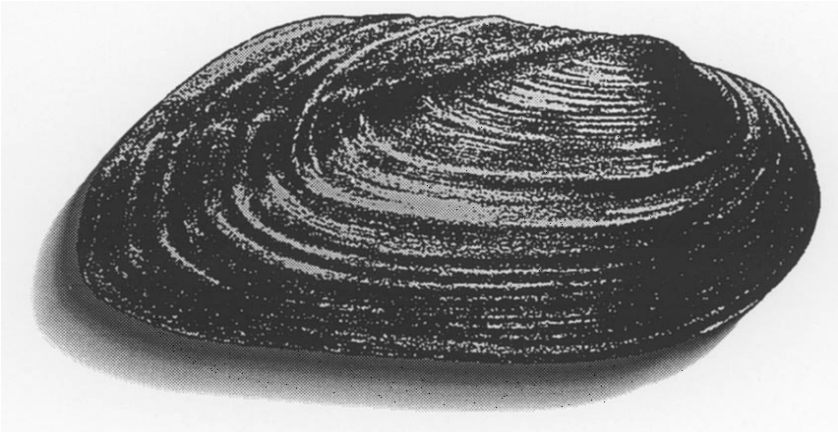
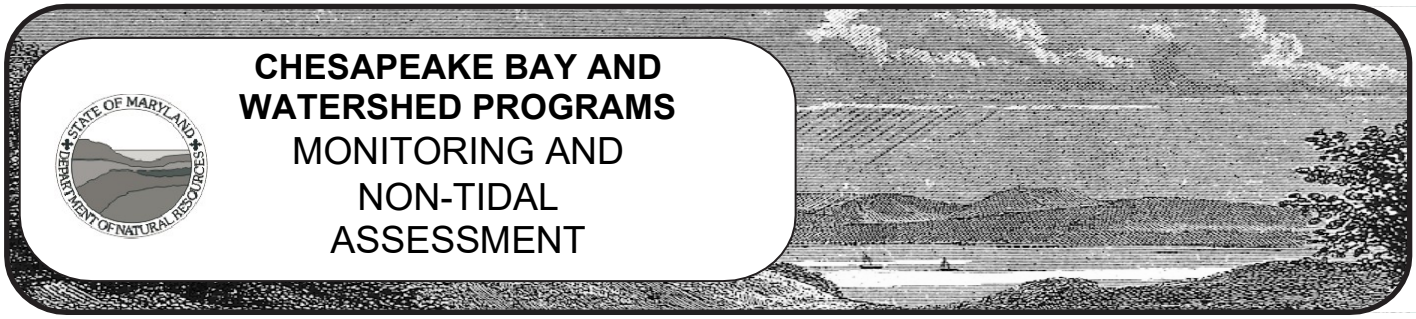
MANUAL OF THE FRESHWATER BIVALVES OF MARYLAND





CHESAPEAKE BAY AND WATERSHED PROGRAMS
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MARYLAND DEPARTMENT
OF NATURAL RESOURCES
Resource Assessment Service
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MANUAL OF THE FRESHWATER BIVALVES OF MARYLAND

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INTRODUCTION

The freshwater bivalves of the state of Maryland are represented historically by 16 native unionid species, at least two introduced unionid species, at least two species that occur near Maryland in the Susquehanna River basin, and by at least 22 species prehistorically in the Monongahela River Basin. The only comprehensive monograph of the freshwater bivalves of the region of including Maryland and Pennsylvania was prepared by Arnold E. Ortmann (1913, 1919), while working at The Carnegie Museum of Natural History, Pittsburgh. This workbook is designed to provide an introduction to the freshwater bivalves of Maryland. This is accomplished by providing a list of all of the freshwater unionids, their common names and distribution by river basin. Distributional maps contain publicly available natural history museum records, personal observations of Department of Natural Resource biologists, survey records for DNR and non-DNR biologists (Map 2), and incidental observations sent to DNR with verifiable shell vouchers. A dichotomous key based on shell characters for all of the species is provided. Each species has a detailed shell description and is supplemented by a color figure of a representative specimen of the species. A glossary is included to obviate any obscure descriptive terms used in the notebook. An introductory bibliography is included to facilitate entry into the literature on freshwater mussels occurring in the state. The former bibliography has been removed as it was out of date and has been subsumed with an annual update published by the Illinois Natural History survey and now with a searchable database.

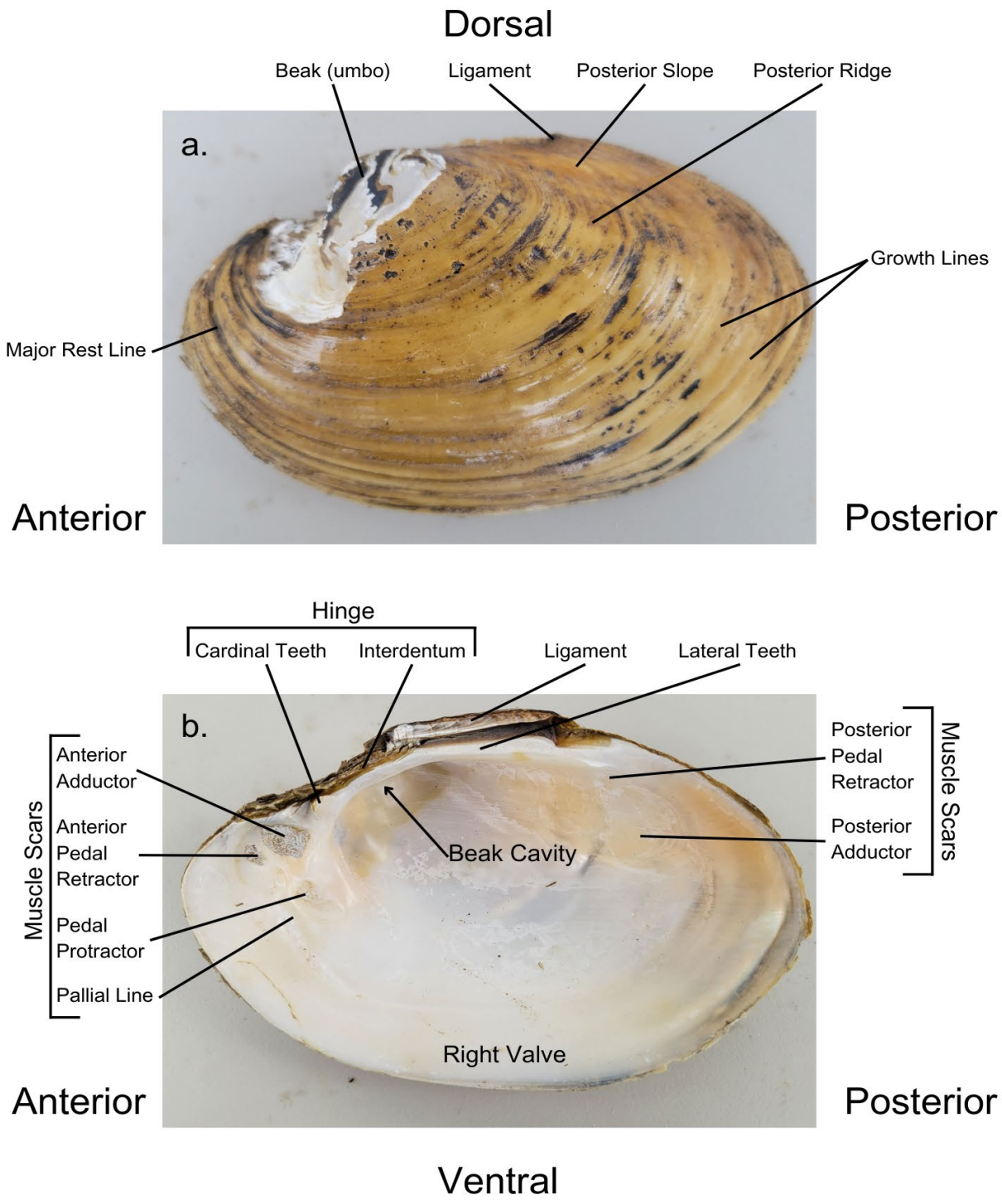
The purpose of the document is to train regulatory agency biologists and other professionals (e.g., private consultants) in the identification of freshwater bivalves that either are known or suspected to occur in Maryland. It is hoped that such training will lead to increased knowledge of species distribution in the state and consideration for mussels in the aquatic environment. This is particularly important due to regulatory statutes in Maryland that relate to the presence of mussels and therefore the correct identification of species. Distributional maps also provide a snapshot of species distribution that may aid the environmental review process.

The format for each of the species accounts includes: a map of the distribution of the species, which includes historical (bullseye) and contemporary (solid dot) records. Historic records are a best account of museum specimens verified by DNR staff or institutional malacologists, recognizing that a full accounting of these collections was beyond the scope of the original workshop and subsequent key revisions. Historical observations were made before 1990. Contemporary records have been made or verified by DNR staff from 1990 to 2024. Map style was modified from Gerberich (1984); common and scientific names follow Williams et al. (2017) and its subsequent revisions (FMCS 2019, 2023, and 2025); synonymy includes junior synonyms and previous generic combinations; shell description is a detailed list of the characteristics of the shell of the species described; distribution is the list of states in which the species occurred historically based on Williams et al. (1993) with conservative refinement from Natural Heritage Program sourced databases (e.g., NatureServe) and literature; ecology is the published notes on the ecology of the species; breeding season is that period of the year when female specimens have been observed with glochidia in the marsupium; fish hosts are noted, when known, as compiled from the literature by Cummings and Watters (2014); status is the federal or state ranking within the state as presented by Maryland DNR (2023).

ACKNOWLEDGMENTS

John Christmas facilitated the 1997 identification workshop that developed the original key to the freshwater bivalves of Maryland. Dr. John Rawlins, Curator of Invertebrates, Carnegie Museum of Natural History, provided access to the collection for the photography of several species of unionids and provided specimens for the workshop. The Delaware Museum of Natural History and Dr. Paula M. Mikkelson, Curator of Malacology also graciously provided study specimens used during the 1997 workshop. Contemporary distribution records are primarily the result of thousands of hours of survey effort made by biologists with Maryland Department of Natural Resources' Natural Heritage Program, including James McCann, Dan Feller, Dave Brinker, and others, along with the Monitoring and Non-Tidal Assessment division's work on the Maryland Biological Stream Survey and Freshwater Mussel Assessment program. Dr. Arthur Bogan, Curator of Aquatic Invertebrates, North Carolina Museum of Science, provided insight and review of editorial updates and distribution maps to the 2016 revision. Dr. John Pfieffer, Curator of Mollusks, National Museum of Natural History provided new images for species accounts and taxonomic review for consistency with the Freshwater Mollusk Conservation Society's standard scientific names list. Jennifer Morton, Megan Gallagher, Jessica Woodall, Katherine Philipp, Sally Ehlers and Megan Kubala provided assistance in document formatting and applying revisions from numerous field and hand written notes.

Figure 1. Morphology of a freshwater mussel shell illustrating structures and terminology. a. exterior of right valve, b. interior of left valve.



GLOSSARY OF BIVALVE TERMS

Alate - with an extension or wing on the dorsal edge of the shell.
Angular (subangulate) - having either the anterior or posterior margins forming a relatively acute (sharp) angle.
Anterior - front or forward.
Arcuate - bent in a bow or arched.
Beak - the raised portion of the dorsal margin of a shell; formed by the embryonic shell around 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, under the interdentum.
Beak sculpture - raised ridges or undulations on the umbo.
Biangulate - having two angles.
Bradytictic - mussels which are long term breeders; females retain glochidia in their gills typically over the winter.
Byssus, byssal threads - a bundle of tough threads secreted by the byssal gland in the foot of a bivalve, used to anchor the bivalve to some hard substrate.
Cardinal teeth - teeth located between the lateral teeth in *Corbiculidae* and *Sphaeriidae.*
Chevron - shaped like a wide-angled V.
Clinal variation - the graded variation in morphology exhibited by a species in mollusks from headwater areas to the mouth of the highest order stream.
Compressed (subcompressed) - 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.
Corrugated - marked by wrinkles or ridges and grooves.
Crescentic - shaped like the figure of the crescent moon with a convex and a concave edge.
Decorticate - to remove the outer covering, in mollusks the epidermis.
Disc - the middle or central portion of the exterior of a valve; distinct from the posterior slope or other areas immediately adjacent to the margin of the valve.
Discoidal - round and flat like a disc.
Dorsal - the top or back; in mussels, the hinge area.
Edentulous - lacking both pseudocardinal and lateral teeth.
Effuse - spread out broadly.
Elliptical (subelliptical) - elongated, having the form of an ellipse.
Elongate - long or extended.
Emarginate - having a shallow notching at the margin.
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 included on or being considered for the U.S. List of Endangered Fauna and Endangered and Threatened Plant Species of the United States, under the Endangered Species Act of 1973.
Epidermis - exterior or outside (corneous) layer of the shell.
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.
Form - an animal with questionable taxonomic status; that is, one exhibiting variation but the extent or degree is not well enough known to determine whether it is a species, subspecies or simply individual or population variation.
Fusiform – tapering toward each end.
Gills - a thin plate-like paired structure within the mantle cavity which serves as a respiratory organ in aquatic mollusks and in female unionids all of the gills or certain portions of the gills serve as the marsupium.

Globose - globe-like, spherical.
Glochidium (plural of glochidia) - the bivalve larvae of unionids which are generally parasitic on the gills of fish.
Gravid female - a female which has embryos in the marsupium.
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, corneous structure that unites the two valves dorsally along the hinge plate.
Holotype - single specimen designated as the "type" by the author in the publication of a new species level taxon.
lnequilateral - in a bivalve, having the two unequal ends (i.e., one end is wider or thicker than the other).
Inflated (subinflated) - moderately to greatly inflated.
Interdentum - a flattened area of the hinge plate between the pseudocardinal and lateral teeth.
Iridescent - showing colors like those of a rainbow.
Lachrymose - term describing teardrop-shaped pustules.
Lateral teeth - the elongated, raised and interlocking structures along the hinge line of the valve.
Lectotype - one of a series of syntypes which, subsequent to the publication of an original description of a species level taxon, is selected (by publication) to serve as the type specimen for that taxon.
Lunule - depressed area immediately anterior to the umbo.
Marsupial swelling - a section of the posterior ventral margin of the female unionid shell, which is enlarged or inflated to provide space for expansion of the marsupium with the development of the glochidia.
Marsupium (marsupial pouch) - in unionids, a brood pouch for eggs and developing glochidia, formed by a restricted portion of the outer gill, the complete outer gill or all four gills.
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.
Naiad - formerly a tribe of mollusca nearly equivalent taxonomically to the family *Unionidae*, often used as a synonym of unionid.
Nodule (subnodulous) - a small rounded mass of irregular shape.
Oblique - slanting; angled, but not horizontal or vertical.
Obovate (subobovate) - ovate.
Orbicular (suborbicular) - having the form of an orb; circular or nearly circular in outline.
Oval, Ovate (subovate) - egg-shaped, broadly elliptical.
Pallial line - an indented groove or line approximately parallel with the ventral margin of a bivalve shell which marks the line of muscles attaching the mantle to the shell.
Paratype - each specimen of a type series other than the holotype designated in the original publication of the taxon.
Periphery - the external boundary on a surface's edge.
Periostracum - see epidermis.
Plications - parallel ridges on the surface of the shell.
Posterior - hind or rear.
Posterior ridge - a ridge on the exterior 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.
Pustule - small, raised structure on the external or outside surface of the shell (see also tubercle).
Quadrate (subquadrate) - square, or nearly square in outline.
Radial furrow - a groove or depression; in naiads a groove running from the umbo area toward the shell margin.

Radiating - proceeding outward from a central point.
Rare - seldom appearing, occurring widely separated in space; extremely few in numbers.
Rectangular - a shape with four sides possessing four right-angles.
Rest mark - see growth lines.
Rhomboid (subrhomboid) - having generally four distinct sides, two sides being longer than the others.
Semicircular - a partial or incomplete circle.
Serrated - notched or grooved.
Sexual dimorphism - a condition in which males and females of the same species are morphologically different, usually indicated by an expanded posterior marsupial area in the female in contrast to a more pointed or bluntly rounded area in the male.
Sinus - a character of some unionids which have a depression above or below the posterior ridge.
Solid (subsolid) - shells which are thick and heavy.
Species - group of interbreeding natural populations that are reproductively isolated from all other such groups.
Striae - impressed or raised lines on a shell.
Striate - having striae.
Subspecies - a geographically defined aggregate of local populations within a species which differ morphologically and/or physiologically from other aggregations of local populations within that species.
Sulcus (plural - sulci) - a longitudinal furrow or depression.
Sympatric - pertaining to populations of two or more closely related species which occupy identical or broadly overlapping geographical areas.
Syntype - one of a series of specimens of the same taxon which formed the material studied by the original author to describe a new species level taxon, form which no type specimen (holotype) was designated.
Tachytictic - mussels which are short-term breeders; i.e., glochidia are found in the gills of the female only during the summer.
Taxon - any formal taxonomic unit or category of an organism; e.g., a species or genus.
Threatened -This status at the state level includes forms which are likely to become Endangered in the foreseeable future if certain conditions are not met. This includes forms which exhibit a considerable decrease in numbers beyond normal population fluctuations or a documented range contraction, but are not yet considered Endangered. At the national level this applies to the Endangered Species Act of 1973.
Trapezoid (subtrapezoid) - a shape having four distinct sides with two sides parallel.
Triangular (subtriangular) - a shape having three sides and three angles, like a triangle.
Truncate (subtruncate) - having the end squared off.
Tubercle (tuberculate) - small, raised, rounded knob on the outside of the shell.
Tuberculate - having tubercles on the outside of the shell.
Type - a designated specimen or specimens of an organism that serves as the basis for the original name and description of any species level taxon.
Umbo/umbone - the dorsally raised, inflated area of the bivalve shell.
Unionids - refers to any member of the freshwater bivalve mollusks which 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 following volumes, in addition to *Webster's Unabridged Dictionary*, were used to compile the definitions used in the glossary, which was largely adapted from Bogan (1993).

Bogan, A. E. 1993. Workshop on Freshwater Bivalves of Pennsylvania Wewell, N.J. 80 pp. 22 pl. 65 fig.

Burch, J. B. 1962. *How to know the eastern land snails*, Pictured Key Nature Series, Wm. C. Brown Company Publishers, Dubuque, Iowa, 214 pp. 519 fig.

Burch, J. B. 1975. *Freshwater Unionacean Clams (Mollusca: Pelecypoda) of North America*. Malacological Publications, Hamburg, Michigan, 204 pp. 252 fig.

