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Conservation Status of Freshwater Mussels of the United States and Canada

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ABSTRACT

The American Fisheries Society (AFS) herein provides a list of all native freshwater mussels (families Margaritiferidae and Unionidae) in the United States and Canada. This report also provides state and provincial distributions; a comprehensive review of the conservation status of all taxa; and references on biology, conservation, and distribution of freshwater mussels. The list includes 297 native freshwater mussels, of which 213 taxa (71.7%) are considered endangered, threatened, or of special concern. Twenty-one taxa (7.1%) are listed as endangered but possibly extinct, 77 (20.6%) as endangered but extant, 43 (14.5%) as threatened, 72 (24.2%) as of special concern, 14 (4.7%) as undetermined, and only 70 (23.6%) as currently stable. The primary reasons for the decline of freshwater mussels are habitat destruction from dams, channel modification, siltation, and the introduction of nonindigenous mollusks. The high numbers of imperiled freshwater mussels in the United States and Canada, which harbor the most diverse fauna in the world, portend a trajectory toward an extinction crisis that, if unchecked, will severely impoverish one of our richest components of aquatic biodiversity.

Freshwater mussels (also called *naiads*, *unionids*, or *clams*) of the families Margaritiferidae and Unionidae are worldwide in distribution but reach their greatest diversity in North America with about 297 recognized taxa (281 species and 16 subspecies). Adults range in size from 4 cm to more than 30 cm and occupy a wide range of habitats but are most often associated with lotic waters. Mussels are planktivores and serve as food for fishes and other vertebrate predators.

Freshwater mussels were used by Native Americans for food, source material for tools, and ornamental objects. Their importance to Native Americans is revealed by the large shell mounds associated with villages located along streams with abundant mussel populations (Parmalee and Klippel 1974). Until the advent of plastics, mussels represented an important commercial fishery in which shells were used in the manufacture of buttons (Coker 1919). Today, the commercial value of freshwater mussels revolves around the use of shell for

production of seed pearls in the cultured pearl industry.

During the past 30 years, numbers both of individuals and species diversity of native mussels have declined throughout the United States and Canada. Freshwater mussels (as well as other aquatic species) are imperiled disproportionately relative to terrestrial species. For example, The Nature Conservancy recognized 55% of North America's mussels as extinct or imperiled compared to only 7% of the continent's bird and mammal species (Master 1990). This alarming decline, the severity of which was not recognized until recently, is primarily the result of habitat destruction and degradation associated with adverse anthropogenic activities.

On recognizing the decline of native mussels, the AFS Endangered Species Committee initiated a comprehensive review of the current status of mussels to inform the conservation and fisheries communities and to assist managers in forming protection and recovery plans. In this paper, our purpose is to provide (1) state and provincial distributions, (2) a comprehensive review of conservation status for all native freshwater mussels in the United States and Canada, and (3) a list of biology, conservation, and distribution references for freshwater mussels in the United States and Canada.

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Threats

Threats to endangered species generally are categorized under headings such as habitat destruction, overutilization for commercial or other purposes, disease, predation, introduction of nonindigenous species, pollution, hybridization, and restricted range. The decline of freshwater mussels during the past century has involved a variety of threats, the single most important being the destruction of habitat. While habitat destruction continues, expansion of the distribution and populations of nonindigenous mollusks such as the Asian clam, *Corbicula fluminea*, and zebra mussel, *Dreissena polymorpha*, appear poised to decimate many of the remaining native mussel populations.

Mussels are sessile organisms and are considered good indicators of the health of aquatic ecosystems. They are dependent on good water quality and physical habitat conditions and an environment that will support populations of host fish. Destruction of mussel habitat has ranged from the obvious—dams, dredging, and channelization—to the more subtle—siltation and contaminants. Dams change the physical, chemical, and biological environment of

streams, both upstream and downstream of the structure, to the point that approximately 30% to 60% of the mussel fauna is destroyed (Layzer et al. 1993; Williams et al. 1992). The most detrimental effect of dams is likely the disruption of the reproductive cycle by eliminating host species.

Erosion, caused in part by deforestation, poor agricultural practices, and destruction of riparian zones, has led to both increased silt loads and shifting, unstable stream bottoms. Siltation and contaminants, such as heavy metals, pesticides, and acid mine drainage, have long been recognized as threats to mussels (Ortmann 1909; Ellis 1931). An outstanding review of the effects of habitat alteration on mussels can be found in Fuller (1974).

The introduction and spread of nonindigenous mollusks has contributed to the demise of native freshwater mussels. The Asian clam, first introduced to the West Coast in the 1930s, is the most widespread nonindigenous aquatic bivalve mollusk in North America (McMahon 1983). The high densities (up to thousands per square meter) of *Corbicula* in some areas also have been implicated in the decline of native unionids. Harm to native mussels resulting from the invasion of Asian clams may vary



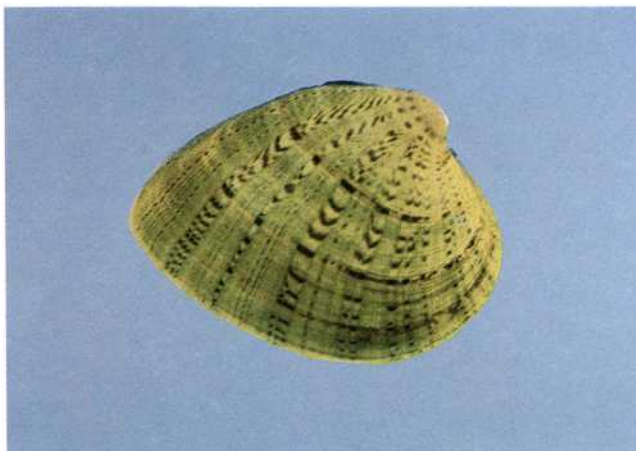
The minnow-like mantle of the pocketbook, *Lampsilis ovata*, lures fish, who act as swimming nurseries for baby mussels.



Ouachita rock-pocketbook, *Arkansia wheeleri*. *Endangered*. Ouachita River, Arkadelphia [Clark] County, AR. Length: 2.75 in (7.05 cm). A. A. Hinkley collection.



Western fanshell, *Cyprogenia aberti*. *Threatened*. White River, Norfolk [Baxter] County, AR. Length: 2.25 in (5.77 cm). A. A. Hinkley collection.



Butterfly, *Ellipsaria lineolata*. *Special Concern*. Mississippi River, Rock Island County, IL. Length: 2.125 in (5.45 cm). K. D. Blodgett et al. collection.

geographically and with time (Belanger et al. 1990; Leff et al. 1990).

