



Freshwater Molluscs

*Many freshwater
mollusc species
are at risk due to
loss and degradation
of aquatic habitats.*





What are freshwater molluscs?

Within the large group of animals known as molluscs, three subgroups – snails, mussels and clams – have representatives that live in fresh water. Because all freshwater molluscs have hard shells that are often washed up on shores, they are some of the most conspicuous of the freshwater invertebrates.

About 180 species of freshwater molluscs are known to occur in Canada. Of these, at least 85 species, including 54 snails, 5 mussels and 26 clams, are found in British Columbia. Although a few freshwater molluscs are believed to have survived the last period of glaciation in B.C., most species have repopulated the province within the past 10 000 years, moving in from adjacent unglaciated areas.

Freshwater molluscs are an integral part of the complex web of life that supports biodiversity. Like other invertebrates, they play an important role in nutrient cycling, functioning as decomposers and as critical links in the food chain.

Why are freshwater molluscs at risk?

Although freshwater molluscs in B.C. are not being lost to direct exploitation, much of their habitat is being lost or degraded. The hazards they face vary. For the many snails that must return to the water surface to breathe, pollutants such as oils and soaps that accumulate around the edges of water bodies are potentially disastrous. Rare, hot water adapted snails suffer habitat loss when hot springs are diverted for human use. A decline in water quality may affect

mussels directly or may reduce the availability of host fish that they depend upon to disperse their young. The introduction of non-native mollusc species can result in unnatural competition for food and habitat, as has occurred in eastern North America with the introduction of the Zebra Mussel. So little is known about the B.C. freshwater mollusc fauna that it is difficult to assess which species are currently at risk.

Where do they live?

Freshwater molluscs live in all types of wet habitats from large lakes and rivers to roadside ditches and backyard ponds. They are most commonly found along the shallow edges of water bodies where warmer temperatures and

*Each shell,
each crawling
insect holds a
rank ...
which lost
Would break
the chain
and leave
behind a gap
Which
Nature's self
would rue.*

*stillingfleet,
circa 1882*

additional light provide them with more food than is available in deeper water. Some species of freshwater molluscs can be found in temporary wet areas, where they survive by burrowing into the substrate to wait out dry periods. Burrowing is also a strategy used by some molluscs to survive winter freezing. Others are able to avoid

the ice by retreating to unfrozen areas. All freshwater molluscs evolved from marine ancestors. The shift between radically different environments required the development of specialized adaptations. For example, the movement of fresh water is very

different than that of oceans. In the ocean, tides result in complex water flow patterns, whereas inland waters are always ultimately flowing in one direction – toward the ocean. In order to live in fresh water, molluscs had to evolve reproductive adaptations that would ensure their eggs and sperm could meet and that larvae and juveniles could disperse without being drawn into that one-way flow to the sea.