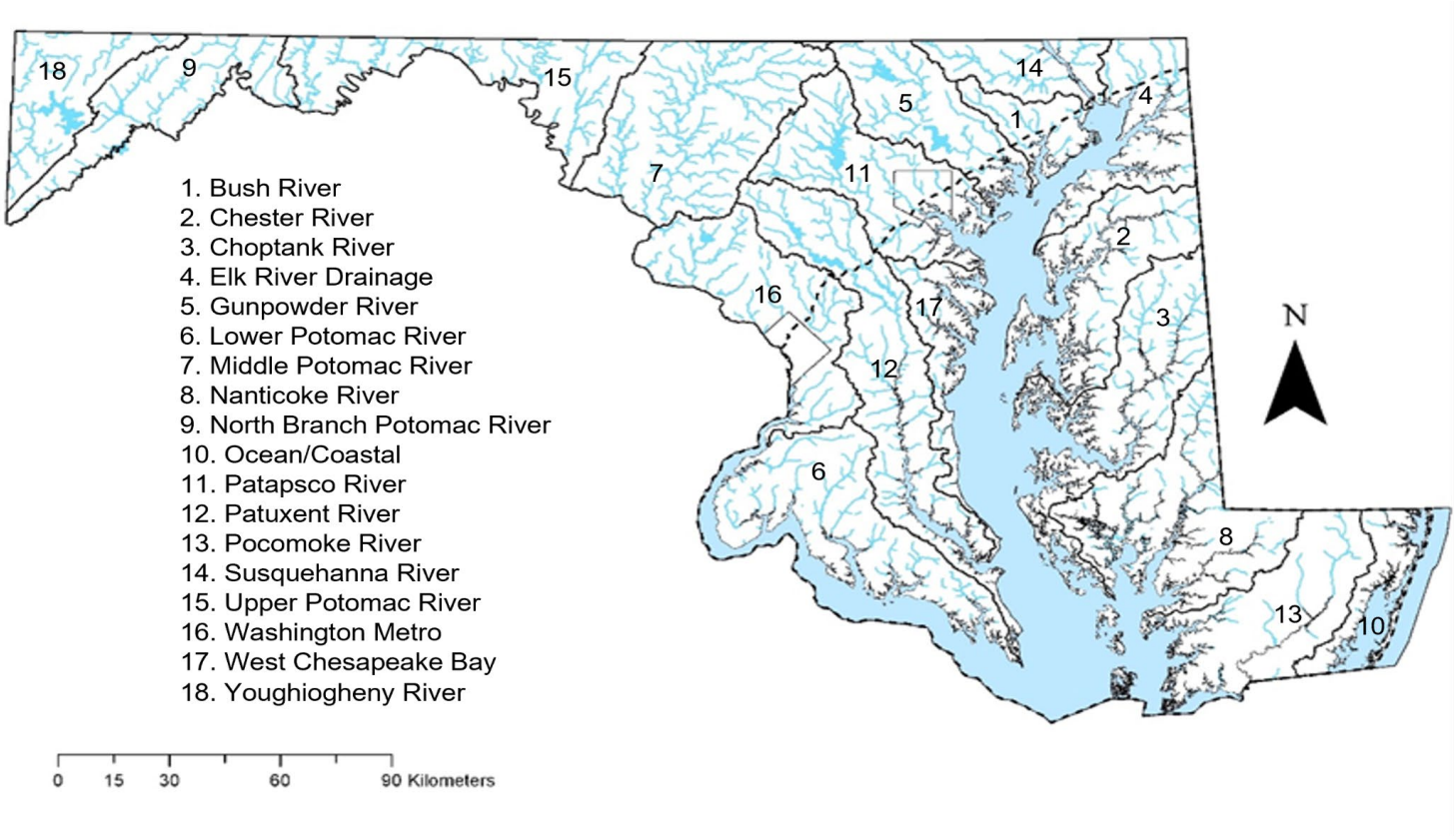
Leonard, A. B. 1954. Handbook of Gastropods in Kansas. *University of Kansas Museum of Natural History Miscellaneous Publication* No. 20, pp. 1-224, 22 pl.

Murray, H. D. and A. B. Leonard. 1962. Handbook of Unionid Mussels in Kansas, *University of Kansas Museum of Natural History Miscellaneous Publication* No. 28, pp. 1-184, 45 pl. 42 fig.

Parmalee, P. W. 1967. The Freshwater Mussels of Illinois. *Illinois State Museum, Popular Science Series*, Vol. 8, pp 108, 35 pl. 4 fig.

Pennak, R. W. 1964. *Collegiate dictionary of zoology*, The Ronald Press Company, New York. 583 pp.

Map 1. Major drainage basins of Maryland. Fall line is represented as a dashed line.



Taxonomic order of freshwater bivalves occurring in Maryland.

Phylum Mollusca
- Class Bivalvia
  - Subclass Paleoheterodonta
    - Order Unionoida
      - Superfamily Unionoidea
        - Family *Unionidae* [3 Tribes, 12 genera, 19 species]
          - Subfamily *Unioninae* [1 Tribe, 7 genera, 9 species]
            - Tribe *Anodontini*
              - *Alasmidonta marginata* (Say, 1818) [Elktoe]
              - *Alasmidonta undulata* (Say, 1817) [Triangle Floater]
              - *Alasmidonta varicosa* (Lamarck, 1819) [Brook Floater]
              - *Platynaias subviridis* (Conrad, 1835) [Green Floater]
              - *Prolasmidonta heterodon* (Lea, 1829) [Dwarf Wedgemussel]
              - *Pyganodon cataracta* (Say, 1817) [Eastern Floater]
              - *Strophitus undulatus* (Say, 1817) [Creeper]
              - *Utterbackia imbecillis* (Say, 1829) [Paper Pondshell]
              - *Utterbackiana implicata* (Say, 1829) [Alewife Floater]
          - Subfamily *Ambleminae* [2 Tribes, 5 genera, 9 species]
            - Tribe *Lampsilini*
              - *Atlanticoncha ochracea* (Say, 1817) [Tidewater Mucket]
              - *Lampsilis cardium* (Rafinesque, 1820) [Plain Pocketbook]
              - *Lampsilis cariosa* (Say, 1817) [Yellow Lampmussel]
              - *Lampsilis radiata* (Gmelin, 1791) [Eastern Lampmussel]
              - *Sagittunio nasutus* (Say, 1817) [Eastern Pondmussel]
              - *Toxolasma parvum* (Barnes, 1823) [Lilliput]
            - Tribe *Pleurobemini*
              - *Elliptio complanata* (Lightfoot, 1786) [Eastern Elliptio]
              - *Elliptio fisheriana* (Lea, 1838) [Northern Lance]
              - *Elliptio lanceolata* (Lea, 1828) [Yellow Lance]

KEY TO THE SHELLS OF THE FRESHWATER BIVALVES OF MARYLAND

1	a.	Valves with cardinal teeth and two sets of smooth lateral teeth	***Sphaeriidae***
	b.	Valves with one set of lateral teeth and pseudocardinal teeth or without teeth (Unionidae)	2
2 (1b)	a.	Hinge teeth absent	3
	b.	Hinge teeth present	6
3 (2a)	a.	Beaks not projecting above the hinge line (fig. 19)	***Utterbackia imbecillis***
	b.	Beaks projecting above the hinge line	4
4 (3b)	a.	Beak sculpture double looped[1]	5
	b.	Vestige of pseudocardinal teeth usually represented by a thickening near the beaks (fig. 17); nacre usually orange in the beak cavity, beak sculpture concentric	***Strophitus undulatus***
5 (4a)	a.	Shell prominently thickened along the anterior third of the ventral margin of the shell below the pallial line, nacre salmon or copper colored (fig. 20)	***Utterbackiana implicata***
	b.	Ventral margin of shell uniformly thin, nacre bluish or white, greenish epidermis (fig. 15)	***Pyganodon cataracta***
6 (2b)	a.	Lateral teeth well developed, functional and interlocking	9
	b.	Lateral teeth absent or reduced, neither functional nor interlocking	7
7 (6b)	a.	Fine transverse ridges present on the posterior slope, pseudocardinal teeth reduced and elongate, with smooth surfaces	8
	b.	Transverse ridges on posterior slope absent, pseudocardinal teeth strong and triangular, with rough surfaces, shell small to medium size, triangular to ovate (fig. 3)	***Alasmidonta undulata***
8 (7a)	a.	Posterior ridge angular and prominent, shell truncated, color of posterior margin lighter than rest of shell (fig. 2)	***Alasmidonta marginata***
	b.	Posterior ridge and shell rounded, usually less than 70-mm-long (fig. 4)	***Alasmidonta varicosa***
9 (6a)	a.	Right valve with two lateral teeth, rare (fig. 14)	***Prolasmidonta heterodon***
	b.	Right valve with one lateral tooth	10
10 (9b)	a.	Height/length ratio less than or equal to 0.5 shell elongate	11
	b.	Height/length ratio greater than 0.5	12

11 (10a) a. Posterior ridge prominent, posterior end of shell subangular; pseudocardinal teeth thin, bladelike, some shells with prominent rays, shell usually less than 110-mm-long (fig.16)…….. ***Sagittunio nasutus***

b. Dark brown periostracum, posterior ridge rounded, posterior end typically rounded to a point below the shells midline, ventral margin broadly rounded lacks rays (fig. 8)……***Elliptio fisheriana***[2]

c. Periostracum yellowish or greenish-yellow, with straight, dark green rays, sharply defined, and often broken, shell elliptical, elongated, moderately inflated, sexual dimorphism with females broadly rounded posterior margin and males coming to blunt point near the midpoint of the posterior margin of the shell (fig. 6)……***Cambarunio iris***

d. Posterior ridge rounded, posterior end bluntly rounded, ventral margin broadly rounded lacks rays (fig. 9), periostracum waxy, ranging from green to yellow……***Elliptio lanceolata***

12 (10b) a. Nacre purple or white, may grade to a salmon color, shell subrhomboid with well-defined posterior ridge and slope, very common (fig. 7) periostracum yellowish green to black……***Elliptio complanata***

b. Nacre white or colored but not purple……13

13 (12b) a. Left valve with small interdental tooth, giving the appearance of three pseudocardinal teeth, shell more or less compressed and subrhomboid in outline, periostracum dark green with numerous green rays or brown, adult shell less than 65-mm-long, posterior ridge rounded, beak sculpture is prominent raised bars (fig. 13).....***Platynaias subviridis***

b. Left valve without interdental tooth, valve appears to have two pseudocardinal teeth……14

14 (13b) a. Shell elliptical or wedge-shaped, small and inflated, less than 50-mm-long, outer shell surface with fabric-like texture (fig. 18). Non-native species that has been introduced into the Potomac River…… ……..***Toxolasma parvum***

b. Shell ovate or sub-ovate, inflated……15

15 (14b) a. Adult shell usually less than 80 mm in length, and thin, hardly thicker anteriorly than posteriorly, periostracum dull yellow without rays or with fine rays all over the shell, in or near tidewaters, nacre often a salmon color (fig. 5).....***Atlanticoncha ochracea***

b. Adult shell often greater than 80-mm-long, much thicker anteriorly than posteriorly, may have obvious broad color rays……16

16 (15b) a. Over 1.5 times as long as high. Height/length less than 0.60 in males and in most females, shell with rays all over the shell (may be obscured in old adults), posterior ridge low and broadly rounded, beaks not prominent (fig. 12).....***Lampsilis radiata***

b. Height/length greater than 0.60 beaks prominent, periostracum yellow to light brown now bluish white……..17

17 (16b) a. Periostracum glossy yellow reddish brown in adults. Green rays, if present, are very thin and restricted to the posterior slope. Posterior ridge is smooth and rounded. Pseudocardinal teeth are both serrated, angle between anterior pseudocardinal tooth in left valve is obtuse (>150°) with hinge line, posterior teeth on left valve is parallel to hinge line. (fig. 11).....***Lampsilis cariosa***

b. Periostracum dull yellow becoming yellowish-brown to dark brown in adults. Green rays are often distinct, which can be present throughout the shell and thicker than those in L. cariosa (indistinct in old shells). Shell globose, almost as high as long, beaks very inflated (fig. 10) nacre silver white and pink under beak. Posterior ridge is rounded to slightly concave and typically darker than the periostracum. In the left valve, angle between the anterior pseudocardinal tooth on left valve is obtuse to hinge line. Angle between posterior tooth in left valve and lateral teeth is slightly obtuse (<150°) approaching perpendicular. Non-native species that has been introduced into the Potomac River…***Lampsilis cardium***[3]

[1]Beak sculpture is often difficult to evaluate, as a result of shelf erosion, in all but very small specimens.

[2]The synonymy of lanceloate *Elliptio* species proposed by Johnson (1970) led to confusion regarding its status in Maryland. Several names were used for lanceolate species in the genus *Elliptio* including *E. lanceolata*, (Lea 1828), *E. fisheriana* (Lea 1838), *E. producta* (Conrad, 1836) and *E. angustata* (Lea, 1831). The last two species were described from the Savannah River in South Carolina and Georgia and the Cooper and Congaree rivers in South Carolina, respectively. *Elliptio fisheriana* (Lea, 1838) was described from "the head of Chester River, [Kent Co.] Maryland". Based on shell morphology, *E. fisheriana* or *E. producta* was used most recently to identify dark-shelled lanceolate *Elliptio* in Maryland. Two unpublished phylogenetic analyses found that all dark lanceloate *Elliptio* in the Chesapeake Bay drainage represent *E. fisheriana*. Most specimens previously reported as *E. lanceolata* were dark and rayed. They appear to have been assigned to *Unio lanceolatus* at the time of their collection and remained under this synonym. However, a pair of specimens (no date) from the "Potomac River D.C." is yellow, waxy, and rayless. Recent observations and newly discovered historic collections of valid *E. lanceolata* specimens have all been limited to the Patuxent River basin.

[3]The inclusion of *Lampsilis ovata* (Say, 1817) on prior lists of species for Maryland was previously thought to be in error. It stems from the placement of the subspecies Ortmann described, *ventricosa cohongoronta* Ortmann, 1912, from the Potomac River. The confusion was a result of some using *ventricosa* (Barnes, 1823) as either a subspecies or junior synonym of *L. ovata*, which it is not. *Lampsilis cardium* Rafinesque, 1820 is an earlier name and senior synonym for *ventricosa*. Ongoing phylogenetic analyses indicate two molecular lineages occur in the Potomac: *cariosa*-like animals and o*vata*-like animals; however, relationships among *Lampsilis* spp. (i.e., *cardium*, *cariosa*, *dollabreformis*, *satura*, and *ovata*) are unresolved. There has been no assessment on potential hybridization between introduced and native species.

Alasmidonta marginata Say, 1818 **Elktoe** Fig. 2

SYNONYMY

Alasmidonta marginata Say, 1818
Mya rugulosa Wood, 1828
Alasmidonta (Decurambis) scriptum Rafinesque, 1831
Unio swanaonensis Hanley, 1842
Alasmidonta corrugate DeKay, 1843
Marginata marginata "var. *truncata*" Wright, 1898
Alasmidonta marginata susquehannae Ortmann, 1919
Alasmidonta marginata variabilis F.C. Baker, 1928
Alasmidonta (Decurambis) marginata Say, 1818

SHELL DESCRIPTION. Shell elongated, dorsal margin generally rounded, ventral margin nearly straight, anterior end rounded, shell inflated, relatively thin, posterior ridge sharp and prominent, posterior slope broad, flat and often covered with fine flutings beak sculpture heavy double-looped ridges, periostracum yellowish brown often a rusty color, numerous green rays with dark green spots, pseudocardinal teeth elongate, lateral teeth reduced to a swelling, beak cavity open and moderately deep, nacre color bluish white often with a tinge of salmon.

DISTRIBUTION. Alabama, Arkansas, Iowa, Illinois, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, North Dakota, Nebraska, New York, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Virginia, Vermont, Wisconsin, and West Virginia.

ECOLOGY. Ortmann (1919:186) reported the ecology of *Alasmidonta marginata* from the Interior Basin as "most decidedly a species of the riffles, being found there in finer or coarse, but firmly packed gravel in swift currents. Call (1900) remarked on the strongly developed foot of this species that "when fully extended, the foot is firmly attached to the gravel in the river bed, and it requires quite an effort to dislodge the specimens." He noted that in the Susquehanna River basin "frequents riffles, and this renders it the more conspicuous, since there are few species on the Atlantic Slope which prefer this habitat."

USNM 150545

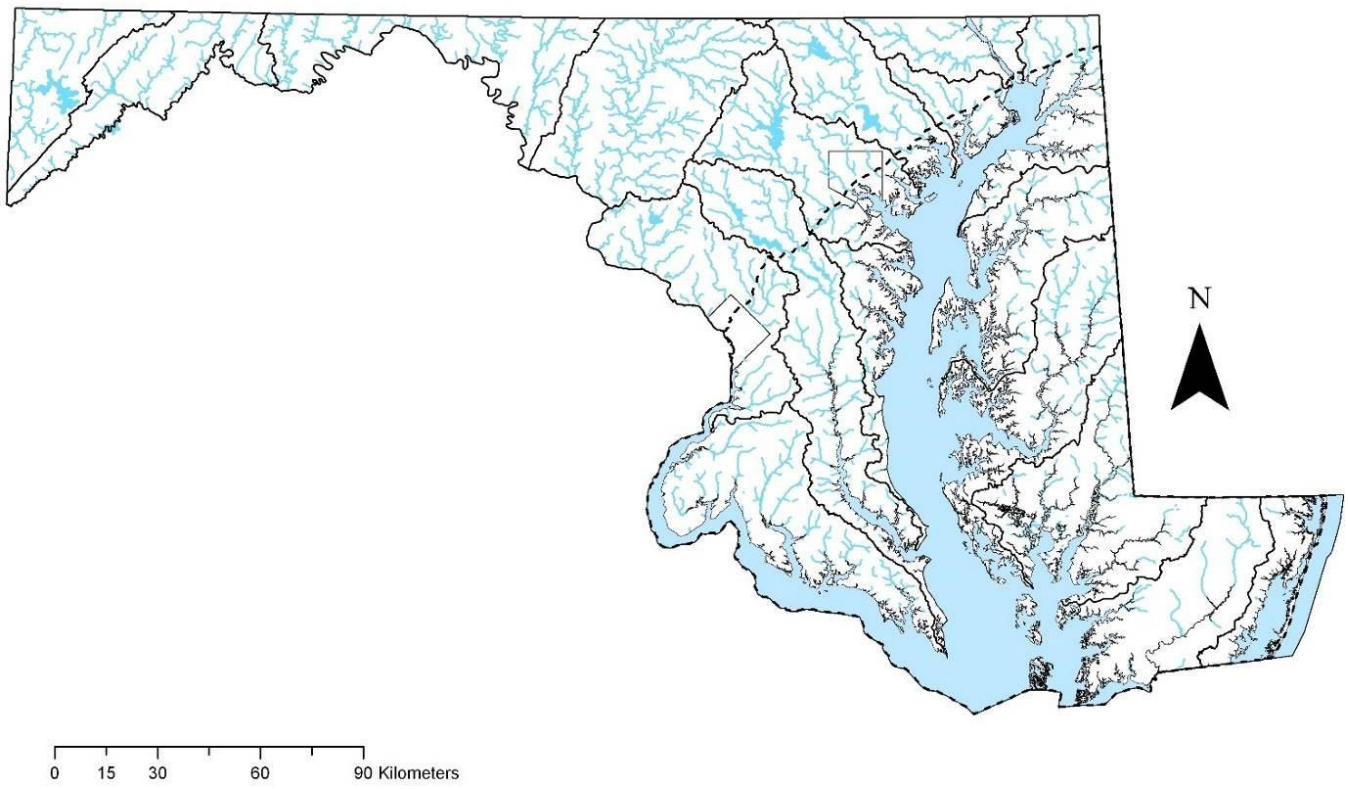
BREEDING SEASON. Ortmann (1919:188) reported glochidia in August and noted it is probably bradytictic. Bloodsworth et al. (2013) collected gravid Elktoe in September and October.

