

# Saving Our Mussels:

## What you can do to help

### Why our mussels need our help

Ontario's freshwater mussels are in big trouble. Thirteen of our 41 species are listed as Endangered or Threatened. Most of the other species are also declining; only 13 species are considered secure in Ontario. Many of Ontario's at-risk mussels are disappearing throughout their range and are in danger of extinction. Ontario's Carolinian life zone has some of the last remaining healthy populations in the world of some of these mussel species, making this area globally important in the battle against extinction.

While we may not often encounter these underwater creatures, they have a fascinating, complex life cycle and are an important part of the ecosystem. Because they require good water quality and are sensitive to certain kinds of human activities, freshwater mussels indicate how well we are caring for our waterways and the lands that surround them. Mussels are slow growing and sedentary animals that depend upon their host fishes for the survival and dispersal of their young. Mussels have a slow rate of population growth that makes it difficult for devastated populations to recover on their own.

### What you can do to help

Identify and help protect some of the at-risk mussels living within the Carolinian Life Zone using this guide.

### Do you live near mussel habitat?

Everyone lives near mussel habitat! If you live near a stream, wetland or the lake shore, you can help improve habitat for mussels and their fish hosts right on your property. But water from large areas flows across the landscape into those streams, wetlands and lakes. So, if you have ever felt a raindrop you can help make sure the water that ends up in our lakes and waterways is safe and healthy for mussels. You can also help mussels by following best practices when you enjoy recreational activities such as boating and fishing.



Photo credit: S. Caveney

### Retain habitat for mussels

Habitat loss and degradation through activities such as channelization, dredging, drain maintenance, impoundments and dam construction are big threats to mussel species. These activities change water conditions such as temperature, nutrient levels, flow, substrate and oxygen levels. Whenever possible, retain existing stream routes and water flow patterns, and adhere to all relevant laws, regulations, permits and guidelines.

If alteration to water flow is necessary, seek appropriate guidance from your local conservation authority, Ontario Ministry of Natural Resources and Fisheries and Oceans Canada. Remember that damage or alteration to Species At Risk habitat can only be done with a permit from Ontario Ministry of Natural Resources and Fisheries and Oceans Canada and typically only under exceptional circumstances.

### *Did you know?*

There's an app for that! You can get to know our native mussels with your very own Canadian Freshwater Mussel Guide app. For more details see [www.canadamussels.ca](http://www.canadamussels.ca)

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### Retain habitat for mussels

- ✓ **Retain habitat for mussels** by maintaining natural shorelines, stream meanders, and riffles and pools. Shorelines and banks should be stable and not eroding.
- Leave aquatic vegetation in place since it helps stabilize the stream bed. Mussels require stable stream beds to burrow into and remain anchored in position. They are unable to quickly move to new areas if the substrate shifts.
- Leave a vegetated buffer strip along the water's edge. A vegetated buffer and overhanging vegetation along streams, rivers, lakes, and marshes keeps water temperatures from rising too high. Natural shorelines also maintain water quality by filtering out pollutants and reducing erosion. Buffers around drains have the added benefit of minimizing the need for drain maintenance.
- Use natural vegetation buffers and storm-water retention ponds to stabilize shorelines instead of hardening the shoreline (e.g., gabion baskets).

### Best Stewardship Practices

- ✓ If you accidentally pick up a mussel, immediately put it back in the same place in the same position. If you don't know which end was pointed up, lay it flat on its side. Mussels need to sit in a certain position in the riverbed, otherwise they will be unable to breathe, feed or move.
- ✓ Leave mussel shells where you find them. The shells of dead mussels are an important way for biologists to determine which species occur (or used to occur) in a specific area.
- ✓ Help control raccoon populations by ensuring they cannot get into your garbage or compost. Raccoons are a major predator of shallow water mussels. Garbage and compost that is left accessible to raccoons helps maintain high raccoon populations, which can significantly harm mussel populations.

### Get advice

- ✓ **Get advice** from your local conservation authority, Ontario Ministry of Natural Resources and Fisheries and Oceans Canada before starting a project near or in the water (e.g., constructing a dock, boathouse, or boat launch, creating or stabilizing a beach, removing aquatic vegetation, dredging a channel, stabilizing a shoreline). Find out about:
  - Best times of the year to do your project to avoid harm to mussels and their host fishes during spawning periods and other critical life stages.
  - What types of construction materials are non-toxic and suitable for use near water.
  - Effective and appropriate vegetation removal techniques.
  - Methods to prevent erosion and other unintended damage to mussel habitat.
  - What Species at Risk might be living in your area or be affected by your project.
  - Regulations and permitting requirements applicable to your project.
- ✓ **Contact** your local Ontario Ministry of Natural Resources office to learn more about programs that provide funding and support for community-based stewardship projects.

### *Did you know?*

Under the Ontario Endangered Species Act and the federal Species at Risk Act it is illegal to pick up any Endangered or Threatened Species at Risk without a permit. It is also illegal to collect or even possess the shells of Species at Risk mussels without a permit.

# Saving Our Mussels:

## What you can do to help

### Maintain high water quality for mussels

✓ Mussels are very sensitive to ammonia, certain pesticides, other chemicals, and siltation. Maintain high water quality for mussels by following these guidelines:

- Use fertilizers, herbicides and pesticides in ways that minimize effects on water quality. Rain water transports these chemicals into the water, impairing water quality and causing unintended harm to aquatic species. Fertilizers, especially phosphorus, can cause algae blooms. You can minimize the impacts of fertilizer use by altering the timing of application (avoiding wet periods in spring and fall), changing the type of fertilizer you use (non-phosphorous based) and modifying the rate of application (use only what is needed based on soil tests).
- If you have a septic system, make sure the tank is pumped out on a regular basis. Maintain shrubs or trees in the area between your septic system and the water. Plants help absorb some of the nutrients that pass through your septic system.
- Establish adequate manure collection and storage systems to avoid accidental spills and winter-spreading of manure. Develop and implement a Nutrient Management Plan.
- Don't dump chemicals down storm drains. In most municipalities, storm water does not go through any treatment processes before it is released into local lakes and streams.
- Take your unwanted pharmaceuticals back to pharmacies rather than throwing them in the garbage or down your drain. We do not yet know the effects these drugs have on wild animals. Long term exposure to minute quantities of pharmaceuticals may also have harmful effects on human health.
- Report spills or suspected pollution problems to appropriate authorities immediately.

- Ensure all chemical mixing and tank refilling, vehicle refueling, and vehicle maintenance is done at least 50 m away from waterbodies, well heads and septic systems to minimize the risk of spills.
  - Install effective sediment and erosion control measures before starting work on bridges, culverts, drains, and streamside trails or roads to reduce the amount of sediment released into waterbodies. Inspect these control measures regularly and make all necessary repairs if any damage occurs.
  - Water from tile drains is often loaded with fine sediments, which can clog the gills of mussels and affect their food supply by reducing the amount of sun light available for aquatic plants. Install a sediment sand trap (a strategically placed deep spot) in your drain to remove some of the fine sediment and to reduce the frequency and scale of drain clean outs.
  - Ensure that any vehicles that will be used in or near water are clean (i.e., do not have oil, grease, or other pollutants on the body) and are not leaking any fluids.
  - Keep livestock and vehicles out of streams and away from shorelines. Install alternative watering sources for livestock or a water crossing if necessary. The movement of livestock and vehicles in waterways churns up riverbeds, which damages and destroys mussel habitat, and can also accidentally trample and kill mussels.
- ✓ **Municipalities and industrial facilities:**
- Keep wastewater treatment facilities functioning up to specifications to minimize the amount of ammonia, nutrients, and chemicals released. Upgrade to better systems whenever possible
  - Review stormwater management systems for quantity and quality control and make appropriate improvements. Use settling ponds to remove sediment before releasing storm water into waterways.

