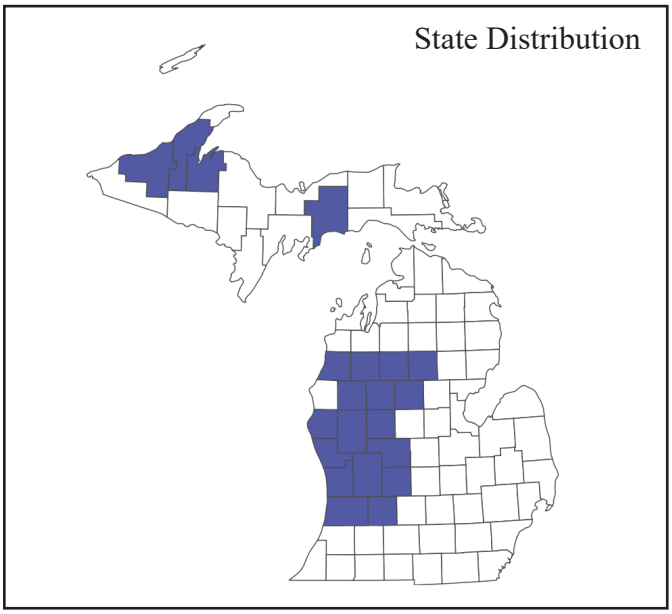
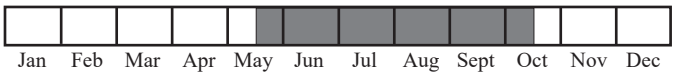
Notropis dorsalis Agassiz — Bigmouth Shiner



Best Survey Period



Status: State threatened

Global and state ranks: G5/S2

Family: Cyprinidae

Synonyms: *Hybopsis dorsalis* Agassiz, 1854; *Photogenis piptolepis* Cope, 1871; *Notropis gilberti* Jordan and Meek, 1885; *Notropis keimi* Fowler, 1909; *Notropis horatii* Cockerell, 1911; *Ericymba dorsalis* (Stout et al. 2022)

Range: The global range of bigmouth shiner is restricted to North America, and includes the Great Lakes basin, Hudson Bay (Red River), and the Mississippi River basin from New York west to Wyoming, and Manitoba south to Tennessee. There are disjunct populations in western New York, Pennsylvania, West Virginia, Ohio, and Michigan (Page and Burr 1991). Though its global conservation status rank is Secure (G5), its state conservation rank ranges from Extirpated (SX) to Secure (S5).

State distribution: In the Upper Peninsula of Michigan, bigmouth shiners have been documented in the Otter and Sturgeon Rivers, the headwaters of the Ontonagon River (Lake Superior drainage), and the West Branch of the Manistique River (Lake Michigan drainage). In the Lower Peninsula, they have been documented in the western portion of the state from the Manistee River watershed, Pere Marquette River watershed, White River, Muskegon River watershed including Houghton Lake and three smaller inland lakes, the western portion of the Grand River watershed, Rabbit River watershed, and the lower Kalamazoo River watershed including two small inland lakes. Bigmouth shiner tends to occur in smaller tributaries and not the main stems of these systems.

Recognition: Bigmouth shiner has a maximum body length of 70 mm (2.8 inches) (Becker 1983). Its body shape, unlike most Notropis species, is slender, flat-bellied, and more hump-backed. The eyes appear to focus upward when viewed from above due to the pupil being skewed dorsally. Body color is olive-yellow on the back and silvery on the sides and belly. A mid-dorsal stripe runs along the top of the body and around the dorsal fin base (McCulloch 2003). There is no significant dif-

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ference in morphology between males and female bigmouth shiners (Underhill and Merrell 1959). The dorsal fin has eight rays. There are no teeth present in the mouth. It has a complete lateral line with 36-39 scales. The anal fin usually has eight rays, but rarely has seven or nine. The head is flattened on the ventral surface giving it a triangular or wedge-shaped appearance. The mouth is horizontal and large, with the length of the upper jaw longer than eye diameter except in very young individuals. The shape of the head, body proportions, and silver color are very similar to the silverjaw minnow (*Notropis buccata*). Bigmouth shiner lacks the cavernous spaces that are present on the ventral surface of the head of silverjaw minnows. They are superficially similar to sand shiner (*Notropis stramineus*), mimic shiner (*Notropis volucellus*), and silver chub (*Macrhybopsis storeriana*). The other species of minnow with eight anal rays differ from bigmouth shiner by having either a distinct lateral band, greatly elevated lateral line scales, a spot at the caudal fin base, or a spot on the dorsal fin. Chubs have barbels, tiny finger-like, sensory projections of skin, at the corners of the mouth (Trautman 1981).

Best survey time: The best time of year for surveying for bigmouth shiner in Michigan is May through the beginning of September when water levels are relatively low and water clarity high. From September to mid-October, night-time electrofishing surveys can be employed (Schneider et al. 2000).

Habitat: Bigmouth shiner is usually found in moderately fast-moving creeks and streams less than one meter (3.3 feet) deep but is occasionally found in larger rivers and inland lakes (McCulloch 2003). It often inhabits small streams of moderate gradient where sandy bottoms of pools, bars, and riffles are free of silt (Trautman 1981). It is most often found near the bottom of the water column and the upstream edge of pools (Mendelson 1975). Bigmouth shiner shares similar habitat preferences to silverjaw minnow. In Michigan, bigmouth shiner has been found in smaller tributary rivers and inland lakes, not from larger mainstem rivers (MNFI 2024).