The most recent nonindigenous bivalve introduction, the zebra mussel, may prove to be the death knell for many species of freshwater mussels. First discovered in Lake St. Clair in 1988, the zebra mussel quickly spread throughout most of the Great Lakes. In early 1991, it was discovered in the Illinois River, the first record outside of the Great Lakes drainage. By late 1991, the zebra mussel had been reported as far south as the lower portion of the Ohio and Tennessee rivers (Nalepa and Schloesser 1992); recently, it has been found in the lower Mississippi River in southern Louisiana. Ultimately, the range of the zebra mussel may include most of the United States and southern Canada.

Commercial Harvesting

During the past decade a resurgence has occurred in commercial harvest of native mussels for the cultured pearl trade.

Most shells harvested are sold to the Japanese pearl industry, where they are cut and ground into beads that form the nucleus of cultured pearls. The increased demand for shell during the past three to five years pushed shell prices in the United States to \$6 per pound on the Japanese market. The preferred source for thick, high quality shells is from wild mussel populations in the United States. The high price for raw shell resulted in as many as 75 to 100 commercial mussel boats simultaneously harvesting single reservoirs. In 1991, the total tonnage exported to Japan was 9,000 short tons, but demand has declined during the past two years and leveled at about 4,500 short tons (Baker 1993). The value of the mussel and cultured pearl business has attracted the interest of the U.S. aquaculture industry (Fassler 1991a, 1991b).

No federal regulations restrict the harvest of native mussels unless species are listed as endangered or threatened under the Endangered Species Act. In response to the increased harvest and shell value, several states have implemented regulations with species, size, location, and season restrictions. The impacts of intensive harvesting are unknown, but some states have initiated monitoring programs to obtain data on the potential threats of this activity.

Although the amount of shell harvested is a potential threat, a more immediate concern is the method used to harvest shell. The two primary harvest methods used are diving and brailing. Dive gear usually involves surface-based air compressors with hookah regulators and to a lesser extent SCUBA. Dive methods allow the sheller to find dense mussel concentrations and selectively harvest legal-size specimens of the approximately 15 commercially valuable species.

Brailing involves dragging a crowfoot dredge or brail across the substrate to "snag" mussels. A brail



Altamaha lance, *Elliptio shepardiana*. *Threatened*. Altamaha River, GA. Length: 4.5 in (11.54 cm). A. A. Hinkley collection.



Sugarspoon, *Epioblasma arcaeiformis*. *Endangered, possibly extinct*. Cumberland River, TN. Length: 1.125 in (2.88 cm). A. A. Hinkley collection.

is a metal or wooden bar, usually 8 to 16 ft long, with long cotton, nylon, or chain stringers attached at 6- to 12-in intervals along the length of the bar. The stringers have many four-pronged, blunt or beaded tipped hooks called *crowsfeet* attached along their length. Hooks drag across the substrate, and mussels close on the metal prongs when the hooks cross the incumbent aperture. Brailing is nonselective, and undersized or unwanted mussels harvested during brailing are discarded. The survival of discarded mussels after they are removed from the brail is unknown, although one study observed that mortality of undersized mussels may be as high as 50% (Sickel 1989). The impacts of commercial harvesting on native mussel populations, including the effects of collection methods such as brailing, need further investigation.

Methods and Definitions

Our review of the conservation status of mussels includes all species and subspecies of mussels from the United States and Canada as reported in the AFS list of common and scientific names of mollusks (Turgeon et al. 1988). We deviated from Turgeon et al. (1988) in the recognition of the family Margaritiferidae (Smith and Wall 1984; Smith 1986) and the recognition of the genera *Pyganodon* and *Utterbackia*, which were removed from the genus *Anodonta* (Hoeh 1990; W. R. Hoeh, University of Michigan, doctoral dissertation). We also corrected a few errors in spelling of common and scientific names in Turgeon et al. (1988). The status and distribution information was derived from a variety of sources such as state and regional endangered species lists, research publications, and books. We also relied on information and original data from biologists actively working on mussels.

The AFS Endangered Species Committee has reviewed existing distribution and status information and is responsible for the opinions expressed here. The assignment of status categories is based on the status of the taxon throughout its range without regard for political boundaries or considerations. We reviewed species on the federal list of endangered and threatened species and are in agreement with those status classifications. There are several species that currently are under study and consideration for listing by the U.S. Fish and Wildlife Service. The status we have assigned these species may change upon completion of detailed status reviews.

The conservation status categories are defined as follows: **Endangered (E)**—A species or subspecies in danger of extinction throughout all or a significant portion of its range—an asterisk (*) following the letter “E” indicates the taxon is possibly extinct; **Threatened (T)**—A species or subspecies that is likely to become endangered throughout all or a significant portion of its range; **Special Concern (SC)**—A species or subspecies that may become endangered or threatened by relatively minor disturbances to its habitat, and deserves careful monitoring of its abundance and distribution; **Undetermined (U)**—A species or subspecies whose historic and current distribution and abundance has not been evaluated in recent years; **Currently Stable (CS)**—A species or subspecies whose distribution and abundance may be stable, or it may have declined in portions of its range but is not in need of immediate conservation management actions.

For each mussel, the list includes common and scientific names, the author who described the species, status in bold letters, and historic distribution by state or province (or an indication of presence in Mexico). We follow the list of standard two-letter abbreviations for states and provinces given in Williams et al. (1989).



Yellow blossom, *Epioblasma florentina florentina*. Endangered, possibly extinct. Duck River, TN. Length: 2.0 in (5.13 cm) for male (top); 2.125 in (5.45 cm) for female (bottom). A. A. Hinkley collection.



Acornshell, *Epioblasma haysiana*. Endangered, possibly extinct. Tennessee River, Florence [Lauderdale] County, AL. Length: 1.25 in (3.20 cm) for male (top); 1.125 in (2.88 cm) for female (bottom). A. A. Hinkley collection.

List of Taxa

The list of mussel species and subspecies is arranged alphabetically by genus and by species and subspecies within the genus. Following the common and scientific name, the conservation status is given using a letter code, **E** = Endangered; **E*** = Endangered, Possible Extinct; **T** = Threatened; **SC** = Special Concern; **U** = Undetermined; and **CS** = Currently Stable. The known historical distribution is listed by states of the United States and provinces of Canada. Taxa known to occur southward into Mexico are so indicated.

