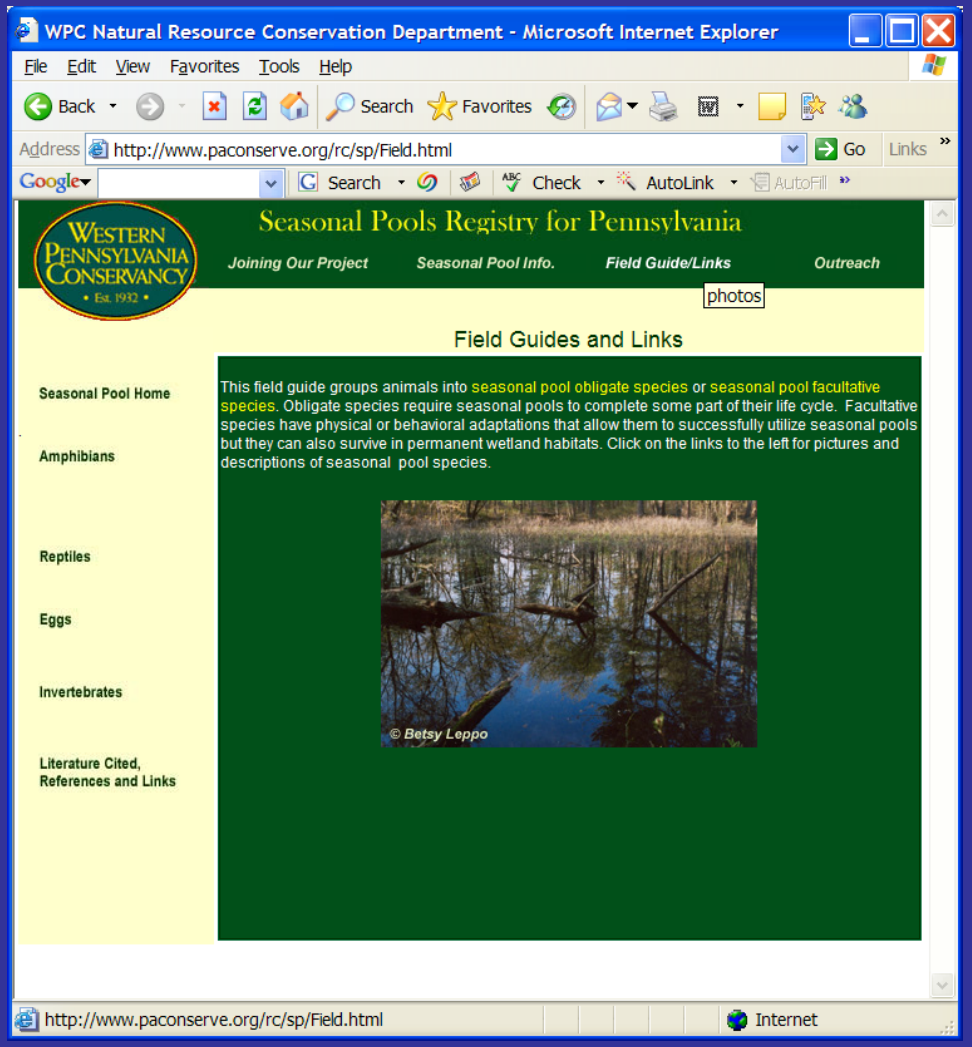
Find Information on Pennsylvania's Vernal Pools

- Vernal pool terms and definitions
- Ecology (soils, hydrology, vegetation)
- Laws and Regulations
- Conservation and management practices



View Field Guides for Vernal Pool Species

- Original photography of characteristic species
  - Reptiles
  - Amphibians
  - Invertebrates
  - Eggs
- References and links to other seasonal pool registry programs and online field guides



REGISTER A POOL!!

Registering a pool provides information that shows pool is truly *seasonal* and not *permanent* in nature.

