



Annotated Checklist of Freshwater Truncatelloidean Gastropods of the Western United States, with an Illustrated Key to the Genera

Technical Note 449

June 2017



Cover photo: Live specimen of *Pyrgulopsis robusta* (Snake River, Idaho). Photo by Robert Hershler.

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Amnicola limosa. Photo by Karolyn Darrow.

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Pyrgulopsis stearnsiana. Photo by Carolyn Darrow.

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Potamopyrgus antipodarum. Photo by Carolyn Darrow.

Abstract

This technical note provides an illustrated key to the 13 genera and a checklist for the 178 currently recognized species of freshwater, inland saline, and estuarine truncatelloidean gastropods (primarily belonging to the families Amnicolidae, Cochliopidae, Hydrobiidae, Lithoglyphidae, and Tateidae) in the western United States. It also outlines methods of specimen preparation and dissection to facilitate use of the generic key. The checklist includes bibliographic information for each species (and their synonyms), type localities, type material, and geographic distributions. The appendix includes a comprehensive synopsis of the available DNA barcoding sequences (the COI gene, cytochrome *c* oxidase subunit I) for members of this fauna in the anticipation that these data will be increasingly used for both taxonomic and conservation genetic applications. This technical note serves as an entry portal for resource managers, taxonomists, and other individuals interested in this species-rich and highly imperiled fauna.



Pyrgulopsis californiensis. Photo by Karolyn Darrow.

Introduction

The western United States contains a large, highly endemic fauna of gastropods belonging to the superfamily Truncatelloidea (totaling 178 species, Table 1), which has recently become a major focus of conservation actions because of the various threats to its typically groundwater-dependent habitats (e.g., *Pyrgulopsis*, Hershler et al. 2014a). These snails are a challenging group to study because of their diminutive size (the shells of most species are <10 mm long) and rather featureless and monotonous shells; identification of these animals to useful taxonomic levels usually requires the examination of soft parts, particularly the genitalia. In spite of the increasing interest from the conservation community, there are no recently published overviews of this fauna, which has mushroomed in size (from 33 to 178 species) and otherwise been extensively revised taxonomically (e.g., Hershler 1994; Hershler and Frest 1996; Hershler 2001) since the last such compilations were published over 30 years ago (Taylor 1975; Burch and Tottenham 1980; Burch 1982). The purpose of this technical note is to provide a synopsis of the freshwater truncatelloidean snails in the western United States that can serve as an entry point for members of the conservation community and other biologists interested in studying these long neglected and still poorly known animals. The generic key and accompanying illustrations may also assist land managers and conservation biologists in their efforts to track the spread of the New Zealand mudsnail (*Potamopyrgus antipodarum*), a highly invasive pest that is easily confused with other truncatelloidean snails (ANS Task Force 2005). This technical note includes a simple, illustrated key to differentiate the freshwater truncatelloidean genera of the western United States, images of representative shells of each genus, and an annotated checklist (and bibliography) for all of the currently recognized regional species (175 native, 3 introduced). We also provide a detailed compilation of published mitochondrial DNA sequences of the “barcoding” gene (COI, cytochrome *c* oxidase subunit I) for the freshwater truncatelloideans in the western United States; these data have proved to be an invaluable tool for taxonomic studies of these animals and are also beginning to be used to identify conservation management units (e.g., Hurt 2004).



Amnicola micrococcus



Colligyrus greggi



Eremopyrgus eganensis



Ipnobius robustus



Littoridinops monroensis



Tryonia angulata



Pyrgulopsis owyheensis



Fluminicola minutissimus



Potamopyrgus antipodarum



Pristinicola hemphilli



Taylorconcha serpenticola

Generic Key and Checklist

The key to the genera provided herein uses superficial character states that can be readily observed using a dissecting microscope (at 50x) and is not structured phylogenetically. We designed this key specifically for the distinctive fauna of the western United States, and it has limited utility for other geographic areas. We also detail methods of specimen preparation and dissection to facilitate the use of this key. Morphological terminology largely follows that of Hershler and Ponder (1998).

The checklist follows the recent changes in the higher taxonomy of the Hydrobiidae *sensu lato* (Kabat and Hershler 1993), which has been split into multiple families based on both morphologic evidence and a rapidly growing body of molecular evidence (Wilke et al. 2001; Wilke et al. 2013). The families are arranged alphabetically in the checklist and the genera and species within each family are also listed in this manner. For each genus, images of shells of representative species are provided; types are illustrated when feasible. For each species (and junior synonyms thereof), the reference to the original description consists of the author(s), date, page(s) and figure number(s), type locality, and type material. Extralimital (outside the western United States) synonyms are not listed for several species. Type localities are listed as in the original publication, with comments or corrections given in brackets. The list of secondary types may not be complete for some species.

The institutions and museums where the cited types (and other referenced material) are housed are identified by the following acronyms: ALBRCIDA, Orma J. Smith Museum of Natural History, The College of Idaho, Caldwell, Idaho (formerly Albertson College of Idaho); ANSP, Academy of Natural Sciences of Drexel University, Philadelphia, Pennsylvania; CAS, California Academy of Sciences, San Francisco, California; LACM, Los Angeles County Museum, Los Angeles, California (now the Natural History Museum of Los Angeles County); MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; NHMUK, Natural History Museum, London, England; NMW, Naturhistorisches Museum Wien, Vienna, Austria; SBMNH, Santa Barbara Museum of Natural History, Santa Barbara, California; UF, Florida Museum of Natural History, University of Florida, Gainesville, Florida; UMMZ, University of Michigan, Museum of Zoology, Ann Arbor, Michigan; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC; UTEP, University of Texas at El Paso, El Paso, Texas (now the Centennial Museum and Chihuahuan Desert Gardens).

The common name for each species is listed following Turgeon et al. (1998) and Johnson et al. (2013); new (common) names are introduced for several recently described species. The geographic distribution of each species is given based on the most current published information, with references provided when this source postdates the original descriptions. The taxonomy section lists papers that provide

illustrations that are useful for identification purposes (excluding original descriptions). The remarks section is primarily used to highlight species requiring taxonomic revision.

The COI sequences are available (in GenBank) for 160 of the 178 species of freshwater truncatelloideans in the checklist, including some taxonomically undescribed populations; these sequences are compiled in the appendix. These summaries are arranged by genus and species alphabetically within each family and include (for each sequence) the species name, published sample codes, accession numbers, number of specimens (N), sequence variation (% pairwise distance), most distant conspecific sequences (%), closest interspecific sequences (%), and collection locality (including county and state). The sequence divergence comparisons are restricted to populations and species in the western United States.

Specimen Preparation and Study

Freshwater truncatelloidean snails usually are locally abundant, enabling ready collection of sizeable samples (i.e., >100 specimens). A portion of each sample should be directly preserved in concentrated (90-100%) nondenatured ethanol; half of these specimens can be subsequently (air-) dried and designated as shell vouchers while the rest can be retained (in ethanol) for possible DNA analysis. The remaining portion of the live sample should be anesthetized (relaxed) with menthol crystals (prior to fixation and preservation) to facilitate examination of soft parts required for identification. (Menthol is an organic compound obtained from mint plants that is readily available in crystalline form from chemical supply houses.) Relaxed material is particularly useful for study of the penis, while pertinent details of the female genitalia usually can be obtained from contracted specimens that were directly preserved in ethanol. Snails should be relaxed in a large container (such as a 1-pint [473-ml] Mason jar) that is nearly filled with habitat water and kept cool and out of the sun. A small quantity (about half a teaspoon) of powdered menthol crystals (they can be crushed in one's hand) should be sprinkled over the water surface, after which the container should be capped and left undisturbed. The snails usually require about 13 hours for proper relaxation, although some species (e.g., *Pyrgulopsis robusta*) may require considerably more time. Once the specimens are anesthetized, at which time the head-foot is well extended and insensitive to touch, most of the water should be decanted and dilute formalin (10% of stock solution) should be slowly added. After 4-6 hours of fixation, the material should be rinsed and preserved in 70% ethanol.

Alcohol-preserved snails can be quickly separated from their shells by placing them in a small quantity of concentrated hydrochloric acid (which dissolves the calcareous shell). The appearance of the distal portion of the oviduct—whether it is glandular (Figure 2A) or thin-walled and containing brooded young (Figure 2B)—can be readily

determined without dissection. The bursa copulatrix can be viewed by pinning the animal, cutting the mantle along the left side of the head-foot, and pulling this tissue over (as shown in Figure 2A) to expose the oviduct and associated structures (Figure 2C-D). The penis is attached to the “neck” of the snail behind the snout and usually extends beyond the mantle edge (Figure 3A-C); both the upper (dorsal) and lower (ventral) surfaces of the penis should be examined for glands, which are relatively large and quite obvious; the internal penial glands of amnicolids are clearly visible in appropriately prepared specimens (Figure 3D). We recommend that workers practice the methods of anesthetizing, preserving, and dissecting snails before applying them to essential specimens.

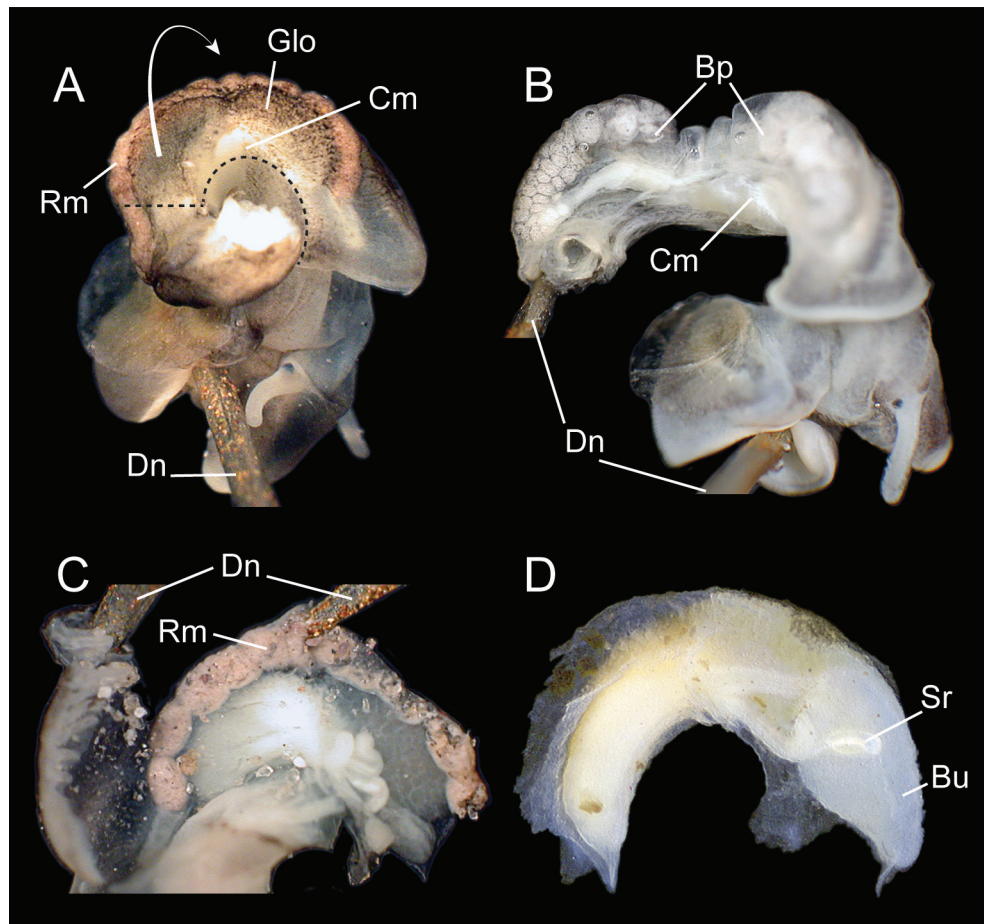


Figure 2. Photographs of female snails. A. Oviparous specimen having a thickened, glandular oviduct (*Pyrgulopsis*). Dashed black lines indicate the incisions made prior to pulling the tissue over (in the direction of the curved white arrow) to expose the left side of the oviduct and the associated structures (shown in C-D). B. Ovoviparous specimen with thin-walled oviduct containing brooded young (*Tryonia*). C-D. Left side of glandular oviduct and associated structures (*Pyrgulopsis*). Bp, brood pouch; Bu, bursa copulatrix; Cm, columellar muscle; Dn, dissecting needle; Glo, glandular oviduct; Rm, rectum; Sr, seminal receptacle.

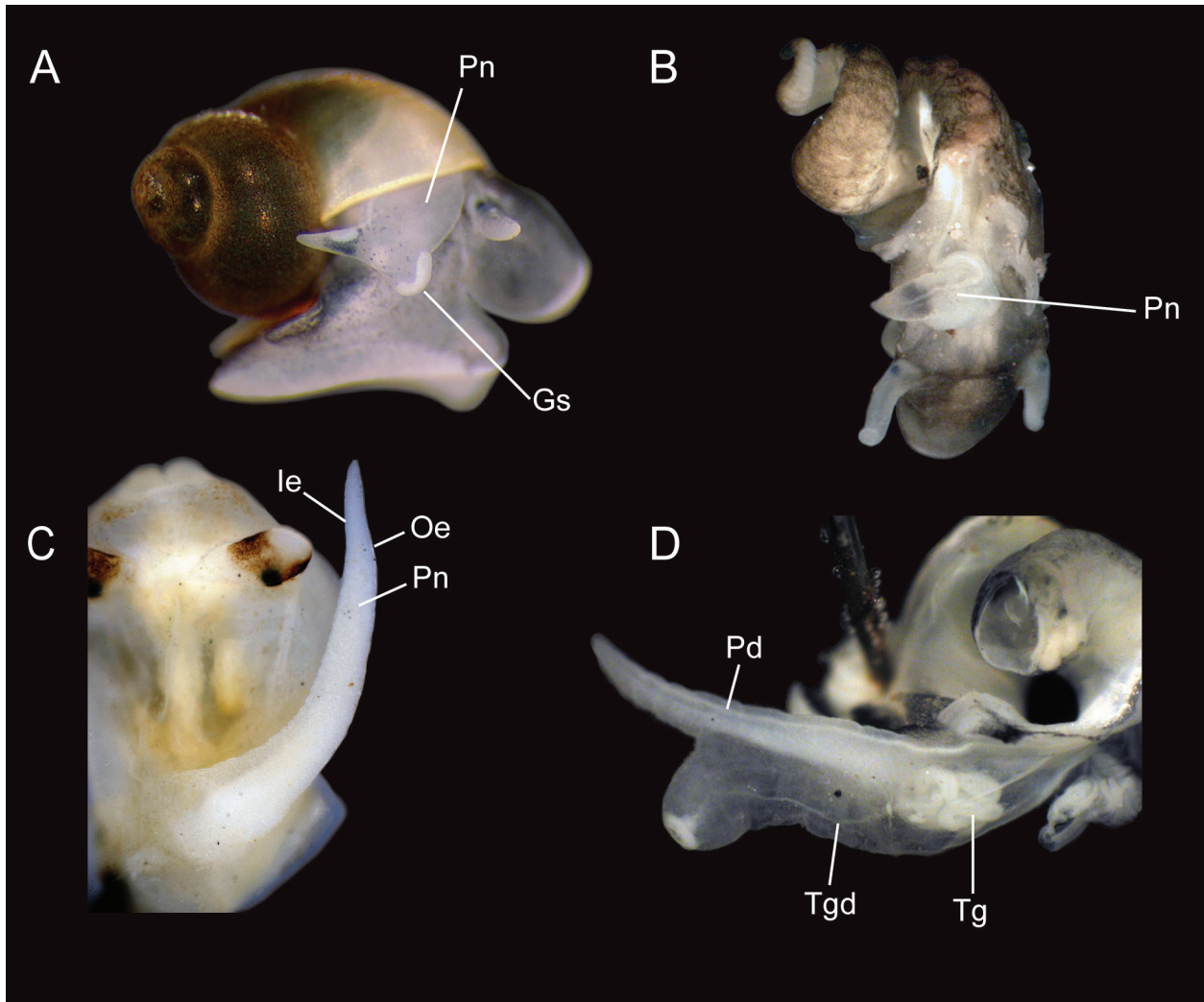


Figure 3. Photographs of male snails. A. Relaxed specimen with extended penis (*Pyrgulopsis*). B-C. Specimens with portion or all of pallial roof removed to show attachment of penis to “neck.” (*Pyrgulopsis*, *Taylorconcha*, respectively). D. Penis with internal “tubular” gland (*Amnicola*). Gs, glandular strip; le, inner edge of penis; Oe, outer edge of penis; Pd, penial duct; Pn, penis; Tg, tubular gland; Tgd, tubular gland duct.



Spurrinkia salsa. Photo by Karolyn Darrow.

Key to the Freshwater Truncatelloidean Genera of the Western United States

1. Female oviduct glands well developed (oviparous reproductive mode) (Figure 2A), shell globose to turriform _____ 2

Female oviduct glands reduced, serving as brood pouch (ovoviviparous) (Figure 2B), shell conical to turriform _____ 11

2. Penial glands absent (Figure 3B-C) _____ 3

Penial glands present (Figure 3A, D) _____ 7

3. Terminal papilla of (distal end of) penis large (Figure 4A); estuarine _____ **Spurwinkia**

Terminal papilla of (distal end of) penis very small or absent (Figure 4B-G); inland aquatic _____ 4

Figure 4.

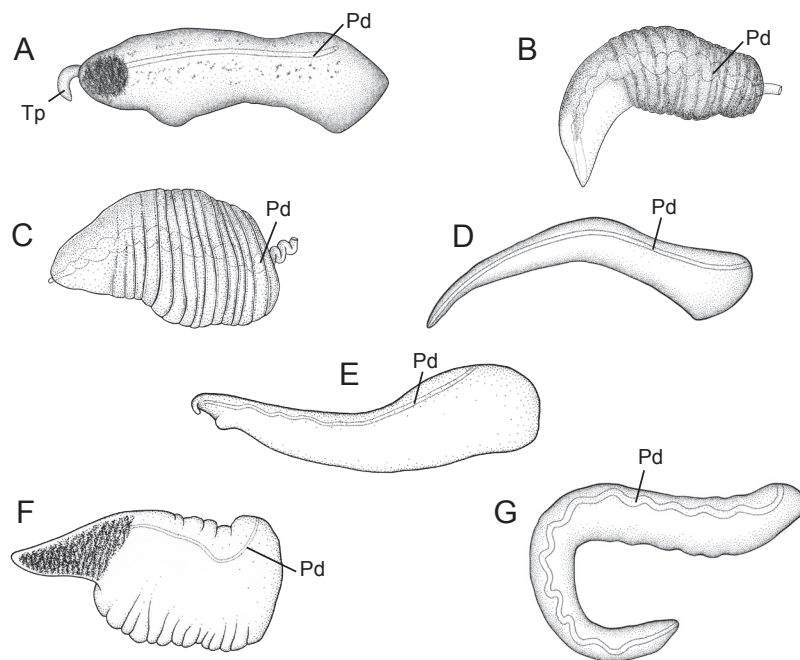
Drawings of penes (dorsal aspect).

- A. *Spurwinkia salsa*.
- B. *Fluminicola fuscus*.
- C. *Fluminicola virens*.
- D. *Taylorconcha serpenticola*.
- E. *Pyrgulopsis lockensis*.
- F. *Pyrgulopsis millenaria*.
- G. *Pristinicola hemphilli*.

Distal edge to left.

Pd, penial duct;

Tp, terminal papilla.



4. Bursa copulatrix absent (Figure 5A) _____ **Taylorconcha**

Bursa copulatrix present (Figure 5B-D) _____ 5

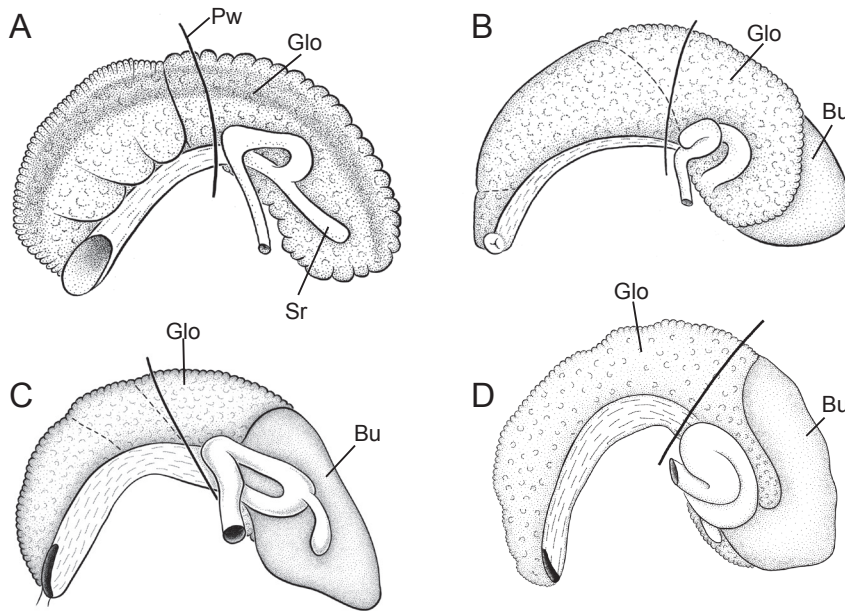


Figure 5. Drawings of (female) glandular oviducts and associated structures (left side).
A. *Taylorconcha serpenticola*.
B. *Fluminicola ahjumawi*.
C. *Pyrgulopsis militaris*.
D. *Pristinicola hemphilli*.
 Anterior to left.
 Bu, bursa copulatrix;
 Glo, glandular oviduct;
 Pw, posterior wall of pallial cavity;
 Sr, seminal receptacle.

5. Bursa copulatrix overlapping right side of albumen gland (Figure 5B); protoconch sculptured with spiral lines (Figure 6A) _____ **Fluminicola**

Bursa copulatrix overlapping left side of albumen gland (Figure 5C-D); protoconch surface wrinkled or pitted (Figure 6B) _____ 6

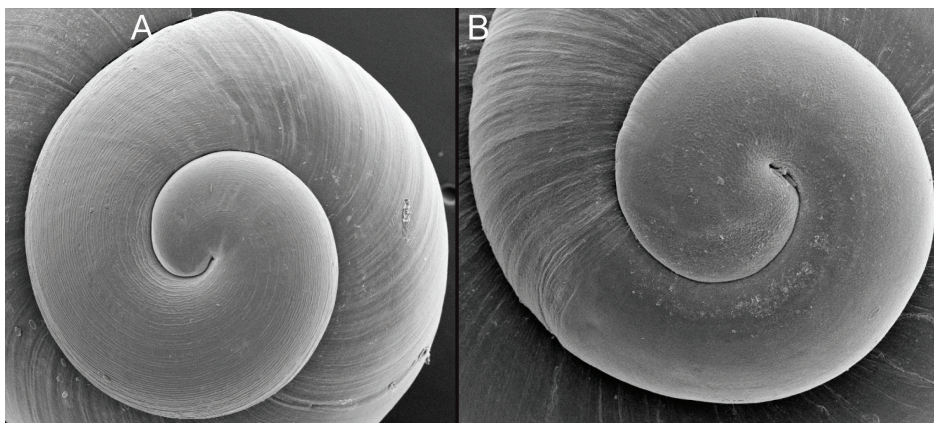
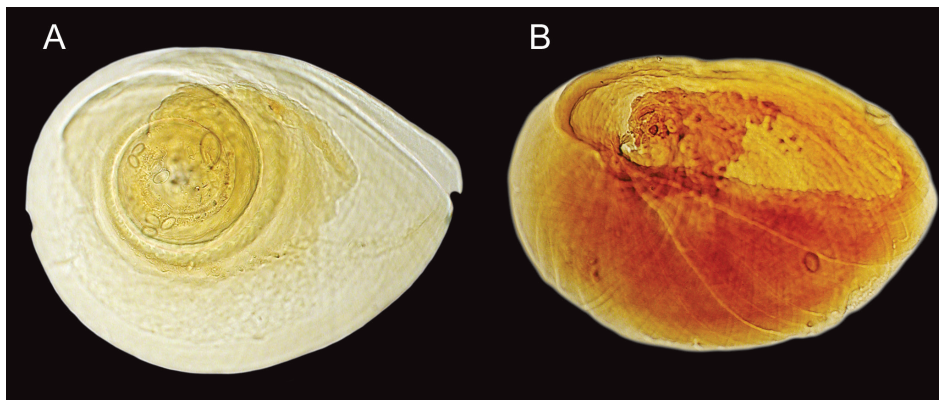


Figure 6. Scanning electron micrographs showing sculpture on shell apical whorls.
A. *Fluminicola gustafsoni*.
B. *Pyrgulopsis castaicensis*.

6. Shell near planispiral to turriform, rarely pupiform; whorls usually convex; operculum amber-colored (Figure 7A); penis rectangular to elongate (<4x longer than wide); penial duct narrow (Figure 4E-F) _____ **Pyrgulopsis** (in part)

Shell pupiform; whorls near flat; operculum reddish (Figure 7B); penis vermiform (>6x longer than wide); penial duct wide (Figure 4G) _____ **Pristinicola**

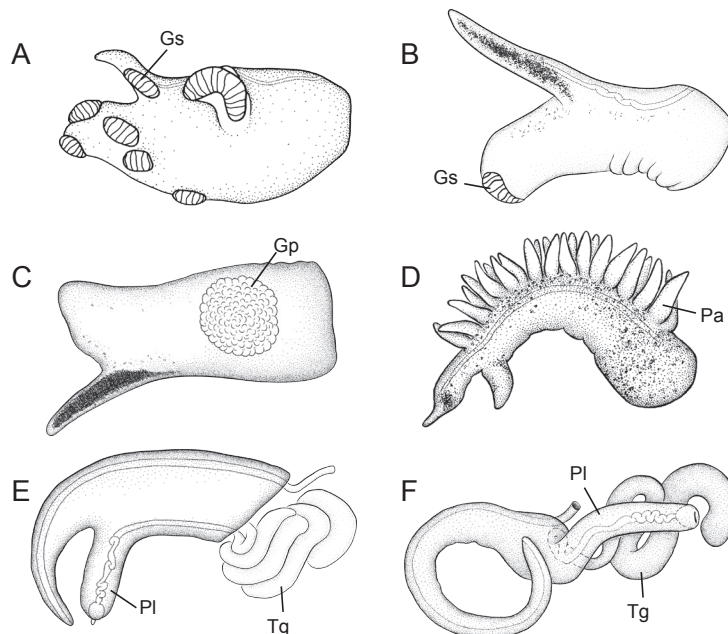
Figure 7. Photographs of opercula (dorsal aspect).
A. *Pyrgulopsis orbiculata*.
B. *Pristinicola hemphilli*.



7. Penial surficial glands (glandular strips or pads) present (Figure 8A-C) _____ **Pyrgulopsis** (in part)

Penial surficial glands absent _____ 8

Figure 8. Drawings of penes (A-B, D-F, dorsal side; C, ventral side).
A. *Pyrgulopsis militaris*.
B. *Pyrgulopsis perforata*.
C. *Pyrgulopsis fresti*.
D. *Littoridinops monroensis*.
E. *Amnicola limosa*.
F. *Colligyryus convexus*.
 Distal edge to left.
 Gp, glandular pad;
 Gs, glandular strip;
 Pa, glandular papilla;
 Pl, penial lobe;
 Tg, tubular gland.



8. Penis has glandular papillae (Figure 8D) _____ **Littoridinops**

Penis has an internal, tubular gland (Figure 8E-F) _____ 9

9. Shell 3.0-4.5 mm tall; penial lobe medially positioned (Figure 8E); bursa copulatrix large relative to albumen gland (Figure 9A) _____ **Amnicola**

Shell 1.3-3.3 mm tall; penial lobe basally positioned (Figure 8F); bursa copulatrix small relative to albumen gland (Figure 9B-C) _____ 10

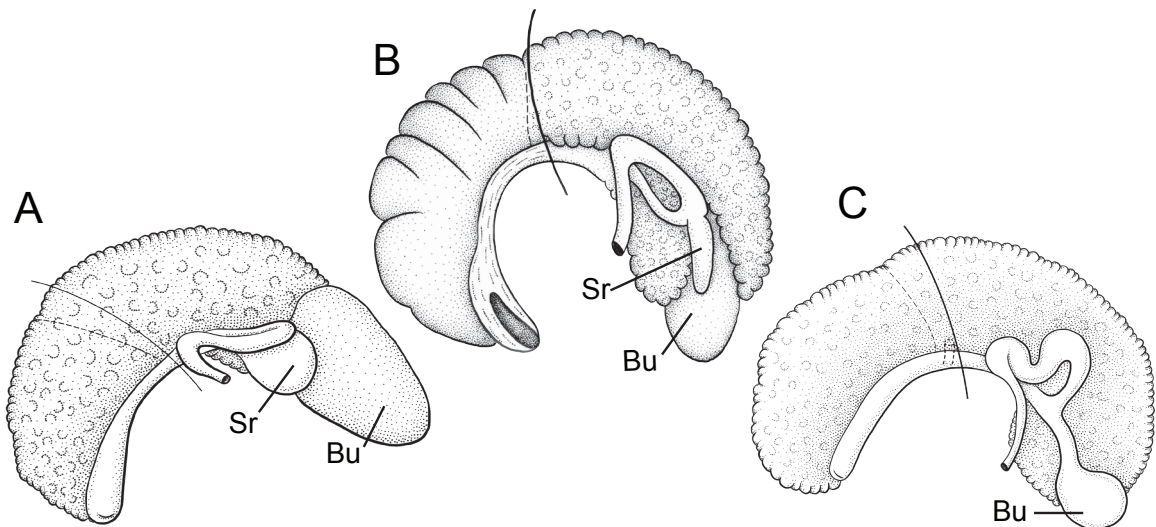


Figure 9. Female glandular oviducts of amnicolid snails.

A. *Amnicola limosa*. **B.** *Colligyrus convexus*.

Anterior to left. **C.** *Lyogyrus* sp.

Bu, bursa copulatrix; Sr, seminal receptacle.

10. Females have two sperm pouches (bursa copulatrix, seminal receptacle) (Figure 9A-B) _____ **Colligyrus**

Females have one sperm pouch (bursa copulatrix) (Figure 9C) _____ **Lyogyrus**

11. Males absent in most populations; penial lobes absent (Figure 10A); white smear often present on inner side of operculum (Figure 11A, C) _____ **Potamopyrgus**

Males common (except in one species of *Tryonia*), penial lobes present (Figure 10B-D); white smear absent on inner side of operculum (Figure 11B) _____ 12

Figure 10. Drawings of penes (dorsal aspect). Distal edge to left.
A. *Potamopyrgus antipodarum*.
B. *Tryonia clathrata*.
C. *Eremopyrgus eganensis*.
D. *Ipnobius robustus*.

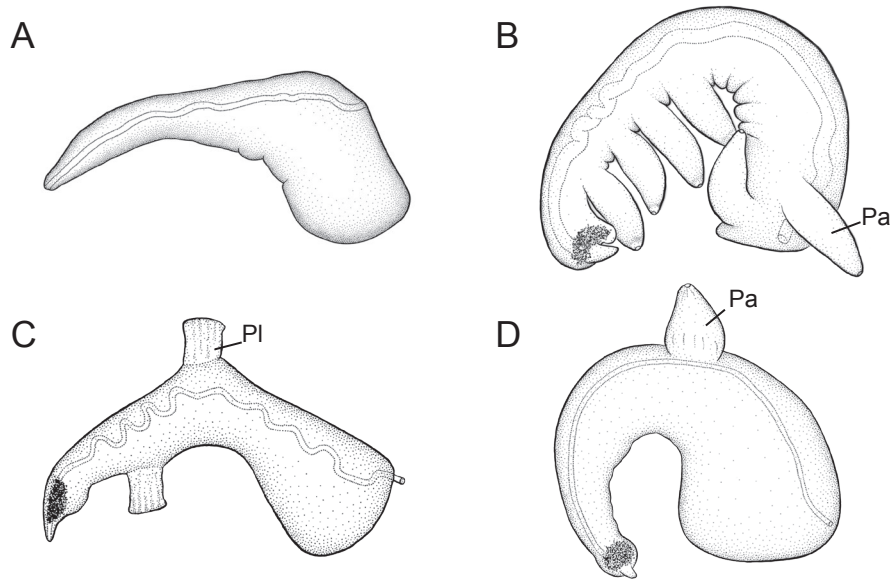
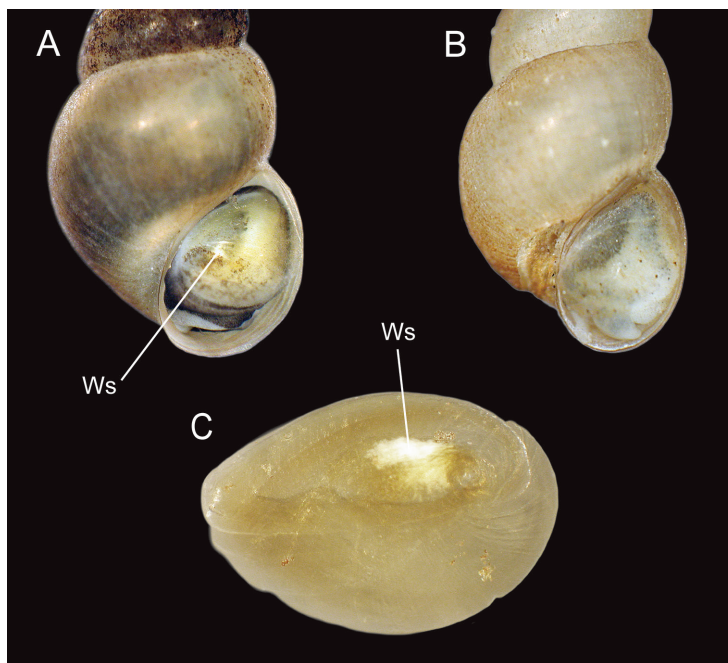


Figure 11. Photographs of shells and opercula.
A. *Potamopyrgus antipodarum*.
B. *Tryonia imitator*.
C. Operculum (inner side), *Potamopyrgus antipodarum*.
 Ws, white smear.



12. Penis has square-shaped lobe(s)
(Figure 10C) _____ ***Eremopyrgus***

Penis has papillae (Figure 10B, D) _____ 13

13. Penis has multiple papillae, including at least one positioned
on inner edge (Figure 10B) _____ ***Tryonia***

Penis has single papilla, positioned on outer edge
(Figure 10D) _____ ***Ipnobius***

Species Checklist

Superfamily Truncatelloidea Gray, 1840

Family Amnicolidae Tryon, 1863

Genus *Amnicola* Gould and Haldeman in Haldeman, 1840

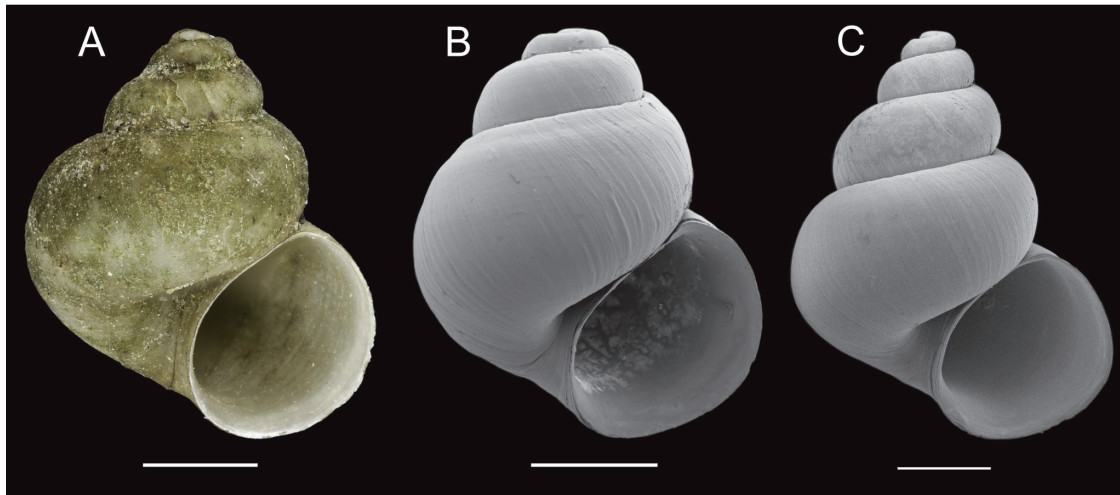


Figure 12. *Amnicola limosa*. A. McWenneger Slough, Flathead County, Montana (University of Minnesota Bell Museum of Natural History [BellMNH] 21425). B. Utah Lake, Utah County, Utah (USNM 47865). C. Curlew Lake, Ferry County, Washington (USNM 1256491). Scale bars, 1.0 mm.

Amnicola Gould and Haldeman in Haldeman, 1840: 3 [type species, *Paludina porata* Say, 1821 (= *Paludina limosa* Say, 1817); subsequent designation by Herrmannsen 1846: 38].

Remarks: *Amnicola* (containing six species) lives in a variety of lotic and lentic habitats and is distributed in a large portion of eastern North America (north of Mexico). One congener (*A. limosa*) is found in the western United States.

Amnicola limosa (Say, 1817)

Paludina limosa Say, 1817: 125-126. Delaware and Schuylkill Rivers. Types have not been found.

Paludina porata Say, 1821: 174. Cayuga Lake [New York]. Lectotype, ANSP 283866; paralectotypes, ANSP 368398.

Amnicola ferruginea Calkins 1880: 6, unlabeled figure (on p. 6). Calumet River, Ill. [Illinois]. Type has not been found.

Amnicola orbiculata Lea, 1844: 34. Springfield, Ohio, and Schuylkill? [sic] near Philadelphia. Holotype, USNM 121342.

Common name: Mud amnicola.

Distribution: Widely ranging in eastern North America (Burch and Tottenham 1980; Clarke 1981); also found in several lakes in Montana and Washington (Liu et al. 2016). The historic population in Utah Lake appears to be extinct (Taylor and Bright 1987).

Taxonomy: Taylor and Bright (1987: fig. 8), Liu et al. (2016).

Remarks: The synonymy does not include the many (extralimital) subspecies of *Amnicola limosa*.

Genus *Colligyrus* Hershler, 1999

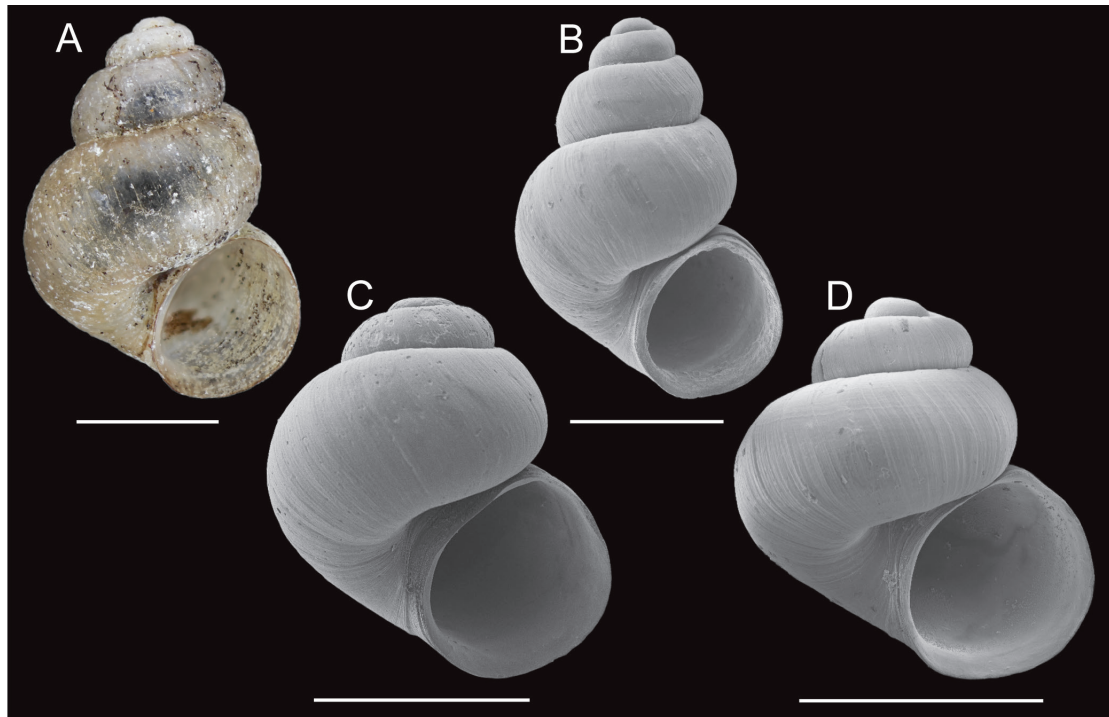


Figure 13. *Colligyrus*. A-B. *C. greggi*, springs along Cliff Creek, Sublette County, Wyoming (USNM 905410, USNM 883531, respectively). C. *C. depressus*, springs along Cricket Creek, Harney County, Oregon (USNM 860756 [paratype]). D. *C. convexus*, Lava Creek, Shasta County, California (USNM 1004536 [paratype]). Scale bars, 1.0 mm.

