

**Atlas of the
Freshwater Mussels (Unionidae)
(Class Bivalvia: Order Unionoida)
Recorded at the
Old Woman Creek
National Estuarine Research Reserve
& State Nature
Preserve, Ohio
and surrounding watersheds**

by

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(Revised from 2009)**

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The Old Woman Creek National Estuarine Research Reserve in Ohio is part of the National Estuarine Research Reserve System (NERRS), established by section 315 of the Coastal Zone Management Act, as amended. Additional information on these preserves and programs is available from the Estuarine Reserves Division, Office for Coastal Management, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, 1305 East West Highway, Silver Spring, MD 20910.

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Division of Wildlife
2514 Cleveland Road East
Huron, Ohio 44839



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Introduction

The bivalve family, Unionidae, represent the best known native freshwater mussels that inhabit Old Woman Creek and its estuary, as well as the surrounding watersheds. They are shelled animals, producing a pair of valves, as do clams, oysters and scallops. The animal develops encased within the two mineralized shell halves, or valves, that are articulated by a ligament on the dorsal surface. This ligament is stretched across the back as the shell closes, and therefore acts as a spring when relaxed to open the shell. The strong adductor muscles close the shell, although these may be supported by the substrate surrounding the animal as it embeds.

All freshwater mussels are part of an old lineage of bivalves (Class Bivalvia; subclass Palaeoheterodonta). The Unionidae are placed in the order, Unionoida, which is a group of freshwater species that are only weakly related to a sister order of brackish water mussels (the Trigonioida). Only a few of those species still survive in the subtidal waters around Australia (Darragh, 1998). The freshwater mussels live on all continents except Antarctica and compose some 900 species in five families (Graf and Cummings, 2006), with North America possessing the highest diversity (Williams et al., 1993).

All of the U.S. species are in the one family Unionidae, and almost 50 species once inhabited the Lake Erie watershed (Graf, 2002). Some 30 species of these mussels have been recorded from the local watersheds that include Old Woman Creek, the Huron River, which borders the watershed to the west, and the Vermilion River, which borders the watershed to the east.

Ecologically, mussels live partially buried in sediments where they feed primarily by filtering water. They have ciliated internal gills that cause water to flow through a pair of siphons formed by mantle tissue located inside the shell. Water pumped into their bodies provides them with oxygen and suspended organic matter, some of which they ingest as food. They have a large, powerful foot that is extensible from the mantle cavity and allows them to burrow and crawl. During their feeding, mussels also churn up the sediment through the activity of their foot affecting nutrient transport within the system. In turn, mussels serve as a food source for birds and small mammals, and they can be an important physical component of the stream benthos in areas with soft substrates; mussel shells are often covered, mostly by algae, but they also harbor a variety of other living things from caddisflies, to leeches or just about anything that can live in algal beds.

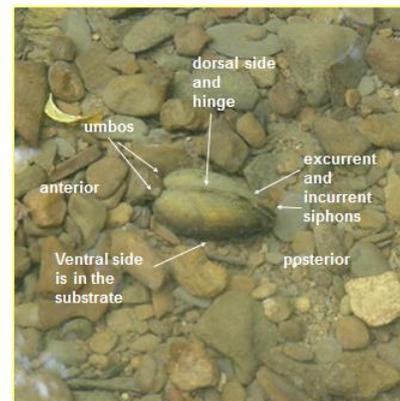


Fig. 1. An atypically well exposed giant floater (*P. grandis*) lightly embedded in the substrate of the Rocky River, OH.

Shells of adult freshwater mussel grow typically to about five inches long, although some species barely exceed one inch and some can exceed 10 inches. They are oval to elliptical in shape. The outer shell surface is

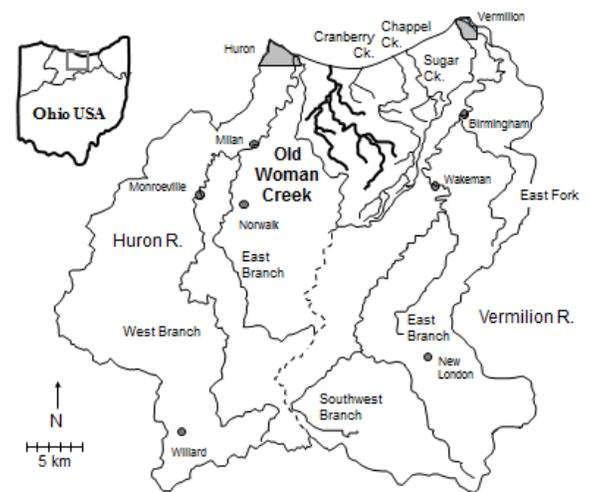
covered by an organic layer called a periostracum that may be rayed or otherwise appear patterned, and colorful, at least after exposed surfaces are cleaned of mud and algae. This surface also may be ornamented with ridges, furrows, wedges, and pustules that are believed to help anchor the mussel in substrate. The top of the shell is the location where the two halves of the shell are connected by a hinge, noting again that the left and right “valves” create the “bi-valve” appearance. The umbo on the dorsal surface leans to the anterior or front of the shell, with the siphons extending through the dorsal-posterior. Thus telling the left and right valves apart is straightforward.

Newly hatched mussels do not look like small adults. Their mothers perform parental care, harboring the growing larva in a brood pouch at the margins of its gills. In most species, these larvae grow to a glochidia stage, which is a parasite, and are only released in the presence of a proper fish host (Haag and Warren, 2000). The glochidia attaches to the gills or scales of a fish, receiving both nutrients and transportation. As adults, mussels can move only locally like snails if the substrate is soft, extending and contracting a muscular foot. Therefore most movement of species within a river or lake is while they are juveniles, where they spend 2-4 weeks or more attached to a fish before they drop off, settle to the substrate, and develop into a mussel. This lifestyle is useful to a freshwater existence as they would otherwise never be able to move upstream in a river.

Mussels once were phenomenally abundant in the soft sands of western Lake Erie, with populations estimated in the billions. In the early 1990’s, the invasion of the region by zebra mussels (a sedentary freshwater mussel of the family Dreissenidae) began to eradicate the larger unionid species from Lake Erie (Schloesser and Nalepa, 1994).

“periostracum” that may be rayed or
The dreissenids coat the exposed surfaces of unionid mussels, which live mostly imbedded in the bottom sediment. By competing for food in the water (both species filter plankton), the unionids slowly starve and/or suffocate in the presence of their small but more numerous competitors. While zebra mussels and probably a related species, the quagga mussel, occur in Old Woman Creek and the neighboring rivers, they have not become sufficiently abundant to cause a problem to the unionids living there. Dreissenids reproduce by releasing free swimming veliger larvae that cannot move against currents.

Fig. 2. Old Woman Creek and the surrounding watersheds.



Mussels in OWC and its Estuary

Four lengthy surveys were made specifically to find unionids during the summers of 2007 and 2008. Two surveys applied canoeing/walking through the estuary at low water in a visual search of mussels. The two species of unionids found in these surveys of the Old Woman Creek estuary were the Paper Pondshell (*Utterbackia imbecillis*) and

the Giant Floater (*Pyganodon grandis*), predominantly of just young individuals. Two other surveys involved searching by feel within the creek channel where the water depth was too great to see the substrate. The shells and live unionid mussels found are listed in Tables 1 and 2. A few small individuals were also identified from Eckman samples taken as part of a survey of smaller bivalves in the family Sphaeriidae (order Veneroidea).

Table 1. Unionid species found at Old Woman Creek within the deeper water of the old stream channel.

Species	Live mussels	whole fresh shells	single valves
<i>Leptodea fragilis</i>	6	1	3
<i>Ligumia nasuta</i>			1
<i>Pyganodon grandis</i>	30	6	15
<i>Quadrula quadrula</i>	3	1	1
<i>Toxolasma parvum</i>			3
<i>Unio merus tetralasmus</i>	1		
<i>Utterbackia imbecillis</i>	1		2
Total specimens	37	8	22

Table 2. Additional young individuals, mostly 1st year, found live within the shallow Old Woman Creek estuary.

Species	Live mussels
<i>Pyganodon grandis</i>	33
<i>Utterbackia imbecillis</i>	22

When Lake Erie was an abundant source of mussels, fish entering Old Woman Creek would likely have transported a diverse assemblage of mussels into this small watershed. Connections of river mouths to the large lake contributed to small streams, like Old Woman Creek, supporting a much larger assemblage than would be expected for a watershed of its size. Typically, the number of mussel species increase with watershed size (Krebs et al., 2010), and were Old Woman Creek simply an isolated “creek”, no more than one or two species would be expected to occur. As a consequence of the loss of mussels in the adjoining lake, most unionid species may be in decline. With the exception of Giant Floaters and the Paper Pondshell, the population sizes of remaining species are very small, and only Fragile Papershell (*Leptodea fragilis*) likely exists in sufficient numbers to lead to recolonizing of the estuary.

Concern therefore exists for the numerous small and largely isolated assemblages of other species remaining in small tributaries and estuaries along Lake Erie’s coast, including Old Woman Creek, where just the two unionid mussels appear common enough to persist. One other species, the Lilliput (*Toxolasma parvum*) is small, difficult to sample by feel, and often found in low abundance. That two of the three shells found were tiny juveniles collected in Eckman samplers suggests that the population in Old Woman Creek is a breeding one.

The past assemblage of unionid mussels in Old Woman Creek is also represented by the single live Pondhorn (*Unio merus tetralasmus*) and several shells found of Eastern Pondmussel (*Ligumia nasuta*), which are listed respectively as threatened

and endangered species in the state of Ohio. The rarity of pondhorn rests in part with Ohio being the eastern edge of its distribution, and Old Woman Creek is now the farthest east where this species has been found in the last 30 years. Although the species once inhabited Lake Erie, the lower Vermilion River is the easternmost historical record for the species, which remains abundant in Indiana and southern Michigan.



Fig. 3. Worn valves found in Old Woman Creek (A) an Eastern Pondmussel and (B) diverse subfossils from beaches near OWC and Sheldon Marsh, which are suggestive of the past fauna that lived near OWC when the mussel assemblage of Lake Erie was diverse.

Surveys of beaches along the waters around Old Woman Creek provided a further hint of change in diversity (Crail et al., 2011). The short beach at Old Woman Creek and Ohio's

longest undisturbed stretch of coastline, the mile long beach at Sheldon Marsh, were each surveyed multiple times for evidence that mussels still live in Lake Erie. Small numbers of fresh shells were discovered for several of the faster growing (thin-shelled) unionid species that are known to prefer pond type habitats: Fragile Papershell, Giant Floater and Paper Pondshell. Their presence suggested the possibility that some live mussels continue to inhabit Lake Erie and their shells had washed upon the beach after a recent death (Crail et al., 2011). The shells of these species are far too thin to survive long periods of time exposed to storm events. Extensive numbers of Fragile Papershell along the beaches at Port Clinton and a place called Potters Pond (Ottawa National Wildlife Preserve near Cedar Creek) attest to a return of at least this one species in reasonable numbers in the Western Basin of Lake Erie (Krebs et al., 2015). This species has been reported on beaches in Vermilion by 2012, and a specimen was recovered near Cleveland in 2015.

The total diversity of unionids in Lake Erie today is limited perhaps to 17 species based on recent and extensive surveys of coastal shallow areas, marshes and estuaries across Lake Erie, which demonstrates the impacts on unionids 25 years after the dreissenid invasion (Zanatta et al., 2015).



Fig. 4A. Shells at Sheldon Marsh



Fig. 4B. Shells representing the difference of shell condition, fresh or worn, that may occur along the beach at Sheldon Marsh (and see above, previous page).

Nearby small streams: Cranberry, Chappel and Sugar Creeks

Several small streams that flowed directly to Lake Erie were surveyed along with Old Woman Creek. Chappel Creek and Sugar Creek appeared as intermittent streams. Both streams were dry for the majority of the 2007 field season indicating that these streams are unlikely to support a population of unionids except near their mouths (Mark Lyons, personal communication). Prescott (2014) surveyed the mouths of Cranberry Creek and Chappel Creek in 2010, and while

no mussels were present in the degraded and human-impacted Chappel Creek, 16 young mussels of 4 species were found in the mouth of Cranberry Creek: Giant Floater, Mapleleaf, Fragile Papershell and Lilliput, which is a fauna similar to that found at Old Woman Creek. In a pair of surveys in 2012 at the mouth of Sugar Creek and Chappel Creek, again no mussels were found (Zanatta et al., 2015), and therefore, of the small streams in the region, only Old Woman Creek and Cranberry Creek appear to support unionid mussels.