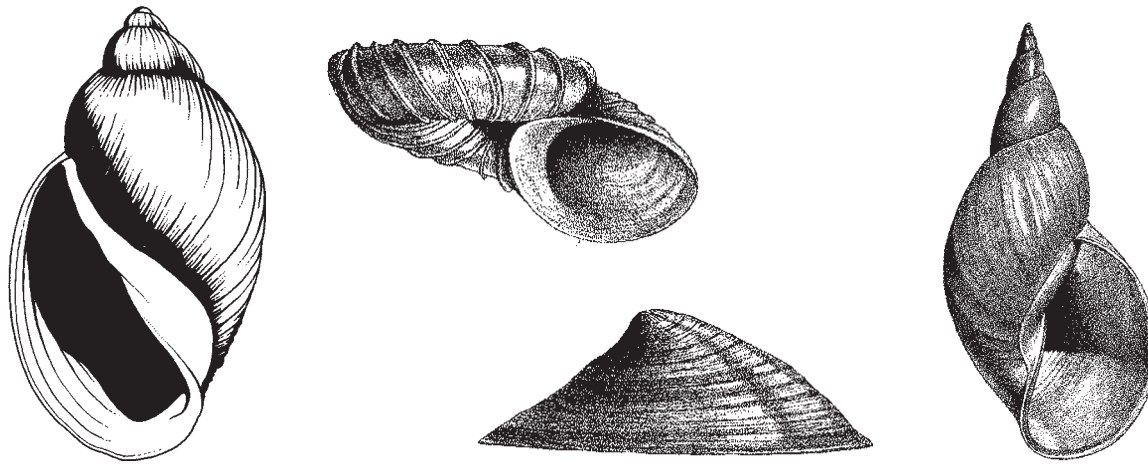
Freshwater snails

Snails have shells that come in a variety of shapes, from flattened, cone-shaped and uncoiled to elongated, multi-coiled and high-spired. Those with coiled shells may spiral to the left or to the right, depending on family.

Some freshwater snails evolved directly from marine species and still have gills like their relatives in salt water. However, most of British Columbia's freshwater snails evolved from snails that had first moved from the ocean onto land and had developed a lung to breathe air. When these snails took up life in fresh water, many maintained the need to return to the surface to breathe air.

Snails eat by grazing on organic material that accumulates on plants, rocks or soft bottom sediments. They scrape these surfaces using a unique, file-like mouthpart called a radula.

Snail reproduction involves internal fertilization. After mating they lay their eggs in jelly masses or egg capsules attached to a solid surface. Unlike their marine relatives that generally have free-swimming larvae, a freshwater snail hatches from its egg as a miniature adult and crawls away. This ensures that the juvenile snail is not swept downstream, as a swimming larva might be.



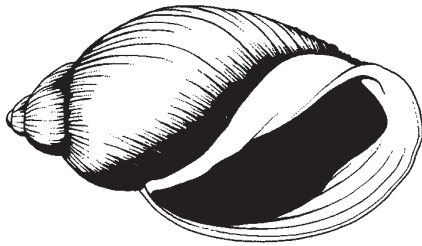
SNAIL SHELLS COME IN A WIDE VARIETY OF SHAPES

Freshwater snails at risk

Hotwater Physa

Physella wrighti (Te and Clarke)

This small, five-millimetre-long snail is the first mollusc to be recognized both



HOTWATER PHYSA *PHYSELLA WRIGHTI*

federally and provincially as an endangered species. It has been placed on British Columbia's Red List, and has been designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The only place in the world that the Hotwater Physa lives is a 34-metre reach of warm stream that forms part of the Liard River Hotsprings complex in far northern B.C. During the last ice age, the major ice sheets did not meet at this location. The climate between the ice sheets would have been inhospitable to most organisms, but the lack of ice cover and the presence of incoming hot water allowed this species to survive glaciation. It is believed to have lived at this site for at least 100 000 years.

Due to its very limited distribution and the precise (though not yet fully known) habitat requirements that restrict it to such a small area, the Hotwater Physa is at risk. The population is so localized that a single calamity could result in the loss of this species forever.

Rocky Mountain Capshell

Acroloxus coloradensis (Henderson)

Within British Columbia, this small limpet-shaped snail is found only in the



ROCKY MOUNTAIN CAPSHELL
ACROLOXUS COLORADENSIS

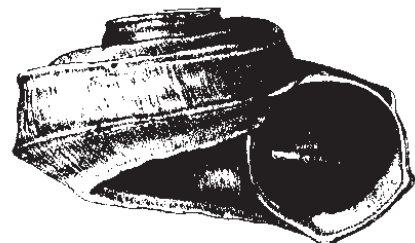
east-central region. It may have survived glaciation in high altitude lakes above the ice sheets. For years it was known from only one B.C. location – Purden Lake, east of Prince George – and was considered very rare. Recently, however,

a study of freshwater molluscs in northern B.C. found Rocky Mountain Capshells at six additional locations. This is an example of how the lack of scientific knowledge about British Columbia's freshwater molluscs can affect assessments as to which species are at risk.

