

# FRESHWATER MUSSELS OF MAINE



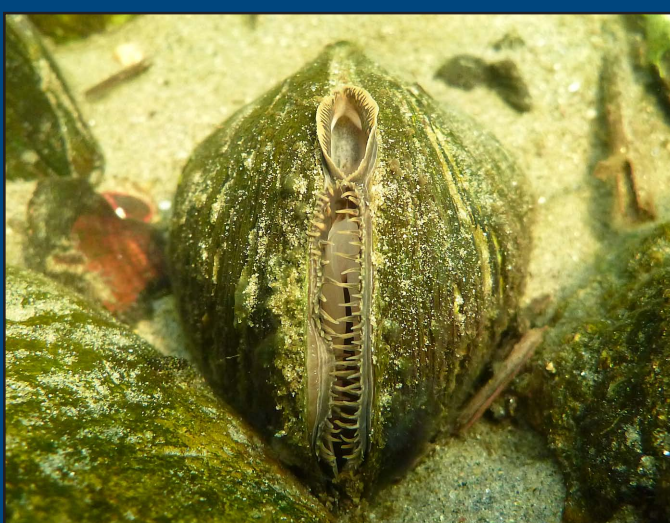
**TIDEWATER MUCKET** State Threatened



**YELLOW LAMPMUSSEL** State Threatened



**CREEPER**



**ALEWIFE FLOATER**



**EASTERN ELLIPTIO**



*Tidewater Mucket*  
**THREATENED**



*Creeper*



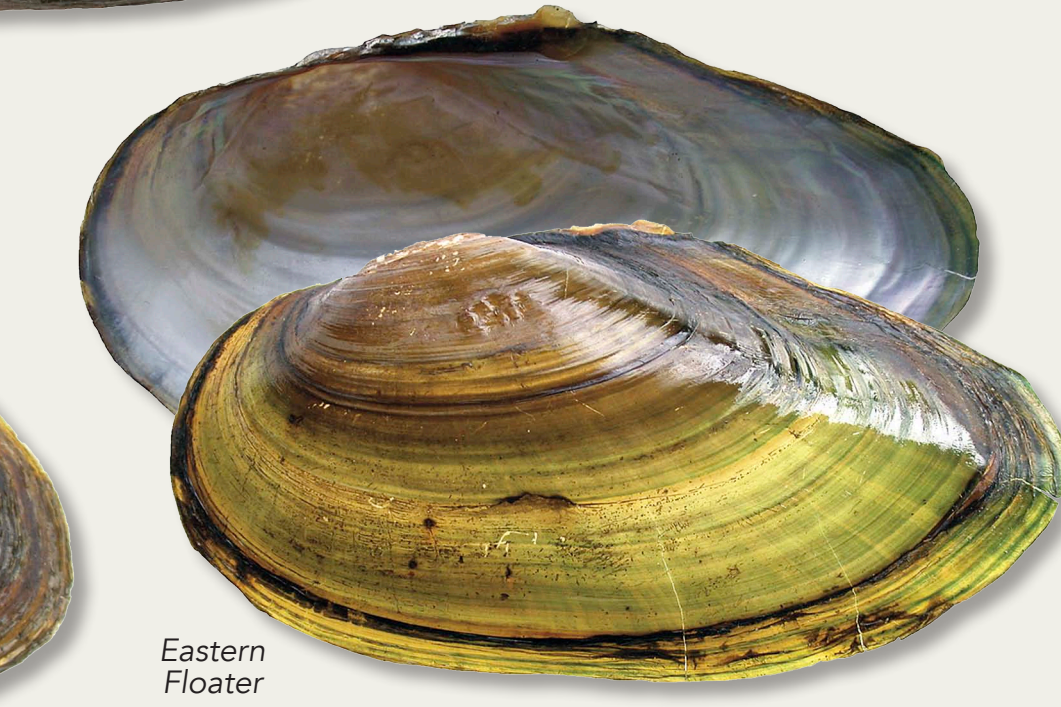
*Alewife Floater*



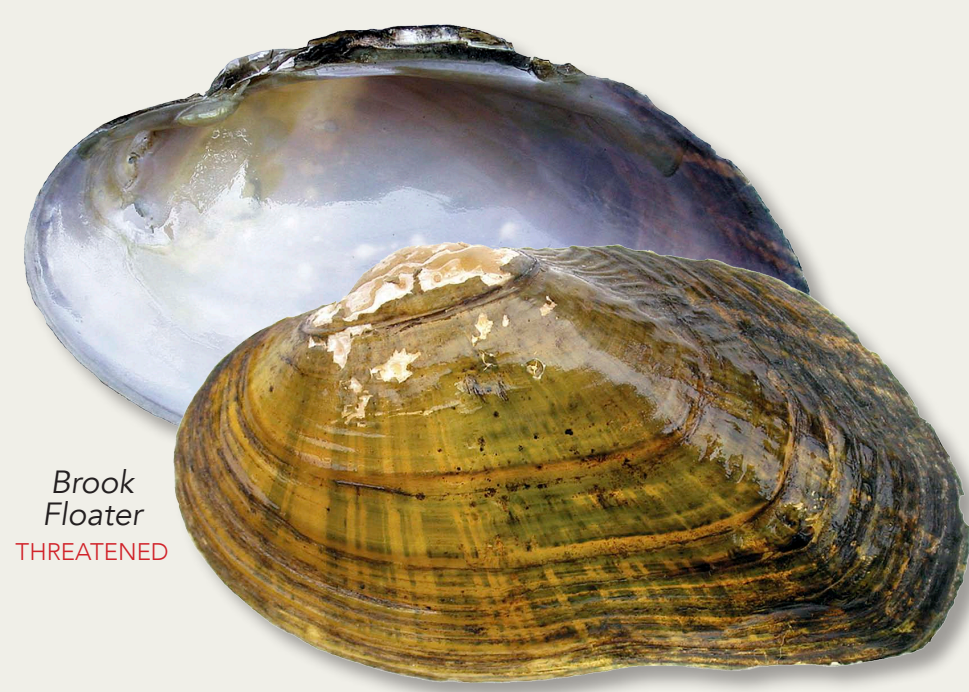
*Eastern Elliptio*



*Yellow Lampmussel*  
**THREATENED**



*Eastern Floater*



*Brook Floater*  
**THREATENED**



*Triangle Floater*



*Eastern Pearlshell*



*Eastern Lampmussel*



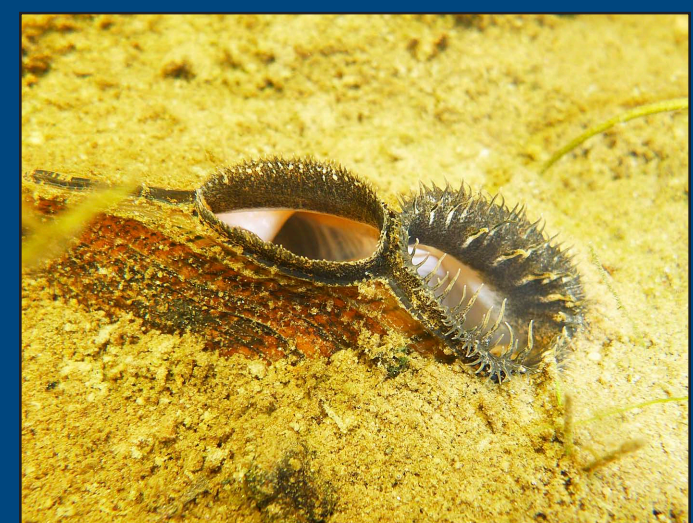
**BROOK FLOATER** State Threatened



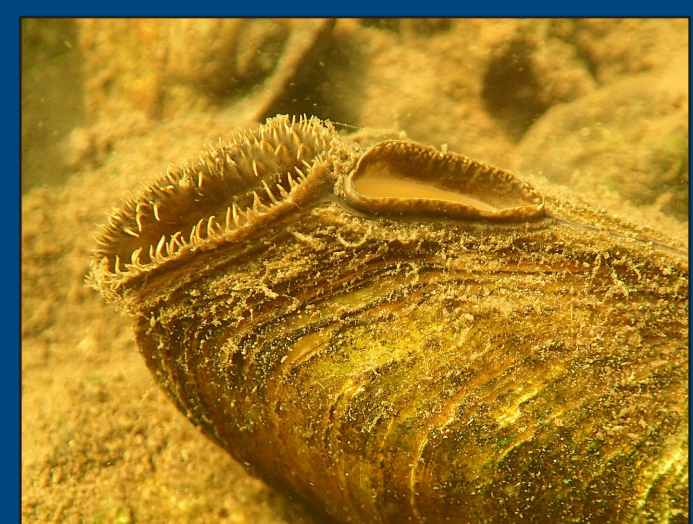
**TRIANGLE FLOATER**



**EASTERN PEARLSHELL**



**EASTERN LAMPMUSSEL**



**EASTERN FLOATER**





## FRESHWATER MUSSELS!?

Did you know Maine is home to ten species of freshwater mussels? They occur throughout the state, from small upland streams to large tidal rivers, and in lakes of all sizes. Their shells display an array of colors, from muted yellows, greens, and browns on the outside to iridescent silver, blues, and pinks on the inside. Have you noticed them? Maybe you've seen piles of empty shells discarded by a foraging otter, or a maze of narrow trails left behind by roving mussels in shallow water? While often hidden to us, freshwater mussels are vitally important to the ecology of our lakes