

# Cumberland Mussels

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## Taxonomy

**Phylum Mollusca:** Next to insects, the mollusks have the most named species in the animal kingdom - probably more than 100,000 living species. The name Mollusca comes from the Latin *molluscus*, meaning soft, indicating a common feature of this group, a soft body. This diverse group includes chitons, snails, slugs, conchs, squids, octopi, and nautilus. Mollusks range from the microscopic to the giant squid that grows up to 50 feet long. This phylum is very old, with a continuous record since the Cambium time. Perhaps no group has left more or better fossils than mollusks because their shells easily formed fossils.

**Class Bivalvia:** Bivalved mollusks have two shells (valves) and include over 7,000 species of mussels, clams, scallops, oysters, and shipworms, ranging from 1 mm to 1 meter in length. Most are specialized for a sedentary type of life and have evolved a filter-feeding mechanism that depends on gills for assistance in obtaining food by ciliary currents. Cilia are short, hairlike structures on the surface of cells that rhythmically beat the surrounding fluid to move along the fluids and particles.

Bivalves and gastropods (snails) are the only classes of mollusks with species that adapted to freshwater and in the case of snails, to land. Most mollusks remain marine. Because of their calcareous shells, bivalves need to live in "hard" water.

**Order Unionidae:** This order includes a diverse group of freshwater mussels, nearly 900 species. Freshwater mussels possess unique characteristics that set them apart from all other bivalves, namely their restriction to freshwater, parental care, and its parasitic larvae. Some bivalves prefer quiet ponds, but others want moderately swift water. Those in still water have thinner shells than those in a brisk current. The order Unionidae has received a lot of deserved attention because of their imperiled conservation status.

## Anatomy

**The Shell:** Bivalves are laterally compressed and covered by a pair of valves (shells) secreted by the mantle lobes and hinged together at its back. An elastic hinge ligament holds the two shells together and causes them to gape in the front. Powerful muscles attached to the shell draw the valves together. The oldest and thickest part of the valve is the umbo, a rounded area near the hinge and surrounding it are successive concentric lines of growth.

**The Mantle:** The mantle is formed by folds of the body wall that hang down, one on each side of the soft body, adhering to the valves. The space inside the two mantles is the mantle cavity that holds the body itself.

**The Foot:** Bivalves move by extending a slender muscular foot between the valves. Blood swells the end of the foot to anchor it in mud or sand, and then other muscles contract to shorten the foot and pull the animal forward.

## Physiology

**Feeding:** Adult freshwater mussels are filter feeders, orienting themselves in the substrate to facilitate the siphoning of the water for oxygen and food. They commonly consume detritus, diatoms, phytoplankton, zooplankton, and other microorganisms. A pair of ciliated palps (appendages) on each side of the mouth directs microscopic food particles toward the mouth. These particles are brought into the mantle cavity by the respiratory current, are trapped in mucus secreted by the palps, and are then carried to the mouth by cilia on the surface of the palps.

**Digestion:** A rotating mucus food cord attaches itself to incoming particles and covers it with mucus. As this mucus mass spins, food particles detach from it and land on the stomach floor, folded into ciliary tracts for sorting the continuous stream of particles. Unsuitable particles are directed to the intestines for elimination. Nutritive particles are taken into the digestive gland and digested.

**Circulation:** The circulatory system is open and consists of a heart, arteries, and veins. The heart has two auricles and a ventricle and beats at the rate of about six times per minute. The colorless blood carries nutrients, oxygen, wastes,

and other chemicals throughout the body. A pair of kidneys removes wastes from the blood.

**Respiration:** Respiration is carried on by both the mantle and the gills. Water enters the gills and propelled by ciliary action. Blood vessels within the gills are used for gas exchange.

**Nervous and Sensory System:** The nervous system consists of three pairs of widely separated ganglia (nerve centers) connected by a network of nerves. The ganglia are near the mouth, the foot, and below hinge muscle. Sense organs are poorly developed, but a mussel can balance on its foot and test the quality of incoming water. These bivalves have simple tactile organs.

### Life Cycle

**Fertilization:** The sexes are usually separate in freshwater mussels, although a few species possess both male and female organs. Within females, the ovaries discharge eggs into tubes in the gills. The males release sperm into the water which is taken into the female's body through the incurrent aperture and then carried to tubes in the gills where the eggs are fertilized. The gills then serve as brood pouches, called marsupia, as well as respiratory organs.

