

The Asiatic Clam (*Corbicula fluminea*) 'Rediscovered' on Vancouver Island

By Lisa Kirkendale, Invertebrate Curator at the Royal BC Museum and
Jeremy Clare, Student at WestShore Centre for Learning and Training.

Earlier this year [2008], two specimens of freshwater bivalve were brought in for identification from the Sooke watershed. One was quickly identified as a native freshwater mussel, *Anodonta kennerleyi* (Fig. 1A) relatively common in many lakes and streams in the area. The other was tougher to identify; something didn't look quite right and it certainly wasn't a mussel! A closer look through the literature yielded a startling discovery - this animal was the notorious bivalve invader *Corbicula fluminea*, commonly known as the Asiatic Clam and about as fun to have in your watersheds as the zebra mussel (Fig. 1B). A quick flurry of activity followed - who was this invader, how did it get here and where else was it?

Background

Native to China, Korea, southeastern Russia and the Ussuri Basin (Aguirre and Poss 1999), *Corbicula fluminea* or the Asiatic clam is a widespread freshwater bivalve pest throughout its range that includes Japan, much of Europe and the Americas. *Corbicula fluminea* is restricted to freshwater, unlike many other members of the family *Corbiculidae* and is of moderate size with pronounced concentrically-ribbed shells ('corbus' = basket) (Fig. 1B). Their ability to establish viable populations from very few individuals is probably due in large to their remarkable reproductive plasticity. *Corbicula fluminea* is a known protandric or sequential (male first, female second) hermaphrodite (Morton, 1977) that exhibits ovoviparity and can self-fertilize. Water temperatures above 16°C are required for larval release (Global Invasive Species Database). Under favorable conditions, larvae spawned in late spring or early summer are capable of reaching sexual maturity by the following fall, just over one year (Aguirre and Poss 1999). Individuals are not only restricted to sexual modes of reproduction, clonality (genetically identical individuals) Lee et al. 2005), as well as androgenesis (all-male lineages) (Hedtke et al. 2008) reproductive strategies have been documented in some populations.

Distribution

The oldest documented record of this species in North America, and the first record of occurrence in Canada, was based on dead shells collected from Nanaimo, BC in 1924 (Counts 1981). Deposited in the National Museum of Natural History (Smithsonian), this record was sent with a label that stated "Dead on beach. Probably a Japanese import". Burch (1944) discovered the first population of live Asiatic clams in 1938 in the sand and gravel banks of the Columbia River, Washington. Later surveys in Nanaimo by the Field Museum of Natural History (Chicago) did not uncover *Corbicula fluminea* (Haas 1954) and no further records of this species in Canada were ever reported until now - 84 years later! In the US, the most likely vector is widely thought to be immigrant Chinese laborers in the U.S. (Hanna 1966, Fox 1971a,b and Morton 1973). In Asia, *Corbicula fluminea* is widely available and consumed as a favored food source, where it is known (in some regions) as the "prosperity, pygmy or golden clam" (Miller and McClure 1931).

It is thought that the Asiatic clam might have been originally introduced as bait in North America. A local bait shop was contacted, to follow-up on this as a possible explanation for the live population of *Corbicula* recently discovered in Sooke, however the representative said that live clams (of any sort) are currently unavailable and not commonly used as bait in and around Victoria. An online aquarium trade search yielded a much different response. In both Canada and the U.S., the Asiatic clam is available, where it is marketed as the (golden) clam and featured as a great way to keep algal populations in check.

The Vancouver Island specimens were collected this past year at a site in the Sooke Watershed now known as Irwin Park (previously Humpback Valley Campgrounds) and comprised of two man-made lakes, Humpback Lakes, built by Joe Pekter beginning in 1971 (Fig. 2). Humpback Lakes are part of a system of interconnected waterways that fall just outside the present boundaries of the Greater Victoria Water Supply System (Fig. 3). Since 2005, Irwin Park has been environmentally



Fig. 1A. *Anodonta kennerleyi*, the Western floater.
Scale 10 cm. Photo: J. Clare



Fig. 1B. *Corbicula fluminea*, the Asiatic clam.
Scale 5 cm. Photo: Mike McNall, Royal British Columbia Museum.



