Species Predicted Distribution Maps
Qualifications and Limitations

There are three ways of expressing or mapping species distributions: 1) *actual distribution,* which is based on exhaustive, long–term surveys that are very rare; 2) *known distribution*, which is based on current knowledge of where the species has been found and is usually incomplete, and 3) *predicted distribution*, which combines known distributions with quantitative or qualitative models of species-habitat associations to extrapolate to unsampled areas where the species is expected to occur (Csuti and Crist 1998). It is simply impractical to map the distribution of hundreds of species through intensive field surveys across entire states, regions, or nations (Scott et al. 1996). For instance, the nearly 7,000 fish, mussel, and crayfish collection records we compiled for our project only cover 0.03% of the total stream miles in Missouri.

The purpose of our predicted distribution maps is to provide more precise information about the historic and current distribution of individual native and nonnative species within their general ranges. With this information, better estimates can be made about the amount of available habitat for each species, how much has been lost, how much is currently represented within the existing matrix of public lands, and where are the best management options for conserving a particular species. The underlying assumption of our predicted distribution maps is that a species has a relatively high probability of occurring in appropriate habitat types that fall within its known or predicted geographic range (Csuti and Crist 1998).

Most rivers and streams and their associated biological assemblages have been altered by local and watershed disturbances such as impoundments, channelization, urban and agricultural runoff, point-source pollution, and the introduction of exotic species. Even with the significant advancements in our understanding of species-habitatt relations over the last 50 years, we still lack the necessary understanding of how these and other human activities act individually or cumulatively to specifically alter instream habitat and local biological assemblages (Poff 1997). We also lack the necessary geospatial data for some of these human disturbances. Consequently, it is currently impossible to accurately predict the present-day distribution of the vast majority of riverine biota. Due to these and other confounding factors, our predictive distributions reflect the biological potential of a given stream segment and not necessarily the present-day assemblage of species. This means that the assemblage we predict to occur in a given segment of stream will in some instances (e.g., highly disturbed streams) be quite different from the present-day assemblage. However, in relatively undisturbed locations our predictions should be relatively accurate provided our models are accurate.

Our species distribution maps were produced at 1:100,000 and are intended for applications at relatively broad spatial scales (homogeneous areas generally covering 1,000 to 1,000,000 ha and stream segments ranging from 10 to 1000 km, which are made up of multiple local biotic communities). Applications of these data to local site-level analyses are likely to be compromised by finer-grained patterns of environmental heterogeneity not captured within our models. The models presented in this report should be viewed as testable hypotheses as their suitability will vary with each given application.

Because of these and other qualifications and limitations it is imperative that individuals, interested in using these distribution maps for personal or professional means, read Chapter 4 of the Missouri Aquatic GAP Final Report. The USGS Biological Resources Division or the University of Missouri shall not be held liable for improper or incorrect use of these data.

Arkansas Brokenray

Lampsilis reeveiana reeveiana

Native: Yes

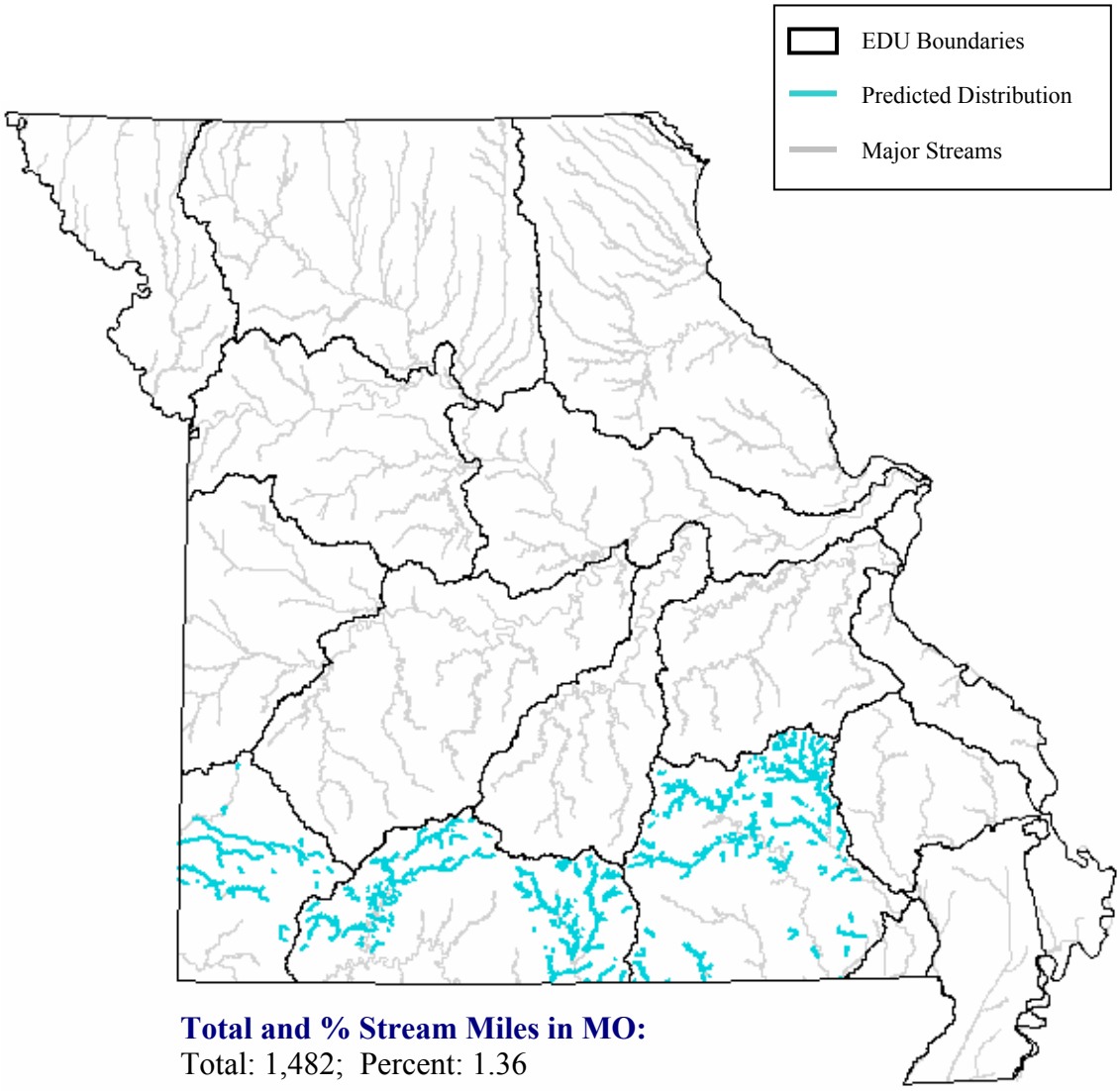
Endemism: Ecological Drainage Unit

State Rank: S2?

ITIS Code: 80024

Global Rank: G3T1T2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 1,482; Percent: 1.36

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to Oesch (1995), this species was considered to be restricted to the upper reaches of the North Fork River Basin, which is part of the Ozark/White Ecologic Drainage Unit (EDU). However, collections by the Missouri Department of Conservation place this species in the James River Basin within the same EDU as well as the Neosho and Black/Current EDUs.

Habitat Affinities:

Like the other two subspecies, *Lampsilis reeveiana brevicula* and *L. r. brittsi*, the Arkansas brokenray prefers cool, clear, headwater streams (Oesch 1995). However, Harris and Gordon (1990) state that this species is typically found in streams ranging in size from large creeks to medium-sized rivers. It is generally collected from shallow, gravel-bottomed, stream segments having relatively swift current (Oesch 1995; Bruenderman et al. 2002).

Predictive Model(s):

Ozark Model

([Flow] = 1) and ([Rgrad_subr] >= 2) and ([LinkR] >= 1) and ([LinkR] <= 6)

References:

Barnhart, M. C., 1997. Reproduction and fish hosts of unionid species of concern. Final Report. Prepared for Missouri Department of Conservation, Jefferson City, MO, 38 pp.

Barnhart, M. C. and A. D. Roberts. 1997. Reproduction and fish hosts of unionids from the Ozark Uplifts. pp. 15-20 *In* K.S. Cummings, A. C. Buchanan, C. A. Mayer, and T. J. Naimo, eds. Conservation and management of freshwater mussels II: Initiatives for the future. Proceedings of a UMRCC Symposium, 16-18 October 1995, St. Louis Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois. 293 pp.

Bruenderman, S. and J. Sternburg. 1999. Missouri's freshwater mussels. Missouri Conservationist 60: 17-23.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Call, R. E. 1887. Descriptions of two new species of the genus Unio from the Ozark region of Missouri. Proceedings of the United States National Museum 10: 498-500.

Gordon, M. E. 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist 27: 347-352.

Harris, J. L. and M. E. Gordon. 1987. Distribution and status of rare and endangered mussels (Mollusca: Margaritiferidae, Unionidae) in Arkansas. Arkansas Academy of Science Proceedings 41: 49-56.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Warren, R. E. 1991. Ozark Mussels: Struggling for survival. Living Museum 53: 19-22.

Warren, R. E. 1992. Prehistoric mussel faunas from the northern Ozark Highland of Missouri: cultural and geological implications. Missouri Archeologist 53: 80-100.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Asian Clam

Corbicula fluminea

Native: No

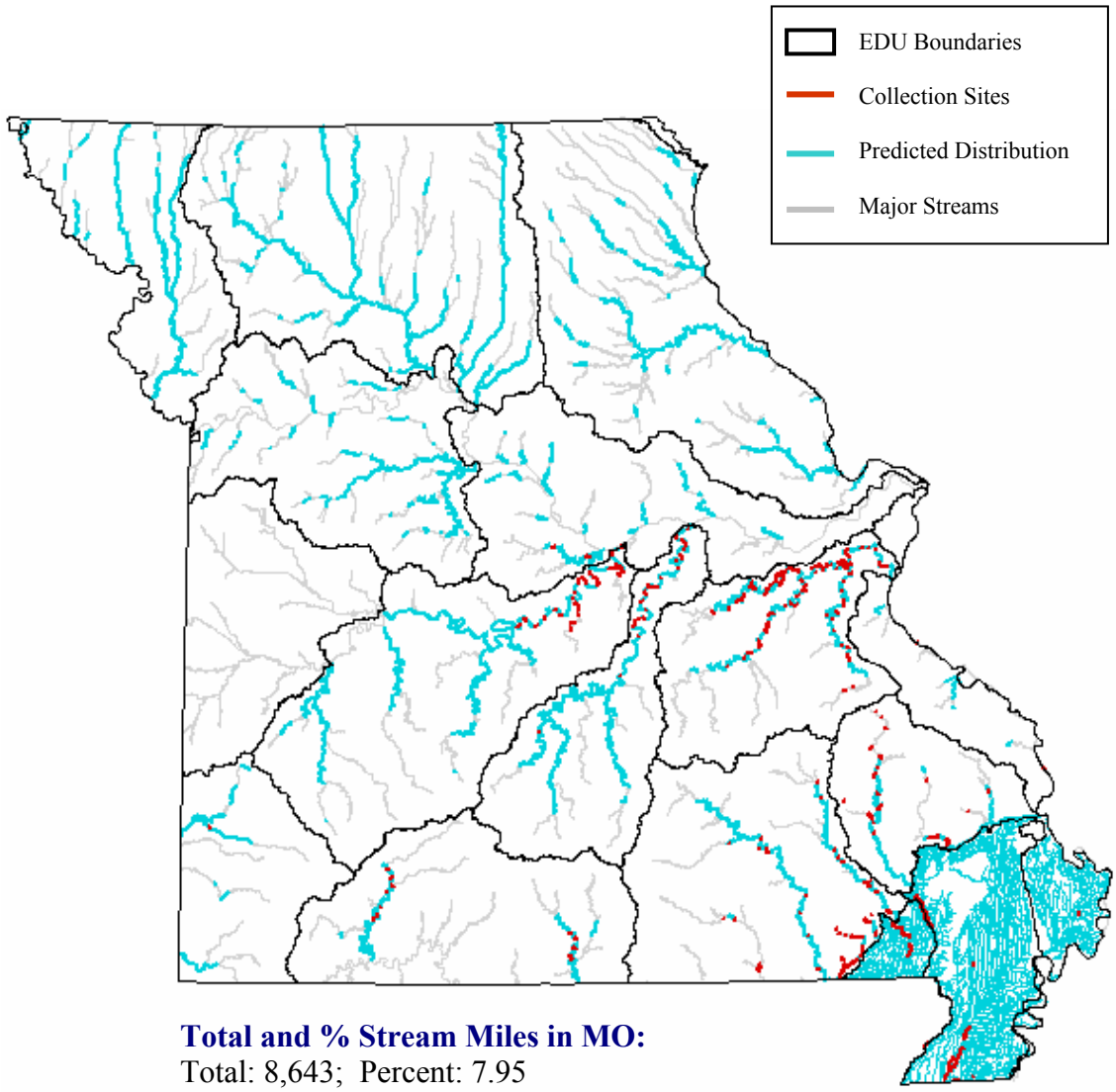
Endemism: NA

State Rank: SE

ITIS Code: 81378

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 8,643; Percent: 7.95

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

Although most collections for this exotic species are located in the Ozark Aquatic Subregion it is believed that this species occurs nearly statewide (Sue Bruenderman (MDC), personal communication).

Habitat Affinities:

The Asiatic clam seems to have a varied habitat preference which probably includes every type of habitat (Oesch 1995). Its preferred habitat appears to be small to medium-sized streams with stable gravel in swift water (Oesch 1995). However, it has also invaded numerous lentic waters (Counts 1986).

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([Linkr] = 5) and ([GradsegR] = 1)) or (([Linkr] >= 6) and ([Linkr] <= 7) and ([Temp_code] = 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Bruenderman, S. and J. Sternburg. 1999. Missouri's freshwater mussels. Missouri Conservationist 60: 17-23.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Clarke, A. H. 1981. *Corbicula fluminea* in Lake Erie. Nautilus 95: 83-84.

Clench, W. J. 1971. *Corbicula manilensis* Philippi in Oklahoma. Nautilus 85: 145

Counts, C. L. III. 1985. *Corbicula fluminea* (Bivalvia: Corbiculidae) in the state of Washington in 1937, and in Utah in 1975. Nautilus 99: 18-19.

Counts, C. L., III. 1986. The zoogeography and history of the invasion of the United States by *Corbicula fluminea* (Bivalvia: Corbiculidae). American Malacological Bulletin, Special Edition No. 2: 7-39.

Dundee, D. S. and H. A. Dundee. 1958. Extension of known ranges of four Mollusca. Nautilus 72:51-53.

Eckblad, J. W. 1975. The Asiatic clam, *Corbicula*, in the upper Mississippi River. Nautilus 89: 4.

Fetchner, F. K. 1962. *Corbicula fluminea* (Müller) from the Ohio River. Nautilus 75: 126.

Fox, R. O. 1969. The *Corbicula* story: a progress report. Second Annual Meeting, Western Society of Malacologists. 11 pp.

Fox, R. O. 1970. The *Corbicula* story: chapter two. Third Annual Meeting, Western Society of Malacologists. 10 pp.

Fox, R. O. 1971. The *Corbicula* story: chapter three. Fourth Annual Meeting, Western Society of Malacologists. 5 pp.

Fuller, S. L. H. and C. E. Powell. 1973. Range extension of *Corbicula manilensis* (Philippi) in the Atlantic drainage of the United States. Nautilus 87: 59.

Gleason, E. 1984. The Freshwater Clam (Corbicula fluminea) in California. California Department of Fish and Game, Inland Fish Information Pamphlet 37: 8.

Heard, W. H. 1964. *Corbicula fluminea* in Florida. Nautilus 77: 105-107.

Heard, W. H. 1966. Further records of *Corbicula fluminea* (Müller) in the southern United States. Nautilus 79: 105-107.

Hillis, D. M. and J. C. Patton. 1982. Morphological and electrophoretic evidence for two species of Corbicula (Bivalvia: Corbiculidae) in North America. American Midland Naturalist 108: 74-80.

Hubricht, L. 1963. *Corbicula fluminea* in the Mobile River. Nautilus 77: 31.

Ingram, W.H. 1959. Asiatic clams as potential pests in California water supplies. Journal of the American Water Works Association 51: 363-370.

Isom, B.G. 1986. Historical review of Asiatic clam (*Corbicula*) invasion and biofouling of waters and industries in the Americas. American Malacological Bulletin, Special Edition No. 2: 1-5.

Mackie, G. L. and D. G. Huggins. 1983. Sphaeriacean clams of Kansas. Technical Publications of the State Biological Survey of Kansas, University of Kansas, Lawrence. 92 pp.

McLeod, M. J. 1986. Electrophoretic variation in North American *Corbicula*. American Malacological Bulletin, Special Edition 2: 125-132.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Metcalf, A. L. 1966. *Corbicula manilensis* in the Mesilla Valley of Texas and New Mexico. Nautilus 80:16-20.

Morton, B. 1986. *Corbicula* in Asia - an updated synthesis. American Malacological Bulletin, Special Edition No. 2: 113-124.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Sickel, J. B. 1986. *Corbicula* population mortalities: factors influencing population control. American Malacological Bulletin, Special Edition 2: 89-94.

Sinclair, R. M. and B. G. Isom. 1961. A preliminary report on the introduced Asiatic clam *Corbicula* in Tennessee. Tennessee Stream Pollution Control Board, Tennessee Department of Public Health. 31 pp.

Stein, C. B. 1962. An extension of the known range of the Asiatic clam, *Corbicula fluminea* (Müller), in the Ohio and Mississippi Rivers. Ohio Journal of Science 62: 326-327.

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Bankclimber

Plectomerus dombeyanus

Native: Yes

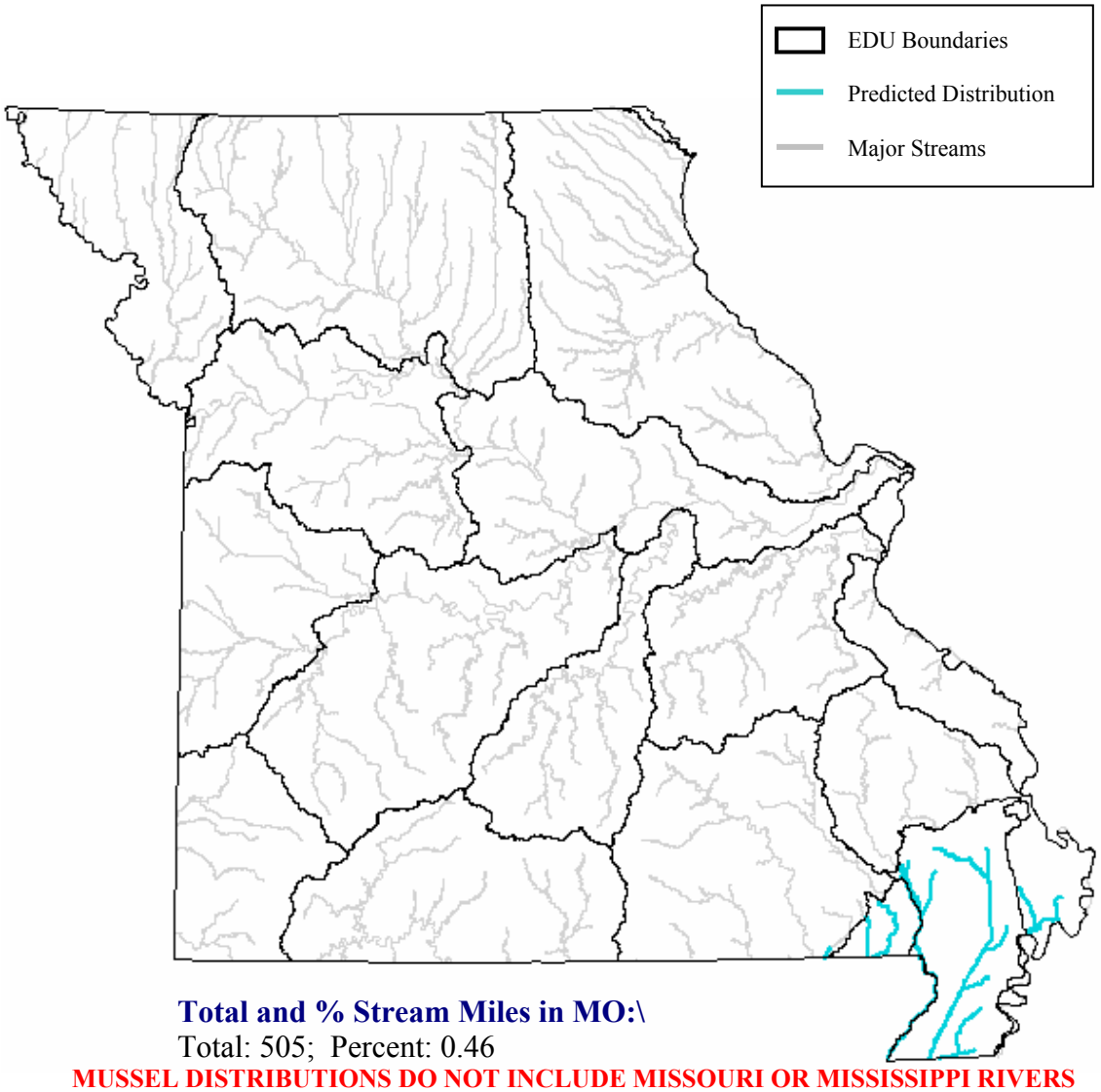
Endemism: Region

State Rank: S3

ITIS Code: 80231

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:

Total: 505; Percent: 0.46

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The bankclimber distribution in Missouri is largely restricted to the Mississippi Alluvial Basin (MAB) Aquatic Subregion (Oesch 1995). It has also been collected from the lower ends of some larger Ozark streams just above the boundary between the Ozarks and the MAB.

Habitat Affinities:

This mussel is generally found in larger creeks, rivers, ditches and their backwaters, which drain the lowlands of the Mississippi Alluvial Basin Aquatic Subregion (Harris and Gordon 1990; Oesch 1995). It prefers mud, mud-rock/gravel or mud/sand stream beds with moderate to sluggish current and has been found in shallow water near the streams' bank (Harris and Gordon 1990; Oesch 1995). Call (1895) states that the bankclimber is a mud-loving species, which prefers sluggish waters.

Predictive Model(s):

Ozark/ Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 3) and ([Ssize_code] <= 4)

References:

Branson, B. A. 1982. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 1 – Ambleminae. Proceeding of the Oklahoma Academy of Science 62: 38-45.

Call, R. E. 1895. A study of the Unionidae of Arkansas with incidental reference to their distribution in the Mississippi valley. Transactions of the Academy of Science of St. Louis 7: 1-65.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Pharris, G. L., J. B. Sickel and C. C. Chandler. 1984. Range extension of the freshwater mussel, *Plectomerus dombeyanus*, into the Tennessee River, Kentucky. Nautilus 98: 74–77.

Stansbery, D. H. and C. B. Stein. 1982. The unionid mollusks of the lower Saint Francis River in Arkansas. Ohio State University Museum of Zoology Reports 1982(7):1-24.

Vanatta, E. G. 1910. Unionidae from southeastern Arkansas and northeastern Louisiana. Nautilus 23: 102-104

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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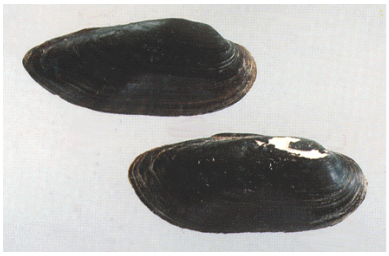
Black Sandshell

Ligumia recta



Native: Yes

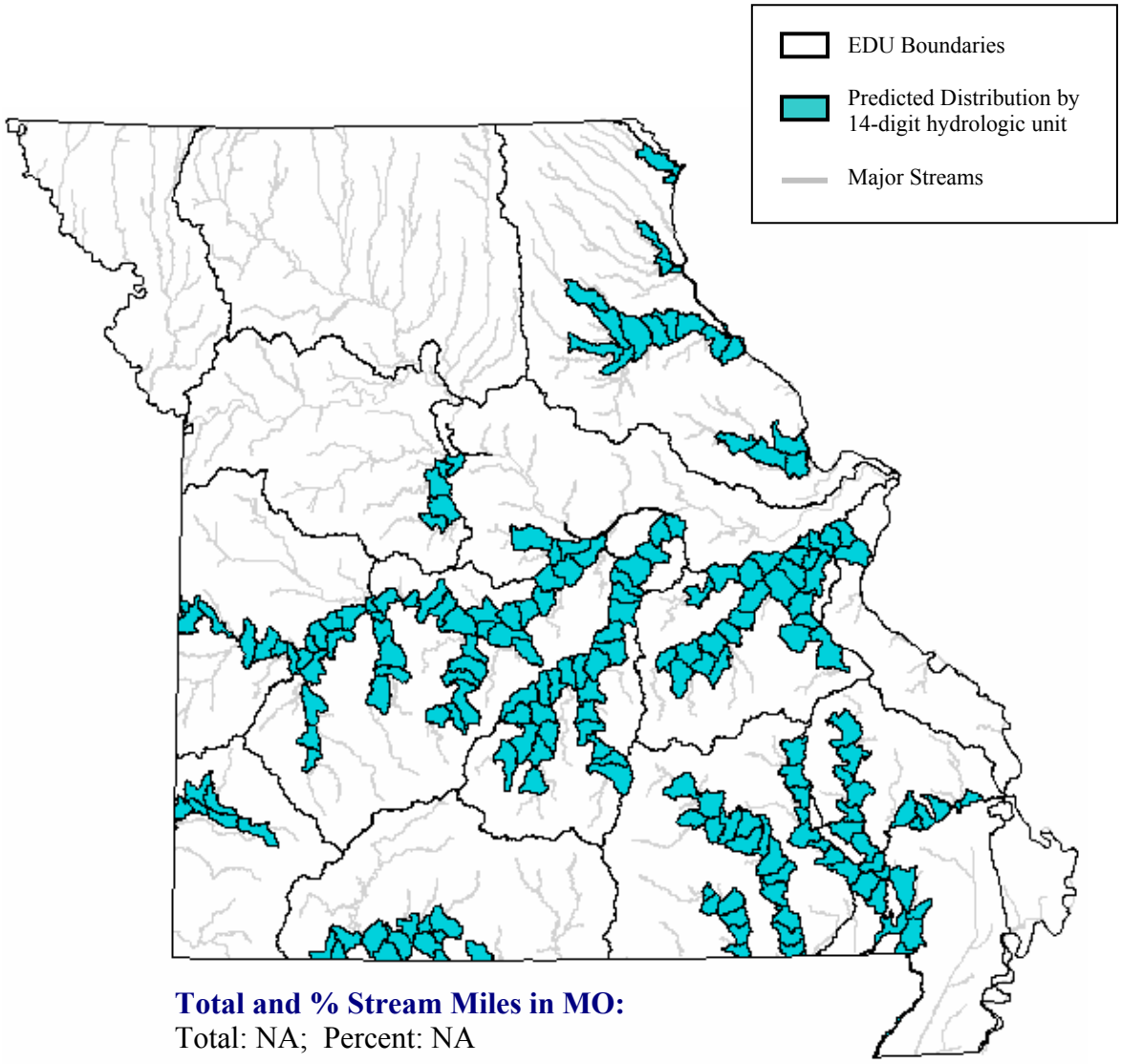
Endemism: Subzone

State Rank: S1S2

ITIS Code: 80196

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The black sandshell is found in all three Aquatic Subregions of Missouri. The Central Plains populations occur in the Salt River watershed, major tributaries to the Mississippi River in the northeast, and the Lamine River watershed. This species is also found in most major drainages of the Ozarks and in the western portion of Mississippi Alluvial Basin.

Habitat Affinities:

This species occurs in small to large rivers (Buchanan 1980; Cummings and Mayer 1992). It is usually collected in riffles or swift currents with gravel or firm sand (Cummings and Mayer 1992; Oesch 1995). However, Buchanan (1980) has collected this species in a variety of substrates from silt to cobble to boulders. This species has also been collected in both lentic and lotic habitats (Buchanan 1980).

Predictive Model(s):

Central Plains/Ozark Model
(([Flow] = 1) and ([Linkr] >= 6))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Branson, B. A. 1982. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 1 – Ambleminae. Proceeding of the Oklahoma Academy of Science 62: 38-45.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1895. A study of the Unionidae of Arkansas with incidental reference to their distribution in the Mississippi valley. Transactions of the Academy of Science of St. Louis 7: 1-65.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Stansbery, D. H. and C. B. Stein. 1982. The unionid mollusks of the lower Saint Francis River in Arkansas. Ohio State University Museum of Zoology Reports 1982(7):1-24.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Bleedingtooth Mussel

Venustaconcha pleasi

Native: Yes

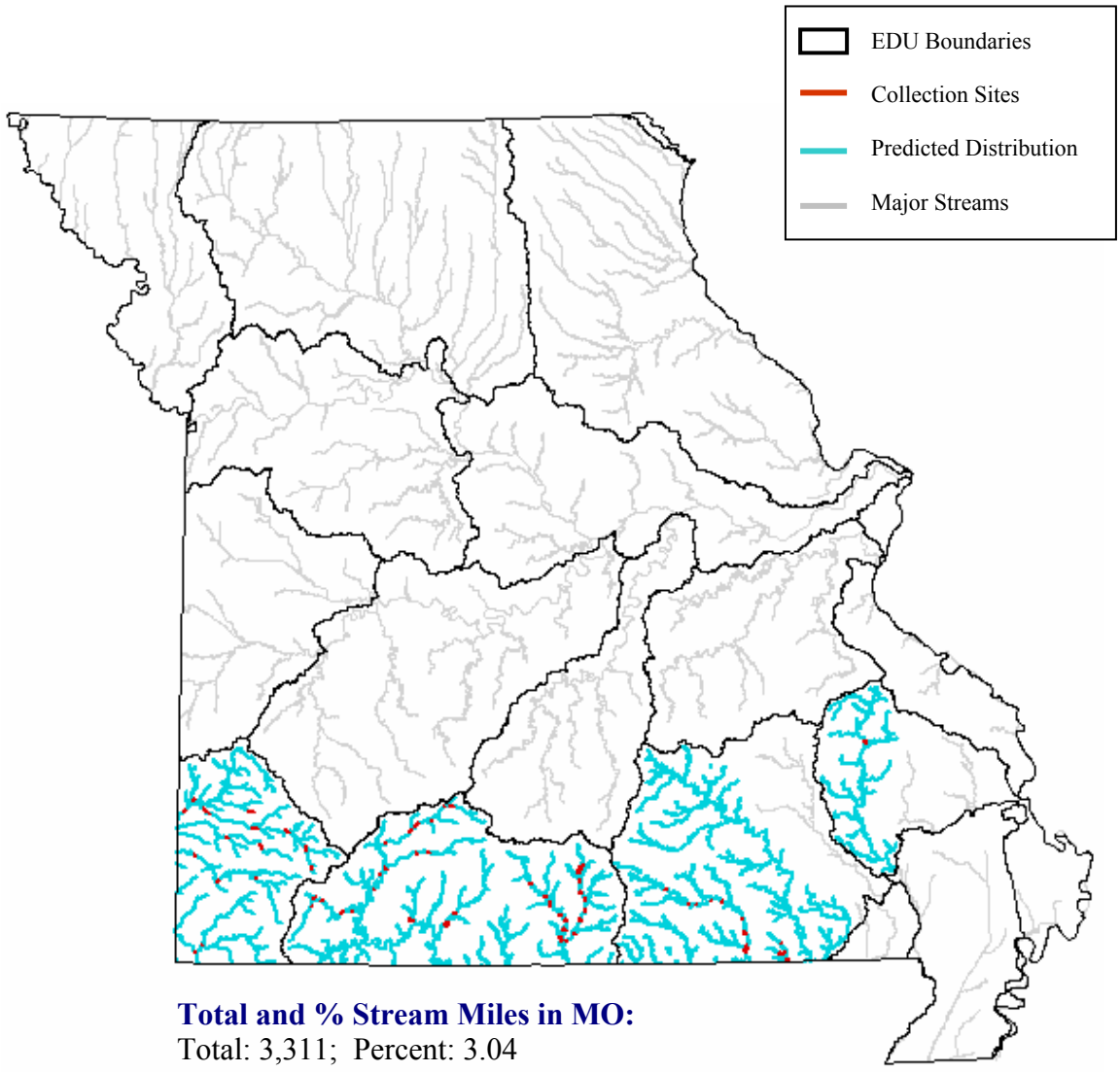
Endemism: Subregion

State Rank: SU

ITIS Code: 80296

Global Rank: G3G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 3,311; Percent: 3.04

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The bleedingtooth mussel is only found in those stream systems draining south and west off of the Springfield and Salem Plateaus in the Ozark Aquatic Subregion (Oesch 1995).

Habitat Affinities:

This species occurs in small to medium size streams in gravel or mixed sand and gravel (Cummings and Mayer 1992).

Predictive Model(s):

Ozark Model
([Linkr] >= 3) and ([Gradsegr] >= 1) and ([Gradsegr] <= 5)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceeding of the Oklahoma Academy of Science 64: 20-36.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri., Southwestern Naturalist, 27: 347-352.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Bleufer

Potamilus purpuratus

Native: Yes

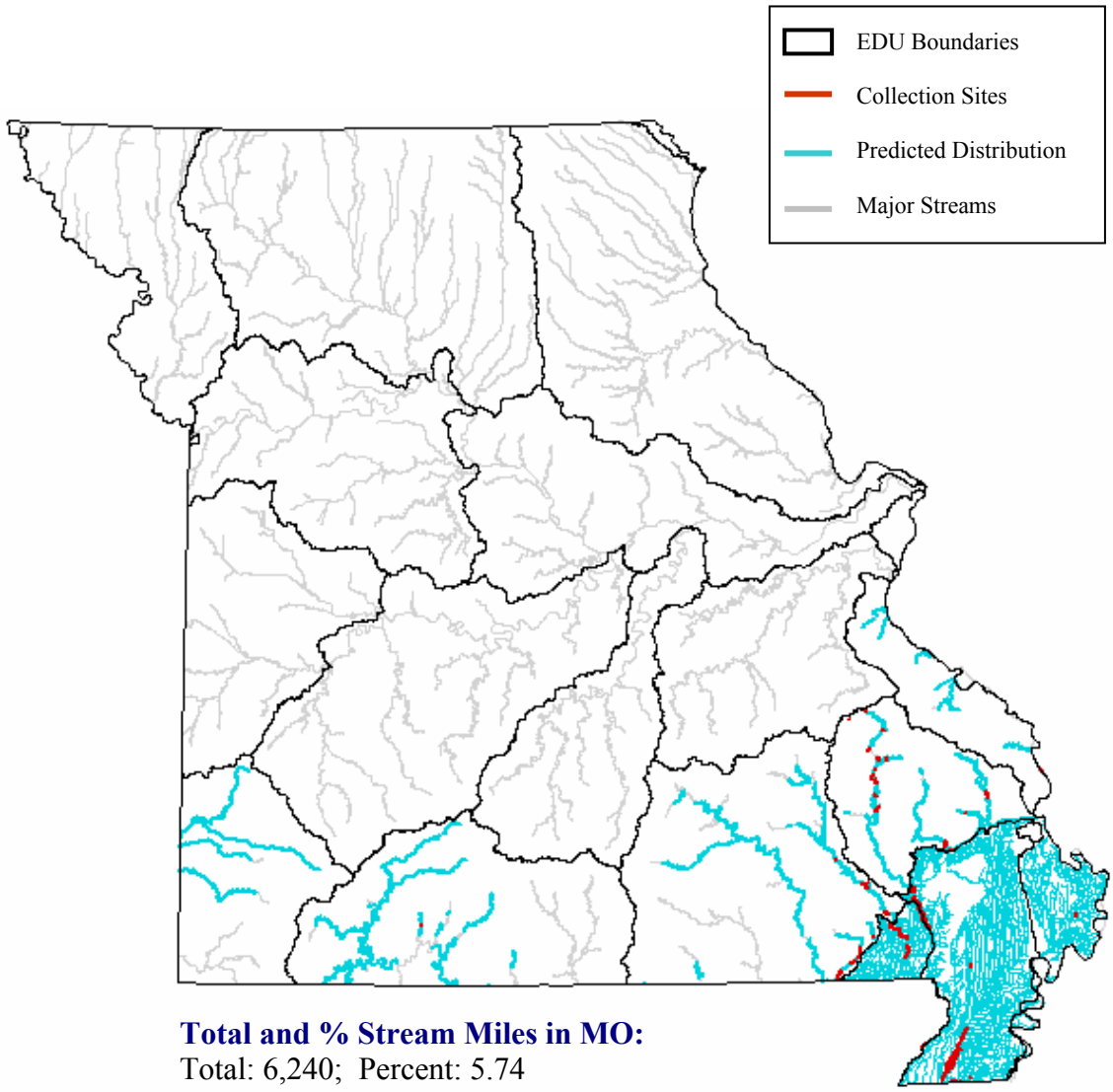
Endemism: Region

State Rank: S?

ITIS Code: 80289

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 6,240; Percent: 5.74

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The bleufer occurs in the rivers of the Mississippi Alluvial Basin and in the Mississippi River below the Ohio River (Cummings and Mayer 1992; Oesch 1995). It also occurs in the Black, Castor, St. Francis, White and Whitewater Rivers in Missouri (Oesch 1995). However, collections by the Missouri Department of Conservation place this species in the Neosho, Apple/Joachim, and more of the Black/Current Ecological Drainage Units of the Ozarks as well.

Habitat Affinities:

This species is mainly found in large rivers (Cummings and Mayer 1992) over substrates of small to medium gravel interspersed with mud (Oesch 1995; Bruenderman et. al 2002) in areas with moderate stream flow (Harris and Gordon 1990).

Predictive Model(s):

Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: ([Linkr] >= 5) and ([Gradsegr] >= 1) and ([Gradsegr] <= 3)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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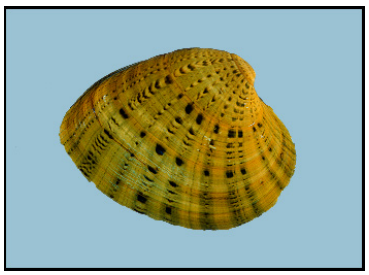


Butterfly

Ellipsaria lineolata

Native: Yes

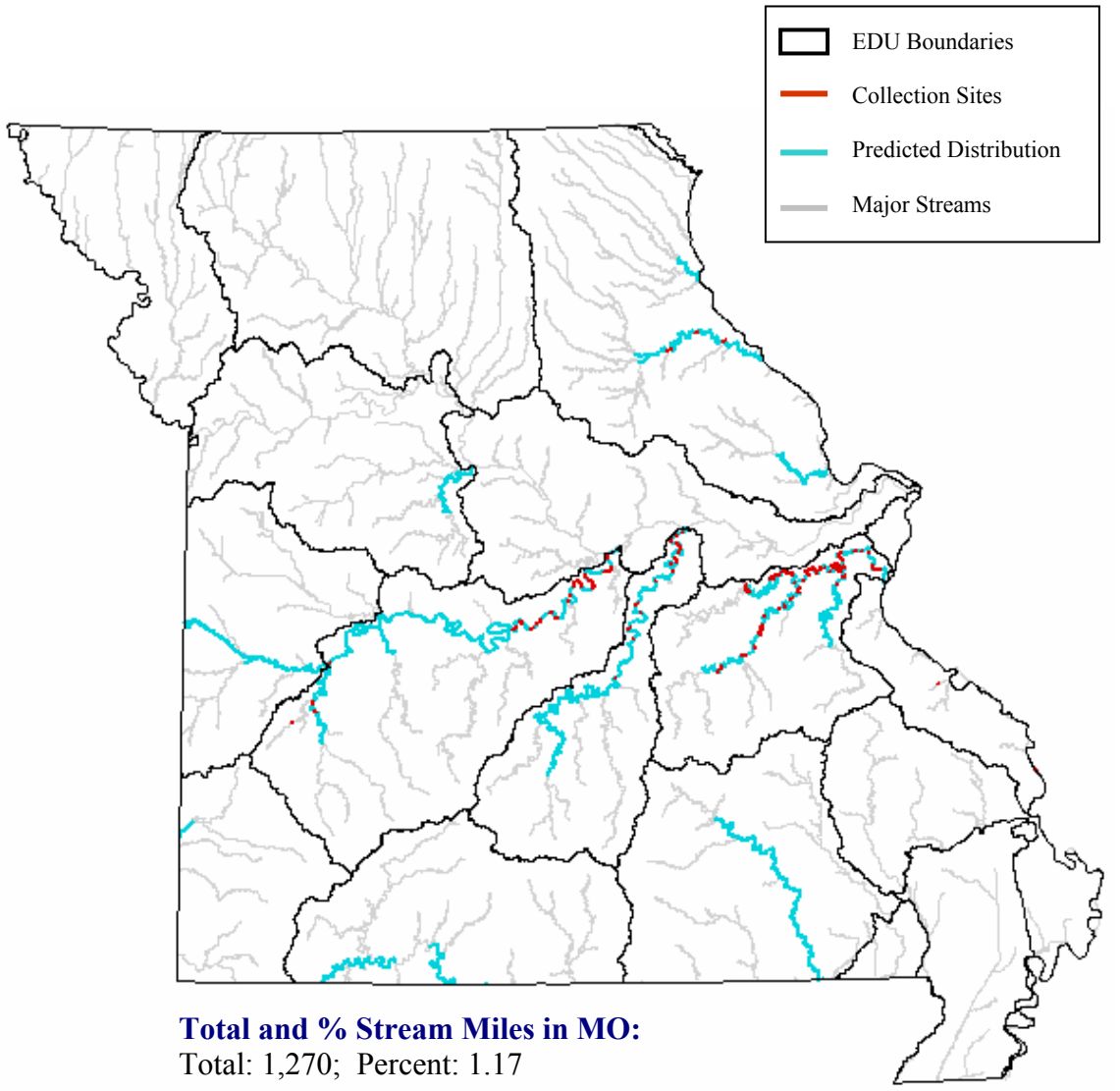
Endemism: Region

State Rank: S?

ITIS Code: 80250

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 1,270; Percent: 1.17

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The butterfly occurs mainly in the Ozark Aquatic Subregion. It occurs in a band from east to west in those rivers that flow north into the Missouri and Mississippi Rivers (Oesch 1995). It also occurs in the Central Plains/Cuivre/Salt Ecological Drainage Unit (EDU) of northeast Missouri and in the Black/Current and White EDU's to a lesser degree.

