Aquatic Animal Life of the St. Joseph River (Maumee Drainage, Hillsdale County, MI)

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Left photo: A pearly mussel called the fatmucket (*Lampsilis siliquoidea*). Photo by Peter Badra.
Middle photo: Blackside darter (*Percina maculata*), a member of the Perch Family. Photo by Konrad Schmidt.
Right photo: A large stonefly from Bean Creek, Lenawee County (*Acroneuria arenosa*, 2 inch length). Photo courtesy Bean/Tiffin Watershed Coalition.
Background photo: The St. Joseph River, Hillsdale County. Photo by Reuben Goforth.

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Introduction

While some tropical regions are well known for their diverse insect and plant communities, Eastern North America is home to some of the richest freshwater animal communities in the world. The United States, in particular, has more species of mussels, crayfish, snails, stoneflies, mayflies, and caddisflies than any other country (Master et al. 1998). For example, there are nearly 300 species of freshwater mussels in Eastern North America (Williams et al. 1993).

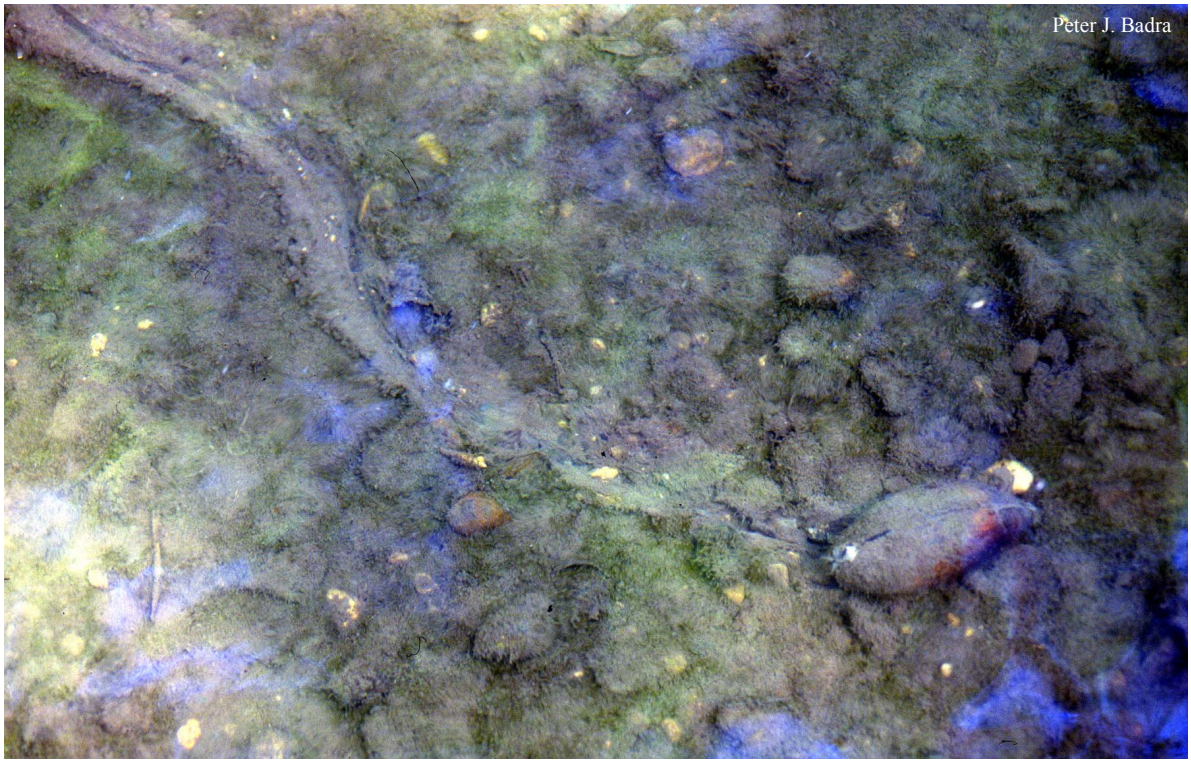

Figure 1. A fatmucket mussel leaves a small trench in the stream bottom as it slowly pulls itself along with its muscular foot.

The St. Joseph River (Maumee drainage, Hillsdale Co.) is home to many types of aquatic animals, including mussels, fish, and insects. The unique conditions in this river support a large number of species, including globally significant populations. Pearly mussel populations in the St. Joseph River include state and globally rare species making it one of the most biologically important rivers in Michigan. The St. Joseph is one of two watersheds in Michigan identified as critical watersheds to conserve fish and mussel species by The Nature Conservancy and NatureServe (Master et al. 1998). In the summers of 1998-2000 the Michigan Natural Features Inventory (MNFI) performed mussel, fish, and aquatic insect surveys with a focus on the globally rare northern clubshell mussel (*Pleurobema clava*). This report provides an overview of the biology of freshwater mussels and an introduction to the mussels, fish, and aquatic insects commonly found in the St. Joseph River.

Freshwater Mussel Biology and Ecology

This guide focuses on freshwater pearly mussels (Unionidae, Figure 1); however, there are three other families of mussels or clams that live in the streams and lakes of Michigan: the zebra mussel family (Dreissenidae), the Asian clam (Corbiculidae), and fingernail or pea clams (Sphaeriidae). The zebra mussel family is represented by two species, the zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*Dreissena bugensis*) (Figure 2). Zebra and quagga mussels were accidentally introduced to North America in the 1980s by being transported in the ballast water of shipping vessels. The zebra mussel has had an

economic impact on certain industries due to its habit of attaching to water intake pipes and other underwater structures in great numbers. They interfere with the functioning of the pipes by obstructing water flow and are costly to remove. Zebra mussels are also having a dramatic ecological impact on Michigan's lakes and rivers due to their consumption of plankton and ability to colonize other aquatic animals such as native freshwater mussels. Many fish species rely on plankton for food and now have to compete with zebra mussels for this resource. The Asian clam (*Corbicula fluminea*) is the only species of its family in North America (Figure 3). Asian clams are a snack food in China. This species was introduced to North America in 1938 as a food species and has spread throughout the U.S. by being accidentally transported by people. The pea clams, or fingernail clams, are native to North America and are fairly widespread in Michigan (Figure 4). The pearly mussels, often referred to simply as 'freshwater mussels', are of particular interest because of their unique life history, importance to aquatic ecosystems, use as indicators of change in water and habitat quality, and because they have undergone significant declines in range and status over the past century.

