

Field Guide to the Freshwater Mussels of Minnesota

2nd Edition

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EWI_0002_2027

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).



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Foreword

This field guide is an update of the version published by the Minnesota Department of Natural Resources in 2003. Like the original, it is a resource for anyone interested in freshwater mussels and other bivalves found in Minnesota. It provides general information on freshwater mussel biology, ecological importance, threats, current conservation status, collection methods and regulations, and detailed accounts for all 51 native mussel species and 4 nonnative species. To improve its usefulness as an identification tool, shell descriptions were revised and expanded to highlight characteristics that distinguish similar species, and new or additional shell photographs were included.

Extensive surveys and research have greatly improved our knowledge of Minnesota's freshwater mussels since 2003. More than 4,000 sites have been surveyed across all major river drainages to document the composition, distribution, and status of mussels statewide. Notably, three native species were added to this edition of the guide: the lake floater (*Pyganodon lacustris*), canary kingshell (*Lampsilis sietmani*) and Gulf mapleleaf (*Quadrula nobilis*). Two nonnative species were also added: the Yangtze basket clam (*Corbicula largillierti*) and the quagga mussel (*Dreissena rostriformis bugensis*).

DNA-based analyses are now widely used to test and refine traditional morphology-based classifications and infer evolutionary relationships among species. Studies using molecular tools have been instrumental in clarifying species boundaries, including those listed above, and have led to name revisions for many others. Species names that have changed since 2003 are noted in the comments of those accounts.

Early life history studies have significantly improved our understanding of host relationships and infection strategies of many mussel species. This edition includes known hosts or host groups for each species and highlights several examples of host infection strategies, many of which were discovered through research in Minnesota.

This guide is for the experienced and inexperienced alike. It is meant to provide information and answer questions, but also to encourage curiosity and exploration of these fascinating animals. Whether you've been studying freshwater mussels for years or are seeing one for the first time, it is our hope that this guide enhances your understanding and appreciation of these ecologically important species.

Acknowledgments

This guide would not have been possible without the many individuals who contributed their time, expertise, and resources to its preparation. We are especially grateful to the DNR's Center for Aquatic Mollusk Programs (CAMP) staff — Jacob Keay, Isabel Boyce, Jordan Holcomb, Kathryn Holcomb, Lindsay Ohlman and Zebulin Secrist — for their support and patience throughout this project and for their many insightful reviews, discussions and suggestions. We owe special thanks to Zeb for developing and managing the DNR's mussel survey database and producing the species distribution maps; to Jordan for reviewing the species accounts and providing numerous helpful suggestions and edits; and to Kate, Lindsay, and Isabel for securing funding.

We appreciate Gabriela Beachey, Don Eaton, Bridget Henning-Randa, Greg Husak, Lindsey Kemp, Sean Keogh, and Kelly Pennington for their thoughtful reviews and suggestions on all or portions of the text, which significantly improved the guide.

We are indebted to the museum curators and staff who generously provided access to their collections and resources, specimen data and photographs: Kassandra Ford and Andrew Simons, University of Minnesota Bell Museum; Allison Stodola, Illinois Natural History Survey; Nathaniel Shoobs, Ohio State University Museum of Biological Diversity; Sean Keogh, Field Museum of Natural History, Chicago; Ellen Strong and John Pfeiffer, National Museum of Natural History, Smithsonian Institution; to Jesse Weinzinger for sharing the Wisconsin Department of Natural Resources' mussel data; and to Kevin S. Cummings for permission to use portions of the glossary from their publication *Field Guide to Freshwater Mussels of the Midwest*.

Survey data used in this field guide was collected over the course of several decades. Funding for statewide mussel surveys was provided by the Office of Conservation Investment — State Wildlife Grants Program, LCCMR, and a variety of other state and federal funding sources. We are grateful for the support from countless biologists, interns, and other individuals representing state and federal agencies, organizations, and volunteers who assisted with surveys.

We are very grateful to Amy Beyer for producing the design and layout of the guide and offering helpful advice, and to Deborah Rose for photographing the bulk of the shell images.

Lastly, we thank Mike Davis, who initiated the first statewide mussel survey that laid the foundation for the Minnesota DNR's Mussel Program, and who has been an exceptional teacher and mentor on all things mussels.

Contributed photographs and illustrations

Robert Bright – Umbo sculpture photos (pp. 36, 42, 44, 46, 48, 52, 54, 64, 68, 98, 104, 106, 126).

Mike Davis – Fragile papershell lure (p. 14), purple wartyback conglutinate (p. 15), zebra mussels and threehorn wartyback (p. 138).

Sarah Douglass – Mudpuppy (p. 52).

Jerry Gagne – Quagga mussel (FMNH 310454) (p. 138).

Rick Hart – Button shells (p. 17).

Sean Keogh – Canary kingshell umbo sculpture (JFBM 22438.5) (p. 102).

Don Luce – Mussel anatomy and lifecycle illustrations (pp. 11-13).

Ashleigh McCallum – Sheepnose juvenile (INHS 44254), canary kingshell male (INHS 1676) and juvenile (INHS 1068), juvenile flat floater (INHS 93519), juvenile elephantear (INHS 1462), female scaleshell (INHS 20374), and juvenile fat pocketbook (INHS 32690) (pp. 72, 102, 58, 66, 122, 118).

Amy Mester – Original artwork (p. 23).

Nathaniel Shoobs – Large male scaleshell (OSUM IZB 56849) (p. 122).

Introduction to Freshwater Mussels

Freshwater mussels are mollusks, distant relatives of snails, slugs, octopuses, and other members of the phylum Mollusca. More specifically, they belong to the class Bivalvia: a large and diverse group of marine and freshwater mollusks with two shells, or “valves,” held together by an elastic ligament. Freshwater mussels (order Unionida), sometimes referred to as “clams” or “unionids,” share many similarities with better-known saltwater bivalves such as oysters and scallops. In fact, unionids are descendants of marine clams. There are more than 300 species of freshwater mussels native to the United States and Canada, 51 of which have been recorded in Minnesota.

Other freshwater bivalve groups occur in Minnesota, but they are not closely related to unionid mussels. These include native fingernail, pill or pea clams (order Sphaeriida) and four nonnative, invasive species: the well-known zebra mussel (*Dreissena polymorpha*) and its close relative the quagga mussel (*Dreissena rostriformis bugensis*) (order Myida), Chinese basket clam (*Corbicula fluminea*) and Yangtze basket clam (*Corbicula largillierti*) (order Venerida). While native unionid mussels share some traits with these species as bivalves, as well as the name “mussel,” they differ in important ways, including reproduction, development and ecological impacts. For a more detailed overview of North American freshwater bivalves and the differences among them, see Cummings and Graf (2015).

Hereafter, when the term “mussel” is used it refers only to native unionid mussels.

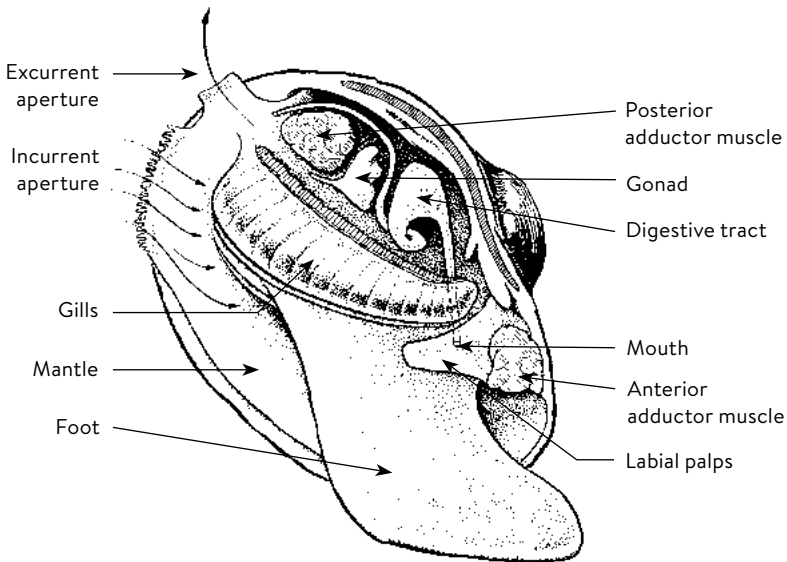
Mussel Biology

Mussels spend most of their lives buried in the bottom sediments of permanent water bodies and can occur in nearly any aquatic habitat where fish are present. Most species live exclusively in flowing streams, and diversity commonly increases as streams become larger. Fewer species occur in lakes, with those in Minnesota typically supporting only one to three species, and they tend to be uncommon or absent in streams that stay cool year-round, such as trout streams. Mussels are often found in multi-species assemblages called mussel beds. Since many species can live for decades, and some for over a century, mussel beds persist in habitats that provide long-term stability, even during extreme events such as floods and drought. Mussel beds can support 30 or more species and reach densities exceeding 100 individuals per square meter.

Mussels are filter feeders: organisms that capture tiny particles suspended in the water. Unlike many other bivalves, unionids lack true tubular siphons, but instead have unfused incurrent and excurrent apertures that function as siphons. They draw water in through the incurrent aperture and pass it over their gills, where oxygen is extracted and food particles such as algae, bacteria and other organic matter are captured. Tiny, hairlike cilia on the gills move captured material to the labial palps, where food is sorted from non-food particles and passed to the mussel's mouth. Rejected particles are bound in mucus to form pseudofeces, which is expelled through the excurrent aperture along with feces.

Mussels are mostly sedentary but can move short distances using a hatchet-shaped muscle called the foot, which they extend out between the valves. They use the foot to burrow and anchor in the sediment, or to scooch by extending it into the substrate and contracting it to pull themselves forward. Mussels are capable of moving long distances during the parasitic larval stage of their life cycle (see p. 13).

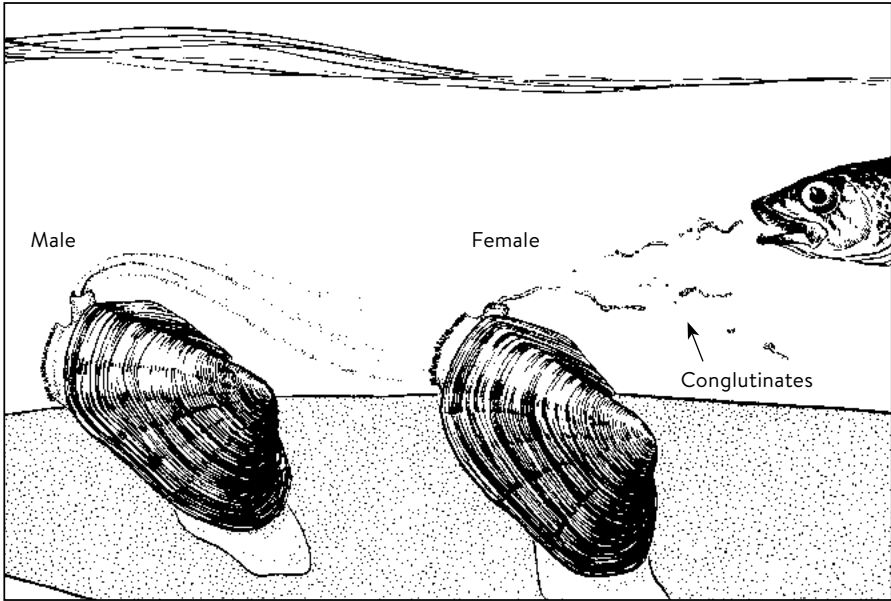
Mussel Anatomy



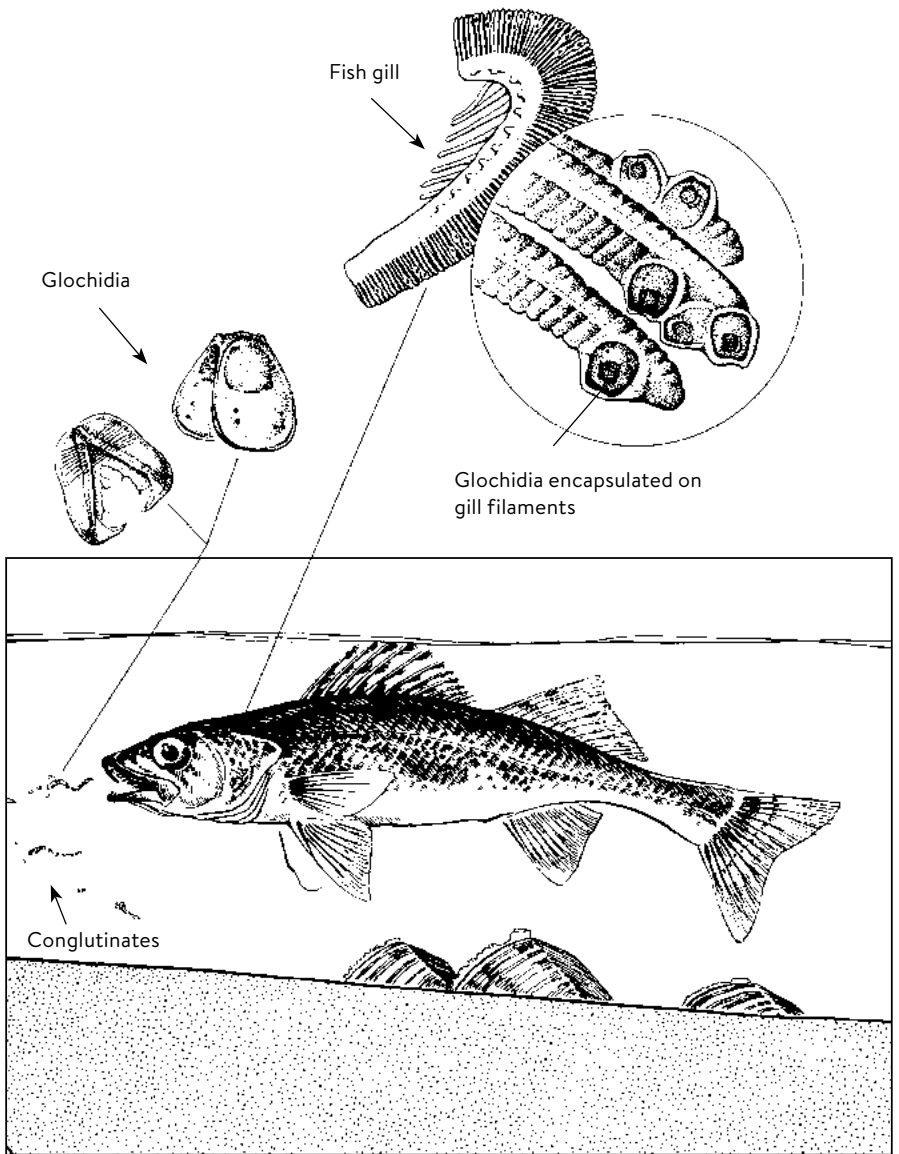
Mussel Life Cycle

Freshwater mussels have a complex and fascinating life cycle that includes a parasitic larval stage, a unique trait among bivalves. Males release sperm into the water, which females draw in through the incurrent aperture. Fertilized eggs are brooded in the female's gills, where they develop into tiny clam-shaped larvae called glochidia. To complete the next stage of their life cycle, glochidia must attach to a suitable host, typically on the gills or fins of a fish. A unique exception is the salamander mussel (*Simpsonaias ambigua*), which uses the mudpuppy (*Necturus maculosus*), an amphibian, as its host. Some mussels require a specific species of fish as a host, while others can use multiple species.

Mussels use several strategies to increase the likelihood that their larvae attach to a suitable host. Some species broadcast glochidia by simply releasing them into the water, while others release strands or webs of mucus containing glochidia that attach to fish upon contact. Other species have more specialized adaptations for attracting and infecting their hosts; these include mantle lures that resemble prey items, such as small fish or aquatic insects, and are moved by rhythmic flapping or twitching. When a fish strikes the imposter “prey,” the mussel’s gills rupture, releasing glochidia that attach to the fish’s gills. Another strategy involves releasing glochidia in small packets called *conglutinates*, which mimic insect larvae, worms or other prey that host fish commonly eat. When a fish attempts to eat a conglutinate, glochidia are released and attach to the gills. Conglutinates of some species, such as Wabash pigtoe (*Fusconaia flava*) and round pigtoe (*Pleurobema sintoxia*), also contain unfertilized eggs that provide structure and color (see p. 15).



Glochidia become encapsulated by host tissue, where they remain attached for a period of weeks to several months, obtaining nutrients needed for development. During this time, they undergo metamorphosis into juvenile mussels. When this process is complete, they detach from the host and burrow into the sediment to continue growing as free-living mussels. Since mussels have limited mobility, the parasitic stage serves as their primary means of dispersal. The parasitic larvae rarely harm the host, and infected fish can acquire immunity to subsequent infection.



Mussel Lures

Mussels displaying their mantle lure to attract host fish.



Plain pocketbook (*Lampsilis cardium*)



Black sandshell (*Ligumia recta*)



Fragile papershell (*Potamilus fragilis*)



Winged mapleleaf (*Quadrula fragosa*)



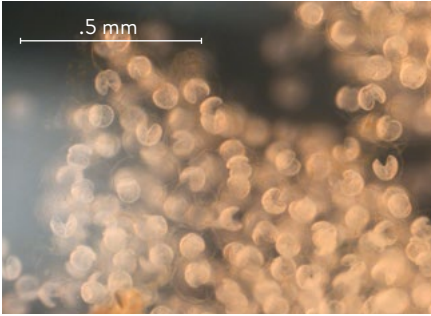
Pistolgrip (*Quadrula verrucosa*)



Rockshell (*Theliderma metanevra*)

Mussel Conglutinates

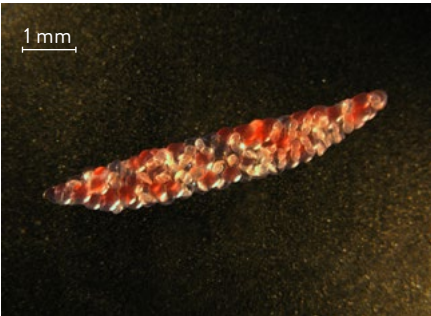
Mussel conglutinates containing glochidia.



Spectaclecase larvae
(*Cumberlandia monodonta*)



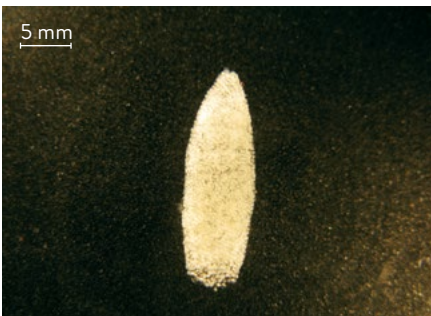
Purple wartyback
(*Cyclonaias tuberculata*)



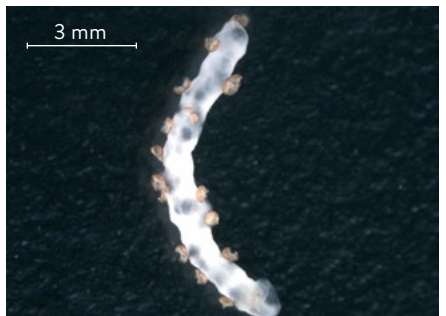
Wabash pigtoe (*Fusconaia flava*)



Wabash pigtoe (*Fusconaia flava*)



Round pigtoe (*Pleurobema sintoxia*)



Creeper (*Strophitus undulatus*)

The Role of Mussels in Ecosystems and Human History

In their natural environment, mussels are easily overlooked by the casual observer. When they are noticed at all, it is often only as empty shells lying on the bank, the animal inside long gone. Despite their inconspicuous nature, mussels play an important role in river and lake ecosystems and aquatic food webs.

Mussels filter large volumes of water as they feed. They capture and remove suspended particles from the water column and deposit unassimilated organic matter on river and lake bottoms, which becomes food for other organisms. Mussels are also eaten by muskrats (*Ondatra zibethicus*), river otters (*Lontra canadensis*), raccoons (*Procyon lotor*), and several species of fish, including freshwater drum (*Aplodinotus grunniens*) and channel catfish (*Ictalurus punctatus*). A single muskrat can consume hundreds of mussels in a year, discarding shells into piles called middens on the bank. These middens are sources of information about the species of mussels that live there.

Mussels and their empty shells add physical structure to streams and lakes. They provide habitat for algae, insect larvae and other organisms that attach to or occupy the shells of living and dead mussels. Empty shells also serve as egg-laying sites for fish and invertebrates, and shelter from predators for small fish and crayfish. By anchoring themselves in place, mussels may even help stabilize the substrate against the scouring effects of flowing water.

Humans have used mussels for millennia. Archaeological excavations have unearthed shell material in eastern North America from sites dating back 10,000 years. Indigenous peoples used mussels for food and used the shells to make tools and jewelry and to temper pottery. By the mid-1800s, European Americans in the eastern United States had discovered that natural pearls form within mussel shells. Pearl hunting spread throughout the United States, and pearlers were collecting mussels from as far west as the Mississippi River by the end of the 1800s. Middens left by indigenous peoples and pearlers persist today, providing valuable evidence of past mussel assemblages.

Beginning in the 1890s, mussels were harvested to make pearl buttons from their shells. Mussel shells were harvested in vast quantities from the Mississippi River and its major tributaries until the 1940s, when plastic buttons took the place of pearl buttons. More recently, freshwater mussels have been harvested for use in the cultured pearl industry. The mussel shells are ground into beads and inserted into live oysters. The mantle of the oyster secretes thin layers of mother-of-pearl over the inserted beads, eventually forming a cultured pearl.



Mussel shells drilled for buttons

Current Status of Freshwater Mussels

A quick view of distribution maps in the species accounts illustrates the vulnerable status of many species in Minnesota. Over half of the state's mussel species are classified as Species in Greatest Conservation Need, with the majority of these listed as Extirpated, Endangered, Threatened, or Special Concern (see Status Classifications, p. 24). This reflects a national and global pattern of declining abundance, extirpations and extinctions associated with various environmental disturbances. The precise causes of some declines are difficult to pinpoint and likely involve the combined effects of multiple disturbances. In other cases, declines remain unexplained and are referred to as “enigmatic” (Haag 2012).

Historically, severe water pollution and overharvesting were major causes of mussel declines. Today, habitat degradation is a leading threat to mussel populations. Changes in flow regimes, along with landscape alterations from a variety of human activities, have degraded mussel habitats. The effects of these disturbances have been especially severe in some southern Minnesota watersheds, including the Minnesota and Des Moines, which have lost a significant portion of their historical species assemblages. Dams are particularly damaging to mussels: they isolate populations by blocking the movements of host fishes (which are essential to the mussel life cycle and larval dispersal), altering natural flow and temperature regimes, and converting upstream reaches into silt-laden impoundments that are unsuitable for many mussel and fish species.

In addition, invasive zebra mussels continue to threaten native mussel populations. Zebra mussels compete with native mussels for food and can cause direct mortality by encrusting their shells and interfering with feeding, movement and reproduction. Their impact may be especially severe on native species in lakes, where zebra mussels often reach high densities.

Mussel Collecting Regulations

All native mussel species are protected under Minnesota's game and fish laws.

At the time of this writing in 2025, any person possessing a valid Minnesota angling license is permitted to collect and possess up to 24 whole or 48 half shells of mussels found dead that are not state or federally listed as endangered or threatened species, or prohibited invasive species. Shells may not be collected from the St. Croix River, and no shells may be bought or sold. Consult Minnesota's fishing regulations for the most current laws on collecting shells.

If you are interested in mussels from a naturalist perspective and enjoy posting species sightings to iNaturalist or the Clam Counter Minnesota app, only examine dead shells and leave live mussels undisturbed to reduce stress.

If you intend to collect or handle live mussels for scientific research or educational programs, a special permit issued by the Minnesota DNR's Endangered Species Program is required. More information on permitting can be found on the DNR's website.

How to Find Mussels

For persons who have acquired the proper permit(s) to handle or collect living mussels, some recommended methods are summarized below.

- Wading in shallow water is an easy way to find mussels and shells. If visibility allows, watch for and follow furrows: the tracks that mussels leave as they plow through the substrate while moving (see photo on facing page, p. 21). If the water is murky, you might have to feel for mussels with your hands. Sweep your hands back and forth and run your fingers through loose sediment like a rake. The symmetrical shape and tapered edge of the shell helps distinguish mussels from rocks, and there is often more resistance when you bump into a mussel because it is anchored in place. You can even feel for mussels with your feet in deeper areas with soft sediment, but wearing shoes is recommended.
- In clear water, searching with a mask and snorkel is an excellent way to see mussels in their natural environment. Since mussels are usually burrowed into sediment, often all that is visible are the apertures or a small portion of the posterior (see p. 21). A useful tool to see underwater can be made by cutting out the bottom of a 5-gallon bucket and replacing it with plexiglass. This allows an unobstructed view of the stream bottom on windy days or in riffles where the water's surface is rough.
- Keep live mussels moist and cool to reduce stress and return them to collection sites as soon as possible.
- When returning a live mussel to the river after examining it, it is best to lay it on its side on top of the substrate. It will burrow back into the substrate on its own. It is important to not put the mussel back into the substrate upside down because it could suffocate.

Keeping a record of the locality of mussels and shells that you find will add scientific value. At a minimum, record the water body, latitude and longitude, date of collection, collector name(s) and high-quality photos of the specimen, including the umbo sculpture if present.



Tracks left by crawling mussels (top). Apertures of a pink heelsplitter buried in the sediment (bottom); the incurrent aperture has papillae that help exclude debris.

You Can Participate in Mussel Conservation

There are many ways you can make a difference in mussel conservation in Minnesota. Most important is to spread the word about how interesting mussels are and how ecologically important they are to the health of Minnesota's rivers and lakes. Good land use practices at home can help improve water quality and protect the habitats mussels depend on for survival. Using less salt in winter, leaving a natural vegetation buffer at the water's edge on waterfront properties and reducing the use of fertilizers and pesticides in your yard are all habits that can help mussels and the environment.