Freshwater Mussels

Family—Margaritiferidae

Cumberlandia

Spectaclecase, *C. monodonta* (Say). **T**. AL, AR, IA, IL, IN, KY, MN, MO, OH, TN, VA, WI

Margaritifera

Western pearlshell, *M. falcata* (Gould). **U**. AK, CA, ID, MT, NM, NV, OR, UT, WA, WY. Canada, BC
Louisiana pearlshell, *M. hembeli* (Conrad). **T**. LA
Eastern pearlshell, *M. margaritifera* (Linnaeus). **SC**. CT, MA, ME, NH, NY, PA, RI, VT. Canada, NB, NF, NS, PE, PQ
Alabama pearlshell, *M. marrianae* R. I. Johnson. **E**. AL

Family—Unionidae

Actinonaias

Mucket, *A. ligamentina* (Lamarck). **CS**. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, NY, OH, OK, PA, TN, VA, WI, WV. Canada, ON
Pheasantshell, *A. pectorosa* (Conrad). **SC**. AL, KY, TN, VA

Alasmidonta

Altamaha arc-mussel, *A. arcuata* (I. Lea). **T**. GA
Cumberland elktoe, *A. atropurpurea* (Rafinesque). **E**. KY, TN
Dwarf wedge mussel, *A. heterodon* (I. Lea). **E**. CT, DE, MA, MD, NC, NH, NJ, NY, PA, VA, VT. Canada, NB
Coosa elktoe, *A. mccordi* Athearn. **E***. AL
Elktoe, *A. marginata* Say. **SC**. AL, AR, IA, IL, IN, KS, KY, MD,

MI, MN, MO, ND, NY, OH, OK, PA, SD, TN, VA, WI, WV. Canada, ON

Appalachian elktoe, *A. raveneliana* (I. Lea). **E**. NC, TN

Carolina elktoe, *A. robusta* Clarke. **E***. NC, SC

Triangle floater, *A. undulata* (Say). **SC**. AL, CT, DE, FL, GA, MA, MD, ME, NC, NH, NJ, NY, PA, RI, SC, VA, VT, WV. Canada, NB, NS, ON, PQ

Brook floater, *A. varicosa* (Lamarck). **T**. CT, DE, GA, MA, MD, ME, NC, NH, NJ, NY, PA, RI, SC, VA, VT, WV. Canada, NB, NS

Slippershell mussel, *A. viridis* (Rafinesque). **SC**. AL, IA, IL, IN, KS, KY, MD, MI, MO, MS, NC, NY, OH, SD, TN, VA, WI. Canada, ON

Ochlockonee arc-mussel, *A. wrightiana* (Walker). **E***. FL

Ambelma

Fat threeridge, *A. neislerii* (I. Lea). **E**. FL, GA

Roundlake, *A. plicata perplicata* (Conrad). **CS**. AL, AR, FL, GA, LA, MS, TN, TX

Threeridge, *A. p. plicata* (Say). **CS**. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, ND, NY, OH, OK, PA, SD, TN, TX, VA, WI, WV. Canada, MB, SK, ON

Anodonta

Yukon floater, *A. beringiana* Middendorff. **U**. AK. Canada, YT, BC

California floater, *A. californiensis* I. Lea. **U**. AZ, CA, ID, NV, OR, UT, WA, WY. Mexico

Barrel floater, *A. couperiana* I. Lea. **CS**. FL, GA, NC, SC

Alewife floater, *A. implicata* Say. **CS**. CT, DE, MA, MD, ME, NC, NH, NJ, NY, PA, RI, SC, VA, VT. Canada, NB, NS, PQ

Western floater, *A. kennerlyi* I. Lea. **U**. OR, WA. Canada, AB, BC

Winged floater, *A. nuttalliana* I. Lea. **U**. ID, UT. Canada, BC

Oregon floater, *A. oregonensis* I. Lea. **U**. CA, OR, UT, WA

Flat floater, *A. suborbiculata* Say. **CS**. AL, AR, FL, IA, IL, IN, KS, KY, LA, MO, MS, OH, OK, TN, TX, WI

Anodontoides

Cylindrical papershell, *A. ferussacianus* (I. Lea). **CS**. AR, CO, IA, IL, IN, KS, KY, MI, MN, MO, ND, NE, OH, OK, PA, SD, TN, WI, WY. Canada, MB, ON, PQ, SK

Rayed creekshell, *A. radiatus* (Conrad). **SC**. AL, FL, GA, LA, MS

Arcidens

Rock-pocketbook, *A. confragosus* (Say). **CS**. AL, AR, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, OK, SC, TN, TX, WI, WV

Arkansia

Ouachita rock-pocketbook, *A. wheeleri* Ortmann and Walker. E. AR, OK

Cyclonaias

Purple wartyback, *C. tuberculata* (Rafinesque). SC. AL, AR, IA, IL, IN, KY, MI, MN, MO, OH, OK, PA, TN, VA, WI, WV. Canada, ON

Cyprogenia

Western fanshell, *C. aberti* (Conrad). T. AR, KS, MO, OK
Fanshell, *C. stegaria* (Rafinesque). E. AL, IL, IN, KY, OH, PA, TN, VA, WV

Cyrtonaias

Tampico pearlymussel, *C. tampicoensis* (I. Lea). CS. TX. Mexico

Disconaias

Salina mucket, *D. salinasensis* (Simpson). T. TX. Mexico

Dromus

Dromedary pearlymussel, *D. dromas* (I. Lea). E. AL, KY, TN, VA

Ellipsaria

Butterfly, *E. lineolata* (Rafinesque). SC. AL, AR, GA, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, OK, PA, TN, TX, WI, WV