HOST FISH. Banded Killifish, *Fundulus diaphanus*; Allegheny Pearl Dace, *Margariscus margarita*; Blackspotted Topminnow, *Fundulus olivaceus*; Banded Sculpin, *Cottus carolinae*; Blackstripe Topminnow, *Fundulus olivaceous*; Bleeding Shiner, *Luxilus zonatus*; Brook Stickleback, *Culea inconstans*; Creek Chub, *Semotilus atromaculatus*; Creek Chubsucker, *Erimyzon oblongus*; Golden Redhorse, *Moxostoma erythrurum*; Golden Shiner, *Notemigonus crysoleucas*; Hornyhead Chub, *Nocomis biguttatus*; Longnose Dace, *Rhinichthys cataractae*; Mosquitofish, *Gambusia affinis*; Mottled Sculpin, *Cottus bairdii*; Northern Hogsucker, *Hypentelium nigricans*; Northern Studfish, *Fundulus catenatus*; Quillback, *Carpiodes cyprinus*; River Carpsucker, *Cyprinus carpio*; Rock Bass, *Ambloplites rupestris*, Shorthead Redhorse, *Moxostoma macrolepidotum*; Silver Redhorse, *Moxostoma anisurum*; Slimy Sculpin, *Cottus cognatus*; Smallmouth Buffalo, *Ictiobus bubalus*;

Striped Shiner, *Luxilus chrysocephalus*; Warmouth, *Lepomis gulosus*; White Sucker, *Catostomus commersoni*.

STATUS. None.

COMMENTS: Gerebrich (1984) noted this taxon has not been reported in Maryland, but it probably occurred historically in the Susquehanna River. Walsh (pers. comm.) reported it from near York Haven, Pennsylvania, which is 10 river miles from the border with Maryland.



Map 2. Distribution of *Alasmidonta marginata* Say, 1818 in Maryland.

Alasmidonta undulata (Say, 1817) **Triangle Floater** Fig. 3

SYNONYMY

*Unio undulat*a Say, 1817
"*Unio glabratus*? Lamarck" Sowerby, 1823
Unio hians Valenciennes, 1827
Alasmidonta sculptilis Say, 1829
Uniopsis radiata Swainson, 1840
Uniopsis mytiloides Swainson, 1840
Margaritana triangulate Lea, 1858
Unio swainsoni Sowerby, 1868
Alasmidonta (Alasmidonta) undulata (Say, 1817)

SHELL DESCRIPTION. Shell ovate to triangular, thickened anteriorly becoming thin posteriorly, ventral margin evenly rounded, posterior margin rounded and pointed ventrally, beak somewhat inflated and located in the anterior third of the shell, posterior ridge well marked and rounded, posterior slope of adults with a few low coarse ridges, periostracum smooth and shiny, yellowish with green rays becoming brownish to black in adult specimens, pseudocardinal teeth stumpy, interdental projection well developed in left valve, nacre white and some with salmon or pink.

DISTRIBUTION. Alabama, Connecticut, Delaware, Florida, Georgia, Massachusetts, Maryland, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, Vermont, West Virginia, Canada: New Brunswick, Nova Scotia, Ontario, Quebec.

ECOLOGY. Ortmann (1919:180) noted this species "is quite evident that it avoids the larger rivers, and prefers the smaller streams, where it becomes locally abundant, going far up towards the headwaters…It does not seem to favor riffles and very rough water, but is found chiefly in more quiet parts, but with some current, for instance, above riffles, where a steady flow of water prevails. It does not like slack water, but occasionally it is found in ponds and canals. It also likes mill races, if the current is not too rapid. It lives mostly in a mixture of coarse or finer gravel with sand and mud; but I have taken it also in eddies with slow current embedded in the mud deposited between larger stones."

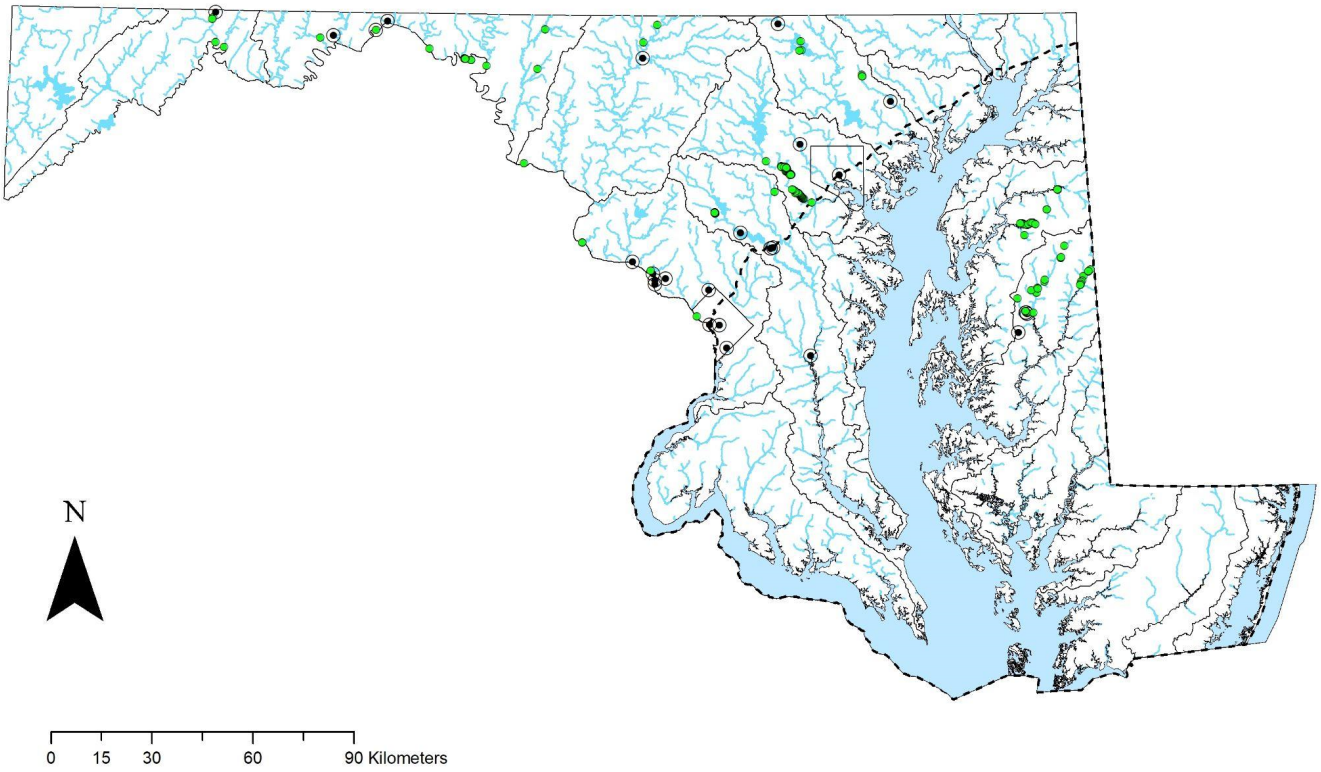
Unvouchered specimen, collected by MDNR.

In Maryland, it can be found in larger streams and rivers. Also inhabits moderate to headwater streams of the Eastern Shore often in silted pools.

BREEDING SEASON. Ortmann (1919:178) reported gravid females July to September and April to June, a bradytictic species.

HOST FISH. Blacknose Dace, *Rhinichthys atratulus;* Blackside Darter, *Percina maculata*; Central Stoneroller, *Campostoma anomalum*; Common Shiner, *Luxilus cornutus*; Fallfish, *Semotilus corporalis*; Fantail Darter, *Etheostoma flabellare*; Largemouth Bass, *Micropterus salmoides*; Longnose Dace, *Rhinichthys cataracte*; Northern Hogsucker, *Hypentelium nigricans*; Pumpkinseed, *Lepomis gibossus*; Rosyface Shiner, *Notropis rubellus*; Slimy Sculpin, *Cottus cognatus*; Spotfin Shiner, *Cyprinella spiloptera;* White Perch, *Morone americana*.

STATUS. State threatened.



Map 3. Distribution of *Alasmidonta undulata* (Say, 1817) in Maryland.

Alasmidonta varicosa (Lamarck, 1819) **Brook Floater** Fig. 4

SYNONYMY

Unio varicosa Lamarck, 1819
Alasmidonta corrugata DeKay, 1843
Alasmidonta (Decurambis) varicosa (Lamarck, 1819)
Mya rugulosa Wood, 1856

SHELL DESCRIPTION. Kidney shaped, thin shelled, slightly thicker anteriorly, ventral margin straight and slightly concave centrally, beaks narrow and bluntly pointed, posterior ridge broad, flat and inflated, posterior slope flattened to slightly concave, often with poorly developed corrugations or custations, periostracum yellowish and partly to completely covered with green rays, hinge teeth poorly developed to rudimentary, interdental projection well defined or a small swilling, beak cavity open and shallow, nacre bluish to bluish white, tan to olive or pinkish in the beak cavity. Foot color is orange-cream.

DISTRIBUTION. Connecticut, Delaware, Georgia, Massachusetts, Maryland, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, Vermont, West Virginia, Canada: New Brunswick, Nova Scotia.

ECOLOGY. Ortmann (1919:193) noted 'in the smaller streams this species is more abundant, and locally common…. It is distinctly a shell which prefers strong currents and gravelly bottoms, thus being most frequently found in and near riffles… it goes far up into the headwaters."

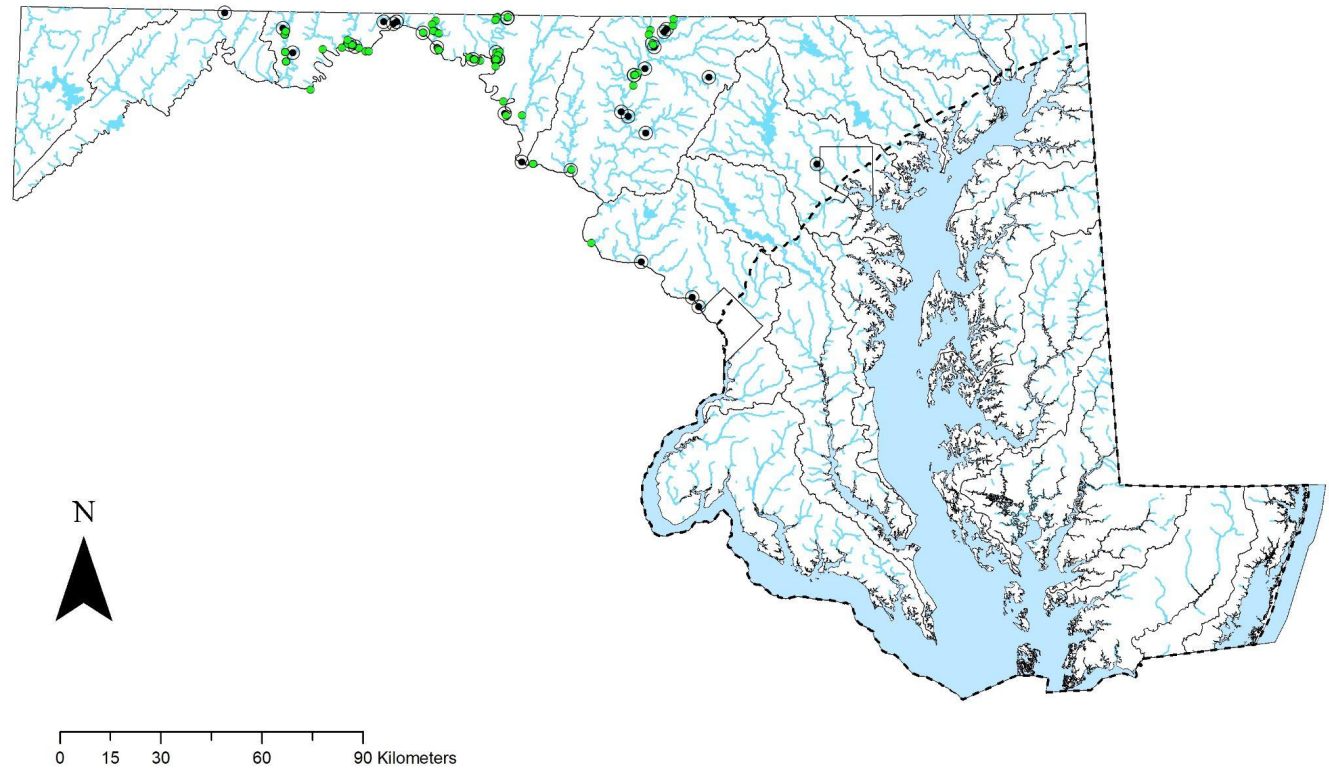
In Maryland the species can be found in larger streams and rivers with moderate flow, such as Licking Creek. Recently found in low numbers in the Potomac River, specifically in the vicinity of islands with smaller channels and depositional substrate.

BREEDING SEASON. Ortmann (1919:191-192) observed eggs in the marsupium in August, glochidia in September and discharge of glochidia in May. The species is bradytictic.

Unvouchered specimen, collected by MDNR.

HOST FISH. Golden Shiner, *Notemigonus chrysoleucas*; Mottled Sculpin, *Cottus bairdi*; Slimy Sculpin, *Cottus cognatus*; Fantail Darter, *Etheostoma flabellare*; Johnny Darter, *Etheostoma nigrum*; Redbreast Sunfish, *Lepomis auritus*; Pumpkinseed, *Lepomis gibbosus*; Bluegill, *Lepomis macrochirus*; White Shiner, *Luxilus albeolus*; Margined Madtom, *Noturus insignis*; Yellow Perch, *Perca flavescens*; Piedmont Darter, *Percina crassa*; Longnose Dace, *Rhinichthys cataracte*; Blacknose Dace, *Rhinichthys atratulus*.

STATUS. State endangered.



Map 4. Distribution of *Alasmidonta varicosa* (Lamarck, 1819) in Maryland.

Atlanticoncha ochracea (Say, 1817) **Tidewater Mucket** Fig. 5

SYNONYMY

Mytilus fluviatilis Gmelin 1791 (Nomen dubium)
Unio ochraceus Say, 1817
Lampsilis rosea Rafinesque, 1820
Unio rosaceus Conrad, 1849
Lampsilis ochracea (Say, 1817)
Lampsilis (Lampsilis) ochracea (Say, 1817)
Leptodea ochracea (Say, 1817)

SHELL DESCRIPTION. Shell relatively small, male shell elliptical and female more ovate, shell subinflated and thin, anterior end rounded, posterior margin evenly rounded, somewhat pointed in males and truncated in females, posterior ridge rounded, often with a few ridges or wrinkles (inter-annuli). Beaks moderately swollen and raised above the hinge line, located near the midline of the shell. Periostracum is slightly shiny, brownish olive, greenish-yellow, yellow or reddish, often with fine blue or green rays over most of the shell. Pseudocardinal teeth compressed, thin, lateral teeth short and curved, beak cavities shallow, nacre white or pinkish.

DISTRIBUTION. Connecticut, Delaware, Georgia, Massachusetts, Maryland, Maine, North Carolina, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, USA and New Brunswick, Nova Scotia, Canada.

ECOLOGY. Ortmann (1919:320) noted this species was found in "most tide waters north of the Savannah River…It is a form of estuaries, ponds, canals, and ditches, probably with more or less muddy bottoms.

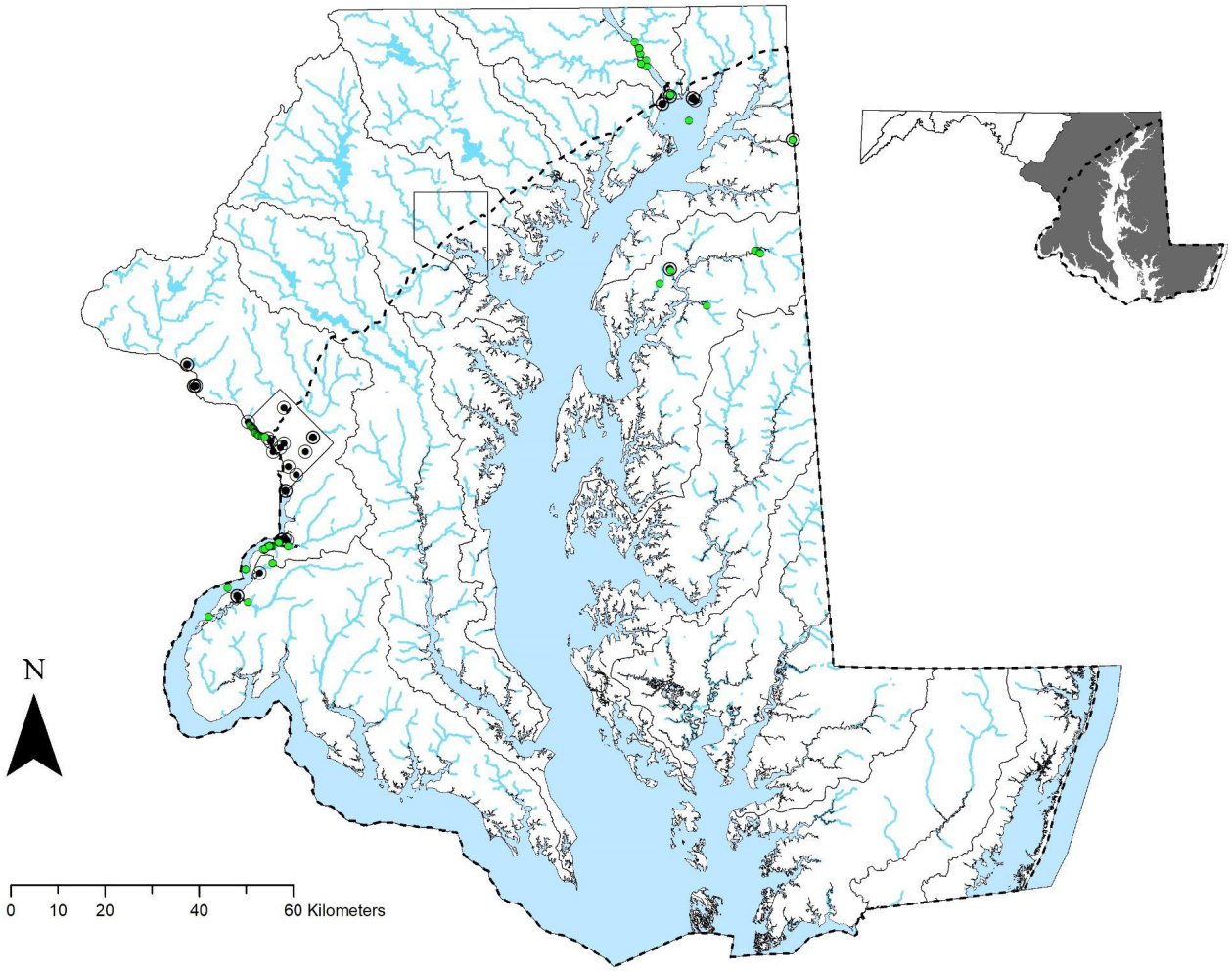
In Maryland, the species is restricted to tidal-freshwater. Substrates are sand, fine gravel, and mud. Shells are often numerous, yet live individuals are rarely found.