# Saving Our Mussels:

## What you can do to help

### Protect fish hosts

The larvae (glochidia) of most mussel species must attach to the gills of certain fish species for several weeks to develop into juveniles. Many of the known or suspected host fish species are commonly used as baitfish.

- ✓ **Read the latest version** of the Ontario Fishery Regulations, Ontario Recreational Fishing Regulations Summary and the Bait Fish Primer to learn what can be used for live bait, where and how bait species can be caught, and where bait can be purchased and used in Ontario.
- ✓ **Be sure you can identify the fishes you are using for bait.** Learn which fish species are hosts to species at risk mussels and release those fish immediately where you caught them.
- ✓ **Consider using artificial lures** instead of baitfish to reduce impacts of recreational fishing on host fish species, which mussels need to reproduce.

Dams and impoundments change the physical, chemical, and biological environment of streams, upstream and downstream of the structure. They also block the movement of fish hosts, making it impossible for mussels to colonize suitable habitat upstream or downstream of the dam. Loss of host species prevents mussel reproduction.



Photo credit: Upper Thames River Conservation Authority

Eastern Sand Darter – host fish for Round Hickorynut – is also a Species at Risk in Ontario (Endangered).

- ✓ **Install fishways or fish ladders** that allow the host fishes of the mussels in your watershed to move freely up and downstream past barriers.
- ✓ **Manage water levels** and flows through impoundments and dams so they don't drown out mussel habitat upstream or dry out riffle areas downstream.
- ✓ **Replace perched culverts**, which create a waterfall, with level culverts if possible. Perched culverts act as a barrier to fish movement.
- ✓ **Leave vegetation, rocks, logs**, and other natural materials that provide important habitat for host fishes in waterbodies.



Photo courtesy of Steve May

### *Did you know?*

Spending time in nature is good for your health! Besides the benefits of physical activities such as hiking or swimming, nature provides mental health benefits. Get to know the natural treasures and unique species living in your area and get a boost from nature. Make sure you consider the needs of your wild neighbours wherever you enjoy the outdoors: treat habitat with care and respect.

# Saving Our Mussels:

## What you can do to help

### Learn about Aquatic Invasive Species

The invasive Zebra and Quagga mussels are among the biggest threats to all of Ontario's freshwater mussels. These introduced mussels attach to any hard surface, including the shells of native mussels. When they attach, they interfere with the mussel's feeding, growth, movement, respiration, and reproduction, eventually killing it. They also remove excessive amounts of food from the water, starving out the native mussels. Native mussels have disappeared from almost every lake and river that has become infested with these exotic species.

Invasive plants and fishes are also devastating mussel populations by taking over mussel beds and eliminating habitat. Invasive fishes compete with our mussels' host fishes for food and spawning beds, decreasing their populations or pushing them out. The Round Goby, an exotic fish, is a voracious predator of mussels.

Your local Conservation Authority or Ontario Ministry of Natural Resources Office can provide you with information on invasive species that occur in your area and what you can do to help prevent their spread. Visit the Invading Species Awareness Program website ([www.invadingspecies.com](http://www.invadingspecies.com)) for more information on invasive species.



Invasive  
Zebra  
Mussels

Photo credit: Amy Benson, U.S. Geological Survey, Bugwood.org

Please help prevent the spread of invasive species by following these guidelines:

- ✓ **Always clean all your equipment** before moving it from one waterbody to another:
  - Remove any visible vegetation from items that were in the water (e.g. boats, trailers).
  - Water in engine cooling systems, live wells, and bilges can contain aquatic insects, eggs or larvae of fishes, crayfishes, or mussels, and seeds or pieces of plants. Thoroughly flush these systems with tap water (hot if possible).
  - Dry boat and other equipment for at least 48 hours.
  - Examine boat exterior for mussels; if mussels are found or exterior is fouled by algae, either clean fouled surfaces or leave boat out of the water for at least 5 days.
- ✓ **Dispose of all unused bait** by dumping the contents of the bait bucket, including the water, on land at least 30 meters away from any waters (including storm drains). Bait can also be placed in the trash. Never release any live bait or dump bait bucket water into any waterway. The water could contain larvae, seeds, or eggs of invasive species. It is illegal to release live bait or dump the contents of a bait bucket within 30 m of any waters.
- ✓ **Never release aquatic species** into any waterbody other than the one they were harvested from.
- ✓ **If you are certain you have caught an invasive species**, immediately destroy it and report it; do not release it back into any waters.
- ✓ **Report any sightings or captured introduced species** to the Invading Species Hotline. The hotline is operated by the Ontario Federation of Anglers and Hunters in partnership with the Ontario Ministry of Natural Resources.

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### General Best Stewardship Practices

- ✓ **Learn about stewardship activities** in your area and actively participate in protecting Species at Risk. To find more information about stewardship activities in your area, contact Carolinian Canada Coalition, Ontario Ministry of Agriculture and Food, or your local conservation authority, stewardship council, or naturalist club. See last page for websites.
- ✓ **Take advantage of the Environmental Farm Plan program.** To learn more contact the Ontario Ministry of Natural Resources or the Ontario Ministry of Agriculture and Food.
- ✓ **Consider retiring sensitive lands** under the Conservation Land Tax Incentive Program (CLTIP) or the Ecological Gifts Program. To learn more contact the Ontario Ministry of Natural Resources (for CLTIP) or Environment Canada (for Ecological Gifts Program).
- ✓ **Read the Rural Landowner Stewardship Guide** and complete the worksheets. Attend a Carolinian Canada Coalition workshop to develop an action plan for your property.
- ✓ **If you have Species at Risk** on your property, you may be eligible for stewardship programs or financial incentives that support the protection and recovery of Species at Risk and their habitats. Contact the Ontario Ministry of Natural Resources for more information.
- ✓ **Report any illegal activity** related to plants and wildlife to 1-877-TIPS-MNR (847-7667). You can also call Crime Stoppers anonymously at 1-800-222-TIPS (8477).
- ✓ **Report sightings or captured introduced species** to the Invading Species Hotline at 1 - 8 0 0 - 5 6 3 - 7 7 1 1 or visit [www.invadingspecies.com](http://www.invadingspecies.com). The Hotline is operated by the Ontario Federation of Anglers and Hunters in partnership with the Ontario Ministry of Natural Resources.
- ✓ **Report sightings of Species at Risk** to the Natural Heritage Information Centre. You can use an online form to report your sightings (<http://nhic.mnr.gov.on.ca>). Photographs and specific locations or coordinates are helpful.



Photo credit: Niagara Peninsula Conservation Authority

### *Did you know?*

Restoration projects near streams and lakes benefit fish by improving water quality and providing fish habitat, but they also provide ecological services to people – improved filtration of water, protection from erosion and flooding, habitat for pollinating insects that ensure our food supply and many more!