One of the most important differences between the pearly mussels and the other freshwater bivalves is their unique life cycle. Pearly mussels require a fish host to complete their life cycle, whereas other mussel families produce free-swimming larvae that develop into the adult form without a host. Eggs are fertilized and develop into larvae within the female pearly mussel. These larvae, called glochidia, are released into the water and must attach to a suitable fish host to survive and transform into the adult form. Glochidia attach to the gills or fins of fish. They are very small (length approximately 1/100 inch), and do not harm their host (Figure 5). Each pearly mussel species has one or more particular fish species that it uses as hosts. One species in Michigan, called the salamander mussel (*Simpsonaias ambigua*), attaches to an aquatic salamander (mudpuppy, *Necturus maculosus*).

Figure 2. Zebra mussel (*Dreissena polymorpha,* left) and quagga mussel (*Dreissena bugensis*, right). Length approximately 1/2 to 1 inch.

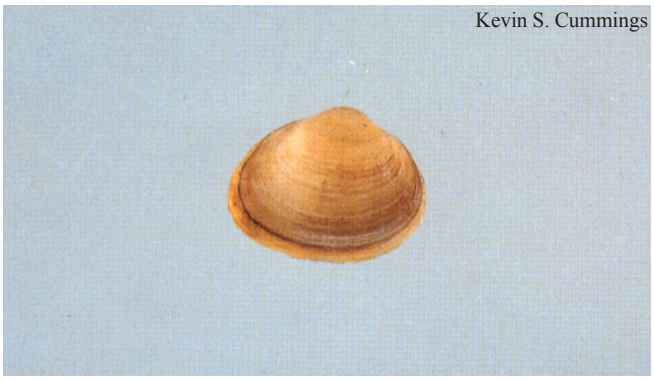

Figure 4. Pea clam (Sphaeriidae). Length 1/2 inch.

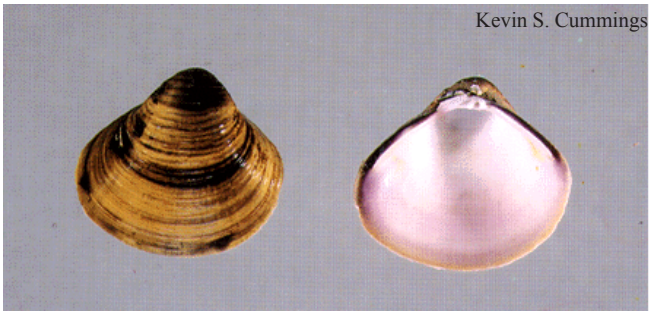

Figure 3. Asian clam (*Corbicula fluminea*). Length 1-1/2 inches.

Figure 5. Pearly mussel larvae (called glochidia). The larger ones are fatmuckets (*Lampsilis siliquoidea*, length 1/100 inch) and the smaller ones are spectaclecase (*Cumberlandia monodonta*, length 1/400 inch).

Pearly mussels have developed ingenious ways of attracting fish to complete their life cycle. The females of some species have structures resembling small fish, crayfish, or other prey which are displayed when the glochidia are ready to be released (Figures 6 and 7). When fish bite the lure the mussel releases its glochidia. This gives the glochidia much better chances of attaching to a host than if they were released into the water without a fish present. Some species display packets of glochidia (called conglutinates) that are trailed out in the stream current attached to the mussel by a clear strand so that the mussel appears to be

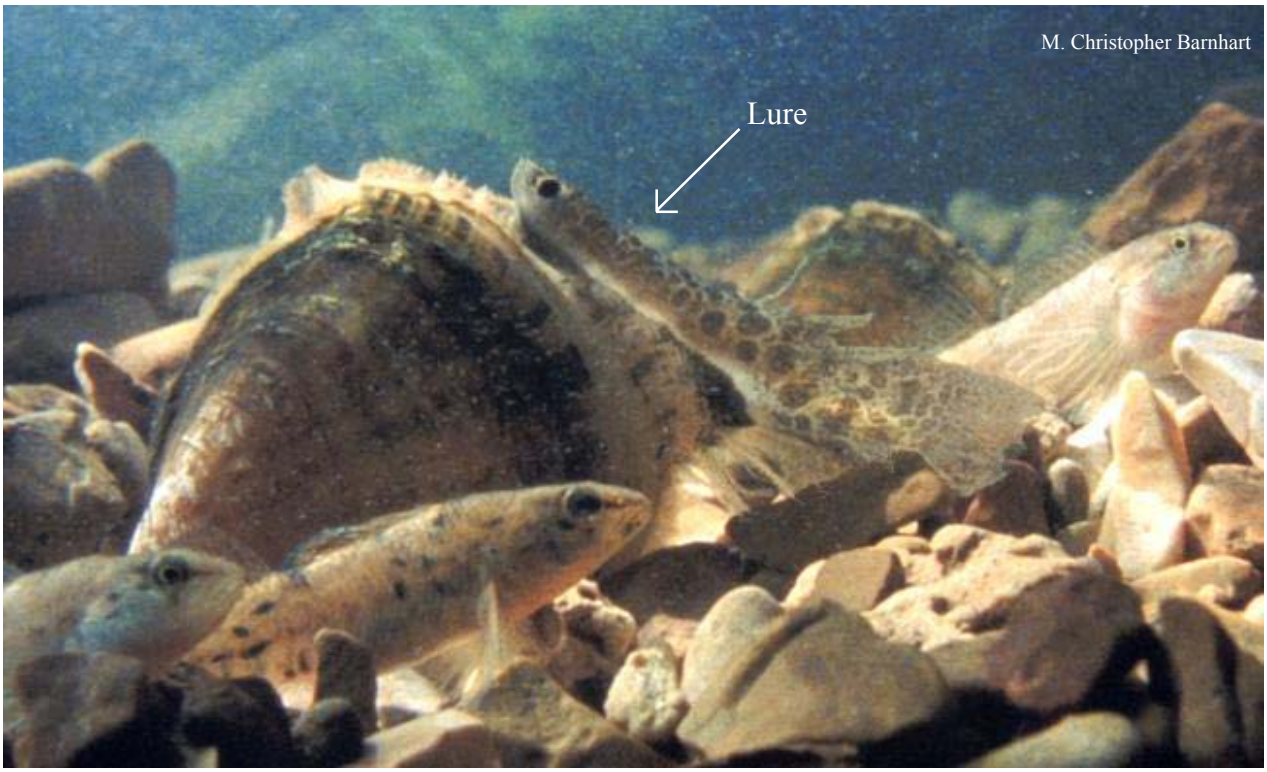

Figure 6. A female pearly mussel displaying its lure to attract potential fish hosts (broken-rays mussel, *Lampsilis reeveiana*). A dark spot resembling the eye of a fish makes the lure more convincing.

