

Atlas of Missouri Amphibians and Reptiles for 2023



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Introduction

Since 1988, members of the Missouri Herpetological Association have compiled new county distribution records for amphibians and reptiles native to the state (Daniel *et al.* 2022 and previous updates). Cumulative accounts of these new records were presented in Powell *et al.* (1993), Powell and Daniel (1997), and Daniel and Edmond (2002). Johnson (2000) presented revised distribution maps based on a combination of these cumulative accounts and more recent annual compilations. The publication of Johnson (1987, 2000) renewed interest in expanding our knowledge of the distribution of the state's herpetofauna. Briggler and Johnson (2021) published an updated version of the *The Amphibians and Reptiles of Missouri* that incorporated all *Atlas* records up until that time. We follow their taxonomy and nomenclature here. In order to provide herpetologists working in Missouri with current information that is easily taken into the field, we are presenting revised species distribution and county records maps in a format that can be easily updated as new records are documented.

In 1997, with the initiation of the Missouri Herpetological Atlas Project (MOHAP), a database was established to serve as the basis for verifying new distribution records and tracking changes in individual species distributions within the state (Edmond and Daniel 2024). Qualification for inclusion in the database requires a catalogued voucher specimen housed in an institutional collection (Appendix A). However, in order to be valuable in tracking changes in the distribution of individual species, it is important to document historical records. Many of the specimens collected prior to the 1970s, most notably those reported by Hurter (1911) and Anderson (1965), were documented by specimens that have since been lost or destroyed. In order to provide the most accurate picture of the distribution of the state's herpetofauna we have included some literature records (Appendix B).

Some records were not included because the identification could not be determined with certainty. Within Missouri, the *Hyla versicolor* complex consists of two broadly sympatric and morphologically indistinguishable species (*H. chrysoscelis* and *H. versicolor*). Specimens collected for which the species identification was not determined by some non-morphological trait were not included.

Currently, the MOHAP database contains 38,487 entries and 34,349 valid, non-duplicated collections. This represents specimens housed in 37 museum collections and cited from 33 historical literature sources; 5,347 documented county records; 10,816 unique localities; and 18,150 unique species / locality combinations. This new total constitutes 679 new database entries since the 2021 edition of the *Atlas* (Daniel and Edmond 2022). The total number of species contained in the current edition of the atlas is 118, comprised of 116 native species and 2 non-native species.

Previous editions of the atlas are available upon request. Readers may contribute new records and read more about project details online (Edmond and Daniel 2024). Questions, comments, and suggestions should be directed to the senior author.

Amphibians and Reptiles of Possible Occurrence

A number of species found in surrounding states are known to occur in close proximity to the borders of Missouri. While not currently recognized as part of the Missouri herpetofauna, some or all of these species may eventually be found within the state.

A number of primarily eastern species have distributions that reach the Mississippi River along a portion of the Missouri border. These include: Southern Two-lined Salamander (*Eurycea cirrigera*), Three-lined Salamander (*Eurycea guttolineata*), Northern Zigzag Salamander (*Plethodon dorsalis*), Northern Slimy Salamander (*Plethodon glutinosus*), Eastern Cricket Frog (*Acris crepitans*), Western Chorus Frog (*Pseudacris triseriata*), Bird-voiced Treefrog (*Hyla avivoca*), Eastern Fence Lizard (*Sceloporus undulatus*), Gray Ratsnake (*Pantherophis spiloides*), and Eastern Ribbonsnake (*Thamnophis sauritus*).

Rivers, even large ones, change course over time and typically form an imperfect geographic barrier. Shepard and Kuhns (2017) examined the separation between Northern Slimy Salamanders (*Plethodon glutinosus*) and Western Slimy Salamanders (*Plethodon albagula*) along the Illinois-Missouri border. They found that salamanders on Fountain Bluff, an island formed of Missouri uplands cut off by post-glacial changes in the Mississippi River channel, belong to the species found in Illinois.

Spotted Dusky Salamander (*Desmognathus conanti*) and Midwestern Earthsnake (*Carphophis amoenus*) have been reported in the southern portion of Crowley's Ridge of Arkansas. Crowley's Ridge is a thin, sandy upland formed during the Pleistocene, which extends from northeastern Arkansas through southeast Missouri to the Shawnee Hills of Illinois. Populations of one or both of these species may exist in the isolated remnants of Crowley's Ridge in Missouri.

Powell *et al.* (2016) shows the distribution of the Western Milksnake (*Lampropeltis gentilis*) extending into western Missouri along the Kansas border. However, the sparsity of records from this region makes it difficult to accurately define the species boundary. Until additional material is available for evaluation, we have not included this species as part of the state herpetofauna.

Erroneously Reported and Non-Native Species

Anderson (1945) reported two specimens of the Dwarf Salamander (*Eurycea quadridigitata*) from Roaring River State Park in Barry County. With the nearest known naturally occurring populations of *E. quadridigitata* in southern Arkansas, more than 125 miles from the Missouri border, it is likely that this record is based on misidentified, but morphologically similar Oklahoma Salamanders (*E. tynerensis*).

Johnson and Bader (1974) included Lesser Earless Lizard (*Holbrookia maculata*) based on two specimens

collected from Knob Noster State Park in Johnson County. Nickerson and Krager (1972) considered this record problematic because of the close proximity of the park to Whiteman Air Force Base and Central Missouri State University. The nearest record of this species is more than 115 miles away in central Kansas. Further searches failed to produce additional specimens. As a result, this species is not considered to be part of Missouri's herpetofauna.

Anderson (1957) listed the occurrence of the Queensnake (*Regina septemvittata*) in Missouri based on three specimens deposited in the American Museum of Natural History collection. These specimens were ascribed to G.K. Noble and reported to come from Stone County. In further investigation by Roger Conant (1960), Byron C. Marshall, who worked with Noble in the Interior Highlands during this period, reportedly had no recollection of finding this species. The nearest known populations of Queen Snake are in the Boston Mountains of Arkansas, approximately 80 miles south of this locality. The questions about the origin of the specimens and the absence of additional records from Missouri suggest that this species does not occur in the state.

One species of non-native frog and two species of lizards have been reported in Missouri. A population of Greenhouse Frogs (*Eleutherodactylus planirostris*) was established inside a commercial greenhouse in Jefferson City, Missouri (J. Briggler, pers. comm.). The population of these small terrestrial breeding frogs persisted for several years, but has apparently disappeared following renovation of the greenhouse. There are no other reports of this tropical species occurring within the state. Its apparent inability to survive extreme winter weather makes it unlikely for these frogs to exist in Missouri as a free-ranging species outside of sheltered habitats, such as greenhouses.

Mediterranean Gecko (*Hemidactylus turcicus*) is native to the Mediterranean basin and western Asia. This species is easily transported and a highly successful colonizer. Populations of this species have been established worldwide. In the United States, this species is currently established widely throughout the south, especially along the Gulf and East Coasts. Isolated populations are also found around numerous urban centers of the Midwest and central plains (Powell *et al.* 2016). Two populations appear to be established in Missouri. Bufalino (2004) reported this species from St. Louis County. A second population was discovered in Joplin, Missouri by Mr. A. Braun (Daniel *et al.* 2015).

Briggler *et al.* (2015) reported the presence of a robust population of Italian Wall Lizard (*Podarcis siculus*) in a Joplin neighborhood after being contacted by a resident in 2013. This population apparently descended from a series of lizards imported from Topeka, KS, which escaped in 2001. In many states, including Missouri, it is illegal to release non-native species. Despite prohibitions, the majority of introduced populations of this species in North America originated from released animals in the pet trade (Burke and Deichsel 2008).

Thus far, non-native amphibians and reptiles in Missouri have been confined to urban centers and do not appear to constitute a threat to our native herpetofauna. However, this is not the case everywhere and non-native

species that have become invasive are considered by many biologists to be a major threat, second only to habitat loss or degradation, to native species. Responsible pet owners should always exercise care to prevent the spread of this and all non-native species into the natural environment.

Distributions

Distribution is one of many characteristics used to describe a species and range maps (such as those found in Conant and Collins (1998)) are used to approximate a species' likely distribution. This atlas uses locality dot maps, with each dot representing a known locality for that species. This conservative method results in an underestimate of a species distribution but is more accurate than a range map. The purpose of the atlas project is to document as closely as possible both current and historical distributions for all native amphibians and reptiles in Missouri.

However, the printed version of the atlas only reflects the best historical approximation of each species' distribution in the state. The most noticeable resulting incongruity is that fact that some species are shown in historical localities in which they are almost certainly no longer found. For example, the Smooth Greensnake (*Opheodrys vernalis*) was once found in scattered populations in the prairie regions of the state. Due to extensive habitat loss and possibly other reasons, they are extremely rare or extirpated in the state.

While natural communities have long been a staple in ecology, formal classification of natural communities has been undertaken relatively recently in Missouri (Nelson 2005). Like individual species, natural communities can be described and characterized with distinct distributions and abundances in different ecoregions (see next section). For example, glades are common in the Ozarks but rare elsewhere in the state. Steyermark (1963), Yatskievych (1999), Pflieger (1989), Hawker (1992), and Unklesbay and Vineyard (1992) all describe and summarize the complex interplay among geology, natural history, ecoregions, natural divisions, and natural communities from slightly different perspectives. Taken together, these ideas form the basis of the biogeography of Missouri and they are essential in understanding why plants and animals have the distributions that we see today.

Terrestrial Ecoregions

An ecoregion classification system attempts to define and describe geographic regions that correspond to broad ecosystem patterns, topography, geology, soils, vegetation patterns, and the distributions of plants and animals. Omernik (1987) described ecoregions (Levels I, II, and III) for the conterminous United States as a hierarchical scheme with Level I corresponding to large regions and Level III representing smaller, more precisely described regions. The Environmental Protection Agency (2003) is coordinating an effort to further subdivide Level III regions into Level IV regions. Nigh and Schroeder (2002) published Level III and Level IV ecoregions for Missouri.

Some amphibian and reptile species follow defined ecoregions closely. For example, the Cave Salamander (*Eurycea lucifuga*) is neatly confined to the Ozark Highlands (Level III) and found throughout the ecoregion, with the exception of most of the Springfield Plateau (Level IV). Several species found in the southeastern alluvial plain are particularly characteristic and also confined to that area (e.g., Three-toed Amphiuma (*Amphiuma tridactylum*) and Southern Watersnake (*Nerodia fasciata*)).

Many species, however, seem to be abundant throughout Missouri, regardless of the region or natural community. The American Bullfrog (*Lithobates catesbeianus*), Snapping Turtle (*Chelydra serpentina*), and Western Ratsnake (*Pantherophis obsoletus*) among several others fall into this category. Finally, many species are more closely associated with a particular natural community or habitat than with a particular ecoregion or natural division. For example, The Flat-headed Snake (*Tantilla gracilis*) can be found in the Ozark Highlands, Osage Prairie, and Interior River Valleys and Hills but it is restricted to rocky glades.

In general, Level IV ecoregions are too granular to be useful in describing the distributions of Missouri amphibians and reptiles, several Ozark salamander species and many of the coastal plains species being notable exceptions. However, this level of detail is useful to understand natural community distributions on which some species are dependent. It also underscores the importance of looking at border states and across artificial political boundaries to understand distributions within Missouri.

Level I (page 8), Level II (page 9), Level III (page 10), and Level IV (page 11) ecoregion maps for Missouri and surrounding states, based on Omernik (1987) and Nigh and Schroeder (2002) are included here. The hierarchy for Levels I, II, and III is included in Table 1 (below), while the Level III and Level IV hierarchy is included in Table 2 (below). Unfortunately, the authors' coding scheme for Level III is inconsistent, though the names do match. Both authors' codes for Level III are included in the tables as a cross-reference. An earlier approach by Thom and Wilson (1980) divided Missouri into natural divisions and sections (page 7), roughly corresponding to Level III and Level IV ecoregions, respectively.

Table 1. List of Level I, II, and III Terrestrial Ecoregions from Omernik (1987). Those regions marked with an asterisk (*) do not occur in Missouri but are sufficiently close to be of interest to Missouri biologists. Level III codes from Nigh and Schroeder (2002) are in parentheses.