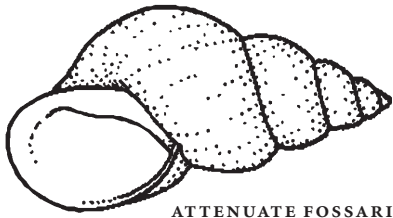
Threeridged Valvata

Valvata tricarinata (Say)

This snail is quite rare in western North America. The only record of it occurring in B.C. is from 1969, when it was collected at Kootenay Lake. This lake has since been altered by chemical contaminants from industrial activity and by the introduction of a foreign species of shrimp in an attempt to enhance the number and size of fish in the lake. Survey work is required to confirm the continued existence of this species in British Columbia.



THREERIDGED VALVATA
VALVATA TRICARINATA



ATTENUATE FOSSARIA
FOSSARIA TRUNCATULA

Attenuate Fossaria

Fossaria truncatula (Müller)

In Canada, this snail has been found only in the far northwest and far southeast of British Columbia, where it lives in water bodies with mud bottoms. This disjunct distribution pattern can be interpreted in two ways. One is that this species was eliminated by glaciation and has re-entered the province from unglaciated refugia in the far north as well as from areas to the south. The second possible interpretation is that this geographic gap indicates a knowledge gap. Such a divergence in the geographic zones in which the Attenuate Fossaria has been found suggests that it may be tolerant of a wide range of habitat conditions. If so, this snail may be present throughout the province and our minimal information on freshwater mollusc distribution provides only scattered records of its occurrence.

Freshwater Mussels

Freshwater mussels are the most endangered animal group in North America and are disappearing at the fastest rate of any known group of organisms. The unique adaptations of these animals to life in fresh water have made them extremely vulnerable to changes in their habitat.

Freshwater mussels live in both rivers and lakes. They partially burrow into the substrate and inhale and exhale water for respiration and feeding. Fine organic particles removed from the incoming water provide their nourishment.

In the ocean, marine mussels reproduce by releasing sperm and eggs into the water, where they unite and develop into swimming larvae that are carried off to settle in other suitable habitats by the complex water flow patterns. In fresh water, the unidirectional flow has resulted in unique reproductive adaptations.



SOME MOLLUSCS DEVELOP
FISH-MIMICKING TISSUE FLAPS
TO ATTRACT HOST FISH.

Freshwater mussels release sperm into the water but retain their eggs within their shells. The eggs are fertilized by sperm inhaled by the female. The fertilized eggs develop into specialized larvae called *glochidia* (singular *glochidium*) that are often equipped with sharp hooks. Some species release the glochidia onto the



MUSSEL GLOCHIDIA HAVE SHARP HOOKS
TO ATTACH TO THESE HOST FISH.

bottom. When a foraging fish touches a glochidium, it quickly clamps on to the fish. Other mussel species have evolved elaborate schemes to attract host fish, such as growing a flap of tissue that resembles a small fish. When a larger fish comes to investigate this possible prey, the female

mussel releases the glochidia, which immediately hook on to the host.

However the attachment is brought about, the fish now grows tissue around this parasitic glochidium. Inside this cyst the glochidium develops into a miniature adult, which breaks out generally after 10 to 30 days and takes up life in a new location – one that may be far upstream from its parent. It is estimated that it may take the production of 100 million glochidia to guarantee that one will reach maturity. Some mussel glochidia are generalists, able to develop on any one of a number of different fish; others are specialists and require a particular fish species to act as a host.

Freshwater mussels at risk

More than half of all North American species of freshwater mussels are considered imperilled. As aquatic habitats are degraded or become altered for other uses, the habitat for freshwater mussels is disappearing. Even where conditions allow the continued existence of the mussels themselves, if the habitat can no longer support the required fish host or if access to the fish host is eliminated by dam construction, water diversion, or alien fish species, the mussels cannot reproduce and will eventually disappear.

Six species of freshwater mussels live in British Columbia. Three of these are restricted to the far south of the province. The rarest species is the Western Ridged Mussel, *Gonidea angulata* (Lea), found only in the



WESTERN RIDGED MUSSEL
GONIDEA ANGULATA



(TOP) FRESHWATER MOLLUSCS ARE OFTEN ABUNDANT IN SHALLOW, VEGETATED PONDS. LARGE LAKES (BOTTOM) OFFER A VARIETY OF HABITATS FOR FRESHWATER MOLLUSCS. THE IMPACT OF HUMAN ACTIVITIES ON THESE HABITATS IS NOT WELL STUDIED. *Jacqueline S. Lee photo*

Okanagan and Kootenay rivers. Habitat alteration is occurring at a rapid pace in the vicinity of both these rivers.

