

2 SPRINGS DEPENDENT TAXA

We define springs-dependent taxa (SDT) as those that require or most often occur in springs or springs-supported habitats during one or more phases of their life cycles. Some springs types support endemic (unique) taxa or other SDT, particularly limnocrene (pool-forming), mound-forming, helocrene (marsh-forming), and gusset springs (e.g., Spamer and Bogan 1994, Stevens and Meretsky 2008, Stevens and Polhemus 2008, Stevens and Bailowitz 2009). For example, several endemic subspecies of speckled dace (*Rhinichthys osculus*) and many pupfish (*Cyprinodon* spp.) are SDT, occurring in hillslope or limnocrene springs run-out channels, which are springs-supported habitats (Minckley 1973; Unmack and Minckley 2008). Rheocrene (in-channel) springs are somewhat less likely to support endemic or rare SDT due to increased flooding disturbance. In addition to springs type, several other factors influence species richness and the occurrence of SDT at springs, including springs habitat area, isolation, and geomorphic complexity (Hallam 2010, Schaller 2013).

SDT include a wide array of aquatic springs source invertebrate biota. For example, most *Pyrgulopsis* springsnails (Hydrobiidae), many elmrid riffle beetles, many stoneflies (Plecoptera); some freshwater amphipods and isopods, and many cyprinodontid pupfish are springs-dependent and live in habitat formed and influenced by springs sources. Several plant species are restricted to wetland or mesic habitats influenced by springs sources, including *Carex specuicola* (Navajo sedge, Cyperaceae), *Flaveria mcdougallii* (McDougal's flaveria, Asteraceae), *Primula specuicola* (cave-dwelling primrose, Primulaceae). More than 170 species of *Pyrgulopsis* springsnails are known from western North America, the majority of which occur at the sources of individual springs, and among which at least 17 are or

have been considered for listing as endangered species. Leopard frogs (Ranidae: *Lithobates* spp.) in the Southwest are commonly found at spring-fed cienegas, fens, and other helocrene and low gradient hillslope springs (Fig. 2–1; Clarkson and Rorabaugh 1989). Numerous native fish species in the American Southwest are SDT (Beckman 1952, Minckley 1973, Sublette et al. 1990, Sigler and Sigler 1996, Wallace and Zaroban 2013). We exclude as SDT those generalist species that occasionally (non-obligatorily) occur in springs-generated habitats, including non-native crayfish and non-native fish. However, some generalist taxa occur obligatorily in springs in particular regions and such populations will be regarded as being conditionally SDT. For example, American Dipper (*Cinclus mexicanus*) nest virtually obligatorily in cool spring-supported streams when they nest at low elevations in the arid Southwest (Stevens et al. 1997); and northern water shrews (*Sorex palustris*) may occur primarily along high elevation springfed streams and in wet meadows (Hoffmeister 1986).



Fig. 2–1. Northern leopard frog at T-Six Spring in the Coconino National Forest, Arizona. Where they occur in the US Southwest, northern leopard frogs are springs-dependent.

Pondsnails

Lymnaeidae: *Stagnicola*



Stagnicola are common and widely distributed in Nevada, although their exact distribution is poorly known. There are native *Stagnicola* in Nevada and also some non-natives that have been dumped from aquaria. This group of freshwater snails can be up to 25 mm in length.

Ambersnails

Succineidae: *Catinella*, *Oxyloma*



These terrestrial wetland snails range significantly in size, and somewhat resemble *Physa*. Ambersnails are found in Ash Meadows National Wildlife Refuge, and are expected in wetlands in Clark County, Nevada.

Physid/Bladder Snails

(Physidae: *Physa* and *Physella*)

Physid snails are large (up to 2 cm) and have a sinistral shell (curves up to the left). They are common in a wide array of lentic habitats throughout Nevada, sometimes co-occurring with springsnails.



Nevada Mollusks Native*

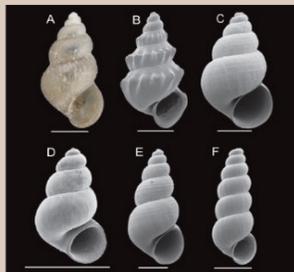
Springsnails

Hydrobiidae: *Pyrgulopsis*



Pyrgulopsis is the most diverse springsnail genus in Nevada, and many species are narrowly endemic. There are over 180 species found in North America, and approximately 50 of them live in Nevada springs. Nevada springsnails are tiny (1-3 mm) and have a dextral shell (curves up to the right) with wide, often dark green or black, whorls.