Elliptio

Southern lance, *E. ahenea* (I. Lea). SC. FL
Carolina lance, *E. angustata* (I. Lea). SC. GA, MD, NC, SC, VA
Alabama spike, *E. arca* (Conrad). T. AL, GA, LA, MS, TN
Delicate spike, *E. arctata* (Conrad). SC. AL, FL, GA, MS, TN
Florida shiny spike, *E. buckleyi* (I. Lea). CS. FL
Chipola slabshell, *E. chipolaensis* Walker. T. AL, FL
Box spike, *E. cistelliformis* (I. Lea). U. NC
Eastern elliptio, *E. complanata* (Lightfoot). CS. AL, CT, DE, FL, GA, MA, MD, ME, MI, MN, NC, NH, NJ, NY, PA, RI, SC, VA, VT, WI, WV. Canada, NB, NS, ON, PQ
Carolina slabshell, *E. congaraea* (I. Lea). SC. GA, NC, SC, VA
Elephant-ear, *E. crassidens* (Lamarck). CS. AL, FL, GA, IA, IL, IN, KY, LA, MN, MO, MS, OH, OK, PA, TN, VA, WI, WV
Georgia elephant-ear, *E. dariensis* (I. Lea). SC. GA
Spike, *E. dilatata* (Rafinesque). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, NC, OH, OK, PA, TN, VA, WI, WV. Canada, ON
Satilla elephant-ear, *E. downiei* (I. Lea). SC. FL, GA
Northern lance, *E. fisheriana* (I. Lea). SC. DE, MD, PA, VA
Pod lance, *E. folliculata* (I. Lea). SC. GA, NC, SC
Brother spike, *E. fraterna* (I. Lea). E. AL, GA, SC
Altamaha slabshell, *E. hopetonensis* (I. Lea). SC. GA
Variable spike, *E. icterina* (Conrad). CS. AL, FL, GA, NC, SC, VA
Flat spike, *E. jayensis* (I. Lea). U. FL, GA
Yellow lance, *E. lanceolata* (I. Lea). E. NC, VA
Fluted elephant-ear, *E. mcMichaeli* Clench and Turner. SC. AL, FL
Cape Fear spike, *E. marsupiobesa* Fuller. CS. NC
Winged spike, *E. nigella* (I. Lea). E. AL, GA
Atlantic spike, *E. producta* (Conrad). SC. GA, MD, NC, SC, VA
Carolina spike, *E. raveneli* (Conrad). CS. GA, NC, SC
Roanoke slabshell, *E. roanokensis* (I. Lea). SC. GA, NC, SC, VA
Altamaha lance, *E. shepardiana* (I. Lea). T. GA
Altamaha spiny mussel, *E. spinosa* (I. Lea). E. GA
Tar spiny mussel, *E. steinstansana* R. I. Johnson and Clarke. E. NC
Waccamaw spike, *E. waccamawensis* (I. Lea). SC. NC, SC
Florida lance, *E. waltoni* (Wright). T. FL

Elliptoideus

Purple bankclimber, *E. sloatianus* (I. Lea). T. AL, FL, GA

Epioblasma

Sugarspoon, *E. arcaeformis* (I. Lea). E*. AL, KY, TN
Angled riffleshell, *E. biemarginata* (I. Lea). E*. AL, KY, TN
Cumberlandian combshell, *E. brevidens* (I. Lea). E. AL, KY, TN, VA
Oyster mussel, *E. capsaeformis* (I. Lea). E. AL, KY, TN, VA
Leafshell, *E. flexuosa* (Rafinesque). E*. AL, IL, IN, KY, OH, TN
Curtis pearlymussel, *E. florentina curtisi* (Utterback). E. AR, MO
Yellow blossom, *E. f. florentina* (I. Lea). E*. AL, KY, TN
Tan riffleshell, *E. f. walkerii* (Wilson and H. W. Clark). E. KY, TN, VA
Acornshell, *E. haysiana* (I. Lea). E*. AL, KY, TN, VA
Narrow catspaw, *E. lenior* (I. Lea). E*. AL, TN
Forkshell, *E. lewisii* (Walker). E*. AL, KY, TN
Upland combshell, *E. metastrata* (Conrad). E. AL, GA, TN
Catspaw, *E. obliquata obliquata* (Rafinesque). E. AL, IL, IN, KY, OH, TN
White catspaw, *E. o. perobliqua* (Conrad). E. IL, IN, KY, MI, OH
Southern acornshell, *E. othcaloogensis* (I. Lea). E. AL, GA, TN
Southern combshell, *E. penita* (Conrad). E. AL, GA, MS
Round combshell, *E. personata* (Say). E*. IL, IN, KY, OH
Tennessee riffleshell, *E. propinqua* (I. Lea). E*. AL, IL, IN, KY, OH, TN
Wabash riffleshell, *E. sampsonii* (I. Lea). E*. IL, IN, KY
Cumberland leafshell, *E. stewardsoni* (I. Lea). E*. AL, KY, TN
Green blossom, *E. torulosa gubernaculum* (Reeve). E*. TN, VA
Northern riffleshell, *E. t. rangiana* (I. Lea). E. IL, IN, KY, MI, OH, PA, WV. Canada, ON
Tubercled blossom, *E. t. torulosa* (Rafinesque). E*. AL, IL, IN, KY, OH, TN, WV
Snuffbox, *E. triquetra* (Rafinesque). T. AL, AR, IA, IL, IN, KS, KY, MI, MO, MS, OH, PA, TN, VA, WI, WV. Canada, ON
Turgid blossom, *E. turgidula* (I. Lea). E*. AL, AR, TN

Fusconaia

Texas pigtoe, *F. askewi* (Marsh). SC. LA, OK, TX
Tennessee pigtoe, *F. barnesiana* (I. Lea). SC. AL, MS, NC, TN, VA
Gulf pigtoe, *F. cerina* (Conrad). CS. AL, LA, MS
Shiny pigtoe, *F. cor* (Conrad). E. AL, TN, VA
Fine-rayed pigtoe, *F. cuneolus* (I. Lea). E. AL, TN, VA
Ebonyshell, *F. ebena* (I. Lea). CS. AL, AR, GA, IA, IL, IN, KY, LA, MN, MO, MS, OH, OK, TN, WI
Narrow pigtoe, *F. escambia* Clench and Turner. T. AL, FL
Wabash pigtoe, *F. flava* (Rafinesque). CS. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, ND, NY, OH, OK, PA, SD, TN, TX, WI. Canada, MB, ON
Triangle pigtoe, *F. lananensis* (Frierson). SC. TX
Atlantic pigtoe, *F. masoni* (Conrad). T. GA, NC, SC, VA
Ozark pigtoe, *F. ozarkensis* (Call). SC. AR, KS, MO, OK
Long-solid, *F. subrotunda* (I. Lea). SC. AL, IL, IN, KY, OH, PA, TN, VA, WV
Purple pigtoe, *F. succissa* (I. Lea). SC. AL, FL

Glebula

Round pearlshell, *G. rotundata* (Lamarck). CS. AL, FL, KY, LA, MS, OK, TX

Gonidea

Western ridgemussel, *G. angulata* (I. Lea). U. CA, ID, MT, NV, OR, WA. Canada, BC

Hemistena

Cracking pearlymussel, *H. lata* (Rafinesque). E. AL, IL, IN, KY, OH, PA, TN, VA

Lampsilis

Pink mucket, *L. abrupta* (Say). E. AL, AR, IL, IN, KY, LA, MO,



Western ridgemussel, *Gonidea angulata*. Undetermined. Santa Clara County, CA. Length: 3.5 in (8.97 cm). W. A. Nason collection; ex. L. G. Yates collection.