8. Eastern Temperate Forests

8.3. Southeastern USA Plains

8.3.3. Interior Plateau* (71)

8.3.6. Mississippi Valley Loess Plains (74)

8.3.2. Interior River Valleys and Hills (72)

8.4. Ozark / Ouachita / Appalachian Forests

8.4.5. Ozark Highlands (39)

8.4.6. Boston Mountains* (38)

8.5. Southeast US Coastal Plain

8.5.2. Mississippi Alluvial Plain (73)

9. Great Plains

9.2. Temperate Prairies

9.2.3. Western Corn Belt Plains (47)

9.2.4. Central Irregular Plains (40)

Table 2. List of Level III and Level IV Terrestrial Ecoregions from Nigh and Schroeder (2002). Those regions marked with an asterisk (*) do not occur in Missouri but are sufficiently close to be of interest to Missouri biologists. Those regions marked with a caret (^) are contained entirely within the state's borders.

38. Boston Mountains* (8.4.6)

38a. Upper Boston Mountains*

38b. Lower Boston Mountains*

39. Ozark Highlands (8.4.5)

39a. Springfield Plateau

39b. Elk River Hills

39c. White River Hills

39d. Central Plateau

39e. Osage / Gasconade River Hills^

39f. Saint Francois Knobs / Basins^

39g. Meramec River Hills^

39h. Current River Hills^

39i. Easter Ozark Border^

39j. Black River Hills Border^

39k. Prairie Ozark Border^

40. Central Irregular Plains (9.2.4)

40a. Loess Flats and Till Plains

40b. Osage Cuestas*

40c. Wooded Osage Plains

40d. Cherokee Plains

40e. Claypan Prairie^

47. Western Corn Belt Plains (9.2.3)

47d. Missouri Alluvial Plain

47e. Steeply Rolling Loess Prairies

47f. Rolling Loess Prairies

47h. Nebraska / Kansas Loess Hills*

47i. Loess and Glacial Drift Hills*

47m. Western Loess Hills

71. Interior Plateau* (8.3.3)

71m. Northern Shawnee Hills*

71n. Southern Shawnee Hills*

72. Interior River Valleys and Hills (8.3.2)

72a. Wabash / Ohio Bottomlands*

72d. Upper Mississippi Alluvial Plain

72e. Middle Mississippi Alluvial Plain

72f. River Hills

72g. Southern Ozarkian River Bluffs*

72i. Western Dissected Illinoian Till Plain*

72j. Southern Illinoian Till Plain*

72k. Cretaceous Hills*

72l. Karstic Northern Ozarkian River Bluffs*

73. Mississippi Alluvial Plain (8.5.2)

73a. Northern Holocene Meander Belts

73b. Northern Pleistocene Valley Trains*

73c. Saint Francis Lowlands

73f. Western Lowlands Holocene Meander Belts

73g. Western Lowlands Pleistocene Valley Trains

74. Valley Loess Plains (8.3.6)

74a. Bluff Hills

74b. Loess Plains

- * Apple / Joachim (a)
- * Black / Current (d)
- * Gasconade (b)
- * Meramec (a)
- * Moreau / Loutre (b)
- * Osage (b)
- * Neosho (c)
- * Upper Saint Francis / Castor (a)
- * White (d)

* Mississippi Alluvial Subregion

- * Black / Cache (a)
- * Saint Francis / Little (a)
- * Saint Johns Bayou (a)

Aquatic Subregions

Like terrestrial ecoregions, aquatic subregions can be classified in discrete units, based on watershed and hydrological characteristics. Subregions are composed of ecological drainage units, which are major watersheds that are consolidated based on similarity and proximity (MSDIS 2009a). Subregions and their component drainage units can be seen in Table 3 (below).

Naturally, many of the same patterns emerge in both terrestrial and aquatic geographic classifications since the two are not independent of one another. However, aquatic subregions and ecological drainage units can differ from their terrestrial counterparts since most aquatic organisms are confined to watersheds as well as specific habitats. Since many species of amphibians and reptiles are partially or wholly dependent on aquatic habitats, distributions can sometimes be best understood and explained by examining aquatic subregions, ecological drainage units, and even individual watersheds.

The base map for major rivers and streams (page 12) shows locations of actual rivers and streams inside Missouri and just outside the state's borders where appropriate (USGS 1994; MDC 2007b). The watershed boundaries map (page 13) displays the maximum terrestrial boundary for major watersheds (NRCS 2002). Both of these maps are underlain with unique background colors to display Missouri's primary drainage systems: a) Mississippi River, b) Missouri River, c) Arkansas River, and d) White River.

Some species found in the state exhibit distributions that can be better understood by referring to these primary drainage systems. The ecological drainage units map (page 14) shows a somewhat consolidated view of the watersheds map based on those watersheds and other characteristics. It is underlain with unique background colors showing the three broad aquatic subregions in the state. Still more detailed aquatic region classifications are available but often include areas based on very small creeks and their watersheds and are therefore not included here.

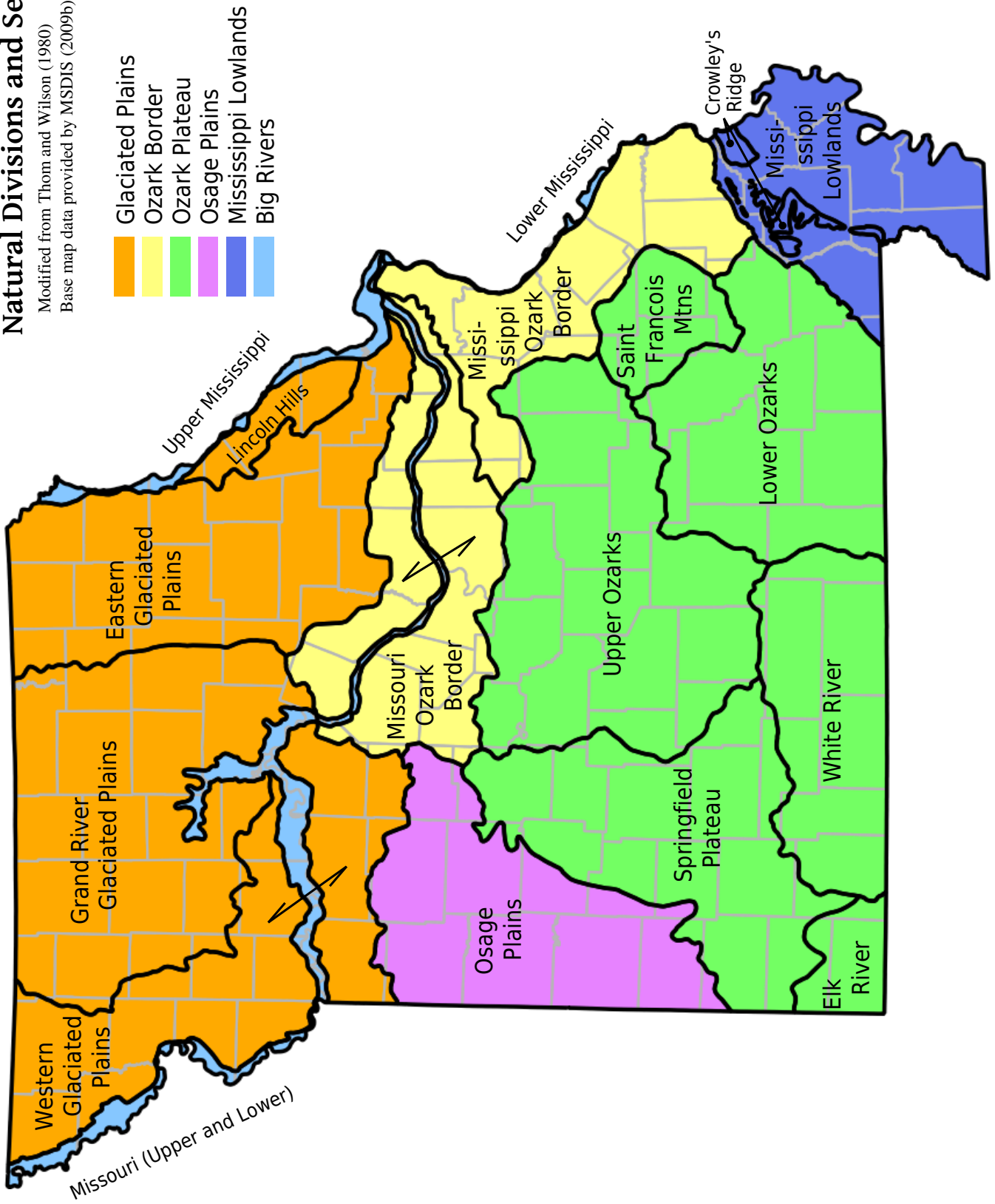
Table 3. List of Aquatic Subregions and Ecological Drainage Units from MSDIS (2009a, 2009c). Each drainage unit is indicated with its primary drainage system: a) Mississippi River, b) Missouri River, c) Arkansas River, d) White River.

- * Central Plains Subregion
 - * Blackwater / Lamine (b)
 - * Cuivre / Salt (a)
 - * Des Moines (a)
 - * Grand / Chariton (b)
 - * Kansas (b)
 - * Nishnabotna / Platte (b)
 - * Osage / South Grand (b)
- * Ozarks Subregion

Natural Divisions and Sections

Modified from Thom and Wilson (1980)

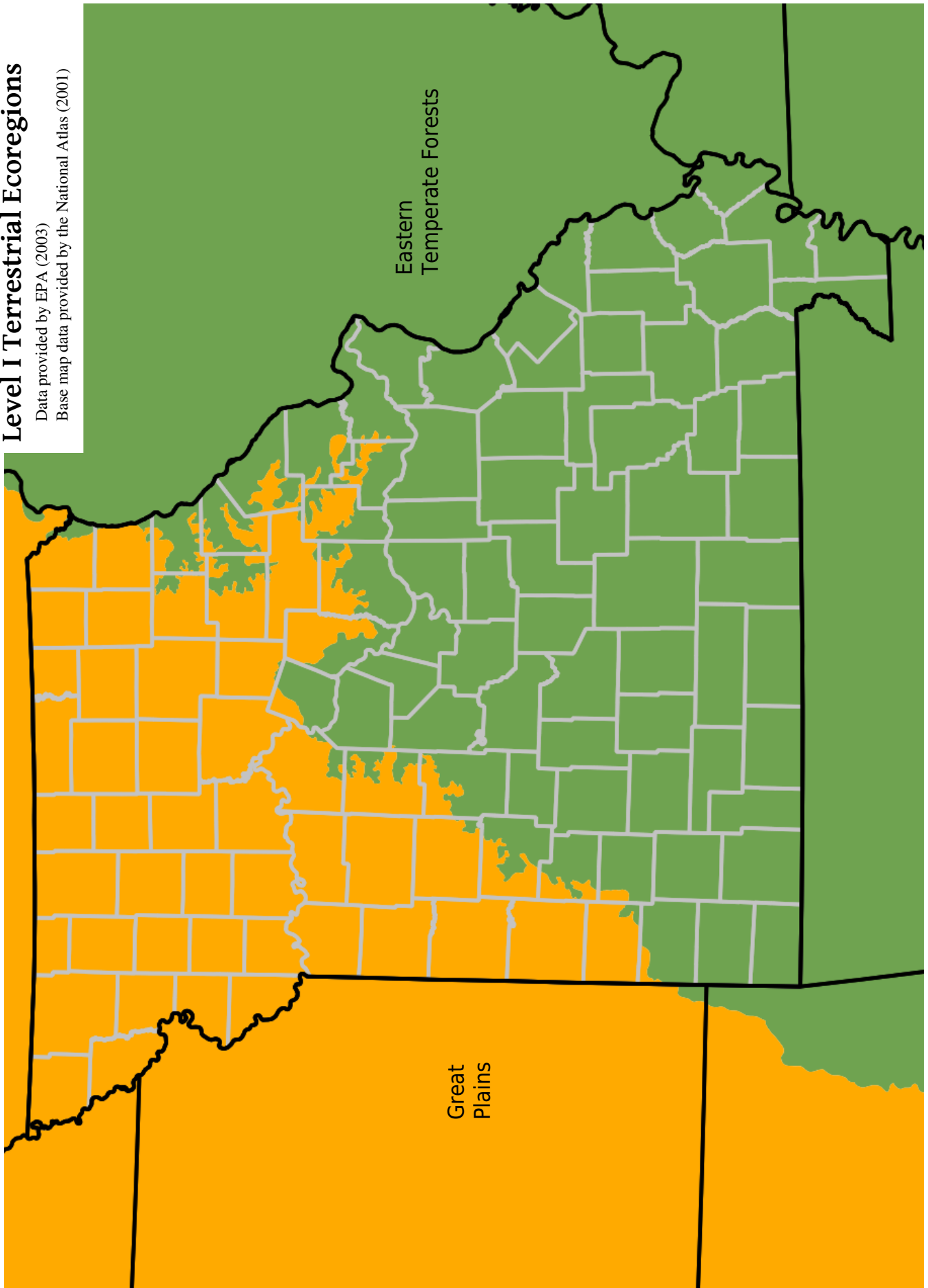
Base map data provided by MSDIS (2009b) and MDC (2007a)