**Glochidia:** Within the brood pouch or gill, the fertilized eggs develop into small larvae called glochidia which are typically rounded, oval, or triangular in outline. They possess only the embryonic stages of a mouth, intestines, heart, and foot when they are discharged by the female into the water through her excurrent siphon.

**Parasitic Stage:** Females release a large number of glochidia into the water, but only a fraction encounter a fish and attach to its gills or fins within a short time. Most fall to the bottom and die. Different species have unique ways to lure a fish and attach to it. Some species require certain species of fish to serve as host.

During the parasitic stage, each glochidium remains embedded in the tissues of a host fish, changing little in size but developing many of the adult organs and structures. This stage may last a week or as long as six weeks. Most infestations of glochidia are light and apparently do not harm the host fish.

**Adult Stage:** Upon completion of its parasitic stage, the young mussel breaks through the tissue of the fish and falls to the bottom where it begins an independent adult life. The animal's adult structures continue to form, including a shell.

**Growth Rates and Longevity:** Freshwater mussels grow rapidly for the first few years then growth slows appreciably when sexually mature, at about the age of three years. Heavy shelled mussels grow slower than thinner shelled ones. As a group, mussels are extremely long-lived, with maximum life spans of 100-200 years for certain species. Heavier shelled ones have longer lives than thinner shelled ones.

## Mussels of the Obed and Emory Watersheds

### *Lampsilis fasciola* - Wavyrayed Lampmussel

**General Distribution:** Found throughout the Great Lakes drainage area, the Ohio-Mississippi drainage area south to the TN River system.

**TN Distribution:** This mussel occurs in a large number of the small creeks and medium-sized rivers throughout East and Middle TN.

**Description:** The elliptical or ovate shells found in the Obed River are very thick and may reach 110 mm. The shell's surface is shiny with numerous raised rest lines. The surface is reddish brown with green rays of varying widths, characteristically wavy in appearance. The nacre (innermost layer of the shell) is white or bluish white.

**Life History and Ecology:** The Wavyrayed Lampmussel lives in small to medium-sized rivers, usually occurring at depths of three feet or less. It prefers moderate current and a stable substrate composed of mud, sand, and gravel. This mussel appears tolerant of habitat conditions unfavorable to many species. Researchers have only found its glochidia to parasitize smallmouth bass.

**Status:** Currently stable.

### *Lampsilis virescens* - Alabama Lampmussel

**General Distribution:** Restricted to the Tennessee River drainage, northern Alabama, and East TN.

**TN Distribution:** Formerly the Alabama Lampmussel occurred in the Emory River in Morgan and Roane counties. Now it is found only in the headwaters of the Paint Rock River on the TN and AL border.

**Description:** The elliptical shells are relatively thin, growing up to 70 mm in length. The shell is typically shiny, greenish to straw-colored and sometimes with thin green rays. The nacre color is bluish white.

**Life History and Ecology:** Little more is known about this mussel except that it once inhabited small to medium-sized rivers in East TN and that it apparently lived in sand and gravel substrates in shoal areas.

**Status: Endangered.** This mussel is now probably extirpated (exterminated) throughout its former range in TN. The U.S. Fish and Wildlife Service has developed a recovery plan for this species.

#### ***Medionidus conradicus* - Cumberland Moccasinshell**

**General Distribution:** This mussel is endemic (belonging exclusively) to the TN and Cumberland River drainages.

**TN Distribution:** The Moccasinshell was commonly found in the Emory and also the Clinch, Powell, Holston, Watauga, Little Pigeon, Little TN, Tellico, Duck and Little rivers, the main Tennessee River and in numerous small streams. The mussel has been reported from archaeological deposits along the Tellico River and other streams.

**Description:** The Cumberland Moccasinshell is a small species, seldom exceeding 30 mm in length. Its shell is usually elongate and elliptical in outline. The shell is slightly shiny, tawny to yellowish green in color, and covered with weak, broken dark green rays. The nacre color is bluish to dirty white.

**Life History and Ecology:** The mussel inhabits a substrate composed of sand and grave, often living in cracks in the bedrock or under flat rocks. Usually it occurs at depths of less than three feet in moderate to strong current. The fantail darter and the redline darter have been identified as hosts for the glochidia.