Forkshell, *Epioblasma lewisii*. Endangered, possibly extinct. Tennessee River, TN. Length: 2.25 in (5.77 cm). A. A. Hinkley collection.

OH, PA, TN, VA, WV
 Fine-lined pocketbook, *L. altilis* (Conrad). T. AL, GA, MS, TN
 Southern sandshell, *L. australis* Simpson. T. AL, FL
 Lined pocketbook, *L. binominata* Simpson. E*. AL, GA
 Texas fatmucket, *L. bracteata* (Gould). SC. TX
 Plain pocketbook, *L. cardium* (Rafinesque). SC. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, TN, TX, WI
 Yellow lampmussel, *L. cariosa* (Say). T. CT, DE, GA, MA, ME, MD, NC, NJ, NY, PA, SC, VA. Canada, NB, NS
 Altamaha pocketbook, *L. dolabraeformis* (I. Lea). T. GA
 Wavy-rayed lampmussel, *L. fasciola* Rafinesque. CS. AL, GA, IL, IN, KY, MI, NC, OH, PA, TN, VA, WV. Canada, ON
 Waccamaw fatmucket, *L. fullerkeri* R. I. Johnson. T. NC
 Haddleton lampmussel, *L. haddletoni* Athearn. E. AL
 Higgins eye, *L. higginsii* (I. Lea). E. IA, IL, MN, MO, WI
 Louisiana fatmucket, *L. hydiana* (I. Lea). CS. AR, LA, MS, OK, TX
 Southern pocketbook, *L. ornata* (Conrad). SC. AL, AR, FL, GA, LA, MS, TN
 Pocketbook, *L. ovata* (Say). SC. AL, IL, IN, KY, MD, MS, NY, OH, PA, TN, VA, VT, WV, WY. Canada, MB, ON, PQ, SK
 Orange-nacre mucket, *L. perovalis* (Conrad). T. AL, MS
 Arkansas fatmucket, *L. powelli* (I. Lea). T. AR
 Carolina fatmucket, *L. radiata conspicua* (I. Lea). CS. NC, SC
 Eastern lampmussel, *L. r. radiata* (Gmelin). CS. CT, DE, MA, MD, ME, MI, NC, NH, NJ, NY, OH, PA, RI, SC, VA, VT, WV. Canada, NB, NS, ON, PQ
 Neosho mucket, *L. rafinesqueana* Frierson. T. AR, KS, OK, MO
 Ozark broken-ray, *L. reeviana brevicula* (Call). SC. MO
 Northern broken-ray, *L. r. brittsi* Simpson. SC. MO
 Arkansas broken-ray, *L. r. reeviana* (I. Lea). T. AR, MO
 Sandbank pocketbook, *L. satur* (I. Lea). SC. AR, LA, MS, OK, TX
 Fatmucket, *L. siliquioidea* (Barnes). CS. AR, CO, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, MT, ND, OH, OK, PA, SD, WI. Canada, AB, MB, NT, ON, PQ, SK
 Rayed pink fatmucket, *L. splendida* (I. Lea). SC. GA, SC
 Southern fatmucket, *L. straminea claibornensis* (I. Lea). CS. AL, FL, GA, LA, MS, TN
 Rough fatmucket, *L. s. straminea* (Conrad). SC. AL, MS
 Speckled pocketbook, *L. streckeri* Frierson. E. AR
 Shiny-rayed pocketbook, *L. subangulata* (I. Lea). T. AL, FL, GA
 Yellow sandshell, *L. teres* (Rafinesque). CS. AL, AR, CO, FL, GA, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, OK, SD, TN, TX, WI
 Alabama lampmussel, *L. virescens* (I. Lea). E. AL, TN



Snuffbox, *Epioblasma triquetra*. Threatened. Embarras River, Douglas County, IL. Length: 2.4 in (6.15 cm) for male (top); 1.9 in (4.87 cm) for female (bottom). K. S. Cummings and C. A. Mayer collection.



Higgins eye, *Lampsilis higginsii*. Endangered. Mississippi River, Rock Island County, IL. Length: 3.5 in (8.97 cm) for male (top); 3.0 in (7.69 cm) for female (bottom). K. D. Blodgett et al. and R. Lewis and J. Brice collections.

Lasmigona

Alabama heelsplitter, *L. complanata alabamensis* Clarke. SC. AL, GA, MS
White heelsplitter, *L. c. complanata* (Barnes). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, ND, NE, OH, OK, PA, SD, TN, TX, WI, WV. Canada, AB, MB, ON, SK
Creek heelsplitter, *L. compressa* (I. Lea). CS. IA, IL, IN, KY, MI, MN, ND, NE, NY, OH, PA, SD, VT, WI, WV. Canada, MB, ON, PQ, SK
Fluted-shell, *L. costata* (Rafinesque). CS. AL, AR, GA, IA, IL, IN, KS, KY, MI, MN, MO, MS, ND, NY, OH, OK, PA, SD, TN, VA, VT, WI, WV. Canada, MB, ON, PQ
Carolina heelsplitter, *L. decorata* (I. Lea). E. NC, SC
Tennessee heelsplitter, *L. holstonia* (I. Lea). SC. AL, GA, NC, TN, VA
Green floater, *L. subviridis* (Conrad). T. GA, KY, MD, NJ, NY, NC, PA, SC, TN, VA, WV

Lemiox

Birdwing pearlymussel, *L. rimosus* (Rafinesque). E. AL, TN, VA

Leptodea

Fragile papershell, *L. fragilis* (Rafinesque). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, NE, NY, OH, OK, PA, SD, TN, TX, VA, VT, WI, WV. Canada, ON, PQ
Scaleshell, *L. leptodon* (Rafinesque). E. AL, AR, IA, IL, IN, KY, MI, MO, MS, OH, OK, SD, TN, WI
Tidewater mucket, *L. ochracea* (Say). SC. CT, DE, GA, MA, MD, ME, NC, NJ, NY, PA, RI, SC, VA. Canada, NB, NS

Lexingtonia

Slabside pearlymussel, *L. dolabelloides* (I. Lea). T. AL, KY, TN, VA
Virginia pigtoe, *L. subplana* (Conrad). E. VA