Figure 7. A female rainbow (*Villosa iris*) displaying a lure resembling a crayfish.

Figure 8. A female orange-nacre mucket (*Lampsilis perovalis*) displaying a conglutinate, a packet of thousands of glochidia that are ready to attach to a host fish. The mussel's in-current and out-current siphon openings can be seen on the far left side of the mussel.

"fishing" for a host (Figure 8). This amazing strategy for attracting fish hosts with conglutinate lures was discovered in 1993. Lures can been seen in mid to late summer. Glochidia complete metamorphosis and drop off their host in the adult form after a period of time ranging from 6-160 days, depending on the mussel species (Kat 1984). Since adult mussels move very little throughout their lifetime, the ride that glochidia get while attached to their fish host allows pearly mussels to disperse to new habitat and interbreed between populations (Kat 1984, Watters 1995a). This life cycle illustrates the interconnected nature of species in an ecosystem. Without the presence of healthy fish host populations pearly mussels are unable to reproduce.

Pearly mussels play a significant ecological role in rivers. Both live individuals and empty shells provide habitat for aquatic insects. Empty shells also provide habitat for crayfish. Pearly mussels play a substantial role in completing the food chain in stream ecosystems. They often comprise the highest percentage of biomass relative to other bottom-dwelling stream animals (Strayer et al. 1994) and are a key link in the food chain between aquatic microorganisms, like algae, and predators such as crayfish, birds, and muskrats.

Pearly mussels are useful water and habitat quality indicators for several reasons. Most species are long-lived, some with life spans up to 50 years or more. They are generally sessile, spending most of their lives within a small section of stream. Because they are filter feeders, mussels are sensitive to and tend to accumulate contaminants. Also, empty shells can reveal which species were present at a site in the past since they remain intact for many years after death. Habitat requirements for pearly mussels vary among species, but the most species rich mussel beds are usually found in areas with the following characteristics: a mixture of pebble, gravel, and sand stream bottom with relatively little silt; clear water without excessive suspended particles; and good stream current. Mussel species richness and fish species richness are related; that is, rivers with lots of fish species tend to have lots of mussel species, and rivers with few fish species tend to have few mussel species (Watters 1992). The high diversity of pearly mussels in the St. Joseph River indicates that the river is a high quality system with relatively healthy aquatic animal populations.

Freshwater Mussels of the St. Joseph River

Habitat, host, and length information were taken from *A Guide to the Freshwater Mussels of Ohio* (Watters 1995b); *Field Guide to Freshwater Mussels of the Midwest* (Cummings and Mayer 1992); and *Missouri Naiades: A Guide to the Mussels of Missouri* (Oesch 1984). Look up these books for more in-depth information on mussels in the Midwest. Listed under "Known hosts" are fish species found in Michigan that have been determined in lab studies to be suitable hosts for that particular mussel species. For assistance in identifying mussels and other aquatic animals, contact Michigan Natural Features Inventory (517-241-4179). A permit is required to collect live mussels or empty shells.

Species Most Common in the St. Joseph River:

Clubshell
Pleurobema clava
Description: Wedge shaped. Yellow shell, usually with a few wide green rays that end about half way down the shell. Maximum length 3-1/2 inches. **Status:** Endangered in Michigan, Federally listed as Endangered. Global range has been reduced to a few river sections. **Habitat:** Rivers with cool, clear water, good current, and sand and gravel bottoms. May be associated with ground water inflow. **Known hosts:** Logperch, blacksided darter, striped shiner, and central stoneroller.


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Fatmucket
Lampsilis siliquoidea
Description: Oval in outline. Yellow colored shell with several wide green rays. Maximum length 5 inches. **Status:** Stable or expanding, one of the most common species in the Midwest. **Habitat:** Widespread in rivers and lakes with a wide range of bottom types. Is tolerant of silt and low or no current. Often the only pearly mussel found at heavily impacted sites. **Known hosts:** A wide range of fish species including bluegill, other sunfishes, basses, and shiners.


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Kidneyshell
Ptychobranchus fasciolaris
Description: Thin and flat, sometimes with a kidney shaped outline. Yellow shell, usually with several green rays that go from top to bottom of the shell but are interrupted or dashed. Shells are thick. Maximum length 6 inches. **Status:** Stable. **Habitat:** Rivers with cool, clear water with good current, and sand and gravel bottoms. **Known hosts:** None reported.


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Pocketbook
Lampsilis ventricosa
Also known as *Lampsilis cardium*.
Description: Very inflated, spherical in shape. Yellow shell, usually with a few wide green rays. Maximum length 6 inches. **Status:** Stable. **Habitat:** Rivers and lakes with sandy muddy bottoms in still or flowing water. **Known hosts:** Largemouth and smallmouth bass, bluegill, sauger, walleye, white crappie, and yellow perch.


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Rainbow
Villosa iris
Description: Oval outline. Shell with green rays that get broader and more distinct toward one end. Maximum length 3 inches. (Also see Figure 7.) **Status:** Species of special concern in Michigan. **Habitat:** Streams with sandy, muddy bottoms and good current. **Known hosts:** None reported.


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Round pigtoe
Pleurobema sintoxia
Description: Somewhat round outline. Highly variable shape. Dark brown or occasionally black shell. Maximum length 5 inches. This species can be very difficult to distinguish from Wabash pigtoe. **Status:** Species of special concern in Michigan. **Habitat:** Small streams to larger rivers with sandy mud or sand and gravel bottoms with good current. **Known hosts:** Bluegill.

Slippershell
Alasmidonta viridis
Description: Very small compared to other mussels. Maximum length 1-1/2 inches. **Status:** Species of special concern in Michigan. **Habitat:** Most often found in the headwaters of small streams. **Known hosts:** Mottled sculpin and johnny darter.

Spike
Elliptio dilatata
Description: Long, pointed shape with dark brown shell. Inside of shell is often purple. Maximum length 5 inches. **Status:** Stable. **Habitat:** Rivers and sometimes lakes with bottoms ranging from mud to gravel. **Known hosts:** Rainbow darter, gizzard shad, flathead catfish, black and white crappie, sauger, and yellow perch.