BREEDING SEASON. Ortmann (1919:319) noted that Isaac Lea communicated this species was gravid from October to November. There is a lack of information on the anatomy and biology of this species.

USNM 336093

HOST FISH. Banded Killifish, *Fundulus diaphanous*; White Perch, *Morone americana*.

STATUS. Federally at-risk and state watchlist.



Map 5. Distribution of *Atlanticoncha ochracea* (Say, 1817) in Maryland.

Cambarunio iris (Lea, 1829) **Rainbow** Fig. 6

SYNONYMY

Unio iris Lea, 1829
Margarita (Unio) iris (Lea, 1829)
Unio novi-eboraci Lea, 1838a
Margarita (Unio) novi-eboraci Lea, 1838b
Margaron (Unio) novi-eboraci (Lea, 1838)
Margaron (Unio) iris (Lea, 1829)
Unio subrostratus Say, 1831
Unio opalina Anthony, 1866
Lampsilis iris (Lea, 1829)
Lampsilis novi-eboraci (Lea, 1838)
Eurynia (Micromya) iris (Lea, 1829)
Unio fatuus var. De Gregorio, 1914
Eurynia iris (Lea, 1929)
Eurynia (Micromya) iris novi-eboraci (Lea, 1838)
Micromya iris (Lea, 1829)
Micromya iris novi-eboraci (Lea, 1838)
Lampsilis fasciata opalina (Anthony, 1866)
Lampsilis nervosa (Rafinesque, 1820)
Ligumia iris novi-eboraci (Lea, 1838)
Villosa iris (Lea, 1829)
Ligumia nervosa (Rafinesque, 1820)
Villosa iris iris (Lea, 1829)

SHELL DESCRIPTION. Shell outline is elongate elliptical to elongate ovate, and somewhat compressed. Shell is thicker anteriorly than posteriorly. Anterior margin evenly rounded, posterior margin broadly rounded, dorsal margin convex, and ventral margin straight to convex. Umbo is broad with coarse ridges, becoming weakly double-looped ventrally. Periostracum is tawny to greenish brown with well-developed, variable green rays. Small, compressed pseudocardinal teeth located parallel to the hinge line, and thin, moderately short, straight to slightly curved lateral teeth. Interdentum long, narrow to very narrow, umbo cavity shallow, and nacre usually bluish white, rarely salmon.

DISTRIBUTION. Alabama, Georgia, Illinois, Indiana, Kentucky, Michigan, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin.

USNM 58223

ECOLOGY. Ortmann (1919:270) found this species only once in a creek where "it was abundant in riffles in fine sand and gravel" and in Lake Erie "often among a scanty growth of rushes."

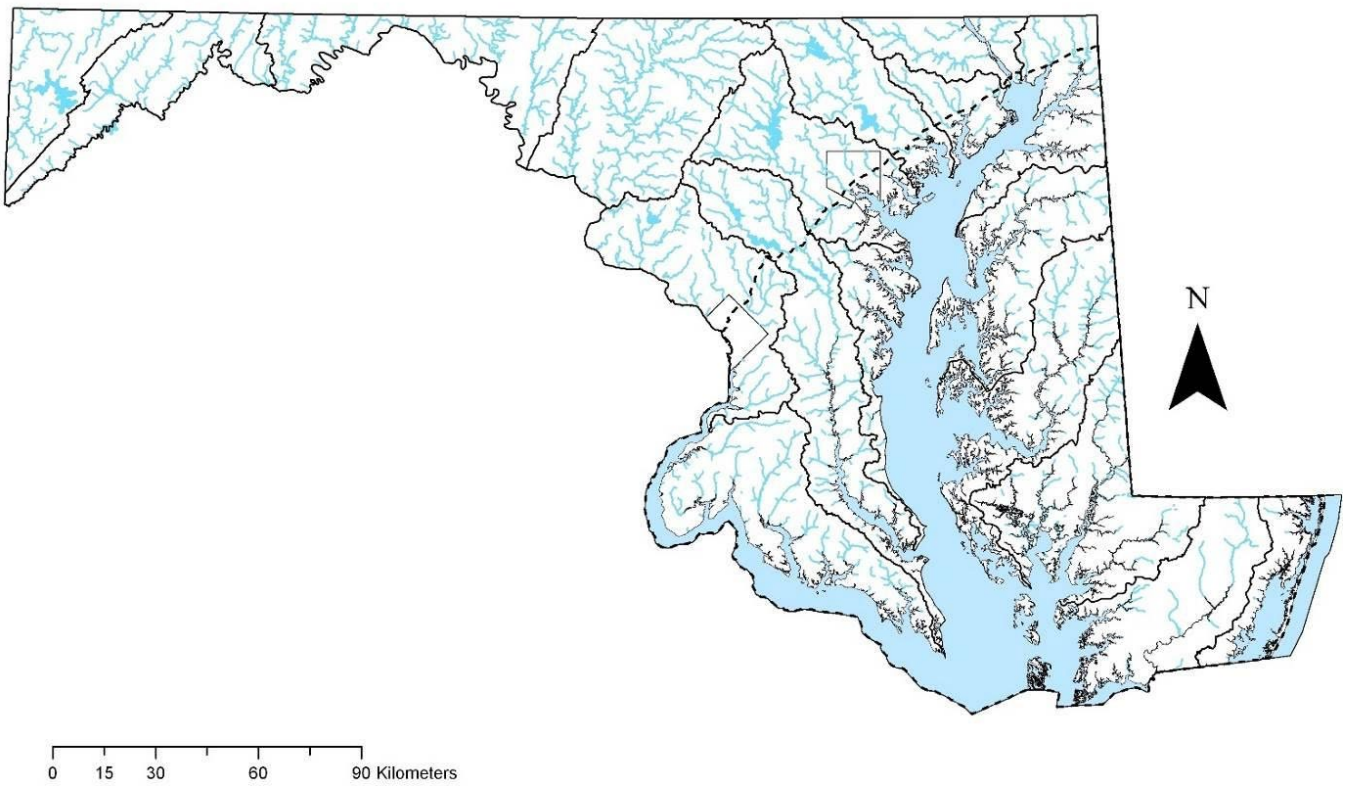
BREEDING SEASON. Ortmann (1919:269) has found gravid females, all with glochidia, in May. Presumably bradytictic.

HOST FISH. Black Redhorse, *Moxostoma duquesnei*; Blackside Darter, *Percina maculata*; Bluebreast Darter, *Etheostoma camurum*; Bluegill, *Lepomis macrochirus*; Green Sunfish, *Lepomis cyanellus*; Largemouth Bass, *Micropterus salmoides*; Rock Bass, *Ambloplites rupestris*; Suwannee Bass, *Micropterus notius*; Spotted Bass, *Micropterus punctulatus*; Western Mosquitofish, *Gambusia affinis*; Smallmouth Bass, *Micropterus dolomieu*; Mottled Sculpin, *Cottus bairdii*; Greenside Darter, *Etheostoma blennioides*; Rainbow Darter, *Etheostoma caeruleum*; Streamline Chub, *Erimystax dissimilis*; Striped Shiner, *Luxilus chrysocephalus*; Yellow Perch, *Perca flavescens*; Longear Sunfish, *Lepomis megalotis*; Central Stoneroller, *Campostoma anomalum*; Creek Chub, *Semotilus atromaculatus*; Gravel Chub, *Erimystax punctatus*;

Hornyhead Chub, *Nocomis biguttatus*; Redfin Shiner, *Lythrurus umbratilis*; Rosyface Shiner, *Notropis rubellus*; Sand Shiner, *Notropis stramineus*; Silver Shiner, *Notropis photogenis*; Spotfin Shiner, *Cyprinella spiloptera*; Suckermouth Minnow, *Phenacobius mirabilis*; Logperch, *Percina caprodes*; Tippecanoe Darter, *Etheostoma tippecanoe*; Variegate Darter, *Etheostoma variatum.*

STATUS. None.

COMMENTS: Not currently known from Maryland. The nearest population is in the Susquehanna River at Bainbridge, Pennsylvania approximately 40 river miles from Maryland.



Map 6. Distribution of *Cambarunio iris* (Lea, 1829) in Maryland.

Elliptio complanata (Lightfoot, 1786) **Eastern Elliptio**

SYNONYMY

Mya complanata Lightfoot, 1786
Unio violaceus Spengler, 1793
Unio purpureus Say, 1817
Unio rarisulcata Lamarck, 1819
Unio coarctata Lamarck, 1819
Unio purpurascens Lamarck, 1819
Unio rhombula Lamarck, 1819
Unio carinifera Lamarck, 1819
Unio georgina Lamarck, 1819
Unio glabrata Lamarck, 1819
Unio sulcidens Lamarck, 1819
Unio virginiana Lamarck, 1819
Unio aurata Rafinesque, 1820
Unio fluviatilis Green, 1827
Mya rigida Wood, 1828
Unio griffithianus Lea, 1834
Unio complanatus subinflatus Conrad, 1835
Unio jejunus Lea, 1838
Unio fuliginosus Lea, 1845
Unio cuvierianus Lea, 1852
Unio errans Lea, 1856 good species????
Unio vicinus Lea, 1856
Unio geminus Lea, 1856
Unio abbevillensis Lea, 1857
Unio percoarctatus Lea, 1857
Unio wheatleyi Lea, 1857
Unio catawbensis Lea, 1861
Unio insulsus Lea, 1857
Unio spadiceus Lea, 1857
Unio macer Lea, 1857
Unio contractus Lea, 1857
Unio virens Lea, 1857
Unio savannahensis Lea, 1857
Unio subflavuslea, 1857
Unio fumatus Lea, 1857
Unio subniger Lea, 1857
Unio neusensis Lea, 1857
Unio purus Lea, 1858
Unio exactus Lea, 1858
Unio pastellii Lea, 1858
Unio roswellensis Lea, 1859
Unio burkensis Lea, 1859
Unio hallenbeckii Lea, 1859
Unio baldwinensis Lea, 1859
Unio salebrosus Lea, 1859
Unio raeensis Lea, 1859
Unio latus Lea, 1859
Unio quadratus Lea, 1859
Unio squameus Lea, 1861
Unio rostrum Lea, 1861
Unio northamptonensis Lea, 1861
Unio decumbens Lea, 1861
Unio raleighensis Lea, 1863
Unio aberrans Lea, 1863
Unio weldonensis Lea, 1863
Unio mecklenbergensis Lea, 1863
Unio chathamensis Lea, 1863
Unio gastonensis Lea, 1863
Unio quadrilaterus Lea, 1863
Unio indefinilus Lea, 1863
Unio indefinitus Lea, 1866
Unio mediocris Lea, 1863
Unio perlucens Lea, 1863
Unio curatus Lea, 1863
Unio protensus Lea, 1865
Unio lazarus Sowerby, 1868 in Reeve.
Unio beaverensis Lea, 1868
Unio nubilus Lea, 1868
Unio datus Lea, 1868
Unio humerosus Lea, 1868
Unio uhareensis Lea, 1868
Unio tortuosus Sowerby, 1868
Unio santeensis Lea, 1871
Unio yadkinensis Lea, 1872
Unio amplus Lea, 1872
Unio ligatus Lea, 1872
Unio differtus Lea, 1872
Unio subparallelus Lea, 1872
Unio oblongus Lea, 1872
Unio curvatus Lea, 1872
Unio irwinensis Lea, 1872
Unio subsquamosus Lea, 1872
Unio infuscus Lea, 1872
Unio ratus Lea, 1872
Unio basalis Lea, 1872
Unio dissimilis Lea, 1872
Unio cirratus Lea, 187 4
Unio subolivaceus Lea, 1874
Unio infulgens Lea, 1874
Unio corneus Lea, 1874
Unio dooleyensis Lea, 1874
Unio gesnerii Lea, 1874
Unio invenustus Lea, 1874
Unio (Arconaia) provancheriana Pilsbry, 1890
Unio palliatus 'Ravenel' Simpson, 1900
Unio pullatus majusculus De Gregorio, 1914
Unio complanatus mainensis Rich, 1915
Elliptio (Elliptio) complanata (Lightfoot, 1786)

Elliptio complanata (Lightfoot, 1786) **Eastern Elliptio** Fig. 7

SHELL DESCRIPTION. Shell outline long, trapezoidal, to rhomboid or subelliptical, shell compressed to inflated and thin to solid. Displays considerable clinal variation. Dorsal and ventral margins roughly parallel and often straight, posterior ride broad, double and rounded to angular, beaks low and uninflated, periostracum brownish or yellowish green becoming almost black with age often with green rays over the entire shell. Lateral teeth straight, beak cavity very shallow, nacre usually purple but white to light orange or salmon occur.

DISTRIBUTION. Alabama, Connecticut, Delaware, Florida, Georgia, Massachusetts, Maryland, Maine, Michigan, Minnesota, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Virginia, Vermont, Wisconsin, West Virginia, Canada: New Brunswick, Nova Scotia, Ontario, Quebec.

ECOLOGY. Ortmann (1919:109) records the ecology as: "it apparently has no ecological preferences, being found practically in any permanent body of water as well as in large rivers with strong current and have gravel and rocks. In the small creeks it goes very far into the headwaters."

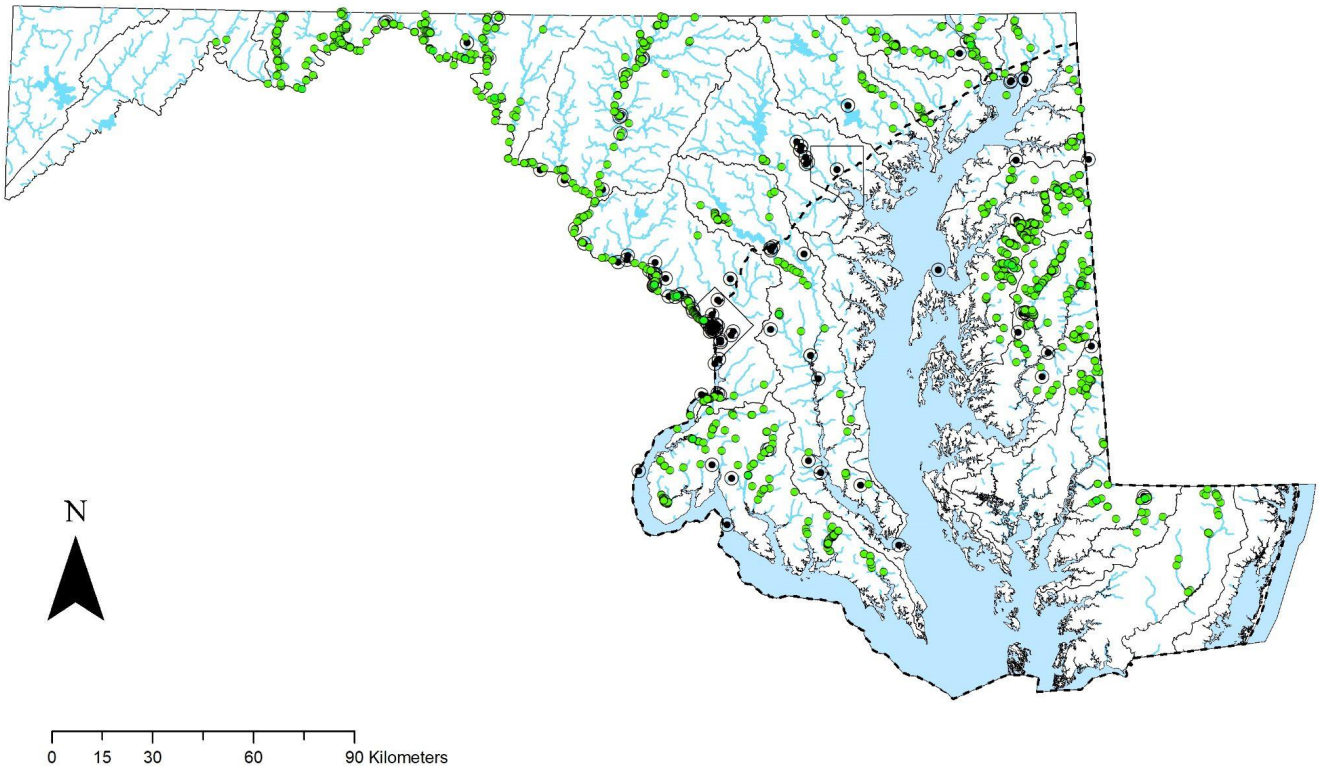
In Maryland, Ortmann's description holds true. It can be found in tidal rivers, coastal headwater streams, mill ponds, and rivers and streams of varying size throughout much of the state. They are generally absent from urban areas of the Baltimore-Washington D.C. corridor, acidic streams of the lower Delmarva, and watersheds of far western Maryland due to zoogeographic and anthropogenic constraints.

ECOLOGY. Ortmann (1919:104) reported gravid females from April to mid-July with glochidia present in early June and as late as August, a tachytictic species.

USNM 336087

HOST FISH. Alewife, *Alosa pseudoharengus*; American Eel, *Anguilla rostrata*; Banded Killifish, *Fundulus diaphanous*; Bluegill, *Lepomis macrochirus;* Brook Trout, *Salvelinus fontinalis*; Green Sunfish, *Lepomis cyanellus*; Lake Trout, *Salvelinus namaycush*; Largemouth Bass, *Micropterus salmoides*; Mottled Sculpin, *Cottus bairdii*; Pumpkinseed, Lepomis gibbosus; Orangespotted Sunfish, *Lepomis humilis*; Redbreast Sunfish, *Lepomis auritus*; Slimy Sculpin, *Cottus cognatus;* Smallmouth Bass, *Micropterus dolomieu*; White Crappie, *Pomoxis annularis*; White Perch, *Morone americana*; Yellow Perch, *Perca flavascens*.

STATUS. None.



Map 7. Distribution of *Elliptio complanata* (Lightfoot, 1786) in Maryland.

Elliptio fisheriana (Lea, 1838) **Northern Lance** Fig. 8

SYNONYMY

Unio fisherianus Lea, 1838
Margarita (Unio) fisherianus (Lea, 1838)
Margarita (Unio) fisherianus (Lea, 1838)
Elliptio fisherianus (Lea, 1838)

SHELL DESCRIPTION. Elongate (rarely exceeding 100 mm), compressed, thin, beaks low, posterior ridge subangular to angular, posterior end bluntly rounded, ventral margin broadly curved, anterior end rounded, periostracum olive, green to brown and black with age, often with faint rays, beak cavity very shallow, nacre white to purplish, posteriorly iridescent.

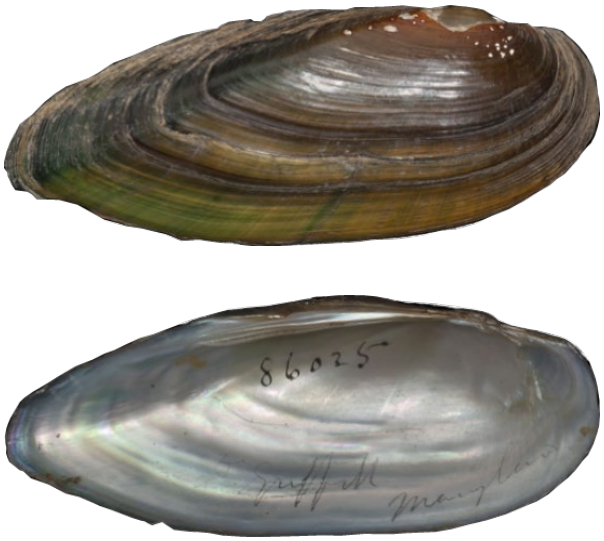
DISTRIBUTION. Delaware, Maryland, North Carolina, Pennsylvania, South Carolina West Virginia, Virginia.