Ligumia

Eastern pondmussel, *L. nasuta* (Say). SC. CT, DE, MA, MD, ME, MI, NC, NH, NJ, NY, OH, PA, RI, SC, VA. Canada, ON
Black sandshell, *L. recta* (Lamarck). SC. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, ND, NY, OH, OK, PA, SD, TN, VA, VT, WI, WV. Canada, MB, ON, PQ, SK
Pondmussel, *L. subrostrata* (Say). CS. AL, AR, IA, IL, IN, KS, KY, LA, MO, MS, OH, OK, SD, TN, TX

Medionidus

Alabama moccasinshell, *M. acutissimus* (I. Lea). T. AL, GA, MS, TN
Cumberland moccasinshell, *M. conradicus* (I. Lea). SC. AL, GA, KY, NC, TN, VA
Tombigbee moccasinshell, *M. macglameriae* van der Schalie. E*. AL
Coosa moccasinshell, *M. parvulus* (I. Lea). E. AL, GA, TN
Gulf moccasinshell, *M. penicillatus* (I. Lea). E. AL, FL, GA
Ochlocknee moccasinshell, *M. simpsonianus* Walker. E. FL, GA
Suwannee moccasinshell, *M. walkeri* (Wright). T. FL

Megaloniais

Round washboard, *M. boykiniana* (I. Lea). SC. AL, FL, GA
Washboard, *M. nervosa* (Rafinesque). CS. AL, AR, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, OK, SD, TN, TX, WI, WV

Obliquaria

Threehorn wartyback, *O. reflexa* Rafinesque. CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, PA, TN, TX, WI, WV. Canada, ON

Obovaria

Southern hickorynut, *O. jacksoniana* (Frierson). SC. AL, AR, LA, MO, MS, OK, TX
Hickorynut, *O. olivaria* (Rafinesque). CS. AL, AR, IA, IL, IN, KS,

KY, LA, MI, MN, MO, NY, OH, PA, TN, WI. Canada, ON, PQ
Ring pink, *O. retusa* (Lamarck). E. AL, IL, IN, KY, OH, PA, TN, WV

Round ebonyshell, *O. rotulata* (Wright). E. AL, FL
Round hickorynut, *O. subrotunda* (Rafinesque). SC. AL, IL, IN, KY, MI, MS, OH, PA, TN, WV. Canada, ON
Alabama hickorynut, *O. unicolor* (I. Lea). SC. AL, LA, MS

Pegias

Little-wing pearlymussel, *P. fabula* (I. Lea). E. AL, KY, NC, TN, VA

Plectomerus

Bankclimber, *P. dombeyanus* (Valenciennes). CS. AL, AR, FL, KY, LA, MO, MS, OK, TN, TX

Plethobasus

White wartyback, *P. cicatricosus* (Say). E. AL, IL, IN, KY, OH, TN
Orange-foot pimpleback, *P. cooperianus* (I. Lea). E. AL, IL, IN, KY, OH, PA, TN
Sheepnose, *P. cyphus* (Rafinesque). T. AL, IA, IL, IN, KS, KY, MN, MO, MS, OH, PA, TN, VA, WI, WV

Pleurobema

Highnut, *P. altum* (Conrad). E. AL, GA
Hazel pigtoe, *P. avellanum* Simpson. E. AL
Mississippi pigtoe, *P. beadleanum* (I. Lea). SC. LA, MS
Scioto pigtoe, *P. bournianum* (I. Lea). E*. OH
Painted clubshell, *P. chattanoogaense* (I. Lea). E. AL, GA, TN
Clubshell, *P. clava* (Lamarck). E. AL, IL, IN, KY, MI, OH, PA, TN, WV
Round pigtoe, *P. coccineum* (Conrad). CS. AR, IA, IL, IN, KS, KY, MI, MN, MO, OH, OK, PA, SD, TN, WI. Canada, ON
James spinymussel, *P. collina* (Conrad). E. VA, WV
Ohio pigtoe, *P. cordatum* (Rafinesque). SC. AL, IL, IN, KY, OH, PA, TN, VA, WV
Black clubshell, *P. curtum* (I. Lea). E. AL, MS
Southern clubshell, *P. decisum* (I. Lea). E. AL, GA, MS, TN
Yellow pigtoe, *P. flavidulum* (I. Lea). U. AL, MS
Dark pigtoe, *P. furvum* (Conrad). E. AL
Southern pigtoe, *P. georgianum* (I. Lea). E. AL, GA, TN
Cumberland pigtoe, *P. gibberum* (I. Lea). E. TN
Georgia pigtoe, *P. hanleyanum* (I. Lea). E. AL, GA, TN
Alabama pigtoe, *P. johannis* (I. Lea). U. AL, GA, TN
Flat pigtoe, *P. marshalli* Frierson. E. AL, MS
Coosa pigtoe, *P. murrayense* (I. Lea). E. AL, GA, TN
Longnut, *P. nucleopsis* (Conrad). E. AL, GA
Tennessee clubshell, *P. oviforme* (Conrad). SC. AL, KY, NC, TN, VA
Ovate clubshell, *P. perovatum* (Conrad). E. AL, GA, MS, TN
Rough pigtoe, *P. plenum* (I. Lea). E. AL, IL, IN, KY, OH, PA, TN, VA
Pyramid pigtoe, *P. pyramidatum* (I. Lea). T. AL, AR, IL, IN, KY, LA, MS, OH, PA, TN, VA, WV
Oval pigtoe, *P. pyriforme* (I. Lea). E. AL, FL, GA
Louisiana pigtoe, *P. riddelli* (I. Lea). SC. LA, TX
Warrior pigtoe, *P. rubellum* (Conrad). E. AL, GA, TN
Fuzzy pigtoe, *P. strodeanum* (Wright). SC. AL, FL
Heavy pigtoe, *P. taitianum* (I. Lea). E. AL, MS
Alabama clubshell, *P. troschelianum* (I. Lea). E. AL, GA, TN
True pigtoe, *P. verum* (I. Lea). E. AL

Popenaias

Texas hornshell, *P. popei* (I. Lea). T. NM, TX. Mexico

Potamilus

Pink heelsplitter, *P. alatus* (Say). CS. AL, AR, IA, IL, IN, KS, KY, MI, MN, MO, MS, ND, NE, OH, OK, PA, SD, TN, VA, VT, WI, WV. Canada, MB, ON, PQ
Texas heelsplitter, *P. amphichaenus* (Frierson). T. LA, TX