Colligyrus Hershler, 1999: 306-308 [type species: *Taylorconcha serpenticola* Hershler, Frest, Johannes, Bowler and Thompson, 1994; original designation.]

Remarks: *Colligyrus* is widely distributed in the northwestern United States and typically lives in springs and small streams. Molecular evidence suggests that there are undescribed congeners in the Klamath River (Hershler et al. 2003a) and Puget Sound (Liu et al. 2015a) basins.

***Colligyrus convexus* Hershler, Frest, Liu, and Johannes, 2003**

Colligyrus convexus Hershler, Frest, Liu, and Johannes, 2003a: 278-280, 282, figs. 2-3, 4a, 5. Lava Creek at and west of Island Road bridge near mouth to Eastman Lake, Lava Creek Ranch, north side of The Island, about 8.3 km north of Glenburn, Shasta County, California. Holotype, USNM 1004535; paratypes, USNM 1004536.

Common name: Canary duskysnail.

Distribution: Fall River, Hat Creek, and lower Burney Creek drainages (Pit River basin), California (Hershler et al. 2003a).

***Colligyrus depressus* Hershler, 1999**

Colligyrus depressus Hershler, 1999: 311, 312, 314, 316, figs. 2E-F, 3B, 6. Unnamed springs, Cricket Creek, Silvies River drainage, Harney County, Oregon. Holotype, USNM 883876; paratypes, USNM 860756.

Common name: Harney Basin duskysnail.

Distribution: Known only from the type locality.

***Colligyrus greggi* (Pilsbry, 1935)**

Hydrobia greggi Pilsbry, 1935: 93-94, fig. 2. Cliff Creek Canyon, a fork of Hoback Canyon, about 29 miles [46.7 km] south of Jackson, Wyoming, in the Snake River drainage. Lectotype, ANSP 163812; paralectotypes, ANSP 375735.

Common name: Rocky Mountain duskysnail.

Distribution: Upper Snake River basin (Idaho, Wyoming), northeastern Great Basin (Idaho, Utah), lower Columbia River basin (Oregon, Washington) (Hershler 1999; Liu et al. 2015a).

Taxonomy: Hershler (1999), Liu et al. (2015a).

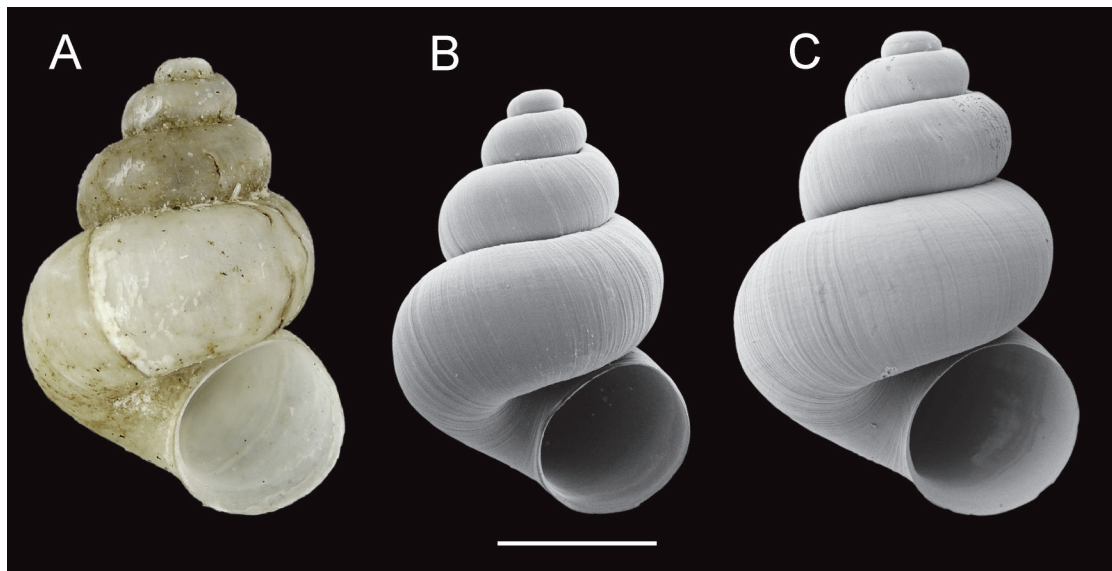


Figure 14. *Lyogyrus* sp. **A.** Browns Lake, Powell County, Montana (USNM 1263003). **B.** Fish Lake, Chelan County, Washington (USNM 1258915). **C.** Upsata Lake, Powell County, Montana (USNM 1262996). Scale bar, 1.0 mm.

Lyogyrus Gill, 1863: 34 [type species: *Valvata pupoidea* Gould, 1839; original designation].

Remarks: *Lyogyrus* (containing nine species) is widely distributed in a variety of freshwater and brackish water habitats in North America from the Mississippi River basin eastward. Additionally, one congener of uncertain species status is found in several lakes in the northwestern United States. *Lyogyrus* was frequently treated in the 20th century literature as a subgenus of *Amnicola*, but is currently recognized as a distinct genus based on morphological and molecular evidence (Thompson and Hershler 1991; Liu et al. 2015a).

Lyogyrus sp.

Lyogyrus sp.—Liu et al. 2016: 467-469, figs. 6-8.

Common name: Masked duskysnail.

Distribution: Several lakes in northern Washington and Montana (Liu et al. 2015a).

Remarks: The taxonomic status of this snail is uncertain pending further study of the poorly known eastern species of *Lyogyrus*.

Family Cochliopidae Tryon, 1866

Genus *Eremopyrgus* Hershler, 1999

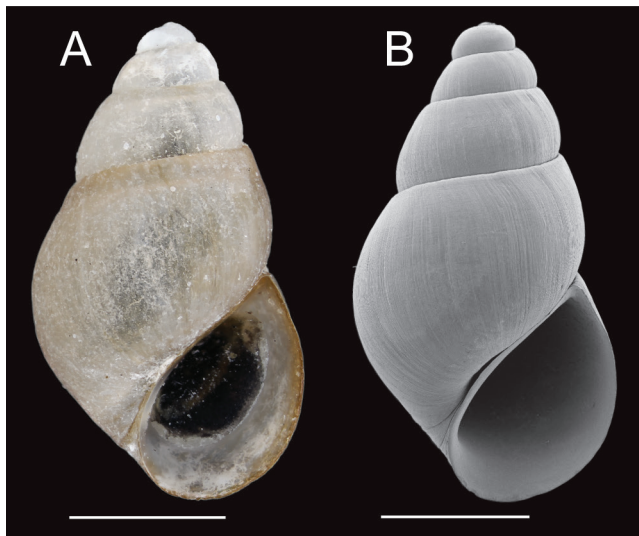


Figure 15. *Eremopyrgus eganensis*. **A-B.** Spring northwest of Clark Spring, Steptoe Valley, White Pine County, Nevada (USNM 883529, USNM 860759 [paratype], respectively). Scale bars, 1.0 mm.

Eremopyrgus Hershler, 1999: 326-328 [type species: *Eremopyrgus eganensis* Hershler, 1999; original designation].

Remarks: *Eremopyrgus* is composed of two locally endemic, spring-dwelling species in Nevada and northeastern Mexico (Hershler et al. 2002).

***Eremopyrgus eganensis* Hershler, 1999**

Eremopyrgus eganensis Hershler, 1999: 328, figs. 3C, 12, 13A-C. Spring northwest of Clark Spring, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 874692; paratypes, USNM 860759.

Common name: Steptoe hydrobe.

Distribution: Several springs in Steptoe Valley, Nevada.

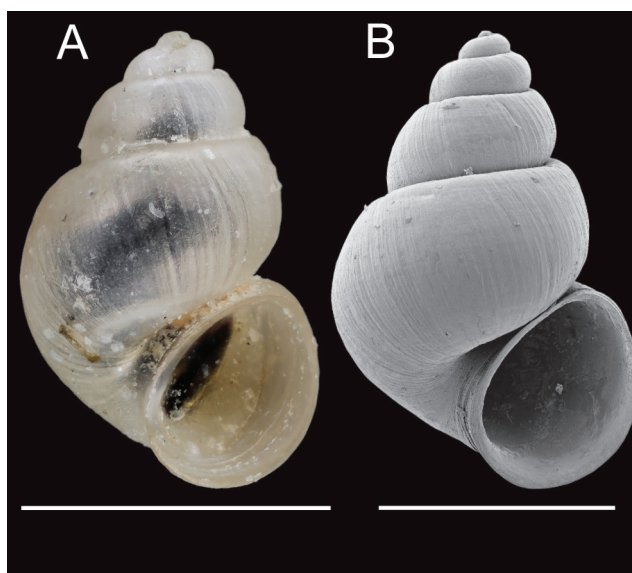
Genus *Ipnobius* Hershler, 2001

Figure 16. *Ipnobius robustus*. **A-B.** Nevares Springs, Death Valley, Inyo County, California (USNM 883311, USNM 853557 [paratype], respectively). Scale bars, 1.0 mm.

Ipnobius Hershler, 2001: 19 [type species, *Tryonia robusta* Hershler, 1989; original designation].

Remarks: *Ipnobius* is a monotypic genus that is distributed in thermal springs in Death Valley, California.

***Ipnobius robustus* Hershler, 1989**

Tryonia robusta Hershler, 1989: 208-211, figs. 51d, 55-58. Nevares Springs, Death Valley, Inyo County, California. Holotype, USNM 860411; paratypes, USNM 853557.

Common name: Robust tryonia.

Distribution: Two spring complexes in central Death Valley, California.

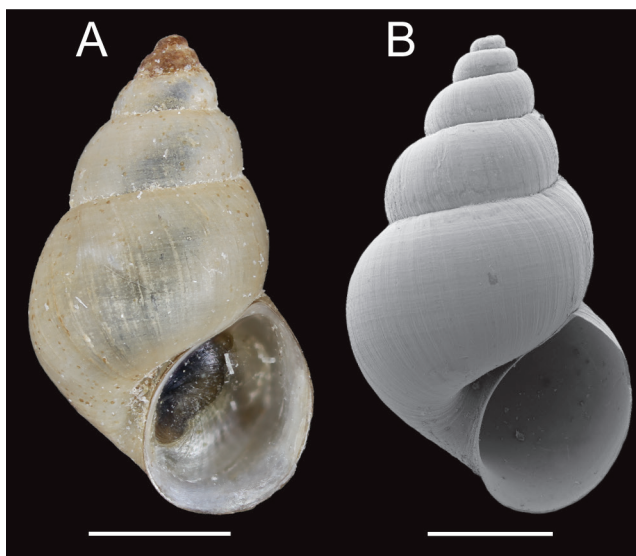


Figure 17. *Littoridinops monroensis*. **A.** Sulphur Springs, Hillsborough County, Florida (USNM 874865). **B.** Suisun Bay (San Francisco Estuary), Contra Costa County, California (USNM 1087202). Scale bars, 1.0 mm.

Littoridinops Pilsbry, 1952: 51 [type species: *Amnicola tenuipes* Couper in Haldeman, 1844; original designation].

Remarks: *Littoridinops* (containing four species) is widely distributed along the North American Atlantic Coast from New Jersey to Campeche, Mexico; also found on several islands in the West Indies (Hershler and Thompson 1992; Vázquez et al. 2012). Members of this genus live in estuarine coastal waters and occasionally in inland freshwater habitats.

Littoridinops monroensis (Frauenfeld, 1863)

Hydrobia monroensis Frauenfeld, 1863: 1023. Lakeman Rok, Florida [possibly referring to Lake Monroe, Volusia County]. Lectotype, NMW; paralectotypes, NMW (per Thompson 1968).

Common name: Cockscomb hydrobe.

Distribution: Florida, Bahama Islands, and Cuba (Thompson 1968; Vázquez et al. 2012). Introduced to San Francisco Bay (Hershler et al. 2007a).

Taxonomy: Hershler et al. (2007a).

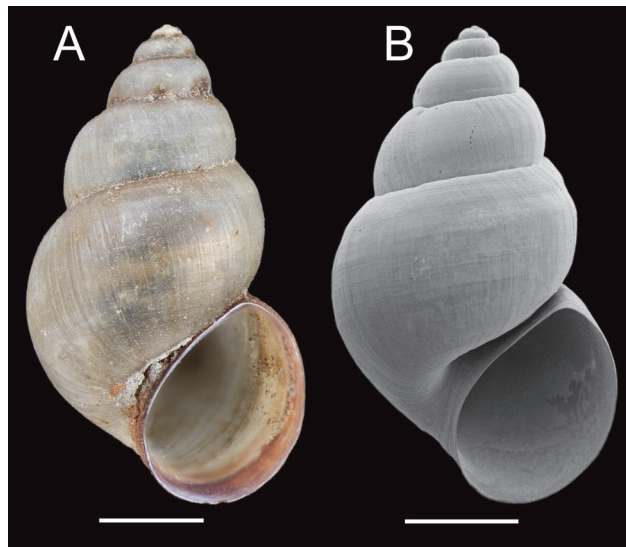


Figure 18. *Spurwinkia salsa*. **A.** Near Harvard Bridge, Boston, Massachusetts (USNM 435954). **B.** Eden Landing (San Francisco Estuary), Alameda County, California (USNM 1120373). Scale bars, 1.0 mm.

Spurwinkia Davis, Mazurkiewicz, and Mandracchia, 1982: 162ff [type species: *Hydrobia salsa* Pilsbry, 1905; original designation].

Remarks: *Spurwinkia* is a monotypic genus that is distributed in estuarine habitats along the North American Atlantic Coast.

Spurwinkia salsa (Pilsbry, 1905)

Paludestrina salsa Pilsbry, 1905: 90-91, pl. 3: fig. 10. Cohasset, Massachusetts.
Lectotype, ANSP 90445; paralectotypes, ANSP 461848.

Common name: Saltmarsh hydrobe.

Distribution: Widely ranging along the western Atlantic coast from New Brunswick to Georgia (Hershler and Thompson 1992; McAlpine et al. 2005). Introduced to San Francisco Bay (Hershler et al. 2015a).

Taxonomy: Hershler et al. (2015a)

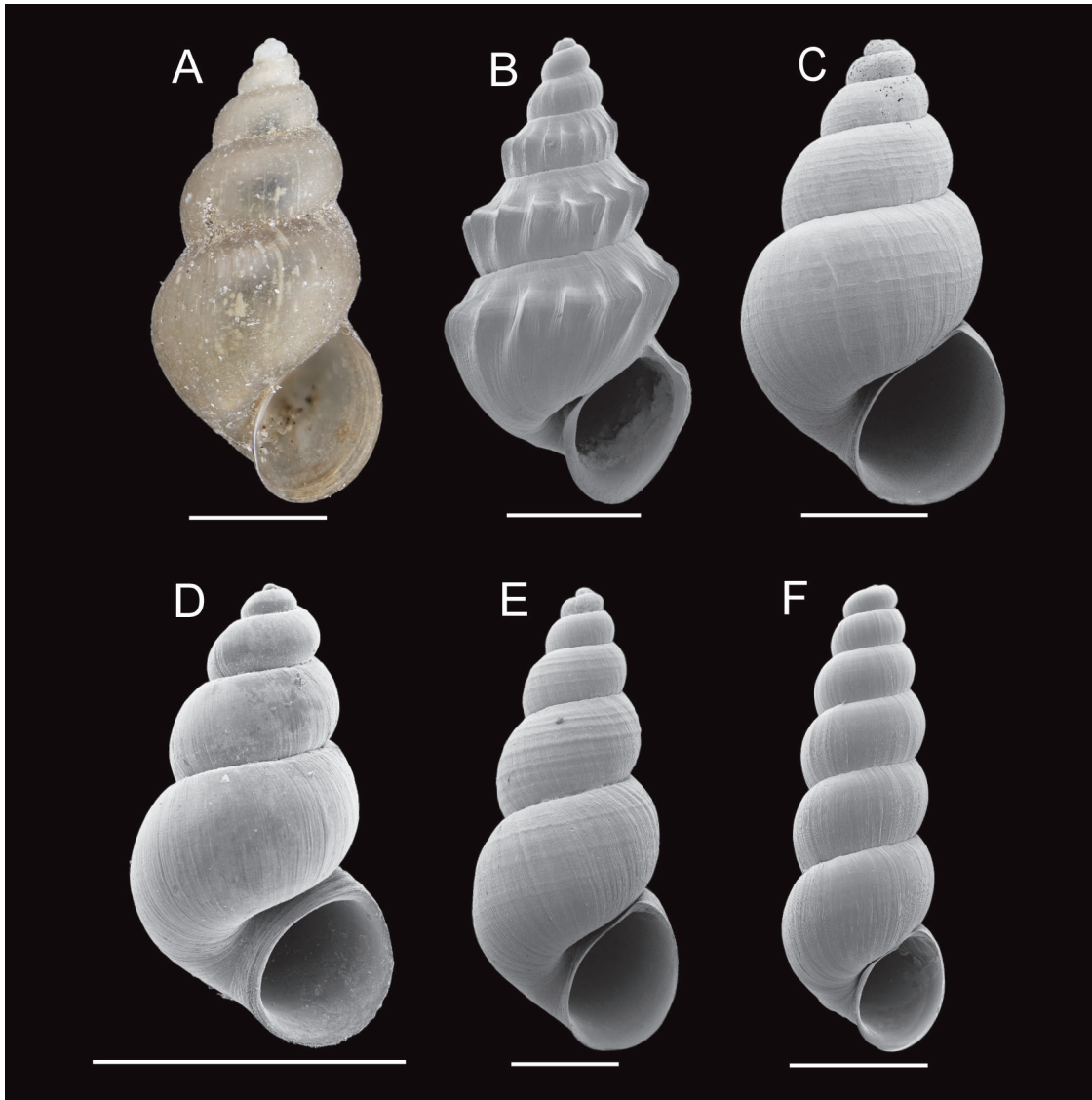


Figure 19. *Tryonia*. **A.** *T. angulata*, Big Spring, Ash Meadows, Nye County, Nevada (USNM 883304). **B.** *T. clathrata*, Cardy Lamb Spring, Moapa Valley, Clark County, Nevada (USNM 874355). **C.** *T. imitator*, Morro Estuary, San Luis Obispo County, California (USNM 892057). **D.** *T. ericae*, North Scruggs Spring, Ash Meadows, Nye County, Nevada (USNM 859163 [paratype]). **E.** *T. porrecta*, southern Suisun Bay (San Francisco Estuary), Contra Costa County, California (USNM 1087204). **F.** *T. monitorae*, Hot Springs, Potts Ranch, Monitor Valley, Nye County, Nevada (USNM 860760 [paratype]). Scale bars, 1.0 mm.

Tryonia Stimpson, 1865: 54 [type species: *Tryonia clathrata* Stimpson, 1865; original designation].

Calipyrgula Pilsbry, 1934: 15 [type species: *Calipyrgula carinifer* Pilsbry, 1934; original designation].

Durangonella Morrison, 1945: 18 [type species: *Hydrobia seemani* Frauenfeld, 1863; original designation].

Hyalopyrgus Thompson, 1968: 43-46 [type species: *Bythinella aequicostata* Pilsbry, 1890; original designation].

Paupertryonia Taylor, 1987: 38 [type species: *Potamopyrgus cheatumi* Pilsbry, 1935; original designation].

Remarks: *Tryonia* is a relatively large genus (33 species) that is widely distributed in southwestern North America and is also found in the Florida Peninsula. Fourteen congeners are distributed in drainages of the western United States. *Tryonia* usually inhabits thermal springs; a few species live in lakes and/or coastal waters. Molecular evidence suggests that *Tryonia* is paraphyletic relative to the monotypic northern Mexican genus *Minckleyella*; these taxa are currently recognized as distinct because of the differences in their female reproductive anatomy (Hershler et al. 2011).

***Tryonia angulata* Hershler and Sada, 1987**

Tryonia angulata Hershler and Sada, 1987: 810-811, 814-817, figs. 39a, 40-41, 42a,d, 43. Fairbanks Spring, Ash Meadows, Nye County, Nevada. Holotype, USNM 859151; paratypes, UF 93960, USNM 859152.

Common name: Sportinggoods tryonia.

Distribution: Three large spring pools in Ash Meadows, Nevada.

Taxonomy: Hershler (2001).

***Tryonia clathrata* Stimpson, 1865**

Tryonia clathrata Stimpson, 1865: 54, pl. 8, fig. 1. Basin of the Colorado Desert [in error, probably Moapa Valley, Nevada; Hershler 1999]. Lectotype (and paralectotypes), ANSP 27969.

Common name: Grated tryonia.

Distribution: White River drainage, Nevada (Hershler 2001).

Taxonomy: Hershler (2001).

***Tryonia elata* Hershler and Sada, 1987**

Tryonia elata Hershler and Sada, 1987: 831, figs. 39b, 42c, 53e-h, 56. Point of Rocks Springs, Ash Meadows, Nye County, Nevada. Holotype, USNM 859159; paratypes, UF 93963, USNM 859160.

Common name: Point of Rocks tryonia.

Distribution: Two small springs at Point of Rocks, Ash Meadows, Nevada.

Taxonomy: Hershler (2001).

***Tryonia ericae* Hershler and Sada, 1987**

Tryonia ericae Hershler and Sada, 1987: 826-831, figs. 39c-d, 42f,i, 53a-d, 54. North Scruggs Spring, Ash Meadows, Nye County, Nevada. Holotype, USNM 859162; paratypes, UF 93962, USNM 859163.

Common name: Minute tryonia.

Distribution: Two closely proximal springs in Ash Meadows, Nevada.

Taxonomy: Hershler (2001).

***Tryonia gilae* Taylor, 1987**

Tryonia gilae Taylor, 1987: 36-37, fig. 17. Unnamed spring on north side of Gila River about 2 mi [3.2 km] north of Bylas, Graham County, Arizona. Holotype, LACM 2187; paratypes, UTEP 10063.

Tryonia gilae Hershler in Hershler and Landye, 1988: 43, 47-49, 58, figs. 14c,f, 39a-e, 40, 41a-c, 42, 43d-i, 44-45, 46a, 47b. Small spring near Bylas, Graham County, Arizona. Holotype, USNM 859059; paratypes, USNM 859060.

Common name: Gila tryonia.

Distribution: Springs along the north side of the Gila River between Bylas and Pima, Arizona.

Taxonomy: Hershler (2001).

Remarks: *Tryonia gilae* Hershler is both a junior primary homonym and junior subjective synonym of *Tryonia gilae* Taylor.

***Tryonia imitator* (Pilsbry, 1899)**

Paludestrina imitator Pilsbry, 1899: 124. Santa Cruz, California. Lectotype, ANSP 6270; paralectotypes, ANSP 457182.

Paludestrina curta Arnold, 1903: 305, pl. VIII: fig. 2. San Pedro bluffs [California], Upper San Pedro Series [Pleistocene]. Holotype, USNM 162542.

Common name: Mimic tryonia.

Distribution: Widely ranging along the central and southern California coast (Taylor 1981).

Taxonomy: Hershler (2001).

***Tryonia infernalis* Hershler, Liu, and Simpson, 2015**

Tryonia infernalis Hershler, Liu, and Simpson, 2015b: 114-116, figs. 4-5. Blue Point Spring, Clark County, Nevada. Holotype, USNM 883884; paratypes, USNM 1266143.

Common name: Blue Point tryonia [name newly introduced herein].

Distribution: Found only at the type locality.

***Tryonia margae* Hershler, 1989**

Tryonia margae Hershler, 1989: 202-205, figs. 48-50, 51a. (Upper) warm spring on limestone bench, Grapevine Springs, Death Valley, California. Holotype, USNM 860408; paratypes, USNM 857952.

Common name: Grapevine Springs elongate tryonia.

Distribution: Found only at the type locality and a second, closely proximal spring.

Taxonomy: Hershler (2001).

***Tryonia monitorae* Hershler, 1999**

Tryonia monitorae Hershler, 1999: 332, 334, figs. 3D, 13D-G, 15. Hot Springs, Potts Ranch, Monitor Valley, Nye County, Nevada. Holotype, USNM 892046; paratypes, USNM 860760.

Common name: Monitor tryonia.

Distribution: Known only from the type locality.

Taxonomy: Hershler (2001).

***Tryonia porrecta* (Mighels, 1848)**

Paludina porrecta Mighels, 1848: 22. Oahu [Hawaii]. Type has not been found [however, NHMUK 1995123 may be a syntype lot; Hershler 2001].

Amnicola protea Gould, 1855: 129-130. Colorado Desert (Gran Jornada). Lectotype, USNM 121074; paralectotypes, USNM 27906, USNM 860867.

Melania exigua Conrad, 1855: 269. Colorado Desert, California. Lectotype (and paralectotypes), ANSP 27965.

Pyrgulopsis imminens Taylor, 1950: 30-31, figs. 4-6. Shore of Salton Sea by Fish Springs (= Desert Shores), Imperial County, California. Holotype, SBMNH 35497; paratypes, SBMNH 35498, SBMNH 35499, USNM 613967.

Pyrgulopsis blakeana Taylor, 1950: 31-32, fig. 7. Holotype, SBMNH 35500; paratypes, SBMNH 35501, SBMNH 35502, USNM 613966.

Pyrgulopsis cahuillarum Taylor, 1950: 31-32, fig. 7. Holotype, SBMNH 35503.

Common name: Desert tryonia.

Distribution: Lower Colorado River basin (Arizona, California, Mexico), Great Basin (Nevada, Utah), San Francisco Bay (California), Hawaii. The populations in San Francisco Bay (Hershler et al. 2007a) and artificial lakes in Phoenix (Hershler et al. 2015a) may have been introduced. (The Hawaiian population could be native or prehistorically introduced; Cowie 1997.)

Taxonomy: Hershler (2001), Hershler et al. (2007a).

Remarks: Most populations of *T. porrecta* are parthenogenetic and entirely composed of females (Hershler et al. 1999a; Hershler et al. 2005); one of the San Francisco Bay populations contains males (Hershler et al. 2007a).

***Tryonia quitobaquitae* Hershler in Hershler and Landye, 1988**

Tryonia quitobaquitae Hershler in Hershler and Landye, 1988: 50, figs. 39f-h, 41d-f, 43a-c, 46a, 47a. Quitobaquito Springs, Organ Pipe [Cactus] National Monument, Pima County, Arizona. Holotype, USNM 859061; paratypes, USNM 859062.

Common name: Quitobaquito springsnail.

Distribution: Two closely proximal springs in the Rio Sonoyta basin, southern Arizona.

Taxonomy: Hershler (2001).

***Tryonia rowlandsi* Hershler, 1989**

Tryonia rowlandsi Hershler, 1989: 211-215, figs. 51b, 59-60. Grapevine Springs, Grapevine Mountains, Death Valley, Inyo County, California. Holotype, USNM 860409; paratypes, USNM 857953.

Common name: Grapevine Springs squat tryonia.

Distribution: Found only at the type locality.

Taxonomy: Hershler (2001).

***Tryonia salina* Hershler, 1989**

Tryonia salina Hershler, 1989: 215-216, figs. 51e, 61-62. Spring brook in Cottonball Marsh, Death Valley, Inyo County, California. Holotype, USNM 860410; paratypes, USNM 853556.

Common name: Cottonball Marsh tryonia.

Distribution: Several springs in Cottonball Marsh, Death Valley (California).

Taxonomy: Hershler (2001).

***Tryonia variegata* Hershler and Sada, 1987**

Tryonia variegata Hershler and Sada, 1987: 817, 819, 822, 824-826, figs. 39e-g, 42b,e,g-h, 45-52. Five Springs, Ash Meadows, Nye County, Nevada. Holotype, USNM 859166; paratypes, UF 93961, USNM 859167.

Common name: Amargosa tryonia.

Distribution: Amargosa River drainage, from Ash Meadows south to Saratoga Spring (Hershler 1989).

Taxonomy: Hershler (2001).

Remarks: Genetic evidence suggests that *T. variegata* is composed of two evolutionarily distinct lineages and requires taxonomic revision (Hershler et al. 1999a).

Family Hydrobiidae Stimpson, 1865

Subfamily Nymphophilinae Taylor, 1966

Genus *Pyrgulopsis* Call and Pilsbry, 1886

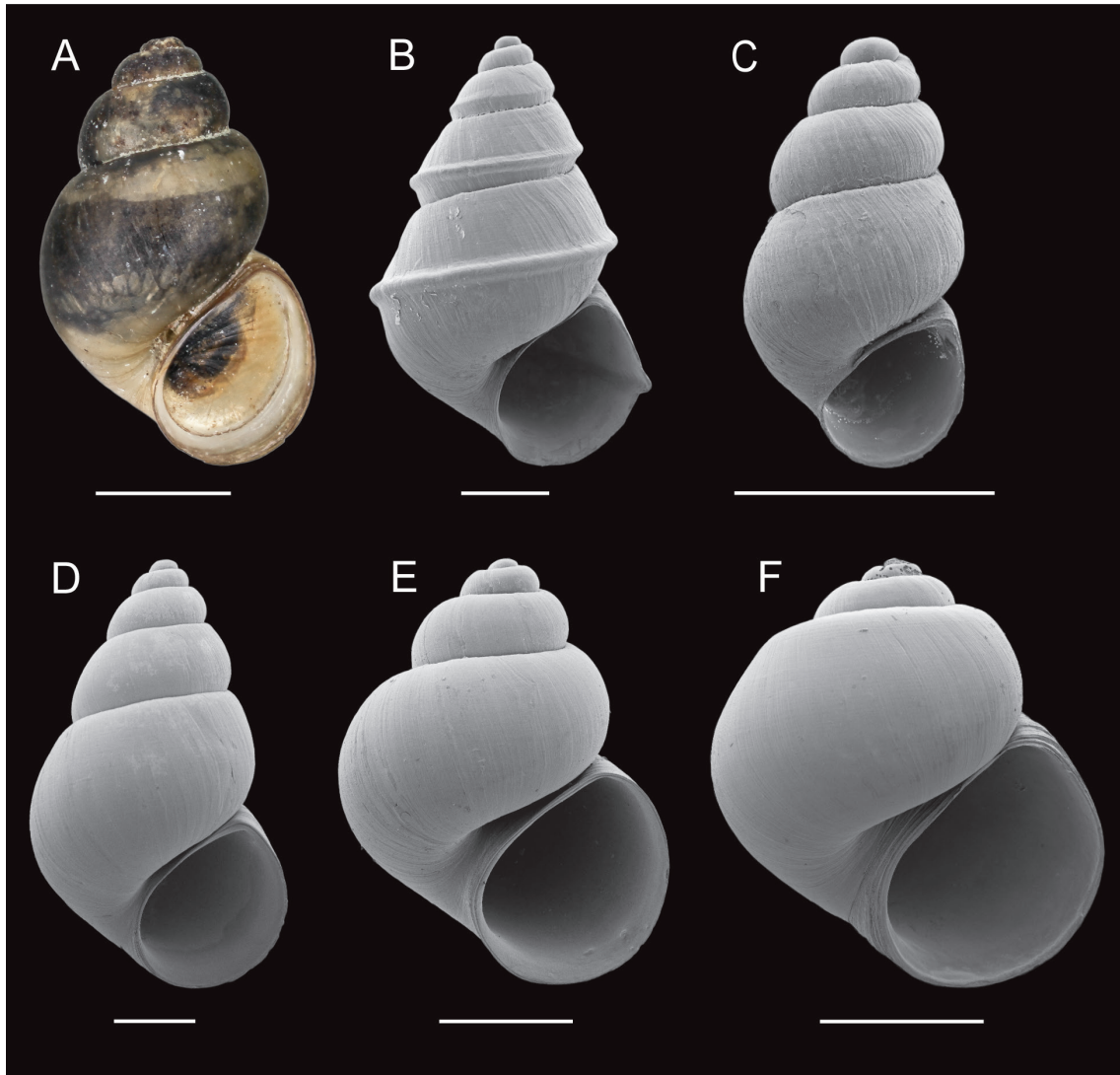


Figure 20. *Pyrgulopsis*. **A.** *P. californiensis*, Grapevine Spring, Anza-Borrego Desert State Park, San Diego County, SBMNH 4349. **B.** *P. nevadensis*, Pyramid Lake, Washoe County, Nevada (USNM 590364). **C.** *P. dixensis*, spring in Dixie Valley, Pershing County, Nevada (USNM 860688 [paratype]). **D.** *P. robusta*, Snake River, north of Jackass Butte, Elmore County, Idaho (ALBRCIDA 7568). **E.** *P. aardahli*, spring at Bramlette Ranch, Benton Valley, Mono County, California (USNM 857951 [paratype]). **F.** *P. merriami*, Ash Spring, Pahrangat Valley, Lincoln County, Nevada (USNM 873395). Scale bars, 1.0 mm.

Pyrgulopsis Call and Pilsbry, 1886: 9-10 [type species: *Pyrgula nevadensis* Stearns, 1883; original designation].

Fontelicella Gregg and Taylor, 1965: 103-104 [type species: *Fontelicella californiensis* Gregg and Taylor, 1965; original designation].

Natricola Gregg and Taylor, 1965: 108-109 [type species: *Pomatiopsis robusta* Walker, 1908; original designation].

Microamnicola Gregg and Taylor, 1965: 109 [type species: *Amnicola micrococcus* Pilsbry in Stearns, 1893; original designation].

Savaginius Taylor, 1966b: 130 [type species: *Paludestrina nanna* Chamberlain and Berry, 1933; original designation].

Nymphophilus Taylor, 1966a: 199-203 [type species: *Nymphophilus minckleyi* Taylor, 1966a; original designation].

Mexistiobia Hershler, 1985: 46-47 [type species: *Mexistiobia manantiali* Hershler, 1985; original designation].

Apachecoccus Taylor, 1987: 32 [type species: *Apachecoccus arizonae* Taylor, 1987; original designation].

Yaquicoccus Taylor, 1987: 34 [type species: *Yaquicoccus bernadinus* Taylor, 1987; original designation].

Remarks: *Pyrgulopsis* contains 143 currently recognized species; 126 are distributed in the western United States while the others are found in the Missouri River headwaters and in northern Mexico. *Pyrgulopsis* typically lives in springs and spring-fed streams, although a few species live in lakes and/or rivers. The systematics of *Pyrgulopsis* have been unstable in recent decades (see Hershler and Thompson 1987; Hershler 1994; Thompson and Hershler 2002; Liu and Hershler 2005), and genetic evidence suggests that the genus, as currently constituted, may be paraphyletic relative to *Floridobia*, which is distributed in Atlantic Coastal drainages (Hershler et al. 2003b; Liu and Hershler 2005). These taxa continue to be recognized as distinct (pending further phylogenetic study) because of their broad geographic separation and differences in their female reproductive anatomy (Liu and Hershler 2005).

***Pyrgulopsis aardahli* Hershler, 1989**

Pyrgulopsis aardahli Hershler, 1989: 179-181, figs. 10-13. Spring at Bramlette Ranch, Benton Valley, Mono County, California. Holotype, USNM 860406; paratypes, USNM 857951.

Common name: Benton Valley springsnail.

Distribution: Known only from the type locality.

Taxonomy: Hershler (1994).

***Pyrgulopsis aloba* Hershler, 1998**

Pyrgulopsis aloba Hershler, 1998: 60-62, figs. 7F, 19D-E, 33A-B. Spring, northwest of Duckwater, Duckwater Valley, Nye County, Nevada. Holotype, USNM 883847; paratypes, USNM 860681.

Common name: Duckwater pyrg.

Distribution: Three springs in Duckwater Valley, Nevada.

***Pyrgulopsis amargosae* Hershler, 1989**

Pyrgulopsis amargosae Hershler, 1989: 181-182, figs. 15-16, 17a, 18. Saratoga Spring, southern Death Valley, San Bernardino County, California. Holotype, USNM 860401; paratypes, USNM 853515.

Common name: Amargosa springsnail.

Distribution: Lower portion of Amargosa River drainage (Tecopa area, southern Death Valley), California.

Taxonomy: Hershler (1994).

Remarks: Genetic evidence suggests that *P. amargosae* is composed of at least two evolutionarily distinct lineages and requires taxonomic revision (Hershler and Liu 2008; Hershler et al. 2013).

***Pyrgulopsis anatina* Hershler, 1998**

Pyrgulopsis anatina Hershler, 1998: 63-64, figs. 7H, 19H-I, 33F-H. Spring southeast of Old Collins Spring, Duckwater Valley, Nye County, Nevada. Holotype, USNM 883848; paratypes, USNM 860710.

Common name: Southern Duckwater pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis anguina* Hershler, 1998**

Pyrgulopsis anguina Hershler, 1998: 110-111, figs. 9K, 23H-J, 44A-E. Big Springs, Snake Valley, White Pine County, Nevada. Holotype, USNM 874678; paratypes, USNM 860725.

Common name: Longitudinal gland pyrg.

Distribution: Snake Valley (Bonneville basin), Nevada-Utah.

***Pyrgulopsis archimedis* Berry, 1947**

Pyrgulopsis archimedis Berry, 1947: 76-77, pl. 7, fig. 6. Upper Klamath Lake near Algoma, Klamath County, Oregon. Holotype, USNM 739417; paratypes, USNM 613965.

Common name: Archimedes pyrg.

Distribution: Upper Klamath Lake and the uppermost reach of its outflow (Link River), Oregon; Hat Creek and Fall River drainages, lower Pit River basin, California (Hershler 1994; Hershler et al. 2003a).

Taxonomy: Hershler (1994), Hershler et al. (2003a).

***Pyrgulopsis arizonae* (Taylor, 1987)**

Apachecoccus arizonae Taylor, 1987: 32, fig. 15. Unnamed spring on north side of Gila River about 2 mi [3.2 km] north of Bylas, Graham County, Arizona. Holotype, LACM 2203; paratypes, ANSP 376020, UF 160939, USNM 854090, UTEP 10050.

Pyrgulopsis sancarlosensis Hershler in Hershler and Landye, 1988: 35, 39-40, figs. 13e, 26e, 31a-g, 32-33. Springs west of Tom Niece Springs, Graham County, Arizona. Holotype, USNM 859051; paratypes, USNM 859052.

Common name: Apache springsnail.

Distribution: Springs along north side of Gila River between Bylas and Pima, southern Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis augustae* Hershler, 1998**

Pyrgulopsis augustae Hershler, 1998: 89, figs. 9B, 22A, 40A-B. Cain Spring, Antelope Valley, Lander County, Nevada. Holotype, USNM 874402; paratypes, USNM 860687.

Common name: Elongate Cain Spring pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis aurata* Hershler, 1998**

Pyrgulopsis aurata Hershler, 1998: 74-75, figs. 8E, 20K-L, 36E-G. Coyote Spring, Pershing County, Nevada. Holotype, USNM 874393; paratypes, USNM 860696.

Common name: Pleasant Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis avernalis* (Pilsbry, 1935)**

Fluminicola avernalis Pilsbry, 1935: 92-93, fig. 1. Colorado Desert [probably in error as there are no other reliable records for this species from the Colorado Desert; Hershler 1994]. Lectotype, ANSP 27784; paralectotypes, ANSP 375737 (mixed with *Pyrgulopsis carinifera*).

Common name: Moapa pebblesnail.

Distribution: Springs in Moapa Valley (lower Colorado River basin), Nevada (Hershler 1998).

Taxonomy: Hershler (1994).

***Pyrgulopsis bacchus* Hershler in Hershler and Landye, 1988**

Pyrgulopsis bacchus Hershler in Hershler and Landye, 1988: 21, figs. 10d, 11e-g, 12d-f, 14b, 15. Grapevine Spring, Mohave County, Arizona. Holotype, USNM 859037; paratypes, USNM 859038.

Common name: Grand Wash springsnail.

Distribution: Two closely proximal springs in Grand Wash, lower Colorado River basin, Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis basiglans* Hershler, 1998**

Pyrgulopsis basiglans Hershler, 1998: 91-93, figs. 9D, 13D, 22D, 40F-H. Spring, Cooks Creek, Carico Lake Basin, Lander County, Nevada. Holotype, USNM 874280; paratypes, USNM 860692.

