Freshwater mollusks found during a survey for *Potamopyrgus antipodarum* (New Zealand mudsnail) within a five-mile radius of Capitol Lake, Thurston County, Washington.*

by Edward J. Johannes

During a bird-watching trip on October 22, 2009, Bert Bartleson discovered the first evidence that *Potamopyrgus antipodarum* (Gray, 1843) (New Zealand mudsnail) had reached the Puget Sound Basin at Capitol Lake, Marathon Park, Olympia, Thurston County, Washington. He found 16 specimens of the New Zealand mudsnail inside a live Anodonta shell, which he showed to me for confirmation at the Pacific Northwest Shell Club meeting on November 15th, 2009. I contacted Kevin Aitkin at U.S. Fish & Wildlife Service (USFWS) the next day, who, subsequently contacted Washington State Department of Fish & Wildlife (WDFW) personnel.

As a consequence of the find of the *P. antipodarum* in Capitol Lake, I was contracted by the Washington Invasive Species Council (Washington State Recreation & Conservation Office) to conduct the first survey to determine if there were any additional introductions of *P. antipodarum* outside of Capitol Lake. The survey covered mapped freshwater bodies within a 5-mile radius of Capitol Lake. Though main purpose of the survey was to find evidence of *P. antipodarum* introductions outside of Capitol Lake, a secondary result was the first detailed survey of the freshwater mollusk fauna of the region around Capitol Lake. Not much was reported in the literature regarding freshwater mollusk occurrences in the Olympia area. Malacologists such as Henry Hemphill and Junius Henderson conducted surveys in western Washington, which briefly included this area. Branley Branson did extensive surveys in western Washington, but he surveyed immediately adjacent areas in the Cascades and Olympic Peninsula. Terry Frest (deceased) and I largely collected springs and streams, and very few lakes in Thurston County, mostly adjacent to the area of this survey. Thurston County recently conducted macroinvertebrate surveys and reported *Juga* from Black Lake ditch, Deschutes River, Green Cove, Little McAllister, Moxlie, Percival and Woodland creeks; Fluminicola from the Deschutes River.

I collected a total of 85 sites during this survey in which 59 (86%) had mollusks present. The field portion of the study was carried out for a total of 10 days spread out in August and additional 2 days in September, 2010. I conducted the survey by myself except in September when Bert Bartleson joined me in the field for two days. Fifteen lakes (26 sites), 3 marshes (3 sites), 4 ponds (4 sites), 3 springs (10 sites), 1 river (3 sites), and 22 creeks and tributaries (39 sites) were sampled. Because of the possibility of introductions of the New Zealand mudsnail by humans and or their pets, sites on water bodies with public access or possible public access (boat ramps, fishing access, parks, public trails, and road crossings or bridges) were chosen for sampling sites. Most sites, except 13, were within a 5-mile radius of Capitol Lake. Most sites outside the 5-mile radius were within a mile beyond the boundary with 2 exceptions that were up 2 miles from the boundary. Despite being just outside the project area, I felt that Hicks, Long and Pattison lakes should be surveyed as well.

I used standard methods in malacology to implement the survey. Search methods varied according to substrate type and degree of aquatic macrophyte or plant cover. In coarse substrate areas with cobbles or boulders, a random sample of stones was removed and the mollusks were either hand collected or washed from them into a plastic tray and examined. Areas with mud, sand, silt substrate or with rooted aquatic macrophyte vegetation were sampled using a dip net. Material collected from each site was placed into a labeled plastic container and were kept in a cooler to keep the mollusks alive until they were transported to the lab for further processing.

Seventeen native freshwater mollusks (11 gastropods and 6 bivalves), 1 terrestrial mollusk (*Oxyloma* sp.) and 2 freshwater introduced species (1 gastropod and 1 bivalve) were found (Table 1).

The total number of cold-water species found in the survey area was 6 (*Valvata mergella* Westerlund, 1883, *Amnicola* n. sp. 1, *Pristinicola hemphilli* (Pislbry, 1890), *Fluminicola* n. sp., *Juga silicula* (Gould, 1847), and *Pisidium (N.) insigne* Gabb, 1868). All should be considered Species of Concern except *Pisidium insigne*. Twenty-eight sites had Species of Concern and cold-water species.