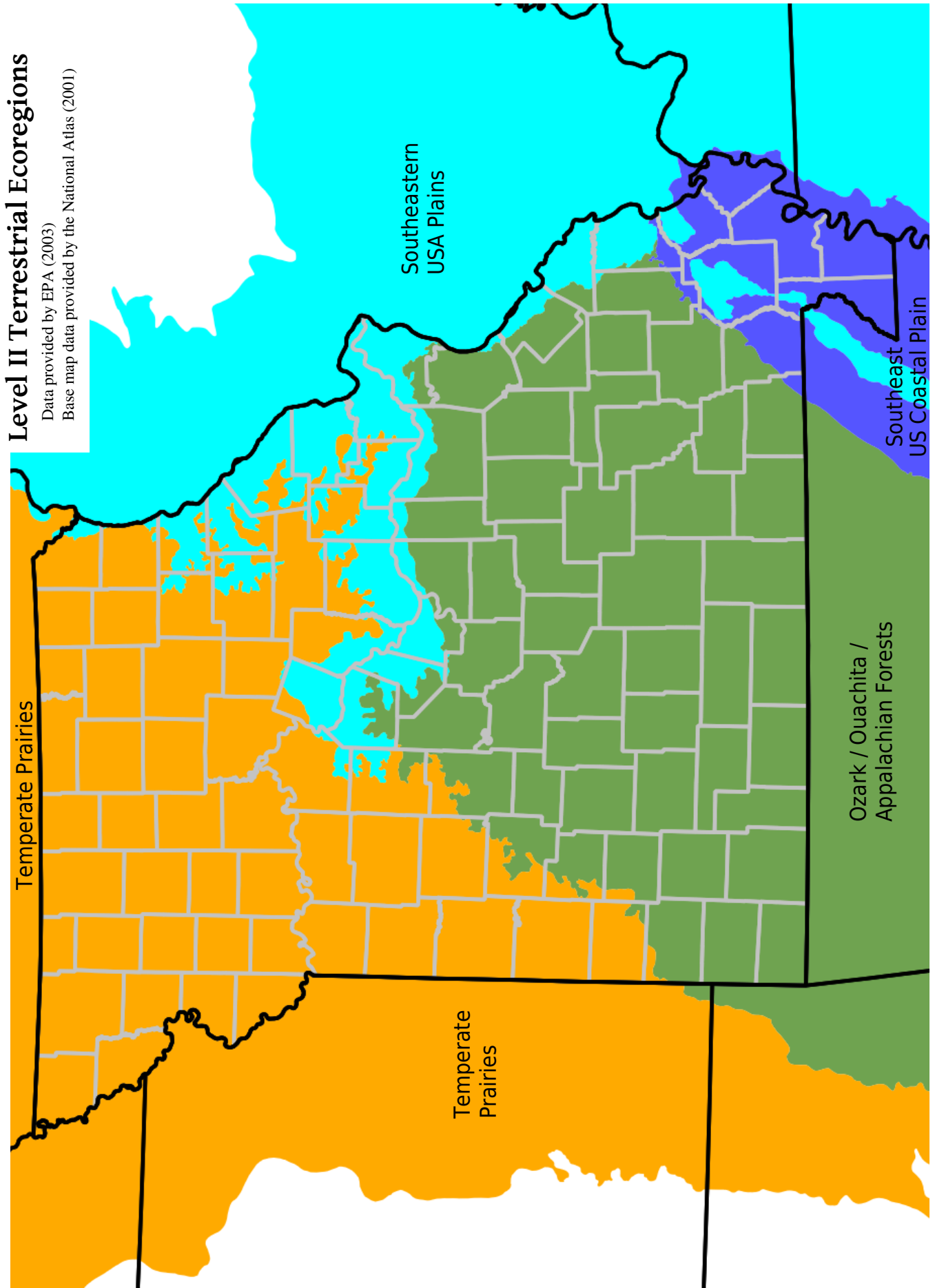


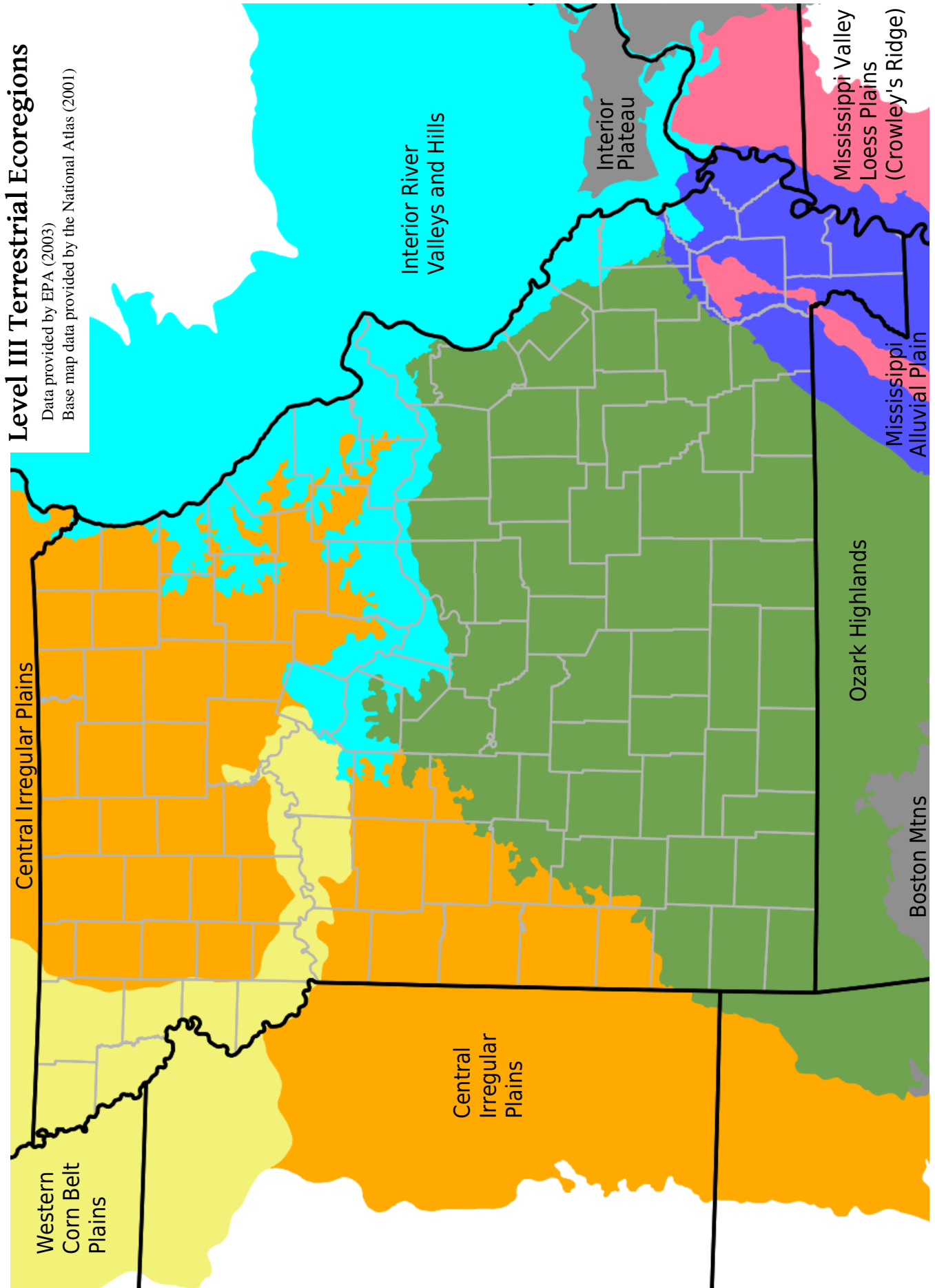
Level I Terrestrial Ecoregions

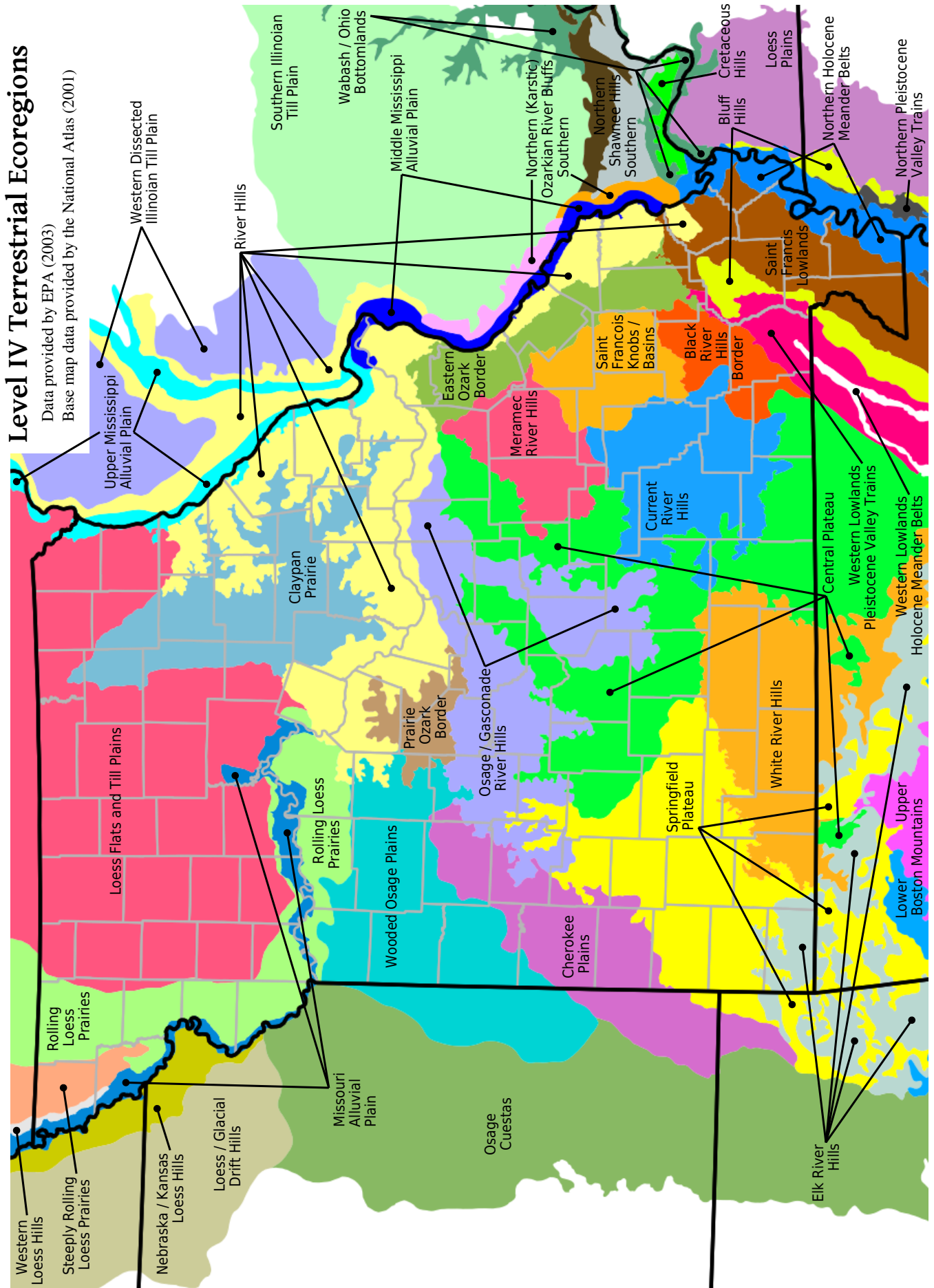
Data provided by EPA (2003)

Base map data provided by the National Atlas (2001)