Habitat Affinities:

This species is found in medium to large rivers (Buchanan 1980; Harris and Gordon 1990; Cummings and Mayer 1992) over sand and gravel substrates in areas with moderate to swift current (Harris and Gordon 1990; Cummings and Mayer 1992; Oesch 1995).

Predictive Model(s):

Central Plains/Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 7)

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

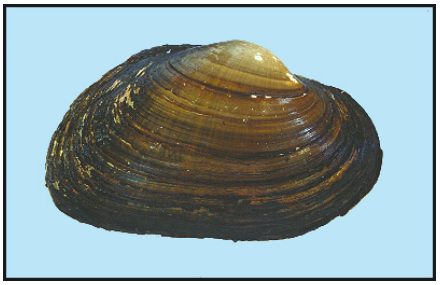
Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper left: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Upper right: Photo courtesy of the W. H. McCullagh.



Creeper

Strophitus undulatus

Native: Yes

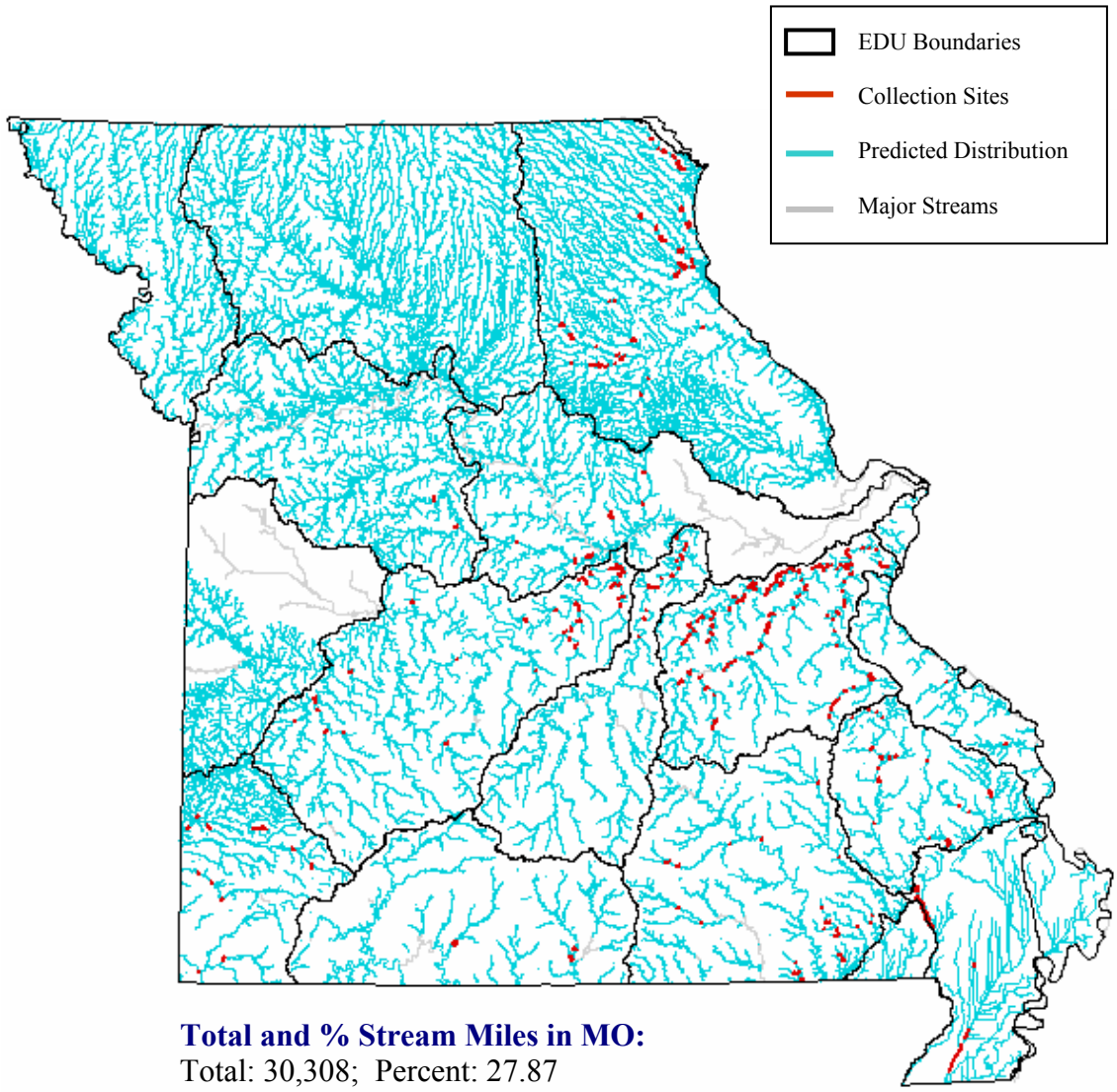
Endemism: Subzone

State Rank: S?

ITIS Code: 80151

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 30,308; Percent: 27.87

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The creeper is found in all major rivers south of the Missouri River and in the northern tributaries of the Mississippi River in eastern Missouri (Oesch 1995). However, collections by the Missouri Department of Conservation place this species throughout most of the state.

Habitat Affinities:

This species occurs in small to medium-sized streams and occasionally large rivers (Cummings and Mayer 1992; Oesch 1995). It can be found in a variety of substrates (Buchanan 1980), but seems to prefer areas of gravel or gravel-mud mixtures (Oesch 1995). It is usually found in flowing water (Oesch 1995), however, Buchanan (1980) found this species in conditions ranging from standing water to swift currents.

Predictive Model(s):

Central Plains/Ozark Model
([Temp_code] = 2) and ([Gradsegr] >= 1) and ([Gradsegr] <= 5)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Buchanan, A. C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri. Missouri Department of Conservation Aquatic Series 17: 1-68.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Curtis Pearlymussel

Epioblasma florentina curtisii

Native: Yes

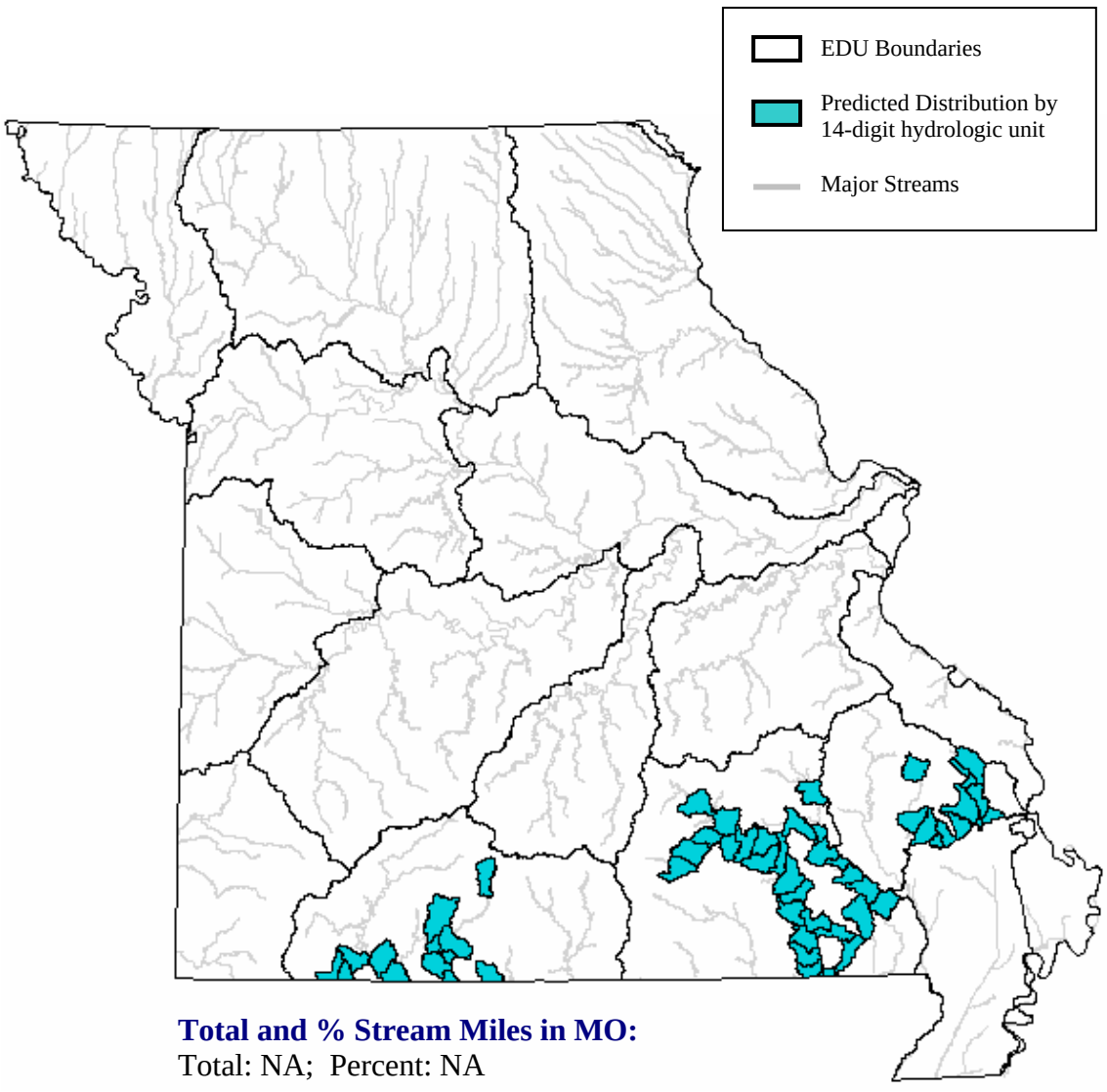
Endemism: Ecological Drainage Unit

State Rank: S1

ITIS Code: 80310

Global Rank: G1T1

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

Curtis pearlymussel is one of the rarest mussels in the United States (Oesch 1995). According to Oesch (1995), the range of this species is currently restricted to the Black River, Castor River, Little Black River, and possibly Cane Creek. However, collections by the Missouri Department of Conservation suggest that this species may be slightly more widespread that previously thought.

Habitat Affinities:

This species inhabits large creeks to medium-sized rivers with clean gravel or gravel-sand substrates (Harris and Gordon 1990). It is usually found in areas with small to medium gravel substrates and in quiet water at the edge of riffles or areas with good or moderate current (Harris and Gordon 1990; Oesch 1995). This species may be buried several centimeters below the surface of the gravel.

Predictive Model(s):

Ozark Model
([Temp_code] = 2) and ([Flow] = 1) and ([Linkr] >= 5) and ([Linkr] <= 7) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2)

References:

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

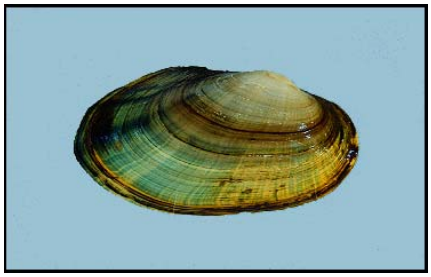
Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper Left: Photo courtesy of the U.S. Fish and Wildlife Service.



Cylindrical Papershell

Anodontoides ferussacianus

Native: Yes

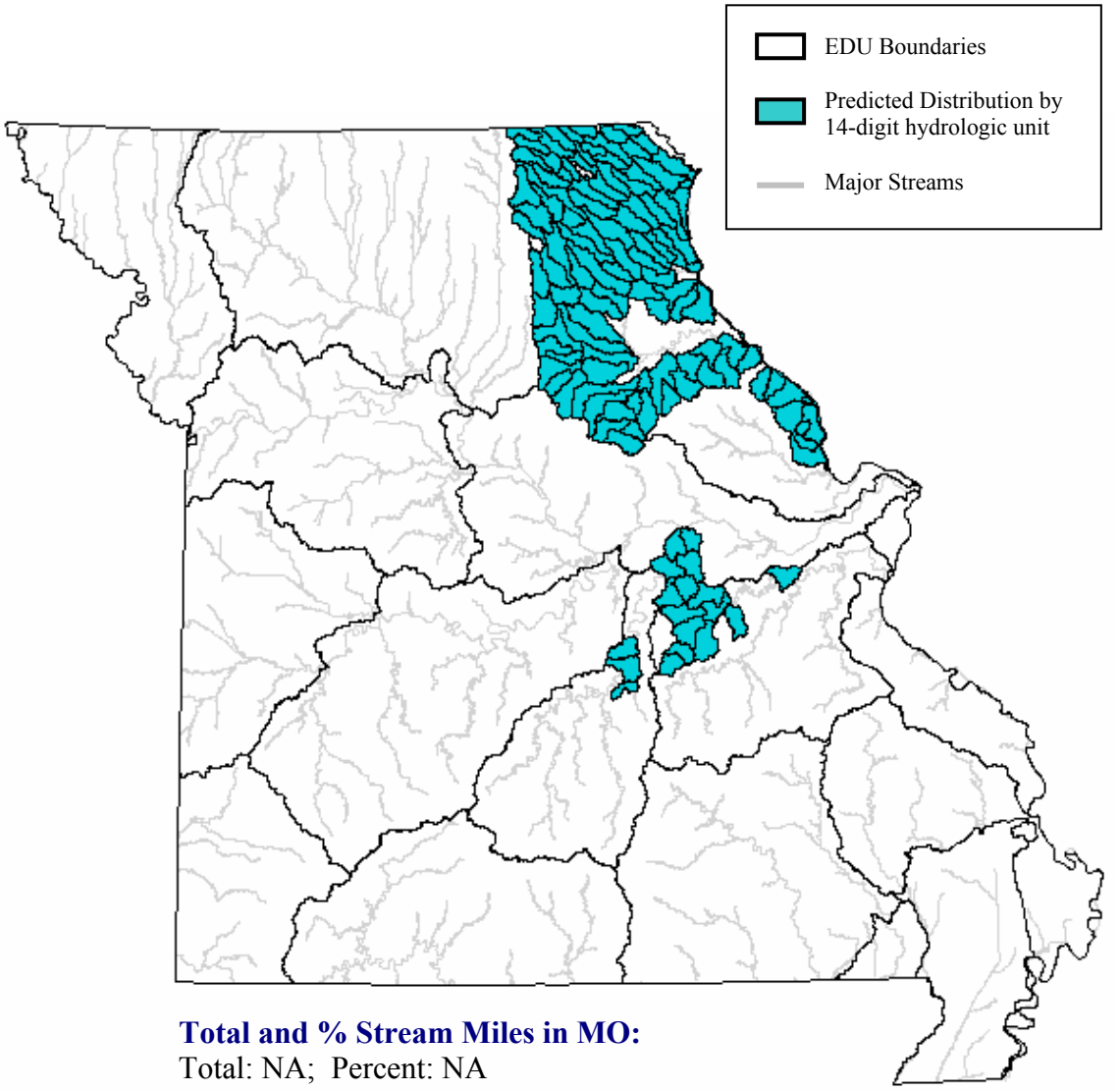
Endemism: Subzone

State Rank: S1?

ITIS Code: 80148

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The cylindrical papershell occurs in the Central Plains/Cuivre/Salt Ecological Drainage Unit, excluding the Cuivre River watershed. In the Ozarks this species has been collected from the lower Gasconade and Bourbeuse River watersheds.

Habitat Affinities:

This species occurs in small creeks and headwaters of larger streams (Cummings and Mayer 1992; Oesch 1995). Buchanan (1980) collected this species from silt or gravel and cobble substrates, however, Parmalee (1967) and Baker (1928) report collecting this species in shallow water over sand or fine gravel substrates.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: ([Linkr] >= 3) and ([Linkr] <= 5) and ([Gradsegr] >= 1) and ([Gradsegr] <= 3)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

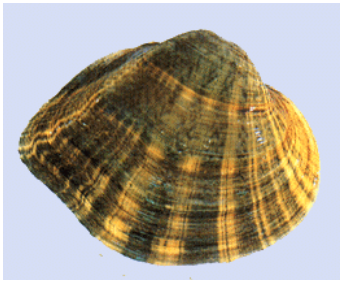
Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.



Deertoe

Truncilla truncata

Native: Yes

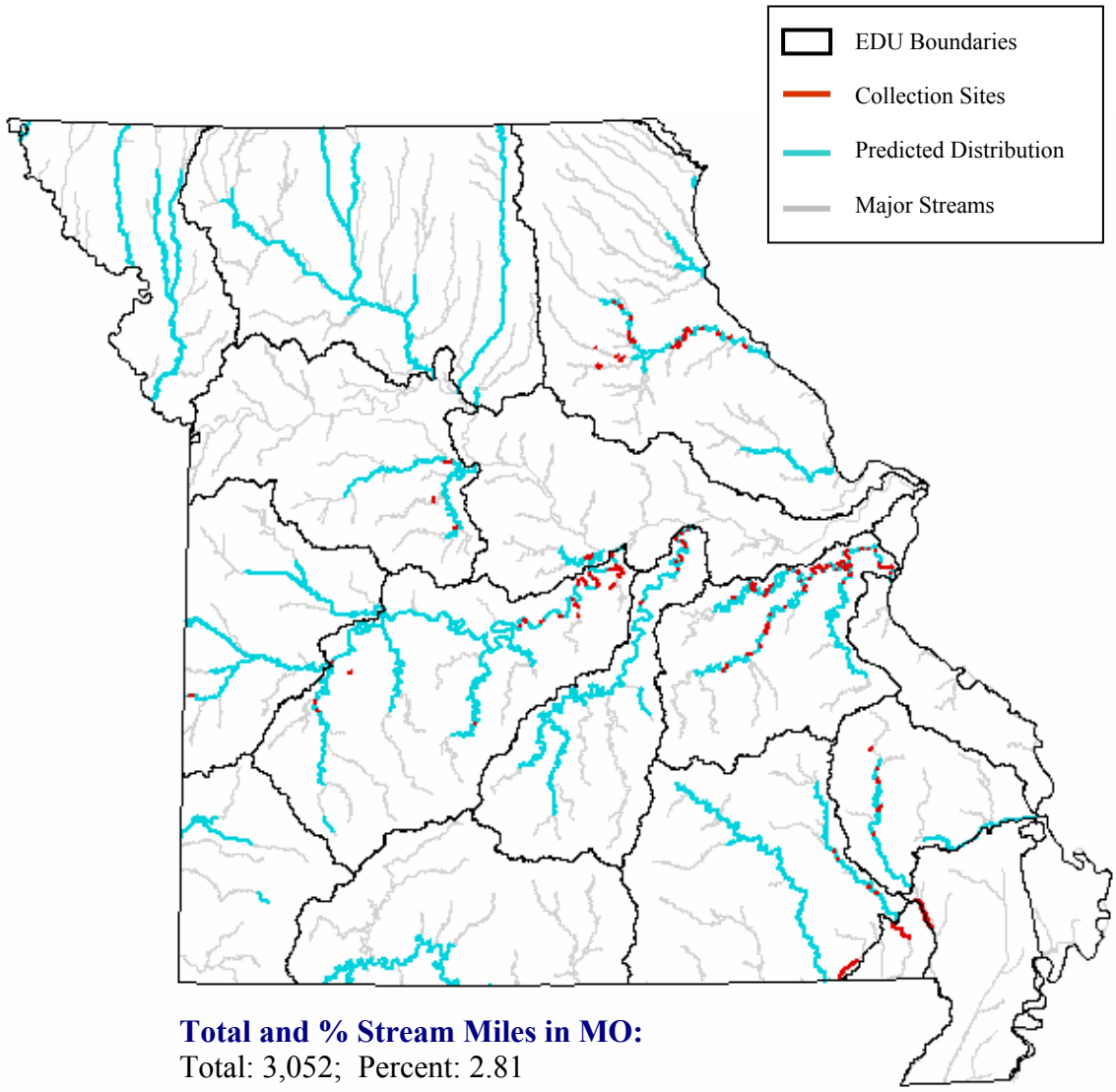
Endemism: Region

State Rank: S?

ITIS Code: 80167

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 3,052; Percent: 2.81

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The deertoe has a sporadic in distribution in Missouri. It is found in some of the major streams of southeastern Missouri, in the Salt River of eastern Missouri, and in band across the state in the north-flowing rivers draining the Salem and Springfield plateaus (Oesch 1995). More recent collections and professional reviews have indicated that this species may be found in portions of many of the major streams throughout the state, excepting most of the Mississippi Alluvial Basin Aquatic Subregion.

Habitat Affinities:

This species occurs in small to large rivers (Buchanan 1980; Cummings and Mayer 1992). It is found over a variety of substrates in water from several inches to a few feet deep with moderate to swift current (Buchanan 1980; Oesch 1995; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([Linkr] = 5) and ([Rgrad_subr] >= 2) and ([Temp_code] = 1)) or (([Linkr] = 6)) or (([Linkr] = 7) and ([Rgrad_subr] = 1) and ([Temp_code] = 2)) or (([Linkr] = 7) and ([Rgrad_subr] >= 2)) or (([Linkr] >= 8))

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Ebonyshell

Fusconaia ebena

Native: Yes

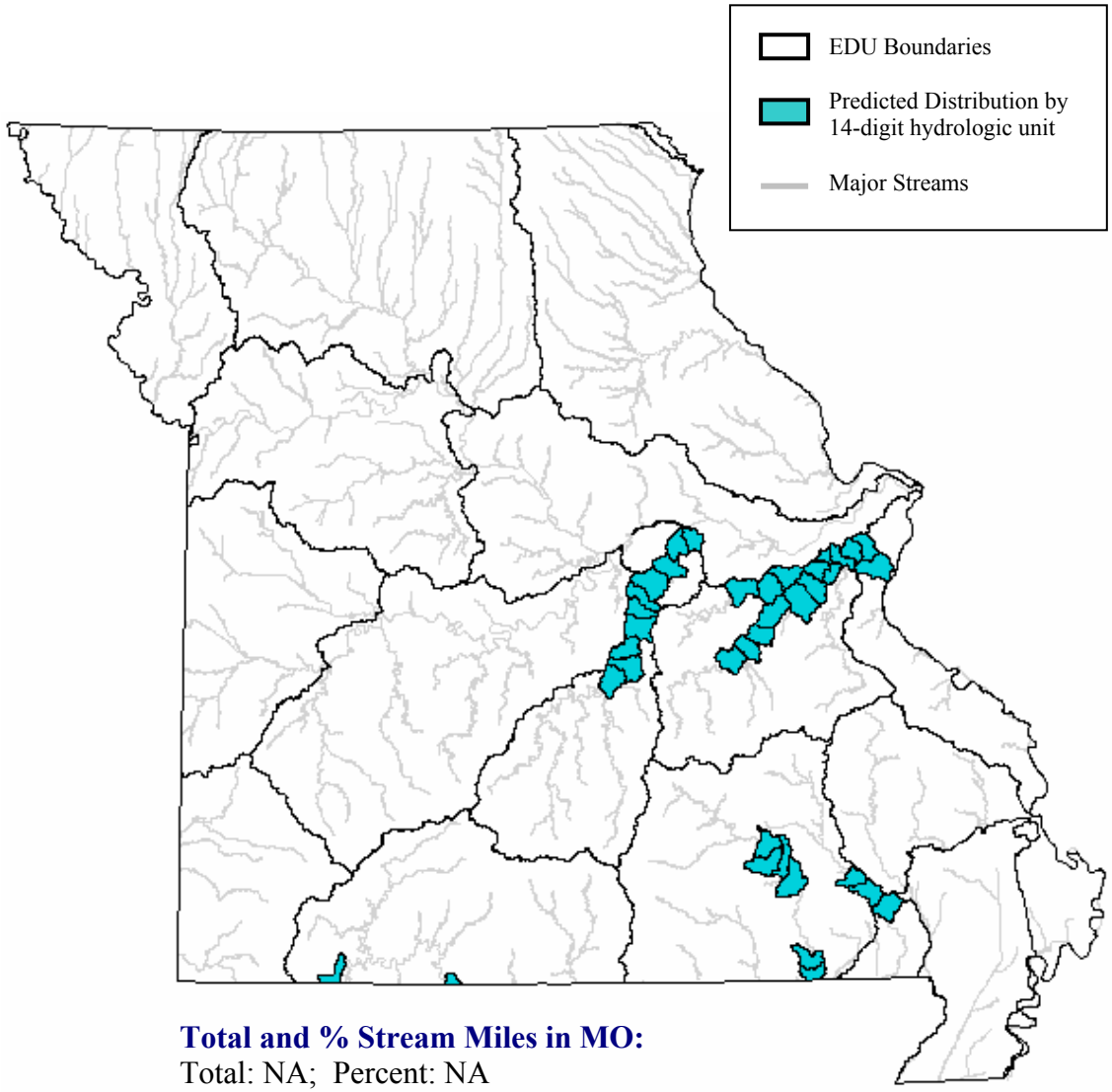
Endemism: Region

State Rank: S1?

ITIS Code: 80046

Global Rank: G4G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

Oesch (1995) states that the ebonyshell has been collected from the Mississippi River and the lower portions of the Meramec, Osage and Little Black Rivers in Missouri. More recent collections and professional review indicate that this species may also be found in portions of the Current, lower Gasconade and White River watersheds.

Habitat Affinities:

This species is found primarily in large rivers in variety of currents and over substrates ranging from sand to coarse gravel (Buchanan 1980; Cummings and Mayer 1992; Oesch 1995). Oesch (1995) suggests the ebonyshell prefers areas with swift current.

Predictive Model(s):

Ozark Model

([Flow] = 1) and ([Temp_code] = 2) and ([GradsegR] = 1) and ([Linkr] >= 7)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Way, C. M., A. C. Miller and B. S. Payne. 1989. The influence of physical factors on the distribution of abundance of freshwater mussels in the lower Tennessee River. Nautilus 103: 96-98.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Upper left: Photo courtesy of the W. H. McCullagh.

Elephantear

Elliptio crassidens

Native: Yes

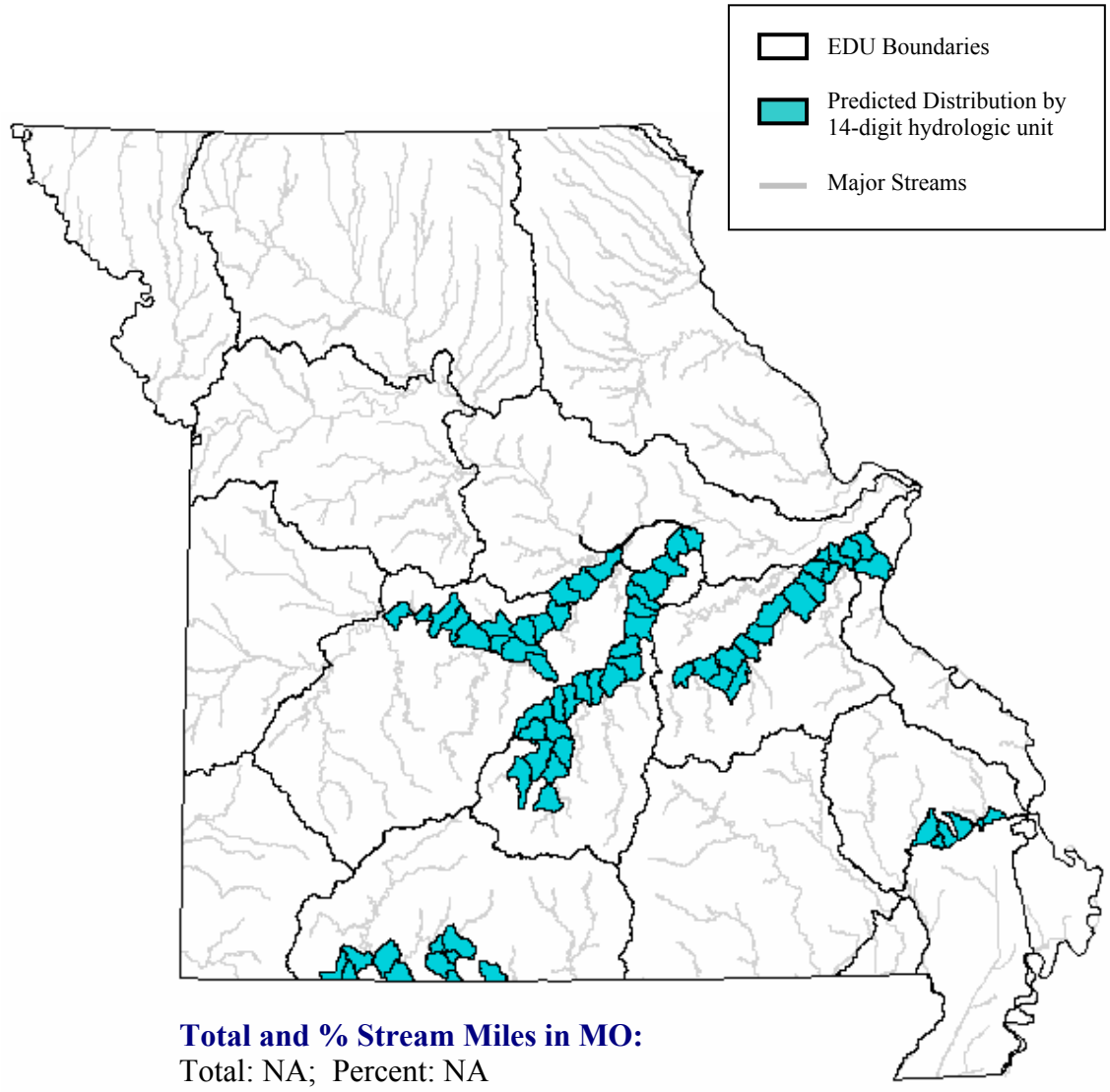
Endemism: Region

State Rank: S1

ITIS Code: 79958

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

Historically the elephantear has been collected from the main stems of the Castor, Gasconade, Meramec, Osage and White Rivers. Currently, however, it is believed that this species now only occurs in the Meramec River basin (Buchanan 1980; Oesch 1995).

Habitat Affinities:

This species is usually found in medium to large rivers in areas of swift current (Buchanan 1980; Cummings and Mayer 1992; Oesch 1995). It has been collected from a variety of substrates ranging from mud and sand (Cummings and Mayer 1992), stone and coarse gravel (Buchanan 1980) and even cobbles and even boulders (Oesch 1995).

Predictive Model(s):

Ozark Model

([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

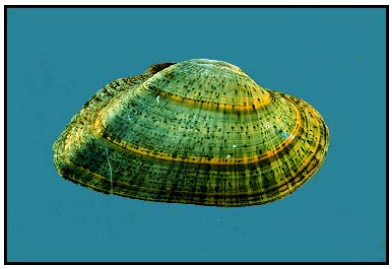
Way, C. M., A. C. Miller and B. S. Payne. 1989. The influence of physical factors on the distribution of abundance of freshwater mussels in the lower Tennessee River. Nautilus 103: 96-98.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper left: Photo courtesy of Deborah Wills; Copyright © 1995 D. R. Wills.

Upper right: Photo courtesy of the W. H. McCullagh.



Elktoe

Alasmidonta marginata

Native: Yes

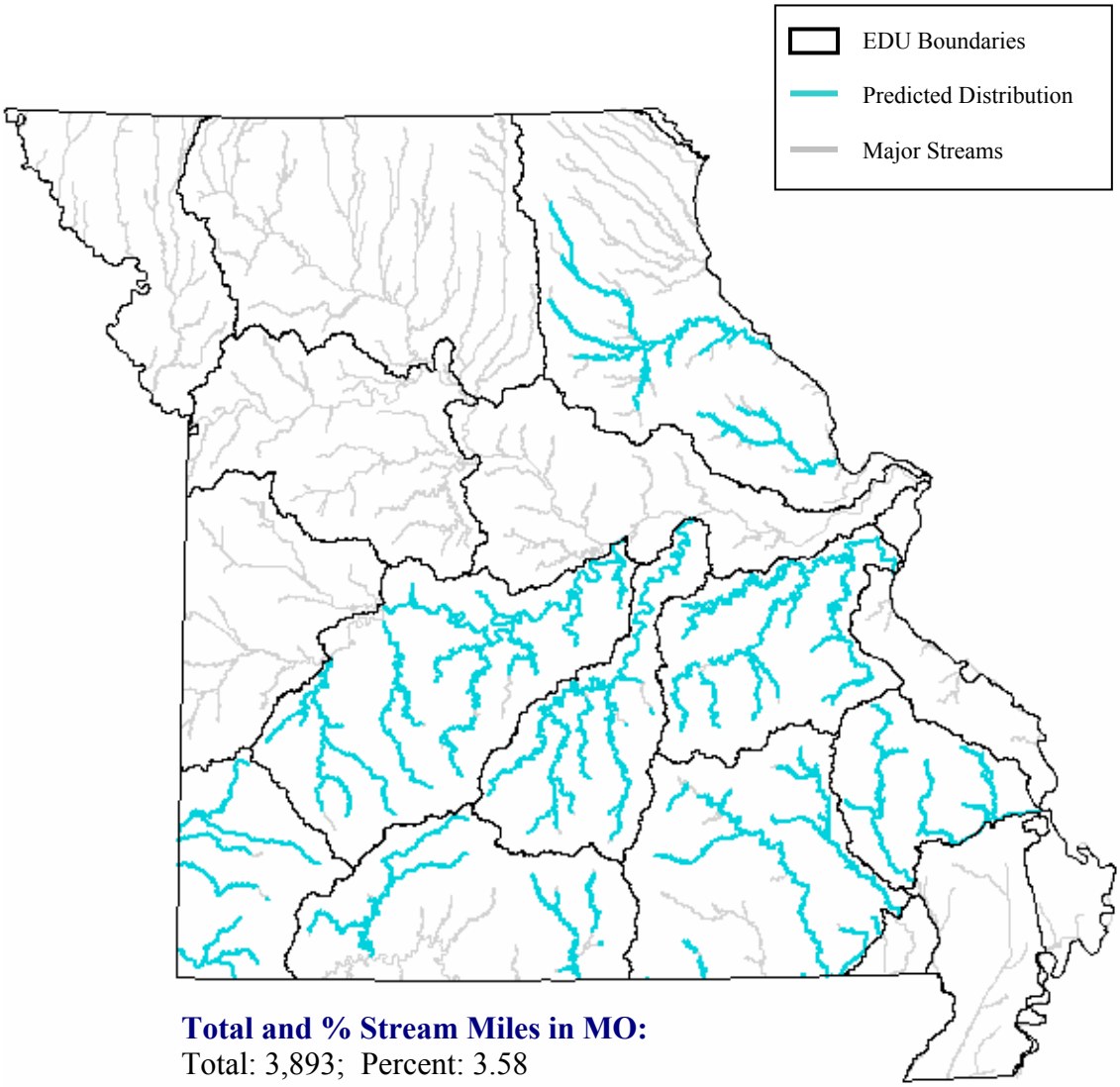
Endemism: Subzone

State Rank: S2?

ITIS Code: 79918

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 3,893; Percent: 3.58

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The elk-toe is found in most of the major streams draining the Ozark Aquatic Subregion. It is also known from the Salt and Cuivre Rivers of northeast Missouri (Oesch 1995).

Habitat Affinities:

This species is usually found in large creeks and small to medium-sized rivers (Harris and Gordon 1990). Collections of this species mainly come from areas of slow to swift currents over substrates ranging from silt to cobble (Buchanan 1980; Cummings and Mayer 1992; Oesch 1995).

Predictive Model(s):

Central Plains/Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 5)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Ellipse

Venustaconcha ellipsiformis

Native: Yes

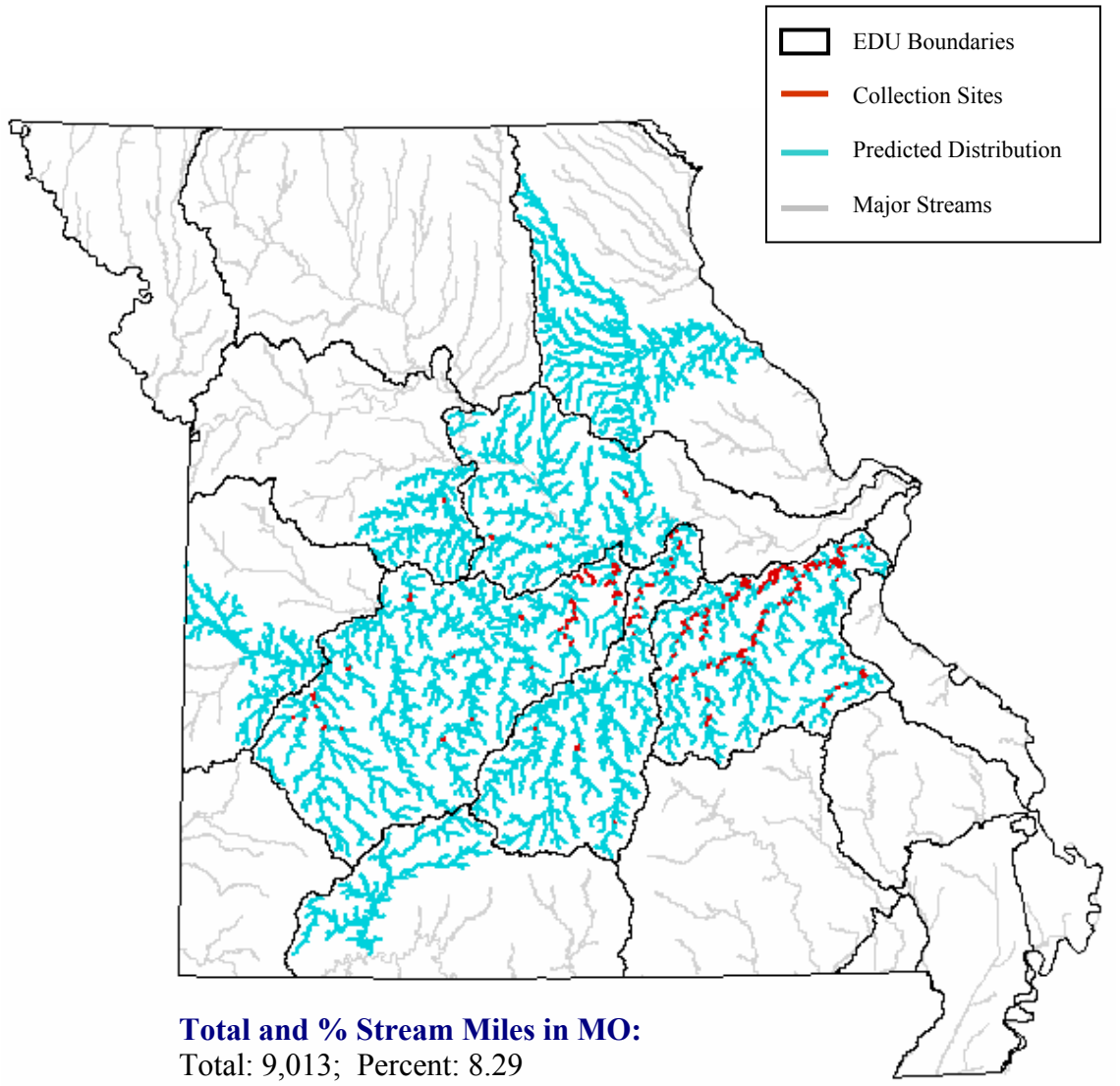
Endemism: Subzone

State Rank: S?

ITIS Code: 80295

Global Rank: G3G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa,



Total and % Stream Miles in MO:
Total: 9,013; Percent: 8.29

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The ellipse occurs primarily in three of the Ozark Ecological Drainage Units (EDU) in Missouri; the Gasconade, Meramec and Osage. It is also known to occur in the Lamine River drainage, western portions of the Ozark/Moreau/Loutre EDU, the Salt River drainage and the James River basin of White EDU, which is the only location in a south flowing drainage from Missouri.

Habitat Affinities:

This species is usually found in small to relatively large rivers (Bruenderman et. al 2002). However, Buchanan (1980) also reported collecting this species from headwater streams in the Meramec drainage. The ellipse is usually collected from areas with noticeable current and firm sand or sand and gravel substrates (Bruenderman et. al 2002).

Predictive Model(s):

Central Plains/Ozark Model
([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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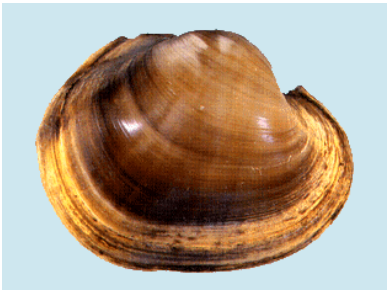


Fat Pocketbook

Potamilus capax

Native: Yes

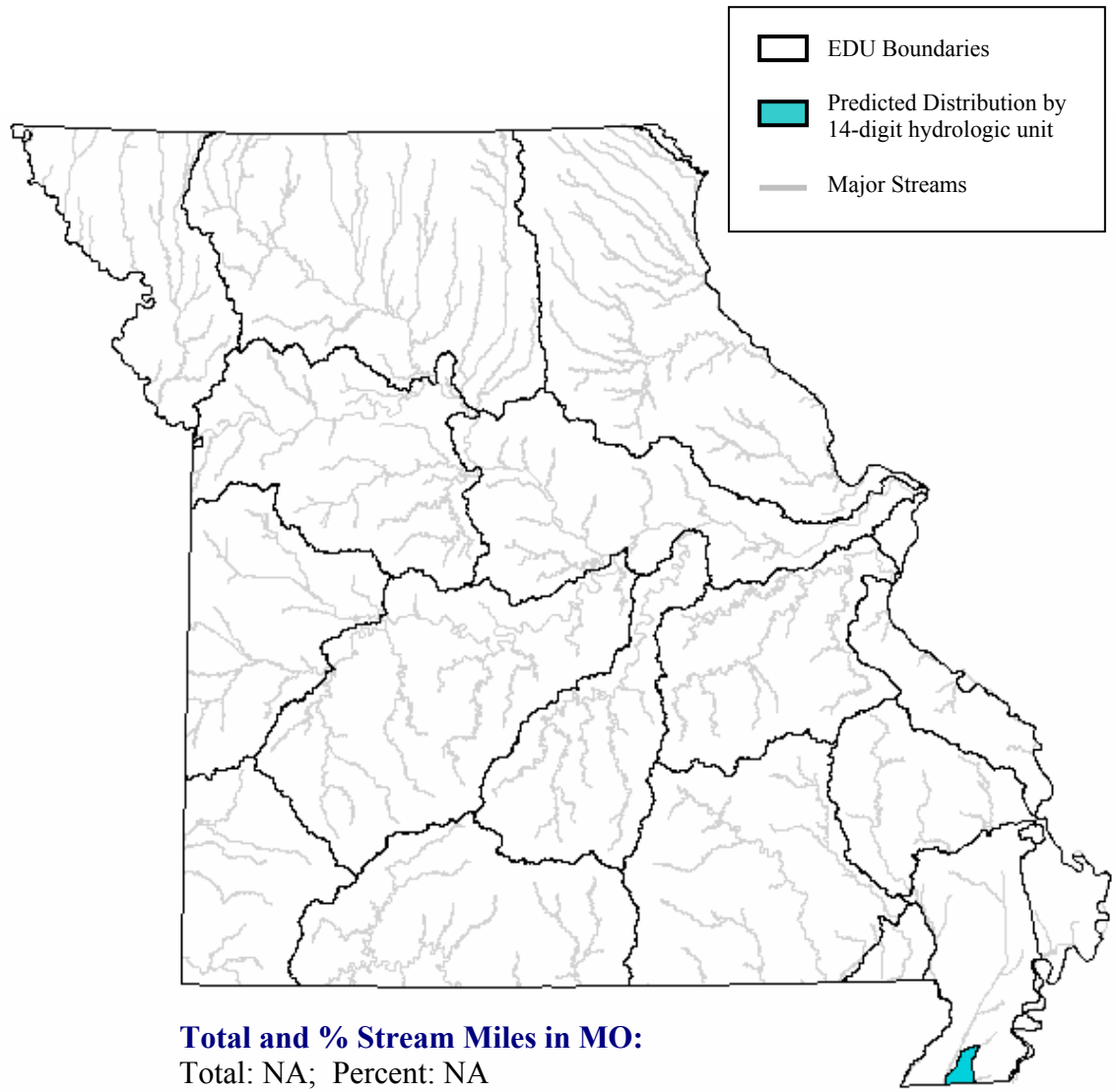
Endemism: Region

State Rank: S1

ITIS Code: 80284

Global Rank: G1

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

In Missouri the fat pocketbook is only known to occur in the Mississippi River above the town of Louisiana, Missouri (Oesch 1995). It has also been collected from the southern part of the Mississippi Alluvial Basin/ St. Francis/ Little Ecological Drainage Unit in Missouri.