ECOLOGY. Johnson (1970:335) lists the ecology of *Elliptio lanceolata sensu lato* as "Lives on sandy bottoms, often found crawling about with much of the shell out of the sand, also found among rocks and in mud where the current is not too swift."

In Maryland, they are often found in mud or clay of runs and pools near the stream bank, occasionally found buried in the slope of the bank. Typically, they are the second most abundant mussel of coastal streams.

BREEDING SEASON. A tachytictic species that is gravid in late spring to early summary and releases glochidia in the summer.

HOST FISH. Bluegill, *Lepomis macrochirus*; Creek Chub, *Semotilus atromaculatus*; Glassy Darter, *Etheostoma vitreum*; Goldfish, *Carassius auratus*; Green Sunfish, *Lepomis cyanellus*; Johnny Darter, *Etheostoma nigrum*; Largemouth Bass, *Micropterus salmoides*; Redbreast Sunfish, *Lepomis auratus*; Roanoke Darter, *Percina roanoka*; Satinfin Shiner, *Cyprinella analostana*; Shield Darter, *Percina peltate*; and White Shiner, *Luxilus albeolus*.

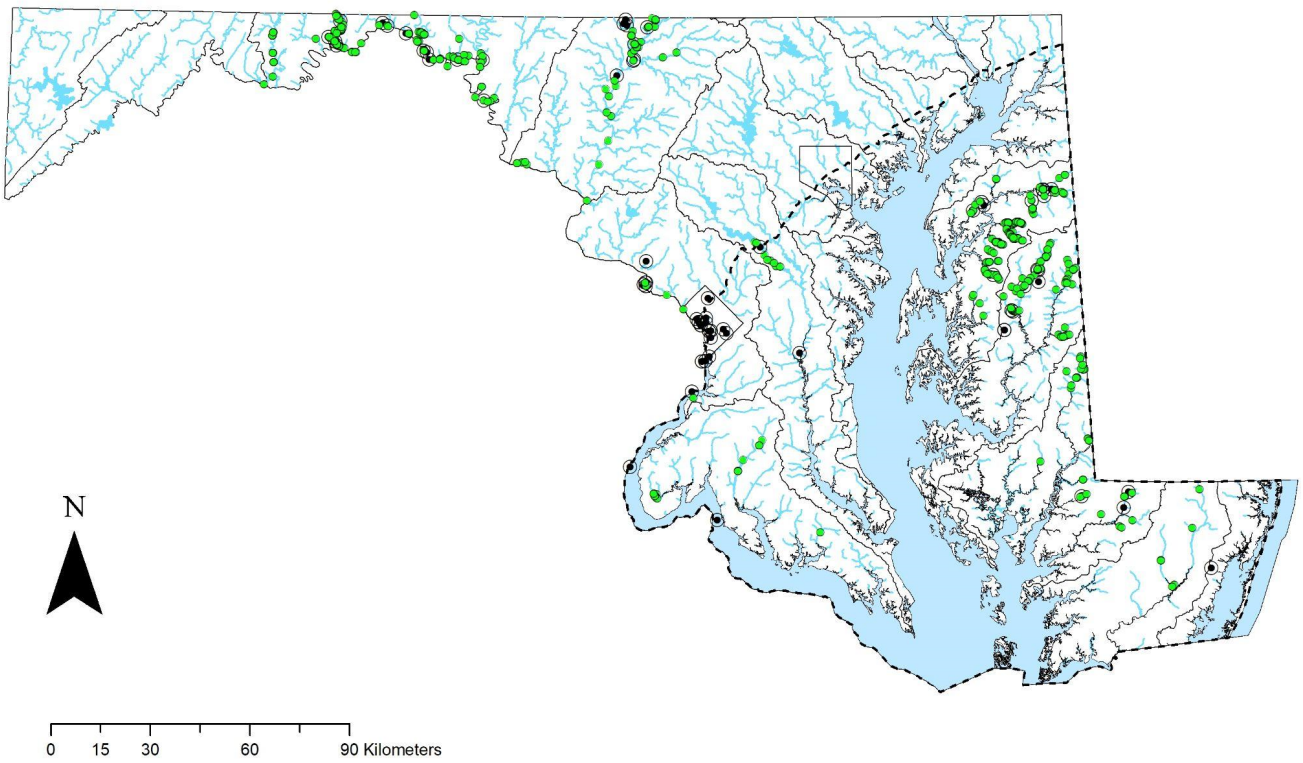


USNM 86025

STATUS. None.

COMMENTS: The type locality of this species is "head of the Chester River [Kent Co.] Maryland (Johnson 1970:333)", presumably in reference to the head of tide. Taxonomic relationships among dark lanceolate *Elliptio* spp. are not well understood and names have been used seemingly interchangeably.

Both Bogan et al. (2009) and Lohmeyer (2020) found the variously identified dark lanceolate taxa (*E. fisheriana*, *E. producta*, and *E. angustata*) from watersheds of the Chesapeake Bay represent a single, phylogenetic clade (*E. fisheriana*) that does not include topotypic *E. angustata* or *E. producta*.



Map 8. Distribution of *Elliptio fisheriana* (Lea, 1838) in Maryland.

Elliptio lanceolata (Lea, 1828) **Yellow Lance** Fig. 9

SYNONYMY

Unio lanceolatus Lea, 1828
Unio duttonianus Lea, 1841
Unio sagittformis Lea, 1852
Unio rostraeformis Lea, 1856
Unio rostriformis Lea, 1856
Unio emmonsii Lea, 1857
Unio naviculoides Lea, 1857
Unio hazelhurstianus Lea, 1858
Unio viridulus Lea, 1863
Unio haslehurstianus Sowerby, 1866
Margaron (Unio) hazlehurstianus Lea, 1859
Margaron (Unio) sagittaeformis Lea, 1870
Unio rostreformis de Gregorio, 1914
Unio arctior var. fisheropsis de Gregorio, 1914
Elliptio lanceolata (Lea, 1828)

USNM 102249

SHELL DESCRIPTION. Elongate (rarely exceeding 100 mm), compressed, thin, beaks low, posterior ridge subangular to angular, posterior end bluntly rounded, ventral margin broadly curved, anterior end rounded, periostracum waxy, yellow, often with distinct growth lines, rayless, beak cavity very shallow, nacre white to purplish, and posteriorly iridescent.

DISTRIBUTION. Maryland, North Carolina, South Carolina, Virginia.

ECOLOGY. Johnson (1970:335) lists the ecology of *Elliptio lanceolata sensu lato* as "Lives on sandy bottoms, often found crawling about with much of the shell out of the sand, also found among rocks and in mud where the current is not too swift."

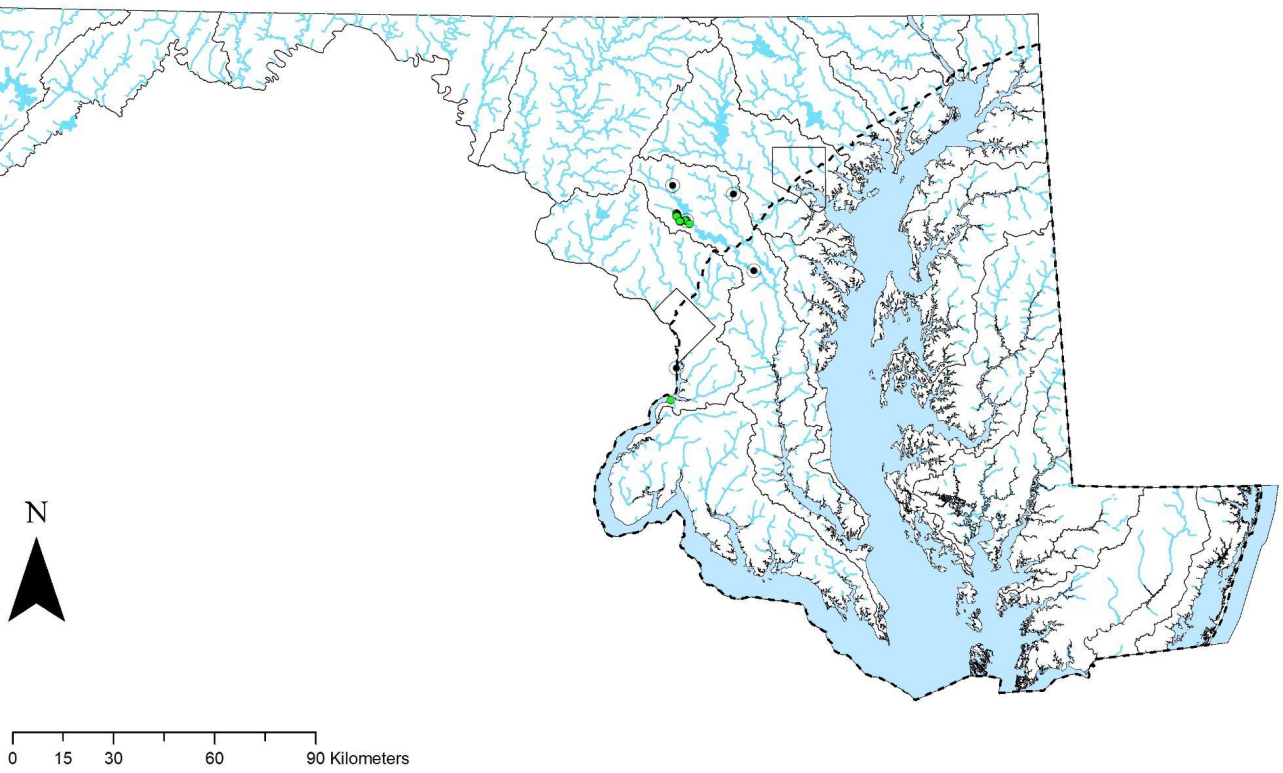
In Maryland, they appear restricted to sand-gravel substrates in runs and glides. Occasionally found in riffles and near woody debris. Villella (2006) reported two individuals from the tidal-freewater Potomac River at Bryan Point.

BREEDING SEASON. Ortmann (1919: 111) reported gravid females (presumably a dark lanceolate *Elliptio*) on May 6, June 3-8, 1912, in the Potomac and James River. Gravid mussels have been observed in late June in the Hawlings River. Presumably a tachytictic species.

HOST FISH. Pinewoods Shiner (*Lythrurus matutinus*) and White Shiner (*Luxilus albeolus*).

STATUS. Federally and state threatened.

COMMENTS: Taxonomic uncertainty and multiple synonyms have clouded the issue around the status of this species. Recent observations during surveys and examination of voucher shells has confirmed the existence of a historic and extant Patuxent River basin population. It is likely that a population historically existed in the upper reaches of the tidal-freshwater Potomac River, based on the presence of valid voucher material of *E. lanceolata*.



Map 9. Distribution of *Elliptio lanceolata* (Lea, 1828) in Maryland.

Lampsilis cardium (Rafinesque, 1820) **Plain Pocketbook** Fig. 10

SYNONYMY

Lampsilis cardium Rafinesque, 1820
Unio ventricosus Barnes, 1823
Unio occidens Call, 1887
Lampsilis ventricosus (Barnes, 1823)
Lampsilis ovata ventricosa (Barnes, 1823)
Unio occidens Lea, 1829
Unio subovatus Lea, 1831
Unio lenis Conrad, 1838
Unio canadensis Lea, 1857
Unio latissimus Sowerby, 1868
Lampsilis ventricosa var. *lurida* Simpson, 1914
Lampsilis ventricosa cohongoronta Ortmann, 1912
Lampsilis ventricosa winnebagoensis Baker, 1928
Lampsilis ventricosa pergloboas Baker, 1928
Lampsilis ovata ventricosa (Barnes, 1823)

SHELL DESCRIPTION. Shell globose, elliptical, ventral margin evenly rounded, shell relatively thin but stout, moderately inflated, posterior ridge not prominent and rounded, sexually dimorphic. Female shells are more rectangular and inflated posteriorly. Periostracum yellowish to tan becoming darker with age. Broad to narrow rays usually cover the shell, although some shells may not have rays. Pseudo cardinal teeth compressed, lateral teeth short, interdentum narrow, beak cavity wide and deep, nacre white.

DISTRIBUTION. Alabama, Arkansas, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, Mississippi, Ohio, Oklahoma, Tennessee, Texas, West Virginia, and Wisconsin.

ECOLOGY. Ortmann (1919:306) listed the ecology of this species as favoring "rather quiet pools and eddies above and below riffles. Open pools in riffles, in Dianthera-patches, with moderate current, and a bottom of fine gravel covered with a tin layer of mud…occasionally this form is found in pure sand and rather deep.

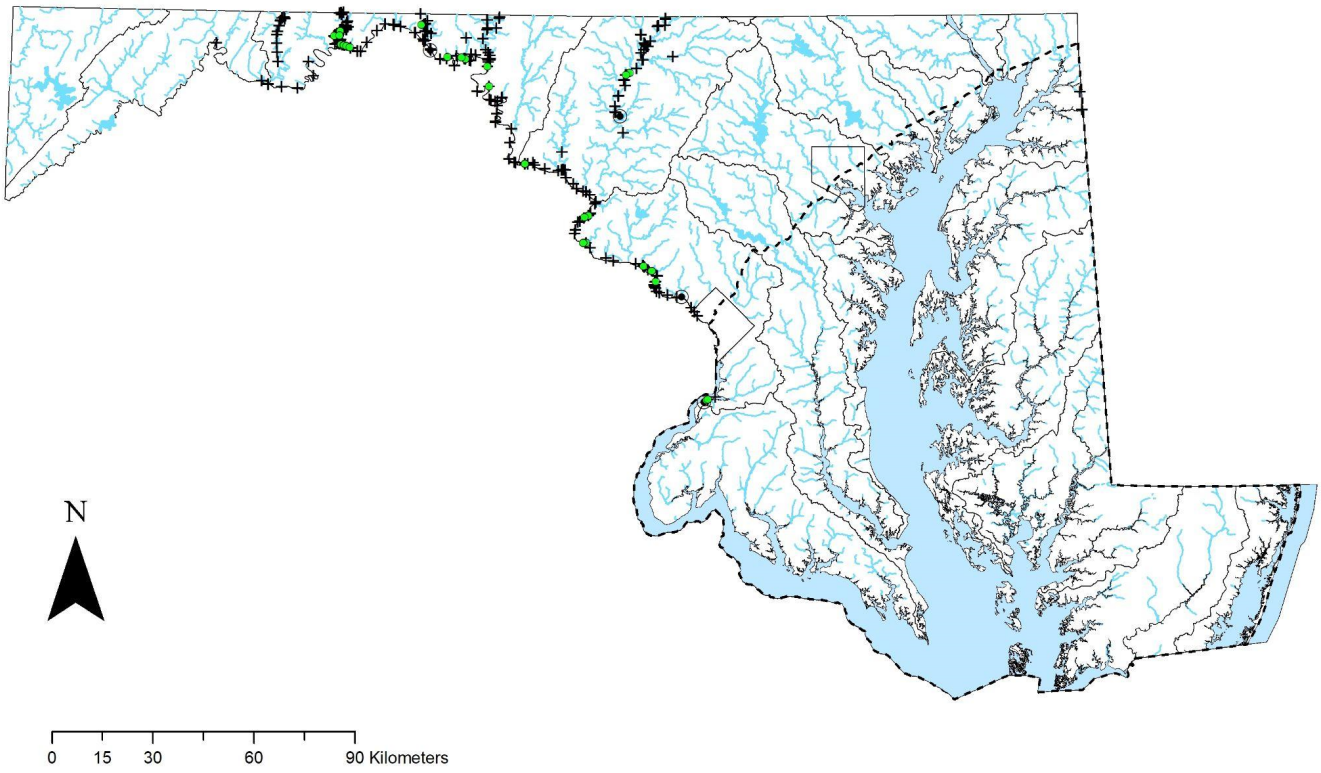
In Maryland, the species is found in runs and pools with gravel-sand-silt substrates in the Potomac River, from at least Hancock to Great Falls, and in its major tributaries.

USNM 515740

HOST FISH. Banded Killifish, *Fundulus diaphanous*; Black Crappie, *Pomoxis nigromaculatus*; Bluegill, *Lepomis macrochirus*; Green Sunfish, *Xiphophorus helleri;* Largemouth Bass, *Micropterus salmoides*; Pumpkinseed, *Lepomis gibbosus*; Smallmouth Bass, *Micropterus dolomieu*; White Crappie, *Pomoxis annularis*; Sauger, *Stizostedion canadense*, Walleye, *Stizostedion vitreum*; Yellow Perch, *Perca flavescens*.

STATUS. Introduced

COMMENTS: The type locality is the Potomac River at Hancock, Washington County, Maryland. Introduced into the Potomac River basin.



Map 10. Distribution of *Lampsilis cardium* (Rafinesque, 1820) in Maryland. *Lampsilis* sp. records displayed as plus (+) symbols.

Lampsilis cariosa (Say, 1817) **Yellow Lampmussel** Fig. 11

SYNONOMY

Unio cariosus Say, 1817
Margarita (Unio) cariosus (Say, 1817)
Margaron (Unio) cariosus (Say, 1817)
Lampsilis pallida Rafinesque, 1820
Unio ovata Valenciennes, 1827 PREOCCUPIED
Unio viridis Ferussac, 1835
Unio crocatus Lea, 1841
Unio oratus Conrad, 1849
Lampsilis cariosa (Say, 1817)
Lampsilis (Lampsilis) cariosa (Say, 1817)

SHELL DESCRIPTION. Shell medium size, dimorphic. Male shell elliptical and somewhat elongate, female shells subobovate to obovate, moderately inflated, thick, anterior margin rounded, ventral margin slightly curved, dorsal margin straight, posterior ridge rounded, umbos swollen, and raised just above the hinge line and located enterer of the midline of the shell. Periostracum shiny, waxy or straw yellow, becoming darker brownish yellow, green or black rays when present are usually restricted to the posterior slope. Pseudocardinal teeth compressed beak cavity moderately deep, nacre color white or tinged with salmon

DISTRIBUTION. Connecticut, Delaware, Georgia, Massachusetts, Maine, Maryland, North Carolina, New Jersey, New York, Pennsylvania, South Carolina, Virginia, New Brunswick, Nova Scotia Canada.

ECOLOGY. Ortmann (1919:317) reported "Where found this species is generally abundant, even in smaller streams…It Is always found in lively currents, on shoals and riffles, in finer or coarser gravel, and often in bars of pure sand."

In Maryland, the majority of historical and seemingly valid, contemporary records are in the Potomac and Susquehanna rivers, surrounding the Fall Line.

