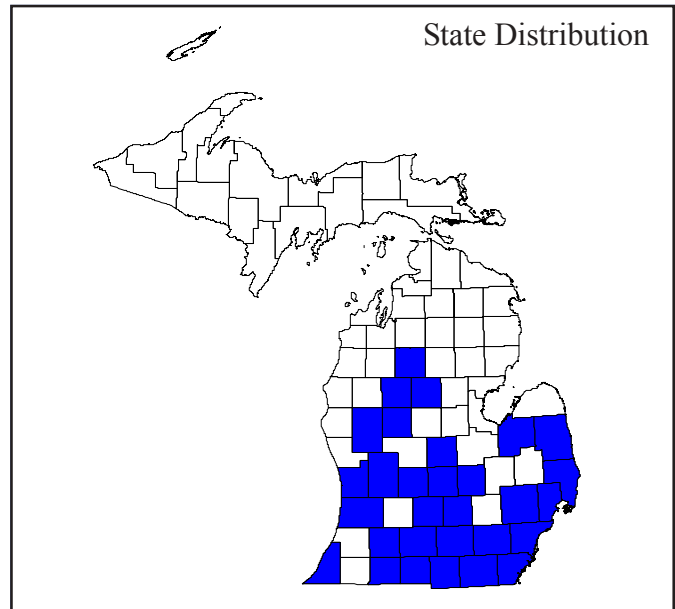
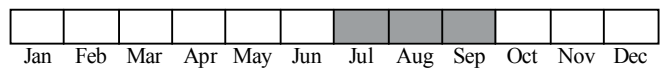




Photo by Kurt Stepnitz, MSU University Relations



Best Survey Period



**Status:** State listed as Special Concern

**Global and state ranks:** G4/S2S3

**Family:** Unionidae (Pearly mussels)

**Synonyms:** *Pleurobema coccineum* (Conrad). Other common names include false pig-toe, solid pigtoe, flat pigtoe, and bullnose

**Total range:** The global range of the round pigtoe is restricted to eastern North America, from Ontario, Canada south to Alabama, west to South Dakota and east to New York. It is present in the Mississippi and Ohio River drainages, and Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie drainages. (Burch 1975, NatureServe 2006)

**State distribution:** In Michigan the round pigtoe has been documented in most of the major drainages in the southern half of the Lower Peninsula, including the St. Joseph (Lake Michigan drainage), Kalamazoo, Grand, Muskegon, Saginaw, St. Clair, Clinton, Detroit, Huron, and Raisin watersheds. Though this species is fairly wide ranging in Michigan it was found infrequently and in relatively low abundance in recent surveys (Badra and Goforth 2003, Carman and Goforth 2003, Badra 2004, Badra 2005)

**Recognition:** The round pigtoe has a roughly circular outline. It is relatively compressed, as opposed to inflated or spherical. The outside of the shell is smooth, without bumps or ridges, and is usually brown or dark brown in color. Rays are absent. Maximum length of the round pigtoe is approximately 4 inches (102mm). The beaks (also known as umbos) are low, only slightly elevated above the hinge line. Beak sculpture consists of 2 or 3 ridges. The shells are thick and heavy relative to most species in Michigan. Pseudocardinal and lateral teeth are well developed. The beak cavity ranges from shallow to moderately deep. The nacre is most often white but can be pink or salmon colored. Shells of males and females are morphologically similar. Round pigtoe shell morphology can vary widely between rivers of different sizes. Those in smaller rivers tend to be more compressed, round in outline, and have low beaks, while those in large rivers tend to be the opposite.

Similar species in Michigan are wabash pigtoe (*Fusconaia flava*), northern clubshell (*Pleurobema clava*), hickorynut (*Obovaria olivaria*), and round hickorynut (*Obovaria subrotunda*). Round pigtoe can be very difficult to separate from wabash pigtoe, which usually has a more rectangular outline and deeper beak cavity. The northern clubshell is more elongate in shape than round pigtoe and usually have broad green rays and a lighter yellow colored shell. The hickorynut is



less compressed and has proportionately larger beaks. The round hickorynut is smaller, has a more centrally placed beak, and less developed pseudocardinal and lateral teeth. Hickorynut and round hickorynut are usually lighter colored than round pigtoe. (Clark 1981, Oesch 1984, Cummings and Mayer 1992, Watters 1995, pers. observation of Michigan shells)

**Best survey time:** Surveys for the round pigtoe, as with most freshwater mussels, are best performed in the summer when water levels are low and water clarity is high. Low water levels make it easier to spot mussels and can expose muskrat middens containing empty freshwater mussel shells. During the winter months unionid mussels tend to burrow deeper into the stream bottom making them difficult to detect. In water that is less than two to three feet deep, a glass-bottomed bucket is an efficient tool for finding live mussels. In deeper habitats, SCUBA is often needed to perform surveys.

**Habitat:** The round pigtoe is found in medium to large rivers with sand and gravel or sand and mud substrates. Suitable habitat for fish host species must be present for round pigtoe reproduction to be successful (see Biology).