Vermilion and Huron Rivers

The Vermilion and Huron Rivers are significantly larger bodies of water not far from Old Woman Creek (watershed size drained, Vermilion River: 694 km², Huron River: 1052 km²). In the Vermilion River, shells and/or live individuals of 19 species were collected and 19 were also found in the Huron River (Tevesz and Krebs, 2008; Krebs et al., 2010). Each river possessed four species not present in the other giving 23 species found in total (Table 3), with Pondhorn in OWC making no more than 24 species living nearby today. Two species, Round Hickorynut and Fawnsfoot, are known for the region based on historical records but are likely locally extirpated. The rare finding of only worn shells of Threeridge and Wabash Pigtoe suggest that they are gone locally. Fortunately these species are present elsewhere in the Lake Erie watershed as Fawnsfoot state listed as endangered in Ohio, and while once common in shallow areas, Mapleleaf appears to be displacing it and even Giant Floater where the benthos has become very silty (Prescott, 2014; Zanatta et al., 2015).

Table 3. The occurrence of mussels found in surveys of the two rivers bordering the watershed of Old Woman Creek or as shells washed ashore on beaches in the region. The Vermilion lies to the east and the Huron to the west of the research reserve.

Species	Common name	Vermilion River	Huron River
Black Sandshell	<i>Ligumia recta</i>		
Creek Heelsplitter	<i>Lasmigona compressa</i>	Uncommon	uncommon
Creeper	<i>Strophitus undulatus</i>	common	Common
Cylindrical Papershell	<i>Anodontoides ferussacianus</i>	Headwaters	headwaters
Deertoe	<i>Truncilla truncata</i>		Rare
Eastern Pondmussel	<i>Ligumia nasuta</i>		
Elktoe	<i>Alasmidonta marginata</i>	Uncommon	uncommon
Fat Mucket	<i>Lampsilis siliquoidea</i>	Common	Common
Fawnsfoot	<i>Truncilla donaciformis</i>	extirpated	
Fluted Shell	<i>Lasmigona costata</i>	Common	Common
Fragile Papershell	<i>Leptodea fragilis</i>	Rare	uncommon
Giant Floater	<i>Pyganodon grandis</i>	common	Common
Kidneyshell	<i>Ptychobranthus fasciolaris</i>	uncommon	shells only
Lilliput	<i>Toxolasma parvum</i>	rare	
Mapleleaf	<i>Quadrula quadrula</i>		Common
Paper Pondshell	<i>Utterbackia imbecillis</i>	uncommon	
Pimpleback	<i>Quadrula pustulosa</i>		
Pink Heelsplitter	<i>Potamilus alatus</i>	uncommon	uncommon
Plain Pocketbook	<i>Lampsilis cardium</i>	Common	Common
Pondhorn	<i>Unio merus tetralasmus</i>	extirpated	
Rainbow	<i>Villosa iris</i>	uncommon	shells only
Round Hickorynut	<i>Obovaria subrotunda</i>	extirpated	
Round Pigtoe	<i>Pleurobema sintoxia</i>	uncommon	shells only
Slippershell	<i>Alasmidonta viridis</i>	shells only	shells only
Spike	<i>Elliptio dilatata</i>	shells only	Common
Three-horn Wartyback	<i>Obliquaria reflexa</i>		
Threeridge	<i>Amblema plicata</i>		Extirpated
Wabash Pigtoe	<i>Fusconaia flava</i>	Extirpated	Extirpated
Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>	Rare	
White Heelsplitter	<i>Lasmigona complanata</i>	Uncommon	uncommon

Identification of species

While a common approach to learning and teaching a group of animals often begins with a dichotomous key, and these exist for mussels (e.g., Bogan and Alderman, 1998; Watters et al., 2009), keys fail in two

respects. First, shells vary in shape for many reasons, and often as a response to the environment in which the individual developed and in which the species evolved. Therefore, many shell characteristics occur in different genera making keys for a large number of mussel species very complex.

Second, keys, assuming they are based solely on shell characters, still require viewing both inside as well as the outer parts of the shell, with the former impossible with live animals. Furthermore, where live animals are discovered, applying a key is not practical, as one needs a quick identification and to return the animal to the substrate.

Therefore, the only practical option for field identification of mussels is sight recognition of live material, although the presence of shells often provides vouchers for later investigation. A significant advantage to these identifications is to produce a list of the species known for any particular watershed and region prior to entering the water.

A second useful step is to become familiar with the terminology applied to the shell characteristics of freshwater mussels.

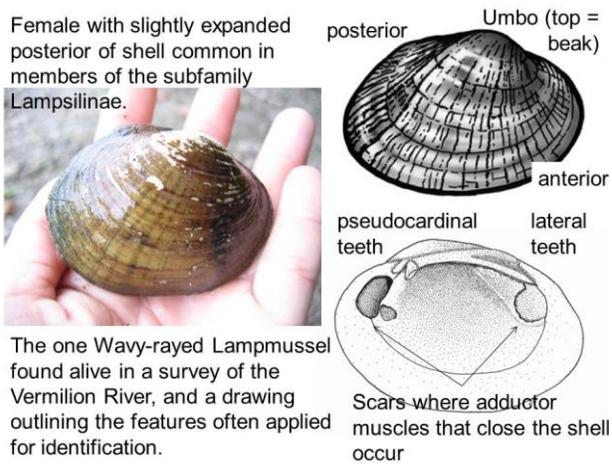


Fig. 5. Photograph of a live animal and contrast to a drawing showing relevant features for identification.

For the species shown in Fig. 5, shell shape is similar to several other species, but the broken pattern of greenish rays on the shell are distinct, especially in a medium sized, but heavy, shell. The Pocketbook can be much larger, juveniles would be a little

rounder, and green rays would be continuous. The rays of the Fat Mucket tend to be broader.

Sexual dimorphism in shells is another challenge, and the drawing of a male to the right of the photograph in Fig. 5., shows how the female possesses an expanded shell posterior typical for females in the Lampsilinae, a subfamily of the Unionidae. A section of the posterior ventral margin of the female unionid shell often is enlarged or inflated to provide space for expansion of the marsupium where the larvae (glochidia) develop. Sometimes those differences can appear greater than the characteristics assigned to tell two species apart. In many other species, shells of males and females are identical.

The following pages are organized alphabetically by genus and species to aid in the identification of all the mussel species in the local region or found living during surveys of Lake Erie in 2010-2013. While common names of species have been used predominantly, contrasts and comparisons in the descriptions tend to relate to species within the same genus making alphabetical organization by Latin binomial necessary.

An index to species and a glossary for the terms encountered are appended at the end of this chapter. Reference to each species may be useful to first become comfortable with this group.

Descriptions are provided to identify the seven species of mussels that were found in Old Woman Creek and all those from the Vermilion and Huron Rivers. Old shells, however, still wash ashore or erode from the banks of the lake, showing past deposits. By comparing any shells, if not too worn, to the description enclosed, an accurate identification should be possible. Questions

can be addressed to the author (r.krebs@csuohio.edu, krebs.r@gmail.com), especially if you believe you found a species not listed for that particular stream. Please bear in mind that this chapter presently describes only the large unionid mussels. Shells of the order Veneroida may occur in the watershed, which include both dreissenid species, the Zebra and Quagga mussels, as well as a diverse fingernail and pea clam assemblage (Sphaeriidae). All of these latter species are less than an inch in length, and they can be smaller than 1/8 inch.

Each species of unionid mussel is described and illustrated on a separate page, with the key identifying features highlighted. Many species may appear similar if you were to observe the 300 or so species in the Unionidae present throughout the U.S. or worse, if you examined all freshwater species known throughout the world. The characters highlighted in the photographs that follow consider only differences among the 30 total species recorded from Lake Erie or its tributaries east of the Maumee River in Ohio.

A standard format for each mussel species is used to make identification easy, or at least as simple as it gets. Since only a handful of species are likely to occur, identification is often easier by reading through the descriptions and examining each picture provided rather than to work through mollusk keys like that in Clark (1981) or Watters (2009).

Provided is a description of the species, habitat and distribution, as well as the current conservation status.

Remember that mussels or their shells may not be collected in the state of Ohio without an approved permit. Even the transport of shells is prohibited to reduce illegal

harvesting for the pearl industry, as beads made from some species of American unionids are used as seeds for cultured pearls. Fortunately, that trade has largely ceased with the saturation of the pearl market by Chinese production.

The following format is used:

Species: Physical description of the species present and comparison to shells similar in form within the watershed.

Habitat: Stream conditions where the species may be expected to be found.

Distribution: Occurrence in the area's watersheds including designation of where the species has been found recently and information on past distributions where known.

Conservation status derives from the Nature Serve Explorer website:
<http://www.natureserve.org/explorer/servlet/NatureServe>

The information used to construct these descriptions derived from several sources in addition to my observations of variation in shell shape and color within the local watersheds:

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1. Elktoe, *Alasmidonta marginata*

Species description:

Alasmidonta marginata is a medium size mussel, reaching up to 4 inches (10cm). It is described as typically greenish with pale green and tan rays and dark flecks. The diagnostic feature, however, is the low, oblique ribs on the dorsal (upper) portion of the shell, which indicates an affinity to *Lasmigona costata*. However, the ribs of the Elktoe are much finer, the dorsal surface is flatter and the shell more inflated. In live individuals, the reddish foot is a second clear indicator of the species identity. The beak sculpture regionally is of very heavy double loops, although this is described also as a few strong, rhomboidal, concentric ridges in some books. Internally, the hinge lacks a lateral tooth and this species has only a weak pseudocardinal tooth that is more pronounced in the left valve than in the right. The nacre tends to be silvery white.

Habitat:

The habitat is sandy mud only of clean, flowing streams of moderate size below riffle/run portions of the stream, and therefore it is described as much rarer in larger rivers. It does not tolerate impoundments.

Distribution:

This species is widespread and occurs in most of the cleaner streams in NE Ohio, but is never very abundant, and in these moderate streams, it usually occurs in the middle reaches. Therefore this species is listed as one of special concern by the State of Ohio.

The species was found living in both the Huron and Vermilion Rivers, usually in the middle reaches in clean undisturbed sites.

Conservation status:

Federal: G4

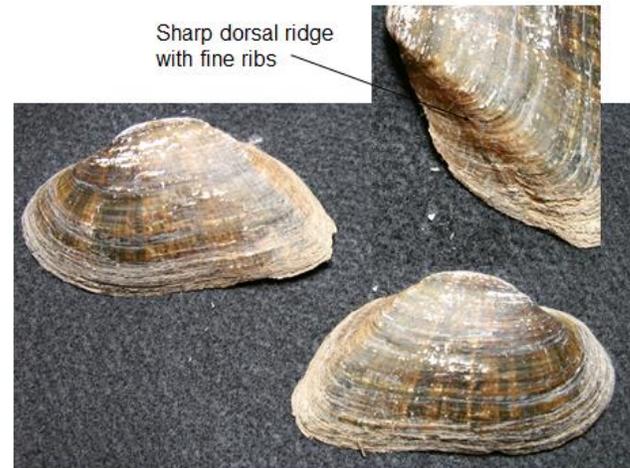
Canada: N3

Ohio: Species of concern

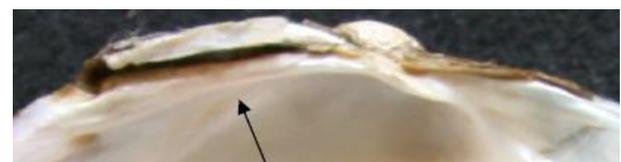
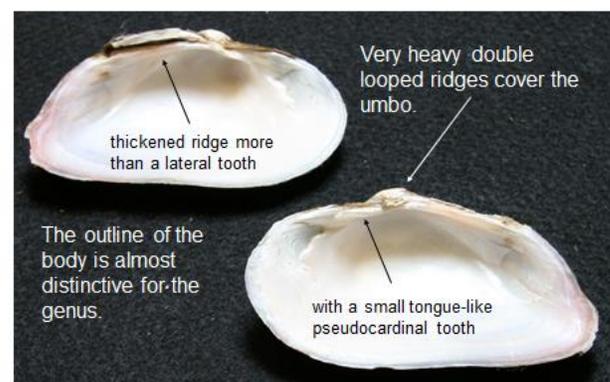
American Fisheries Society Status (AFSS): Special Concern (Jan., 1993)

Fragility: Moderately vulnerable

Fragility Comments: Sensitive to pollution, siltation, habitat loss, impoundment, and loss of fish hosts.



Alasmidonta marginata, the elk toe. This relative of *Lasmigona* looks a little like *L. costata* with the dorsal end pushed in. Rays are common in younger specimens. like this 8.9 cm shell.