Squawfoot
Strophitus undulatus
Description: Shell light brown or grey near the top, dark brown or black around the bottom edges. Highly variable species that can look very similar to giant floater, spike, or cylindrical papershell. Maximum length 4 inches. **Status:** Stable. **Habitat:** Rivers in pools and areas of good current with mud to sand and gravel bottoms. **Known hosts:** Creek chub, largemouth bass, and green sunfish.

Three-ridge
Amblema plicata
Description: Has three or four distinct ridges that run diagonally across the shell. Outside of shell almost always dark brown. Maximum length 6 inches. **Status:** Stable. **Habitat:** Small and large rivers and lakes with bottoms composed of muddy sand, gravel, or large rock. **Known hosts:** A wide variety of fish including bluegill, other sunfishes, flathead catfish, and the basses.


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Wabash pigtoe
Fusconaia flava
Description: Outline of shell somewhat square in shape. Maximum length 4 inches. This species can be very difficult to distinguish from round pigtoe. **Status:** Stable. **Habitat:** Rivers and sometimes lakes with a wide range of bottom types. **Known hosts:** Black and white crappie, and bluegill.


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Wavy-rayed lampmussel
Lampsilis fasciola
Description: Inflated and more spherical shaped than most other mussels. Numerous narrow green rays. Similar to the pocketbook but smaller and more narrow rays. Maximum length 4 inches.
Status: Threatened in the State of Michigan.
Habitat: Streams with sand to gravel bottoms and good current. **Known hosts:** Smallmouth bass.


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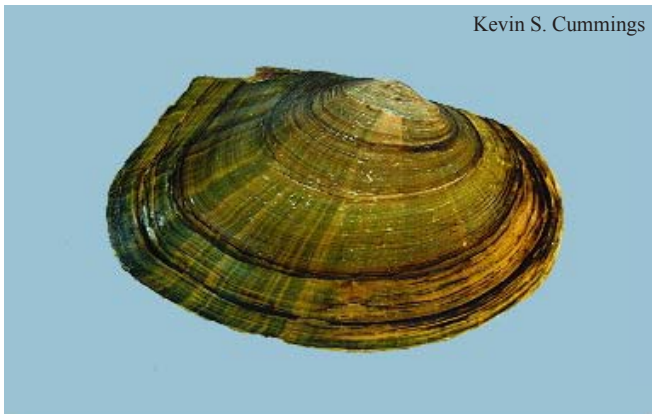
Species Found in the St. Joseph River in Low Numbers:

Creek heelsplitter
Lasmigona compressa
Description: Thin, flat shape. Green and brown rays. Maximum length 4 inches.
Status: Stable. **Habitat:** Usually found in small streams in areas with sandy mud and good current
Known hosts: Spotfin shiner, slimy sculpin, black crappie, and yellow perch.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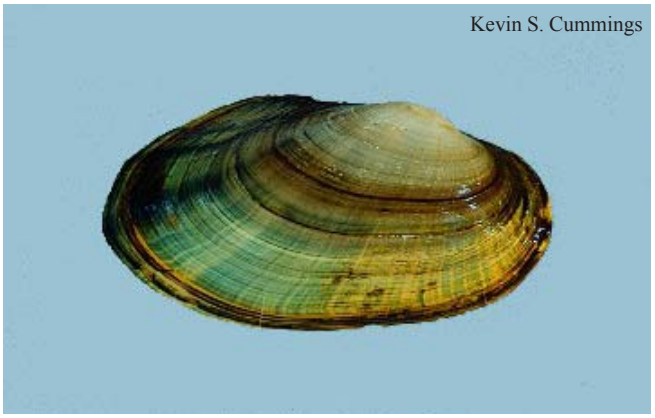
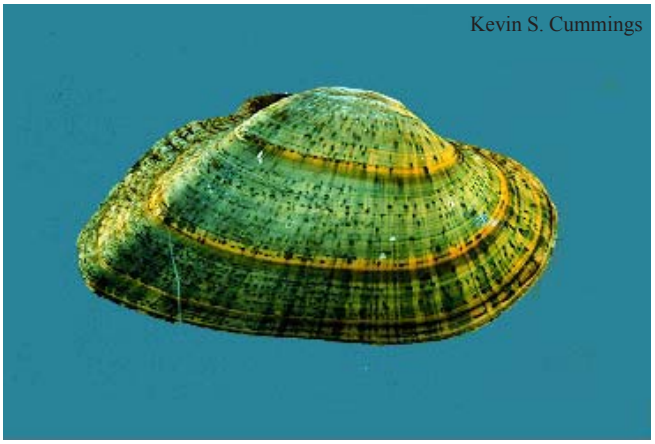
Cylindrical papershell
Anodontoides ferussacianus
Description: Thin shell, very similar to giant floater but much smaller. Maximum length 4 inches. **Status:** Stable. **Habitat:** One of the few species that prefers lakes or pools in streams with little current and muddy bottoms. **Known hosts:** Common shiner, mottled sculpin, white sucker, largemouth bass, bluegill, black crappie, and other minnows.



Ellipse
Venustaconcha ellipsiformis
Description: Oval outline. Numerous thin green rays. Very similar to rainbow. Maximum length 3-1/2 inches. **Status:** Species of special concern in Michigan. **Habitat:** Small rivers with good current and sand and gravel bottoms. **Known hosts:** None reported.

Elktoe
Alasmidonta marginata
Description: The only mussel in Michigan with rays and dots on the outside of its shell. Maximum length four inches. **Status:** Species of special concern in Michigan. **Habitat:** Clear streams of moderate size and good flow. **Known hosts:** Northern hog sucker, white sucker, rock bass, shorthead redhorse, and warmouth.



Giant floater
Pyganodon grandis
Description: Thin shell with smooth, shiny exterior surface. Maximum length 6 inches. **Status:** Stable. **Habitat:** One of the few species that prefers lakes or pools in streams with little current and muddy bottoms. **Known hosts:** Can utilize a wide variety of fish species. Thirty-seven host species have been reported.

