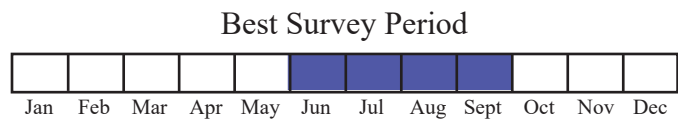
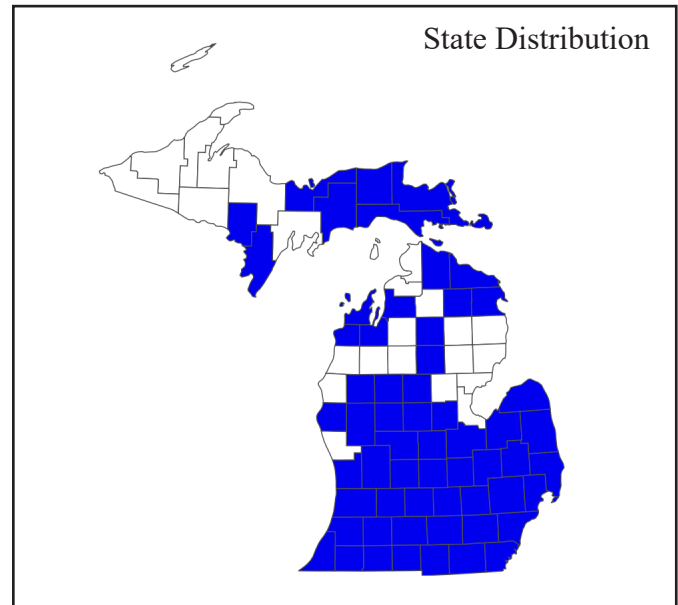




Photo by Kurt Stepnitz



Status: State Special Concern

Global and State Rank: G5 (Globally Secure) / SNR (State Not Ranked)

Family: Unionidae (Pearly mussels)

Synonyms: *Alasmidonta costata*, *Alasmidonta rugosa*, *Alasmidonta papyraceum*, *Mya rugosa*, *Alasmodon hians*, *Lasmigona rugosum*, *Alasmodonta costata*, *Alasmodonta hians*, *Margarita (Margaritana) rugosa*, *Unio rugosa*, *Alasmodon rugosa*, *Unio rugosus*, *Complanaria costata*, *Baphia rugosa*, *Margaritana rugosa*, *Symphynota (Lasmigona) costata*, *Lasmigona costata* var. *eriganensis*, *Lasmigona costata pepinesis*, *Lasmigona costata nuda*, *Lasmigona (Lasmigona) costata*, *Lasmigona sulcatum*, *Sulcularia papyraceum* (MolluscaBase 2025, Watters et al. 2009)

Other Common Names: Flutedshell, sandshell, fluted riffleshell, hackle-back, ribbed creek shell, ribbed riffleshell

Total Range: Flutedshell can be found in the Mississippi River system, ranging from southern

Ontario and Manitoba to Mississippi and Alabama, the Great Lakes drainage, and St. Lawrence and Hudson Rivers (NatureServe 2025).

Listed as apparently secure (S4) toward the middle of its range (Missouri, Kentucky, Virginia, Indiana, Ohio, Pennsylvania) and secure (S5) in the northern (Ontario) and southern portion of its range (Tennessee), the status of flutedshell changes dramatically in the rest of its range. It is considered possibly extirpated (SH) in Georgia and critically imperiled (S1) in both Kansas and Oklahoma, USA. Along the northwestern (Manitoba, Canada, Minnesota and Iowa, USA) and northeastern (Quebec, Canada and Vermont and New York, USA) edges of its range the flutedshell is considered either imperiled (S2) or vulnerable (S3).

State Distribution: Flutedshell can be found in both the Upper (Goodrich and Van der Schalie, 1939) and Lower Peninsula in Michigan. Records exist from most areas of the Lower Peninsula and the eastern portion of the Upper Peninsula (MNFI 2025). Knowledge of the true extent and distribution of this species require systematic surveys throughout the state. It has been found in the Lake



Michigan and Lake St. Clair drainages (Badra and Goforth 2003) as well as the Kalamazoo River (Mulcrone and Mehne 2001). Recent surveys (32 total surveys post 2010) documented live individuals or shells of flutedshell in the following watersheds: Black River (St. Clair County)(Kost et al. 2012), Muskegon (Cohen et al. 2018), St. Joseph (Badra 2019, Badra 2021), Kalamazoo River (Badra 2019), Lone Lake – Ocqueoc (Badra 2020), Huron River (Badra 2010), White River (Badra 2012), Thornapple (Lincoln et al. 2022) and Manistique (Cohen et al. 2018; Cuthrell et al. 2019).

Recognition: Flutedshell have a distinct washboard (fluted) texture to the shell along the posterior-dorsal slope are relatively large mussels, with a maximum length of 15 cm (6 in). Since the posterior end of the mussel often extends above the substrate, this characteristic washboard-like feature can be hidden underneath algae, insect larvae, or marl. The shells are generally ovate or elongated and are slightly compressed. The anterior margin is roundly arched to the ventral margin, which is nearly straight to rounded, and can be indented near the midline. The posterior end of the flutedshell is truncated and angular where the ridge meets the shell margin. The beak (umbo) is low, with three to four concentric ridges with a vaguely “W” shape. The outside of the shell (periostracum) tends to be a variation of yellow, tan, or brown with green rays along the posterior side on younger individuals.

