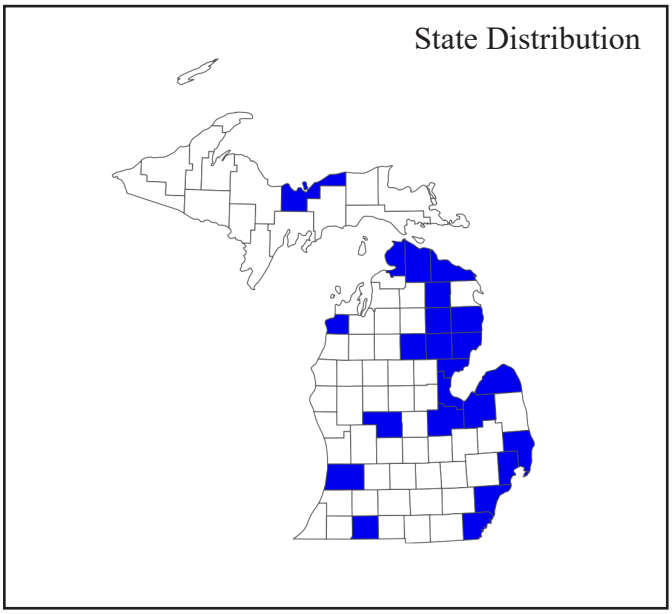
Sagittunio nasutus Say — Eastern Pondmussel



Best Survey Period

Status: State endangered

Global and State Rank: G3 (Vulnerable) / S2 (State Imperiled)

Family: Unionidae (freshwater mussels)

Synonyms: *Ligumia nasuta* (Say), *Lampsilis (Eurynia) nasuta* (Say), *Lampsilis (Eurynia) nasutus* (Say), *Lampsilis (Ligumia) nasuta* (Say), *Lampsilis nasuta* (Say), *Margarita (Unio) nasutus* (Say), *Margaron (Unio) nasutus* (Say), *Obliquaria (Ellipsaria) attenuata* (Rafinesque), *Unio nasutus* (Say), *Unio praeanodontoides* (Whitfield) (MolluscaBase 2025)

Total Range: The eastern pondmussel is restricted to eastern North America, occurring from Ontario, east to Massachusetts, south to South Carolina, and west to Wisconsin (Watters et al. 2009, COSEWIC 2017, NatureServe 2025). While the historical distribution has remained largely unchanged (COSEWIC 2017), the species is declining throughout its range. It is considered Critically Imperiled (S1) in Delaware, Maryland, New Hampshire, Ontario, and Rhode Island, Imperiled (S2) in Connecticut, Michigan, New Jersey, New York, North Carolina, Ohio, and South Carolina, Vulnerable (S3) in Virginia, and is currently Unrankable (SU) in Wisconsin (NatureServe 2025).

State Distribution: Eastern pondmussel has been documented widely throughout Michigan, with 105 element occurrences recorded in 23 counties (MNFI 2025). Occurrences are concentrated along the eastern Lower Peninsula, with scattered records present in the central and western portions of the Lower Peninsula and a single occurrence documented in the Upper Peninsula. In the Lower Peninsula, records extend from the Ottawa-Stony and St. Joseph watersheds in the south to Lone Lake-Ocqueoc and Boarman-Charlevoix in the north, while occurrences in the Upper Peninsula are restricted to the Betsy-Chocolay watershed (MNFI 2025). Many of the occurrences are limited to observations of shells only, with evidence of live or recently dead individuals documented in the following waterbodies: Au Sable River, Burt Lake, Carp Lake River, Douglas Lake, Houghton Lake, Lake Erie, Lake Paradise, Lake St. Clair, Mud Creek (Cheboygan Co.), Round Lake (Emmet Co.), and Tawas Lake Drainage (Zanatta et al. 2002, Zanatta et al. 2015, MNFI 2025). Of these, Lake Paradise, Lake St. Clair, Houghton Lake, and Burt Lake appear to support the largest populations (MNFI 2025).

Recognition: The eastern pondmussel is a medium to large-sized mussel with an average length of 7 cm (2.7 in) and a maximum length of roughly 15 cm (6 in) (Watters et al. 2009, DFO 2011, COSEWIC 2017). The shell is thin yet sturdy, elongate, and laterally compressed with a rounded anterior end, a narrowly angled

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and pointed posterior end, and a distinct posterior ridge (DFO 2011, COSEWIC 2017, Mulcrone and Rathbun 2020). Beak sculpture is absent or fine double-looped ridges (Mulcrone and Rathbun 2020). The outer shell is yellow or greenish in juveniles but becomes darker with age, appearing dark brown or black in adults. Well-defined narrow green rays are sometimes evident. The inside of the shell (nacre) is highly variable, ranging in color from white or bluish-white to purple and pink, and the beak (umbo) is low and wide (Watters et al. 2009, DFO 2011, COSEWIC 2017, Mulcrone and Rathbun 2020). Similar species found in Michigan include the spike (*Eurynia dilatata*), which has a beak sculpture of 2-4 coarse ridges and a smoothly elliptical outline lacking the angled posterior end of eastern pondmussel; and black sandshell (*Ligumia recta*), which is thicker and larger relative to its age (as indicated by the number of external annular rings), and has a more broadly rounded posterior end and glossy shell surface.