Common name: Large gland Carico pyrg.

Distribution: Two springs in the Carico Lake basin, Nevada.

***Pyrgulopsis bernardina* (Taylor, 1987)**

Yaquicoccus bernardinus Taylor, 1987: 34-35, fig. 16. Spring, 2,300 ft E, 4,600 ft S of NW corner, sec. 15, T24S, R30E, Cochise County, Arizona. Holotype, LACM 2186; paratypes, ANSP 376019, UF 160934, USNM 854078.

Pyrgulopsis cochisi Hershler in Hershler and Landye, 1988: 41, figs. 25d, 30h-k, 33-34. Spring at San Bernardino Ranch, Cochise County, Arizona. Holotype, 859055; paratypes, USNM 859056.

Common name: San Bernardino springsnail.

Distribution: Several springs in the upper San Bernardino basin, southern Arizona and northern Sonora (Mexico) (Varela-Romero et al. 2013).

Taxonomy: Hershler (1994).

***Pyrgulopsis bifurcata* Hershler, 1998**

Pyrgulopsis bifurcata Hershler, 1998: 93-94, figs. 9E, 22E, 41A-C. Springs west of Carico Lake, Carico Lake Basin, Lander County, Nevada. Holotype, USNM 874306; paratypes, USNM 860693.

Common name: Small gland Carico pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis breviloba* Hershler, 1998**

Pyrgulopsis breviloba Hershler, 1998: 39, 41, figs. 6G, 11C, 14D-F, 17L-M, 28D-F. Flag Springs (the middle of three), White River Valley, Nye County, Nevada. Holotype, USNM 873174; paratypes, USNM 860689.

Common name: Flag pyrg.

Distribution: Flag Springs complex (White River Valley), and one spring in Dry Lake Valley, Nevada.

***Pyrgulopsis bruesi* Hershler and Sada, 2000**

Pyrgulopsis bruesi Hershler and Sada, 2000: 367-368, 370-372, figs. 1-4. Small stream that enters Fly Reservoir, about 23 airline-km north-northeast of Gerlach, Washoe County, Nevada. Holotype, USNM 892079; paratypes, USNM 860868.

Common name: Fly Ranch pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis bruneauensis* Hershler, 1990**

Pyrgulopsis bruneauensis Hershler, 1990: 803, 805, 809, 811, 813-814, figs. 1-6. Spring along west side of Bruneau River, ca. 100 m downflow from Hot Creek's confluence with the river, Owyhee County, Idaho. Holotype, USNM 860507; paratypes, USNM 860508.

Common name: Bruneau Hot springsnail.

Distribution: Small springs along Hot Creek and confluent Bruneau River (Idaho).

Taxonomy: Hershler (1994).

***Pyrgulopsis bryantwalkereri* Hershler, 1994**

Fluminicola nevadensis Walker, 1916: 6-7, unlabeled figure. Spring in the Cortez foot-hills, Humboldt Valley, Elko County, Nevada. Lectotype, UMMZ 118012; paralectotypes, ANSP 115948, MCZ 31450.

Pyrgulopsis bryantwalkereri Hershler, 1994: 23. Replacement name for *Fluminicola nevadensis* Walker, 1916; preoccupied in *Pyrgulopsis* by *Pyrgula nevadensis* Stearns, 1883.

Common name: Cortez Hills pebblesnail.

Distribution: Known from a single spring in the Humboldt River basin, Nevada (Hershler 1994).

Taxonomy: Hershler (1994).

***Pyrgulopsis californiensis* (Gregg and Taylor, 1965)**

Fontelicella californiensis Gregg and Taylor, 1965: 109. Campo Creek, San Diego County, California, 0.6 mi. [1.0 km] east of Mountain Empire Dam. Holotype, UMMZ 220000.

Distribution: Southern California and adjacent Baja California. From the southern Sierra Nevada (western slope only) through the western Transverse Ranges and coastal plains to the Laguna Mountains.

Common name: Laguna Mountain springsnail.

Taxonomy: Hershler (1994).

Remarks: Genetic evidence suggests that *P. californiensis* is composed of two evolutionarily distinct lineages and requires taxonomic revision (Hershler and Liu 2010).

***Pyrgulopsis carinata* Hershler, 1998**

Pyrgulopsis carinata Hershler, 1998: 60, figs. 7E, 19C, 32F-G. Little Warm Spring, Duckwater Valley, Nye County, Nevada. Holotype, USNM 883975; paratypes, USNM 860680.

Common name: Carinate Duckwater pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis carinifera* (Pilsbry, 1935)**

Fluminicola avernalis carinifera Pilsbry, 1935: 93, fig. 3. Colorado Desert [in error, probably Moapa Valley, Nevada; Hershler 1994]. Lectotype, ANSP 164091; paralectotypes, ANSP 375736.

Common name: Moapa Valley pyrg.

Distribution: Moapa Valley, lower Colorado River basin (Hershler 1998).

Taxonomy: Hershler (1994).

Remarks: Elevated to full species by Hershler (1994).

***Pyrgulopsis castaicensis* Hershler and Liu, 2010**

Pyrgulopsis castaicensis Hershler and Liu, 2010: 6-10, figs. 3-5. Middle Canyon Spring, ca. 1.46 km southwest of Castaic Junction, Los Angeles County, California. Holotype, USNM 1120442; paratypes, USNM 1132532.

Common name: Middle Canyon Spring pyrg.

Distribution: Known only from the type locality in the Santa Clara River basin.

***Pyrgulopsis chamberlini* Hershler, 1998**

Pyrgulopsis chamberlini Hershler, 1998: 122-124, figs. 10G, 25A-C, 47D-G. Spring, Glenwood, Sevier River drainage, Sevier County, Utah. Holotype, USNM 883576; paratypes, USNM 860729.

Common name: Smooth Glenwood pyrg.

Distribution: Two closely proximal springs in the Sevier River drainage (Utah).

***Pyrgulopsis cinerana* Hershler, Frest, Liu, and Johannes, 2003**

Pyrgulopsis cinerana Hershler, Frest, Liu, and Johannes, 2003a: 296-299, figs. 4D, 18-19. Nearest spring east of Ash Valley Road (Modoc County 527) crossing of Ash Creek, north side of creek, JJJ Ranch, Lassen County, California. Holotype, USNM 1004543; paratypes, USNM 1004544.

Common name: Ash Valley pyrg.

Distribution: Cold springs associated with upper Ash Creek, upper Pit River basin.

***Pyrgulopsis coloradensis* Hershler, 1998**

Pyrgulopsis coloradensis Hershler, 1998: 29, figs. 6C, 17D, 27A-B. Blue Point Spring, Colorado River drainage, Clark County, Nevada. Holotype, USNM 854621; paratypes, USNM 860677.

Common name: Blue Point pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis conica* Hershler in Hershler and Landye, 1988**

Pyrgulopsis conicus Hershler in Hershler and Landye, 1988: 21, figs. 10e, 16a-d, 17-18. Dripping Springs, Mohave County, Arizona. Holotype, USNM 859039; paratypes, USNM 859040.

Common name: Kingman springsnail.

Distribution: Three springs in the Black Mountains, lower Colorado River basin, Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis cruciglans* Hershler, 1998**

Pyrgulopsis cruciglans Hershler, 1998: 72, figs. 8C, 20F-H, 36A-B. Flat Spring, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 874285; paratypes, USNM 860709.

Common name: Transverse gland pyrg.

Distribution: Several springs in Steptoe Valley and adjacent basins, eastern Nevada.

***Pyrgulopsis crystalis* Hershler and Sada, 1987**

Pyrgulopsis crystalis Hershler and Sada, 1987: 797, 799-802, figs. 8c,f,i, 18c, 23d, 24b, 28. Crystal Pool, Ash Meadows, Nye County, Nevada. Holotype, USNM 859205; paratypes, UF 93956, USNM 859206.

Common name: Crystal springsnail.

Distribution: Known only from the type locality.

Taxonomy: Hershler (1994).

***Pyrgulopsis cybele* Hershler and Liu, 2012**

Pyrgulopsis cybele Hershler and Liu, 2012a: 23, 26-27, figs. 2-4. Unnamed spring brook on east side of South Fork Owyhee River, Elko County, Nevada. Holotype, USNM 1148155; paratypes, USNM 1157696.

Common name: Nature pyrg.

Distribution: Two closely proximal springs that discharge to the “Devil’s Pinball” reach of the South Fork Owyhee River.

***Pyrgulopsis deaconi* Hershler, 1998**

Pyrgulopsis deaconi Hershler, 1998: 23, 25, figs. 6B, 11A, 17B-C, 26D-G. Red Spring, Red Rock Canyon Recreation Lands [Red Rock Canyon National Conservation Area], Las Vegas Valley, Clark County, Nevada. Holotype, USNM 874454; paratypes, USNM 860676.

Common name: Spring Mountains pyrg.

Distribution: Spring Mountains (Las Vegas and Pahrump Valley drainages), Nevada.

***Pyrgulopsis deserta* (Pilsbry, 1916)**

Amnicola deserta Pilsbry, 1916: 111. Washington County, Utah. Lectotype, ANSP 12112; paralectotypes, ANSP 396958.

Common name: Desert springsnail.

Distribution: Springs in the St. George area (Utah) and below the Virgin River narrows near Littlefield (Arizona), lower Colorado River basin (Hershler and Landye 1998).

Taxonomy: Hershler and Landye (1988), Hershler (1994).

***Pyrgulopsis diablensis* Hershler, 1995**

Pyrgulopsis diablensis Hershler, 1995: 344-345, 347, 349, figs. 1-3, 5A. Unnamed creek, Del Puerto Canyon, Del Puerto [Canyon] Road, 20 km west of HW [Interstate] 5, Stanislaus County, California. Holotype, USNM 860645; paratypes, USNM 883791.

Common name: Diablo Range pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis dixensis* Hershler, 1998**

Pyrgulopsis dixensis Hershler, 1998: 73-74, figs. 8D, 13C, 20I-J, 36C-D. Springs west-southwest of Hot Springs, Dixie Valley, Pershing County, Nevada. Holotype, USNM 874391; paratypes, USNM 860688.

Common name: Dixie Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis eremica* Hershler, 1995**

Pyrgulopsis eremica Hershler, 1995: 349-351, 354, figs. 5B, 7-9. Unnamed springs, tributary to Willow Creek, Willow Creek Valley, Lassen County, California. Holotype, USNM 860644; paratypes, USNM 858264.

Common name: Smoke Creek pyrg.

Distribution: Portions of the northeastern Great Basin in California.

***Pyrgulopsis erythropoma* (Pilsbry, 1899)**

Fluminicola fusca var. *minor* Stearns, 1893: 282 [*nomen nudum*].

Fluminicola erythropoma Pilsbry, 1899: 125-126. Ash Meadows, Nye County, Nevada [Probably Kings Pool at Point of Rocks; Hershler and Sada 1987]. Lectotype, ANSP 73607; paralectotypes, ANSP 396951.

Common name: Ash Meadows pebblesnail.

Distribution: Point of Rocks spring complex, Ash Meadows.

Taxonomy: Hershler and Sada (1987), Hershler (1994).

Remarks: Stearns's (1893) publication of *Fluminicola fusca* var. *minor* was not accompanied by a description and therefore this name is not available per International Code of Zoological Nomenclature Article 12.1. His cited material for this *nomen nudum* (USNM 123624) was from the type locality of *P. erythropoma* (per Hershler 1994: 35) and closely conforms to this species in all respects.

***Pyrgulopsis fairbanksensis* Hershler and Sada, 1987**

Pyrgulopsis fairbanksensis Hershler and Sada, 1987: 796-797, figs. 8d,g, 18a-b, 19a, 24d, 26-27. Fairbanks Spring, Ash Meadows, Nye County, Nevada. Holotype, USNM 859203; paratypes, UF 93955, USNM 859204.

Common name: Fairbanks springsnail.

Distribution: Known only from the type locality.

Taxonomy: Hershler (1994).

***Pyrgulopsis falciglans* Hershler, Frest, Liu, and Johannes, 2003**

Pyrgulopsis falciglans Hershler, Frest, Liu, and Johannes, 2003a: 293-296, figs. 4C, 15-16. Cold spring about 0.4 km southeast of Smokey Charlie [Charley] Spring and 0.32 km west of Modoc County 63, at source next to homestead cabin, Modoc County, California. Holotype, USNM 1004605; paratypes, USNM 1004606.

Common name: Likely pyrg.

Distribution: Two closely proximal springs along the South Fork Pit River.

***Pyrgulopsis fausta* Hershler, 1998**

Pyrgulopsis fausta Hershler, 1998: 15, 23, figs. 6A, 12A, 17A, 26A-C. Corn Creek Springs, Las Vegas Valley, Clark County, Nevada. Holotype, USNM 874757; paratypes, USNM 860765.

Common name: Corn Creek pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis fresti* Hershler and Liu, 2009**

Pyrgulopsis fresti Hershler and Liu, 2009: 9, 11-12, figs. 3-5. Tudor Warm Springs, east side of Owyhee River, second spring from north, Malheur County, Oregon. Holotype, USNM 1102148; paratypes, USNM 1116914.

Common name: Owyhee Hot springsnail.

Distribution: Springs along a short reach of Owyhee River drainage above Three Forks (Oregon).

***Pyrgulopsis fusca* Hershler, 1998**

Pyrgulopsis fusca Hershler, 1998: 122, figs. 10F, 24K-M, 47A-C. Spring brook, Otter Creek, ca. 1.6 km above The Narrows, Piute County, Utah. Holotype, USNM 883439; paratypes, USNM 860728.

Common name: Otter Creek pyrg.

Distribution: Sevier River drainage, Utah.

***Pyrgulopsis gibba* Hershler, 1995**

Pyrgulopsis gibba Hershler, 1995: 354, 357-358, figs. 5C, 10-12. Unnamed springs west of Fee Reservoir, Surprise Valley, Modoc County, California. Holotype, USNM 860643; paratypes, USNM 858275.

Distribution: Northwestern Great Basin (California, Nevada, Oregon) (Hershler 1998).

***Pyrgulopsis gilae* (Taylor, 1987)**

Fontelicella gilae Taylor, 1987: 16, fig. 7. Springs on north side of East Fork of Gila River, Grant County, New Mexico. Holotype LACM 2214; paratypes, ANSP 376025, UF 160936, USNM 854087, UTEP 10054.

Common name: Surprise Valley pyrg.

Distribution: Several groups of springs in lower reach of the East Fork Gila River basin (below the mouth of Black Canyon), and a single spring along the Gila River ca. 2 km below the East Fork confluence (New Mexico) (Hershler et al. 2014b).

Taxonomy: Hershler (1994), Hershler et al. (2014b).

***Pyrgulopsis giulianii* Hershler and Pratt, 1990**

Pyrgulopsis giulianii Hershler and Pratt, 1990: 279-281, 283-285, figs. 1-3. Sand Canyon, Kern County, California. Holotype, USNM 860444; paratypes, SBMNH 35140, USNM 853519.

Common name: Southern Sierra Nevada springsnail.

Distribution: Springs along the flanks of the southern Sierra Nevada, California.

Taxonomy: Hershler (1994).

***Pyrgulopsis glandulosa* Hershler in Hershler and Landye, 1988**

Pyrgulopsis glandulosa Hershler in Hershler and Landye, 1988: 8, 11, 15, 17, figs. 3a-c, 4-9, 10a-b. Nelson Place Spring, Yavapai County, Arizona. Holotype, USNM 859047; paratypes, USNM 859048.

Common name: Verde Rim springsnail.

Distribution: Headwaters (two closely proximal springs) of Sycamore Creek, Verde River drainage, central Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis gracilis* Hershler, 1998**

Pyrgulopsis gracilis Hershler, 1998: 43, 45, 47, figs. 6I, 11D, 18B-C, 29F-H. Emigrant Springs (northernmost in spring complex), White River Valley, Nye County, Nevada. Holotype, USNM 873158; paratypes, USNM 860698.

Common name: Emigrant pyrg.

Distribution: Emigrant Springs complex, White River Valley, Nevada.

***Pyrgulopsis greggi* Hershler, 1995**

Pyrgulopsis greggi Hershler, 1995: 358-359, figs. 5D, 14-16. Grapevine Creek, Fort Tejon State Historical Park, Kern County, California. Holotype, USNM 860641; paratypes, USNM 874319.

Common name: Kern River springsnail.

Distribution: Grapevine Creek drainage, upper Kern River basin (California).

***Pyrgulopsis hamlinensis* Hershler, 1998**

Pyrgulopsis hamlinensis Hershler, 1998: 106-108, figs. 9I, 22K, 43A-C. Springs 0.5 km east of White Rock Cabin Springs, Hamlin Valley, Beaver County, Utah. Holotype, USNM 883215; paratypes, USNM 860695.

Common name: Hamlin Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis hovinghi* Hershler, 1998**

Pyrgulopsis hovinghi Hershler, 1998: 115, 117, figs. 10B, 11I, 16D-F, 24E, 45G-I. Prather Springs, Thousand Springs Valley, Elko County, Nevada. Holotype, USNM 874075; paratypes, USNM 860720.

Common name: Upper Thousand Spring pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis hualapaiensis* Hershler, Liu, and Stevens, 2016**

Pyrgulopsis hualapaiensis Hershler, Liu, and Stevens, 2016b: 74-79, figs. 2-4. Upper Peach Springs, outflow just below concrete weir, Hualapai Indian Reservation, Mohave County, Arizona. Holotype, USNM 1248611; paratypes, USNM 1266144.

Common name: Hualapai pyrg [name newly introduced herein].

Distribution: Found only at upper Peach Springs (consisting of two closely proximal spring complexes), lower Colorado River basin, Arizona.

***Pyrgulopsis hubbsi* Hershler, 1998**

Pyrgulopsis hubbsi Hershler, 1998: 33, 35-36, figs. 6E, 14A-C, 17F-G, 27F-H. Hiko Spring, Pahrnagat Valley, Lincoln County, Nevada.

Common name: Hubbs pyrg.

Distribution: Pahrnagat Valley, White River drainage, Nevada.

***Pyrgulopsis humboldtensis* Hershler, 1998**

Pyrgulopsis humboldtensis Hershler, 1998: 97, figs. 9H, 13E, 22H-J, 42F-I. Springs, East Fork Beaver Creek (above Cabin Creek confluence), North Fork Humboldt River, Elko County, Nevada. Holotype, USNM 874722; paratypes, USNM 860718.

Common name: Humboldt pyrg.

Distribution: Humboldt River drainage, northern Nevada.

***Pyrgulopsis imperialis* Hershler, 1998**

Pyrgulopsis imperialis Hershler, 1998: 86-87, figs. 8L, 21J-K, 39D-F. Spring, south side of road, Thacker Pass, Kings River Valley, Humboldt County, Nevada. Holotype, USNM 874207; paratypes, USNM 860716.

Common name: Kings River pyrg.

Distribution: Two closely proximal springs in Kings River Valley, Nevada.

***Pyrgulopsis inopinata* Hershler, 1998**

Pyrgulopsis inopinata Hershler, 1998: 124-125, figs. 10H, 25D-F, 47H-J. Spring, Glenwood, Sevier River drainage, Sevier County, Utah. Holotype, USNM 883493; paratypes, USNM 860730.

Common name: Carinate Glenwood pyrg.

Distribution: Three springs in the Sevier River drainage, Utah.

***Pyrgulopsis intermedia* (Tryon, 1865)**

Pomatiopsis intermedia Tryon, 1865: 220, pl. 22: fig. 8. Crooked Creek, Owyhee, southeastern Oregon. Lectotype, ANSP 27958; paralectotypes, ANSP 396959.

Common name: Crooked Creek springsnail.

Distribution: Great Basin (Barren Valley) and Owyhee River basin, Oregon (Hershler and Liu, 2009).

Taxonomy: Hershler (1994), Hershler and Liu (2009).

***Pyrgulopsis isolata* Hershler and Sada, 1987**

Pyrgulopsis isolata Hershler and Sada, 1987: 807-810, figs. 19d, 29c,f, 33d,g, 37-38. Spring south of Clay Pits, Ash Meadows, Nye County, Nevada. Holotype, USNM 859201; paratypes, UF 93959; USNM 859202.

Common name: Elongate-gland springsnail.

Distribution: Known only from the type locality.

Taxonomy: Hershler (1994).

***Pyrgulopsis kolobensis* (Taylor, 1987)**

Fontelicella kolobensis Taylor, 1987: 19, fig. 8. Toquerville Springs, Washington County, Utah. Holotype, LACM 2216.

Fontelicella pinetorum Taylor, 1987: 20, fig. 9. Spring tributary to Leeds Creek, Washington County, Utah. Holotype, LACM 2217.

Common name: Toquerville springsnail.

Distribution: Eastern Great Basin and lower Colorado River drainage (Idaho, Nevada, Utah) (Hershler 1998).

Taxonomy: Hershler (1994).

***Pyrgulopsis landyei* Hershler, 1998**

Pyrgulopsis landyei Hershler, 1998: 70-71, figs. 8A, 20B, 35C-F. Spring ca. 1.6 km north-northwest of Steptoe Ranch, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 892014; paratypes, USNM 860685.

Common name: Landyes pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis lasseni* Hershler, Frest, Liu, and Johannes, 2003**

Pyrgulopsis lasseni Hershler, Frest, Liu, and Johannes, 2003a: 299, 301-302, figs. 4E, 20-21. Willow Creek on both sides of wooden foot bridge at a picnic area just downstream (west) of Willow Creek Campground, north side of CA 139, about 0.16 rd. km west of Hayden Hill Cut Off [Cutoff] Road junction, Modoc National Forest, Lassen County, California. Holotype, USNM 1004532; paratypes, USNM 1004533.

Common name: Willow Creek pyrg.

Distribution: Upper reach of Willow Creek and an associated thermal spring complex, upper Pit River basin (California).

***Pyrgulopsis lata* Hershler, 1998**

Pyrgulopsis lata Hershler, 1998: 41, 43, figs. 6H, 12D, 18A, 29A-E. Butterfield Springs, White River Valley, Nye County, Nevada. Holotype, USNM 874667; paratypes, USNM 860697.

Common name: Butterfield pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis lentiglans* Hershler, 1998**

Pyrgulopsis lentiglans Hershler, 1998: 118-120, figs. 10D, 24G-H, 46C-E. Crittenden Springs, Thousand Springs Creek, Elko County, Nevada. Holotype, USNM 874724; paratypes, USNM 860722.

Common name: Crittenden pyrg.

Distribution: Two springs in the Thousand Springs drainage, northeastern Nevada.

***Pyrgulopsis leporina* Hershler, 1998**

Pyrgulopsis leporina Hershler, 1998: 96-97, figs. 9G, 22G, 42A-E. Springs, Rabbit Creek, Humboldt River drainage, Elko County, Nevada. Holotype, USNM 874336; paratypes, USNM 860717.

Common name: Elko pyrg.

Distribution: Single springs in both the Humboldt River drainage and Ruby Valley, Nevada.

***Pyrgulopsis licina* Hershler, Liu, and Bradford, 2013**

Pyrgulopsis licina Hershler, Liu, and Bradford, 2013: 32-34, 36, figs. 3, 4A-B. Spring south of Clay Pits, Ash Meadows, Nye County, Nevada. Holotype, USNM 850347; paratypes, USNM 1204732.

Common name: Curved filament pyrg [name newly introduced herein.]

Distribution: Ash Meadows, Amargosa River basin (Nevada).

***Pyrgulopsis limaria* Hershler, 1998**

Pyrgulopsis limaria Hershler, 1998: 82-83, figs. 8I, 21E-F, 38A-E. Spring brook, Mud Meadow drainage, Humboldt County, Nevada. Holotype, USNM 873232; paratypes, USNM 860706.

Common name: Squat Mud Meadows pyrg.

Distribution: Mud Meadow drainage, northwestern Nevada.

***Pyrgulopsis lindae* Hershler, Liu, Babbitt, Kellogg, and Howard, 2016**

Pyrgulopsis lindae Hershler, Liu, Babbitt, Kellogg, and Howard, 2016a: 7, 9-10, figs. 3A, 4. San Domingo Creek, 3.8 km up flow [upflow] from Dogtown along San Domingo Road, Calaveras County, California. Holotype, USNM 905258; paratypes, USNM 1254709.

Common name: San Domingo pyrg.

Distribution: Three localities in the upper Calaveras and upper Tuolumne River basins, western California.

***Pyrgulopsis lockensis* Hershler, 1998**

Pyrgulopsis lockensis Hershler, 1998: 57-59, figs. 7C, 12F, 14G-I, 19A, 32A-C. Spring at Lockes, Duckwater Valley, Nye County, Nevada. Holotype, USNM 874779; paratypes, USNM 860679.

Common name: Lockes pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis longae* Hershler, 1995**

Pyrgulopsis longae Hershler, 1995: 359, 362, figs. 5E, 17-19. Unnamed spring about 4.8 km west-southwest of Hallelujah Junction, Long Valley, Lassen County. Holotype, USNM 860642; paratypes, USNM 858262.

Common name: Long Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis longiglans* Hershler, 1998**

Pyrgulopsis longiglans Hershler, 1998: 77-79, figs. 8F, 20M-P, 37A-C. Spring north-northwest of Holbrook Junction, Antelope Valley, Douglas County, Nevada. Holotype, USNM 873409; paratypes, USNM 860701.

Common name: Western Lahontan pyrg.

Distribution: Several basins in northwestern Nevada.

***Pyrgulopsis longinqua* (Gould, 1855)**

Amnicola longinqua Gould, 1855: 130. Colorado Desert (Cienega Grande). Types not located [USNM 12112 may be syntypes of this species; Hershler 1994].

Common name: Salton Sea springsnail.

Distribution: A single spring in the Salton Sea basin, eastern California (Hershler 1994).

Taxonomy: Hershler (1994).

***Pyrgulopsis marcida* Hershler, 1998**

Pyrgulopsis marcida Hershler, 1998: 47-50, figs. 6J, 18D-F, 30A-C. Hardy Springs, White River Valley, Nye County, Nevada. Holotype, USNM 873154; paratypes, USNM 860711.

Common name: Hardy pyrg.

Distribution: Several springs in White River Valley and one spring in Cave Valley (Nevada).

***Pyrgulopsis marilynae* Hershler, Ratcliffe, Liu, Lang, and Hay, 2014**

Pyrgulopsis marilynae Hershler, Ratcliffe, Liu, Lang, and Hay, 2014b: 76-78, figs. 3, 4A-B. Spring 0.48 km north, 0.48 km west of Jordan Canyon, Catron County, New Mexico. Holotype, USNM 1135068; paratypes, USNM 1232474.

Common name: Jordan Hot springsnail [name newly introduced herein].

Distribution: Short reach of the Middle Fork Gila River drainage just below Jordan Hot Springs (New Mexico).

***Pyrgulopsis merriami* (Pilsbry and Beecher in Pilsbry, 1892)**

Fluminicola merriami Pilsbry and Beecher in Pilsbry, 1892: 143. A warm spring in Pahranaagat Valley, Nevada. Lectotype, ANSP 67278; paralectotypes, ANSP 27782, USNM 123626.

Common name: Pahranaagat pebblesnail.

Distribution: White River and Pahranaagat Valleys, southern Nevada (Hershler 1998).

Taxonomy: Hershler (1994).

***Pyrgulopsis micrococcus* (Pilsbry in Stearns, 1893)**

Amnicola micrococcus Pilsbry in Stearns, 1893: 277, fig. 1. Small spring in Oasis Valley, Nevada. Lectotype, ANSP 67279; paralectotypes, ANSP 368399, USNM 123622.

Common name: Oasis Valley springsnail.

Distribution: Oasis Valley, upper Amargosa River basin (Nevada) (Hershler et al. 2013).

Taxonomy: Hershler and Sada (1987), Hershler (1989, 1994), Hershler et al. (2013).

***Pyrgulopsis militaris* Hershler, 1998**

Pyrgulopsis militaris Hershler, 1998: 79-80, figs. 8G, 15G-I, 21A-B, 37D-F. Spring west of Soldier Meadow Ranch, Humboldt County, Nevada. Holotype, USNM 873203; paratypes, USNM 860704.

Common name: Northern Soldier Meadow pyrg.

Distribution: One site each in Soldier Meadow and Craine Creek drainage, northwestern Nevada.

***Pyrgulopsis millenaria* Hershler, 1998**

Pyrgulopsis millenaria Hershler, 1998: 117-118, figs. 10C, 24F, 46A-B. Springs below Twentyone Mile Dam, Thousand Springs Creek, Elko County, Nevada. Holotype, USNM 874720; paratypes, USNM 860721.

Common name: Twentyone Mile pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis milleri* Hershler and Liu, 2010**

Pyrgulopsis milleri Hershler and Liu, 2010: 10, 12-15, figs. 6-8. Creek 1.13 km east of Pierpoint Spring along California Highway 190, ca. 25.1 km east of Springville, Tulare County, California. Holotype, SBMNH 83651; paratypes, SBMNH 74688, USNM 1132568.

Common name: Pierpoint Spring pyrg.

Distribution: Several springs along a short reach of the South Fork of the Middle Fork Tule River.

***Pyrgulopsis montana* Hershler, 1998**

Pyrgulopsis montana Hershler, 1998: 31, 33, figs. 6D, 11B, 12B, 17E, 27C-E. Spring, upper Camp Valley, Lincoln County, Nevada. Holotype, USNM 874786; paratypes, USNM 860694.

Common name: Camp Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis montezumensis* Hershler in Hershler and Landye, 1988**

Pyrgulopsis montezumensis Hershler in Hershler and Landye, 1988: 23, 28, 30, figs. 10g, 13a,d, 21a-c, 22-23. Montezuma Well, Yavapai County, Arizona. Holotype, USNM 859043; paratypes, USNM 859044.

Common name: Montezuma Well springsnail.

Distribution: Known only from the type locality and its upper 110 m of outflow, Verde River drainage (lower Colorado River basin).

Taxonomy: Hershler (1994).

***Pyrgulopsis morrisoni* Hershler in Hershler and Landye, 1988**

Pyrgulopsis morrisoni Hershler in Hershler and Landye, 1988: 21, 23, figs. 10f, 16e-h, 19-20. Page Springs, Yavapai County, Arizona. Holotype, USNM 859041; paratypes, USNM 859042.

Common name: Page springsnail.

Distribution: Verde Valley, lower Colorado River basin, Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis nanus* Hershler and Sada, 1987**

Pyrgulopsis nanus Hershler and Sada, 1987: 802-804, figs. 29a,d, 30-32, 33a,b. Five Springs, Ash Meadows, Nye County, Nevada. Holotype, USNM 859191; paratypes, UF 93957, USNM 859192.

Common name: Distal-gland springsnail.

Distribution: Four spring brooks in Ash Meadows.

Taxonomy: Hershler (1994).

***Pyrgulopsis neritella* Hershler, 1998**

Pyrgulopsis neritella Hershler, 1998: 68-70, figs. 7L, 11G, 20A, 35A-B. Springs north of Steptoe Ranch, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 883932; paratypes, USNM 860684.

Common name: Neritiform Steptoe Ranch pyrg.

Distribution: Two closely proximal springs in Steptoe Valley.

***Pyrgulopsis nevadensis* (Stearns, 1883)**

Pyrgula nevadensis Stearns, 1883: 173, unlabeled figure (p. 173). Pyramid Lake, Washoe County, Nevada. Lectotype, ANSP 27811; paralectotypes, ANSP 375739.

Common name: Corded pyrg.

Distribution: Three lakes in the western Great Basin; has not been collected in many years and may now be extinct.

Taxonomy: Hershler and Thompson (1987), Hershler (1994).

***Pyrgulopsis nonaria* Hershler, 1998**

Pyrgulopsis nonaria Hershler, 1998: 125, 127, figs. 10I, 25G, 48A-C. Spring along east side of Ninemile Reservoir, San Pete [Sanpete] County, Utah. Holotype, USNM 883566; paratypes, USNM 860731.

Common name: Ninemile pyrg.

Distribution: Two closely proximal springs in the San Pitch River drainage, Utah.

***Pyrgulopsis notidicola* Hershler, 1998**

Pyrgulopsis notidicola Hershler, 1998: 83-84, figs. 8J, 21G-H, 38F-H. Spring, Mud Meadow drainage, Humboldt County, Nevada. Holotype, USNM 873215; paratypes, USNM 860707.

Common name: Elongate Mud Meadows pyrg.

Distribution: Mud Meadow drainage, northwestern Nevada.

***Pyrgulopsis ojaiensis* Hershler, Liu, Babbitt, Kellogg, and Howard, 2016**

Pyrgulopsis ojaiensis Hershler, Liu, Babbitt, Kellogg, and Howard, 2016b: 10-12, figs. 3B, 5. Sisar Creek, 3.4 km up flow [upflow] from Sulphur Springs, Ventura County, California. Holotype, SBMNH 74347; paratypes, SBMNH 46096.

Common name: Sisar pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis orbiculata* Hershler, 1998**

Pyrgulopsis orbiculata Hershler, 1998: 67-68, figs. 7K, 19L, 34F-G. Spring at Steptoe Ranch, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 873196; paratypes, 860682.

Common name: Sub-globose Steptoe Ranch pyrg.

Distribution: Several springs in Steptoe Valley.

***Pyrgulopsis owensensis* Hershler, 1989**

Pyrgulopsis owensensis Hershler, 1989: 187-189, figs. 26a-d, 27-31. Unnamed spring in canyon south of Piute Creek, Owens Valley, Mono County, California. Holotype, USNM 860404; paratypes, USNM 857955.

Common name: Owens Valley springsnail.

Distribution: Springs in northeastern Owens Valley; also found in one spring along the East Fork Walker River (Hershler and Pratt 1990).

Taxonomy: Hershler (1994).

***Pyrgulopsis owyheensis* Hershler and Liu, 2009**

Pyrgulopsis owyheensis Hershler and Liu, 2009: 13-14, 16-19, figs. 6-9. Owyhee Spring, Malheur County, Oregon. Holotype, USNM 883435; paratypes, USNM 1116915.

Common name: Owyhee upland pyrg.

Distribution: Owyhee and Malheur River basins (Oregon).

***Pyrgulopsis papillata* Hershler, 1998**

Pyrgulopsis papillata Hershler, 1998: 59-60, figs. 7D, 11E, 19B, 32D-E. Big Warm Spring, Duckwater Valley, Nye County, Nevada. Holotype, USNM 873185; paratypes, USNM 860678.

Common name: Big Warm Spring pyrg.

Distribution: Two springs in Duckwater Valley, Nevada.

***Pyrgulopsis peculiaris* Hershler, 1998**

Pyrgulopsis peculiaris Hershler, 1998: 108-110, figs. 9J, 23A-G, 43D-I. Spring, Maple Grove, Round Valley, Millard County, Utah. Holotype, USNM 883933; paratypes, USNM 860703.

Common name: Bifid duct pyrg.

Distribution: East-central portion of the Bonneville basin (Nevada, Utah).

***Pyrgulopsis pellita* Hershler, 1998**

Pyrgulopsis pellita Hershler, 1998: 94-96, figs. 9F, 22F, 41D-F. Sullivan Spring, Antelope Valley, Eureka County, Nevada. Holotype, USNM 883850; paratypes, USNM 860715.

Common name: Antelope Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis perforata* Hershler, Liu, and Bradford, 2013**

Pyrgulopsis perforata Hershler, Liu, and Bradford, 2013: 36-37, 39. Easternmost spring from Scotty's [Scottys] Castle along California Highway 72, Grapevine Canyon, Death Valley, Inyo County, California. Holotype, USNM 853507; paratypes, USNM 1204734.

Common name: Scottys Castle pyrg [name newly introduced herein].

Distribution: Lower portion of Grapevine Canyon and Grapevine Mountains (lower Amargosa River basin, California).

***Pyrgulopsis perturbata* Hershler, 1989**

Pyrgulopsis perturbata Hershler, 1989: 189-190, 192, 194, figs. 26e-g, 33-35. Southern of two “Northwest Springs,” Fish Slough, Mono County, California. Holotype, USNM 860407; paratypes, USNM 853546.

Common name: Fish Slough springsnail.

Distribution: Fish Slough, Owens River drainage.

Taxonomy: Hershler (1994).

***Pyrgulopsis pictilis* Hershler, 1998**

Pyrgulopsis pictilis Hershler, 1998:89-91, figs. 9C, 22B-C, 40C-E. Cain Spring, Antelope Valley, Lander County, Nevada. Holotype, USNM 874401; paratypes, USNM 860713.

Common name: Ovate Cain Spring pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis pilsbryana* (Baily and Baily, 1952)**

Amnicola pilsbryi Baily and Baily, 1951: 50, pl. 4: fig. 3. Lifton, Ideal Beach, Bear Lake, Idaho. Holotype, ANSP 187691; paratypes, ANSP 368401.

Amnicola pilsbryana Baily and Baily, 1952: 144. Replacement name for *Amnicola pilsbryi* Baily and Baily, 1951; preoccupied in *Amnicola* by *Amnicola pilsbryi* Walker, 1906.

Common name: Bear Lake springsnail.

Distribution: Bear River basin (Idaho, Utah) (Hershler 1998).

Taxonomy: Hershler (1994).

***Pyrgulopsis pisteri* Hershler and Sada, 1987**

Pyrgulopsis pisteri Hershler and Sada, 1987: 804-807, figs. 29b,e, 33c, 34a-e, 35-36. Marsh Spring, Ash Meadows, Nye County, Nevada. Holotype, USNM 859197; paratypes, UF 94958, USNM 859198.

Common name: Median-gland springsnail.

Distribution: Three sites in Ash Meadows.

Taxonomy: Hershler (1994).

***Pyrgulopsis planulata* Hershler, 1998**

Pyrgulopsis planulata Hershler, 1998: 64-66, figs. 7I, 13B, 15A-C, 19J, 34A-C.
Spring northwest of Clark Spring, Steptoe Valley, White Pine County, Nevada.
Holotype, USNM 892023; paratypes, USNM 860686.

Common name: Flat-topped Steptoe pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis plicata* Hershler, 1998**

Pyrgulopsis plicata Hershler, 1998: 120-121, figs. 10E, 13F, 24I-J, 46F-G. Spring,
Black Canyon, East Fork Sevier River, Garfield County, Utah. Holotype,
USNM 883594; paratypes, USNM 860727.

Common name: Black Canyon pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis robusta* (Walker, 1908)**

Pomatiopsis robusta Walker, 1908: 97, unlabeled figure. Jackson Lake, Wyoming.
Types have not been located.

Amnicola hendersoni Pilsbry, 1933: 10, pl. 2: figs. 2, 9 10. South of Burns, Oregon.
Holotype, ANSP 145951; paratypes, ANSP 396668.

Amnicola idahoensis Pilsbry, 1933: 11, pl. 2, figs. 3-5. [Snake River] at Homedale,
Owyhee County, Idaho. Lectotype, ANSP 152677; paralectotype, ANSP
396960.

Common name: Jackson Lake springsnail.

Distribution: Portions of the Snake-Columbia River basin and Oregon Great Basin
(Hershler and Liu 2004a; Lysne et al. 2007).

Taxonomy: Hershler (1994), Hershler and Liu (2004a).

Remarks: Microsatellite evidence suggests that *P. robusta* may be a polyploid
(Liu and Hershler 2014).

***Pyrgulopsis ruinosa* Hershler, 1998**

Pyrgulopsis ruinosa Hershler, 1998: 54-56, figs. 7A, 18M, 31A-C. Spring southwest of
The Crossing, Fish Lake Valley, Esmeralda County, Nevada. Holotype,
USNM 874307; paratypes, USNM 860700.

Common name: Fish Lake Valley pyrg.

Distribution: Known only from the type locality and may now be extinct (Hershler
1998).

***Pyrgulopsis rupinicola* Hershler, Frest, Liu, and Johannes, 2003**

Pyrgulopsis rupinicola Hershler, Frest, Liu, and Johannes, 2003a: 288-292, figs. 4B, 11-12. Sucker Springs Creek east of California Fish and Game [California Fish and Wildlife] Pit River Hatchery on northwest side of access road above intake for the hatchery, northwest of Pit River, over 1.6 km southwest of Pit 1 Powerhouse (Pacific Gas and Electric), Shasta County, California. Holotype, USNM 892187; paratypes, USNM 1004526, USNM 1004527.

Common name: Sucker Springs pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis sadai* Hershler, 1998**

Pyrgulopsis sadai Hershler, 1998: 87-89, figs. 9A, 21L-N, 39G-J. Spring, Moss Creek, Reese River Valley, Lander County, Nevada. Holotype, USNM 874397; paratypes, USNM 860702.