Fat pocketbook, *P. capax* (Green). E. AR, IA, IL, IN, KY, LA, MN, MO, MS, OH, OK, WI
 Inflated heelsplitter, *P. inflatus* (I. Lea). T. AL, LA, MS
 Pink papershell, *P. ohiensis* (Rafinesque). CS. AL, AR, IA, IL, IN, KY, LA, MI, MN, MO, MS, ND, NE, OH, OK, SD, TN, TX, WI
 Bleufer, *P. purpuratus* (Lamarck). CS. AL, AR, GA, IL, KS, KY, LA, MO, MS, OK, TX

Ptychobranchus

Kidneyshell, *P. fasciolaris* (Rafinesque). CS. AL, IL, IN, KY, MI, MS, OH, PA, TN, VA, WV. Canada, ON
 Triangular kidneyshell, *P. greeni* (Conrad). E. AL, GA, TN
 Southern kidneyshell, *P. jonesi* (van der Schalie). T. AL, FL
 Ouachita kidneyshell, *P. occidentalis* (Conrad). T. AR, KS, LA, MO, MS, OK, TX
 Fluted kidneyshell, *P. subtentum* (Say). SC. AL, KY, TN, VA

Pyganodon

Eastern floater, *P. cataracta* (Say). CS. AL, CT, DE, GA, MA, MD, ME, MI, NC, NH, NJ, NY, PA, RI, SC, VA, VT, WI, WV. Canada, NB, NS, ON, PE, PQ
 Newfoundland floater, *P. fragilis* (Lamarck). CS. Canada, NB, NF, NS, PQ
 Gaspé floater, *P. marginata* (Say). CS. ME
 Inflated floater, *P. gibbosa* (Say). SC. GA
 Giant floater, *P. grandis* (Say). CS. AL, AR, CO, FL, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, MT, NC, ND, NE, NY, OH, OK, PA, SD, TN, TX, VA, VT, WI, WV. Canada, AB, MB, NT, ON, PQ, SK, YT. Mexico

Quadrula

Southern mapleleaf, *Q. apiculata* (Say). CS. AL, LA, MS, TX
 Alabama orb, *Q. asperata* (I. Lea). SC. AL, GA, MS
 Golden orb, *Q. aurea* (I. Lea). SC. TX
 Rio Grande monkeyface, *Q. couchiana* (Lea). E. TX
 Rabbitsfoot, *Q. cylindrica cylindrica* (Say). T. AL, AR, IL, IN, KS, KY, LA, MO, MS, OH, OK, PA, TN
 Rough rabbitsfoot, *Q. c. strigillata* (Wright). E. TN, VA
 Winged mapleleaf, *Q. fragosa* (Conrad). E. AL, IA, IL, IN, KY, MN, MO, OH, TN, WI
 Smooth pimpleback, *Q. houstonensis* (I. Lea). T. TX
 Cumberland monkeyface, *Q. intermedia* (Conrad). E. AL, TN, VA
 Monkeyface, *Q. metanevra* (Rafinesque). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, PA, TN, WI
 Wartyback, *Q. nodulata* (Rafinesque). CS. AL, AR, IA, IL, IN, KS, KY, LA, MN, MO, MS, OH, OK, TN, WI
 Texas pimpleback, *Q. petrina* (Gould). T. TX
 Western pimpleback, *Q. pustulosa mortoni* (Conrad). CS. AR, LA, TX
 Pimpleback, *Q. p. pustulosa* (I. Lea). CS. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, PA, SD, TN, TX, VA, WI, WV. Canada, ON
 Mapleleaf, *Q. quadrula* (Rafinesque). CS. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, ND, NE, OH, OK, PA, SD, TN, TX, WI. Canada, MB, ON
 Purple pimpleback, *Q. refulgens* (I. Lea). SC. LA, MS
 Ridged mapleleaf, *Q. rumphiana* (I. Lea). SC. AL, GA, MS
 Appalachian monkeyface, *Q. sparsa* (I. Lea). E. KY, TN, VA
 Stirrupshell, *Q. stapes* (I. Lea). E. AL, MS
 Rough rockshell, *Q. tuberosa* (I. Lea). E*. KY, TN

Quincuncina

Tapered pigtoe, *Q. burkei* Walker. T. AL, FL
 Sculptured pigtoe, *Q. infucata* (Conrad). SC. AL, FL, GA
 False spike, *Q. mitchelli* (Simpson). T. TX

Simpsonaias

Salamander mussel, *S. ambigua* (Say). SC. AR, IA, IL, IN, KY, MI, MN, MO, NY, OH, PA, TN, WI, WV. Canada, ON

Strophitus

Alabama creekmussel, *S. connasaugaensis* (I. Lea). SC. AL, GA, MS, TN
 Southern creekmussel, *S. subvexus* (Conrad). SC. AL, FL, GA, LA, MS, TX
 Squawfoot, *S. undulatus* (Say). CS. AL, AR, CO, CT, DE, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV. Canada, MB, NB, NS, ON, PQ, SK

Toxolasma

Southern lilliput, *T. corvunculus* (I. Lea). U. AL
 Pale lilliput, *T. cylindrellus* (I. Lea). E. AL, TN
 Purple lilliput, *T. lividus* (Rafinesque). SC. AL, AR, IL, IN, KY, MI, MO, OH, OK, TN, VA
 Western lilliput, *T. mearnsi* (Simpson). CS. TX
 Lilliput, *T. parvus* (Barnes). CS. AL, AR, FL, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, NY, OH, OK, PA, SD, TN, TX, WI, WV. Canada, ON
 Iridescent lilliput, *T. paulus* (I. Lea). CS. AL, FL, GA
 Savannah lilliput, *T. pullus* (Conrad). T. GA, NC, SC
 Texas lilliput, *T. texasensis* (I. Lea). CS. AR, IL, IN, KY, LA, MS, TN, TX

Tritogonia

Pistolgrip, *T. verrucosa* (Rafinesque). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MN, MO, MS, NC, OH, OK, PA, TN, TX, VA, WI, WV

Truncilla

Mexican fawnsfoot, *T. cognata* (I. Lea). E. TX. Mexico
 Fawnsfoot, *T. donaciformis* (I. Lea). CS. AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, PA, TN, TX, WI. Canada, ON
 Texas fawnsfoot, *T. macrodon* (I. Lea). E. TX
 Deertoe, *T. truncata* Rafinesque. CS. AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, PA, SD, TN, TX, VA, WI, WV. Canada, ON