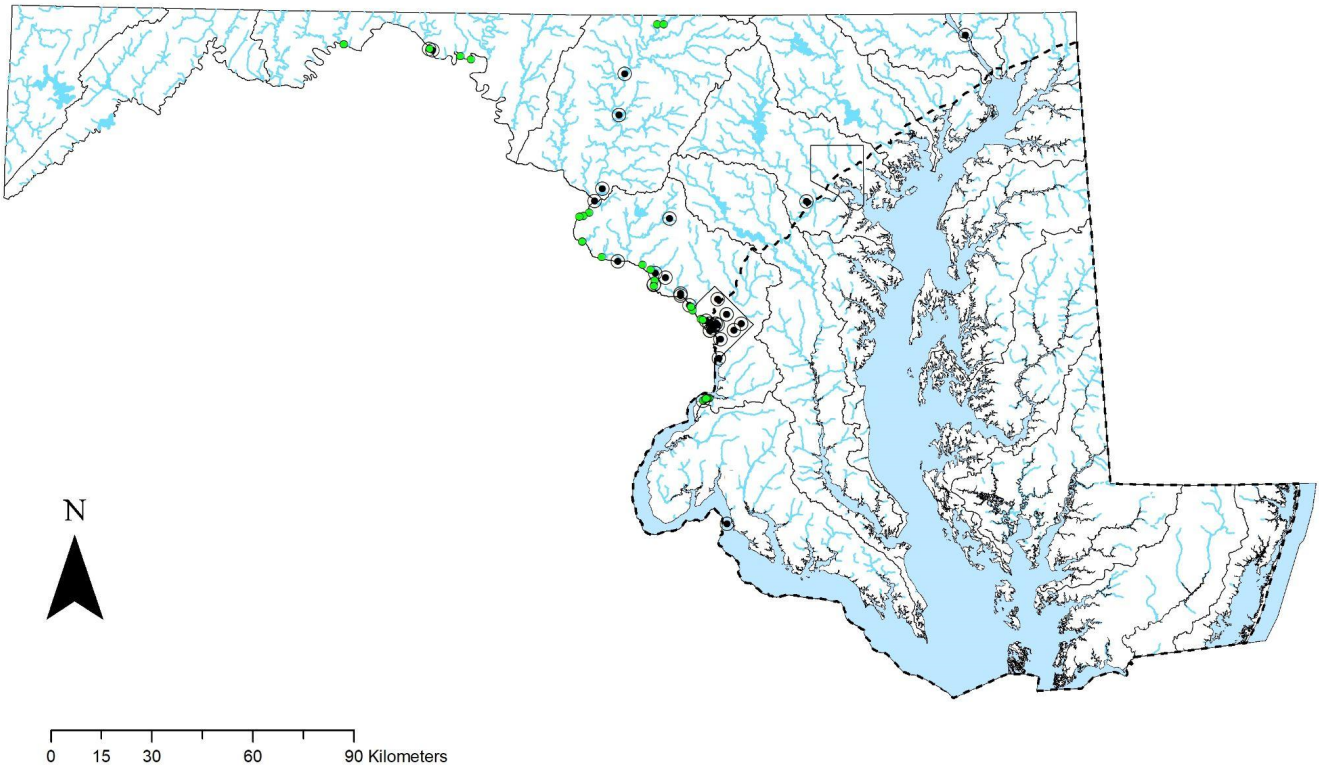
HOST FISH. Banded Killifish, *Fundulus diaphanous*; Chain Pickerel, *Esox niger*; Largemouth Bass,

USNM 227692

Micropterus salmoides, Smallmouth Bass, *Micropterus dolomieu;* White Perch, *Morone americana*; White Sucker, *Catostomus commersoni*; Yellow Perch, *Perca flavescens*.

STATUS. Federally at-risk and state uncertain.

COMMENTS: Previously listed as extirpated in Maryland, but current status is unranked due to taxonomic confusion obscuring the certainty of recent collection records in the middle and upper Potomac River where a non-native Lampmussel has been present since at least the 1900s.



Map 11. Distribution of *Lampsilis cariosa* (Say, 1817) in Maryland.

Lampsilis radiata (Gmelin, 1791) **Eastern Lampmussel** Fig. 12

SYNONYMY

Mya radiata Gmelin, 1791
Unio luteola Lamarck, 1819
Unio lineata 'Valenciennes' Bory de St. Vincent, 1827
Unio tenebrosus Conrad, 1834
Unio melinus Conrad, 1838
Unio boydianus Lea, 1840
Unio rosaceus De Kay, 1843
Mya oblongata Wood, 1856
Unio elongata S.G. Goodrich, 1858
Unio obliquiradiatus Reeve, 1865
Unio conspicuus Lea, 1872
Unio virginiana Simpson, 1900
Lampsilis radiata (Gmelin, 1791)
Lampsilis radiata oneidensis Baker, 1916
Unio virginea Frierson, 1927
Lampsilis radiata radiata (Gmelin, 1791)
Lampsilis radiata var. *conspicua* (Lea, 1872)
Lampsilis (Lampsilis) radiata radiata (Gmelin, 1791)

SHELL DESCRIPTION. Shell medium to large, subelliptical or subovate in outline, moderately elongate, valves from not inflated to quite inflated, anterior end rounded, posterior end in females broadly expanded and rounded, dorsal margin straight and ventral margin straight to gently curved, posterior ridge mostly absent, posterior slope broad, beaks rather sharp but not very inflated. Periostracum yellowish or brownish green with dark green rays over the entire surface, no interdentum, beak cavity shallow, nacre white, may be tinged pink or salmon.

DISTRIBUTION. Connecticut, Delaware, Massachusetts, Maryland, Maine, Michigan, North Carolina, Vermont, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Virginia, West Virginia, New Brunswick, Nova Scotia, Ontario, and Quebec, Canada.

ECOLOGY. Ortmann (1919:317) recorded this species "Where found, this species is generally abundant, even in smaller streams…It is always found in lively current on shoals and riffle, in finer or coarser gravel and very often in bars of pure sand."

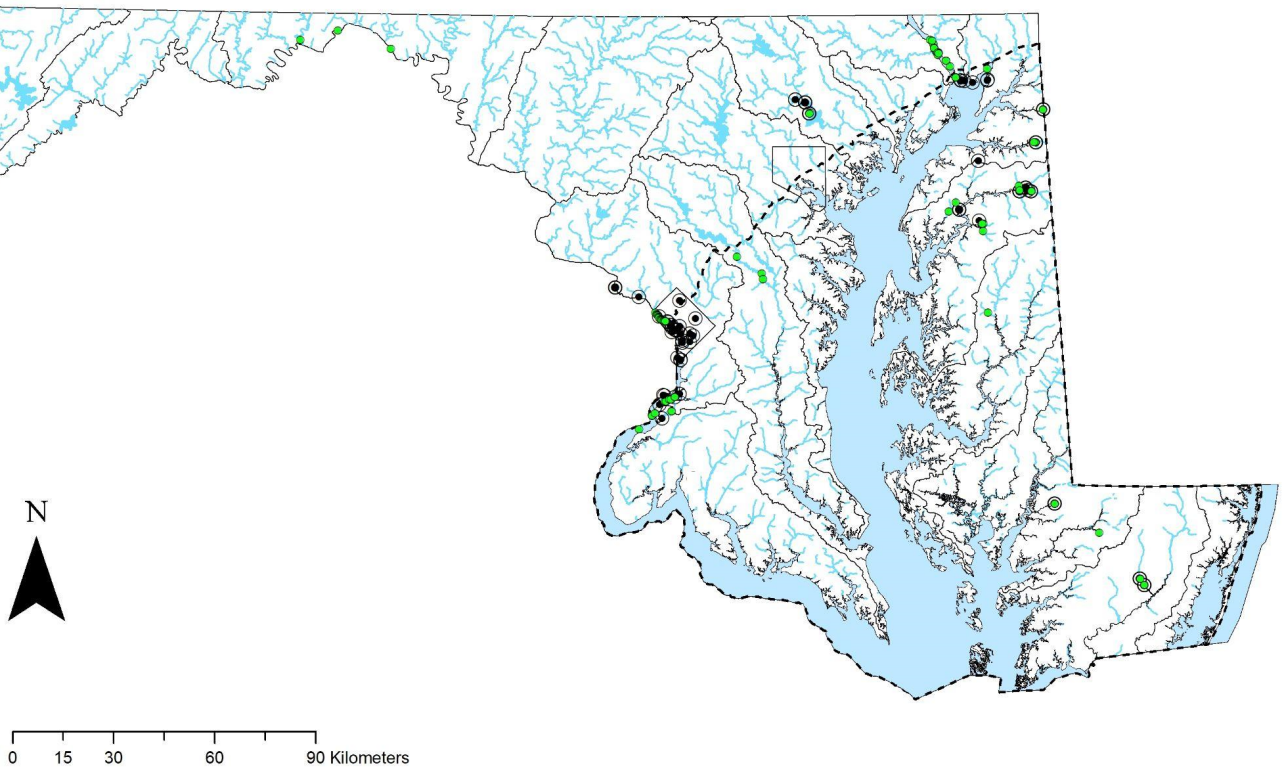
USNM 42795

In Maryland, this species is primarily restricted to and in greatest abundance in tidal-freshwater where it can be found in silt, sand, and gravel often near shorelines and submerged aquatic vegetation. They can be also found in ponds and reservoirs, where stocking of host fish likely introduced mussels.

BREEDING SEASON. Ortmann (1919:293) reported gravid females in late August. Fully gravid, displaying females have been collected in Maryland during September through October.

HOST FISH. Banded Killifish, *Fundulus diaphanous*; Black Crappie, *Pomoxis nigromaculatus*; Largemouth Bass, *Micropterus salmoides*; Rock Bass, *Amblopites rupestris*; Pumpkinseed, *Lepomis gibbosus*; Smallmouth Bass, *Micropterus dolomieu*; White Perch, *Morone americana*; Yellow Perch, *Perca flavescens*.

STATUS. State watchlist.



Map 12. Distribution of *Lampsilis radiata* (Gmelin, 1791) in Maryland.

Platynaias subviridis (Conrad, 1835) **Green Floater** Fig. 13

SYNONYMY

Unio subviridis Conrad, 1835
Unio tappanianus Lea, 1838
Unio hyalinus Lea, 1845
Margaritana quadrata Lea, 1861
Unio pertenius Lea, 1863
Lasmigona (Platynaias) subviridis (Conrad, 1835)

SHELL DESCRIPTION. Shell ovate trapezoid, thin and rather fragile, beaks only projecting slightly above the hinge line, posterior ridge rounded, periostracum green, light yellow or brown with numerous green rays especially in juveniles. Pseudocardinal and lateral teeth small and delicate, interdental tooth present, beak cavity shallow, nacre whitish to blush and iridescent posteriorly.

DISTRIBUTION. Georgia, Kentucky, Maryland, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia.

ECOLOGY. Ortmann (1919:124) listed the ecology of the species: "this species is very erratic in its distribution…The specimens found by myself in larger rivers generally were few, and often in small branches of the river. But even in small streams, it is not everywhere present…it is averse to very strong current, and prefers more quiet parts, pools or eddies, with gravelly and sandy bottoms, and it also goes into canals."

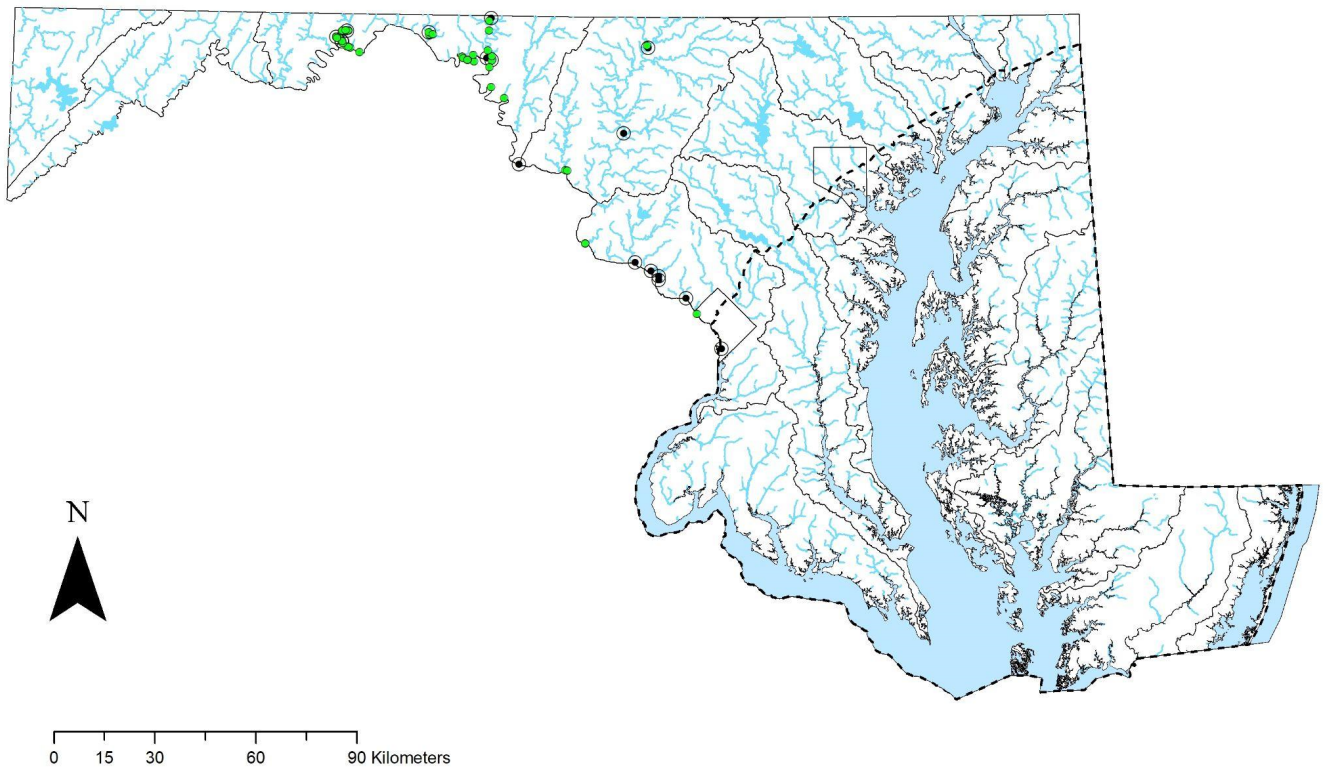
In Maryland, it is restricted to pools and slow runs of larger streams and rivers where they can be sporadically found in fine substrates.

BREEDING SEASON. Ortmann (1919:122) reported gravid females from August to September and April to June, a bradytictic species. They are unique among unionids in that they seemingly do not require a host fish. Fully transformed juveniles were found in females during April in Sideling Hill Creek (Barfield & Watters 1998, Lellis & King 1998).

USNM 251570

HOST FISH. Not required.

STATUS. State endangered



Map 13. Distribution of *Platynaias subviridis* (Conrad, 1835) in Maryland.

Prolasmidonta heterodon (Lea, 1829) **Dwarf Wedgemussel** Fig. 14

SYNONYMY

Unio heterodon Lea, 1829
Alasmidonta heterodon (Lea, 1829)
Alasmidonta (Pressodonta) heterodon (Lea, 1829)
Prolasmidonta heterodon (Lea, 1829)

SHELL DESCRIPTION. Shell small, subtrapezoid or "hump backed" shell thick anteriorly and thinning posteriorly, ventral margin mostly straight, posterior margin pointed near the base, dorsal margin slightly curved, beaks low and rounded, projecting only slightly above the hinge line, posterior ridge rounded, somewhat inflated and prominent, periostracum yellowish, olive brown to blackish with variable width reddish brown rays, hinge teeth unusual with an interdental projection, beak cavity narrow and rather shallow, nacre bluish white.

DISTRIBUTION. Connecticut, Delaware, Massachusetts, Maryland, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, Vermont, and New Brunswick, Canada.

ECOLOGY. Ortmann (1919:176) observed "I found this species in very small streams ("runs"), in strongly flowing water, and in rather coarse gravel, …in a small branch of the river in sand and moderate current…in the canal at Manayunk at time when the water had been drained off … Here the bottom consisted of larger and smaller stones, the interstices filled with sandy mud. This however, cannot be regarded as normal, and the ecological conditions of this species remain to be studied".

In Maryland, this species inhabits small to medium sized Coastal Plain streams, although historically known from the Potomac River Gorge and Choptank River. Typically found in shallow runs with sand-gravel substrates, often in the outside bends of stream channels as it transitions into a pool.

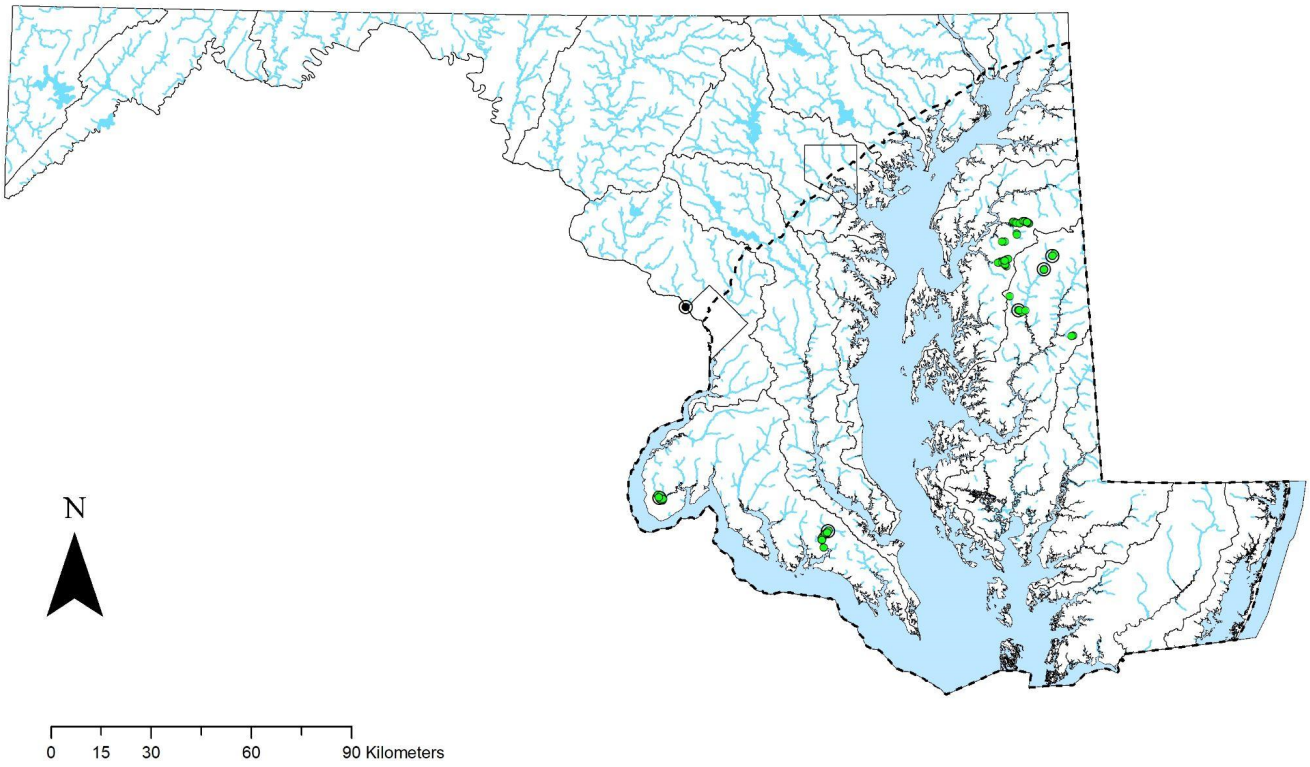
BREEDING SEASON. Ortmann (1919:174) reported gravid females from February to April.