and rivers. As filter-feeders, they remove algae, bacteria, and other particles from the water, which helps keep the water clean and cycles nutrients. Like earthworms in your garden, their movements enhance aquatic substrates to the benefit of all bottom-dwelling organisms. Although not very palatable to humans, they are an important food for wildlife such as otters, raccoons, and muskrats. Because freshwater mussels live a long time (10 to more than 100 years!), spend most of their lives in one spot, and are sensitive to changes in their environment, they also are one of the most valuable indicators of the health of our freshwater ecosystems.

## STATUS AND THREATS

Freshwater mussels are one of the most endangered groups of animals in North America. Nearly three-quarters of the continent's 297 native species are imperiled, and 35 species have gone extinct since the early 1900s. Of the ten species found in Maine, three are listed as Threatened under the Maine Endangered Species Act. Because mussels are among the most sensitive freshwater animals, they are especially vulnerable to changes in their habitat. Impacts to water quality, flow regimes, water levels, and fish hosts can adversely affect mussel populations. Specific threats to freshwater mussels and their habitat include:

- water pollution
- loss of forested buffers to agriculture, forestry, and development
- dams and other water control structures that alter habitat and block fish passage
- sedimentation caused by adjacent land use practices
- dredging and channelization
- water withdrawal for irrigation and energy production
- introduction and spread of exotic, invasive aquatic species
- effects of climate change (floods, droughts, warmer water)

## PROTECTION AND RESTORATION

Maine harbors some of the best remaining populations of the region's rarest mussel species. This should come as no surprise considering Maine's exceptional freshwater resources! Protecting these resources is a priority for MDIFW. Conservation actions that MDIFW and its many state, federal and private conservation partners use to benefit mussels and their habitat include:

- inventory, map, monitor, and research mussel populations to inform conservation needs and strategies
- review proposed land and water use projects to identify and minimize adverse effects
- identify and regulate sources of water pollution
- recover and relocate species when impacts can't be avoided
- protect and restore forested upland buffers to maintain and improve water quality
- remove dams and other barriers to restore habitat and connectivity within watersheds
- monitor, prevent and manage the introduction and spread of invasive species
- raise public awareness and support for conservation of freshwater mussels and aquatic ecosystems