Preventing the spread of aquatic invasive species (AIS) is essential for protecting Minnesota's aquatic ecosystems and native mussels. Steps you can take to prevent the spread of AIS can be found on the DNR's Aquatic Invasive Species website. It is illegal to release any nonnative species into the wild in Minnesota without approval from the DNR. In addition, you may not possess, import, purchase, transport, or introduce prohibited invasive species except under a permit for disposal, control, research, or education. A list of invertebrates designated as prohibited invasive species can be found in Minnesota Rules (part 6216.0250) and on the DNR's AIS website. In this guide, these include zebra and quagga mussels and the golden clam (recognized as two distinct species: Chinese basket clam and Yangtze basket clam).

Additionally, applications such as the DNR's Clam Counter Minnesota app and iNaturalist offer citizen science opportunities to improve our understanding of mussel distributions across the state. The Clam Counter app also helps users identify specimens, record collection data, and access tools and tips for accurate identification (see Mussel Resources Online, p. 149).

Introduction to Species Accounts

Species accounts are organized by taxonomic group with individual accounts for each native mussel species and for fingernail clams, basket clams, and zebra and quagga mussels. Native mussel species are further grouped by family, subfamily and tribe. Species within tribes are ordered alphabetically by their scientific name. Grouping the accounts in this way is intended to simplify comparisons between closely related species that may look similar. Common and scientific names follow the Freshwater Mollusk Conservation Society's checklist of freshwater mussels of the United States and Canada (Williams et al. 2017; revised in 2025). The common name is listed first, followed by the scientific name. Each species account includes state and federal legal protection statuses, shell photographs, a list of similar species with distinguishing characteristics, a shell description, known hosts, a general description of habitat and distribution, and a distribution map.



Status Classifications

Status, as used in the species accounts, indicates whether a species receives specific protections under the federal Endangered Species Act of 1973, Minnesota Statute 84.0895 Protection of Threatened and Endangered Species, or both. Note that Minnesota Game and Fish laws protect all live, native mussels.

Federal Protections

The federal Endangered Species Act of 1973 includes multiple possible designations of species. This guide defines only the statuses held by mussel species known to occur in Minnesota as of 2025. The federal Lacey Act also allows for designation of wildlife (typically invasive species) as “injurious” and requires federal permits for their importation to the U.S. and any transportation between U.S. states and territories.

FEDERAL STATUS: ENDANGERED

Federal Status: Endangered – in danger of extinction throughout all or a significant portion of its range.

FEDERAL STATUS: PROPOSED ENDANGERED

Federal Status: Proposed Endangered – determined to be endangered (see above) and currently proposed for listing under federal protections.

FEDERAL STATUS: INJURIOUS WILDLIFE

Federal Status: Injurious Wildlife – under a provision of the Lacey Act (18 U.S.C. 42), any importation of injurious wildlife into the United States or its territories or possessions must be authorized under a permit issued by the U.S. Fish and Wildlife Service. In addition, for any injurious specimens listed in the code of federal regulations (50 CFR 16), transport between the continental United States, the District of Columbia, Hawai‘i, the Commonwealth of Puerto Rico, or any territory or possession of the United States by any means whatsoever must be authorized by the U.S. Fish and Wildlife Service.

State Protections

Minnesota Statute 84.0895 Protection of Threatened and Endangered Species defines three designations for species: endangered, threatened, and special concern. Additionally, the state game and fish laws protect all live, native mussels in Minnesota, not just those classified on the state list of endangered, threatened, and special concern species. The DNR also designates some nonnative, invasive bivalve species as prohibited and regulates the possession and use of such species.

STATE STATUS: EXTIRPATED

Minnesota Status: Extirpated – a species no longer found alive within the state.

STATE STATUS: ENDANGERED

Minnesota Status: Endangered – threatened with extinction throughout all or a significant portion of its range within Minnesota.

STATE STATUS: THREATENED

Minnesota Status: Threatened – likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.

STATE STATUS: SPECIAL CONCERN

Minnesota Status: Special Concern – extremely uncommon in Minnesota or has unique or highly specific habitat requirements and careful monitoring of its status is required. Species on the periphery of their range that are not listed as threatened may be included in this category, along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

STATE STATUS: UNCLASSIFIED

Minnesota Status: Unclassified – a species that has no special designation under the state or federal endangered species laws. As noted above, all living, native mussels are protected under Minnesota's game and fish laws.

STATE STATUS: PROHIBITED INVASIVE SPECIES

Minnesota Status: Prohibited Invasive Species – a nonnative species prohibited for possession, import, purchase, propagation, transport, or introduction in the state without a permit.

Photographs and Shell Characteristics

Shell photographs were selected to illustrate external and internal features useful for identifying mussel species in Minnesota.

Characteristics described in species accounts represent forms typically found in Minnesota and the upper Mississippi River basin. Some characteristics may not apply in other areas of a species' range. Photographs represent some of the variation that may be encountered, including smaller and larger individuals. Smaller individuals and juveniles enclosed in a circle are shown at a larger scale with a separate scale bar. An image of umbo sculpture is included when it is a useful identifying feature.

Multiple characteristics are often needed to identify shells, and the combination of useful characteristics varies among mussel species. Specialized terms used in species descriptions are defined in the Glossary (p. 144) and illustrated in the diagram of Shell Morphology (p. 28). Some of Minnesota's mussel species are distinctive and can be easily identified using photographs. In other cases, you may need to narrow down the possible species to a few candidates and carefully compare their descriptions to make an accurate identification. Shell characteristics, such as thickness, shape, size and color, vary among species but may also vary widely within a species. For example, thickness and shape may differ depending on an individual's age and where it lives (a lake, small stream or large river). Shell sculpture, such as pustules and ridges, also varies between individuals of the same species. As mussels age, their shells typically darken, rays fade, and surface layers may become eroded. Although shells of dead mussels can persist for decades or even centuries and may exhibit extreme wear, identifying features often remain.

The umbo is the oldest part of the shell and often has features that help distinguish similar species. Umbo sculpture, a pattern of ridges or bumps that typically form during the first few months of growth, is often a key characteristic when other shell traits are inconclusive. The outline of the shell when an individual was young is also informative and often more consistent than the shape of older individuals, which can be influenced by habitat and environmental conditions over time. In species accounts, this is referred to as the "young outline." In older individuals, the young outline is preserved in annual growth rings (annuli) near the umbo. The degree of umbo inflation, its elevation relative to the hinge line or position along the dorsal margin may also be key or supporting characters for identifying some species.

Most of the specimens in the species accounts were collected in Minnesota and are housed at the University of Minnesota's James Ford

Bell Museum of Natural History. Some specimens of species that are rare or extirpated in Minnesota were collected in Wisconsin, Illinois or Missouri and are housed in mollusk collections at the Illinois Natural History Survey (INHS), Field Museum of Natural History (FMNH) and The Ohio State University Museum of Biological Diversity (OSUM).

Mussel Hosts

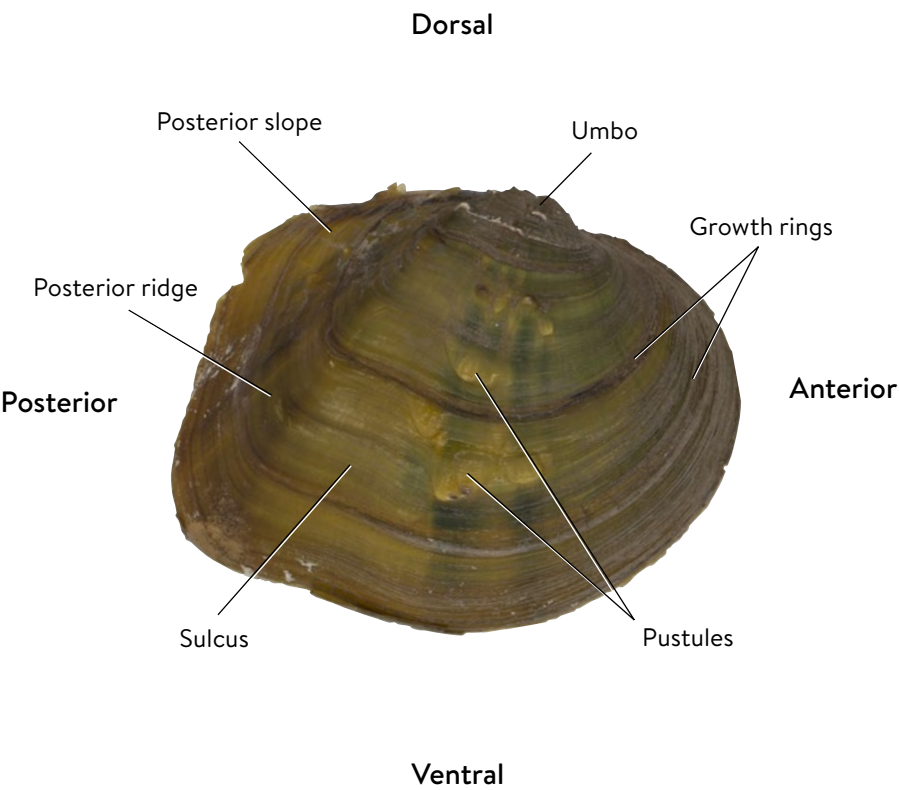
Host fish species are known to some degree for most mussel species in Minnesota. Each species account includes specific species or groups of species that are known or presumed to be important hosts. Most host relationships were determined from laboratory studies that exposed multiple fish species to glochidia to test their compatibility. If glochidia develop into juvenile mussels, that species is considered a suitable host. Hosts for some species have been confirmed in nature by identifying juvenile mussels recovered from fish captured in the wild. This is considered the gold standard for determining host relationships. It is not always practical or useful to list all known hosts because many species have a large number of suitable hosts that vary widely in their compatibility. In these cases, hosts are lumped into groups of similar species, or the mussel is classified as a host generalist. Host generalist mussels have broad compatibility with many families and species of fishes.

Host groups may include one or more species and are categorized by the common name of the fish family or similarity of species within the group. Host group names used in accounts include: **catfishes** (Ictaluridae); **gars** (Lepisosteidae); **minnows** (Leuciscidae; formerly Cyprinidae); **suckers** (Catostomidae); **sturgeons** (Acipenseridae); **sculpins** (Cottidae); **basses**, largemouth bass (*Micropterus nigricans*), smallmouth bass (*Micropterus dolomieu*) and white bass (*Morone chrysops*); **sunfishes**, species of *Ambloplites*, *Lepomis*, and *Pomoxis*; **darters**, species of *Etheostoma* and *Percina*; **large percids**, walleye (*Sander vitreus*), sauger (*Sander canadensis*) and yellow perch (*Perca flavescens*); **percids**, darters and large percids combined.

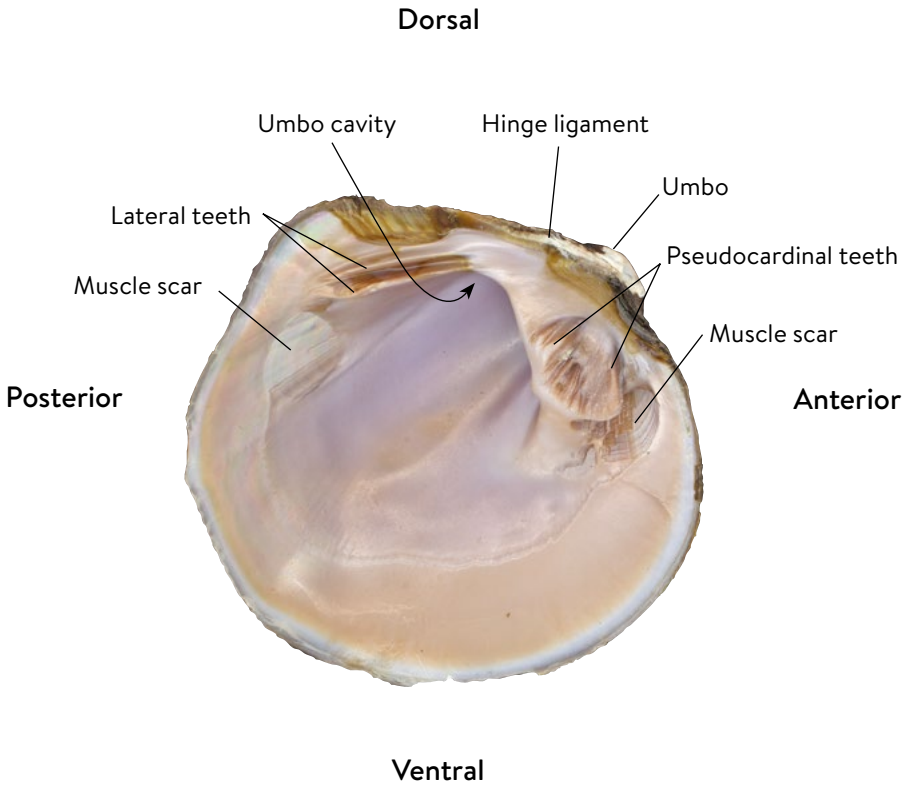
Much of the information on host relationships is based on research by Mark Hove (University of Minnesota) and collaborations with the Minnesota DNR. Host information was summarized from Haag (2012), Hornbach et al. (2024) and sources in the Freshwater Mussel Host Database (2023).

Shell Morphology

Right valve

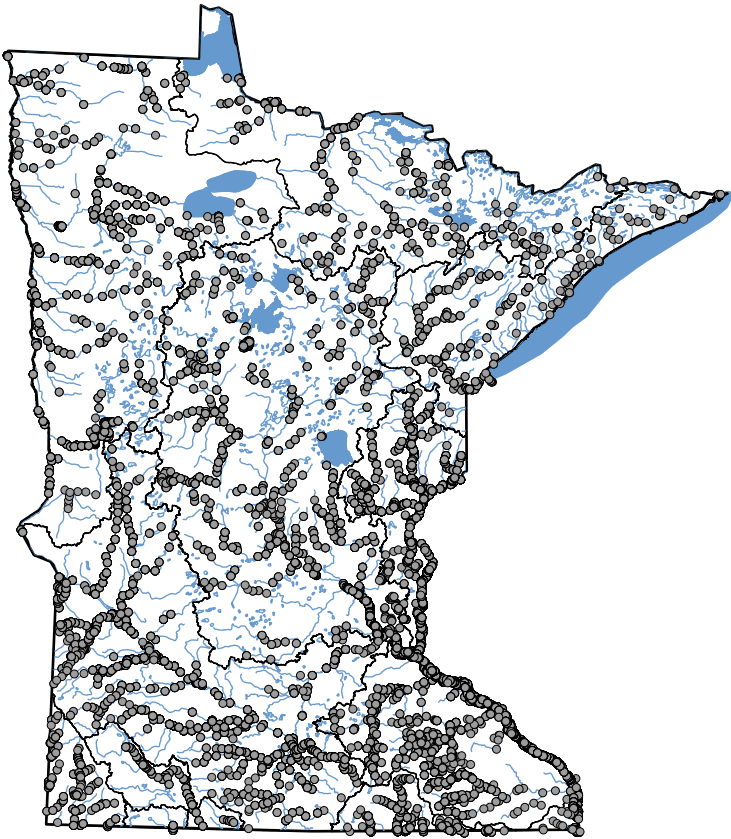


Left valve



Distribution Maps

Each species account includes a map of known occurrences in Minnesota. Most of these data were collected by the Minnesota DNR, which began a concerted statewide mussel survey effort in 1999. Additional records are from Wisconsin DNR surveys in border waters conducted since 2000, as well as pre-1999 surveys by the Minnesota DNR and Bright et al. (1988). Distribution maps for some native species that are rare or presumed extirpated from Minnesota may be based partly or entirely on verified museum specimens. Nonnative species distributions were based primarily on EDDMapS (2025), along with verified museum specimens. Museum records were obtained from the University of Minnesota Bell Museum, Illinois Natural History Survey, Smithsonian National Museum of Natural History and The Ohio State University Museum of Biological Diversity.



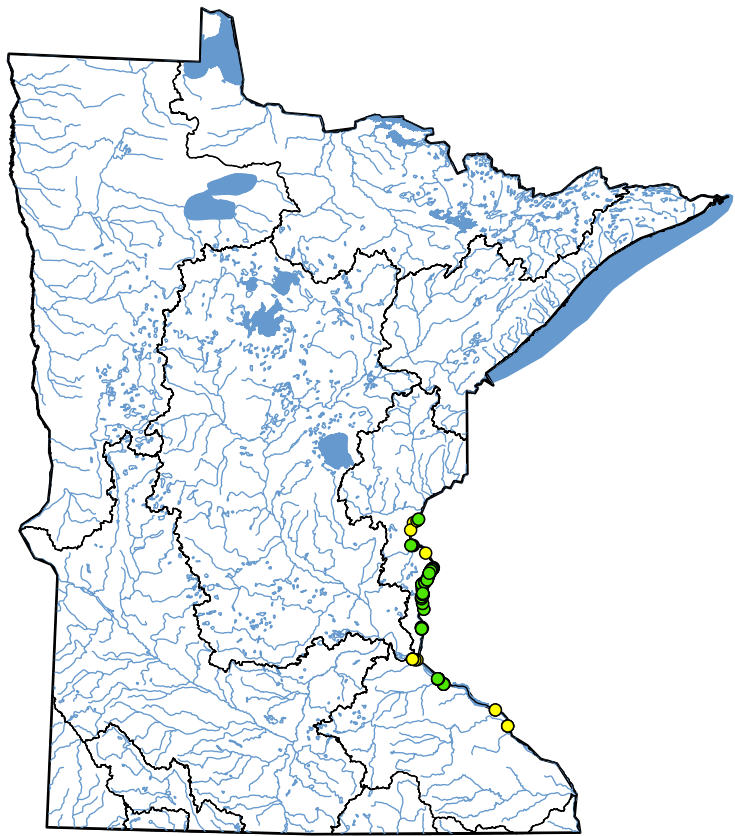
Freshwater mussel survey sites in Minnesota, 1999-2025.

In species accounts, the Mississippi River Headwaters refers to the watershed above St. Anthony Falls, which was a barrier to upstream dispersal of fishes and mussels prior to the construction of Upper and Lower St. Anthony Falls locks and dams. The upper and lower St. Croix River refer to the watershed upstream and downstream of St. Croix Falls Dam at Taylors Falls, where a six-mile stretch of rapids, now flooded by the reservoir, may have been a partial barrier to the upstream dispersal of some mussel species. The dam now completely blocks upstream movement of both fish and mussels.



Watershed boundaries of Minnesota’s major river systems, their primary tributaries, and the general direction of water flow (green arrows). The Red River of the North and Rainy River–Lake of the Woods systems drain to Hudson Bay, while the Great Lakes–Lake Superior system drains to the Atlantic Ocean. The remaining watersheds are part of the Mississippi River basin, which drains to the Gulf of Mexico.

Reviewing distribution maps can help narrow down which species are likely to occur within a given watershed. Keep in mind that the maps reflect our current knowledge of species distributions, which may change or be incomplete. If you think you have found a species where it has not been observed before, please email clamcountertermn.dnr@state.mn.us to report a possible new distribution record.



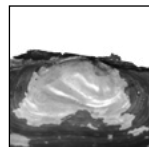
Example species distribution map. Bold lines depict watershed boundaries of Minnesota’s major river systems. Green dots indicate sites where at least one live specimen was collected since 1999. Yellow dots indicate sites where only shells were found, or the species was found alive before 1999. For nonnative bivalve species, all known occurrences are mapped, which may include live or dead specimens.

Spectaclecase

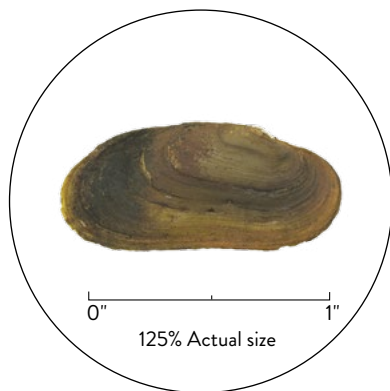
Cumberlandia monodonta

STATE STATUS: ENDANGERED

FEDERAL STATUS: ENDANGERED



Umbo sculpture



0" 1"
50% Actual size

Similar Species

Black sandshell, salamander mussel and spike. Spectaclecase is distinguished from black sandshell and spike by its thinner, more compressed shell, rounded posterior margin, absence of rays and reduced teeth. Juvenile spectaclecase differ from salamander mussel by their distinct umbo sculpture, more compressed shell and presence of lateral teeth.

Shell Characteristics

Thin and sturdy, anterior becoming thicker with age; elongate; compressed. Ventral margin usually concave, posterior margin rounded; posterior ridge broad and low; umbo low, barely elevated above the hinge line. Umbo sculpture two or three thick ridges, visible only in young. Periostracum usually rough in texture; brown to black; rays absent. Pseudocardinal teeth small, lateral teeth thin and straight when young, becoming thicker with age; umbo cavity shallow; nacre white. Length: up to 8 inches.

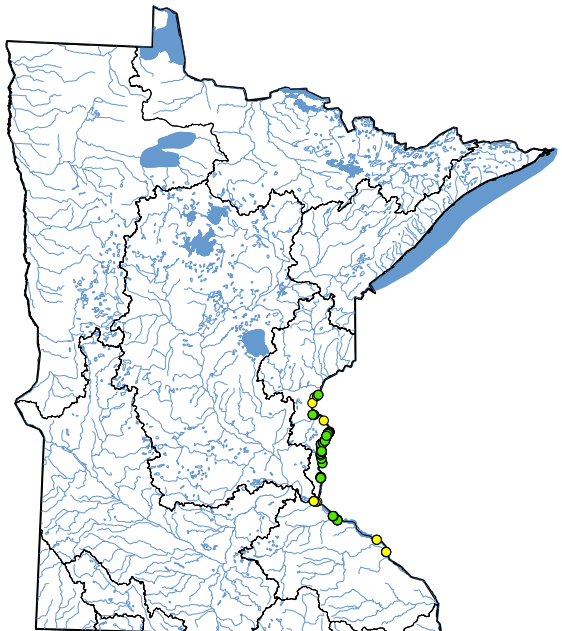
Hosts

Mooneye (*Hiodon tergisus*) and goldeye (*Hiodon alosoides*).

Distribution and Habitat

Occurs in large rivers in Minnesota. Colonies typically live in cavities under or between boulders, sometimes in large numbers. The St. Croix River below Taylors Falls supports one of the largest remaining populations. Localized and very rare in the Mississippi River in Minnesota below St. Anthony

Falls. A remnant, aging population upstream of Taylors Falls is declining due to the absence of host fish, which are blocked by the St. Croix Falls Dam. The dam has isolated this population since its completion in 1907, and the remaining individuals are likely over 100 years old.

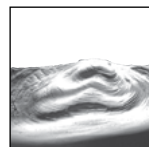


Elktoe

Alasmidonta marginata

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



Posterior view



0" 1"
75% Actual size

Similar Species

Deertoe and snuffbox. Elktoe is distinguished from both by its prominent umbo sculpture, speckled periostracum and reduced teeth. Elktoe are usually larger; young individuals have thinner shells than deertoe and snuffbox. Fine ridges on the posterior slope distinguish it from deertoe.

Shell Characteristics

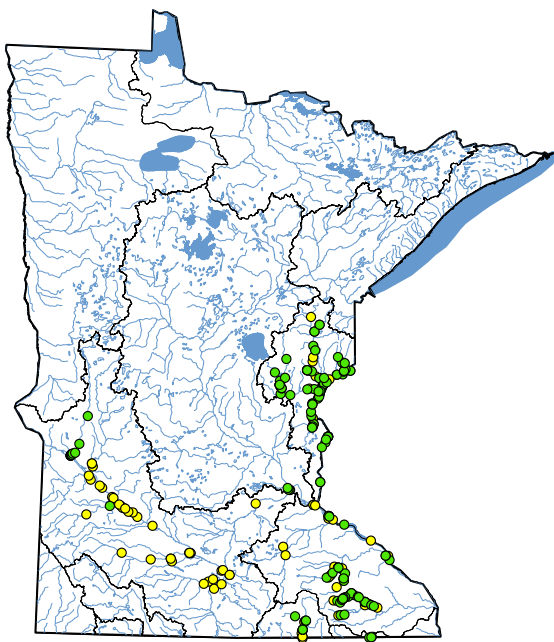
Thin and very sturdy, becoming thicker with age; triangular, sometimes elongate; usually inflated. Posterior ridge is prominent and sharply angled; posterior slope is flat, usually with numerous fine ridges. Umbo sculpture a few thick, weakly double-looped ridges. Periostracum greenish-yellow with numerous green rays and dark speckles. Pseudocardinal teeth thin, lateral teeth absent; nacre white. Length: up to 5.5 inches.

Hosts

Suckers; other species including minnows may be marginal hosts.

Distribution and Habitat

Occurs in small creeks to large rivers. Extirpated from the Cannon River and much of the Minnesota River drainage. Uncommon or rare in the Mississippi River below St. Anthony Falls and some Mississippi River tributaries in southeastern Minnesota. Widespread and relatively common in the upper St. Croix River drainage. Populations in the Pomme de Terre and Cedar rivers seem to be improving.

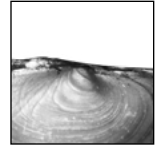


Cylindrical papershell

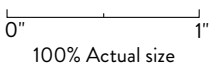
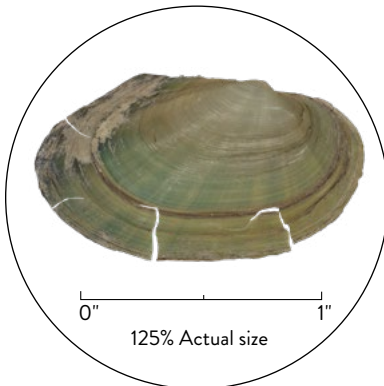
Anodontoides ferussacianus

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



Similar Species

Creeper, giant floater, lake floater, paper pondshell and salamander mussel. Cylindrical papershell differs from these species by its distinct and diminutive umbo sculpture. It is further distinguished from paper pondshell by its elevated umbo, from giant floater and lake floater by its typically rounder posterior margin, from creeper by the absence of teeth and comparatively thinner shell, and from salamander mussel by the presence of rays.

