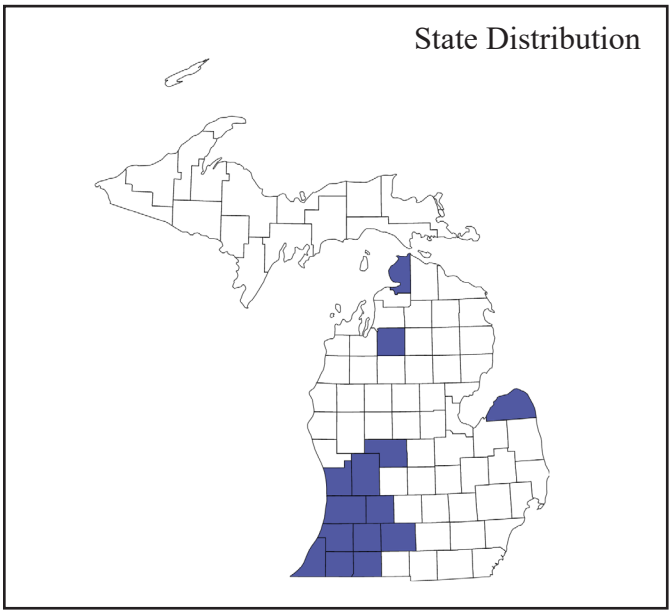
Fontigens nickliniana Lea — Watercress Snail



Best Survey Period

Status: Species of special concern

Global and state ranks: G5/S2S3

Family: Fontigentidae

Synonyms: *Paludina nickliniana* Lea, *Paludestrina nickliniana* Lea, *Bythinella obtusa* Lea, *Paludina obtusa* Lea, *Amnicola attenuata* Haldeman, *Cincinnatia binneyana* Hannibal. The genus *Fontigens* was elevated to its own Family (Fontigentidae, formerly Emmericiidae) based on genetic evidence (Wilke et al. 2013, Gladstone and Whelan 2022).

Range: The global range of watercress snail includes the eastern half of North America, with most occurrences concentrated in Michigan and the Appalachian region of Virginia, West Virginia, Kentucky, and Tennessee. Several scattered records for the species are to the north in Pennsylvania, New York, and Ontario; to the south in Alabama; and the Midwest states of Ohio, Indiana, and Illinois. Its status is most secure in Virginia and Tennessee where its state conservation rank is apparently secure (S4) and vulnerable (S3) respectively. Watercress snails were last documented in New York in the 1940s (New York Natural Heritage Program 2022) and in Pennsylvania, were found at only three out of 398 sites in streams and springs in a recent survey (Evans and Ray 2010, Badra et al. 2014, NatureServe 2022, GBIF 2022). Its global range and status are not well known due to a shortage of survey effort across its range.

State distribution: Watercress snail occurrences within the state of Michigan are concentrated in the southwestern part of the lower peninsula, especially in the Grand Rapids and Kalamazoo area, south to the Indiana boarder. Several occurrences are scattered across other parts of the lower peninsula, including one near Grayling that is currently one of the healthiest populations documented in Michigan (Michigan Natural Features Inventory 2022, GBIF 2022).

Recognition: Watercress snails are very small (3.5-4.5 mm in height), with a dark brown to black colored shell. The shell has a tall conical shape, more than twice as high as wide, with 4.5-7.5 whorls that are egg-shaped or nearly round in cross-section. The operculum (lid that seals the aperture) is roundly ovate with 4-5 rapidly enlarging spirals and

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is about 1 mm in width (Berry 1943). Watercress snail shells are very similar to those of the invasive New Zealand mudsnail (*Potamopyrgus antipodarum*), which has less incised sutures, whorls slightly teardrop shaped being slightly pointed at the top in cross section, 4-6 mm in height with 7-8 whorls, and an aperture that is reflected around most of the lip versus part of the lip for watercress snail. Boreal marstonia (*Marstonia lustrica*) is also similar but has a broader conical shape than watercress snail. Brown walker (*Pomatiopsis cincinnatiensis*) has an umbilicus whereas watercress snail does not, and brown walker's whorls increase in diameter faster. Slender walker (*Pomatiopsis lapidaria*) is slightly larger at 5.5-8.5 mm in height with 6-7.5 whorls. For more information on identifying freshwater snails, see Burch (1989).

Best survey time: The best time of year to survey for watercress snails is the first week of May through the first week of September.

Habitat: Watercress snails are found in springs and spring-fed headwater streams. They are strongly associated with the watercress (*Nasturtium officinale*), which is considered an introduced plant species in North America. Watercress snails are often seen on the stems and leaves of watercress, and immediately adjacent to the plants at the water's edge where the plant grows. They can be found in isolated springs, springs within shaded riparian zones along the banks of larger streams and rivers and around small lakes, as well as the edges of small spring fed headwater streams (Berry 1943). At some sites outside of Michigan, watercress snails have been documented in streams within caves (Hershler et al. 1990).

