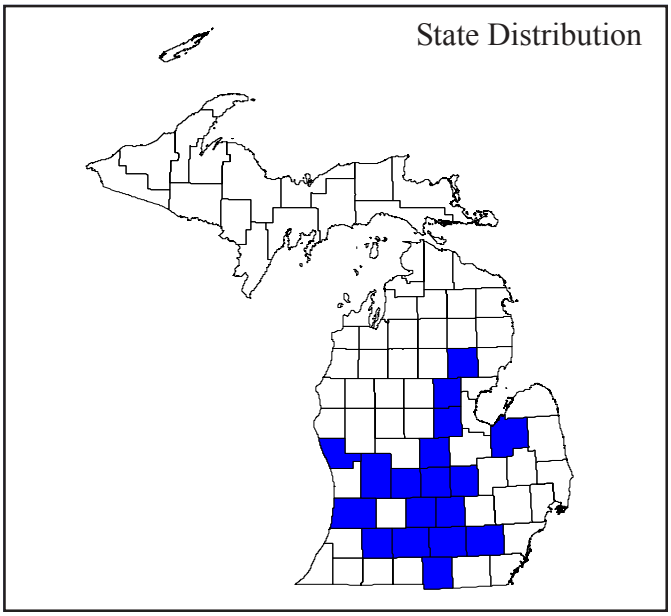
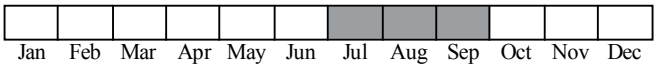
Venustaconcha ellipsiformis Conrad — Ellipse

Photo by Kurt Stepnitz, MSU University Relations



Best Survey Period



Status: State listed as Special Concern

Global and state ranks: G3G4/S2S3

Family: Unionidae (Pearly mussels)

Synonyms: No other recent synonyms reported.

Total range: The global range of the ellipse is restricted to the mid-western region of the United States, from Minnesota, east to Ohio, and southwest to Oklahoma and Arkansas. It is currently presumed extirpated from Ohio (NatureServe 2006).

State distribution: In Michigan the ellipse has been documented in the St. Joseph (Lake Michigan drainage), St. Joseph (Maumee drainage, Hillsdale Co.), Kalamazoo, Grand, Muskegon, Saginaw, Pinnebog and Pigeon (Huron Co.), and Raisin watersheds. Though it occurs sporadically throughout its range in Michigan, a relatively dense population was recently documented in the Cass River of the Saginaw watershed. (Badra and Goforth 2003, Carman and Goforth 2003, Badra 2004, Badra 2005)

Recognition: The ellipse has an oval or elliptical outline that is often pinched at the posterior end of the shell. It is moderately compressed, as opposed to highly inflated or highly compressed. The outside of the shell is smooth, without bumps or ridges, and is yellow to dark tan in color. Green rays are almost always present, becoming thin and wavy toward the posterior end of the shell. Maximum length of the ellipse is approximately 3 inches (75mm). The beaks (also known as umbos) are low, only slightly raised above the hinge line. Beak sculpture consists of 3 or 4 fine, double looped ridges. The shells are of moderate thickness relative to most species in Michigan. Pseudocardinal and lateral teeth are well developed and the lateral teeth are thick. The hinge line is relatively short. The beak cavity is shallow. The nacre is white, iridescent posteriorly, and sometimes tinged with orange under the beaks. Shells of males and females are morphologically similar.

Similar species in Michigan are the rainbow (*Villosa iris*), slippershell (*Alasmidonta viridis*), and spike (*Elliptio dilatata*). Ellipse can be difficult to separate from the rainbow, which has a longer hinge line and is usually less pinched at the posterior end than the ellipse. The rainbow has rays that tend to be less wavy and increase in width toward the posterior end of the shell. The slippershell is more inflated than the ellipse and is smaller, although large old slippershells can be equal in size to small young ellipses. The slippershell also has a roughly rectangular outline. The spike is a larger

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species than the ellipse, brown to black in color, and lacks rays. (Clark 1981, Oesch 1984, Cummings and Mayer 1992, Watters 1995, pers. observation of Michigan shells)

Best survey time: Surveys for the ellipse, 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 ellipse is found in small to medium sized streams with firm sand and gravel substrates. Suitable habitat for fish host species must be present for ellipse reproduction to be successful (see Biology).

Biology: Like most freshwater mussels of the family Unionidae, the ellipse 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 ellipse lure consists of a mantle flap (edge of the mussels body near the siphons), which is flapped in the water to attract hosts. Some unionids are winter breeders that carry eggs, embryos, or glochidia through the winter and into the spring (bradytictic), while others are summer breeders whose eggs are fertilized and glochidia released during one summer (tachytictic). The ellipse's breeding schedule is not well known.

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. The greenside darter (*Etheostoma bleniodes*), rainbow darter (*Etheostoma caeruleum*), orangethroat darter (*Etheostoma spectabile*), redfin darter (*Etheostoma whipplei*), and banded sculpin (*Cotttus carolinae*) are known to be suitable hosts for the ellipse (Riusech and Barnhart 2000). These species were identified as hosts in the Neosho/Arkansas river system. Other fish species may act as hosts in Michigan. Maximum life-span for some unionids is over 50 years. Ellipse likely live to over 15 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 ellipse'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 improve our management of the stream and lake ecosystems they inhabit.

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. Ellipse 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 ellipse in Michigan.

Related abstracts: Rainbow (*Villosa iris*), Slippershell (*Alasmidonta viridis*), Wavy-rayed lampmussel (*Lampsilis fasciola*)

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