



Species Action Plan:

Salamander Mussel

(*Simpsonaias ambigua*)

Purpose and Goals

Purpose: This Species Action Plan is an initial five-year blueprint for actions to address near-term and long-term goals for the conservation and recovery of the Salamander Mussel. Given the complexity of managing and recovering this species, as new information becomes available, this document plan will be updated to reflect progress toward these goals. This plan also supports the 2015 Pennsylvania Wildlife Action Plan (PA-SWAP) by specifically addressing the following goals: GOAL 1. Conserve Pennsylvania's native wildlife and its habitat by implementing conservation actions in the Wildlife Action Plan. GOAL 2. Base wildlife conservation decisions on the best available science, with an emphasis on Species of Greatest Conservation Need and its habitat, and GOAL 5. Develop a knowledgeable citizenry that supports and participates in wildlife conservation. Several Objectives and Strategies within these goals are also addressed. This Species Action Plan (SAP) also includes a description of the species natural history, its distribution and threats that have led to its rarity or imperilment.

Goals: The goals of this Species Action Plan are to:

- Guide the maintenance and protection of extant populations of Salamander



Salamander Mussel (*Simpsonaias ambigua*): Photo credit: Karen Little, Illinois State Museum.

Mussel in the Commonwealth, to ensure sufficient distribution,

- To adequately secure the species and,
- Secure its populations and remove this species from the list of Pennsylvania endangered species (58 Pa. Code §75.1).

Natural History

Taxonomy: Class Bivalvia, Order Unionoida, Family Unionidae (unionids), Salamander Mussel (*Simpsonaias ambigua*, Say, 1825). See Watters *et al.* (2009) for synonymy.

Description: Parmalee and Bogan (1998) describe the shell characteristics as “thin, fragile, considerably elongated, and inflated, especially along the broadly rounded posterior ridge, which is sometimes more swollen in females. This is a small species – individuals rarely exceed 50 mm in length.” The shell noticeably lacks rays and is differentiated from similar-looking Anodontine genera *Anodontooides*, *Pyganodon*, and *Strophitus* by having rudimentary cardinal teeth (Watters *et al.* 2009).

Habitat: The Salamander Mussel is found in riverine conditions underneath flat shelter rocks where it typically co-occurs with its only known host, the Mudpuppy salamander (*Necturus maculosus*).



Life History: The maximum age of Salamander Mussel is approximately 10 years, although most individuals collected have been around 4-5 years of age (Watters *et al.* 2009). The Salamander Mussel is a long-term brooder (bradyctictic) and releases its glochidia (larvae) in the fall. The mechanism that triggers glochidial release onto its only known host, the mudpuppy, is unknown. The glochidia metamorphose into juveniles in the spring. The Salamander Mussel diet is unknown, but presumed to be bacteria, detritus, phytoplankton, and zooplankton. The Salamander Mussel is the only North American unionid that uses an amphibian host.

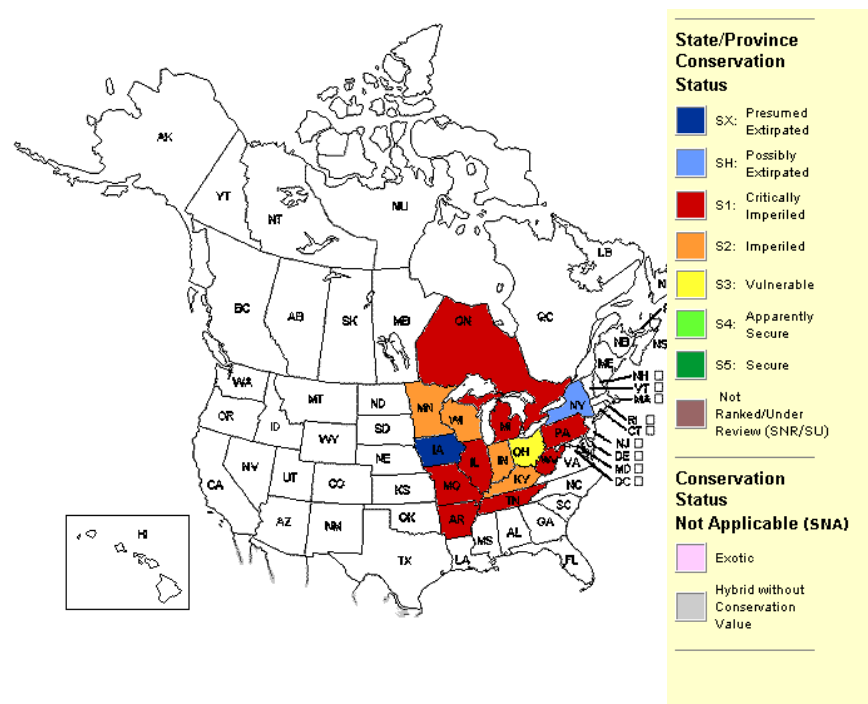


Figure 1. National range and conservation status of *Simpsonais ambigua*.