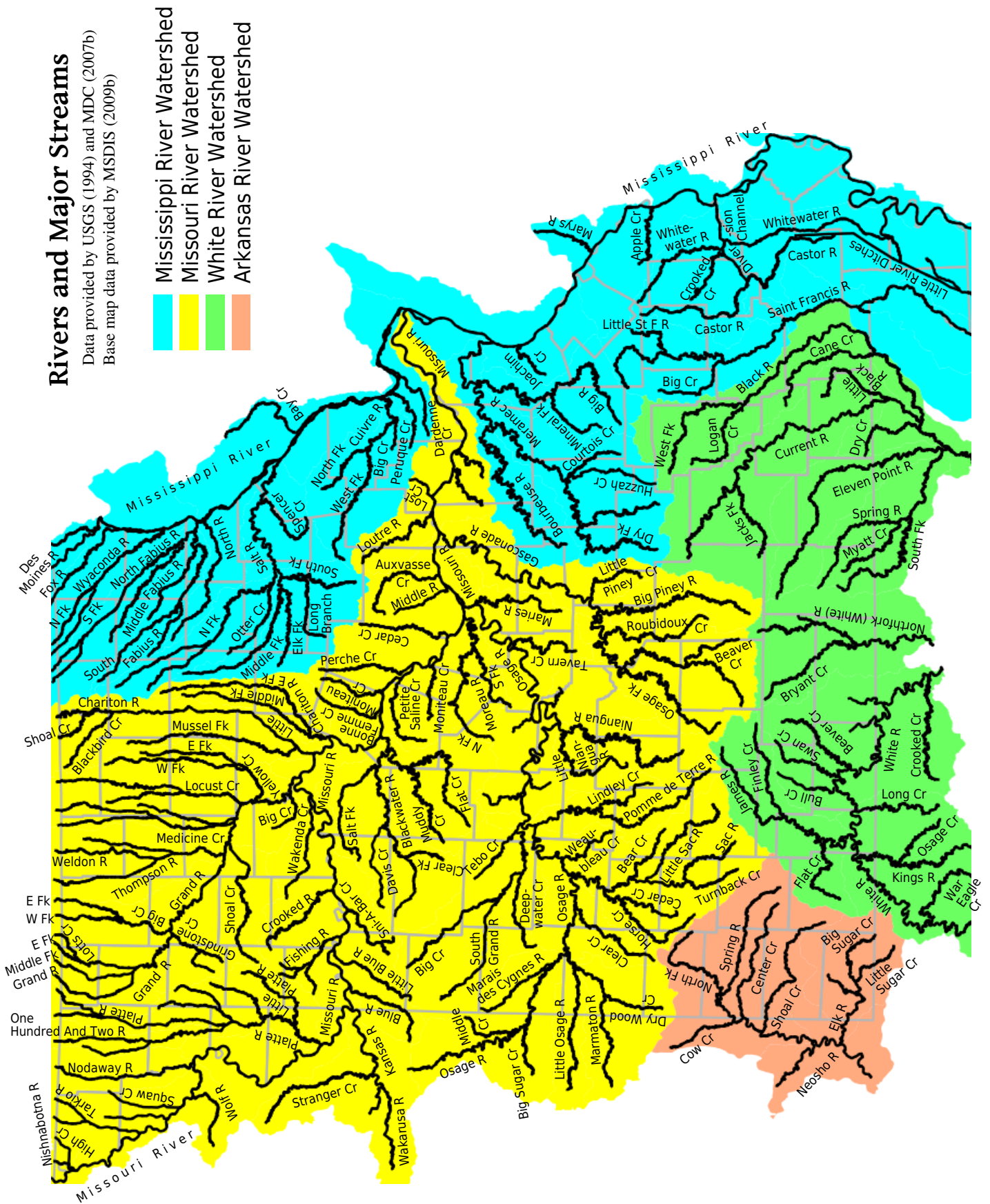


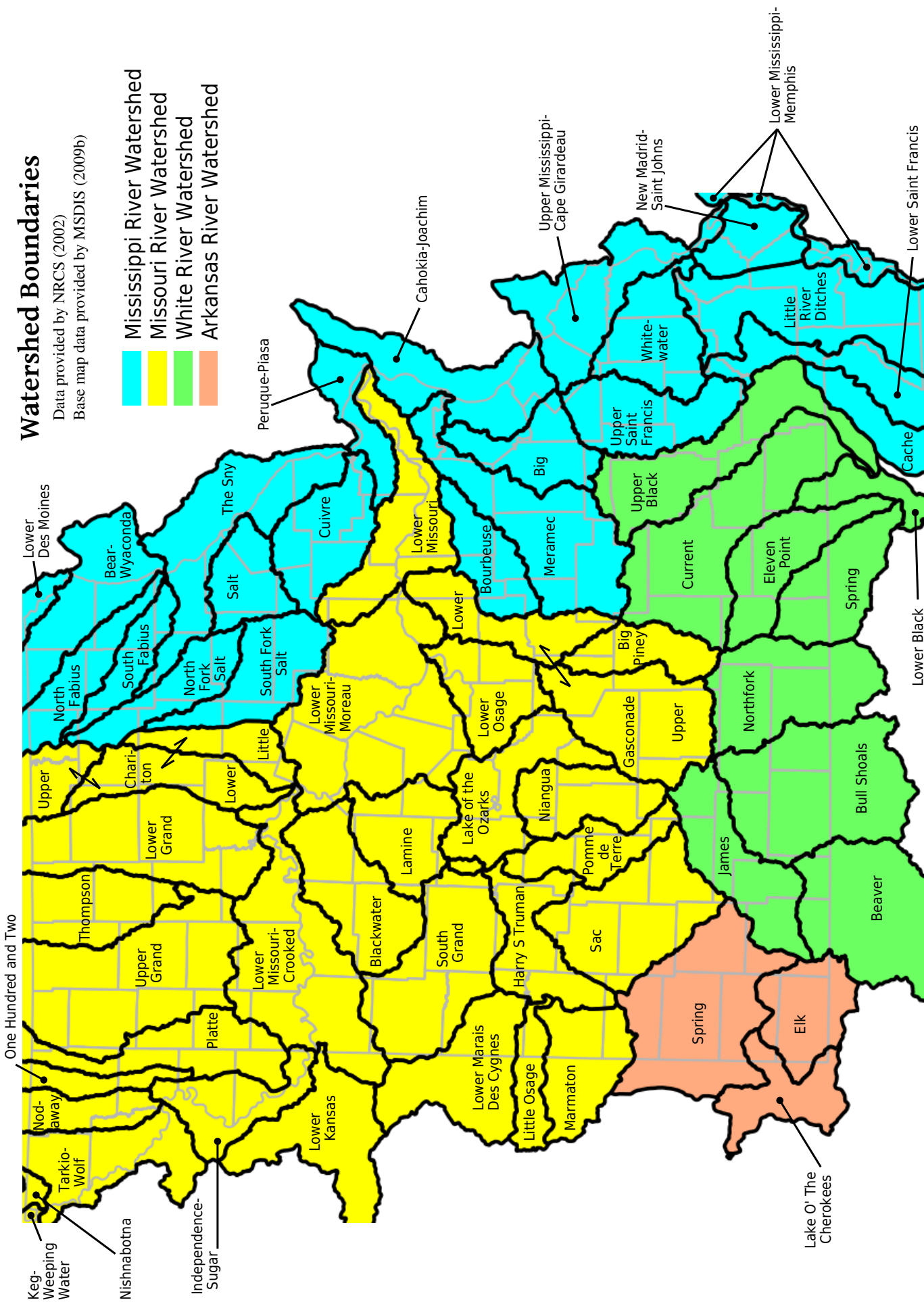


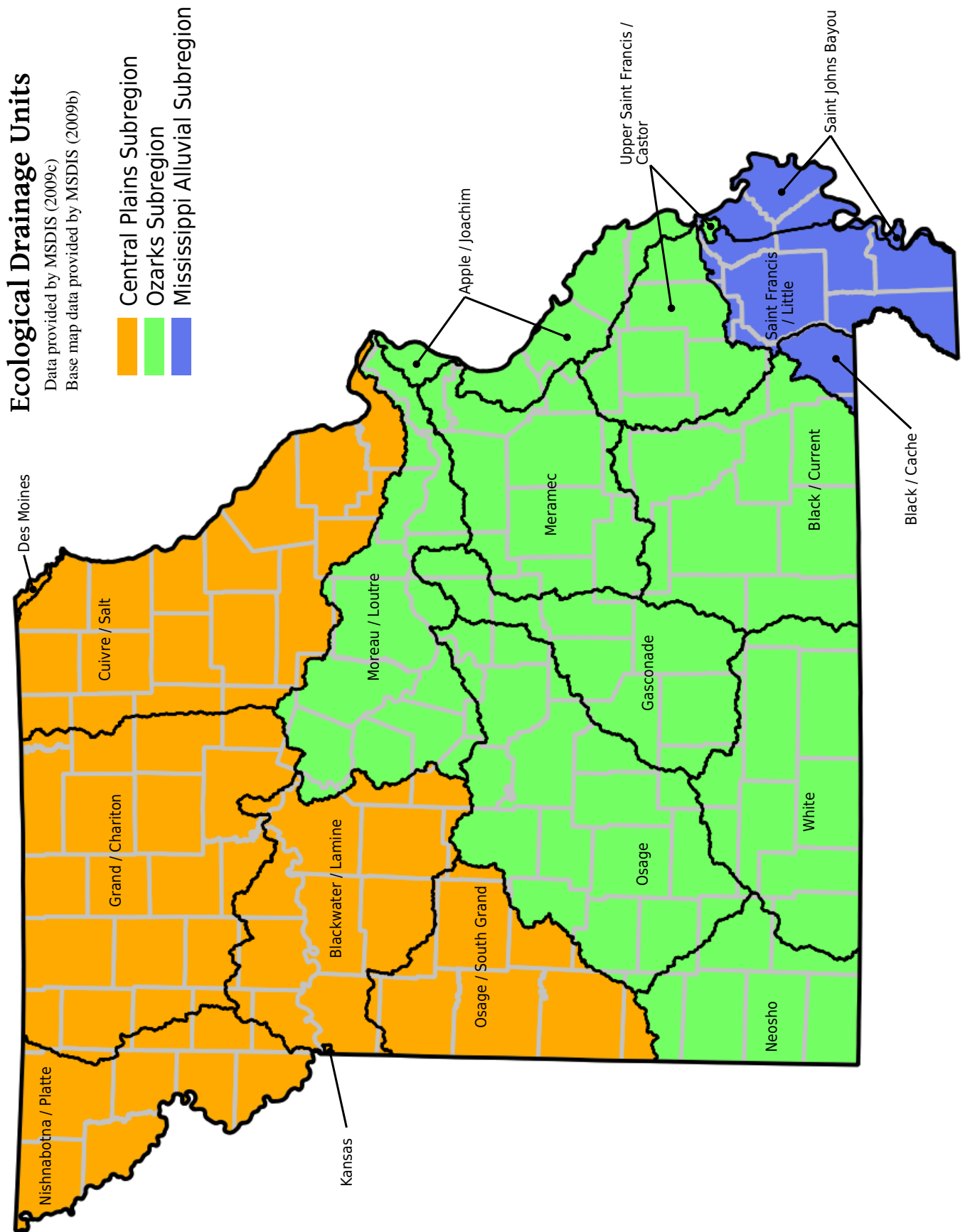


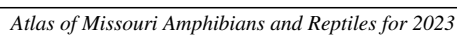
Rivers and Major Streams

Data provided by USGS (1994) and MDC (2007b)
Base map data provided by MSDIS (2009b)