**Status:** Special Concern.

#### ***Toxolasma lividus* - Purple Lilliput**

**General Distribution:** The Purple Lilliput is known from the Ohio River Basin west of PA, including OH, MI, IL, IN, and KY. It occurs in the TN and Cumberland River drainages in TN, VA, and KY, and is also known from AK, OK, and MO.

**TN Distribution:** Found throughout the upper Tennessee River system, including the Emory, as well as the main channel of the TN River below Knoxville. It also occurs in the Caney Fork in the Cumberland River system.

**Description:** The Purple Lilliput is short, solid, and elliptical in outline. The shell length seldom exceeds 35 mm. The outer shell color varies from dark brown to black and is rayless. The nacre color is usually a deep purple.

**Life History and Ecology:** It is found in small to medium sized rivers in mud, sand, and gravel substrates. The green sunfish and longear sunfish have been listed as hosts for the glochidia.

**Status:** Special concern.

#### ***Villosa iris* - Rainbow**

**General Distribution:** The Rainbow is found throughout the Tennessee, Cumberland, and Ohio River basins, the upper Mississippi River, and the St. Lawrence River system from Lake Huron to Lake Ontario, including their tributaries.

**TN Distribution:** This mussel occurs throughout the Tennessee and Cumberland rivers drainage including the Obed River and Caney Fork.

**Description:** The Rainbow shell is elongate elliptical, attaining a length of 75 mm. The shell is yellowish to greenish yellow with numerous dark green rays varying from narrow to wide. The nacre color varies from white to salmon,

pink and purple.

**Life History and Ecology:** The Rainbow lives in riffles and along the edges of emerging vegetation, in gravel and sand in moderate to strong currents. It becomes most numerous in clean, well-oxygenated stretches at depths of less than three feet. The following have been identified as fish hosts for the glochidia: largemouth bass, smallmouth bass, spotted bass, Suwanee bass, rockbass, and western mosquitofish.

**Status:** Currently stable.

### *Villosa perpurpurea* - Purple Bean

**General Distribution:** Historically, the Purple Bean was found in the Upper Tennessee River drainage in TN and VA.

**TN Distribution:** The Purple Bean was apparently quite rare in the Tennessee River drainage in TN. It was found, but is now extirpated, in the Emory River in Roane County. It is also known from the Obed River in Cumberland County.

**Description:** The shell is elongate with irregularly oval valves. The shell is a dingy olive green with numerous faint wavy green rays. The nacre color exhibits varying intensities of purple. This species has been viewed for many years as either falling within the variation or subspecies of *Villosa trabalis*.

**Life History and Ecology:** The Purple Bean is typically encountered in a substrate of coarse sand and gravel that includes some silt, in moderate to strong current, and at depths of less than three feet. It also occurs in rock piles and under large, flat rocks. Suitable host fish for this bivalve includes sculpin, the greenside darter, and fantail darter.

**Status:** Endangered.

### Regional Threats to Mussels

**Impoundment:** Dams are the major source of mussel decline, acting as barrier to dispersal of species, blocking recolonization of extirpated populations, and isolating populations. TVA and the Corps of Engineer dams are the major problems, but every dam built on a stream adds to the problem.

**Sedimentation:** Sediment reduces the respiratory and feeding efficiency of mussels and can completely smother populations. Agriculture is the major source of sediment, but it also comes from construction, deforestation, and storm water runoff.

**Toxic Pollution and pH:** Mussels are among the most sensitive to heavy metals. These toxics come from leaching mine waste, industry spills, urban runoff and agriculture. Acid mine drainage lowers the pH of water, disrupting the life cycle of mussels.

**Gravel Mining:** Next time you buy river gravel to landscape around your home or business, think about where it comes from. Gravel mined from stream beds destroys habitat, water quality, and all the creatures living in that habitat.

**Resources:** Cleveland Hickman, et. al. *Integrated Principles of Zoology* (1974); Paul Parmalee and Arthur E. Bogan, *The Freshwater Mussels of Tennessee* (UT Press 1998); USFW 2003 Draft Recovery Plan (for regional mussels.)

The Obed Community Association has as its purpose community appreciation and volunteer involvement in ongoing research of the natural and cultural heritage of the Obed River watershed within Cumberland County. Louise Gorenflo, OWCA director, produced this fact sheet. Those wanting to join this membership organization or more information may contact OWCA at 484-2633 or at 185 Hood Drive, Crossville, TN 38555.