Habitat Affinities:

This species occurs primarily in large rivers in areas of slow current with substrates of sand and mud (Cummings and Mayer 1992; Oesch 1995). However, Harris and Gordon (1990) report that in Arkansas the fat pocketbook is found in streams ranging from small ditches to large rivers and substrates ranging from mud-sand to sand-gravel.

Predictive Model(s):

The distribution is based upon existing collection records and professional review.

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

Van der Schalie, H. and A. Van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J. D., M. L. Warren, Jr., K. S. Cummings, J. L. Harris, and R. J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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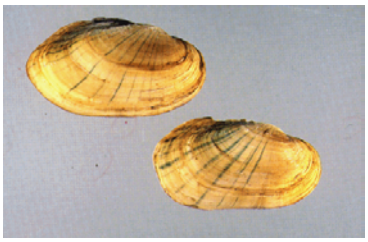


Fatmucket

Lampsilis siliquoidea

Native: Yes

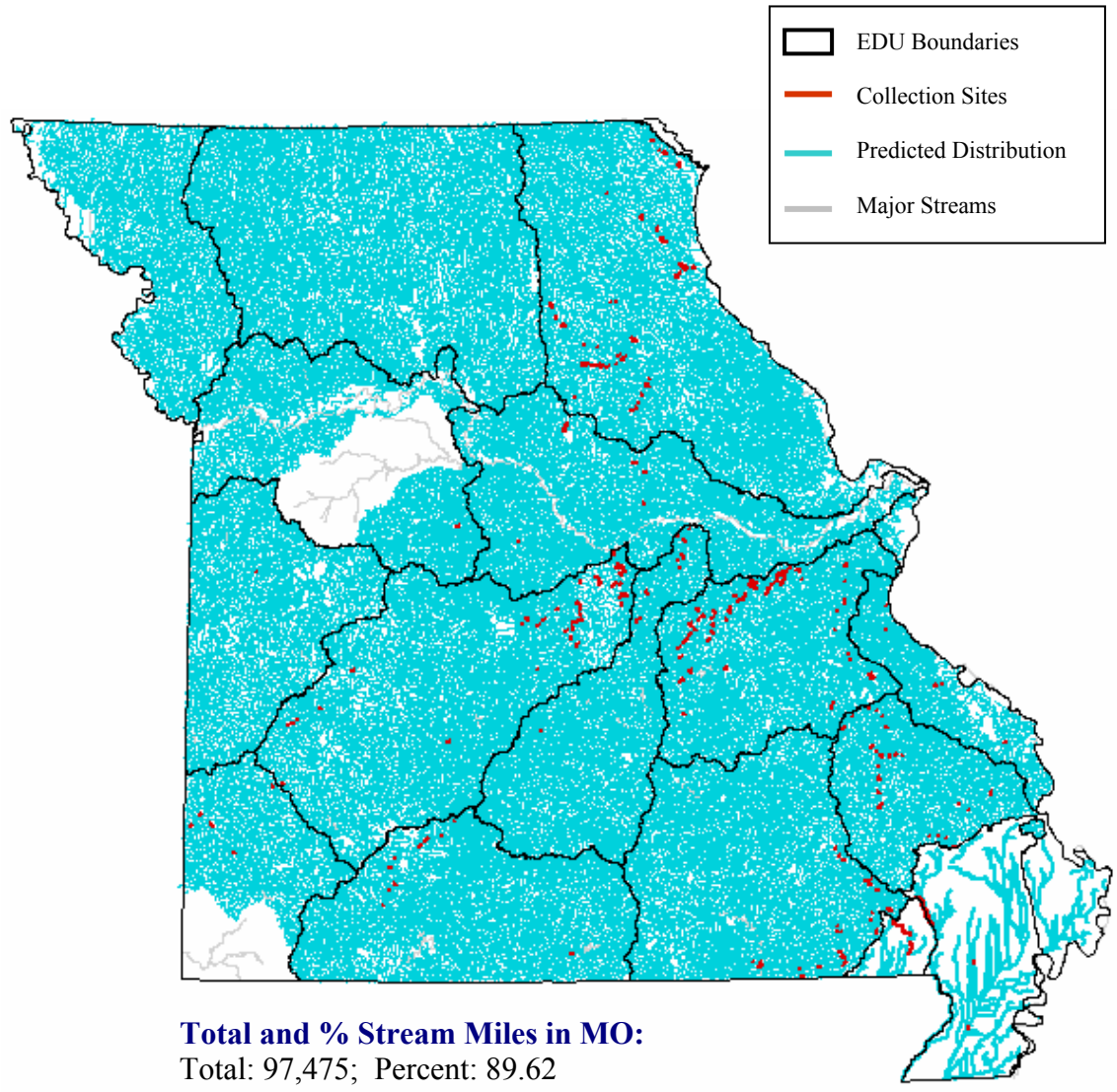
Endemism: Subzone

State Rank: S?

ITIS Code: 80028

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 97,475; Percent: 89.62

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to collection records and professional review it is believed that this species occurs nearly statewide.

Habitat Affinities:

This species occurs in lakes and small to large rivers (Bruenderman et. al 2002). It has been collected from all substrate types in everything from standing to swiftly flowing water (Buchanan 1980; Oesch 1995).

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Temp_code] = 2)
Query 2: (([GradsegR] = 1) and ([Linkr] >= 5)) or (([GradsegR] >= 2))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

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Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

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Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

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Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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Fawnsfoot

Truncilla donaciformis

Native: Yes

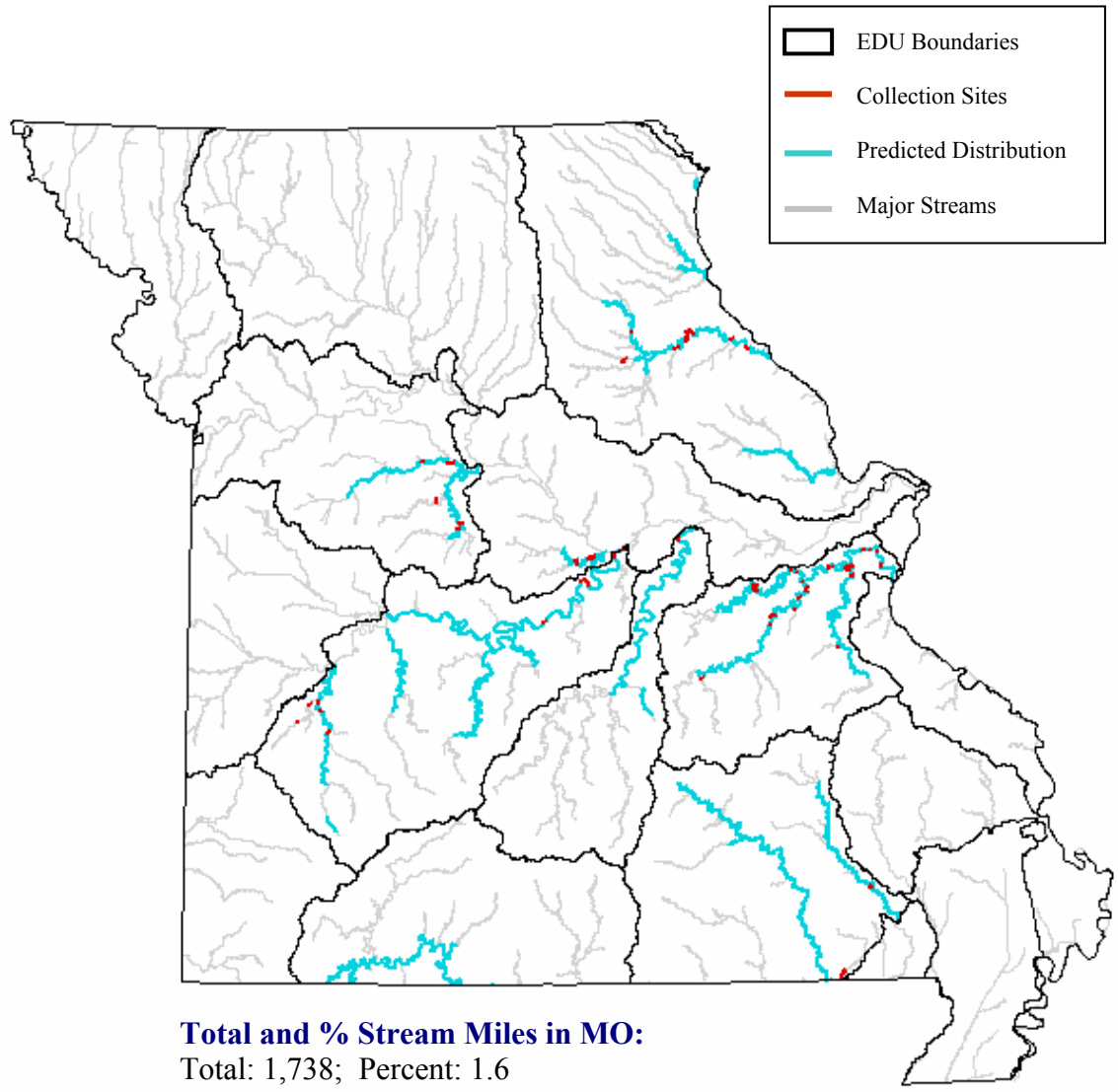
Endemism: Region

State Rank: S?

ITIS Code: 80166

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 1,738; Percent: 1.6

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The fawnsfoot occurs in the many of the major drainages within the Ozark Aquatic Subregion as well as the Blackwater Lamine River systems and major tributaries to the Mississippi River within the Cuivre/Salt Ecological Drainage Unit of the Central Plains Aquatic Subregion.

Habitat Affinities:

This species occurs primarily in large rivers and the lower segments of small rivers (Cummings and Mayer 1992; Oesch 1995). Buchanan (1980) reports finding the fawnsfoot in areas of standing or swiftly moving water over all types of substrates, but that it is most commonly found in either silt or gravel/cobble substrates.

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Ozark Model Mus335 sub2 LinkR by8
Query 1: ([Flow] = 1)
Query 2: (([Linkr] = 5) and ([Rgrad_subr] >= 2) and ([Temp_code] = 1)) or (([Linkr] = 6)) or (([Linkr] = 7) and ([Rgrad_subr] = 1) and ([Temp_code] = 2)) or (([Linkr] = 7) and ([Rgrad_subr] >= 2)) or (([Linkr] >= 8))

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

Van der Schalie, H. and A. Van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Flat Floater

Anodonta suborbiculata

Native: Yes

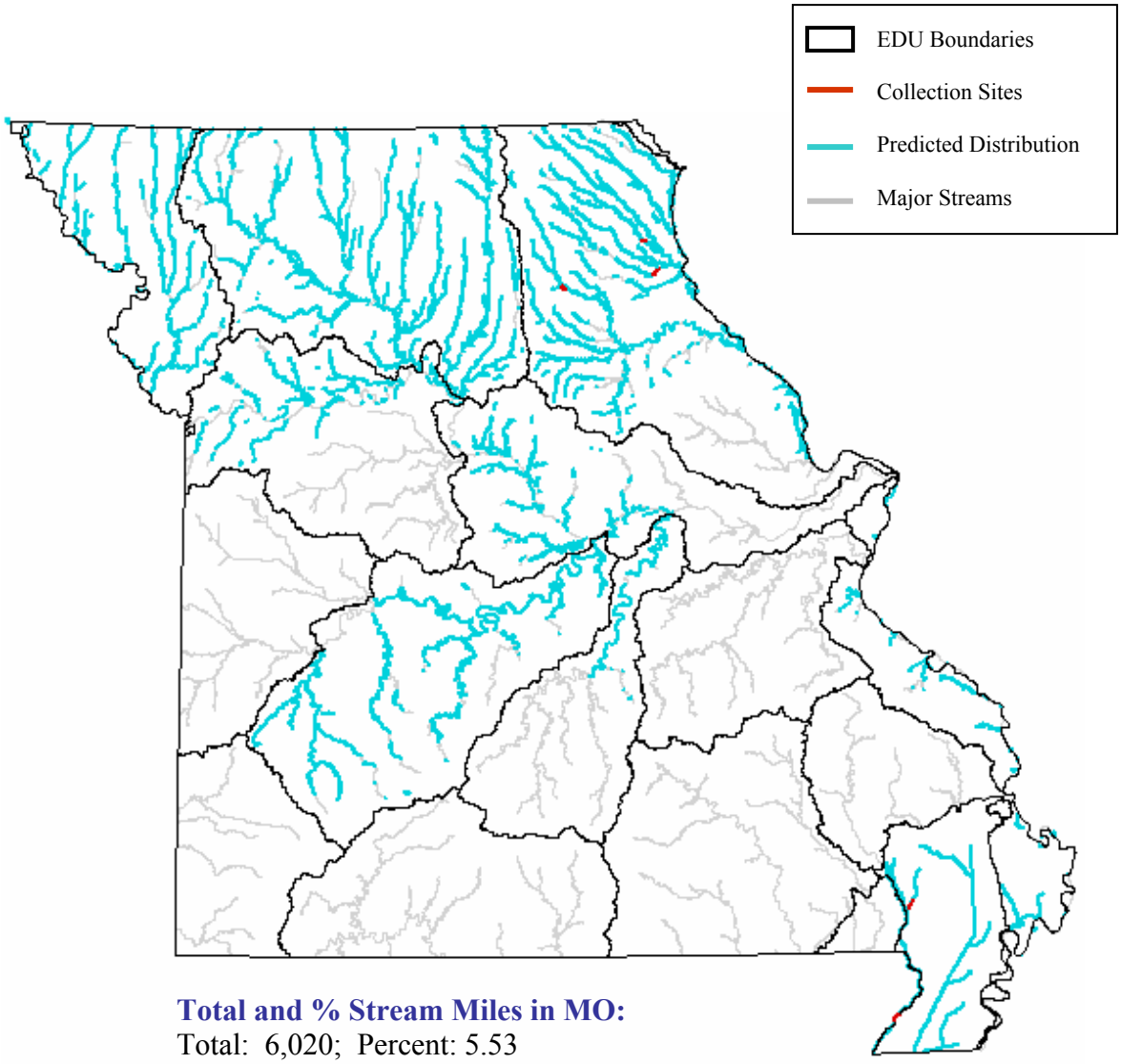
Endemism: Region

State Rank: S2

ITIS Code: 79945

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 6,020; Percent: 5.53

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to Oesch (1995), the flat floater is one of the rarest mussels in Missouri. However, Harris and Gordon (1990) state that the flat floater probably occurs in all major river systems in Arkansas despite the rarity of collection records for this species since most investigators do not make collections in the muddy backwater habitats that this species usually inhabits. According to professional review it is believed that this species occurs across a much wider portion of the state than existing collection records suggest.

Habitat Affinities:

This species occurs primarily in the muddy bottoms of backwaters and oxbows of large rivers and also ponds or lakes (Harris and Gordon 1990; Oesch 1995). Cummings and Mayer (1992) report that the flat floater can be found in the sluggish pools of creeks.

Predictive Model(s):

Central Plains/Ozark Model

Query 1: ([Flow] = 1) and ([Temp_code] = 2) and ([Ssize_code] >= 2) and ([Ssize_code] <= 4) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2)

Query 2:Secondary channels and disconnects associated with small rivers, large rivers and great rivers (done within a 500 meter stream buffer).

Mississippi Alluvial Basin Model

([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 3) and ([Ssize_code] <= 4)

References:

Baker, F. C., 1928. The fresh-water mollusca of Wisconsin, Part II. Pelecypoda, Bulletin of Wisconsin Geological Natural History Survey, 70: 1-495.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

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Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

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Van der Schalie, H. and A. Van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper left: Photo courtesy of the W. H. McCullagh.

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Flutedshell

Lasmigona costata

Native: Yes

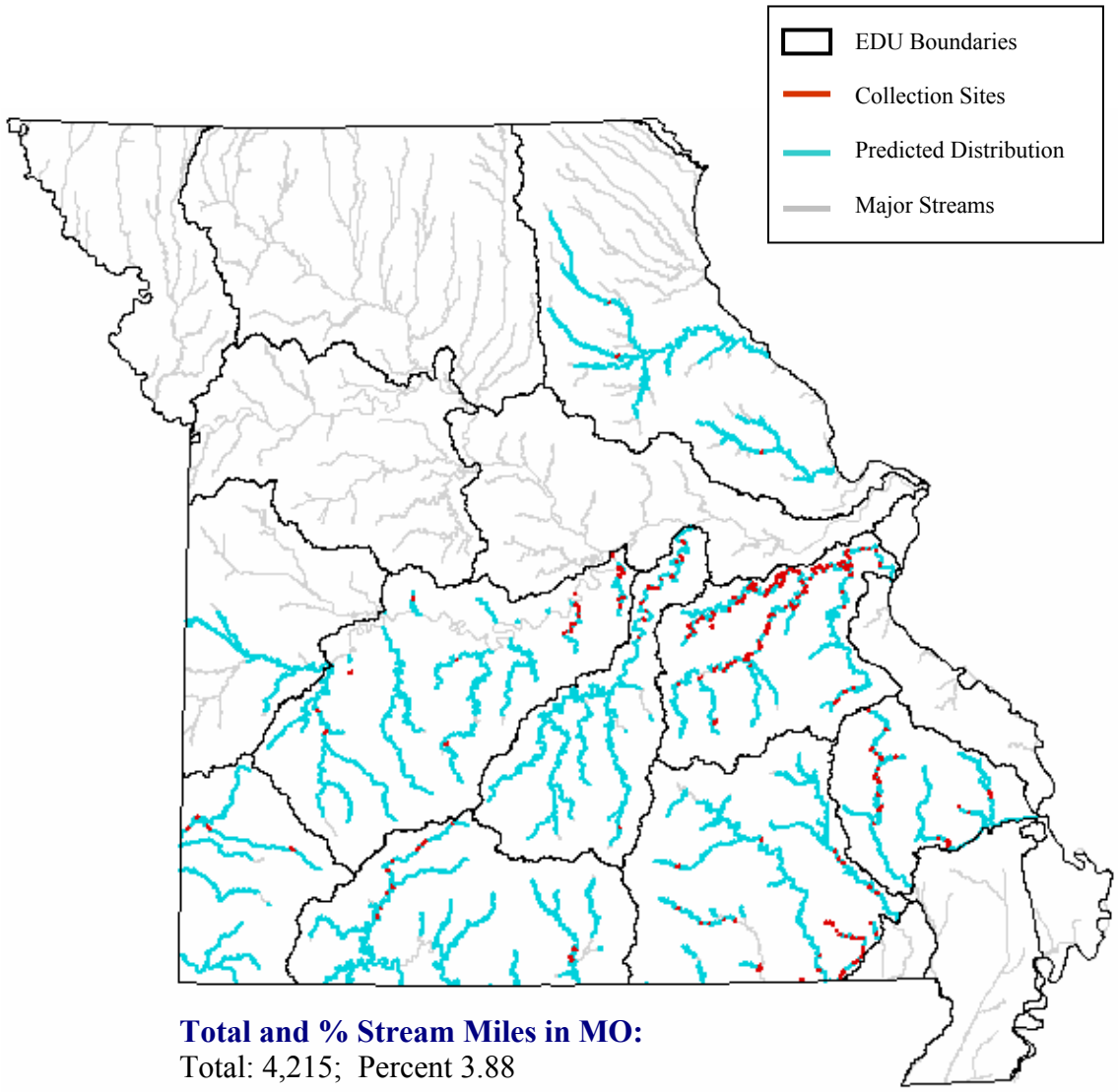
Endemism: Subzone

State Rank: S?

ITIS Code: 80139

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 4,215; Percent 3.88

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The flutedshell has been found in all of the major drainages of the Ozark Aquatic Subregion and the western Osage. It is most prevalent in the north flowing drainages of this Subregion (Oesch 1995). A single specimen of this species has also been found in the Cuivre River and historical records exist from the Des Moines, Salt River drainage and Mississippi River of northeast Missouri (Oesch 1995).

Habitat Affinities:

This species is primarily found in small to large rivers in sand, mud or fine gravel substrates in areas with slow to moderate current (Cummings and Mayer 1992; Oesch 1995). In the Meramec drainage Buchanan (1980) reported finding this species in all stream sizes and in all types of substrates and flow conditions. Harris and Gordon (1990) also report that this species favors moderate to swift flowing water.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Temp_code] = 2)
Query 2: (([Linkr] >= 5) and ([Linkr] <= 6) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2) and ([Flow] = 1)) or (([Linkr] >= 5) and ([Linkr] <= 6) and ([Gradsegr] >= 3)) or (([Linkr] = 7))

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

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Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

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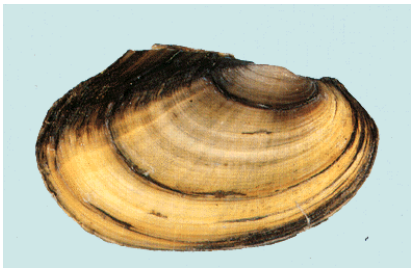
Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Fragile Papershell

Leptodea fragilis



Native: Yes

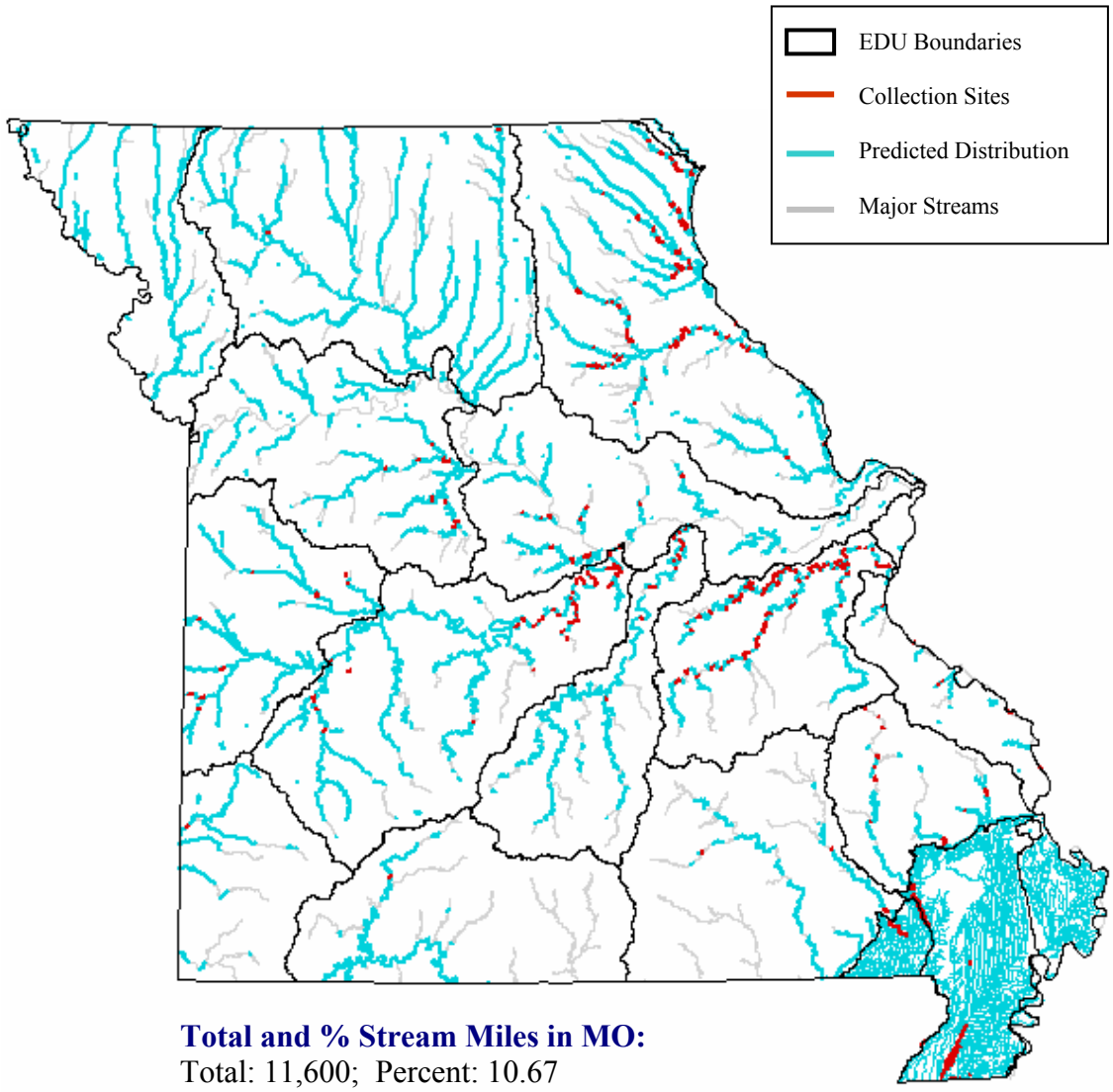
Endemism: Region

State Rank: S?

ITIS Code: 80182

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 11,600; Percent: 10.67

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The fragile papershell is found nearly statewide except that it is conspicuously absent from the entire Eleven Point and North Fork of the White River drainages just north of the Missouri-Arkansas border (Oesch 1995). Harris and Gordon (1990) state that this species is especially prominent within the White River in Arkansas.

Habitat Affinities:

This species is found in streams of all sizes (Cummings and Mayer 1992; Bruenderman et al. 2002). It occurs primarily in mud, mud-gravel or firm sand substrates in areas of reduced current in both turbid or clear water (Oesch 1995; Bruenderman et al. 2002). However, Harris and Gordon (1990) report that this species can be found inhabiting virtually all bottom types and flow regimes.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([GradsegR] = 1) and ([Linkr] >= 1) and ([Linkr] <= 5)) or (([GradsegR] = 1) and ([Linkr] >= 6) and ([Linkr] <= 7) and ([Temp_code] = 2)) or (([GradsegR] = 1) and ([Linkr] >= 8)) or (([GradsegR] = 2) and ([Linkr] >= 5))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceeding of the Oklahoma Academy of Science 64: 20-36.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri., Southwestern Naturalist, 27: 347-352.

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Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

Van der Schalie, H. and A. Van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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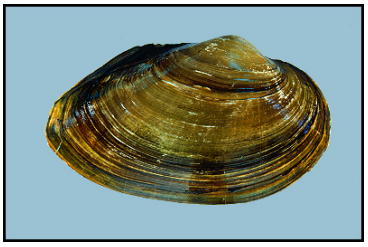
Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Giant Floater

Pyganodon grandis



Native: Yes

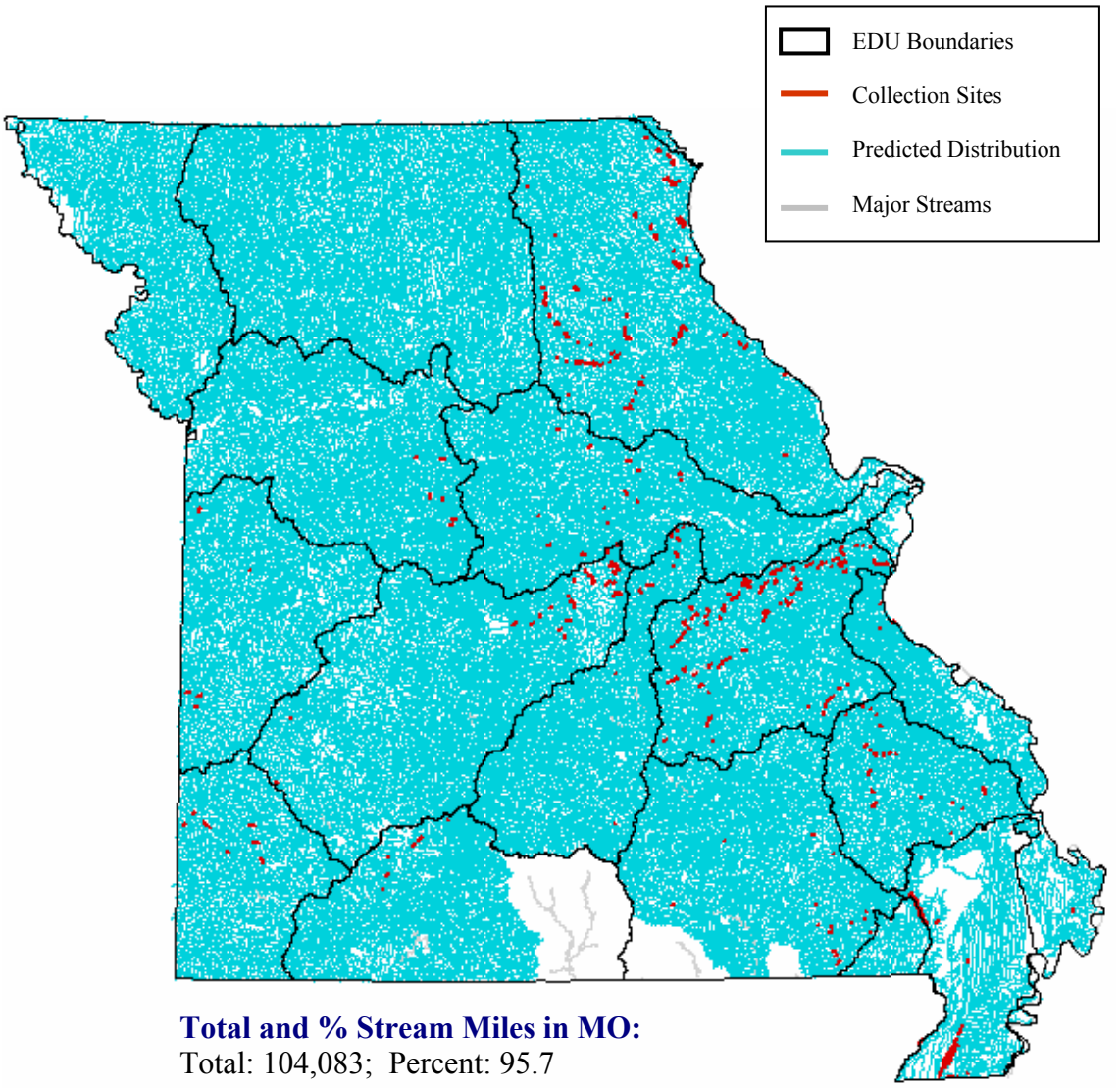
Endemism: Subzone

State Rank: S?

ITIS Code: 10001

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 104,083; Percent: 95.7

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The giant floater is commonly found throughout virtually all of Missouri, except for some of the south-central drainages, such as the North Fork of the White River, along the Missouri-Arkansas border (Oesch 1995; Bruenderman et al. 2002).

Habitat Affinities:

This species is primarily found stream sizes ranging from small creeks to large rivers and also backwaters, oxbows, lakes and ponds (Buchanan 1980; Harris and Gordon 1990; Cummings and Mayer 1992). It is most commonly encountered in areas with little or no flow over mud, silt and fine-gravel substrates (Buchanan 1980; Harris and Gordon 1990; Oesch 1995; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains/Ozark Model
([Temp_code] = 2)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

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Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey

Hickorynut

Obovaria olivaria

Native: Yes

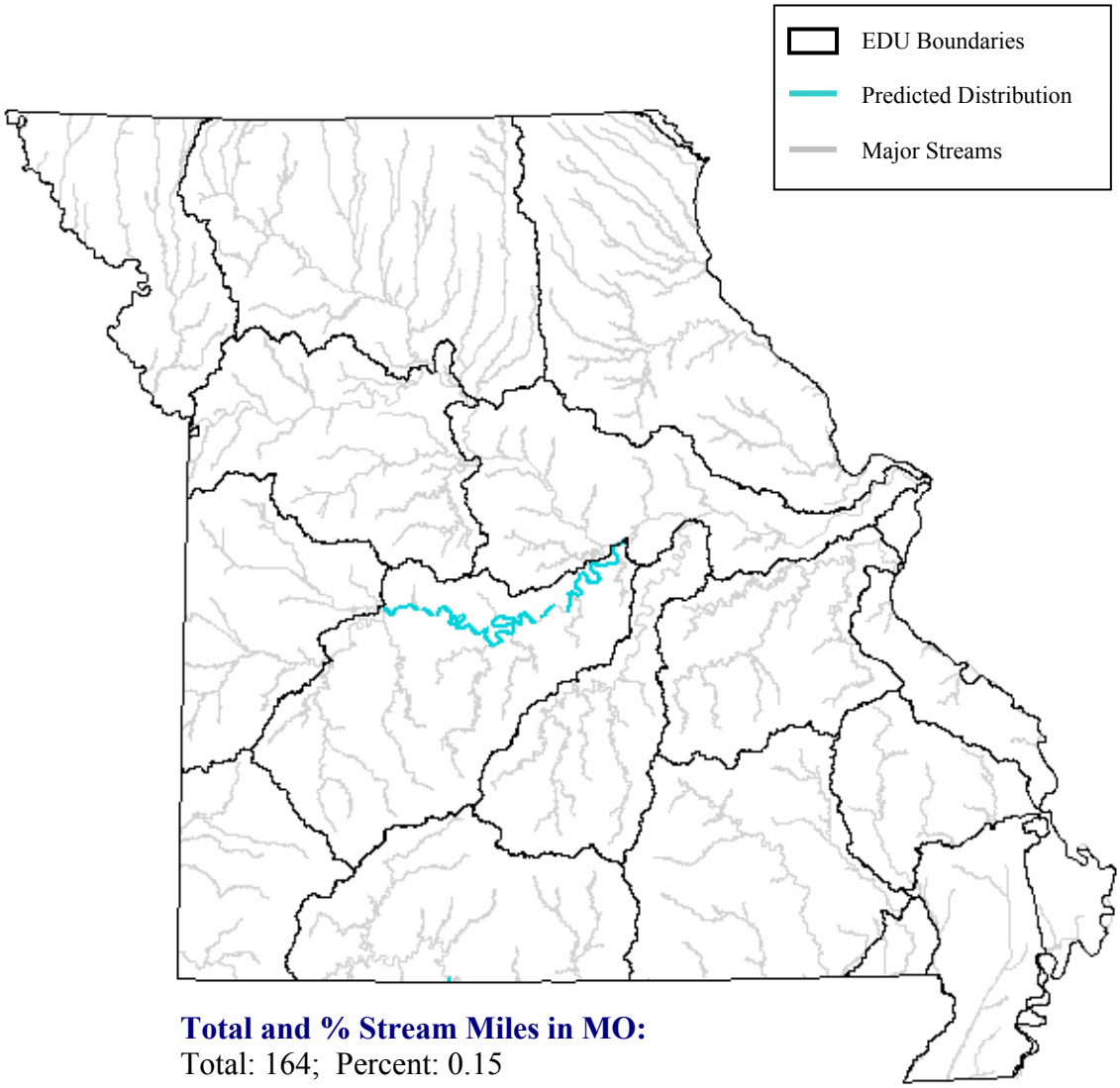
Endemism: Subzone

State Rank: S2S3

ITIS Code: 80173

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 164; Percent: 0.15

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The hickorynut is an extremely rare mussel in Missouri. Specimens have been collected from scattered locations throughout the Mississippi River above the Ohio River and in 1980 this species was collected at a handful of locations in the extreme lower sections of the Osage River. Oesch (1995) reported that aside from the Mississippi River, the only collections of the hickorynut made during his statewide survey were in the Meramec drainage during 1969. However, a subsequent intensive survey of the Meramec drainage by Buchanan (1980) failed to locate living specimens of this species. As a result, the Meramec drainage was omitted as part of the hickorynut's range during the professional review process.

Habitat Affinities:

This species is primarily found large rivers (rarely in medium or small streams) over gravel, gravel-sand and gravel-mud substrates in moderate to swift current (Goodrich and van der Schalie 1944; Parmalee 1967; Harris and Gordon 1990; Cummings and Mayer 1992).

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([LinkR] >= 7) and ([GradsegR] = 1)

References:

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

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Goodrich, C. and H. van der Schalie. 1944. A revision of the Mollusca of Indiana. American Midland Naturalist 32: 257-326.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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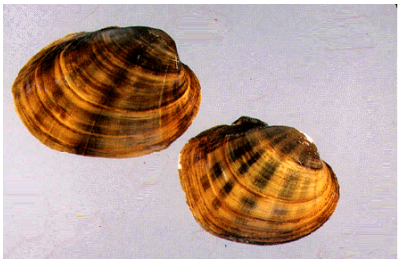


Higgins Eye

Lampsillis higginsii

Native: Yes

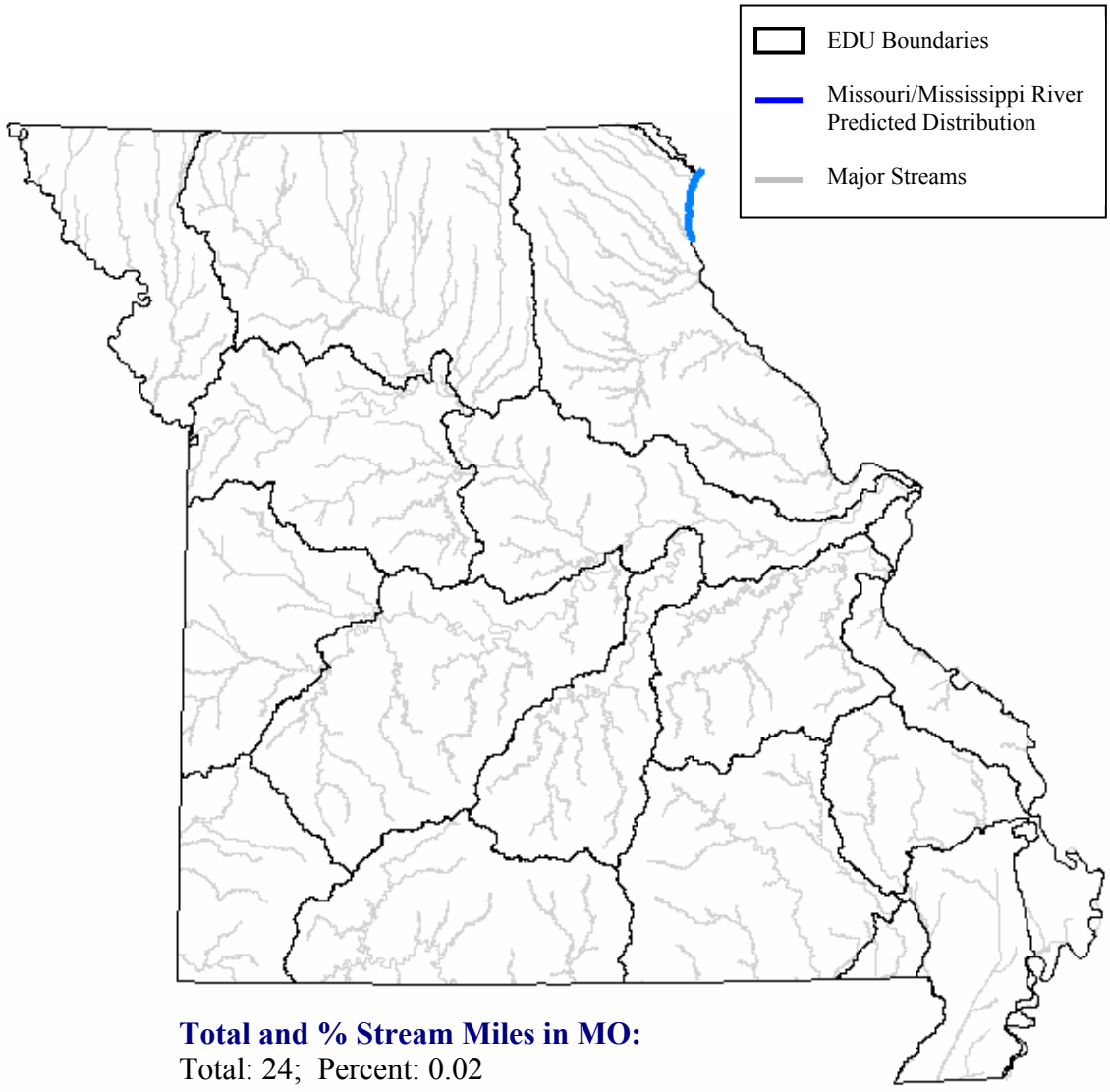
Endemism: Region

State Rank: SA

ITIS Code: 80173

Global Rank: G1

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 24; Percent: 0.02

State Range:

The Higgins eye mussel is extremely rare in Missouri, with only a single population known from the Mississippi River between Hannibal, MO and the outlet of the Des Moines River.

Habitat Affinities:

The Higgins eye is a large river species found only in the Mississippi River and some of its larger tributaries over gravel or sand substrates (Cummings and Mayer 1992).

Predictive Model(s):

Great River Model
The distribution is based upon habitat affinity and professional review.