Fig. 2 A. Site of Humpback main lake in 1971.
Photo courtesy of Dorothy Pekter.



Fig. 2 B. Similar view of Humpback main lake today. Photo: J. Clare

juveniles are present and that reproduction is likely occurring. Levels in the second of the two Humpback lakes have not dropped so drastically and no indication that *C. fluminea* inhabits this other Humpback lake (e.g. dead shells on banks) were found, suggesting that *C. fluminea* may reside at slightly deeper depths than is generally frequented by summer snorkelers or aquatic naturalists/biologists conducting littoral survey work.

Following the discovery of the Vancouver Island population of *C. fluminea*, Department of Fisheries and Oceans was contacted. This led to the discovery that a second population had been found, on the mainland and prior to when the Humpback Lake population was first reported (February 2008). A confirmed observation of the Asiatic clam at the confluence of Scott Creek and the Coquitlam River in the Lower Fraser Area (Maurice Coulter-Boisvert, pers. comm.) suggests that the Asiatic clam may be more widespread than is presently appreciated (it is uncertain whether the recently discovered mainland siting is based on live specimens or not). For example, if widely known records of the Asiatic clam existed, it is likely that the species would have been included in a 2000 pamphlet entitled *Freshwater Molluscs*

by the Ministry of Environment, Lands and Parks. Given how long it has taken to rediscover the Asiatic clam in the province, the first record may represent an isolated incidence of a handful of discarded clams that never formed an established population in BC. Similarly, the larger of the two Humpback Lakes was previously stocked with trout and the *C. fluminea* population recently discovered there could have been established from discarded clams used as bait (but not from recently, or even locally purchased bait, see above). It is unlikely that the two records of *C. fluminea* on Vancouver Island are related, especially given that the Humpback Lakes were not in existence prior to 1972.

Impact

When conditions are favorable, huge populations can occur (5000 clams/m² in California, 12,000/m² Texas), likely stressing native and often endangered (e.g. freshwater mussels) benthic communities. Like the highly invasive zebra mussel, *Dreissena polymorpha*, the Asiatic clam can clog intake pipes, necessitating considerable and costly maintenance procedures to clear. An estimated 1 billion dollars was spent in the USA in 1986 mitigating damage caused specifically by *C. fluminea* (Isom 1986). The Asiatic clam has likely been spread not by waterfowl,



Fig. 4. Hut at Irwin Park rebuilt by students from the Westshore Center. Photo: J. Clare

rehabilitated by students from West Shore Center for Learning and Training that have taken great pride in cleaning up the park, documenting the local wildlife in the area (that includes mallards, river otters, freshwater sponges, cnidarians, molluscs) and working on a hut intended to house an interpretative center (Fig. 4). Future plans have Irwin Park slated for a LEED development known as Westhills that has garnered mixed reviews from some local residents concerned that no concrete environmental targets have yet been set (Goldstream News Gazette, May 2008).

Although the Western floater *Anodonta kennerleyi* was found living in both 'lakes', *C. fluminea* was only recorded from one (Fig. 3-inset). The water levels in the lake where *C. fluminea* was recovered dropped about 2 metres over the past year, exposing shells that lined the bank adjacent to where live populations were found (Fig. 5). *C. fluminea* was hand-collected in <0.5 m of water, from a muddy, gravelly bottom. Individuals ranging from 1-5 cm were found, indicating that