Hydrobiidae: *Tryonia*



Tryonia usually have taller, elongate shells and are 1-3 mm in size. Shells can be ornate or smooth. Although they are often confused with certain landsnails, *Tryonia* are found in freshwater or springs in Nevada.

*Not all representatives within these taxa are native to Nevada. All identifications require genetic or morphological verification.

Clams

Bivalvia



California floaters (*Anodonta*; left) and finger clams (*Pisidium*; right) are native to Nevada springs and springfed streams. Nevada finger clams 7 mm or less in size, and are commonly found in lentic or slow-moving water. California floaters are larger, growing up to 10 cm. Dam releases and spring/ stream dewatering threaten multiple clam species, as well as other mollusks.

Large Landsnails

(Helminthoglyptidae and Oreohelicidae)



Nevada landsnails live in upland habitats, and are often endemic to individual boulder fields. They range significantly in size and have a wide distribution.

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Nevada Mollusks

Non-native

Red-rimmed Melania

Thiaridae: *Melanooides tuberculata*



Red-rimmed melania is a common non-native snail in Nevada, although its distribution and competitive impacts on native springsnails are far from sufficiently well known. These snails of European origin, are large (up to 5 cm long) and are brightly colored/patterned (unlike native springsnails).

Ram's Horn & Aquarium Snails

Heterobranchia - Planorbidae



These snails are common in Nevada and often are introduced from aquaria. Most are non-native, though there are some native taxa in this group. Found in cattle tanks and mud, they are circular and large (6 mm to 6 cm). Ram's horn and aquarium snails are often intermediate hosts for parasitic trematodes/flukes.

New Zealand Mudsnail

Tateidae: *Potamopyrgus antipodarum*



Introduced via boats and water equipment, these snails are highly invasive and compete with native springsnails. Classified as Hydrobiidae by some taxonomists, New Zealand mudsnails are small (less than 4 mm) and have straight shells with sutures that are shallow compared to those of *Pyrgulopsis* and *Tryonia*.

Asian Clam

Cyrenidae: *Corbicula fluminea*

This introduced freshwater bivalve is common in river systems, including in the Colorado River. It is up to 5 cm in diameter with elevated concentric rings on the shell. Color can vary, and ranges from light to dark.



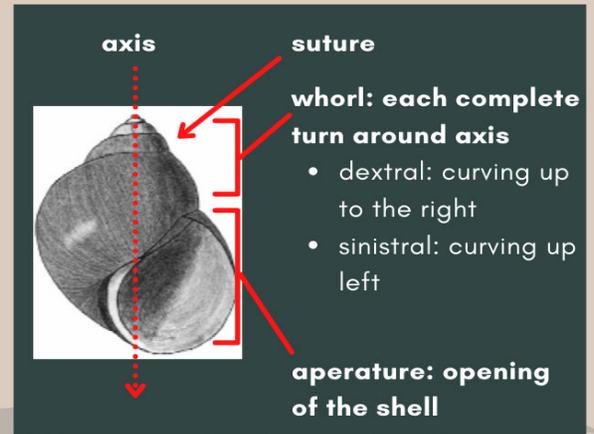
Quagga Mussel

Dreissenidae: *Dreissena rostriformis bugensis*



Quagga mussel populations are dense, and often colonize on top of each other. They are established at Lake Mead and spreading widely across southern Nevada. They are 2-3 cm long and the shell color can vary widely.

Identifying Nevada Mollusks



Mollusks are an incredibly diverse group of organisms in the Phylum Mollusca. It is often impossible to identify freshwater mollusks to species by sight: accurate taxonomic ID requires genetic and/or morphological review by a professional. Additionally, collection in the state of Nevada requires a mollusk collection permit, as many species are sensitive. Even so, pictures and description of mollusks at springs and wetlands can inform biologists and land managers of endemic, invasive, or otherwise biologically significant species for further evaluation.



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