Common name: Sadas pyrg.

Distribution: Lahontan basin and Owyhee River drainage, north-central Nevada.

***Pyrgulopsis sanchezi* Hershler, Liu, and Bradford, 2013**

Pyrgulopsis sanchezi Hershler, Liu, and Bradford, 2013: 39-42, figs. 4E-F, 7. Purgatory Spring, Ash Meadows, Nye County, Nevada. Holotype, USNM 850333; paratypes, USNM 1204735.

Common name: Sanchez pyrg [name newly introduced herein].

Distribution: Five groundwater discharge areas in the Amargosa River basin (California, Nevada).

***Pyrgulopsis sathos* Hershler, 1998**

Pyrgulopsis sathos Hershler, 1998: 37, 39, figs. 6F, 12C, 17H-K, 28A-C. Flag Springs, White River Valley, Nye County, Nevada. Holotype, USNM 874664; paratypes, USNM 860691.

Common name: White River Valley pyrg.

Distribution: White River Valley, Colorado River basin, Nevada.

***Pyrgulopsis saxatilis* Hershler, 1998**

Pyrgulopsis saxatilis Hershler, 1998: 111, 113, figs. 9L, 11H, 16A-C, 23K-L, 44F-H.
Warm Springs, Snake Valley, Millard County, Utah. Holotype, USNM 883237;
paratypes, USNM 860726.

Common name: Sub-globose Snake pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis serrata* Hershler, 1998**

Pyrgulopsis serrata Hershler, 1998: 71-72, figs. 8B, 15D-F, 20C-E, 35G-J. Indian Ranch
Spring, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 874314;
paratypes, USNM 860719.

Common name: Northern Steptoe pyrg.

Distribution: Several springs in Steptoe Valley.

***Pyrgulopsis similis* Hershler, Ratcliffe, Liu, Lang, and Hay, 2014**

Pyrgulopsis similis Hershler, Ratcliffe, Liu, Lang, and Hay, 2014b: 78-81, figs. 4C-D, 5.
Spring along Beaver Creek, ca. 0.29 km north and 0.4 km west of confluence
with Taylor Creek, Catron County, New Mexico. Holotype, USNM 1135064;
paratypes, USNM 1135065.

Common name: Catron pyrg [name newly introduced herein].

Distribution: Short reach of the East Fork Gila River drainage from just above Wall
Lake to slightly above the mouth of Burnt Corral Canyon (New Mexico).

***Pyrgulopsis simplex* Hershler in Hershler and Landye, 1988**

Pyrgulopsis simplex Hershler in Hershler and Landye, 1988: 32, figs. 21g-j, 26b,
27-28. Spring near Strawberry, Gila County, Arizona. Holotype, USNM
859049; paratypes, USNM 859050.

Common name: Fossil springsnail.

Distribution: Fossil Creek drainage, Verde River drainage, Arizona.

Taxonomy: Hershler (1994).

***Pyrgulopsis sola* Hershler in Hershler and Landye, 1988**

Pyrgulopsis solus Hershler in Hershler and Landye, 1988: 30, 32, figs. 21d-f, 24, 25, 26a. Brown Spring, in southern end of Verde Valley, Yavapai County, Arizona. Holotype, 859045; paratypes, USNM 859046.

Common name: Brown springsnail.

Distribution: Known only from the type locality in the lower Colorado River basin.

Taxonomy: Hershler (1994).

***Pyrgulopsis stearnsiana* (Pilsbry, 1899)**

Pyrgulopsis stearnsiana Pilsbry, 1899: 124-125. Near Oakland (California). Lectotype, ANSP 27961; paralectotypes, ANSP 396667.

Distribution: Central California coastal drainages (Hershler et al. 2016a).

Common name: Yaqui springsnail.

Taxonomy: Hershler (1994).

Remarks: Genetic evidence suggests that *P. stearnsiana* is paraphyletic relative to *P. diablensis* and *P. giulianii*, and may require taxonomic revision (Hershler et al. 2016a).

***Pyrgulopsis sterilis* Hershler, 1998**

Pyrgulopsis sterilis Hershler, 1998: 53-54, figs. 6L, 18K-L, 30G-I. Spring, Hunts Canyon Ranch, Ralston Valley, Nye County, Nevada. Holotype, USNM 874876; paratypes, USNM 860714.

Common name: Sterile basin pyrg.

Distribution: Three springs in Ralston and Stone Cabin Valleys, southwestern Nevada.

***Pyrgulopsis sublata* Hershler, 1998**

Pyrgulopsis sublata Hershler, 1998: 56-57, figs. 7B, 12E, 18N-O, 31D-F. Wambolt Springs, Lake Valley, Lincoln County, Nevada. Holotype, USNM 874681; paratypes, USNM 860724.

Common name: Lake Valley pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis sulcata* Hershler, 1998**

Pyrgulopsis sulcata Hershler, 1998: 66-67, figs. 7J, 11F, 19K, 34D-E. Springs north of Grass Springs, Steptoe Valley, White Pine County, Nevada. Holotype, USNM 874326; paratypes, USNM 860683.

Common name: Southern Steptoe pyrg.

Distribution: Two springs in Steptoe Valley, Nevada.

***Pyrgulopsis taylori* Hershler, 1995**

Pyrgulopsis taylori Hershler, 1995: 362-363, 365, 367, figs. 5F, 20-22. Unnamed spring tributary to San Luis Obispo Creek, 4.8 km north of San Luis Obispo, east of HW 101, San Luis Obispo County, California. Holotype, USNM 860646; paratypes, USNM 883792.

Common name: San Luis Obispo pyrg.

Distribution: San Luis Obispo Creek drainage (California).

***Pyrgulopsis thermalis* (Taylor, 1987)**

Fontelicella thermalis Taylor, 1987: 28, fig. 13. Hot spring on east side of Gila River, NE1/4 SW1/4 sec. 17 T13S R13W, Grant County, New Mexico. Holotype, LACM 2224; paratypes, ANSP 376026, UF 160941, USNM 954086, UTEP 10058.

Common name: New Mexico hot springsnail.

Distribution: Thermal springs along the East Fork Gila River, New Mexico.

Taxonomy: Hershler (1994).

***Pyrgulopsis thompsoni* Hershler in Hershler and Landye, 1988**

Pyrgulopsis thompsoni Hershler in Hershler and Landye, 1988: 41-42, figs. 26f, 36-38. Peterson Ranch Springs, Santa Cruz County, Arizona. Holotype, USNM 859057; paratypes, USNM 859058.

Common name: Huachuca springsnail.

Distribution: Lower Gila River drainage, southern Arizona; one site in the Rio Magdalena basin (Gulf of California drainage), northern Sonora (Mexico) (Hershler and Landye 1988; Tsai et al. 2007).

Taxonomy: Hershler (1994).

Remarks: Genetic evidence suggests that *P. thompsoni* is paraphyletic relative to *P. conica* and may require taxonomic revision (Hurt 2004).

***Pyrgulopsis torrida* Hershler, Liu, Babbitt, Kellogg, and Howard, 2016**

Pyrgulopsis torrida Hershler, Liu, Babbitt, Kellogg, and Howard, 2016b: 12-14, figs. 3C, 6. Little Sycamore Canyon, creek 3.2 km up flow [upflow] from Hwy 1, Ventura County, California. Holotype, SBMNH 74238; paratypes, SBMNH 46092.

Common name: Little Sycamore pyrg.

Distribution: Known only from the type locality.

***Pyrgulopsis transversa* Hershler, 1998**

Pyrgulopsis transversa Hershler, 1998: 129-130, figs. 10J, 16G-I, 25H-K, 48D-H. Sixmile Springs, Simpson Mountains, Old River Bed, Tooele County, Utah. Holotype, USNM 883221; paratypes, USNM 860732.

Common name: Southern Bonneville pyrg.

Distribution: West-central Utah (Great Basin).

***Pyrgulopsis trivialis* (Taylor, 1987)**

Fontelicella trivialis Taylor, 1987: 30-32, fig. 14. Spring-fed pond 1,000 ft [0.305 km] N of SW corner sec. 5, T5N, R29E, Apache County, Arizona. Holotype, LACM 2225.

Pyrgulopsis confluentis Hershler in Hershler and Landye, 1988: 32, 35, figs. 3d-g, 26c, 29-30. Spring on north side of Blanket Creek at Three Forks, Apache County, Arizona. Holotype, USNM 859053.

Common name: Black River springsnail.

Distribution: Two spring complexes in the Black River drainage, lower Colorado River basin, Arizona (Hurt 2004; Martinez and Myers 2008).

Taxonomy: Hershler (1994).

***Pyrgulopsis turbatrix* Hershler, 1998**

Pyrgulopsis turbatrix Hershler, 1998: 50-53, figs. 6K, 18G-J, 30D-F. Horseshutem Springs, Pahrump Valley, Nye County, Nevada. Holotype, USNM 883978; paratypes, USNM 860699.

Common name: Southwest Nevada pyrg [original name incorrectly given as Southeast Nevada pyrg.]

Distribution: Spring Mountains region, San Bernardino Mountains, central Death Valley region (California, Nevada) (Hershler et al. 2013).

Taxonomy: Hershler et al. (2013).

***Pyrgulopsis umbilicata* Hershler, 1998**

Pyrgulopsis umbilicata Hershler, 1998: 81, figs. 8H, 21C-D, 37G-I. Spring near mouth of Warm Springs canyon, Soldier Meadow, Humboldt County, Nevada. Holotype, USNM 873208; paratypes, USNM 860705.

Common name: Southern Soldier Meadow pyrg.

Distribution: Soldier Meadow, Nevada.

***Pyrgulopsis variegata* Hershler, 1998**

Pyrgulopsis variegata Hershler, 1998: 113-115, figs. 10A, 24A-D, 45A-F. Spring ca. 2.5 km south of South Patterson Spring, Pilot Valley, Box Elder County, Utah. Holotype, USNM 883627; paratypes, USNM 860723.

Common name: Northwest Bonneville pyrg.

Distribution: North-central Great Basin and one site in the Snake River drainage (Nevada, Utah).

***Pyrgulopsis varneri* Hershler, Liu, and Sada 2007**

Pyrgulopsis varneri Hershler, Liu, and Sada, 2007b: 176-777, 180, figs. 7, 11. Spring brook north of Mud Meadow Reservoir, Humboldt County, Nevada. Holotype, USNM 1083246; paratypes, USNM 1096917.

Common name: Varners pyrg.

Distribution: Three spring complexes in Soldier Meadow, northeastern Great Basin (Nevada).

***Pyrgulopsis ventricosa* Hershler, 1995**

Pyrgulopsis ventricosa Hershler, 1995: 367, 369, 372-373, figs. 5G, 23-25. Unnamed creek, Seigler Canyon, 7.4 km south of HW 29 along Seigler Canyon Road, Lake County, California. Holotype, USNM 860647; paratypes, USNM 883790.

Common name: Clear Lake pyrg.

Distribution: Seigler Creek drainage, south end of the Clear Lake basin (California).

***Pyrgulopsis villacampae* Hershler, 1998**

Pyrgulopsis villacampae Hershler, 1998: 62-63, figs. 7G, 13A, 19F-G, 33C-E. Little Warm Spring, Duckwater Valley, Nye County, Nevada. Holotype, USNM 873191; paratypes, USNM 860712.

Common name: Duckwater Warm Springs pyrg.

Distribution: Two springs in Duckwater Valley, Nevada.

***Pyrgulopsis vinyardi* Hershler, 1998**

Pyrgulopsis vinyardi Hershler, 1998: 84-86, figs, 8K, 21I, 39A-C. Spring, Willow Creek, 1.6 km southwest of Willow Creek Reservoir, Squaw Valley drainage, Elko County, Nevada. Holotype, USNM 874740; paratypes, USNM 860708.

Common name: Vinyards pyrg.

Distribution: Two springs in the Squaw Valley drainage, north-central Nevada.

***Pyrgulopsis wongi* Hershler, 1989**

Pyrgulopsis wongi Hershler, 1989: 196, 198-202, figs. 41-46. Unnamed western spring tributary to Pine Creek, Birchim Canyon, Owens Valley, Inyo County, California. Holotype, USNM 860403; paratypes, USNM 857941.

Common name: Wong's springsnail.

Distribution: Several valleys in the southwestern Great Basin (California, Nevada) (Hershler and Pratt 1990; Hershler 1998).

Taxonomy: Hershler (1994).

Remarks: Genetic evidence suggests that *P. wongi* is composed of two evolutionarily distinct lineages and requires taxonomic revision (Liu and Hershler 2007).

Family Lithoglyphidae Troschel, 1857

Genus *Fluminicola* Carpenter, 1864

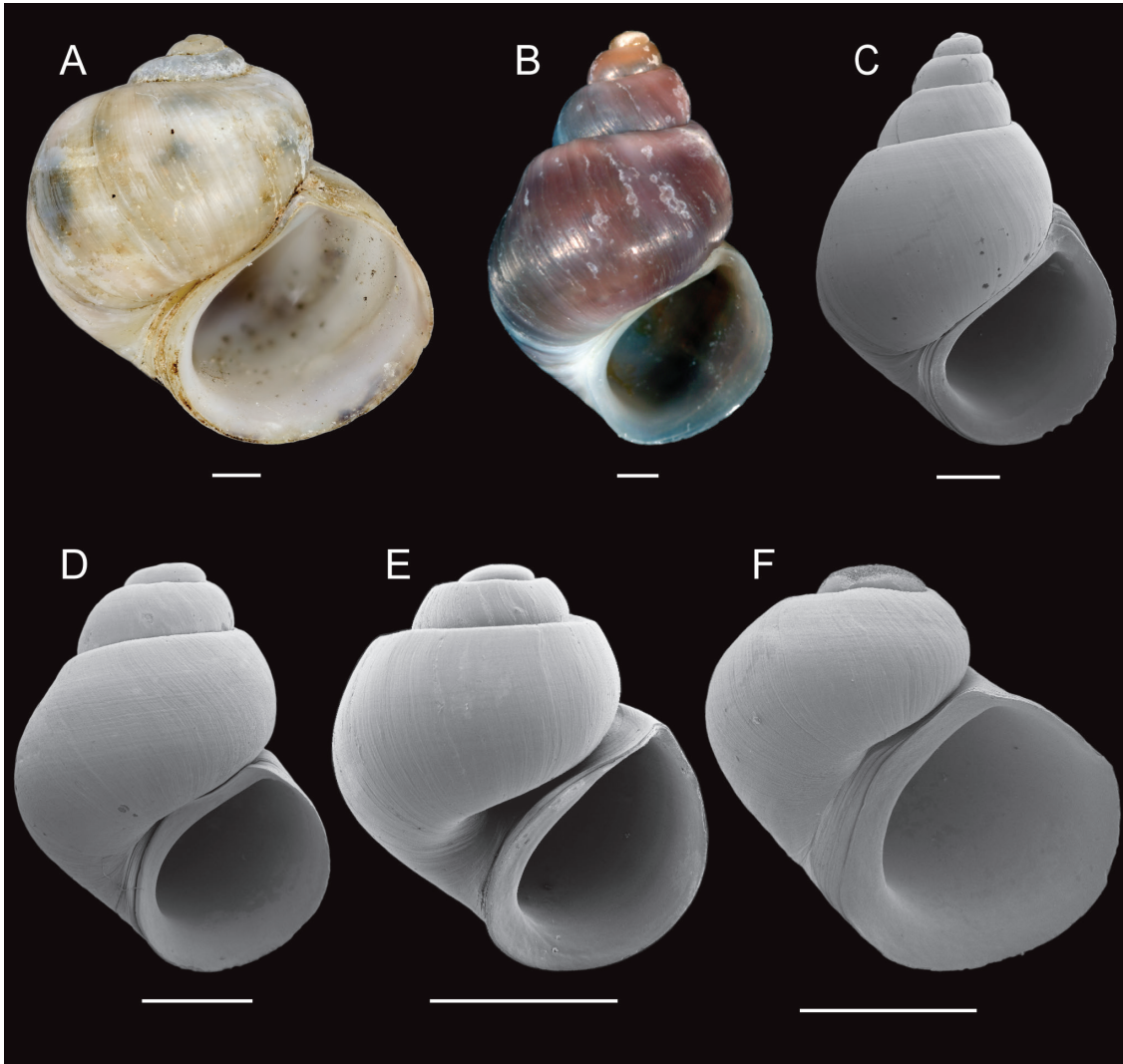


Figure 21. *Fluminicola*. **A.** *F. nuttallianus*, Willamette River, Oregon (USNM 121467 [lectotype]). **B.** *F. coloradoense*, Snake River at Clear Lake bridge, Gooding County, Idaho (USNM 905345). **C.** *F. virens*, Willamette River, French Prairie State Park, Clackamas County, Oregon (USNM 883183). **D.** *F. warnerensis*, Soup Spring, Pit River drainage, Modoc County, California (USNM 1020654). **E.** *F. virginius*, spring source of Hardscrabble Creek, Pyramid Lake basin, Washoe County, Nevada (USNM 874105). **F.** *F. neritoides*, Springs at Willow Creek Campground, Pit River drainage, Lassen County, California (USNM 883563, holotype). Scale bars, 1.0 mm.

Fluminicola Carpenter, 1864: 676 [type species: *Paludina nuttalliana* Lea, 1838; original designation.]

Heathilla Hannibal, 1912: 186-187 [type species: *Paludina seminalis* Hinds, 1842; original designation].

Remarks: *Fluminicola* is widely distributed in the northwestern United States and also present in portions of western Canada. Members of this genus typically live in rivers, springs, and large streams and are occasionally found in “spring influenced” lacustrine habitats. *Fluminicola* is composed of two anatomically distinctive subgroups (Hershler and Frest 1996; Hershler and Liu 2012b), which form evolutionarily distinct and genetically divergent lineages evidenced by mitochondrial DNA data (Hershler and Liu 2012b). One of these is composed of two species from the Snake-Columbia River drainage (*F. gustafsoni*, *F. virens*), while the other contains the remaining congeners (for which data are available). This polyphyletic assemblage continues to be classified as a single genus pending resolution of the phylogenetic relationships of the poorly known type species.

***Fluminicola ahjumawi* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola ahjumawi Hershler, Liu, Frest, and Johannes, 2007c: 402, 404, figs. 7H, 16. Spring south of Sam Wolfen Spring, south of Pit River and powerlines, 1.93 km southwest of Pit 1 Powerhouse, Pacific Gas and Electric land, Shasta County, California. Holotype, USNM 1020691; paratypes, USNM 1020699.

Common name: Sculpin snail.

Distribution: Widely ranging in the lower Pit River basin and also present at one site in the upper Pit River basin, California.

***Fluminicola anserinus* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola anserinus Hershler, Liu, Frest, and Johannes, 2007c: 409-410, 412, figs. 6F, 7J, 21. Unnamed spring on west side of Goose Valley Road and Goose Valley, north of Goose Creek ca. 0.8 km, Shasta County, California. Holotype, USNM 1020727; paratypes, USNM 1020728.

Common name: Striated hydrobe.

Distribution: Lower Pit River basin from Lake Britton (including Burney Creek drainage) to vicinity of Chalk Mountain, California.

***Fluminicola caballensis* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola caballensis Hershler, Liu, Frest, and Johannes, 2007c: 398, 400, figs. 7F, 14. Davis Creek at crossing of road 0.32 km south of junction with FS22, Lassen National Forest, Lassen County, California. Holotype, USNM 1020675; paratypes, USNM 1020676.

Common name: Horse Creek pebblesnail.

Distribution: Horse Creek and Bob Creek drainages (lower Pit River basin), California.

***Fluminicola coloradoense* Morrison, 1940**

Fluminicola coloradoense Morrison, 1940: 125-126. Green River, Wyoming. Holotype, USNM 526631; paratypes, USNM 526576.

Fluminicola coloradensis.—Hershler and Frest, 1996: 8 [unjustified emendation of *coloradoense*].

Common name: Green River pebblesnail.

Distribution: Upper Green River basin (Wyoming), northeastern Great Basin (Idaho, Utah), upper Snake River basin (Idaho, Oregon) (Liu et al. 2013a).

Taxonomy: Hershler and Frest (1996), Liu et al. (2013a).

***Fluminicola dalli* (Call, 1884)**

Amnicola dalli Call, 1884: 21, 45-47, figs. 2-3, pl. VI: figs. 4-6. Small tributary to Pyramid Lake, near the north end, at Symons Ranch [Nevada]. Lectotype, MCZ 2087; paralectotypes, MCZ 2088.

Common name: Pyramid Lake pebblesnail.

Distribution: Northern portion of the Pyramid Lake basin, Nevada (Hershler and Frest 1996)

Taxonomy: Hershler and Frest (1996).

***Fluminicola erosus* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola erosus Hershler, Liu, Frest, and Johannes, 2007c: 394-396, fig. 6C, 7D, 12. Moderate-sized unnamed spring, ca. 0.4 km southeast of Smokey Charlie [Charley] Spring and 0.32 km west of Modoc County 63, at source next to homestead cabin, Modoc County, California. Holotype, 1020663; paratypes, USNM 1020664.

Common name: Smokey Charlie [Charley] pebblesnail.

Distribution: Two closely proximal springs in the upper Pit River basin, California.

***Fluminicola favillaceus* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola favillaceus Hershler, Liu, Frest, and Johannes, 2007c: 396-398, figs. 6D, 7E, 13. Ash Creek south culvert channel on west side of Ash Valley Road (Modoc County [Highway] 527), Crown D Ranch, Lassen County, California. Holotype, USNM 1020669; paratypes, USNM 1020670.

Common name: Ash Valley pebblesnail.

Distribution: Ash Creek, upper Pit River basin, California.

***Fluminicola fremonti* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola fremonti Hershler, Liu, Frest, and Johannes, 2007c: 386, figs. 6A, 7A, 8. Hunters Spring on the north side of FS28, Fremont National Forest [Fremont-Winema National Forest], Lake County, Oregon. Holotype, USNM 1020662; paratypes, USNM 1020661.

Common name: Fremont pebblesnail.

Distribution: Found only at the type locality in the Thomas Creek drainage, Goose Lake basin, Oregon.

***Fluminicola fuscus* (Haldeman, 1841)**

Anculosa fusca Haldeman, 1841: cover. Oregon. Type has not been located.

Amnicola hindsi Baird, 1863: 63. River Kootanie [*sic*, misspelling of Kootenai]. Lectotype, NHMUK 1863.2.4.17A; paralectotypes, NHMUK 1863.2.4.17.

Fluminicola columbiana Pilsbry, 1899: 125. Columbia River, near Wallula. Lectotype, ANSP 27767; paralectotypes, ANSP 398349.

Common name: Ashy pebblesnail.

Distribution: Lower Snake River, Columbia River, and large tributaries (Idaho, Oregon, Washington, British Columbia [historically] (Hershler and Frest 1996; Liu et al. 2013a).

Taxonomy: Hershler and Frest (1996).

***Fluminicola gustafsoni* Hershler and Liu, 2012**

Fluminicola gustafsoni Hershler and Liu, 2012b: 324-325, 327-328, figs. 2-4. Salmon River at Pine Bar Rapids, Idaho County, Idaho. Holotype, USNM 905409; paratypes, USNM 1175400.

Common name: Gustafson pebblesnail [name newly introduced herein].

Distribution: Clearwater River, lower Salmon River, and the short reach of the Snake River between the mouths of these streams (Idaho, Washington).

***Flumicola insolitus* Hershler, 1999**

Flumicola insolitus Hershler, 1999: 319, 321, figs. 8D, 9, 10A-C. Page Springs, Donner und Blitzen River drainage, Harney County, Oregon. Holotype, USNM 883466; paratypes, USNM 860757.

Common name: Donner und Blitzen pebblesnail.

Distribution: Found only at the type locality.

***Flumicola lunsfordensis* Hershler, Liu, Frest, and Johannes, 2007**

Flumicola lunsfordensis Hershler, Liu, Frest, and Johannes, 2007c: 393-394, figs. 7C, 11. Lunsford Spring above Lunsford Springs Road, source of Canyon Creek, Modoc County, California. Holotype, USNM 1020688; paratypes, USNM 1020689.

Common name: Lunsford pebblesnail.

Distribution: Known only at the type locality in the upper Pit River basin.

***Flumicola minutissimus* Pilsbry, 1907**

Flumicola minutissimus Pilsbry, 1907: 76, pl. XI; fig 4. Price Valley, Weiser Canyon, Washington County, Idaho. Lectotype, ANSP 94273; paralectotypes, ANSP 398350.

Common name: Pixie pebblesnail.

Distribution: Known only from type locality, lower Snake River basin.

Remarks: *Flumicola minutissimus* is known only from shells. It has not been collected subsequent to its first discovery and may be extinct (Hershler and Frest 1996).

***Flumicola modoci* Hannibal, 1912**

Flumicola modoci Hannibal, 1912: 187, pl. 8: fig. 30. Fletchers [Fletcher] Spring, south end, Goose Lake, California. Lectotype (and paralectotypes), CAS 60798.

Common name: Modoc pebblesnail.

Distribution: Two springs in the Goose Lake basin (Hershler 1999).

Taxonomy: Hershler and Frest (1996).

***Fluminicola multifarius*, Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola multifarius, Hershler, Liu, Frest, and Johannes, 2007c: 415, 417-419, figs. 7M, 24-25. Big Springs (source) at Big Springs City Park northwest of the city of Mount Shasta, south of Spring Hill, Siskiyou County, California. Holotype, USNM 883782; paratypes, USNM 1020753.

Common name: Shasta pebblesnail.

Distribution: Sacramento River headwater region and upper reaches of the McCloud River drainage, California.

***Fluminicola neritoides* Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola neritoides Hershler, Liu, Frest, and Johannes, 2007c: 400-402, figs. 6E, 7G, 15. Springs at Willow Creek Campground along CA [Highway] 139, Lassen County, California. Holotype, USNM 883563; paratypes, USNM 1020682.

Common name: Willow Creek pebblesnail.

Distribution: Willow Creek and associated thermal springs (upper Pit River basin), California.

***Fluminicola nuttallianus* (Lea, 1838)**

Paludina nuttalliana Lea, 1838: 101, pl. XXIII: fig. 89. Wahlamat [*sic*, misspelling of Willamette] River, near its junction with the Columbia River [Oregon]. Lectotype, USNM 121467; paralectotypes, USNM 860648.

Common name: Dusky pebblesnail.

Distribution: Restricted to the type locality near the mouth of the Willamette River (Oregon).

Taxonomy: Hershler and Frest (1996).

Remarks: This species is known only from shells. It has not been collected for more than 100 years and may be extinct (Hershler and Frest 1996).

***Fluminicola potemicus*, Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola potemicus, Hershler, Liu, Frest, and Johannes, 2007c: 412-414, figs. 7K, 22. Unnamed spring pool on the west side of FS27 (Fenders Ferry Road), ca. 10.8 rd km north of CA 299 junction, 4.18 km north of FS27 bridge over Potem Creek, west side of Potem Creek, inholding in Shasta National Forest [Shasta-Trinity National Forest], Shasta County, California. Holotype, USNM 1020718; paratypes, USNM 1020719.

Common name: Potem Creek pebblesnail.

Distribution: Found only at the type locality.

***Fluminicola scopulinus*, Hershler, Liu, Frest, and Johannes, 2007**

Fluminicola scopulinus, Hershler, Liu, Frest, and Johannes, 2007c: 414, figs. 7L, 23. Northernmost of three springs and runs southwest of Popcorn Spring, west side of North Fork Castle Creek, 0.35 km from FS25 along FS38N35Y (west side), Shasta National Forest, Shasta County, California. Holotype, USNM 1020721; paratypes, USNM 1020722.

Common name: Castle Creek pebblesnail.

Distribution: Three closely proximal springs in the Castle Creek drainage, Sacramento River headwaters, California.

***Fluminicola seminalis* (Hinds, 1842)**

Paludina seminalis Hinds, 1842: 83-84. Rio Sacramento, California. Type has not been located.

Lithoglyphus cumingii Frauenfeld, 1863: 195. California. Lectotype, NHMUK 1993047; paralectotypes, NMW.

Common name: Nugget pebblesnail.

Distribution: Sacramento River basin from near its mouth (historically) upstream into the Pit River basin, California (Taylor 1981; Hershler and Frest 1996; Hershler et al. 2007c).

Taxonomy: Hershler and Frest (1996).

***Fluminicola turbiniformis* (Tryon, 1865)**

Amnicola turbiniformis Tryon, 1865: 219, pl. 22: fig. 5. West side of Steens Mountains, Harney County, Oregon. Lectotype, ANSP 27779; paralectotypes, ANSP 398352.

Common name: Turban pebblesnail.

Distribution: Northwestern Great Basin (California, Nevada, Oregon) (Taylor 1966b; Hershler, 1999).

Taxonomy: Hershler and Frest (1996).

***Flumicola umbilicatus* Hershler, Liu, Frest, and Johannes, 2007**

Flumicola umbilicatus Hershler, Liu, Frest, and Johannes, 2007c: 407, 409, figs. 7I, 19. Big Spring, tributary of Hat Creek, south of Old Station (PO [Post Office]) at the south end of Hat Creek Hill, flowing from beneath CA [Highway] 89/44 on the south side, Lassen National Forest, Shasta County, California. Holotype, USNM 1020705; paratypes, USNM 1020706.

Common name: Goose Valley pebblesnail.

Distribution: Lost Creek and upper section of Hat Creek drainage (lower Pit River basin), California.

***Flumicola virens* (Lea, 1838)**

Paludina virens Lea, 1838: 91, pl. XXIII: fig. 93. Wahlamat [*sic*, misspelling of Willamette] (River), near its junction with the Columbia River [Oregon]. Lectotype, USNM 121431; paralectotypes, USNM 860649.

Paludina nuclea Lea, 1838: 91, pl. XXIII: fig. 103. Wahlamat [*sic*] (River), near its junction with the Columbia River. Type has not been located.

Common name: Olympia pebblesnail.

Distribution: Willamette River (and large tributary streams), from Corvallis to its mouth; lower Columbia River below Portland (Oregon, Washington) (Hershler and Frest, 1996).

Taxonomy: Hershler and Frest (1996).

***Flumicola virginius* Hershler, 1999**

Flumicola virginius Hershler, 1999: 323-324, figs. 8H, 10D-F, 11. Unnamed (“waterfall”) spring, source of Hardscrabble Creek, Pyramid Lake basin, Washoe County, Nevada. Holotype, USNM 874902; paratypes, USNM 860758.

Common name: Virginia Mountains pebblesnail.

Distribution: Found only at the type locality.

***Flumicola warnerensis* Hershler, Liu, Frest, and Johannes, 2007**

Flumicola warnerensis Hershler, Liu, Frest, and Johannes, 2007c: 388, 389, 392-393, figs. 6B, 7B, 10. Parsnip Springs, south of Southern Warner Road (FS64, also designated as 39NO1), in wet, open meadow, Modoc National Forest, Lassen County, California. Holotype, USNM 1020652; paratypes, USNM 1020653.

Common name: Topaz pebblesnail.

Distribution: South Fork Pit River drainage, along Pit River just above Big Valley (California).

Family Tateidae Thiele, 1925

Genus *Potamopyrgus* Stimpson, 1865

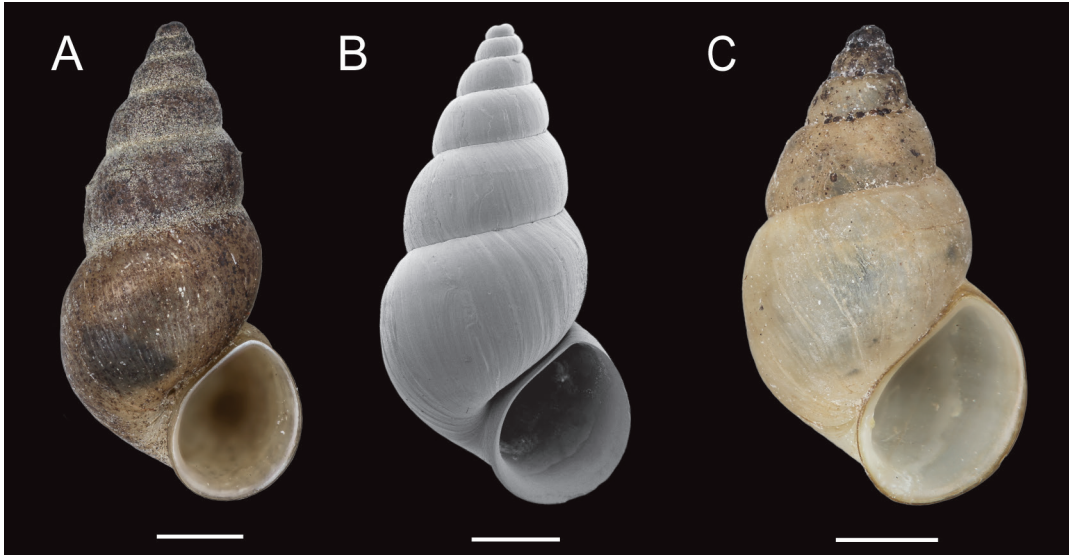


Figure 22. *Potamopyrgus antipodarum*. **A, B.** Cassia Creek at Conner Bridge, Snake River drainage, Cassia County, Idaho (USNM 894703). **C.** Snake River, opposite Pilgrim Spring, Gooding County, Idaho (USNM 1097249). Scale bars, 1.0 mm.

Potamopyrgus Stimpson, 1865: 53-54 [type species: *Melania corolla* Gould, 1847; = *Amnicola antipodarum* Gray, 1843].

***Potamopyrgus antipodarum* (Gray, 1843)**

Amnicola antipodanum [sic] Gray, 1843: 241. New Zealand, in fresh water. Syntypes, NHMUK (per Ponder 1988).

Amnicola antipodarum Gray, 1844: 356 [correction of original spelling].

Common name: New Zealand mudsnail.

Distribution: Native to New Zealand (Ponder 1988), widely introduced in Australia, Europe, North America, and parts of Asia (Alonso and Castro-Díez 2012). Recorded from all of the western United States except New Mexico (USGS 2016).

Remarks: See Ponder (1988) for a list of the numerous (extralimital) junior synonyms of this species.

Family uncertain

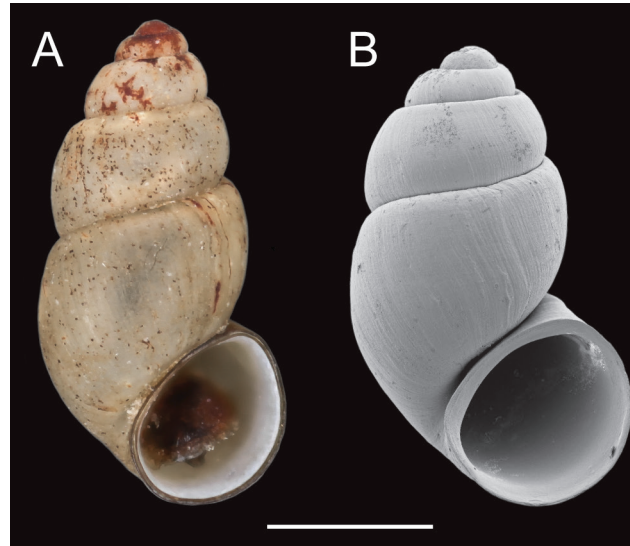
Genus *Pristinicola* Hershler, Frest, Johannes, Bowler, and Thompson, 1994

Figure 23. *Pristinicola hemphilli*. **A.** Mountain springs, Silvies River drainage, Grant County, Oregon (USNM 883878). **B.** Spring, Price Valley, 4.8 km northwest of Hwy 95, Adams County, Idaho (USNM 874184). Scale bar, 1.0 mm.

Pristinicola Hershler, Frest, Johannes, Bowler, and Thompson, 1994: 222-225
[type species: *Bythinella hemphilli* Pilsbry, 1890; original designation].

Remarks: *Pristinicola* is a monotypic genus that is distributed in the northwestern United States. It cannot be assigned to any currently recognized truncatelloidean family and does not appear to be closely related to other North American taxa (Hershler et al. 1994; Hershler and Liu 2012b).

***Pristinicola hemphilli* (Pilsbry, 1890)**

Bythinella hemphilli Pilsbry, 1890: 63-64. Near Kentucky Ferry, Snake River, Washington [precise location unknown]. Lectotype, ANSP 32276; paralectotypes, ANSP 368405.

Common name: Pristine pyrg.

Distribution: Lower Snake River and Columbia River basins (Idaho, Oregon, Washington), minor Pacific Coastal drainages (Washington) (Hershler et al. 1994).

Taxonomy: Hershler et al. (1994).

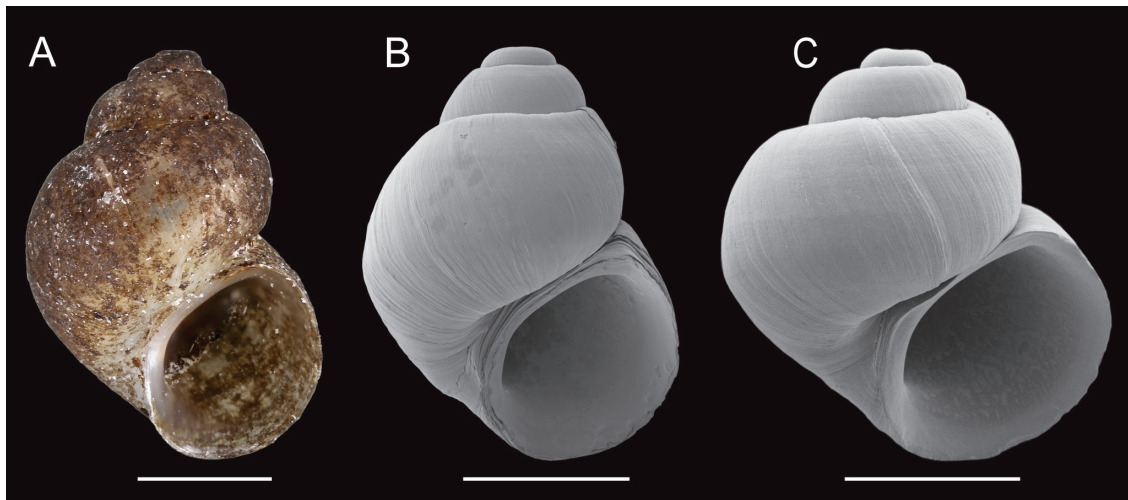


Figure 24. *Taylorconcha*. **A.** *T. serpenticola*, Snake River at Clover Creek confluence, Elmore County, Idaho (USNM 874590). **B.** *T. serpenticola*, Thousand Springs (north springs), Snake River drainage, Gooding County, Idaho (USNM 874588 [paratype]). **C.** *T. insperata*, Owyhee River at the Cave, Malheur County, Oregon (USNM 1018182 [holotype]). Scale bars, 1.0 mm.

Taylorconcha Hershler, Frest, Johannes, Bowler, and Thompson, 1994: 233

[type species: *Taylorconcha serpenticola* Hershler, Frest, Johannes, Bowler and Thompson, 1994; original designation.]

Remarks: *Taylorconcha* is distributed in the Owyhee River and in the Snake River and associated springs. This genus is morphologically similar to the lithoglyphids (Hershler et al. 1994) and was delineated as sister to the lithoglyphid clade in a recent analysis of COI sequence data (Hershler and Liu 2012b); additional studies that include a broader range of truncatelloidean taxa are needed to confidently ascertain its relationships.

***Taylorconcha insperata* Hershler, Liu, Frest, Johannes, and Clark, 2006**

Taylorconcha insperata Hershler, Liu, Frest, Johannes, and Clark, 2006: 175, figs. 6B, 7-8. Owyhee River at the Cave, 1.6 river km below the mouth of Big Antelope Creek at river km 269.4, Malheur County, Oregon. Holotype, USNM 1018182; paratypes, USNM 1071513.

Common name: Unexpected pebblesnail.

Distribution: Middle Owyhee River and lower Snake River (Hells Canyon) (Idaho, Oregon).

***Taylorconcha serpenticola* Hershler, Frest, Johannes,
Bowler, and Thompson, 1994**

Taylorconcha serpenticola Hershler, Frest, Johannes, Bowler, and Thompson, 1994: 233, 235, 237, 239, 240-242, figs. 1 (bottom row), 8-12. Thousand Springs (north springs), Gooding County, Idaho. Holotype, USNM 860583; paratypes, UF 194616, USNM 874588.