Photo credit: Niagara Peninsula Conservation Authority

# Saving Our Mussels:

## Life Cycle of Freshwater Mussels

The life cycle of the freshwater mussel is one of the most complex and interesting in the animal world. Unlike other animals that can actively search for a mate, the sedentary mussel depends on the river current to reproduce. The process begins with the male releasing sperm and the female located downstream drawing it in through her incurrent siphon. Numbering in the hundreds to the hundreds of thousands, the fertilized eggs are transferred to two specialized brooding regions in the posterior half of the outer gills, called the marsupia, where they develop into glochidia (larvae). Once they reach this stage of development, they are released into the water column to begin the second part of their lives attached to the outer body of a host, usually the gills, fins, or scales of freshwater fishes. The necessary point of attachment varies with the mussel species. The process is further complicated because not only do the glochidia have to find a host, but it has to be one of a few specific species for the life cycle to continue.

Mussels use a variety of tactics to give their larvae a better chance of finding a suitable host. The method of attracting the host varies with the species and include allowing the fish to eat the mussel (and its larvae-laden marsupia), forming and releasing bundles of glochidia bound in mucous (conglutinates) that look like the host's typical prey, and complex lures that mimic the typical prey of the host fish. Mussels of the *Epioblasma* genus actually use their lures to capture and hold their hosts while the mussel releases its glochidia. These adaptations to attract hosts are quite amazing considering mussels don't even have eyes to see what they are mimicking. Female mussels are stimulated to release their glochidia in response to factors such as shadows, touching of the female's mantle edge, or the release of natural substances or chemicals by the host; the stimulus varies between mussel species.

If a glochidium attaches to the correct host species, it encysts into the host's tissue and undergoes a short life as a parasite, feeding on the body fluids of the host.

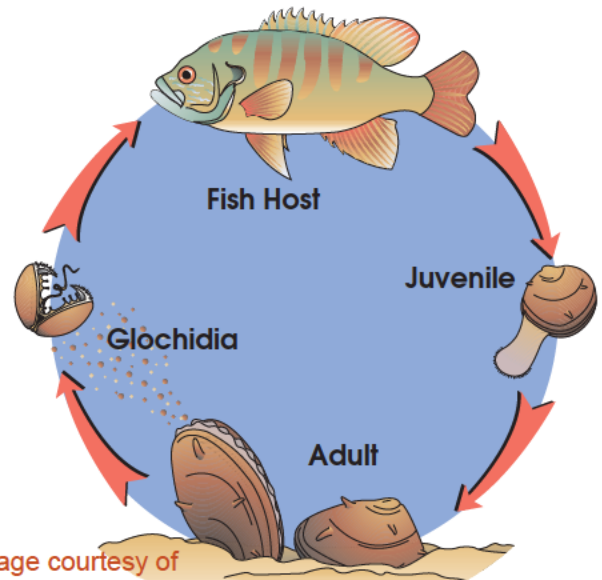


Image courtesy of  
North Carolina Wildlife Resources Commission

During this time, it transforms into a juvenile mussel, but does not grow in size. It takes six days to over six months to complete the transformation, depending on the species and other factors. The fully transformed, but still microscopic, juvenile ruptures its cyst by extending its foot and drops off the fish to burrow into the stream bottom. Unbeknownst to the fish, it has just served as a nursery and a taxi, sheltering and feeding the young mussels while transporting them into new location away from its parent.

Juvenile mussels remain completely buried in the sediment until they reach maturity. During this time, they obtain food particles directly from the substrate or from the water that moves through the tiny spaces between the substrate particles. The number of years required to reach adulthood varies by species, ranging from 2 to 12 years. Once a mussel reaches adulthood, it moves up to the top of the substrate, where it exposes at least the siphons, which they use to filter food from the water. Mussels may use their foot to create a current that moves food particles from the sediment to the body, where they are conveyed to the mouth by the gills. If the mussel is lucky enough to grow into an adult, it may live 20-100 years depending on the species.

Natural predators include muskrats, the Raccoon, mink, the North American River Otter, turtles, chironomid larvae, and some species of birds and fish.

# Saving Our Mussels:

## Mussel body parts

**Anterior:** the end of the mussel that the foot emerges from; towards the front of the mussel.

**Beak (Umbo):** a rounded, knobby protuberance near the anterior end of the hinge. This is the oldest part of the shell.

**Beak Sculpture:** ridges on the beak. The shape and thickness of these ridges are useful for distinguishing species.

**Conglutinates:** packages of glochidia encased in mucous or a cellular membrane (see life cycle). The size of the conglutinate varies with the species; some can be metres long (super conglutinates).

**Dorsal Margin:** The hinged edge of the shell, where the two halves of the shell (valves) are joined.

**Foot:** large muscular foot used for digging and anchorage.

**Glochida:** mussel larvae. Look like transparent, microscopic clams.

**Hinge teeth:** structures along the hinge line of the shell that keep the valves aligned. Used in identification of species.

**Mantle:** a fold of skin that encloses the internal organs and secretes the substance that produces the shell.

**Marsupium:** a specialized area in the gills of female mussels that is used to brood fertilized eggs. Each mussel has two, so the plural (marsupia) is usually used.

**Nacre:** inner surface of shell; only visible on remnant shells of dead animals

**Periostracum:** outer surface of the mussel's shell. Gives the mussel its colour and patterns.

**Posterior:** the end of the mussel that the siphons emerge from; towards the rear end of the mussel.

**Posterior ridge:** ridge passing over or originating near the beak/umbo and running diagonally towards the posteroventral part of the shell.

**Rays:** a solid or broken stripe on the periostracum that usually radiates from the beak/umbo.

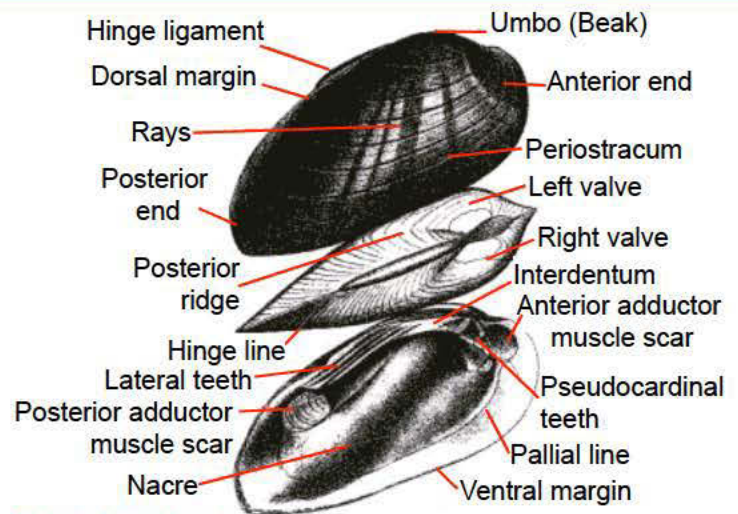


Image courtesy of  
North Carolina Wildlife Resources Commission

**Siphons:** tube-like structures used for feeding, reproduction, respiration and movement.

**Ventral margin:** the side of the shell that opens.

## Other Standard Definitions:

**Channelization:** straightening and deepening a waterbody.

**Siltation** is the accumulation of silt and/or other fine particles in the water or on river beds. High levels of fine particles in the water increases the turbidity. As the fine particles drop out of the water onto the river bed, they fill up the spaces between pebbles, rocks, logs, etc. When waterways become excessively 'silty', they lose some of their oxygen content, which affects the health of aquatic species and ultimately reduces their odds of survival. Siltation is one of the greatest causes of habitat loss for aquatic species in Canada.