Fluted-shell
Lasmigona costata
Description: Very similar to the creek heelsplitter but has closely spaced washboard-like ridges (or "flutes") on one end. Maximum length 6 inches. **Status:** Stable. **Habitat:** Medium to large rivers in sandy areas with good flow. **Known hosts:** Carp, bowfin, northern pike, bluegill, largemouth bass, yellow perch, and walleye.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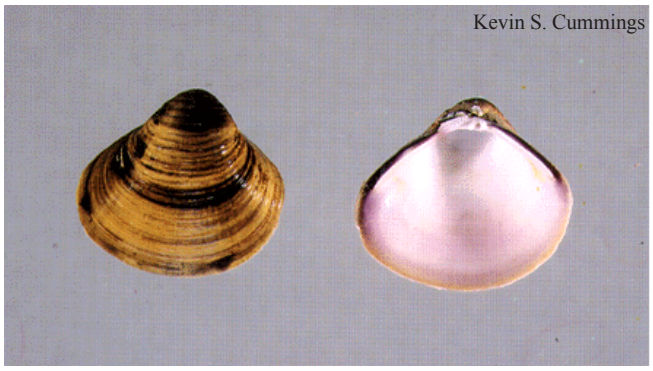
Asian clam
***Corbicula fluminea* (exotic)**
Description: Yellow, yellow-green, or black shell. Symmetrical shape. Similar to pea clams but have numerous raised concentric ridges and thicker shells. Maximum length one inch. **Status:** Introduced to North American in 1938 from Eurasia. **Habitat:** Widespread and can be very abundant in rivers. **Known hosts:** Does not require a host to reproduce.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Fishes of the St. Joseph River

The following species were found in surveys from 1998-2000. Fish are grouped by family. An "*" indicates this species is one of the top ten most abundant species in the St. Joseph. Information about each fish family was taken from *Freshwater Fishes of Virginia* (Jenkins and Burkhead 1994); *A Field Guide to Freshwater Fishes, North America North of Mexico* a Peterson Field Guide (Page and Burr 1991); and *Fishes of the Great Lakes Region* (Hubbs and Lagler 1958). To find out more about the fishes of Michigan refer to these books.

Bullhead catfish Family (Ictaluridae)

Fishes in this group are mainly active at night. Madtoms have venomous glands with spines in their fins. If handled carelessly they can produce a sting similar to a bee. Species in this family range from a maximum size of a couple inches for madtoms to five feet and over 130 lbs for blue and flathead catfish. The larger species are important for commercial aquaculture.

Brindled madtom
Noturus miurus
Maximum length 5 inches.
Species of special concern in Michigan.


Ohio Division of Natural Areas and Preserves

Stonecat
Noturus flavus
Maximum length 12 inches.

Minnow Family (Cyprinidae)

This is the largest family of fishes with over 2,000 species worldwide. These species include carnivores that feed on small crustaceans and insects, and herbivores that feed on algae. Herbivores, such as the central stoneroller, have a hard plate on their lower jaw that allows them to scrape food (algae) off the surface of rocks. The stonerollers (*Campostoma spp.*) and chubs (*Nocomis* spp.) are known for building nests in gravel. These look like craters or mounds in the stream bottom about 10-20 inches in diameter. Some species become brightly colored during breeding season. All but the carp have no spines in their fins.

Blacknose dace
Rhinichthys obtusus
(Previously known as *Rhinichthys atratulus*)
Maximum length 4 inches.

Bluntnose minnow*
Pimephales notatus
Maximum length 4 inches.

Central stoneroller*
Campostoma anomalum pullum
Maximum length 8 inches. Host for the clubshell.

Common carp
***Cyprinus carpio* (exotic)**
Maximum length 48 inches. Introduced from Eurasia.

Common shiner*
Luxilus cornutus
Maximum length 7 inches.

Creek chub*
Semotilus atromaculatus
Maximum length 12 inches.

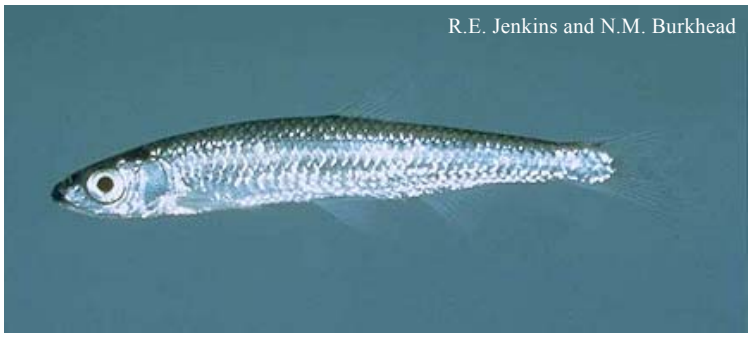
Golden shiner
Notemigonus crysoleucas
Maximum length 12 inches.

Hornyhead chub*
Nocomis biguttatus
Maximum length 10 inches.

River chub
Nocomis micropogon
Maximum length 12 inches.

Rosyface shiner
Notropis rubellus
Maximum length 5 inches.

Silver shiner
Notropis photogenis
Maximum length 5 inches. State listed as Endangered in Michigan.



Striped shiner
Luxilus chrysocephalus
Maximum length 7 inches. Host for the clubshell.

Mudminnow Family (Umbridae)

This small family contains only four species, one of which is found in Michigan. During daylight hours mudminnows stay hidden in vegetation. At night they come out to feed on small invertebrates. Mudminnows can get oxygen by breathing air, allowing them to survive in poorly oxygenated water that is unsuitable for other fishes.

Central mudminnow
Umbra limi
Maximum length 5 inches.

Perch Family (Percidae)

The walleye, yellow perch, and sauger are well known members of the Percid family. The rest of the 153 species in this group are darters. Darters are adapted to living on stream and lake bottoms, where they eat small bottom-dwelling crustaceans and insects. The males of many species, such as the greenside darter, turn brightly colored during the breeding season.

Blackside darter
Percina maculata
Maximum length 4 inches. Host for the clubshell.

Fantail darter
Etheostoma flabellare
Maximum length 3 inches.

Greenside darter
Etheostoma blennioides
Maximum length 6 inches.

Johnny darter*
Etheostoma nigrum
Maximum length 2½ inches.

Logperch
Percina caprodes
Maximum length 7 inches. Host for the clubshell.

Pike Family (Esocidae)

These distinct torpedo shaped fish are powerful predators that feed on a variety of smaller fishes. Pike have large canine teeth and are specialized for quick bursts of speed to capture prey. The diet of large pike can include frogs, snakes, small mammals, and birds. They often hover under the cover of vegetation or logs, waiting to ambush prey. Their fins have no spines.

Grass pickerel
Esox americanus vermiculatus
Maximum length 15 inches.

Sculpin Family (Cottidae)

Most species in this family are marine, but a few have adapted to live in streams and lakes. Freshwater sculpin are most often found in cool swift water streams, between rocks in fast flowing areas. Members of this family lay eggs in small cavities under rocks and logs, and guard the nest from predators. They have a frog-like face and have spines on the dorsal and pelvic fins.

