

**ARIZONA GAME AND FISH DEPARTMENT  
HERITAGE DATA MANAGEMENT SYSTEM**

**Invertebrate Abstract**

**Element Code:** IMGASJ0950  
**Data Sensitivity:** No

**CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE**

**NAME:** *Pyrgulopsis bernardina* Taylor  
**COMMON NAME:** San Bernardino Springsnail  
**SYNONYMS:** *Yaquicoccus bernardinus*, *Pyrgulopsis cochisi*, *P. bernardenus*  
**FAMILY:** Hydrobiidae

**AUTHOR, PLACE OF PUBLICATION:** D.W. Taylor. 1987. Fresh-water molluscs from New Mexico and vicinity. New Mexico Bureau of Mines and Mineral Resources. Bulletin 116: 34-36.

**TYPE LOCALITY:** Springs at San Bernardino Ranch, Cochise County, Arizona.

**TYPE SPECIMEN:** Holotype: LACM 2186. D.W. Taylor, 27 July 1968.

**TAXONOMIC UNIQUENESS:** This genus comprises 35 described species and an additional 20-25 undescribed species in the Southwest.

**DESCRIPTION:** Adult shell height (height from top of shell to bottom of shell) 1.3-1.7 mm. Shell is narrowly conical. Spire has 3.25 to 4.0 whorls. Operculum is pale amber in color. Operculum attachment scar has a narrow discrete thickening all around, but leaves no conspicuous trace. Females are larger than males. Snout with light to dark dusting of pigment. Sides of head/foot somewhat less pigmented than snout. All hydrobioids have a foot with a rounded posterior end. Penis is simple, with no accessory lobe, bearing a large, long-oval glandular patch on a prominent lobule on both left dorsal and ventral surfaces.

**AIDS TO IDENTIFICATION:** Due to the small size of this animal, it cannot be identified to species in the field but must be identified in a laboratory by a qualified authority. The rule of thumb that springsnail species are specific to a particular location (i.e. a single spring or group of springs connected or close to each other), may be used as a means of preliminary identification.

**ILLUSTRATIONS:**

Line drawings (Taylor 1987)  
Line drawings (Hershler and Landye 1988)  
Scanning electron microscope micrographs of radula (Hershler and Landye 1988)  
Line drawings (Hershler and Ponder 1998)

**TOTAL RANGE:** Restricted to a couple of springs on private property in Cochise County, Arizona, along with seven sites in adjacent Sonora, Mexico (Varela-Romero and Myers 2010).

**RANGE WITHIN ARIZONA:** Currently occupies one spring (Goat Spring) on private property adjacent to San Bernardino National Wildlife Refuge. Historically occupied a pond and spring on the Private property and probably several sites on the refuge (Malcom *et al.* 2003).

### **SPECIES BIOLOGY AND POPULATION TRENDS**

**BIOLOGY:** The hydrobioid digestive system is typical of style-bearing neotaenioglossans. The mouth opens to a short oral area containing a pair of dorsolateral chitinous jaws composed of small, simple rodlets, immediately behind which is a well-developed buccal mass (situated within the snout). A pair of simple, unbranched, tubular salivary glands opens anterodorsally to the buccal cavity and (almost always) pass posteriorly over the nerve ring, rarely stopping short of the ring, but never passing through it in hydrobioids. Hydrobioids have a taenioglossate radula (i.e., seven teeth per row) comprising numerous rows of cusped teeth, each of which includes a typically squarish or trapezoidal central tooth flanked on each side by lateral, inner marginal, and outer marginal teeth. Teeth near the anterior end of the radula are often worn or broken, whereas the proximal portion of the ribbon has several to many rows of poorly differentiated or incompletely formed teeth. (Hershler and Ponder 1998).

**REPRODUCTION:** Most hydrobioids are oviparous, with females depositing small egg capsules, either singly or (rarely) in strings, on the substrate. A small number of hydrobioids are ovoviviparous, in which female's brood shelled young in the pallial gonoduct. Hydrobioid egg capsules are typically hemispherical to spherical. Copulation in hydrobioids is usually via an anterior opening to the glandular oviduct. The ventral channel may be traversed at least in part by the penis, but it is more likely that the penis only enters the anterior most section. (Hershler and Ponder 1998).

**FOOD HABITS:** While the specific food habits of *Pyrgulopsis bernardina* have yet to be identified, "hydrobiid snails primarily feed on periphyton, which is a complex mixture of algae, bacteria, microbes, and detritus, that live upon submerged surfaces in aquatic environments" (Mladenka 1992).