Biology: The age of reproductive maturity in female bigmouth shiners is two years. Spawning season lasts an average of 12 weeks in the late spring and summer (Becker 1983). Spawning was observed from May to June in Illinois (Gilbert 1980) and late July to August in Iowa (Starrett 1951). Spawning is thought to occur in mid-water, with eggs drifting downstream (Lee et al. 1980). Eggs are 0.9 mm in diameter (Gotelli and Pyron 1991). In cyprinids (minnow and carp family), the average difference in male and female body length for each species has been shown to relate to the mating system employed by the species. When females are the same size or larger than males, this is a strong predictor that group spawning occurs, and when males are larger than females, pair spawning is predicted to occur (Pyron 1996). Based on the mean lengths of males vs. females (males 48.6 mm, females 51.0 mm) Pyron et al. (2013) predict that bigmouth shiners are group spawners rather than pair spawners. Bigmouth shiner has been known to hybridize with sand shiner (*Notropis stramineus*) and northern mimic shiner (*Notropis volucellus*). Young-of-the-year vary in length from 28-50 mm, and adults range from 50-75 mm (Trautman 1981). Seasonal movements of bigmouth shiner documented by Mendelson (1975) found that bigmouth shiners migrate upstream during fall and winter and return downstream in summer. They were also found to move into shallow water habitats at night.

In a study of multiple Notropis species in a Wisconsin stream bigmouth shiner was most frequently found near the stream bottom and showed a strong preference for the upstream edge of pools. Bottom-dwelling fishes fed on benthic genera of chironomids, tipulids, oligochaetes, and other organisms commonly found on pool substrates while midwater species tended to feed on drifting chironomids,

copepods, terrestrial insects, and other animals found in the water column (Mendelson 1975). In the Des Moines River, Iowa, bigmouth shiner were found to show more preference for "Entomostraca" (Crustaceans including the Branchiopoda, Cephalocarida, Ostracoda, Copepoda and Maxillopoda) than any of the other co-occurring minnow species. Adult and emerging Diptera are an important food of bigmouth shiner in the fall, when they are feeding more at the surface of the water than in other seasons. Overhanging trees and other vegetation are an important source of food for bigmouth shiner and other minnow species due to the small adult terrestrial insects that fall from this vegetation into the water. They are especially reliant on this food source in the fall when the availability of aquatic insects has declined. Terrestrial insects eaten by bigmouth shiner and co-occurring minnow species include (Orthoptera) Locustidae, Gryllidae; (Neuroptera) Chrysopidae; (Hemiptera) Miridae, Lygaeidae; (Homoptera) Cicadellidae, Aphidae; (Coleoptera) Carabidae, Staphylinidae, Tenebrionidae, Elateridae, Anthicidae, Scarabaeidae, Chrysomelidae, Rhyllcophora, Curculionidae; and (Hymenoptera) Formicidae, Ichneumonidae, Pompilidae (Starrett 1950).

Conservation/Management: Although there are eighty-four occurrence records for bigmouth shiner in Michigan (MNFI 2024) all but 13 were documented at least 30 years ago and most are museum records that are over 80 years old. A total of 636 sites were surveyed by Latta (2005) across Michigan from 1993 to 2001 to determine the status of Michigan fishes thought to be declining. Bigmouth shiners were found at only 12 (1.9%) sites.

Several factors are impacting stream fish assemblages in Michigan. Dams and impoundments across Michigan's watersheds are barriers to fish passage, preventing movement of individuals among populations and associated benefits of gene flow, migration to new habitats, and dispersal to avoid impacts and stressors. Dams convert flowing stream habitats to still water impoundments. They alter the transport of sediments in stream and river systems, namely increasing silt deposition in the impoundment upstream of the dam and starving the streambed of sediments downstream of the dam. Water temperature and flow regimes can also be highly altered. These changes alter habitat in ways that make it unsuitable for bigmouth shiner. A 2002 review of existing literature on the effects of impoundments on native stream fishes found that bigmouth shiner was absent above and below impoundments (Mammoliti 2002). Removal of obsolete dams and impoundments can have long term benefits to bigmouth shiner and other Michigan fish species.

The conversion of naturally vegetated land (especially lands adjacent to streams and rivers) to more impervious land use types, such as parking lots, urban areas, and agriculture is increasing the flashiness of streams. Higher maximum flows and lower minimum flows is increasing erosion and transport of sediments across the land into streams. Increased variability in precipitation caused by climate change is also increasing stream flashiness and associated impacts. Erosion and subsequent sedimentation of silt leads to loss of bigmouth shiner habitat because they have low tolerance to siltation. Populations of silverjaw minnow, which has similar habitat requirements, have been observed to decline over several years-time with the increase of silt over formerly silt free sand habitats (Trautman 1981). Maintaining naturally vegetated riparian zones can help minimize erosion and siltation. Overhanging riparian vegetation allows for the input of terrestrial insects for bigmouth shiner food and shade to maintain cooler water temperatures.

Bigmouth shiner and silverjaw minnow occupy similar habitats, and display similar schooling, feeding, and predator avoidance behaviors. Trautman (1981) notes that if bigmouth shiner maintained large or fair-sized populations it remained the dominant species, and when it became rare, silverjaw minnow became abundant. The range

of bigmouth shiner has continued to shrink and, at least in Ohio, is reportedly being replaced by silverjaw minnow (Trautman 1981). It is not clear if silverjaw minnow is outcompeting bigmouth shiner or just replacing them as their populations decline.

Research needs: Considering the large proportion of historical records for bigmouth shiner in Michigan, and low levels of survey effort over the past 20+ years, the most pressing research need is for targeted surveys for the species throughout its range in the state. In 2005, Latta notes that the status of bigmouth shiner should be reviewed and that its abundance appears to be considerably reduced in parts of its range, particularly the Upper Peninsula. Surveys to provide more up to date data on the occurrence of the species and status of its populations in Michigan are needed to inform conservation and management efforts.

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