Best Survey Time: The best time of year to survey for eastern pondmussel and other freshwater mussels in Michigan is typically the first week of June through the last week of September. Within this time frame, periods of high flow and high turbidity should be avoided to improve detection rates. Surveys occurring outside of this time frame or during periods when water temperatures are below 10º C (50º F) should be avoided, as mussels are more likely to burrow into the substrate as temperatures decrease, making detection difficult (Hanshue et al. 2021).

Habitat: Eastern pondmussel occur in inland lakes and ponds, slow-moving rivers and streams, and coastal areas of the Great Lakes. Individuals are typically found in sheltered, nearshore areas of lakes and slackwater areas of rivers and streams, preferring fine sand and mud substrates and depths of 0.3 – 4.5 m (1 – 15 ft) (Watters et al. 2009, DFO 2011, COSEWIC 2017). In Michigan, the largest populations occur in inland lakes and sheltered bays of Lake St. Clair (MNFI 2025). Limited details exist on substrate composition of occupied sites in Michigan, but in Ontario inland lake sites consisted of a roughly even mix of silt/organics and sand/gravel, while sites in Lake St. Clair were composed of over 95% sand (DFO 2011, COSEWIC 2017).

Biology: Like all unionids, reproduction begins with males releasing sperm into the water column, which is taken up by females for internal fertilization (Cummings and Mayer 1992). Eggs are fertilized within the female in late summer and develop into microscopic larvae (glochidia) by early spring, with gravid females reported from August to the following May (Ortman 1919). Eastern pondmussel are bradytictic, which means the glochidia (parasitic larvae) are brooded overwinter within the gravid female until they are ready to be released the following spring (Watters et al. 2009, DFO 2011, COSEWIC 2017). Once these glochidia are released by the female, they must attach to the gills or fins of a suitable host fish to survive and successfully transform into juveniles.

When glochidia are ready to be released, female eastern pondmussel use a visual display to lure potential hosts. Females partially or completely unbury themselves from the substrate, part their valves to display their mantle edge, and rapidly move white papillae in a synchronized fashion to resemble a swimming amphipod (a type of crustacean). Potential host fish readily attack displaying females, at which time glochidia are released for attachment (Corey et al. 2006). No infestations or successful transformations have been documented in natural settings (Freshwater Mussel Host Database 2017), but glochidia have successfully transformed on seven species in laboratory settings, six of which occur in Michigan: bluegill (*Lepomis macrochirus*), brook stickleback (*Culaea inconstans*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), redear sunfish (*Lepomis microlophus*), and yellow perch (*Perca flavescens*) (Eads et al. 2015, Freshwater Mussel Host Database 2017). Studies to determine host suitability indicate that yellow perch is the preferred host, with significantly more juveniles transforming on this species relative to others that were tested (DFO 2011, Eads et al. 2015). While less effective than yellow perch, bluegill, largemouth bass, and pumpkinseed also appear to be suitable hosts (Eads et al. 2015).

After successful infestation of a suitable host fish, glochidia metamorphose and eventually detach from the host as newly transformed juveniles. In laboratory settings, the duration of glochidial attachment on host fish ranged from 15-24 days (Eads et al. 2015). These detached juveniles develop into adults, remaining relatively sessile on the bottom of the waterbody. Adults are filter feeders that consume algae, bacteria, detritus, microscopic animals, and dissolved organic material from the water column or sediment (Silverman et al. 1997, Nichols and Garling 2000, Christian et al. 2004, Strayer et al. 2004). Individuals may live for 10 years or more (Watters et al 2009).

Conservation/Management: The most prominent

threats to eastern pondmussel populations include contamination and degradation of water quality, invasive species, habitat modification and fragmentation, recreational use, changes to the hydrological regime, and the loss or decline of suitable host fish. These threats are not mutually exclusive and often work together to threaten populations.