Hinge teeth of left valve

2. Slippershell mussel, *Alasmidonta viridis*

Species description:

Alasmidonta viridis is a very small species generally of an inch in length, and not exceeding 1.5 inches (4 cm). Therefore it can be aptly called short and chunky, with the posterior appearing truncate as is representative of the genus. The shell is sculptureless except for growth lines (there are no ridges as in *A. marginata*). The beak is composed of heavy concentric loops, and the shell color varies from yellow-brown to semi-metallic silvery-gray with green or brownish rays. Unlike *A. marginata*, it may have a lateral tooth, the pseudocardinal teeth are short but stocky, and the nacre is silvery white. Due to their size, live specimens are rare, and none were found in recent surveys in the region.

Shells of this species are easily identified. The possibility that some of these individuals may have a weak tooth allow some confusion with a young *Strophitus undulatus*, but that species lacks a pseudocardinal tooth and the beak sculpture is coarse rather than “heavy” = thick.

Habitat:

The shells were typically found high in the watershed and they may occur down into the middle reaches. Believed to burrow into sand or sandy mud, this species is thought to not be visible on the surface. *Alasmidonta* species appear intolerant of impoundments.

Distribution:

Fresh shells recovered: Vermilion and Huron Rivers, primarily in the middle reaches

Conservation status:

This species is widespread in the eastern U.S. and its distribution runs from Lake Huron, St. Clair and Erie, and upper

Mississippi River system, south to Ohio, Cumberland, and Tennessee River systems. Although intolerant of impoundment, it is considered stable throughout most of its range.

Federal: N4

Canada: N3

Ohio: S5 (only state where listed as stable)

American Fisheries Society Status (AFSS):

Special Concern (Jan., 1993)



Small teeth and lateral almost fused with shell margin in the left valve

3. Threeridge, *Amblema plicata*

Species description: *Amblema plicata* can be a large species, up to 6 inches in length (15 cm) with a very heavy shell. While the shape of the species is highly variable, rounded to quadrate, and the shell may be compressed to inflated, the three (sometimes four) ridges that sculpture the shell makes it one of the most recognizable. Specimens from impoundments are described as more inflated and less sculptured, but it has not been found within impounded waters in the region. The classic characteristics are several large, oblique, undulating large ribs, and these can be discontinuous as to appear more like rows of pustules or knobs across the posterior end. They tend not to extend anterior of the umbo. The posterior slope may be extended into a fluted wing. Young individuals can be greenish or yellowish, often devoid of sculpture; older shells are found more often as they seem to persist in the watershed long after the death of the animal. These are brown or black. The beak sculpture is of several double looped ridges. Hinge teeth are massive, thick and may appear flattened; the nacre tends to be white with some blotches of gold or silver, but so few were found in the present survey that local characteristics cannot be provided.

There are no similar species in the Lake Erie watershed. The rarer and even larger *Megalonias nervosa* has more sculptured ribs, and in this species the ribs progress anterior of the umbo. Species of similar size may have large, but less massive hinges than does *Amblema*.

Habitat:

The habitat can be varied, from small streams to lakes and rivers. *Amblema plicata* was one of the most common species in Lake Erie and may persist in the western basin in adjacent wetlands and marshes.

Preferred substrate ranges from muddy sand to cobble.

Distribution: Surprisingly uncommon in the Lake Erie central basin watershed, possibly due to a preference for larger rivers. Likely gone from the Huron and Vermilion Rivers, as well as most rivers to the east where the species had lived in the lower reaches.

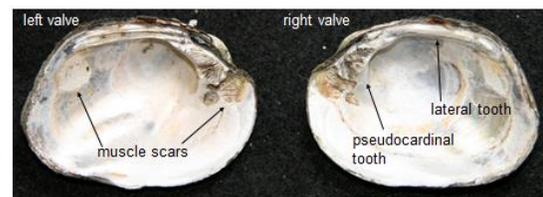
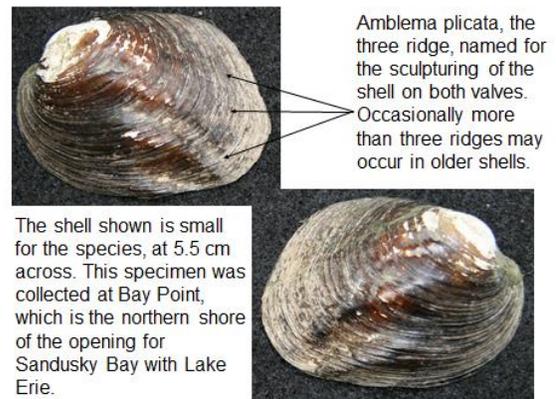
Conservation status:

This species is common and widespread throughout much of the U.S. and Canada.

Federal: N5 Canada: N5

Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



The massive pseudocardinal and lateral hinge teeth connect the two thick valves. The teeth don't project far into each other, appearing relatively flattened. The blotches of gold or silver on a white nacre are not uncommon.



Teeth of left valve

4. Cylindrical Papershell, *Anodontoides ferussacianus*

Species description:

Anodontoides ferussacianus can be small to medium sized, but reaches a maximum of 4 inches (10 cm). The species is elongate with a very inflated shell, which can appear almost round in cross section. This shape is the most diagnostic feature of live specimens, as the shells are sculptureless except for growth lines, and can be yellow, green or brown/dark brown, with or without rays. The beak sculpture is of fine concentric rays, which would be a diagnostic feature if they were not usually worn smooth except in impounded areas. No hinge teeth occur although the shell may be thickened beneath the umbo. The nacre is silvery.

The similar species in the area are *Strophitus undulatus*, which in headwaters can be very difficult to discriminate if the beak sculpture is worn. However, the coarse beak sculpture of the creeper usually doesn't wear down completely. Differences in shape are quantitative with *A. ferussacianus* longer, thinner between dorsal and ventral edges, and generally more inflated than *S. undulatus* on average, but overlap in appearance is common in young specimens. *Pyganodon grandis*, when small, can also be inflated, but it possesses a double looped beak sculpture.

Habitat:

Habitat is usually headwaters but the species can stray downstream to the middle reaches. Individuals can be found buried in fine silt or lying almost exposed on bedrock. This species, and *S. undulatus*, occur higher in the watershed than do any other species, and can be found in stagnating pools.

Distribution:

The species was found locally at Sheldon Marsh and living in both the Huron and Vermilion Rivers, with all records from high in the watershed. Similarly, several were found in Wellington Creek within the Black River watershed.

Conservation status:

This species is wide-ranging in North America and is considered stable throughout much of its range, with some exceptions.

Federal: N5

Canada: N5

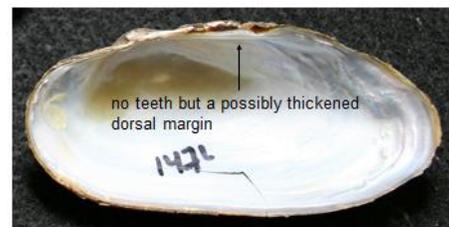
Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Anodontoides ferussacianus
Cylindrical papershell

This species is distinctly inflated to almost round, in this 8.1 cm shell whose length is more than twice the width.



no teeth but a possibly thickened dorsal margin

Look for fine concentric loops, if the shell is not too worn



5. Spike, *Elliptio dilatata*

Species description:

Elliptio dilatata may reach 5 inches (12 m) as an elongate, somewhat cylindrical to compressed shell. Because the species is often twice as long as they are wide, providing the common name, spike, this shell is easy to identify, especially if fresh dead, as the nacre often is purple. However, forms with white nacre also occur, and in Ohio's Grand River similar proportions of purple and white-forms co-occur at the same site. Elsewhere a salmon nacre has been reported. To create a shell of short breadth, the umbos are set low, and they lean anteriorly, while the posterior end draws to a point, or it may be slightly truncated. Outer color is variable, from yellowish to greenish and rayed when young, becoming dark brown to black in older adults. The beak sculpture is of several undulating, concentric coarse ridges, and internally, hinge teeth are well developed, but short.

Habitat:

The habitat of the spike is variable, occurring in lakes and rivers, and in both mud and gravel. When present along mud banks, the species can be locally numerous. The one similar appearing shell in Ohio is that of young *Ligumia recta*, the Black Sandshell, but that species did not occur in surveys of the local watersheds. While the Black Sandshell can have a purple nacre, the Lake Erie form, now gone, did not. All other species exhibiting purple nacre are unmistakable, making a hint of purple in an elongate shell diagnostic for *E. dilatata* in local systems.

Distribution:

Elliptio dilatata is listed as widespread and numerous in the state, but its distribution in the Lake Erie watershed is patchy, as it is missing or rare within the central rivers. The

species was found living and common in the middle reaches of the Huron River; only shells of the species were found in the Vermilion River.

Conservation status:

This species is widespread in the eastern U.S., occurring throughout much of the Mississippi/Ohio River system, and portions of the Great Lakes drainage. It can often be abundant in small areas.

Federal: N5

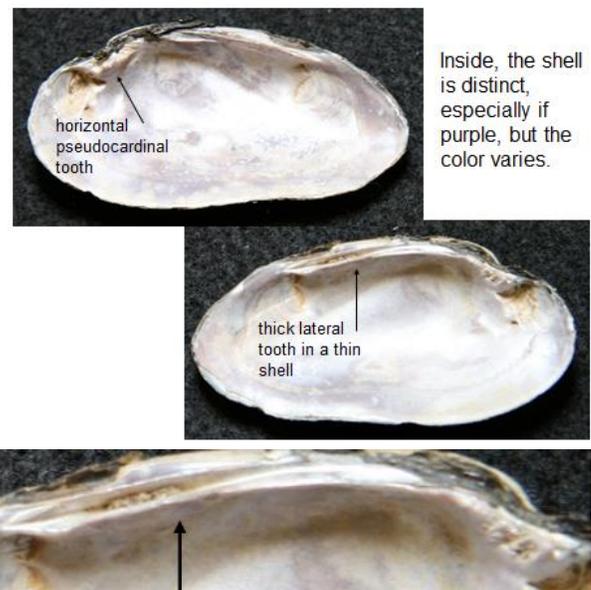
Canada: N5

Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Young specimens may have a sleek black appearance, with shells becoming much thicker and heavier with age



6. Wabash Pigtoe, *Fusconaia flava*

Species description:

Fusconaia flava grows only to about 4 inches (10 cm), and like many mussels, its appearance can be highly variable depending on stream conditions. The shell may range from triangular in flowing water to more round in headwater areas. The best identifying feature is a distinct sulcate shell, giving it a well-defined posterior ridge. The umbo is almost central or a little anterior. The shell is sculptureless except for growth lines, with a tan to dark brown exterior that can occasionally be rayed. The beak sculpture is described as one of concentric ridges, perhaps with small pustules posteriorly. Internally, the hinge teeth are well developed, the beak cavity is deep and narrow, and the nacre is white, rarely salmon in color.

In NE Ohio as elsewhere, the similar *Pleurobema sintoxia* or Round Pigtoe, with the similarity in names attesting to common shell characteristics, may occasionally co-occur. That species tends to be more rounded and a little less inflated in the region, but determining differences may be difficult. At their extremes, the strongly sulcate *F. flava* and the very rounded *P. sintoxia* make determining species presence straightforward, but individuals can overlap in shell shape. A shallower beak is considered a differentiating character.

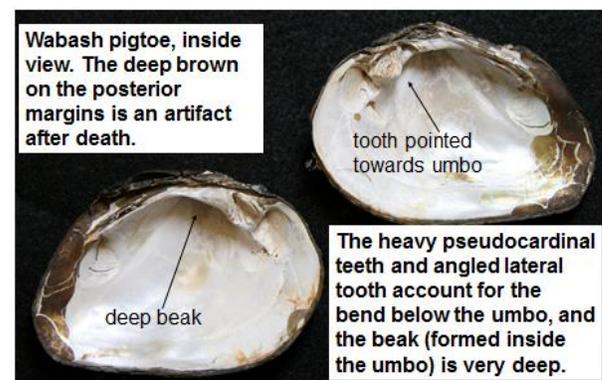
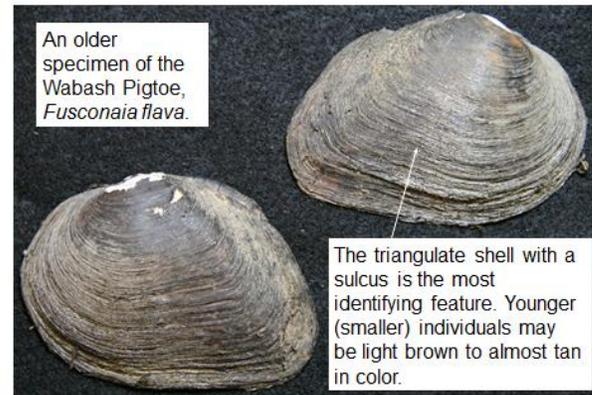
Habitat:

Fusconaia flava is noted as widespread in small creeks to major rivers and lakes. While it may tolerate many substrates, its abundance is often highest in smaller streams.