**Triangle Floater (*Alasmidonta undulata*)**  
**State Status:** Secure  
**Range:** Statewide; uncommon in northern and northwestern Maine  
**Description:** Small (<3 inch), triangular to ovate, with prominent beaks. Shell yellowish or greenish-brown to nearly black, with prominent green rays on light-colored animals. Pseudocardinal teeth stout and lateral teeth absent. Nacre distinctly bicolored: bluish-pink posteriorly and white anteriorly.  
**Habitat and Biology:** Primarily rivers and streams of all sizes, but occasionally natural lakes. It is the only *Alasmidonta* species that can tolerate standing water (i.e., lakes and ponds). Numerous fish hosts have been identified, including native shiners, dace, suckers, perch, and sunfish.

**Brook Floater (*Alasmidonta varicosa*)**  
**State Status:** Threatened  
**Range:** Kennebec and Penobscot River watersheds, several Midcoast and Downeast rivers, and one coastal river in southern Maine  
**Description:** Small (<3.5 inch), trapezoidal to elliptical, often with indented ventral margin. Shell yellow-green to brown-black, with rays and distinct ridges on dorso-posterior slope. Pseudocardinal teeth knob-like and lateral teeth absent. Cantaloupe-colored foot.  
**Habitat and Biology:** Streams and rivers with high water quality and stable channels, especially in less disturbed watersheds. Fish hosts include native dace, shiners, pumpkinseed sunfish, and slimy sculpin. Maine has the best remaining populations of this regionally rare species.

**Tidewater Mucket (*Atlanticoncha ochracea*)**  
**State Status:** Threatened  
**Range:** Penobscot, St. George, and lower Kennebec River watersheds, including Merrymeeting Bay  
**Description:** Medium-sized (<4 inch), ovate, with thin but strong shell. Shell yellow or greenish-brown, with bronze or reddish hue and numerous green rays, especially on young individuals. Nacre pink or salmon-colored. Hinge teeth delicate. Sometimes confused with yellow lampmussel. Genus recently changed from *Leptodea*.  
**Habitat and Biology:** Lakes, ponds, and rivers, including freshwater tidal habitats. Fish hosts include white perch, banded killifish, and possibly striped bass.

**Eastern Elliptio (*Elliptio complanata*)**  
**State Status:** Secure  
**Range:** Statewide  
**Description:** Medium to large (<5.5 inch), trapezoidal to elliptical. Shell yellowish-brown to dark brown or black, with rays on light-colored animals. Hinge teeth well-developed. Nacre purplish, rose-colored, or white.  
**Habitat and Biology:** Lakes, ponds, rivers, and streams of all sizes. Tolerates poor water quality and marginal habitats. Maine's most abundant mussel in freshwater ecosystems, serving a vital role in filtering, nutrient cycling, and as food for other animals. Fish hosts include a variety of species such as yellow perch, American eel, alewife, smallmouth bass, and sunfish.

**Yellow Lampmussel (*Lampsilis cariosa*)**  
**State Status:** Threatened  
**Range:** Penobscot, St. George, and lower Kennebec River watersheds  
**Description:** Medium to large (<5 inch), ovate, with thick strong shell. Shell bright yellow, often with green rays. Older animals may be darkly stained. Hinge teeth well-developed. Nacre white or bluish-white.  
**Habitat and Biology:** Large rivers and lakes, but occasionally small rivers. Fish hosts include bass, white perch, and yellow perch. Spawning females attract potential hosts with a brightly pigmented mantle margin and flap that has an eyespot and resembles a small minnow. Lifespan may exceed 30 years.