Shell Characteristics

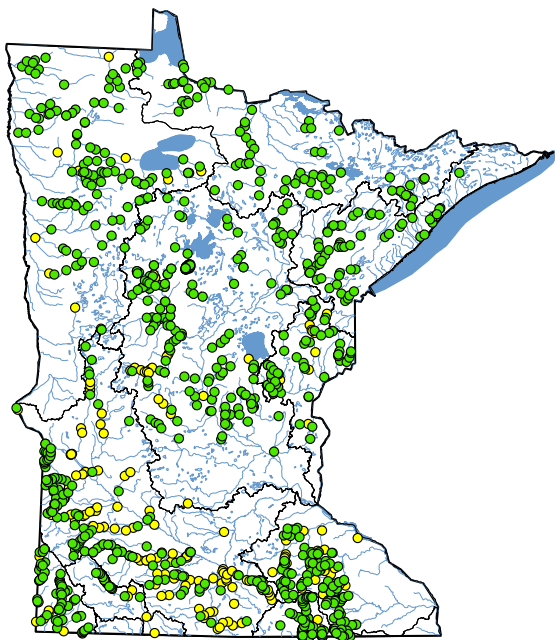
Thin and sturdy; elliptical or elongate; moderately compressed to inflated. Posterior margin bluntly pointed or rounded; posterior ridge broadly rounded and often inflated; umbo elevated slightly above the hinge line. Umbo sculpture two or three small concentric ridges, angled posteriorly. Periostracum somewhat glossy; yellowish, greenish or brown, cream-colored in first year; usually with green rays. Teeth absent; nacre white or silvery. Length: up to 4 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs statewide in creeks to medium rivers and occasionally in lakes. Often common or abundant in headwaters. Diminished in portions of the Minnesota River drainage.

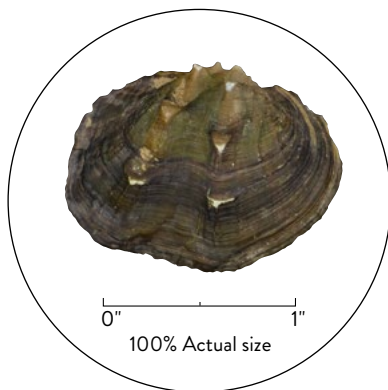


Rock pocketbook

Arcidens confragosus

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
50% Actual size

Similar Species

Threeridge and washboard. Rock pocketbook has distinctive umbo sculpture, a thinner shell and thinner teeth than these species.

Shell Characteristics

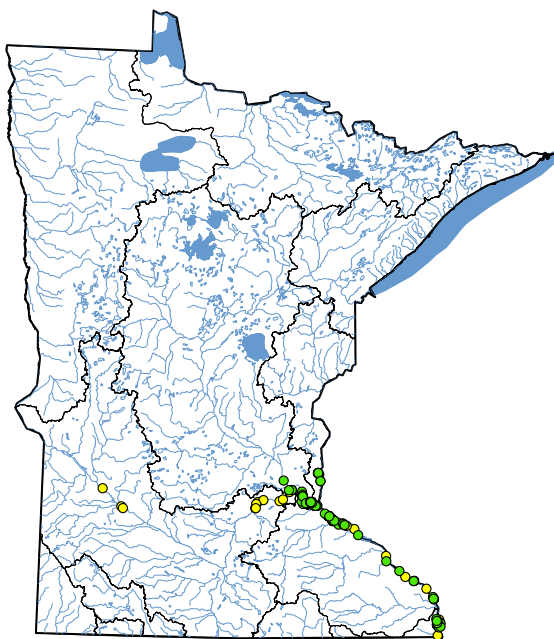
Thin to moderately thick; oval to rhomboidal; inflated. Umbo sculpture two rows of elevated nodules, irregular folds and wrinkles, nodules often bluntly pointed and sometimes resemble a W-shaped pattern, transitioning to parallel ridges on posterior two-thirds of the shell as the individual matures. Periostracum green to dark brown. Pseudocardinal teeth somewhat small and compressed, lateral teeth reduced; nacre white. Length: up to 5.5 inches.

Hosts

Generalist; suckers may be important hosts.

Distribution and Habitat

Occurs in large rivers in Minnesota. Sporadic in the Mississippi River below St. Anthony Falls but relatively common in Pool 2 from Hastings to St. Paul. Presumably extirpated from the Minnesota River. Rare in the lower St. Croix River, where the absence of historical records or relic shells suggests a recent range expansion.

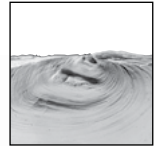


Flutedshell

Lasmigona costata

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
100% Actual size

Similar Species

Creek heelsplitter. Flutedshell has sculpturing on the posterior slope, thick and distinctive umbo sculpture, thicker pseudocardinal teeth, and less-developed lateral teeth than creek heelsplitter.

Shell Characteristics

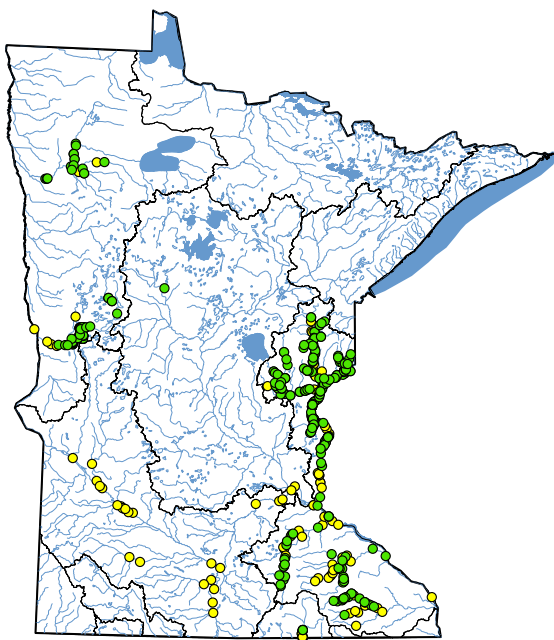
Moderately thick, young are thin; elongate; compressed. Posterior margin biangular to bluntly pointed; posterior slope typically has many narrow ridges and small wrinkles, sometimes poorly developed, small wrinkles often present on posterior half of shell; umbo low, barely elevated above the hinge line. Umbo sculpture two to four thick ridges. Periostracum cloth-like in texture; greenish, brown to dark brown; sometimes with green rays. Pseudocardinal teeth present, lateral teeth reduced; nacre white, sometimes cream or salmon. Length: up to 7 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs in medium to large rivers. Found locally in tributaries of the Mississippi River below St. Anthony Falls and sporadically in the Red River of the North drainage. Extirpated from the Minnesota River drainage and diminished in Mississippi River tributaries in southeastern Minnesota. Most substantial populations are in the upper St. Croix River drainage and Otter Tail River. Rarely found in the Mississippi River mainstem. Presence in the Crow Wing River drainage of the Mississippi Headwaters, outside its historical range, is presumably an accidental introduction.

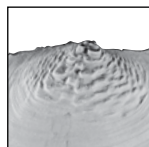


Creek heelsplitter

Platynaias compressa

STATE STATUS: SPECIAL CONCERN

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
100% Actual size

Similar Species

Flutedshell and white heelsplitter. Creek heelsplitter more closely resembles flutedshell but is distinguished from both by the absence of sculpture on the posterior slope, finer umbo sculpture and well-developed, more blade-like lateral teeth. It is also more elongate than white heelsplitter, especially the young outline.

Shell Characteristics

Thin and very sturdy, becoming thicker with age; somewhat elongate or oblong; compressed. Posterior margin biangular or bluntly pointed; posterior ridge broad and flattened; umbo low, elevated slightly above the hinge line. Umbo sculpture several double-looped ridges, sometimes irregular or broken, with smaller broken ridges anteriorly. Periostracum greenish or brown; usually with narrow to broad green rays. Pseudocardinal teeth reduced, lateral teeth well developed with two in the left valve and one in the right valve; nacre white, sometimes cream or salmon. Length: up to 5 inches.

Hosts

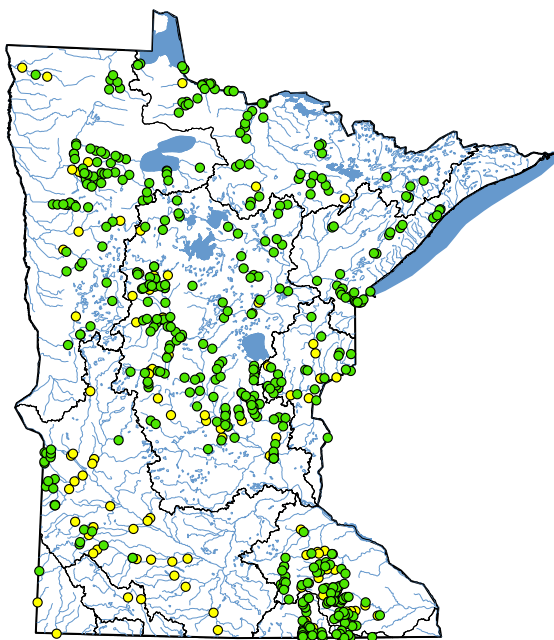
Generalist.

Distribution and Habitat

Occurs statewide in creeks to medium streams. Extirpated or diminished in southwestern Minnesota drainages and much of the Minnesota River drainage. Most common in headwaters but rarely abundant.

Comments

Listed as *Lasmigona compressa* in the first edition. Predominantly hermaphroditic and capable of self-fertilization.

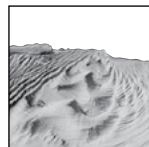


White heelsplitter

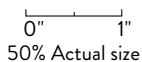
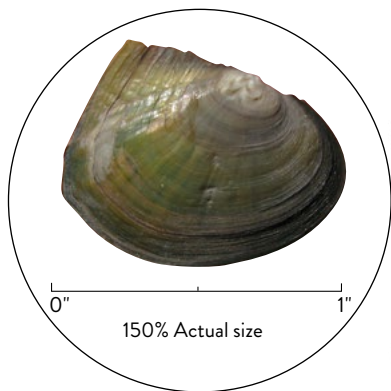
Pterosyna complanata

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



Similar Species

Creek heelsplitter, pink heelsplitter and pink papershell. White heelsplitter is distinguished from these species by its thick double-looped umbo sculpture, sculptured wing, thicker pseudocardinal teeth and reduced lateral teeth. The young outline has a more rounded shape than creek heelsplitter, the shell is thicker than pink papershell and white nacre distinguishes it from pink heelsplitter and pink papershell.

Shell Characteristics

Thin to moderately thick, thicker anteriorly; rounded, sometimes becoming oblong with age; compressed to moderately inflated, young are highly compressed. Pronounced posterior wing usually present, often with low ridges and wrinkles; umbo flattened, not elevated above the hinge line. Umbo sculpture thick double-looped ridges, posterior loop is usually V-shaped. Periostracum greenish or brown, becoming black with age; sometimes with green rays; umbo is often off-white. Pseudocardinal teeth thick, lateral teeth reduced; nacre white. Length: up to 8 inches.

Hosts

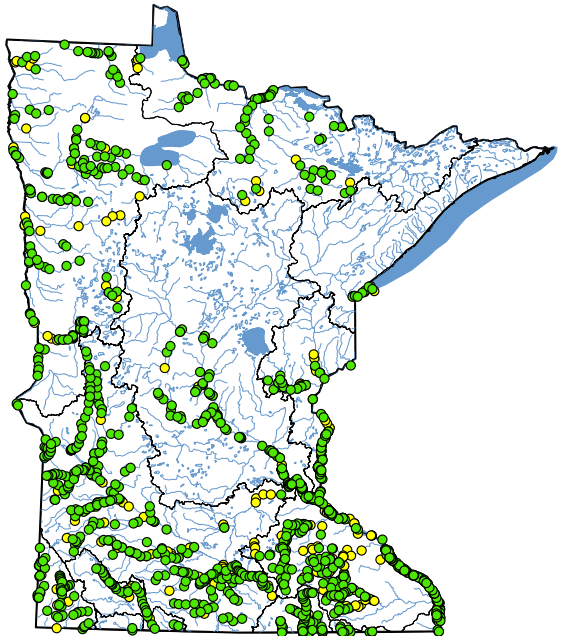
Generalist.

Distribution and Habitat

Occurs statewide in creeks to large rivers. Often common or abundant in small to medium streams, including those with degraded habitat. In the Mississippi Headwaters, its range is limited to areas below Brainerd Dam, suggesting the watershed above St. Anthony Falls is outside its historical range and it was presumably introduced there accidentally. Its range in the Lake Superior drainage is restricted to areas below the St. Louis River gorge and rapids.

Comments

Listed as *Lasmigona complanata* in the first edition.

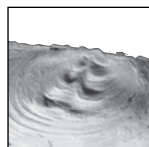


Giant floater

Pyganodon grandis

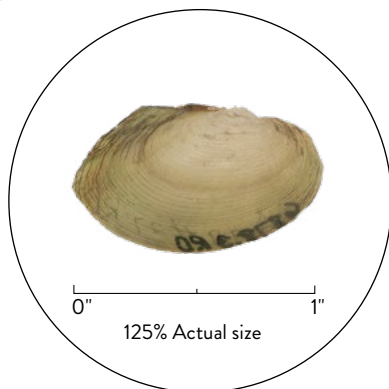
STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture

Corpulenta form



0" 1"
50% Actual size

Similar Species

Creeper, cylindrical papershell, flat floater, lake floater and paper pondshell. Giant floater is distinguished from these species by its thicker, nodulous double-looped umbo sculpture, typically with paired loops that are similar in size. It closely resembles lake floater but has a sturdier shell and an angled anterior-dorsal margin, most evident in younger individuals. It is typically less elongate, with a more pointed posterior than cylindrical papershell, and lacks reduced pseudocardinal teeth present in creeper. The large river *corpulenta* form of giant floater superficially resembles flat floater, but its umbo is inflated and elevated above the hinge line, characters that also distinguish it from paper pondshell.

Shell Characteristics

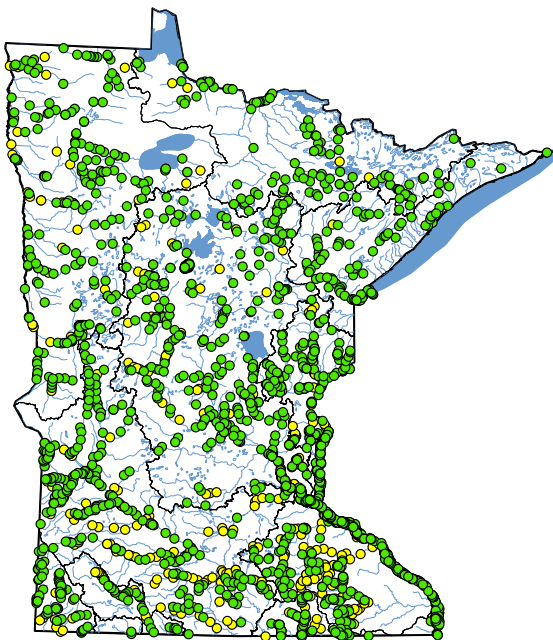
Thin; usually elliptical to elongate; inflated. Shape and size are highly variable depending on habitat. Dorsal margin anterior to umbo is straight, forming a distinct angle with the rounded anterior end, less evident in older individuals; umbo elevated above the hinge line. Umbo sculpture a few to several double-looped ridges, moderately thick and elevated at the base of loops (nodulous). Periostracum smooth to somewhat rough; yellowish, greenish or brown; often with faint green rays. Teeth absent; nacre usually silvery white, often salmon- or copper-tinged near the umbo. Length: up to 7.5 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs statewide in creeks to large rivers, lakes and reservoirs. Most abundant in smaller streams and lakes. Often found in soft substrates along stream and lake margins and in backwaters.

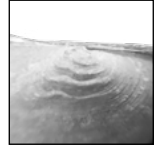


Lake floater

Pyganodon lacustris

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
100% Actual size

Similar Species

Cylindrical papershell, giant floater and paper pondshell. Lake floater differs from these species by its distinctive double-looped umbo sculpture, typically with unevenly sized loops lacking nodules. Compared to giant floater, its shell is thinner, more fragile and flexible; the dorsal-anterior margin is more evenly rounded, umbo is less elevated, posterior end is longer, and periostracum is often shinier. It is further distinguished from paper pondshell by an elevated umbo and from cylindrical papershell by its larger size.

Shell Characteristics

Thin and fragile; elliptical or elongate; moderately inflated. Anterior margin evenly rounded; umbo elevated slightly above the hinge line. Umbo sculpture several double-looped ridges lacking nodules, anterior loop is long and broadly rounded, posterior loop is short and V-shaped. Periostracum somewhat glossy; pale to light yellow, greenish or light brown; sometimes with fine green rays. Teeth absent; nacre off-white or silvery. Length: up to 6 inches.

Hosts

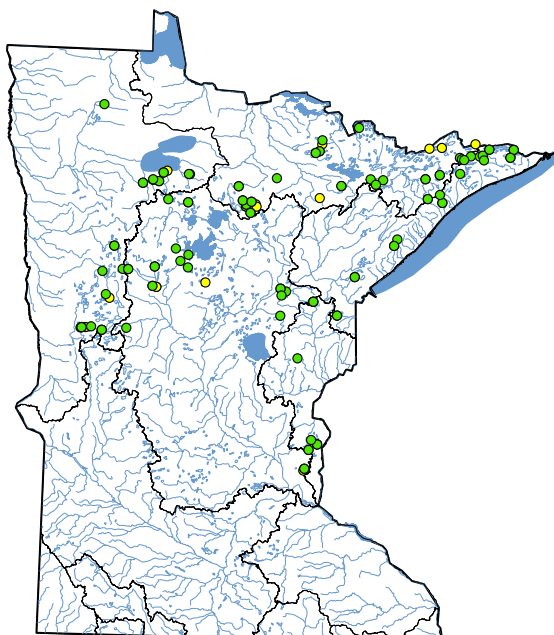
Generalist.

Distribution and Habitat

Primarily occurs in lakes but is occasionally found in streams connected to lake populations. Most records are from the northern half of the state; however, under-sampling of lakes and historical records farther south in adjacent states suggest it may be, or may have been, more widespread.

Comments

Lake floater is possibly the only widespread mussel in North America that depends primarily on lake habitats. Its broad recognition as a distinct species is relatively recent.

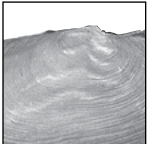


Salamander mussel

Simpsonaias ambigua

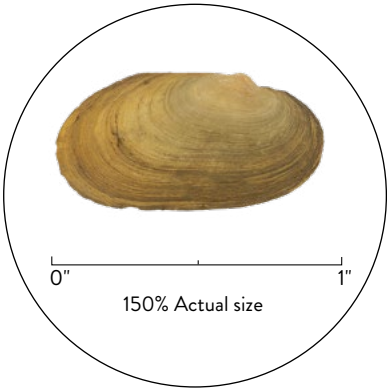
STATE STATUS: ENDANGERED

FEDERAL STATUS: PROPOSED ENDANGERED



Umbo sculpture

Mudpuppy



Similar Species

Cylindrical papershell, lilliput and juvenile spectaclecase. Salamander mussel is distinguished from these species by its inverted V-shaped umbo sculpture. It is also more inflated than spectaclecase and typically has a straight, not concave, ventral margin. It differs from cylindrical papershell by the presence of small pseudocardinal teeth and absence of rays, and from lilliput by its thinner, more elongate shell and poorly developed teeth.

Shell Characteristics

Small and thin; elongate or oblong; moderately compressed to inflated. Posterior margin rounded; umbo elevated slightly above the hinge line. Umbo sculpture a few ridges resembling an inverted V-shape. Periostracum yellowish-tan to dark brown; rays absent. Pseudocardinal teeth very small and thin with one per valve, lateral teeth absent; nacre off-white. Length: up to 2 inches.

Hosts

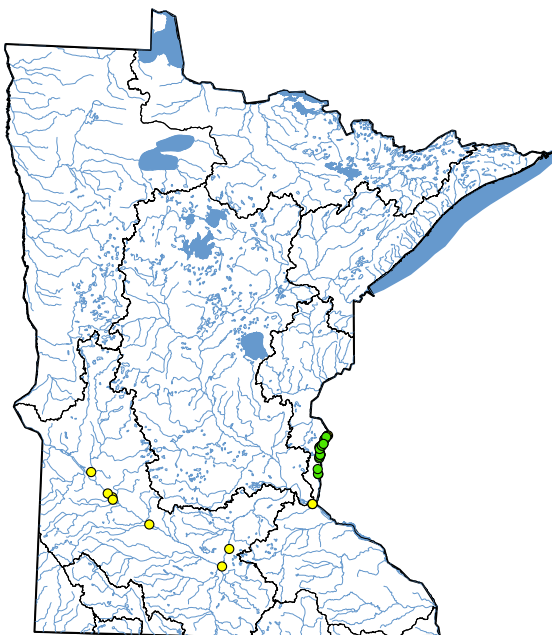
Mudpuppy (*Necturus maculosus*); an aquatic salamander and a species of special concern in Minnesota.

Distribution and Habitat

Occurs in medium to large rivers in Minnesota. Historically occurred in the Mississippi River below St. Anthony Falls and portions of the Minnesota River drainage. It is now presumably limited to the lower St. Croix River, where it is rare and highly localized. It is typically found in soft sediment under large flat rocks, boulders or other structures where mudpuppies live.

Comments

Salamander mussel is the only mussel species known to use an amphibian as its primary host.

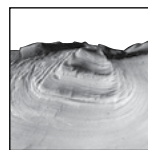


Creeper

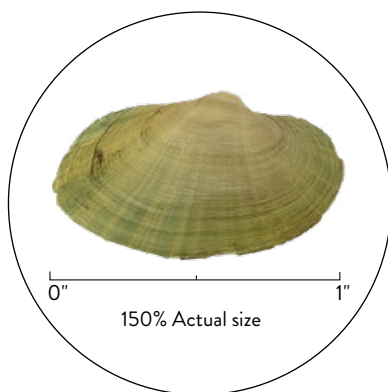
Strophitus undulatus

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
75% Actual size

Similar Species

Cylindrical papershell, giant floater and paper pondshell. Creeper differs from these species by its distinctive umbo sculpture, reduced pseudocardinal teeth, comparatively thicker shell and often more prominent, darker rays. The inflated umbo, elevated above the hinge line, further distinguishes it from paper pondshell.

Shell Characteristics

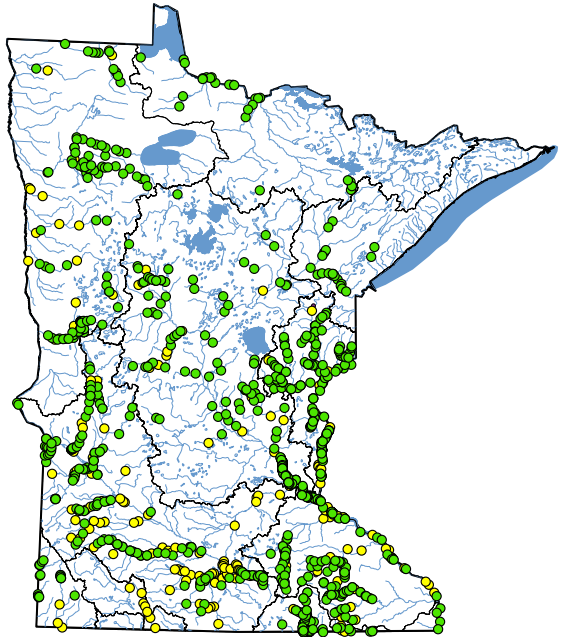
Thin and very sturdy, becoming thicker with age; oval or oblong; moderately inflated. Posterior margin biangular or bluntly pointed; umbo elevated above the hinge line. Umbo sculpture two or three thick curved ridges. Periostracum greenish to brown, becoming darker with age; often with thin to broad green rays. Pseudocardinal teeth reduced to a small swelling, lateral teeth absent; nacre white, sometimes salmon. Length: up to 5 inches.

Hosts

Generalist; one of the few species reported to bypass the parasitic stage, completing development within the female mussel's gills.

Distribution and Habitat

Occurs statewide in creeks to large rivers but is most common in small to medium streams. Extirpated or diminished in southwestern Minnesota drainages and portions of the Minnesota River and Red River of the North drainages.

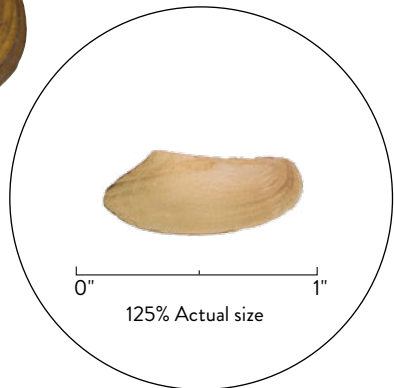


Paper pondshell

Utterbackia imbecillis

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
100% Actual size

Similar Species

Creeper, cylindrical papershell, giant floater and lake floater. Paper pondshell differs from these species by a flat umbo, not elevated above the hinge line, and thin double-looped umbo sculpture. Only lake floater has a similarly fragile shell. Absence of teeth also distinguishes it from creeper.