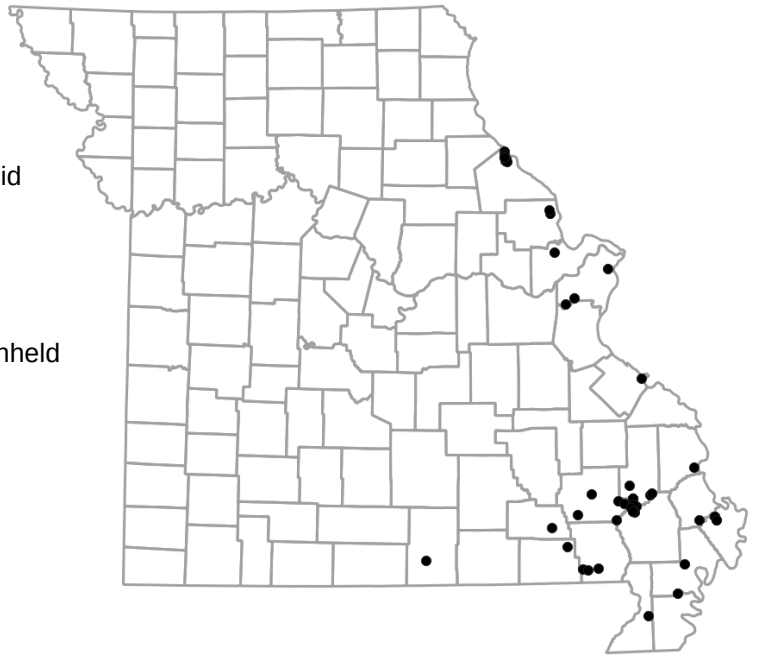




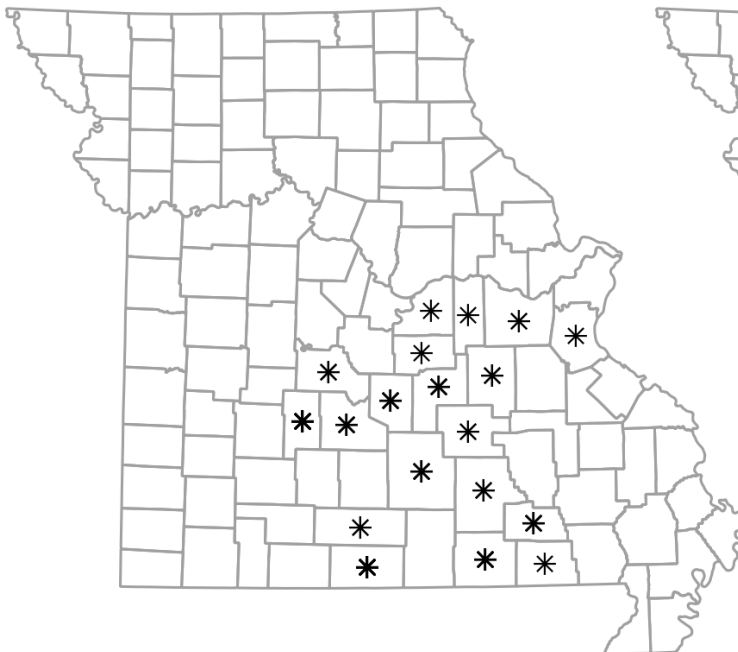
Species Locality Maps

Key:

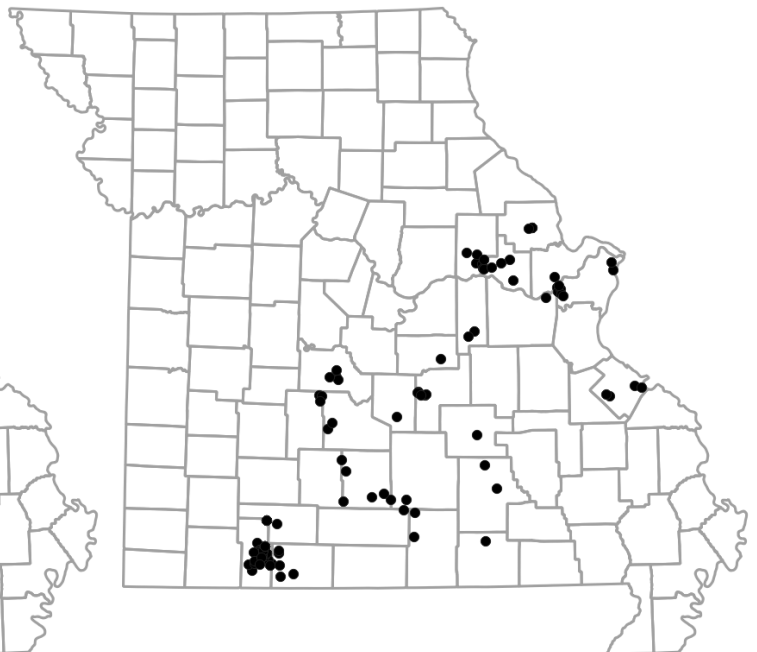
- Museum or published record believed to be valid
- * County record only for:
 - Valid record without a specific locality
 - Species of conservation concern, locality withheld
- ? Questionable record that may be valid