**Eastern Lampmussel (*Lampsilis radiata*)**  
**State Status:** Secure  
**Range:** Primarily lower Androscoggin, Kennebec, and Penobscot River watersheds; uncommon in some smaller Midcoast and Downeast watersheds  
**Description:** Medium-sized (<5 inch), elliptical to ovate, with strong shell. Shell yellowish-green in young individuals and brownish-green to black in adults, with green rays usually obvious. Nacre bluish-white or pink. Hinge teeth well-developed.  
**Habitat and Biology:** Lakes, ponds, rivers, and streams. Fish hosts include bass, perch, sunfish, and others. Spawning females attract potential hosts with a showy mantle margin and flap that resembles a small minnow. Glochidia are released in packets that mimic fish prey.

**Eastern Pearlshell (*Margaritifera margaritifera*)**  
**State Status:** Secure  
**Range:** Statewide; uncommon in northwestern Maine  
**Description:** Large (<6 inch), elongate, with ventral margin often indented on adults. Shell light brown in younger individuals and dark brown or black in adults. Nacre white or bluish-white with faint pits centrally. Pseudocardinal teeth prominent and lateral teeth absent. Mantle apertures dark.  
**Habitat and Biology:** Clean coldwater streams and rivers, especially in undisturbed forested watersheds. Relies on salmonids as host, including native brook trout and Atlantic salmon. Females can produce millions of glochidia annually. May live 100 years or more.

**Eastern Floater (*Pyganodon cataraeta*)**  
**State Status:** Secure  
**Range:** Statewide  
**Description:** Large (<6.5 inch), elongate to ovate, with thin fragile shell. Shell color variable: typically green but also yellow or brown, occasionally with faint green rays. Hinge teeth absent. Nacre silvery-white or bluish.  
**Habitat and Biology:** Primarily lakes and ponds but also streams and rivers. Can inhabit challenging environments such as bog ponds, swamps, manmade ponds, and deep lakes, in areas of silt, mud, dense vegetation, and low dissolved oxygen. Fish hosts likely include sunfish, bass, and perch. Their thin shells make them easy prey for muskrats, otters, and raccoons.

**Creepers (*Strophitus undulatus*)**  
**State Status:** Uncommon  
**Range:** Mostly Androscoggin, Kennebec, and Penobscot River watersheds  
**Description:** Small (<3.5 inch), trapezoidal to elliptical, with thin fragile shell. Shell greenish-brown to nearly black, with rays on light-colored animals. Pseudocardinal teeth barely evident and lateral teeth absent. Nacre bluish-white, and dull yellow or green toward beak cavity. Foot often pale beige or orange. Live individuals difficult to distinguish from several other native species.  
**Habitat and Biology:** Rivers and streams of all sizes, never in lakes or ponds. Many fish hosts have been identified, including shiners, dace, suckers, perch, bass, sunfish, bullhead, and salmon.

**Alewife Floater (*Utterbackiana implicata*)**  
**State Status:** Secure  
**Range:** Coastal watersheds, especially Midcoast to Downeast  
**Description:** Large (<6.5 inch), trapezoidal or elliptical, with thin shell that is conspicuously thicker toward anterior ventral margin. Shell color variable: yellow, green, brown, or black. Hinge teeth absent. Nacre white or pinkish. Genus recently changed from *Anodonta*.  
**Habitat and Biology:** Lakes, ponds, rivers, and streams throughout coastal areas. Distribution closely tied to dispersal constraints of hosts, which include alewife and American shad. Benefits from efforts to restore migratory fish species, such as installation of fish ladders and dam removal.