**Turbidity:** a measure of the clarity of water. Particles suspended in water scatter and/or absorb light, higher concentrations of these particles cause higher levels of turbidity. Clay, silt, fine inorganic and organic matter, soluble coloured organic compounds, and microscopic organisms can cause turbidity. Typical sources include waste discharges, runoff (especially from disturbed or eroding land), algae or aquatic weeds, organic compounds produced by decaying plants, and high iron concentrations.

(EPA Guidance Manual, Turbidity Provisions, 1999).

# Saving Eastern Pondmussel:

The Eastern Pondmussel (*Ligumia nasuta*) is a medium-sized freshwater mussel that grows to a length of 7 cm. The thin, but strong, shell is long, elliptical, and compressed with a distinctive bluntly pointed posterior end.

The life cycle of Eastern Pondmussel follows the general cycle of most mussels. Spawning occurs during late summer. Males release sperm into the water and females siphon it out of the water and filter it with their gills. The eggs are fertilized and brooded over the winter in a special area of the gill (marsupium) where they develop into larvae (glochidia). Once released, the following spring, glochidia require a suitable host on which they become encysted and feed. The host species for Eastern Pondmussel has not been identified but is likely a fish since the glochidia do not have hooks. The glochidia remain on the host for several weeks until they develop into juveniles, at which time they drop off and bury in the sediment. They remain buried until sexual maturity, which is estimated to be between 6 and 12 years.

## Do you live near Eastern Pondmussel?

In Canada, the Eastern Pond Mussel only occurred in the Great Lakes region, in lakes St. Clair, Erie and Ontario and their connecting channels and tributaries. It was once one of the most common freshwater mussels in Ontario but scientists believe that it has been lost from over 90% of its historical range in Canada. Today it only remains in the delta area of Lake St. Clair (in the transition zone between wetlands and open water) and in a tributary of the St. Lawrence River. The Eastern Pondmussel prefers the sheltered areas of lakes or slow streams where bottom substrates are fine sand or mud and water depths are less than 4.5 m.

## Did you know?

Since the mid-1980s, over 90% of the area once occupied by the Eastern Pondmussel has become infested with Zebra Mussels.

## Status: Endangered

The Eastern Pondmussel is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Photo credit: S. Staton

## Field tips

- ✓ Medium to large in size (average 70 mm) with a long, elliptical, compressed shell
- ✓ Posterior ridge is well-developed, distinct and angled near the beak; posterior end is bluntly pointed
- ✓ Anterior end is rounded; ventral margin broadly curved
- ✓ Females have a swelling along the posterior ventral margin; lacking in males
- ✓ Beaks are located in the anterior quarter of the shell and are low and slightly raised above the hinge line
- ✓ Shell surface is rough with concentric wrinkles and visible lines of growth
- ✓ Juveniles are yellowish or greenish black with narrow green rays at posterior end
- ✓ Adults are dark brown or black

# Saving Fawnsfoot:

The Fawnsfoot (*Truncilla donaciformis*) is a small, oval to triangular freshwater mussel with a prominent posterior ridge. The Fawnsfoot's small size and large chevron-shaped markings make it easy to distinguish from all other Canadian freshwater mussel species. The Deertoe (*Truncilla truncata*) may also have chevron markings, but the markings are much finer. The Deertoe is up to twice as large as the Fawnsfoot and has a sharply angled posterior ridge.

The life cycle of the Fawnsfoot is believed to follow the general life cycle of most mussels. The host fish for Canadian populations have not been conclusively identified, but are probably the Freshwater Drum (*Aplodinotus grunniens*) and Sauger (*Sander canadensis*). The Fawnsfoot's method of attracting a host is unknown, but females of the closely related Deertoe will open their valves and expose the bright white, swollen marsupia (which contains the glochidia) when attacked by a fish. Freshwater Drum is known to eat mussels; the glochidia would be released into the mouth of the fish when the marsupia is eaten, and would have a chance to attach to the gills as they pass through. The Fawnsfoot likely uses the same strategy to get its larvae attached to the right host.

Although the time for a Fawnsfoot to grow to maturity is unknown, the average age of maturity for similar species is 6-12 years. Fawnsfoot live up to 20 years.

## Do you live near Fawnsfoot?

In Canada, the Fawnsfoot occurs only in southern Ontario but has disappeared from much of its former range. It is currently only found in several areas of the lower Thames River and at single sites in the St. Clair River delta. The populations are widely separated, which would prevent sperm from travelling between populations, but the probable host fish will travel long distances in a single year, enabling the glochidia to travel between populations as well as to new areas.

The Fawnsfoot is generally found in areas of moderate to low flowing water in the lower portions of medium to large rivers. It usually inhabits shallow waters (one to five metres deep) with sandy or muddy bottoms. In Ontario, it is usually found on fine sand or gravel substrates. Adults reside at the substrate surface in the summer but may burrow in the winter.

## Status: Endangered

The Fawnsfoot is protected provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ Shell is oval to rectangular in shape, smooth and moderately thick
- ✓ Prominent posterior ridge
- ✓ Posterior ridge is rounded and flattened dorsally
- ✓ Beaks are full, located near the centre of the dorsal margin, and slightly elevated above the hinge line
- ✓ Beaks have three to eight fine bars: first bar is concentric, the others are weakly double-looped
- ✓ Shell is yellow to greenish in colour with dark green V-shaped or chevron markings
- ✓ Average length of adults is 35 mm; maximum length is 45 mm

## Did you know?

The Thames River population is likely the largest remaining known population in Canada.

# Saving Hickorynut:

The Hickorynut (*Obovaria olivaria*) is one of two species of the genus *Obovaria* that occur in Canada. The other species is the Round Hickorynut (*O. subrotunda*), which is also a species at risk. This species is easily distinguished from other mussels in Canada by its medium-sized, nearly oval shell and the placement of the beak far back on the anterior edge. The closely related Round Hickorynut has a nearly round shell with beaks near the middle of the hinge line.

The life cycle of Hickorynut follows the general cycle of most mussels. After the eggs are fertilized, female Hickorynut are thought to brood their fertilized eggs in the marsupia over the winter. The host species for Hickorynut is the Lake Sturgeon (*Acipenser fulvescens*), also a species at risk in Ontario. The glochidia remain on the host for several weeks until they develop into juveniles, at which time they drop off and bury in the sediment. They remain buried until sexual maturity which is estimated to be between 6 and 12 years.

Like other freshwater mussels, Hickorynuts live partly to almost completely buried in the river bottom, with only the siphons exposed. Because of its heavy shell and rounded shape, the Hickorynut is more limited in its ability to crawl through substrates than mussels that have tapered shells and is likely more sedentary than other mussel species.

## Do you live near Hickorynut?

In Ontario, it is currently known to occur in the Ottawa River and the Mississagi River (northern Lake Huron). It may occur in other large rivers that flow into Lake Huron and Lake Superior that have Lake Sturgeon. Historically, it is known to have been in western Lake Erie, Lake St. Clair, and the Detroit and Niagara rivers. Industrial pollutants likely led to the decline of sturgeon and the disappearance of Hickorynut from the Niagara River. The invasion of Zebra and Quake mussels, combined with industrial pollutants and the decline in its host, likely caused its disappearance from the Detroit River, Lake Erie, and Lake St. Clair.

The Hickorynut lives mainly in large, deep (more than 2 m) rivers with steady, moderate to strong currents, and sandy substrates.