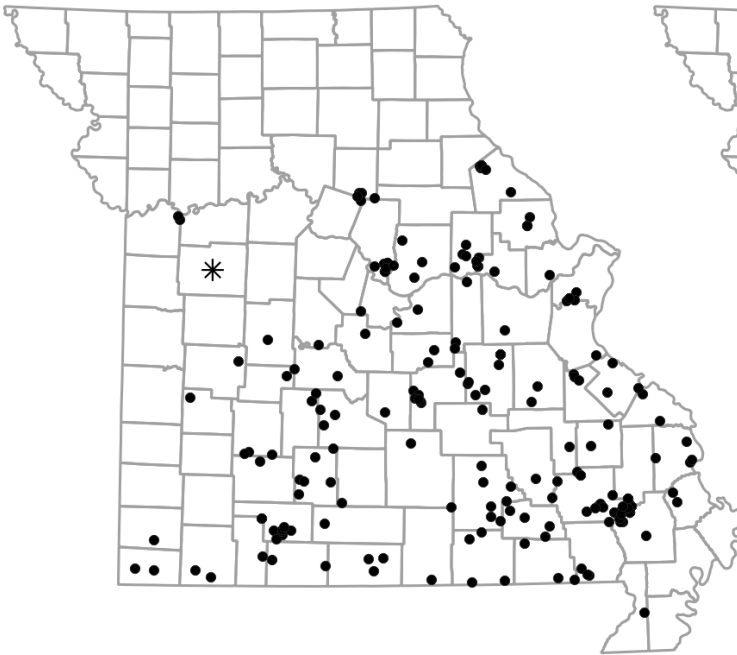
Siren intermedia
Western Lesser Siren



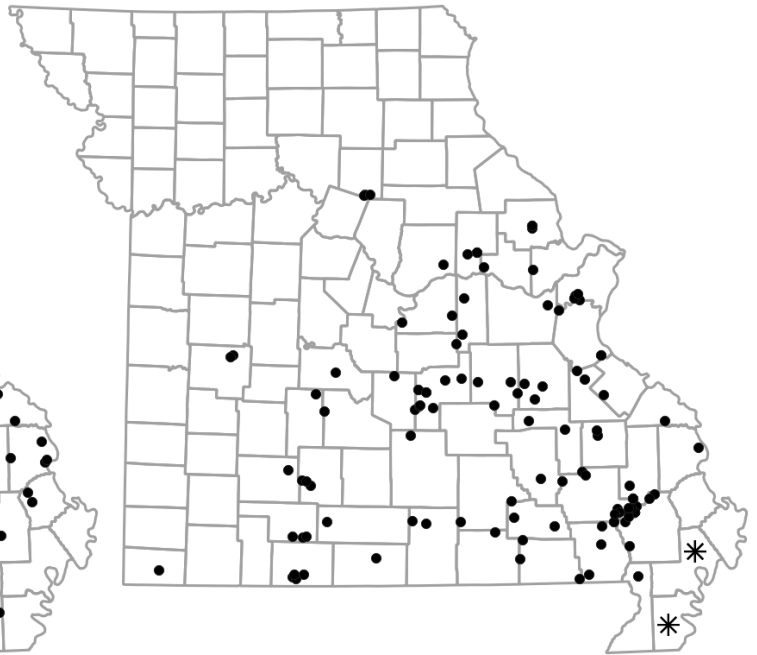
Cryptobranchus alleganiensis
Hellbender



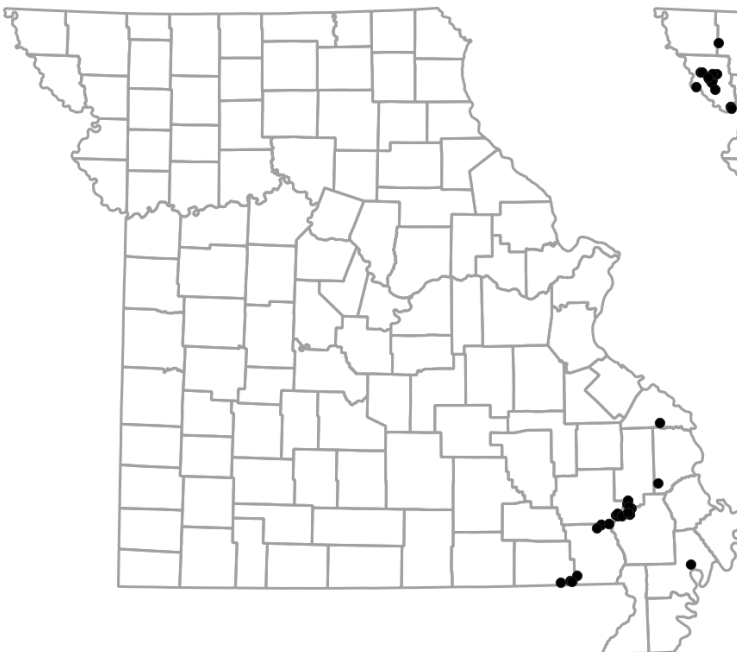
Ambystoma annulatum
Ringed Salamander



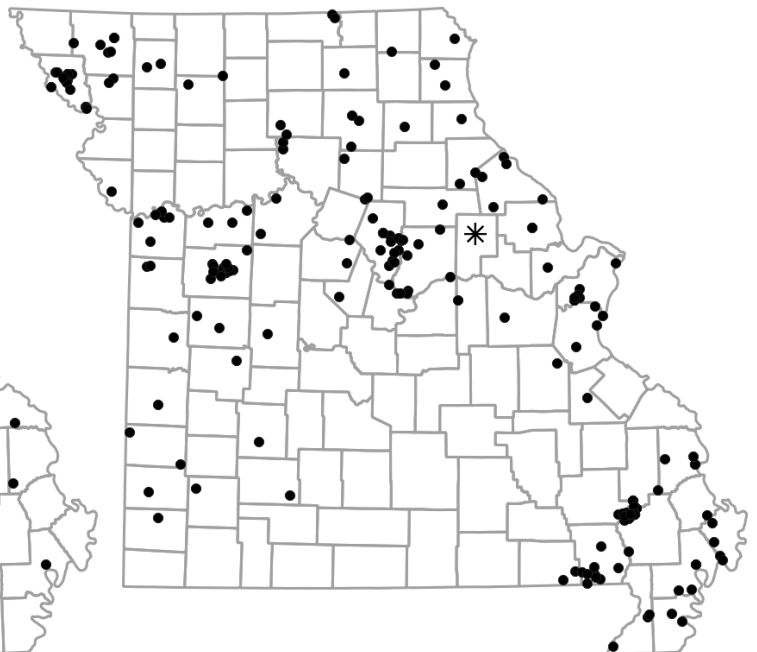
Ambystoma maculatum
Spotted Salamander



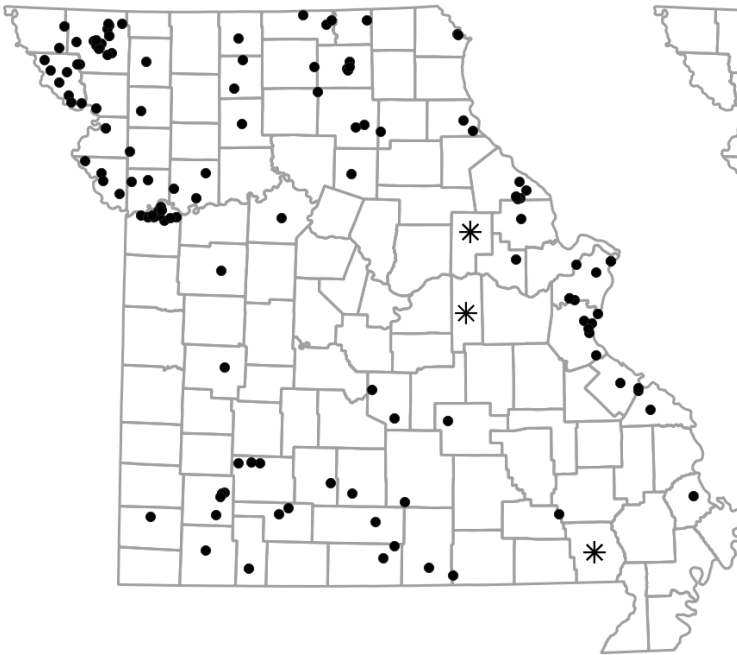
Ambystoma opacum
Marbled Salamander



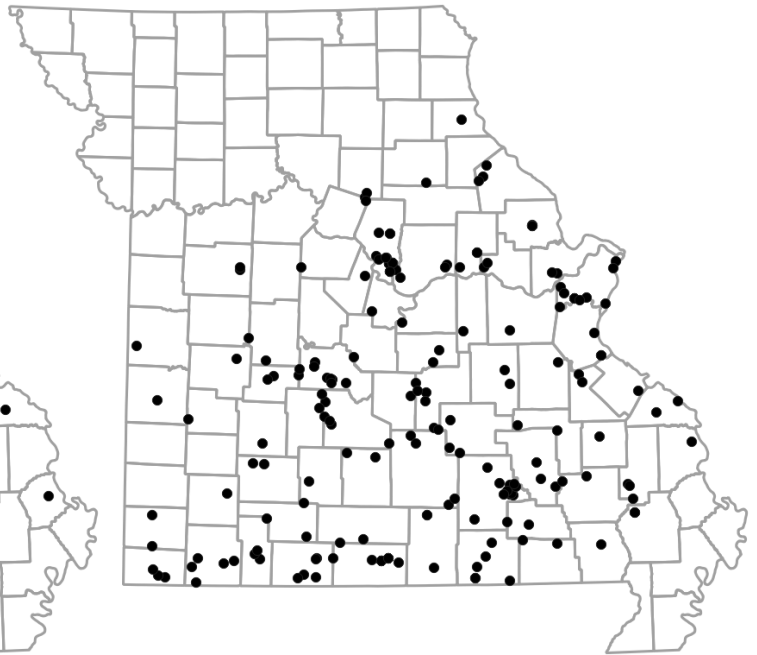
Ambystoma talpoideum
Mole Salamander



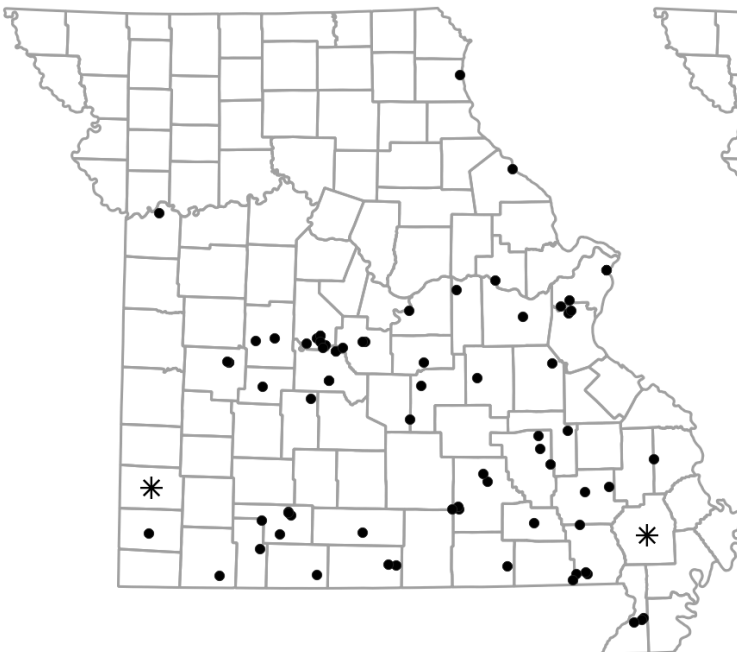
Ambystoma texanum
Small-mouthed Salamander



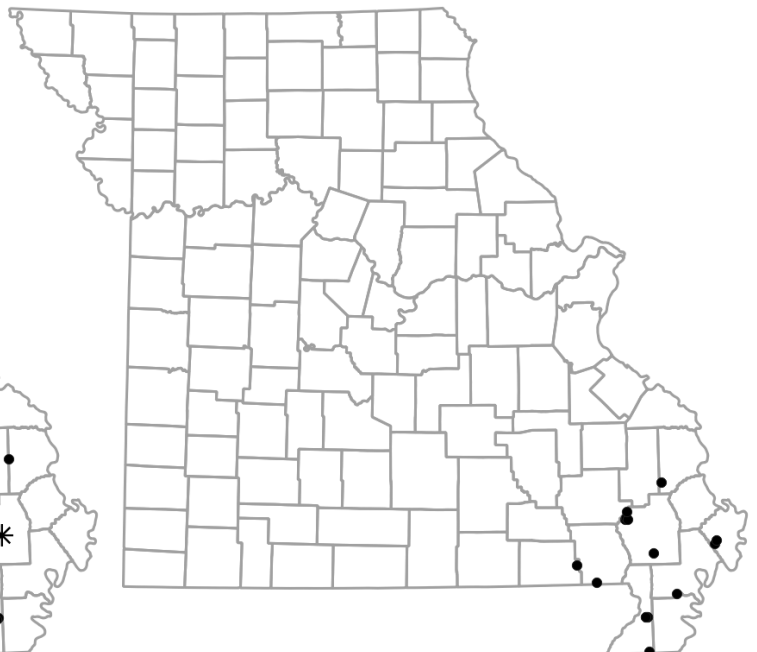
Ambystoma tigrinum
Eastern Tiger Salamander



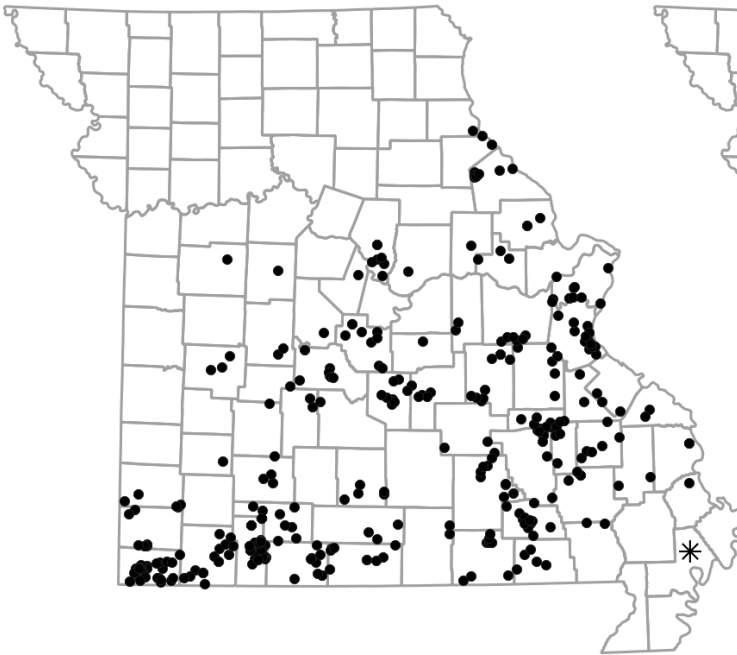
Notophthalmus viridescens
Central Newt



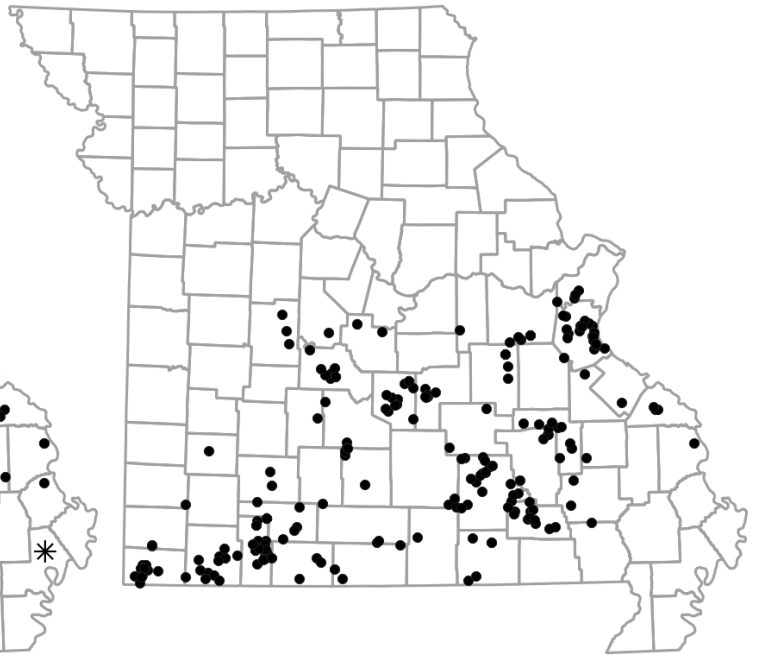
Necturus maculosus
Mudpuppy



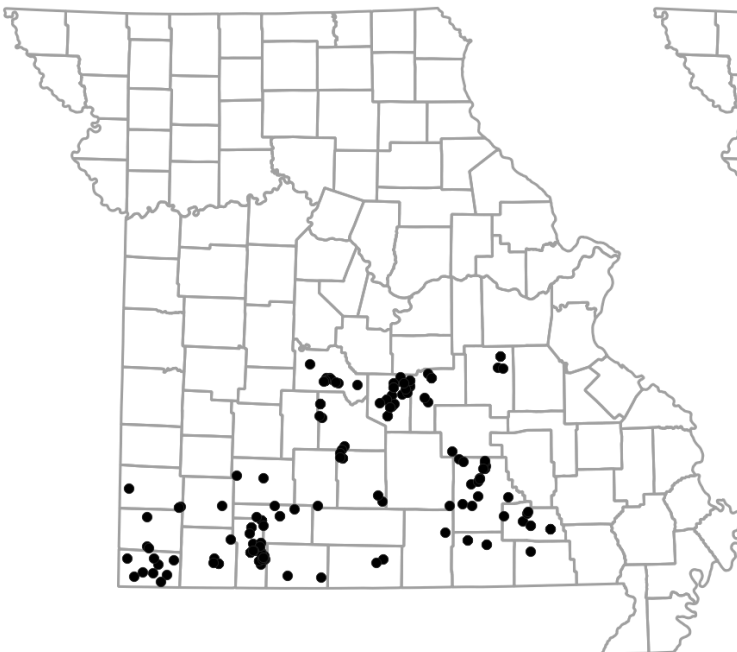
Amphiuma tridactylum
Three-toed Amphiuma



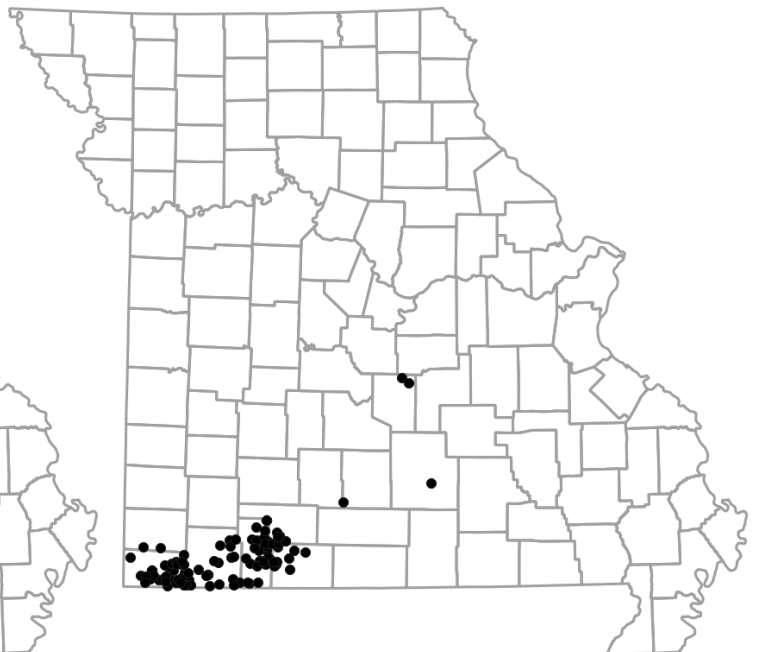
Eurycea longicauda
Long-tailed Salamander