## UNWANTED EXOTIC BIVALVES

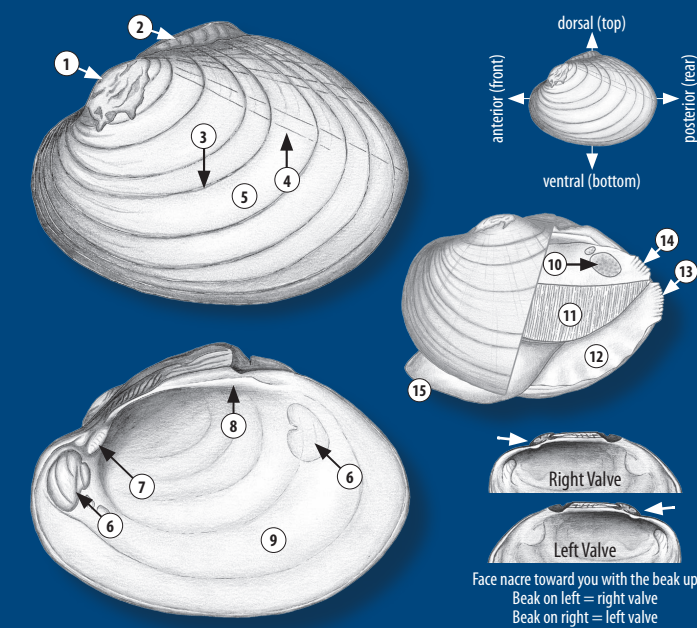
REPORT OBSERVATIONS TO MDIFW!

**Asian Clam (*Corbicula fluminea*)**  
 Small (<1 inch), triangular to ovate bivalve with centrally located beak and distinct concentric rings on shell, which is usually light yellow to brown. This species was introduced to North America in the early 20<sup>th</sup> century and has spread throughout southern New England. It has not yet been discovered in Maine, but many of our lakes and rivers provide ideal habitat. It can become exceptionally abundant, greatly outnumbering native bivalves and severely affecting native species by competing for space and food.

**Zebra Mussel (*Dreissena polymorpha*)**  
 Small (<1.5 inch), wedge-shaped mussel with distinct dark stripes. Unlike native freshwater bivalves, they attach to objects with byssal threads. Native to Eurasia, this species was accidentally introduced to the Great Lakes in the 1980s and has spread throughout much of North America, including to western New England and the lower St. Lawrence River. It has not yet been found in Maine, where most of our lakes and rivers are too acidic, and lack enough calcium, to support this species. Once established, zebra mussels can quickly overwhelm aquatic habitats and native species by competing for food and space, altering water chemistry, and completely encrusting submerged objects, including native mussels.