Common name: Bliss Rapids snail.

Distribution: Snake River and associated springs between Twin Falls and the Indian Cove Bridge, Idaho (Hershler et al. 1994).

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Appendix

Compilation of COI sequences. *Amnicola*: Liu et al. 2016; *Colligyryus*: Hershler et al. 2003a, Liu et al. 2015a; *Lyogyryus*: Liu et al. 2016; *Eremopyrgus*: Hershler et al. 1999; *Ipnobius*: Hershler et al. 1999; *Littoridinops*: Hershler et al. 2007a; *Spurwinkia*: Hershler et al. 2015a; *Tryonia*: Hershler et al. 1999a, Hershler et al. 1999b, Hershler et al. 2015a, Hershler et al. 2015b; *Pyrgulopsis*: Hershler et al. 2003a, Hershler et al. 2003b, Liu et al. 2003, Hershler and Liu 2004a, Hershler and Liu 2004b, Hurt 2004, Liu and Hershler 2005, Hershler et al. 2007b, Liu and Hershler 2007, Hershler and Liu 2008, Hershler et al. 2008, Hershler and Liu 2009, Hershler and Liu 2010, Hershler and Liu 2012a, Liu and Hershler 2012, Hershler et al. 2013, Liu et al. 2013b, Hershler et al. 2014b, Liu et al. 2015b, Hershler et al. 2016a, Hershler et al. 2016b; *Fluminicola*: Hershler et al. 2007c, Hershler and Liu 2012b, Liu et al. 2013a; *Pristinicola*: Hershler et al. 2003b; *Taylorconcha*: Hershler et al. 2006.

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Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
<i>Amnicola</i>								
<i>Amnicola limosa</i>	AM5, AM11	KU991117, KU991123	6	0%	0.5% with AM15		Pattison Lake, east side at Washington Department of Fish and Wildlife boat ramp, Thurston Cso., WA	
	AM6	KU991118, KU991119	4	0-0.20%	0.5% with AM15		Bonaparte Lake, south end at campground, Okanogan Co., WA	
	AM7	KU991120	4	0%	0.5% with AM15		Curlew Lake at state park west of Hwy 21, Ferry Co., WA	
	AM8	KU991121	4	0%	0.5% with AM15		Spectacle Lake, south side, near resort, Okanogan Co., WA	
	AM9	KU991122	4	0%	0.5% with AM15		Leader Lake, north side near dam, Okanogan Co., WA	
	AM12	KU991124	4	0-0.20%	0.6% with AM15		McWeneger Slough, south side near Hwy 35, Flathead Co., MT	
	AM15	KU991126, KU991127	4	0-0.50%	0.6% with AM12		Browns Lake, cutoff pond along northeast side, Powell Co., MT	
	AM16	KU991128, KU991129	4	0-0.30%	0.5% with AM12, AM15		Georgetown Lake, east side north of Stuart Campground, Granite Co., MT	
<i>Colligyryus</i>								
<i>Colligyryus convexus</i>	BL	AY196166	1	0%	0.3% with MB	<i>Colligyryus</i> sp. KL, differ by 3.9%	Baum Lake, Pit River basin, Shasta Co., CA	
	TS	AY196167	1	0%	0.5% with MB	<i>Colligyryus</i> sp. KL, differ by 4.0%	Fall River (spring source), Pit River basin, Shasta Co., CA	
	MB	AY196168, AY196169	2	0%	0.5% with TS	<i>Colligyryus</i> sp. KL, differ by 3.8%	Burney Creek, Pit River basin, Shasta Co., CA	
<i>Colligyryus depressus</i>	SRa	AY196170	1	0%	0% with SRb	<i>C. convexus</i> , differ by 7.8-8.2%, <i>Colligyryus</i> sp. KL, differ by 7.8%	Second spring south of Turner Ranch, Silvies River basin, Harney Co., OR	
	SRb	AY196171	1	0%	0% with SRa	<i>C. convexus</i> , differ by 7.8-8.2%, <i>Colligyryus</i> sp. KL, differ by 7.8%	Third spring south of Turner Ranch, Silvies River basin, Harney Co., OR	

Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
<i>Colligyus greggi</i>	COL1	KT248021	4	0%	2.2% with SN	<i>C. depressus</i> , differ by 9.3%	Small spring, Brooks Meadow, middle Columbia River basin, Hood River Co., OR	
	COL2	KT248022	4	0%	2.5% with SN	<i>C. depressus</i> , differ by 9.3%	Spring tributary, Tony Creek, middle Columbia River basin, Hood River Co., OR	
	COL3	KT248023	4	0%	2.2% with SN	<i>C. depressus</i> , differ by 9.3%	Bottle Prairie, middle Columbia River basin, Hood River Co., OR	
	COL4	KT248024	4	0%	2.2% with SN	<i>C. depressus</i> , differ by 9.3%	Spring tributary, Ramsey Creek, middle Columbia River basin, Wasco Co., OR	
	COL5	KT248025 (N=3), KT248026 (N=1)	4	0-0.30%	2.2% with SN	<i>C. depressus</i> , differ by 9.2-9.3%	Spring tributary, Clear Creek, Deschutes River basin, Wasco Co., OR	
	COL6	KT248027 (N=3),	4	0-0.20%	2.7% with SN	<i>C. depressus</i> , differ by 9.3-9.5%	Bear Creek, Hood River Co., OR	
	CL	AY196174	1	0%	2.3% with SN	<i>C. depressus</i> , differ by 9.2%	Oak Grove Fork [Clackamas River], Willamette River basin, Clackamas Co., OR	
	SN	AY196172	1	0%	2.7% with COL6	<i>C. depressus</i> , differ by 9.8%	Springs along Cliff Creek, upper Snake River basin, Sublette Co., WY	
	BR	AY196173	1	0%	2.3% with COL6	<i>C. depressus</i> , differ by 10.2%	Spring at Saint Charles Campground, Bear Lake basin, Bear Lake Co., ID	
	AM17	KT248030	2	0%	2.3% with COL6	<i>C. depressus</i> , differ by 10.3%	Spring at Porcupine Campground, Bear Lake basin, Bear Lake Co., ID	
	AM20	KT248031	2	0%	2.3% with COL6	<i>C. depressus</i> , differ by 10.1%	Springs along Trail Creek, upper Snake River basin, Caribou Co., ID	
<i>Colligyus sp.</i>	KL	AY196175	1	0%		<i>C. convexus</i> , differ by 3.8-4.0%	Link River, Klamath River basin, Klamath Co., OR	
<i>Colligyus sp.</i>	COL7	KT248029	1	0%		<i>C. greggi</i> , differ by 10.3-11.2%, <i>Colligyus sp. KL</i> , differ by 10.6%	Allison Springs, Puget Sound drainage, Thurston Co., WA	

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Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
Lyogyrus								
<i>Lyogyrus</i> sp.	AM10	KU991131	4	0%	0.5% with AM13		Fish Lake, south side at Cove Resort, Chelan Co., WA	
	AM22	KU991131	3	0%	0.5% with AM13		Curlew Lake at Camp Curlew Road terminus, Ferry Co., WA	
	AM13	KU991132, KU991133, KU991134	4	0-0.20%	0.8% with AM13		Smith Lake, south side at public access boat ramp, Flathead Co., MT	
	AM14	KU991134, KU991136	4	0-0.20%	0.6% with AM13		Upsata Lake, east side near outlet, Powell Co., MT	

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Eremopyrgus								
<i>Eremopyrgus eganensis</i>		AF129317	1	0.00%			Spring, southeast Steptoe Valley, north of Ely, White Pine Co., NV	<i>Tryonia</i> sp. in GenBank; <i>Tryonia</i> n. sp. 2 in Hershler et al. (1999b)
Ipnobius								
<i>Ipnobius robustus</i>		AF061774	1				Travertine Springs, Death Valley, Inyo Co., CA	<i>Tryonia robusta</i> in GenBank
Littoridinops								
<i>Littoridinops monroensis</i>	MISC1A	EF490565	1	0.00%			Restored tidal marsh on north side of Waterfront Road, Point Edith Wildlife Area, Contra Costa Co., CA	
Spurwinkia								
<i>Spurwinkia salsa</i>		KP057916	4	0.00%			Salt marsh, Eden Landing, south San Francisco Bay, Alameda Co., CA	
Tryonia								
<i>Tryonia angulata</i>		AF061764	1	0.00%		<i>T. variegata</i> SS, differ by 0.5%	Big Spring, Ash Meadows, Nye Co., NV	
<i>Tryonia clathrata</i>		AF061767	1	0.00%		<i>T. infernalis</i> , differ by 3.4-3.9%	Warm Spring, Moapa Valley, Clark Co., NV	
<i>Tryonia elata</i>		AF61766	1	0.00%		<i>T. ericae</i> , differ by 2.3%	Spring tributary to Kings Pool, Point of Rocks, Ash Meadows, Nye Co., NV	
<i>Tryonia ericae</i>		AF061768	1	0.00%		<i>T. elata</i> , differ by 2.3%	Spring north of Collins Ranch, Ash Meadows, Nye Co., NV	

Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
<i>Tryonia gilae</i>		AF129309	1	0.00%		<i>T. angulata</i> , differ by 4.2%	Tom Niece Spring, Graham Co., AZ	
<i>Tryonia imitator</i>	M, MO	AF061770	1	0.00%	0.2% with S/PE	<i>T. salina</i> , differ by 1.8%	Moro Cojo Slough, Moss Landing, Monterey Co., CA	
	S, PE	AF061769	1	0.00%	0.2% with M/MO	<i>T. salina</i> , differ by 1.6%	Los Penasquitos Lagoon, San Diego Co., CA	
<i>Tryonia infernalis</i>	BP2	KP899916-18	6	0.0-1.1%		<i>T. clathrata</i> , differ by 3.4-3.9%	Blue Point Spring, just below source, Clark Co., NV	
<i>Tryonia margae</i>		AF061771	1	0.00%		<i>T. monitorae</i> , differ by 1.9%	Grapevine Springs (upper warm spring), Death Valley, Inyo Co., CA	
<i>Tryonia monitorae</i>		AF129316	1	0.00%		<i>T. margae</i> , differ by 1.9%	Spring, Potts Ranch, Monitor Valley, Nye Co., NV	<i>Tryonia</i> sp. in GenBank, <i>Tryonia</i> n. sp. 1 in Hershler et al. (1999b)
<i>Tryonia porrecta</i>	WH	AF061773 (HI)	3	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Whitmore Hot Springs, Long Valley, Mono Co., CA	<i>Tryonia protea</i> in GenBank
	HC	AY803024 (HI)	3	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Hot Creek, Long Valley, Owens River basin, Mono Co., CA	
	OA	AF061772 (HI)	1	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.8-4.9%	Oasis Spring, Salt Creek, Salton Trough, Riverside Co., CA	<i>Tryonia protea</i> in GenBank
	HU	AY803025 (HI)	4	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Hunters Spring, Salton Sea basin, Riverside Co., CA	
	SS	AY803023 (HI), AY803029 (HIII), AY803030 (HX), AY803031 (HIX)	6	0.0-2.5%	HI: 2.1% with SS (HX) and HF (HVIII); HIII: 2.5% with SS (HX), HF (HVIII), Misc4A, and Misc5A; HX: 2.6% with HS (HV); HIX: 2.5% with HS (HV)	<i>T. imitator</i> , differ by 4.8-5.1%	South Springs, Fish Springs Flat, Bonneville basin, Juab Co., UT	

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Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments	
<i>Tryonia porrecta</i> (continued)	HS	AF129312 (HIV), AY803027 (HII), AY803028 (HV), AY803032 (HVI)	4	0.8-2.3%	HIV: 2.4% with SS (HX), HF (HVIII), Misc4A, and Misc5A; HII: 2.5% with SS (HX), HF (HVIII), Misc4A, and Misc5A; HV: 2.6% with SS (HX), HF (HVIII), Misc4A, and Misc5A; HVI: 2.3% with HS (HV)	<i>T. imitator</i> , differ by 4.6-5.1%	Horseshoe Springs, Skull Valley, Tooele Co., UT	<i>Tryonia protea</i> in GenBank, collection locality given as Warm Spring in GenBank	
	WS	AF129313 (HI)	2	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.1%	Warm Springs, Tooele Valley, Tooele Co., UT	<i>Tryonia protea</i> in GenBank	
	BL	AF129314 (HI)	2	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.7-4.9%	Spring, Blue Lake, Great Salt Lake Desert, Tooele Co., UT	<i>Tryonia protea</i> in GenBank	
	HF	AY803033 (HVIII), AY803034 (HVII)	5	0.0-0.2%	2.5-2.6% with HS (HV)	<i>T. imitator</i> , differ by 4.9-5.3%	Spring, Hualapai Flat, Lahontan basin, Washoe Co., NV		
	ED	AY803026 (HI)	3	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Spring at El Doctor, Colorado River basin, Sonora, Mexico		
	FS	AF129311 (HI)	1	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Spring, south end of Fish Springs National Wildlife Refuge, Juab Co., UT	<i>Tryonia protea</i> in GenBank	
			KP057915 (HI)	1	0.00%	2.1% with SS (HX) and HF (HVIII)	<i>T. imitator</i> , differ by 4.9-5.0%	Garden Lakes, Avondale, Maricopa Co., AZ	
		Misc4A	EF490563	1	0.00%	2.6% with HS (HV)	<i>T. imitator</i> , differ by 4.6-5.0%	Restored tidal marsh on north side of Waterfront Road, Point Edith Wildlife Area, Contra Costa Co., CA	
		Misc5A	EF490564	1	0.00%	2.6% with HS (HV)	<i>T. imitator</i> , differ by 4.6-5.0%	Restored tidal marsh, southeast of Point Edith Wildlife Area, Contra Costa Co., CA	
	<i>Tryonia quitobaquitae</i>		AF129315	1	0.00%		<i>T. angulata</i> , differ by 5.0%	Quitobaquito Springs, Pima Co., AZ	
<i>Tryonia rowlandsi</i>		AF061775	1	0.00%		<i>T. angulata</i> , differ by 3.8%	Grapevine Springs (lower warm spring), Death Valley, Inyo Co., CA		

Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
<i>Tryonia salina</i>		AF061776	1	0.00%		<i>T. imitator</i> , differ by 1.6-1.8%	Spring, Cottonball Marsh, Death Valley, Inyo Co., CA	
<i>Tryonia variegata</i>	DV, DH	AF061778	1	0.00%		<i>T. ericae</i> , differ by 2.9%	Devils Hole, Ash Meadows, Nye Co., NV	
	SA, SS	AF061777	1	0.00%		<i>T. angulata</i> , differ by 0.5%	Saratoga Spring, Amargosa River drainage, San Bernardino Co., CA	
Pyrgulopsis								
<i>Pyrgulopsis amargosae</i>	<i>P. amer</i> 2	AY367479	1	0.00%	7.3-7.4% with <i>P. "amargosae"</i> (2)	<i>P. anatina</i> , differ by 4.8%, <i>P. bacchus</i> , differ by 4.0-5.1%, <i>P. perforata</i> , differ by 4.5-4.8%	Saratoga Spring, Death Valley, San Bernardino Co., CA	
	<i>P. "amargosae"</i> (1)	DQ364002	1	0.00%	6.9% with <i>P. amargosae</i>	<i>P. bifurcata</i> , differ by 4.9%, <i>P. intermedia</i> , differ by 4.8-5.4%, <i>P. thompsoni</i> , differ by 4.8-5.9%	Third spring along trail (from north), Amargosa Canyon, Inyo Co., CA	<i>Pyrgulopsis</i> sp. 1 HPL-2003 in GenBank
	<i>P. "amargosae"</i> (2)	AF520924, KF559193	2	1.30%	7.3-7.4% with <i>P. amargosae</i>	<i>P. intermedia</i> , differ by 5.1-5.8%, <i>P. micrococcus</i> , differ by 5.3-5.6%, <i>P. milleri</i> , differ by 5.4-5.7%, <i>P. thompsoni</i> , differ by 5.0-6.3%	Spring, Amargosa Canyon, Inyo Co., CA	
<i>Pyrgulopsis anatina</i>	P58	AY627926	1	0.00%		<i>P. bifurcata</i> , differ by 4.5%, <i>P. torrida</i> , differ by 4.5%	Spring southeast of Old Collins Spring, Railroad Valley, Nye Co., NV	
<i>Pyrgulopsis anguina</i>	P94B	EU700466	1	0.00%		<i>P. kolobensis</i> , differ by 3.2-4.4%, <i>P. marcida</i> , differ by 3.4%, <i>P. nonaria</i> , differ by 3.6%, <i>P. variegata</i> , differ by 3.6%	Big Springs, Snake Valley, White Pine Co., NV	
<i>Pyrgulopsis archimedis</i>	AH	AY197583	1	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Big Lake Springs, Pit River basin, Shasta Co., CA	
	BL, D8B	AY197579	1	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Baum Lake, Pit River basin, Shasta Co., CA	

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<i>Pyrgulopsis archimedis</i> (continued)	FR_a/D1A, D1D	AY197577 (FR_a/D1A), AY426357 (D1D)	2	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Fall River (CalTrout Access), Pit River basin, Shasta Co., CA	AY426357/ D1D listed as <i>P. intermedia</i> in GenBank
	FR_b	AY197581	1	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Spring source, Fall River, Pit River basin, Shasta Co., CA	
	JS	AY197578	1	0.00%	0.3-0.6% with UK/P50	<i>P. rupinicola</i> , differ by 2.9-3.1%, <i>P. sp. A</i> , differ by 2.6-3.1%	Ja She Creek, Pit River basin, Shasta Co., CA	
	KL_a/D31A, D31B	AY197586 (KL_a/D31A), AY426356 (D31B)	2	0.00%	0.3-0.6% with UK/P50	<i>P. rupinicola</i> , differ by 2.6-2.7%, <i>P. sp. A</i> , differ by 2.4-2.9%	Fifth Link River spring, Klamath basin, Klamath Co., OR	AY426356/ D31B listed as <i>P. intermedia</i> in GenBank
	L01, L02	AY197584 (L01), AY197585 (L02)	2	0.00%	0.3% with JS, KL_a/D31	<i>P. rupinicola</i> , differ by 2.9-3.1%, <i>P. sp. A</i> , differ by 2.6-2.9%	Lost River near Horsefly Irrigation District, Klamath basin, Klamath Co., OR	
	PR/D7A, D7C	AY197580 (PR/D7A), AY426358 (D7C)	2	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Pit River at confluence with Hat Creek, Shasta Co., CA	AY426358/ D7C listed as <i>P. intermedia</i> in GenBank
	TH	AY197582	1	0.00%	0.2-0.4% with UK/P50	<i>P. rupinicola</i> , differ by 2.7-2.9%, <i>P. sp. A</i> , differ by 2.4-2.9%	Three unnamed springs, Pit River basin, Shasta Co., CA	
	UK/P50A, P50C	AF520950 (UK/P50A), AY426355 (P50C)	2	0.20%	0.3-0.6% with JS, KL_a/D31	<i>P. rupinicola</i> , differ by 2.9-3.2%, <i>P. sp. A</i> , differ by 2.6-3.6%	Upper Klamath Lake at Hagelstein Park outlet, Klamath Co., OR	
<i>Pyrgulopsis arizonae</i>	P148	AY627948	1	0.00%	1.5-1.7% with Psan6-9	<i>P. coloradensis</i> , differ by 5.0%, <i>P. sanchezi</i> , differ by 4.1-5.2%	Medicine Spring, Bylas, Gila River basin, Graham Co., AZ	
	Psan1, Psan2, Psan3, Psan4, Psan5	AY485561 (Psan1, N=26), AY485562 (Psan2, N=1), AY485563 (Psan3, N=1), AY485564 (Psan4, N=1), AY485565 (Psan5, N=1)	30	0.2-0.6%	1.1-1.5% with Psan6-9	<i>P. coloradensis</i> , differ by 5.6-5.9%, <i>P. sanchezi</i> , differ by 4.6-5.9%	Cold	Hurt (2004), listed as <i>P. sancarlosensis</i> in GenBank

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<i>Pyrgulopsis arizonae</i> (continued)	Psan6, Psan7, Psan8, Psan9	AY485566 (Psan1, N=30), AY485567 (Psan2, N=1), AY485568 (Psan3, N=1), AY485569 (Psan4, N=1)	34	0.2-1.2%	1.5-1.7% with P148	<i>P. coloradensis</i> , differ by 6.1-6.4%, <i>P. sanchezi</i> , differ by 5.2-6.2%	Tom Niece	Hurt (2004), listed as <i>P. sancaarlosensis</i> in GenBank
<i>Pyrgulopsis aurata</i>	P144A	EU700473	1	0.00%		<i>P. pictilis</i> , differ by 0.0%, <i>P. bryantwalkeri</i> , differ by 0.3%, <i>P. kolobensis</i> , differ by 1.7-2.9%, <i>P. nonaria</i> , differ by 2.0%, <i>P. variegata</i> , differ by 2.0%	Coyote Spring, Pleasant Valley, Pershing Co., NV	
<i>Pyrgulopsis avernalis</i>		AF520930	1	0.00%		<i>P. perforata</i> , differ by 8.6%	Muddy Spring, Moapa Valley, Clark Co., NV	
<i>Pyrgulopsis bacchus</i>	P191	DQ364005	1	0.00%		<i>P. montana</i> , differ by 2.2%	Tassi Spring, Grand Wash, Colorado River basin, Mohave Co., AZ	
	Pbac1, Pbac2	AY485540 (N=17), AY485541 (N=13)	30	0.20%		<i>P. montana</i> , differ by 2.2-2.4%	Grapevine	Hurt (2004)
	Pbac1, Pbac6, Pbac8	AY485540 (N=5), AY485544 (N=27), AY485545 (N=1)	33	0.5-0.6%		<i>P. montana</i> , differ by 2.4-2.6%	Whiskey	Hurt (2004)
	Pbac2, Pbac3, Pbac5	AY485541 (N=1), AY485542 (N=32), AY485543 (N=1)	34	0.2-0.5%		<i>P. montana</i> , differ by 2.2-2.6%	Tassi	Hurt (2004)
<i>Pyrgulopsis bernardina</i>	Pber	AY485595 (N=23, Pber1), AY485596 (N=7, Pber2), AY485597 (N=1, Pber3)	31	0.7-4.9%		<i>P. kolobensis</i> , differ by 5.5-7.5%, <i>P. owyheensis</i> , differ by 5.4-7.1% <i>P. pilsbryana</i> , differ by 4.8-6.1%, <i>P. rupinicola</i> , differ by 5.1-7.0%, <i>P. sp. C</i> , differ by 4.7-6.0%, <i>P. sp. D</i> , differ by 5.2-6.1%, <i>P. sp. H</i> , differ by 4.8-6.1%	San Bernardino	Hurt (2004), listed as <i>P. cochisi</i> , <i>P. bernadensis</i> in GenBank

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<i>Pyrgulopsis bifurcata</i>	P56	AY627925	1	0.00%		<i>P. pellita</i> , differ by 3.3%, <i>P. perforata</i> , differ by 3.3-3.5%	Springs west of Carico Lake, Carico Lake basin, Lander Co., NV	
<i>Pyrgulopsis breviloba</i>	P63	AY627928	1	0.00%		<i>P. lata</i> , differ by 0.5%, <i>P. kolobensis</i> , differ by 3.4-4.8%, <i>P. marcida</i> , differ by 3.7%, <i>P. nonaria</i> , differ by 3.7%	Flag Springs (middle), White River Valley, Nye Co., NV	
<i>Pyrgulopsis bruesi</i>		AF520926	1	0.00%		<i>P. dixensis</i> , differ by 0.3%, <i>P. conica</i> , differ by 3.4%, <i>P. glandulosa</i> , differ by 3.3-3.8%, <i>P. montana</i> , differ by 3.3%, <i>P. thompsoni</i> , differ by 3.2-4.4%	Fly Geyser, Black Rock Desert, Washoe Co., NV	
<i>Pyrgulopsis bruneauensis</i>	bruneauensis	AF520941	1	0.00%	1.8% with Pbr1	<i>P. kolobensis</i> , differ by 5.3-6.1%, <i>P. marcida</i> , differ by 5.3%, <i>P. pilsbryana</i> , differ by 5.3%, <i>P. variegata</i> , differ by 5.3%, <i>P. sp. B</i> , differ by 5.3%, <i>P. sp. C</i> , differ by 5.2-5.3%, <i>P. sp. D</i> , differ by 5.3%, <i>P. sp. H</i> , differ by 5.3%, <i>P. sp. I</i> , differ by 5.1%	Bruneau Hot Springs, Owyhee Co., ID	
	Pbr1	JN184636-645	10	0.00%	1.8% with bruneauensis	<i>P. kolobensis</i> , differ by 5.2-6.5%, <i>P. marcida</i> , differ by 5.3%, <i>P. pilsbryana</i> , differ by 5.7%, <i>P. variegata</i> , differ by 5.3%, <i>P. sp. B</i> , differ by 5.3%, <i>P. sp. C</i> , differ by 5.6-5.8%, <i>P. sp. D</i> , differ by 5.7%, <i>P. sp. H</i> , differ by 5.8%, <i>P. sp. I</i> , differ by 5.1%	Pool at mouth of Hot Creek, Owyhee Co., ID	

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<i>Pyrgulopsis bruneauensis</i> (continued)	Pbr2	JN184646-655	10	0-1.5%	0.3-1.8% with bruneauensis	<i>P. kolobensis</i> , differ by 4.4-6.5%, <i>P. marcida</i> , differ by 4.5-5.3%, <i>P. pilsbryana</i> , differ by 4.7-5.7%, <i>P. variegata</i> , differ by 4.3-5.3%, <i>P. sp. B</i> , differ by 4.5-5.3%, <i>P. sp. C</i> , differ by 4.6-5.8%, <i>P. sp. D</i> , differ by 4.8-5.7%, <i>P. sp. H</i> , differ by 4.7-5.8%, <i>P. sp. I</i> , differ by 4.3-5.1%	Spring along Bruneau River below Hot Creek confluence, Owyhee Co., ID	
	Pbr3	JN184656-665	10	0-1.4%	0.7-1.8% with bruneauensis	<i>P. kolobensis</i> , differ by 4.4-6.5%, <i>P. marcida</i> , differ by 4.5-5.3%, <i>P. pilsbryana</i> , differ by 4.7-5.7%, <i>P. variegata</i> , differ by 4.3-5.3%, <i>P. sp. B</i> , differ by 4.5-5.3%, <i>P. sp. C</i> , differ by 4.6-5.8%, <i>P. sp. D</i> , differ by 4.8-5.7%, <i>P. sp. H</i> , differ by 4.7-5.8%, <i>P. sp. I</i> , differ by 4.3-5.1%	Spring along Bruneau River above Hot Creek confluence, Owyhee Co., ID	
	Pbr4	JN184666-672	7	0-1.4%	0.7-1.8% with bruneauensis	<i>P. kolobensis</i> , differ by 4.4-6.5%, <i>P. marcida</i> , differ by 4.5-5.3%, <i>P. pilsbryana</i> , differ by 4.7-5.7%, <i>P. variegata</i> , differ by 4.3-5.3%, <i>P. sp. B</i> , differ by 4.5-5.3%, <i>P. sp. C</i> , differ by 4.6-5.8%, <i>P. sp. D</i> , differ by 4.8-5.7%, <i>P. sp. H</i> , differ by 4.7-5.8%, <i>P. sp. I</i> , differ by 4.3-5.1%	Hot Creek ca. 100 m upflow from mouth, Owyhee Co., ID	

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<i>Pyrgulopsis bruneauensis</i> (continued)	Pbr5	JN184673-679	7	0-1.5%	0.7-2.0% with bruneauensis	<i>P. kolobensis</i> , differ by 4.7-6.7%, <i>P. marcida</i> , differ by 4.8-5.5%, <i>P. pilsbryana</i> , differ by 5.0-5.9%, <i>P. variegata</i> , differ by 4.7-5.4%, <i>P. sp. B</i> , differ by 4.8-5.5%, <i>P. sp. C</i> , differ by 4.9-6.0%, <i>P. sp. D</i> , differ by 5.2-5.8%, <i>P. sp. H</i> , differ by 5.0-5.9%, <i>P. sp. I</i> , differ by 4.6-5.3%	Spring along Bruneau River below Hot Creek confluence, Owyhee Co., ID	
	Pbr6	JN184680-686	7	0-1.4%	0.7-1.8% with bruneauensis	<i>P. kolobensis</i> , differ by 4.4-6.5%, <i>P. marcida</i> , differ by 4.5-5.3%, <i>P. pilsbryana</i> , differ by 4.7-5.7%, <i>P. variegata</i> , differ by 4.3-5.3%, <i>P. sp. B</i> , differ by 4.5-5.3%, <i>P. sp. C</i> , differ by 4.6-5.8%, <i>P. sp. D</i> , differ by 4.8-5.7%, <i>P. sp. H</i> , differ by 4.7-5.8%, <i>P. sp. I</i> , differ by 4.3-5.1%	Bruneau River below Hot Creek confluence, Owyhee Co., ID	
<i>Pyrgulopsis bryantwalkerii</i>	P121A	AY627942	1	0.00%		<i>P. aurata</i> , differ by 0.3%, <i>P. pictilis</i> , differ by 0.3%, <i>P. kolobensis</i> , differ by 1.7-2.7%, <i>P. nonaria</i> , differ by 2.0%, <i>P. variegata</i> , differ by 2.0%, <i>P. sp. B</i> , differ by 1.9%	Warm Spring, Humboldt River drainage, Elko Co., NV	
<i>Pyrgulopsis californiensis</i>	P30	DQ364019	3	0.00%	3.4% with P31	<i>P. kolobensis</i> , differ by 4.1-5.3%, <i>P. variegata</i> , differ by 4.3%,	Spring tributary to Lytle Creek, Santa Ana River basin, San Bernardino Co., CA	
	P31	AY367481	1	0.00%	3.4% with P30	<i>P. chamberlini</i> , differ by 5.1%, <i>P. leporina</i> , differ by 5.1%	Spring tributary to Snow Creek, Whitewater River basin, Riverside Co., CA	

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<i>Pyrgulopsis californiensis</i> (continued)	P33	AY627924	2	0.00%	7.0% with P30	<i>P. longinqua</i> , differ by 2.4%	Spring tributary to Campo Creek, Southern California coastal drainage, San Diego Co., CA	
<i>Pyrgulopsis carinifera</i>	P9	AY627920	1	0.00%		<i>P. archimedis</i> , differ by 6.3-7.5%, <i>P. bruneauensis</i> , differ by 6.9-7.5%, <i>P. lentiglans</i> , differ by 6.9%, <i>P. thermalis</i> , differ by 6.0-12.1%	Muddy Spring, Moapa Valley, Clark Co., NV	
<i>Pyrgulopsis castaicensis</i>		GQ275097	3	0.00%		<i>P. hualapaiensis</i> , differ by 3.3%	Middle Canyon Spring, Southern California coastal drainage, Los Angeles Co., CA	<i>Pyrgulopsis</i> sp. 1 HPL-2009 in GenBank
<i>Pyrgulopsis chamberlini</i>	P101A	EU700468	1	0.00%		<i>P. variegata</i> , differ by 1.9%, <i>P. sp. B</i> , differ by 1.8%, <i>P. sp. I</i> , differ by 1.9%	Spring at Glenwood, Sevier River drainage, Sevier Co., UT	
<i>Pyrgulopsis cinerana</i>	AC	AY197602	1	0.00%		<i>P. falciglans</i> , differ by 4.8%	Ash Creek, Pit River basin, Lassen Co., CA	
<i>Pyrgulopsis coloradensis</i>	BP1A	KP899919	1	0.00%		<i>P. sanchezi</i> , differ by 3.8-5.0%	Blue Point Spring, Clark Co., NV	
<i>Pyrgulopsis conica</i>	DS	AY627958	1	0.00%	0.0% with Pcon1	<i>P. glandulosa</i> , differ by 2.6-3.0%, <i>P. perforata</i> , differ by 2.6-2.7%	Dripping Spring, Sacramento Wash, Mohave Co., AZ	
	Pcon1	AY485546	30	0.00%	0.0% with DS	<i>P. glandulosa</i> , differ by 2.6-3.0%, <i>P. perforata</i> , differ by 2.6-2.7%	Dripping	Hurt (2004)
<i>Pyrgulopsis cruciglans</i>	P70A	AY627931	1	0.00%		<i>P. kolobensis</i> , differ by 3.0-4.2%, <i>P. marcida</i> , differ by 3.3%, <i>P. variegata</i> , differ by 3.3%	Flat Spring, Steptoe Valley, White Pine Co., NV	

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<i>Pyrgulopsis crystalis</i>		AY367482	1	0.00%		<i>P. pisteri</i> , differ by 0.6%, <i>P. erythropoma</i> , differ by 4.5%	Crystal Pool, Ash Meadows, Nye Co., NV	
<i>Pyrgulopsis cybele</i>	P237	JN255353-58	6	0.0-0.5%	0.0-0.5% with P252	<i>P. glandulosa</i> , differ by 2.8-3.2%, <i>P. intermedia</i> , differ by 2.9-3.6%	Spring brook entering north side of South Fork Owyhee River, Elko Co., NV	<i>Pyrgulopsis</i> sp. HPL2011a isolate P237A, P237B, P237C, P237D, P237E, P237F in GenBank
	P252	JN255350-52	3	0.0-0.2%	0.0-0.5% with P237	<i>P. glandulosa</i> , differ by 2.8-3.0%, <i>P. intermedia</i> , differ by 2.9-3.5%	Spring brook entering north side of South Fork Owyhee River, Elko Co., NV	<i>Pyrgulopsis</i> sp. HPL2011a isolate P252A, P252B, P252C in GenBank
<i>Pyrgulopsis deaconi</i>		AY367483	1	0.00%		<i>P. eremica</i> , differ by 6.6-10%, <i>P. kolobensis</i> , differ by 6.8-8.6%, <i>P. variegata</i> , differ by 6.8%, <i>P. sp. A</i> , differ by 6.3-7.3%	Red Spring, Las Vegas Valley, Clark Co., NV	
<i>Pyrgulopsis deserta</i>	P115	DQ251077	1	0.00%	0.8-4.4% with Pdes1/2, 1.1-3.6% with Pdes6/7	<i>P. kolobensis</i> , differ by 5.9-7.0%, <i>P. pilsbryana</i> , differ by 6.2-6.4%, <i>P. sp. D</i> , differ by 6.2%	Springs tributary to Virgin River, Littlefield, Mohave Co., AZ	
	Pdes1, Pdes2	AY485534 (N=15), AY485535 (N=13)	28	3.60%	0.8-4.4% with P115, 0.6-4.4% with Pdes4/5, 0.6-4.1% with Pdes5, 0.8-5.7% with Pdes6/7	<i>P. kolobensis</i> , differ by 5.5-7.8%, <i>P. pilsbryana</i> , differ by 5.7-7.0%, <i>P. sp. C</i> , differ by 5.9-6.9%, <i>P. sp. D</i> , differ by 5.7-7.0%, <i>P. sp. H</i> , differ by 5.9-6.9%	Green	Hurt (2004)
	Pdes4, Pdes5	AY485536 (N=6), AY485537 (N=25)	31	0.20%	0.8-4.4% with Pdes1/2, 1.0-4.0% with Pdes6/7	<i>P. kolobensis</i> , differ by 5.6-7.0%, <i>P. pilsbryana</i> , differ by 5.8-6.5%, <i>P. sp. D</i> , differ by 5.8-6.1%	Littlefield I	Hurt (2004)
	Pdes5	AY485537	33	0.00%	0.6-4.1% with Pdes1/2, 1.0-3.9% with Pdes6/7	<i>P. kolobensis</i> , differ by 5.6-6.6%, <i>P. pilsbryana</i> , differ by 5.8-6.0%, <i>P. sp. D</i> , differ by 5.8%	Littlefield II	Hurt (2004). In Hurt (2004) table 3 listed haplotypes Pdes5 and Pdes6 are both at 100% frequency.