Distribution and Status

National Distribution: The Salamander Mussel is restricted to North American streams and rivers in the Great Lakes and the Mississippi River and Ohio River basins of the following states: Arkansas, Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, West Virginia, Wisconsin and Ontario, Canada (NatureServe 2012) (Figure 1).

Pennsylvania Distribution: Little is known about the historical distribution of this species in Pennsylvania. Early surveys (e.g., Ortmann 1919) did not detect this species. The first occurrence of this species in Pennsylvania are specimens collected from Allegheny River pool

Pennsylvania Legal Status: Endangered

State Rank: S1 – Critically Imperiled

Global Status: G3 – Vulnerable

5 by D. Tanner (1968) and D. Stansbery (1970) (Clarke 1985). Presently, the only extant Salamander Mussel population occurs in the Allegheny River. Since the first collections of this species in Pennsylvania in the late 1960's, a total of three Allegheny River navigational pools (5, 6, and 8) are known to harbor Salamander Mussels (EnviroScience 2007; Aquatic Systems 2008; USFWS 2008; Smith and Meyer 2010; Swecker 2013). A shell of this species was recently found in Pool 9 (D. Counahan, *personal communication*).

The Salamander Mussel also occurs in the Great



Lakes basin including Ohio tributaries to Lake Erie (Watters *et al.* 2009). A specimen was recently found in the Ohio portion of Conneaut Creek (Crail, *personal communication*).

Two shell specimens were collected from French Creek in 1985 and 1995 by C. Bier (Western Pennsylvania Conservancy). Despite intensive surveys of French Creek and its tributaries (e.g., Smith and Crabtree 2010), no live Salamander Mussels have been collected from this watershed.

The Salamander Mussel was known to occur in Dunkard Creek prior to a 2009 pollution event which destroyed the Dunkard Creek mussel fauna (Zeto 1982; Wood 1994; PFBC *unpublished data*).

The Salamander Mussel will be considered for delisting when 80% of the historically-occupied streams contain three distinct naturally-reproduced year classes (PABS Bivalve Committee listing criteria) and a minimum number of individuals in each stream. A minimum number will be determined after

analysis of occupied streams. Historical populations can include yet-undiscovered populations. Populations that contain at least three distinct year classes and a minimum number of individuals will be considered viable. A viable population is defined as *a naturally reproducing population large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural environmental changes* (Soule 1980).

Management Status

The Allegheny River, French Creek (Ohio River Basin), Dunkard Creek, and Conneaut Creek have been surveyed in recent times.

Population trends: In the absence of other information, the status of the Allegheny River population is presumed stable. The status of the French Creek population is presumed extirpated because evidence of this species occurrence in French Creek has not been observed since 1995 (see above). The Dunkard Creek mussel population was destroyed by a 2009 toxic event. No live specimens of this species have ever been collected from the Pennsylvania portion of Conneaut Creek.

Threats

Historical threats have resulted in a decline of Pennsylvania's Salamander Mussel populations. Due to the historical and recent distribution of Salamander Mussels over a geologically and land-use diverse Pennsylvania landscape, qualitative uncertainty ranges were used to measure the scope of threats facing this species.

Existing and possible future threats (Salafsky *et al.* 2008) to the

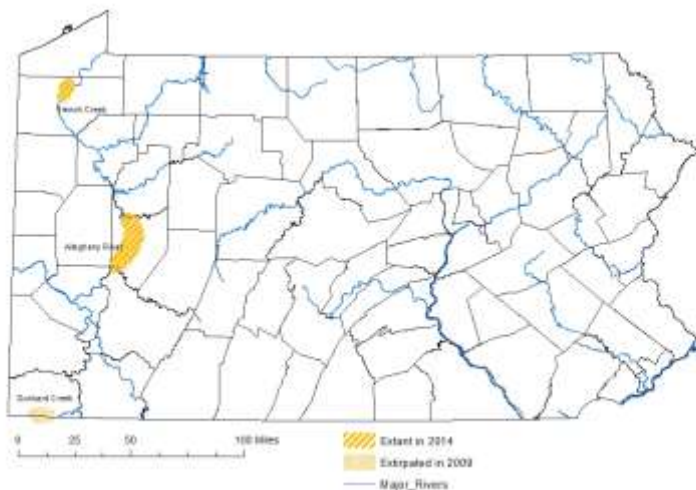


Figure 2. Salamander Mussel historic and extant occupied watersheds in Pennsylvania.