Distribution:

Fusconaia flava is probably extirpated from both the Huron and Vermilion Rivers, as

only a single worn valve was found in the East Branch Huron River, but it remains the most common species in the East Branch Black River (one watershed east of the Vermilion).



Teeth of left valve

Conservation status:

Widely distributed along the entire Mississippi drainage and includes Alabama. In Canada, it occurs in the Lake Huron-Lake Erie drainage basins of Ontario, and in the Red River system of Manitoba.

Federal: N5 Ohio: S5

Canada: N4

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)

7. Plain Pocketbook, *Lampsilis cardium*

Species description:

Lampsilis cardium (also called *Lampsilis ventricosa*) is probably synonymous with or is very closely related to *Lampsilis ovata*. Whatever the name, *L. cardium* is one of the larger species present in the Lake Erie watershed and can reach 6 inches (15 cm), with a sexually dimorphic shell typical in Lampsilines (a subfamily of the Unionidae). The shell is oval, inflated, and has a rounded, convex or straight dorsal ridge, or even concave in old Lake Erie specimens, which remain common. Umbos are prominent above the dorsal margin. The male is more rounded and the posterior is pointed bluntly and also expanded in females, sometimes giving the impression that you have found two different species. The shell has only growth lines, and the color tends towards tan or yellowish, with green rays (especially when young). The beak sculpture is of double loops becoming parallel ridges. Internally, the hinge teeth are well developed, the nacre is white, but sometimes a little pink.

Lampsilis siliquoidea (*L. radiata luteola*) is more elongate for a shell of similar size, its umbos are lower, and because it doesn't grow as large as *L. cardium*, large *L. siliquoidea* shells tend to be much thicker. *Actinonaias ligamentina* (Mucket) is a second confounding species, but is more oval, its umbos are almost flush with the dorsal ridge, and it now occurs regionally only in Ohio's Grand River, where Muckets are common.

The sight of the mantle lure on this species is spectacular, mimicking a small fish that undulates in the water to attract a host fish usually of a bass species, for larval release. On contact, a small bright yellow packet is released that breaks apart if touched, releasing glochidia to the gills.

Habitat:

The habitat is described as widespread from creeks to rivers, usually in sandy mud in quiet to moving water. Regionally it also associates with gravel and cobble habitat in lower stretches of rivers.

Distribution:

Lampsilis cardium occurs throughout the Vermilion and Huron Rivers, with shells so high up in streams that water depth was not much greater than the width of the mussels.

Lampsilis cardium, the plain pocketbook



Rays may vary on the left (above) and right valves (below)

Irritants lodged between a mussel and its shell induce the deposition of nacre that can form attractive freshwater pearls or just thick masses inside the shell. The lower valve displays a normal appearance.



Teeth of the left valve

Conservation status:

Upper Mississippi River drainage, the Great Lakes- St. Lawrence system and into central Canada;

Federal: N5 Ohio: S5

Canada: N5

American Fisheries Society Status (AFSS):
Special Concern (Jan., 1993)

IUCN Red List Category: NT - Near threatened citing declining abundance, especially in its southern distribution.

8. Wavy-rayed Lampmussel, *Lampsilis fasciola*

Species description:

Lampsilis fasciola is only small to medium sized, reaching a maximum of 4 inches (10 cm), but the shell is heavy for its size, oval and inflated. The umbos are very low. Like in other lampsilines, sexual dimorphism is present, but less extreme; females are only a little more rounded posteriorly than are males. There is no sculpture to the shell. As the name implies, the clear and diagnostic feature is the fine wavy green rays on a yellowish background, and the shell may seem polished. Examined closely, these rays may appear broken and uneven rather than continuous. The beak presents coarse double looped ridges. Interiorly, the hinge teeth and lateral tooth are well developed; the nacre is white.

The only similar species in the watershed is the more common *Lampsilis cardium*, which tends to be much larger, have higher umbos, is more rounded, possesses a heavier hinge, and if present, rays are broad and straight.

Habitat:

The habitat for *Lampsilis fasciola* is that of good quality streams, as its presence is documented only for a few rivers regionally, like Ohio's Grand River. This species is seldom common in Ohio.

Distribution:

A single live specimen was photographed by Erin Steiner in the Vermilion River (Tevesz and Krebs, 2008). Clarke (1981) cites the range of this species as the Great Lakes drainage in the tributaries of Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie, and the Ohio-Mississippi drainage south to Tennessee.

Conservation status:

Federal: N5

Canada: N1

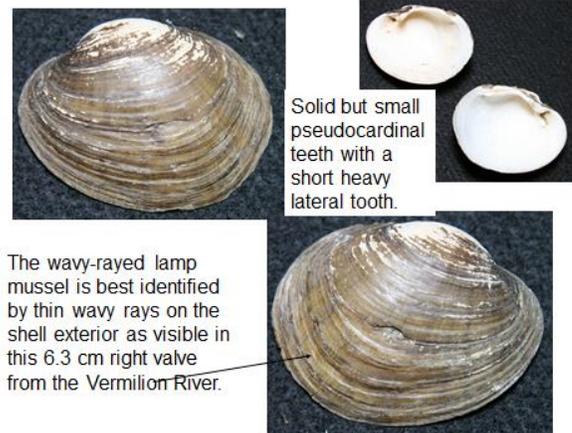
Ohio: S3 species of concern

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)

Committee on the Status of Endangered
Wildlife in Canada (COSEWIC):

Endangered (Oct., 1999)

Threats: Sedimentation from urban projects, loss of habitat through clearing of riparian vegetation and livestock access to waterways, industrial and municipal outfalls, zebra mussel impacts.



Short teeth of the left valve

9. Fat Mucket, *Lampsilis siliquoidea* often called *Lampsilis radiata luteola* in Ohio.

Species description:

Lampsilis siliquoidea is another medium sized mussel, but it can approach 5 inches (12 cm) in length. Fat Muckets can be moderately to greatly inflated, with the female much more so posteriorly than are the males, which may taper to a blunt point. This extreme difference also can give the appearance of separate species for males and females. Furthermore, the shell can be quite variable in color and shape but always with a low umbo. Hinge teeth are very well developed, but small for a shell of its size. The beak sculpture is of numerous fine to coarse, double looped lines. The nacre is white, possibly iridescent posteriorly. Shell color can range from yellow to greenish to tan, sometimes with very thick green rays, especially in younger specimens. The lateral tooth is almost completely straight.

Where this species overlaps with *Lampsilis cardium*, some care is required to keep them separate, although *L. siliquoidea* is never as large as *L. cardium* can be, and *L. siliquoidea* tends to be both longer and thicker for a shell of the same linear size, and the lateral tooth does not curve. Small specimens may overlap with *Villosa iris* (which shares similarity in the small hinge tooth and sexual dimorphism, which makes males similar, but *Villosa* varies in body shape and in NE Ohio, the rays in *Villosa* are always more pronounced in the posterior, while the rays of *L. radiata luteola* are more even across the shell.

This species, like *L. cardium*, expresses a modified mantle as a darter mimic when ready to release glochidia, although the display is less detailed than in *L. cardium*.

Habitat:

Lampsilis siliquoidea was the most common species in Lake Erie, it is often the most common species in a river of mid to small size, and is found in almost every flowing stream of NE Ohio that supports mussels. However, it tends to be replaced by *L. cardium* as the habitat becomes more dominated by cobble than mud/sand.

Distribution:

This species is numerous in both the Huron and Vermilion Rivers, but tends not to extend down into the estuaries.

Conservation status:

This species is extremely wide ranging and is stable and secure throughout its range.

Federal: N5 Ohio: S5

Canada: N5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



The fat mucket is known for sexual dimorphism, where females, especially older females, are greatly inflated posteriorly and they expand dorsal-ventrally.

The shell of this old female (9.75 cm across), which is very thick, came from the Vermilion R.



Small pseudocardinal teeth in the left valve.

10. White Heelsplitter, *Lasmigona complanata*

Species description:

Lasmigona complanata produces a large, rounded, flat shell that can be up to 6 inches (15 cm) across. This size and shape make it an easy species to identify as the shell can also possess a substantial dorsal wing. Multiple ridges usually extend up this wing.

If the shell has a short wing, the ridges still tend to occur along the dorsal margin, similar to the Fluted Shell, *Lasmigona costata*, but that species is much more elongate, meaning that it tends to be much longer than it is wide, and the ridges extend down the side of the shell. The hinge tooth in *L. complanata* is massive and the nacre is always white.

Habitat:

The habitat of the White Heelsplitter is very broad, ranging from medium sized rivers up to small tributaries, which is unexpected for so large a species. Generally, individuals live in slower water in sandy mud, and its potential tolerance of pollution, at least as an adult, may explain its presence around impoundments, even in the lower reaches of the Black River.

Distribution:

The distribution of *L. complanata* is restricted locally. It occurred only in the lower mainstem of the Huron River below the confluence of the east and west branches, while in the Vermilion River, the species was found only in a small section of the middle reaches downstream of Wakeman. The species also occurs in the mouths of small tributaries close to the lake.

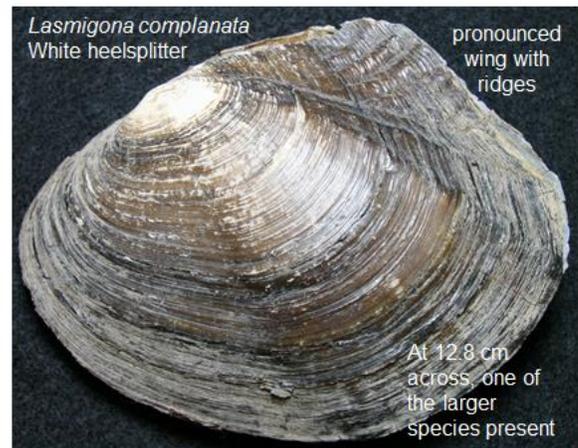
Conservation status:

This species is widely distributed throughout the entire Mississippi River drainage

including the middle Great Lakes-St. Lawrence River system and tributaries of Lake Michigan, Lake St. Clair, and Lake Erie.

Federal: N5
Canada: N5
Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Teeth of the left valve

11. Creek Heelsplitter, *Lasmigona compressa*

Species description:

Lasmigona compressa grows to about 4 inches (10 cm) and can be elongate, but at other times more oval in shape. The most pronounced feature of this species is that it can be very compressed, providing its common name. The posterior slope may form a small wing but with no sculpture, and the wing rises barely above the umbo if present at all. Although Watters (1995) describes a broad, very low rib or swelling emanating from the umbo to the posterior margin, this feature is difficult to identify in small individuals, and the green and black rays, also commonly expected, are not common in the NE Ohio region. This makes identification of this species from the exterior alone sometimes difficult. The beak sculpture is of heavy double loops. Fresh shells are more easily identified by tongue-like hinge teeth, often appearing as just one per valve laid out lengthwise, and lateral teeth are present.

The only similar species to *L. compressa* is *Lasmigona costata*, but the latter has the ridges (costa) emanating down the posterior margin (except in some specimens of the Chagrin River), which can sometimes be felt more easily than seen. Internally the teeth are very different, with the cardinal teeth of *L. costata* much heavier while lateral teeth are slight if present.

Habitat:

While considered a species of headwaters, *L. compressa* can be found as an occasional inhabitant throughout the small watersheds of NE Ohio, but never abundantly or with many individuals in any one site. Thus it is listed as a species of concern based on declining abundance. Reports suggest that *L. compressa* should occur in sandy mud with good current, but stray shells can be found

even near more lacustrine conditions. Clean water is required.

Distribution:

Lasmigona compressa was found alive but not commonly so along the length of both the Huron and Vermilion Rivers.

Conservation status:

This is a wide ranging species that is stable in most areas except at the edges of its range.

Federal: N5 Ohio: S3 species of

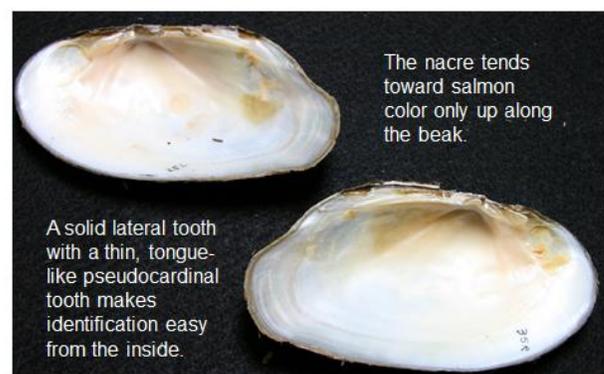
Canada: N5 concern

American Fisheries Society Status (AFSS):

Currently Stable (Jan., 1993)



This non-descript shell is often easiest to identify for what it lacks, no costates on the posterior dorsal margin in a thin (not inflated) shell. This is a large specimen for this mid-sized species at 11.3 cm long.