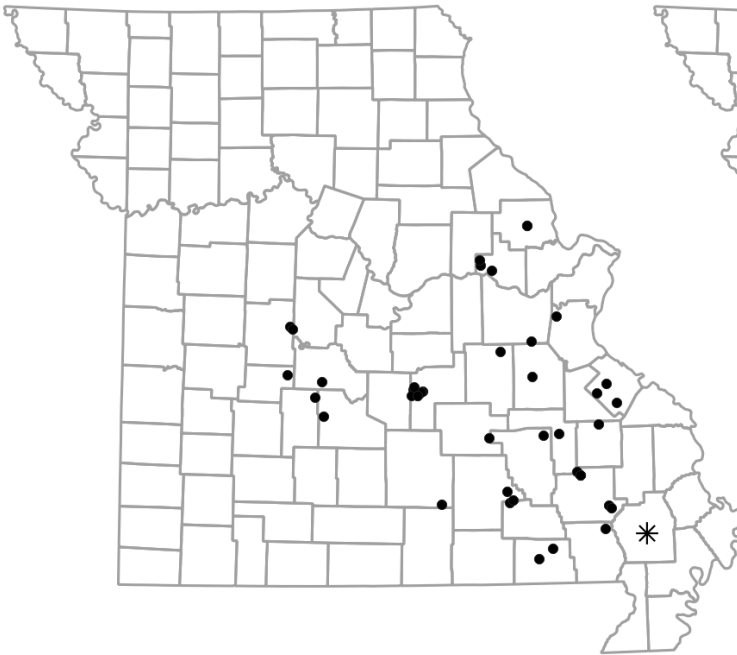
Eurycea lucifuga
Cave Salamander



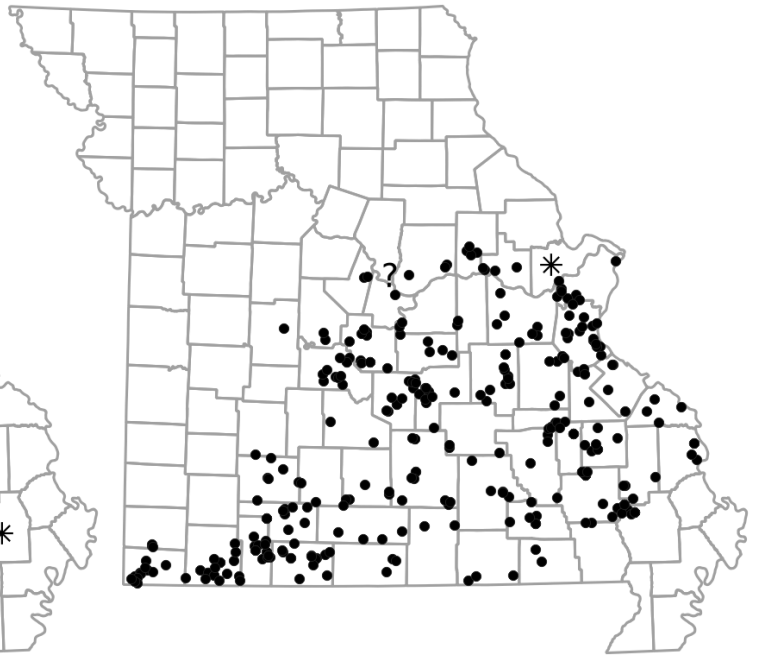
Eurycea spelaea
Grotto Salamander



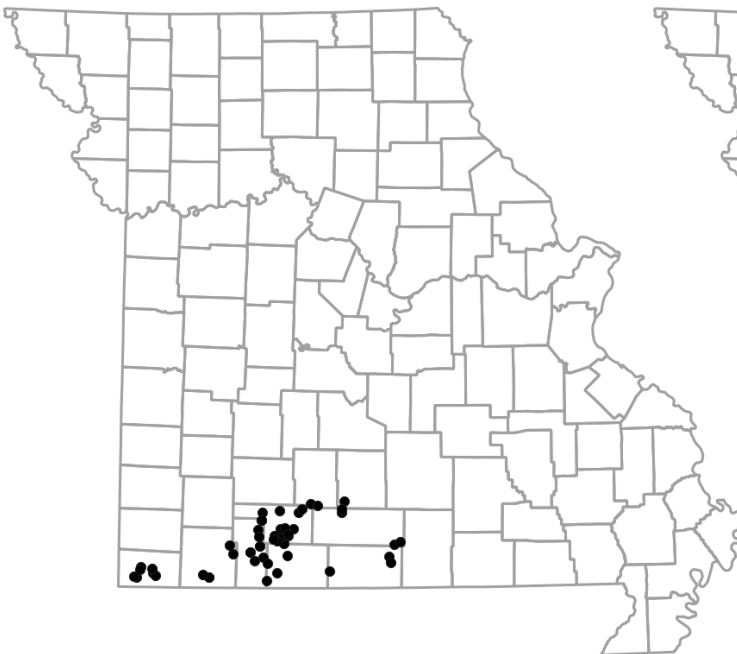
Eurycea tynerensis
Oklahoma Salamander



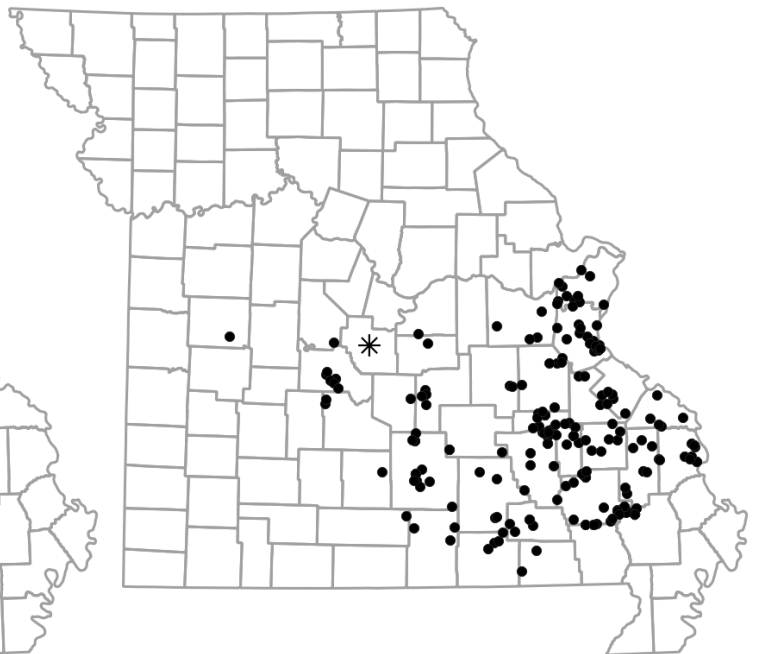
Hemidactylium scutatum
Four-toed Salamander



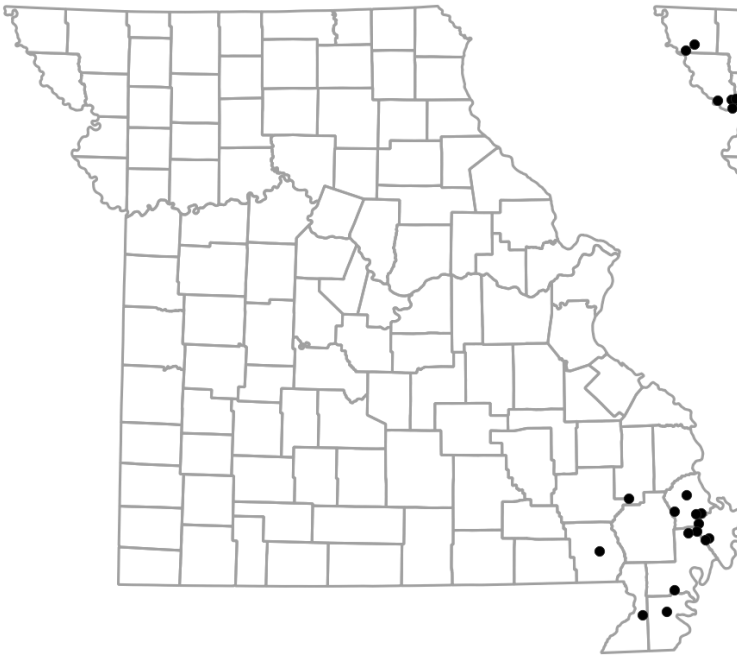
Plethodon albagula
Western Slimy Salamander



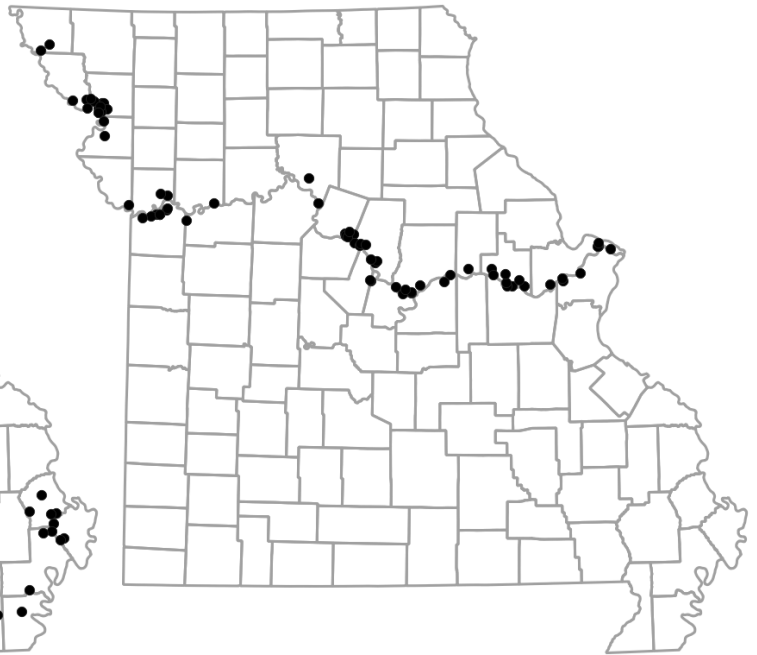
Plethodon angusticlavius
Ozark Zigzag Salamander



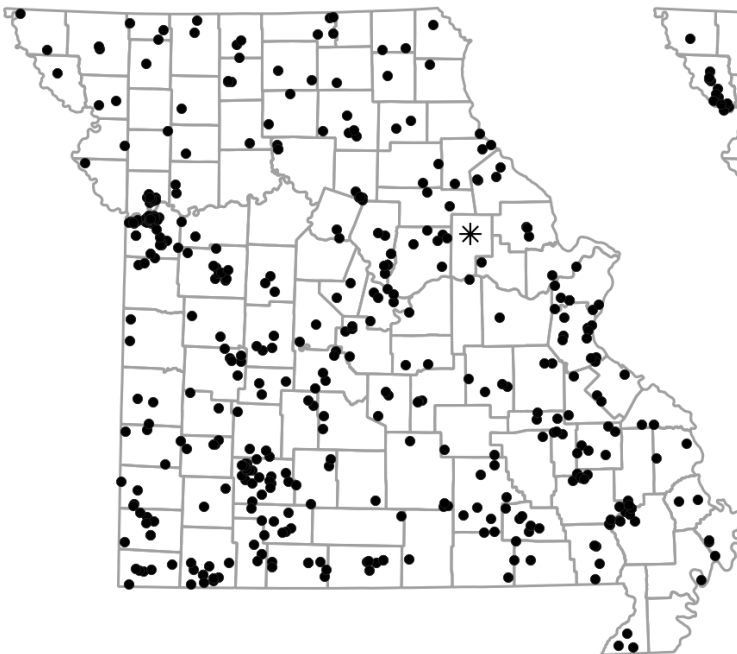
Plethodon serratus
Southern Red-backed Salamander