Citizen-Scientists

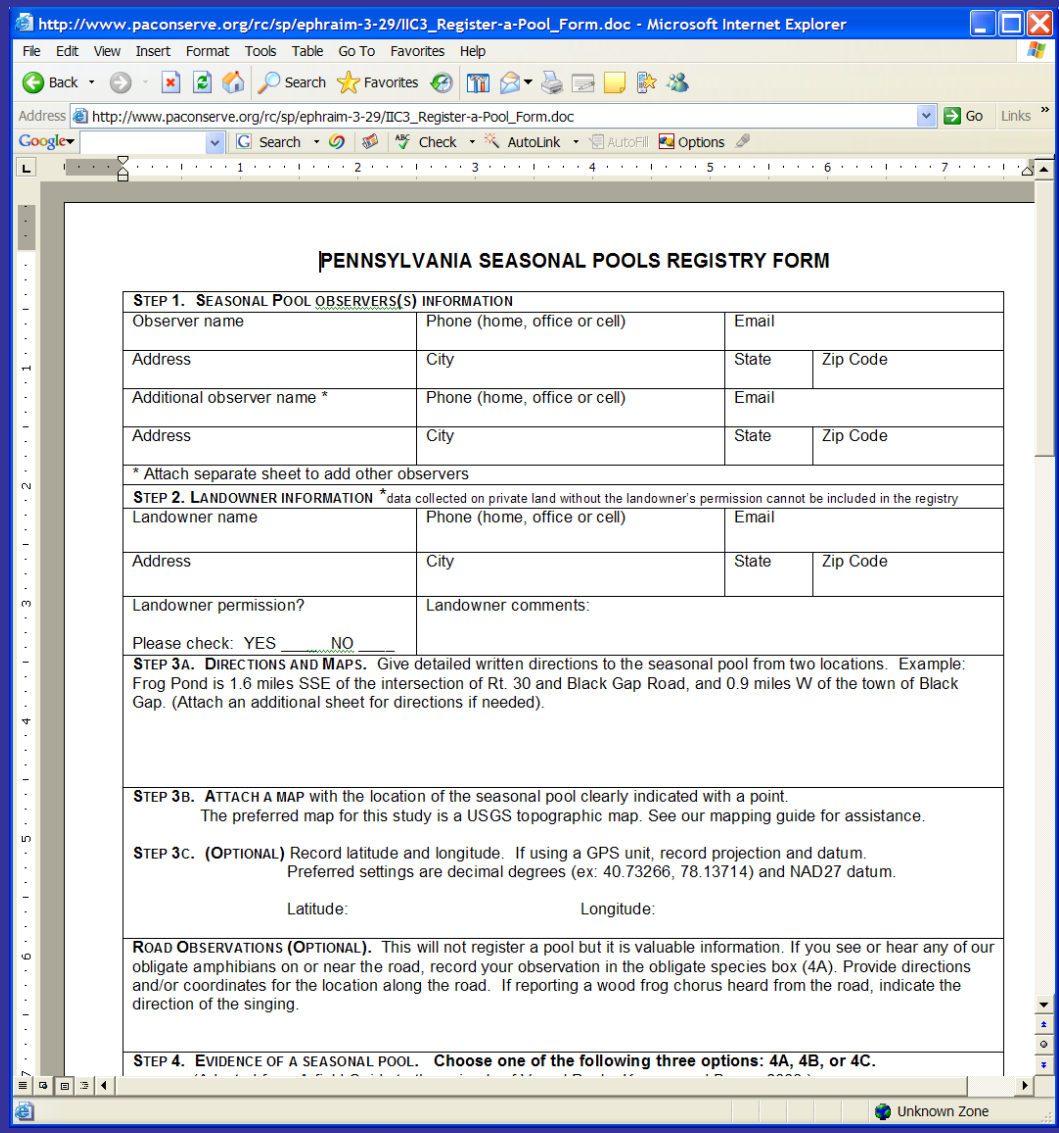
The PA Seasonal Pool Registry relies on expert and amateur volunteers and landowners to:

- Register locations of seasonal pools in the Commonwealth
- Document locations of characteristic vernal pool animals.
- Collect basic descriptive information on seasonal pool habitats
- Create a database of seasonal pool locations for conservation planning and environmental review

Similar “citizen-scientist” initiatives in other states have been very successful in raising awareness of seasonal pools and have directly contributed to their conservation

Paper and E-Forms

- Registry forms and instructions can be downloaded from the website
- Hard copies of forms available upon request
- Submit via snail mail or email



Three ways to Register a Pool

Choose from one of these three methods to show a pool is vernal and not permanent (details on website):

1) Indicator Species Method
2) Facultative Species Method
3) Dry Pool Method

1: INDICATOR SPECIES METHOD

Based on the presence of vernal pool specialists that reproduce most successfully in fishless waters.

<u>One Step</u>: Document the presence of indicator vernal pool species*

*VERNAL POOL INDICATORS

- Marbled Salamander
- Jefferson Salamander
- Spotted Salamander
- Wood Frog
- Eastern Spadefoot
- Fairy Shrimp (Anostraca)

wood frog tadpole

2: FACULTATIVE SPECIES METHOD

Based on the presence of animals that commonly breed in vernal pools, but can use permanent wetlands too.

Three Steps:

1) Photograph the pool when it is wet
2) Document the presence of facultative species*
3) Photograph the pool when it is dry

**A few examples: spring peepers, American toads, gray tree frogs, green frogs, dragonflies and damselflies, predacous diving beetles, back swimmers, water boatmen, caddisflies, mosquitoes, phantom midges, aquatic worms*

3: DRY POOL METHOD

Based on evidence that the wetland experiences a dry phase.