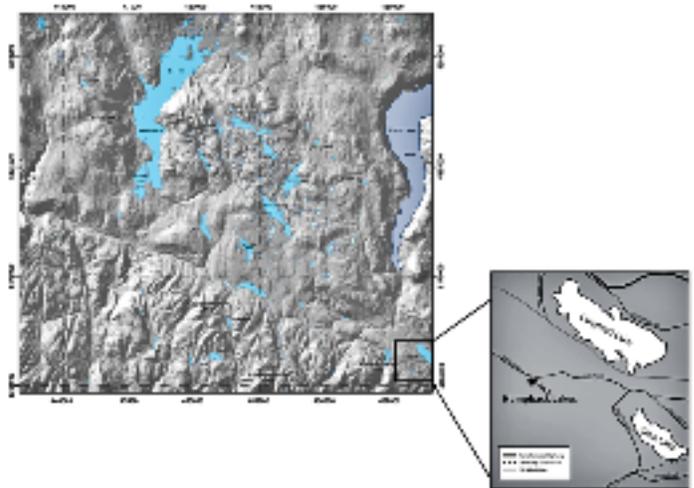


Fig. 3. Overview map of Victoria Watershed showing location of Humpback Lakes. Inset shows close-up of Humpback Lakes marks where *C. fluminea* was recovered (filled circle). After CRD Fire Weather Station map.

as studies indicate it cannot survive passage through the gut, but by inherent aspects of its reproductive biology that permits establishment from a small number of initial settlers. Humans have probably helped increase its introduced range (e.g. in the USA), perhaps collecting it as an aquarium curiosity and later releasing it in the wild, thereby assisting with long distance transport.

The Asiatic clam can tolerate a wide range of water temperatures, but it is restricted from sexually reproducing unless water temperatures are at or above 16°C (although *C. fluminea* has been reported from cold countries such as Hungary and Poland, these records are from isolated instances of populations that may be living in artificially heated water, such as found in cooling ponds associated with power plants, Domagala *et al.* 2004). Because of this, although the Asiatic clam can survive here, it is likely restricted to summer reproductive bouts, which may limit its spread in our region. That said, we can look to our southern neighbors as a portent of things to come, given predictions of temperature increase as a result of global warming. This could mean more *Corbicula* in the near future. The discovery of the Humpback Lake population is a reminder to be careful of what you toss into rivers, lakes and streams. Remember that what is bought in the pet trade (for aquaria), should stay indoors in carefully monitored tanks or terraria and not later dumped into wild areas. Purchasing dead bait or locally-collected live bait is also a good practice.

Future Plans

Our future plans are to search for more populations of this species and continue to document its occurrence on Vancouver Island and around British Columbia. We would appreciate if interested parties would keep an eye out and inform us if they spot anything that looks like the animal featured in the photos. If found, please collect, freeze and contact Lisa Kirkendale, lkirkendale@royalbcmuseum.bc.ca

Note: While this paper was in press, a dead specimen of *Corbicula fluminea* was discovered in a collection donated to the Royal British Columbia Museum. The specimen was collected 26 November 1989 from beach drift near the high tide line in Stanley Park.