Uniomerus

Florida pondhorn, *U. caroliniana* (Bosc). CS. AL, FL, GA, NC, SC
 Tapered pondhorn, *U. declivus* (Say). CS. AL, AR, LA, MS, TX
 Polished pondhorn, *U. excultus* (Conrad). U. LA
 Southern pondhorn, *U. obesus* (I. Lea). CS. GA, NC, SC, VA
 Pondhorn, *U. tetralasmus* (Say). CS. AL, AR, CO, FL, GA, IL, IN, KS, KY, LA, MO, MS, NE, OH, OK, TN, TX, VA, WV

Utterbackia

Paper pondshell, *U. imbecillis* Say. CS. AL, AR, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MN, MO, MS, NC, NE, NM, NY, OH, OK, PA, SC, TN, TX, VA, WI, WV. Canada, ON. Mexico
 Florida floater, *U. peggyae* R. I. Johnson. CS. AL, FL, GA

Venustaconcha

Ellipse, *V. ellipsiformis* (Conrad). SC. IA, IL, IN, MI, MN, MO, OH, WI
 Bleedingtooth mussel, *V. pleasi* (Marsh). SC. AR, KS, MO

Villosa

Florida rainbow, *V. amygdala* (I. Lea). CS. FL
 Ouachita creekshell, *V. arkansasensis* (I. Lea). SC. AR, OK
 Choctaw bean, *V. choctawensis* Athearn. T. AL, FL
 Notched rainbow, *V. constricta* (Conrad). SC. NC, VA
 Eastern creekshell, *V. delumbis* (Conrad). CS. GA, NC, SC
 Rayed bean, *V. fabalis* (I. Lea). SC. AL, IL, IN, KY, MI, NY, OH, PA, TN, VA, WV. Canada, ON
 Rainbow, *V. iris* (I. Lea). CS. AL, AR, IL, IN, KY, MI, MO, NC, NY, OH, OK, PA, TN, VA, WI, WV. Canada, ON
 Little spectaclecase, *V. lienosa* (Conrad). CS. AL, AR, FL, GA, IL, IN, KY, LA, MO, MS, OH, OK, TN, TX, WV

Alabama rainbow, *V. nebulosa* (Conrad). T. AL, GA
 Kentucky creekshell, *V. ortmanni* (Walker). SC. KY
 Purple bean, *V. perpurpurea* (I. Lea). E. GA, TN, VA
 Painted creekshell, *V. taeniata* (Conrad). CS. AL, KY, TN
 Cumberland bean, *V. trabalis* (Conrad). E. AL, KY, TN, VA
 Coosa creekshell, *V. vanuxemensis umbrans* (I. Lea). SC. AL, GA, TN
 Mountain creekshell, *V. v. vanuxemensis* (I. Lea). SC. AL, KY, NC, TN, VA
 Carolina creekshell, *V. vaughaniana* (I. Lea). SC. NC
 Southern rainbow, *V. vibex* (Conrad). CS. AL, FL, GA, MS, SC, TN
 Downy rainbow, *V. villosa* (Wright). SC. FL, GA

Additional Reading

We provide this section as a starting point for obtaining additional information on freshwater mussels in North America. Literature on freshwater mussels is extensive but often hard to find without access to a major university or museum library. We list here some of the relatively easy to obtain papers

concerning a variety of topics related to the biology of mussels. The list is organized alphabetically by state and includes both historical and recent publications dealing with large geographic regions (i.e., statewide or large drainages) and endangered species. The list is not comprehensive but includes papers that have relatively large literature cited sections that can be searched to find other papers of interest.

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Isom, B. G. 1969. The mussel resource of the Tennessee River. *Malacologia* 7:397–425.
La Rocque, A. 1962. Key references to the Mollusca of Alabama. *Sterkiana* 7:4, 6.



Cracking pearlymussel, *Hemistena lata*. Endangered. Duck River, Columbia [Maury] County, TN. Length: 2.75 in (7.05 cm). A. A. Hinkley collection.



Slabside pearlymussel, *Lexingtonia dolabelloides*. *Threatened*. Duck River, Columbia [Maury] County, TN. Length: 2.0 in (5.13 cm). W. A. Nason collection.



Rough pigtoe, *Pleurobema plenum*. *Endangered*. Barren River, Warren County, KY. Length: 3.0 in (7.69 cm). K. S. Cummings, C. A. Mayer, and R. R. Cicerello collections.



Louisiana pearlshell, *Margaritifera hembeli*. *Threatened*. Hunters Creek, Conecuh County, AL. Length: 3.5 in (8.97 cm). A. A. Hinkley collection.



Inflated heelsplitter, *Potamilus inflatus*. *Threatened*. Black Warrior River, Tuscaloosa County, AL. Length: 2.375 in (6.09 cm). P. Hartfield, J. Stewart, and R. Bowker collections.



Clubshell, *Pleurobema clava*. *Endangered*. Tippecanoe River, Talma, Fulton County, IN. Length: 1.875 in (4.81 cm). K. S. Cummings et al. collection.



Cumberland monkeyface, *Quadrula intermedia*. *Endangered*. Duck River, Columbia, TN. Length: 1.5 in (3.85 cm). A. A. Hinkley collection.

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Summary

The list includes 297 native freshwater mussels, the entire known fauna, of the United States and Canada. Of these, 213 taxa (71.7%) are considered endangered, threatened, or of special concern; only 70 (23.6%) are listed as currently stable. We emphasize that many taxa in the latter group may be subject to severe future declines as the zebra mussel invades large southern rivers and reservoirs. Twenty-one taxa (7.1%) are listed as possibly extinct, 77 (26.0%) as endangered, 43 (14.5%) as threatened, 72 (24.2%) as of special concern, and 14 (4.7%) as undetermined. Imperilment is extreme in some genera. Within the genera *Epioblasma* and *Pleurobema*, comprising 56 total taxa, 15 taxa are possibly extinct and 31 others

are extant but endangered. Clearly, efforts to protect aquatic resources are inadequate for freshwater mussels as well as other elements of the aquatic biota (Williams et al. 1989; Master 1990). We reiterate here the plea of Williams et al. (1989) that natural resource agencies manage proactively for conservation of entire ecosystems rather than relying on reactive efforts targeted at individual species, but grimly admit that many of the mussels listed herein obviously need emergency attention or they will perish. Freshwater mussels are valuable as a commercial resource, as indicators of aquatic environmental health, and as a major component of worldwide freshwater biodiversity. The numbers of imperiled mussels in the United States and Canada portend a trajectory toward an extinction crisis that, unless dampened by prompt conservation action, may result in the complete loss of some genera and severe impoverishment of the richest freshwater mussel fauna in the world. 

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