## Status: Endangered

The Hickorynut is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ Easily distinguished from other mussels by its almost oval shape
- ✓ Shell is thick, green to yellowish brown, becoming dark brown in old individuals
- ✓ Juveniles often have thin greenish rays on their shells
- ✓ Most individuals are less than 75 mm long; maximum length in Canada is 100 mm
- ✓ Beaks near the anterior edge of the shell, curved inward and elevated well above the hinge line

## Did you know?

Since the host species, Lake Sturgeon, are long lived, they eventually develop resistance to the Hickorynut's larvae. Many Ontario sturgeon populations are mainly made up of old fish, making it more difficult for the Hickorynut to successfully produce a new generation of adults.

Surveys for Hickorynut have to be done by SCUBA divers because they live on the river bottom.

# Saving Kidneyshell:

The Kidneyshell (*Ptychobranthus fasciolaris*) is a medium to large-sized freshwater mussel that grows up to 13 cm long in Ontario, but most individuals are less than 10 cm long.

The life cycle of the Kidneyshell is believed to follow the general cycle of most mussels. The Kidneyshell, however, has a specialized method of delivering glochidia designed to increase the likelihood of encountering a suitable host (Blackside Darter, Fantail Darter, and Johnny Darter). The glochidia are released in mucous encased packages (conglutinates) that resemble either fish fry (complete with eye spots), or benthic invertebrates such as chironomids. The host species eat fish fry and benthic insects, so these forms stimulate the feeding instincts of the host causing it to take the conglutinates into its mouth where the conglutinates rupture, releasing glochidia in close proximity to the gills. The hookless glochidia clamp onto the gills of the host and become encapsulated in a fluid filled sac where they are nourished by the host until they metamorphose and break free, settling to the substrate to begin life as free-living juveniles. They remain buried until sexual maturity, which is estimated to be between 6 and 12 years.

## Do you live near Kidneyshell?

In Canada, it is historically known only from southern Ontario, where it has been found in the Grand, Thames, Sydenham, Ausable, Welland, Niagara and Detroit rivers, as well as Lake Erie and Lake St. Clair. This species has disappeared from about 70% of its historical range in Ontario. It is now limited to the Sydenham and Ausable rivers with a few specimens in the Lake St. Clair delta.

The Kidneyshell is most often found in small to medium-sized rivers and streams, where it prefers shallow areas with clear, swift-flowing water and firmly packed sand and gravel substrates. It is rarely found in either large rivers or headwater creeks, but has been found on gravel shoals in Lake Erie and Lake St. Clair. It is usually found buried deep in the substrate and is often found near beds of American Water-willow (*Justica americana*), a threatened aquatic plant.

## Status: Endangered

The Kidneyshell is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Photo credit: S. Staton

## Field tips

- ✓ Distinguished from other mussels by its elongated, yellow to brown shell
- ✓ Wide, interrupted green rays that look like squarish spots
- ✓ Medium to large mussel with a maximum length of approximately 13 cm
- ✓ Shell is solid, heavy and compressed, and may have a humped shape in old individuals
- ✓ Anterior end is rounded and the posterior end is bluntly pointed
- ✓ Old individuals may be dark brown and rayless
- ✓ Outside of shell is unsculptured except for coarse growth rests and a roughened posterior slope
- ✓ The more common Spike (*Elliptio dilatata*) can be distinguished from old, rayless Kidneyshells by its longer shape and its heavy beak sculpture

# Saving Mapleleaf Mussel:

The Mapleleaf Mussel (*Quadrula quadrula*) is a medium to large-sized freshwater mussel that grows to length of 12cm. Its heavy shell has two bands of raised, warty bumps (nodules) radiating in a V-shape from the beak to the ventral margin. In Ontario, the only mussel that the Mapleleaf Mussel could be confused with is the Pimpleback (*Quadrula pustulosa*). The Mapleleaf Mussel's nodules are restricted to 2 bands whereas the Pimpleback's are scattered and more uniformly distributed. The Mapleleaf Mussel is square shaped; Pimpleback is rounded in outline.

The life cycle of Mapleleaf Mussel follows the general cycle of most Unionidae mussels. The Mapleleaf Mussel only broods its glochidia for a short time (late spring to early summer) before releasing them in small, white, lance-head-shaped, conglutinates. Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictus olivaris*) are known hosts for the glochidia. The conglutinate bursts and releases the glochidia when the host fish attempts to eat it. The hookless glochidia clamp onto the gills of the host where they are nourished by the host for several weeks until they metamorphose into juveniles. Then they drop off and bury in the sediment and remain there until sexual maturity, which is estimated to be between 3 and 10 years.

## Do you live near Mapleleaf Mussel?

In Canada, the Mapleleaf Mussel is restricted to the Red River drainage (Manitoba) and the Great Lakes-St. Lawrence watershed (Ontario). The Great Lakes-Western St. Lawrence population is confined to larger rivers draining into Lake St. Clair and Lake Erie including the Sydenham, Ausable, Grand and Thames rivers. Historically, it was also found in Lake Erie, Lake St. Clair, and the Niagara and Detroit rivers. Overall, this mussel has disappeared from nearly 50% of its former range in Ontario.

The Mapleleaf Mussel occurs in a variety of habitats ranging from medium to large rivers with slow to moderate current, lakes and reservoirs in mud, sand, or gravel substrates. In Ontario they are typically found in medium to large rivers in firmly packed coarse gravel and sand to firmly packed clay/mud substrate.

## Status: Threatened

The Mapleleaf Mussel is protected provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ Thick, square-shaped shell with one squared end and one rounded end
- ✓ Can reach 125 mm in length, 100 mm in height and 50 mm in width
- ✓ Raised nodules form a v-shape from the beak to the ventral margin, separated by a shallow groove
- ✓ The ventral margin has a rounded notch between the rows of nodules
- ✓ Small beak, only slightly raised above the hinge line
- ✓ Annual growth lines obvious and well defined
- ✓ Young specimens are yellowish green to light brown and older specimens are greenish brown to dark brown

## Did you know?

Mapleleaf Mussel can be long lived; specimens up to 64 years old have been found in Manitoba!

# Saving Salamander Mussel:

The Salamander Mussel (*Simpsonaias ambigua*), formerly known as Mudpuppy Mussel, is a small-sized freshwater mussel that grows to a length of 5 cm. The Salamander Mussel is the only mussel whose host is not a fish – it uses a salamander: the Mudpuppy (*Necturus maculosus*).

The life cycle of Salamander Mussel follows the general cycle of most mussels. Once released, the glochidia must attach to the external gills of the Mudpuppy where they become encysted and undergo a short life as a parasite, feeding on the Mudpuppy's body fluids. The glochidia have large, well-developed hooks with microscopic spines on the edges of their valves that penetrate the host's skin, helping it become securely attached. The glochidia remain on the host for several weeks until they develop into juveniles, at which time they drop off and bury in the sediment. They remain buried until sexual maturity which is estimated to be between 2 to 5 years.

## Do you live near Salamander Mussel?

The Salamander Mussel was historically known in 14 states and the Province of Ontario. In Canada, it was historically known from the Detroit, Sydenham and Thames rivers although it is now restricted to 4 sites within a 50 km stretch of the East Sydenham River, where it appears to be reproducing. During a 1998 survey a single fresh valve was found on the Thames River in the city of London. However, no other evidence of the species has been found in the Thames River since then, despite extensive mussel surveys.

The Salamander Mussel is found in all types of clear, freshwater habitat, including creeks, streams, rivers and lakes. It is most often found burrowed in sand or silt under large, flat rocks in shallow areas with swift current, although it can also be found in mud and on gravel bars. Habitat is dependent on areas that meet the nesting and sheltering requirements of its larval host, the Mudpuppy. When larvae have transformed into juvenile mussels they are likely released into the hiding place of the Mudpuppy, creating large clusters of up to several hundred Salamander Mussels in one area.