Shell Characteristics

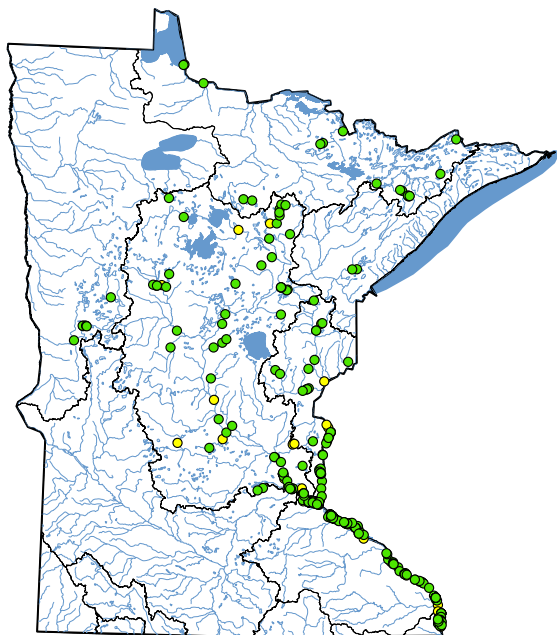
Thin and fragile; oblong; young are highly compressed and nearly transparent, adults inflated. Posterior margin bluntly to somewhat sharply pointed; umbo flat, not elevated above the hinge line. Umbo sculpture thin double loops. Periostracum often glossy; greenish to brown; often with fine green rays. Teeth absent; nacre off-white, iridescent posteriorly. Length: up to 4 inches.

Hosts

Generalist; predominantly hermaphroditic, one of the few species capable of bypassing the parasitic stage, completing development within the mussel's gills.

Distribution and Habitat

Occurs in small to large rivers and lakes, usually in soft sediments. Widespread and relatively common in the Mississippi River mainstem below Minneapolis-St. Paul and in the lower St. Croix River. Widespread but sporadic in the Mississippi River Headwaters, upper St. Croix and Rainy river drainages, localized in the Lake Superior and Red River of the North drainages, and presumably absent from the remaining Mississippi River tributaries below St. Anthony Falls. The extent of its historical distribution is unclear. Early accounts suggest its northern range reached the lowermost portion of the Mississippi River Headwaters and the lower St. Croix River. It is possible that populations in the Mississippi River Headwaters, the St. Croix River above Taylors Falls and other disjunct drainages are introduced. Often introduced into lakes and ponds through fish stocking.

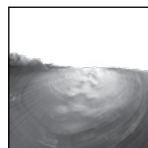


Flat floater

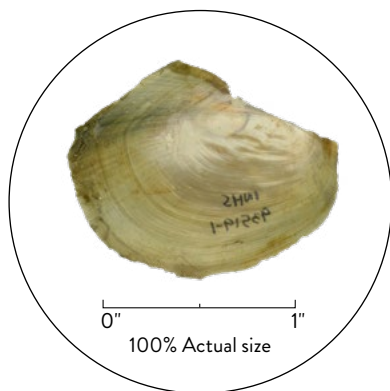
Utterbackiana suborbiculata

STATE STATUS: SPECIAL CONCERN

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



Similar Species

Giant Floater and pink papershell. Flat floater differs from these species by its distinctive umbo sculpture, umbo that is not elevated above the hinge line and typically yellow or golden periostracum. It is further distinguished from giant floater by its rounded outline (although the *corpulenta* form of giant floater appears similar), compressed shell and flattened umbo, and from pink papershell by the absence of teeth.

Shell Characteristics

Thin; round or oval; compressed. Dorsal margin straight, anterior-ventral margin evenly rounded; posterior margin bluntly pointed, usually with a small posterior wing; umbo low, not elevated above the hinge line. Umbo sculpture a few double-looped or broken nodulous ridges. Periostracum glossy and often iridescent; yellowish, golden or brown; light green rays sometimes present. Teeth absent; nacre silvery, salmon or orangish. Length: up to 7 inches.

Hosts

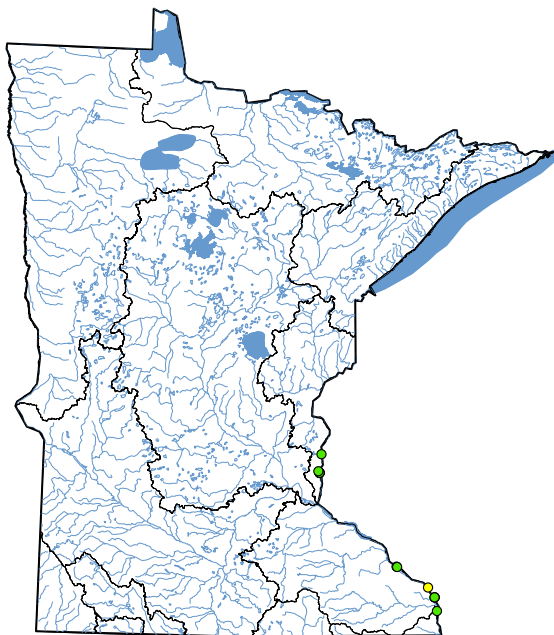
Generalist.

Distribution and Habitat

Occurs in large rivers in Minnesota, primarily in backwater or riverine lakes and sloughs with soft substrate and little or no current. Rare in the Mississippi River below St. Anthony Falls and in the lower St. Croix River. Given the absence of historical records and its known tendency to colonize impounded rivers, flat floater may have expanded into Minnesota following the construction of locks and dams on the Mississippi River.

Comments

Listed as *Anodonta suborbiculata* in the first edition.



Threeridge

Amblema plicata

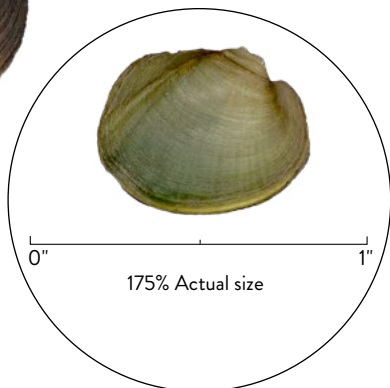
STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED

Large-river form



Small-stream form



0" 1"
50% Actual size

Similar Species

Rock pocketbook and washboard. Threeridge is easily distinguished by the absence of prominent umbo sculpture found in rock pocketbook and washboard.

Shell Characteristics

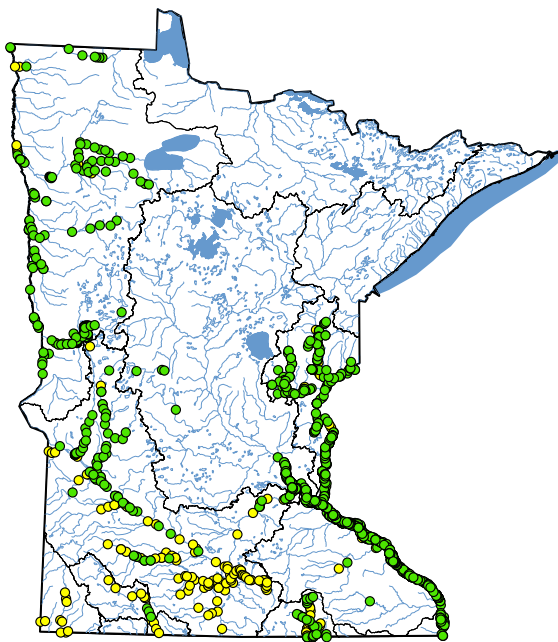
Thick; round to oblong. Multiple parallel ridges or folds on posterior three-quarters of shell, sometimes poorly developed. Shape and number of ridges is variable depending on stream size; often compressed with a greater number of ridges in small streams; more inflated with fewer and broader ridges in large rivers. Umbo sculpture two or three small, curved, concentric ridges, visible only in young. Periostracum usually brown to black, young olive-green or yellowish; rays usually absent, faint in very young. Pseudocardinal teeth thick, lateral teeth well developed; nacre white, sometimes bluish near the posterior margin. Length: up to 7 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs in small to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls and the Red River of the North drainage. Extirpated or diminished in southwestern Minnesota drainages and portions of the Minnesota River drainage. Largely absent from Mississippi River tributaries in southeastern Minnesota. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Additional populations in the Mississippi River Headwaters, outside its historical range, are presumably accidental introductions. Can be abundant in small to large streams and is often the dominant species.



Ebonyshell

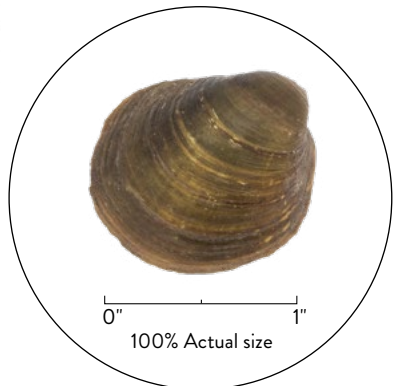
Reginaia eburnus

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
75% Actual size



Similar Species

Hickorynut, round pigtoe and Wabash pigtoe. Ebonyshell most closely resembles round pigtoe but has a more circular outline, whereas adult round pigtoe are more pyramid-shaped where they co-occur. Round outline, typically black periostracum and absence of rays distinguish ebonyshell from hickorynut and Wabash pigtoe. It also lacks the distinct posterior ridge and sulcus present in Wabash pigtoe where they co-occur. Ebonyshell has a much deeper umbo cavity than all three species.

Shell Characteristics

Thick; round or oval; moderately inflated. Umbo inflated and curved anteriorly. Umbo sculpture obscure. Periostracum brown to black; rays absent. Pseudocardinal and lateral teeth thick, pseudocardinal teeth oriented parallel to lateral teeth; umbo cavity very deep and narrow; nacre white. Length: up to 4 inches.

Hosts

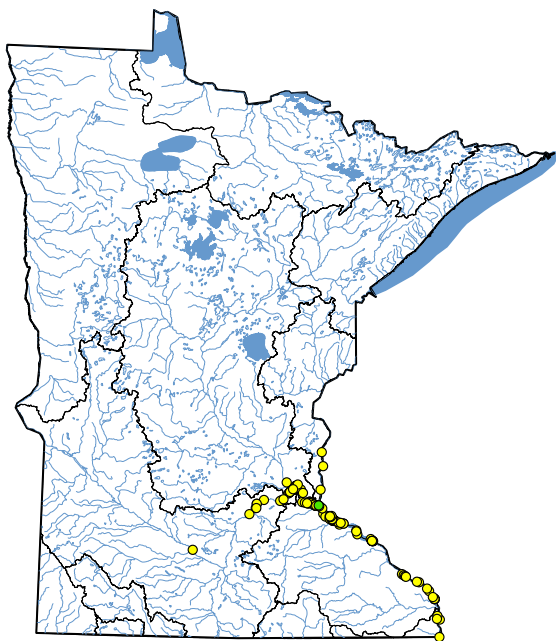
Skipjack herring (*Alosa chrysochloris*).

Distribution and Habitat

Occurs in large rivers. Historically abundant in the Upper Mississippi River and some large tributaries, including the lower Minnesota River, based on relic shells. Populations declined after the construction of Lock and Dam 19 on the Mississippi River in 1913, which blocked the seasonal migration of its host fish. The last known population in Minnesota occurs in the lower St. Croix River, where it is extremely rare and aging, with individuals likely over 100 years old.

Comments

Listed as *Fusconaia ebena* in the first edition. It was formerly a prized species in the pearl button industry.

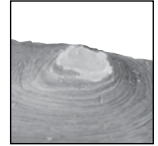


Eastern elliptio

Elliptio complanata

STATE STATUS: SPECIAL CONCERN

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
100% Actual size

Similar Species

Superficially resembles black sandshell and spike. The range of eastern elliptio overlaps with black sandshell but not spike. It is easily distinguished from both by its compressed shell, prominent posterior ridge and broader posterior slope. Its brown cloth-like periostracum and prominent umbo sculpture also differ from black sandshell.

Shell Characteristics

Moderately thick; trapezoidal or elliptical; usually compressed. Posterior ridge distinct; posterior slope fairly broad; umbo low, elevated slightly above the hinge line. Umbo sculpture two or three thick ridges, angled posteriorly. Periostracum cloth-like in texture; brown to dark brown; often with faint green rays. Pseudocardinal and lateral teeth well developed; umbo cavity shallow; nacre off-white or purple. Length: up to 5 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs in various habitat types in other parts of its range, including small to large rivers, lakes and ponds. In Minnesota, it is present only in the Lake Superior basin, having migrated from the Atlantic region. Common to abundant in the St. Louis River estuary; its range is apparently restricted to below the Fond du Lac Dam, although it may have historically extended upstream to the St. Louis River gorge and rapids before dam construction. It is also present in the Pigeon River below High Falls.

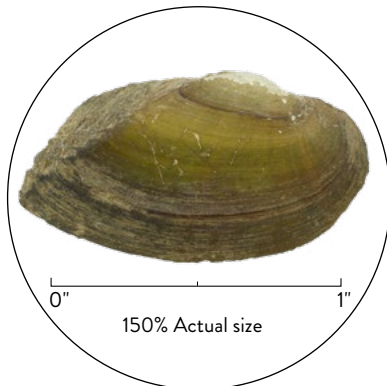


Elephantear

Elliptio crassidens

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

Mucket and spike. Elephantear differs from both by its triangular shape, distinct posterior ridge and, when visible, fine corrugations on the posterior slope. The young outline is less elongate than spike, and its shallow umbo cavity, typically thicker teeth and presence of purple nacre distinguish it from mucket.

Shell Characteristics

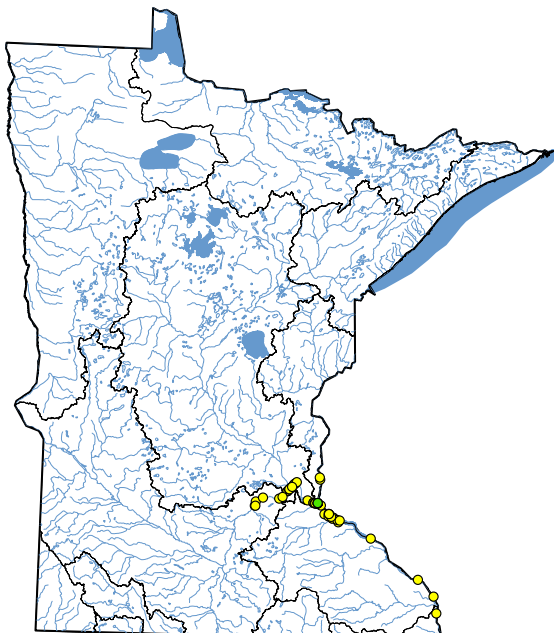
Thick; triangular; compressed to moderately inflated. Posterior ridge well defined and sharply angled; posterior slope fairly narrow, usually with small narrow ridges or corrugations that are often inconspicuous. Umbo sculpture thick loops, visible only in uneroded shells. Periostracum brown to black; rays usually absent, faint in young. Pseudocardinal and lateral teeth thick; umbo cavity very shallow; nacre usually light purple or white. Length: up to 5 inches.

Hosts

Skipjack herring (*Alosa chrysochloris*).

Distribution and Habitat

Occurs in large rivers in Minnesota. Historically present in the Mississippi River below St. Anthony Falls and lower Minnesota River, where it was apparently common. Populations declined after the construction of Lock and Dam 19 on the Mississippi River in 1913, which blocked the seasonal migration of its host fish. The lower St. Croix River has the only remaining population in Minnesota, where it is extremely rare and aging, with individuals likely over 100 years old.

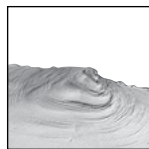


Spike

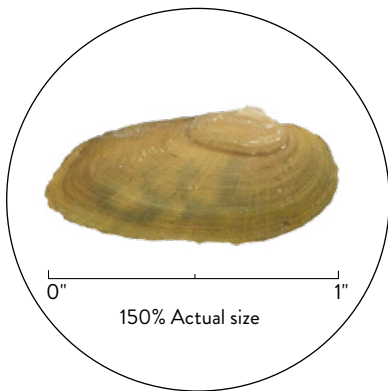
Eurynia dilatata

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
75% Actual size

Similar Species

Black sandshell, eastern elliptio, elephantear and spectaclecase. Spike is most easily confused with black sandshell but is distinguished by cloth-textured periostracum, prominent umbo sculpture, a curved dorsal margin and very shallow umbo cavity. A thicker, more inflated shell, pointed posterior margin, thicker teeth and purple nacre distinguish it from spectaclecase. Spike is more elongate than elephantear (especially the young outline), has a broader, rounder posterior ridge and lacks sculpture on the posterior slope. Its posterior slope is narrower and posterior ridge is more rounded than Eastern elliptio, and ranges do not overlap.

Shell Characteristics

Moderately thick to thick; elongate; compressed to moderately inflated, more inflated and much thicker in large rivers. Dorsal margin often curved, posterior margin bluntly pointed; posterior ridge low and rounded; umbo low and broad. Umbo sculpture two or three thick ridges. Periostracum cloth-like in texture; light brown to black; often with faint green rays. Pseudocardinal teeth thick, lateral teeth thick and often angled ventrally; umbo cavity very shallow; nacre usually purple, sometimes white, orange or a combination. Length: up to 6 inches.

Hosts

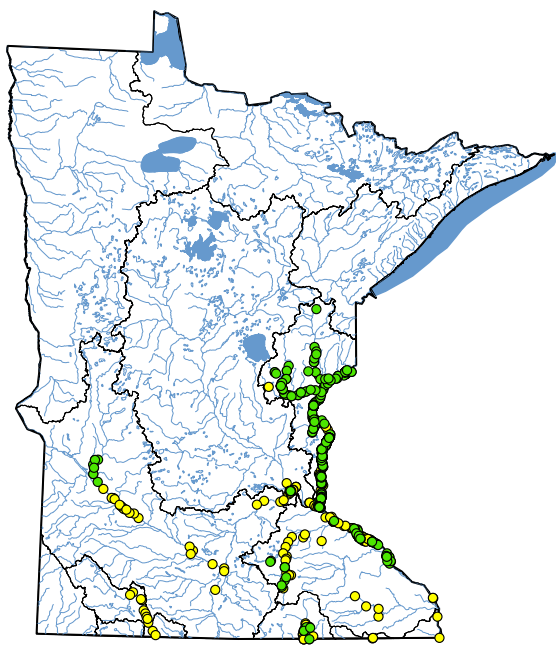
Percids and sunfishes.

Distribution and Habitat

Occurs in small streams to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls. Widespread and common or abundant in the St. Croix River drainage but diminished or extirpated elsewhere. Isolated populations persist in the lower Chippewa, upper Cannon and upper Cedar river drainages. Presence in upper Pool 2 of the Mississippi River at St. Paul represents translocated adults.

Comments

Listed as *Elliptio dilatata* in the first edition.



Wabash pigtoe

Fusconaia flava

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED

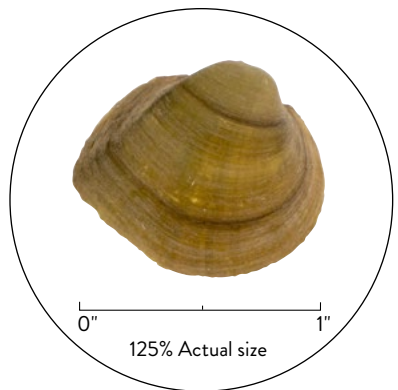
Large-river form



Small-stream form



0" 1"
75% Actual size



Similar Species

Deertoe, ebonyshell, round pigtoe and sheepnose. Wabash pigtoe is most easily confused with round pigtoe, especially in smaller streams, but is more triangular and pointed posteriorly, with a more prominent posterior ridge and sulcus, a deeper umbo cavity, and often an orange-colored foot. It is distinguished from ebonyshell by its triangular outline, posterior ridge, sulcus and shallower umbo cavity, from deertoe by its less-angular posterior ridge and brown, weakly rayed periostracum, and from sheepnose by its lack of sculpture, typically darker periostracum and deeper umbo cavity.

Shell Characteristics

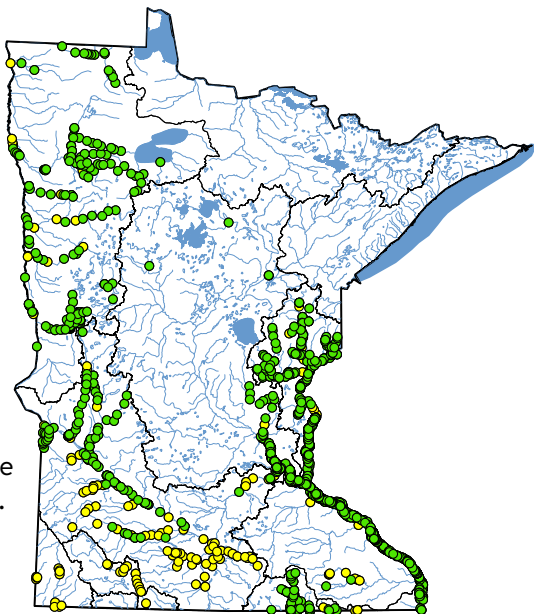
Moderately thick to thick; triangular. Distinct posterior ridge; shallow sulcus. Varies with stream size; thinner and more compressed with a weaker posterior ridge in small streams; thicker and more inflated with a more prominent posterior ridge in large rivers. Umbo sculpture two or three small ridges, visible only in young. Periostracum cloth-like in texture; light to dark brown; sometimes with fine green rays. Pseudocardinal and lateral teeth thick; umbo cavity deep; nacre white, occasionally light salmon. Length: up to 5.5 inches.

Hosts

Minnows.

Distribution and Habitat

Occurs in creeks to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls and the Red River of the North drainage. Extirpated or diminished in southwestern Minnesota and parts of the Minnesota River drainage, rare in Mississippi River tributaries in southeastern Minnesota; common or abundant elsewhere. It has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Mississippi River Headwaters populations are presumably accidental introductions, including the Rum River where it is widespread and abundant.



Sheepnose

Plethobasus cyphus

STATE STATUS: ENDANGERED

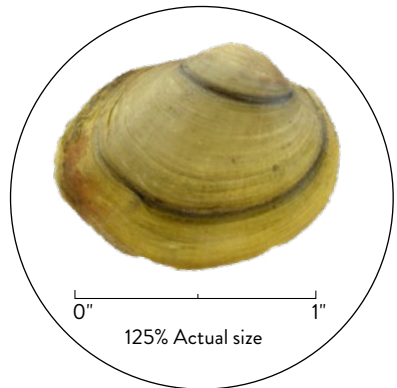
FEDERAL STATUS: ENDANGERED



Umbo sculpture
dorsal view



0" 1"
75% Actual size



Similar Species

Hickorynut, round pigtoe, threehorn wartyback and Wabash pigtoe. The presence of broad knobs and absence of rays distinguish sheepnose from hickorynut, round pigtoe and Wabash pigtoe. Compared to threehorn wartyback, knobs are less elevated and form simultaneously on each valve, the posterior slope lacks sculpture and color is less variable. Periostracum is usually lighter than Wabash pigtoe and round pigtoe (especially in younger individuals), sulcus is more prominent than round pigtoe and umbo cavity is shallower than Wabash pigtoe.

Shell Characteristics

Thick; roundly triangular or ovate. Ventral margin is usually convex; middle of shell is slightly elevated with a row of low broad knobs extending down the center that are sometimes inconspicuous; shallow sulcus between knobs and posterior ridge. Umbo sculpture two thick ridges, visible only in uneroded shells. Periostracum yellow to dark brown; rays absent. Pseudocardinal and lateral teeth thick; umbo cavity shallow; nacre white. Length: up to 5 inches.

Hosts

Minnows.

Distribution and Habitat

Occurs in medium to large rivers. Extirpated from the Cedar, lower Minnesota and lower St. Croix rivers. Extremely rare in the Mississippi River below St. Anthony Falls. Early accounts suggest it was historically rare in Minnesota.



Round pigtoe

Pleurobema sintoxia

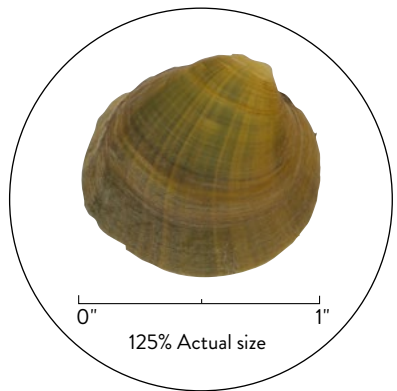
STATE STATUS: SPECIAL CONCERN

FEDERAL STATUS: UNCLASSIFIED

Large-river form



Small-stream form



0" 1"
100% Actual size

Similar Species

Ebonyshell, hickorynut, sheepsnose and Wabash pigtoe. Round pigtoe closely resembles Wabash pigtoe (especially in small streams) but has a less-prominent posterior ridge, most evident in large rivers; it also has a more evenly rounded ventral margin, less-pointed posterior, often darker reddish-brown periostracum, more distinct rays when young and a shallower umbo cavity. It has a more triangular outline than ebonyshell and hickorynut, typically darker periostracum than hickorynut and a much shallower umbo cavity than ebonyshell. It is distinguished from sheepsnose by its unsculptured shell, poorly developed or absent sulcus and usually darker periostracum.

Shell Characteristics

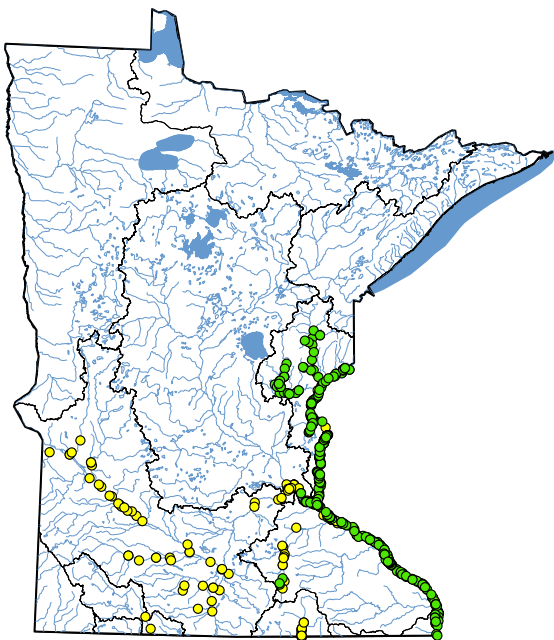
Moderately thick to thick; rounded to triangular (pyramid-shaped). Varies with stream size; thinner, more compressed and rounder in small streams; thicker, more inflated and triangular in large rivers, where a weak sulcus may develop in older individuals. Ventral margin is usually evenly rounded regardless of stream size. Umbo sculpture two or three small ridges, visible only in young. Periostracum yellowish-, greenish- or reddish-brown, becoming dark brown to black; sometimes with faint green rays that fade or disappear with age. Pseudocardinal and lateral teeth thick; umbo cavity shallow; nacre white, occasionally pink. Length: up to 5 inches.