Salamander Mussel include the following:

1. Energy production and mining
 - a. Mining and quarrying
Despite the relocation of several Salamander Mussels, commercial sand and gravel dredging activities in Allegheny River pool 5 have recently resulted in loss of habitat for both Salamander Mussel and Mudpuppies and presumably some level of Salamander Mussel mortality may have occurred as a result of these activities.
2. Transportation and service corridors
 - a. Utility and service lines
Threats associated with pipeline crossings could be locally severe; however, severity is reduced when stream crossings are accomplished using directional boring methods. Directional boring is preferred where feasible despite some risk associated with bentonite spills that can be associated with directional bores. These events can lead to the smothering of mussels or the choking of interstitial spaces and/or shelter rock habitat. Consultations for the recent discovery of Rayed Bean (*Villosa fabalis*, a state and federally threatened mussel species) in the Salamander Mussel-inhabited Allegheny River (pool 5) may also limit the risk of pipeline crossings to freshwater mussels.
3. Pollution
 - a. Industrial and military effluents.
Generally, freshwater mussels are vulnerable to point-source pollution, and particularly catastrophic events. With the increase in pipeline stream crossings, there is a risk associated with oil and gas spills as a result of a ruptured pipeline or

industrial accident although the scope and severity of this particular risk is unpredictable. A single catastrophic pollution event could destroy Pennsylvania's only remaining Salamander Mussel population in the Allegheny River.

Conservation and Recovery Actions

A. Allegheny River

1. Protect, conserve and enhance existing Salamander Mussel populations located in pools 5, 6, 8 and 9.
 - a. Gather baseline information
 - i. Characterize Salamander Mussel populations.
 1. Collect the following quantitative population demographic information:
 - a. Shell lengths, widths, depths.
 - b. Determine gravidity period for Pennsylvania.
 - c. Ratio of gravid/nongravid (using non-lethal methods).
 - d. Number of individuals.
 - e. Density, if practical.
 - f. Number of individuals found under each rock structure that can be surveyed.
 - ii. Quantitatively and qualitatively characterize physical habitat.
 1. Measure streamflow, water chemistry at known locations.
 2. Measure length, width, depth of occupied rock structures.
 3. Estimate number or density of rock structures in occupied areas.
 4. Qualitatively describe surrounding habitat associated with occupied rock structures.



- iii. Characterize host (Mudpuppy) population.
 1. Develop Mudpuppy sampling methodology.
 - b. Examine existing GIS analyses to identify restoration areas and ground truth each area.
 - i. Use existing Western Pennsylvania Conservancy Priority River Habitats evaluation to identify and prioritize by pool potential restoration areas.
 - ii. Ground truth these areas to examine habitat availability and current use by both Salamander Mussels and mudpuppies.
 - iii. Identify funding sources for ground-truthing.
 - c. Improve habitat in Allegheny River pools
 - i. Design and implement experimental habitat creation projects.
 1. Develop experimental design for rock structure placement in the following areas:
 - a. Pools with Salamander Mussels and mudpuppies.
 - b. Pools without Salamander Mussels but contain mudpuppies.
 2. Determine source of rock structure material.
 3. Place rock structures.
- B. French Creek**
1. Protect, conserve and enhance population, if present.
 - a. Gather baseline quantitative information
 - i. Conduct surveys at last observed location in French Creek (near Venango, PA).
 - ii. Characterize Salamander Mussel population.
1. Collect the following quantitative population demographic information:
 - a. Shell lengths, widths, depths.
 - b. Determine gravidity period for Pennsylvania.
 - c. Ratio of gravid/non-gravid (using non-lethal methods).
 - d. Number of individuals.
 - e. Density, if practical.
 - f. Number of individuals found under each rock structure that can be surveyed.
 - iii. If Salamander Mussel population found, characterize host (Mudpuppy) population.
 1. Use same sampling methodology developed for the Allegheny River (see above).
- C. Dunkard Creek**
1. Restore Dunkard Creek Salamander Mussel population.
 - a. Develop Dunkard Creek mussel recovery plan.
 - b. Identify sources of funding.
 - c. Gather baseline information at sites sampled in 2009 during the mussel kill.
 - i. Characterize existing mussel community, if one is present.
 - ii. Use historic data from watershed.
 1. Use Smith et al. (2001) sampling protocol and USGS Mussel Estimation Program.
 - d. Restore native mussel community including Salamander Mussel (see F, below).
 - e. Maintain water volume and flow
 - i. Work with USEPA, PADEP, WVDEP and WVDNR to develop flow recommendations that are protective of Salamander Mussel.



- f. Ensure protection from pollution and invasive species.
- i. Work with DEP to monitor TDS and osmotic pressure.
- ii. Work with academic institution to monitor golden alga (*Prymnesium parvum*) levels in Dunkard Creek including sampling for residual spores as feasible.

D. Long-term Monitoring

- 1. Begin long-term monitoring of Allegheny River populations.
 - a. Identify and establish long-term monitoring sites for Allegheny River (3 sites; 1 each in pool 5, 6, 8, and 9).

- b. Monitor triennially.

E. Propagation, Augmentation, Reintroduction, and Habitat Restoration

- 1. Propagation.
 - a. Investigate feasibility of establishing a Salamander Mussel culture program.
- 2. Augmentation.
 - a. Depends upon #1 above.
- 3. Reintroductions.
 - a. Depends upon #1 above.
- 4. Habitat Restoration.
 - a. Determine areas where restoration efforts could benefit Salamander Mussels.
 - b. Determine shelter rock material (natural or man-made).
 - c. Establish monitoring protocol.



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