## Status: Endangered

The Salamander Mussel is protected federally under the Species At Risk Act, and provincially under Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ Shell is thin, fragile, oval to elliptical in shape, and considerably elongated
- ✓ Thicker at the anterior than the posterior end
- ✓ Shell is rounded at both ends while top and bottom edges are nearly parallel
- ✓ The beak (raised part at the top of the shell) is slightly swollen and sculptured with 4 to 5 double-looped ridges
- ✓ Maximum shell length is about 50 mm
- ✓ Shell is yellowish tan to dark brown with no markings

## Did you know?

Since the Salamander Mussel is only found in a short stretch of a single river, one catastrophic upstream event (e.g., a chemical spill) could wipe out the entire Ontario population.

# Saving Northern Riffleshell:

The Northern Riffleshell (*Epioblasma torulosa rangiana*) is a small to medium-sized, colourful mussel. Males and females are extremely different in appearance and size (males are smaller than females).

The life cycle of Northern Riffleshell follows the general cycle of most freshwater mussels. When the glochidia are ready to be released, the female gapes widely and displays her spongy, pure white mantle lining which is visible from several metres in clear water. This attracts the host fish, which pokes its snout into the mussel looking for a meal. Instead of a meal, it is captured by the mussel, which clamps shut on the fish's head. The female's mantle has a spongy ridge that helps prevent the fish from escaping. Once the fish stops fighting, the mussel forms a gasket around the fish's head and pumps glochidia into the fish's mouth. The glochidia pass through the mouth and clamp onto the gills. The mussel then releases the fish. Once the juveniles drop off the host and bury in sediment, it takes 3 to 5 years to reach adulthood. The Northern Riffleshell can live for 15 years or more, but is relatively short-lived for a mussel.

The Ontario host fish have not been conclusively identified.

## Do you live near Northern Riffleshell?

In Ontario, it is historically known from western Lake Erie and the Detroit River, Lake St. Clair, Sydenham River and the Ausable River. The Northern Riffleshell has suffered dramatic declines in North America over the past century and has disappeared from over 95% of its range. The Ontario range is now limited to the middle reaches of the Sydenham and Ausable Rivers. The Sydenham River population is one of only three populations in the world that are still reproducing.

The Northern Riffleshell lives mainly in highly oxygenated riffle areas of rivers. It uses substrates ranging from rocky, sandy bottoms to firmly packed sand and fine to coarse gravel. In surveys of the Sydenham River, all live mussels were found in stable substrates of coarse sand to fine gravel in shallow (generally <30 cm), flowing waters in or near riffles. This subspecies occurs in streams of various sizes, from small to large.

## Status: Endangered

The Northern Riffleshell is protected federally under the Species At Risk Act, and provincially under Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

*Strange but true!*



Photo credit: S. Staton

## Field tips

- ✓ Outside of shell is brownish yellow to yellowish green with diffuse, fine green rays
- ✓ Beaks are elevated above the hinge line and have finely double-looped sculpturing
- ✓ Males: egg-shaped; have a wide, shallow groove on the anterior side of the posterior ridge that makes a shallow dent in the male's ventral margin
- ✓ Females: oval, with one side much narrower and shorter than the other; swollen where the groove would be found on the male; ventral margin is not dented
- ✓ Mature individuals vary in length from 38 to 76 mm (males smaller than females)

# Saving Rainbow:

The Rainbow (*Villosa iris*) is a small (usually 55 mm long), flattened, elliptical freshwater mussel with a yellow or yellowish-green shell with numerous broken dark green lines that radiate from the beak (“rays”). The posterior end of the mussel is quite thin; this end is bluntly pointed in males and more broadly rounded in females. The anterior end is thicker and may not have any rays. There are no other mussels in Canada that are this size and shape with these markings.

The life cycle of the Rainbow Mussel follows the general cycle of most mussels. Females have mantle flaps that, when inflated, mimic the shape of a crayfish, complete with eye spots and leg and tail-like projections. When the glochidia are ready to be released (in the spring), the female manipulates the flaps to mimic the movement of a crawling crayfish. The glochidia are released when a fish touches the lure. Seven of the nine fish species identified as hosts in the US are found in the Ontario range, including Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*M. salmoides*), Green Sunfish (*Lepomis cyanellus*), Yellow Perch (*Perca flavescens*), Striped Shiner (*Luxilus chrysocephalus*), and 2 darters. The glochidia remain on the host for several weeks until they develop into juveniles, at which time they drop off and bury in the sediment. They remain buried for several years until they reach sexual maturity.

## Do you live near Rainbow?

In Canada, it occurs only in the Ausable, Bayfield, Maitland, Saugean, Sydenham, and Thames River watersheds and the St. Clair River delta in southwestern Ontario and in the Moira, Salmon, and lower Trent River watersheds in eastern Ontario. The Maitland River supports the largest remaining Ontario population. Overall, this mussel no longer exists in roughly 30% of its historical Canadian range.

The Rainbow is most abundant in shallow (<1 m deep), clear, well-oxygenated areas of small- to medium-sized rivers on beds of cobble, gravel, sand and occasionally mud. It is usually found in moderate to strong currents in riffle areas and along the edges of patches of emergent vegetation.

## Status: Threatened

The Rainbow is protected provincially under Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Gary Peeples,  
US Fish and Wildlife Service, Bugwood.org

UGA125103

## Field tips

- ✓ Flattened, long and elliptical in shape, becomes very thin at posterior end
- ✓ Average adult length 55 mm; maximum length roughly 85 mm
- ✓ Low, rounded ridge on posterior end;
- ✓ Low, compressed beaks with four to six distinct ridges
- ✓ Yellow, yellowish green or brown shell with many broken, dark green rays of differing widths
- ✓ Rays may be absent on anterior end and may be indistinct on old, brown mussels

## Did you know?

The Rainbow Mussel gets its common name from the iridescent inner surface (nacre) of its shell.

# Saving Rayed Bean:

The Rayed Bean (*Villosa fabalis*) is a very small mussel that only reaches 45 mm in length (rarely over 38 mm long), making it one of the smallest unionid mussels in Canada. Its elliptical shell is light or dark green and crowded with obvious, wavy, dark green rays. Females tend to be shorter and more inflated with a broader, more rounded posterior end (i.e., more egg shaped) than males. The beaks are slightly higher than the hinge line and have double-looped ridges. Juvenile and adult Rayed Beans are often anchored to a stone or other object by protein fibres called “byssal threads”. These threads can be over 10 cm long.

The life cycle of the Rayed Bean is believed to follow the general cycle of most mussels. When the glochidia are ready to be released, the female gapes and exposes her bright white, swollen marsupia to attract fish hosts. It is unknown if Rayed Bean supplements this display with a lure. The suspected host fishes in Canada are the Greenside Darter (*Etheostoma blennioides*), Mottled Sculpin (*Cottus bairdi*), Rainbow Darter (*Etheostoma caeruleum*) and Largemouth Bass (*Micropterus salmoides*). The glochidia remain on the host for several days until they develop into juveniles, at which time they drop off and bury in the sediment. Unlike other species, adult Rayed Beans usually remain deeply buried in the sediment. Rayed Bean only lives up to 11 years. The Rayed Bean is globally rare, and is endangered in the US as well as Canada.

