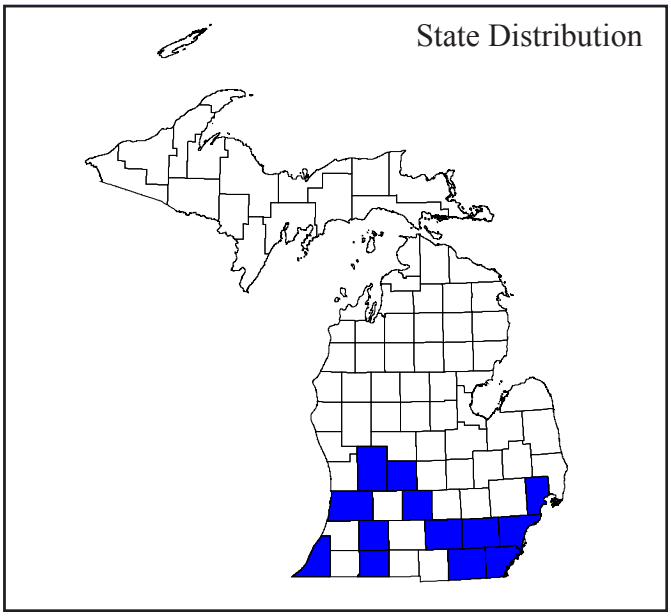
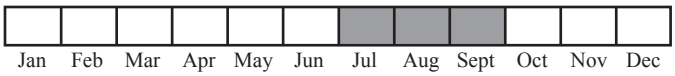
Cyclonaias tuberculata Rafinesque — Purple wartyback

Photograph courtesy of Kevin S. Cummings, Illinois Natural History Survey



Best Survey Period



Status: State threatened

Global and state ranks: G5/S2S3

Family: Unionidae (Pearly mussels)

Total range: The global range of the purple wartyback is restricted to eastern North America, from Ontario, Canada south to Alabama, west to Oklahoma and east to Pennsylvania. It is present in the Mississippi and Ohio River drainages, and the Lake Michigan, Lake St. Clair, and Lake Erie drainages (Burch 1975).

State distribution: In Michigan the historic range of the purple wartyback includes the St. Joseph, Kalamazoo, Grand, Huron, Raisin, and Detroit Rivers, as well as Lake St. Clair. Recent occurrences of live individuals have been documented in the St. Joseph and Grand Rivers (Badra and Goforth 2002). This species was extirpated from much of the Huron River by 1975, when it was listed as a species of special concern in Michigan. Surveys in 1986 (Scavia and Mitchell 1989) revealed that the purple wartyback had reestablished itself in portions of the river where it had disappeared. This partial recovery was attributed to improvements in water quality between 1975 and 1986.

Recognition: The purple wartyback has a roughly circular outline with numerous bumps (or "warts") covering about 3/4 of the outside of the shell. It is relatively compressed or thin, as opposed to inflated or spherical. The beaks are small and beak sculpture consists of numerous wavy ridges. The outer covering of the shell (periostracum) is yellow-brown or green-brown in young individuals, becoming dark brown in older individuals. Rays are usually absent. Maximum length of the purple wartyback is approximately 5 inches (127mm). The inside of the shell is quite distinct with very heavy, well developed pseudo-cardinal teeth and lateral teeth along the hinge. The beak cavity is very deep. Nacre color ranges from white with a hint purple to deep purple. The shell is overall very thick and heavy. Shells of males and females are morphologically similar.

Similar species found in Michigan include the round pigtoe (*Pleurobema sintoxia*) which is similar in shape and color but has no bumps or warts on the outside of the shell, the pimpleback (*Quadrula pustulosa*) which has bumps but also has a broad green ray near the beak that the purple wartyback lacks, and the mapleleaf (*Quadrula quadrula*) which usually has a concave furrow (sulcus) down the outside of the shell with bumps on either side and is somewhat rectangular in outline. These three species have white nacres.

Michigan Natural Features Inventory
P.O. Box 30444 - Lansing, MI 48909-7944

Best survey time: Surveys for the purple wartyback, 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. 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 accurate surveys.