References:

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

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Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

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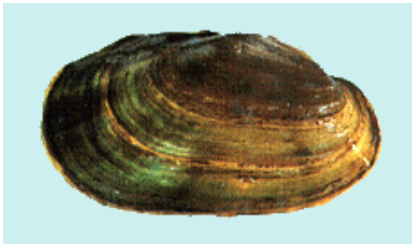


Lilliput

Toxolasma parvus

Native: Yes

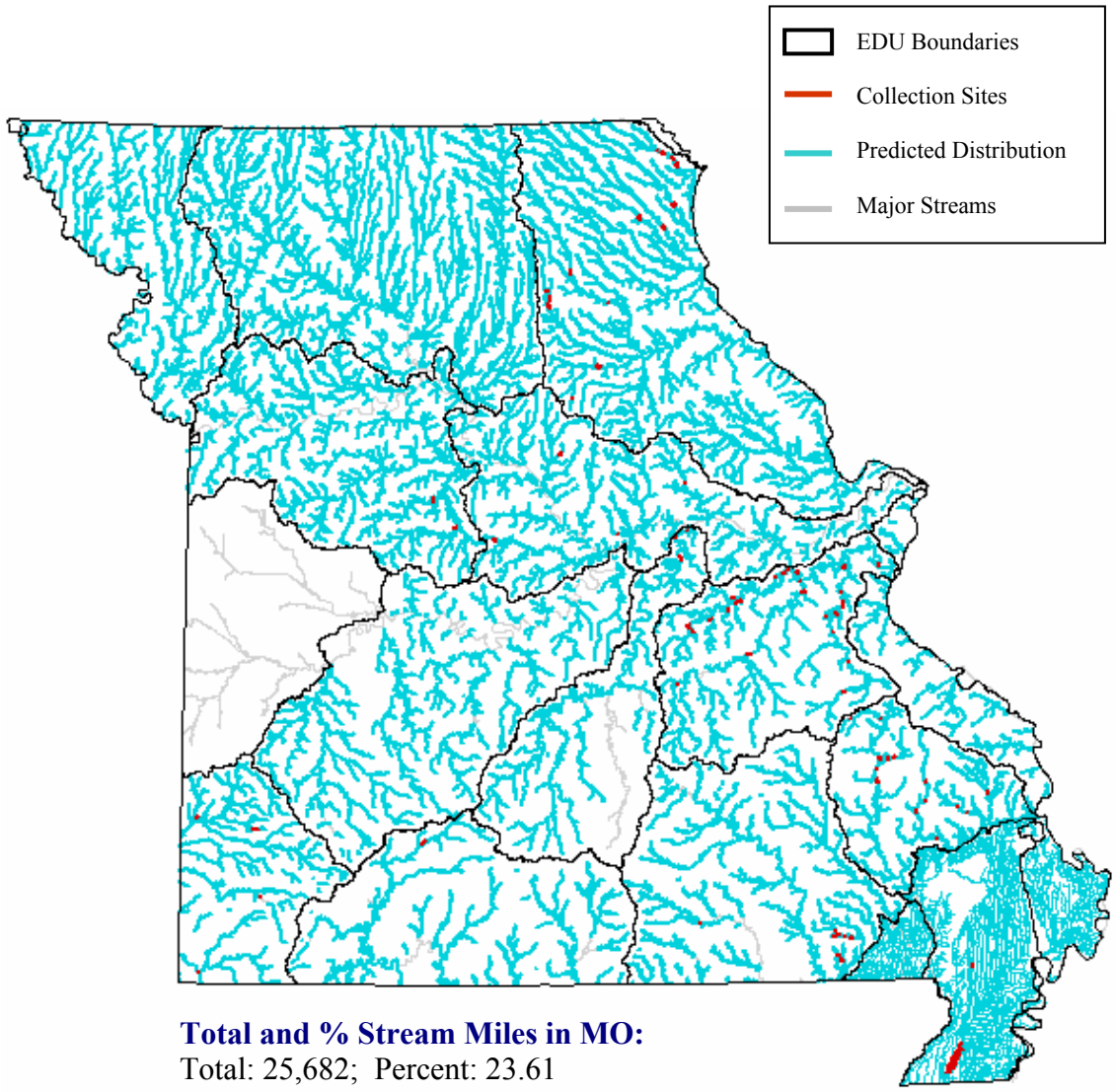
Endemism: Region

State Rank: S?

ITIS Code: 80364

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 25,682; Percent: 23.61

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

Recent sampling efforts and professional review suggest that the lilliput can be found throughout most of Missouri with the exception of the Central Plains/Osage/South Grand Ecological Drainage Unit (Sue Bruenderman (MDC), personal communication).

Habitat Affinities:

This species is found in a range of stream sizes (creeks to large rivers), but is most abundant in larger rivers (Buchanan 1980; Cummings and Mayer 1992; Bruenderman et. al 2002). It is usually found in areas with little or no current over substrates of silt, silt and sand, or gravel (Buchanan 1980; Bruenderman et. al 2002). Harris and Gordon (1990) state that the lilliput appears to adapt to almost any type of substrate.

Predictive Model(s):

Central Plains/Ozark Model
([Temp_code] = 2) and ([Linkr] >= 2) and ([Linkr] <= 7) and ([Gradsegr] >= 1) and ([Gradsegr] <= 5)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 3)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

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Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

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Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Little Spectaclecase

Villosa lienosa

Native: Yes

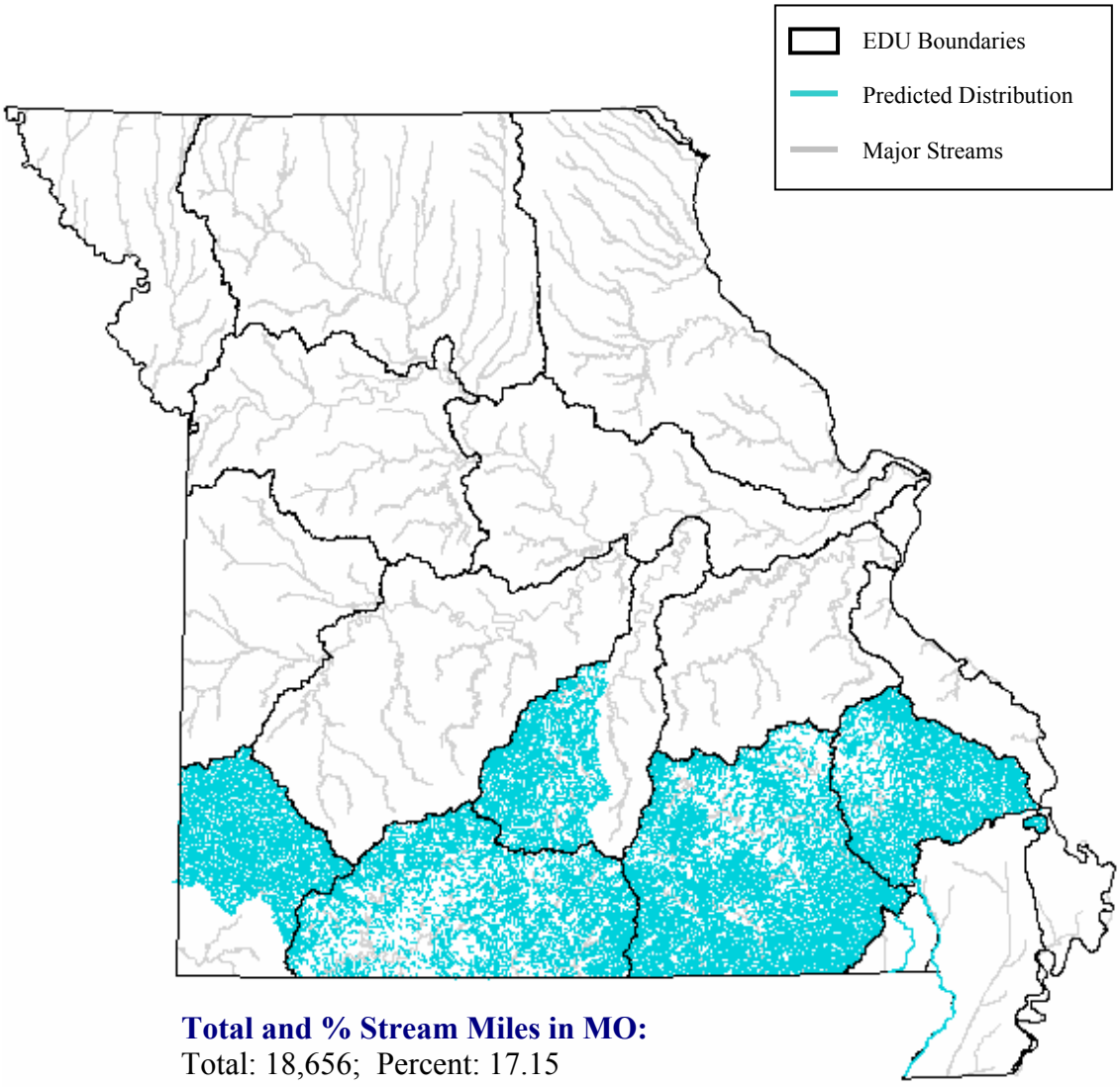
Endemism: Region

State Rank: S3

ITIS Code: 80208

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 18,656; Percent: 17.15

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The little spectaclecase is found mainly in south flowing streams of the Ozark Aquatic Subregion. In addition, the species is located in the Black and St. Francis Rivers of the Mississippi Alluvial Basin. More recently this species has been discovered in the upper Gasonade drainage, which is the only north flowing stream that this species has been collected from in Missouri (S. Bruenderman, pers. com).

Habitat Affinities:

This species is found in a range of stream sizes (creeks to large rivers), but is most abundant in larger rivers (Buchanan 1980; Cummings and Mayer 1992; Bruenderman et. al 2002). It is usually found in areas with little or no current over substrates of silt, silt and sand, or gravel (Buchanan 1980; Bruenderman et. al 2002). Harris and Gordon (1990) state that the lilliput appears to adapt to almost any type of substrate.

Predictive Model(s):

Ozark Model
([Rgrad_subr] >= 1) and ([Rgrad_subr] <= 2) and ([Temp_code] = 2)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Mapleleaf

Quadrula quadrula

Native: Yes

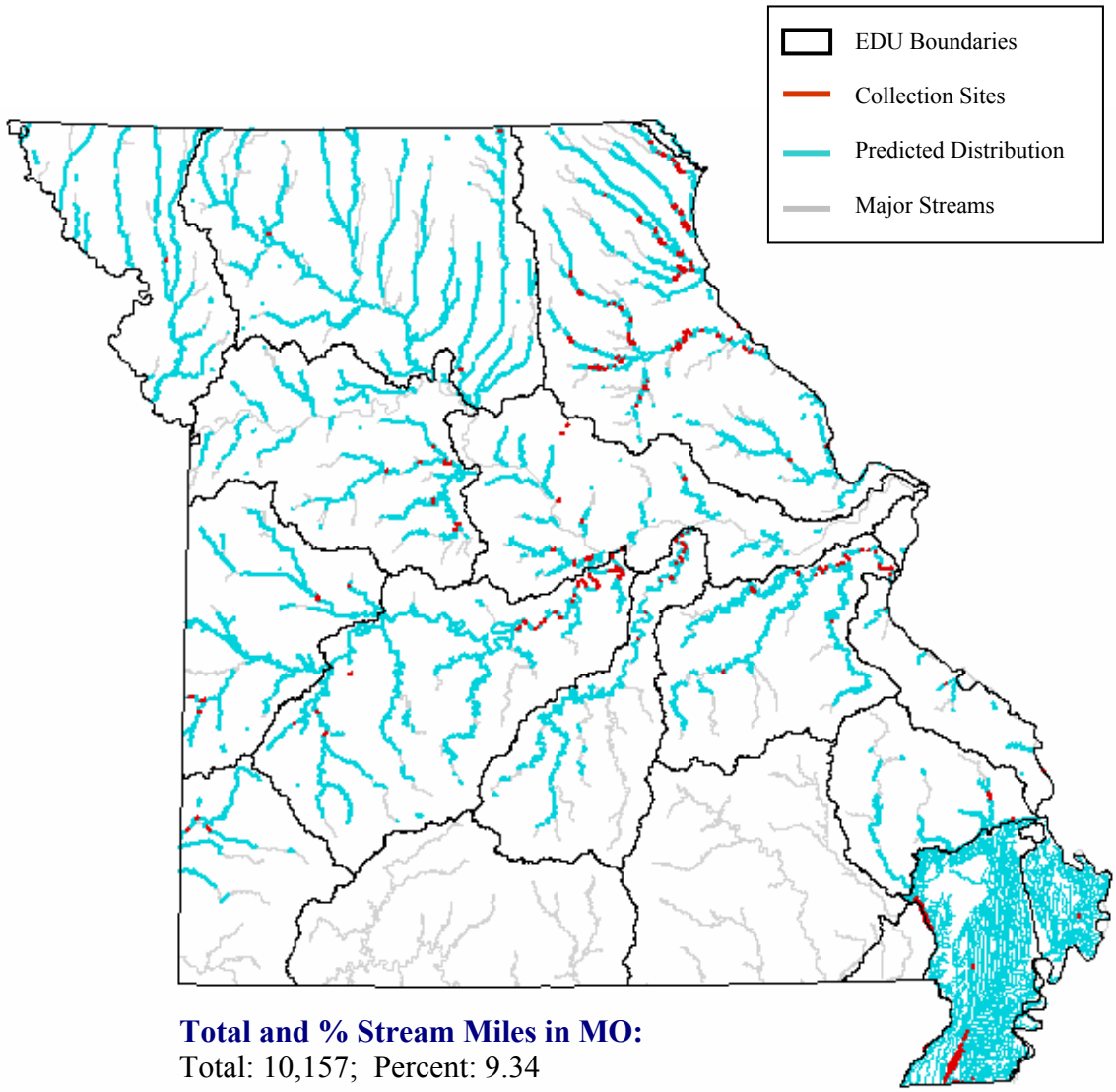
Endemism: Subzone

State Rank: S?

ITIS Code: 80060

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 10,157; Percent: 9.34

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The mapleleaf is widespread in Missouri (Oesch 1995). It is found throughout northern Missouri, the Mississippi Alluvial Basin Aquatic Subregion, and all of the northern flowing streams of the Ozark Aquatic Subregion. Widely scattered populations also exist in some of the south flowing drainages of the Ozarks, including the Castor, St. Francis and Spring River drainages.

Habitat Affinities:

This species is found in medium to large rivers and also oxbows, lakes and reservoirs (Buchanan 1980; Cummings and Mayer 1992; Bruenderman et. al 2002). It is usually found in areas with slow to moderate current over a wide range of substrates (Buchanan 1980; Harris and Gordon 1990; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([GradsegR] = 1) and ([linkr] >= 3)) or (([GradsegR] = 2) and ([Linkr] >= 5))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

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Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J. C. and G. A. Schuster. 1989. Freshwater mussel investigations of the Ohio River, mile 317.0 to mile 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 57 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

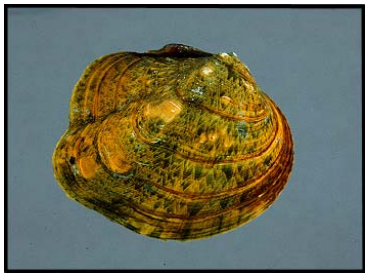
Photo Credits:

Upper left: Photo courtesy of Deborah Wills; Copyright © 1995 D. R. Wills.

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Monkeyface

Quadrula metanevra



Native: Yes

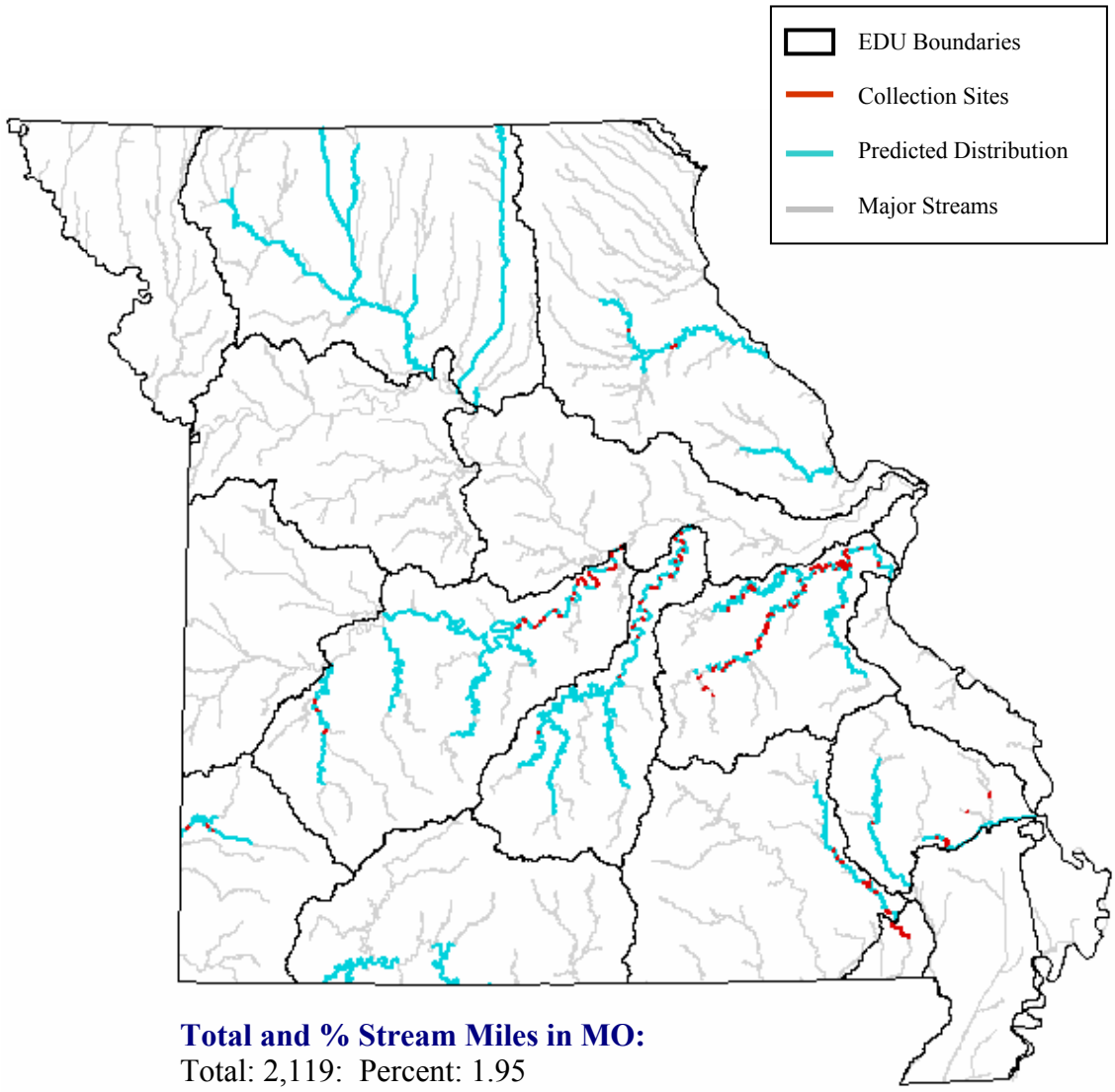
Endemism: Region

State Rank: S?

ITIS Code: 80071

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,119: Percent: 1.95

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The monkeyface is found in almost all rivers flowing off the Salem and Springfield plateaus except for some of the south flowing streams in central part of state (Oesch 1995). Populations also exist in the Salt and Cuivre River drainages of northeast Missouri and in the Grand/Chariton Ecological Drainage Unit.

Habitat Affinities:

This species is typically found in riffles of medium to large rivers having relatively swift flow, clear water and a clean mix of sand and gravel substrates (Buchanan 1980; Oesch 1995; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains/Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

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Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper left: Photo courtesy of the W. H. McCullagh.

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Mucket

Actinonaias ligamentina

Native: Yes

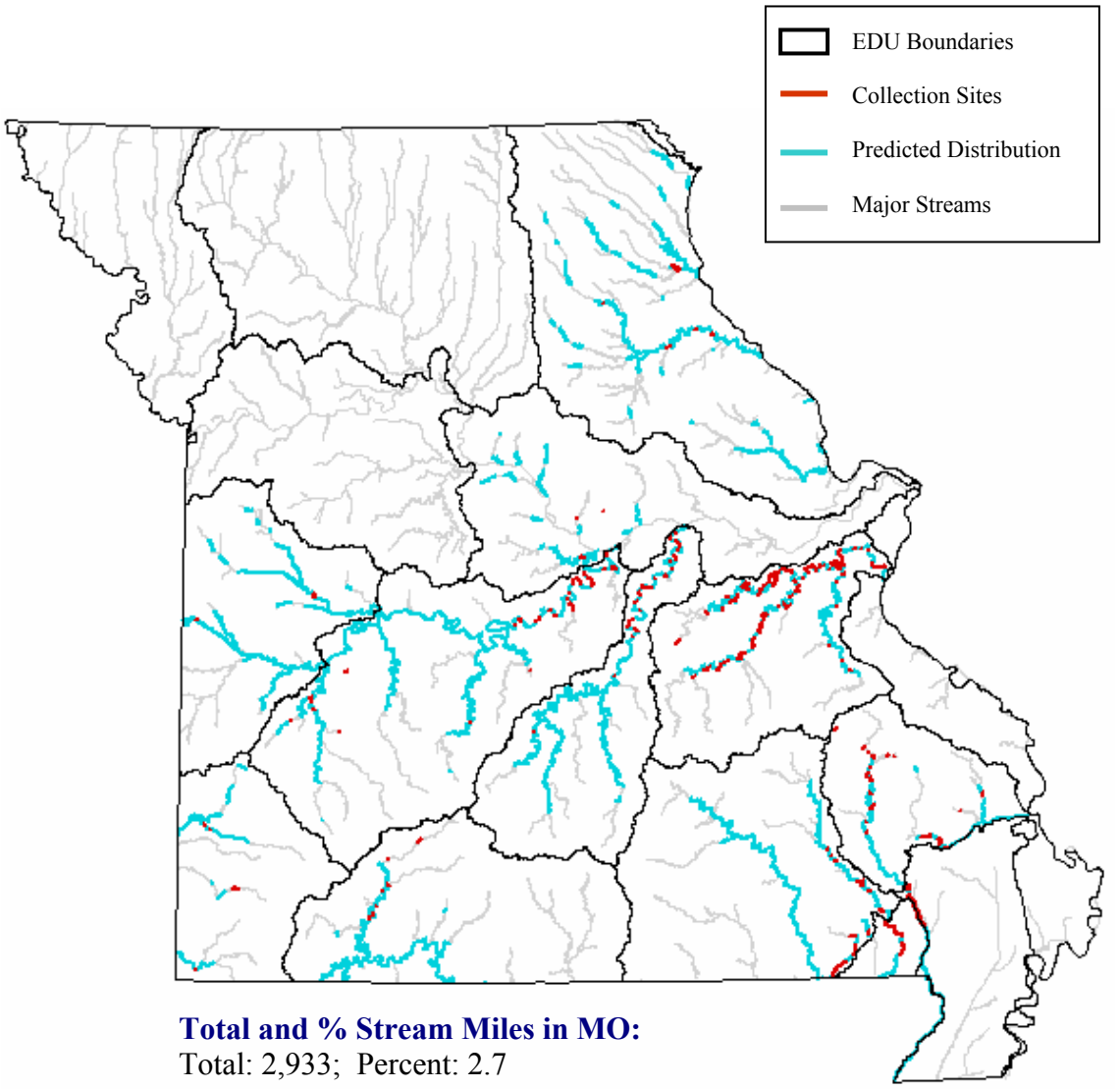
Endemism: Subzone

State Rank: S?

ITIS Code: 80193

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,933; Percent: 2.7

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The mucket is one of the most widespread and abundant mussels in the southern half of Missouri (Oesch 1995). It is found in almost all rivers flowing off the Salem and Springfield plateaus except for some of the south flowing streams in central part of state. Populations also exist in tributaries to the Missouri River between the Lamine and Osage River outlets. It also exists in a handful of tributaries to the Mississippi River within the Central Plains/Cuivre/Salt Ecological Drainage Unit.

Habitat Affinities:

This species is typically found in small to large rivers in areas of relatively swift flow and a stable mix of sand, gravel and cobble substrates (Cummings and Mayer 1992; Oesch 1995; Bruenderman et. al 2002). However, Buchanan (1980) found this species in a variety flow conditions and substrates ranging from silt to boulders. Harris and Gordon (1990) state that mucket is usually found in large creeks and small to medium-sized rivers and that it is occasionally found in large rivers, but at very low numbers.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([Linkr] = 5) and ([GradsegR] = 1)) or (([Linkr] >= 6))

Mississippi Alluvial Basin Model
Mus341 Sub3 Size by8
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

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Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

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Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Neosho Mucket

Lampsilis refinesqueana

Native: Yes

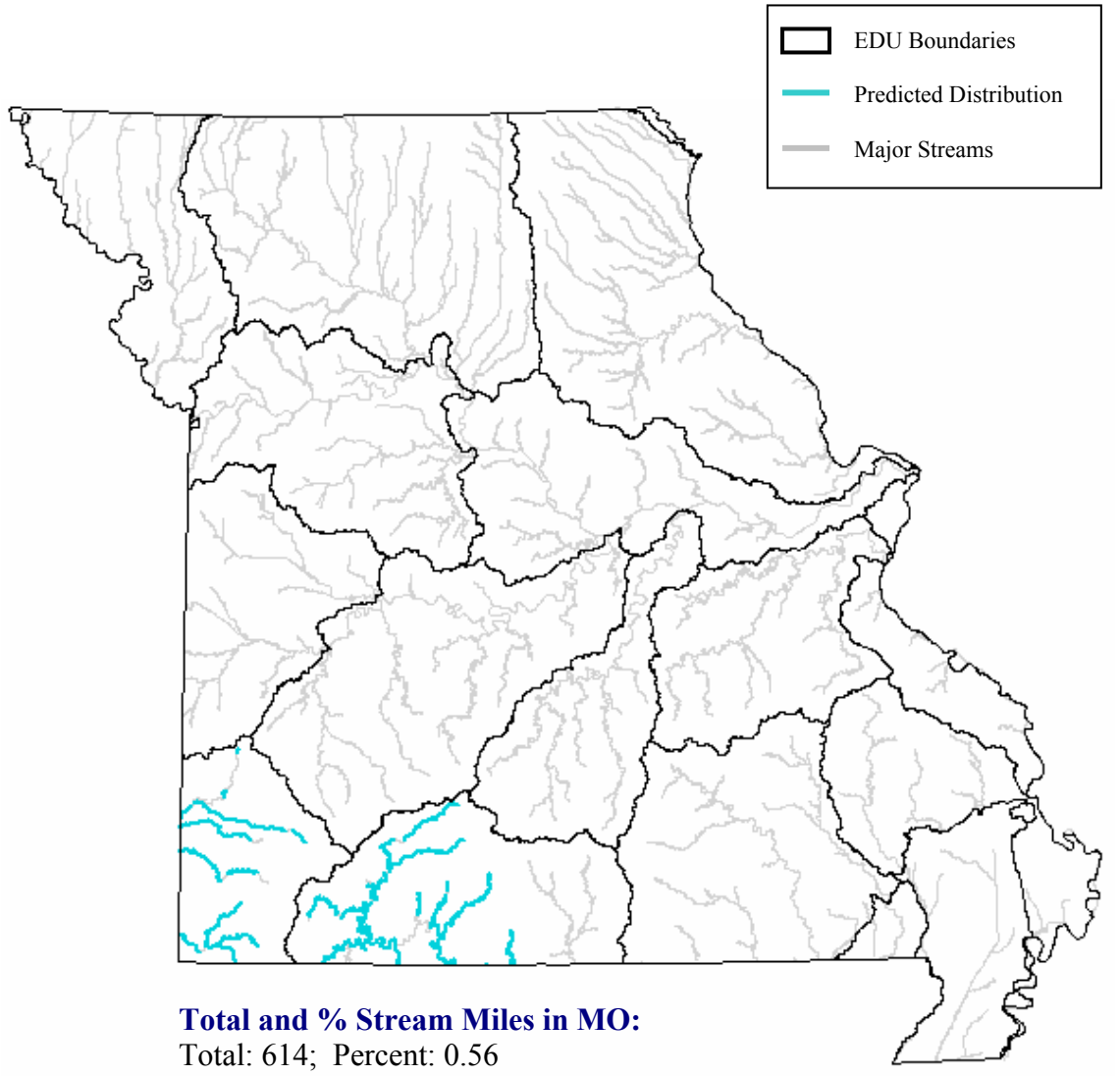
Endemism: Ecological Drainage Unit

State Rank: S2

ITIS Code: 80022

Global Rank: G2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 614; Percent: 0.56

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Neosho mucket is one of the rarest mussels in Missouri (Oesch 1995). It is known from the Neosho and White Ecological Drainage Units of the Ozark Aquatic Subregion.

Habitat Affinities:

This species is typically found in moderately flowing shallow water in fine to medium gravel substrates (Oesch 1995).

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([LinkR] >= 5) and ([Rgrad_subr] >= 2)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Obermeyer, B. K., D. R. Edds, C. W. Prophet, E. J. Miller. 1997. Freshwater mussels (bivalvia, unionidae) in the Verdigris, Neosho, and Spring River basins of Kansas and Missouri, with emphasis on species of concern. American Malacological Bulletin 14: 41-55.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Chris Barnhart, Southwest Missouri State University (Juveniles, less than 17 months old).

Upper left: Photo courtesy of Ed Miller.

Northern Brokenray

Lampsilis reeveiana brittsi

Native: Yes

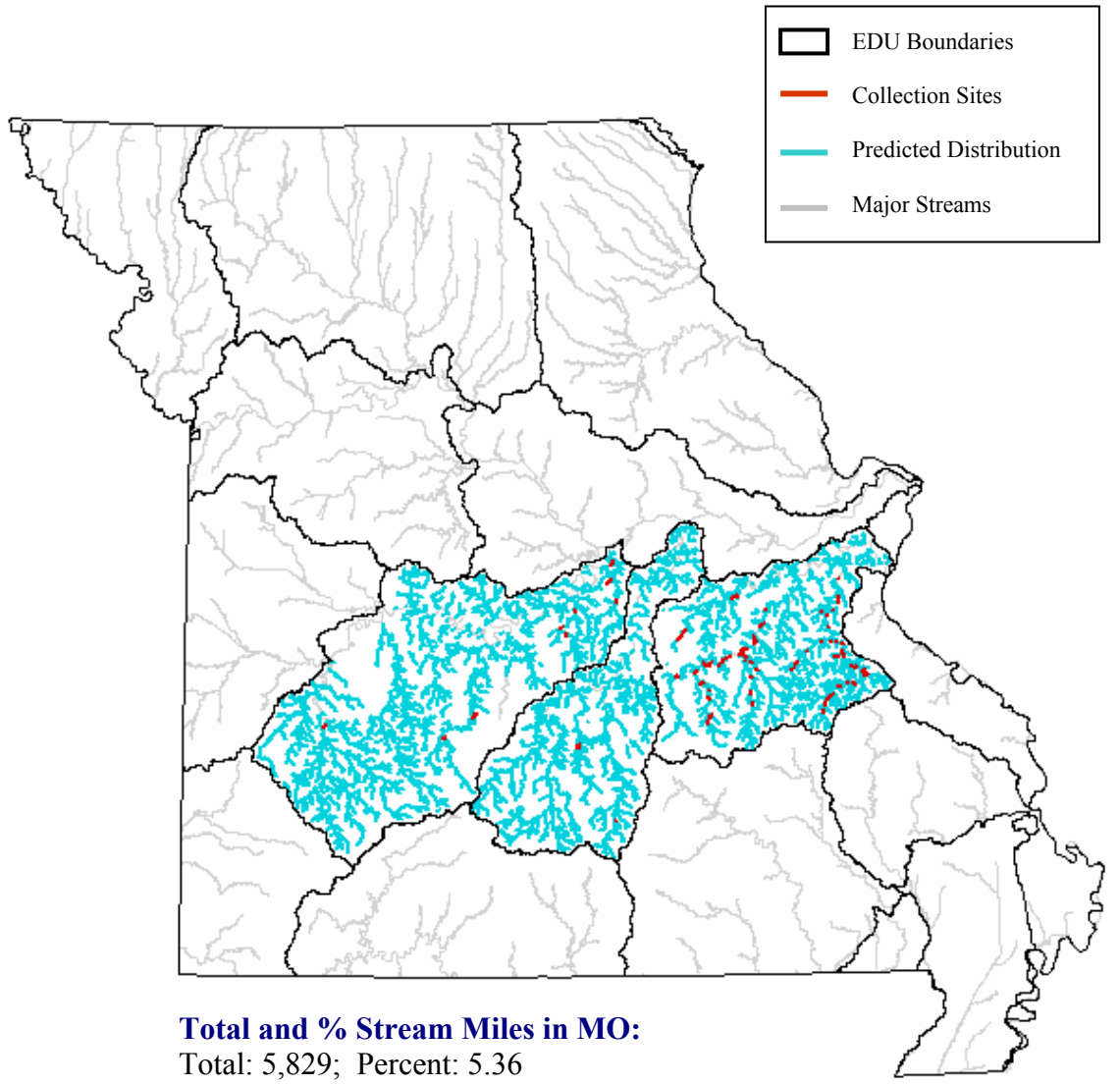
Endemism: Subregion

State Rank: S?

ITIS Code: 80026

Global Rank: G3T2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 5,829; Percent: 5.36

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The northern brokenray is only known from three north flowing streams draining the Ozark Aquatic Subregion in Missouri including the Gasconade, Meramec and Osage River watersheds.

Habitat Affinities:

This species prefers cool, clear water and is typical of headwaters of spring-fed streams and does not tolerate the warmer murky water of larger rivers and usually disappears before the mouths of rivers are reached (Oesch 1995). It is typically found in areas with good current over small gravel substrates (Buchanan 1980; Oesch 1995). However, Buchanan (1980) did find the northern brokenray in a variety of flow conditions and substrate types. He also frequently collected this species among the roots of water willow (*Justica spp*.).

Predictive Model(s):

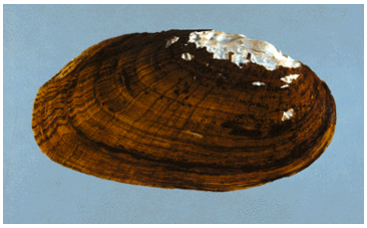
Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([Temp_code] = 1)) or (([Temp_code] = 2) and ([Rgrad_subr] = 1) and ([Linkr] >= 1) and ([Linkr] <= 6)) or (([Temp_code] = 2) and ([Rgrad_subr] >= 2))

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.



Ouachita Kidneyshell

Ptychobranchus occidentalis

Native: Yes

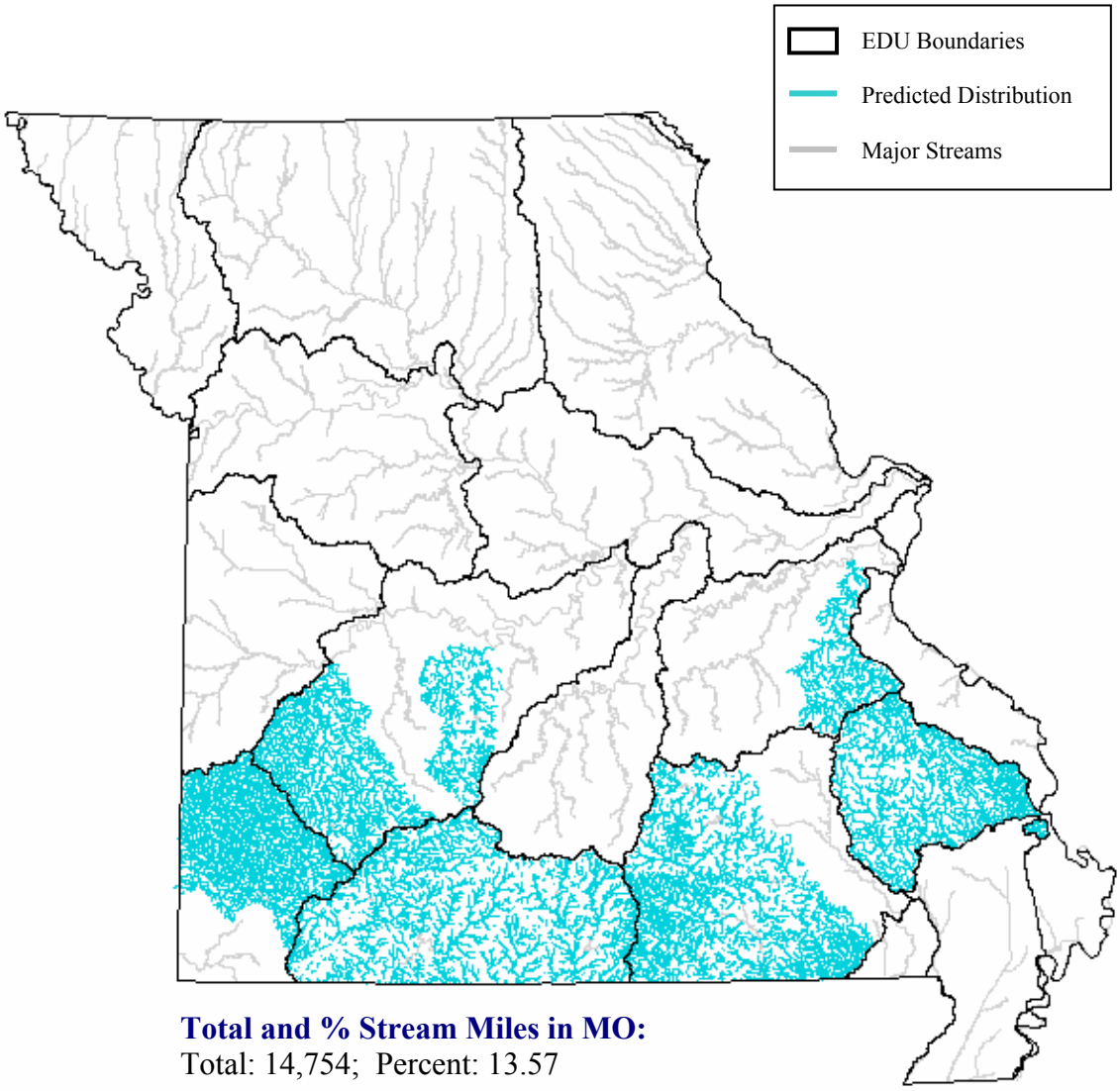
Endemism: Subregion

State Rank: S2S3

ITIS Code: 80161

Global Rank: G3G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 14,754; Percent: 13.57

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Ouachita kidneyshell is found in most of the major south and west flowing drainages of the Ozark Aquatic Subregion except the Black River and Elk River watersheds. The Sac, Niangua, and Big River watersheds are the only north flowing drainages where this species is known to occur in Missouri.

Habitat Affinities:

This species prefers medium-sized rivers with substrates of gravel-mud and gravel, and slow to moderate current (Oesch 1995). However, Harris and Gordon (1990) state that this species is most often found in large creeks and medium rivers with gravel and sand substrates and moderate to swift flow. They further state that it is seldom found in sluggish, low-gradient, streams. Oesch (1995) generally found the Ouachita kidneyshell in shallow water within riffles, where it may be completely buried beneath the surface.

Predictive Model(s):

Ozark Model

(([Rgrad_subr] = 1)) or (([Rgrad_subr] >= 2) and ([Flow] = 1) and ([Temp_code] = 2))

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

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Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Ozark Brokenray

Lampsilis reeveiana brevicula

Native: Yes

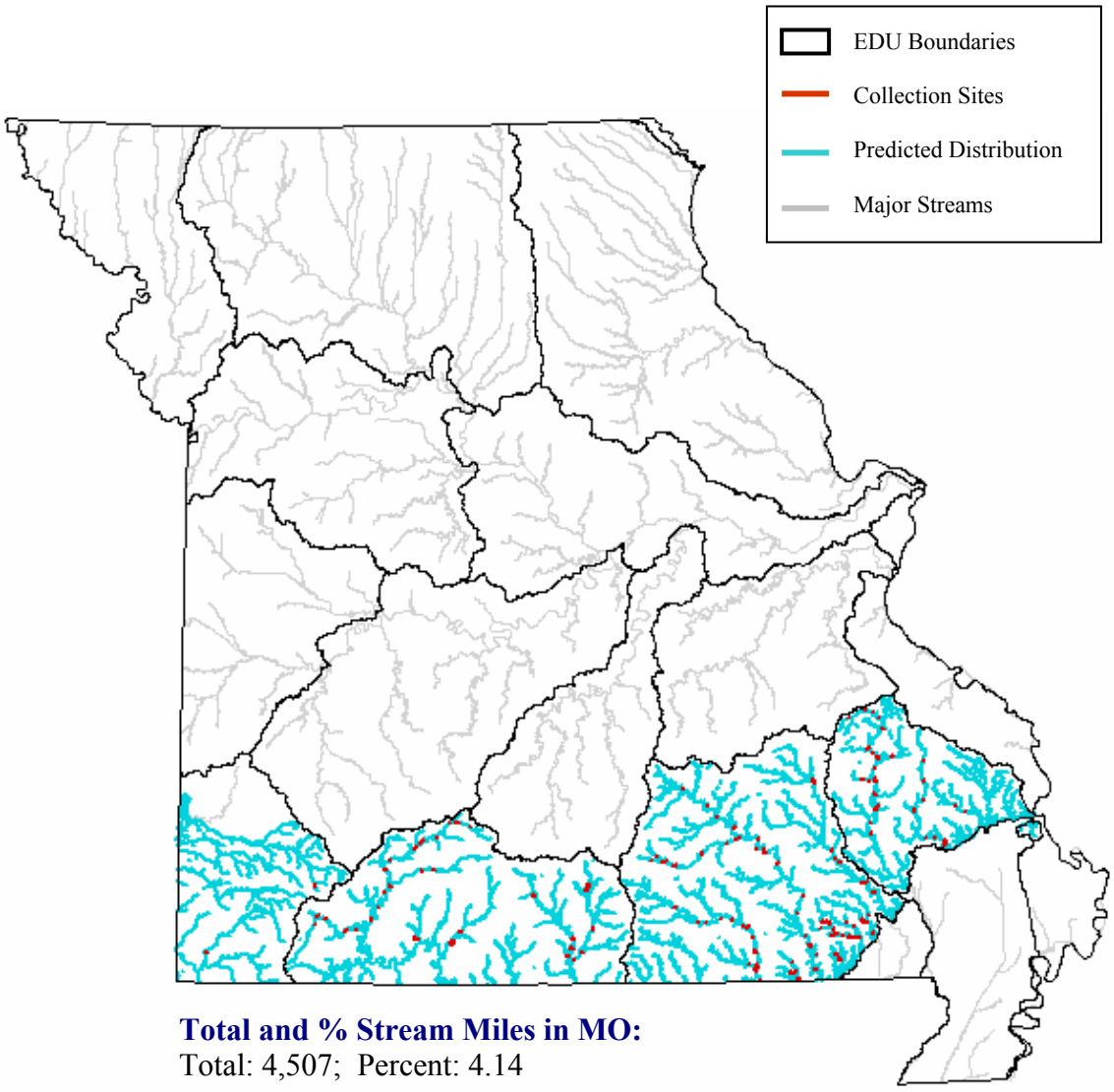
Endemism: Subregion

State Rank: S?