Two steps: Take photos of the vernal pool when it's 1) wet and 2) dry

For fun, look for evidence of past aquatic life in the pool bed:

- shells of fingernail clams
- shells of aquatic snails
- cases of caddisfly larvae
- exuvia (shed exoskeleton) of dragonflies
- exuvia (shed exoskeleton) of damselflies

RESULTS OF THE REGISTRY

- Increases understanding of seasonal pools
- Identifies high quality vernal pool sites
- Documents the variety of types of seasonal pool communities
- Helps landowners manage their vernal pool resources
- Builds a database of seasonal pool locations and associated wildlife throughout Pennsylvania
- Reduces accidental destruction of vernal pools which might be overlooked during permit reviews.

So you have a vernal pool...now what?

Individual landowners can play a critical role in the protection of vernal pools.

Private Landowner Assistance

The organizations highlighted here support landowners seeking technical assistance for managing their vernal pools.

See the following local, state, federal, and website slides for more vernal pool resources.

Visit the Seasonal Pool Registry
http://www.waterlandlife.org/54

Contacts for more information:

PA Natural Heritage Program
Attn. Betsy Leppo
208 Airport Drive
Middletown, PA 17357
phone: (717) 948-3839
bleppo@paconserve.org

The Nature Conservancy
Attn. Tracy Coleman
2101 North Front Street
Building #1, Suite 200
Harrisburg, Pa 17110
phone: (717) 232-6001 ext. 124
tcoleman@tnc.org

ClearWater Conservancy
Attn. Katie Ombalski
2555 North Atherton Street
State College, PA 16803
(814) 237-0400
Katie@clearwaterconservancy.org

State Resources

Fish & Boat Commission Landowner Incentive Program (LIP):
http://www.fish.state.pa.us/promo/grants/lip/00lip.htm

Game Commission Private Landowner Assistance Program (PLAP):
http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=513&q=168220

Department of Conservation & Natural Resources (DCNR) Service Foresters:
http://www.dcnr.state.pa.us/FORESTRY/serviceforesters_select.aspx

Department of Environmental Protection (DEP) Wastershed Management:
http://www.depweb.state.pa.us/watershedmgmt/site/default.asp

Department of Agriculture Pennsylvania Invasive Species Council (PISC):
http://www.invasivespeciescouncil.com/

Local Resources

County Conservation Districts county directory at: http://www.pacd.org/districts/directory.htm

Penn State University (PSU) Cooperative Extension: Contact information for extension offices by County at: http://extension.psu.edu/extmap.html

Conservancies: The Pennsylvania Land Trust Association maintains a list of conservancies, visit their website to find one near you at: http://conserveland.org

Watershed Organizations: The Pennsylvania Directory of Watershed Organizations is available online at: www.pawatersheds.org/WatershedDirectory/index.asp

Federal Resources

Natural Resource Conservation Service (NRCS)
http://www.nrcs.usda.gov/

Conservation Reserve Enhancement Program (CREP):
http://www.nrcs.usda.gov/programs/CRP/

Conservation Stewardship Program:
http://www.nrcs.usda.gov/programs/new_csp/csp.html#fact

Environmental Quality Incentives Program (EQIP):
http://www.nrcs.usda.gov/PROGRAMS/EQIP/

State Acres for Wildlife Enhancement (SAFE):
http://www.fsa.usda.gov/Internet/FSA_File/safe08.pdf

Wildlife Habitat Incentive Program (WHIP):
http://www.nrcs.usda.gov/Programs/whip/

Wetlands Reserve Program (WRP):
http://www.pa.nrcs.usda.gov/grograms/WRP/index.html

Great Websites!

- Amphibians and reptiles of Pennsylvania – PA Fish and Boat Commission (http://sites.state.pa.us/PA_Exec/Fish_Boat/amp_rep.htm)
- Amphibian Research and Monitoring Initiative (http://www.pwrc.usgs.gov/nearmi/)
- Frogwatch USA - National Wildlife Federation (http://www.nwf.org/frogwatchUSA)
- Mid-Atlantic Region Seasonal Pools - U.S. Environmental Protection Agency: (http://epa.gov/maia/html/SeasonalPools_PDF.html)
- New Jersey Seasonal Pools (sponsored by New Jersey Department of Environmental Protection – Division of Fish and Wildlife): (http://www.state.nj.us/dep/fgw/ensp/vernalpool.htm)
- Ohio Vernal Pool Partnership (http://www.ovpp.org/)
- Rhode Island Vernal Pools (http://www.uri.edu/cels/nrs/paton/vernal_pool_def.html)
- Roger Tory Peterson Institute of Natural History (http://vernalpools.rtpi.org/index.htm)
- The Vernal Pool Association (http://www.vernalpool.org/)
- Upper Susquehanna Coalition (http://www.u-s-c.org/html/vernalpoolpage.htm)
- Vernal Pool Society of Virginia (http://www.lynchburgbiz.com/virginiasvernalpools/)

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Photo credits

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THE END