Biology: Watercress snails belong to the operculate snail group, often referred to as prosobranchs. They have a calcareous disc-shaped structure, called an operculum, they use to seal the aperture of their shell. This provides resistance to harsh conditions and some protection from predators. Watercress snails have a gill, which allows them to absorb oxygen from the water. They evolved from marine snail species that also have opercula and gills. In contrast, the non-operculate freshwater snails (often referred to as pulmonates) lack an operculum, have a lung-like structure for respiration, and evolved from terrestrial snail species.

Watercress snails are dioecious, meaning individuals are either male or female. Specific details about their reproduction and life history are not well known although they follow the general pattern of prosobranch snails. They reproduce with internal fertilization. Females lay small eggs (<1 mm) they attach to solid surfaces underwater and cover them with fine particle such as sand or mud. After several weeks juvenile snails hatch from the eggs with the ability to crawl.

Watercress snails graze diatoms and detritus from the stems and leaves of watercress plants and other surfaces. Like most snails, they use a radula to scrape food off the surface and move it towards their mouths. The radula is a ribbon shaped structure with hundreds of tiny teeth of various shapes organized in rows. Material scraped loose with the radula travels to the stomach where it enters a muscular chamber known as the gizzard. Sand grains are present within the gizzard that help grind up food particles and aid digestion. Diatoms are an important food for watercress snails. They may also eat other types of algae, bacteria, and dead plant material, which are known to be important food items for many other aquatic snail species. Freshwater snails are a significant food source for fish, turtles, ducks, and crayfish. They are a link in the chain of life between primary producers like algae, that gather energy from the sun, and vertebrate and crustacean predatory species.

Snails require calcium to build and maintain their shells. The calcium rich springs and spring fed streams where watercress snails are found supply them with needed calcium. Shell material is secreted from glands in the mantle along the edge of the shell. The oldest part of the shell is at the apex,

or top. Snail shells coil in one of two directions, dextral (right) or sinistral (left). With the aperture of the shell facing you, and the pointed end of the spire pointed up, a dextral shell will have the aperture on the right side of the shell while a sinistral shell will have the aperture on the left. Watercress snails have dextral shells.

Conservation/Management: Freshwater snails are important components of aquatic ecosystems throughout the world, occurring in rivers, lakes, springs, vernal pools, and permanent wetlands. They can dominate benthic stream communities in terms of abundance and biomass (Johnson and Brown 1997, Brown and Lydeard 2010) illustrating their significant role in aquatic food webs and nutrient cycling (Covich et al. 1999). A large proportion of aquatic snail species are endemic to small ranges, in some cases restricted to a single river basin, stream reach, lake, or spring. Declines in the status of freshwater snails have been driven by direct habitat alteration and cumulative downstream impacts, including dams, impoundments, channelization, erosion, excessive sedimentation, ground water withdrawal, point and non-point source pollution, and invasive species (Johnson et al. 2013). Of the 742 species of freshwater snails in the U.S. and Canada, 354 (48%) are thought to be critically imperiled (G1) or extinct (NatureServe 2022).

Watercress snails depend on the particular temperature regime, water chemistry, and physical structure of microhabitats found in springs and groundwater seeps on the margins of streams and lakes where watercress plants grow. Populations of watercress snails are restricted to the unique conditions found in these habitats. Avoiding hydrologic alterations, such as draining and filling, near occupied springs can help to maintain groundwater flow that creates this habitat type. Retaining or restoring naturally vegetated buffers around springs, streams, and lakes with watercress snail provides shade, moderate temperatures, and reduces potential for erosion. Sedimentation of fine particles and erosion along the banks of streams where watercress snails occur can be reduced by maximizing the amount of naturally vegetated landcover and minimizing impervious surfaces in the watershed. Higher proportions of impervious and non-naturally vegetated landcover types can lead to flashier stream flows and increased erosion of stream banks. Forms of pollution the species may be most susceptible to are road salt, metals (e.g. copper, mercury, and zinc), and excess nutrients from agricultural runoff (Lydeard et al. 2004, Johnson et al. 2013). One of the biggest factors limiting the conservation and management of watercress snail in Michigan is the lack of knowledge of the distribution and status of their populations.

Research needs: Documented survey effort for watercress snail in Michigan in recent decades is very sparse. Due to watercress snail's specific habitat requirements and small size, general surveys for aquatic snails in rivers and lakes would likely miss this species. Targeted surveys throughout its range might reveal it is more common than previously documented in the past, conversely, if historically documented populations are no longer present, its conservation status may need to be adjusted to help slow the decline of the species. Identifying additional populations and planning for their conservation could help ensure this species does not become threatened or endangered in Michigan.