Teeth of the left valve

12. Fluted-Shell, *Lasmigona costata*

Species description:

Lasmigona costata is listed as approaching 5 inches (12 cm) in length, but some specimens will exceed this length, and on average, specimens are much larger than for *Lasmigona compressa*. The shells of older individuals can be very thick and heavy, even widening between the dorsal and ventral margins. Across all ages (sizes), individuals are elongate and sometimes compressed, and the shells usually have undulating ribs (washboard like costates) on the posterior dorsal slope. The shell can be rayed with green or brown but not commonly so in Northern Ohio. Beak sculpture is of several concentric ridges that may be wavy. The hinge teeth are pronounced, with a tongue like single tooth in the left valve that fits between a pair of smaller teeth in the right valve. There is no lateral tooth, but a thickened shell margin occurs. The nacre is white, often tinged with salmon towards the beak cavity.

If costates are present, the species is unmistakable. Only *Lasmigona complanata* in this region has similar costates and that species is round to oval rather than elongate. However, costates may be subtle in some individuals, particularly in the Chagrin River. If algae are washed away from the posterior and you run your fingers across the shell, you should be able to feel their presence. If uncertain, which is more likely in a worn shell, *Lasmigona compressa* has a lateral tooth and only one pronounced cardinal tooth on each valve.

Habitat:

Lasmigona costata is known from all larger NE Ohio streams, and it may be moderately common. The species may occur from the river mouth to high up in the headwaters. The species is found in soft mud to rocky riffle areas.

Distribution:

Lasmigona costata is widely dispersed regionally and restricted perhaps only from silty areas. The species is found throughout the middle reaches of the Vermilion River, and is abundant in the West Branch Huron River

Conservation status:

This species is found throughout most of the Mississippi River system, some of the southern and western tributaries of the Great Lakes, and into Canada.

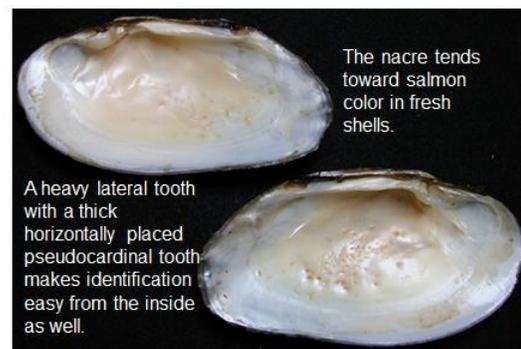
Federal: N5 Ohio: S4

Canada: N5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



This shell was photographed wet to bring out the broad rays that persist in younger specimens. Even at 13.4 cm long, this is not a large shell for this species.



Teeth of the left valve

13. Fragile Papershell, *Leptodea fragilis*

Species description:

Leptodea fragilis is a medium sized species that can reach 6 inches (15 cm) but usually is not over 4 inches. It is easily recognized as the thinnest shelled of the species that produce a posterior wing. The color is also distinctive, as its compressed shell is usually yellowish, darkening towards the umbo and with age. The hinge and teeth are weakly developed. A thin lateral tooth only is apparent, while all other winged shells have pronounced pseudocardinal hinge teeth, or no teeth (*P. grandis*, which is rarely winged). The nacre can be white or yellowish, but a hint of light purple under the umbo and lateral tooth is diagnostic even in shell fragments.

The only similar species in NE Ohio is *Potamilus alatus*, which has a heavier, dark colored shell, and that species possesses a small but well developed pseudocardinal tooth. *Lasmigona complanata* has ridges (costates) along the wing.

Habitat:

Leptodea fragilis likes muddy gravel and moves around more than most, leaving wide tracks in the substrate. While it can live far upstream, you do not find it above the first dam in each river. The spatial restriction probably arises because the dams exclude the host fish, freshwater drum, which is a bottom feeder.

Distribution:

The distribution of *Leptodea fragilis* was restricted locally to the lower mainstem of the Huron River below the confluence of the east and west branches, while in the Vermilion River, the species was found only in a small section of the middle reaches downstream of Wakeman (the site of a large dam). It also lives in Old Woman Creek but

was rare. This species apparently is returning to Lake Erie, especially the western basin, and spreading eastward and has reached Edgewater Park, along the Cleveland Shoreline.

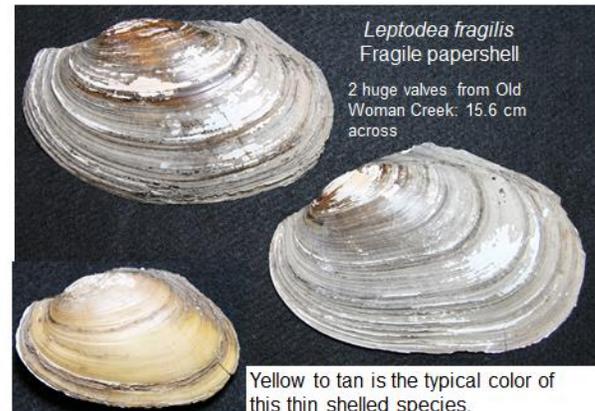
Conservation status:

This species has a very large range throughout the entire Mississippi River drainage into the Gulf of Mexico and Great Lakes and St. Lawrence River system. It is secure throughout its range.

Federal: N5 Ohio: S5

Canada: N4

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Teeth of left valve of the male, above.

14. Black Sandshell, *Ligumia recta*

Ligumia recta can possess a huge shell up to 10 inches (25 cm) in length, making large specimens of this species unmistakable. Shells are elongate and can be inflated to almost cylindrical. The color, which can be yellow to green with rays in juveniles, becomes almost black in larger specimens. Hinge teeth are well developed, and the pseudocardinal tooth is triangular in shape. The nacre listed as white, pink or purple, but in NE Ohio, only specimens with white nacre have been found.

Males can be similar to *Elliptio dilatata*, but that shell tends to be less shiny, less distinctly rayed, and the beak sculpture is more trapezoidal. That some individuals of the Black Sandshell can be huge makes a good indicator of whether both species are present. If all specimens are small to mid sized and many are purple, the species present may more likely be *E. dilatata*. Errors when identifying small individuals are possible as a pinkish or light purple nacre in *Ligumia recta* is possible.

Habitat:

A large stream species in sandy mud to gravel.

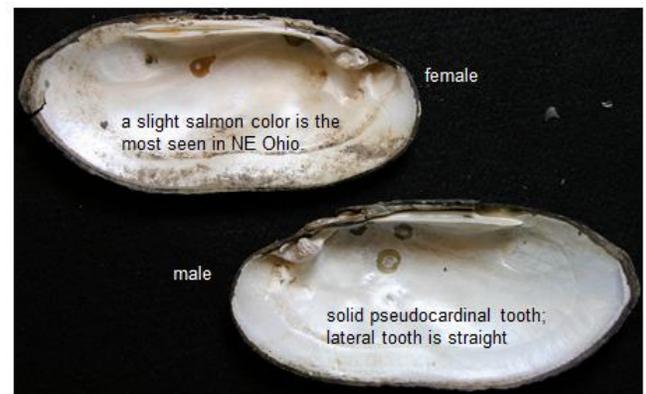
Distribution:

In NE Ohio the species appears restricted to Ohio's Grand River, where the nacre is white in all specimens found, but worn shells still can be found within Lake Erie estuaries and on beaches.

Conservation status:

This species is widespread in eastern and central U.S. and Canada, occurring from the Great Lakes basin south into Mississippi River drainage to Louisiana and in some Gulf Coast drainages with some declines throughout its range.

Federal: N4N5
 Canada: N4
 Ohio: S2 threatened
 American Fisheries Society Status (AFSS):
 Special Concern (01Jan1993)
 IUCN Red List Category: NT - Near
 threatened



Teeth of left valve



Teeth of right valve

15. Eastern Pondmussel, *Ligumia nasuta*

Species description:

Ligumia nasuta is a small species, elongated and not high, reaching a length of no more than 10 cm (4 inches). The species is elliptical in shape with the posterior end of the shell usually pointed (males) or rounded (some females), and moderately compressed. A posterior ridge along the shell is well marked. The color can be olive green, to brown or blackish, the latter characterizing the color in the upper Cuyahoga River. The nacre is reported as purple to salmon or silvery white with possible yellow suffusions. The umbo barely rises above the shell margin, but that is enough to separate the species from darkened *Utterbackia imbecillus*. The beak sculpture, often worn, is of fine double looped lines. The lateral tooth is strong, but narrow, and mainly straight, while the pseudocardinal tooth is small, erect and compressed. Some similarity exists with *Ligumia recta*, but that species has much heavier pseudocardinals, it does not form a point on the posterior end (*L. nasuta* males only), and can be much larger and heavier.

Habitat:

Still water of good quality, lakes, ponds or backwaters of rivers, in mud or sand.

Distribution:

Although once one of the more common species in Lake Erie, only one live specimen was found in coastal surveys. Shells along the shore are therefore, still common. The last viable population known in NE Ohio is in the Upper Cuyahoga River.

Conservation status:

The distribution is limited and the population in the Cuyahoga may be declining.

Federal: N4

Canada: N1

Ohio: S1 endangered

American Fisheries Society Status (AFSS):
Special Concern (01Jan1993)

IUCN Red List Category: NT - Near threatened



Small pseudocardinal plus lateral of the left valve

The above shells derive from the Upper Cuyahoga River, the only currently known population left in Ohio, but even there, live specimens are not common.

16. Three-horn Wartyback, *Obliquaria reflexa*

Species description:

Obliquaria reflexa is one of the most recognizable species in the family, even in old worn shells. This small but heavy species can reach 3 inches (7.5 cm) in length, but is usually no more than 2 inches. Two to five large nodules (usually 2 or 3) adorn each valve; their nodules are thick projections often wider than they are tall projecting from the more anterior of two ridges extending from the umbo, with a slight furrow in between. The distinct feature is that the nodules are in alternate positions on the left and right valves, producing a clear asymmetry to the shell. The color may be yellow brown to greenish brown with green rays that may be broken, especially in younger individuals. The nacre is white, but is described as possibly iridescent posteriorly and tinged pink or blue. Hinge teeth are thick and perhaps stumpy with deep serrations, 1 in the right valve, two in the left. Lateral teeth are well developed and almost straight, but short. The alternating nodules on the outside of the shell are sufficient for identification.

Habitat:

Reported to like gravel, sand and mud. I found live individuals only in coarse sand in the Toussaint Creek mouth.

Distribution:

This species lives in large rivers and Lake Erie, and while composing only 10 individuals in the recent Lake Erie survey, I have found the occasional fresh shell washed ashore at several locations along the western basin and even Middle Bass Island, suggesting that it persists at low density in the open lake. The one recently identified population is within the mouth of Toussaint

Creek, perhaps the best estuarial habitat for mussels in the region due its size and absence of dredging.

Conservation status:

The distribution is limited and the population in the Cuyahoga may be declining.

Federal: N5 Ohio: S2

Canada: N1

American Fisheries Society Status (AFSS):

Currently stable (01Jan1993)



Heavy teeth of the left valve

17. Round Hickorynut, *Obovaria subrotunda*

Species description:

Obovaria subrotunda is a smaller species, which at 3 inches (7 cm) maximum, can be hard to find if rare. The mussel is round, inflated with no sulcus, and the centrally placed umbos are distinctive for shells in this region. The shell is profoundly plain, but is easily identified as a thick shell with low umbos, and a color that is dark brown, but usually lighter to the posterior, giving the shell a diagnostic two-tone appearance. The beak sculpture has coarse concentric ridges pointed posteriorly, and the hinge and teeth are well developed. The pseudocardinal teeth, which are large but not massive, align vertically. The nacre is white, occasionally rose or salmon, and it is iridescent posteriorly.

The most similar species is *Obovaria olivaria*, if working with worn shells, but that species is larger, more oval, the umbos face forward and the pseudocardinal teeth align horizontally, and most importantly, it has been lost from the region.

Habitat:

The Round Hickorynut occurs in clean streams and rivers, reportedly between medium sized headwaters to larger streams. That it was once present in Lake Erie may explain the occurrence of shells in the lower stretches of rivers.

Distribution:

Obovaria subrotunda was not found alive in the present survey or in the recent survey of Lake Erie coast areas, but the Ohio State University of Biological Diversity holds two specimens collected from the Vermilion River in 1957. I have a few shells along beaches in the western basin and live

populations in tributaries of Ohio's Grand River.

Conservation status:

This is a wide-ranging species that is starting to disappear from many areas; declines are particularly evident in last remaining population in Canada (Lake St. Clair) and other Great Lakes localities.