ITIS Code: 80025

Global Rank: G3T2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 4,507; Percent: 4.14

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Ozark brokenray is restricted to the south flowing drainages of the Ozark Aquatic Subregion.

Habitat Affinities:

This species prefers cool, clear water and is typical of headwaters (Oesch 1995; Bruenderman et. al 2002). It is usually the first species to inhabit sections of streams below major springs (Oesch 1995).

Predictive Model(s):

Ozark Model

([Ssize_code] >= 1) and ([Ssize_code] <= 4) and ([Gradsegr] >= 1) and ([Gradsegr] <= 5)

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Obermeyer, B. K. 1997. An evaluation of the Neosho River, Kansas, mussel refuge. Journal of Freshwater Ecology 12: 445-452.

Obermeyer, B. K., D. R. Edds, C. W. Prophet, E. J. Miller. 1997. Freshwater mussels (bivalvia, unionidae) in the Verdigris, Neosho, and Spring River basins of Kansas and Missouri, with emphasis on species of concern. American Malacological Bulletin 14: 41-55.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Ozark Pigtoe

Fusconaia ozarkensis

Native: Yes

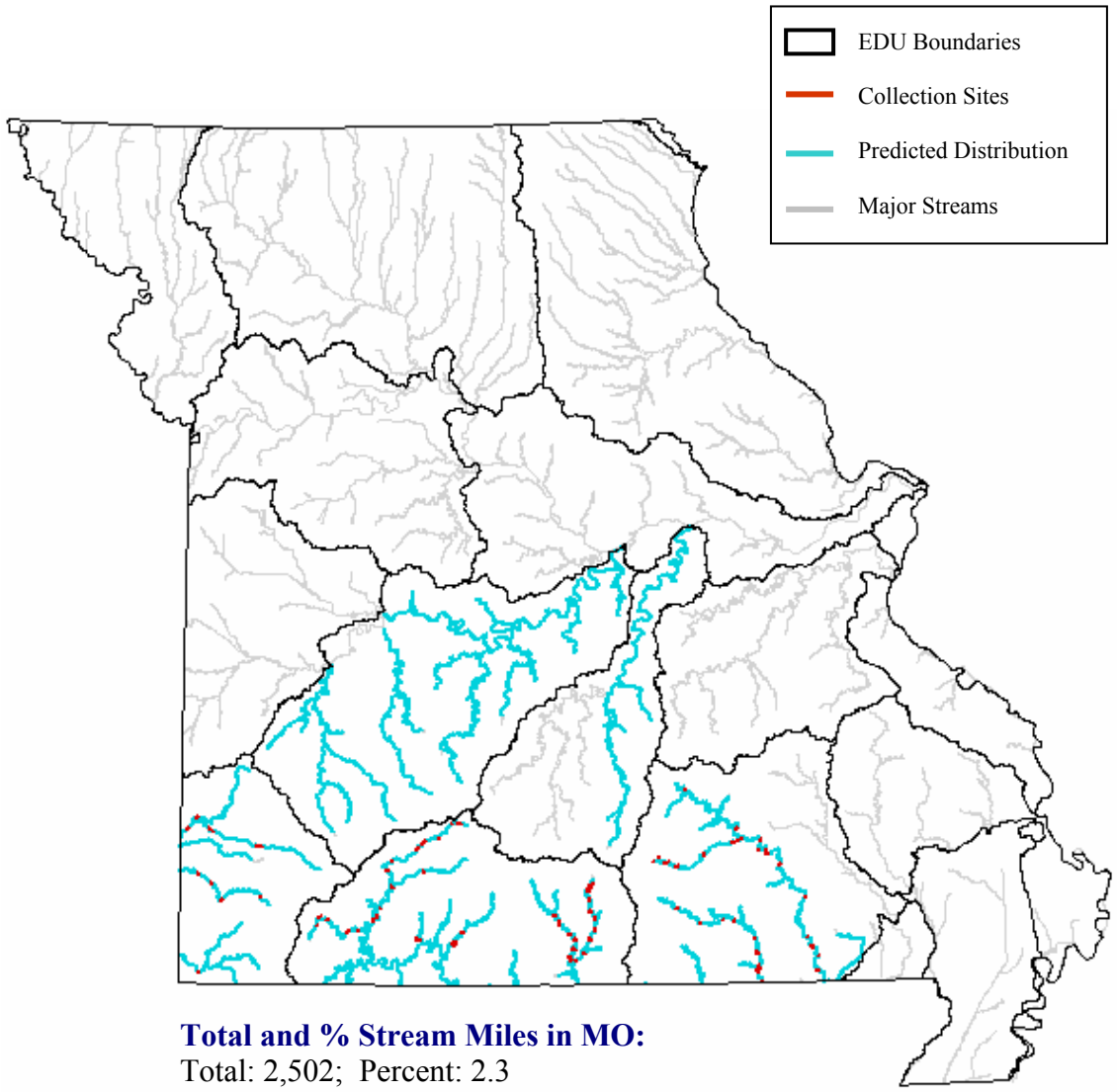
Endemism: Subregion

State Rank: S4

ITIS Code: 80050

Global Rank: G3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,502; Percent: 2.3

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Ozark pigtoe is primarily restricted to the southward flowing drainages of the Ozark Aquatic Subregion, but also exists in the north-flowing Gasconade and Osage drainages.

Habitat Affinities:

Very little is known about the habitat affinities of the Ozark pigtoe, however, Oesch (1995) states that this mussel is usually found in medium-sized gravel in moderate to swift current in a few inches to several feet of water.

Predictive Model(s):

Ozark Model
(([Linkr] >= 5))

References:

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Obermeyer, B. K., D. R. Edds, C. W. Prophet, E. J. Miller. 1997. Freshwater mussels (bivalvia, unionidae) in the Verdigris, Neosho, and Spring River basins of Kansas and Missouri, with emphasis on species of concern. American Malacological Bulletin 14: 41-55.

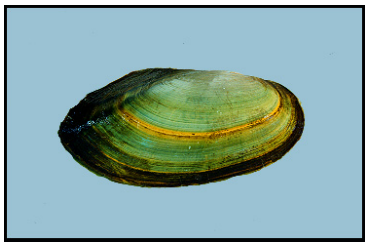
Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Paper Pondshell

Utterbackia imbecillis



Native: Yes

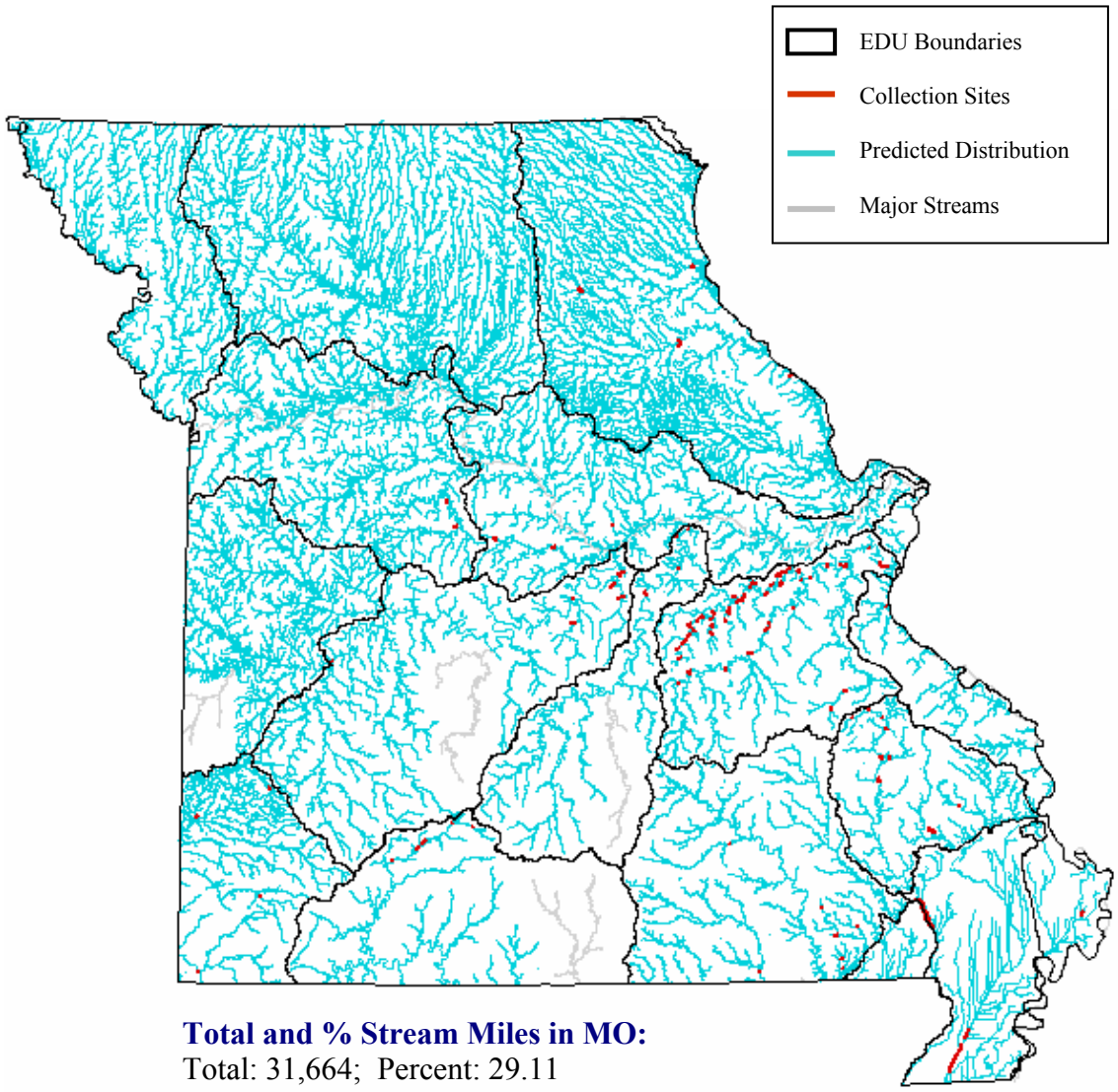
Endemism: Region

State Rank: S?

ITIS Code: 10002

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 31,664; Percent: 29.11

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to collection records and professional review it is believed that this species occurs nearly statewide.

Habitat Affinities:

This species is primarily found stream sizes ranging from small creeks to large rivers and also backwaters, oxbows, lakes and ponds (Buchanan 1980; Harris and Gordon 1990; Cummings and Mayer 1992). It is most commonly encountered in areas with little or no current over mud, silt, and fine-sand or fine-gravel substrates (Buchanan 1980; Harris and Gordon 1990; Oesch 1995; Bruenderman et. al 2002). Buchanan (1980) states that the paper pondshell is most commonly found in silt substrates.

Predictive Model(s):

Central Plains/Ozark Model
([GradsegR] >= 1) and ([GradsegR] <= 5)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

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Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

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Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

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Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Pimpleback

Quadrula pustulosa

Native: Yes

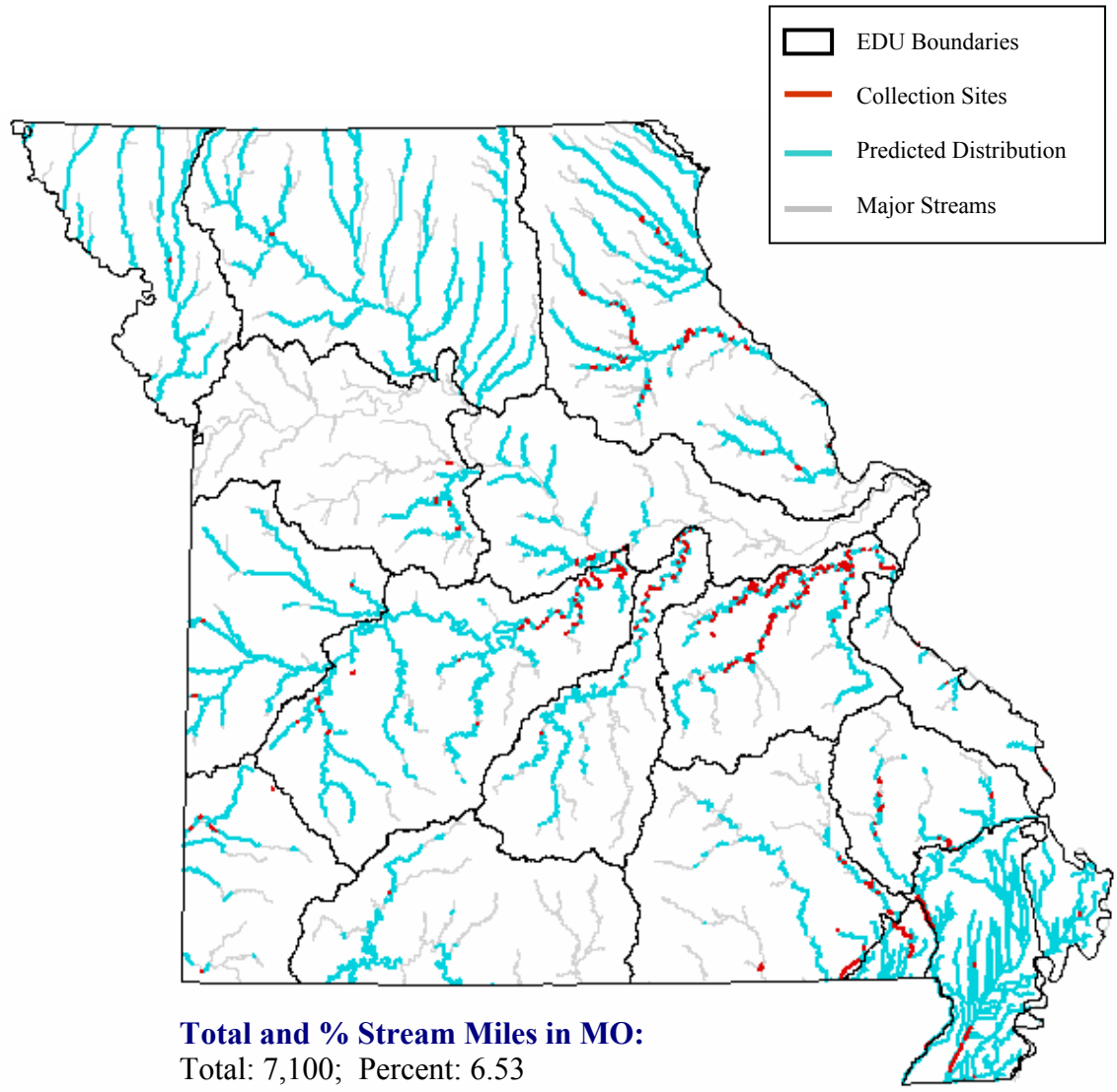
Endemism: Region

State Rank: S?

ITIS Code: 80062

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 7,100; Percent: 6.53

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:
According to collection records and professional review it is believed that this species occurs nearly statewide.

Habitat Affinities:
This species is primarily found stream sizes ranging from small streams to large rivers (Buchanan 1980; Cummins and Mayer 1992). It has been collected from a wide range of habitats, including areas with little or no current to areas with swift moving water over virtually all substrates except for shifting sand (Buchanan 1980; Oesch 1995). However, Parmalee and Bogan (1998) state that the pimpleback is usually found in substrates of coarse-gravel, sand and silt.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] >= 5) and ([GradsegR] >= 1) and ([GradsegR] <= 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

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Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

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Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

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McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

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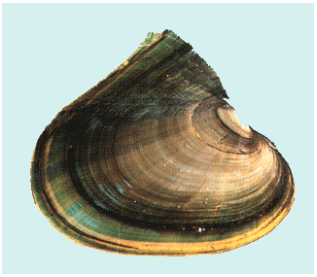
Pink Heelsplitter

Potamilus alatus



Native: Yes

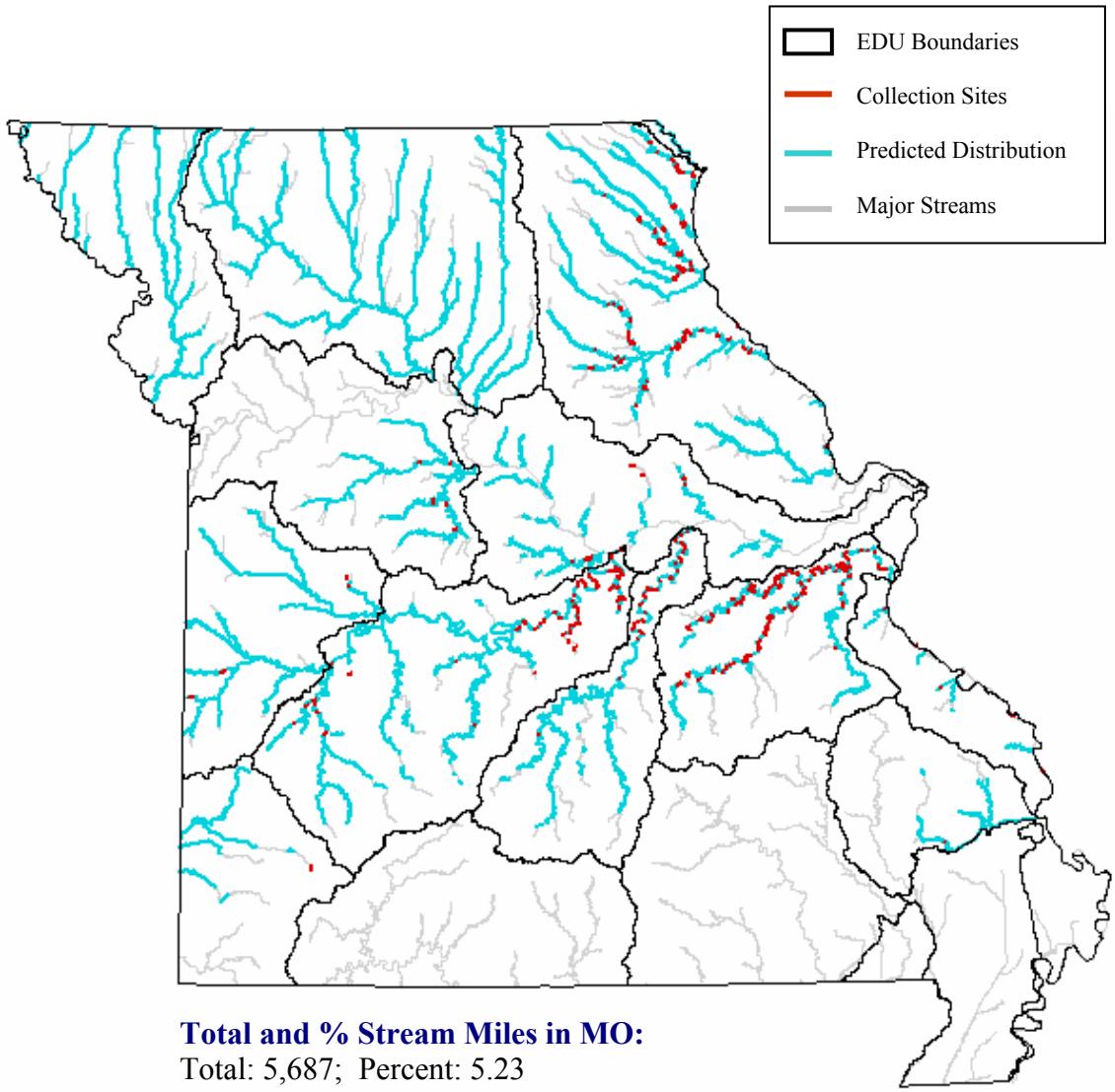
Endemism: Region

State Rank: S?

ITIS Code: 80282

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 5,687; Percent: 5.23

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The pink heelsplitter is found in the Mississippi River both above and below the Missouri River, in the tributaries of the MS River north of St. Louis, in a handful of the southeastern rivers of Missouri, but is most prevalent in the north-flowing streams coming off the Ozark Aquatic Subregion (Oesch 1995). Based on professional review it is believed that this species occurs, or at one time occurred, throughout northwest Missouri.

Habitat Affinities:

This species is primarily found in small and large rivers, but also occurs in lakes and ponds (Buchanan 1980; Oesch 1995). It has been collected from a wide range of habitats, including areas with little or no current to areas with swift moving water over virtually all substrates (mud to boulders) (Buchanan 1980; Oesch 1995). However, both Cummins and Mayer (1992) and Bruenderman et. al (2002) state that the preferred substrates of the pink heelsplitter is mud, mixed sand and mud, or gravel substrates.

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 5)

Ozark Model
(([Linkr] >= 6)) or (([Linkr] = 5) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2))

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

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Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

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McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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Pink Mucket

Lampsilis abrupta

Native: Yes

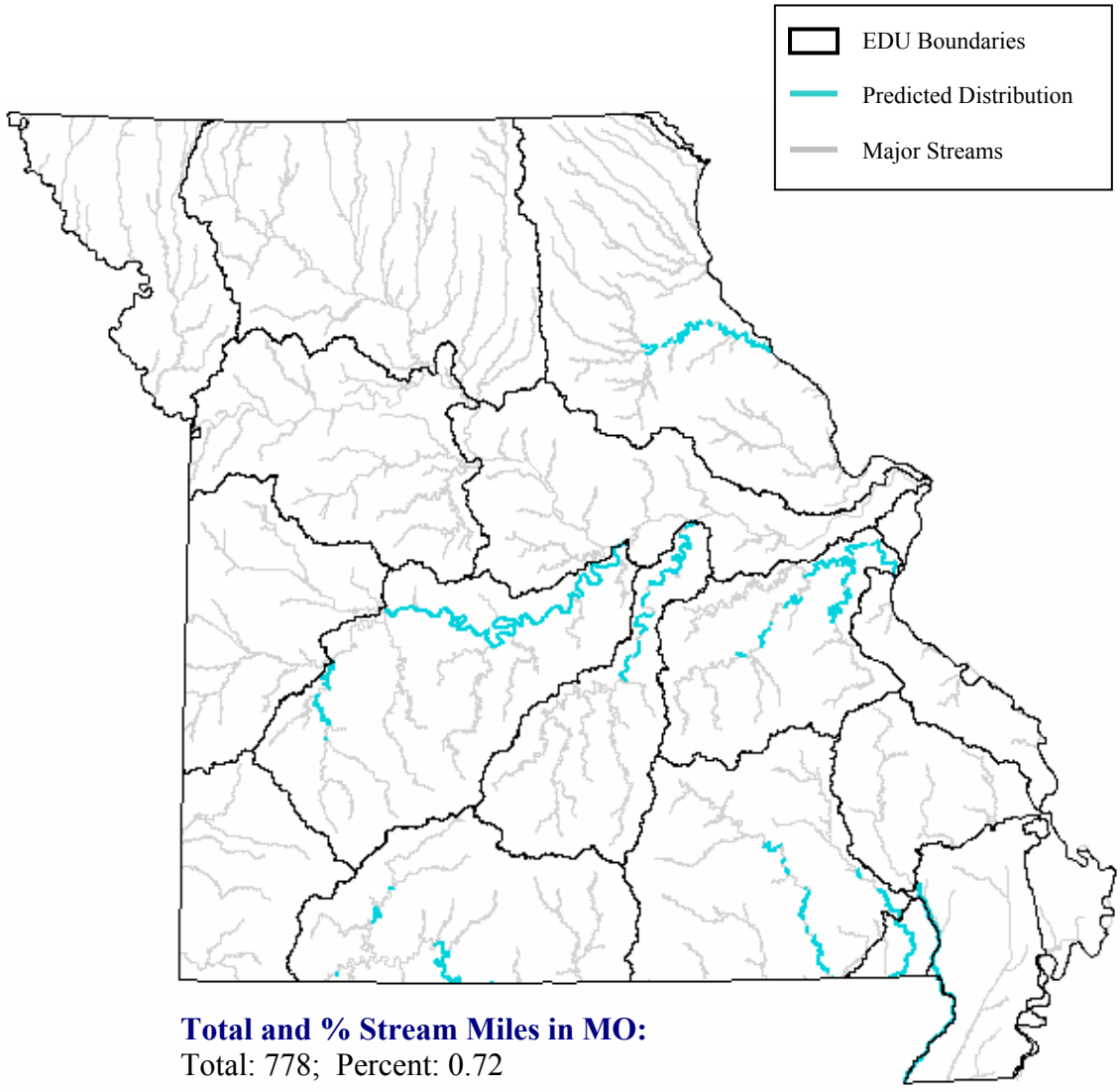
Endemism: Region

State Rank: S2

ITIS Code: 80015

Global Rank: G2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 778; Percent: 0.72

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The pink mucket has a very sporadic distribution in Missouri. It been found in the Mississippi River near the outlet of the Salt River in northeast Missouri and from the lower mainstems of many streams in the Ozark Aquatic Subregion (Oesch 1995).

Habitat Affinities:

This species is primarily large-river species (Cummings and Mayer 1992). Buchanan (1980) found this species most often in gravel and cobble substrates in standing or moderately flowing water, while Hickman (1937) collected this species mainly from rocky substrates in swift-flowing waters.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] = 7) and ([Rgrad_subr] >= 1) and ([Rgrad_subr] <= 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

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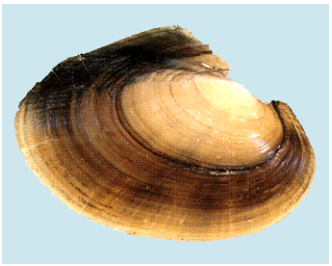
Pink Papershell

Potamilus ohiensis



Native: Yes

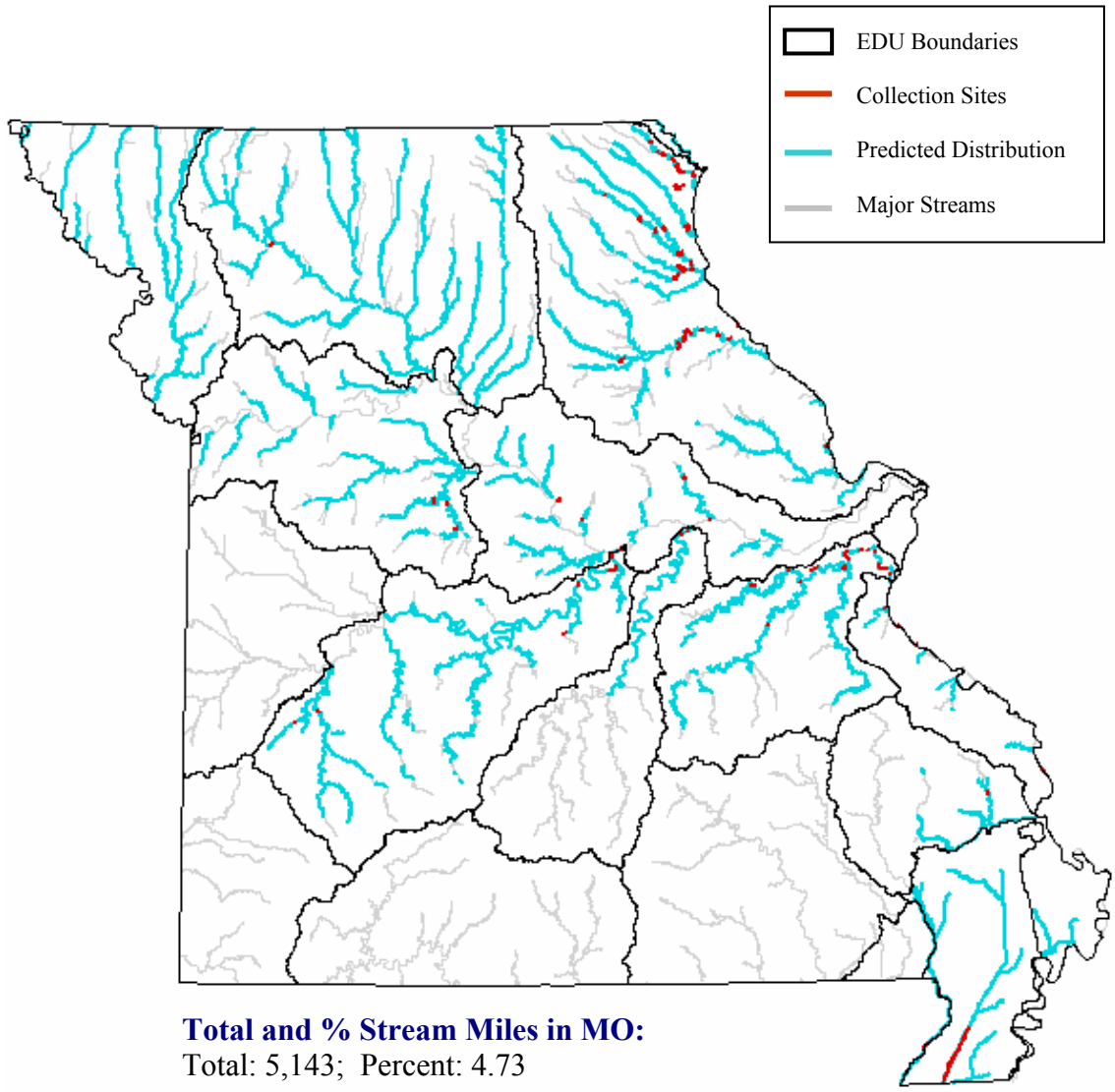
Endemism: Region

State Rank: S?

ITIS Code: 80288

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 5,143; Percent: 4.73

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The pink papershell is found in the Mississippi River both above and below the Missouri River. It is also found in most of the principle drainage of the state except for the south-flowing streams coming off the Ozark Aquatic Subregion (Oesch 1995).

Habitat Affinities:

This species occurs in shallow water of medium to large rivers (Cummings and Mayer 1992; Bruenderman et. al 2002). It is usually found in quiet water or slow currents over a variety of substrates (Buchanan 1980; Parmalee and Bogan 1998; Bruenderman et. al 2002). However, Oesch (1995) states that the pink papershell prefers areas with good flow or current.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] >= 5) and ([GradsegR] >= 1) and ([GradsegR] <= 2))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 3) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

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Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Pistolgrip

Tritogonia verrucosa

Native: Yes

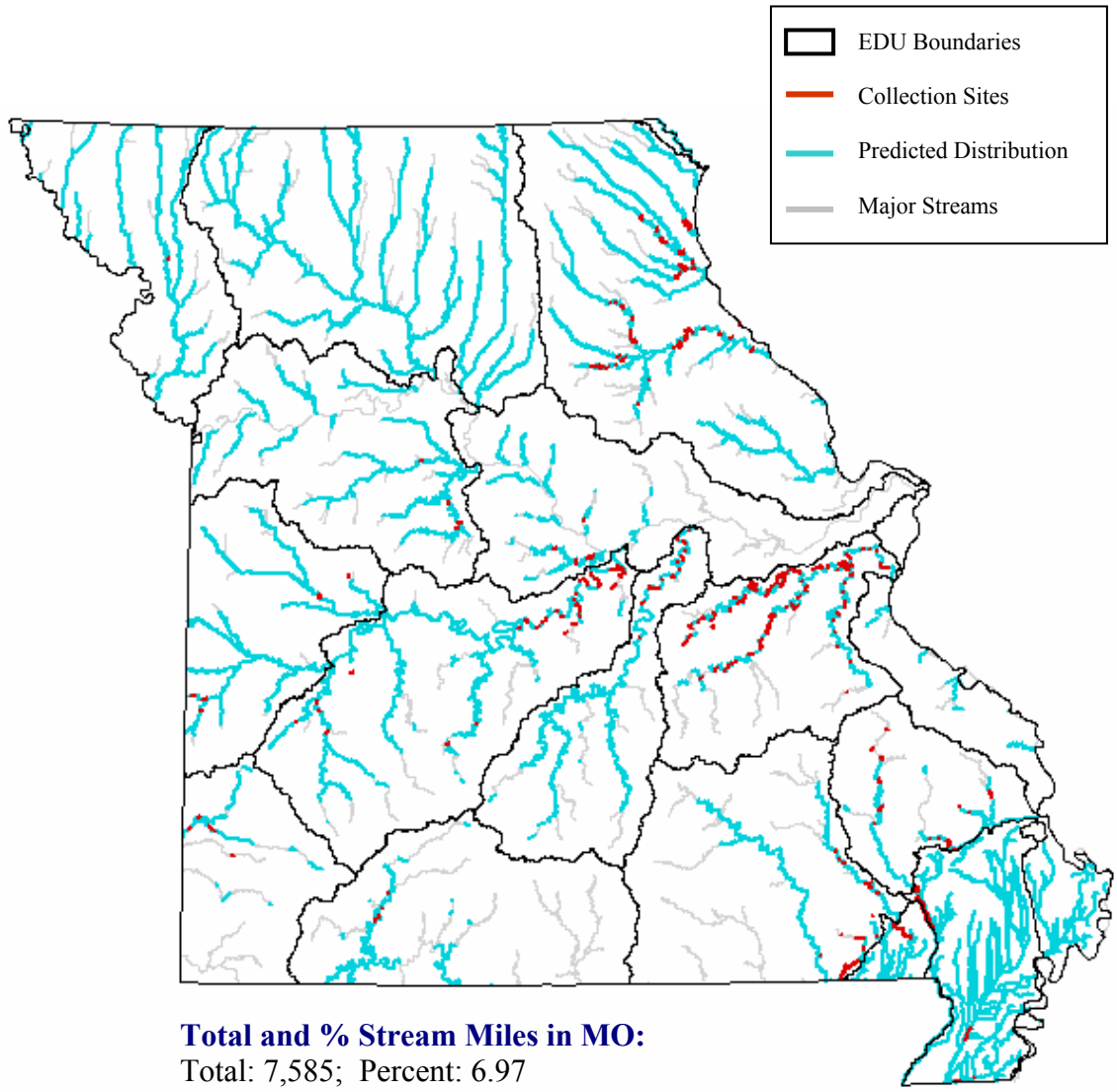
Endemism: Region

State Rank: S?

ITIS Code: 80293

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 7,585; Percent: 6.97

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The pistolgrip is relatively widespread throughout Missouri and has been collected from every major drainage in the state, but is conspicuously absent from most of the North Fork of the White River watershed and the entire Eleven Point River watershed.

Habitat Affinities:

This species occurs in large creeks to large rivers in virtually any type of substrate, including sand if it is stable (Harris and Gordon 1990; Oesch 1995). It is also found under virtually all flow conditions from standing to swiftly flowing water, but is usually associated with moderate currents (Buchanan 1980; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 5)

Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([Linkr] = 5) and ([Rgrad_subr] = 1)) or (([Linkr] = 6)) or (([Linkr] = 7) and ([Temp_code] = 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

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Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

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Plain Pocketbook

Lampsilis cardium

Native: Yes

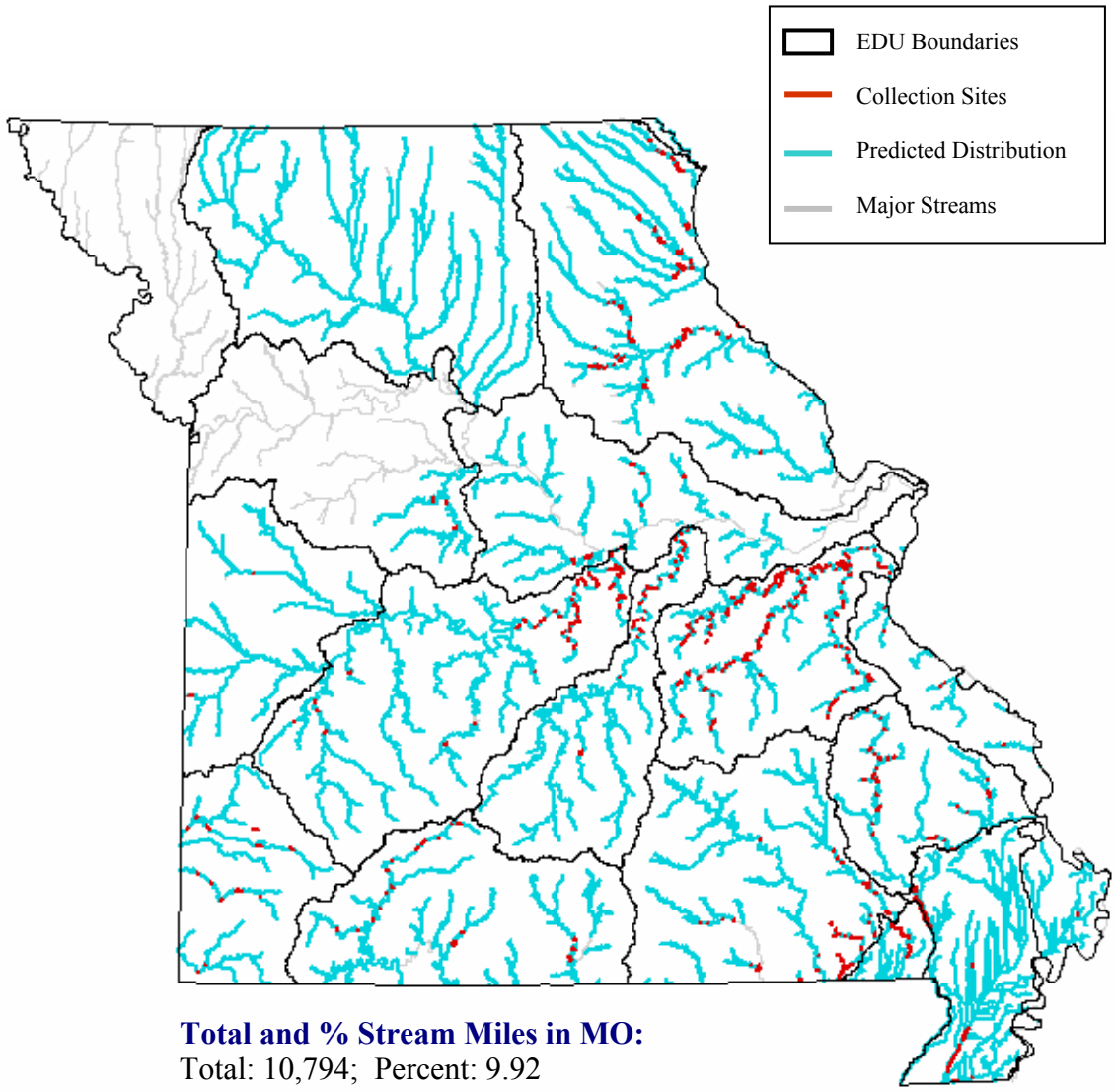
Endemism: Subzone

State Rank: S?

ITIS Code: 80016

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 10,794; Percent: 9.92

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The plain pocketbook is found throughout the Mississippi River and nearly statewide except for the extreme northwestern portion of the state.

Habitat Affinities:

This species occurs is found in a wide variety of flowing waters (creeks to large rivers) and occasionally oxbows associated with these size streams (Harris and Gordon 1990; Bruenderman et. al 2002). It is generally collected from areas of moderate to swift current in mud, sand, gravel and cobble substrates (Cummins and Mayer 1992; Parmalee and Bogan 1998; Bruenderman et. al 2002). Oesch (1995) states that the plain pocketbook may be found in quiet to swift water over virtually any type of substrate except shifting sand. Parmalee and Bogan (1998) also state that this species seems to thrive on stable substrates composed of a high percentage of mud and silt.

Predictive Model(s):

Central Plains/Ozark Model

(([Linkr] >= 4) and ([Linkr] <= 5)) or (([Linkr] = 6) and ([Temp_code] = 2)) or (([Linkr] = 7) and ([Temp_code] = 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model

([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

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van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Pondhorn

Uniomerus tetralasmus

Native: Yes

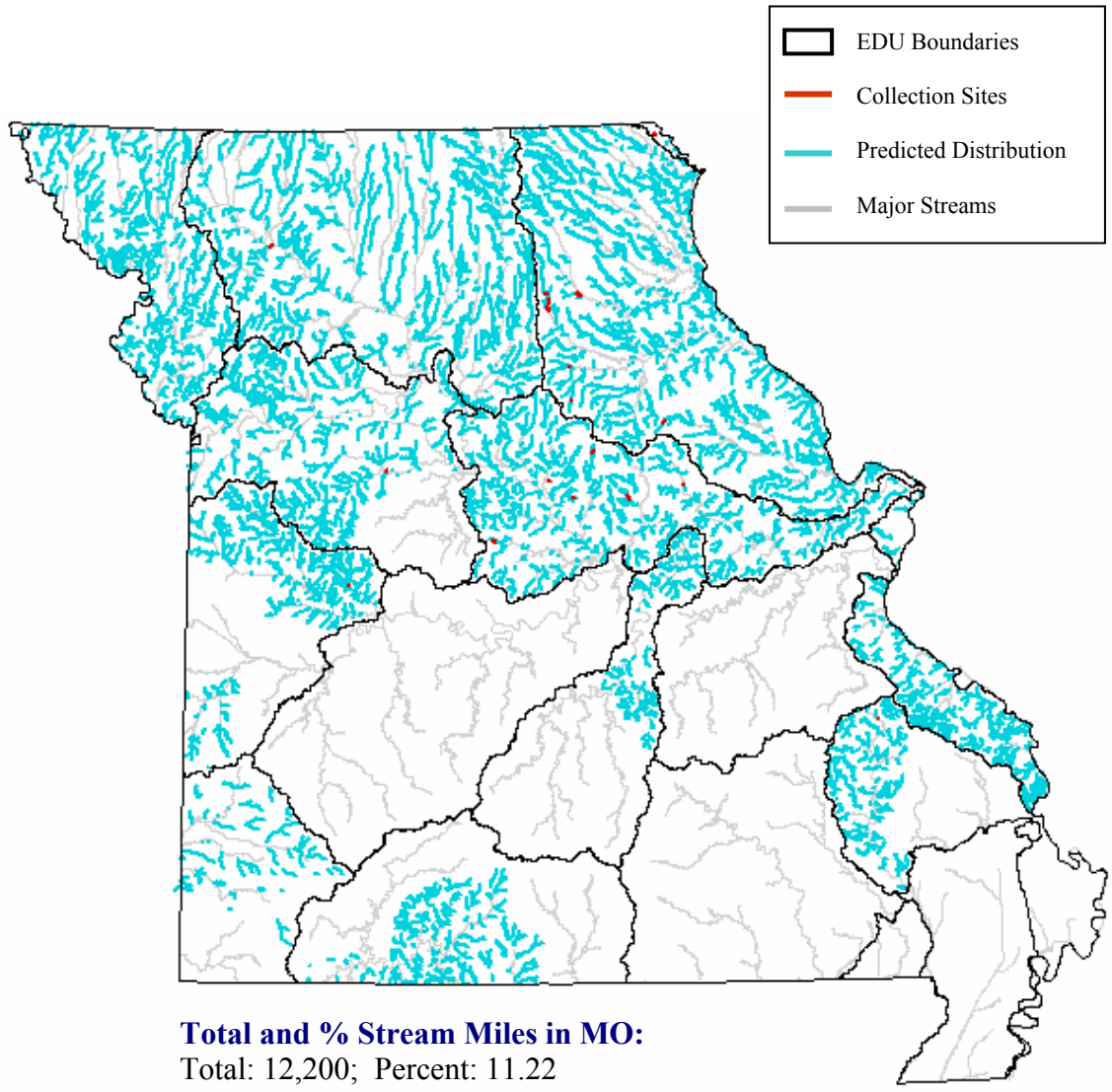
Endemism: Region

State Rank: S?