Habitat: The purple wartyback is found in medium to large rivers with gravel or mixed sand and gravel substrates (Cummings and Mayer 1992). Recent occurrences of live individuals in the Grand River were found in substrates ranging from gravel/sand mix to large gravel and pebble, in an area with relatively fast current. In the St. Joseph River, live individuals were found in a sand/gravel mix in an area of slow current and very clear water (Badra and Goforth 2002). Suitable habitat for fish host species must be present for purple wartyback reproduction to be successful (see Biology).

Biology: Like most freshwater mussels of the family Unionidae, this species 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" may entice fish into coming into contact with glochidia, increasing the chances that glochidia will attach to a suitable host. The purple wartyback 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, while others are summer breeders whose eggs are fertilized and glochidia released during one summer. The purple wartyback 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. Known hosts for the purple wartyback are the yellow bullhead (*Ameiurus natalis*) and channel catfish (*Ictalurus punctatus*)(Watters 1995). These species were identified as hosts in laboratory experiments. It is possible that additional species are utilized as hosts in natural environments. Maximum life-span for some unionids is over 50 years. Purple wartybacks likely live to over 25 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. 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 our direct and indirect impacts to aquatic ecosystems. Threats include habitat and water quality degradation from changes in water temperature and flow, 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 2002). 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 that 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 in the St. Joseph River where live purple wartybacks were found. At one site, one out of twenty purple warty backs had zebra mussels attached.

Because unionid conservation involves such 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 improve our management of the streams and lakes they inhabit.

Research needs: The status of fish host populations need to be investigated to more accurately assess purple wartyback population viability. Purple wartyback populations that are threatened by zebra mussels should be monitored. Methods for preventing future invasive species from being introduced need to be developed. Additional studies are needed to determine which fish species act as hosts for the purple wartyback. The purple wartyback is often 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 profitable agricultural, development, and other landuses. Cultural, economic, and ecological perspectives need to be integrated into management plans for each watershed.

Related abstracts: Northern clubshell (*Pleurobema clava*), Hickorynut (*Obovaria olivaria*), White catspaw (*Epioblasma obliquata perobliqua*), Northern rifffleshell (*Epioblasma torulosa rangiana*), Snuffbox (*Epioblasma triquetra*), and Rayed bean (*Villosa fabalis*)

Selected references:

Badra, P.J. and R.R. Goforth. 2002. Surveys of Native Freshwater Mussels in the Lower Reaches of Great Lakes Tributary Rivers in Michigan. Report number MNFI 2002-03. Report to Michigan Dept. of Environmental Quality, Coastal Zone Management Unit, Lansing, MI. 39pp.

Bogan, A.E. 1993. Freshwater bivalve extinctions (Mollusca: Unionoida): A search for causes. American Zoologist 33:599-609.

Box, J.B. and J. Mossa. 1999. Sediment, land use, and freshwater mussels: prospects and problems. Journal of the North American Benthological Society 18:99-117.

Burch, J.B. 1975. Freshwater unionacean clams (Mollusca: Pelecypoda) of North America. Malcological Publications, Hamburg, Michigan. 204pp.

Cummings, K.S., and C.A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194pp.

Fuller, S. 1974. Clams and mussels (Mollusca: Bivalvia). In: Hart, C.W. Jr., Fuller S.L.H. eds. Pollution ecology of freshwater invertebrates. Academic Press, New York, pages 228-237.

Kat, P.W. 1984. Parasitism and the Unioniacea (Bivalvia). Biological Review 59:189-207.

National Native Mussel Conservation Committee. 1997. National strategy for the conservation of native freshwater mussels. Journal of Shellfish Research 17:1419-1428.

NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 15, 2004).

Oesch, R.D. 1984. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation. 270pp.

Scavia, E. and M. Mitchell. 1989. Reoccurrence of Cyclonaias tuberculata in the Huron River, Michigan. The Nautilus 103:40-41.

Turgeon, D.D., J.F. Quinn, Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Middelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M. Vecchione, and J.D. Williams. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks, 2nd edition. American Fisheries Society, Special Publication 26, Bethesda, Maryland.

Watters, G.T. 1995. A guide to the freshwater mussels of Ohio, 3rd ed., Ohio Department of Natural Resources, Division of Wildlife. 122pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.L. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18:6-22.

Abstract Citation: Badra, P.J. 2004. Special Animal Abstract for *Cyclonaias tuberculata* (purple wartyback). Michigan Natural Features Inventory. Lansing, MI. 4pp.

Upadated April 2009.

Funding provided by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center via the Great Lakes Commission.