USNM 125234

Michaelson and Neves (1995) found gravid females beginning in September through November in North Carolina. Glochidia were probably released in April. In Massachusetts, glochidia release and host infection was observed from early May to late June (McClain and Ross 2005).

HOST FISH. Johnny Darter *Etheostoma nigrum*; Tessellated Darter, *Etheostoma olmstedi*; Mottled Sculpin, *Cottus bairdi*; Atlantic Chub, *Salmo salar*; Brown Trout, *Salmo trutta*; Banded Killifish, *Fundulus diaphanus*; Striped Bass, *Morone saxatalis*; Shield Darter, *Percina peltata*.

STATUS. Federally and state endangered.



Map 14. Distribution of *Prolasmidonta heterodon* (Lea, 1829) in Maryland.

Pyganodon cataracta (Say, 1817) **Eastern Floater** Fig. 15

SYNONYMY

Anodonta cataracta Say, 1817
Anodonta marginata Say, 1817
Anodonta teres Conrad, 1834
Anodon excurvata De Kay, 1843
Anodonta virgulata Lea, 1857
Anodonta lacustris Lea, 1857
Anodonta hallenbeckii Lea, 1858
Anodonta gesnerii Lea, 1858
Anodonta dariensis Lea, 1858
Anodonta williamsii Lea, 1862
Anodonta tryoni Lea, 1862
Anodonta dolearis Lea, 1863
Anodonta doliaris Lea, 1866
Anodonta (Pyganodon) cataracta cataracta Say, 1817

SHELL DESCRIPTION. Shell medium to large, outline subelliptical and elongate, shell inflation increases with age, shell thin, posterior margin pointed, ventral margin straight to slightly curved, posterior ridge indistinct, slope often with two faint ridges, beaks slightly swollen, located in the anterior third of shell. Periostracum is usually smooth, shiny, straw yellow to light green to dark green, rays on posterior slope darker than rays on disk of shell. No teeth are present, muscle scars poorly defined, nacre bluish-white.

DISTRIBUTION. Alabama, Connecticut, Delaware, Georgia, Massachusetts, Maryland, Maine, Michigan, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, Vermont, Wisconsin, West Virginia, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Quebec, Canada.

ECOLOGY. Ortmann (1919:158) noted a creek and a pond form and remarked: "I collected the pond-form in rather small ponds, with very muddy bottoms, and also, but more rarely, in quiet pools of creeks…the creek-form…It seems to avoid the larger rivers…It favors small rivers and creeks. Here it lives on gravelly bottoms, in more or less strongly flowing water, or in more quiet pools in gravel, sand or mud. The short high form… seems to prefer large rivers with muddy bottoms."

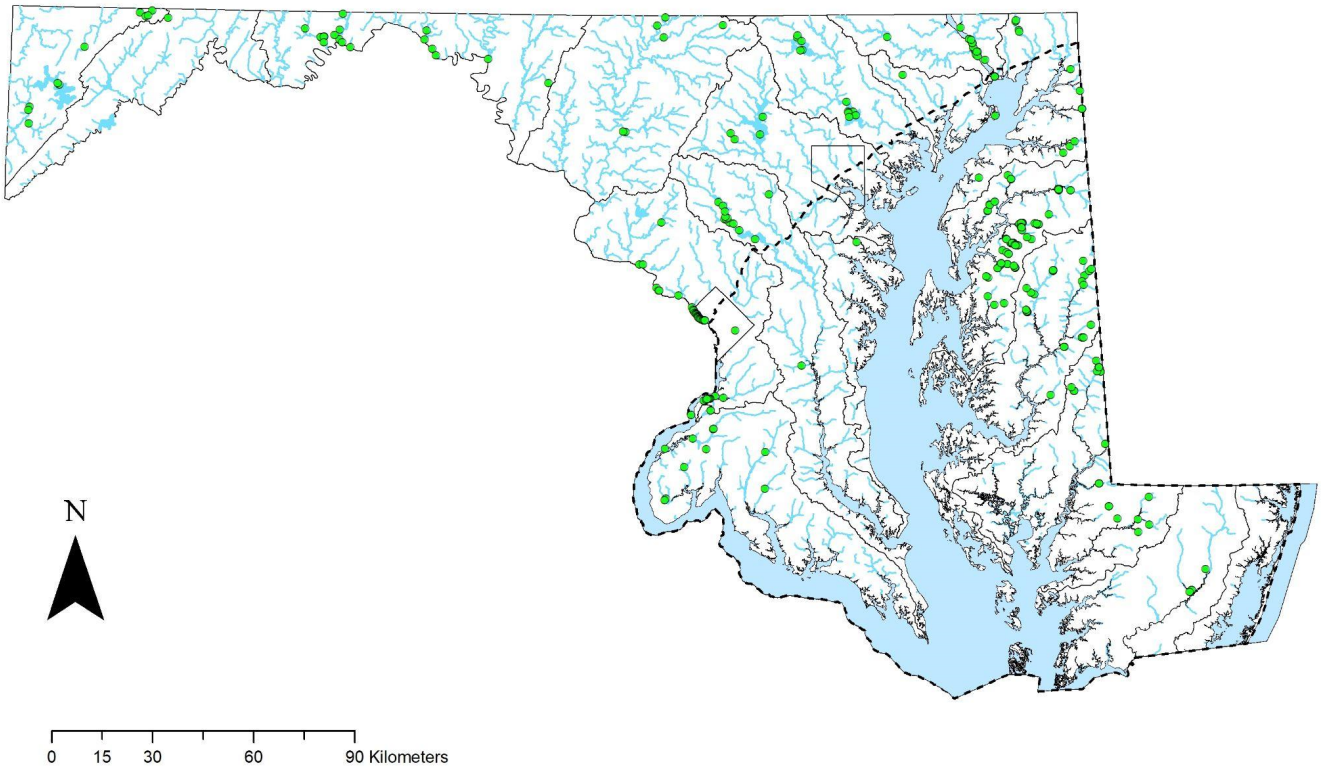
USNM 707481

In Maryland, it can be found in most lentic waters, including ponds, canals, reservoirs, and tidal-freshwater. They are occasionally found in streams, especially those with nearby connections to impoundments.

BREEDING SEASON. Ortmann (1919:153) reported gravid females from late July to late April. A bradytictic species.

HOST FISH. Common Carp, C*yprinus carpio*; Pumpkinssed, *Lepomis giboosus*; Rock Bass, *Ambloplites rupestris*; Threespine Stickleback, *Gasterosteus aculeatus*; White Sucker, *Catostomus commersoni*.

STATUS. None.



Map 15. Distribution of *Pyganodon cataracta* (Say, 1817) in Maryland.

Sagittunio nasutus Say, 1817 **Eastern Pondmussel** Fig. 16

SYNONYMY

Unio nasutus Say, 1817
Obliquaria attenuata Rafinesque, 1820
Unio rostrata Valenciennes, 1827
Unio vaughanianus Sowerby, 1868
Unio fisherianus Kuester, 1860 non Lea, 1838
Lampsilis nasuta (Say, 1817)
Eurynia nasuta (Say, 1817)
Ligumia nasuta (Say, 1817)
Sagittunio nasutus Say, 1817

USNM 251536

SHELL DESCRIPTION. Shell elongated, subelliptical, shell is over twice as long as high, rather thin, subinflated, posterior end bluntly pointed, dorsal margin straight, ventral margin curved, posterior ridge distinct, beaks low and located in anterior quarter of shell. Periostracum greenish-yellow to dark olive or brown sometimes with fine rays. Beak cavity shallow, lateral teeth long and straight, pseudocardinal teeth compressed, nacre white. Male shell tape to a blunt point posteriorly, female shell is distinctly swollen posteriorly.

DISTRIBUTION. Connecticut, Delaware, Massachusetts, Maryland, Maine, Michigan, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Virginia, and Ontario, Canada.

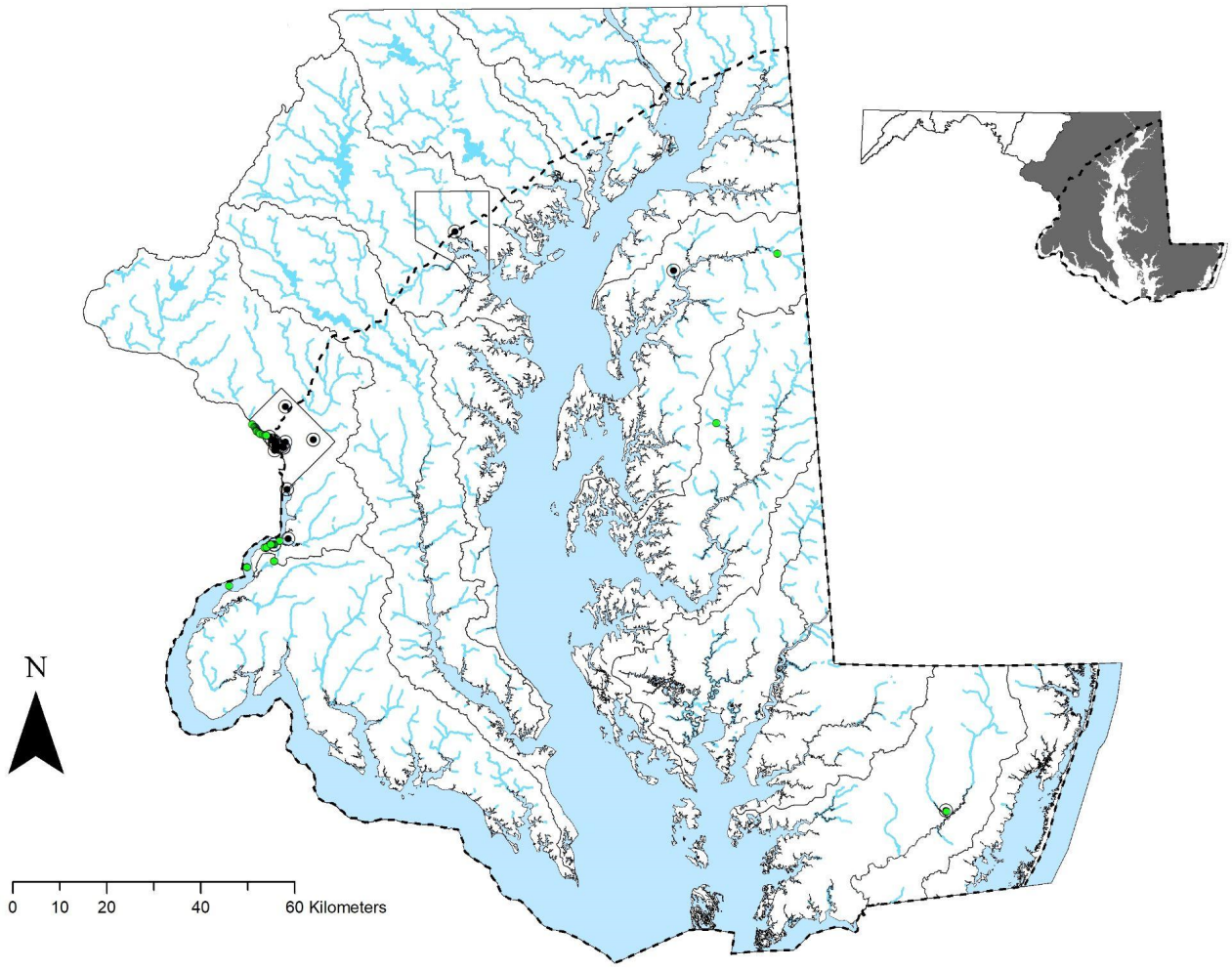
ECOLOGY. Ortmann (1919:275) recorded the ecology of this species as ”Sandy bottom of great, quiet bodies of water (tidewaters, lakes and probably also canals) seem to furnish the conditions most favorable to this species.”

In Maryland, they are restricted to tidal-freshwater and can be found among beds of submerged aquatic vegetation.

BREEDING SEASON. Ortmann (1919) reported gravid females from eastern Pennsylvania from September and May. He noted gravid females form Lake Erie from August to early July, a bradytictic species.

HOST FISH. Bluegill, *Lepomis macrochirus*; Brook Stickleback, *Culaea inconstans*; Largemouth Bass, *Micropterus salmoides*; Pumpkinseed, *Lepomis gibbosus*; Redbreast Sunfish, *Lepomis auratus*; Redear Sunfish, *Lepomis microlophus*; Yellow Perch, *Perca flavescens*.

STATUS. State watchlist.



Map 16. Distribution of *Sagittunio nasutus* (Say, 1817) in Maryland.

Strophitus undulatus (Say, 1817) **Creeper** Fig. 17

SYNONYMY

Anodonta undulata Say, 1817
Alasmodonta edentula Say, 1820
Anodon rugosus Swainson, 1822
Anodonta arkansensis Call, 1885
Anodonta edentula (Say, 1817)
Strophitus edentulus (Say, 1817)
Strophitus rugosus (Swainson)
Anodonta pensylvanica [sic] Lamarck, 1819
Anodon areolatus Swainson, 1829
Alasmodonta edentula Say, 1829
Anodonta virgata Conrad, 1836
Anodonta pavonia Lea, 1836
Anodonta wardiana Lea, 1838
Anodon unadilla De Kay, 1843
Anodonta tetragona Lea, 1845
Anodonta arkansensis Lea, 1852
Anodonta shaefferiana Lea, 1852
Alasmodon rhombica Anthony, 1865
Anodon papyracea Anthony, 1865
Anodon annulatus Sowerby, 1867
Anodon quadriplicatus Sowerby, 1867
Anodonta salmonia Clessin, 1873
Strophitus undulatus ovatus Frierson, 1927
Strophitus rugosus pepinensis Baker, 1928
Strophitus rugosus winnebagoeinsis Baker, 1928
Strophitus rugosus lacustris Baker, 1928
Strophitus edentulus (Say, 1817)

SHELL DESCRIPTION. Shell oblong oval, dorsal and ventral margins rounded, shell thin and fragile when young but becoming thicker with age, length to 11 cm. Shell compressed to inflated, posterior ridge rounded, beaks narrow but only slightly raised above the hinge. Periostracum yellow-brown to greenish becoming darker with age, green rays may cover the shell. Pseudocardinal teeth are only swellings or thickening along the hinge, lateral teeth absent, beak cavity shallow, hinge line undulate, nacre white with cream or salmon color in beak cavity.

DISTRIBUTION. Alabama, Arkansas, Colorado, Connecticut, Delaware, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, Mississippi, North Carolina, North Dakota, Nebraska, New Hampshire, New

USNM 215171

Jersey, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, Vermont, Wisconsin, and West Virginia, Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, and Saskatchewan Canada.

ECOLOGY. Ortmann (1919:204-205) reported "it is distinctly averse to large rivers…We may call *S. edentulous* a form characteristic of smaller streams…Baker says that it is found in the larger lakes and rivers on muddy bottoms…while Scammon reports it to prefer mud and quiet water, and to be the most abundant in small streams (in Kansas)…in small streams it avoids riffles, but delights in quiet and protected pools and eddies, where there is a moderate and rather uniform current, and a deposit of fine gravel or sand."

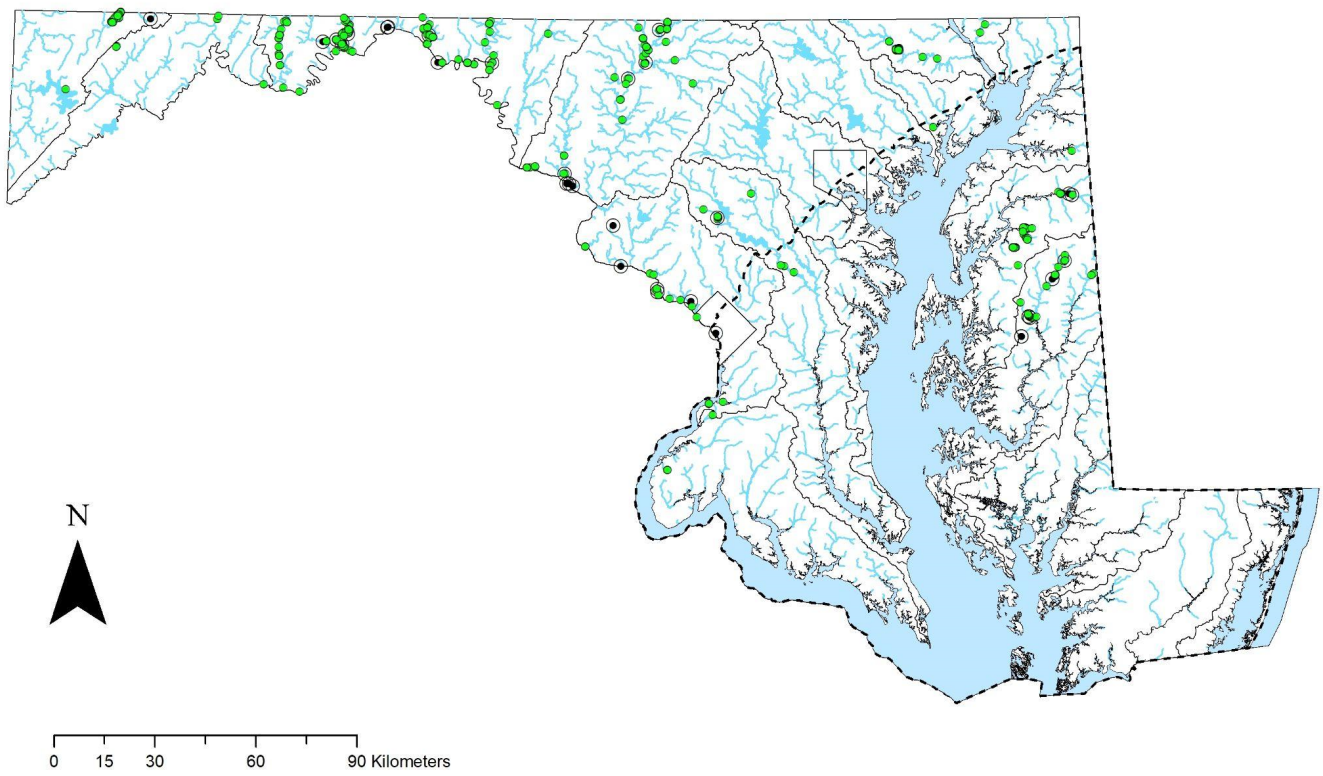
In Maryland, this species inhabits most major rivers and the headwaters of some watersheds. In low abundance range wide.

BREEDING SEASON. Ortmann (1919:196) reported Atlantic slope individuals were "gravid in

December and March, but not in April and May", a bradytictic species.