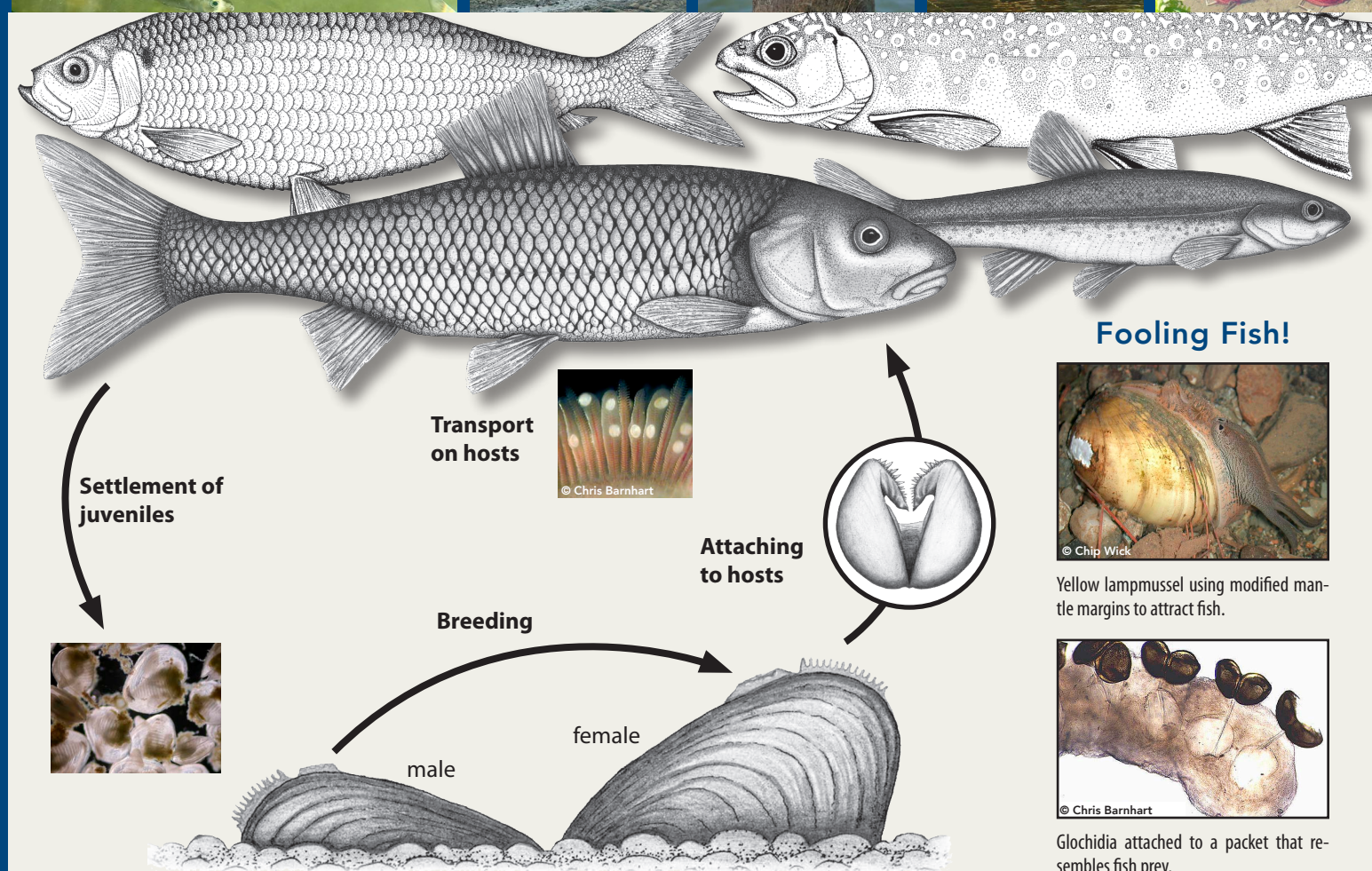
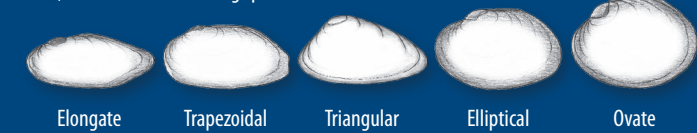


## FRESHWATER MUSSEL MORPHOLOGY



1. **Beak:** rounded or raised area on dorsal edge of each valve (i.e., each half of a shell)
2. **Hinge:** portion of dorsal edge where the two valves connect
3. **Growth ring:** concentric ring usually indicating a period of annual growth
4. **Rays:** lines radiating from beak, perpendicular to growth rings
5. **Periostracum:** colored outer lining of shell
6. **Adductor muscle scar:** attachment sites of anterior and posterior adductor muscles
7. **Pseudocardinal teeth:** thick and often stout hinge "teeth" located under beak
8. **Lateral teeth:** long thin hinge "teeth" parallel to hinge; hinge teeth strengthen the connection between the two valves and are not present on all species
9. **Nacre:** mother-of-pearl inner lining of shell
10. **Adductor muscles:** strong muscles that pull the two valves together
11. **Gill:** organ essential for filtration, respiration, and larval development (females)
12. **Mantle:** thin sheet of tissue lining the inner shell and enveloping the mussel's organs
13. **Inhalent aperture:** modified portion of mantle through which water, food, and sperm are drawn into the body cavity
14. **Exhalent aperture:** modified portion of mantle through which filtered water, waste, and sperm (males) or larvae (females) exit the body cavity
15. **Foot:** large strong muscle used for locomotion and feeding

**Shell Shapes:** these terms are used to generally describe species, but shell shapes can vary a lot, both within and among species!