Hosts

Minnows.

Distribution and Habitat

Occurs in small to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls. Widespread and common in the St. Croix River drainage and Mississippi River mainstem but extirpated or diminished elsewhere. An isolated population persists in the upper Cannon River drainage.

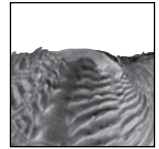


Purple wartyback

Cyclonaias tuberculata

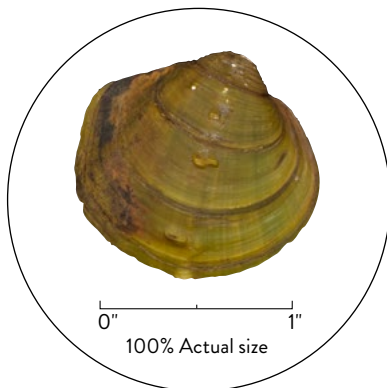
STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture

0" 1"
75% Actual size



0" 1"
100% Actual size

Similar Species

Pimpleback and wartyback; superficially resembles Gulf mapleleaf, mapleleaf, rockshell and winged mapleleaf. Purple wartyback is distinguished from pimpleback and wartyback by its distinctive umbo sculpture, more compressed shell, often convex and slightly angled posterior margin, very deep and narrow umbo cavity and purple nacre. It also has more scattered pustules and darker periostracum than wartyback. Compared to mapleleaf species, it lacks a prominent sulcus, has purple nacre and a deeper umbo cavity. It lacks the prominent posterior ridge and green chevrons of rockshell.

Shell Characteristics

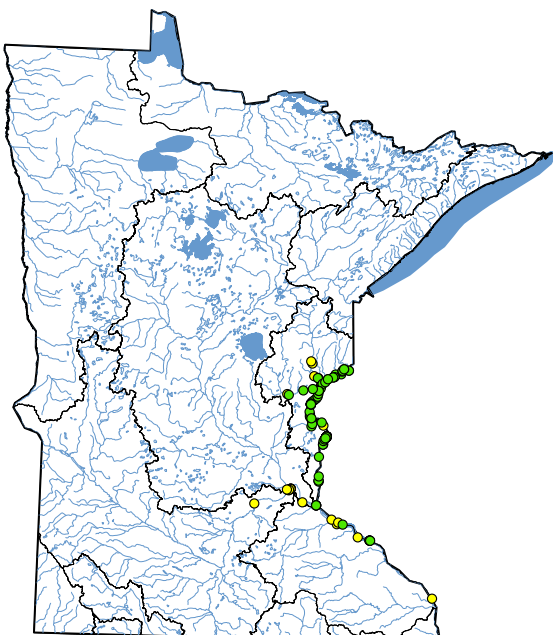
Thick; round to somewhat quadrate; compressed. Posterior margin truncated or convex, often appearing biangular at the posterior ridge and concave at the base of a small posterior wing; posterior ridge low and rounded; posterior slope broad, may be flat or with a shallow sulcus at base of the wing, often with multiple short narrow ridges; several to numerous small to large or elongate pustules present across posterior two-thirds of shell. Umbo sculpture numerous fine irregular ridges, visible only in uneroded shells. Periostracum yellowish-brown to dark brown, olive-green or yellowish when young; rays generally absent, faint green rays when young. Pseudocardinal and lateral teeth thick, separated by a broad flat space; umbo cavity very deep and narrow; nacre purple. Length: up to 4 inches.

Hosts

Catfishes.

Distribution and Habitat

Occurs in medium to large rivers. Extirpated from the Minnesota River and very rare in the Mississippi River below St. Anthony Falls. The largest remaining population is in the St. Croix River drainage, where it is locally common in the upper mainstem.



Washboard

Megalonaias nervosa

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
50% Actual size



0" 1"
125% Actual size

Similar Species

Pistolgrip, rock pocketbook and threeridge. Washboard is most often confused with threeridge but is easily distinguished by its prominent umbo sculpture. It has a much thicker shell and teeth than rock pocketbook. Its quadrate outline, prominent ridges and poorly developed posterior ridge distinguish it from pistolgrip, and its umbo sculpture is distinct from both rock pocketbook and pistolgrip.

Shell Characteristics

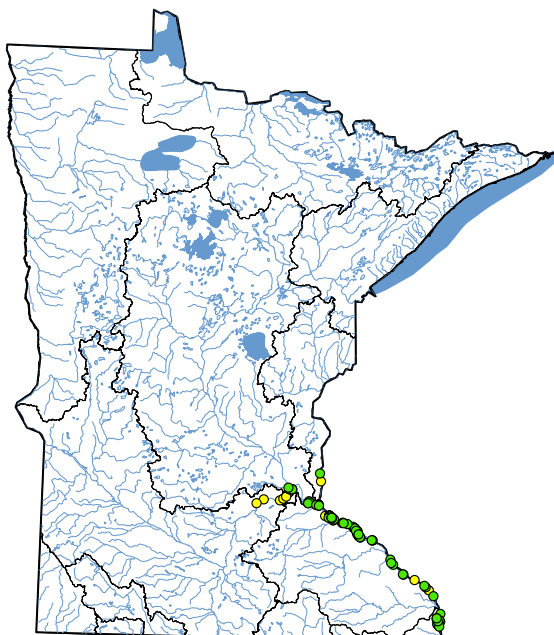
Large; thick; quadrate or rectangular; moderately inflated but somewhat compressed when young. Posterior slope is broad and wing-like with several ridges or flutes; umbo is densely sculptured with ridges and wrinkles, developing parallel ridges as it ages. Umbo sculpture thick double-looped ridges. Periostracum brown or black; rays absent. Pseudocardinal and lateral teeth thick; nacre white, often with large brownish blotches. Length: up to 8 inches.

Hosts

Generalist.

Distribution and Habitat

Occurs in large rivers in Minnesota. Extirpated from the lower Minnesota River and rare in the lower St. Croix River. Widespread but uncommon in the Mississippi River below St. Anthony Falls.



Wartyback

Pustulosa nodulata

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
125% Actual size



Similar Species

Pimpleback and purple wartyback; superficially resembles Gulf mapleleaf, mapleleaf, rockshell, threehorn wartyback and winged mapleleaf. Wartyback is most easily confused with pimpleback, but has a rayless umbo, fewer pustules or nodules that are often paired, and a broader, flatter posterior slope forming a small wing. Its distinct pustule pattern, usually lighter periostracum and white nacre distinguish it from purple wartyback. Its pustule pattern, truncated posterior margin and absence of rays distinguish it from threehorn wartyback. Wartyback lacks the sulcus and densely sculptured umbo of mapleleaf species, and the prominent posterior ridge and green chevrons of rockshell.

Shell Characteristics

Thick; rounded, truncated posteriorly; moderately inflated. A few to several widely spaced pustules or larger nodules form two rows from the umbo to the ventral margin, typically paired but sometimes single, pustules on the umbo are tiny; posterior slope is fairly wide and flat, forming a small wing, often with a few to several small pustules that may be arranged in rows. Umbo sculpture one or two small ridges. Periostracum light yellow, olive-brown or brown, darkening with age; rays absent or very faint. Pseudocardinal and lateral teeth thick; nacre white. Length: up to 3 inches.

Hosts

Catfishes.

Distribution and Habitat

Occurs in large rivers.

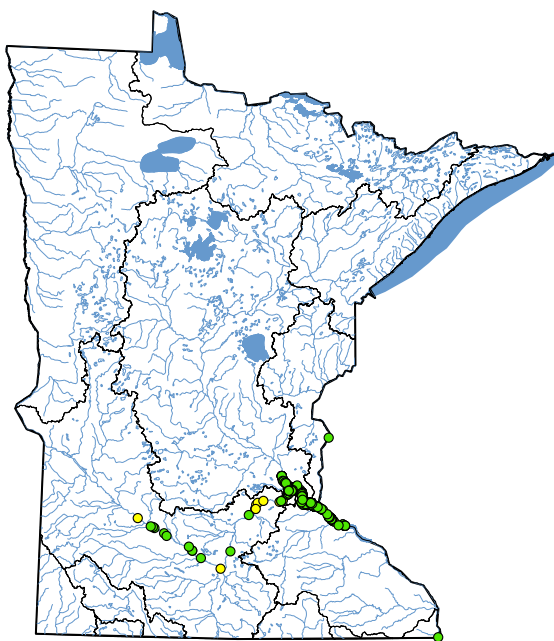
Relatively common in the Mississippi River upstream of Lake Pepin, but largely absent downstream.

Uncommon in the middle and lower Minnesota River.

It has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Its occurrence in the St. Croix River is likely incidental.

Comments

Listed as *Quadrula nodulata* in the first edition.

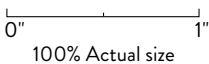
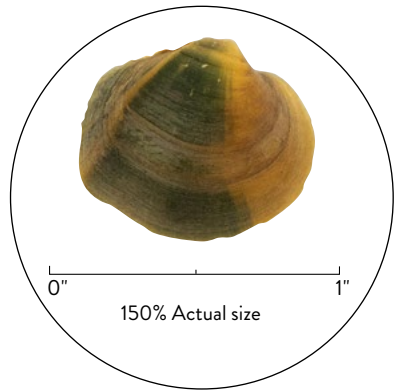


Pimpleback

Pustulosa pustulosa

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

Purple wartyback and wartyback; superficially resembles Gulf mapleleaf, mapleleaf, rockshell and winged mapleleaf. Pimpleback resembles wartyback and purple wartyback but is easily distinguished by a broad green ray on the umbo. It also has a narrower posterior slope that rarely appears winged, more abundant and disorganized pustules and darker periostracum than wartyback. Pimpleback has a truncated posterior margin and is typically more inflated than purple wartyback, and it lacks finely ridged umbo sculpture and purple nacre. It also lacks the sulcus and densely sculptured umbo of mapleleaf species, and the prominent posterior ridge and green chevrons of rockshell.

Shell Characteristics

Thick; rounded, truncated posteriorly; moderately inflated. Scattered pustules on posterior two-thirds of shell, varying in number and rarely absent, few or absent in young; posterior slope narrow. Umbo sculpture one or two small ridges, visible only in young. Periostracum yellowish-, orangish-brown or brown, becoming darker brown with age; umbo has a broad green ray, sometimes interrupted or with narrower rays posteriorly. Pseudocardinal and lateral teeth thick; nacre white. Length: up to 3.5 inches.

Hosts

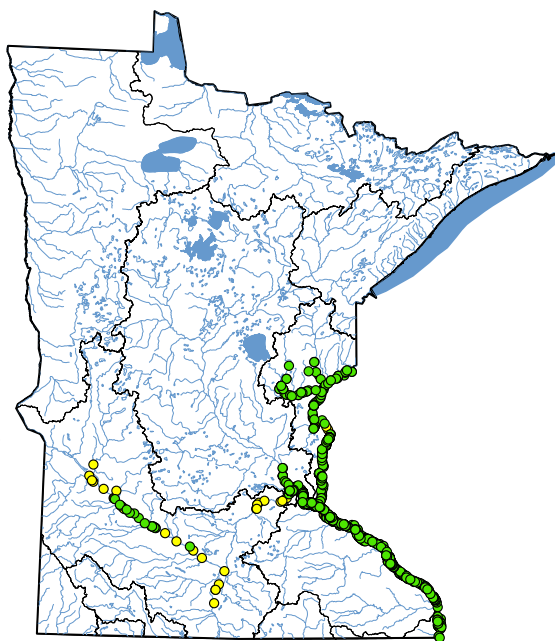
Catfishes.

Distribution and Habitat

Occurs in medium to large rivers. Diminished or uncommon in much of the Minnesota River drainage. Widespread and common in the St. Croix River drainage and Mississippi River below St. Anthony Falls. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks.

Comments

Listed as *Quadrula pustulosa* in the first edition.

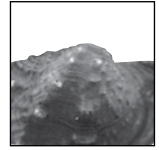


Winged mapleleaf

Quadrula fragosa

STATE STATUS: ENDANGERED

FEDERAL STATUS: ENDANGERED



Umbo



0" 1"
100% Actual size

Similar Species

Gulf mapleleaf and mapleleaf; superficially resembles pimpleback, purple wartyback, rockshell and wartyback. Winged mapleleaf differs from Gulf mapleleaf and mapleleaf by its more quadrate outline throughout life and distinctive posterior wing with ridges and wrinkles. Adults typically have a wider field of pustules (often on the sulcus) and reddish-brown, more satin-like periostracum than mapleleaf. It lacks the distinctive posterior ridge and green chevrons of rockshell and purple nacre of purple wartyback. Pimpleback, purple wartyback and wartyback lack a central sulcus.

Shell Characteristics

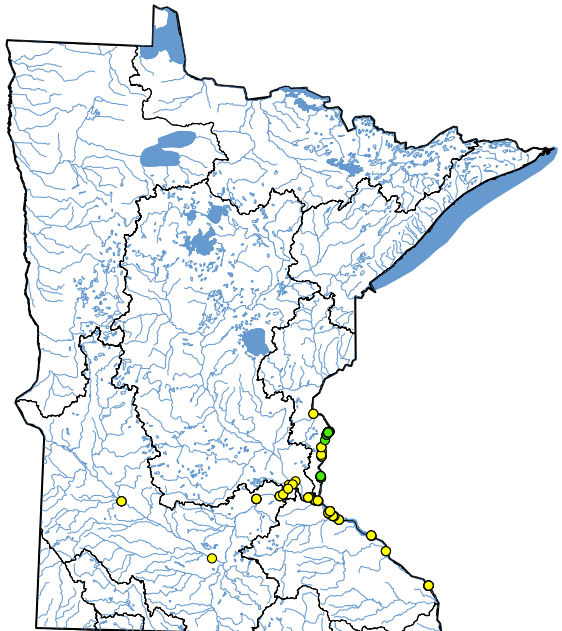
Thick, posterior margin often uncalcified; quadrate or rounded; moderately inflated. Posterior margin of young truncated, becoming weakly biangular ventrally to broadly rounded with age; posterior ridge narrow in young, broader and flatter with age; posterior slope shallow and wide (winged), typically with narrow radiating ridges, pustules and small wrinkles; pustules are typically numerous and develop through adulthood, mostly absent on anterior third of adult shell; sulcus with or without pustules, often bordered by elevated pustules or tubercles that may form two rows that extend from umbo. Umbo sculpture two diverging rows of nodules or nodulous ridges bordered by small irregular or broken ridges. Periostracum satin-like in texture; greenish-, reddish-brown or dark brown; faint or interrupted green rays. Teeth thick; nacre white. Length: up to 3.5 inches.

Hosts

Catfishes; channel catfish (*Ictalurus punctatus*) in Minnesota.

Distribution and Habitat

Occurs in medium to large rivers. Extirpated from the lower Minnesota River and Mississippi River below St. Anthony Falls. Rare in short reaches of the lower St. Croix River, among the few remaining reproducing populations range-wide. Reintroduced downstream of Stillwater.

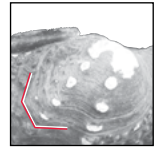


Gulf mapleleaf

Quadrula nobilis

STATE STATUS: UNCLASSIFIED

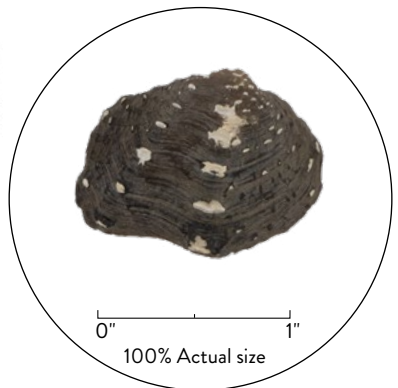
FEDERAL STATUS: UNCLASSIFIED



Umbo



0" 1"
75% Actual size



0" 1"
100% Actual size

Similar Species

Mapleleaf, pistolgrip and winged mapleleaf; superficially resembles pimpleback, purple wartyback, rockshell and wartyback. Gulf mapleleaf closely resembles mapleleaf and winged mapleleaf; however, the biangular posterior-ventral margin of the young outline is definitive. Two conspicuous rows of pustules bordering the sulcus and anterior pustules on adults distinguish it from mapleleaf and often winged mapleleaf. It is less quadrate than winged mapleleaf and lacks a posterior wing, the young outline is less elongate than pistolgrip, and it lacks the distinctive posterior ridge and green chevrons of rockshell and purple nacre of purple wartyback. Pimpleback, pistolgrip, purple wartyback and wartyback lack a central sulcus.

Shell Characteristics

Thick; somewhat quadrate, trapezoidal or elongated; moderately inflated. Posterior-ventral margin distinctly biangular and straight between angles (chamfered), clearly visible on young outline; posterior ridge broadens and flattens with age, sometimes elongating posteriorly; two rows of elongated shelf-like pustules, often paired and partially eroded, extend from the umbo and are separated by a wide sulcus; sulcus smooth or with pustules; anterior pustules often develop through adulthood, varying in number; posterior slope narrow, moderately steep, often with narrow ridges or pustules. Umbo sculpture two diverging rows of nodules or nodulous ridges bordered by small irregular or broken ridges. Periostracum brown to reddish-brown, young greenish or light brown. Teeth thick; nacre white. Length: up to 5 inches.

Hosts

Catfishes.

Distribution and Habitat

Occurs in large rivers. Presumably extirpated from Minnesota; known only from relic shells in the Mississippi and lower Minnesota rivers. Its distribution and status in the upper Mississippi River basin are poorly known.

Comments

Remarkable shell variation in mapleleaf and Gulf mapleleaf has historically confounded researchers. Broad acceptance of Gulf mapleleaf as a valid species is fairly recent.

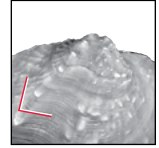


Mapleleaf

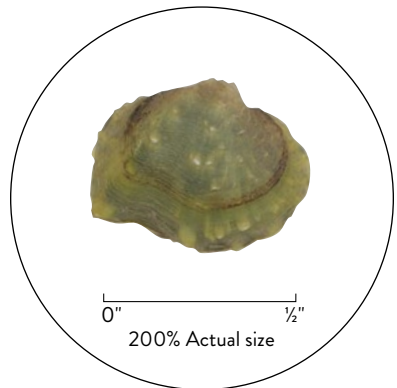
Quadrula quadrula

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo



0" $\frac{1}{2}$ "
200% Actual size

0" 1"
75% Actual size

Similar Species

Gulf mapleleaf and winged mapleleaf; superficially resembles pimpleback, purple wartyback, rockshell and wartyback. Mapleleaf closely resembles Gulf mapleleaf and winged mapleleaf; however, its posterior-ventral margin has a single $\sim 90^\circ$ or curved angle, and it typically has fewer pustules (none on the sulcus) and weaker posterior slope sculpture. It lacks a posterior wing and has shinier periostracum than winged mapleleaf; adults lack the anterior pustules of Gulf mapleleaf. A central sulcus distinguishes it from pimpleback, purple wartyback and wartyback, and it lacks the distinctive posterior ridge and green chevrons of rockshell and purple nacre of purple wartyback.

Shell Characteristics

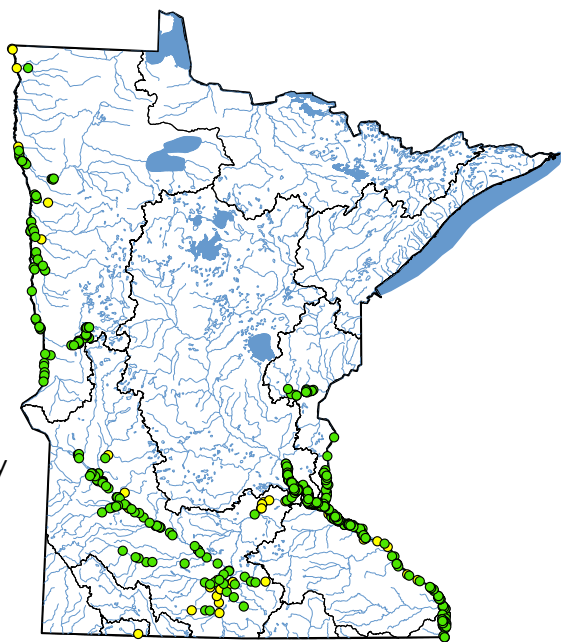
Thick; typically quadrate; moderately inflated. Posterior-ventral margin of young outline angled $\sim 90^\circ$; posterior margin truncate or sloping slightly; posterior ridge narrow, broadening with age, usually with a row of pustules; posterior slope fairly narrow and steep with reduced pustules and ridges; anterior pustules disorganized, variable in number and size, reduced or absent with age; sulcus wide, typically without pustules. Umbo sculpture two diverging rows of nodules or nodulous ridges bordered by small irregular or broken ridges. Periostracum dull to somewhat glossy, yellowish- or greenish-brown to dark brown; often with faint or interrupted green rays. Teeth thick; nacre white. Length: up to 5 inches.

Hosts

Catfishes.

Distribution and Habitat

Occurs in medium to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls and the Red River of the North drainage. Locally common and occasionally abundant. Absent or extirpated from southeastern and southwestern Minnesota tributaries. Its range has expanded above St. Anthony Falls to Coon Rapids Dam; the Snake River population may be introduced, given its absence elsewhere in the upper St. Croix watershed.



Pistolgrip

Quadrula verrucosa

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
75% Actual size

Similar Species

Gulf mapleleaf and juvenile washboard. Pistolgrip may superficially resemble both but is distinguished by its elongate shape, especially the young outline, and more prominent posterior ridge. It further differs from Gulf mapleleaf by lacking two distinct rows of elongated pustules separated by a sulcus.

Shell Characteristics

Thick, posterior thinner; elongate. Posterior ridge prominent; numerous pustules of various sizes scattered across shell anterior to posterior ridge; posterior slope broad, with numerous wrinkles or ridges radiating from posterior ridge to posterior margin. Female is compressed and expanded posteriorly; male posterior-ventral margin is biangular and more truncated. Umbo sculpture irregular ridges, rarely visible except in very young individuals. Periostracum greenish to dark brown. Pseudocardinal and lateral teeth thick; nacre white. Length: up to 7 inches.

Hosts

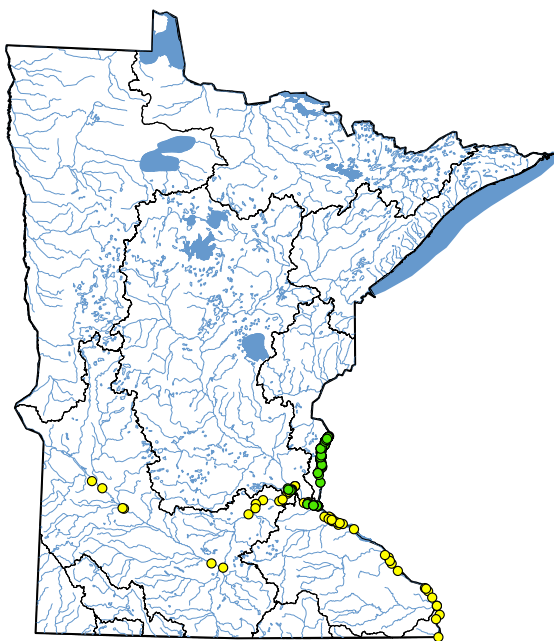
Catfishes; primarily flathead catfish (*Pylodictis olivaris*).

Distribution and Habitat

Occurs in large rivers in Minnesota. Presumably extirpated from the Minnesota River and extremely rare in the Mississippi River. The largest population occurs in the lower St. Croix River, where it is locally common but rarely abundant. The St. Croix population has apparently expanded into the Mississippi River upstream to St. Paul.

Comments

Listed as *Tritogonia verrucosa* in the first edition.

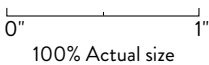
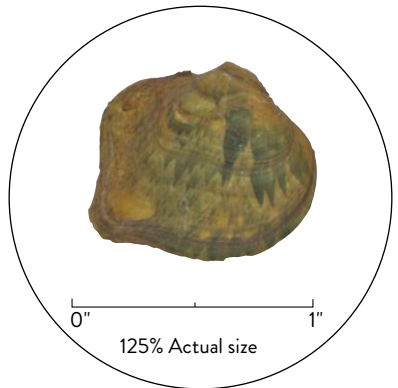


Rockshell

Theliderma metanevra

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

Gulf mapleleaf, mapleleaf, pimpleback, purple wartyback, wartyback and winged mapleleaf. Rockshell superficially resembles these species, but its elevated posterior ridge, usually lined with large nodules, and periostracum marked with green chevrons are distinctive among Minnesota mussels. It also differs from mapleleaf species by lacking a sulcus extending from the umbo.

Shell Characteristics

Thick; quadrate to rhomboidal; moderately compressed to inflated. Posterior ridge prominent and elevated, usually with large, widely spaced knobs; posterior slope steep, flattening abruptly at the base of the posterior ridge to form a small wing; posterior margin truncated, often expanded along the posterior ridge and slightly concave where posterior ridge and flattened posterior slope meet; often slightly convex where ventral margin and posterior ridge meet; pustules scattered from anterior to posterior ridge and often aligned as narrow curved ridges on the posterior slope. In smaller streams it is more compressed, posterior ridge is less elevated and knobs are reduced or absent. Umbo sculpture thick nodules or nodulous ridges aligned on the posterior ridge. Periostracum yellowish, greenish or brown; typically with green chevrons varying in size and darkness, sometimes with additional green rays. Pseudocardinal and lateral teeth thick; nacre white. Length: up to 5 inches.