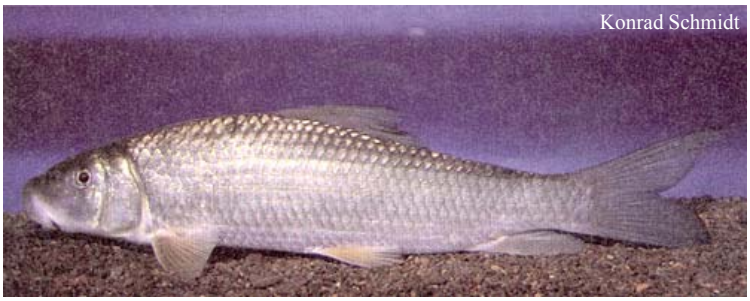
Mottled sculpin*
Cottus bairdi
Maximum length 6 inches.

Sucker Family (Catostomidae)

Suckers have large, thick lips and no spines in their fins. Their mouths are oriented toward the underside of the head allowing them to feed on small invertebrates, insect larvae, and plant material that they suck up from the bottom. Suckers typically spawn in the spring and early summer, often migrating large distances in streams. This family is often very abundant in streams and lakes.

Black redhorse
Moxostoma duquesnei
Maximum length 20 inches.

Golden redhorse
Moxostoma erythrurum
Maximum length 30 inches.



Northern hogsucker*
Hypentelium nigricans
Maximum length 24 inches.

Quillback
Carpiodes cyprinus
Maximum length 26 inches

Spotted sucker
Minytrema melanops
Maximum length 19 inches.

White sucker
Catostomus commersoni
Maximum length 25 inches.

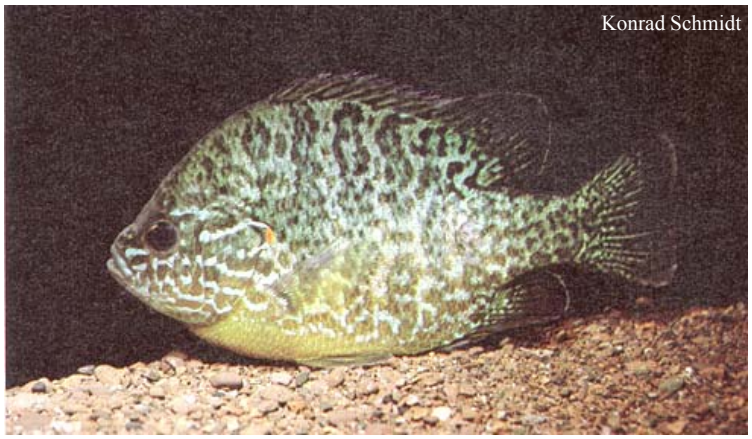
Sunfish and Bass Family (Centrarchidae)

This family is found only in North America and includes many popular sport fish. These species typically live in lakes, ponds, and pools in streams. They are carnivores, feeding by sight on insects, fish, and crustaceans. Bluegill, green sunfish, and pumpkinseed hybrids are fairly common in the wild. Male sunfish and bass build nests in gravel or vegetation, and after spawning, remain to guard the eggs and young from predators. They have spines in the dorsal fin.

Bluegill*
Lepomis macrochirus
Maximum length 16 inches.

Green sunfish*
Lepomis cyanellus
Maximum length 12 inches.

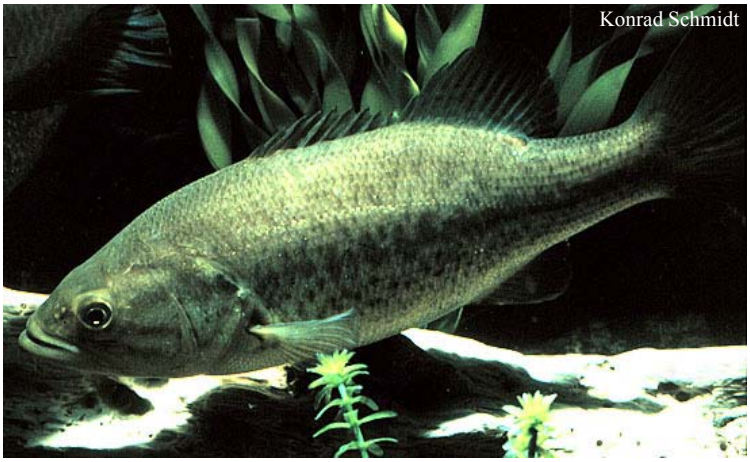
Pumpkinseed
Lepomis gibbosus
Maximum length 16 inches.



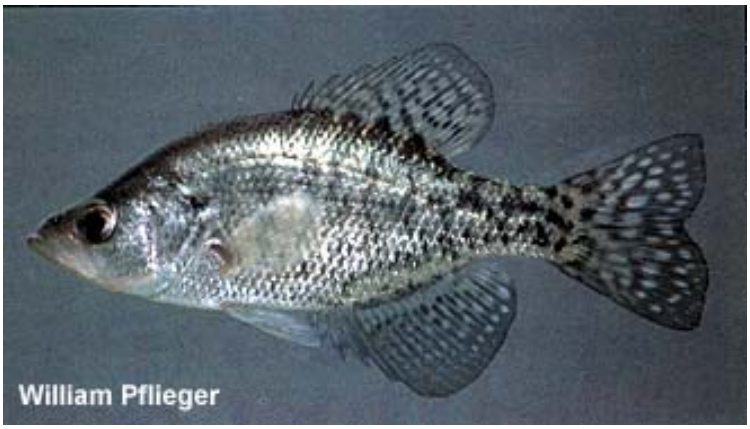
Rockbass
Ambloplites rupestris
Maximum length 17 inches.

Smallmouth bass
Micropterus dolomieu
Maximum length 27 inches.

Largemouth bass
Micropterus salmoides
Maximum length 38 inches.



White crappie
Pomoxis annularis
Maximum length 21 inches.



Aquatic Insects of the St. Joseph River

Insect collections from streams typically focus on the larval stage. Pictured here are larval insects that are familiar to most of us only in their adult form. Dragonflies, for example, spend 1-4 years in a larval form, living underwater before undergoing metamorphosis to the adult form. Aquatic insects are one of the most important food sources for many fish, completing an important link in the food chain. There is a direct connection between fly fishing and the morphology and biology of aquatic insects. Fly-fisherman use lures made to look like certain types of aquatic insects at specific times of the year when those insects are hatching. For more information on insects found in streams and lakes look up *Aquatic Entomology: The Fisherman's and Ecologist's Illustrated Guide to Insects and Their Relatives* (McCafferty 1998). For identification of aquatic insects to the genus level see *An Introduction to the Aquatic Insects of North America*, 3rd edition (Merritt and Cummins 1996). For an overview of all groups of aquatic invertebrates see *Ecology and Classification of North American Freshwater Invertebrates* (Thorp and Covich 1991). The following insect families were identified in samples from the St. Joseph River. A representative photo is given for each family.