## FRESHWATER MUSSEL LIFE CYCLE

Freshwater mussels have a remarkable life cycle that includes a parasitic (but not harmful) relationship with freshwater or diadromous fish. Mussels rely on fish to develop and disperse within a waterbody or watershed.

**Breeding:** Males release sperm into the water, which is filtered by females and results in fertilization of eggs held in a region of the females' gills called the marsupium. Within the marsupium, the resulting embryos develop into larvae called glochidia.

**Attaching to Hosts:** Females release glochidia into the water, where they must encounter and attach to the fins or gills of a fish host. The likelihood of a single glochidium finding and attaching to a suitable host is slim, but mussels produce high numbers of glochidia and exhibit an array of traits to increase

their chances of attaching to hosts. For example, glochidia may be released in stringy mucous webs that ensnare a fish's fins, or in packets that resemble natural prey that fish will attack, thereby putting glochidia in contact with a fish's gills. Some mussels attract fish with modified mantle margins that mimic fish prey ("lures"), and release glochidia when they sense fish nearby.

**Transport on Hosts:** Once attached to a fish, glochidia become encased in cysts and remain on the fish until transformation into juveniles. Fish may travel long distances while carrying glochidia, offering mussels a chance for long-distance dispersal.

**Settlement:** Juvenile mussels release from the fish host, sink to the bottom, burrow into the sediment, and remain there as they mature. Adults spend the rest of their lives partially buried.

## HOW CAN YOU HELP?

- Don't disturb freshwater mussels – leave them to fulfill their role as living water filters!
- Protect Maine's freshwater resources – don't pollute!
- Don't introduce non-native aquatic plants, fish or other animals to Maine's waterbodies.
- Report observations of the zebra mussel, Asian clam, and other invasive aquatic species to MDIFW.
- Maintain and restore forested buffers along waterways.
- Fence livestock out of natural waterbodies.
- Join or support a land trust or watershed association that works to protect Maine's freshwater resources.
- Support conservation of Maine's nongame and endangered species by contributing to the Chick-a-dee Check-off and purchasing a Conservation License Plate.

## ARE MAINE'S FRESHWATER MUSSELS PROTECTED?

The Brook Floater, Yellow Lampmussel, and Tidewater Mucket are protected by Maine's Endangered Species Act. It is illegal to collect, possess, kill, or otherwise cause harm to these mussels without a Scientific Collection or Incidental Take permit from MDIFW. These permits are only granted for special circumstances, such as surveys, research, and relocation efforts. In Maine, it also is illegal to harvest any freshwater mussel for export, sale or commercial purposes without a Commercial Nonmarine Invertebrate Permit issued by MDIFW. However, freshwater mussel species that are NOT state-listed or designated as State Special Concern (currently none), are legal to possess or harvest for personal use without a permit.

## LEARN MORE ABOUT FRESHWATER MUSSELS

There are many excellent sources of information about freshwater mussels. Here are just a few to get you started:

- Freshwater Mussels of Maine**  
mefishwildlife.com/mussels
- Freshwater Mollusk Conservation Society**  
molluskconservation.org
- Xerces Society: All About Freshwater Mussels**  
xerces.org/endangered-species/freshwater-mussels/about
- America's Mussels: Silent Sentinels**  
fws.gov/midwest/endangered/clams/mussels



## SUPPORT MAINE'S ENDANGERED & NONGAME WILDLIFE!

Purchase a Conservation Plate | Check-off at Tax Time



Maine Department of Inland Fisheries and Wildlife  
 353 Water Street, Augusta, ME 04330  
 phone: (207) 287-8000 | mefishwildlife.com



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