ITIS Code: 80233

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 12,200; Percent: 11.22

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The pondhorn is found nearly everywhere in the Central Plains Aquatic Subregion of Missouri, however, it has a very sporadic distribution in the Ozark Aquatic Subregion.

Habitat Affinities:

The pondhorn is a quiet-water species usually found, as the name implies, in the mud or mucky substrates of ponds or the backwaters and oxbows of medium to large rivers (Murray and Leonard 1962; Parmalee 1967; Harris and Gordon 1990). Cummins and Mayer (1992) state that the pondhorn can also be found in small creeks and the headwaters of larger streams in mud or sand substrate. Several authors also note that this mussel can withstand periods of aestivation and as a result is often present in areas where few other mussels are found (Goodrich and van der Schalie 1944; Stansbery 1973; Cummins and Mayer 1992; Parmalee and Bogan 1998).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 1) and ([Linkr] <= 4)

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 1) and ([Linkr] <= 3)

References:

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

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Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Stansberry, D. H. 1973. Unionid mollusks collected from the Osage River system above Warsaw, Missouri, in August, 1973. Unpublished.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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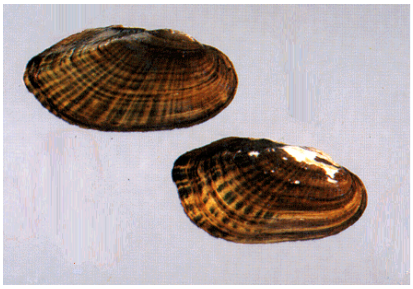


Pondmussel

Ligumia subrostrata

Native: Yes

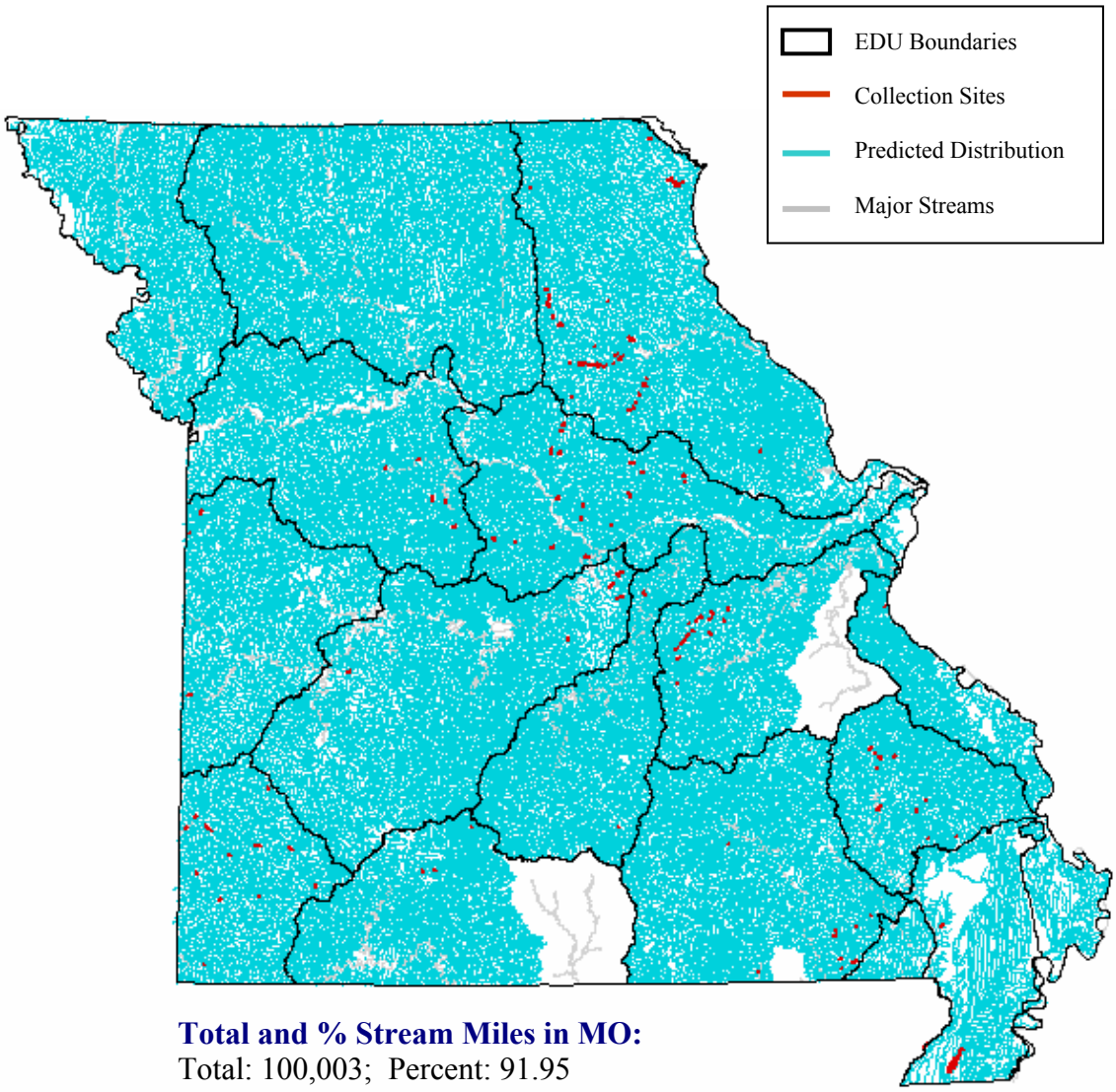
Endemism: Region

State Rank: S?

ITIS Code: 80199

Global Rank: G4G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 100,003; Percent: 91.95

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to collection records and professional review it is believed that this species occurs nearly statewide, except for the North Fork of the White River and Big River watersheds. Within much of this range the pondmussel has a very sporadic distribution of relatively isolated populations.

Habitat Affinities:

The pondmussel occurs in small creeks to small rivers and also the shallow water of ponds and lakes (Oesch 1995; Parmalee and Bogan 1998). Like the pondhorn (Uniomerus tetralasmus) the pondmussle is a quiet-water species and is usually found in sand, silt or mud substrates (Cummins and Mayer 1992; Bruenderman et. al 2002). However, Buchanan (1980) found this species in standing and swiftly flowing water over a variety of substrates, but also stated that it was most common in areas of slow to no current.

Predictive Model(s):

Central Plains/Ozark Model
([Linkr] >= 1) and ([Linkr] <= 6)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >=1) and ([Ssize_code] <= 3)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

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Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

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Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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Purple Lilliput

Toxolasma lividus

Native: Yes

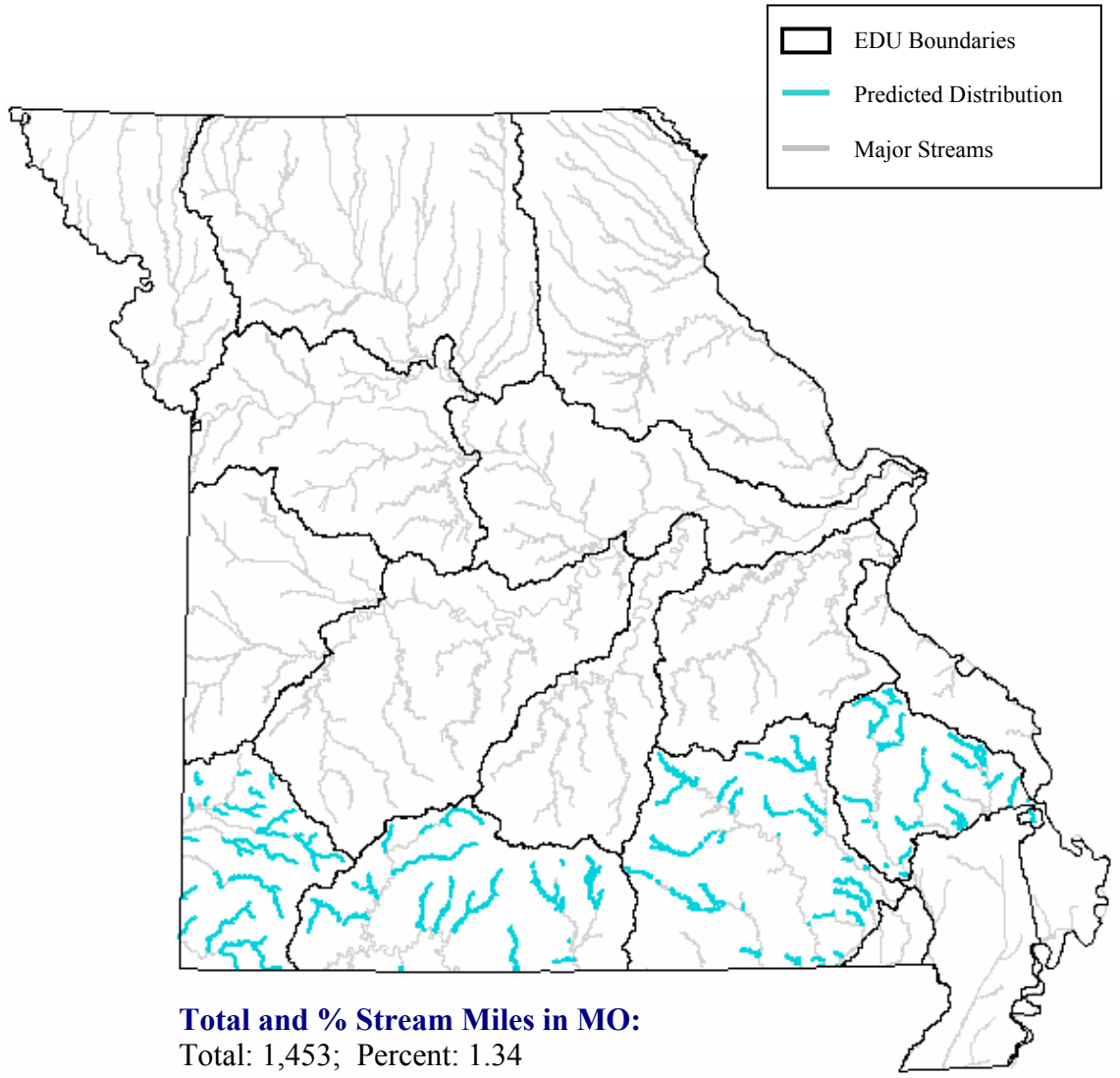
Endemism: Region

State Rank: S2

ITIS Code: 80362

Global Rank: G2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 1,453; Percent: 1.34

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The purple lilliput occurs in all of the south-flowing drainages of the Ozark Aquatic Subregion.

Habitat Affinities:

This species inhabits small creeks to medium-sized rivers in sand, mud and gravel substrates and also inhabits lakes, impounments and oxbows (Harris and Gordon 1990; Cummins and Mayer 1992; Parmalee and Bogan 1998).

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Linkr] >= 3) and ([Linkr] <= 5) and ([Gradsegr] >= 3) and ([Gradsegr] <= 4)

References:

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

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Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

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Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Purple Wartyback

Cyclonaias tuberculata

Native: Yes

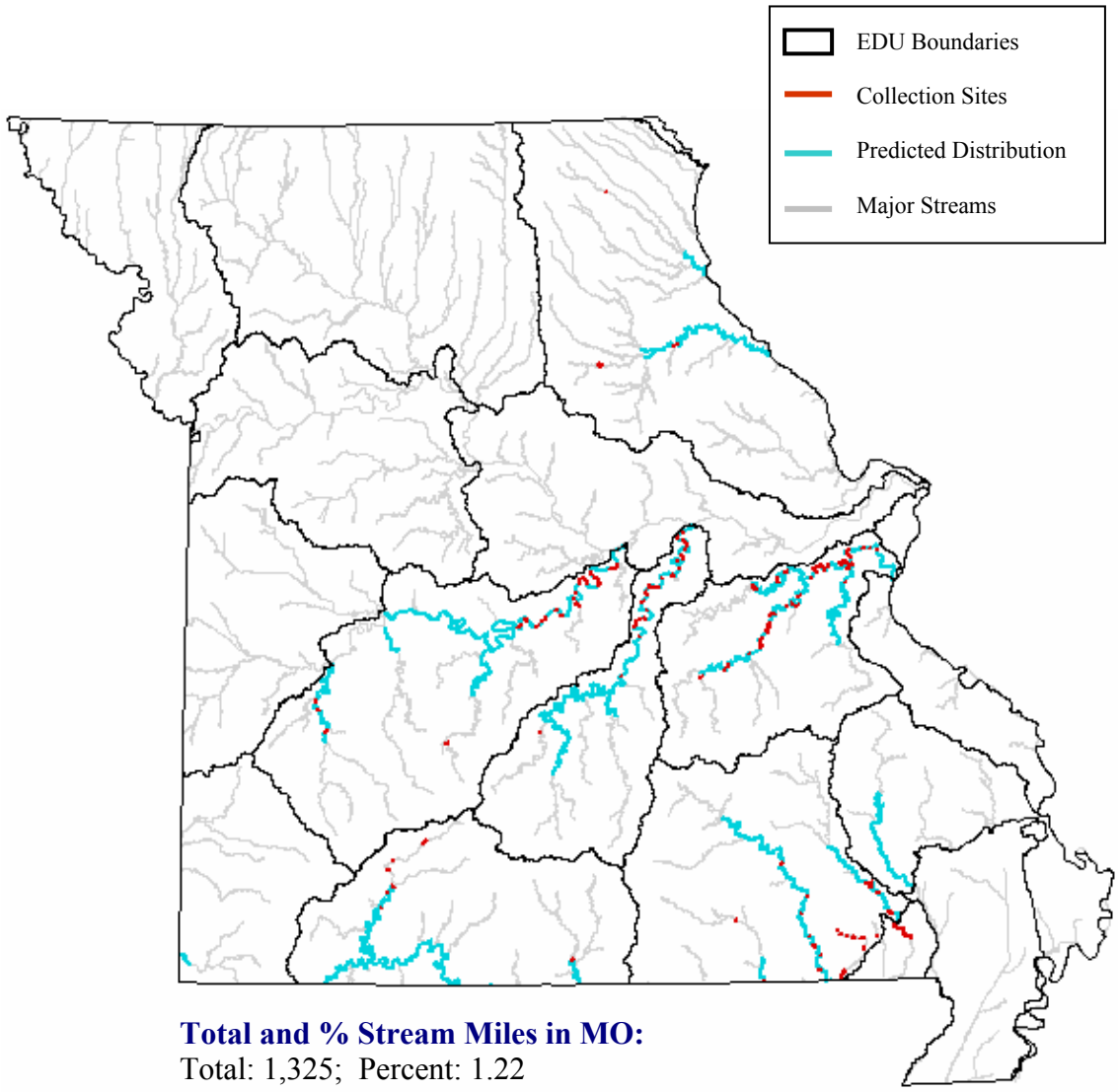
Endemism: Region

State Rank: S?

ITIS Code: 80085

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 1,325; Percent: 1.22

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The purple wartyback occurs throughout the Ozark Aquatic Subregion, except for tributaries to the Mississippi River below the Missouri River and the Castor River drainage. It also occurs in the Salt and Fabius River watersheds of northeast Missouri.

Habitat Affinities:

This species inhabits medium to large rivers in gravel or mixed sand and gravel substrates in moderate currents (Harris and Gordon 1990; Cummins and Mayer 1992; Parmalee and Bogan 1998; Bruenderman et. al 2002). Buchanan (1980) found this species primarily in gravel and rubble substrates within slow to moderate currents during his survey of the Meramec watershed.

Predictive Model(s):

Central Plains/Ozark Model
([Flow] = 1) and ([Linkr] >= 7)

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Rabbitsfoot

Quadrula cylindrica cylindrica

Native: Yes

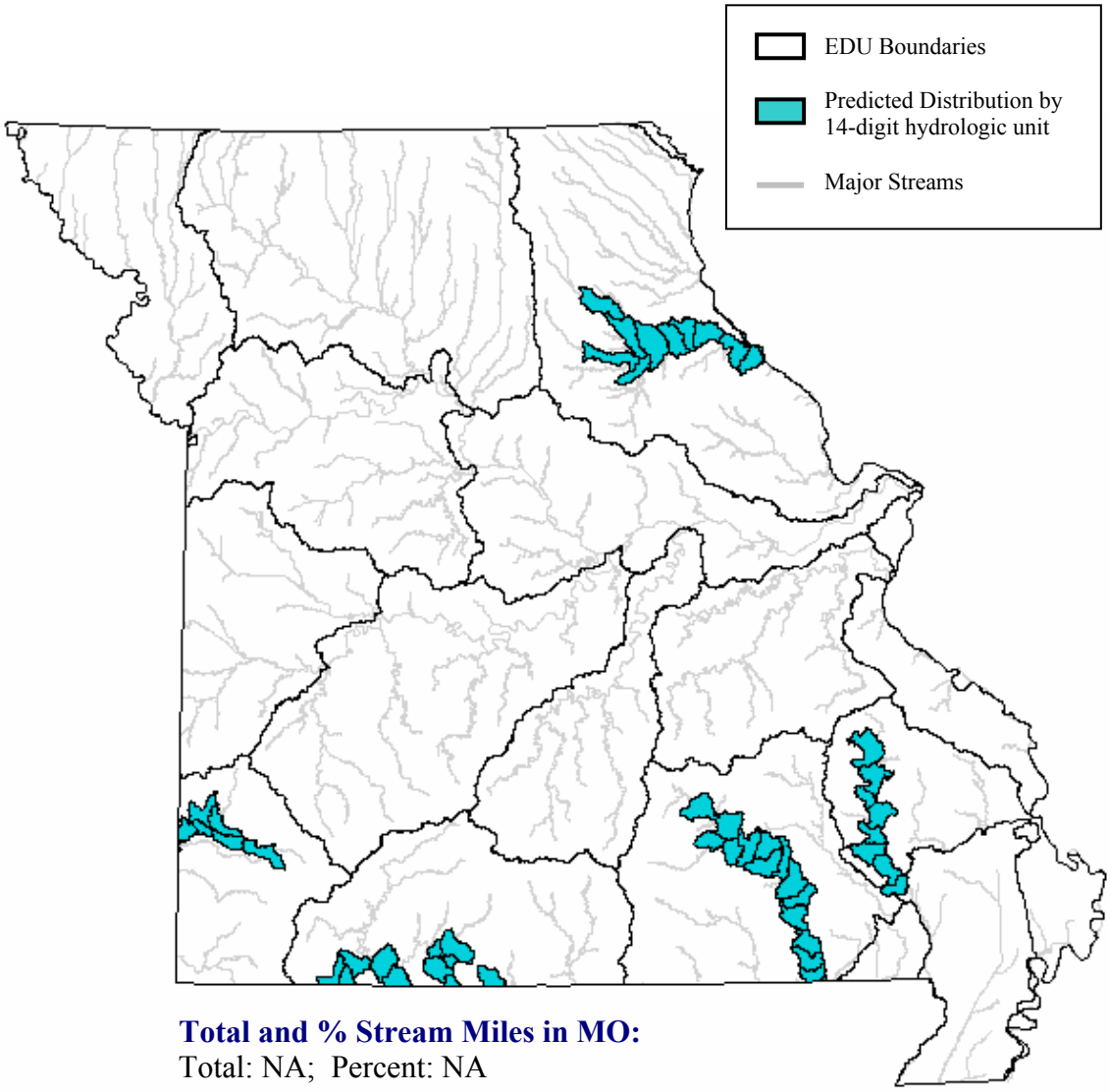
Endemism: Region

State Rank: S1

ITIS Code: 80067

Global Rank: G3T3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The rabbitsfoot has an extremely limited distribution in Missouri found only in the Salt River in the northeast corner of the state and also the Current and St. Francis, Spring and White Rivers in the Ozark Aquatic Subregion (Oesch 1995).

Habitat Affinities:

This species inhabits small to rivers having clear water and is usually found in shallow water with moderate current in sand and gravel substrates (Harris and Gordon 1990; Oesch 1995; Parmalee and Bogan 1998). Parmalee and Bogan (1998) state that shoal and riffle areas near the stream bank seem to provide the most suitable habitat for this species.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] >= 6))

References:

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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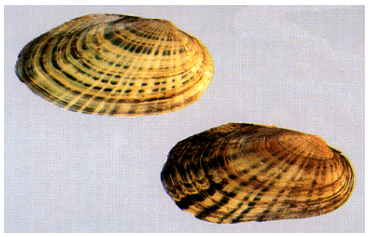
Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Rainbow

Villosa iris



Native: Yes

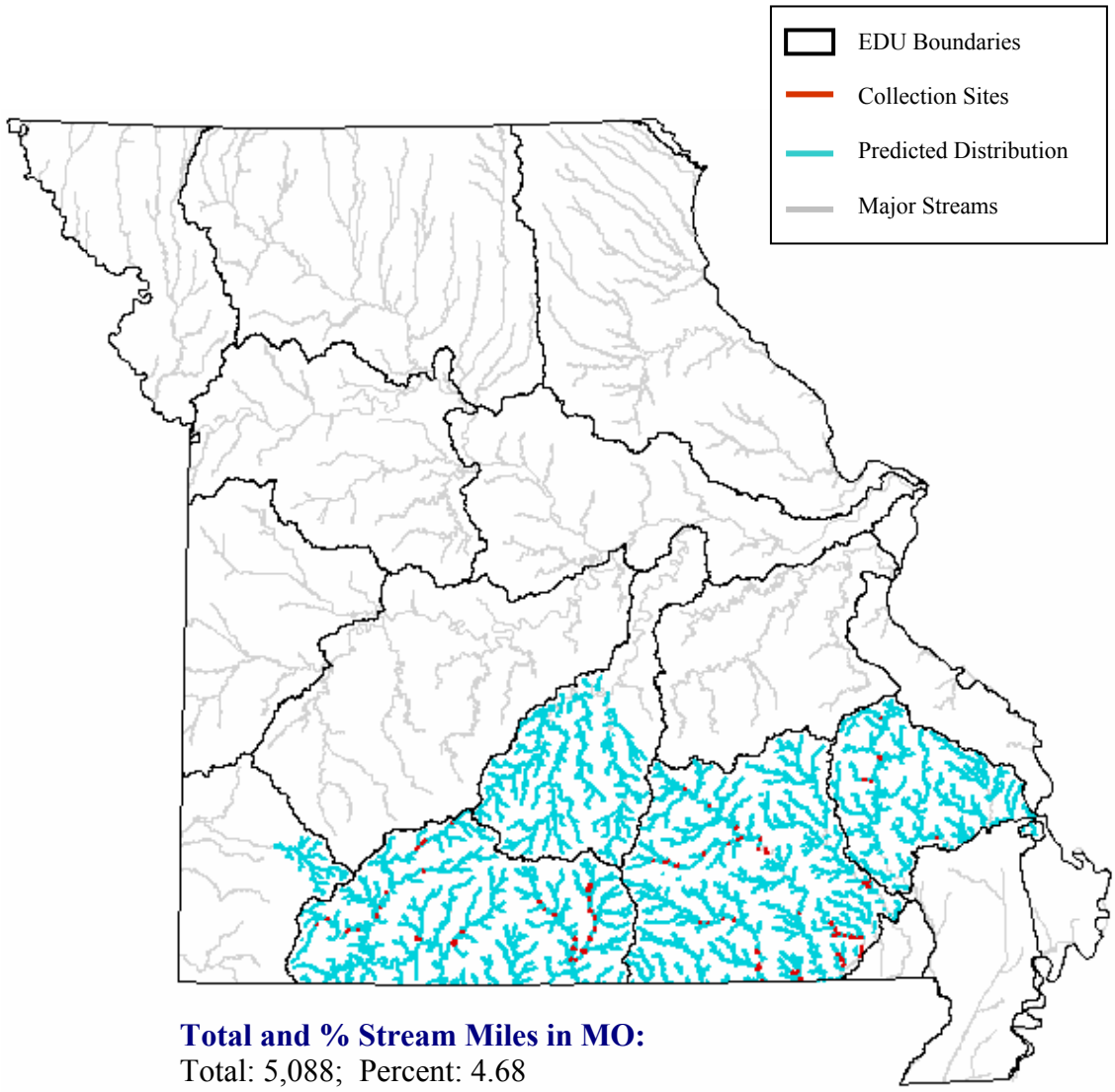
Endemism: Subzone

State Rank: S?

ITIS Code: 80202

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 5,088; Percent: 4.68

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The rainbow is restricted to the south-flowing drainages of the Ozark Aquatic Subregion and also the upper portion of the Gasconade River watershed.

Habitat Affinities:

This species prefers the cool upper reaches of small to medium-sized rivers in areas of slow to swift currents over sand and gravel or gravel and cobble substrates (Buchanan 1980; Cummings and Mayer 1992; Oesch 1995). Parmalee and Bogan (1998) state that the rainbow is most often found in riffles near the edge of emerging vegetation, such as beds of *Justica spp.* and becomes most numerous in clean, well-oxygenated, reaches at depths of less than three feet.

Predictive Model(s):

Ozark Model
([GradsegR] >= 2) and ([GradsegR] <= 6) and ([Linkr] >= 2)

References:

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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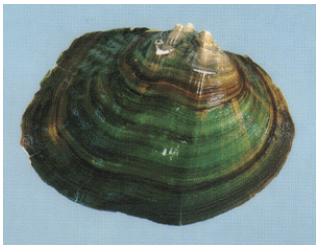
Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Rock Pocketbook

Arcidens confragosus



Native: Yes

Endemism: Region

State Rank: S3

ITIS Code: 80239

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick

Total and % Stream Miles in MO:
Total: 1,945; Percent: 1.79

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The rock pocketbook has a very patchy distribution in Missouri. It is found in scattered sections of the Mississippi River and scattered drainages throughout all three Aquatic Subregions, including the Nishnabotna, Platte, Salt, Sac, lower Osage, Meramec, Current, and Little River watersheds.

Habitat Affinities:

This species occurs in medium to large rivers in pools and areas of reduced flow with mud and sand substrates (Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998). However, Buchanan (1980) found this species in a variety of substrates (silt to boulders) and both Parmalee (1967) and Murray and Leonard (1962) report collecting this species in currents ranging from slow to swift.

Predictive Model(s):

Central Plains/Ozark Model
([Linkr] >= 7) and ([Linkr] <= 8) and ([Gradsegr] = 1) and ([Flow] = 1) and ([Temp_code] = 2)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

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Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

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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. 184 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper left: Photo courtesy of the W. H. McCullagh.

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Round Pigtoe

Pleurobema sintoxia

Native: Yes

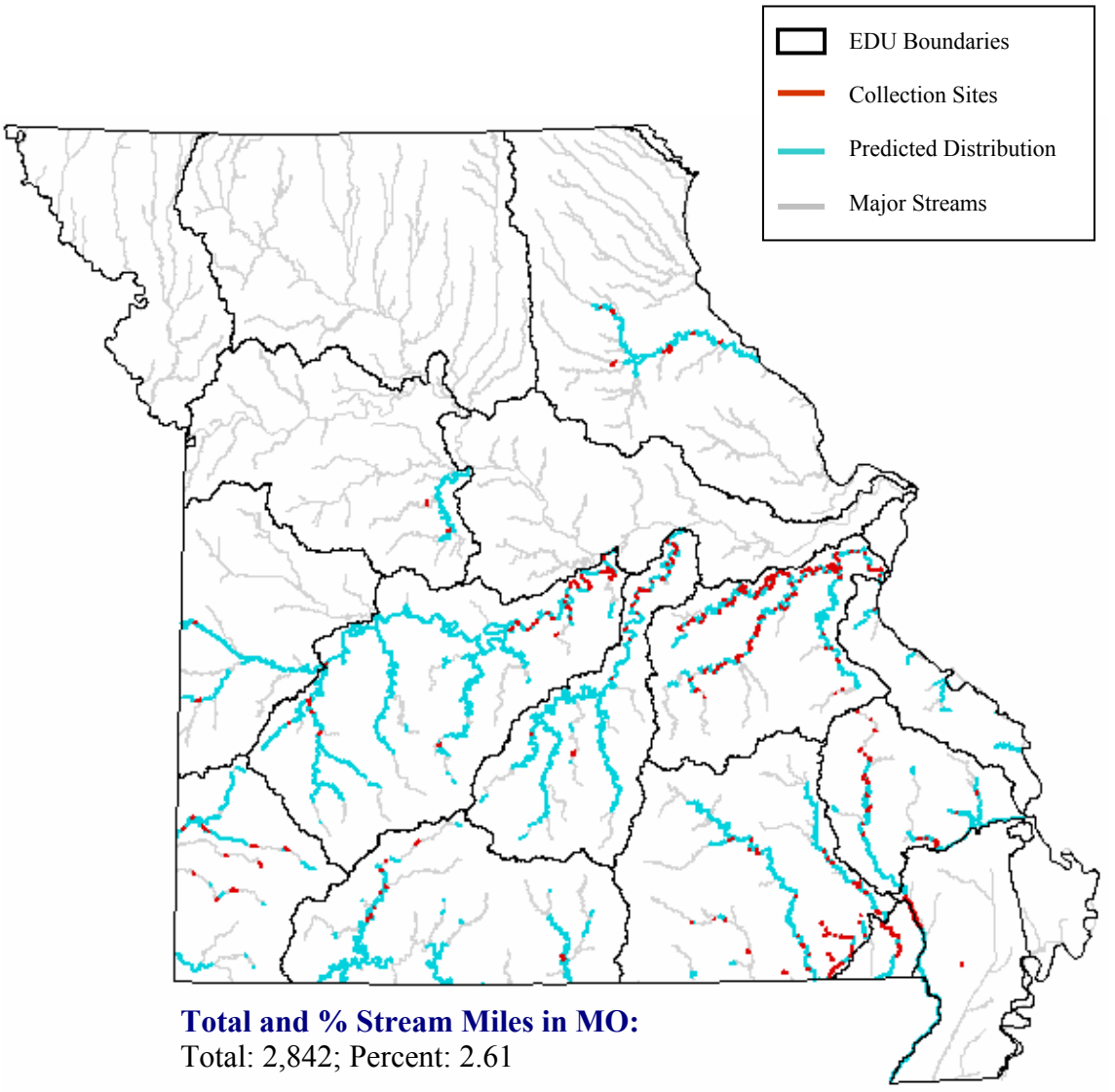
Endemism: Region

State Rank: S?

ITIS Code: 568107

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,842; Percent: 2.61

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The round pigtoe is found throughout most of the Ozark and the western portion of the Mississippi Alluvial Basin Aquatic Subregions. It also occurs in the western Osage, Lamine and Salt River watersheds of the Central Plains Aquatic Subregion.

Habitat Affinities:

This species is primarily found in medium to large rivers in gravel or gravel-mud substrates within areas of moderate flow (Cummins and Mayer 1992; Oesch 1995). Buchanan (1980) found this species in a wide variety of substrates within standing or moderately flowing water that was one inch to five feet deep. He further states that this species was most commonly found in gravel and rubble substrates. Several others have found the round pigtoe in small to large rivers over sand and gravel bottoms in swift current (Goodrich and van der Schalie 1944; Murray and Leonard 1962; Parmalee 1967).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Ozark Model
(([Linkr] = 5) and ([Rgrad_subr] = 1)) or (([Linkr] = 6) and ([Temp_code] = 2)) or (([Linkr] = 7) and ([Temp_code] = 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

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Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

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Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Goodrich, C. and H. van der Schalie. 1944. A revision of the Mollusca of Indiana. American Midland Naturalist 32: 257-326.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

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. 184 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Salamander Mussel

Simpsonaias ambigua

Native: Yes

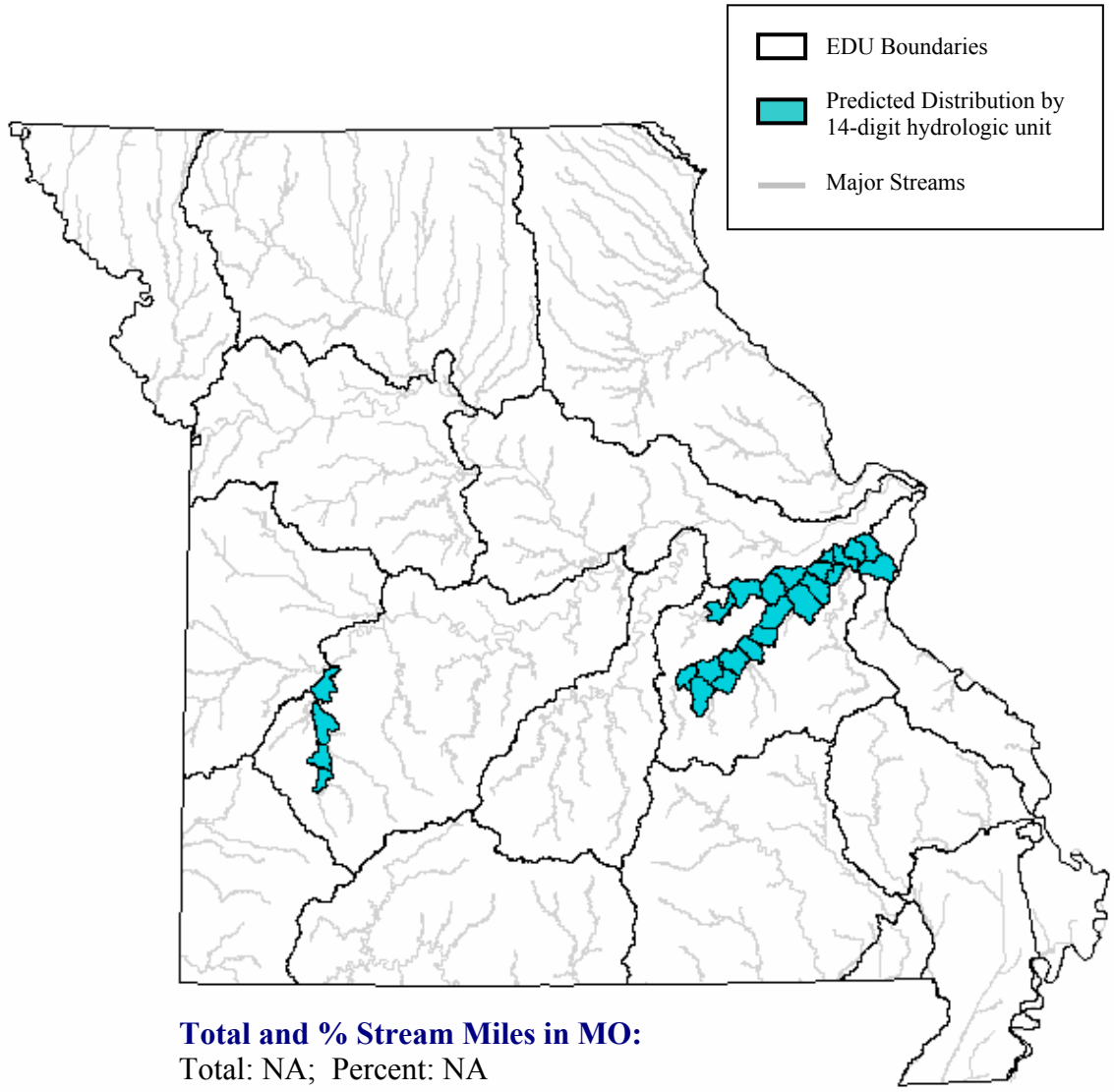
Endemism: Region

State Rank: S1?

ITIS Code: 80145

Global Rank: G3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The salamander mussel has a very restricted distribution in Missouri, occurring only in the Sac, Bourbeuse and Meramec Rivers.

Habitat Affinities:

This species is found in medium to large rivers under large flat rocks in a variety of substrates (mud, sand, gravel, cobble or boulder) within shallow areas of swift current (Baker 1928; Buchanan 1980; Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998). This is the only confirmed species to utilize the mud puppy (*Necturus maculosus*), which occupies the same habitat, as a glochidial host (Oesch 1995; Parmalee and Bogan 1998).

Predictive Model(s):

Ozark Model
([Linkr] >= 6) and ([Linkr] <= 8) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

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Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Photo Credits:

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Scaleshell

Leptodea leptodon

Native: Yes

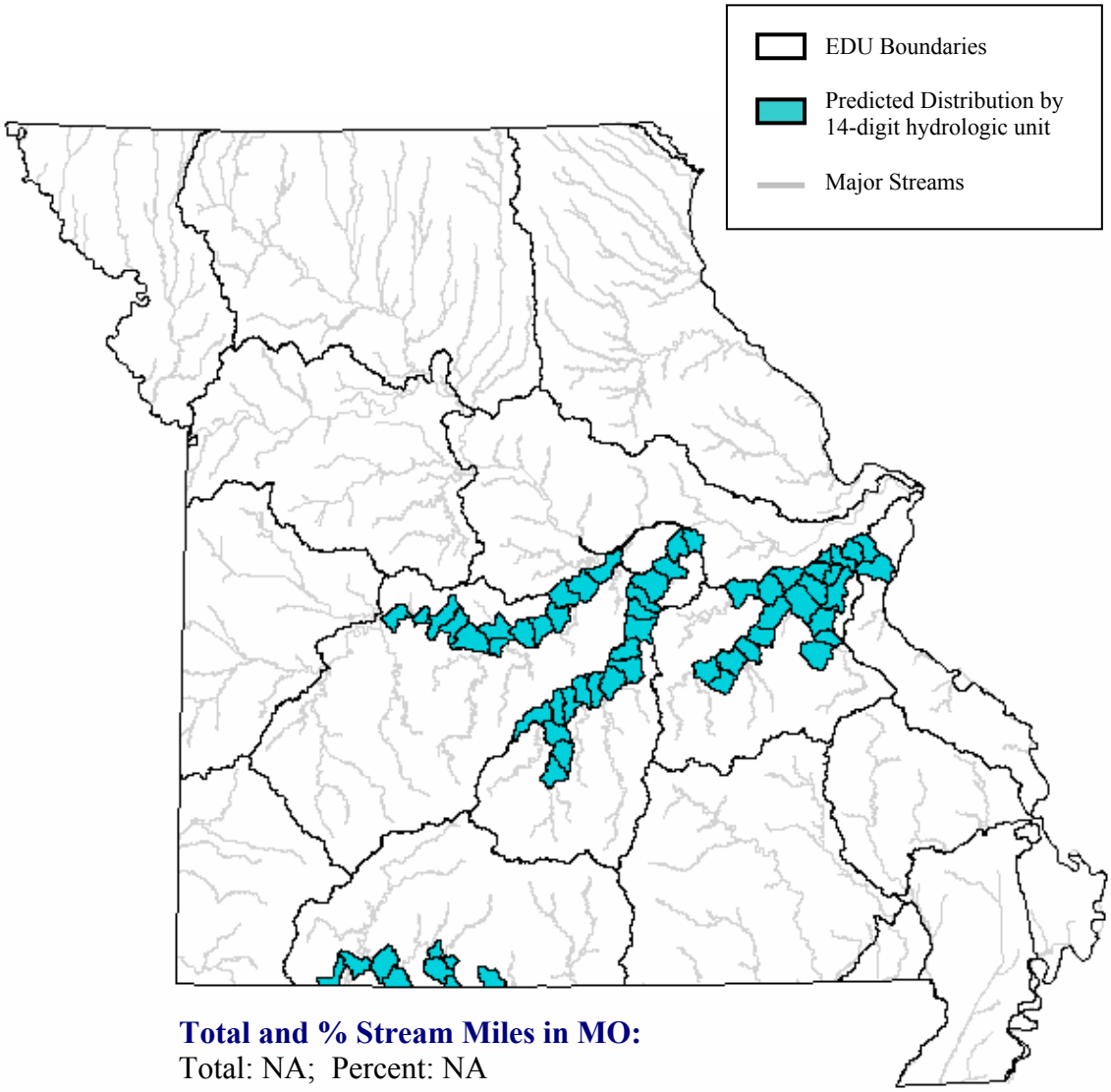
Endemism: Region

State Rank: S1S2

ITIS Code: 80185

Global Rank: G1

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The scaleshell has a very restricted distribution in Missouri only occurring in the Big, Bourbeuse, Gasconade and Meramec, Osage, and White Rivers.

Habitat Affinities:

This species is found in large rivers having clear, unpolluted, water (Cummins and Mayer 1992; Oesch 1995). Collections have been reported from areas of slow to moderate current and substrates ranging from mud to cobble (Call 1900; Goodrich and van der Schalie 1944; Buchanan 1980; Oesch 1995). The scaleshell often buries itself in riffle gravel to a depth of four to five inches (Frieda Schilling, pers. comm., 1974, cited *In* Oesch (1995)).