Federal: N4

Canada: N1

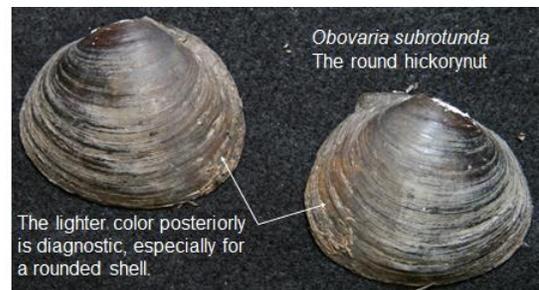
Ohio: S4

American Fisheries Society Status (AFSS):
Special Concern (Jan., 1993)

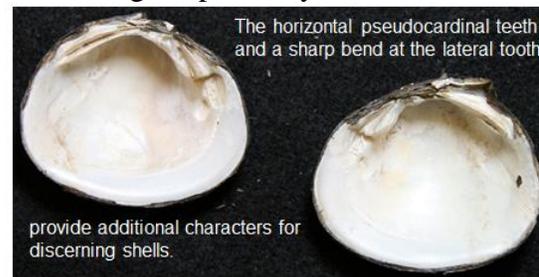
Committee on the Status of Endangered
Wildlife in Canada (COSEWIC):

Endangered (May, 2003)

IUCN Red List Category: NT - Near
threatened



These two small shells measure only 1.8 and 1.9 cm long, respectively.



Teeth of the left valve

18. Round Pigtoe, *Pleurobema sintoxia*

Species description:

Pleurobema sintoxia is a medium sized species that can exceed 4 inches (10 cm), but its variable shape in response to stream conditions can make it one of the tougher species to identify. Shells tend to be rounded and compressed in slow water and lakes, or where headwaters cut into the banks forming linear “ponds,” but the shells become more inflated and triangular in larger streams. The umbos are central in rounded specimens, but they lean anteriorly (often at a pronounced level) in the oval ones. These oval forms can also be slightly sulcate. The shell is sculptureless except for a low posterior ridge in inflated specimens, although the beak is sculptured with a few pustules along the posterior ridge. The hinge and teeth are well developed, the beak cavity is open and shallow, and the nacre can also be variable, ranging from white to salmon, pink or rose.

Confusion can occur between this species and *Fusconaia flava*, especially with respect to the river forms. *Fusconaia flava* is never as rounded, and tends to be more inflated and therefore more sulcate in rivers. The limited overlap in the extant distributions within the Lake Erie watershed reduces the opportunity for confusion.

Habitat:

Pleurobema sintoxia can be widespread from streams to rivers, but tends not to extend its distribution far into the headwaters and is rarely common. It usually occurs in sandy mud or sand in streams of good current.

Distribution:

Pleurobema sintoxia is a rare species in local rivers. Only a single live specimen was found in surveys of the Vermilion and

Huron Rivers, although shells in the middle reaches were not uncommon.

Conservation status:

The large river populations have become increasingly rare. Distribution is greatly fragmented but remains relatively wide. Long-term viability of most populations is questionable, especially those in large rivers where zebra mussel populations are now established.

Federal: N4N5

Canada: N1N2

Ohio: S3 species of concern

American Fisheries Society Status (AFSS):

Currently Stable (Jan., 1993)

Committee on the Status of Endangered Wildlife in Canada (COSEWIC):

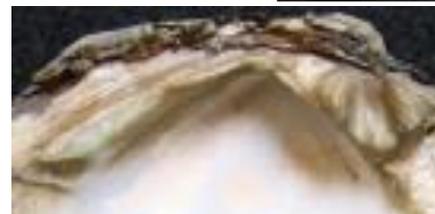
Endangered (May, 2004)

Environmental Specificity Comments: This species is somewhat sensitive to pollution, siltation, habitat perturbation, inundation, and loss of glochidial hosts.



Pleurobema sintoxia
Round pigtoe

At left is an uncommonly large specimen, 9.7 cm across from the Blanchard R. and another at 6.1 cm. Both show just a hint of a sulcus, heavy teeth, angled to create a round shell.



Teeth of the left valve

19. Pink Heelsplitter, *Potamilus alatus*

Species description:

Potamilus alatus, the pink heelsplitter, is one of the largest species in the region, with shells reaching 8 inches (20 cm) across. When collected from slow water, shells have a pronounced dorsal wing that remains present in the species unless it inhabits swift current. Sculptureless except for growth lines, adults of this species are easily identified by the rounded (female) to elliptical (male) shape of the compressed shell, and the shell is almost uniformly black or dark brown. Juveniles can be greenish with broad, dark rays. The beak sculpture is of a few concentric lines. Hinge and teeth are moderately well developed, although the pseudocardinal tooth is small for a shell of this size. The nacre is a uniform purple.

The only similar species is *Leptodea fragilis*, which has a lighter colored, thinner shell and nacre only flushed with purple under the umbos.

Habitat:

The pink heelsplitter is considered to be associated with rivers, lakes and large streams, in mud and gravel of both quiet and flowing water. It probably inhabited the lower reaches of all of the rivers up to the first dam, as like the other species whose host fish is the freshwater drum, it tends not to move above even low-head dams. Poor water quality may have eliminated *P. alatus* from the mouths of some of the regions streams.

Distribution:

Like *Leptodea fragilis*, and other species whose host fish is freshwater drum, the distribution of *Potamilus alatus* is restricted locally. It occurred only in the lower main stem of the Huron River below the confluence of the east and west branches,

while in the Vermilion River, the species was found only in a small section of the middle reaches downstream of Wakeman (the site of a large dam).

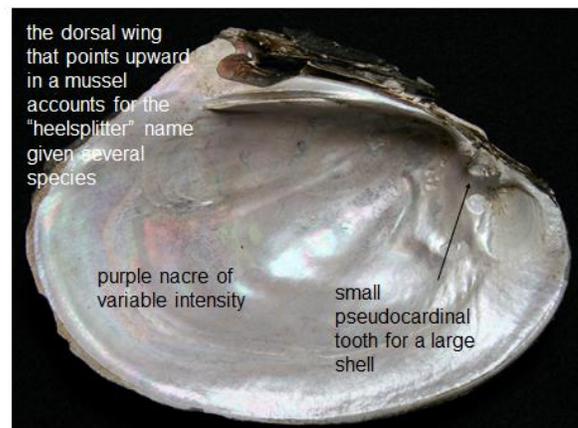
Conservation status:

This species is widespread throughout central North America and is considered stable and secure throughout its range.

Federal: N5 Ohio: S5

Canada: N3

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Teeth of the left valve

20. Kidneyshell, *Ptychobranthus fasciolaris*

Species description:

Ptychobranthus fasciolaris, or the Kidneyshell, is a solid, flattened species that can reach 6 inches (15 cm), but tends to be smaller in the region. The species is somewhat compressed, or flattened, with anterior umbos and often a humped appearance. The shell is sculptureless except for growth lines. The color can be the most recognizable feature, as the shell is yellowish to tan with distinct, interrupted green rays, perhaps appearing as blotches. No other species is similar. The beak sculpture is of fine concentric ridges, with round nodules posteriorly. The hinge and teeth are well developed, massive relative to the size of the shell, and the arch formed by the hinge and heavy curved lateral tooth is distinctive. The nacre is white. Females may have low undulations down the center of the shell giving it the kidney shape.

While the arch in the lateral tooth and color cannot be confused with any other species in the region, small live specimens may be confused with *Villosa iris*. That species has a finer hinge, a V-shaped beak sculpture, and most importantly, rays that tend to be more pronounced posteriorly. The rays of the kidneyshell tend to be stronger in the center of the shell and fade both anteriorly and posteriorly. Internally the teeth of *V. iris* are more delicate.

Habitat:

The Kidneyshell inhabits good quality streams and small rivers, preferring muddy sand and gravel in moving water. It is widespread but sporadic in occurrence.

Distribution:

While shells of this species were not uncommon in the middle reaches of both the Vermilion and Huron Rivers, only two live

individuals were observed from the Vermilion.

Conservation status:

A wide range throughout Mississippi River system, including the Ohio, Tennessee, and Cumberland Rivers but has declined in Ohio and significantly so in Canada.

Federal: N4N5

Canada: N1

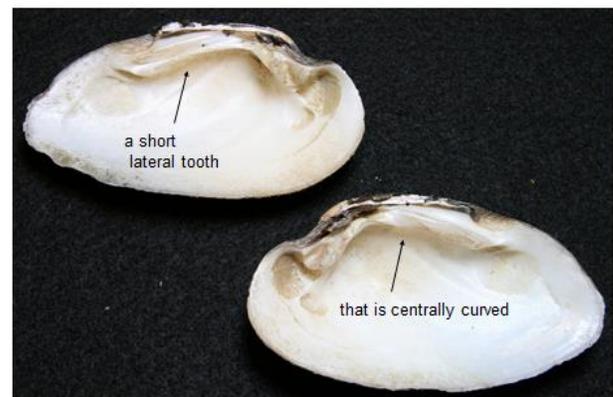
Ohio: S3

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)

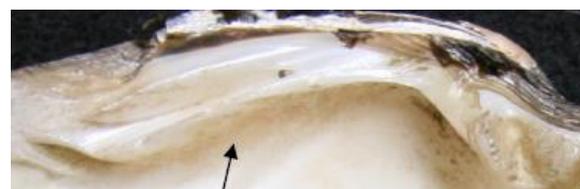
COSEWIC: Endangered (May, 2003)



Exteriorly, the dark green band more pronounced in the middle of a medium sized (9.7 cm shown here), but heavy, shell gives this species away.



The thickness and weight of the kidneyshell is distinctive.



Thick teeth of the left valve

21. Giant Floater, *Pyganodon grandis*

Species description:

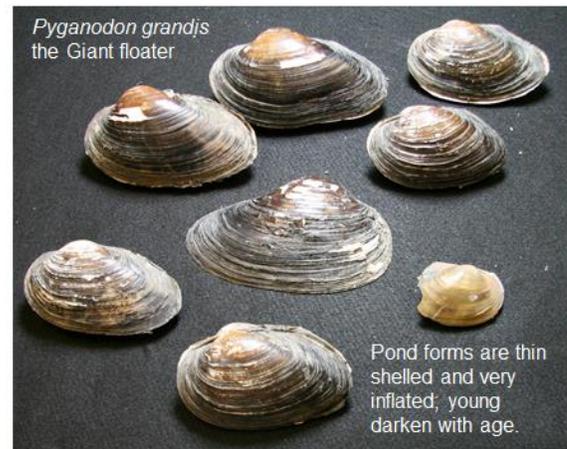
Pyganodon grandis is a common species that ranges in size from small to immense, with length listed up to 6 inches (15 cm). The species is amazingly variable and phenotypically plastic, as shell thickness, color and shape vary by habitat. The shell is generally thin when growth is fast, and rarely possesses faint greenish or brown rays. I have seen only one or two specimens showing even a hint of rays in hundreds of individuals in NE Ohio. The shell is sculptureless except for growth lines and even these may be thin and far apart. Internally, the hinge is devoid of teeth and is barely even thickened, which is a key character for quickly identifying empty shells. The nacre is variable, being white, yellow, pink, copper, or iridescent. Individuals from lacustrine habitats, and slow moving areas of streams are very inflated, while individuals from faster moving streams can be solid and even possess a posterior notch along the ventral margin. The most identifying feature, other than the lack of shell structure, is a medium strength double loop beak structure that resembles a broadened McDonald's "M". This feature usually is visible, because the species is rare in fast moving water. River forms may be less inflated and simply look unusually stout, suggesting that live *P. grandis* may be best identified by possessing none of the characteristics of the other species listed for a particular stream. Because shells are light, they may be one of the few species washed a significant way downstream, appearing below dams, spillways and in shallow headwaters where live individuals are not found.

Similar species to large specimens do not occur. To differentiate smaller individuals, look at the umbo and its position above the

dorsal margin. The umbo of *Utterbackia imbecillis* is flush with the shell margin. *Strophitus undulatus* and *Anodontoidea ferussacianus* can be more similar to smaller specimens especially if *S. undulatus* lacks rays, but that species has coarse concentric beak sculpturing, while in *Anodontoidea*, the shell is more cylindrical and the beak has fine concentric loops. Also in *S. undulatus*, the umbo leans posteriorly, creating a slight S-shape to the dorsal shell margin.

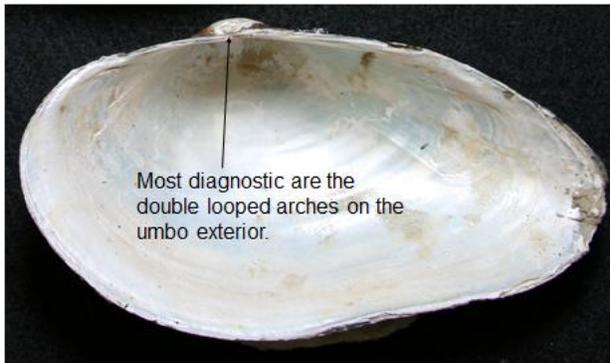
Habitat:

The species is rarely common in flowing rivers, but may be dense in ponds and lakes or canals, even where the streams that emanate from the ponds are quite small. In rivers, look along back-washes and other quiet spots. The species is fairly tolerant of impoundment.