Related abstracts: Spike-lip crater (*Appalachina sayana*), Pleistocene catinella (*Catinella exile*), marsh hive (*Euconulus alderi*), cherrystone drop (*Hendersonia occulta*), and six species of Vertigo.

Selected references:

Badra, P.J. 2023. Surveys for Watercress Snail (*Fontigens nickliniana*) in and around Fort Custer Training Center. Michigan Natural Features Inventory Report Number 2023-03, Lansing, MI. 17pp.

Badra, P.J., D.L. Cuthrell, M.J. Monfils, J.J. Paskus, Y.M. Lee, B.J. Klatt. 2014. Conservation Status Assessments of Michigan's Species of Greatest

Conservation Need. Michigan Natural Features Inventory Report No. 2014-12. Report to Michigan Dept. of Natural Resources, Wildlife Division, Lansing, MI. 29pp.

Berry, E.G. 1943. The Amnicolidae of Michigan: Distribution, Ecology, and Taxonomy. Miscellaneous Publications of the Museum of Zoology, University of Michigan, 57: 1-68.

Brown, K.M. and C.E. Lydeard. 2010. Mollusca: Gastropoda. Pages 277-307 in J.H. Thorpe and A.P. Covich, editors. Ecology and Classification of Freshwater Invertebrates of North America. Elsevier.

Burch, J.B. 1989. North American Freshwater Snails. Malacological Publications: Hamburg, Michigan. 365 pp.

Covich, A.P., M.A. Palmer, and T.A. Crowl. 1999. The role of benthic invertebrate species in freshwater ecosystems. BioScience 49: 119-127.

Dillon, R.T. 2000. The Ecology of Freshwater Molluscs. Cambridge University Press: Cambridge, United Kingdom. 509pp.

Dillon, R.T., Jr., B.T. Watson, T.W. Stewart, and W. K. Reeves. The freshwater gastropods of North America. Online. http://www.fwgna.org

Evans, R.R. and S.J. Ray. 2010. Distribution and environmental influences on freshwater gastropods from lotic systems and springs in Pennsylvania, USA, with conservation recommendations. American Malacological Bulletin 28:135-150.

Freshwater Mollusk Conservation Society (FMCS). 2021. The 2021 checklist of freshwater gastropods (Mollusca: Gastropods) of the United States and Canada. Considered and approved by the Gastropods Names Subcommittee December 2020. Online: https://molluskconservation.org/MServices_Names-Gastropods.html

GBIF 2022. *Fontigens nickliniana* (I.Lea, 1838) in GBIF Secretariat. GBIF Backbone Taxonomy. Checklist dataset https://doi.org/10.15468/39omei.

Gladstone, N.S. and N. Whelan. 2022. Pushing barcodes to their limits: phylogenetic placement of *Fontigens* Pilsbry, 1933 (Caenogasatropoda: Littorinimorpha: Truncatelloidea) and elevation of Fontigentidae Taylor, 1966. Journal of Molluscan Studies 88: eyab038. https://doi.org/10.1093/mollus/eyab038

Hershler, R., J.R. Holsinger, and L. Hubricht. 1990. A revision of the North American freshwater snail genus *Fontigens* (Prosobranchia: Hydrobiidae). Smithsonian Contributions to Zoology 509: 1-50.

Johnson, P.D. and K.M. Brown. 1997. The role of current and light in explaining the habitat distribution of the lotic snail *Elimia semicarinata* (Say). Journal of the North American Benthological Society 16: 545-561.

Johnson, P., A. Bogan, K. Brown, N. Burkhead, J. Cordeiro, J. Garner, P. Hartfield, D. Lepitzki, G. Mackie, E. Pip, T. Tarpley, J. Tiemann, N. Whelan, and E. Strong. 2013. Conservation Status of Freshwater Gastropods of Canada and the United States. Fisheries. 38. 247. 10.1080/03632415.2013.785396.

Lydeard, C., R.H. Cowie, W.F. Ponder, A.E. Bogan, P. Bouchet, S.A. Clark, K.S. Cummings, T.J. Frest, O. Gargominy, D.G. Herbert, R. Hershler, K.E. Perez, B. Roth, M. Seddon, E.E. Strong, F.G. Thompson. 2004. The global decline of nonmarine mollusks. Bioscience 54: 321-330.

NatureServe. 2022. NatureServe Explorer: An online encyclopedia of life [web application].

NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/

Wilke T., Haase M., Hershler R., Liu H-P., Misof B., Ponder W. 2013. Pushing short DNA fragments to the limit: Phylogenetic relationships of "hydrobioid" gastropods (Caenogastropoda: Rissooidea). Molecular Phylogenetics and Evolution 66: 715 – 736.

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