Caddisflies (Trichoptera)

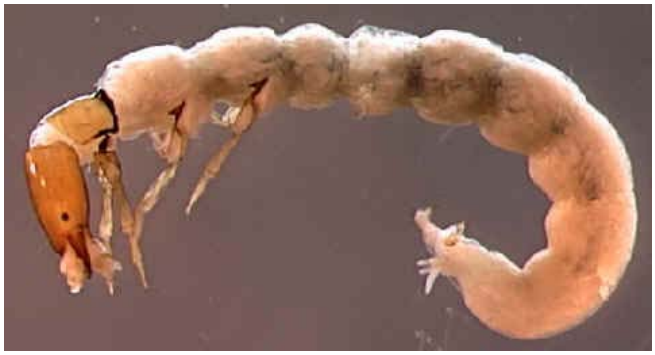
This group of aquatic insects includes over 1,300 species in North America and is an important part of the invertebrate community in streams and some lakes. Most caddisfly larvae live inside portable cases that they build from silk and tiny pebbles or plant material. These cases protect larvae from predators. When larvae are ready to metamorphose they seal off the opening, and after a time ranging from a few days to a few weeks they cut their way out of the case, swim to the surface, and emerge as adults. Adult caddisflies live on land and look similar to small moths. These case building species are herbivores, eating algae they scrape off of rocks. The larvae of other caddisfly species produce silk that they weave into nets. These are constructed on rocks exposed to the stream current and can be easily found in many streams. Algae, detritus, and small invertebrates are caught in the nets and provide food for larvae. Caddisfly larvae are, in turn, eaten by many types of fish. They are often used as indicators of water quality because of wide variation in tolerance to pollution among the species. Lengths of caddisflies range from 1/8-1/2 inch. Also found in the St. Joseph, but not pictured, is the Leptoceridae. All caddisfly photos by New York State Department of Environmental Conservation - Stream Biomonitoring Unit.

Glossosomatidae

Helicopsychidae

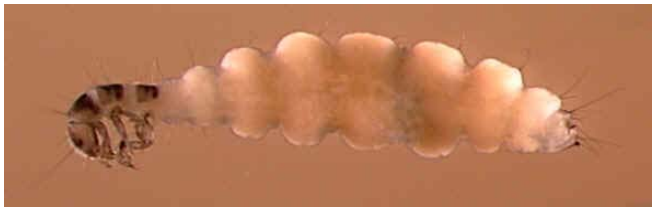
Hydropsychidae

Limnephilidae



Philopotamidae

Psychomiidae



Hydroptilidae

Odontoceridae

Polycentropodidae

Rhyacophilidae

Dobsonflies and Alderflies (Megaloptera)

The larvae of these insects can be relatively large (maximum length 3 ½ inches) and aggressive looking with big pincer-like mandibles. This is a small group of insects containing only three families, two of which were found in the St. Joseph River. Most species occur in cool streams with good current due to their need for high oxygen content in the water.

Corydalidae (dobsonflies)

Sialidae (alderflies)

Dragonflies and Damselflies (Odonata)

Over 400 species of Odonates are known from North America. About two-thirds of these live as larvae in streams and one-third in lakes or ponds. Both dragonfly and damselfly larvae are predators that eat other invertebrates. Adults are also predators, eating mosquitoes and other flying insects. Damselflies live underwater as larvae for one year before undergoing metamorphosis to the adult form. Dragonflies live underwater for 1-4 years before the adult stage. Damselfly larvae have three gills that look like tails while dragonfly larvae have a pointed abdomen. When larvae are ready to emerge they crawl up the stream bank, shed their larval exoskeleton, inflate their wings, and fly off as an adult. This process takes a matter of minutes and with some luck can be seen in late spring or early summer. The adult form that we are most familiar with lives only a matter of weeks. During this time they mate and lay eggs on plants near or in the water. Empty exoskeletons (called exuviae) of the larvae (similar to those from cicadas) can often be found on shoreline vegetation, rocks, or other vertical structures such as bridge abutments just above the water surface throughout the summer. Also found in the St. Joseph, but not pictured, are the Calopterigidae and Gomphidae.

Aeshnidae (a dragonfly family)

Coenagrionidae (a damselfly family)

Flies and Midges (Diptera)

This is a large group of insects that includes several families with aquatic larvae. The fly and midge family inhabits nearly every type of aquatic habitat from streams and lakes to seasonal floodings and small pools of water. Their relatively quick life cycles allow them to take advantage of aquatic habitats that dry up for most of the year. Some larvae have physical adaptations, such as a retractable siphon that reaches to the water surface, or behavioral adaptations, such as repeatedly swimming to the surface to get air, that allows them to survive in low oxygen environments. Many species in this group are yet to be discovered and described. Also found in the St. Joseph, but not pictured, are the Empididae, Simuliidae (black flies), and Tabanidae (deer flies and horse flies).

Athericidae

Chironomidae (midges)

Tipulidae (crane flies)

Mayflies (Ephemeroptera)

The larvae of most mayfly species inhabit streams, but some are found in lakes. Mayflies usually spend a year underwater in the larval form and live for only a few hours to a few weeks after emerging as adults. During this brief period they mate and then lay eggs on the water surface by repeatedly touching the water with their abdomen while in flight. Mayfly larvae can be identified by the presence of three long tails and gills attached to their abdomen that look like tiny leaves or filaments. Larvae are herbivores (eat plant material) and detritivores (eat small organic particles that settle to the bottom). Mayflies are an important source of food for fish. Also found in the St. Joseph, but not pictured, is the Oligoneuriidae. All mayfly photos by New York State Department of Environmental Conservation Stream Biomonitoring Unit.

Baetidae

Caenidae

Ephemeridae

Heptageniidae

Leptophlebiidae

Potamanthidae

Stoneflies (Plecoptera)

Stonefly larvae can be identified by the presence of two long tails in contrast to three tails in the mayflies. Stoneflies crawl on the stream bottom and generally are not good swimmers. They have long antennae and their gills are not present on the entire abdomen as in mayflies. Because of the absence or limited number of gills, stoneflies need oxygen-rich water to live. Cold, fast-flowing streams typically have more oxygen than warmer, slow-moving streams. Many impacts to streams, such as impoundment and removal of trees that shade the water, result in warmer water temperatures and slower stream flow. Due to their intolerance for these conditions, stoneflies act as indicators of high quality stream habitat. Greatest diversity in this group is found in mountainous regions where cold, fast flowing streams are common.