Distribution:

Live individuals of *Pyganodon grandis* were common throughout the middle reaches of the Vermilion and Huron Rivers. Shells were scattered even outside of this range. In Old Woman Creek, adults were common in the stream bed and numerous young were found throughout the shallow estuary.



There are no teeth and the dorsal margin is gently curved and barely thickened.



Double loop "m" on beak

Conservation status:

This species is widespread and common in North America and can tolerate a much wider range of habitats than many other unionids.

Federal: N5

Canada: N5

Ohio: S5

American Fisheries Society Status (AFSS):

Currently Stable (Jan., 1993)

22. Wartyback, *Quadrula pustulosa*

Species description:

Quadrula pustulosa generally is medium sized, reaching 4 inches (10 cm), but the shells found in the region tend to be no more than 2 inches in diameter and height, and are heavy for their size. The shells can appear almost rounded except for curved angles along the posterior margins of the shell. The shell is moderately compressed with a variable surface sculpture usually of numerous irregular pustules progressing from the umbo. These features can vary in covering most of the central part of the shell to very few present and even absent. They are not arranged in two rows, nor does there tend to be furrow down the center of the shell. Most shells found locally are old and worn, with pustules appearing almost as scars on the shell. When fresh, the color may be a yellowish brown and greenish rays can occur on young individuals. The nacre is white. Hinge teeth are heavy, serrated in fresh shells, with a large tooth in the right valve and two small projections on either side; the left valve has a pair of pseudocardinal teeth. The lateral teeth are almost continuous with the pseudocardinals and, short and a little curved.

Habitat:

Quadrula postula is described as present in rivers of various sizes and gravel, sand or mud.

Distribution:

Once common in the region, the species appears now to be limited to the far western parts of Lake Erie and the Maumee River. Host fish are diverse and include Catfish, as does *Q. quadrula*, so the cause for the almost complete displacement of *Q. pustulosa* by *Q. quadrula* is not known.

Quadrula pustulosa has not been found alive in the area around Old Woman Creek for a while, but older shells like those pictured below from beaches along the western basin can be found.

Conservation status:

The range includes the entire Mississippi River drainage, from New York and Pennsylvania west to the Dakotas, eastern Texas, Louisiana and Alabama

Federal: N5 Ohio: S5

Canada: N3

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Teeth of the left valve

23. Mapleleaf, *Quadrula quadrula*

Species description:

Quadrula quadrula generally is medium sized, reaching 4 inches (10 cm) but older specimens can be significantly larger and quite heavy. The shell is quadrate and moderately compressed, with a surface sculptured of numerous irregular pustules progressing from the umbo in two rows, one along the mid-ventral margin of the shell and a second row extending to the posterior margin. This feature gives the shell a shallow sulcus that lacks pustules between the two rows. The Mapleleaf may also have numerous ribs on the posterior dorsal slope of the shell. Its color ranges from yellow brown to green, and it may often be rayed. The beak is sculptured with nodules along double-looped ridges. The hinge is short and thick, with teeth well developed. The nacre is white.

Habitat:

Quadrula quadrula lives predominantly in rivers and large streams and therefore is often restricted to the lower reaches of Lake Erie's smaller northeast Ohio tributaries. This species can be the most common one present in silty habitat and may occur even where the substrate is too soft to support standing.

Distribution:

The Mapleleaf was found only in the lower Huron River, with individuals common but not abundant along sand/gravel areas within the lowest sites. Potentially the species is more abundant in the deeper parts of the estuary and it occurs in Old Woman Creek.

Conservation status:

Distribution includes the entire Mississippi River drainage, various localities in the St. Lawrence basin, the Red River of the North,

southwest into eastern Texas, and southeast to Louisiana.

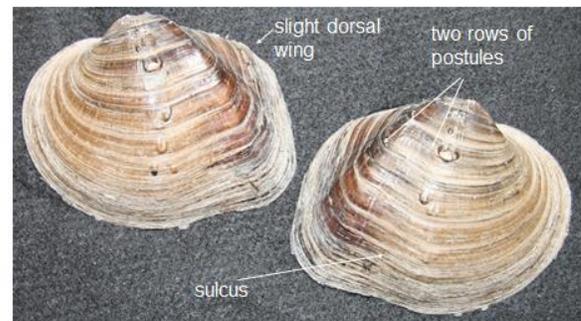
Federal: N5

Canada: N2N3

Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)

Implied Status under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC): PS



A worn Mapleleaf shell at 6.8 cm, collected at Bay Point, Ohio, near the mouth of Sandusky Bay.



Teeth of a left valve

24. Creeper, *Strophitus undulatus*

Species description:

Strophitus undulatus is a medium sized mussel reaching 4 inches (10 cm) and is simply described as the most variable species. Headwater individuals tend to be small, at about 2 inches (5 cm) and much more inflated, while river forms are larger and more compressed. The shell is sculptureless except for growth lines, and the color is yellowish, greenish or more commonly brown or gray, with or without rays. I find rays more common in faster flowing/larger streams. The best identifier is the coarse concentric ridges on the beak, which can be sharply angled posteriorly. The hinge lacks teeth, but the margin of the hinge may be greatly thickened and slightly bent to the posterior, forming a subtle S shape. The nacre may be flushed salmon in larger individuals but silver to white in other forms.

The thickened posterior margin is the best identifier among other members of the Anodontinae (the toothless unionids). *Alasmidonta marginata* has a very heavy double looped beak, and a small hinge tooth, while *Pyganodon grandis* has a modest double looped beak, and is never thickened at the shell margin. Headwater forms clearly overlap with *Anodontoidea ferussacianus*, but the shell is less cylindrical; *Anodontoidea* tends to be twice as long as it is wide, and more inflated. If beak characteristics are present, identification of the fine concentric ridges can confirm *Anodontoidea*, but this feature is often worn flat in that species. Remnants of the coarse ridges tend to persist in *Strophitus*.

Habitat:

Strophitus lives almost anywhere, but never seems to be the most common species,

except in some high headwater sites where many juveniles may be found together.

Distribution:

At least a couple shells of this species were found at almost every site surveyed in the Vermilion and Huron Rivers, although the abundance of live material was highest in the middle reaches of both rivers, which seemed to be the regions of highest diversity generally.

Conservation status:

The species is distributed throughout the Mississippi River and Great Lakes systems, the northern Atlantic Coast drainages, and parts of the Canadian Interior Basin.

Federal: N5

Canada: N5

Ohio: S5

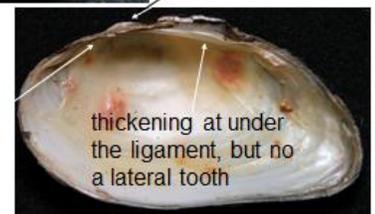
American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Coarse ridges on umbo

The creeper is highly variable with few key characters.

slight S-bend sometimes present in the dorsal margin



thickening at under the ligament, but no a lateral tooth



A large river form of the creeper, at 9.7 cm long; hinge (no teeth present) of rights valve expanded.

25. Lilliput, *Toxolasma parvum*

Species description:

Toxolasma parvum tops out at 1.5 inches (4 cm) receiving the suitable nickname of Lilliput for being one of the smallest of the unionid mussels. The shell is cylindrical, rounded on both the anterior and posterior ends, but slightly wider posteriorly. The umbo rises just above the dorsal margin of the shell. The external shell is sculptureless except for growth lines and these appear fine and close together, and the color is tan to dark brown, but more often with a silvery gloss in NE Ohio that can appear cloth-like in texture. The beak sculpture is of coarse-concentric ridges. The hinge and teeth are well developed, but the pseudocardinal tooth appears delicate. The nacre is white and iridescent posteriorly.

No other species in the same habitat looks like the Lilliput due to inflated appearance and greater depth dorsally than ventrally. Due to its size, care must be made to separate this species from young specimens of other species. The shell shape of another small species, *Alasmidonta viridis*, is very different, and even the young of the Lilliput lack rays, but the very young look wrinkled.

Habitat:

The Lilliput is a lacustrine species and inhabitant of still water in sandy mud or mud. Nowhere does it seem common. Due to its small size, finding live individuals is rare. Some were found on the stream bank just below the water surface in the upper Cuyahoga River.

Distribution:

Just two shells were found in the Vermilion River and one fresh adult and two juvenile valves were found in Old Woman Creek. Shells and even live individuals were

reported from other estuaries in the western basin and Sandusky Bay.

Conservation status:

This species is widespread throughout the Mississippi watershed to southern Canada. Although considered stable throughout much of its range, it is rare in Canada (only a few records from Ontario).

Federal: N5 Ohio: S5

Canada: N1

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



This large valve of *T. parvum* (4.8 cm) was found in the stream channel of Old Woman Creek. The silvery-grey periostracum began showing wear shortly thereafter, which is a problem after drying, especially under fluorescent lighting.

26. Fawnsfoot, *Truncilla donaciformis*

Species description:

Truncilla donaciformis, or the Fawnsfoot, reaches no more than two inches (5 cm) in length. The shell is elongate and rounded anteriorly, but it may taper to a point posteriorly. The umbo is prominent above the dorsal ridge line, and it leans only slightly to the anterior of the shell. The dorsal slope is therefore rounded. Overall the shell is sculptureless except for growth lines, the color is yellowish or greenish, and it usually has numerous rays composed of finely separated chevrons that give the appearance of continuous rays. The beak sculpture is one of fine, double looped lines. Internally, the hinge and teeth are well developed, but thin, while the nacre is white and iridescent posteriorly.

The most similar species around the region is the congeneric species, *T. truncata*, of which males have a similar shape, color, and pattern. *Truncilla truncata* is less elongate, the dorsal slope is sharper, the cardinal tooth is larger and oriented vertically, and the shell overall can be much larger.

Habitat:

Truncilla donaciformis lives in rivers and lakes in mud or sandy mud, both in quiet or in moving water. It is more common in larger rivers, and is predicted to occur not far upstream in the Lake Erie tributaries, but seems to be displaced of late by *Quadrula quadrula* in soft substrate. However, the species is very rare east of the Sandusky River.

Distribution:

The fawnsfoot was found in recent surveys around Lake Erie except after a seiche event in Oct. 2011 at the western end of Lake Erie. One historical record lists a specimen from the Vermilion River. Recent surveys suggest

its past habitat is becoming more silty leading to displacement by Mapleleaf, *Quadrula quadrula*, especially in the lower Portage River.

Conservation status:

This species is wide ranging but has experienced some declines in the Great Lakes and northern Mississippi River drainages.

Federal: N5

Canada: N2

Ohio: S2 (Threatened)

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



Truncilla donaciformis, the fawnsfoot



Truncilla donaciformis, the fawnsfoot



A typical Fawnsfoot specimen at 3.7 cm and teeth of right valve

27. Deertoe, *Truncilla truncata*

Species description:

The Deertoe is another small species, but it is a little larger than *T. donaciformis*, reaching 3 inches (7 cm). The shell shape is triangulate and moderately inflated, with a sharp dorsal ridge, which are features that makes the animal stand out compared to anything else you may find. The umbos are prominent. The shell is sculptureless except for growth lines, varied in color, and patterned. Like *T. donaciformis*, its color ranges from yellow, to green, brown, and rose, usually with numerous rays, spots and or chevrons. The beak sculpture is one of fine double looped lines. The hinge and pseudocardinal teeth are well developed but short. The nacre is white, and rarely rose colored.

The most similar species around the region is the congeneric *T. doniciformis*, which is fairly easy to separate because it tends to be more elongate, and the dorsal slope is shallower. The pseudocardinal tooth of that species is also less vertical in orientation.

Habitat:

Also like the Fawnsfoot, this species lives in rivers, lakes and their estuaries in sandy mud, but also gravel, and may be more often found in moving water.

Distribution:

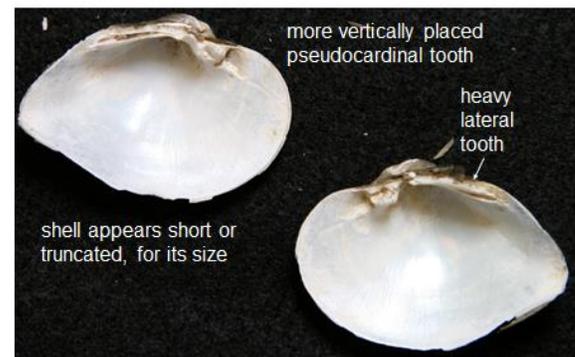
A single large adult was found in the lower Huron River just below the first riffle along with 2 fresh shells, also in the lower reaches. The two *Truncilla* species also use the sheephead as their primary (only) host fish in the region. Because it is more common in larger rivers, streams and lakes, Deertoe tends to be rare east of the Sandusky River.