The nacre (inside surface of the shell) tends to be an iridescent white or blue-white that may have a faint salmon, yellow, or cream coloring near the beak cavity. The beak cavity tends to be shallow, and the shell is shallow and open. The lateral teeth are shortened and reduced to swellings on the hinge line while pseudocardinal teeth are moderately thick.

Flutedshell can be confused with creek heelsplitter, although creek heelsplitter lacks the predominant ridges present in the flutedshell. Additionally, the lateral teeth of creek heelsplitter are larger than those in flutedshell (Watters et al. 2009, Mulcrone

and Rathbun 2020).

Best Survey Time: The best time to survey for flutedshell is the first week of June to the first week of October. Females are carrying their fertilized eggs or developed glochidia (gravid) from the first week of August to the fourth week of August, so extra care should be taken during surveys at this time. Periods of high water and turbidity after rain should be avoided to help ensure detection rates are high.

Habitat: Flutedshell can be found in small and medium rivers and lakes (Lake St. Clair and Lake Erie). They tend to be in areas with sandy mud, gravel, and cobble substrates in areas with some water current.

Biology: As a member of the unionid family of freshwater mussels, flutedshell are primarily filter feeders, removing phytoplankton, zooplankton, bacteria, fine organic matter, and other particles primarily through filtering, although they can also obtain food from sediments (Vaughn et al. 2008). Flutedshell are bradyctictic, where spawning occurs in the summer, with eggs developing in August (Watters et al. 2009). The glochidia (larvae) of flutedshell can have two different forms: a triangular hooked glochidium and a rounded unhooked glochidium.

It is thought that the two types may form at different times of the year (Watters and O’Dee1998) and the second, unhooked glochidium are not parasitic, but rather grow shell material while developing in the female. For the hooked glochidia, there are multiple known hosts, including: gizzard shad (*Dorosoma cepedianum*), river redhorse (*Moxostoma carinatum*), common carp (*Cyprinus carpio*), banded darter (*Etheostoma zonale*), rainbow darter (*E. caeruleum*), fantail darter (*E. flabellare*), striped darter (*E. virgatum*), northern hogsucker (*Hypentelium nigricans*), pumpkinseed (*Lepomis gibbosus*), green sunfish (*L. cyanellus*), bluegill (*L. macrochirus*), longear sunfish (*L. megalotis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*M.*



dolomieu), longnose dace (*Rhinichthys cataractae*), creek chub (*Semotilus atromaculatus*), goldfish (*Carassius auratus*), central stoneroller (*Camptostoma anomalum*), rock bass (*Ambloplites rupestris*), brown bullhead (*Ameiurus nebulosus*), bowfin (*Amia calva*), banded sculpin, (*Cottus carolinae*), northern pike (*Esox lucius*), northern studfish (*Fundulus catenatus*), and walleye (*Sander vitreus*) (Watters et al. 2009).

Like other mussels, flutedshell grow quickly in the first two to three years of their lives, after which their growth rates slow dramatically. Flutedshell can live up to 20 years.

Conservation / Management: Like other freshwater mussel species, flutedshell is impacted by altered stream flows, pollution (point source and non-point source), fragmentation blocking fish movement, and invasive species. Throughout Michigan, flutedshell are threatened by zebra mussels (*Dreissena polymorpha*). This non-native mussel was introduced to the Great Lakes region in the late 1980s and has since spread throughout the area. Zebra mussels must attach to a solid surface to survive, which can include the shells of native mussels. Large numbers of zebra mussels can attach to native mussels and prevent them from feeding, moving, and reproducing, eventually resulting in death (Mackie 1991). To avoid the spread of zebra mussels, care should be taken to avoid transplanting them via water, aquatic plants, boats, trailers, and gear.

Flutedshell populations inhabiting the lower watersheds of Michigan are particularly threatened by point and non-point pollution due to urban and agricultural runoff, industrial waste, herbicides, pesticides, and general human impacts. Most freshwater mussels are sensitive to heavy metals (Naimo 1995), chlorides, like those found in road salts (Gibson et al. 2018), and ammonia (Newton 2003). While the exact mechanisms are still unknown, heavy metals can severely impact the ability for glochidia to attach to host fish, limiting the success of reproduction (Heubner and Pynnönen 1992). While the

flutedshell may have additional glochidia that aren't reliant on host fish species for development, more research is needed to compare the developmental success of the two different glochidia forms. In addition, Gillis (2012) found that flutedshell located further downstream on the Grand River (Ontario, Canada), were chronically exposed to multiple contaminants (including copper, zinc, aluminum, nickel, lead, and chromium) significantly shortened life spans and negatively impacted overall mussel health.

Altered flow regimes, such as those that occur after impoundment, lead to the exclusion of many fish species that specialize in flowing waters. One such group are the darters (Percidae, Etheostomatidae), a group of fish species that flutedshell have adapted to use as hosts. Garner and McGregor (2001) noted the loss of short-lived fish specializing in flowing water, such as darters or minnows, within the first 15 years after an impoundment was placed on the Tennessee River.

While some populations remain stable, the multiple threats to the flutedshell are leading to declines throughout its range. In addition to maintaining natural areas surrounding streams, ensuring that stream reaches within a watershed maintain connectivity is essential for the movement and survival of fish hosts. This includes reducing and removing barriers to movement and migration of fish, such as obsolete dams and poorly placed or small culverts.

Research Needs: As a species of special concern, flutedshell require attention to ensure its survival, particularly as so few populations remain secure. Additional surveys to better understand the current status and range are needed to better develop and inform a conservation plan leading to action. In addition, as stated above, further research is needed to understand the survival rates of the two glochidia types to determine the reliance of flutedshell on fish hosts.



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