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 7)

References:

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

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Photo Credits:

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Sheepnose

Plethobasus cyphyus

Native: Yes

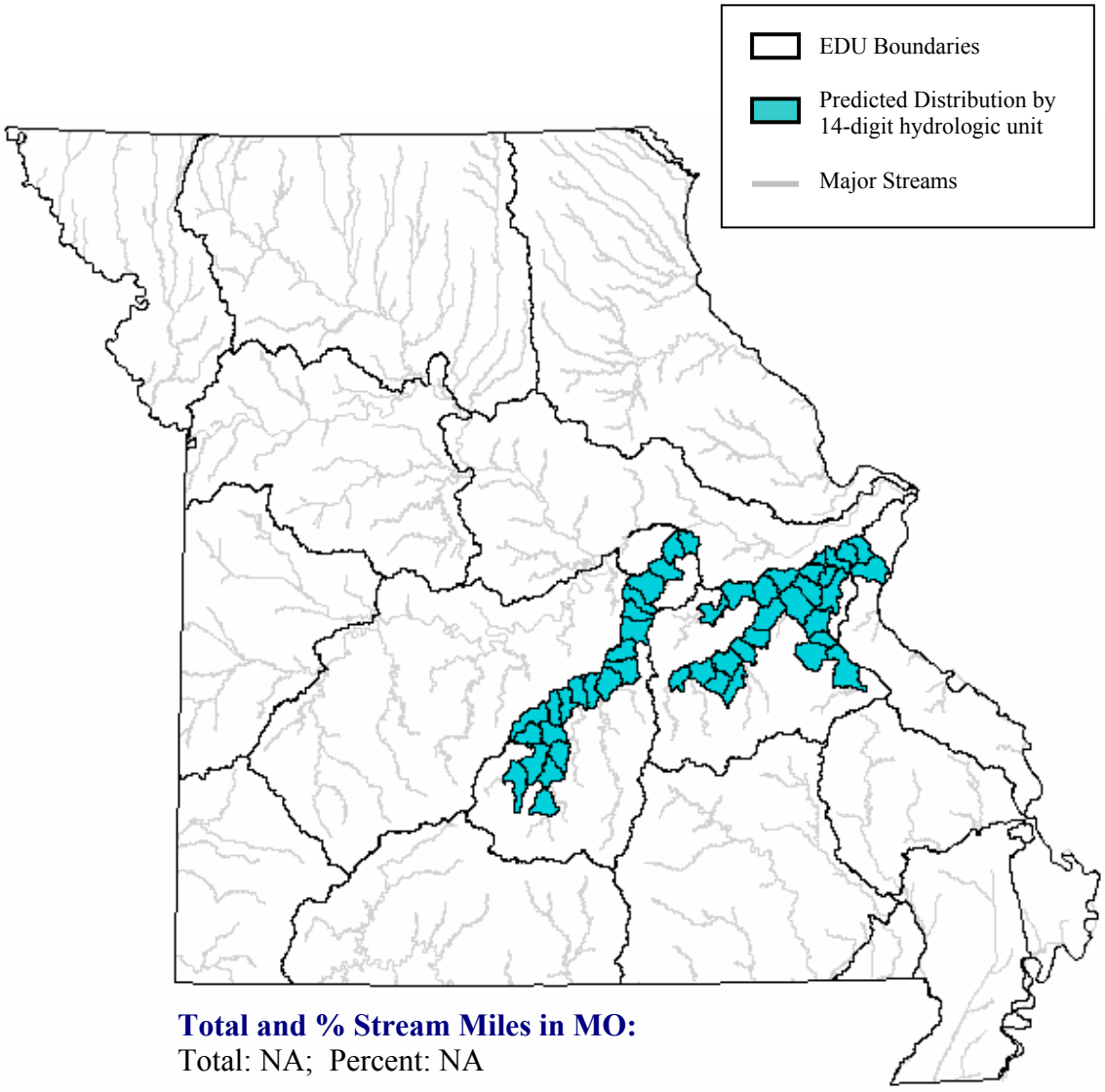
Endemism: Region

State Rank: S1

ITIS Code: 80229

Global Rank: G3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The sheepnose has a very restricted distribution in Missouri only occurring in Mississippi River above St. Louis and also the Big, Bourbeuse, Gasconade and Meramec Rivers.

Habitat Affinities:

This species is found in medium to large rivers in moderate to swift water and coarse sand and gravel substrates (Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998). Buchanan (1980) reported that the sheepnose was most commonly collected from swift waters in gravel and cobble substrates.

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

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Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

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van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

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Slippershell Mussel

Alasmidonta virdis

Native: Yes

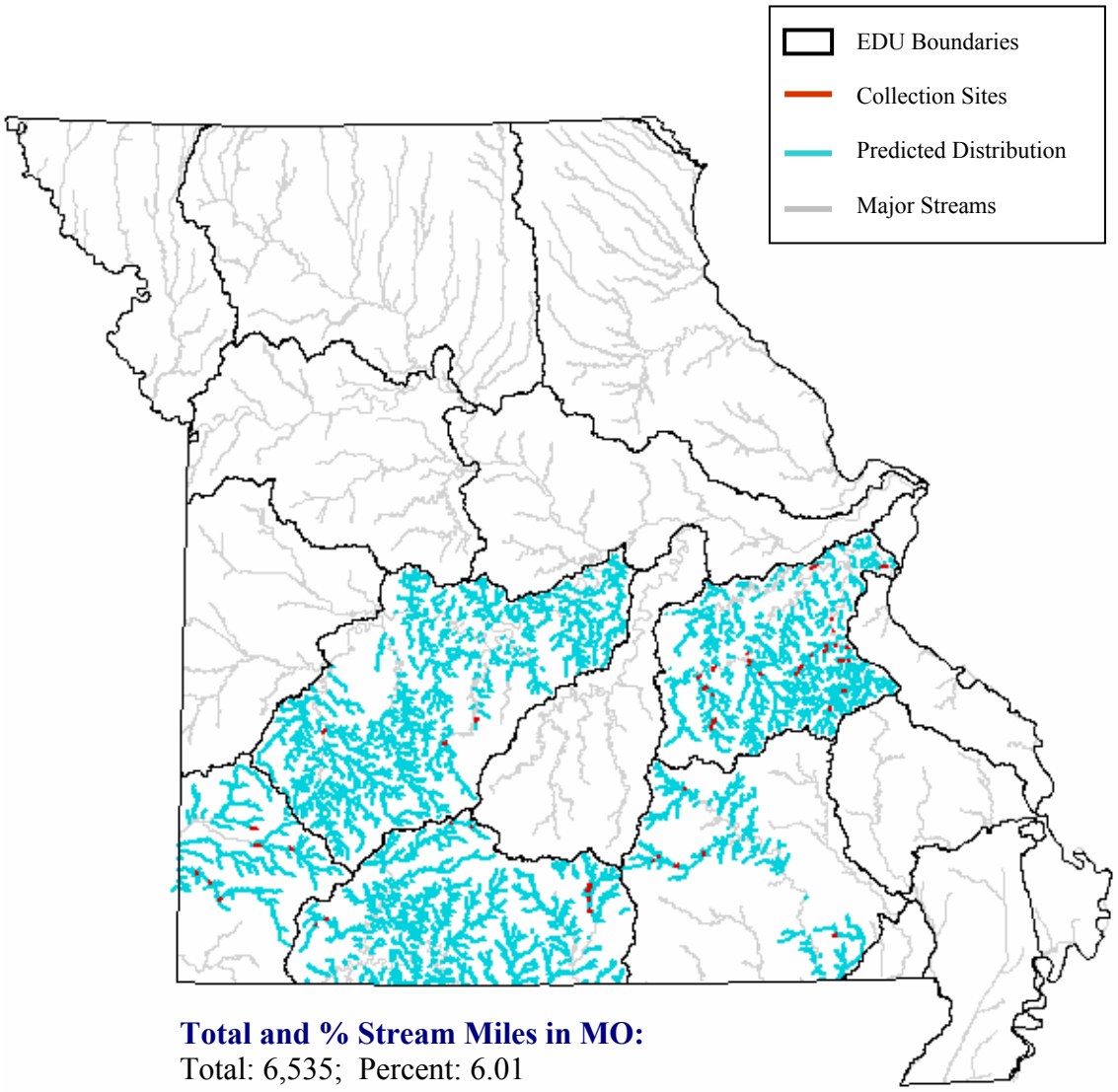
Endemism: Subzone

State Rank: S?

ITIS Code: 79916

Global Rank: G4G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 6,535; Percent: 6.01

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The slippershell mussel is found in most of the major drainages of the Ozark Aquatic Subregion, except the Gasconade and St. Francis River watersheds.

Habitat Affinities:

This species is most frequently found in spring-fed headwaters and small creeks, where the water shallow, clear and cool within areas of slow to moderate flow over sand to fine gravel substrates (Oesch 1995; Parmalee and Bogan 1998). However, Parmalee and Bogan (1998) state that before impoundment the slippershell once inhabited the shoals and riffles of large rivers such as the French Broad and Holston in Tennessee. Also, Buchanan (1980) most commonly found the slippershell mussel in standing to slow moving water over a variety of substrates (silt to rubble) among beds of water willow (*Justica spp*.). Baker (1928) found this species over sandy bottoms in streams and lakes.

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Linkr] >= 1) and ([Linkr] <= 5)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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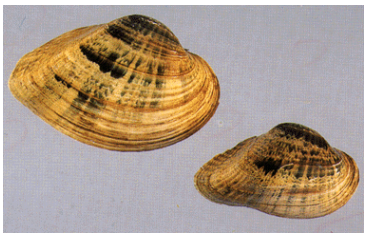


Snuffbox

Eplioblasma triquetra

Native: Yes

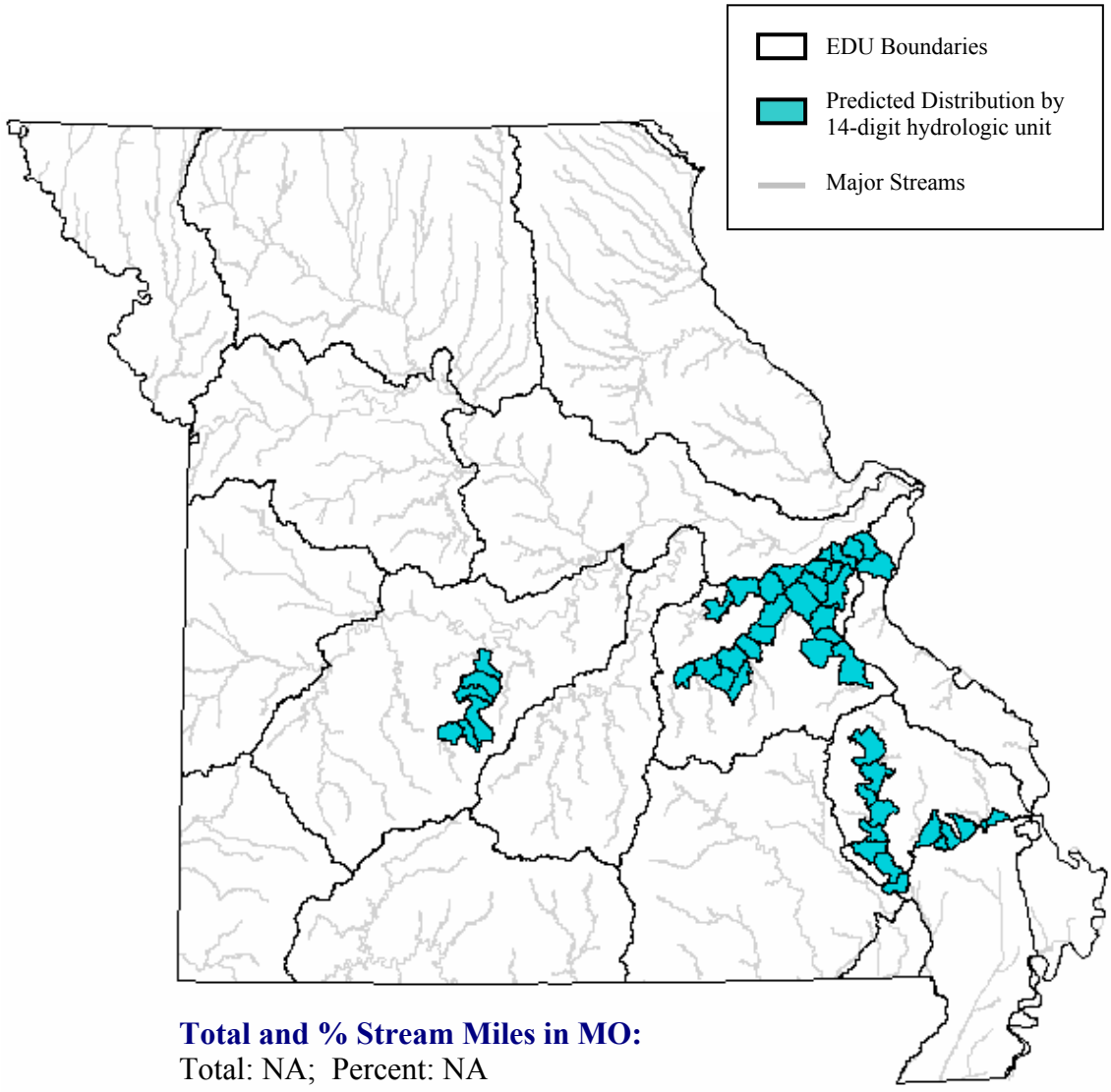
Endemism: Region

State Rank: S1

ITIS Code: 80345

Global Rank: G3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The range of the snuffbox in Missouri is largely restricted to the Meramec and St. Francis Ecological Drainage Units within the Ozark Aquatic Subregion, but also occurs in the Niangua River watershed.

Habitat Affinities:

This species occurs in medium to large rivers having clear water within areas of moderate to swift flow and gravel to boulder substrates (Buchanan 1980; Oesch 1995). Most authors list sand or gravel as the preferred substrate (Harris and Gordon 1990; Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998). It is usually collected from shallow riffles and is often buried beneath the substrate (Baker 1928; Hickman 1937; Buchanan 1980; Parmalee and Bogan 1998).

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

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Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Hickman, M. E. 1937. A contribution to the knowledge of the molluscan fauna of East Tennessee. Unpublished MS Thesis. University of Tennessee, Knoxville, TN. 165 pp.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Southern Hickorynut

Obovaria jacksoniana

Native: Yes

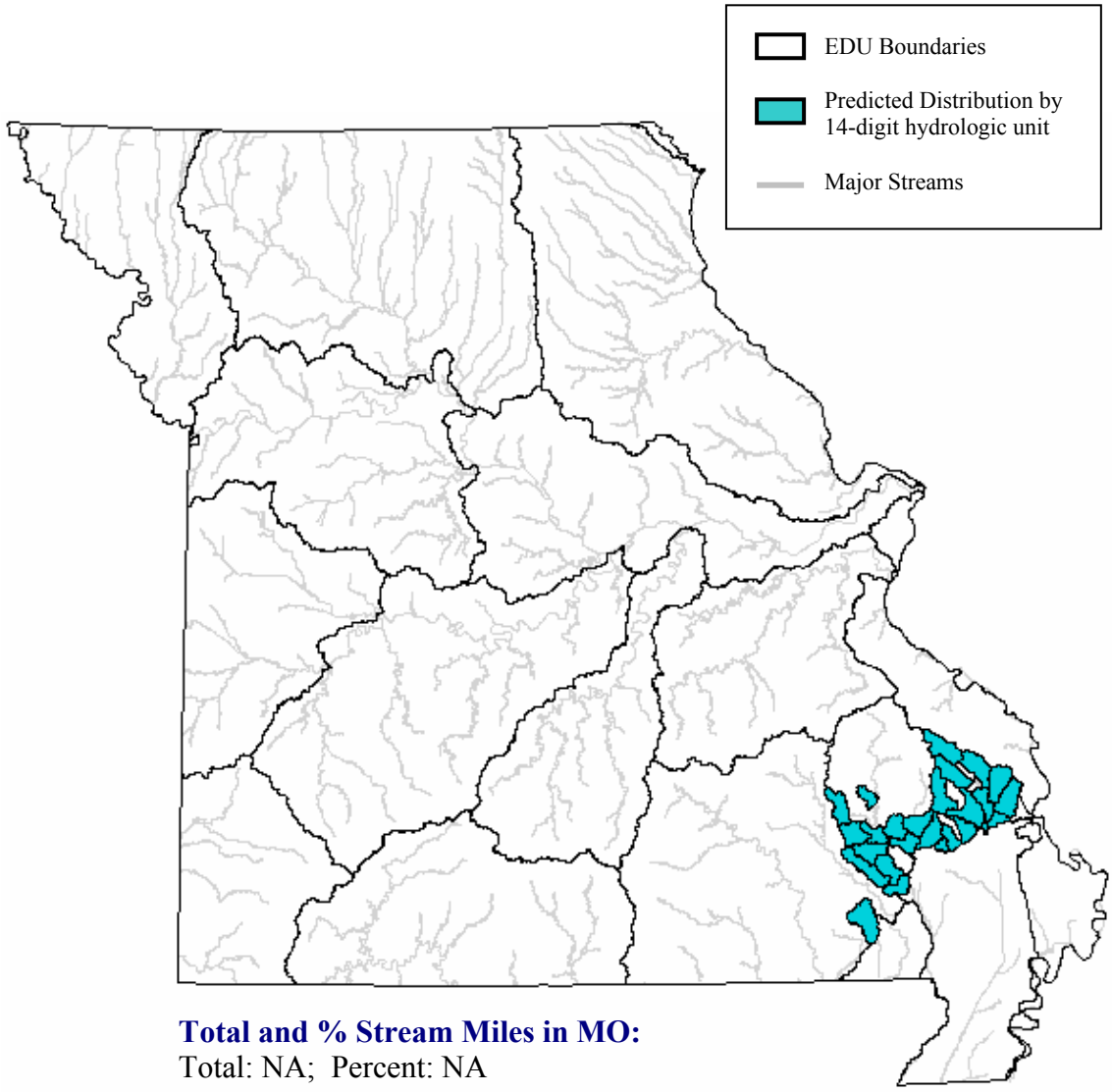
Endemism: Region

State Rank: S1

ITIS Code: 80180

Global Rank: G1G2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Southern hickorynut is one of the rarest naiads in Missouri with a range restricted to a handful of streams along the border of the Ozark and Mississippi Alluvial Basin Aquatic Subregions.

Habitat Affinities:

The few specimens of this species that have been collected in Missouri have come from areas with slow to moderate current with medium-sized gravel substrates (Oesch 1995). In Tennessee, Manning (1989) found this species in areas of slow current over stable gravel and silt substrate.

Predictive Model(s):

Ozark Model
([Linkr] >= 4) and ([Linkr] <= 7) and ([Flow] = 1) and ([Temp_code] = 2) and ([Rgrad_subr] = 1)

References:

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Manning, D. 1989. Freshwater mussels (Unionidae) of the Hatchie River, a tributary to the Mississippi River, in West Tennessee. Sterkiana 72: 11-18.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper right: Photo courtesy of the W. H. McCullagh.

Spectaclecase

Cumberlandia monodonta

Native: Yes

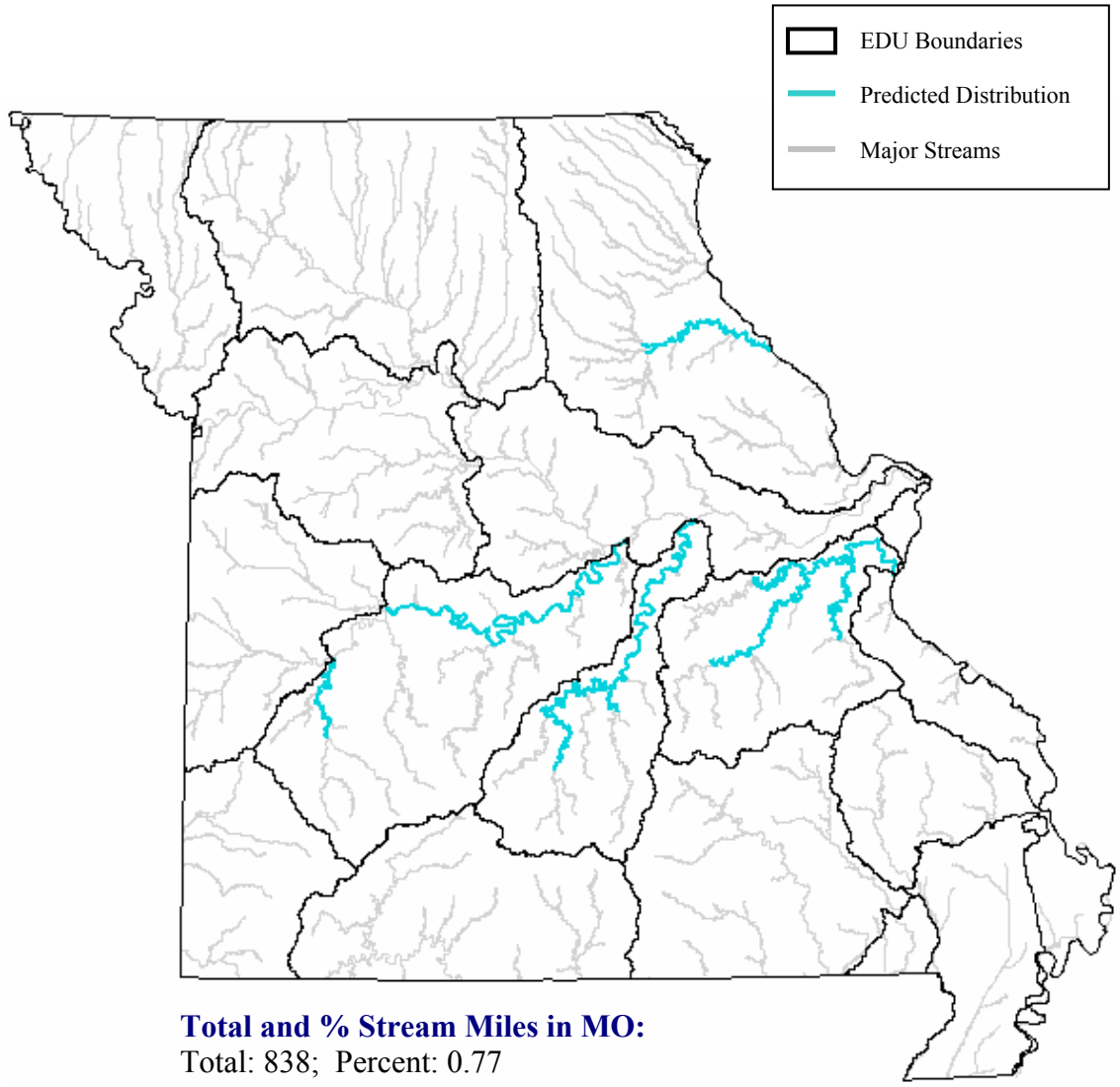
Endemism: Region

State Rank: S3

ITIS Code: 80376

Global Rank: G2G3

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 838; Percent: 0.77

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The spectaclecase is found in the northward flowing drainages of the Ozark Aquatic Subregion and also the Salt River watershed of northeast Missouri.

Habitat Affinities:

This species occurs occurs in medium to large rivers with swiftly flowing water among boulders or in patches of sand, gravel or cobble (Parmalee 1967; Cummins and Mayer 1992; Bruenderman et. al 2002). Oesch (1995) reports that the specataclecase needs a stable bottom of rocks or boulders and is sometimes found in dead tree stumps and root masses. Several authors state that this species is generally found in areas of reduced current adjacent to swift moving water (Stansberry 1966; Buchanan 1980; Cummins and Mayer 1992; Bruenderman et. al 2002). Stansbery (1973) reported finding this species near swift current and deeply imbedded in fined sand, firm mud, vegetation r between rocks.

Predictive Model(s):

Central Plains/Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 7)

References:

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Fuller, S. L. H. 1978. Fresh-water mussels (Mollusca: Bivalvia: Unionidae) of the Upper Mississippi River: Observations at selected sites within the 9-foot channel navigation project on behalf of the U.S. Army Corps of Engineers. Academy of Natural Sciences of Philadelphia. 401 pp.

Goodrich, C. and H. van der Schalie. 1944. A revision of the Mollusca of Indiana. American Midland Naturalist 32: 257-326.

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Stansberry, D. H. 1966. Observations on the habitat distribution of the naiad *Cumberlandia monodonta* (Say, 1829) (Abstract). American Malacological Union, Inc., Annual Reports for 1966. 33: 29-30.

Stansberry, D. H. 1973. A preliminary report on the naiad fauna of the Clinch River in the southern Appalachian Mountains of Virginia and Tennessee (Mollusca: Bivalvia:Unionida). Bulletin of the American Malacological Union, Inc., for 1972: 20-22.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Spike

Elliptio dilatata

Native: Yes

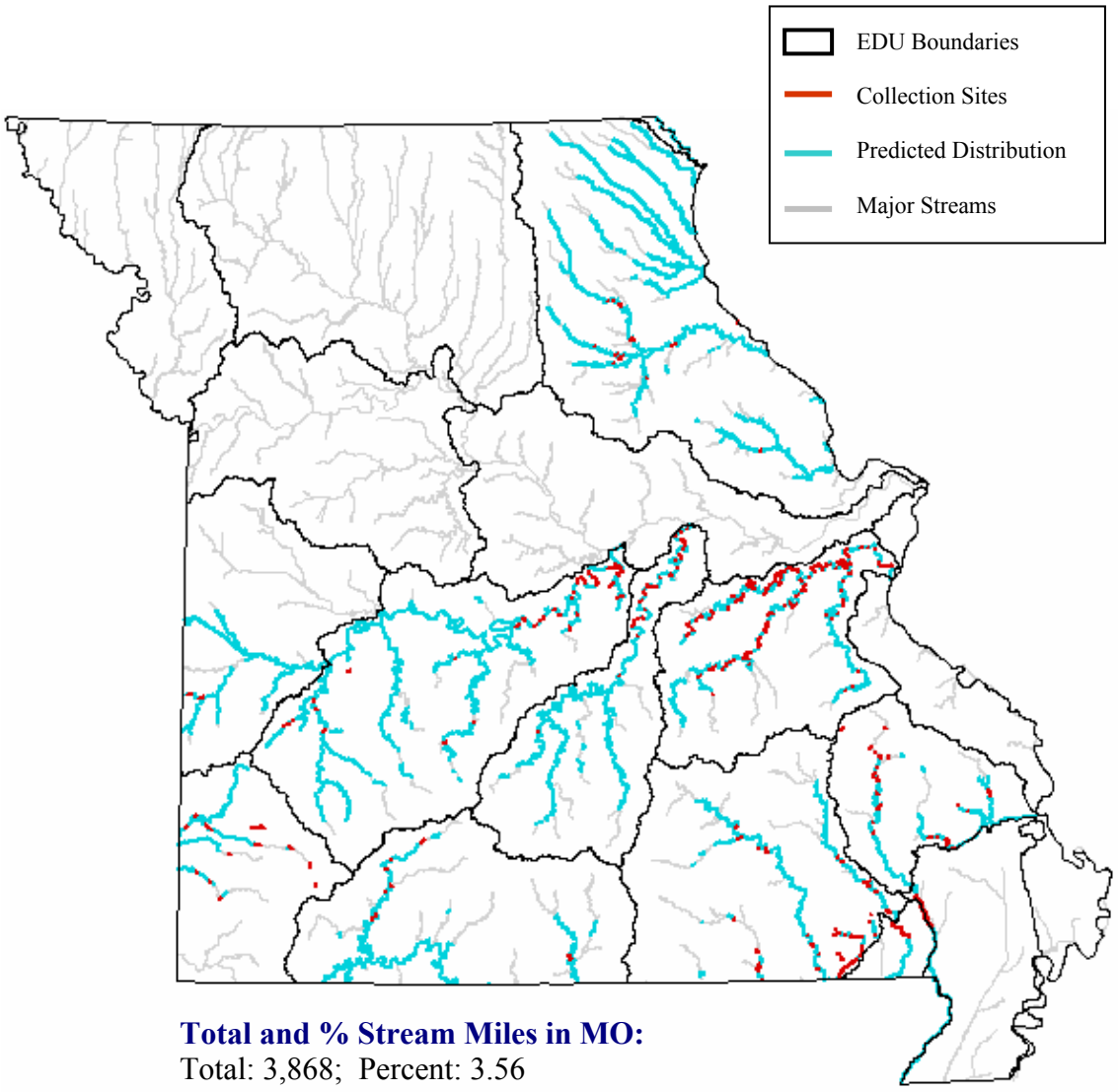
Endemism: Subzone

State Rank: S?

ITIS Code: 79953

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 3,868; Percent: 3.56

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The spike is found throughout most of the Ozark Aquatic Subregion and also the western Osage, and the major tributaries to the Mississippi River in northeast Missouri. It also occurs in the lower Current, Black, Little Black, and St. Francis Rivers as they flow within the Mississippi Alluvial Basin Aquatic Subregion.

Habitat Affinities:

This species is found in small to large rivers in all range of current velocities and all types of substrates (Buchanan 1980; Cummins and Mayer 1992; Oesch 1995). However, stable sand and gravel substrates in moderate to strong currents appear to provide the most suitable habitat for the spike (Harris and Gordon 1990; Parmalee and Bogan 1998; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains/Ozark Model

(([Linkr] = 5) and ([GradsegR] >= 1) and ([GradsegR] <= 2)) or (([Linkr] = 6) and ([Temp_code] = 2)) or (([Linkr] >= 7))

Mississippi Alluvial Basin Model

([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Call, R. E. 1900. A descriptive illustrated catalogue of the Mollusca of Indiana. Indiana Department of Geology and Natural Resources Annual Report 24: 335-535.

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Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

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. 184 pp.

Obermeyer, B. K., D. R. Edds, C. W. Prophet, and E. J. Miller. 1997. Freshwater mussels (Bivalvia: Unionidae) in the Verdigris, Neosho, and Spring River basins of Kansas and Missouri, with emphasis on species of concern. American Malacological Bulletin 14: 41-55.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Texas Lilliput

Toxolasma texasensis

Native: Yes

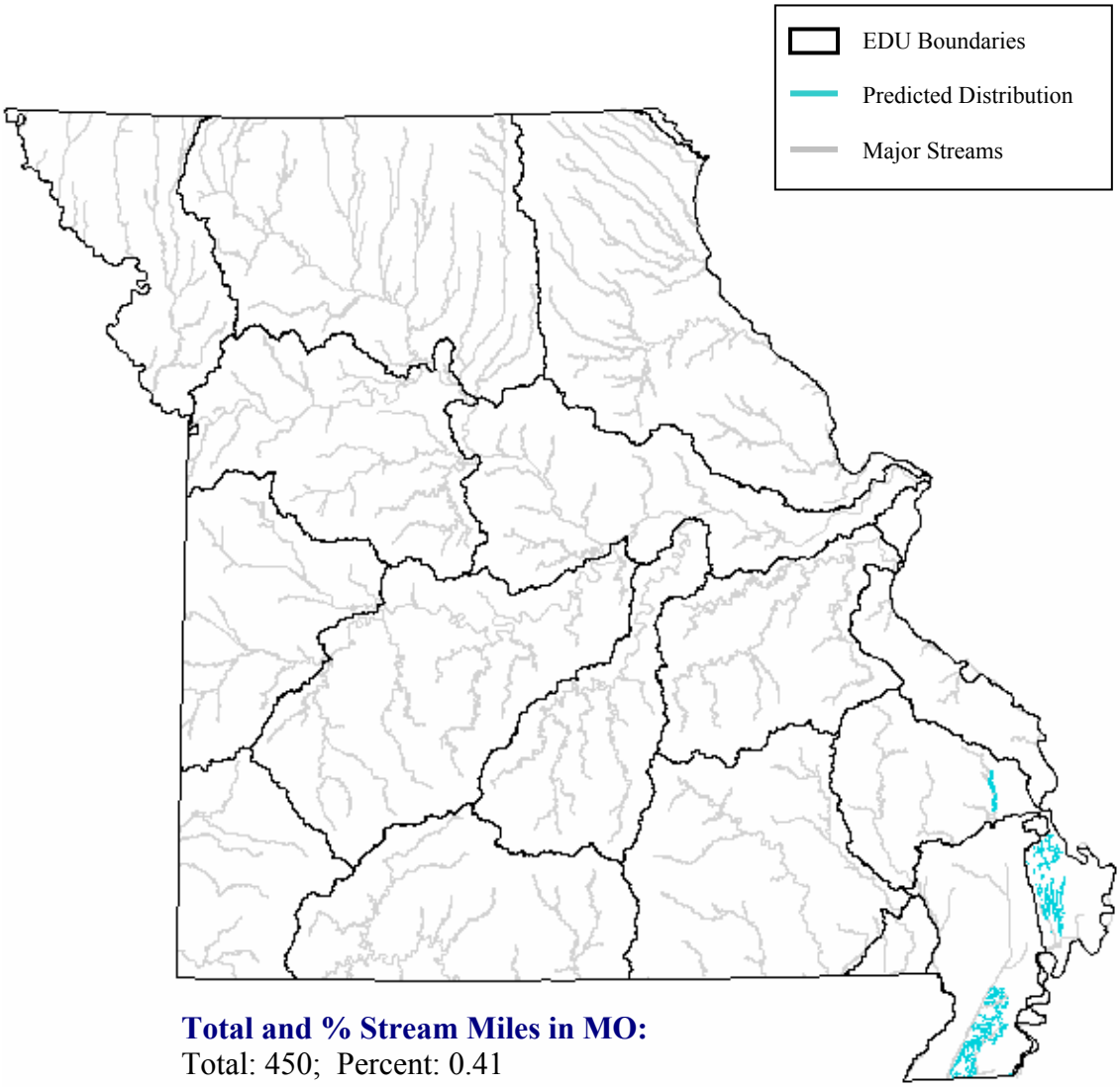
Endemism: Region

State Rank: S3

ITIS Code: 80369

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 450; Percent: 0.41

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Texas lilliput is restricted to southeast Missouri and is found throughout the Mississippi Alluvial Basin Aquatic Subregion and also the lower sections of the Whitewater River watershed within the Ozark Aquatic Subregion.

Habitat Affinities:

This species is found in small to medium-sized rivers and sloughs in areas with little or no current and living in sandy or silty bottoms at depths of less than three feet (Cummins and Mayer 1992; Parmalee and Bogan 1998).

Predictive Model(s):

Ozark Model
The distribution is based upon dominant valley segment type.
([Vst_7var] = "2312110")

Mississippi Alluvial Basin Model
The distribution is based upon dominant valley segment type.
([Vst_7var] = "2101000")

References:

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

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Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Threehorn Wartyback

Obliquaria reflexa

Native: Yes

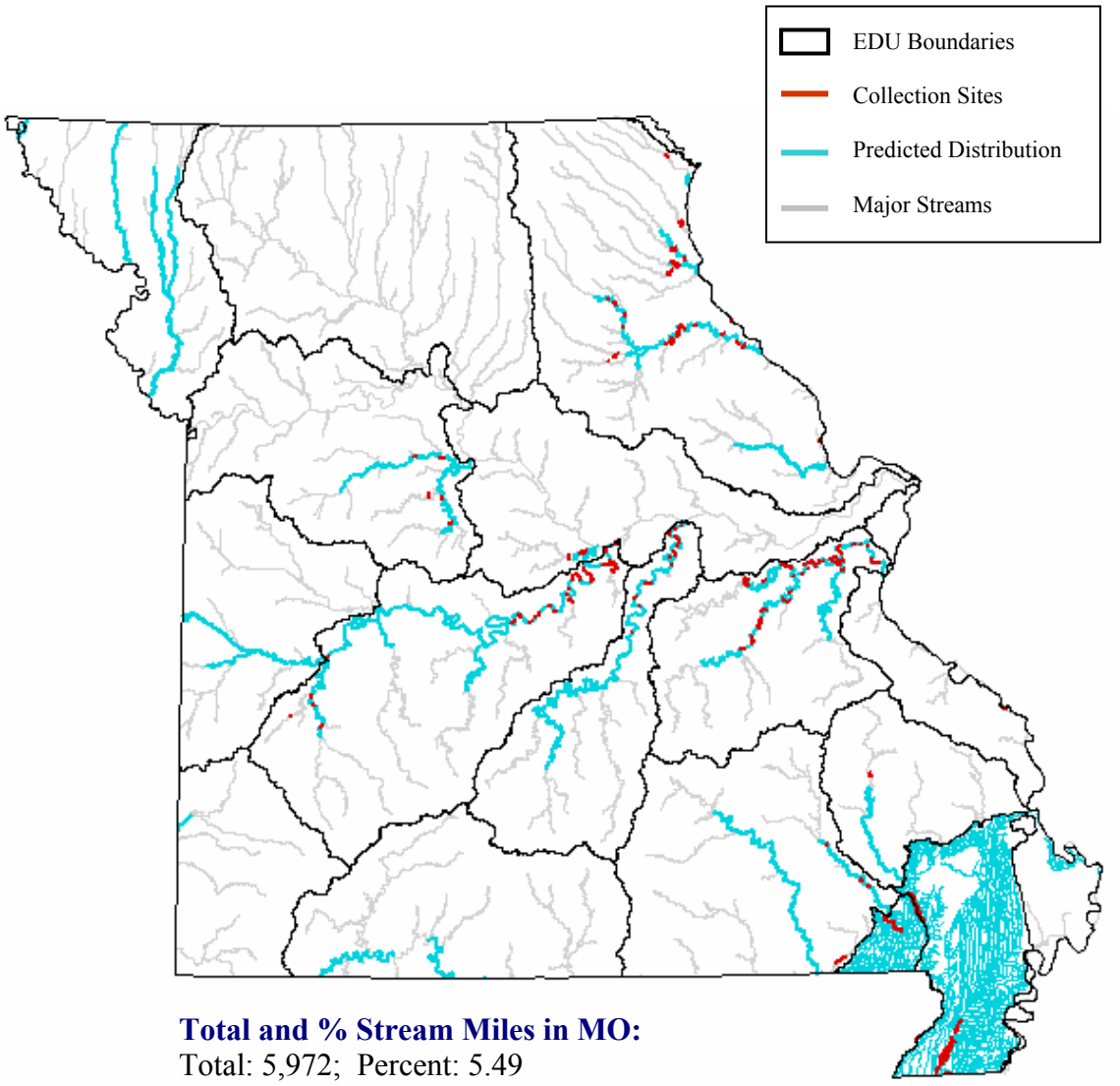
Endemism: Region

State Rank: S?

ITIS Code: 80164

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 5,972; Percent: 5.49

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The threehorn wartyback is found in all three Aquatic Subregions of Missouri and is most commonly found in the drainages along the eastern one-third of the state.

Habitat Affinities:

This species is primarily found in medium to large rivers and also impoundments (Buchanan 1980; Harris and Gordon 1990; Oesch 1995; Bruenderman et. al 2002). It is most commonly encountered in areas with moderate to swift current in mud, sand and gravel substrates (Harris and Gordon 1990; Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998; Bruenderman et. al 2002). However, Buchanan (1980) found the threehorn wartyback in 1 inch to four feet of water within standing to moderately-flowing water and a wide variety of substrates (silt to cobble).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] >= 7))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

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Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

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Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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. 184 pp.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

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van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Threeridge

Amblema plicata

Native: Yes

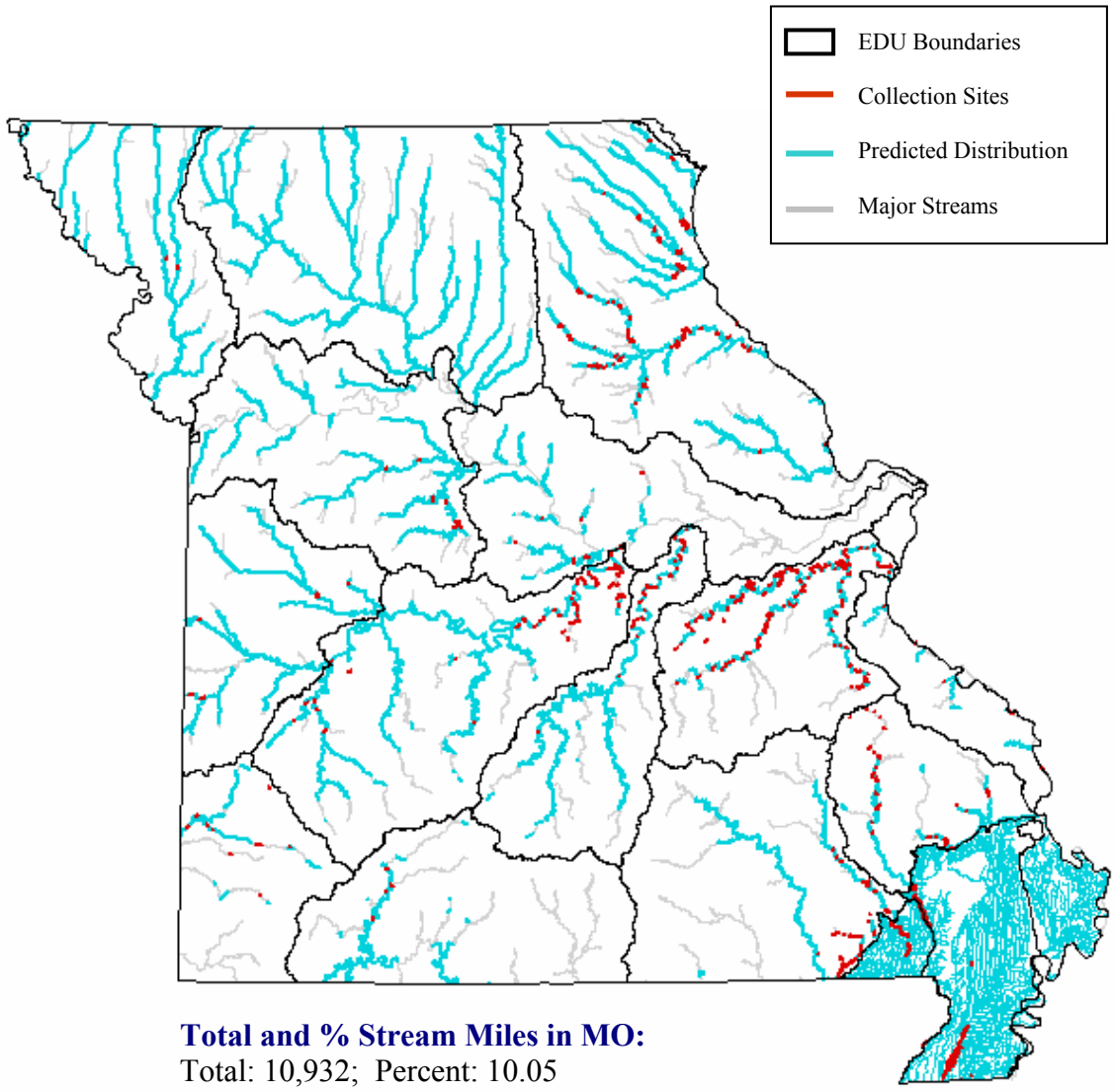
Endemism: Subzone

State Rank: S?

ITIS Code: 80035

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 10,932; Percent: 10.05

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The threeridge is one of the most widespread naiad species in Missouri and is found virtually statewide except for the southwest corners of the state and it is also absent from the North Fork of the White River and the much of the Eleven Point River watersheds.

