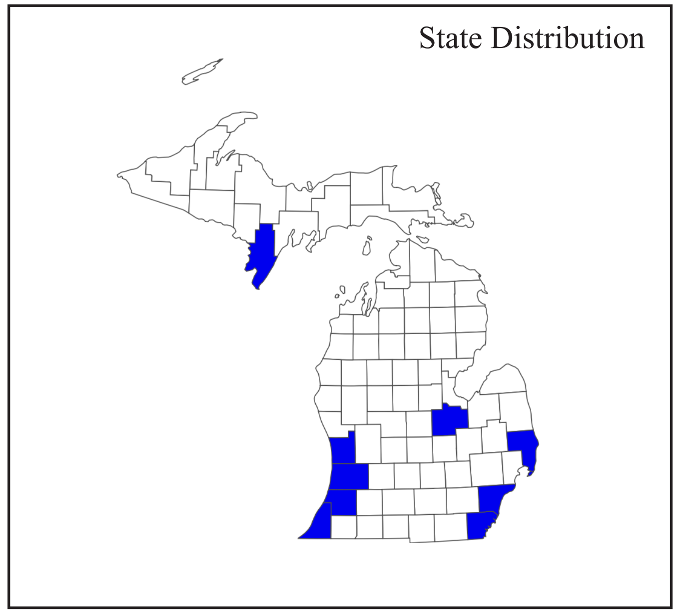
Obliquaria reflexa Rafinesque — Threehorn wartyback

Photo by Kurt Stepnitz



Best Survey Period

Status: State endangered

Global and State Rank: G5 (Globally Secure) / S1 (State Critically Imperiled)

Family: Unionidae (Freshwater mussels)

Synonyms: *Epioblasma phillipsii* (Conrad), *Margarita (Unio) cornutus* (Barnes), *Margarita (Unio) phillipsii* (Conrad), *Margaron (Unio) cornutus* (Barnes), *Margaron (Unio) phillipsii* (Conrad), *Obliquaria (Quadrula) reflexa* (Rafinesque), *Obliquaria reflexa conradi* (Frierson), *Obliquaria reflexa phillipsi* (Conrad), *Pleurobema (Plethobasus) cyphyum phillipsi* (Conrad), *Unio cornutus* (Barnes), *Unio phillipsii* (Conrad) (MolluscaBase 2025)

Total Range: The threehorn wartyback is broadly distributed throughout central North America, occurring north to Ontario, east to Pennsylvania, south to the Gulf of Mexico, and west to Texas and South Dakota (COSEWIC 2013, NatureServe 2024, Watters et al. 2009). The species is considered Critically Imperiled (S1) in Iowa, Michigan, Ontario, and South Dakota, and Vulnerable (S3) in Indiana, Kansas, Ohio, Oklahoma, Pennsylvania, West Virginia, and Wisconsin. Its status is most secure in Illinois, Missouri, and throughout the southern portion of its range, and its conservation status has not been assessed in Minnesota (NatureServe 2024).

State Distribution: There are relatively few records of threehorn wartyback in Michigan, with only 28 element occurrences documented in nine counties (MNFI 2024). Occurrences are concentrated in the southeastern and southwestern portions of the Lower Peninsula, with scattered records present elsewhere. In the southeast, records exist in Lake St. Clair, Lake Erie, and in the Detroit, Ottawa-Stony, Raisin, St. Clair, and Huron watersheds. In southwest Michigan the species has been documented in the Lower Grand, Black-Macatawa, Kalamazoo, and St. Joseph watersheds. Additional records exist in the Saginaw and Tittabawassee watersheds, and occurrences in the Upper Peninsula are restricted to the Menominee watershed (MNFI 2024). Many of the occurrences are limited to observations of shells only, with evidence of live or recently dead individuals restricted to the following waterbodies: Detroit River, Huron River, Menominee River, River Raisin, and Lake Erie (Keretz et al. 2021, MNFI 2024, Zanatta et al. 2015). Of these, the Detroit and Menominee River appear to support the largest populations (Keretz et al. 2021, MNFI 2024), and there was evidence of recent recruitment in the western basin of Lake Erie in 2011-2012 (Zanatta et al. 2015).

Recognition: The threehorn wartyback is a small to medium-sized mussel with a maximum length of 8 cm (3 in). The shell has a rounded outline, is moderately thick, and is very heavy for its size, with a rounded

Michigan Natural Features Inventory
Phone: (517) 284-6200 Email: mnfi@msu.edu
Website: mnfi.anr.msu.edu

anterior end and a pointed posterior end. The most obvious and distinguishing characteristic of this species is the central row of large knobs that alternate in position from the left to right valves. The appearance of the outer shell is variable, ranging in color from shades of yellow to green to brown, often becoming darker with age. The shells of most individuals contain numerous fine green rays and a single, wide green ray that extends through the central row of knobs is sometimes present. The inside of the shell (nacre) is usually pearly white and the beak (umbo) is wide, low, and positioned just front of center (Cummings and Mayer 1992, Mulcrone and Rathbun 2020, Watters et al 2009). The threehorn wartyback can be distinguished from all other species of freshwater mussel found in Michigan by the large knobs that alternate from side to side.