## Do you live near Rayed Bean?

Historically, the Rayed Bean occurred in at least 115 streams, canals and lakes in 11 States and the province of Ontario. It has disappeared from over 73% of its range and is now only found in 31 places in North America. In Ontario, it is now only found in a 61 km stretch of the Sydenham River and a 7 km stretch of the North Thames River.

The Rayed Bean occurs in or near riffle areas of the headwaters and smaller tributaries of river systems with clear, steady flows. It is found deeply buried in sand or gravel, often among the roots of aquatic plants, which makes it difficult to find. It never occurs in areas with silt bottoms. It is occasionally reported from shallow water areas of lakes and large rivers.

## Status: Endangered

The Rayed Bean is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Photo credit: S. Stator

## Field tips

- ✓ Very small (<45 mm long) and almost elliptical in shape
- ✓ Females tend to be thicker and more broadly rounded posteriorly than males
- ✓ Outside of shell is normally light or dark green with crowded, wavy, darker green rays
- ✓ Narrow beak (raised part at the top of the shell), slightly elevated above the hinge line with five crowded double-looped ridges

## Did you know?

Rayed Beans are the only mussels known to use “byssal threads”, fibres made of protein, to attach to substrate. The threads are between 1 and 10 cm long. Byssal threads are seen more often in the Sydenham River than anywhere else.

# Saving Round Hickorynut:

The Round Hickorynut (*Obovaria subrotunda*) is a freshwater mussel that grows to a maximum length of about 60 mm in Canada. It is easily distinguished from other Canadian mussel species by its almost perfectly round shape with prominent, centrally located beaks. It has prominent growth rings but is otherwise smooth. The shell is solid dark brown (growth rings may look dark), often with a band of lighter coloration along the posterior slope. Very young individuals may have darker rays. Females are much smaller than males. The Pimpleback (*Quadrula pustulosa*) can look similar but it has a bright golden yellow shell and usually, but not always, has knobby bumps on its shell.

The life cycle of Round Hickorynut follows the general cycle of most mussels. Spawning occurs during late summer. The eggs are fertilized in the marsupium where they are brooded until the following summer (July or August in Canada). The host fish for Canadian populations have not been conclusively identified, but are probably the Greenside Darter (*Etheostoma blennioides*) and the Eastern Sand Darter (*Ammocrypta pellucida*), an Endangered species in Ontario. The Round Hickorynut's method of attracting a host is unknown, but it does not appear to use an active lure.

## Do you live near Round Hickorynut?

Round Hickorynut has been lost from approximately 90% of its former range in Canada. Most populations in the United States are also in decline. It is still found in the Sydenham River, but its populations have dropped dramatically and it may not be reproducing there. The only large population left in Canada is in the shallow areas of the Lake St. Clair delta near Walpole Island, but this population is also threatened by Zebra Mussels.

The Round Hickorynut lives mainly in medium-sized to large rivers but is also found in shallow lake delta regions. It prefers rivers with steady, moderate flows, and sand and gravel bottoms at depths of up to 2 m. However, in Ontario and southeastern Michigan it has mainly been found in murky, low-gradient rivers with clay/sand or clay/gravel substrates. In Lake St. Clair, it currently occupies shallow (<1 m) nearshore areas with firm, sandy substrates.

## Status: Endangered

The Round Hickorynut is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ Easily distinguished from other mussels by its almost perfectly round shape
- ✓ Shell is thick, and dark brown with a band of lighter colouration along the posterior-dorsal surface
- ✓ Maximum length in Canada approximately 60 mm
- ✓ Centrally located beak curved inward and elevated well above the hinge line

## Did you know?

The introduction and spread of the Zebra Mussel resulted in the loss of the Round Hickorynut from most of its former range in the Great Lakes, and has put the population in the Lake St. Clair delta at risk.

# Saving Round Pigtoe:

The Round Pigtoe (*Pleurobema sintoxia*) is a thick shelled mussel with a rounded anterior end and a squared off or bluntly pointed posterior end. The dorsal margin (hinge line) is nearly straight and the ventral margin (the side that opens) is gently curved. Juveniles have a smooth greenish-brown, light brown or reddish-brown shell with distinct green rays. The rays fade as the mussel ages. Adults are chestnut or dark brown, sometimes almost black. The shell is rough with concentric growth lines. The appearance of the Round Pigtoe varies with its habitat. The river form of the Round Pigtoe is compressed, flattened, and usually somewhat rectangular, but can also be oval or elongated. Its beak is compressed, slightly thicker than the rest of the shell, projects only slightly above the ridge line and has a few coarse, irregular, upwards curving ridges. It is a medium- to large-sized mussel with a maximum length of 120 mm. The similar looking Wabash Pigtoe (*Fusconia flava*) has a lower, more centrally located beak, and a deeper furrow extending from the beak to the edge of the shell, but it is difficult to distinguish between these species based on outer appearance. Pregnant female Wabash Pigtoe have orangish glochidial packets; Round Pigtoes have white packets. The Great Lakes form of the Round Pigtoe is smaller (rarely over 75 mm long) and more inflated, with a full, thick beak that projects forward well beyond the hinge line. This form is similar to the Hickorynut, but is duller, flatter, and less likely to have coloured rays.

The life cycle of Round Pigtoe follows the general cycle of most mussels. Spawning occurs from May to late July. The Round Pigtoe only broods its glochidia for a short time (up to 3 months) before releasing them. Its method of attracting a host is unknown, but its white glochidial packets may resemble the invertebrates that the fish hosts would eat. Fish hosts include Spottfin Shiner (*Cyprinella spiloptera*), Northern Redbelly Dace (*Phoxinus eos*), Bluntnose Minnow (*Pimephales notatus*) and Bluegill (*Lepomis macrochirus*). The lifespan is unknown, but other closely related mussels live over 30 years.

## Status: Endangered

The Round Pigtoe is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.

## Field tips

- ✓ A medium to large freshwater mussel, up to 120 mm long in rivers, almost always less than 75 mm long in the Great Lakes;
- ✓ Somewhat rectangular in shape but may vary with habitat type;
- ✓ River form has compressed and slightly elevated beak, extending slightly beyond the hinge line;
- ✓ Lake form inflated, with full beaks that extend well beyond the hinge line.
- ✓ Shell is relatively thick and solid with a roughened surface and concentric growth lines;
- ✓ Juveniles tan with green rays, darkening to plain, deep reddish brown or black with age

## Do you live near Round Pigtoe?

The Round Pigtoe has disappeared from over 54% of its Canadian range. The healthiest population is in the Sydenham River, where it is rare but still reproducing. Small populations that are not reproducing are still found in the Thames and Grand rivers, and the Lake St. Clair delta.

In small rivers, this species can be found in or downstream of riffle areas of moderate flow on substrates of gravel, cobble and boulder. In larger rivers, it is usually found in mud, sand and gravel, in areas over 3 m deep but it sometimes lives on shallow sand or gravel bars. In Lake St. Clair, it is found in shallow (<1m deep) areas with a firm sandy bottom.

## Did you know?

Muskrats are much less likely to eat Round Pigtoe than other mussels because the Round Pigtoe's heavy shell is difficult to open.

# Saving Snuffbox:

The Snuffbox (*Epioblasma triquetra*) has a solid, thick shell with a high and sharply-angled ridge. The Deertoe (*Truncilla truncate*) usually has v-shaped zigzag markings. The Elktoe (*Alasmidonta marginata*) is much larger (up to 100 mm long) and thin shelled with broad green rays and dark green dots.