Capniidae

Leuctridae


Bean/Tiffin Watershed Coalition

Perlidae


NYS DEC Stream Biomonitoring Unit

Taeniopterygidae

Water Beetles (Coleoptera)

More than 1,100 aquatic beetle species occur in North America. In nearly all of these, both the larvae and adults live under or on water. Both stages can often be seen at a given site throughout the year. Adult whirligig beetles glide on the surface of the water supported by surface tension. These silver beetles move in quick whirling and circular motions usually in groups of 100 or more. Whirligig beetles can be seen in streams and lakes in late summer. Some water beetles carry a bubble of air under their wing covers so they can breathe while underwater. They swim or crawl to the surface periodically to replace the bubble with fresh air. The larvae of some species pierce the stems of aquatic plants to use oxygen produced by the plant. Other species have developed gills to get oxygen directly from the water. Water beetles include predators that eat other invertebrates, such as diving beetles, and herbivores that eat algae and other vegetation such as the riffle beetles.

Dystiscidae (diving beetles)


Adult
David R. Maddison


NYS DEC Stream Biomonitoring Unit (2)

Elmidae (riffle beetles)


Adult


Wayne S. Davis

Gyrinidae (whirligig beetles)


Adult David R. Maddison

Hydrophilidae

Psephenidae (water pennies)

Water Bugs (Hemiptera: Heteroptera)

About 90% of the species in this group are aquatic, either living underwater or on the water surface. Most of these are predators that eat other insects and sometimes even small fish. Larvae are similar to adults but lack wings. Water boatmen are an especially important source of food for fish. Water striders are a familiar sight on lakes and rivers. Also found in the St. Joseph, but not pictured, is the Belostmatidae.

Corixidae (water boatmen)

Veliidae (water striders)

Conservation and Management

A review of the status of U.S. and Canadian pearly mussels by the American Fisheries Society found that a third (97) of the nearly 300 species are endangered (Williams et al. 1993). Similar declines are occurring in other parts of the world as well (Bogan 1993). Thirty-five species are thought to have gone extinct in recent times (Turgeon et al. 1998). There are 45 pearly mussel species native to Michigan, nineteen of which are endangered or at risk of becoming endangered.

The status of mussel populations tends to reflect the health of the aquatic ecosystem as a whole. The decline of this group over the last hundred years has been attributed mainly to our direct and indirect impacts to aquatic ecosystems. Habitat and water quality degradation, including changes in water temperature and flow, the introduction of heavy metals, organic pollution, dredging, and increased sedimentation due to excessive erosion have caused declines in native pearly mussels (Fuller 1974, Bogan 1993, Box and Mossa 1999). These factors have also impacted the fish pearly mussels rely on as hosts, as well as other groups of aquatic life (Waters 1995, Henley et al. 2000). Barriers to fish migration, such as dams and degraded habitat, also act as barriers to the dispersal of pearly mussel glochidia that have hitched

a ride on the fish host (Watters 1995). These barriers can inhibit the re-colonization of native mussels into suitable habitat and prevent their recovery.

Zebra mussels are known to have severe negative impacts on native mussels. Zebra mussels require stable, hard substrates to live on and often attach to pearly mussels. Native mussels can get covered with enough zebra mussels that they cannot reproduce or feed, eventually killing them (Figure 9). 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 boats and trailers or letting both dry overnight, and draining live wells and bilge water reduces the potential for spreading zebra mussels.

Figure 9. Zebra mussels (*Dreissena polymorpha*) attached to a pearly mussel (Unionidae).

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 that regulates water temperature. Management techniques such as conservation tillage, planting grass filter strips between fields and streams, and reforestation in the floodplain can help reduce the input of silt and pollutants into the river. Several incentive programs are available to make these conservation methods economically feasible for farms within the St. Joseph watershed. Contact Joe Draper of The Nature Conservancy (260-665-9141) for more information on these programs.

Literature Cited

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.

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.

Henley, W. F., M. A. Patterson, R. J. Neves, and A. D. Lemly. 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8(2): 125-139.

Hubbs, C. L. and K. F. Lagler. 1947. Fishes of the Great Lakes Region. The University of Michigan Press, Ann Arbor, page 43.

Jenkins, R. E., and N. M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.
Kat, P. W. 1984. Parasitism and the Unionacea (Bivalvia). Biological Review 59:189-207.
Master, Lawrence L., Stephanie R. Flack and Bruce Stein, eds. 1998. River of Life: Critical Watersheds for Protecting Freshwater Biodiversity. The Nature Conservancy, Arlington, Virginia.
McCafferty, W. P. 1998. Aquatic Entomology: The Fisherman's and Ecologist's Illustrated Guide to Insects and Their Relatives. Jones and Bartlett, Sudbury, Massachusetts.
Merrit, R. W. and K. W. Cummins (eds.). 1996. An Introduction to the Aquatic Insects of North America, 3rd edition. Kendall/Hunt, Dubuque, Iowa. 862pp.
Oesch, R. D. 1984. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Dept. of Conservation. Conservation Commission of the State of Missouri, Jefferson City, MO. 270pp.
Page, L. M. and M. B. Burr. 1991. A Field Guide to Freshwater Fishes, North America North of Mexico. Houghton Mifflin Company, Boston, Massachusetts. 432pp.
Strayer, D.L., D.C. Hunter, L.C. Smith, and C.K. Borg. 1994. Distribution abundance, and roles of freshwater clams (Bivalvia, Unionidae) in the freshwater tidal Hudson River. Freshwater Biology 31(2):239-248.
Thorp, J.H., and A.P. Covich (eds.). 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press.
Turgeon, D. D. (Chair), J. F. Quinn, Jr., A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P. M. Mikkelsen, 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.
Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7. Bethesda, Maryland. 251pp.
Watters, G. T. 1992. Unionids, fishes, and the species-area curve. Journal of Biogeography 19:481-490.
Watters, G. T. 1995. Small dams as barriers to freshwater mussels (Bivalvia, Unionoida) and their hosts. Biological Conservation 75:79-85.
Watters, G. T. 1995b. A Guide to the Freshwater Mussels of Ohio, 3rd edition. The Ohio Division of Wildlife. Columbus, Ohio. 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.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