Pristinicola hemphilli is considered a Species of Concern because of the preferred pristine small to medium crenicole habitat make this taxon easily subject to extirpation despite the relatively broad range (for a spring snail). The small, elongate, *Bythinella*-like conch is unique in western North America and shows no close resemblances in morphology to any eastern North American forms either. This monotypic genus has scattered sites in part of the Columbia Basin (with a concentration of sites in the Columbia Gorge), including a few large tributaries; south in the Willamette and the coastal drainages at least to southwestern Oregon and east into western Idaho (not in the Snake system upstream of the Weiser area). Range recently pushed further south to Del Norte, Humbolt, and Trinity counties, California and north to King County, Washington well into glaciated terrain. This species was found at 1 spring site during this survey. Only 1 other *Pristinicola* site is known to occur in Thurston County, just S. of the one found during this survey.

Fluminicola n. sp. could represent more than one species but this only can be determined by anatomical and DNA analysis. About 7 undescribed taxa known over the state; range from common to highly restricted. The genus as now defined is likely not monophyletic. Many taxa are spring snails, but Washington undescribed taxa are mostly amniphiles (stream dwellers). *Fluminicola* was found during this survey in McLane Creek, Deschutes River and uncommonly at Woodward Creek. It co-occurs with Juga in all 3 streams. All Washington State *Fluminicola* should be considered Species of Concern.

Fluminicola virens (Lea, 1838) (Olympia pebblesnail) does not occur in the Olympia area despite the common name. The common name is mysterious in origin, as the type locality is in Oregon and there is no reason to think Olympia, Washington *Fluminicola* are conspecific.

Juga (Juga) silicula is considered a Species of Concern because of its limited range in streams in Thurston, Pierce, and King cos. which are very readily subject to modification and destruction from ongoing rapid urban growth. The range of this species was recently extended N. into glaciated terrain in the Big Soos Creek drainage (Green River tributary), King County, Washington. This species prefers streams and rivers with relatively good water quality, though found very rarely in lakes. Of all the mollusks collected, this species was found at the most sites (Table 1). Found in McLane, Swift, Fish Pond, Percival, Green Cove, Indian, Ellis, Woodland, Woodward and Moxlie creeks; Pattison Lake outlet; unnamed creeks flowing to Little Tykle and Butler coves; tributaries of Perry Creek and Black Lake; Deschutes River; Hewitt Lake. It is possible the Moxlie Creek *Juga* represents a new species, but until this is confirmed by anatomical and DNA analysis, this population is tentatively placed under *silicula*.

Anodonta oregonensis (Lea, 1838) (Oregon floater), *Margaritinopsis falcata* (Gould 1850) (western pearlshell) (originally under *Margaritifera*) and the spring dwelling conchologically unique (for western hydrobiid) *Colligyrus* n. sp. 9 (coastal duskysnail) have been reported in the area but were not found during this survey. Both unionids and *Colligyrus* n. sp. 9 should be considered Species of Concern.

Two Species of Concern were surprise finds during the second to the last day of the survey. They were *Valvata mergella* and *Amnicola* n. sp. 1 both found co-occurring in Pattison Lake (site 83).

Valvata mergella, a very rare species, was first collected near Port Clarence, Seward Peninsula, Alaska by the Swedish Vega Expedition. In Washington, originally only collected from Paradise Lake, north King County, Washington by W. J. Eyerdam in 1941, B. R. Bales in 1958, and T. J. Frest and I in 1995. Pattison Lake is the southern most known occurrence for this species *(ca*. 65 miles from Paradise Lake and over 2000 miles from Port Clarence). This taxon occurs in colder lakes and ponds (kettles) at low to moderate elevations. Presence of oxygenated soft substrate and aquatic macrophyte beds seem to be desiderata. This species seems to avoid nearshore habitats in kettle lakes making collecting by dredge from a boat or a dock necessary. The relatively large size, light green (not blue-green or emerald green as in *V. virens*) shell, and expanded aperture are quite distinctive (Figure 1). Reported from lakes and ponds on the west side of the Cascades in Washington, north to coastal Alaska, essentially to Bering Strait. The southern end of the range is uncertain; but no populations were reported historically from Oregon or California. Status of populations in Alaska uncertain; no reports in recent years despite some searching. No recent reports from British Columbia or the Yukon or Northwest territories.

Figure 1. *Valvata mergella*. Figure 28 in Burch, 1989. Measurement line= 1 mm.