Conservation status:

This species is found throughout the Mississippi River system, as well as some tributaries of Lakes Erie and St. Clair and is considered stable throughout most of its range.

Federal: N5
Canada: N3
Ohio: S3 (Species of concern)

American Fisheries Society Status (AFSS):
Currently Stable (Jan., 1993)



This fresh shell, highlighting teeth of the left valve, of a small specimen came from the upper part of the estuary of the Huron River, just west of Old Woman Creek.

28. Pondhorn, *Uniomerus tetralasmus*

Species description:

The Pondhorn is a medium sized mussel that can reach 5 inches (12 cm) in length. The shell is smooth, fairly inflated and elongate, with low umbos. Anteriorly, the shell is rounded, but pointed posteriorly, and a low posterior ridge tends to be distinct. The external shell is sculptureless except for growth lines, while the color is greenish brown and rayless. The beak sculpture is of coarse concentric semicircles that open towards the anterior of the shell. Internally, the hinge and teeth are weakly developed but apparent, while the nacre is white.

The shell of this species is so plain as to appear similar to some forms of *P. grandis*. The Giant Floater, however, has no teeth at all, and a distinct double looped beak sculpture. In a live individual, the beak sculpture easily separates the Pondhorn from the Giant Floater, and more subtly, presence of a dorsal ridge can be used if the umbos are worn, which I have not seen based on just a few examples, because the species prefers soft substrate and slow water

Habitat:

The pondhorn occurs in varied habitats, but prefers muddy substrates in slow water, and can occur in headwater regions.

Distribution:

As Ohio is the eastern edge of this species' distribution, it is rare in the region. A single live individual was found in the stream channel of Old Woman Creek and an historical record placed this species in the Vermilion River.

Conservation status:

This species is wide-ranging in North America and is considered stable throughout much of its range, with some exceptions.

Federal: N5
 Canada:
 Ohio: S2 (Threatened)
 American Fisheries Society Status (AFSS):
 Currently Stable (Jan, 1993)



Ridge on dorsal posterior of shell



This 12.5 cm shell was discovered in a pond in the upper Wabash River watershed in Ohio.



white nacre

beak sculpture of coarse concentric semi circles that open anteriorly

small pseudocardinal tooth pointing towards the umbo



short lateral tooth



Teeth of the left valve

Although similar to the giant floater in external appearance, the pseudocardinal and lateral teeth make determination of the shell easy. In the upper image, a dorsal ridge is pronounced as are differences in the umbo.

29. Paper pondshell, *Utterbackia imbecillis*

Species description:

Utterbackia imbecillis generally is a small mussel, and while listed up to 4 inches (10 cm) in length, it is more commonly found in the 2-3 inch range. The shell is very elongate and so thin as to be delicate. The umbo does not rise above the dorsal margin at all. Shell color can vary from light green to almost black depending on the substrate. A depressed umbo can give the species almost a dorsal wing in appearance. Sculptureless except for growth lines, the shell in northern Ohio tends to greenish yellow. It is occasionally rayed, and the beak sculpture is double looped. The nacre is silvery. There is no hint of hinge teeth.

The position of the umbo makes the species distinct, and therefore its other similarities to small members of *Pyganodon grandis* or *Strophitus undulatus* rarely causes confusion. The much more similar species is *Anodonta leptodon*, which is a northeastern US species, not found in Ohio.

Habitat:

This species clearly prefers quiet backwaters and impoundments, and tolerates both siltation and pollution. It may be one of the few unionid mussels that is expanding its distribution, likely entering streams due to stocking of fish. Like *Pyganodon grandis*, shells can get washed downstream, revealing populations hidden above deep dams. Expansion of its range may also be aided by possible reproduction directly from glochidia, without requiring a fish host.

Distribution:

Shells of *Utterbackia imbecillis* were found below the dam at Wakeman, and another

was found in a backwater area of the lower Vermilion. This species also is common in the estuary of Old Woman Creek where the large carp population provides a suitable host for glochidia.

Conservation status:

The range of this species is very widespread with many populations across much of the U.S. and also into Mexico. It is stable throughout its range and is tolerant of a wide range of habitat conditions.

Federal: N5
 Canada: N2
 Ohio: S4 but perhaps increasing
 American Fisheries Society Status (AFSS):
 Currently Stable (Jan., 1993)



A young paper pondshell like this 5.6 cm long specimen from the Vermilion R. is often green to light brown.



umbo flush with dorsal margin



Older specimen collected in OWC, with darkened periostracum.

Young specimen washed ashore on the beach at Sheldon Marsh.



30. Rainbow, *Villosa iris novi-eboraci*

Species description:

Fresh shells of *Villosa iris* can be up to 3 inches (7 cm), and the species is easy to identify because of thick rays that are more pronounced on the posterior of the shell, while rays on the anterior become faint. In most other species, rays occur evenly across the shell. This elongate species also has a very anteriorly placed umbo, making the posterior of the shell appear to be unusually long. Shells of males end in a blunt point while those of females are more rounded, but this sexual dimorphism is subtle. Like the Fat Mucket, the hinge teeth are well developed but small and delicate, and as for most small species, finding live individuals is less common than finding fresh shells.

Habitat:

The rainbow is believed to prefer sand and gravel substrates in small to medium sized rivers.

Distribution:

Live individuals were found scattered through the middle reaches of the Vermilion River where shells were also common. Spent shells occurred through most of the Vermilion River. By contrast, scattered shells of *Villosa iris* occurred in the east and west branches of the Huron River, but no live individuals were found.

Conservation status:

This species is widely distributed throughout the Tennessee, Cumberland, and Ohio River basins, the upper Mississippi River, the central Great Lakes and the St. Lawrence River system.

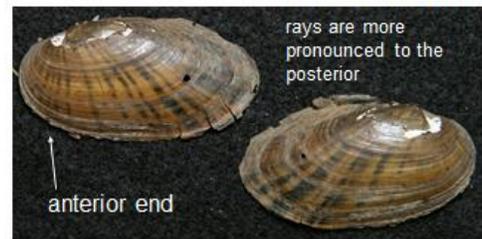
Federal: N5
Canada: N2N3
Ohio: S5

American Fisheries Society Status (AFSS):
Currently Stable (01Jan1993)



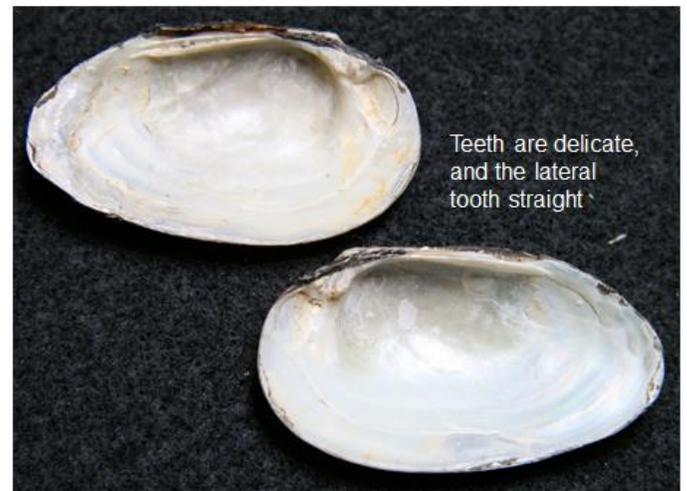
Villosa iris novi-eboraci
Rainbow

At about 4.5 cm for these two typical shells, this species is recognizable in part for its small size. The more rounded and inflated form (left) is thought to be a female, with a male shown below.



rays are more pronounced to the posterior

anterior end



Teeth are delicate, and the lateral tooth straight



Teeth of the left valve

Glossary of terms for identification

Anterior – the short side of a unionid shell, which is the direction the mussel can move in the substrate. The Umbo of a unionid mussel is always on the anterior side of the midline.

Beak - the raised portion of the dorsal margin of a shell from which the rest of the shell develops distally in a concentric manner.

Beak cavity - the cavity on the inside of each valve leading into the beak.

Beak sculpture - raised ridges or undulations on the umbo (outside of the shell).

Cardinal teeth – in Unionids, more correct is to refer to pseudocardinal teeth, which are the triangular-shaped hinge teeth anterior to the lateral teeth.

Chevron - shaped like a wide angled V.

Compressed - flattened out or pressed together.

Concentric - having a common center, such as ridges or loops radiating from the beak of a mussel valve.

Conspecific - pertaining to individuals or populations of the same species.

Dorsal - the top or back in mussels when imbedded in the substrate, the side of the shell containing the hinge teeth.

Elliptical - elongated, having the form of an ellipse.

Elongate - long or extended.

Endangered - this status at the state level includes peripheral forms which may be common in another part of its range, but whose continued existence within the political boundaries of the state is in danger of extirpation. At the national level, this status means the organism is in danger of extinction and is included on the U.S. List of Endangered Fauna.

Extinct - a species which has no living representatives; all individuals are no longer extant.

Extirpated - the extinction of a species within a portion of its range.

Growth lines - compact lines of temporarily arrested growth or rest periods appearing on the epidermis of the shell as a raised or darker concentric line.

Hinge ligament - an elastic, elongate structure that unites the two valves dorsally along the hinge plate.

Inflated - moderately to greatly widened as in the breadth of the left and right valves.

Iridescent - showing colors like those of a rainbow on the nacre of the shell.

Lateral teeth - the elongated, raised and interlocking structures along the hinge line of the Valve, posterior to the triangulate teeth

Marsupium (marsupial pouch) - in unionids, a brood pouch for eggs and developing glochidia, usually formed in the outer gill.

Muscle scar - the area of attachment of a muscle to the inside of the shell; e.g., the anterior adductor muscle scar is the location of attachment for the anterior adductor muscle.

Nacre - the interior iridescent, thin layer of a mussel shell.

Oval, Ovate (subovate) - egg-shaped, broadly elliptical.

Periphery - the external boundary on a surface, edge.

Periostracum - exterior or outside layer of the shell that provides color and pattern. This protein layer is often worn off in old shells or can become mineralized defining the shell as a subfossil.

Posterior - hind or rear. The longer side of a shell or valve.

Posterior ridge - a ridge on the exterior (outside) of a mussel shell, extending from the umbo to the posterior margin.

Posterior slope - the area across the dorsal portion of the valve extending from the umbo to the posterior margin, often above the posterior ridge.

Pseudocardinal teeth - triangular-shaped hinge teeth near the anterior-dorsal margin of the shell and anterior to the lateral teeth.

Pustule - small, raised structure on the external or outside surface of the shell (see also tubercle).

Quadrat - square, or somewhat square in outline.

Radiating - proceeding outward from a central point.

Rare - seldom appearing, occurring widely separated in space; extremely few in number.

Rectangular - a shape with four sides possessing four right-angles.

Rhomboid - having generally four distinct sides, two sides being longer than the others.

Semicircular - a partial or incomplete circle.

Special Concern - Status where the organism exists in small populations, may be declining in numbers, or where the organisms are especially vulnerable to specific pressures, or any other reasons identified by experienced researchers

Species - group of interbreeding natural populations that are reproductively isolated from all other such groups.

Striae - impressed or raised lines on a shell.

Subspecies - a geographically defined aggregate of local populations within a species that differ morphologically and/or physiologically from other populations within that species.

Sulcus (plural, sulci) - a longitudinal furrow or depression.

Taxon (plural, taxa)- any formal taxonomic unit or category of an organism; e.g., a species or genus.

Threatened - This status at the state level includes forms that are likely to become Endangered in the foreseeable future if certain conditions are not met. This includes forms that have exhibited a sharp decline in numbers or a documented range contraction, but are not yet considered Endangered.

Trapezoid - a shape having four distinct sides with two sides parallel.

Triangular - a shape having three sides and three angles.

Truncate - having the end squared off.

Tubercle - a small, raised, rounded knob on the outside of the shell.

Tuberculate - having tubercles on the outside of the shell.

Umbo/umbone - the dorsally raised, inflated area of the bivalve shell.

Unionids - refers to any member of the freshwater bivalve mollusks that belong to the superfamily Unionoidea.

Undulation - pattern with waves; raised ridges or bars.

Valve - the right or left half of a mussel (or unionid) shell.

Ventral - the underside or bottom, the margin opposite the umbo.

These definitions were absconded, with some modification, from Bogan, A.E. and J. Alderman. 2008. Workbook and key to the freshwater bivalves of South Carolina. Revised Second Edition.