Hosts

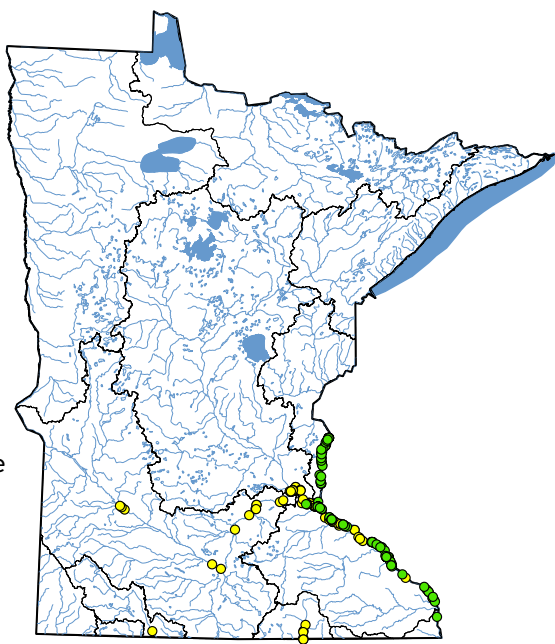
Minnows.

Distribution and Habitat

Occurs in medium to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls. Extirpated from the Minnesota, Cedar and Des Moines rivers. Widespread in the Mississippi and lower St. Croix rivers; uncommon in the Mississippi but occasionally abundant in the lower St. Croix.

Comments

Listed as monkeyface, *Quadrula metanevra*, in the first edition.

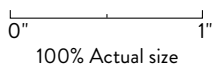
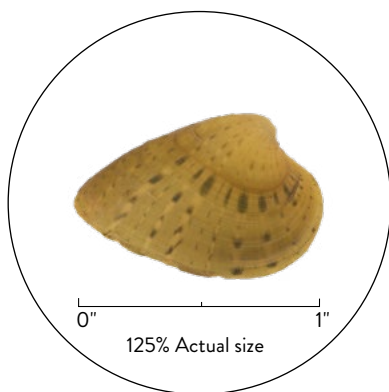
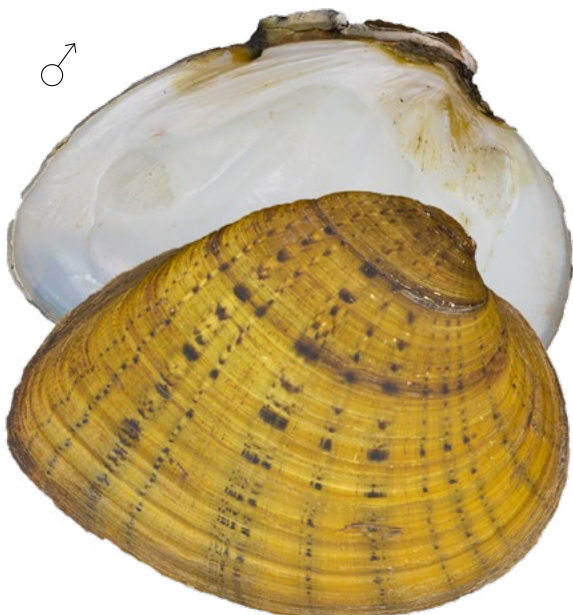


Butterfly

Ellipsaria lineolata

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

No similar species in Minnesota.

Shell Characteristics

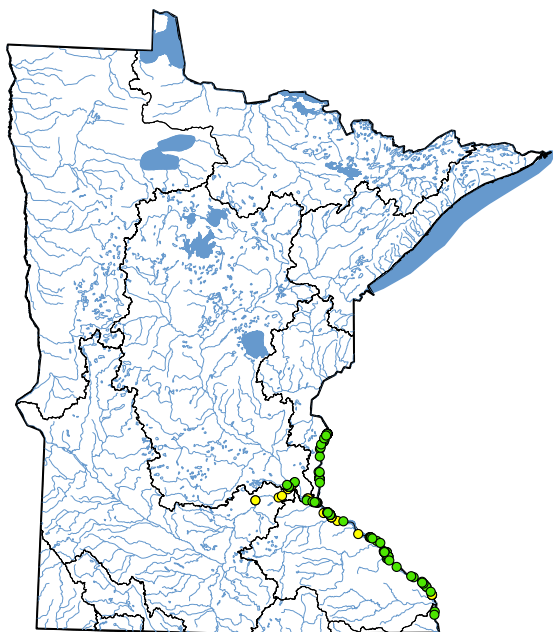
Thick; triangular; compressed. Dorsal margin curved, anterior and ventral margins evenly rounded, posterior margin bluntly pointed; posterior ridge sharply angled dorsally; umbo positioned and curved anteriorly. Female is more oval and slightly inflated; male is compressed. Umbo sculpture a few fine double-looped ridges, usually obscure. Periostracum yellow or light orange, turning brown with age; numerous interrupted brown rays; hinge ligament sometimes dark green. Pseudocardinal and lateral teeth thick; nacre white. Length: up to 4 inches.

Hosts

Freshwater drum (*Aplodinotus grunniens*); also known as sheepshead.

Distribution and Habitat

Occurs in large rivers. Extirpated from the lower Minnesota River. Widespread but typically uncommon in the lower St. Croix River and Mississippi River below St. Anthony Falls.

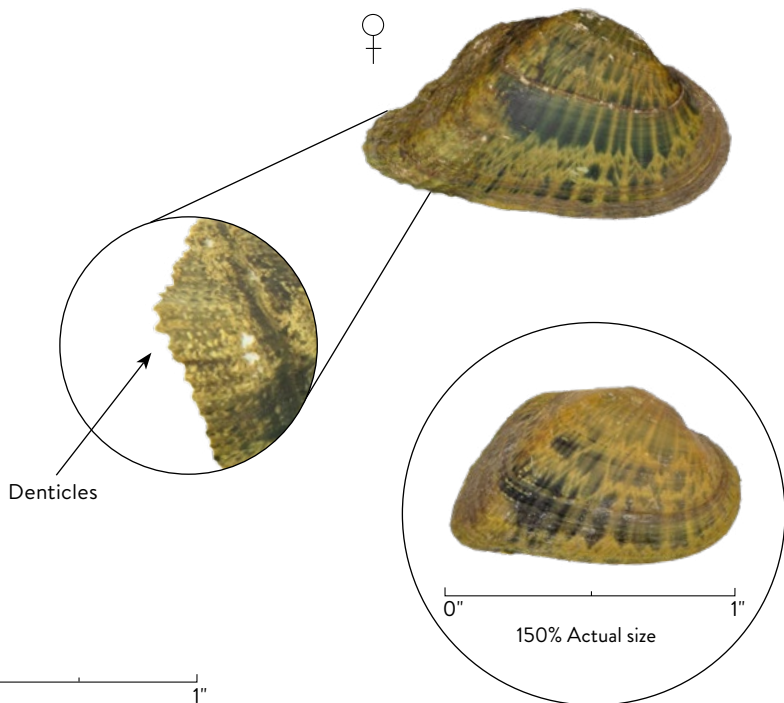


Snuffbox

Epioblasma triquetra

STATE STATUS: ENDANGERED

FEDERAL STATUS: ENDANGERED



0" 1"
125% Actual size

Similar Species

Deertoe and elktoe. Snuffbox differs from these species by the presence of denticles on the posterior margin of females and distinctive rays. Males may be confused with deertoe but have fine grooves on the posterior slope and a less acute posterior ridge. Compared to elktoe, snuffbox has less prominent umbo sculpture and more well-developed teeth.

Shell Characteristics

Small; thick for its size; somewhat triangular; inflated. Posterior ridge is sharply angled with a flat, finely grooved posterior slope. Female is more elongate, posterior is pointed and inflated laterally along the posterior ridge and the posterior margin is lined with denticles (sharp points); male is somewhat triangular and has a thicker shell. Umbo sculpture a few fine double-looped ridges, usually obscure. Periostracum yellowish, turning darker with age, young are orangeish; densely marked with broad to narrow, interrupted greenish-blue rays, often pointed terminally, and variably sized chevrons and speckles. Pseudocardinal and lateral teeth well developed; nacre white. Length: up to 2.5 inches.

Hosts

Darters; primarily logperch (*Percina caprodes*).

Distribution and Habitat

Occurs in large rivers in Minnesota. Extirpated from the Mississippi River below St. Anthony Falls, where it was historically rare. Persists only in a short reach of the lower St. Croix River as one of the largest populations remaining in the Midwest. Reintroduction efforts in upper Pool 2 of the Mississippi River at St. Paul are ongoing (not shown on map).

Comments

Female *Epioblasma* infect hosts by trapping them between the valves. Denticles on female snuffbox help hold the fish.

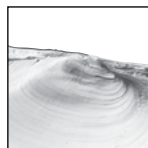


Plain pocketbook

Lampsilis cardium

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
75% Actual size

Similar Species

Fatmucket, fat pocketbook, Higgins eye and mucket. Plain pocketbook is distinguished from these species by its thick and distinctive umbo sculpture. Male plain pocketbook may be confused with mucket and male fatmucket, but its young outline is more rounded. It also differs from mucket and Higgins eye by its glossy, typically yellow periostracum, more inflated umbo than mucket and thinner shell and teeth than Higgins eye. Fat pocketbook has a similar shape and thickness but lacks rays and is extirpated from Minnesota.

Shell Characteristics

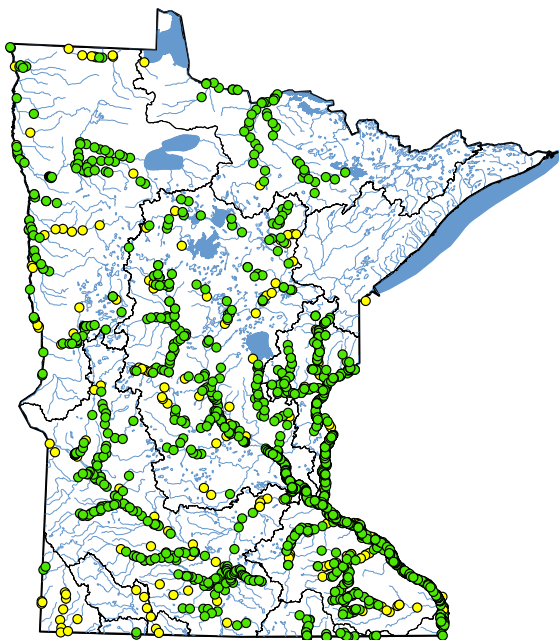
Moderately thick, young are thin; round or oval; umbo inflated. Female is rounder and more inflated with a truncated posterior margin; male is oval with a bluntly rounded posterior margin. Individuals are sometimes more elongate in smaller streams. Umbo sculpture two or three thick ridges. Periostracum usually glossy, especially in younger individuals; yellow to light brown, umbo sometimes reddish; usually with few to many green rays of varying widths. Pseudocardinal and lateral teeth well developed; umbo cavity deep; nacre white, often pink in umbo cavity. Length: up to 6.5 inches.

Hosts

Basses, large percids and sunfishes.

Distribution and Habitat

Occurs statewide in small to large rivers. Presumably extirpated from the Des Moines River, diminished in the Missouri River drainage and some scattered stream reaches elsewhere in the state; otherwise common or abundant. Shells have occasionally been found in the St. Louis River estuary of Lake Superior.

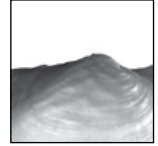


Higgins eye

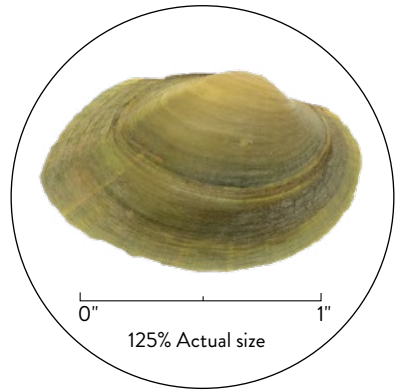
Lampsilis higginsii

STATE STATUS: ENDANGERED

FEDERAL STATUS: ENDANGERED



Umbo sculpture



0" 1"
75% Actual size

Similar Species

Fatmucket, fat pocketbook, hickorynut, mucket and plain pocketbook. Male Higgins eye can closely resemble mucket and male fatmucket where they co-occur but are typically rounder. Usually more inflated than mucket, with a higher, fuller umbo and more prominent umbo sculpture. Umbo sculpture is usually less prominent than fatmucket and periostracum is satin-like rather than glossy. Females are rounder than female fatmucket and have a more truncate posterior than fat pocketbook and hickorynut. The young outline is more elliptical than hickorynut, with a more inflated umbo, deeper umbo cavity and typically broader, darker rays. It has a thicker shell and teeth and darker, more satin-like periostracum than plain pocketbook and fat pocketbook; rays also distinguish it from fat pocketbook.

Shell Characteristics

Thick; oval to elliptical; inflated. Umbo elevated, inflated and positioned anteriorly. Female posterior is truncated and ventral margin is typically straight; male posterior is bluntly rounded and ventral margin is usually evenly rounded. Umbo sculpture fine double-looped or wavy ridges, often obscure. Periostracum satin-like in texture; yellow, greenish, reddish or brown; often with broad or narrow green rays, becoming faded or absent. Pseudocardinal and lateral teeth thick; nacre white, sometimes pink or salmon in umbo cavity. Length: up to 4.5 inches.

Hosts

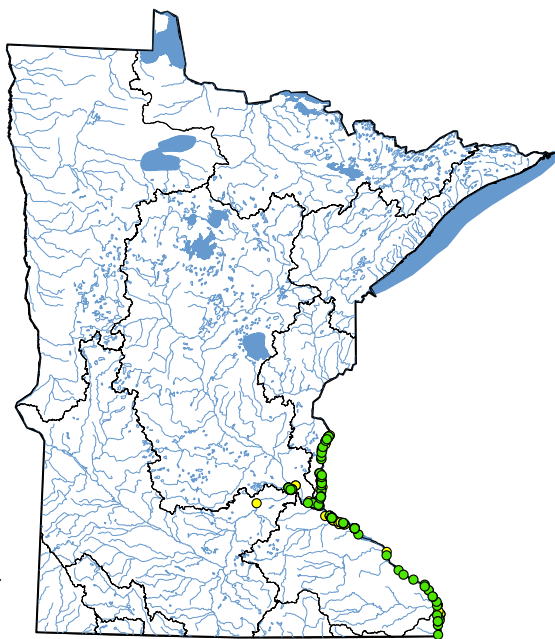
Basses and large percids.

Distribution and Habitat

Occurs in large rivers. Extirpated from the lower Minnesota River and uncommon in the Mississippi River below St. Anthony Falls. The lower St. Croix River has one of the largest remaining populations within its range. Reintroductions in Pool 2 of the Mississippi River have resulted in successful recruitment.

Comments

Higgins eye is the only mussel endemic to the upper Mississippi River basin.

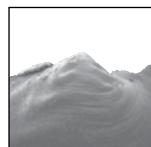


Canary kingshell

Lampsilis sietmani

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
75% Actual size

Similar Species

Fatmucket and yellow sandshell. Canary kingshell closely resembles yellow sandshell but has a thicker, larger shell and a rounder, less elongate outline. Bright yellow periostracum, usually lacking rays, and obscure umbo sculpture distinguish it from both.

Shell Characteristics

Moderately thick; elliptical; moderately inflated. Female posterior margin is slightly expanded, inflated ventrally and bluntly pointed dorsally; male is tapered and pointed posteriorly. Umbo sculpture indistinct or a few broken ridges, visible only in young. Periostracum bright yellow; rays usually absent, young occasionally with faint green rays. Pseudocardinal teeth fairly thick, lateral teeth well developed; nacre white, sometimes salmon in umbo cavity. Length: up to 6 inches.

Hosts

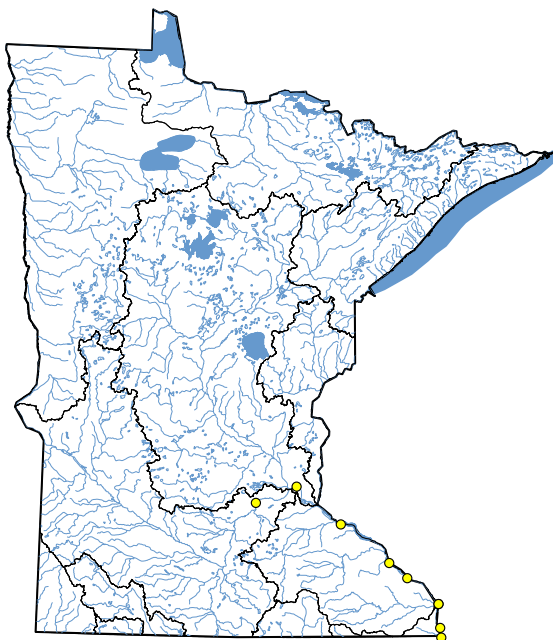
Gars.

Distribution and Habitat

Historically present in the Minnesota River and the Mississippi River below St. Anthony Falls. Most Minnesota records are based on specimens collected in the early 1900s and housed in the Smithsonian National Museum of Natural History's mollusk collection. No live specimens have been documented in Minnesota for many decades.

Comments

Canary kingshell was previously classified as *Lampsilis teres*, but was recently described as a distinct species (Keogh and Simons 2019).

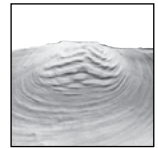


Fatmucket

Lampsilis siliquoidea

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
100% Actual size

Similar Species

Canary kingshell, Higgins eye, mucket, plain pocketbook, pondmussel and yellow sandshell. Male fatmucket may closely resemble male Higgins eye, male plain pocketbook and mucket, depending on location and stream size. Its umbo sculpture differs from plain pocketbook and, although similar to Higgins eye, is usually more prominent; it is much more prominent than mucket. Its periostracum is also glossier than Higgins eye and mucket and more yellow than mucket. The young outline is more elliptical than plain pocketbook and Higgins eye. Fatmucket is less elongate than yellow sandshell, and its umbo sculpture, periostracum color and presence of rays distinguish it from canary kingshell. It has a thicker shell and glossier, more yellow periostracum than pondmussel.

Shell Characteristics

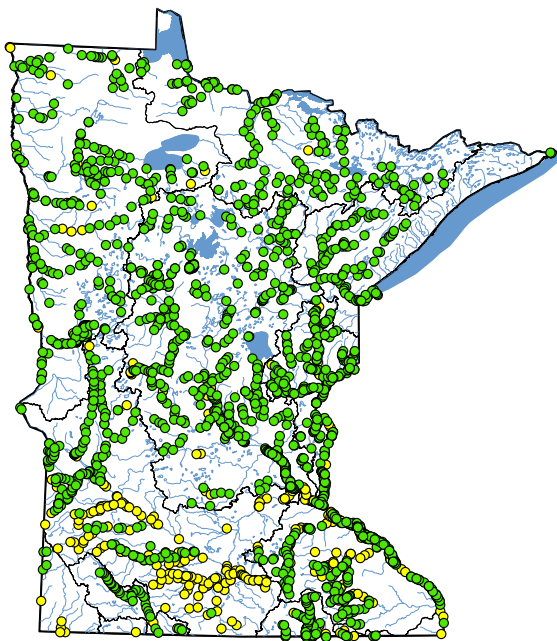
Moderately thick to thick, young are thin and sturdy; elliptical; inflated but moderately compressed when young. Female posterior is truncated and inflated; male posterior is bluntly rounded. Size, shape and thickness are highly variable depending on habitat; thinner and more compressed in small streams, thicker and more inflated in large rivers. Umbo sculpture several fine double-looped ridges. Periostracum often glossy; yellow, greenish-yellow or brown, occasionally stained reddish; usually with sparse to numerous green rays of varying widths. Pseudocardinal and lateral teeth well developed; nacre white. Length: up to 6 inches.

Hosts

Basses, sunfishes and percids; sometimes considered a generalist.

Distribution and Habitat

Occurs statewide in creeks to large rivers and in lakes. Although diminished or extirpated in parts of the Minnesota and Missouri river drainages, it is arguably the most widespread and abundant mussel species in Minnesota.



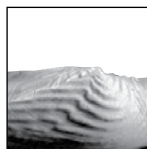
Yellow sandshell

Lampsilis teres

STATE STATUS: ENDANGERED

FEDERAL STATUS: UNCLASSIFIED

♀



Umbo sculpture

♂



0" 1"
100% Actual size

Similar Species

Canary kingshell, fatmucket and pondmussel. Yellow sandshell closely resembles canary kingshell but is distinguished by its thinner and more elongate shell, light yellow and often distinctly rayed periostracum and conspicuous umbo sculpture. It is also more elongate than fatmucket and its shell is comparatively thinner where they are likely to co-occur in Minnesota. Yellow sandshell is unlikely to occur with pondmussel in Minnesota but differs by its thicker, more inflated shell and yellow, glossier periostracum.

Shell Characteristics

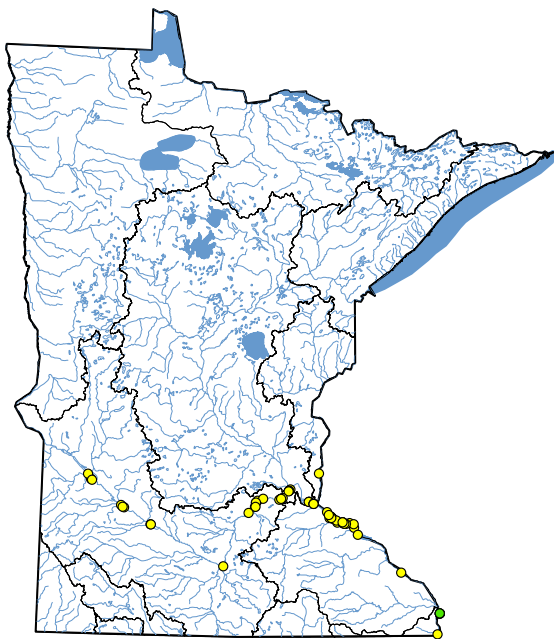
Moderately thick, young are somewhat thin; elongate; inflated. Umbo elevated slightly above the hinge line. Female posterior is expanded, slightly inflated ventrally and bluntly pointed dorsally; male is tapered and pointed posteriorly. Umbo sculpture several fine wavy ridges. Periostracum often glossy, especially younger individuals; straw-colored or light yellow; often with light green rays. Pseudocardinal teeth moderately thick, lateral teeth well developed; nacre white, sometimes salmon in umbo cavity. Length: up to 5 inches.

Hosts

Gars; sunfishes might be important hosts.

Distribution and Habitat

Historically occurred throughout the Minnesota River and the Mississippi River below St. Anthony Falls. This species was thought to be extirpated from Minnesota until recently when individuals were found in Pool 8 of the Mississippi River; these may represent a recovering population or a recent expansion from downstream populations.

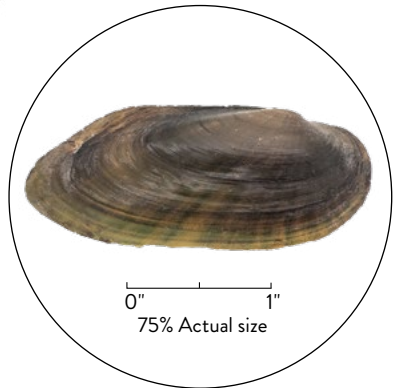


Black sandshell

Ligumia recta

STATE STATUS: SPECIAL CONCERN

FEDERAL STATUS: UNCLASSIFIED



0" 1"
50% Actual size

Similar Species

Eastern elliptio, pondmussel, spectaclecase and spike. Black sandshell differs from these species by its obscure umbo sculpture and typically glossy periostracum. Male black sandshell is most likely to be confused with spike, as they commonly occur together, but has a straighter dorsal margin than spike and a deeper umbo cavity than spike and spectaclecase. It is more inflated than eastern elliptio and spectaclecase, and its thicker shell and teeth and purple nacre further distinguish it from pondmussel and spectaclecase. It also lacks the prominent convex ventral margin of spectaclecase.

Shell Characteristics

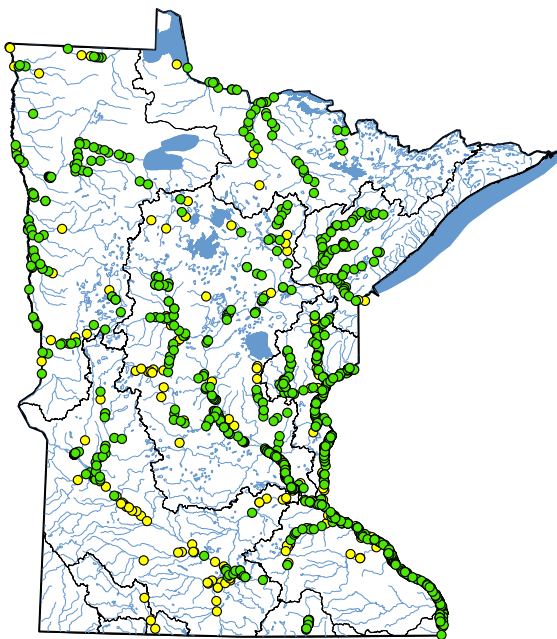
Moderately thick; elongate; moderately inflated. Dorsal margin straight; umbo elevated slightly above the hinge line. Female posterior is expanded, slightly inflated ventrally and bluntly pointed dorsally; male is tapered and pointed posteriorly. Umbo sculpture a few small double-looped ridges, usually obscure. Periostracum glossy, especially younger individuals; greenish or black; usually with broad dark green rays, faded or absent as individuals age and darken. Pseudocardinal teeth moderately thick, lateral teeth straight and long; umbo cavity moderately shallow; nacre white, purple or a combination. Length: up to 7 inches.

Hosts

Large percids; primarily walleye and sauger.

Distribution and Habitat

Occurs in medium to large rivers. Distribution is generally statewide but sporadic. Often common where present but absent, diminished or extirpated from some drainages and stream reaches, particularly in southern Minnesota. Reintroduced in the Cedar River.