Amnicola n. sp. 1 is also a very rare species. The new occurrence for this species at Pattison Lake is a major range extension across a significant drainage divide (Cascades) from the original Columbia River basin sites in Curlew Lake near Republic, eastern Washington (*ca*. 230 miles away) and McWenneger Slough, Flathead County, Montana (*ca*. 420 miles distance). Sites in Idaho have not been found as of yet. Unlike the eastern U.S. *Amnicola limosa* (Say, 1817) (mud amnicola), which occurs in streams as well, this species is apparently strictly a limnophile of which two sites are kettle lakes (Curlew and Pattison), both, which have streams flowing in and out of them and additional site found in a Flathead River oxbow lake (McWenneger Slough). Often this species is found among aquatic macrophyte beds, generally on soft but well-oxygenated substrate, e.g. marl or mud. Absent from dense macrophytes or in areas with anoxic sediments. Depth generally 2-6'+. This species grazes periphyton, apparently from macrophyte surfaces, but is also a detritivore. Shell and body similar to that of *Amnicola limosa*, but dark pigment on mantle concentrated in bar parallel to edge of pallial cavity is distinctive (Figure 2). In addition to *V. mergella*, this species co-occurs with the Clinton Forest Plan ROD (Record of Decision) species *Colligyrus* (formerly *Lyogyrus*) n. sp. 2 (Washington duskysnail) at Curlew Lake.

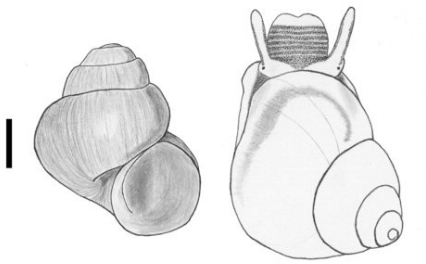

Figure 2. *Amnicola* n. sp. 1. Shell on left and preserved specimen on right. Specimens from McWenneger Slough, Flathead County, Montana. Measurement line= 1 mm.

Both *Amnicola* n. sp. 1 and *V. mergella* face similar threats. Neither are found in lower elevation lakes that have been rotenoned to remove the native fish fauna so game fish could be stocked, had extensive herbicide treatment to kill out aquatic macrophytes, strongly eutropified lakes, lakes with anoxic substrates, ones polluted by or with silitation problems exacerbated by logging, grazing, human development or activity. Terry Frest and I have found very few western or eastern Washington lower elevation lakes to retain the native mollusk fauna. Many of the kettle lakes in the area of occurrence have heavily developed shorelines, including housing with inadequate provisions for sewage and nutrient runoff management. Other *Valvata* species, which are more common than *V. mergella*, are now rarely found in western U.S. lakes and streams. Pattison Lake is in a rapidly growing urban area within the City of Lacey. The nearby introduction of the New Zealand mudsnail in Capitol Lake is another possible threat to both species. The introductions of *Bithynia tentaculata* (Linnaeus, 1758) (faucet snail) into McWennegar Slough and *Esox masquinongy* (Tiger muskies) into Curlew Lake in 1997 by WDFW to control populations of Squaw fish are additional threats to *Amnicola* n. sp. 1.

Both of these species are glacial relicts and their ranges occur just within the edge of the Cordilleran Ice Sheet. It is a mystery where both species lived during the last glacial period, as the habitat they now occupy did not exist until the Cordilleran Ice Sheet receded to the north approximately 12,000 years ago or how they moved north (especially *V. mergella*) to occupy the newly formed habitat. The new range extension for *Amnicola* n. sp. 1 across a major drainage divide may indicate a pre-Cascade (Miocene or earlier) distribution.

The 2 introduced species (*Cipangopaludina chinensis malleata* and *Corbicula fluminea*) were found at 6 sites (all in lakes). *Potamopyrgus antipodarum* (Gray, 1853) was not found during this survey.

Cipangopaludina chinensis malleata, was not reported from the area previously. It was found at Pattison, Hicks, Ken (Simmons), Chambers, and Long lakes during this survey. All, but Ken Lake, occur within 3 miles of the BNSP (formerly Northern Pacific Railroad) mainline, mainline, which runs through the area and cuts across Pattison Lake. It is possible this species was introduced as a food source by Chinese working for the UPRR during construction of the railroad grade in the 1870's.

Strangely, *Radix auricularia* (Linnaeus, 1758) (Big-ear Radix) was not found at any of the survey sites but was found in Capitol Lake during a previous survey.