**HABITAT:** The species was established from a "Spring about 100 ft southeast of an artificial pond.... The spring-brook was a watercress-choked stream about 1 ft wide, trickling over gravel, mud and dead wood and leaves. *Yaquicoccus* was abundant on dead wood, leaves or stones" (Taylor 1987). Like most *Pyrgulopsis* they prefer a rheocrene system. A study by Malcom, Radke and Lang (2005) found *P. bernardina* densities were positively associated with sand and cobblestone substrates, vegetation density, water velocity, and dissolved oxygen, as well as water temperatures (14-22°C) and pH values between 7.6 and 8.0. Snail densities were negatively associated with silt and organic substrates, deep water and high conductance. The study also noted that these snails were better associated with water from a shallow aquifer that is distinct from an adjacent deep aquifer.

**ELEVATION:** 3,860 ft. (1,177 m).

**PLANT COMMUNITY:** Dense vegetation with watercress cover.

**POPULATION TRENDS:** Unknown, but deemed adequate by the USFWS (2012) to determine a threatened, rather than endangered status for the species. This determination is due primarily to additional metapopulation localities having been genetically confirmed in Mexico. Presence at Goat Tank Spring and Horse Spring was confirmed in 2009 and 2010, respectively. In Arizona, this species is currently abundant only at one very confined springbox on Slaughter Ranch. Regarding the Snail Spring type locality, Radke (personal communication, 2008) provides the following: “Population was stable during 2006 surveys by the USFWS. However, springhead flow has declined and property owners piped house pond water to the spring to keep in wet. The vastly different water quality and temperature have altered the micro-environment, favoring *Physa* pond snails over *Pyrgulopsis*. San Bernardino Springsnails may currently be extirpated from this site in Arizona.” The USFWS has restored perennial flow at Snail Spring with a solar-powered low flow pump in the hope of further protecting this population.

### **SPECIES PROTECTION AND CONSERVATION**

**ENDANGERED SPECIES ACT STATUS:** LT with Critical Habitat (USDI, FWS 2012)  
 [PE USDI, FWS 2011]  
 [C USDI, FWS 2007-2010]  
 [None USDI, FWS 1996]  
 [C2 USDI, FWS 1991, 1994]  
 [C2 USDI, FWS 1989]

**STATE STATUS:** 1 (AZGFD, AWCS 2022)  
 [1A (AGFD SWAP 2012)]

**OTHER STATUS:** Bureau of Land Management Sensitive  
 (USDI, BLM AZ 2000, 2005, 2008, 2010)  
 Not Forest Service Sensitive, USDA FS  
 Region 3, 2013.  
 [Forest Service Sensitive ,USDA, FS Region  
 3 1999, 2007]

### **MANAGEMENT FACTORS:**

**Threats:** highly restricted geographic distribution, with associated potential for extinction due to chance events such as wildfires and the use of toxic chemical fire retardants; herbicide and pesticide contaminants, groundwater depletion and resulting loss of spring flow, and the potential invasion and predation by nonnative mosquitofish, crayfish, or invasion and competition from New Zealand mudsnails.

**Management needs:** prevent further loss or degradation of habitat; identify and pursue opportunities for translocation and reestablishment of former population, paying strict attention to specific habitat and water quality requirements.

**PROTECTIVE MEASURES TAKEN:** Listed Threatened by USFWS April 17, 2012 with Critical Habitat under the ESA. Critical Habitat covers four units and approximately two acres near Douglas, Arizona. The Nature Conservancy deeded “water use” rights to the Slaughter Ranch Johnson Historical Museum with the stipulation that use was not to affect wildlife.

**SUGGESTED PROJECTS:** Modify refuge pond/spring for reintroduction, if specific habitat and water quality requirements can be met.

**LAND MANAGEMENT/OWNERSHIP:** Private - Johnson Historical Museum. Historically Tule Pond/Springs (on San Bernardino National Wildlife Refuge), and House Spring and House Pond (private). While the site at NWR is known to be unoccupied it is incorporated in the Critical Habitat with hopes of a future habitat restoration and reintroduction.