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<i>Pyrgulopsis deserta</i> (continued)	Pdes6, Pdes7	AY485536 (N=17), AY485537 (N=14)	31	2.70%	1.1-3.6% with P115, 0.8-5.7% with Pdes1/2, 1.0-4.0% with Pdes4/5, 1.0-3.9% with Pdes5	<i>P. kolobensis</i> , differ by 6.0-7.7%, <i>P. pilsbryana</i> , differ by 6.3-6.6%, <i>P. sp. C</i> , differ by 6.4-6.7%, <i>P. sp. D</i> , differ by 6.3-6.5%, <i>P. sp. H</i> , differ by 6.4-6.6%	Red Hill	Hurt (2004)
<i>Pyrgulopsis diablensis</i>	P25	AY627922	2	0.00%		<i>P. giulianii</i> , differ by 1.1%	Stream, Del Puerto Canyon, San Joaquin River basin, Stanislaus Co., CA	
<i>Pyrgulopsis dixensis</i>	P143	AY627946	1	0.00%		<i>P. bruesi</i> , differ by 0.3%, <i>P. montana</i> , differ by 3.1%	Spring west of Cain Mountain, Dixie Valley, Pershing Co., NV	
<i>Pyrgulopsis eremica</i>	P145	AY627947	1	0.00%	7.1% with EL_a, 7.0-7.1% with EL_b	<i>P. lasseni</i> , differ by 0.3%, <i>P. kolobensis</i> , differ by 4.9-6.1%, <i>P. pilsbryana</i> , differ by 5.1-5.4%, <i>P. sp. D</i> , differ by 5.1%	Spring, tributary to Willow Creek, Eagle Lake basin, Lassen Co., CA	This sequence does not appear to be that of <i>P. eremica</i> (per Hershler et al. 2003a) and was apparently submitted to GenBank in error
	HC	AY197597	1	0.00%	7% with P145	<i>P. kolobensis</i> , differ by 3.7-5.3%, <i>P. sp. D</i> , differ by 3.7%	Spring west of Russell Dairy Spring, Pit River basin, Lassen Co., CA	
	EL_a	AY197598	1	0.00%	7.1% with P145	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. sp. D</i> , differ by 3.9%	Troxel Point Spring, Honey-Eagle Lakes basin, Lassen Co., CA	
	EL_b	AY197599-600	2	0.20%	7.0-7.1% with P145	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. sp. D</i> , differ by 3.9-4.1%	Murrers Upper Meadow, Honey-Eagle Lakes basin, Lassen Co., CA	
<i>Pyrgulopsis erythropoma</i>		AY367484	4	0.00%		<i>P. crystalis</i> , differ by 4.5%, <i>P. pisteri</i> , differ by 4.5%	Kings Pool (outflow), Point of Rocks, Ash Meadows, Nye Co., NV	
<i>Pyrgulopsis fairbanksensis</i>	P19	AY627921	1	0.00%		<i>P. isolata</i> , differ by 0.5%, <i>P. nanus</i> , differ by 1.3%	Fairbanks Spring, Ash Meadows, Nye Co., NV	

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<i>Pyrgulopsis falciglans</i>	SC	AY197601	1			<i>P. cinerana</i> , differ by 4.8%	Smokey Charley Spring, Modoc Co., CA	
<i>Pyrgulopsis fausta</i>		AY367485	1	0.00%		<i>P. longiglans</i> , differ by 6.3%, <i>P. trivialis</i> , differ by 6.3-6.4%	Corn Creek Springs, Las Vegas Valley, Clark Co., NV	
<i>Pyrgulopsis fresti</i>	IP68	FJ172470 (IP68A), FJ172471 (IP68B), FJ172472 (IP68C)	3	0.2-0.3%	2.1-2.3% with IP69B	<i>P. kolobensis</i> , differ by 6.2-7.6%, <i>P. marcida</i> , differ by 6.5-6.7%, <i>P. plicata</i> , differ by 6.5-6.7%, <i>P. serrata</i> , differ by 6.4-6.6%, <i>P. variegata</i> , differ by 6.5-6.7%, <i>P. sp. C</i> , differ by 6.5-6.9%	Tudor Warm Springs, east side of Owyhee River, fourth spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP68A, IP68B, IP68C in GenBank
	IP69B	FJ172473	1	0.00%	2.5% with P207A	<i>P. kolobensis</i> , differ by 6.3-7.3%, <i>P. marcida</i> , differ by 6.4%, <i>P. plicata</i> , differ by 6.4%, <i>P. rupinicola</i> , differ by 6.4-6.6%, <i>P. variegata</i> , differ by 6.4%	Tudor Warm Springs, west side of Owyhee River, first spring north of mouth of Warm Springs Canyon, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP69B in GenBank
	P176B	FJ172474	1	0.00%	2.1% with IP69B	<i>P. kolobensis</i> , differ by 6.2-7.3%, <i>P. neritella</i> , differ by 6.3%	Tudor Warm Springs, east side of Owyhee River, second spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP176B in GenBank
	P207A	FJ172476	2	0.00%	2.5% with IP69B	<i>P. kolobensis</i> , differ by 5.9-7.4%, <i>P. neritella</i> , differ by 6.1%	Spring tributary to Owyhee River upflow from Tudor Warm Springs, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP207A in GenBank
	P208	FJ172477 (P208A), FJ172478 (P208E)	5	0.80%	1.6-2.1% with IP69B	<i>P. kolobensis</i> , differ by 6.1-7.3%, <i>P. serrata</i> , differ by 6.3-6.4%	Spring complex along Owyhee River upflow from Tudor Warm Springs, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP208A, IP208E in GenBank
	P210	FJ172480	3	0.00%	2.1% with IP69B	<i>P. kolobensis</i> , differ by 6.2-7.4%, <i>P. serrata</i> , differ by 6.4%	Tudor Warm Springs, east side of Owyhee River, third spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP210A in GenBank
	P212	FJ172483	2	0.00%	2.1% with IP69B	<i>P. kolobensis</i> , differ by 6.2-7.4%, <i>P. serrata</i> , differ by 6.4%	Tudor Warm Springs, east side of Owyhee River, second spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 2 HPL2008 isolate IP212A in GenBank0

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<i>Pyrgulopsis gibba</i>	P134/SV	AY197603, AY426359	2	0.00%	1.0% with P192	<i>P. vinyardi</i> , differ by 0.5%, <i>P. kolobensis</i> , differ by 4.6-5.9%, <i>P. nonaria</i> , differ by 4.4-4.8%	Spring west of Fee Reservoir, Surprise Valley, Modoc Co., CA	
	P192	DQ364016	1	0.00%	1.0% with P134	<i>P. vinyardi</i> , differ by 1.1%, <i>P. kolobensis</i> , differ by 4.6-5.5%, <i>P. nonaria</i> , differ by 4.6%	Spring along Hwy 395 below Bridgeport Reservoir, Walker River basin, Mono Co., CA	
<i>Pyrgulopsis gilae</i>	G1	KC571284 (N=2), KC571285 (N=1)	3	0-1.2%	0.6-1.5% with Pgil3 and Pgil4	<i>P. marilynae</i> , differ by 3.8-4.0%	Spring along East Fork Gila River, ca. 1.53 km north, 2.9 km east of State Route 527 bridge crossing, Grant Co., NM	
	G2	KC571286 (N=9), KC571287 (N=1)	10	0-0.2%	0.6-1.0% with Pgil3 and Pgil4	<i>P. marilynae</i> , differ by 3.5-3.8%	Spring along East Fork Gila River, ca. 1.29 km north, 0.56 km west of Black Canyon confluence, Grant Co., NM	
	G3	KC571288 (N=4), KC571289 (N=1), KC571290 (N=1)	6	0-0.3%	0.5-1.2% with G1	<i>P. marilynae</i> , differ by 3.6-4.0%	Spring along East Fork Gila River, ca. 1.53 km north, 2.38 km east of State Route 527 bridge crossing, Grant Co., NM	
	G14	KC571288 (N=2), KC571306 (N=1)	3	0-0.2%	0.5-1.2% with G1	<i>P. marilynae</i> , differ by 3.6-4.0%	Alum Hot Spring, ca. 1.93 km south, 0.16 km west of State Route 527 bridge crossing, Grant Co., NM	
	Pgilae	AY627952	1	0.00%	0.0-1.3% with G1	<i>P. marilynae</i> , differ by 3.8-4.0%	Spring tributary to East Fork Gila River, Grant Co., NM	
	Pgil1, Pgil2	AY485570 (N=18), AY485571 (N=14)	32	0-0.2%	0.0-1.4% with G1	<i>P. marilynae</i> , differ by 3.2-3.6%	Gila I	Hurt (2004)
	Pgil3, Pgil4	AY485572 (N=28), AY485573 (N=1)	29	0-0.4%	0.6-1.5% with G1	<i>P. marilynae</i> , differ by 3.5-3.8%	Gila II	Hurt (2004)
	Pgil3	AY485572	29	0.00%	0.6-1.2% with G1	<i>P. marilynae</i> , differ by 3.5-3.6%	Gila III	Hurt (2004)

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<i>Pyrgulopsis giulianii</i>	M23	AF520937	1	0.00%	0% with P21	<i>P. diablensis</i> , differ by 1.1%	Stream, Sand Canyon, Indian Wells Valley (Northern Mojave basin), Kern Co., CA	<i>P. giuliani</i> in GenBank
	P21	DQ364018	1	0.00%	0% with M23	<i>P. diablensis</i> , differ by 1.1%	Dougherty Creek, Hwy 178 crossing, Kern River basin, Kern Co., CA	
<i>Pyrgulopsis glandulosa</i>	NP2	AY627959	1	0.00%	0% with Pgl1	<i>P. intermedia</i> , differ by 2.1-2.6%	Nelson Place Spring, Verde River basin, Yavapai Co., AZ	Hurt (2004)
	Pgl1	AY485557	25	0.00%	0% with NP2	<i>P. intermedia</i> , differ by 2.2-2.4%	Nelson Place	
<i>Pyrgulopsis gracilis</i>	P60	DQ364011	1	0.00%		<i>P. hubbsi</i> , differ by 3.2%, <i>P. sathos</i> , differ by 3.2%	Emigrant Springs (north), White River Valley, Nye Co., NV	
<i>Pyrgulopsis greggi</i>	P22	AF520943 (N=3), GQ275088 (N=2)	5	0-0.3%		<i>P. kolobensis</i> , differ by 4.3-6.5%, <i>P. pilsbryana</i> , differ by 4.8-5.7%, <i>P. transversa</i> , differ by 4.6-5.3%, <i>P. sp. C</i> , differ by 4.8-5.5%, <i>P. sp. H</i> , differ by 4.8-5.3%	Grapevine Creek, Fort Tejon Historic State Park, Kern Co., CA	
<i>Pyrgulopsis hualapaiensis</i>		KU720383	1	0.00%		<i>P. conica</i> , differ by 2.9%, <i>P. milleri</i> , differ by 2.9%, <i>P. thompsoni</i> , differ by 2.5-4.0%	Upper Peach Springs, outflow just below concrete weir, Hualapai Indian Reservation, Mohave Co., AZ	
<i>Pyrgulopsis hubbsi</i>	P7B	AY627918	1	0.00%		<i>P. sathos</i> , differ by 1%	Crystal Spring, Pahranaagat Valley, Lincoln Co., NV	
<i>Pyrgulopsis imperialis</i>	P140	AY379450 (P140A), AY426350 (P140C)	2	0.30%		<i>P. cybele</i> , differ by 3.1-3.7%, <i>P. intermedia</i> , differ by 3.3-4.0%, <i>P. perforata</i> , differ by 3.2-3.7%, <i>P. robusta</i> , differ by 3.4-4.1%	Spring, Thacker Pass, Kings River Valley, Humboldt Co., NV	

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<i>Pyrgulopsis inopinata</i>	P100	AY426360 (P100A), AY426361 (P100C)	2	0.00%		<i>P. kolobensis</i> , differ by 2.6-3.6%, <i>P. marcida</i> , differ by 2.6%, <i>P. plicata</i> , differ by 2.6%	Spring, Glenwood, Sevier River drainage Sevier Co., UT	
<i>Pyrgulopsis intermedia</i>	P. intermedia, OW_b	AF520928, AY197593	2	0.20%	0.2-0.7% with P223	<i>P. glandulosa</i> , differ by 2.2-2.6%	Crooked Creek Spring State Wayside, Harney Co., OR	
	OW_a, P1B/ intermedia1, P1C/ intermedia1, P1E	AY197592, AY379442, AY379443, AY426351	4	0-0.2%	0.2-0.6% with P223	<i>P. glandulosa</i> , differ by 2.2-2.6%	Crooked Creek, Hwy 95 crossing, middle Snake River basin, Malheur Co., OR	
	P2	AY426352 AY426353	2	0.00%	0.3-0.6% with P223	<i>P. glandulosa</i> , differ by 2.2-2.4%	Crooked Creek Spring, Owyhee River drainage, Malheur Co., OR	
	P4/ intermedia2	AY379444, AY379445	2	0.20%	0.2-0.8% with P223	<i>P. glandulosa</i> , differ by 2.2-2.6%	Skylight Spring, Barren Valley, Malheur Co., OR	
	IP60	FJ172460-63	4	0-0.2%	0.3-0.8% with P223	<i>P. glandulosa</i> , differ by 2.2-2.6%	Crooked Creek at Crooked Creek State Wayside, Harney Co., OR	
	IP67	FJ172468-69	2	0.00%	0.2-0.5% with P223	<i>P. glandulosa</i> , differ by 2.2-2.3%	Spring tributary to Birch Creek, Malheur Co., OR	
	P217	FJ172488	1	0.00%	0.2-0.5% with P223	<i>P. glandulosa</i> , differ by 2.2-2.3%	Spring on Owyhee River, above Long Sweetwater rapids, Malheur Co., OR	
	P222	FJ172496-497	2	0.20%	0.2-0.6% with P223	<i>P. glandulosa</i> , differ by 2.2-2.4%	Spring on hillside, Jackson Hole, Malheur Co., OR	
	P223	FJ172498-499	2	0.30%	0.3-0.8% with IP60	<i>P. glandulosa</i> , differ by 2.0-2.4%	Mouth of Rinehart Creek, Malheur Co., OR	
	P224	FJ172500	1	0.00%	0.2-0.5% with P223	<i>P. glandulosa</i> , differ by 2.2-2.3%	Spring west of Twomile Spring, Malheur Co., OR	
<i>Pyrgulopsis isolata</i>		AY367486	1	0.00%		<i>P. fairbanksensis</i> , differ by 0.5%, <i>P. nanus</i> , differ by 1.4%	Spring south of Clay Pits, Ash Meadows, Nye Co., NV	

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<i>Pyrgulopsis kolobensis</i>	P162	AY379448 (P162A), AY379449 (P162B), AY379449 (P162B), AY426354 (P162D)	3	0.00%	3.1% with P193	<i>P. pilsbryana</i> , differ by 0.2-0.3%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.3%, <i>P. sp. D</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0.3%	Big Malad Spring, Malad Valley, Oneida Co., ID	
	P117	AY627939 (Tq3, P117A)	1	0.00%	2.9% with P162	<i>P. variegata</i> , differ by 1.9%	Toquerville Springs, Washington Co., UT	
	P193	DQ364008	1	0.00%	3.1% with P162	<i>P. variegata</i> , differ by 1.9%	Spring southwest of Pinto, Washington Co., UT	
	P194	DQ364009	1	0.00%	1.9% with Kol3, Kol4, P162, 1.7-1.9% with Kol5	<i>P. variegata</i> , differ by 1.1%	Spring, Left Fork Santa Clara River, Pine Valley campground, Washington Co., UT	
	P195	DQ364010	1	0.00%	2.6% with P162	<i>P. variegata</i> , differ by 1.6%	Spring, Meadow Valley Wash, Kershaw-Ryan State Park, Lincoln Co., NV	
	Kol1	KT248032 (Kol1A, N=4), KT248033 (Kol1B, N=1)	5	0-0.8%	2.3-2.8% with P193	<i>P. nonaria</i> , differ by 0.6-1.1%, <i>P. pilsbryana</i> , differ by 0.0-0.9%, <i>P. transversa</i> , differ by 0.8-1.0%, <i>P. sp. C</i> , differ by 0.2-1.0%, <i>P. sp. D</i> , differ by 0.0-0.8%, <i>P. sp. H</i> , differ by 0.2-0.9%	Spring, Right Fork Hobbie Creek, Utah Co., UT	
	Kol2	KT248034 (Kol2A, N=1), KT248035 (Kol2B, N=3), KT248036 (Kol2E, N=1)	5	0-0.3%	2.0-2.2% with P117, 2.0-2.3% with P193	<i>P. nonaria</i> , differ by 0.5-0.6%, <i>P. pilsbryana</i> , differ by 0.6-0.9%, <i>P. transversa</i> , differ by 0.6-0.8%, <i>P. sp. C</i> , differ by 0.8-1.0%, <i>P. sp. D</i> , differ by 0.6-0.8%, <i>P. sp. H</i> , differ by 0.-8-0.9%	Spring Creek, Wallsburg, Wasatch Co., UT	
	Kol3	KT248037 (Kol3A, N=5)	5	0.00%	3.0% with P193	<i>P. pilsbryana</i> , differ by 0.2-0.3%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.3%, <i>P. sp. D</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0.3%	Willow Creek, Wasatch Co., UT	

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<i>Pyrgulopsis kolobensis</i> (continued)	Kol4	KT248038 (Kol4A, N=5)	5	0.00%	2.2-2.9% with Pkol1/Pkol2, 2.6% with P117, P193	<i>P. pilsbryana</i> , differ by 0.2-0.3%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.3%, <i>P. sp. D</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0.3%	Spring at Peoa, Summit Co., UT	
	Kol5	KT248039 (Kol5A, N=2), KT248040 (Kol5B, N=1), KT248041 (Kol5C, N=1), KT248042 (Kol5D, N=1)	5	0-0.5%	2.1-3.1% with Pkol1/Pkol2, 2.6-2.8% with P117, 2.5-2.8% with P193	<i>P. pilsbryana</i> , differ by 0.0-0.5%, <i>P. transversa</i> , differ by 1.0-1.3%, <i>P. sp. C</i> , differ by 0.2-0.5%, <i>P. sp. D</i> , differ by 0.0-0.3%, <i>P. sp. H</i> , differ by 0.2-0.5%	Spring southwest of Francis, Summit Co., UT	
	Pkol1, Pkol2	AY485532 (Pkol1, N=29), AY485533 (Pkol2, N=4)	33	0-0.2%	2.5-3.1% with P162	<i>P. variegata</i> , differ by 1.6-2.1%	Toquerville	Hurt (2004)
<i>Pyrgulopsis landyei</i>	P68A	AY627930	1	0.00%		<i>P. sulcata</i> , differ by 3.7%	Middle Spring, Steptoe Ranch, Steptoe Valley, White Pine Co., NV	
<i>Pyrgulopsis lasseni</i>	WC_a	AY197604	1	0.00%	0.3% with WC_a	<i>P. eremica</i> , differ by 0.3-6.8%, <i>P. kolobensis</i> , differ by 4.4-5.7%, <i>P. pilsbryana</i> , differ by 4.8-4.9%, <i>P. transversa</i> , differ by 4.8%, <i>P. sp. D</i> , differ by 4.8%	Willow Creek west of Lower McBride Springs, Lassen Co., CA	
	WC_b	AY197605	1	0.00%	0.3% with WC_b	<i>P. eremica</i> , differ by 0.3-6.8%, <i>P. kolobensis</i> , differ by 4.8-6.0%, <i>P. pilsbryana</i> , differ by 5.1-5.3%, <i>P. transversa</i> , differ by 5.1%, <i>P. sp. D</i> , differ by 5.1%	Willow Creek downstream from Willow Creek Campground, Lassen Co., CA	

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<i>Pyrgulopsis lata</i>	P61B	AY627927	1	0.00%		<i>P. breviloba</i> , differ by 0.5%, <i>P. kolobensis</i> , differ by 3.9-5.2%, <i>P. marcida</i> , differ by 4.2%, <i>P. nonaria</i> , differ by 4.2%	Butterfield Springs, White River Valley, Nye Co., NV	
<i>Pyrgulopsis lentiglans</i>	P103A	AY627936	1	0.00%		<i>P. millenaria</i> , differ by 1.6%	Crittenden Springs, Thousand Springs Creek drainage, Elko Co., NV	
<i>Pyrgulopsis leporina</i>	P123A	EU700471	1	0.00%		<i>P. sublata</i> , differ by 1.9%	Springs along Rabbit Creek, Humboldt River drainage, Elko Co., NV	
<i>Pyrgulopsis licina</i>	M7	AY367438 (M7A), AY367439 (M7B)	2	0.20%	0.6-0.8% with M29	<i>P. bifurcata</i> , differ by 3.5-3.7%	Last Chance Spring, Ash Meadows, Nye Co., NV	<i>P. micrococcus</i> in GenBank
	M29	AY367476	1	0.00%	0.6-0.8% with M7	<i>P. bifurcata</i> , differ by 3.8%	Spring east of Crystal Reservoir, Ash Meadows, Nye Co., NV	<i>P. micrococcus</i> in GenBank
	M30	AY367477 (M30A, M30C)	2	0.00%	0.5-0.6% with M7	<i>P. bifurcata</i> , differ by 3.7%	Spring south of Clay Pits, Ash Meadows, Nye Co., NV	<i>P. micrococcus</i> in GenBank
	M52	KF559189	2	0.00%	0.5-0.6% with M7	<i>P. bifurcata</i> , differ by 3.7%	Spring ca. 100 m north of Collins Ranch, Ash Meadows, Nye Co., NV	<i>P. perforata</i> in GenBank
	M54	KF559190	3	0.00%	0.5-0.6% with M7	<i>P. bifurcata</i> , differ by 3.7%	Spring south of Rogers Spring, Ash Meadows, Nye Co., NV	<i>P. perforata</i> in GenBank
	M58	KF559191	2	0.00%	0.5-0.6% with M7	<i>P. bifurcata</i> , differ by 3.7%	Spring east of Crystal Reservoir, Ash Meadows, Nye Co., NV	<i>P. perforata</i> in GenBank
<i>Pyrgulopsis limaria</i>	SM2	EF119088-92	6	0-0.9%	0.3-1.5% with SM10, 0.2-1.4% with SM22	<i>P. umblicata</i> , differ by 0.2-0.9%	Spring brook, western Soldier Meadow, Humboldt Co., NV	
	SM7	EF119095-97	5	0-0.3%	0.5-1.1% with SM10	<i>P. umblicata</i> , differ by 0.2-0.5%	Spring 150 m W of Satellite Spring, Humboldt Co., NV	
	SM10	EF119098-100	5	0-0.3%	0.3-1.2% with SM23, SM36, 0.3-1.1% with SM24, SM26, SM29/31, 0.3-1.4% with SM2, 0.5-1.1% with SM7	<i>P. umblicata</i> , differ by 0.6-1.2%	Tole Spring, western Soldier Meadow, Humboldt Co., NV	

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<i>Pyrgulopsis limaria</i> (continued)	SM22	EF119106-110	5	0.2-0.6%	0.2-1.1% with SM23, SM36, 0.3-1.1% with SM26, 0.2-1.4% with SM2	<i>P. umbilicata</i> , differ by 0.5-1.1%	Tole Spring 30 m downflow from source, western Soldier Meadow, Humboldt Co., NV	
	SM23	EF119111-114	4	0.2-0.6%	0.3-1.2% with SM10, 0.2-1.1% with SM22	<i>P. umbilicata</i> , differ by 0.2-0.6%	Satellite Spring complex, spring "A," 60+ m downflow from source, Humboldt Co., NV	
	SM24	EF119115-116	4	0.50%	0.3-1.1% with SM10	<i>P. umbilicata</i> , differ by 0.2-0.6%	Satellite Spring complex, spring "B," Humboldt Co., NV	
	SM26	EF119117-120	4	0.3-0.6%	0.0-1.1% with SM2, 0.3-1.1% with SM10, SM22	<i>P. umbilicata</i> , differ by 0.2-0.8%	Satellite Spring complex, spring "F," Humboldt Co., NV	
	SM29, 31	EF119121-123	7	0-0.5%	0.3-1.1% with SM10	<i>P. umbilicata</i> , differ by 0.2-0.6%	Satellite Spring complex, spring "H," Humboldt Co., NV	
	SM34	EF1190124	2	0.00%	0.0-0.9% with SM2	<i>P. umbilicata</i> , differ by 0.3-0.6%	Satellite Spring complex, spring "J," Humboldt Co., NV	
	SM36	EF119125-126	5	0-0.6%	0.3-1.2% with SM10, 0.2-1.1% with SM22	<i>P. umbilicata</i> , differ by 0.3-0.6%	Satellite Spring 200 m downflow from source, Humboldt Co., NV	
<i>Pyrgulopsis lindae</i>	17/P24	GQ275091	4	0.00%		<i>P. kolobensis</i> , differ by 5.6-7.8%, <i>P. pilsbryana</i> , differ by 6.0%, <i>P. sp. C</i> , differ by 5.9-6.1%, <i>P. sp. C</i> , differ by 5.9-6.1%, <i>P. sp. D</i> , differ by 6.0%	San Domingo Creek, San Joaquin River basin, Calaveras Co., CA	<i>P. sp.</i> USNM905258 isolate P24AA in GenBank, described as <i>P. lindae</i> in Hershler et al. (2016b)
<i>Pyrgulopsis lockensis</i>	P82D	AY627932	1	0.00%		<i>P. villacampae</i> , differ by 2.6%	Big Spring, Lockes Ranch, Railroad Valley, Nye Co., NV	
<i>Pyrgulopsis longiglans</i>	P133A	EF119141, DQ364017	1	0.00%		<i>P. kolobensis</i> , differ by 4.5-5.9%, <i>P. variegata</i> , differ by 5.0%	Spring NNW of Holbrook Junction, Antelope Valley, Douglas Co., NV	DQ364017: <i>P. sp. Virginia</i> HPL-2006 in GenBank
<i>Pyrgulopsis longinqua</i>	P32B	DQ364006	1	0.00%		<i>P. californiensis</i> , differ by 2.4-7.9%, <i>P. montana</i> , differ by 2.9%	Spring west-southwest of Hunters Spring, Salton Sea basin, Riverside Co., CA	

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<i>Pyrgulopsis marcida</i>	P59A	DQ364012	1	0.00%		<i>P. kolobensis</i> , differ by 1.1-2.7%, <i>P. serrata</i> , differ by 1.4%, <i>P. sterilis</i> , differ by 1.4%, <i>P. variegata</i> , differ by 1.4%	Hardy Springs, White River Valley, Nye Co., NV	
<i>Pyrgulopsis marilynae</i>	G8	KC571299 (N=1), KC571300 (N=1), KC571301 (N=3), KC571302 (N=1)	6	0-0.3%	0.2-0.3% with G11	<i>P. gilae</i> , differ by 3.2-4.0%	Spring along Middle Fork Gila River, ca. 0.97 km north, 0.64 km west of Jordan Canyon, Grant Co., NM	<i>P. gilae</i> in GenBank
	G11	KC571305	2	0.00%	0.2-0.3% with G8	<i>P. gilae</i> , differ by 3.4-4.0%	Spring along Middle Fork Gila River, ca. 0.48 km north, 0.48 km west of Jordan Canyon, Grant Co., NM	<i>P. gilae</i> in GenBank
<i>Pyrgulopsis merriami</i>	P8B	AY627919	1	0.00%		<i>P. notidicola</i> , differ by 8.4-9.7%, <i>P. trivialis</i> , differ by 8.6-8.9%	Ash Spring, Pahranaagat Valley, Lincoln Co., NV	
<i>Pyrgulopsis micrococcus</i>	M1	AF520944/ AY367415-417/ AY367420/ AY367424/ AY367427-28 (N=8, M1A-1D, G, K, N-O), AY367418-19 (N=2, M1E-F), AY367421-23/ AY367425-26/ AY367429 (N=6, M1H-J, L-M, P)	16	0-0.6%	0.0-0.3% with M31	<i>P. perforata</i> , differ by 3.9-4.5%	AF520944: Spring just S of Springdale, Nye Co., NV AY367418-29: Spring, Fleur de Lis Ranch, Oasis Valley, Nye Co., NV	
	M31	AY367478	1	0.00%	0.0-0.3% with M1	<i>P. perforata</i> , differ by 3.9-4.3%	Goss Springs, Oasis Valley, Nye Co., NV	
<i>Pyrgulopsis militaris</i>	SM/P147A, P147C, P147D, P147E, P147F	AY197596, AY426362, EF119077, EF119078, EF119079	5	0.0-0.9%	1.5-2.2% with SM1	<i>P. varneri</i> , differ by 2.0-2.7%	Spring, Soldier Meadow, Humboldt Co., NV	
	SM1	EF119076	5	0.00%	1.5-2.2% with P147	<i>P. varneri</i> , differ by 2.3-2.7%	West Spring, Bog Hot Valley, Humboldt Co., NV	

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<i>Pyrgulopsis millenaria</i>	P104A	EU700469	1	0.00%		<i>P. lentiglans</i> , differ by 1.6%	Spring below Twentyone Mile Dam, Thousand Springs Creek drainage, Elko Co., NV	
<i>Pyrgulopsis milleri</i>	P23	GQ275096	3	0.00%		<i>P. glandulosa</i> , differ by 2.8-3.3%, <i>P. hualapaiensis</i> , differ by 2.9%, <i>P. perforata</i> , differ by 2.8-2.9%, <i>P. thompsoni</i> , differ by 2.7-3.4%, <i>P. torrida</i> , differ by 2.8%	Pierpoint Spring, Tulare-Buena Vista Lakes drainage, Tulare Co., CA	<i>Pyrgulopsis</i> sp. 2 HPL2009 isolate P23B in GenBank
<i>Pyrgulopsis montana</i>	P118A	AY627940	1	0.00%		<i>P. bacchus</i> , differ by 2.2-2.6%	Spring, upper Camp Valley, Meadow Valley Wash, Lincoln Co., NV	
<i>Pyrgulopsis montezumensis</i>	Pmon1, Pmon2	AY485552 (Pmon1, N=33), AY485553 (Pmon2, N=1)	34	0.0-0.2%		<i>P. glandulosa</i> , differ by 3.3-3.8%, <i>P. intermedia</i> , differ by 3.6-4.1%, <i>P. perforata</i> , differ by 3.6-3.9%, <i>P. robusta</i> , differ by 3.7-4.4%	Montezuma Well	Hurt (2004)
<i>Pyrgulopsis morrisoni</i>	P150	DQ364007	1	0.00%	0.0-1.7% with Pmor1/2/3/4, 0.5% with Pmor5	<i>P. glandulosa</i> , differ by 3.1-3.5%	Spring, Bubbling Pond Hatchery, Verde River basin, Yavapai Co., AZ	
	Pmor1, Pmor2, Pmor3, Pmor4	AY485547 (Pmor1, N=12), AY485548 (Pmor2, N=4), AY485549 (Pmor3, N=3), AY485550 (Pmor4, N=6)	26	0-1.7%	0.0-1.7% with P150, 0.2-1.5% with Pmor5	<i>P. glandulosa</i> , differ by 2.8-3.6%	Bubbling	Hurt (2004), listed frequency only added to 0.961
	Pmor5	AY185551	30	0.00%	0.5% with P150, 0.2-1.5% with Pmor1/2/3/4	<i>P. glandulosa</i> , differ by 3.3-3.6%	Page	Hurt (2004)
<i>Pyrgulopsis nanus</i>		AY367487	1	0.00%		<i>P. fairbanksensis</i> , differ by 1.3%, <i>P. isolata</i> , differ by 1.4%	Five Springs, Ash Meadows, Nye Co., NV	
<i>Pyrgulopsis neritella</i>		AF520951	1	0.00%		<i>P. sulcata</i> , differ by 3.2%	Big Spring, Steptoe Ranch, White Pine Co., NV	

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<i>Pyrgulopsis nonaria</i>	P97B	EU700467	1	0.00%		<i>P. kolobensis</i> , differ by 0.5-2.5%, <i>P. pilsbryana</i> , differ by 1.1-1.2%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. D</i> , differ by 1.1%	Spring east of Ninemile Reservoir, Sevier River drainage, Sanpete Co., UT	
<i>Pyrgulopsis notidicola</i>	SM6	EF119128	4	0.00%	0-2.6% with SM35, 1.1% with SM9, SM30	<i>P. limaria</i> , differ by 6.2-7.0%, <i>P. umbilicata</i> , differ by 6.4-6.5%	Satellite Spring, western Soldier Meadow, Humboldt Co., NV	
	SM9	EF119132-33	5	0-0.3%	1.1-2.1% with SM35	<i>P. limaria</i> , differ by 5.8-7.1%, <i>P. umbilicata</i> , differ by 5.9-6.4%	Satellite Spring complex, spring brook, Humboldt Co., NV	
	SM27	EF119134-35	4	0-0.5%	0.9-2.3% with SM35	<i>P. limaria</i> , differ by 5.9-7.1%, <i>P. umbilicata</i> , differ by 6.1-6.4%	Satellite Spring complex, spring brook, Humboldt Co., NV	
	SM30	EF119136	3	0.00%	1.1-1.8% with SM35	<i>P. limaria</i> , differ by 6.1-7.1%, <i>P. umbilicata</i> , differ by 6.2-6.4%	Satellite Spring complex, spring "H," Humboldt Co., NV	
	SM32	EF119137-38	3	0-0.2%	0.9-2.0% with SM35	<i>P. limaria</i> , differ by 5.9-7.1%, <i>P. umbilicata</i> , differ by 6.1-6.4%	Satellite Spring complex, spring "I," Humboldt Co., NV	
	SM33	EF119139	5	0.00%	0.9-2.0% with SM35	<i>P. limaria</i> , differ by 5.9-7.0%, <i>P. umbilicata</i> , differ by 6.1-6.2%	Satellite Spring complex, spring "J," Humboldt Co., NV	
	SM35	EF119129-30, EF119140	5	0-2.7%	0.9-2.3% with SM27, 1.1-2.1% with SM9, 0-2.6% with SM6, 0-2.2% with P146	<i>P. limaria</i> , differ by 6.1-7.1%, <i>P. umbilicata</i> , differ by 6.2-6.7%	Satellite Spring, western Soldier Meadow, Humboldt Co., NV	
	P146	EF119131	1	0.00%	0-2.2% with SM35, 1.0% with SM9, SM30	<i>P. limaria</i> , differ by 6.1-6.9%, <i>P. umbilicata</i> , differ by 6.3-6.4%	Northernmost spring of large complex, western Soldier Meadow, Humboldt Co., NV	
<i>Pyrgulopsis ojaiensis</i>	M56	KF559192	3	0.00%	0.8% with P29	<i>P. castaicensis</i> , differ by 3.6%, <i>P. glandulosa</i> , differ by 3.7-4.4%	Grapevine Springs, Death Valley, Inyo Co., CA	<i>P. sp. M56</i> in GenBank

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<i>Pyrgulopsis ojaiensis</i> (continued)	P29	GQ275093	4	0.00%	0.8% with M56	<i>P. castaicensis</i> , differ by 3.8%, <i>P. glandulosa</i> , differ by 3.5-4.3%	Spring tributary to Sisar Creek, Southern California coastal drainage, Ventura Co., CA	<i>P. sp.</i> USNM905259 isolate P29A in GenBank, placed under <i>P. stearnsiana</i> in Hershler and Liu (2010), placed under clade F in Hershler et al. (2013), described as <i>P. ojaiensis</i> in Hershler et al. (2016b)
<i>Pyrgulopsis owensensis</i>	P34	AF520922 (P34C, N=1), GQ275089 (P34AA, N=2), GQ275090 (P34AB, N=2)	5	0-0.5%		<i>P. perturbata</i> , differ by 1.0-1.3%	Spring, Graham Ranch, ca. 8.0 km E of Big Pine, Inyo Co., CA	
<i>Pyrgulopsis owyheensis</i>	IP59	FJ172457 (IP59A, N=1), FJ172458 (IP59C, N=1), FJ172459 (IP59D, N=1)	3	0.2-0.3%	1.8-2.1% with P211, 1.8-2.0% with P213	<i>P. aurata</i> , differ by 4.7-4.9%, <i>P. kolobensis</i> , differ by 4.2-5.9%, <i>P. pictilis</i> , differ by 4.7-4.8%, <i>P. plicata</i> , differ by 4.7-4.8%, <i>P. sublata</i> , differ by 4.6-4.8%	Owyhee Spring, Malheur Co., OR	<i>Pyrgulopsis sp. 3</i> HPL2008 isolate IP59A, IP59C, IP59D in GenBank
	IP62	FJ172464 (IP62A, N=1), FJ172465 (IP62B, N=1), FJ172466 (IP62C, N=1), FJ172467 (IP62D, N=1)	4	0.00%	1.5-1.7% with IP59	<i>P. kolobensis</i> , differ by 4.0-5.7%, <i>P. plicata</i> , differ by 4.7%	Tree Spring, Malheur Co., OR	<i>Pyrgulopsis sp. 3</i> HPL2008 isolate IP62A, IP62B, IP62C, IP62D in GenBank
	P177B	FJ172475	1	0.00%	2.0-2.1% with IP59	<i>P. bryanwalkeri</i> , differ by 5.0%, <i>P. kolobensis</i> , differ by 4.2-5.7%, <i>P. plicata</i> , differ by 5.0%,	Tudor Warm Springs, east side of river, second spring from north, Malheur Co., OR	<i>Pyrgulopsis sp. 3</i> HPL2008 isolate P177B in GenBank
	P209	FJ172479	5	0.00%	1.4-1.5% with IP59	<i>P. lentiglans</i> , differ by 4.8%, <i>P. kolobensis</i> , differ by 4.2-5.7%, <i>P. pictilis</i> , differ by 4.8%, <i>P. plicata</i> , differ by 4.8%	Kane Springs, Malheur River basin, Malheur Co., OR	<i>Pyrgulopsis sp. 3</i> HPL2008 isolate P209A in GenBank

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<i>Pyrgulopsis owyheensis</i> (continued)	P211	FJ172481 (P211A, N=1), FJ172482 (P211B, N=1)	2	0.20%	1.8-2.1% with IP59	<i>P. kolobensis</i> , differ by 4.4-6.4%, <i>P. plicata</i> , differ by 4.7-4.8%	Tudor Warm Springs, east side of river, third spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P21AA, P211B in GenBank
	P213A	FJ172484	1	0.00%	1.8-2.0% with IP59	<i>P. kolobensis</i> , differ by 4.4-5.9%, <i>P. plicata</i> , differ by 4.7%	Tudor Warm Springs, east side of river, second spring from north, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P213A in GenBank
	P215	FJ172485	2	0.00%	1.5-1.7% with IP59	<i>P. kolobensis</i> , differ by 4.4-5.7%, <i>P. lentigians</i> , differ by 4.8%	Spring tributary to Owyhee River upflow from Tudor Warm Springs, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P215A in GenBank
	P216	FJ172486 (P216A), FJ172487 (P216B)	4	0.30%	1.4-1.5% with IP59	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. lentigians</i> , differ by 4.8-4.9%	Spring on Owyhee River, below mouth of Crooked Creek, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P216A, P216B in GenBank
	P218	FJ172489 (P218A), FJ172490 (P218B), FJ172491 (P218C)	4	0-0.5%	1.4-1.7% with IP59	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. plicata</i> , differ by 4.5-4.7%, <i>P. sublata</i> , differ by 4.5-4.8%	Spring on Owyhee River, above Long Sweetwater rapids, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P218A, P218B, P218C in GenBank
	P219, P220	FJ172492 (P219A), FJ172493 (P220B), FJ172494 (P220C)	7	0-0.3%	1.4-1.5% with IP59	<i>P. kolobensis</i> , differ by 3.9-5.7%, <i>P. plicata</i> , differ by 4.5-4.8%	Weeping Wall springs, just below mouth of Granite Creek, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P219A, P220B, P220C in GenBank
	P221	FJ172495	3	0.00%	1.4-1.5% with IP59	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. plicata</i> , differ by 4.5%	Spring on Owyhee River, above Artillery rapids, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P221B in GenBank
	P225, P226	FJ172501 (P225A), FJ172502 (P226A)	4	0.30%	1.4-1.5% with IP59	<i>P. kolobensis</i> , differ by 3.9-5.5%, <i>P. plicata</i> , differ by 4.5-4.7%, <i>P. sublata</i> , differ by 4.6-4.8%	Seep wall on Owyhee River, just above mouth of Crooked Creek, Malheur Co., OR	<i>Pyrgulopsis</i> sp. 3 HPL2008 isolate P225A, P226A in GenBank
<i>Pyrgulopsis peculiaris</i>		AF520912	1	0.00%		<i>P. kolobensis</i> , differ by 5.9-6.9%, <i>P. pilsbryana</i> , differ by 5.9-6.1%, <i>P. sp. D</i> , differ by 5.9%	Spring above Swasey Spring, Whirlwind Valley, Millard Co., UT	
<i>Pyrgulopsis pellita</i>	P125A	AY627943	1	0.00%		<i>P. bifurcata</i> , differ by 3.3%	Sullivan Spring, Antelope Valley, Eureka Co., NV	

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<i>Pyrgulopsis perforata</i>	M3	AY367433 (M3A), AY367434 (M3B, M3O)	3	0.00%	0.2-0.3% with M4	<i>P. conica</i> , differ by 2.6%, <i>P. diablensis</i> , differ by 2.6%, <i>P. glandulosa</i> , differ by 2.6-2.7%, <i>P. simplex</i> , differ by 2.7%	Spring east of Scottys Castle, Grapevine Canyon, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M4	AY367435 (M4A), AY367436 (M4B)	2	0.50%	0.2-0.3% with M3, 0-0.5% with M5	<i>P. conica</i> , differ by 2.6-2.7%, <i>P. diablensis</i> , differ by 2.6-2.7%, <i>P. glandulosa</i> , differ by 2.4-2.7%, <i>P. simplex</i> , differ by 2.6-2.7%	Spring west of Scottys Castle, Grapevine Canyon, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M5	AY367437 (M5A)	1	0.00%	0.2% with M3, 0-0.5% with M4	<i>P. conica</i> , differ by 2.6%, <i>P. diablensis</i> , differ by 2.7%, <i>P. glandulosa</i> , differ by 2.4-2.6%, <i>P. simplex</i> , differ by 2.6%	Surprise Spring, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
<i>Pyrgulopsis perturbata</i>		AY367488	1	0.00%		<i>P. owensensis</i> , differ by 1.0-1.3%	Northeast Spring, Fish Slough, Owens River basin, Mono Co., CA	
<i>Pyrgulopsis pictilis</i>	P126A	AY627944	1	0.00%		<i>P. aurata</i> , differ by 0.0%, <i>P. bryantwalkeri</i> , differ by 0.3%, <i>P. kolobensis</i> , differ by 1.7-2.9%, <i>P. sp. B</i> , differ by 1.9%	Cain Spring, Antelope Valley, Lander Co., NV	
<i>Pyrgulopsis pilsbryana</i>	P137	AY426363-64	2	0.00%	0.2% with P159A	<i>P. kolobensis</i> , differ by 0.2-2.9%, <i>P. transversa</i> , differ by 1.0%, <i>P. sp. C</i> , differ by 0.2%, <i>P. sp. D</i> , differ by 0.0%, <i>P. sp. H</i> , differ by 0.2%	Spring, Saint Charles Creek, Bear Lake Valley, Bear Lake Co., ID	
	P159A	EU700475	1	0.00%	0.2% with P137	<i>P. kolobensis</i> , differ by 0.2-2.7%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.0%, <i>P. sp. D</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0.0%	Bear River, Black Canyon, Caribou Co., ID	<i>Pyrgulopsis</i> sp. Black Canyon isolate P159A in GenBank