Corbicula fluminea is the only other introduced species found during this survey. It was found at 1 site out of 4 in Black Lake. Only shell fragments (no live adults were seen) and one live juvenile was collected. It was also found in Capitol Lake.

Potamopyrgus antipodarum was first noticed near Washington State in the Columbia in 1995, at Youngs Bay near Astoria, Oregon. Since then, it has been reported as far east as Cathlamet Bay, Oregon; north at Port Alberni, Vancouver Island, British Columbia, Canada; and in Washington State at Long Beach. Terry Frest and I extended the species range in the Columbia River eastward, to St. Helens, Oregon in 2004. In Capitol Lake it is estimated the population densities are 20,000 per square meter in limited areas of the North Basin (Allen Pleus (WDFW), pers. comm., 2009). Based on the extent of the area invaded and population density of *P. antipodarum* in Capitol Lake, introduction probably occurred in 2008 or 2009. The species has a attenuate shell; adult height ca. 4-12 mm; adults with 7 to 8 whorls; color varies between gray and dark brown to light brown; aperture oval; some individuals have periostracal fringes (Figure 3). All club members should keep an eye out for this species when collecting in freshwater habitats and report any occurrences.

Figure 3. *Potamopyrgus antipodarum* (Gray, 1843). Height 4.7 mm. Specimen from Capitol Lake, Olympia, Washington.

To the relief of Washington State and Federal agencies, *P. antipodarum* was not found at any of the 85 sites surveyed during this project. Though it cannot be entirely ruled out, the chances of a missed introduction within a 5-mile radius of Capitol Lake is unlikely. Though the primary objective was to survey for New Zealand mudsnail, the secondary result of the project was a detailed survey of the mollusk fauna within a 5-mile radius around Capitol Lake. The find of the rare *Aminicola* n. sp. 1 and *Valvata mergella* in Pattison Lake within a relatively small area surveyed, indicates that our knowledge of freshwater mollusks of Washington State is still mostly incomplete and that detailed surveys are necessary to determine species occurrence and distribution, especially for rare species.

References

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*Johannes, E. J. 2010. Survey for *Potamopyrgus antipodarum* (New Zealand mudsnail) within a five-mile radius of Capitol Lake, Thurston County, Washington. Final Report to Washington Invasive Species Council, Washington State Recreation and Conservation Office, Olympia, Washington. Deixis Consultants, SeaTac, Washington. (This article is an excerpt from this report).

Table 1. Mollusk fauna found within 5-mile radius of Capitol Lake.
Table Explanation:
*=introduced species - bold=Species of Concern - °=cold-water species

Bivalves

Sphaerium patella (Gould, 1850) (Rocky Mountain fingernailclam) 1 site
Musculium raymondi (Cooper, 1890) (western lake fingernailclam) 8 sites
Musculium securis (Prime, 1851) (pond fingernailclam) 1 site
Pisidium (Cyclocalyx) casertanum (Poli, 1791) (ubiquitous peaclam) 1 site
Pisidium (Cyclocalyx) variabile Prime, 1852 (triangular peaclam) 3 sites
°***Pisidium (Neopisidium) insigne*** Gabb, 1868 (tiny peaclam) 1 site
Pisidium sp. (no common name) 4 sites
Sphaeriid indet. (no common name) 6 sites
**Corbicula fluminea* (Müller, 1774) (Asian clam) 1 site

Gastropods

Valvata mergella Westerlund, 1883 (rams-horn valvata) 1 site
**Cipangopaludina chinensis malleata* (Reeve, 1863) (Chinese mysterysnail) 7 sites
°***Amnicola*** n. sp. 1 (lake amnicola; formerly Washington duskysnail) 1 site
°***Pristinicola hemphilli*** (Pilsbry, 1890) (pristine pyrg) 1 site
°***Fluminicola*** n. sp.(no common name) 8,54,55,75&80
°***Juga (Juga) silicula*** (Gould, 1847) (glass juga) 23 sites
Fossaria (Fossaria) modicella Say, 1825 (rock fossaria) 1 site
Gyraulus (Torquis) parvus (Say, 1817) (ash gyro) 10 sites
Menetus (Menetus) callioglyptus Vanatta, 1894 (button sprite) 4 sites
Planorbella (Pierosoma) subcrenatum (Carpenter, 1857) (no common name) 12 sites
Ferrissia californica (Rowell, 1863) (fragile ancylid) 2 sites
Oxyloma sp. (no common name) 3 sites