Threehorn wartyback

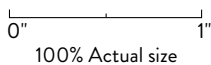
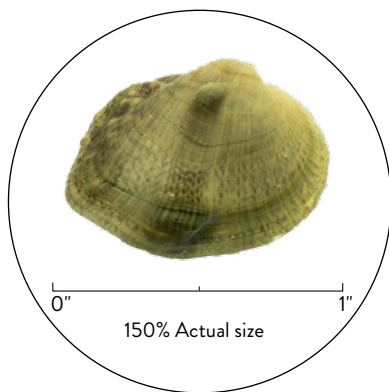
Obliquaria reflexa

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Anterior view



Similar Species

Sheepnose; superficially resembles wartyback. A row of elevated knobs extending from the umbo and alternating between the valves is distinctive. Sheepnose has lower, symmetrically aligned knobs and lacks sculpture on the posterior slope. The bluntly pointed posterior margin and small ridges on the posterior slope distinguish it from wartyback, which may have rows of small pustules resembling ridges. Rays distinguish it from both species.

Shell Characteristics

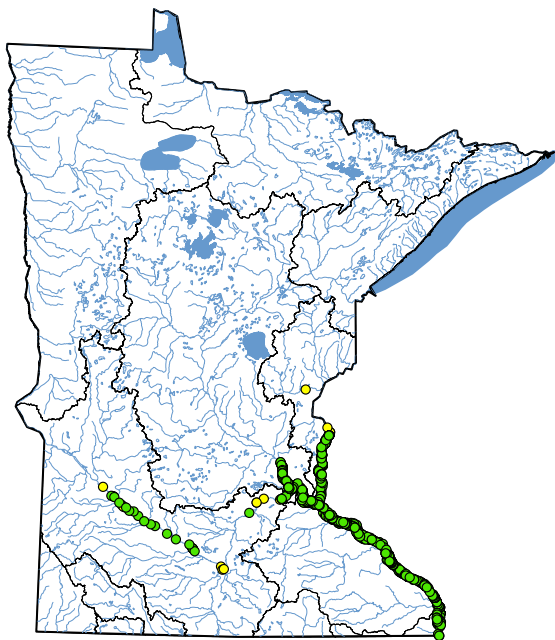
Thick; round or somewhat triangular; inflated. Posterior margin bluntly pointed; a row of elevated, often elongated knobs extend from the umbo down the center of the shell, alternating between valves, sometimes only on the umbo and rarely absent; ventral margin slightly convex below knobs, concave posterior to knobs or evenly rounded; posterior ridge well developed, rounded or distinctly angled; posterior slope usually with several small parallel ridges; shallow sulcus often present between knobs and posterior ridge. Umbo sculpture one or two thick ridges. Periostracum yellow, green or brown; typically with numerous thin dark green rays, V-shaped markings or interrupted lines, often with a broad darker stripe along the knobs. Pseudocardinal and lateral teeth thick; nacre white, occasionally pink. Length: up to 3.5 inches.

Hosts

Unknown.

Distribution and Habitat

Occurs in large rivers in Minnesota. Widespread and abundant in the Mississippi River below St. Anthony Falls, common to abundant in the lower St. Croix River and diminished in the Minnesota River drainage. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Shell records from the St. Croix River above Taylors Falls are sparse and disjunct.

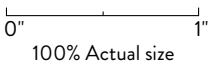
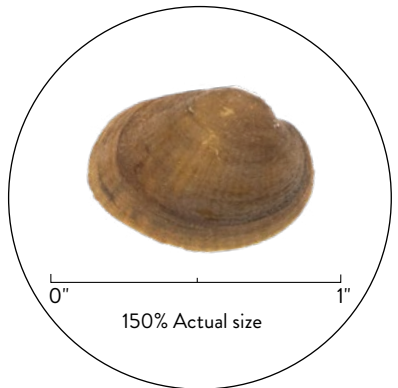


Hickorynut

Obovaria olivaria

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

Ebonyshell, Higgins eye, round pigtoe and sheepnose. Hickorynut, especially older individuals, may resemble Higgins eye but have a more evenly rounded outline, particularly along the ventral margin. Additionally, the young outline is less elliptical, umbo is less inflated, rays are more narrow and faint when present, umbo cavity is shallower and nacre is always white. Hickorynut typically has lighter-colored periostracum than ebonyshell and round pigtoe. It also has a rounder outline than round pigtoe, which is more triangular and bluntly pointed posteriorly, and a much shallower umbo cavity than ebonyshell. Its round outline, absence of shell sculpture and presence of rays distinguish it from sheepnose.

Shell Characteristics

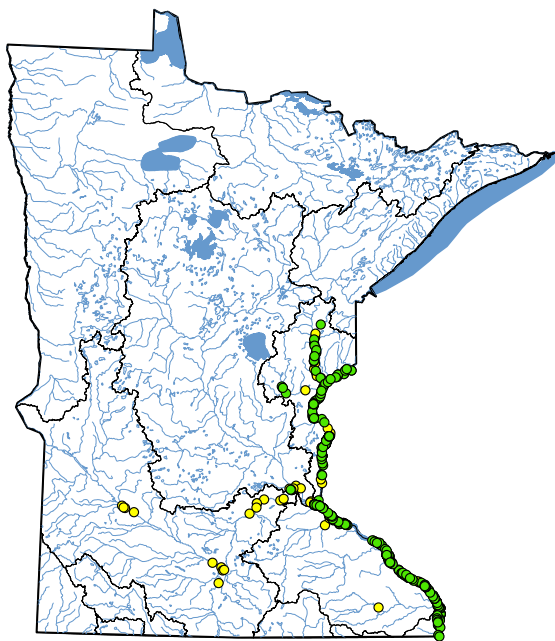
Thick, thinner posteriorly; oval to oblong; usually inflated. Umbo positioned anteriorly. Umbo sculpture a few very fine double-looped ridges, visible only in young. Periostracum satin-like in texture; yellow, greenish or tan, becoming dark brown with age; often with many narrow and usually faint green rays. Pseudocardinal and lateral teeth thick; umbo cavity shallow; nacre white. Length: up to 3.5 inches.

Hosts

Sturgeons.

Distribution and Habitat

Occurs in medium to large rivers. Present in the Mississippi River below St. Anthony Falls and in the St. Croix River drainage, where it is widespread and locally common. Extirpated from the Minnesota River drainage and largely absent from Mississippi River tributaries in southeastern Minnesota.

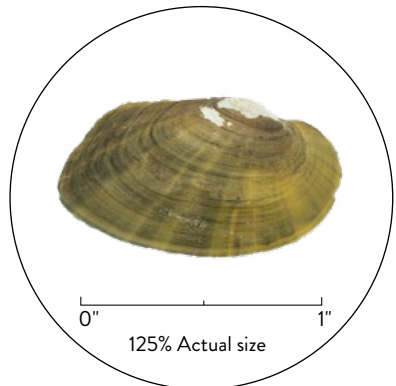


Mucket

Ortmanniana ligamentina

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
75% Actual size

Similar Species

Elephantear, ellipse, fatmucket, male Higgins eye and plain pocketbook. Combinations of elliptical outline, including the young outline, compressed shell and obscure umbo sculpture distinguish mucket from these species. It can closely resemble male Higgins eye and male fatmucket where they co-occur; however, its umbo is lower and less inflated than Higgins eye and its periostracum is not as yellow or glossy as fatmucket and plain pocketbook. It has a deeper umbo cavity and lacks the distinct posterior ridge and posterior slope sculpture of elephantear. Young mucket resemble ellipse but lack fine wavy rays.

Shell Characteristics

Moderately thick to thick; elliptical to oblong; moderately compressed to slightly inflated. Posterior margin bluntly pointed; umbo low, elevated slightly above the hinge line. Umbo sculpture a few small double-looped ridges, typically obscure. Periostracum yellowish or reddish, turning dark brown with age; numerous green rays of varying widths, becoming faded or absent. Pseudocardinal teeth thick and triangular, lateral teeth well developed; nacre white, sometimes pink or salmon, often with brownish blotches. Length: up to 6 inches.

Hosts

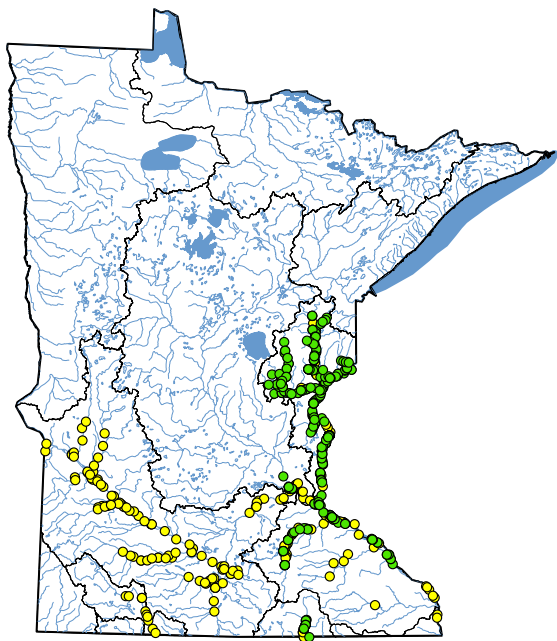
Basses, large percids and sunfishes; sometimes considered a generalist.

Distribution and Habitat

Occurs in medium to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls. Extirpated from much of its historic range in Minnesota, but widespread in the St. Croix River drainage, where it is often the dominant species. Reintroduced in the Cedar River, Cannon River above Northfield and upper Pool 2 of the Mississippi River. A recent record above St. Anthony Falls suggests the Pool 2 population may be expanding.

Comments

Listed as *Actinonaias ligamentina* in the first edition.



Pink heelsplitter

Potamilus alatus

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED

♀



♂



0" 1"
50% Actual size

Similar Species

Fragile papershell, pink papershell and white heelsplitter. Pink heelsplitter is most easily confused with pink papershell and white heelsplitter. It differs from pink papershell and fragile papershell by its thicker shell and teeth and cloth-textured periostracum. The presence of rays and two pseudocardinal teeth in the left valve distinguish it from pink papershell, which typically lacks rays and has one pseudocardinal tooth in the left valve. The absence of umbo sculpture, corrugations on the wing and presence of purple nacre distinguish it from white heelsplitter.

Shell Characteristics

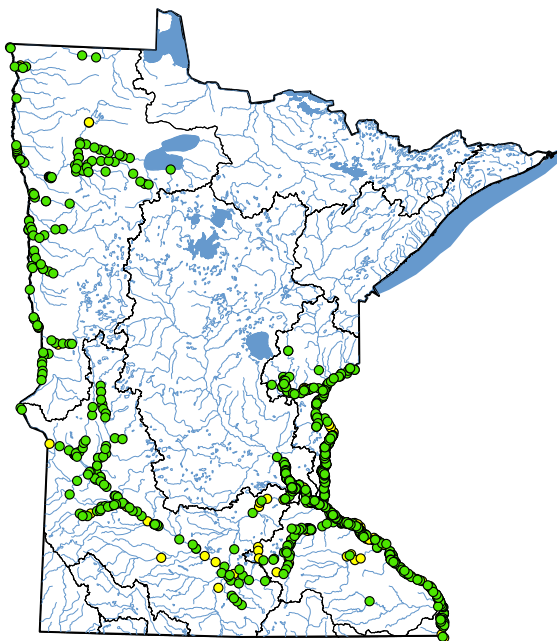
Moderately thick, young are thin; oval to somewhat oblong; compressed. Pronounced posterior wing, sometimes worn down with age; ventral margin usually straight; umbo barely elevated above the hinge line. Female is more inflated with a truncated posterior; male posterior is rounded. Umbo sculpture obscure. Periostracum somewhat cloth-like in texture; greenish to dark brown; usually with green rays. Pseudocardinal and lateral teeth well developed, two pseudocardinal teeth in left valve and two in right valve; nacre pink or purple. Length: up to 7.5 inches.

Hosts

Freshwater drum (*Aplodinotus grunniens*); also known as sheephead.

Distribution and Habitat

Occurs in medium to large rivers. Common and occasionally abundant in the Mississippi River and connected drainages below St. Anthony Falls and the Red River of the North drainage. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks, with a single occurrence just above the dam.



Fat pocketbook

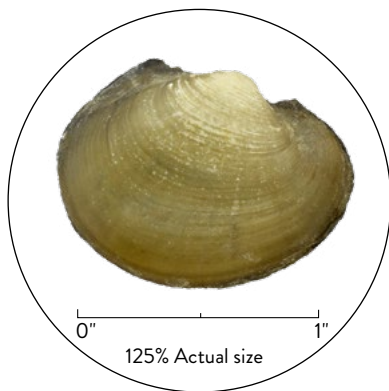
Potamilus capax

STATE STATUS: EXTIRPATED

FEDERAL STATUS: ENDANGERED



0" 1"
100% Actual size



0" 1"
125% Actual size

Similar Species

Higgins eye and plain pocketbook. Fat pocketbook more closely resembles female plain pocketbook but is distinguished from both species by the absence of umbo sculpture and rays and thinner teeth. Fat pocketbook also lacks the truncated posterior margin in females of these species. Higgins eye also has a much thicker shell.

Shell Characteristics

Moderately thick, young are thin; circular; highly inflated; hinge line S-shaped. Umbo inflated, elevated well above the hinge line and turned inward. Umbo sculpture obscure. Periostracum very glossy; yellowish to light brown; rays absent. Pseudocardinal and lateral teeth well developed but relatively thin; nacre white. Length: up to 5 inches.

Hosts

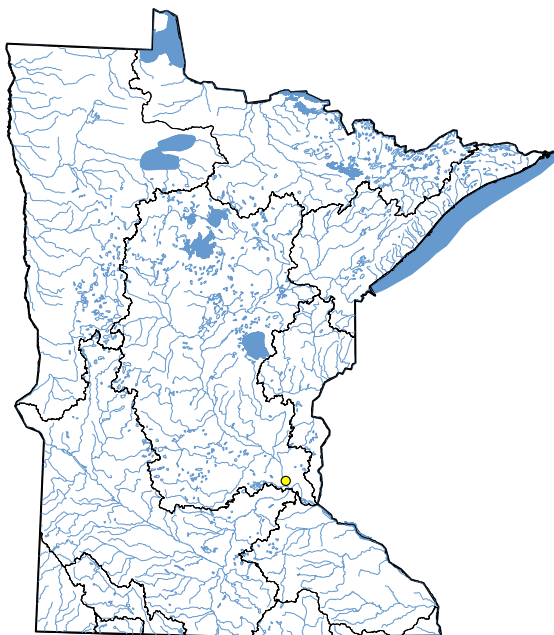
Freshwater drum (*Aplodinotus grunniens*); also known as sheephead.

Distribution and Habitat

Occurs in large rivers. Historically present in the Mississippi River in Minnesota, where it was apparently very rare given its limited mention in early literature and the near absence of museum specimens. One specimen in the Bell Museum of Natural History mollusk collection is labeled from the Mississippi River in Minnesota with an unknown date and locality (catalog no. JFBM 4296).

Comment

The type locality of fat pocketbook is the Mississippi River at St. Anthony Falls, where it was originally collected and described as a new species.



Fragile papershell

Potamilus fragilis

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
50% Actual size

Similar Species

Pink heelsplitter, pink papershell and scaleshell. Fragile papershell is most likely to be confused with pink papershell. It is distinguished from pink heelsplitter and pink papershell by its more elongate outline, yellow periostracum and absence of purple nacre. It further differs from pink papershell by the presence of rays and from pink heelsplitter by its thinner shell and teeth. Scaleshell is more elongate and compressed and is considered extirpated from Minnesota.

Shell Characteristics

Thin; elliptical or oblong; moderately compressed. Posterior wing often present, small anterior wing sometimes present; umbo barely elevated above the hinge line. Female posterior is roundly truncated, fragile and somewhat expanded and inflated; male posterior is bluntly rounded. Umbo sculpture obscure. Periostracum usually light yellow or greenish, becoming darker with age, posterior slope and wing noticeably darker; faint green rays usually present. Pseudocardinal and lateral teeth thin; nacre iridescent white, often light pink dorsally. Length: up to 6.5 inches.

Hosts

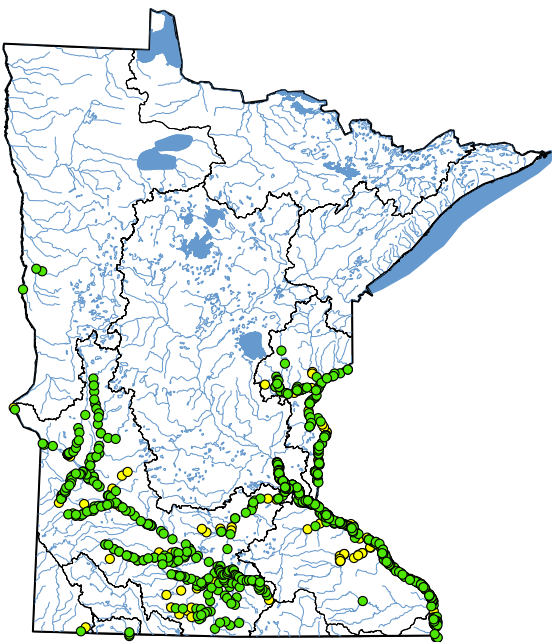
Freshwater drum (*Aplodinotus grunniens*); also known as sheephead.

Distribution and Habitat

Occurs in small to large rivers. Present in the Mississippi River and connected drainages below St. Anthony Falls. Widespread and common in the Minnesota River drainage and the Mississippi River mainstem. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Populations of unknown origin were recently discovered in the upper Red River of the North drainage.

Comments

Listed as *Leptodea fragilis* in the first edition.

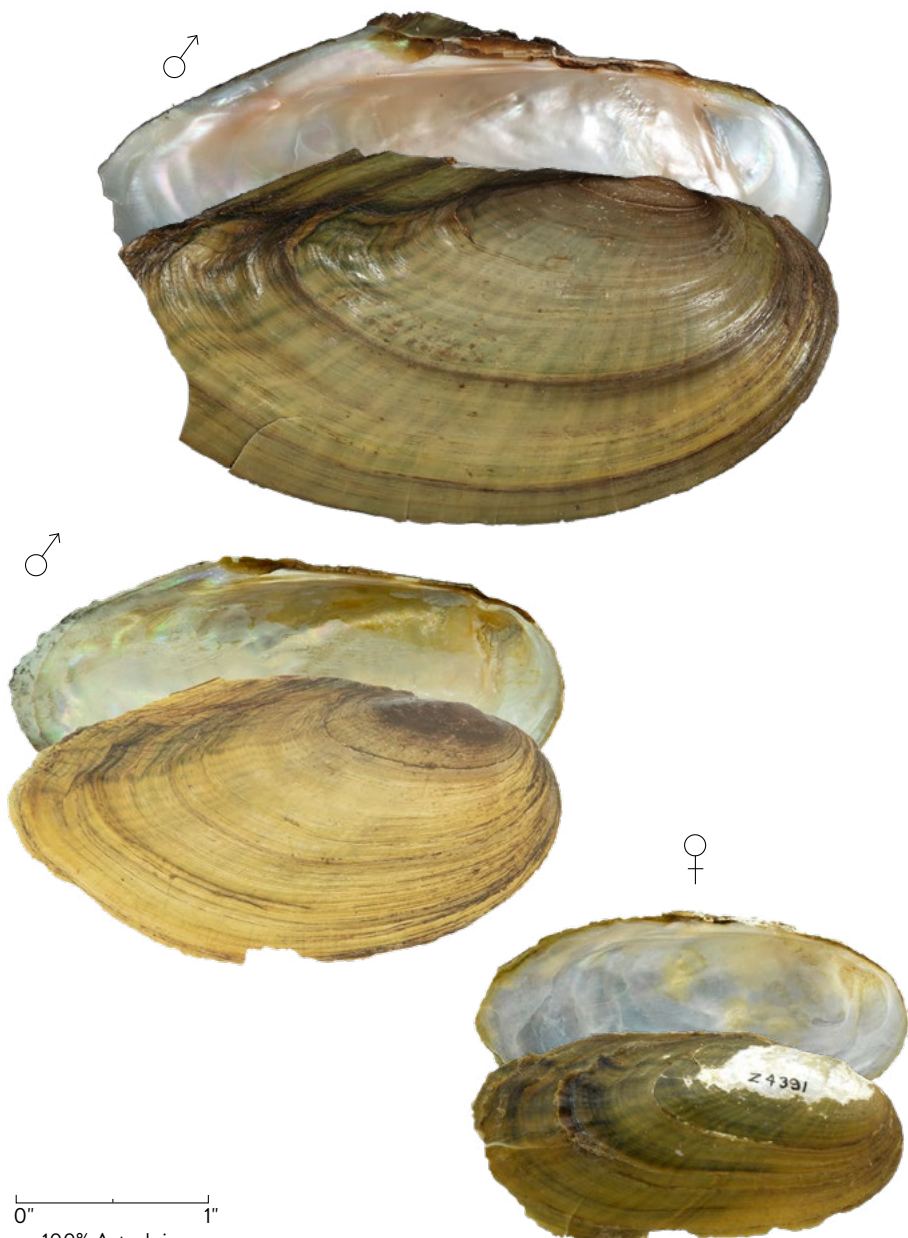


Scaleshell

Potamilus leptodon

STATE STATUS: EXTIRPATED

FEDERAL STATUS: ENDANGERED



Similar Species

Fragile papershell. Scaleshell is distinguished by its more elongate and compressed shell.

Shell Characteristics

Thin; elongate or elliptical; compressed. Low posterior wing often present; umbo low and barely elevated above the hinge line. Female posterior margin is uncalcified, fragile and wavy; male posterior bluntly pointed. Umbo sculpture obscure. Periostracum yellowish with thin green rays. Pseudocardinal teeth rudimentary, lateral teeth very thin; nacre iridescent, whitish-pink or purplish. Length: up to 4 inches.

Hosts

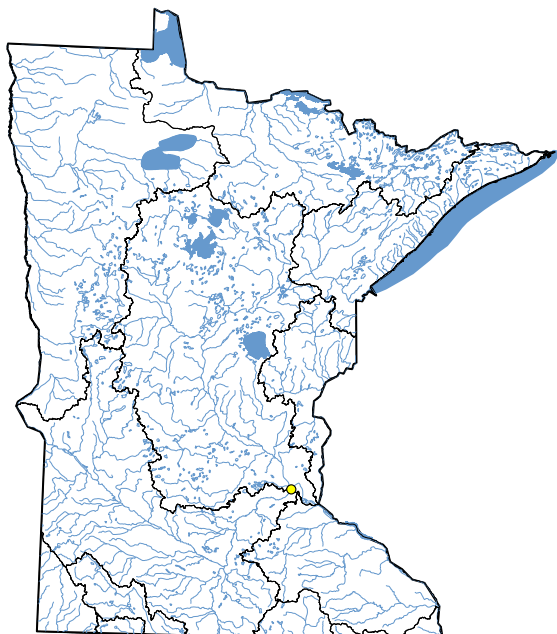
Freshwater drum (*Aplodinotus grunniens*); also known as sheepshead.

Distribution and Habitat

Occurs in medium to large rivers. Its presence in Minnesota is based on a single specimen from the Minnesota River at Mendota, held in The Ohio State University mollusk collection (catalog no. OSUM 56849). Considered exceptionally rare in the upper Mississippi River historically.

Comments

Listed as *Leptodea leptodon* in the first edition.



Pink papershell

Potamilus ohioensis

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
50% Actual size

Similar Species

Flat floater, fragile papershell, pink heelsplitter and white heelsplitter. Pink papershell may closely resemble pink heelsplitter, but is distinguished by its glossy, olive-brown periostracum lacking distinct rays, more rounded outline and ventral margin, thinner shell and teeth, and only one pseudocardinal tooth in the left valve. It differs from flat floater by its slightly elevated umbo, prominent wings and teeth, and from white heelsplitter by its thinner shell and teeth and absence of umbo and wing sculpture. Older individuals with eroded wings may resemble fragile papershell, but their periostracum is typically darker and glossier and the young outline is rounder. It is further distinguished from fragile papershell, white heelsplitter and flat floater by purple nacre.

Shell Characteristics

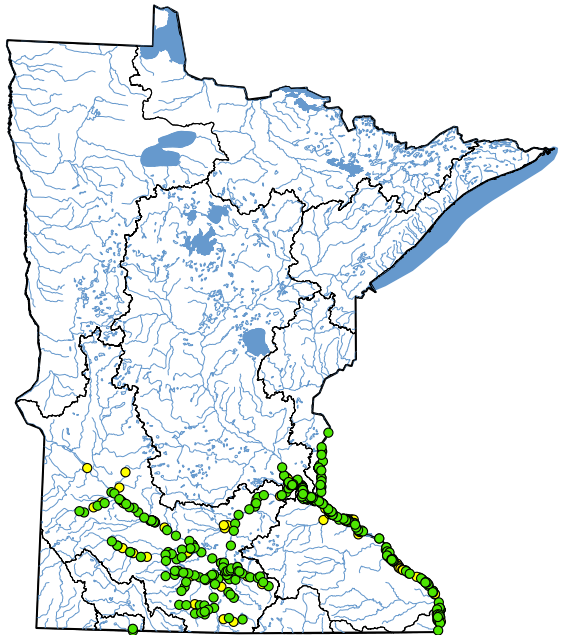
Thin; round to oval; compressed. Usually well-developed posterior wing, small anterior wing often present, wings may be worn-down in older individuals; ventral margin rounded; umbo low and nearly level with hinge line. Umbo sculpture obscure. Periostracum glossy; olive to brown, typically darkening with age; umbo usually pale tan; often has differently colored bands that correspond to periods of growth; a pink or purple tint from underlying nacre shows through the periostracum, sometimes giving a layered or iridescent appearance; rays are faint, usually fine or absent. Pseudocardinal and lateral teeth thin, one pseudocardinal tooth in left valve and two in right valve; umbo cavity shallow; nacre typically light purple. Length: up to 6.5 inches.

Hosts

Freshwater drum
(*Aplodinotus grunniens*);
also known as sheepshead.