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<i>Pyrgulopsis pisteri</i>	P157A	DQ364004	1	0.00%		<i>P. crystalis</i> , differ by 0.6%, <i>P. erythropoma</i> , differ by 4.5%	Marsh Spring, Ash Meadows, Amargosa River basin, Nye Co., NV	
<i>Pyrgulopsis plicata</i>	P99A	AY627935	1	0.00%		<i>P. marcida</i> , differ by 1.6%	Spring, Black Canyon, Sevier River drainage, Garfield Co., UT	
<i>Pyrgulopsis robusta</i>	HL/hendersoni1/P3	AY197594/ AY379430-31	2	0.00%	0.5% with P171, Ida, P181, 0.5-0.6% with P179	<i>P. intermedia</i> , differ by 2.6-3.1%	Hughet Spring, Harney-Malheur Lakes, Harney Co., OR	<i>P. hendersoni/robusta</i> in GenBank
	MA/hendersoni2/P5	AY197595/ AY379432-33	2	0.00%	0.5% with P171, Ida, P181, 0.5-0.6% with P179	<i>P. intermedia</i> , differ by 2.6-3.1%	Spring at South Fork (Malheur River) Reservoir, middle Snake River basin, Malheur Co., OR	<i>P. hendersoni/robusta</i> in GenBank
	D33/hendersoni3	AY379434-35, AY426348-49	4	0.2-0.3%	0.5-0.8% with P179	<i>P. intermedia</i> , differ by 2.6-3.2%	XL Spring, Abert Lake basin (Great Basin), Lake Co., OR	<i>P. hendersoni/robusta</i> in GenBank
	P171/idahoensis1	AY379424-25	2	0.00%	0.5-0.6% with D33	<i>P. intermedia</i> , differ by 2.6-3.0%	Bruneau Arm of CJ Strike Reservoir, (Bruneau) river mile 3.8, Owyhee Co., ID	
	P179/idahoensis2	AY379426-27	2	0.20%	0.3-0.8% with D30, 0.5-0.8% with D33	<i>P. intermedia</i> , differ by 2.6-3.2%	Snake River river mile 538.1, Glenss Ferry, Snake River basin, Elmore Co., ID	
	Ida	AY426346-47	2	0.00%	0.3-0.6% with D30, 0.5-0.6% with D33	<i>P. intermedia</i> , differ by 2.6-3.0%	Snake River, river mile 446.8, Canyon Co., ID	<i>P. idahoensis</i> in GenBank
	P181/idahoensis3	AY379428-29	2	0.00%	0.3-0.6% with D30, 0.5-0.6% with D33	<i>P. intermedia</i> , differ by 2.6-3.0%	Snake River, river mile 365.9, 366.3, 367.2, Malheur Co., OR	
	P178/robusta	AY379436-37	2	0.00%	0.3-0.5% with P179	<i>P. intermedia</i> , differ by 2.7-3.2%	Spring, tributary to Polecat Creek, Teton Co., WY	
	P47B	AF520949	1	0.00%	0.5-0.7% with P179	<i>P. intermedia</i> , differ by 3.0-3.5%	Polecat Creek, west of Flagg Ranch, Teton Co., WY	
	D30/spA1	AY379438-39	2	0.30%	0.3-0.8% with P179	<i>P. intermedia</i> , differ by 2.7-3.2%	Columbia River, East Mayer State Park, Wasco Co., OR	
	P49/spA2	AY379440-41	2	0.00%	0.5% with P171, Ida, P181, 0.5-0.6% with P179	<i>P. intermedia</i> , differ by 2.8-3.4%	Columbia River, Celilo State Park, Wasco Co., OR	
<i>Pyrgulopsis rupinicola</i>	SS1/D3, SS2/D3	AY197590 (N=3), AY197591 (N=1)	4	0-0.5%		<i>P. archimedis</i> , differ by 2.6-3.2%, <i>P. sp. A</i> , differ by 2.4-3.4%	Sucker Springs Creek, Shasta Co., CA	

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<i>Pyrgulopsis sadai</i>	P141A	AY627945	1	0.00%		<i>P. kolobensis</i> , differ by 6.2-7.8%, <i>P. pilsbryana</i> , differ by 6.2-6.5%, <i>P. sp. C</i> , differ by 6.2-6.3%	Spring, Moss Creek, Reese River Valley, Lander Co., NV	
<i>Pyrgulopsis sanchezi</i>	M2	AY367430-32 (M2A-O)	15	0.00%	2.0-2.1% with M25, 1.7-2.1% with M26, 1.8-2.1% with SS	<i>P. coloradensis</i> , differ by 4.1%	Grapevine Springs, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M8	AY367440 (M8A), DQ364001 (N=9, P197A, M8AA-AH)	10	0-0.2%	2.1-2.4% with SS	<i>P. arizonae</i> , differ by 4.1-5.6%, <i>P. coloradensis</i> , differ by 4.3-4.4%	Purgatory Spring, Ash Meadows, Nye Co., NV	<i>P. micrococcus</i> in GenBank
	M25	AY367469 (M25A), AY367470-71 (N=8, M25B-C, AB-AD, AG-AI)	9	0.20%	2.0-2.1% with M2	<i>P. coloradensis</i> , differ by 4.1-4.3%	Spring north of Tecopa Hot Springs, Amargosa River basin, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M26	AY367472 (N=5, M26A, AD-AE, AG, AI), AY367473 (N=3, M26B, M26C, M26AC), KF559187 (N=5, M26AA-AB, AF, AH, AJ), KF559188 (M26AK)	14	0-0.5%	1.8-2.2% with SS, 1.7-2.1% with M2	<i>P. arizonae</i> , differ by 4.7-6.2%, <i>P. coloradensis</i> , differ by 4.6-5.0%	Shoshone Spring, Amargosa River basin, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M51	KF559184 (M51A-B)	2	0.00%	2.1-2.2% with SS	<i>P. coloradensis</i> , differ by 3.8%	Spring ca. 100 m north of Collins Ranch, Ash Meadows, Nye Co., NV	
	M53	KF559185 (M53A-C)	3	0.00%	2.1-2.2% with SS	<i>P. coloradensis</i> , differ by 4.1%	Spring south of Rogers Spring, Ash Meadows, Nye Co., NV	
	M57	KF559186 (M57A-B)	2	0.00%	2.1-2.2% with SS	<i>P. coloradensis</i> , differ by 3.8%	Spring east of Crystal Reservoir, Ash Meadows, Nye Co., NV	
	SS	AY367480 (SS1), DQ364003 (SS2)	2	0.50%	2.1-2.4% with M8	<i>P. arizonae</i> , differ by 4.5-6.1%, <i>P. coloradensis</i> , differ by 4.5%	Saratoga Spring, Death Valley, San Bernardino Co., CA	<i>Pyrgulopsis</i> sp. L HPL-2003 in GenBank
<i>Pyrgulopsis sathos</i>	P62A	DQ364013	1	0.00%		<i>P. hubbsi</i> , differ by 1.0%	Flag Springs (north), White River Valley, Nye Co., NV	

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<i>Pyrgulopsis saxatilis</i>	P95A	AY627934	1	0.00%		<i>P. eremica</i> , differ by 6.6-9.4%, <i>P. lentiglans</i> , differ by 6.7%	Warm Springs, Snake Valley, Millard Co., UT	
<i>Pyrgulopsis serrata</i>	P69A	EU700464	1	0.00%		<i>P. marcida</i> , differ by 1.4%	Indian Ranch Spring, Steptoe Valley, White Pine Co., NV	
<i>Pyrgulopsis similis</i>	G4	KC571291 (N=4), KC571292 (N=1), KC571293 (N=1), KC571294 (N=1)	7	0-1.2%	0.5-1.5% with G6	<i>P. marilynae</i> , differ by 4.0-5.1%	Seepage along Taylor Creek, ca. 0.32 km south, 0.93 km west of Wall Lake Dam (below Wall Lake), Catron Co., NM	<i>P. gilae</i> in GenBank
	G5	KC571295	7	0.00%	1.1% with G7, G13, Pgil6	<i>P. marilynae</i> , differ by 3.8-4.1%	Hillside seep, 1.61 km north, 0.97 km east of Burnt Corral Canyon, Catron Co., NM	<i>P. gilae</i> in GenBank
	G6	KC571296 (N=2), KC571297 (N=6), KC571298 (N=1)	9	0-0.6%	1.2-1.5% with G7, G13, Pgil6	<i>P. marilynae</i> , differ by 3.8-4.3%	Spring along Beaver Creek, ca. 0.29 km north, 0.40 km west of Taylor Creek confluence, Catron Co., NM	<i>P. gilae</i> in GenBank
	G7	KC571292	10	0.00%	1.2-1.5% with G6, 1.2-1.4% with G9	<i>P. marilynae</i> , differ by 4.8-5.1%	Seepage along Taylor Creek, 50 m west of Whitetail Canyon, Catron Co., NM	<i>P. gilae</i> in GenBank
	G9	KC571303 (N=1), KC571304 (N=8)	9	0-0.2%	1.2-1.4% with G7, G13, Pgil6	<i>P. marilynae</i> , differ by 4.0-4.5%	Fall Spring, 1.61 km north, 0.56 km east of Burnt Corral Canyon, Catron Co., NM	<i>P. gilae</i> in GenBank
	G10	KC571304	4	0.00%	1.2% with G7, G13, Pgil6	<i>P. marilynae</i> , differ by 4.0-4.3%	Fall Spring, 1.61 km north, 0.56 km east of Burnt Corral Canyon, Catron Co., NM	<i>P. gilae</i> in GenBank
	G13	KC571292	8	0.00%	1.2-1.5% with G6, 1.2-1.4% with G9	<i>P. marilynae</i> , differ by 4.8-5.1%	Spring along Taylor Creek, 0.81 km north, 1.13 km east of Wall Lake Dam, Catron Co., NM	<i>P. gilae</i> in GenBank
	Pgil6	AY485574	14	0.00%	1.2-1.5% with G6, 1.2-1.4% with G9	<i>P. marilynae</i> , differ by 4.8-5.1%	Wall	Hurt (2004), <i>P. gilae</i> in GenBank

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<i>Pyrgulopsis simplex</i>	P151A	AY627949	1	0.00%	0% with Psim1	<i>P. glandulosa</i> , differ by 2.6-2.7%, <i>P. perforata</i> , differ by 2.6-2.7%	Spring near Strawberry, Verde River drainage, Gila Co., AZ	
	Psim1	AY485558	31	0.00%	0% with P151A	<i>P. glandulosa</i> , differ by 2.6-2.7%, <i>P. perforata</i> , differ by 2.6-2.7%	Strawberry	Hurt (2004)
<i>Pyrgulopsis sola</i>	BRS1	AY627957	1	0.00%	0.2-0.4% with Psol1/2/3	<i>P. glandulosa</i> , differ by 3.3%, <i>P. intermedia</i> , differ by 3.3-3.9%	Brown Springs, Verde River drainage, Yavapai Co., AZ	
	Psol1, Psol2, Psol3	AY485554 (N=19), AY485555 (N=6), AY485556 (N=1)	26	0.2-0.4%	0.2-0.4% with BRS	<i>P. glandulosa</i> , differ by 3.5-3.8%, <i>P. intermedia</i> , differ by 3.5-4.3%	Brown	Hurt (2004), <i>P. solus</i> in GenBank
<i>Pyrgulopsis stearnsiana</i>	16/stearnsianaA/WC	AF520925	2	0.00%	3.6-3.7% with Pst8	<i>P. diablensis</i> , differ by 1.1%	Springs, Wildcat Canyon, El Sobrante, Contra Costa Co., CA	
	18/PC/P26	AY367489 (P26A, N=1), GQ275092 (P26AA, N=1)	2	0.20%	3.2-3.7% with Pst8	<i>P. diablensis</i> , differ by 1.6-1.8%	Partington Creek, Central California coastal drainage, Monterey Co., CA	
	19/CC/P28	AY367490	3	0.00%	3.2-3.4% with Pst8	<i>P. diablensis</i> , differ by 1.1%	Stream in Colson Canyon, Central California coastal drainage, Santa Barbara Co., CA	
	Pst1	KX398371	4	0.00%	3.0-3.2% with Pst8	<i>P. diablensis</i> , differ by 1.7%	Spring run, Glen Canyon Park, San Francisco Co., CA	
	Pst2	KX398372	2	0.00%	3.0-3.2% with Pst8	<i>P. diablensis</i> , differ by 1.7%	Seep under the connector between Hwy 280 and Hwy 101, San Francisco Co., CA	
	Pst3	KX398373 (N=4), KX398374 (N=1)	5	0-0.2%	2.7-3.0% with Pst8	<i>P. diablensis</i> , differ by 0.9-1.1%	Spring north of Laguna Honda, San Francisco Co., CA	
	Pst4	KX398375	4	0.00%	3.6-3.8% with Pst8	<i>P. diablensis</i> , differ by 2.0%	Lobos Creek, San Francisco Co., CA	
	Pst5	KX398376	4	0.00%	3.0-3.2% with Pst8	<i>P. diablensis</i> , differ by 1.7%	Spring along trail northeast of Ft. Miley, San Francisco Co., CA	
	Pst6	KX398377	4	0.00%	2.8% with WC	<i>P. diablensis</i> , differ by 0.6%	Spring north of Geary Road, east of Calaveras Reservoir, Alameda Co., CA	

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<i>Pyrgulopsis stearnsiana</i> (continued)	Pst7	KX398378 (N=3), KX398379 (N=1)	4	0-1.2%	2.7-3.2% with Pst8	<i>P. diablensis</i> , differ by 0.6-1.1%	Spring north of Geary Road, north of Calaveras Reservoir, Alameda Co., CA	
	Pst8	KX398380 (N=3), KX398381 (N=1)	4	0-0.2%	3.6-3.8% with Pst4, 3.0-3.8% with Pst13, 3.3-3.8% with Pst15, 3.6-3.8% with WC, 3.2-3.7% with PC	<i>P. diablensis</i> , differ by 2.7-2.8%	Spring south of Geary Road, northeast of Calaveras Reservoir, Alameda Co., CA	
	Pst9	KX398382	5	0.00%	3.5% with Pst4, 2.9-3.5% with Pst13, 3.2-3.5% with Pst15, 3.4% with WC, 3.0-3.4% with PC	<i>P. diablensis</i> , differ by 2.5%	Spring along Weller Road, west of Calaveras Reservoir, Santa Clara Co., CA	
	Pst10	KX398383 (N=1), KX398384 (N=1)	2	0.60%	2.4-2.9% with Pst8	<i>P. diablensis</i> , differ by 1.1-1.4%	Temescal Creek, Alameda Co., CA	
	Pst11	KX398385	4	0.00%	2.9-3.0% with Pst8	<i>P. diablensis</i> , differ by 0.9%	Spring tributary to northeast corner of Rodeo Lagoon, Marin Co., CA	
	Pst12	KX398386 (N=3), KX398387 (N=1)	4	0-2.4%	2.6-2.9% with Pst8, 2.5-3.0% with WC	<i>P. diablensis</i> , differ by 1.0-1.1%	McWay Creek, Monterey Co., CA	
	Pst13	KX398388 (N=1), KX398389 (N=3)	4	0-0.9%	3.0-3.8% with Pst8, 2.9-3.5% with Pst9	<i>P. diablensis</i> , differ by 0.8-1.4%	Spring at Seven Stairs, Monterey Co., CA	
	Pst14	KX398390	4	0.00%	3.0-3.2% with Pst8	<i>P. diablensis</i> , differ by 0.8%	Stream south of Salmon Creek, Monterey Co., CA	
	Pst15	KX398391 (N=2), KX398392 (N=2)	4	0-0.3%	3.3-3.8% with Pst8, 3.2-3.5% with Pst9	<i>P. diablensis</i> , differ by 1.1-1.4%	Springs southeast of Leffingwell Creek, San Luis Obispo Co., CA	
	Pst16	KX398393 (N=2), KX398394 (N=2)	4	0-1.5%	2.6-3.2% with Pst8, 2.4-2.9% with Pst9, 2.6- 3.0% with WC	<i>P. diablensis</i> , differ by 1.1-1.4%	San Miguelito Creek, Santa Barbara Co., CA	
	Pst17	KX398395	4	0.00%	3.2-3.3% with Pst8	<i>P. giulianii</i> , differ by 1.6-1.7%	Stream at Hilarita, Marin Co., CA	
	Pst18	KX398396	4	0.00%	3.2-3.3% with Pst8	<i>P. diablensis</i> , differ by 1.3%	Seep south of Stinson Beach, Marin Co., CA	
<i>Pyrgulopsis sterilis</i>		AY367491	1	0.00%		<i>P. marcida</i> , differ by 1.4%	Spring, Hunts Canyon Ranch, Ralston Valley, Nye Co., NV	

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<i>Pyrgulopsis sublata</i>	P111A	AY627938	1	0.00%		<i>P. leporina</i> , differ by 1.9%	Wambolt Springs, Lake Valley, Lincoln Co., NV	
<i>Pyrgulopsis sulcata</i>	P66A	AY627929	1	0.00%		<i>P. neritella</i> , differ by 3.2%	Spring northwest of Clark Spring, Steptoe Valley, White Pine Co., NV	
<i>Pyrgulopsis taylori</i>	P27	AY627923 (P27A, N=1), GQ275095 (P27AA, N=3)	4	0-0.3%		<i>P. bacchus</i> , differ by 4.0-4.5%, <i>P. milleri</i> , differ by 3.7-4.0%, <i>P. montana</i> , differ by 3.7-4.0%, <i>P. turbatrix</i> , differ by 3.0-6.9%	Spring tributary to San Luis Obispo Creek, California central coastal drainage, San Luis Obispo Co., CA	
<i>Pyrgulopsis thermalis</i>	P165A	AY627953	1	0.00%	2.7-3.2% with Pthe3/4/5/6/7	<i>P. lockensis</i> , differ by 7.3%	Hot Spring, Gila River drainage, Grant Co., NM	
	Pthe1, Pthe2	AY485575 (N=30), AY485576 (N=1)	31	0-0.3%	2.1-2.7% with Pthe3/4/5/6/7	<i>P. deaconi</i> , differ by 7.1-7.7%, <i>P. lockensis</i> , differ by 7.5-7.8%, <i>P. trivialis</i> , differ by 7.3-7.8%	Gila I	Hurt (2004)
	Pthe3, Pthe4, Pthe5, Pthe6, Pthe7	AY485577 (N=1), AY485578 (N=1), AY485579 (N=1), AY485580 (N=1), AY485581 (N=1)	5	0.2-0.9%	2.7-3.2% with P165, 2.7-3.6% with Pthe8/9/10/11	<i>P. carinifera</i> , differ by 6.4-7.0%	Gila II	Hurt (2004)
	Pthe8, Pthe9, Pthe10, Pthe11	AY485582 (N=?), AY485583 (N=?), AY485584 (N=?), AY485585 (N=?)	31	0.0-0.8%	2.7-3.6% with Pthe3/4/5/6/7	<i>P. kolobensis</i> , differ by 7.1-8.9%, <i>P. lockensis</i> , differ by 7.3-8.3%, <i>P. trivialis</i> , differ by 7.7-9.4%, <i>P. wongi</i> , differ by 7.1-10.5%	Gila III	Hurt (2004), listed frequency greater than 1.0 (1.582)
<i>Pyrgulopsis thompsoni</i>	Ptho1	AY485588	32	0.00%	2.5% with Ptho5	<i>P. conica</i> , differ by 3.2%, <i>P. glandulosa</i> , differ by 3.2-3.3%, <i>P. morrisoni</i> , differ by 2.9-4.6%	Bear	Hurt (2004)
	Ptho1, Ptho2	AY485588 (N=29), AY485589 (N=1)	30	0.00%	2.5% with Ptho5	<i>P. conica</i> , differ by 3.2%, <i>P. glandulosa</i> , differ by 3.2-3.3%, <i>P. morrisoni</i> , differ by 2.9-4.6%	Canelo Hills	Hurt (2004), No variation between Ptho1 and Ptho2 in GenBank

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<i>Pyrgulopsis thompsoni</i> (continued)	Ptho3, Ptho4	AY485590 (N=28), AY485591 (N=2)	30	0.0-1.9%	2.7-3.8% with Ptho5	<i>P. conica</i> , differ by 2.7-3.8%, <i>P. glandulosa</i> , differ by 3.0-3.8%, <i>P. milleri</i> , differ by 3.0-3.4%, <i>P. morrisoni</i> , differ by 2.9-4.6%	Cottonwood	Hurt (2004)
	Ptho5	AY485592	32	0.00%	2.7-3.8% with Pth3/4, 2.9-3.2% with Ptho8/9	<i>P. conica</i> , differ by 2.7%, <i>P. milleri</i> , differ by 2.7%	McClure	Hurt (2004)
	Ptho5	AY485592	36	0.00%	2.7-3.8% with Pth3/4, 2.9-3.2% with Ptho8/9	<i>P. conica</i> , differ by 2.7%, <i>P. milleri</i> , differ by 2.7%	Garden	Hurt (2004)
	Ptho5	AY485592	30	0.00%	2.7-3.8% with Pth3/4, 2.9-3.2% with Ptho8/9	<i>P. conica</i> , differ by 2.7%, <i>P. milleri</i> , differ by 2.7%	Cave	Hurt (2004)
	Ptho8, Ptho9	AY485593 (N=28), AY485594 (N=2)	30	0.0-0.3%	2.9-3.2% with Ptho5	<i>P. conica</i> , differ by 3.2-3.8%, <i>P. glandulosa</i> , differ by 3.2-3.8%, <i>P. hualapaiensis</i> , differ by 2.8-3.4%, <i>P. milleri</i> , differ by 3.0-3.4%, <i>P. montana</i> , differ by 2.8-3.7%	Monkey	Hurt (2004)
	Ptho1, Ptho5	AY485588 (N=34), AY485592 (N=2)	36	0.0-2.5%	0.0-2.5% with Ptho1, Ptho1/2, Ptho5, 0.2-3.8% with Ptho3/4, 0.9-3.2% with Ptho8/9	<i>P. conica</i> , differ by 2.7-3.2%, <i>P. glandulosa</i> , differ by 3.2-3.4%, <i>P. milleri</i> , differ by 2.7-3.4%, <i>P. morrisoni</i> , differ by 2.9-5.0%	Peterson Ranch	Hurt (2004)
	Ptho1	AY485588	32	0.00%	2.5% with Ptho5	<i>P. conica</i> , differ by 3.2%, <i>P. glandulosa</i> , differ by 3.2-3.3%, <i>P. morrisoni</i> , differ by 2.9-4.6%	Sawmill	Hurt (2004)
<i>Pyrgulopsis torrida</i>	21/P250	GQ275094	4	0.00%		<i>P. glandulosa</i> , differ by 2.6-2.7%	Stream, Little Sycamore Canyon, Southern California coastal drainage, Ventura Co., CA	<i>P. sp.</i> USNM1120443 isolate P250AA, described as <i>P. torrida</i> in Hershler et al. (2016b)

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<i>Pyrgulopsis transversa</i>	P112A	EU700470	1	0.00%		<i>P. kolobensis</i> , differ by 0.6-2.7%, <i>P. nonaria</i> , differ by 1.1%, <i>P. pilsbryana</i> , differ by 1.0-1.1%, <i>P. sp. C</i> , differ by 1.1%, <i>P. sp. D</i> , differ by 1%, <i>P. sp. H</i> , differ by 1.1%	Sixmile Springs, Old River Bed, Tooele Co., UT	
<i>Pyrgulopsis trivialis</i>	P119A	AY627941	1	0.00%	0.3% with Ptri1	<i>P. kolobensis</i> , differ by 3.1-4.4%, <i>P. nonaria</i> , differ by 3.6%, <i>P. pilsbryana</i> , differ by 3.6%, <i>P. variegata</i> , differ by 3.7%, <i>P. sp. C</i> , differ by 3.6-3.7%, <i>P. sp. D</i> , differ by 3.6%, <i>P. sp. H</i> , differ by 3.6%	Spring, Three Forks, Gila River drainage, Apache Co., AZ	
	Ptri1	AY485559 (N=31)	31	0.00%	0.5% with Ptri2	<i>P. kolobensis</i> , differ by 3.3-4.8%, <i>P. nonaria</i> , differ 3.8%, <i>P. pilsbryana</i> , differ by 3.9%, <i>P. variegata</i> , differ by 4.0%, <i>P. sp. C</i> , differ by 3.8-4.0%, <i>P. sp. D</i> , differ by 3.9%, <i>P. sp. H</i> , differ by 3.9%	Boneyard Bog	Hurt (2004)
	Ptri2	AY485560 (N=31)	31	0.00%	0.5% with Ptri1	<i>P. kolobensis</i> , differ by 3.2-4.7%, <i>P. nonaria</i> , differ by 3.6%, <i>P. pilsbryana</i> , differ by 3.7%, <i>P. variegata</i> , differ by 3.9%, <i>P. sp. C</i> , differ by 3.6-3.9%, <i>P. sp. D</i> , differ by 3.7%, <i>P. sp. H</i> , differ by 3.7%	Three Forks	Hurt (2004)

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<i>Pyrgulopsis turbatrix</i>	M9	AY367441 (M9A), AY367442 (M9B)	2	0.00%	1.3% with M19, P11	<i>P. imperialis</i> , differ by 5.2%	Stream below Darwin Falls, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M10	AY367443 (M10A), AY367444 (M10B)	2	0.00%	1.4% with M19, P11	<i>P. imperialis</i> , differ by 5.2%	China Garden Spring, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M11	AY367445	1	0.00%	1.4% with M19, P11, P85, P196	<i>P. imperialis</i> , differ by 5.2%	Spring above Darwin Falls, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M12	AY367446 (M12A), AY367447 (M12B)	2	0.00%	1.4% with P11, P196	<i>P. imperialis</i> , differ by 5.0%	Lower spring, Johnson Canyon, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M13	AY367448/ AY367450-52 (N=4, M13A, C-E), AY367449 (M13B), AY367453 (M13F)	6	0-0.3%	1.4-1.6% with P11, P196	<i>P. imperialis</i> , differ by 5.0-5.2%	Stream, Hanaupah Canyon, Death Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M14	AY367454 (M14A), AY367455 (M14B)	2	0.20%	1.4-1.6% with P11, P196	<i>P. imperialis</i> , differ by 5.0-5.2%	Stream, Jail Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M15	AY367456 (M15A, M15M), AY367457 (M15B)	3	0.20%	1.8-1.9% with P11, P196	<i>P. imperialis</i> , differ by 5.2-5.3%	Stream, Hall Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M16	AY367458 (M16A, M16M)	2	0.00%	2.1% with P11, P86, P196	<i>P. imperialis</i> , differ by 5.5%	Spring, Snow Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M17	AY367459	1	0.00%	2.1% with P11, P196	<i>P. imperialis</i> , differ by 5.5%	Cottonwood Spring, Wildrose Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M18	AY367460 (M18A, M18O)	2	0.00%	2.1% with P11, P196	<i>P. imperialis</i> , differ by 5.3-5.5%	Saline Marsh, Saline Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M19	AY367461 (M19A, M19O)	2	0.00%	1.8% with M16	<i>P. imperialis</i> , differ by 5.5%	Cushenbury Springs, San Bernardino Mountains, San Bernardino Co., CA	<i>P. micrococcus</i> in GenBank
	M20	AY367462 (M20A, M20N)	2	0.00%	1.6% with P11, P196	<i>P. imperialis</i> , differ by 5.2%	Springs at Big Bear Ranger Station, San Bernardino Mountains, San Bernardino Co., CA	<i>P. micrococcus</i> in GenBank
	M21	AY367463 (M21A, M21M), AY367464 (M21B)	3	0.00%	1.6% with M16	<i>P. imperialis</i> , differ by 5.3%	Springs, Mill Creek Canyon, San Bernardino Mountains, San Bernardino Co., CA	<i>P. micrococcus</i> in GenBank
	M22	AY367465/ AY367466 (N=2, M22A-B), AY367467 (M22C)	3	0.20%	1.4-1.6% with P11, P196	<i>P. imperialis</i> , differ by 5.0-5.2%	Spring, Knight Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank

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<i>Pyrgulopsis turbatrix</i> (continued)	M24	AY367468 (M24A, M24N)	2	0.00%	1.4% with P11, P196	<i>P. imperialis</i> , differ by 5.0%	Tennessee Spring, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M27	AY367474	1	0.00%	1.4% with P11, P196	<i>P. imperialis</i> , differ by 5.0%	Stream below Limekiln Spring, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	M28	AY367475	1	0.00%	1.4% with P11, P196	<i>P. imperialis</i> , differ by 5.0%	Brewery Spring, Surprise Canyon, Panamint Valley, Inyo Co., CA	<i>P. micrococcus</i> in GenBank
	P11	AF520936 (P11A)	1	0.00%	2.1% with M16, M17, M18	<i>P. imperialis</i> , differ by 5.2%	Horseshutem Springs, Pahrump Valley, Nye Co., NV	
	P84	DQ364014 (P84A)	1	0.00%	1.9% with M16, M17, M18	<i>P. imperialis</i> , differ by 5.0%	Cold Creek Spring, Indian Springs Valley, Clark Co., NV	
	P86	DQ364015 (P86A)	1	0.00%	2.1% with M16	<i>P. imperialis</i> , differ by 5.2%	Spring, Lost Creek Canyon, Las Vegas Wash, Clark Co., NV	
	P196	DQ363999 (P196A), DQ364000 (P196D)	2	0.00%	2.1% with M16, M17, M18	<i>P. imperialis</i> , differ by 3.9-4.2%	Grapevine Springs, Amargosa River basin, Nye Co., NV	
<i>Pyrgulopsis umbilicata</i>	SM3	EF119093-94	4	0-0.2%	0.3-0.5% with SM37	<i>P. limaria</i> , differ by 0.2-1.1%	Spring, northern Soldier Meadow, Humboldt Co., NV	
	SM14	EF119101	5	0.00%	0.3% with SM37	<i>P. limaria</i> , differ by 0.2-0.9%	Spring, northern Soldier Meadow, Humboldt Co., NV	
	SM16	EF119102	5	0.00%	0.3% with SM37	<i>P. limaria</i> , differ by 0.2-0.9%	Spring ca. 40 m downflow from source, northern Soldier Meadow, Humboldt Co., NV	
	SM19	EF119103	5	0.00%	0.5% with SM37	<i>P. limaria</i> , differ by 0.3-1.1%	Spring, northern Soldier Meadow, Humboldt Co., NV	
	SM20	EF119104	4	0.00%	0.3% with SM37	<i>P. limaria</i> , differ by 0.2-0.9%	Spring, southern Soldier Meadow, Humboldt Co., NV	
	SM21	EF119105	4	0.00%	0.3% with SM37	<i>P. limaria</i> , differ by 0.2-0.9%	Spring 5 m downflow from SM20, southern Soldier Meadow, Humboldt Co., NV	
	SM37	EF119127	2	0.00%	0.3-0.5% with SM3, 0.5% with SM19	<i>P. limaria</i> , differ by 0.5-1.2%	Spring, central Soldier Meadow, Humboldt Co., NV	
<i>Pyrgulopsis variegata</i>	P106A	AY627937	1	0.00%		<i>P. kolobensis</i> , differ by 1.1-2.1%, <i>P. sp. B</i> , differ by 1.1%	Spring south of South Patterson Spring, Pilot Valley, Box Elder Co., UT	

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<i>Pyrgulopsis varneri</i>	SM8	EF119080	3	0.00%	0.0-0.3% with SM13, 0.2% with SM15, SM25, SM28	<i>P. militaris</i> , differ by 2.1-2.4%	Spring, southeast Soldier Meadow, 150 m downflow from source, Humboldt Co., NV	
	SM11	EF119081	8	0.00%	0.0-0.3% with SM13, 0.2% with SM15, SM25, SM28	<i>P. militaris</i> , differ by 2.1-2.4%	Spring complex (two springs), southeast Soldier Meadow, Humboldt Co., NV	
	SM13	EF119082-84	4	0-0.5%	0.2-0.5% with SM15, SM25, SM28	<i>P. militaris</i> , differ by 2.1-2.7%	Spring brook downflow from SM11, Humboldt Co., NV	
	SM15	EF119085	5	0.00%	0.2-0.5% with SM13, 0.3% with SM25, SM28	<i>P. militaris</i> , differ by 2.0-2.4%	Spring, northern Soldier Meadow, Humboldt Co., NV	
	SM25	EF119086	5	0.00%	0.2-0.5% with SM13, 0.3% with SM15	<i>P. militaris</i> , differ by 2.3-2.6%	Satellite Spring complex, spring "E," Humboldt Co., NV	
	SM28	EF119087	4	0.00%	0.2-0.5% with SM13, 0.3% with SM15	<i>P. militaris</i> , differ by 2.3-2.6%	Satellite Spring complex, spring "G," Humboldt Co., NV	
<i>Pyrgulopsis ventricosa</i>	P87	AY426365-66	2	0.00%		<i>P. kolobensis</i> , differ by 4.5-5.5%, <i>P. marcida</i> , differ by 4.5%, <i>P. plicata</i> , differ by 4.5%	Spring, Seigler Canyon, Clear Lake Basin, Lake Co., CA	
<i>Pyrgulopsis villacampae</i>	P83A	AY627933	1	0.00%		<i>P. lockensis</i> , differ by 2.6%	Little Warm Spring, Railroad Valley, Nye Co., NV	
<i>Pyrgulopsis vinyardi</i>	SM38A	EU700482	1	0.00%		<i>P. gibba</i> , differ by 0.5-1.1%, <i>P. plicata</i> , differ by 4.6%	Unnamed spring, Squaw Valley, Elko Co., NV	
<i>Pyrgulopsis wongi</i>		AF520923	1	0.00%	7.1% with W3	<i>P. kolobensis</i> , differ by 3.4-4.6%, <i>P. marcida</i> , differ by 3.8%, <i>P. nonaria</i> , differ by 3.9%, <i>P. pilsbryana</i> , differ by 3.8-3.9%, <i>P. transversa</i> , differ by 3.8%, <i>P. sp. D</i> , differ by 3.8%, <i>P. sp. H</i> , differ by 3.9%	Spring, lower Pine Creek Canyon, Inyo Co., CA	
	P185	AY627956 (P185A, P185C)	4	0.00%	6.7% with W3	<i>P. kolobensis</i> , differ by 3.3-4.5%, <i>P. marcida</i> , differ by 3.7%	Spring, Birchim Canyon, Inyo Co., CA	

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<i>Pyrgulopsis wongi</i> (continued)	W01	DQ251052(HI)	8	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.7%, <i>P. marcida</i> , differ by 3.9%	Spring near Conway Summit, Mono Co., CA	
	W02	DQ251053 (HXXI, N=5), DQ251054 (HXXII, N=1), DQ251055 (HXXIII, N=1)	7	0-0.3%	7.1-7.3% with W3	<i>P. kolobensis</i> , differ by 4.4-5.6%, <i>P. marcida</i> , differ by 4.5-4.7%	Springs at Little Lake, Inyo Co., CA	
	W03	DQ251075 (W3A, N=3), DQ251076 (W3C, N=2)	5	0-0.2%	7.1-7.3% with W2, 7.3% with W28	<i>P. rupinicola</i> , differ by 4.8-5.1%	Doud Springs, Douglas Co., NV	
	W04	DQ251056 (HII)	5	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.6-4.8%, <i>P. marcida</i> , differ by 4.0%	River Spring, Mono Co., CA	
	W05	DQ251057 (HIII, N=2), DQ251058 (HIV, N=1), DQ251059 (HV, N=1)	4	0-0.3%	6.5-6.7% with W3	<i>P. kolobensis</i> , differ by 3.5-4.8%, <i>P. marcida</i> , differ by 3.9-4.0%	Spring in Clark Canyon, Mono Co., CA	
	W06	HVI	5	0.00%	6.7% with W3	<i>P. kolobensis</i> , differ by 3.3-4.5%, <i>P. marcida</i> , differ by 3.7%	Springs in Owens River gorge, Mono Co., CA	Haplotype VI is not in GenBank
	W07	HVI	7	0.00%	6.7% with W3	<i>P. kolobensis</i> , differ by 3.3-4.5%, <i>P. marcida</i> , differ by 3.7%	Spring along Pine Creek, Inyo Co., CA	Haplotype VI is not in GenBank
	W08	DQ251060 (HVII)	4	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.7%, <i>P. marcida</i> , differ by 3.9%	Spring along Clearwater Creek, Mono Co., CA	
	W09	DQ251060 (HVII)	3	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.7%, <i>P. marcida</i> , differ by 3.9%	Spring along Rough Creek, Mono Co., CA	
	W10	DQ251056 (HII)	4	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.6-4.8%, <i>P. marcida</i> , differ by 4.0%	Huntoon Spring, Mineral Co., NV	
	W11	DQ251056 (HII, N=3), DQ251061 (HVIII, N=1)	4	0-0.2%	6.4-6.5% with W3	<i>P. kolobensis</i> , differ by 3.6-5.0%, <i>P. marcida</i> , differ by 4.0-4.2%	Jacks Spring, Mineral Co., NV	
	W12	DQ251056 (HII, N=1), DQ251062 (HIX, N=3)	4	0-0.2%	6.4-6.5% with W3	<i>P. kolobensis</i> , differ by 3.6-5.0%, <i>P. marcida</i> , differ by 4.0-4.2%	Company Spring, Mineral Co., NV	

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<i>Pyrgulopsis wongi</i> (continued)	W13	DQ251063 (HX)	4	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.7%, <i>P. marcida</i> , differ by 3.9%	Spring east of McNett Ranch, Esmeralda Co., NV	
	W14	DQ251064 (HXI)	4	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.3-4.4%, <i>P. marcida</i> , differ by 3.7%	Cave Spring, Esmeralda Co., NV	
	W15	DQ251064 (HXI)	8	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.3-4.4%, <i>P. marcida</i> , differ by 3.7%	Corral Springs, Inyo Co., CA	
	W16	DQ251065 (HXII)	6	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.5%, <i>P. marcida</i> , differ by 3.9%	Antelope Springs, Inyo Co., CA	
	W17	DQ251056 (HII, N=5), DQ251063 (HX, N=1)	6	0-0.5%	6.4-6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.8%, <i>P. marcida</i> , differ by 3.9-4.0%	Springs at Pizona, Mono Co., CA	
	W18	DQ251066 (HXIII, N=3), DQ251067 (HXIV, N=1)	4	0-0.2%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.8%, <i>P. marcida</i> , differ by 3.9-4.0%	Layton Springs, Mono Co., CA	
	W19	DQ251060 (HVII, N=2), DQ251068 (HXV, N=1), DQ251069 (HXVI, N=1)	4	0-0.3%	6.5-6.7% with W3	<i>P. kolobensis</i> , differ by 3.5-4.8%, <i>P. marcida</i> , differ by 3.9-4.0%	Springs along northeast side of Blind Spring Hill, Mono Co., CA	
	W20	DQ251060 (HVII)	6	0.00%	6.5% with W3	<i>P. kolobensis</i> , differ by 3.5-4.7%, <i>P. marcida</i> , differ by 3.9%	Spring in West Queen Canyon, Mineral Co., NV	
	W21	DQ251070 (HXVII)	6	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.3-4.4%, <i>P. marcida</i> , differ by 3.7%	Spring south of Warren Lake, Inyo Co., CA	
	W22	DQ251071 (HXVIII, N=5), DQ251072 (HXIX, N=1)	6	0-0.2%	6.5-6.7% with W3	<i>P. kolobensis</i> , differ by 3.2-4.7%, <i>P. marcida</i> , differ by 3.6-3.7%	Spring along Lubken Creek, Inyo Co., CA	
	W23	HVI	4	0.00%	6.7% with W3	<i>P. kolobensis</i> , differ by 3.3-4.5%, <i>P. marcida</i> , differ by 3.7%	Spring in Marble Canyon, Inyo Co., CA	Haplotype VI is not in GenBank
	W24	DQ251053 (HXXI)	5	0.00%	7.1% with W3	<i>P. kolobensis</i> , differ by 4.4-5.5%, <i>P. marcida</i> , differ by 4.5%	Spring south of Summit Creek, Inyo Co., CA	

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<i>Pyrgulopsis wongi</i> (continued)	W25	DQ251064 (HXI)	5	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.3-4.4%, <i>P. marcida</i> , differ by 3.7%	Boron Springs, Inyo Co., CA	
	W26	DQ251064 (HXI, N=3), DQ251073 (HXX, N=2)	5	0-0.2%	6.2-6.4% with W3	<i>P. kolobensis</i> , differ by 3.2-4.4%, <i>P. marcida</i> , differ by 3.6-3.7%	French Spring, Inyo Co., CA	
	W27	DQ251064 (HXI)	5	0.00%	6.4% with W3	<i>P. kolobensis</i> , differ by 3.3-4.4%, <i>P. marcida</i> , differ by 3.7%	Barrel Springs, Inyo Co., CA	
	W28	DQ251074 (HXXIV)	5	0.00%	7.3% with W3	<i>P. kolobensis</i> , differ by 4.6-5.6%, <i>P. marcida</i> , differ by 4.7%	Spring north of Johnson Canyon, Inyo Co., CA	
<i>Pyrgulopsis</i> sp. A	BS/D23A	AY197587 (BS/D23A), AY426367 (D23C)	2	1.20%	1.0-1.2% with KL_b	<i>P. archimedis</i> , differ by 2.6-3.6%, <i>P. rupinicola</i> , differ by 2.4-3.4%	Big Springs at Bonanza, Klamath basin, Klamath Co., OR	AY197587/BS/D23A listed as <i>P. sp.</i> HPL-2003 isolate BS in GenBank, AY426367/D23C listed as <i>P. sp.</i> USNM 1016099 isolate D23C in GenBank
	KL_b	AY197588	1	0.00%	1.0-1.2% with BS/D23	<i>P. archimedis</i> , differ by 2.7-3.2%, <i>P. rupinicola</i> , differ by 3.1-3.2%	Seventh Link River spring, Klamath basin, Klamath Co., OR	AY197588KLb listed as <i>P. sp.</i> HPL-2003 isolate KLb in GenBank
	SP/D25	AY197589 (SP/D25A), AY426368 (D25B)	2	0.00%	0.5-0.7% with D23, 0.5% with KL_b	<i>P. archimedis</i> , differ by 2.4-3.0%, <i>P. rupinicola</i> , differ by 2.6-2.8%	Sprague River north of Beatty, Klamath basin, Lake Co., OR	AY197589/SP/D25A listed as <i>P. sp.</i> HPL-2003 isolate SP in GenBank, AY426368/D25B listed as <i>P. sp.</i> USNM 1016100 isolate D25B in GenBank
<i>Pyrgulopsis</i> sp. B	P161	AY379446-47	2	0.00%		<i>P. variegata</i> , differ by 1.1%, <i>P. sp. l.</i> , differ by 0.2%	Teton River, Buxton Bridge crossing, Teton Co., WY	<i>P. sp.</i> B-HPL-2003 isolate P161A/P161B in GenBank