Habitat Affinities:

This species is primarily found in small to large rivers and also oxbows and impoundments (Buchanan 1980; Harris and Gordon 1990; Cummins and Mayer 1992; Parmalee and Bogan 1998). It is found in virtually all current velocities and substrate types except shifting sand (Buchanan 1980; Oesch 1995), but is most commonly found on bottoms of sand, gravel and mud in one to three feet of water (Harris and Gordon 1990; Parmalee and Bogan 1998; Bruenderman et. al 2002).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 5)

Ozark Model
(([Linkr] = 5) and ([Rgrad_subr] = 1)) or (([Linkr] = 6)) or (([Linkr] = 7) and ([Temp_code] = 2)) or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

Clarke, A. H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, National Museum of Canada, Ottawa, Canada. 446 pp.

Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38: 671-697.

Ferriss, J. H. 1906. Mollusks of Oklahoma. Nautilus 20: 16-17.

Goodrich, C. 1932. The Mollusca of Michigan. Michigan Handbook Series No. 5. University of Michigan Press, Ann Arbor, Michigan. 120 pp.

Goodrich, C. and H. van der Schalie. 1944. A revision of the Mollusca of Indiana. American Midland Naturalist 32: 257-326.

Gordon, M. E., L. R. Kraemer and A. V. Brown. 1979. Unionacea of Arkansas: Historical review, checklist, and observations on distributional patterns. Bulletin of the American Malacological Union, Inc. 1979: 31-37.

Harris, J. L. and M. E. Gordon. 1990. Arkansas mussels. Arkansas Game & Fish Commission, Little Rock, AR. 32 pp.

Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press. 224 pp.

Isely, F. B. 1924. The fresh-water mussel fauna of eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 4: 43-118.

Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Mathiak, H. A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.

McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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. 184 pp.

Obermeyer, B. K., D. R. Edds, C. W. Prophet, and E. J. Miller. 1997. Freshwater mussels (Bivalvia: Unionidae) in the Verdigris, Neosho, and Spring River basins of Kansas and Missouri, with emphasis on species of concern. American Malacological Bulletin 14: 41-55.

Oesch, R. D. 1995. Missouri Naiades: A Guide to the Mussels of Missouri. Missouri Department of Conservation, Jefferson City, MO. 271 pp.

Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. Ohio Journal of Science 89: 188-191.

van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Watters, G. T. 1993. A Guide to the Freshwater Mussels of Ohio. Division of Wildlife, The Ohio Department of Natural Resources. Revised Edition. 106 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Upper right: Photo courtesy of Kevin Cummings and the Illinois Natural History Survey.

Wabash Pigtoe

Fusconaia flava

Native: Yes

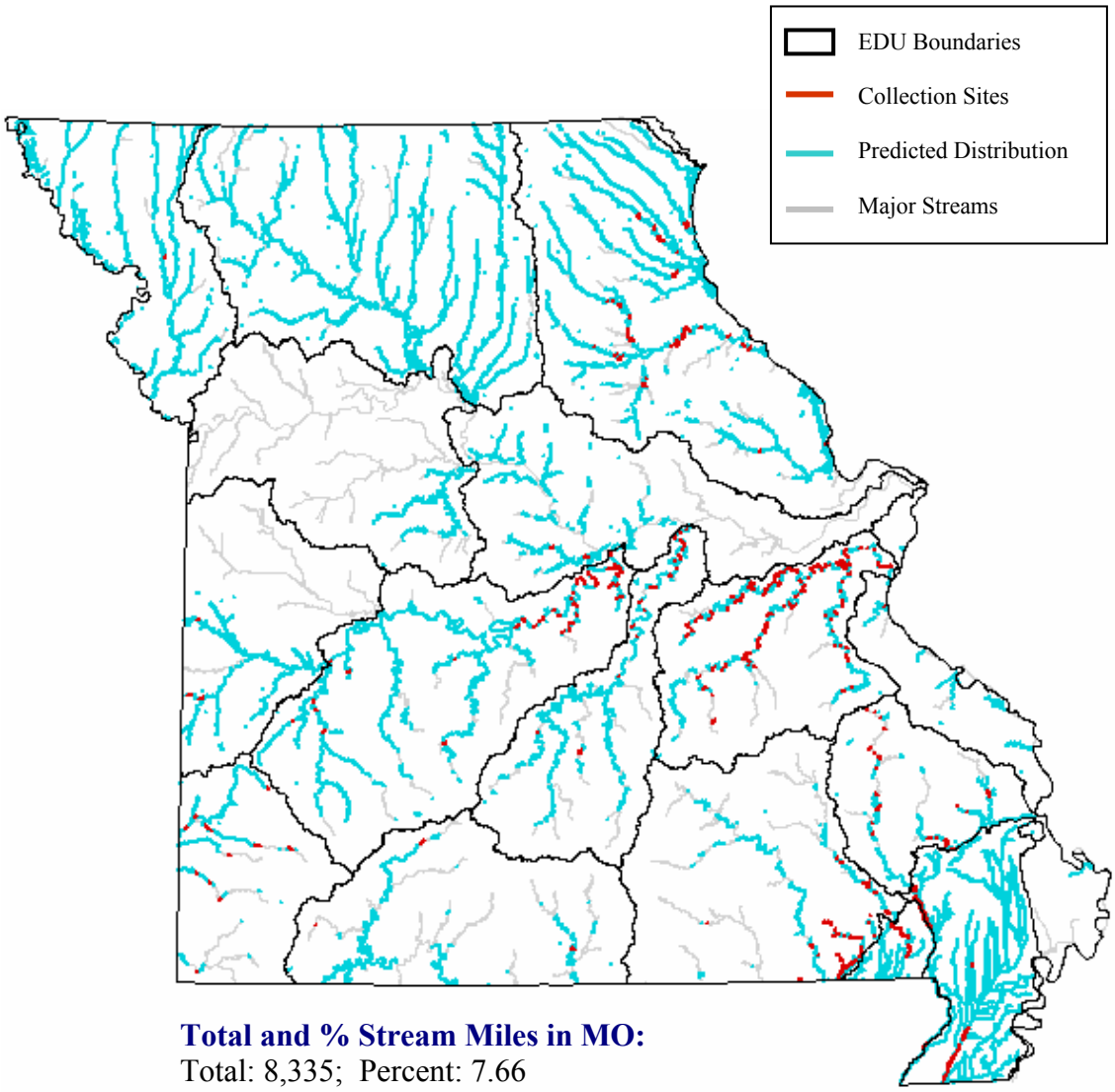
Endemism: Subzone

State Rank: S?

ITIS Code: 80041

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 8,335; Percent: 7.66

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:
According to collection records and professional review it is believed that this species occurs nearly statewide.

Habitat Affinities:
This species is found in everything from creeks to large rivers (Murray and Leonard 1962; Buchanan 1980; Harris and Gordon 1990; Cummins and Mayer 1992). Buchanan (1980) found the Wabash pigtoe in standing to swiftly moving water from one inch to twelve feet deep and stated that this species appeared to show no substrate preference. Parmalee and Bogan (1998) and Bruenderman et. al (2002) list a stable mix of coarse sand and gravel as suitable substrates for this species.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Temp_code] = 2)
Query 2: (([GradsegR] = 1) and ([Linkr] >= 1)) or (([GradsegR] = 2) and ([Linkr] >= 4))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1909. Mollusks from Kansas and Oklahoma. Nautilus 23: 91-94.

Branson, B. A. 1967. A partial biological survey of the Spring River drainage in Kansas, Oklahoma and Missouri. Part I, Collecting sites, basic limnological data, and mollusks. Transactions of the Kansas Academy of Science 69: 242-293.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

Bruenderman, S., J. Sternberg and C. Barnhart. 2002. Missouri's Freshwater Mussels. Missouri Department of Conservation, Jefferson City, MO. 16 pp.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

Buchanan, A.C. 1980. Mussels (Naiades) of the Meramec River Basin, Missouri, Missouri Department of Conservation, Aquatic Series No. 17, 76 pp.

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Gordon, M.E., 1982. Mollusca of the White River, Arkansas and Missouri. Southwestern Naturalist, 27: 347-352.

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Mackie, G. L., D. S. White, and T. W. Zdeba. 1980. A guide to freshwater mollusks of the Laurentian Great Lakes with special emphasis of the genus *Pisidium*. U.S. Environmental Protection Agency EPA-600/3-80-068. Duluth, MN. 144 pp

Manning, D. 1989. Freshwater mussels (Unionidae) of the Hatchie River, a tributary to the Mississippi River, in West Tennessee. Sterkiana 72: 11-18.

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McMahon, R. 1991. Mollusca: Bivalvia, pp. 315-399 *In* J. H. Thorp and A. P. Covich. (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc., New York. 911 pp.

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Parmalee, P. W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8. 108 pp.

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Warren, R. E. 1991. Ozarkian fresh-water mussels (Unionoidea) in the upper Eleven Point River, Missouri. American Malacological Bulletin 8: 131-137.

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Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Wartyback

Quadrula nodulata

Native: Yes

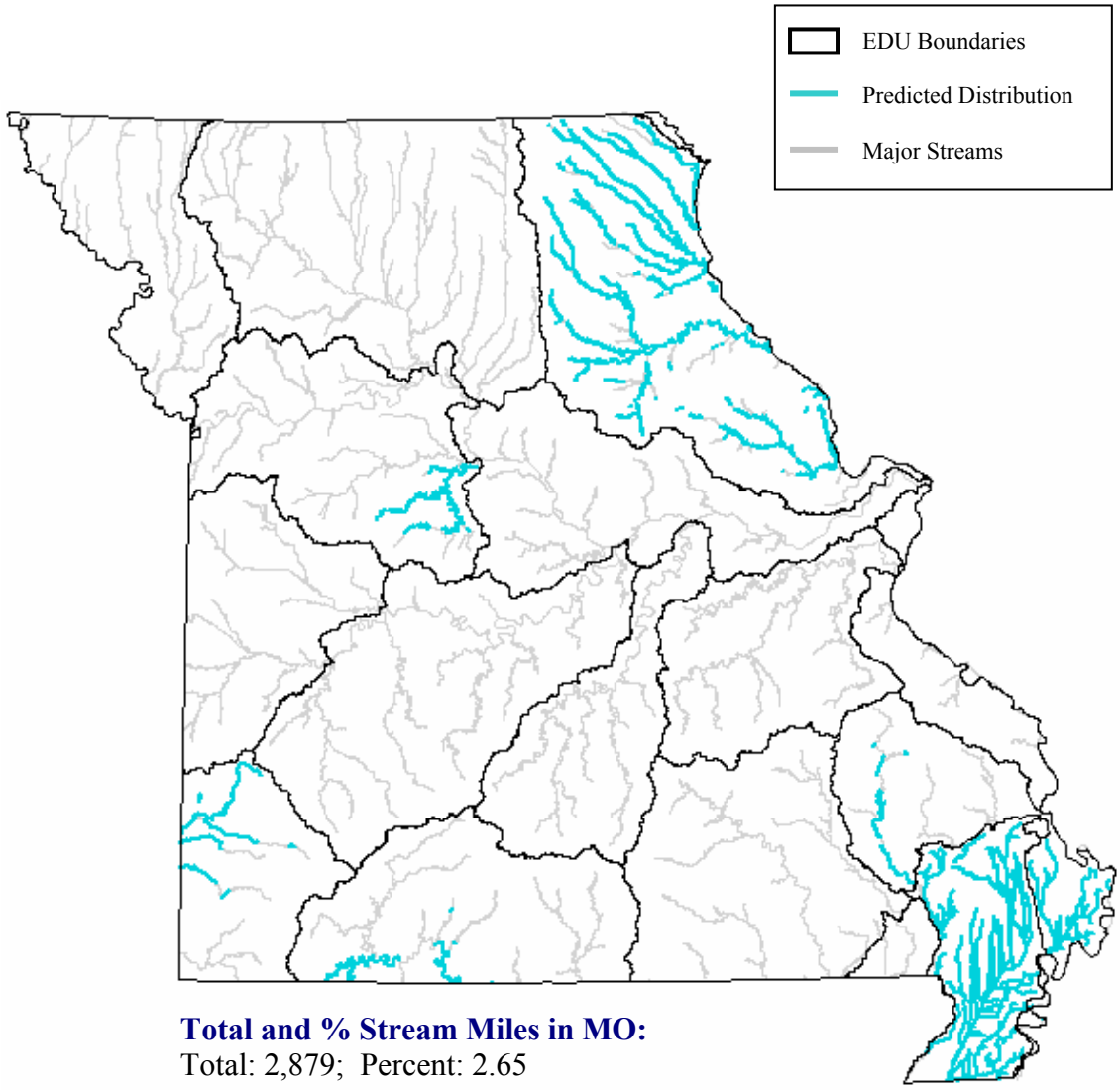
Endemism: Region

State Rank: S3

ITIS Code: 80072

Global Rank: G4

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,879; Percent: 2.65

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The wartyback occurs in extreme southeast Missouri within the Mississippi Alluvial Basin Aquatic Subregion, in sections of the Mississippi River above the Missouri River and all of its principle tributaries. In the Ozark Aquatic Subregion this species occurs within the Spring, St. Francis, and White River watersheds.

Habitat Affinities:

This species is found mainly in large rivers or the lower sections of medium-sized rivers in areas with constant flow and gravel or gravel-sand substrates (Harris and Gordon 1990; Cummins and Mayer 1992).

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Ssize_code] = 2) and ([Gradsegr] = 1)) or (([Ssize_code] >= 3) and ([Ssize_code] <= 4) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 3)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

Branson, B. A. 1983. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 2: The Unioninae, Pleurobemini and Anodontini. Proceedings of the Oklahoma Academy of Science 63: 49-59.

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van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Watters, G. T. 1993. A Guide to the Freshwater Mussels of Ohio. Division of Wildlife, The Ohio Department of Natural Resources. Revised Edition. 106 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

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Washboard

Megalonaias nervosa

Native: Yes

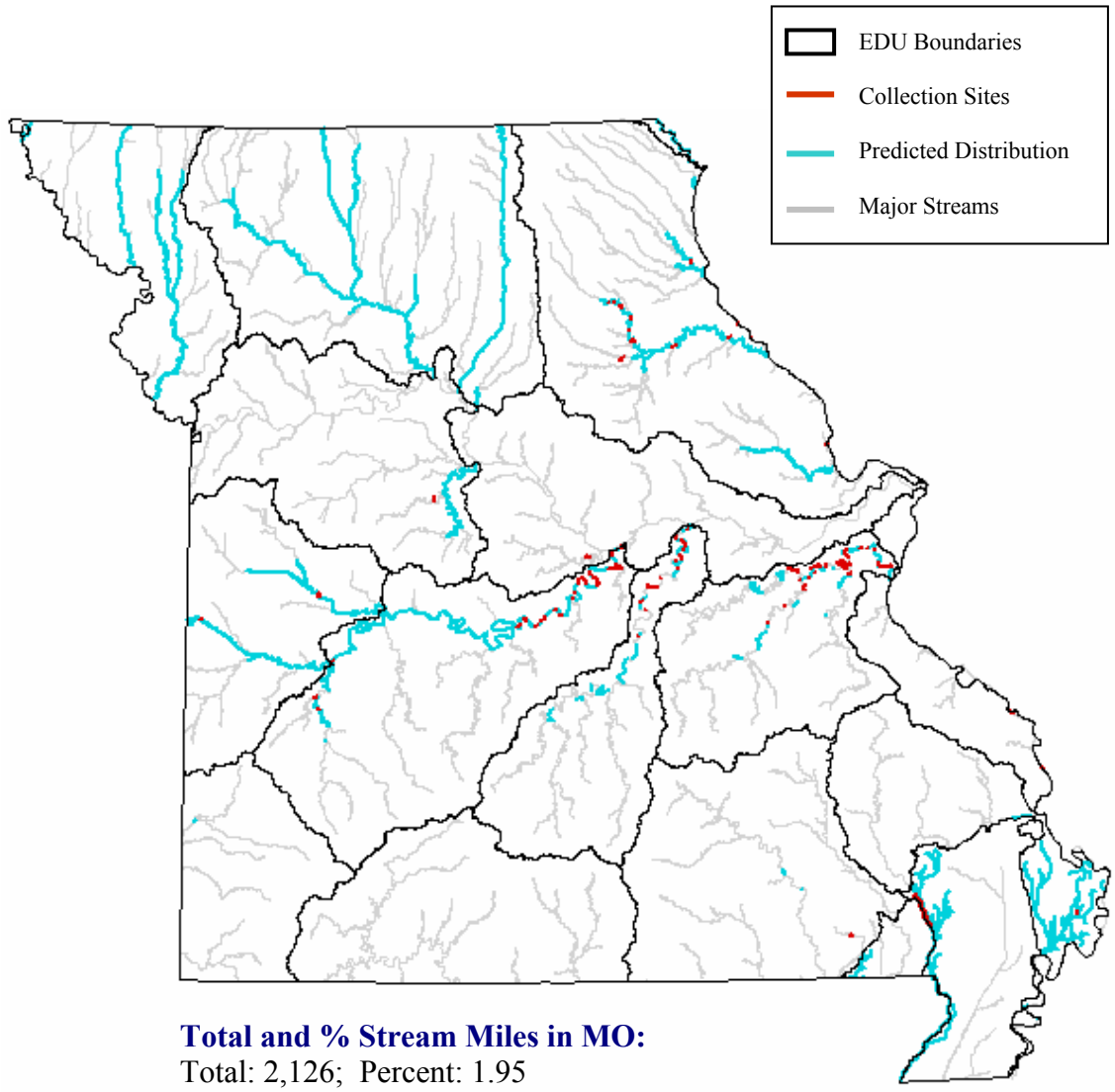
Endemism: Subzone

State Rank: S?

ITIS Code: 80279

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 2,126; Percent: 1.95

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The range of the washboard in Missouri is at best, difficult to describe, occurring in all three Aquatic Subregions of the state. It is relatively uncommon and not very abundant where encountered (Oesch 1995), but within its range it is most prevalent in the Gasconade, Meramec, Osage and Salt River drainages.

Habitat Affinities:

This species is found in the main channel of large rivers and sometimes impoundments and their associated overbank areas (Harris and Gordon 1990; Cummins and Mayer 1992; Oesch 1995; Parmalee and Bogan 1998). Most investigators report the washboard as a quiet-water species found in silt, sand, mud or gravel bottoms in very deep water (10 to 60 feet) (Goodrich and van der Schalie 1944; Murray and Leonard 1962; Parmalee 1967; Harris and Gordon 1990; Parmalee and Bogan 1998). However, in the Meramec basin of Missouri, Buchanan (1980) found this species in standing to moderately flowing water that was one inch to five-feet deep over a variety of substrates (silt to boulder).

Predictive Model(s):

Central Plains Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] = 7) and ([Rgrad_subr] = 1))or (([Linkr] >= 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

References:

Baker, F. C. 1928. The fresh-water Mollusca of Wisconsin. Part III: Pelecypoda. University of Wisconsin Bulletin No. 70, part 2. 495 pp.

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Parmalee, P. W. and A. E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville, TN. 328 pp.

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van der Schalie, H. and A. van der Schalie. 1950. The mussels of the Mississippi River. American Midland Naturalist 44: 448-466.

Watters, G. T. 1993. A Guide to the Freshwater Mussels of Ohio. Division of Wildlife, The Ohio Department of Natural Resources. Revised Edition. 106 pp.

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Western Fanshell

Cyprogenia aberti

Native: Yes

Endemism: Subregion

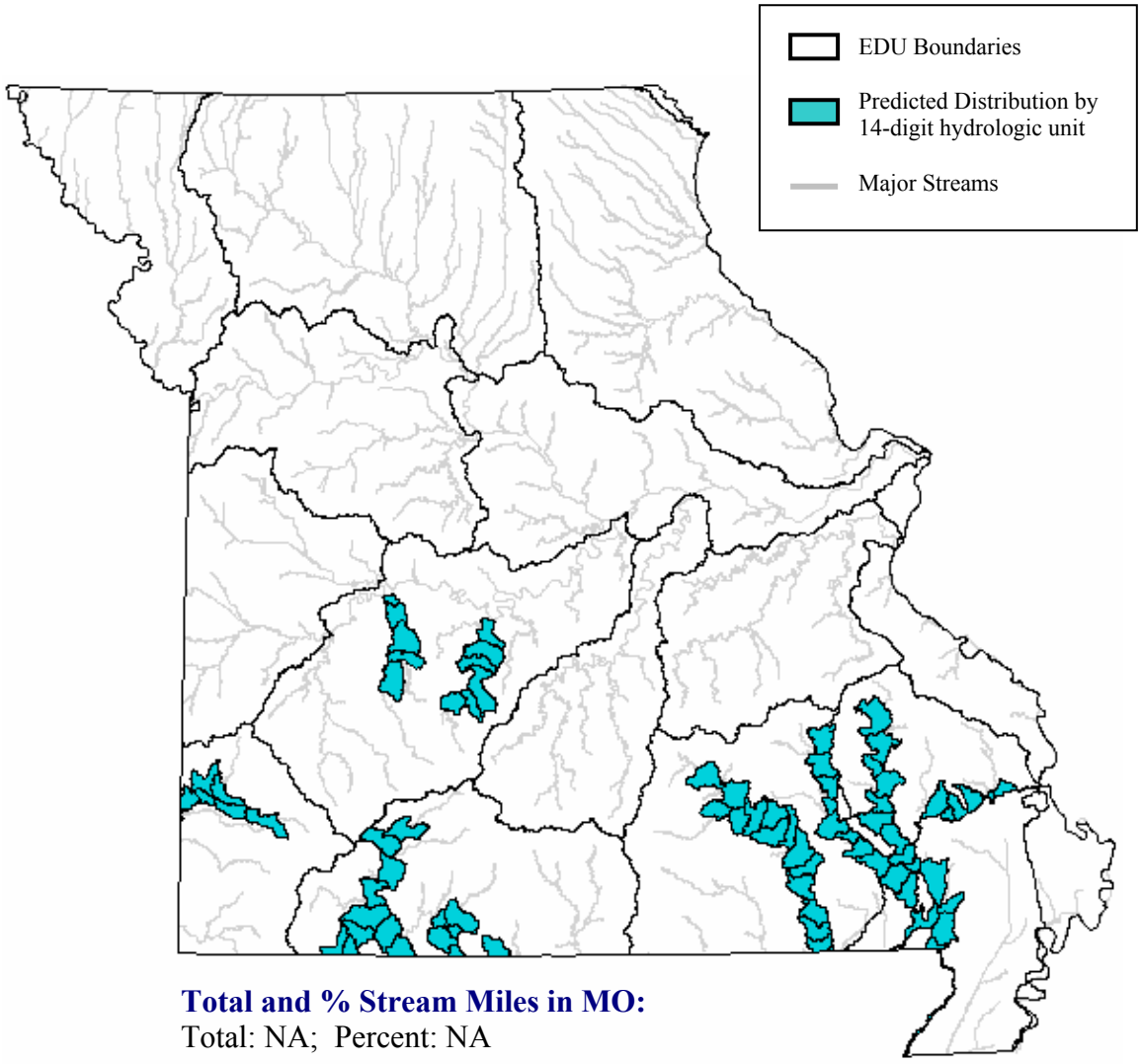
State Rank: S1S2

ITIS Code: 80273

Global Rank: G2

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick

Note: Ongoing studies indicate the existence of several distinct varieties within this species (C. Barnhart pers comm.).



Total and % Stream Miles in MO:
Total: NA; Percent: NA

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The Western fanshell is found in almost all of the major south flowing drainages of the Ozark Aquatic Subregion and also the north flowing Pomme de Terre and Niangua River watersheds. It also occurs in the lower ends of the Black and St. Francis Rivers as they flow through the Mississippi Alluvial Basin.

Habitat Affinities:

Harris and Gordon (1990) state that Western fanshell occurs in large creeks to large rivers with good water quality, moderate to swift current, and sand-gravel or sand-rock substrates. Murray and Leonard (1962) list mud, rock and gravel as suitable substrates and Oesch (1995) states that this mussel does well in shallow water with mixed gravel and mud bottoms.

Predictive Model(s):

Ozark Model
([Flow] = 1) and ([Temp_code] = 2) and ([Linkr] >= 6)

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] = 4)

References:

Branson, B. A. 1984. The mussels (Unionacea: Bivalvia) of Oklahoma - Part 3: Lampsilini. Proceedings of the Oklahoma Academy of Science 64: 20-36.

Buchanan, A. C. 1979. Mussels (Naiades) of the Little Black River Basin in Missouri and Arkansas. Missouri Department of Conservation, Fisheries Research Section. 69 pp.

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White Heelsplitter

Lasmigona complanata

Native: Yes

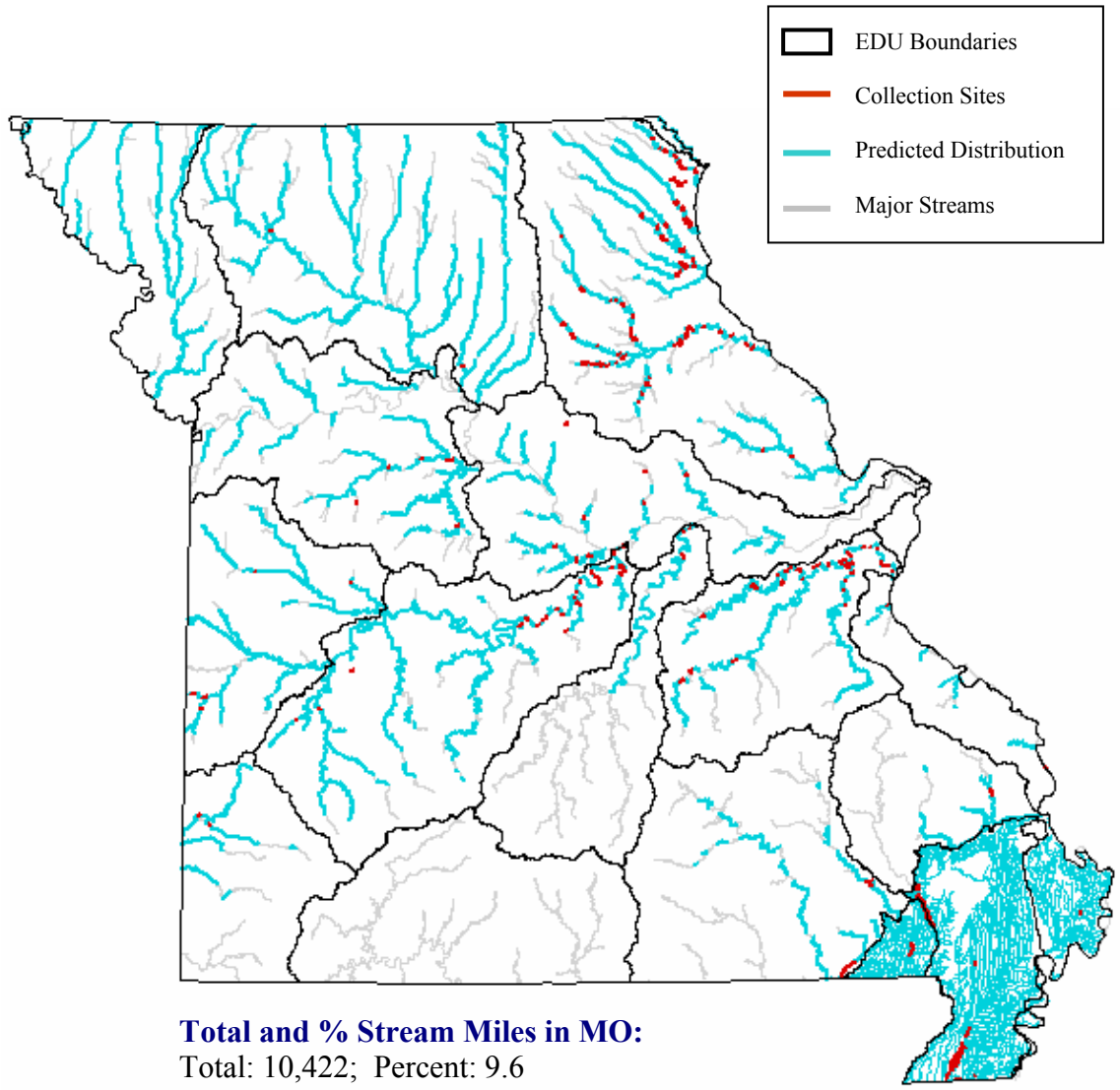
Endemism: Subzone

State Rank: S?

ITIS Code: 80135

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 10,422; Percent: 9.6

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

The white heelsplitter is found nearly statewide except for the Elk, Eleven Point, upper Gasconade, upper St. Francis, and White River drainages.

Habitat Affinities:

The white heelsplitter occurs in a variety of habitats, including medium to large rivers and permanent sloughs, backwaters, oxbows, lakes and reservoirs (Parmalee and Bogan 1998). This species is most prevalent in large rivers or streams with large-river characteristics—sluggish flow and turbid with firm mud, sand or mud-gravel bottoms (Cummins and Mayer 1992; Oesch 1995; Bruenderman et. al 2002). Buchanan (1980) found this species in a variety of flow conditions and substrates, but states that it is most commonly found in areas of slow current with silt substrates. It is usually found in less than three feet of water, but in larger rivers it may be found at depths of fifteen to twenty feet (Parmalee and Bogan 1998).

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1) and ([Temp_code] = 2)
Query 2: (([Linkr] >= 5) and ([Linkr] <= 7) and ([Gradsegr] >= 1) and ([Gradsegr] <= 2)) or (([Linkr] = 8))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 1) and ([Ssize_code] <= 4)

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Yellow Sandshell

Lampsilis teres

Native: Yes

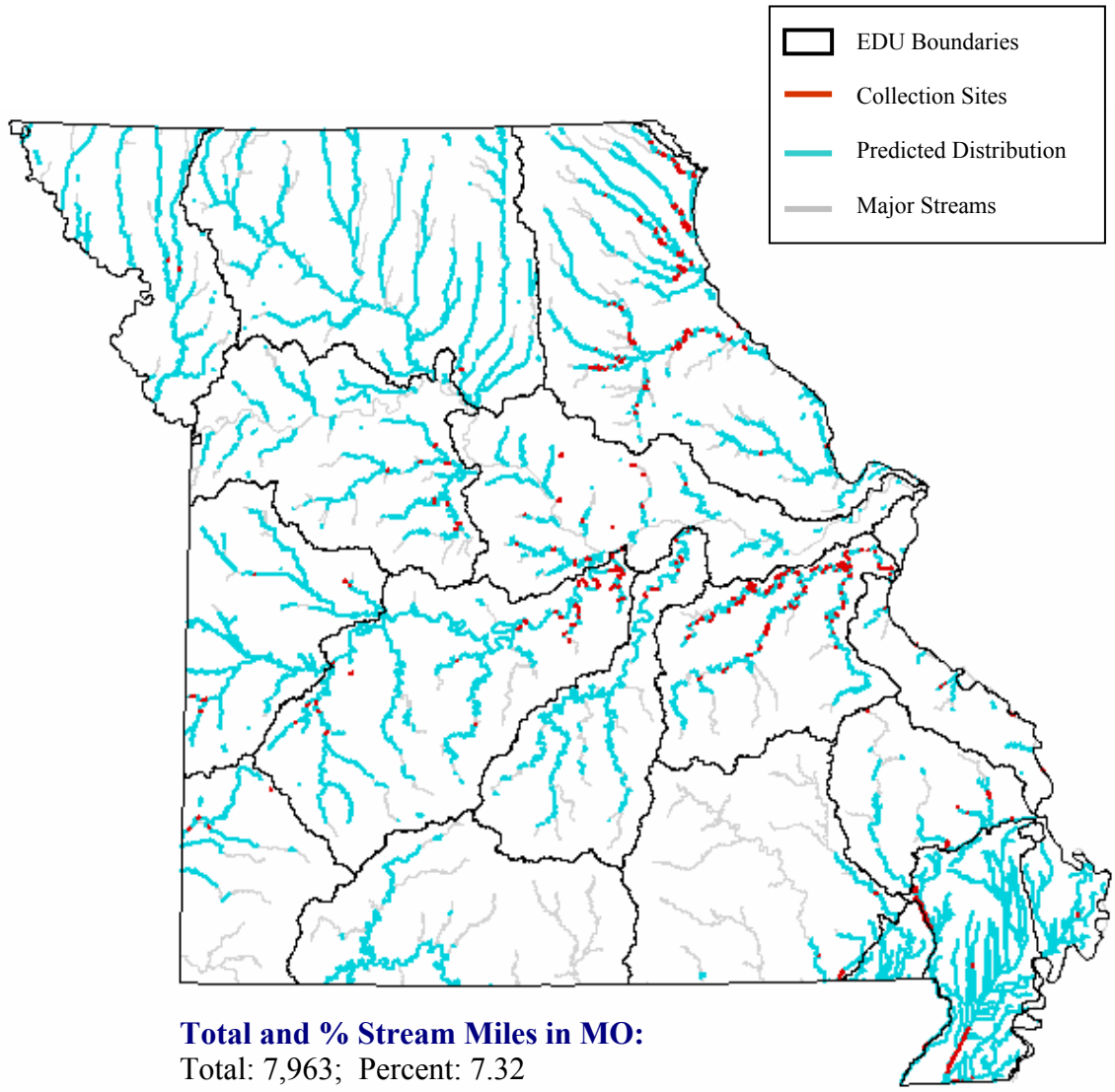
Endemism: Subzone

State Rank: S?

ITIS Code: 80006

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 7,963; Percent: 7.32

MUSSEL DISTRIBUTIONS DO NOT INCLUDE MISSOURI OR MISSISSIPPI RIVERS

State Range:

According to collection records and professional review it is believed that the yellow sandshell is found nearly statewide except for the Elk, Eleven Point, North Fork of the White and upper Current River watersheds.

Habitat Affinities:

The yellow sandshell occurs in small to large rivers in areas of slow to moderate current with turbid water and sand, sandy mud or fine gravel substrates (Harris and Gordon 1990; Cummins and Mayer 1992; Oesch 1995; Bruenderman et. al 2002). It is also found in sloughs, backwaters, oxbows, ponds, lakes and reservoirs (Burenderman et. al 2002). Buchanan (1980) found this species in standing to moderately flowing water and in a variety of substrates, but states that it was most commonly collected from silt substrates.

Predictive Model(s):

Central Plains/Ozark Model
Query 1: ([Flow] = 1)
Query 2: (([GradsegR] = 1) and ([Temp_code] = 2)) or (([GradsegR] = 2) and ([Linkr] >= 5))

Mississippi Alluvial Basin Model
([Core_crowley] = 0) and ([State] = "MO") and ([Ssize_code] >= 2) and ([Ssize_code] <= 4)

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Zebra Mussel

Dreissena polymorpha

Native: No

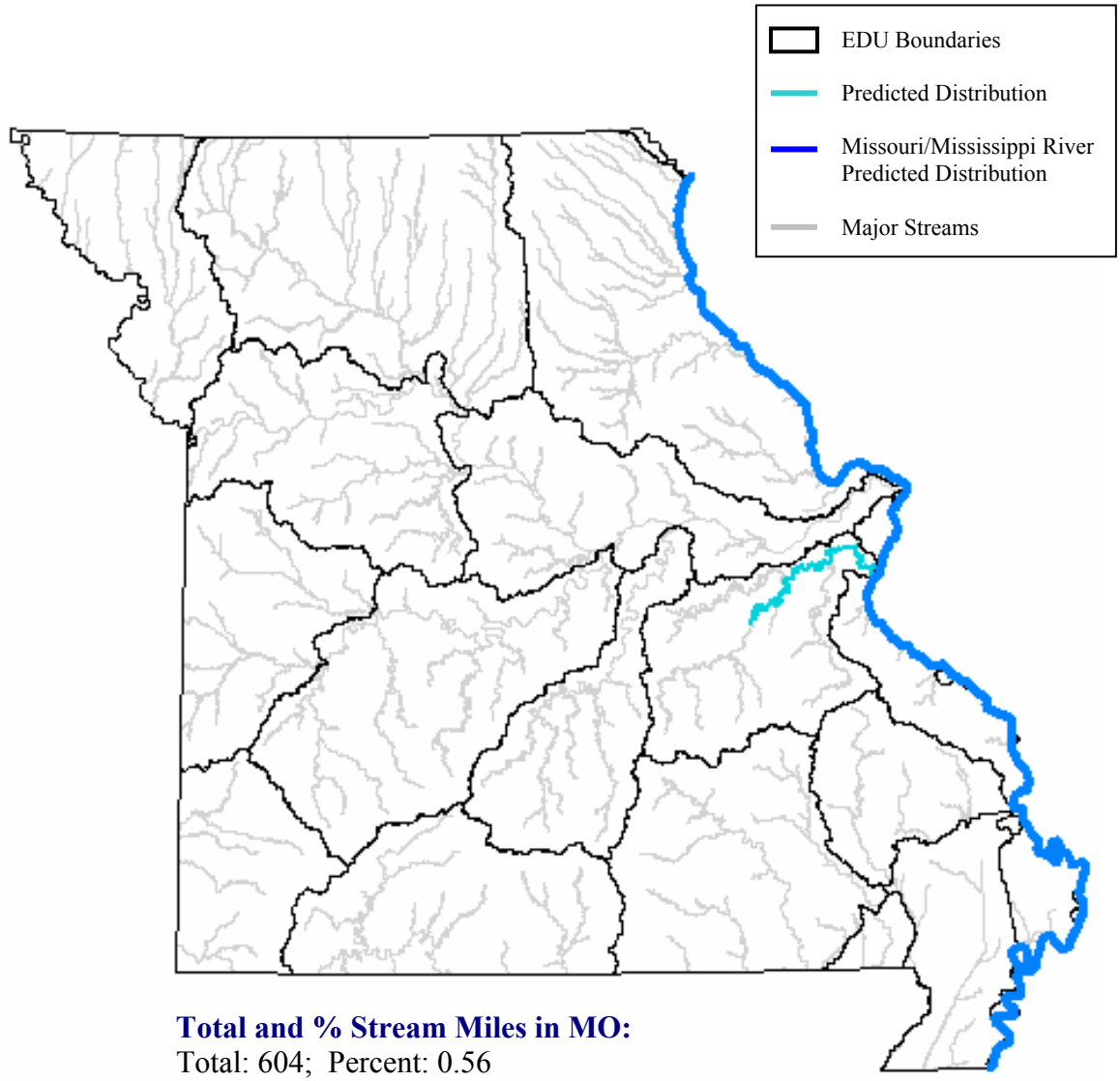
Endemism: NA

State Rank: SE

ITIS Code: 81339

Global Rank: G5

Modeled By: Gust Annis, Pam Haverland, Michael Morey, Scott Sowa, John Stanovick



Total and % Stream Miles in MO:
Total: 604; Percent: 0.56

State Range:

Based on information from the U.S Army Corps of Engineer's Zebra Mussel Information System at: http://www.wes.army.mil/el/zebra/zmis/zmishelp.htm, the present known distribution of the zebra mussel in Missouri includes the Mississippi River below the Illinois River and the lower portion of the Meramec River.

Habitat Affinities:

Taken from the Zebra Mussel Information System website unless noted otherwise.
The zebra mussel inhabits lakes and streams of all sizes (Cummins and Mayer 1992). Adults generally require a hard substrate for attachment via byssal threads, however, zebra mussels can often live in silty sediments by initially attaching to small fragments of plants, wood, shells, and stones and subsequently attaching to each other to form druses. Berkman et al. (1998) found that zebra mussels can directly colonize sand particles smaller than 1 mm and then use their byssal threads to bind sediments into conglomerates. Juveniles will settle in internal piping and along any submerged area with a flow rate of less than 1.5 m/sec (Claudi and Mackie 1994). Zebra mussels avoid high-velocity flow locations and typically will detach from such a poor settlement location and move to a more suitable site. Since zebra mussels cannot withstand freezing temperatures, their lower temperature limit is 0 °C (Paukstis et al. 1997). Although they can survive temperatures slightly in excess of 30 °C for short periods, optimum temperatures are generally less than 25 °C. In European waters, the upper temperature limit has been reported to be about 32-34 °C (Karatayev et al. 1998).

The calcium level of a water body is a very critical characteristic for zebra mussel population establishment. Zebra mussels do not survive when there is low calcium concentration in the water, since calcium is an essential element in the composition of the bivalve shell. Sprung (1987) reported that 40-55 mg/liter was sufficient for larval development and that a minimum of 24 mg/liter was necessary for 10 percent larval survival. Stanczykowska (1977) recorded calcium levels of 28-109 mg/liter in lakes with successful zebra mussel populations. Calcium concentrations of 15 mg/liter or less were found to limit the distribution of zebra mussels in the St. Lawrence River (Mellina and Rasmussen 1994). Hincks and Mackie (1997) reported negative shell growth at calcium levels less than 8.5 mg/liter. The pH of water is a very critical characteristic determining whether zebra mussels will be able to survive and reproduce in a water body. Sprung (1987) indicated that a pH lower than 7.4 inhibited zebra mussel larval development. Kornobis (1977) reported that pH levels of 7.2-8.7 had little effect on veliger densities. Stanczykowska (1977) recorded zebra mussels in European lakes with pH levels of 7.7-8.5. Laboratory studies by Bowman and Bailey (1998) have indicated that the upper pH tolerance limit of zebra mussels is between 9.3 and 9.6. For zebra mussels to successfully grow and reproduce, a sufficient amount of oxygen must be dissolved in the water. Karatayev et al. (1998) indicate that zebra mussels require at least 25 percent oxygen saturation. Oxygen levels near the saturation values for a body of water are best for successful zebra mussel growth and reproduction. Stanczykowska (1977) found zebra mussels in European lakes with hypolimnetic oxygen levels ranging from 0.1-11.2 mg/l. Epilimnetic oxygen levels for the same lakes ranged from 4.2-13.3 mg/l (Stanczykowska 1977). These levels are common in most North American lakes. Zebra mussels

(especially smaller ones) can survive for days under anaerobic (little to no oxygen) conditions, with longer survival at lower temperatures (Matthews and McMahon 1999). Although zebra mussels can survive for periods of time at very low oxygen concentrations, these conditions may not be conducive to growth or successful reproduction (Woynarovich 1961).

Predictive Model(s):

Ozark Model
([Linkr] = 7)
This query is based upon existing collection records and professional review.

Great River Model
The distribution is based upon existing collection records and professional review.

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** For a detailed description of the life history of the zebra mussel, potential control and spread of this species, and a nearly comprehensive bibliography the reader is encouraged to visit the U.S Army Corps of Engineer's Zebra Mussel Information System at: http://www.wes.army.mil/el/zebra/zmis/zmishelp.htm

** The U.S. Geological Survey also has a website providing detailed information on the zebra mussel at: http://nas.er.usgs.gov/zebra.mussel/

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