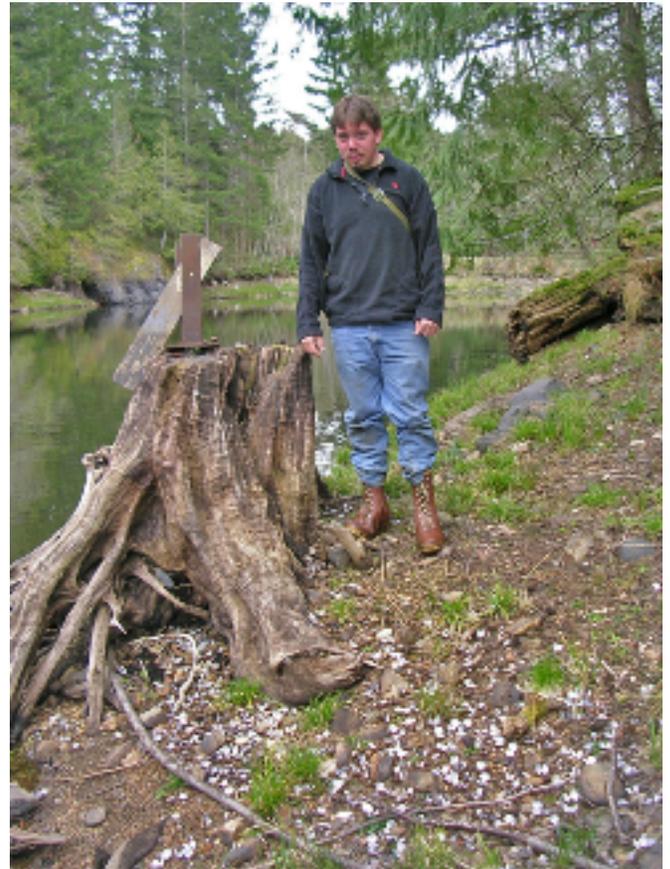


Fig. 5. Jeremy Clare by a previously submerged stump. Dead shells of *C. fluminea* are present in the foreground.
Photo: L. Kirkendale

References

- Aguirre, W. and S.G. Poss. 1999. Non-indigenous Species in the Gulf of Mexico Ecosystem: *Corbicula fluminea* (Muller, 1774). Gulf States Marine Fisheries Commission (GSMFC).
- Burch, J.W. 1944. Checklist of west American Molluscs, Family Corbiculidae. Conchological Club of Southern California Minutes 36:1-18.
- Counts, C.L. 1981. *Corbicula fluminea* (Bivalvia: Sphaeriacea) in British Columbia. The Nautilus 95:12-13.
- Domagala, J., A.M. Labecka, M. Pilecka-Rapacz, B. Migdalska. 2004. *Corbicula fluminea* (O. F. Mueller, 1774)(Bivalvia:Corbiculidae)--a species new to the Polish malacofauna. Folia-Malacologica 12(3): 145-148.
- Fox, R.O. 1971a. The *Corbicula* Story: Chapter Three. Unpublished report, Fourth Annual Meeting of the Western Society of Malacologists, Asilomar Conference Grounds, Pacific Grove, California, June 17, 1971, California Academy of Sciences, Department of Invertebrate Zoology, San Francisco, CA. 5 pp.
- Fox, R. O. 1971b. Have you met *Corbicula* - the freshwater invader? Tabulata 1:3-5.
- Global Invasive Species Database - <http://www.issg.org/database>
- Haas, F. 1954. Non-marine molluscs from the Pacific Slope of North America. The Nautilus 67:94-96.
- Hanna, G.D. 1966. Introduced mollusks of western North America. California Academy of Sciences Occasional Papers 48:1-108.
- Hedtke, S.M., K. Stanger-Hall, R.J. Baker, D.M. Hillis. 2008. All-male asexuality: Origin and maintenance of androgenesis in the Asian clam *Corbicula*. Evolution 62(5): 1119-1136.
- Hill, E. 2008. Langford OCP praise, vilified, *Goldstream News Gazette* (May 23).
- Isom, B.G. 1986. Historical review of Asiatic clam (*Corbicula*) invasion and biofouling of waters and industries in the Americas. American Malacological Bulletin Special Edition. No 2:1-5.
- Lee, J.S. 2000. *Freshwater Molluscs*. British Columbia Ministry of Environment, Lands and Parks Publication. 6 pp.
- Lee, T.S. Siripattawan, C.F. Ituarte, D.O. Foighil. 2005. Invasion of the clonal clams: *Corbicula* lineages in the New World. American Malacological Bulletin 20:113-122.
- Miller, R.C. and F.A. McClure. 1931. The freshwater clam industry of the Pearl River. Lingnan Science Journal 10:307-322.
- Morton, B. 1973. Analysis of a sample of *Corbicula manilensis* Philippi from the Pearl River, China. Malacology Review 6:35-37.
- Morton, B. 1977. The population dynamics of *Corbicula fluminea* (Bivalvia: Corbiculacea) in Plover-Cove Reservoir, Hong Kong. Journal of Zoology 181:21-42.

Lisa Kirkendale and Jeremy Clare wrote this article for *The Victoria Naturalist* where it appeared in the November - December, 2008 issue, Vol. 65.3 p. 12-16. We thank them for allowing us use of their article in *The Dredgings*.