Freshwater clams

Although freshwater clams are very common, they are the most overlooked of all freshwater molluscs. Their small shells attract little attention and, as they spend their lives buried in mud, they are not often noticed. There are at least 25 species in B.C.,

but little is known about the biology of individual species.

Adult freshwater clams range in length from 1.5 to 25 mm, but most are 3 to 4 mm long. Most are active burrowers in soft sediments. By closing their valves as they push forward, they momentarily create a water-filled space from which water is drawn in for food and respiration.

Like freshwater mussels, freshwater clams have unique adaptations to ensure their young are not swept

downstream. The eggs are retained within the shell, and sperm that have been released into the water are drawn inside. The fertilized eggs remain in the clam's shell, where they develop into miniature adults in special pouches. When they are sufficiently developed, the juveniles are exhaled out into the substrate where they can start excavating their own burrows in any direction away from their parent.

Freshwater clams at risk

Little is known about the biology of freshwater clams and their distribution in B.C. that presently, it is not possible to assess which species may be at risk.

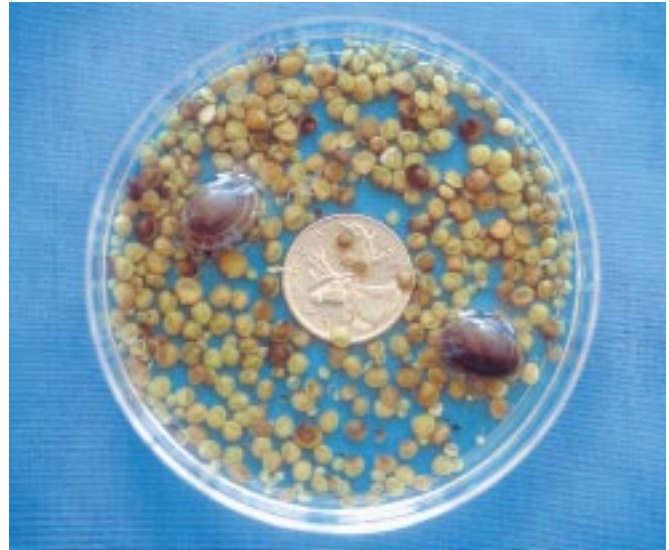
What can we do?

Initial action has been taken by both the federal and provincial governments in recognizing freshwater molluscs in their lists of priorities for research. The BC Conservation Data Centre, which currently collects and manages data on rare vertebrates and plants, is beginning to accumulate information about invertebrates. Research into the status of some seemingly rare and potentially endangered species of freshwater molluscs has been started. Preliminary findings show that apparent rarity may sometimes be due to a lack of information. This lack of information may also be masking the status of species that are rare but are currently unknown.


We need to undertake detailed inventories of freshwater mollusc species and make studies of their habitats. Historic records housed in museums across North America must be gathered and combined with new information to evaluate the current conservation status of British Columbia's freshwater molluscs.



THE FIRST FRESHWATER MOLLUSC TO BE RECOGNIZED AS AN ENDANGERED SPECIES OCCURS AT LIARD HOTSPRINGS IN NORTHERN B.C. *Jacqueline S. Lee photo*



FRESHWATER CLAMS ARE COMMON INHABITANTS OF MOST FRESHWATER HABITATS IN B.C. *Jacqueline S. Lee photo*

Public awareness is a keystone of preservation. Freshwater mollusc conservation will be supported when the vital role of invertebrates within ecosystems is more widely known and better understood. As individuals we can do our part by gaining an appreciation and understanding of all levels of life. We can seek out and examine the biodiversity that exists in even the smallest body of water. We can share our enthusiasm and voice our concerns. We can get involved in public processes that strive to preserve natural diversity and can consider the importance of even the smallest organisms and their habitats. 

FOR MORE INFORMATION ON FRESHWATER MOLLUSCS, CONTACT:

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