

Range extension for the Rocky Mountain Ridged Mussel, *Gonidea angulata*, in British Columbia, Canada

By Linda Schroeder and Edward Johannes

Rick Harbo (Shell Club member, Marine Biologist, Nanaimo, B.C.) recently brought to the first author's attention a range extension in British Columbia, Canada, for *Gonidea angulata* (Lea, 1838) (in the U.S., the western ridged mussel, or in Canada, the Rocky Mountain ridged mussel). It was previously only known to inhabit the Okanagan River basin in B.C. from the north end of Okanagan Lake south to Osoyoos Lake (Canadian spelling of Okanagan is used herein instead of the U.S. spelling of Okanagan). But in 2023 and 2024, a population was discovered in the Pitt River, a lower tributary of the Fraser River, at Coquitlam.

Due to its limited range in Canada, it was federally listed under the Species at Risk Act (SARA) and placed on the List of Wildlife Species at Risk as Special Concern, with consideration underway for Endangered status (COSEWIC, 2010). In the U.S., *Gonidea* has been petitioned for listing under the Endangered Species Act, and a 90-day petition finding concluded that listing "may be warranted," triggering a full status review (USFWS, 2021; Johannes, 2022). Still, no listing determination has been finalized.

In 2023, the initial discovery only found dead shells in the Pitt River and was posted on iNaturalist. In 2024, fresh dead shells were found, and eventually some live mussels. This find was reported by Lea Gelling, who noted that 42 live individuals from the Pitt River were tagged (B.C. Conservation Data Centre, 2024).

To date, it appears the reason this population was overlooked is that this area simply hadn't been surveyed, or perhaps it was surveyed during high water levels when the mussels were not visible. Naturally, there has been speculation as to whether this population is native or introduced. It has been suggested that the population was introduced by human activity from the Okanagan, either by transport of adult *Gonidea* from the Okanagan or Columbia systems to the Fraser system, or by the introduction of fish infected by glochidia (larval form of some freshwater mussels, including *G. angulata*, that attach to fish gills) to the Fraser system. It is known that unionid species have specific fish hosts. Confirmed or suspected fish hosts for *G. angulata* in various parts of its range include sculpins (*Cottus* spp.), hardhead minnow, tule perch, and potentially redbelly darters and lake whitefish, among others (Spring Rivers, 2007; O'Brien et al., 2013).

Several of these species are present in both the Fraser and Okanagan/Columbia systems. The introduction of the New Zealand mud snail (*Potamopyrgus antipodarum*) into the Snake River, Idaho, in the late 1980s during the transport of New Zealand-raised rainbow trout is a perfect example of a fish-mediated human introduction of a freshwater mollusk (Taylor, 1987; Shinn, 2001).

The impact of the Last Glacial Period on the distribution and biogeography of freshwater mollusk populations suggests a possible natural introduction scenario (Taylor 1985; Taylor & Bright, 1987). Columbia Basin fish are clearly a significant component of the Fraser River drainage in comparison to other coastal river drainages (McPhail & Lindsey, 1986). They are presumed to have been introduced into the Fraser by stream capture or by stream diversion during the last glacial period from the Okanagan (Ibid.). More than likely, the Pitt population of *G. angulata* is not a human-mediated introduction into the Fraser drainage.

The report of a fossil-lake deposit of *Amnicola limosus* in the Fraser River drainage, if verified, would further support this possibility (King, 1981). This eastern U.S.-occurring snail was found in northwestern Montana lakes and is presumed to have crossed the continental divide during the last glacial period (Taylor, 1985; Taylor & Bright, 1987; Johannes, 2015). There are several drainage areas where evidence of the interchange of east-west biota has occurred in the Rocky Mountains. One is where two new western U.S. *Pyrgulopsis* endemic snail species were found in Missouri River tributaries (Hershler & Gustafson, 2001; Hershler, Lui, & Gustafson, 2008). Another area is in the Yellowstone Plateau, where populations of *Stagnicola hinkleyi* and *Margaritifera falcata*, both western U.S. species, are found in an eastern U.S. drainage (Taylor, 1985). Far more eastern U.S. mollusk species have crossed the continental divide than have western ones. Initially found in northwestern Montana lakes in the Columbia River drainage basin, *A. limosus* was later discovered in northeastern Washington lakes (Johannes, 2015). It is more than possible that this snail could have entered the Fraser River drainage from the



Gonidea angulata (western ridged mussel) right valve from the Pitt River, California. Scale in cm. Photo by Edward Johannes, Deixis Consultants, SeaTac, WA.



Gonidea angulata (western ridged mussel) from the Middle Fork of the John Day River, Oregon, showing incurrent (lined with bi-fid, or two-pronged, papillae) and ex-current siphons extended. Photo by Alexa Maine, Confederated Tribes of the Umatilla Indian Reservation Mussel Project.

Okanagan drainage. During a survey for the New Zealand mud snail, *A. limosus* was found in western Washington in a lake near Olympia (Johannes, 2010). Recently, the Washington Department of Fish and Wildlife (WDFW) found a second western Washington site for this snail at Magnuson Park in Lake Washington, Seattle (specimens mailed to Deixis Consultants by Sascha Kosh, WDFW, July 11, 2024), and another eastern Washington site in a cut-off channel of the Columbia River near Mattawa (N. Plants, WDFW, photos in email, November 20, 2025). The second site is the southernmost locality found for this snail in Washington State. On the west side of the Cascades, this snail likely rode in a proglacial lake that formed in front of the Puget Lobe of the Cordilleran Ice Sheet as it moved south from the Fraser River drainage into the Puget Sound region and later rode it north as the Puget Lobe retreated during the close of the last glacial period (Bretz, 1910, 1913; Johannes, 2015).

One more mention— a disjunct population of *G. angulata* occurs in the Chehalis River drainage, Washington, which—unlike most coastal drainages—supports Columbia River taxa, including *Juga plicifera*, a snail otherwise restricted to the lower Columbia and major tributaries and unlikely to dis-

perse via small streams (McPhail & Lindsey, 1986; Mock et al., 2020; Johannes, 2022). The presence of Miocene Columbia River flood basalts in the Chehalis indicates occupation of this drainage by the Columbia River during the Miocene (Johannes, 2022). Consistent with this history, genetic analyses show the Chehalis *Gonidea* population is highly distinct and long isolated (Mock et al., 2020).

Nevertheless, DNA analysis of the Pitt River mussel population will be necessary to determine whether it is a natural or human-mediated introduction.

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