Distribution and Habitat

Occurs in small to large rivers in Minnesota. Widespread and common in the Minnesota River drainage and the Mississippi River below St. Anthony Falls; uncommon in the lower St. Croix River. Largely absent from Mississippi River tributaries in southeastern Minnesota.

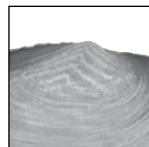


Pondmussel

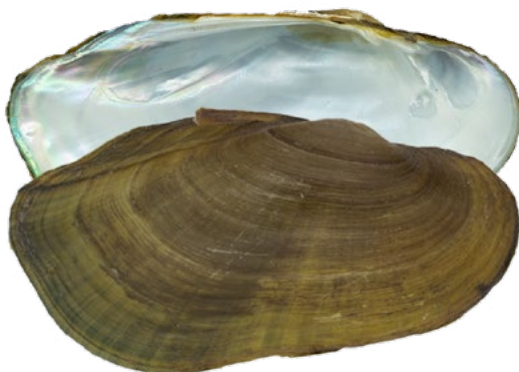
Sagittunio subrostratus

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
125% Actual size

Similar Species

Black sandshell, fatmucket and yellow sandshell. Pondmussel is distinguished from these species by its thinner shell, smaller size and satin-like periostracum with less distinctly yellow or black coloration. Pondmussel is unlikely to be found within the range of yellow sandshell.

Shell Characteristics

Thin and sturdy; elongate; compressed. Female posterior truncated; male posterior pointed. Umbo sculpture several fine double-looped ridges. Periostracum satin-like in texture; greenish- or yellowish-brown; usually with green rays, often concentrated on posterior. Pseudocardinal and lateral teeth well developed but thin; nacre off-white. Length: up to 3.5 inches.

Hosts

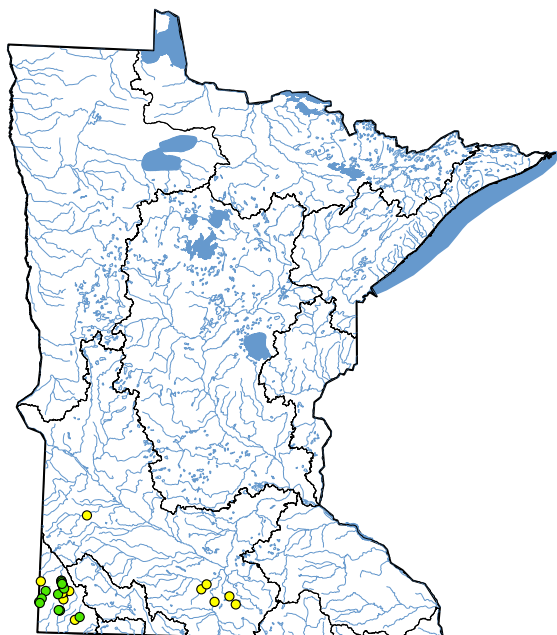
Sunfishes and basses.

Distribution and Habitat

Occurs in creeks and small rivers in Minnesota, typically along stream margins. Also found in ponds and reservoirs elsewhere in its range. Uncommon in tributaries of the Missouri River drainage and possibly extirpated from the Minnesota River drainage. Minnesota may support the largest population remaining in the upper Midwest.

Comments

Listed as *Ligumia subrostrata* in the first edition.

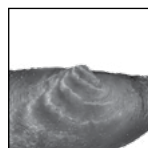


Lilliput

Toxolasma parvum

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Umbo sculpture



0" 1"
200% Actual size

Similar Species

Salamander mussel. Lilliput is distinguished by its sturdier shell that is more inflated and less elongate, distinctive umbo sculpture, cloth-textured periostracum and well-developed teeth.

Shell Characteristics

Small; thin and sturdy; oblong or oval; inflated. Posterior of adults inflated and often expanded with a truncated margin. Umbo sculpture a few to several curved ridges. Periostracum cloth-like in texture; greenish or brown; rays absent. Pseudocardinal and lateral teeth well developed; nacre off-white and iridescent. Length: up to 2 inches.

Hosts

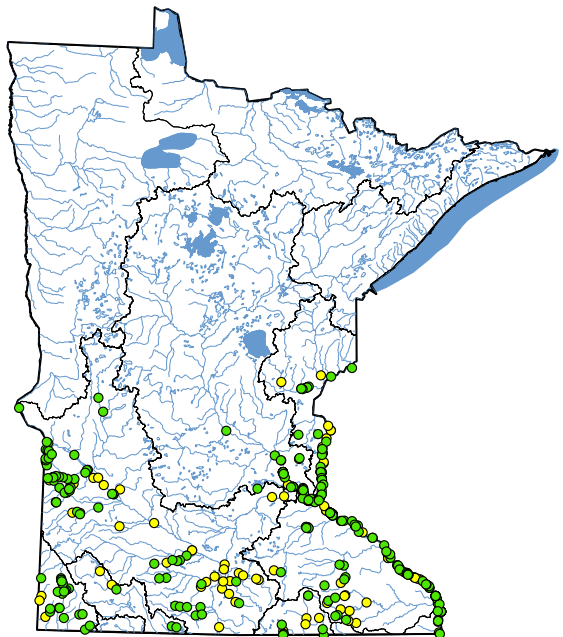
Sunfishes and percids.

Distribution and Habitat

Occurs in creeks to large rivers, typically along stream margins, and is occasionally found in lakes. Sporadic and locally common in the Mississippi River and connected drainages below St. Anthony Falls but is largely absent from the Minnesota River mainstem. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks. Other populations in the Mississippi River Headwaters, outside its historical range, are presumably accidental introductions; its localized distribution in the St. Croix River above Taylors Falls may also reflect an introduction.

Comments

Predominantly hermaphroditic. Listed as *Toxolasma parvus* in the first edition.



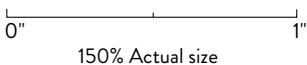
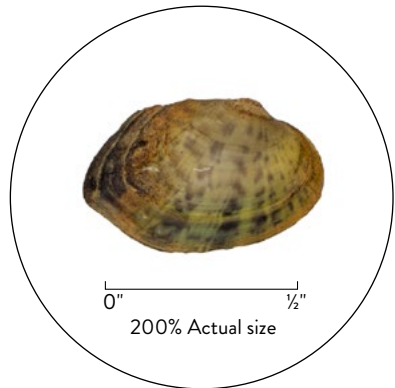
Fawnsfoot

Truncilla donaciformis

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED

Dorsal view



Similar Species

Deertoe. Fawnsfoot has a more elliptical to rounded outline, whereas deertoe is triangular. It also has a less prominent posterior ridge, less variable periostracum color and consistently white nacre.

Shell Characteristics

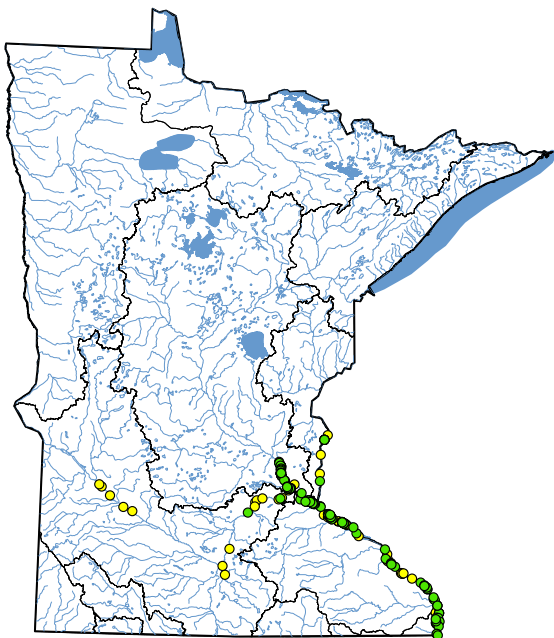
Small; thin and sturdy; somewhat elliptical to oval. Posterior margin bluntly pointed; posterior ridge sharply angled near the umbo. Female is more inflated and posterior-ventral margin is truncated; male ventral margin evenly rounded. Umbo sculpture a few fine double-looped ridges, usually obscure. Periostracum yellowish to greenish; V-shaped or zigzag markings forming distinctive rays with age. Pseudocardinal and lateral teeth well developed; nacre white. Length: up to 2 inches.

Hosts

Freshwater drum (*Aplodinotus grunniens*); also known as sheepshead.

Distribution and Habitat

Occurs mainly in large rivers in Minnesota. Widespread and occasionally common in the Mississippi River. Diminished and rare in the Minnesota River and rare in the lower St. Croix River. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks.



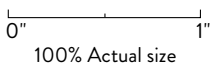
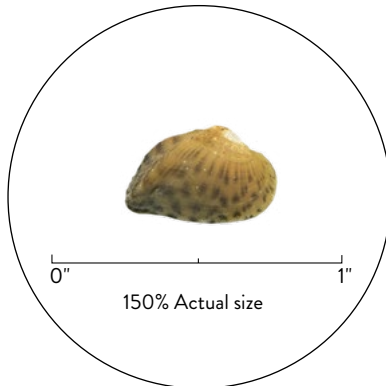
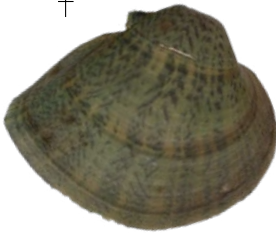
Deertoe

Truncilla truncata

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED

Dorsal view



Similar Species

Elktoe, fawnsfoot, male snuffbox and Wabash pigtoe. Deertoe is most easily confused with fawnsfoot but has a more triangular outline, a more prominent posterior ridge and more variable periostracum and nacre color. Its sharply angled posterior ridge, presence of rays or distinctive ray pattern and varied color distinguish it from male snuffbox and Wabash pigtoe. Deertoe lacks fine grooves on the posterior slope that are typical of elktoe and male snuffbox.

Shell Characteristics

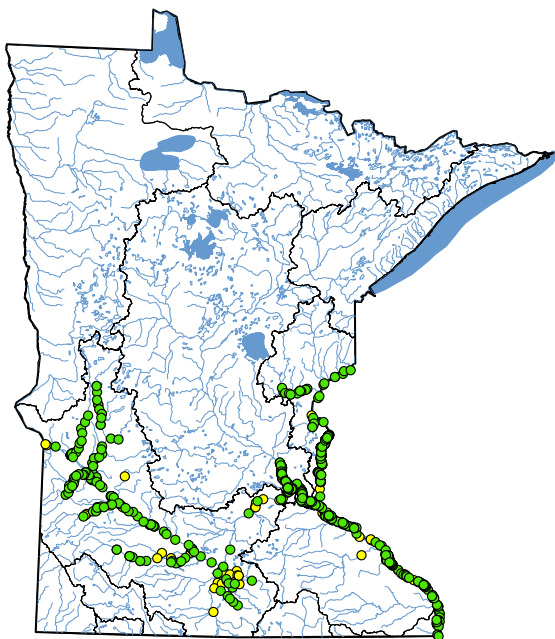
Thin and sturdy to moderately thick; triangular; inflated. Posterior margin pointed; posterior ridge sharply angled. Female ventral margin is evenly rounded or slightly convex and sulcus is absent; males have a shallow sulcus, and ventral margin at sulcus is slightly concave. Umbo sculpture a few fine double-looped ridges, usually obscure. Periostracum color is highly variable with shades of green, yellow or red, turning dark brown with age; usually with broken V-shaped or zigzag markings, sometimes overlaid by broad green rays with interspersed narrow rays. Pseudocardinal and lateral teeth well developed; nacre white, occasionally pink or reddish. Length: up to 3.5 inches.

Hosts

Freshwater drum (*Aplodinotus grunniens*); also known as sheepshead.

Distribution and Habitat

Occurs in small to large rivers. Widespread and common to abundant in the Minnesota River drainage, St. Croix River and Mississippi River. Largely absent from Mississippi River tributaries in southeastern Minnesota. Its range has expanded above St. Anthony Falls to Coon Rapids Dam, likely from infected host fish passing through navigation locks.



Ellipse

Venustaconcha ellipsiformis

STATE STATUS: THREATENED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
125% Actual size

Similar Species

Young mucket. Ellipse is distinguished by the presence of fine wavy rays and its generally smaller size.

Shell Characteristics

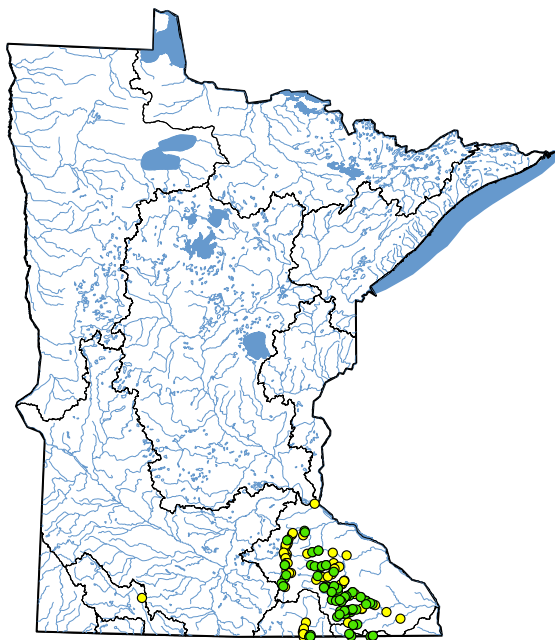
Small; moderately thick for its size; oblong or elliptical. Posterior margin bluntly pointed to slightly biangular; ventral margin gently rounded to nearly straight, sometimes slightly concave posteriorly. Umbo sculpture a few fine double-looped ridges, usually obscure. Periostracum yellowish-green to brown; usually with green rays becoming fine and wavy on posterior half of shell. Pseudocardinal and lateral teeth well developed and thick for its size; umbo cavity shallow; nacre white. Length: up to 4 inches.

Hosts

Darters; sculpins might be important hosts.

Distribution and Habitat

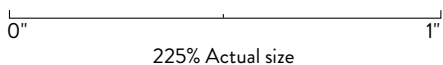
Primarily occurs in creeks and small rivers. Present in small tributaries and upper reaches of the Cannon, Zumbro, Root, Upper Iowa and Cedar rivers in southeastern Minnesota where it is locally common and occasionally abundant. Extirpated from the Mississippi River below St. Anthony Falls and from the Des Moines River where it was presumably rare.



Fingernail, pill and pea clams

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



Similar Species

Basket clams and freshwater mussels ≤ 0.75 inches. Sphaeriid clams differ from basket clams by their thinner and more fragile shells, finer and more closely spaced concentric lines or ridges (striae), and lack of distinctly purple-colored nacre. They superficially resemble small mussels but can be distinguished by their fine striae (if visible), often centrally positioned umbo and two sets of lateral teeth. They also lack the distinctive umbo sculpture of many mussel species.

Shell Characteristics

Small; very thin; round, oval or somewhat triangular. Periostracum smooth or roughened by fine, closely spaced, concentric striae; cream-colored to brown. Teeth small and obscure, two sets of lateral teeth on opposite sides of small cardinal teeth; nacre off-white. Length: up to 0.75 inches; adults of many species are less than 0.25 inches.

Hosts

None; life cycle lacks a parasitic larval stage. Sphaeriids are hermaphroditic; larvae complete development directly within the parent.

Distribution and Habitat

Occur statewide in creeks to large rivers, lakes, ponds and marshes. Some species occur in habitats prone to seasonal drying. Often abundant but may be diminished in some degraded streams.

Comments

Sphaeriids have received far less study than freshwater mussels. Four genera (*Euglesa*, *Odhneripisidium*, *Pisidium*, and *Sphaerium*) and approximately 18 species of Sphaeriidae are thought to occur in Minnesota, including one species native to Europe, *Odhneripisidium moitessierianum* (Bogan et al. 2026).

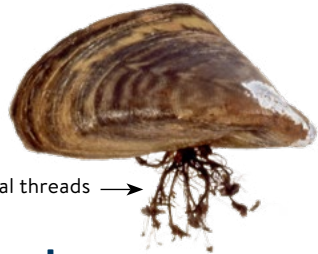
Nonnative Bivalves

STATE STATUS: PROHIBITED INVASIVE SPECIES

FEDERAL STATUS: INJURIOUS WILDLIFE

Zebra mussel

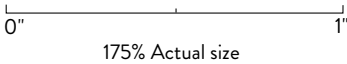
Dreissena polymorpha



Byssal threads →

Quagga mussel

Dreissena rostriformis bugensis



175% Actual size



A native threehorn wartyback mussel infested with zebra mussels.

Similar Species

No similar species in Minnesota.

Shell Characteristics

Small; thin; triangular or D-shaped; inflated. Dorsal and posterior margins broadly rounded, ventral margin relatively flat; umbo bluntly pointed on anterior end. Periostracum color is variable but typically light tan to brown; distinctive dark vertical stripes, often zigzagged, occasionally with horizontal rays or without markings. Both species attach to hard surfaces using byssal threads – hairlike fibers that emerge from the ventral margin between the valves. Length: up to 2 inches.

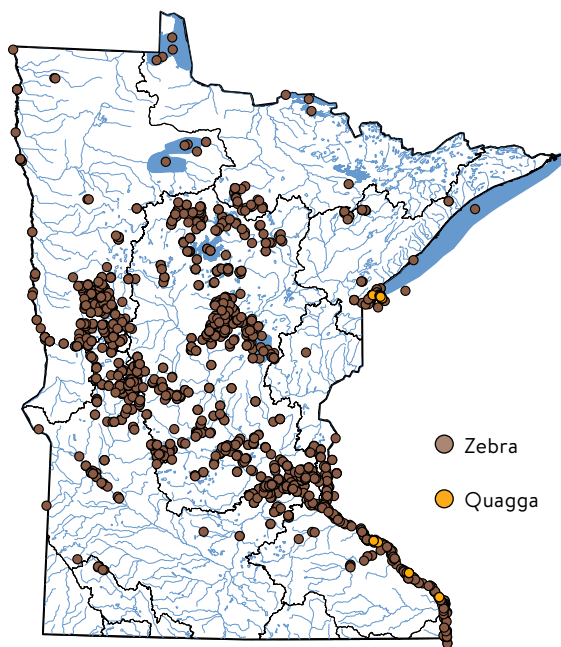
Zebra and quagga mussels are similar and some shell characteristics overlap. In general, quagga mussels are larger, rounder and wider. The ventral surface of the zebra mussel is flat or slightly concave but is convex in quagga mussel. The transition from dorsal to ventral surfaces forms a angled ridge in zebra mussel but is more smoothly rounded in quagga mussel. Zebra mussel valves are symmetrical, whereas quagga mussel valves are uneven when viewed from the umbo end and in the curvature of their ventral margins. Zebra mussel also has a more prominent byssal groove than quagga mussel.

Hosts

None; the life cycle lacks a parasitic larval stage. Zebra and quagga mussels are broadcast spawners with planktonic veliger larvae that develop in the water column before settling and attaching to solid objects.

Distribution and Habitat

Occurs primarily in lakes, reservoirs and large rivers. The zebra mussel was first discovered in Lake Superior's Duluth Harbor in 1989, three years after its initial detection in North America in the western basin of Lake Erie. It was found in the Minnesota-Wisconsin portion of the Mississippi River by 1991. As of 2025, zebra mussels have been detected in every major watershed in Minnesota except the Missouri and



Cedar River basins. It is particularly widespread in the central and north-central lakes region in the Mississippi River Headwaters and Red River of the North drainages, as well as in the Mississippi River and lower St. Croix River below Stillwater. Zebra mussels often reach high densities in lakes, reservoirs and riverine lakes such as Lake Pepin and Lake St. Croix, and may colonize varying distances downstream of established populations.

Quagga mussel was first discovered in Minnesota in the Mississippi River near La Crescent in 2004 and detected in Duluth Harbor the following year. It has not been reported beyond these areas and there appear to be no confirmed records from Minnesota since 2006 – possibly because it is difficult to distinguish from zebra mussel without genetic testing.

Nonnative Bivalves

Chinese basket clam

Corbicula fluminea

STATE STATUS: PROHIBITED INVASIVE SPECIES

FEDERAL STATUS: UNCLASSIFIED



Yangtze basket clam

Corbicula largillierti

STATE STATUS: UNCLASSIFIED

FEDERAL STATUS: UNCLASSIFIED



0" 1"
150% Actual size

Similar Species

Fingernail clams; may superficially resemble juvenile freshwater mussels. Basket clams are most likely to be confused with fingernail clams but they can be distinguished by their thicker shells, prominent concentric ridges, thicker teeth and purple nacre. The centrally located umbo, prominent concentric ridges covering the shell and two sets of lateral teeth distinguish them from freshwater mussels.

Shell Characteristics

Thin and sturdy; rounded or conical; inflated. Prominent concentric ridges cover entire shell; umbo centrally positioned. Two sets of lateral teeth present on opposite sides of small, centrally located cardinal teeth. Length: up to 1.5 inches.

Chinese basket clam is more conical and inflated with thicker concentric ridges; periostracum is yellow and often glossy, turning brown with age, usually with a small purplish stripe on the umbo, most evident in younger individuals; nacre white, often tinged with purple, especially near the umbo. Yangtze basket clam is rounder and less inflated, with finer, more closely spaced concentric ridges; periostracum is olive to brown; nacre purple or violet.

Hosts

None; the life cycle lacks a parasitic larval stage. *Corbicula* are hermaphroditic; young develop within the parent's gills and are released either as late-stage larvae or as juveniles.

Distribution and Habitat

Both species occur in large rivers in Minnesota. Chinese basket clam was first reported from the St. Croix River in 1977 and is now present in the Mississippi River upstream to Monticello, the lower St. Croix River, the Lake Superior estuary and, more recently, the Otter Tail River. It is also present in a few lakes in Minnesota. The first known collection of Yangtze basket clam was from the Mississippi River in 2020; however, its similarity to Chinese basket clam and unresolved taxonomy within the genus may have hampered earlier detection.



Comments

Corbicula fluminea was listed as Asian clam in the first edition of this guide. It also goes by the common name golden clam. An additional *Corbicula* lineage, referred to as “Form-D,” was recently identified in North America from the Illinois and Ohio rivers and may occur elsewhere. Basket clams are not very cold-hardy; some river populations are thought to overwinter only in areas with artificially warmed water and recolonize adjacent habitats during warmer months.

Glossary

Taken in part from Cummings and Mayer (1992), with permission of the authors.

Annuli – darkened lines indicating a period of slow or no growth, typically formed during winter; also called growth rings.

Anterior end – the front end of the shell; shorter end of the shell as measured from the umbo

Aperture – an opening where water enters (incurrent) or exits (excurrent) a mussel, used in feeding and respiration; sometimes called a siphon. Unionid mussels lack a fused mantle that forms true siphons.

Chevron – a V-shaped marking

Compressed – flattened or pressed together laterally

Concave – curved inward

Convex – curved outward

Dorsal – referring to the top part of the shell where the hinge is located

Elliptical – elongated oval shape

Elongate – long or extended

Extirpated – locally extinct, as from a watershed or state

Glossy – surface texture that is shiny

Growth ring – a darkened line indicating a period of slow or no growth, typically formed during winter; also called an annulus (plural: annuli)

Generalist – a mussel species whose larvae (glochidia) can develop on a broad range of fish species and families

Hinge ligament – a springlike proteinaceous structure of the shell that unites the two valves

Host (suitable host) – a fish species that supports the successful metamorphosis (development) of mussel larvae (glochidia) into the juvenile life stage

Inflated – swollen or expanded

Irregular – a ridge or line that is not straight

Iridescent – exhibiting rainbow colors

Knob – large bump or elevated protuberance on the outside surface of the shell; usually few in number

Lateral teeth – the elongated teeth along the hinge line of the shell

Mantle – a thin layer of tissue that covers the mussel's body and produces the shell

- Nacre** – the interior layer of the shell; usually lustrous, and white, purple, pink, or salmon-colored
- Nodule** – elevated protuberance on the outside surface of the shell; larger than a pustule
- Nonnative** – not native to a particular region or country
- Oblong** – having the shape of or resembling a rectangle or ellipse
- Ovate** – egg-shaped
- Periostracum** – the outside layer or covering of the shell
- Posterior end** – the back end of the shell; longer end of the shell as measured from the umbo; the end with the apertures
- Posterior ridge** – the ridge on the back half of the valve running from the umbo to the posterior ventral edge
- Posterior slope** – the area along the dorsal part of the shell between the posterior ridges of the valves. May expand dorsally in some species to form a wing-like structure.
- Pseudocardinal teeth** – the triangular, often serrated, teeth located on the anterior-dorsal part of the shell
- Pustule** – a bump or small elevated protuberance on the outside surface of the shell, often occurring in large numbers
- Ray** – colored line(s) on the periostracum that extend from the umbo toward the ventral shell margin; usually green
- Shell margin** – the circumference of a valve outline when laid flat; also known as the edge
- Sulcus** – a shallow depression or furrow on the outside surface of the shell
- Truncated** – having the end shortened or squared off
- Tubercle** – a pointed, rounded or knoblike projection on the shell
- Umbo** – the inflated dorsal part of the shell; also called the beak; the oldest part of shell
- Umbo cavity** – the depression or pocket on the inside of each valve leading into the umbo
- Umbo sculpture** – small ridges, or bumps on the umbo that develop during the first year of growth; useful for species identification but often eroded away; also called beak sculpture
- Valve** – one of the two halves of the shell
- Ventral** – referring to the bottom edge of the shell
- Young outline** – the outline of the shell when an individual was young; in older individuals this is marked by annual growth rings (annuli) on the umbo

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Mussel Resources Online

- Minnesota DNR Mussel Program (mndnr.gov/mussels).
- Freshwater Mollusk Conservation Society (molluskconservation.org).
- Freshwater Mussel Host Database (mollusk.inhs.illinois.edu/resources/freshwater-mussel-host-database/).
- MusselMapR (musselmapr.shinyapps.io/hic_sunt_naiades/).
- MUSSEL Project Website (musselpdb.org).
- Clam Counter Minnesota app (Free on the App Store and Google Play).

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