### **SOURCES OF FURTHER INFORMATION**

#### **REFERENCES:**

- Arizona Game and Fish Department. 2012. Arizona’s State Wildlife Action Plan 2012-2022. Phoenix, AZ.
- Arizona Game and Fish Department. 2022. Arizona Wildlife Conservation Strategy: 2022-2032. Arizona Game and Fish Department, Phoenix, Arizona. 378 pages.
- Hershler, R. and J.J. Landye. 1988. Arizona Hydrobiidae (Prosobranchia: Rissoacea). Smithsonian Contributions to Zoology. Number 459: 41.
- Hershler, R. and W.F. Ponder. 1998. A Review of Morphological Characters of Hydrobioid Snails. Smithsonian Institution Press, Washington D.C.
- Malcom, J.W. et al. 2002. The San Bernardino Springsnail: Life History, Ecology, and Conservation. Meeting Resource Management Information Needs: Fourth Conference on Research and Resource Management in the Southwestern Deserts, Extended Abstracts.
- Malcom, J.W., W.R. Radke and Brian Lang. 2003. San Bernadino Springsnail (*Pyrgulopsis bernadina*) Population Ecology and Habitat Needs. Report to Arizona Game and Fish Department Heritage Program (Grant I02004). 21 pp.
- Malcom, J.W., W.R. Radke and Brian Lang. 2005. Habitat Associations of the San Bernadino Sprngsnail, *Pyrgulopsis bernardina* (Hyrobiidae). Journal of Freshwater Ecology, Vol 20, No. 1, pp 71-77.
- Mladenka, G.C. 1992. The ecological life history of the Bruneau hot springs snail (*Pyrgulopsis bruneauensis*). Unpublished M.Sc. Thesis, Idaho State University, Pocatello, Idaho.
- Myers, T.L and A.Varela-Romero. 2012. Taxonomic Validation and Population Structure Analysis of *Pyrgulopsis* Populations from the Upper Black River, Arizona (*P. trivialis*) and from the Upper Rio San Bernardino, Arizona (*P. bernardina*). Final Report – Contract No. F11PS01579 submitted to Arizona Ecological Services, USFWS, Phoenix, AZ. 52pp.
- NatureServe Explorer: An online encyclopedia of life [web application]. 2003. Version 1.6. Arlington, Virginia, USA: NatureServe. Available: <https://explorer.natureserve.org/>. (Accessed: November 18, 2003).

- Taylor, D.W. 1987. Fresh-water molluscs from New Mexico and vicinity. New Mexico Bureau of Mines and Mineral Resources. Bulletin 116: 34-35.
- USDA, Forest Service Region 3. 1999. Regional Forester's Sensitive Species List.
- USDA, Forest Service Region 3. 2007. Regional Forester's List of Sensitive Animals.
- USDA, Forest Service Region 3. 2013. Regional Forester's List of Sensitive Animals.
- USDI, Bureau of Land Management. 2000. Arizona BLM Sensitive Species List. Instruction Memorandum No. AZ-2000-018.
- USDI, Bureau of Land Management. 2005. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management Region 2. 2008. Arizona BLM Sensitive Species List.
- USDI, Bureau of Land Management Region 2. 2010. Arizona BLM Sensitive Species List.
- USDI, Fish and Wildlife Service. 1989. Endangered and Threatened Wildlife and Plants; Animal Notice of Review; Proposed Rules. Federal Register 54(4): 554-579.
- USDI, Fish and Wildlife Service. 1991. Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species, Proposed Rule. Federal Register 56(225): 58823.
- USDI, Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species, Proposed Rule. Federal Register 59(219): 59007.
- USDI, Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species. Federal Register 61(40): 7596-7613.
- USDI, Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Notice of Review. Federal Register 72(234): 69034-69106.
- USDI, Fish and Wildlife Service. 2008. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Notice of Review. Federal Register 73(238): 75176-75244.
- USDI, Fish and Wildlife Service. 2009. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Notice of Review. Federal Register 74(215): 57804-57878.
- USDI, Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Notice of Review. Federal Register 75(217):69288.
- USDI, Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status for the Three Forks Springsnail and San Bernardino Springsnail, and Proposed Designation of Critical Habitat; Proposed Rule. Federal Register 76(70):20404.
- USDI, Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Notice of Review. Federal Register 76(207):66434.

- USDI, Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Three Forks Springsnail and Threatened Status for San Bernardino Springsnail throughout Their Range and Designation of Critical Habitat for Both Species. Final Rule. Federal Register 77(74):23060-23092.
- Varela-Romero, A. and T.L. Myers. 2010. Genetic evaluation of springsnails in the San Bernardino River watershed of Sonora, Mexico, in relation to *Pyrgulopsis bernardina* (Taylor, 1987). Final Report to the Arizona Game and Fish Department.

**MAJOR KNOWLEDGEABLE INDIVIDUALS:**

- Bob Hershler - Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C.
- Jerry Landye – Retired. USDI, Fish and Wildlife Service, Pinetop, Arizona.
- Terry Myers – Retired. USDA, US Forest Service
- William Radke – USDI, Fish and Wildlife Service, Douglas, Arizona

**ADDITIONAL INFORMATION:**

Independently described by Hershler and Landye (1988). Taylor (1987) takes precedence as his data was published one month earlier (Sally Stefferud, US Fish and Wildlife Service, pers comm. 1992). Hershler (pers comm. to S. Stefferud, 1991) indicated that Hershler believes the species he described, *Pyrgulopsis cochisi*, holotype, USNM 89055, J.J. Landye, 20 March 1971, to be separate and distinct from *Yaquicoccus bernardinus* described by Taylor (1987).

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	2007-12-10 (TFH)
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