The life cycle of Snuffbox follows the general cycle of most mussels. Logperch (*Percina caprodes*) and Blackside Darter (*P. maculata*) are known host species in Ontario but other hosts may also exist. In May or June, when the glochidia are ready to be released, the female gapes just enough to accommodate a small fish's snout. Logperch turns over stones and mussels to find food and is likely to stick its snout into the open mussel. When it does, the mussel clamps onto the fish, uses its mantle to form a gasket around the fish's head, pumps the glochidia into the fish's mouth, then lets the fish go. The Snuffbox has sharp points on the edges of its shell that help prevent the fish from escaping until it is released. The Logperch's long, reinforced snout enables it to survive the mussel's grip. Weaker skulled fish are often fatally crushed, but the glochidia may become attached to the gills of fish that approach to investigate the trapped fish's thrashing. The glochidia remain on the host for 3 to 6 weeks, depending on water temperature, then they drop off and bury in the sediment, where they remain for several years until they become adults.

## Do you live near Snuffbox?

Snuffbox has disappeared from 60% of the rivers and streams in North America that it used to occur in. The remaining populations throughout its range are small and geographically isolated. In Canada, the Snuffbox is now restricted to a 50 km stretch of the East Sydenham River and to an unknown portion of the Ausable River.

Snuffbox is typically found deeply buried in clean, clear, swift-flowing riffle/run areas in small- to medium-sized streams and rivers with coarse, silt-free substrates consisting of combinations of sand, gravel, stone, cobble and boulder. The Snuffbox is usually found entirely buried in the substrate, or with only the posterior slope exposed. As it usually burrows into the substrate, it may be particularly sensitive to siltation.

## Status: Endangered

The Snuffbox is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Photo credit: S. Staton

## Field tips

- ✓ Shell is solid and thick, top and bottom edges are nearly parallel
- ✓ Males are triangular-shaped and up to 70 mm long with a slightly curved ventral margin (the side that opens)
- ✓ Females are smaller (up to 60 mm long) and much more inflated than males, have a straight ventral margin and a longer, more pointed posterior end
- ✓ Swollen and sculptured beak (the raised part at the top of the shell) with three or four faint double-looped ridges
- ✓ Shell is smooth, yellowish to yellow green and with numerous dark green rays that may resemble dripping paint.

You can watch videos of Snuffbox & Northern Riffleshell catching fish!  
[www.unionid.missouristate.edu/gallery/epioblasma/](http://www.unionid.missouristate.edu/gallery/epioblasma/)

# Saving Wavy-rayed Lampmussel:

The Wavy-rayed Lampmussel (*Lampsilis fasciola*) can be easily identified by its yellow or yellowish-green rounded shell with numerous thin wavy green rays. Females are more inflated at their wide (posterior) end and are more oval than males, which tend to be somewhat square shaped. The more common Pocketbook (*Lampsilis ovata*) is larger and thicker with a more typical oval shape and has straight rays with few interruptions.

The life cycle of Wavy-rayed Lampmussel follows the general cycle of most mussels. Spawning occurs in August. When the glochidia are ready to be released the following summer, the female uses her colourful mantle flaps to trick a potential host fish into striking her. The colour and shape of the lure is highly variable even in the same river, but it usually resembles a small wriggling fish complete with eye spots and fins. When a fish strikes the lure, the impact causes the water tubes in the mussels's gills to rupture and spew the glochidia in the fish's face. Since the lure usually resembles a minnow, the host species are probably larger predatory fish. Smallmouth Bass (*Micropterus dolomieu*) and Largemouth Bass (*M. salmoides*) are the most likely hosts in Canada.

## Do you live near Wavy-rayed Lampmussel?

In Ontario, this species was historically found in western Lake Erie, Lake St. Clair (delta area) and the Maitland, Sydenham, Thames, Detroit, Ausable and Grand rivers. It currently only occurs in the Thames, Sydenham and Ausable rivers, but populations are disappearing or have been lost due to siltation and pollution. There is also some evidence that its most probable fish host, the Smallmouth Bass, is declining in some rivers systems due to overfishing.

The Wavy-rayed Lampmussel is most often found in small to medium sized streams, where the water flow is steady. It is typically found in gravel or sand substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. Since it usually burrows into the substrate and needs good visibility for the female's lure to work effectively, it may be particularly sensitive to siltation.

## Status: Endangered/Threatened

The Wavy-rayed Lampmussel is protected federally under the Species At Risk Act, and provincially under the Ontario Endangered Species Act (ESA), 2007. It is illegal to kill, harm or collect the species, or to destroy its habitat in Ontario. Additional protection is afforded through the federal Fisheries Act.



Photo credit: S. Staton

## Field tips

- ✓ Easily distinguished from other mussels by its yellow or yellow-green shell covered with numerous thin, wavy green rays
- ✓ Rays may be distinctly separate or may blend into wide rays, but are always wavy with multiple interruptions
- ✓ Males have a 4-sided (squared) oval in shape; females are rounded ovals
- ✓ Shells are usually less than 75 mm long but may reach 100 mm
- ✓ Shell is heavy and strong, moderately inflated, and smooth (except for concentric wrinkles and growth rests) with indistinct posterior ridge

## Did you know?

Copper is toxic to Wavy-rayed Lampmussel glochidia, making this species especially sensitive to copper pollution.

# Saving Our Mussels:

## Good sources of information

### **Carolinian Canada Coalition:**

[www.caroliniancanada.ca](http://www.caroliniancanada.ca)

### **Ontario Ministry of Natural Resources:**

Includes information about Ontario Species at Risk

[www.mnr.gov.on.ca/en/](http://www.mnr.gov.on.ca/en/)

### **Ministry of Agriculture and Food**

<http://www.omafra.gov.on.ca>

### **Natural Heritage Information Centre**

<http://nhic.mnr.gov.on.ca/>

### **Find your local Conservation Authority Office:**

[www.conservationontario.ca](http://www.conservationontario.ca)

### **Government of Canada Species at Risk Public Registry:**

[www.sararegistry.gc.ca](http://www.sararegistry.gc.ca)

### **Find your local Stewardship Council:**

[www.ontariostewardship.org](http://www.ontariostewardship.org)

### **Ontario Soil and Crop Improvement Association**

Includes information about the Environmental Farm Plan

[ontariosoilcrop.org](http://ontariosoilcrop.org)

### **Invading Species Hotline**

[www.invadingspecies.com](http://www.invadingspecies.com)

### **Fisheries and Oceans Canada, Aquatic Species at Risk:**

<http://www.dfo-mpo.gc.ca/species-especes/index-eng.htm>

### **Conservation Ontario Aquatic Species at Risk**

Distribution maps for Aquatic Species at Risk by Conservation Authority areas.

<http://www.conservation-ontario.on.ca/projects/DFO.html>

### **Rural Landowner Stewardship Guide**

<http://www.stewardshipmanual.ca/>

### **Bait Fish Primer**

<http://www.dfo-mpo.gc.ca/regions/central/pub/baitfish-appat-on/index-eng.htm>



## *Did you know?*

Carolinian Canada is a natural treasure – a biodiversity hotspot for the nation. Thousands of people are taking action here, at home and work, to slow the loss of biodiversity, a global threat to the planet's health. You can join us! Visit [www.carolinian.org](http://www.carolinian.org) and let us know the great actions you are taking for biodiversity.



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Habitat Stewardship Program for Species At Risk

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