Eastern pondmussel populations in Michigan are likely exposed to both urban and agricultural runoff. Terrestrial habitats surrounding many of the occurrences of live individuals are characterized by low to high intensity development or cultivated crops, and many lack adequate vegetated buffers (USGS 2024). Contaminants from point and non-point sources have both direct and indirect effects on mussels, which are among the most sensitive of all freshwater organisms to heavy metals (Keller and Zam 1991, Naimo 1995, Wang et al. 2007, Wang et al. 2017), pesticides (Bringolf et al. 2007), ammonia (Wang et al. 2007, Wang et al. 2017), and pharmaceuticals (Hazelton et al. 2013). Excess sediment in aquatic systems, resulting largely from surrounding land use changes and resource extraction, is an additional source of contamination (Brim Box and Mossa 1999). High levels of sediment interfere with feeding and respiration (Brim Box and Mossa 1999) and may limit recruitment both directly (Osterling et al. 2010) and indirectly by reducing fish abundance, diversity, and the effectiveness of structures that serve to visually attract hosts (Brim Box and Mossa 1999). High levels of sediment are likely to limit eastern pondmussel recruitment, as high turbidity causes females to stop display behavior (Corey et al. 2006). Excess sediment and increased organic matter can also reduce dissolved oxygen content, which may limit juvenile survival (Sparks and Strayer 1998). The maintenance and restoration of vegetated riparian buffers along occupied waterbodies can help alleviate erosion and excessive sedimentation (Anbumozhi et al. 2005, Wood and Armitage 1997).

The spread of invasive zebra (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*) are an imminent threat to remaining populations and have contributed to population declines and possible extirpation in the Detroit River (Keretz et al. 2021). Biofouling by these species interferes with feeding, reproduction, and movement of native mussels through direct attachment (Conn and Conn 1993, Schloesser et al. 1996), including causing symptoms of starvation (Baker and Hornbach 1997). Direct attachment can dislodge mussels from the substrate and prevent the proper opening of valves (Watters et al. 2009). Eastern pondmussel may be disproportionately impacted by zebra mussels, with lower survival and higher attachment loads than four other species of native mussel studied in Lake St. Clair (COSEWIC 2017).

Shoreline development and other activities that modify existing habitat, such as dredging, are likely to have negative impacts on both lake and river populations. For river populations, in-stream dredging and channelization affects mussels in multiple ways. Such activities alter substrates, increase downstream sediment levels, and can cause direct mortality (Watters et al. 2009). When performing in-stream activities that may negatively impact eastern pondmussel populations, proper mussel survey and relocation procedures should be followed to reduce impact (Hanshue et al. 2021).

Populations also face threats from heavy recreational use, which introduces and spreads invasive species (e.g., zebra mussels), as well as from altered hydrological regimes and artificial barriers. Changes to the hydrological regime may result from several factors including the construction of dams, climate change, and an increase in impervious surfaces (USFWS 2022). Dams have a profound impact on mussel habitat (Watters et al. 2009) and can alter flows to abnormal levels on a daily basis (USFWS 2022). Changes in precipitation patterns due to climate change have led to more frequent and severe droughts and increased stream flashiness, the latter of which is exacerbated by increases in impervious surfaces due to development (USFWS 2022). Maintenance of vegetated riparian buffers along occupied rivers will help to mitigate adverse impacts of increased flashiness. Dams and other artificial barriers such as improperly sized or poorly installed culverts fragment habitat and serve as barriers to fish movement (Watters 1996, Watters et al. 2009), which may artificially restrict distributions of mussel species (Watters 1996). Barriers to host fish movement effectively isolate populations, restricting gene flow and preventing colonization of new habitats. Removing obsolete barriers and improving fish passage within occupied habitats will help to improve population connectivity and overall species viability.

All the threats mentioned above have the potential to impact associated fish communities, which may result in the loss or decline of suitable host fish. Within occupied habitats, efforts should be taken to maintain and enhance populations of yellow perch, bluegill, largemouth bass, and pumpkinseed, which appear to be preferred or suitable hosts based on laboratory tests. Given the lack of evidence regarding which species serve as hosts in

natural settings, efforts to maintain overall fish abundance and diversity would be beneficial.

Research Needs: Michigan's inland lakes have been under surveyed relative to rivers. Additional surveys in lakes are needed to more accurately describe the status and distribution of eastern pondmussel in the state. Periodic monitoring of populations is needed to assess viability and determine population trends. Occurrences of live individuals in Lake Paradise, Lake Erie, the Tawas Lake drainage, and the Au Sable River appear to lack recent survey effort (i.e., within the last 10 years), and targeted surveys are needed to determine the status and condition of these populations. In addition to periodic surveys, consistent monitoring of relevant habitat parameters (e.g., zebra and quagga mussel densities, water quality, substrate composition) at occupied sites would provide a better understanding of suitable conditions and potential causes of population declines. Identifying potential barriers to host fish movement within occupied habitats and seeking ways to improve fish passage would benefit not only this species, but other native mussel and fish species as well. Finally, efforts to document natural infestations of potential host fish would help to inform conservation strategies for this species.

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