Best Survey Time: The best time of year to survey for threehorn wartyback 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: Relative to many unionids, threehorn wartyback appear to have fairly broad habitat tolerances. This species occurs in gravel, sand, and mud substrates in areas containing both swift currents and slackwater conditions. While most typical of large rivers with moderately strong currents, individuals are also found in lakes, shallow embayments, reservoirs, and impoundments with little to no current (COSEWIC 2013, Cummings and Mayer 1992, Grabarkiewicz and Davis 2008, Watters et al. 2009). In Michigan rivers, individuals have been documented in a variety of substrates (MNFI 2024). In the Menominee River, the largest number of individuals were found in substrate comprised primarily of gravel (35%), with equal parts sand, pebble, and cobble (20% each), and a small amount of silt (5%). Other areas of the river containing live individuals were largely composed of equal parts gravel, sand, and pebble (Badra 2010). Conversely, live individuals in the lower Huron River were found in silt-dominated areas (Badra and Goforth 2003), while sites surveyed in the Detroit River, some containing live individuals, were dominated by silt, sand, and clay (Keretz et al. 2021).

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 May and develop into microscopic larvae, called glochidia, from May to August (Lefevre and Curtis 1912, Watters et al. 2001). Threehorn wartyback are tachytictic (Lefevre and Curtis 1912, Watters et al. 2001, Watters et al. 2009), which means the glochidia (parasitic larvae) are brooded within the female for only a short period and released later that summer. In Ohio, glochidia are released in June and July (Watters et al. 2001). Once released by the female, these glochidia must attach to the gills or fins of a suitable host fish to survive and successfully transform into juveniles.

Female threehorn wartyback release packets of glochidia, called conglutinates (Barnhart and Baird 2000, Barnhart et al. 2008, Watters et al. 2009), that act as bait to attract host fish. These conglutinates are targeted by sight-feeding fish and burst when bitten, releasing glochidia for attachment. While the primary host or hosts of threehorn wartyback remains unknown (Martin 2018), several potential hosts have been identified. In laboratory settings, glochidia have successfully transformed on the following species: common shiner (*Luxilus cardinalis*), freshwater drum (*Aplodinotus grunniens*), gizzard shad (*Dorosoma cepedianum*), largemouth bass (*Micropterus salmoides*), longnose dace (*Rhinichtys cataractae*), silverjaw minnow (*Notropis buccatus*), striped shiner (*Luxilus chrysocephalus*), and walleye (*Sander vitreus*) (Freshwater Mussel Host Database 2017, Martin 2018, Watters et al. 2009). No successful transformations have been documented in natural settings, but natural infestations have been observed on bluegill (*Lepronis macrochirus*), goldeye (*Hiodon alosoides*), and skipjack herring (*Alosa chrysochloris*) (Barnhart and Baird 2000, Freshwater Mussel Host Database 2017, Fritts et al. 2016). All fish species noted above, except for goldeye, occur in Michigan (MDNR 2002, NatureServe 2024). Despite observations of natural infestation, glochidia failed to transform on bluegill during laboratory tests (Martin 2018). Additional tests are needed to determine species of fish that serve as definitive hosts in Michigan.

After successful infestation of a suitable host fish, glochidia metamorphose and eventually detach from the host as newly transformed juveniles. These juveniles then develop into adults, remaining relatively sessile on the bottom of the waterbody. Growth occurs rapidly during the first two to three years of life and slows thereafter (Watters et al. 2009). Adults are filter feeders that consume algae, bacteria, detritus, microscopic animals, and dissolved organic material from the water column or sediment (Christian et al. 2004, Nichols and Garling 2000, Silverman et al. 1997, Strayer et al. 2004). Threehorn wartyback are a relatively long-lived species, with maximum life spans of 18 years (Watters et al. 2009).

Conservation/Management: The most prominent threats to threehorn wartyback populations include contamination and degradation of water quality, invasive species, habitat fragmentation, habitat modification, and changes in the availability of suitable host fish. These threats are not mutually exclusive and often work together to threaten populations. Compared to many unionids, this species' tolerance for various flow conditions may make it less susceptible to changes in the hydrologic regime.

Threehorn wartyback populations in Michigan are likely exposed to both agricultural and urban run-off, as upland habitats surrounding many of the occurrences of live individuals are largely characterized by medium-to-high intensity development and/or agricultural use (Badra and Goforth 2003, 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). As a species that relies on sight-feeding consumption of the conglutinates for successful host infestation, high levels of sediment are likely to limit recruitment. 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 rivers 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 threehorn wartyback. Zebra mussels are present in most (Badra 2010, Badra and Goforth 2003, Keretz et al. 2021, Zanatta et al. 2015), if not all, occupied waterbodies. 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).

Artificial barriers such as dams and 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 habitats occupied by threehorn wartyback will help to improve population connectivity and overall species viability.

In-stream activities that directly alter habitat, such as dredging and channelization, affect mussels in multiple ways. Such activities can alter substrates, increase downstream sediment levels, and cause direct mortality (Watters et al. 2009). When performing in-stream activities that may negatively impact threehorn wartyback populations, proper mussel survey and relocation procedures should be followed to reduce impact (Hanshue et al. 2021).

All the threats mentioned above have the potential to impact fish communities, which may result in the loss or decline of suitable host fish within occupied habitats. Given the lack of knowledge regarding primary hosts and the variety of potential hosts reported for threehorn wartyback, efforts should be taken to maintain or enhance overall fish diversity and abundance in occupied habitats.

Research Needs: Occurrences of live individuals in the Huron River, Menominee River, and River Raisin lack recent survey effort (i.e., within last 10 years), and targeted surveys are needed to determine the current status and condition of these populations. Periodic monitoring of extant populations is needed to assess viability and determine population trends. Efforts to document natural infestations in Michigan, along with additional tests of host suitability, would help to inform conservation strategies for this species.

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Michigan Natural Features Inventory
Phone: (517) 284-6200 Email: mnfi@msu.edu
Website: mnfi.anr.msu.edu