HOST FISH. Banded Darter, *Etheostoma zonale*; Black Bullhead, *Ameriurus melas*; Black Crappie, *Pomoxis nigromaculatus*; Blacknose Dace, *Rhinichthys atratulus*; Blackside Darter, *Percina maculata*; Bluegill, *Lepomis macrochirus*; Bluntnose Minnow, *Pimephales notatus*; Brook Stickleback, *Culaea inconstans*; Brook Trout, *Salvelinus fontinalis*; Brown Bullhead, *Ameiurus nebulosus*; Burbot, *Lota lota*; Central Mudminnow, *Umbra limi*; Central Stoneroller, *Campostoma anomalum*; Channel Catfish, *Ictalurus punctatus*; Common Shiner, *Luxilus cornutus*; Creek Chub, *Semotilus atromaculataus*; Fantail Darter, *Etheostoma flabellare*; Fathead Minnow, *Pimephales promelas*; Flathead Catfish, *Pylodictis olivaris*; Flathead Minnow, *Pimephales promelas*; Golden Shiner, *Notemigonus crysoleucas*; Green Sunfish, *Lepomis cyanellus*; Iowa Darter, *Etheostoma exile*; Johnny Darter, *Etheostoma nigrum*; Largemouth Bass, *Micropterus salmoides*; Logperch, *Percina caprodes*; Longear Sunfish, *Lepomis megalotis*; Longnose Dace, *Rhinichthys cataractae*; Northern Redbelly Dace, *Chrosomus eos*; Plains Killifish, *Fundulus zebrinus*; Rainbow Darter, *Etheostoma caeruleum*; Rainbow Trout, *Oncorhynchus mykiss*; River Chub, *Nocomis micropogon*; Rock Bass, *Ambloplites rupestris*; Sand Shiner, *Notropis stramineus*; Slenderhead Darter, *Percina phoxocephala*; Slimy Sculpin, *Cottus cognatus*; Smallmouth Bass, *Micropterus dolomieu*; Spotfin Shiner, *Cyrpinella spiloptera*; Tessellated Darter, *Etheostoma olmstedi*; Walleye, *Stizostedion vitreum*; White Crappie, *Pomoxis annularis*; Yellow Bullhead, *Ameriurus natalis*;

STATUS. State in need of conservation.



Map 17. Distribution of *Strophitus undulatus* (Say, 1817) in Maryland.

Toxolasma parvum (Barnes, 1823) **Lilliput** Fig. 18

SYNONYMY

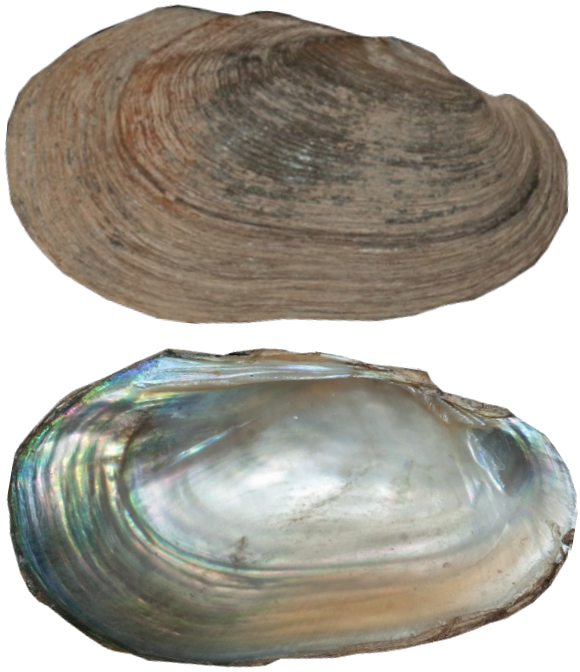
Unio parvus Barnes, 1823
Carunculina parva cahni F.C. Baker, 1928
*Mya parva (*Barnes, 1823)
Margarita (Unio) parvus (Barnes, 1823)
Margaron (Unio) parvus (Barnes, 1823)
Lampsilis (Cornunculina) parvus (Barnes, 1823)
Eurynia (Carunculina) parvus (Barnes, 1823)
Toxolasma parvus (Barnes, 1823)
Toxolasma parva (Barnes, 1823)

SHELL DESCRIPTION. Shell outline oval to elliptical, shell moderately inflated and moderately thin. Dorsal and ventral margins straight to slightly convex, posterior and anterior margins rounded. Posterior slope slightly concave and moderately steep, umbo broad, moderately inflated with single-looped ridges. Periostracum is typically cloth-like, greenish brown to black, without rays. Small, compressed pseudocardinal teeth, lateral teeth thin straight to slightly curved, interdentum short, very narrow to narrow, umbo cavity shallow, and nacre white to bluish white.

DISTRIBUTION. Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, West Virginia, Wisconsin.

ECOLOGY. Ortmann (1919:260) reported that "it lives here in the mud…According to Baker (1898a) and Scammon (1906), this is a species living buried in mud, in sluggish streams, canals, etc."

In Maryland, they are known from the Big Slackwater portion of the Potomac River, in the impoundment created by Dam no. 4, buried in silt near the shoreline.

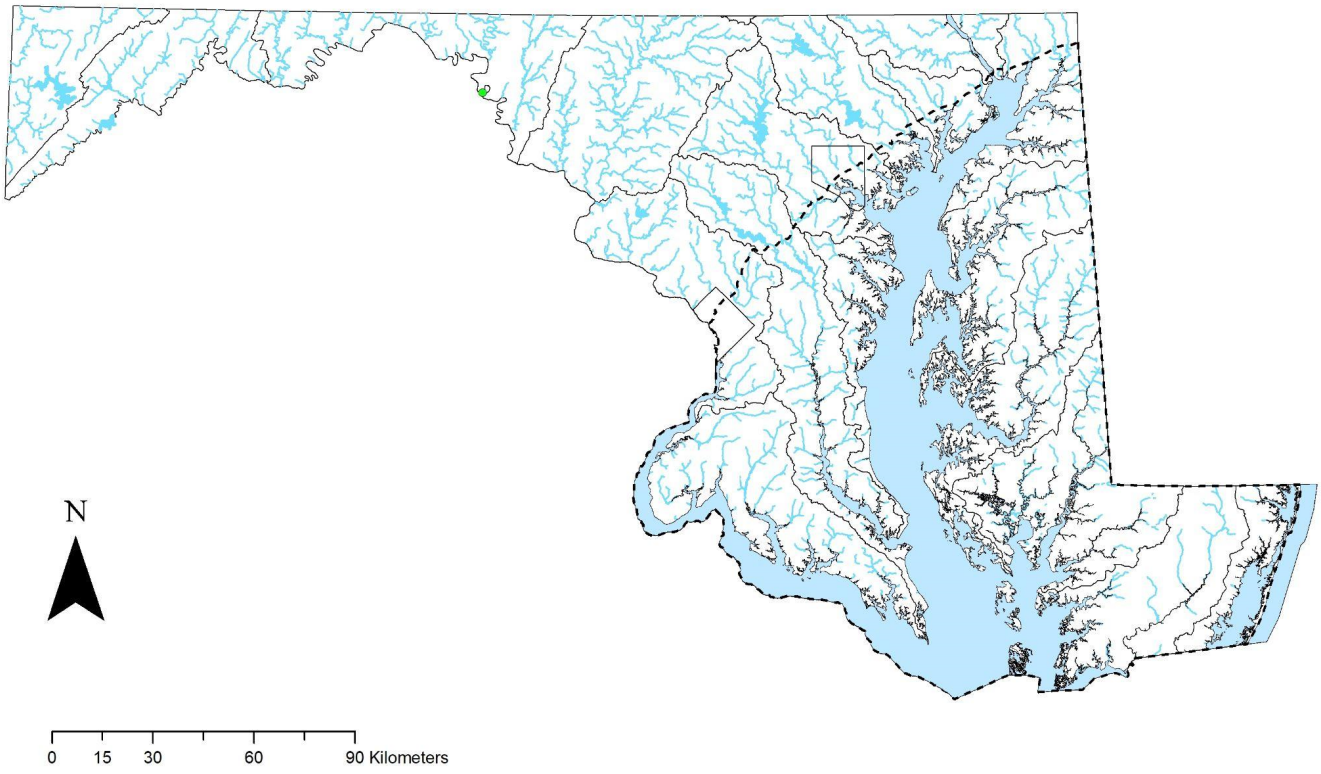


USNM 1744077

BREEDING SEASON. Ortmann (1919:260) reported gravid females in June and August, and females with fully developed glochidia in May and June. A tachytictic species.

HOST FISH. Bluegill, *Lepomis macrochirus*; Green Sunfish, *Lepomis cyanellus*; Johnny Darter, *Etheostoma nigrum*; Orangespotted Sunfish, *Lepomis humilis*; Warmouth, *Lepomis gulosus;* White Crappie, *Pomoxis annularis*.

STATUS. Introduced.



Map 18. Distribution of *Toxolasma parvum* (Barnes, 1823) in Maryland.

Utterbackia imbecillis (Say, 1829) **Paper Pondshell** Fig. 19

SYNONYMY

Anodonta imbecillis Say, 1829
Anodonta imbecilis [sic] Say, 1829
Anodonta incert Lea, 1834
Anodon horda Gould, 1855
Anodonta henryana Lea, 1857
Utterbackia imbecillis fusca Baker, 1927
Anodonta ohiensis Rafinesque, 1820 [in part)
Anodonta (Utterbackia) imbecillis Say, 1829

SHELL DESCRIPTION. Shell elongate, oblong, dorsal hinge line rather short and straight, the ventral margin rounded, shell inflated and thin growing to about 10 cm in length, beaks flat, even with the hinge line, beaks on the anterior third of the shell. Periostracum is shiny, light yellow on the umbo, the rest of the shell bright green with rays and a posterior slope that is dark green to black. Both valves edentulous, nacre bluish-white, often with pink tinges.

DISTRIBUTION. Alabama, Arkansas, Florida, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, Mississippi, North Carolina, Nebraska, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Wisconsin, West Virginia, Ontario Canada, Mexico.

ECOLOGY. Johnson (1970:364) noted "lives in soft mud or sand in ponds, creeks, and near the banks of larger rivers."

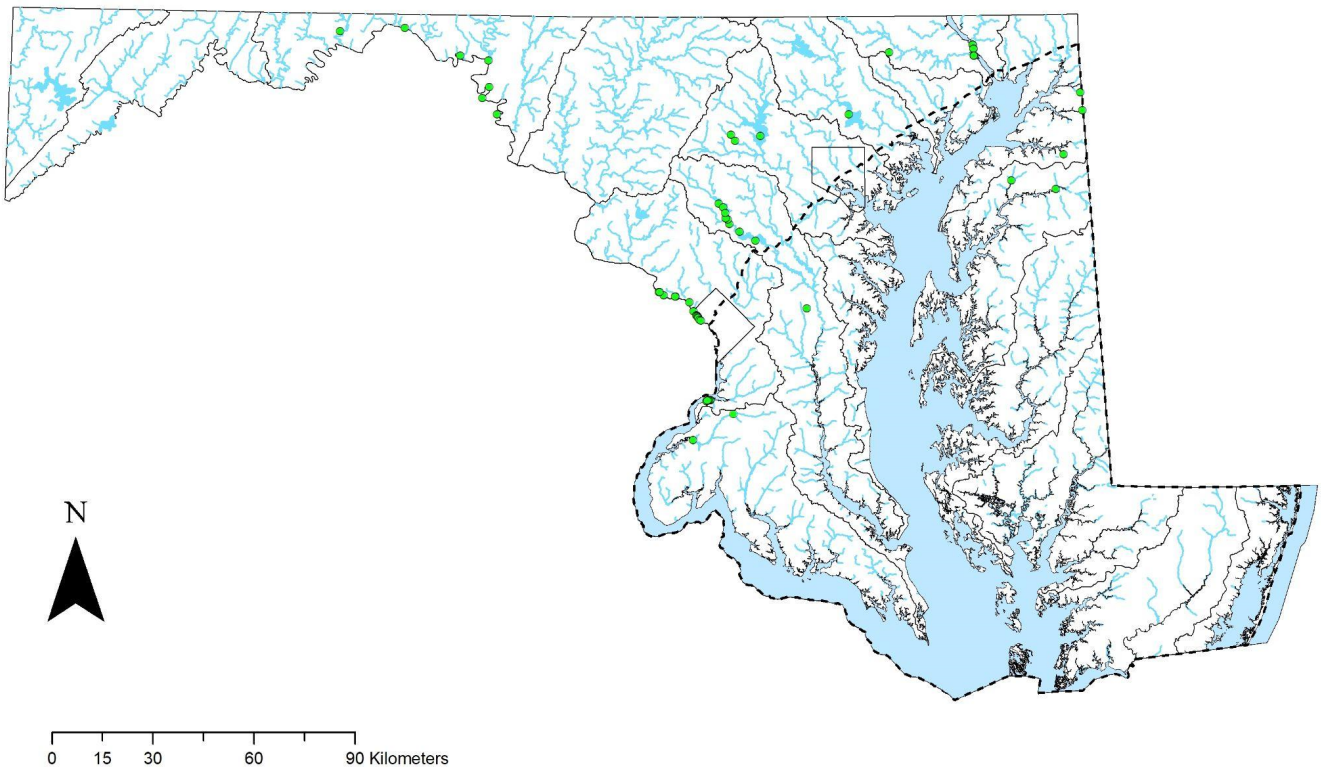
In Maryland, found in ponds, lakes, canals, and reservoirs on sand and mud flats. Can also be found in larger rivers, like the Potomac, where dams have created run-of-river impoundments.

BREEDING SEASON. Ortmann (1919:163) noted this species as bradytictic. Females were gravid in June and July and discharging glochidia in May noted "the succeeding breeding season overlap in June and July, but probably not in the same individual." The species is hermaphroditic (Hoeh 1991).

USNM 605436

HOST FISH. Banded Killifish, *Fundulus diaphanous*; Black Crappie, *Pomoxis nigromaculatus*; Channel Catfish, *Ictalurus punctatus*; Creek Chub, *Semotilus atromaculatus*; Dollar Sunfish, *Lepomis marginatus*; Rock Bass, *Ambloplites rupestris*; Bluegill, *Lepomis macrochirus*; Dollar Sunfish, *Lepomis marginatus*; Green Sunfish, *Lepomis cyanellus*; Golden Shiner, *Notemigonus crysoleucas*; Goldfish, *Carassius auratus*; Greenthroat Darter, *Etheostoma lepidum*; Spotfin Shiner, *Cyprinella spiloptera*; Longear Sunfish, *Lepomis megalotis*; Pumpkinseed, *Lepomis gibbosus*; Warmouth, *Lepomis gulosus*; Largemouth Bass, *Micropterus salmoides*; Western Mosquitofish, *Gambusia affinis*; Yellow Perch, *Perca flavescens*.

STATUS. State watchlist.



Map 19. Distribution of *Utterbackia imbecillis* (Say, 1829) in Maryland.

Utterbackiana implicata (Say, 1829) **Alewife Floater** Fig. 20

SYNONYMY

Anodonta implicata Say, 1829
Anodonta newtonensis Lea, 1836
Anodonta housatonica Linsley, 1845
Anodonta (Pyganodon) implicata Say, 1829
Utterbackiana implicata Say, 1829

SHELL DESCRIPTION. Shell elongate-elliptical to elongate-ovate, valves quite inflated, subcylindrical. Valves thick for *Anodonta*, ventral and dorsal margins straight, posterior ridge rounded and biangulate, umbos somewhat swollen and located in the in the anterior third of the shell, beak sculpture is five to seven double looped bars, periostracum smooth, yellowish brown, greenish brown, reddish brown to black with age. Immature specimens have fine rays. No teeth, beak cavity shallow, shell distinctly thickens along the anterior ventral margin below the pallial line, nacre color pale copper, pinkish, or white.

DISTRIBUTION. Connecticut, Delaware, Massachusetts, Maryland, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, Vermont, Canada: New Brunswick, Nova Scotia, Quebec.

ECOLOGY. Ortmann (1919:162) reported the ecology of this species as: “Generally it is reported as living in ponds, but sometimes also in rivers.”

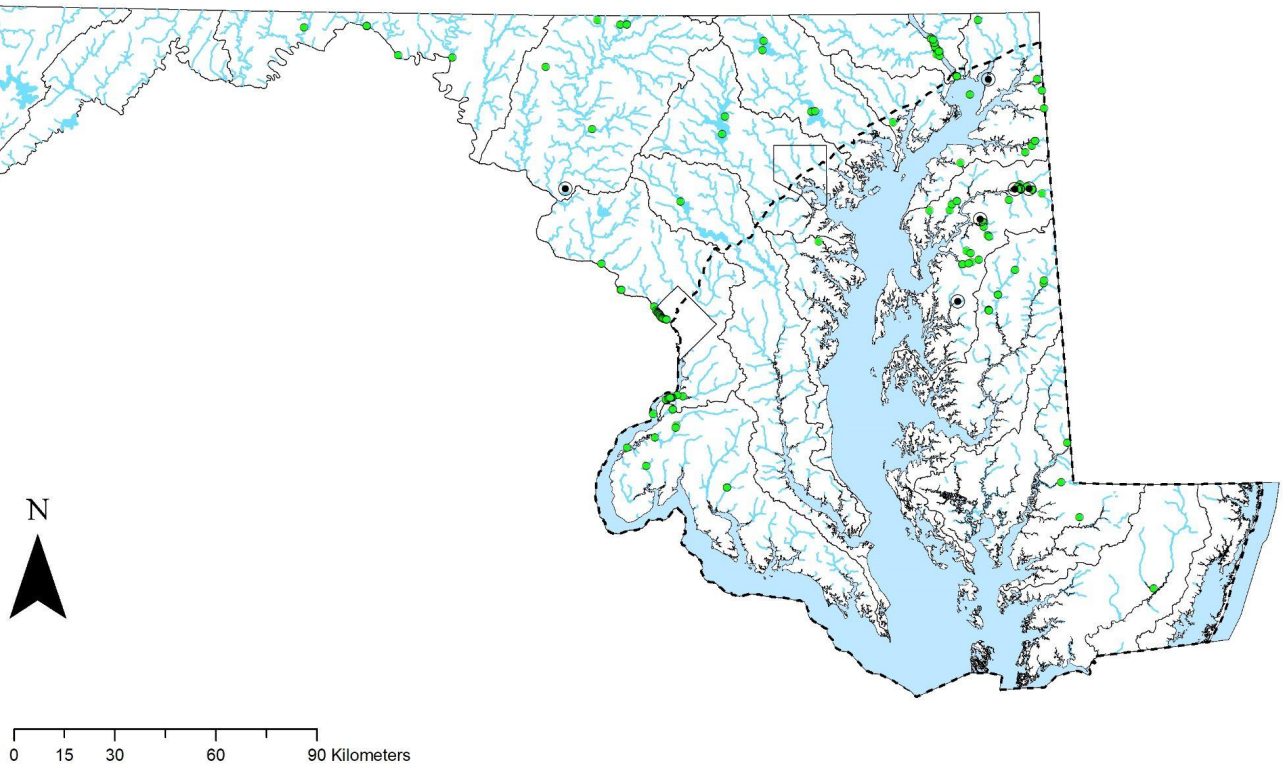
In Maryland, it is found almost exclusively in tidally influenced freshwater water or in close proximity, where blockages do not impede host fish migrations. Also found in mainland impoundments where stocking of host fish likely introduced mussels.

BREEDING SEASON. Ortmann (1919:160) reported the breeding season as September to May, a bradytictic species.

USNM 86562

HOST FISH. Alewife, *Alosa pseudoharengus*; Pumpkinseed, *Lepomis gibbosus*; White Perch, *Morone americana*; White Sucker, *Catastomus commersoni*, Three-spined Stickleback, *Gasterosteus aculeatus*, and Blueback Herring, *Alosa aestivalis*.

STATUS. State watchlist.



Map 20. Distribution of *Utterbackiana implicata* Say, 1829 in Maryland.

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