**Biology:** Like most freshwater mussels of the family Unionidae, the round pigtoe requires a fish host to complete its life cycle. Eggs are fertilized and develop into larvae within the female. These larvae, called glochidia, are released into the water and must attach to a suitable fish host to survive. The females of some unionids have structures resembling small fish, crayfish, or other prey that are displayed when the larvae are ready to be released. Other unionids display conglutinates, packets of glochidia that are trailed out in the stream current, attached to the unionid by a clear strand. These lures entice fish into coming into contact with glochidia, increasing the chances that glochidia will attach to a suitable host. The round pigtoe is not known to have a lure. Some unionids are winter breeders that carry eggs, embryos, or glochidia through the winter and into the spring (bradytic), while others are summer breeders whose eggs are fertilized and glochidia released during one summer (tachytic). The round pigtoe is a summer breeder (Oesch 1984).

Glochidia remain on the fish host for a couple weeks to several months depending on the unionid species and other factors. During this time the glochidia transforms into the adult form then drops off its host (Kat 1984). Although the advantages of having fish hosts are not fully understood, two factors are known to provide benefits. Similar to animal facilitated seed dispersal in plants, fish hosts allow mussels that are relatively sessile as adults to be transported to new habitat and allow gene flow to occur among populations. The fish host also provides a suitable environment for glochidia to transform in. Some unionid species are able to utilize many different fish species as hosts while others have only one or two known hosts. Bluegill (*Lepomis macrochirus*) are known to be suitable hosts for the round pigtoe (Watters 1995). This species was identified as a host in laboratory experiments. It is likely that additional species are utilized as hosts in natural systems. Maximum life-span for some unionids is over 50 years. Round pigtoes likely live to over 20 years of age.

**Conservation/Management:** Eastern North America is the global center of diversity for freshwater mussels with over 290 species. In a review of the status of U.S. and Canadian unionids by the American Fisheries Society, one third (97) of these were considered endangered (Williams et al. 1993). Thirty-five unionids are thought to have gone extinct in recent times (Turgeon et al. 1998). There are 45 species native to Michigan, and nineteen of these are state-listed as endangered, threatened, or special concern.

The decline of this group over the last couple hundred years has been attributed mainly to direct and indirect impacts to aquatic ecosystems. Threats include habitat and water quality degradation from changes in water temperature and flow regime; the introduction of heavy metals; organic pollution such as excessive nutrients from fertilizers, pesticides and herbicides; dredging; and increased sedimentation due to excessive erosion (Fuller 1974, Bogan 1993, Box and Mossa 1999). High proportions of fine particles (sand and silt) were found to be a limiting factor for unionid density and species richness across several watersheds in lower Michigan (Badra and Goforth 2003). Using certain agricultural practices such as conservation tillage, grass filter strips between fields and streams, and reforestation in the floodplain can help reduce the input of silt and other



pollutants. Forested riparian zones help maintain a balanced energy input to the aquatic system, provide habitat for fish hosts in the form of large woody debris, reduce the input of fine particles by stabilizing the stream banks with roots, and provide shade which regulates water temperature. Due to the unique life cycle of unionids, fish hosts must be present in order for reproduction to occur. The loss of habitat for these hosts can cause the extirpation of unionid populations. Barriers to the movement of fish hosts such as dams and impoundments also prevent unionid migration and exchange of genetic material among populations, which helps maintain genetic diversity within populations.

The zebra mussel (*Dreissena polymorpha*) and the Asian clam (*Corbicula fluminea*) are exotics from Eurasia that have spread quickly throughout the Great Lakes region. While the Asian clam has no clear harmful effects, zebra mussels are known to have severe negative impacts on native unionids. Zebra mussels require stable, hard substrates for attachment and often use unionid mussels as substrate. Unionids can get covered with enough zebra mussels that they cannot reproduce or feed, eventually killing the unionid. This exotic has had a dramatic effect on native unionid communities in habitats where it has been introduced. The continued range expansion of the zebra mussel into streams and lakes remains a serious threat. Boaters can reduce the spread of zebra mussels by making sure they do not transport water (which can contain zebra mussel larvae) from one water body to another. Washing boat and trailer or letting both dry overnight reduces the potential for spreading zebra mussels. Zebra mussels are present throughout the round pigtoe's range in Michigan. Laboratory experiments have demonstrated that, at high densities, Asian clams can affect the survival and growth of juvenile native mussels (Yeager et al. 2000).

Because unionid conservation involves a wide range of issues they are useful umbrella taxa for the conservation of aquatic ecosystems as a whole. By working towards solutions to threats to freshwater mussels we ameliorate threats to stream and lake ecosystems they inhabit as well.

**Research needs:** Unionid mussels are found in rivers that are subject to cumulative impacts from upstream. Creative solutions are needed to promote the reduction

of impacts that occur throughout entire watersheds while allowing for agricultural, development, and other landuses. Cultural, economic, and ecological perspectives need to be integrated into management plans for each watershed. Round pigtoe populations that are threatened by zebra mussels should be monitored. Methods for minimizing the spread of zebra mussels and preventing future invasive species from being introduced need to be developed and applied. Additional studies are needed to determine which fish species act as hosts for the round pigtoe.

**Related abstracts:** Northern clubshell (*Pleurobema clava*), Hickorynut (*Obovaria olivaria*), Round hickorynut (*Obovaria subrotunda*), Purple wartyback (*Cyclonaias tuberculata*)

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