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<i>Pyrgulopsis</i> sp. C	P139	EU700472 (P139A), AY426369 (P139B), AY426970 (P139C)	3	0.00%		<i>P. kolobensis</i> , differ by 0.2-3.0%, <i>P. pilsbryana</i> , differ by 0-0.2%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. D</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0%	Mud Creek, Birch Creek Valley, Lemhi Co., ID	<i>P. sp.</i> Birch Creek isolate P139A in GenBank, <i>P. sp.</i> USNM905287 isolate P139B in GenBank, <i>P. sp.</i> USNM905287 isolate P139C in GenBank, <i>P. pilsbryana</i> clade in Hershler et al. (2008)
<i>Pyrgulopsis</i> sp. D	P186	AY426344-45	2	0.00%		<i>P. kolobensis</i> , differ by 0.0-2.9%, <i>P. nonaria</i> , differ by 1.1%, <i>P. pilsbryana</i> , differ by 0-0.2%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.2%, <i>P. sp. H</i> , differ by 0.2%	East Fork Rock Creek, Rockland Valley, Power Co., ID	<i>P. sp.</i> USNM 905313 isolate P186A/P186D in GenBank, <i>P. pilsbryana</i> clade in Hershler et al. (2008)
<i>Pyrgulopsis</i> sp. E	P78B	EU700465	1	0.00%		<i>P. kolobensis</i> , differ by 7.5-9.6%, <i>P. pilsbryana</i> , differ by 7.6-8.0%, <i>P. sp. H</i> , differ by 7.7%	Indian Springs, Cold Creek drainage, Power Co., ID	<i>P. sp.</i> Indian Springs isolate P78B in GenBank
<i>Pyrgulopsis</i> sp. F	P158C	EU700474	1	0.00%		<i>P. variegata</i> , differ by 1.7%	McClenden Spring, Raft River drainage, Cassia Co., ID	<i>P. sp.</i> McClenden isolate P158C in GenBank
<i>Pyrgulopsis</i> sp. G	P160A	EU700476	1	0.00%		<i>P. kolobensis</i> , differ by 3.3-4.6%, <i>P. marcida</i> , differ by 3.8%, <i>P. nonaria</i> , differ by 3.7%, <i>P. variegata</i> , differ by 3.8%	Upper Rock Spring, Bannock Creek drainage, Power Co., ID	<i>P. sp.</i> Upper Rock Spring isolate P160A in GenBank

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<i>Pyrgulopsis</i> sp. H	P163A	EU700477	1	0.00%		<i>P. kolobensis</i> , differ by 0.2-2.7%, <i>P. nonaria</i> , differ by 1.2%, <i>P. pilsbryana</i> , differ by 0-0.2%, <i>P. transversa</i> , differ by 1.1%, <i>P. sp. C</i> , differ by 0.0%, <i>P. sp. D</i> , differ by 0.2%	Kaufman Cabin Springs, Birch Creek Valley, Lemhi Co., ID	<i>P. sp.</i> Kaufman Cabin isolate P163A in GenBank, <i>P. pilsbryana</i> clade in Hershler et al. (2008)
<i>Pyrgulopsis</i> sp. I	P214A	EU700481	1	0.00%		<i>P. variegata</i> , differ by 1.3%, <i>P. sp. B</i> , differ by 0.2%	Spring, at Porcupine Ranger Station, Henrys Fork drainage, Fremont Co., ID	<i>P. sp.</i> Porcupine isolate P214A in GenBank
Fluminicola								
<i>Fluminicola ahjumawi</i>	sem93C	AY962894	1	0%	0.9% with SP476B	<i>F. lunsfordensis</i> , differ by 2.2%	Lost Creek (middle site), Shasta Co., CA	
	F10_116B	AY962895	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 2.0%	Hat Creek at Bridge Picnic Area, Shasta Co., CA	
	F10_164A	AY962896	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 2.0%	Three springs on point opposite large island in Pit River, Shasta Co., CA	
	F10_195C	AY962897	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 1.9%	Spring run near Pit River hatchery, Shasta Co., CA	
	sem340A	AY962898	1	0%	1.2% with SP476B	<i>F. lunsfordensis</i> , differ by 1.9%	Honn Creek, Shasta Co., CA	
	F10_344B	AY962899	1	0%	0.9% with SP476B, 0.9% with Fsem535A	<i>F. lunsfordensis</i> , differ by 1.9%	Spring run north of Sam Wolfen Spring, Shasta Co., CA	
	FSP345E	AY962900	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 1.9%	Upper Sucker Springs Creek, Shasta Co., CA	
	sem347B	AY962901	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 2.0%	Spring west of Thousand Spring run, Shasta Co., CA	
	sem349A	AY962902	1	0%	1.1% with SP476B	<i>F. lunsfordensis</i> , differ by 2.0%	West spring source of Mallard Creek, Shasta Co., CA	
	F10_405A	AY962903	1	0%	0.9% with SP476B, 0.9% with Fsem535A	<i>F. lunsfordensis</i> , differ by 1.9%	Beaver Creek, Lassen Co., CA	
	sem408C	AY962904	1	0%	0.9% with SP476B	<i>F. lunsfordensis</i> , differ by 2.5%	Burney Creek, upstream of Burney Falls, Shasta Co., CA	
	SP476B	AY962905	1	0%	1.2% with sem340A	<i>F. lunsfordensis</i> , differ by 2.7%	Jimmerson Spring, Modoc Co., CA	

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<i>Fluminicola ahjumawi</i> (continued)	Fsem535A	AY962906	1	0%	0.9% with F10_195C, sem340A, F10_344B, F10_405A, SP476B	<i>F. lunsfordensis</i> , differ by 2.7%	Lost Creek near source spring, Shasta Co., CA	
	Fsem536A	AY962907	1	0%	0.8% with F10_195C, sem340A, F10_344B, F10_405A, SP476B	<i>F. lunsfordensis</i> , differ by 2.5%	Lost Creek (uppermost site), Shasta Co., CA	
<i>Fluminicola anserinus</i>	F6_40B	AY962984	1	0%	2.7% with F15_270B, SP395A	<i>F. multifarius</i> , differ by 2.9-3.8%	Spring near Chalk Mountain, Shasta Co., CA	
	F15_270B	AY962908	1	0%	2.7% with F6_40B	<i>F. multifarius</i> , differ by 2.7-3.6%	Spring, Goose Valley, Shasta Co., CA	
	F6_321A	AY962985	1	0%	2.4% with F15_270B, SP395A	<i>F. multifarius</i> , differ by 2.6-3.5%	Blackberry Creek, Shasta Co., CA	
	SP395A	AY962909	1	0%	2.7% with F6_40B	<i>F. multifarius</i> , differ by 2.7-3.6%	Rim of the Lake Spring, Shasta Co., CA	
<i>Fluminicola caballensis</i>	SP400A	AY962910	1	0%	0.8% with FSP401A	<i>F. erosus</i> , differ by 1.7-2.0%	Bob Creek, Lassen Co., CA	
	FSP401A	AY962911	1	0%	0.8% with SP400A	<i>F. erosus</i> , differ by 1.5-1.8%	Davis Creek, Lassen Co., CA	
	SP402A	AY962912	1	0%	0.6% with SP400A	<i>F. erosus</i> , differ by 1.4-1.7%	Russell Dairy Spring, Lassen Co., CA	
	SP403B	AY962913	1	0%	0.6% with SP400A	<i>F. erosus</i> , differ by 1.4-1.7%	Spring run west of Russell Dairy Spring, Lassen Co., CA	
	SP404A	AY962914	1	0%	0.6% with SP400A	<i>F. erosus</i> , differ by 1.4-1.7%	Second spring west of Russell Dairy Spring, Lassen Co., CA	
<i>Fluminicola coloradoense</i>	F01	JQ996156	6	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Portneuf River, upper access area, Bannock Co., ID	
	F02	JQ996157 (n=1), JQ996158 (n=1), JQ996159 (n=1), JQ996160 (n=2)	5	0-0.6%	0.9-1.4% with F60	<i>F. fuscus</i> , differ by 4.3-4.7%	Snake River, Shelley, Bingham Co., ID	
	F04	JQ996161	3	0%	0.8-0.9% with F13, F60	<i>F. fuscus</i> , differ by 4.1-4.4%	Blackfoot River, The Narrows, ca. 1.5 km above weir, Caribou Co., ID	
	F05	JQ996156	5	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Raft River, The Narrows bridge, Cassia Co., ID	

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<i>Fluminicola coloradoense</i> (continued)	F07	JQ996156	5	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Summit Creek, BLM camp, Custer Co., ID	
	F08	JQ996156 (n=5), JQ996162 (n=1)	6	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Henrys Fork, Saint Anthony, Fremont Co., ID	
	F09	JQ996163	5	0%	0.8-0.9% with F13, F60	<i>F. fuscus</i> , differ by 4.1-4.4%	Birch Creek, Mud Creek, Lemhi Co., ID	
	F10	JQ996164 (n=4), JQ996165 (n=1)	5	0-0.2%	0.8-1.1% with F60	<i>F. fuscus</i> , differ by 3.8-4.3%	Little Wood River, Jim Brown bridge, Lincoln Co., ID	
	F12	JQ996165	5	0%	0.9-1.1% with F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Snake River, above Eagle Rock, Power Co., ID	
	F13	JQ996166 (n=4), JQ996167 (n=1)	5	0-0.2%	1.3-1.6% with F60	<i>F. fuscus</i> , differ by 4.4-5.0%	Teton River, Buxton bridge, Teton Co., ID	
	F14	JQ996168 (n=2), JQ996156 (n=1), JQ996169 (n=1), JQ996170 (n=1)	5	0-0.5%	0.6-1.1% with F60	<i>F. fuscus</i> , differ by 3.9-4.6%	Snake River, above Murtaugh, Twin Falls Co., ID	
	F15	JQ996160	5	0%	0.9-1.1% with F60	<i>F. fuscus</i> , differ by 4.3-4.6%	Salt River, Freedom, Lincoln Co., WY	
	F16	JQ996160 (n=7), JQ996163 (n=1)	8	0-0.5%	0.8-1.1% with F60	<i>F. fuscus</i> , differ by 4.1-4.6%	Bear River, Black Canyon, above Grace Power Plant, Caribou Co., ID	
	F17	JQ996156 (n=1), JQ996163 (n=2)	3	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Big Malad Spring, Oneida Co., ID	
	F18	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Hams Fork, Taylor Creek, Lincoln Co., WY	
	F19	JQ996156 (n=4), JQ996171 (n=1)	5	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	New Fork and East Fork Rivers, southwest of New Fork, Sublette Co., WY	
	F20	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Beaver Creek, below Thorn Creek confluence, Summit Co, UT	
	F21	JQ996156 (n=3), JQ996172 (n=1)	4	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	East Canyon Creek, above East Canyon Reservoir, Morgan Co., UT	
	F22	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Strawberry Creek, above Weber River confluence, Morgan Co., UT	
	F23	JQ996165 (n=3), JQ996173 (n=1)	4	0-0.9%	0.9-1.4% with F60	<i>F. fuscus</i> , differ by 3.9-4.7%	Murray Spring, below source, Cache Co., UT	

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<i>Fluminicola coloradoense</i> (continued)	F24	JQ996165 (n=3), JQ996174 (n=1)	4	0-0.9%	0.9-1.4% with F60	<i>F. fuscus</i> , differ by 3.9-4.9%	Blacksmith Fork, below Big Hollow, Cache Co., UT	
	F25	JQ996156 (n=2), JQ996175 (n=2)	4	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	South Fork Smiths Fork, Cokeville, Lincoln Co., WY	
	F26	JQ996156 (n=2), JQ996176 (n=2)	4	0-0.3%	0.6-1.1% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.6%	Green River, above Telephone Island, Sweetwater Co., WY	
	F27	JQ996176	3	0%	0.9-1.1% with F13, F60	<i>F. fuscus</i> , differ by 4.3-4.6%	La Barge Creek, west-southwest of La Barge, Lincoln Co., WY	
	F28	JQ996156	5	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	New Fork River, Hwy 351 bridge, Sublette Co., WY	
	F29	JQ996156 (n=3), JQ996161 (n=1), JQ996177 (n=1)	4	0-0.3%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Snake River, Grand Canyon, Lincoln Co., WY	
	F30	JQ996178 (n=4), JQ996179 (n=1)	5	0-0.3%	1.1-1.3% with F60	<i>F. fuscus</i> , differ by 4.4-4.7%	Snake River, Byington Park, Jefferson Co., ID	
	F31	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Falls River, north-northeast of Grainville, Fremont Co., ID	
	F32	JQ996156 (n=5), JQ996180 (n=1)	6	0-0.2%	0.6-0.8% with F13, F42, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Rock Springs, Arbon Valley, Power Co., ID	
	F33	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Little Malad Spring, Oneida Co., ID	
	F35	JQ996181	3	0%	1.1-1.3% with F60	<i>F. fuscus</i> , differ by 4.4-4.7%	Chubb Springs, north-northeast of Blackfoot Reservoir, Caribou Co., ID	
	F36	JQ996161	3	0%	0.8-0.9% with F13, F60	<i>F. fuscus</i> , differ by 4.1-4.4%	Blackfoot River, mouth of The Narrows, Caribou Co., ID	
	F38	JQ996182	3	0%	1.1-1.3% with F60	<i>F. fuscus</i> , differ by 4.4-4.7%	North Creek, Liberty, Bear Lake Co., ID	
	F39	AY962915	1	0%	0.9-1.1% with F13, F60	<i>F. fuscus</i> , differ by 4.1-4.6%	Green River, Warren Bridge, Sublette Co., WY	
	F40	AF520931/ JQ996183	1	0%	1.0-1.4% with F60	<i>F. fuscus</i> , differ by 4.0-4.3%	Provo River, above Deer Creek Reservoir, Wasatch Co., UT	
	F41	JQ996156 (n=1), JQ996184 (n=1)	2	0-0.6%	0.6-1.4% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.9%	Snake River, ca. 2.4 km below mouth of Malad River, Gooding Co., ID	

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<i>Fluminicola coloradoense</i> (continued)	F42	JQ996185 (n=1), JQ996186 (n=1)	2	1.30%	0.6-1.4% with F13	<i>F. fuscus</i> , differ by 4.1-4.6%	Snake River, Thousand Springs, Minnie Miller Springs, Gooding Co., ID	
	F43	JQ996156	1	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Snake River, below Bliss Dam, Gooding Co., ID	
	F45	JQ996156 (n=3), JQ996187 (n=1), JQ996188 (n=1)	5	0-0.8%	0.6-1.4% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.7%	Deep Creek, above Stone Canal, Oneida Co., ID	
	F47	JQ996160	5	0%	0.9-1.1% with F60	<i>F. fuscus</i> , differ by 4.3-4.6%	Snake River, Black Canyon, Bonneville Co., ID	
	F48	JQ996156	5	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Porcupine Station Springs, Fremont Co., ID	
	F49	JQ996157	3	0%	0.9-1.1% with F60	<i>F. fuscus</i> , differ by 4.3-4.6%	Willow Creek, Kepps Crossing, Bonneville Co., ID	
	F50	JQ996156 (n=1), JQ996160 (n=2)	3	0-0.3%	0.6-1.1% with F60	<i>F. fuscus</i> , differ by 3.9-4.6%	Snake River, Clear Lake bridge, Gooding Co., ID	
	F51	JQ996164 (n=2), JQ996189 (n=1)	3	0-0.3%	0.8-1.3% with F13, F60	<i>F. fuscus</i> , differ by 3.5-4.3%	Willow Creek, Timmerman rest stop, Blaine Co., ID	
	F52	JQ996164 (n=1), JQ996190 (n=1), JQ996191 (n=1)	3	0.2-0.8%	0.8-1.4% with F13	<i>F. fuscus</i> , differ by 3.8-4.6%	Big Wood River, Malad Gorge, Gooding Co., ID	
	F53	JQ996156	4	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Crooked Creek, State Wayside, Malheur Co., OR	
	F56	JQ996156 (n=1), JQ996192 (n=2)	3	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Pahsimeroi River, Goldberg Creek, Custer Co., ID	
	F57	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Salmon River, Kilpatrick, Lemhi Co., ID	
	F58	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Salmon River, Mackay Bar, Idaho Co., ID	
	F59	JQ996156	3	0%	0.6-0.8% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.3%	Salmon River, Gasper Creek, Idaho Co., ID	
	F60	JQ996193 (n=2), JQ996194 (n=1)	3	0-0.8%	1.3-1.6% with F13	<i>F. fuscus</i> , differ by 4.1-4.7%	Len Lewis spring, Hagerman National Fish Hatchery, Gooding Co., ID	

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Species	Published Sample Codes	Accession Numbers	No. of Specimens (N)	Sequence Variation (% pairwise distance)	Most Distant Conspecific Sequences (%)	Closest Interspecific Sequences (%)	Collection Locality	Comments
<i>Fluminicola coloradoense</i> (continued)	F61	JQ996186 (n=2), JQ996195 (n=1)	3	0-0.5%	1.1-1.4% with F60	<i>F. fuscus</i> , differ by 4.3-4.7%	Thousand Springs, power plant outflow just above bridge, Gooding Co., ID	
	F63	JQ996156 (n=2), JQ996196 (n=1)	3	0-0.2%	0.6-0.9% with F13, F60	<i>F. fuscus</i> , differ by 3.9-4.4%	Snake River, King Hill SA, Elmore Co., ID	
<i>Fluminicola dalli</i>	D43A	AY962916	1	0%		<i>F. anserinus</i> , differ by 3.8-4.1%, <i>F. fremonti</i> , differ by 3.8%, <i>F. multifarius</i> , differ by 3.2-4.6%, <i>F. umbilicatus</i> , differ by 3.8-4.0%	Spring west of Thunderbolt Bay, Washoe Co., NV	
<i>Fluminicola erosus</i>	F11_200B, F12_200E	AY962918 AY962920	2	0.20%	0.3-0.5% with F11_202A	<i>F. caballensis</i> , differ by 1.4-1.8%, <i>F. favillaceus</i> , differ by 0.9-1.7%	SmokeyCharley Spring, Modoc Co., CA	
	F10_202E, F11_202A, F12_202A	AY962917 AY962919 AY962921	3	0.3-0.6%	0.2-0.5% with F11_200B	<i>F. caballensis</i> , differ by 1.4-2.0%, <i>F. favillaceus</i> , differ by 0.9-1.8%	Spring southeast of Smokey Charley Spring, Modoc Co., CA	
<i>Fluminicola favillaceus</i>	SP364B	AY962927	1	0%	0.5% with SP510A	<i>F. erosus</i> , differ by 1.1-1.4%	Ash Creek at north culvert, Lassen Co., CA	
	SP487A	AY962928	1	0%	0.6% with SP510A	<i>F. erosus</i> , differ by 0.9-1.2%	Ash Creek above FS39N50 bridge, Lassen Co., CA	
	SP509A	AY962929	1	0%	0.5% with SP487A	<i>F. erosus</i> , differ by 1.4-1.7%	Chisolm Spring, Lassen Co., CA	
	SP510A	AY962930	1	0%	0.6% with SP487A	<i>F. erosus</i> , differ by 1.5-1.8%	Ash Creek, south culvert at Ash Valley Road crossing, Lassen Co., CA	
<i>Fluminicola fremonti</i>	D45aA, D45aB	AY962931 AY962932	2	0%		<i>F. anserinus</i> , differ by 3.5-3.8%, <i>F. dalli</i> , differ by 3.8%	Hunters Spring, Lake Co., OR	
<i>Fluminicola fuscus</i>	F03	JQ996197	8	0%	0.3-1.6% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Boise River, Willow Creek, Boise Co., ID	
	F06	JQ996198 (n=4), JQ996199 (n=1)	5	0-1.9%	0.5-1.7% with F44, F55, 0.2-1.9% with F46	<i>F. coloradoense</i> , differ by 3.6-4.9%	Owyhee River, below Whistling Bird Rapids, Malheur Co., OR	

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<i>Fluminicola fuscus</i> (continued)	F11	JQ996197 (n=4), JQ996200 (n=1)	5	0-0.2%	0.3-1.7% with F06	<i>F. coloradoense</i> , differ by 3.6-5.0%	Bruneau River, BLM low site, Owyhee Co., ID	
	F44	DQ372901/ JQ996201	1	0%	0.5-1.7% with F06	<i>F. coloradoense</i> , differ by 3.8-4.7%	Grande Ronde River, 0.2 km above mouth, Asotin Co., WA	
	F46	JQ996202 (n=4), JQ996203 (n=1)	5	0-0.2%	0.2-1.9% with F06	<i>F. coloradoense</i> , differ by 3.5-4.9%	Methow River north of Squaw Creek mouth, Okanogon Co., WA	
	F54	JQ996197	4	0%	0.3-1.6% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Payette River, Banks Camp [Campground], Boise Co., ID	
	F55	JQ996204	3	0%	0.5-1.7% with F06	<i>F. coloradoense</i> , differ by 3.8-5.0%	Imnaha River, Bare Creek, Wallowa Co., OR	
	F62	JQ996197	3	0%	0.3-1.6% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Snake River, Grand View SA, Owyhee Co., ID	
	F64	JQ996198	3	0%	0-1.9% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Owyhee River, above Beaver Charlie Cabin, Malheur Co., OR	
	F65	JQ996197	4	0%	0.3-1.6% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Boise River, Willow Creek, Boise Co., ID	
	F66	JQ996197	4	0%	0.3-1.6% with F06	<i>F. coloradoense</i> , differ by 3.6-4.9%	Boise River, Badger Camp [Campground], Boise Co., ID	
	<i>Fluminicola gustafsoni</i>	F67	JQ731609 (n=1), JQ731610 (n=2)	3	0-0.2%	0.5-0.8% with F73	<i>F. virens</i> , differ by 6.5-6.6%	Clearwater River, Jim Ford Creek, Clearwater Co., ID
F68		JQ731611	4	0%	0.5-0.6% with F73	<i>F. virens</i> , differ by 6.6%	Clearwater River, Orofino, Clearwater Co., ID	
F69		JQ731612	3	0%	0.3-0.5% with F67	<i>F. virens</i> , differ by 6.3%	Salmon River, Pine Bar Rapids, Idaho Co., ID	
F70		JQ731613	2	0%	0.5-0.6% with F73	<i>F. virens</i> , differ by 6.6%	South Fork Clearwater River, Battlefield, Idaho Co., ID	
F73		JQ731614 (n=1), JQ731615 (n=2)	3	0-0.6%	0.5-0.8% with F67	<i>F. virens</i> , differ by 6.2-6.3%	Snake River, below mouth of Couse Creek, Asotin Co., WA	

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<i>Fluminicola insolitus</i>	D35A	AY962934	1	0%		<i>F. coloradoense</i> , differ by 8.7-9.8%, <i>F. fuscus</i> , differ by 8.8-9.1%	Page Springs, Harney Co., OR	
<i>Fluminicola lunsfordensis</i>	F3_59A, F3_59B	AY962935, AY962936	2	0%		<i>F. ahjumawi</i> , differ by 1.9-2.7%, <i>Fluminicola</i> sp. B, differ by 2.4-2.5%	Lunsford Spring, Modoc Co., CA	
<i>Fluminicola modoci</i>	D42B	AY962938	1	0%	0.9% with D40A	<i>F. seminalis</i> , differ by 5.0-5.6%	Spring at Three Springs Ranch, Modoc Co., CA	
	D40A	AY962937	1	0%	0.9% with D42B	<i>F. seminalis</i> , differ by 5.6-6.1%	Link River at Klamath Falls bridge, Klamath Co., OR	
<i>Fluminicola multifaricus</i>	SP8B	AY962939	1	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Spring near Conant, Siskiyou Co., CA	
	F2_10B	AY962975	1	0%	2.6% with F3_69A	<i>F. anserinus</i> , differ by 3.0-3.5%	Ney Springs, Siskiyou Co., CA	
	F1_12B	AY962976	1	0%	2.6% with F3_69A	<i>F. anserinus</i> , differ by 3.0-3.5%	Sacramento River near Stink Creek, Siskiyou Co., CA	
	F6_27B	AY962940	1	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Crystal Spring, Siskiyou Co., CA	
	F4_30A, F5_30A	AY962941, AY962942	2	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Rock Spring, Siskiyou Co., CA	
	F3_65A, F4_65A, F5_65A, FSP65F	AY962943, AY962944, AY962945, AY962946	4	0-0.2%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Southernmost of Shasta Springs, Shasta Co., CA	
	F4_68A	AY962947	1	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Spring north of Mossbrae Falls, Shasta Co., CA	
	F3_69A	AY962948	1	0%	3.0% with F10_99B	<i>F. anserinus</i> , differ by 3.5-3.8%	Spring runs north of Mossbrae Falls, Shasta Co., CA	
	F10_99B	AY962977	1	0%	3.0% with F3_69A	<i>F. anserinus</i> , differ by 2.6-2.9%	Big Springs (source), northwest of city of Mount Shasta, Shasta Co., CA	
	F1_140A	AY962949	1	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Sacramento River at Cave Springs, Siskiyou Co., CA	
	F2_143A	AY962978	1	0%	2.7% with F3_69A	<i>F. anserinus</i> , differ by 2.6-3.0%	Spring along Sacramento River (third to the) east of Cantara Bend, Siskiyou Co., CA	

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<i>Fluminicola multifarius</i> (continued)	F2_144A	AY962979	1	0%	2.6% with F3_69A	<i>F. anserinus</i> , differ by 3.0-3.5%	Spring along Sacramento River (first to the) east of Cantara Bend, Siskiyou Co., CA	
	SP237A	AY962980	1	0%	2.4% with F3_69A, F10_322B	<i>F. anserinus</i> , differ by 3.2-3.6%	Big Springs, three middle runs, Siskiyou Co., CA	
	SP238B	AY962981	1	0%	2.4% with F3_69A, F10_322B	<i>F. anserinus</i> , differ by 3.2-3.6%	Big Springs, westernmost run, Siskiyou Co., CA	
	F10_239B	AY962982	1	0%	2.7% with F3_69A	<i>F. anserinus</i> , differ by 2.9-3.3%	Big Springs, easternmost run, Siskiyou Co., CA	
	SP241A	AY962983	1	0%	2.6% with F3_69A	<i>F. anserinus</i> , differ by 3.0-3.5%	Big Springs at west side of park, Siskiyou Co., CA	
	F10_322B	AY962950	1	0%	2.7% with F10_99B	<i>F. anserinus</i> , differ by 3.2-3.5%	Bundoora Spring, Siskiyou Co., CA	
	F3_330A	AY962951	1	0%	2.9% with F10_99B	<i>F. anserinus</i> , differ by 3.3-3.6%	Spring north of Crystal Spring, Siskiyou Co., CA	
	ELKSPB	AY962952	1	0%	2.6% with F10_99B	<i>F. anserinus</i> , differ by 3.0-3.3%	Elk Spring (lowermost), Siskiyou Co., CA	
<i>Fluminicola neritoides</i>	F9_369B	AY962953	1	0%	no variation	<i>F. lunsfordensis</i> , differ by 4.9%	Willow Creek at mouth of Hayden Canyon, Lassen Co., CA	
	F9_371A	AY962954	1	0%	no variation	<i>F. lunsfordensis</i> , differ by 4.9%	Willow Creek at lower end of Lower McBride Springs, Lassen Co., CA	
	F9_372A	AY962955	1	0%	no variation	<i>F. lunsfordensis</i> , differ by 4.9%	Willow Creek west of Hayden Hill, Lassen Co., CA	
<i>Fluminicola potemicus</i>	F2_36A, F2_36B	AY962956, AY962957	2	0%		<i>F. anserinus</i> , differ by 3.5-4.1%, <i>F. multifarius</i> , differ by 3.2-3.8%, <i>F. umbilicatus</i> , differ by 3.6-3.8%	Spring near Potem Creek, Shasta Co., CA	
<i>Fluminicola scopulinus</i>	F14_251B	AY962958	1	0%	0.5% with F14_303B	<i>F. anserinus</i> , differ by 3.8-4.0%, <i>F. multifarius</i> , differ by 3.5-4.3%,	Northernmost spring southwest of Popcorn Spring, Shasta Co., CA	

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<i>Fluminicola scopulinus</i> (continued)	F14_303B	AY962959	1	0%	0.5% with F14_251B	<i>F. anserinus</i> , differ by 4.3-4.4%, <i>F. multifarius</i> , differ by 3.6-4.4%	Northernmost spring west of Popcorn Spring, Shasta Co., CA	
<i>Fluminicola seminalis</i>	sem98B	AY962960	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Big Lake outlet near Rat Farm, Shasta Co., CA	
	sem104B	AY962961	1	0%	1.2% with D38, SP366B, sem426A, Fsem532A, Fsem552A	<i>F. modoci</i> , differ by 5.2-5.8%	Baum Lake (deep-water site), Shasta Co., CA	
	sem105A	AY962962	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Fall River at CalTrout Public Fishing Access Area, Shasta Co., CA	
	sem329A	AY962963	1	0%	1.4% with D38, SP366B, sem426A, Fsem532A, Fsem552A	<i>F. modoci</i> , differ by 5.2-5.8%	Baum Lake (shallow-water site), Shasta Co., CA	
	D38A	AY962964	1	0%	1.4% with sem329A	<i>F. modoci</i> , differ by 5.3-5.8%	Battle Creek east of Coleman Fish Hatchery, Shasta Co., CA	
	sem364A	AY962965	1	0%	1.4% with D38, sem426A, Fsem532A, Fsem552A	<i>F. modoci</i> , differ by 5.0-5.6%	Ash Creek at north culvert, Lassen Co., CA	
	SP366B	AY962966	1	0%	1.4% with sem329A	<i>F. modoci</i> , differ by 5.3-5.8%	Ash Creek northwest of Ash Creek Campground, Lassen Co., CA	
	sem411A	AY962967	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Crystal Springs, Shasta Co., CA	
	sem416A	AY962968	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Big Lake Springs, Shasta Co., CA	
	sem425A	AY962969	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Pit River near confluence of Hat Creek, Shasta Co., CA	
	sem426A	AY962970	1	0%	1.4% with sem329A	<i>F. modoci</i> , differ by 5.6-6.1%	Spring Creek on south side of Spring Creek Road, Shasta Co., CA	
	sem487A	AY962971	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.2-5.6%	Ash Creek above FS39N50 bridge, Lassen Co., CA	
	Fsem532A	AY962972	1	0%	1.4% with sem329A	<i>F. modoci</i> , differ by 5.6-6.1%	Lava Creek at boathouse on Hanna Estate, Shasta Co., CA	
	Fsem546A	AY962973	1	0%	1.2% with sem329A	<i>F. modoci</i> , differ by 5.5-5.9%	Spring on west side of Spring Creek, Shasta Co., CA	

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<i>Fluminicola seminalis</i> (continued)	Fsem552A	AY962974	1	0%	1.4% with sem329A	<i>F. modoci</i> , differ by 5.6-6.1%	Lava Creek source spring pool, Shasta Co., CA	
<i>Fluminicola turbiniformis</i>	D34B	AY962986	1	0%		<i>F. warnerensis</i> , differ by 2.3-2.6%	Roaring Springs, Harney Co., OR	
<i>Fluminicola umbilicatus</i>	F8_92A	AY962987	1	0%	0.3% with F7_338A	<i>F. anserinus</i> , differ by 3.5-3.8%, <i>F. multifarius</i> , differ by 3.5-4.3%, <i>F. potemicus</i> , differ by 3.8%	Lost Creek (lowermost site), Shasta Co., CA	
	F8_93B	AY962988	1	0%	0.2% with F7_338A, F8_536A, F8_92A	<i>F. anserinus</i> , differ by 3.3-3.6%, <i>F. multifarius</i> , differ by 3.3-4.1%, <i>F. potemicus</i> , differ by 3.6%	Lost Creek (middle site), Shasta Co., CA	
	F7_99A	AY962989	1	0%	0.2% with F7_338A, F8_536A, F8_92A	<i>F. anserinus</i> , differ by 3.3-3.6%, <i>F. multifarius</i> , differ by 3.3-4.1%, <i>F. potemicus</i> , differ by 3.6%	Big Spring, tributary of Hat Creek, Shasta Co., CA	
	F7_338A	AY962990	1	0%	0.3% with F8_536A, F8_92A	<i>F. anserinus</i> , differ by 3.5-3.8%, <i>F. multifarius</i> , differ by 3.5-4.3%, <i>F. potemicus</i> , differ by 3.8%	Hat Creek at Hat Creek Resort, Shasta Co., CA	
	F8_536A	AY962991	1	0%	0.3% with F7_338A	<i>F. anserinus</i> , differ by 3.5-3.8%, <i>F. multifarius</i> , differ by 3.5-4.3%, <i>F. potemicus</i> , differ by 3.8%	Lost Creek (uppermost site), Shasta Co., CA	
<i>Fluminicola virens</i>	D41A	AY962992	1	0%		<i>F. gustafsoni</i> , differ by 6.2-6.6%	Willamette River at Canby Ferry, Clackamas Co., OR	
<i>Fluminicola virginius</i>	D36B	AY962993	1	0%		<i>F. dalli</i> , differ by 5.8%, <i>F. potemicus</i> , differ by 5.5%, <i>F. scopulinus</i> , differ by 5.5-5.9%	Hardscrabble Creek, Washoe Co., NV	

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	<i>Fluminicola warnerensis</i>	F13_210B	AY962995	1	0%	0.6% with F13_351B	<i>F. turbiniformis</i> , differ by 2.3%	Spring creek east of Blue Lake, Modoc Co., CA	
		F13_217A	AY962996	1	0%	0.5% with SP360A, FSP387F, SP388A, F10_482A, F13_210B	<i>F. turbiniformis</i> , differ by 2.4%	Parsnip Spring, Lassen Co., CA	
		F13_351B	AY962997	1	0%	0.6% with SP360A, FSP387F, SP388A, F10_482A, F13_210B	<i>F. turbiniformis</i> , differ by 2.6%	Soup Spring, Modoc Co., CA	
		SP360A	AY962999	1	0%	0.6% with F13_351B	<i>F. turbiniformis</i> , differ by 2.6%	Springs southeast of Hilton, Modoc Co., CA	
		FSP387F	AY962998	1	0%	0.6% with F13_351B	<i>F. turbiniformis</i> , differ by 2.6%	Springs east of Miller Gulch, Modoc Co., CA	
		SP388A	AY963000	1	0%	0.6% with F13_351B	<i>F. turbiniformis</i> , differ by 2.6%	Miller Spring run, Modoc Co., CA	
		F10_482A	AY962994	1	0%	0.6% with F13_351B	<i>F. turbiniformis</i> , differ by 2.6%	Rush Creek (source), Modoc Co., CA	
	<i>Fluminicola</i> sp. A	SP113A	AY962922	1	0%	0.2% with SP373B	<i>F. lunsfordensis</i> , differ by 4.6%	Springs west of Canby, Modoc Co., CA	
		SP373B, F2SP373A	AY962924, AY962925	2	0.2%	0.2% with SP113A	<i>F. lunsfordensis</i> , differ by 4.4-4.6%	Spring at west end of Upper Rush Creek Campground, Modoc Co., CA	
<i>Fluminicola</i> sp. B	SP373A, F2SP373E	AY962923, AY962926	2	0.2%		<i>F. lunsfordensis</i> , differ by 2.4-2.5%	Spring at west end of Upper Rush Creek Campground, Modoc Co., CA		
Pristinicola									
<i>Pristinicola hemphilli</i>		AF520940	1	0.00%				Springs, 1.8 km east of Lower Kalama Hatchery, Cowlitz Co., WA	
Taylorconcha									
<i>Taylorconcha insperata</i>	OWS	DQ75986-DQ75990	5	0-0.46%	0-0.76% with OWD, 0.15-0.76% with HCH	<i>T. serpenticola</i> , differ by 0.91-1.52%		Owyhee River, upstream from South Cross Canyon, Malheur Co., OR	
	OWD	DQ76011-DQ76014	4	0-0.30%	0-0.76% with OWS	<i>T. serpenticola</i> , differ by 1.06-1.82%		Owyhee River, at Lower Deary Pasture, Malheur Co., OR	
	HCH	DQ75991-DQ75995	5	0-0.15%	0.15-0.76% with OWS	<i>T. serpenticola</i> , differ by 1.06-1.52%		Snake River, above High Bar Rapids, Wallowa Co., OR	
	HCD	DQ76023-DQ76027	5	0%	0-0.61% with OWS	<i>T. serpenticola</i> , differ by 1.22-1.52%		Snake River, just below Davis Creek Rapids, Wallowa Co., OR	

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<i>Taylorconcha serpenticola</i>	NI	DQ75952-DQ75956	5	0-0.30%	0.15-0.76% with TSM	<i>T. insperata</i> , differ by 1.06-1.82%	Niagara Springs, outflow at base of falls, Gooding Co., ID	
	BA	DQ76019-DQ76022	4	0%	0.15-0.46% with TSN, NI	<i>T. insperata</i> , differ by 1.22-1.67%	Banbury Springs outlets, Gooding Co., ID	
	SA	DQ75961-DQ75965	5	0%	0.15-0.46% with TSM	<i>T. insperata</i> , differ by 1.06-1.52%	Sand Spring, ca. 30 m below source, Gooding Co., ID	
	TSN	DQ75996-DQ776000	5	0-0.61%	0.15-0.76% with TSM	<i>T. insperata</i> , differ by 0.91-1.52%	Spring pool of Thousand Springs north outlet, Gooding Co., ID	
	TSM	DQ76015-DQ76018	4	0-0.61%	0.15-0.76% with NI, TSN	<i>T. insperata</i> , differ by 1.06-1.67%	Thousand Springs, springs just south of The Nature Conservancy's water pipeline, south of north inlet, Gooding Co., ID	
	TSS	DQ76001-DQ76005	5	0%	0.15-0.46% with TSM	<i>T. insperata</i> , differ by 1.06-1.52%	Thousand Springs, southernmost and largest outflow of the Minnie Miller Springs complex, Gooding Co., ID	
	BI	DQ75957-DQ75960	4	0%	0.15-0.46% with TSM	<i>T. insperata</i> , differ by 1.06-1.52%	Billingsley Creek, at spring source, Gooding Co., ID	
	CO	DQ75966-DQ75970	5	0-0.30%	0.15-0.61% with TSM	<i>T. insperata</i> , differ by 0.91-1.67%	Cove Creek, just above diversion to Malad River, Gooding Co., ID	
	MA	DQ76006-DQ76010	5	0%	0.15-0.46% with TSM	<i>T. insperata</i> , differ by 1.06-1.52%	Snake River, just below Malad Power Plant outfall, Gooding Co., ID	
	ZI	DQ75971-DQ75975	5	0-0.15%	0.15-0.61% with TSM	<i>T. insperata</i> , differ by 0.91-1.52%	Snake River, above Bliss Reservoir, Gooding Co., ID	
	BC	DQ75981-DQ75985	5	0-0.15%	0.15-0.61% with TSM	<i>T. insperata</i> , differ by 0.91-1.67%	Snake River, just below Bancroft Springs, Elmore Co., ID	
	CL	DQ75976-DQ75980	5	0-0.15%	0.15-0.61% with TSM	<i>T. insperata</i> , differ by 0.91-1.52%	Snake River, just above Clover Creek confluence, Elmore Co., ID	

UNCERTAIN