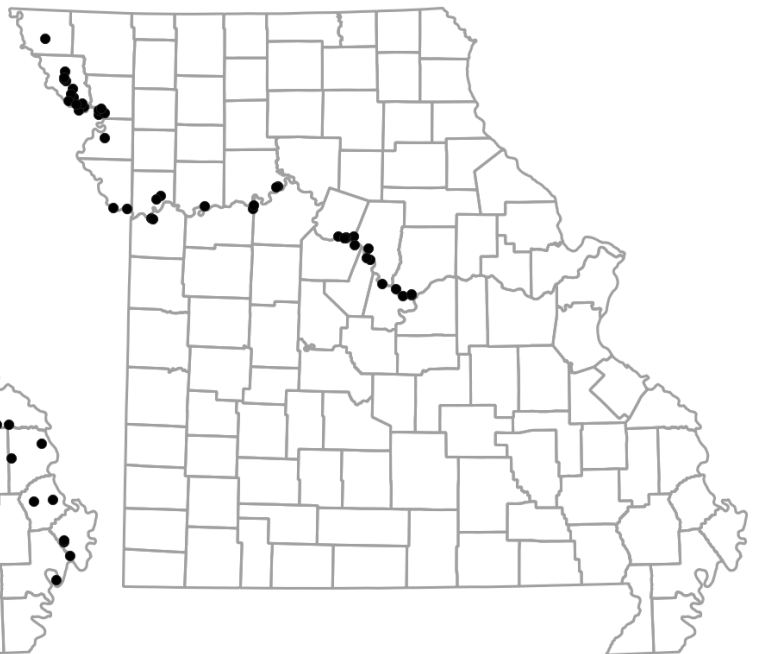
Scaphiopus holbrookii
Eastern Spadefoot



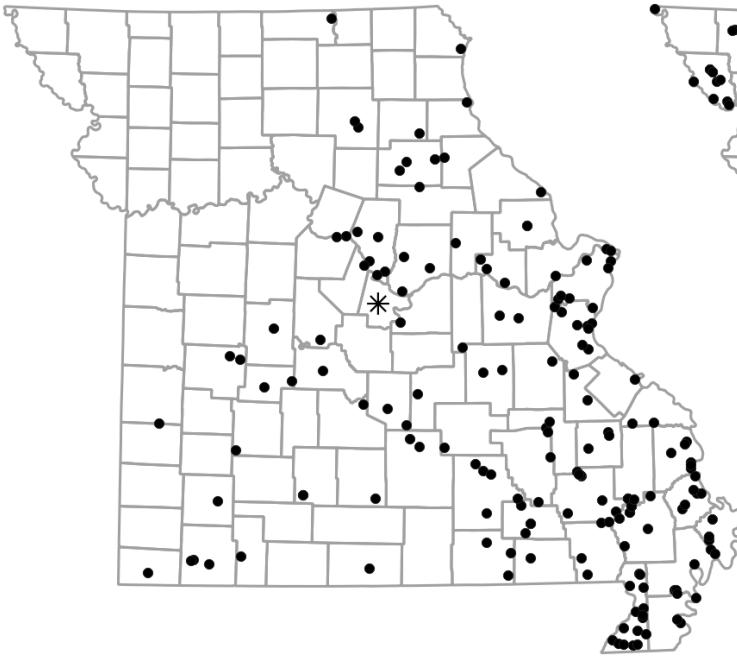
Spea bombifrons
Plains Spadefoot



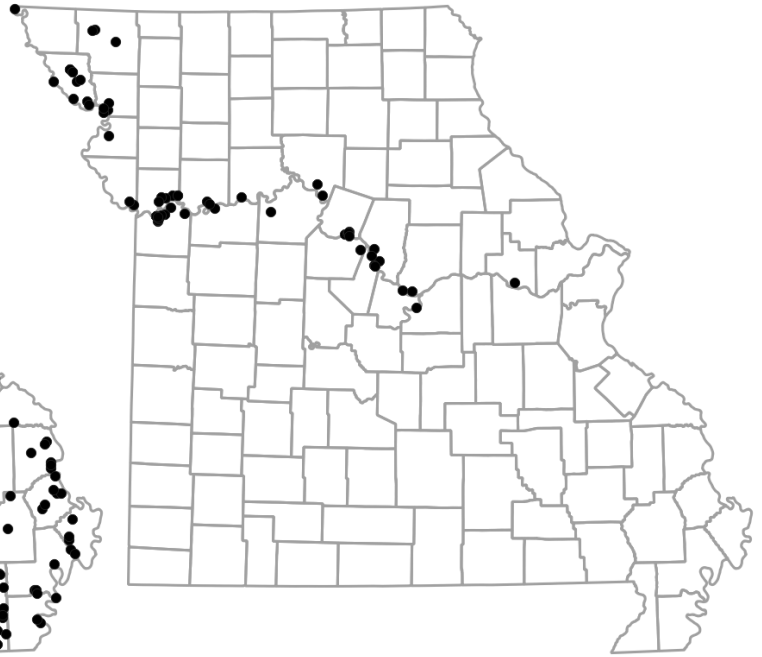
Anaxyrus americanus
American Toad



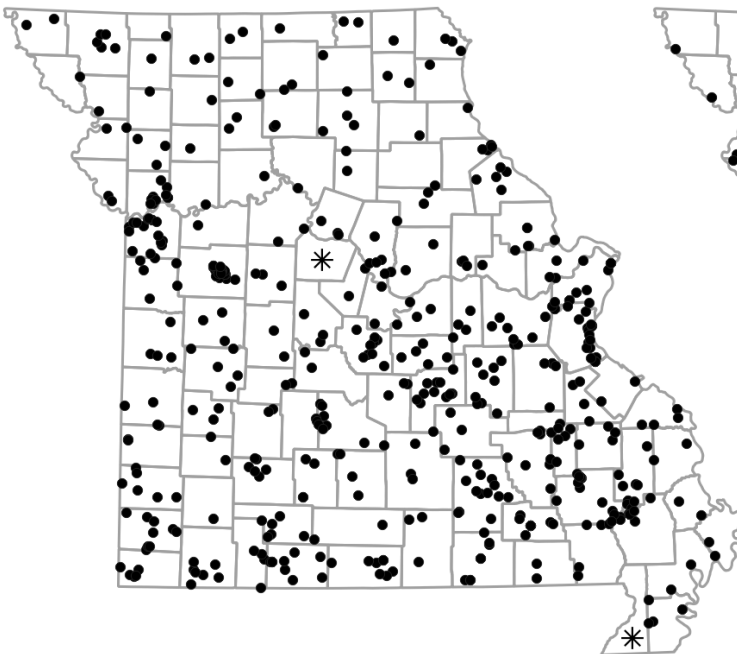
Anaxyrus cognatus
Great Plains Toad



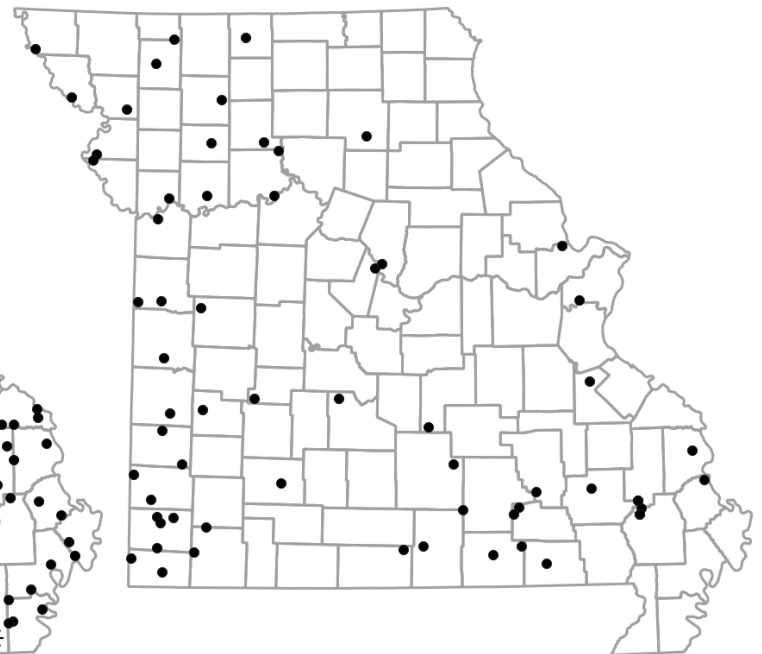
Anaxyrus fowleri
Fowler's Toad



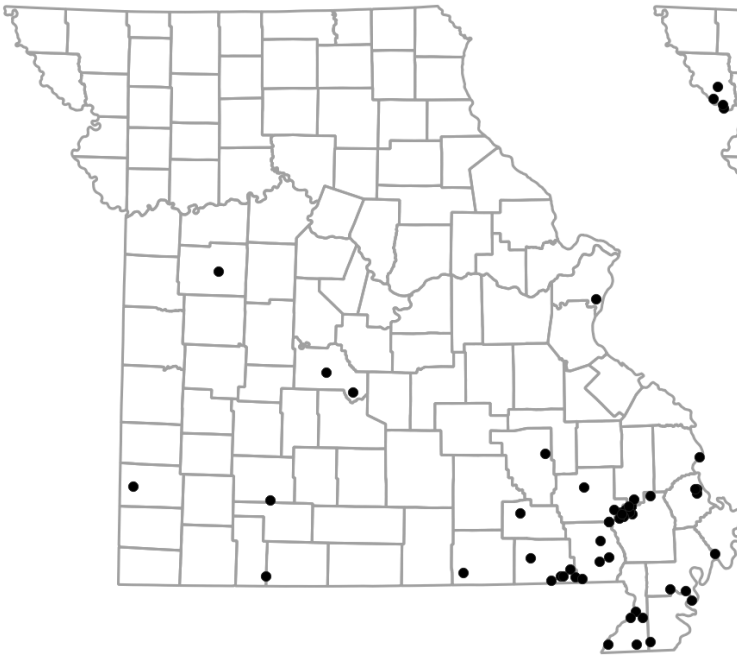
Anaxyrus woodhousii
Woodhouse's Toad



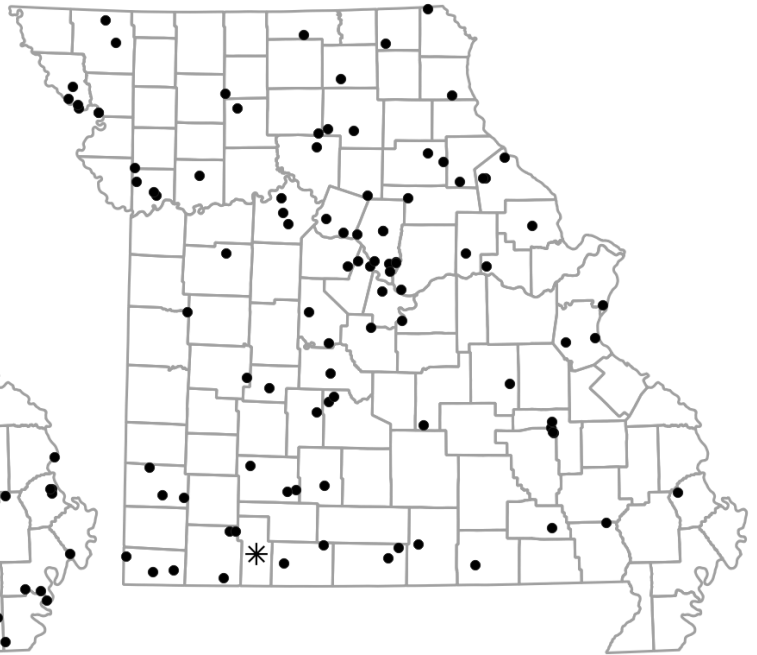
Acris blanchardi
Blanchard's Cricket Frog



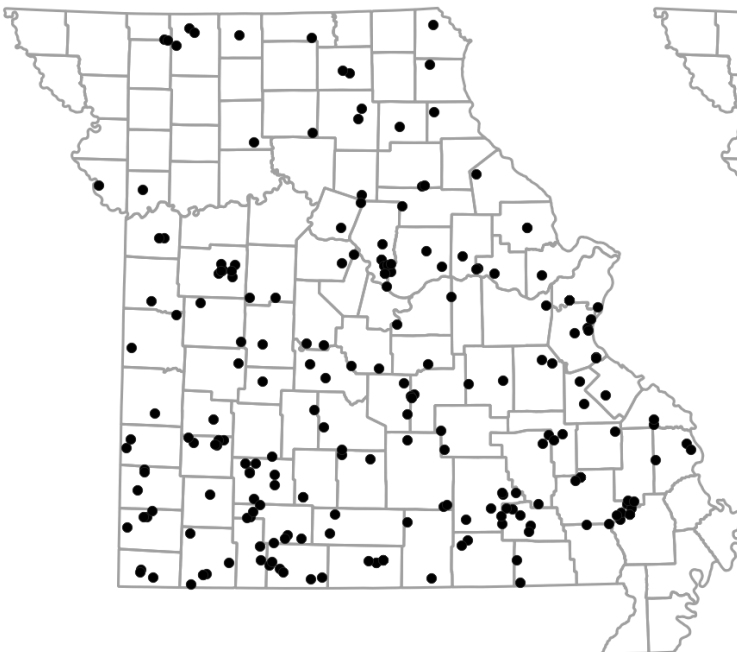
Hyla chrysoscelis
Cope's Gray Treefrog



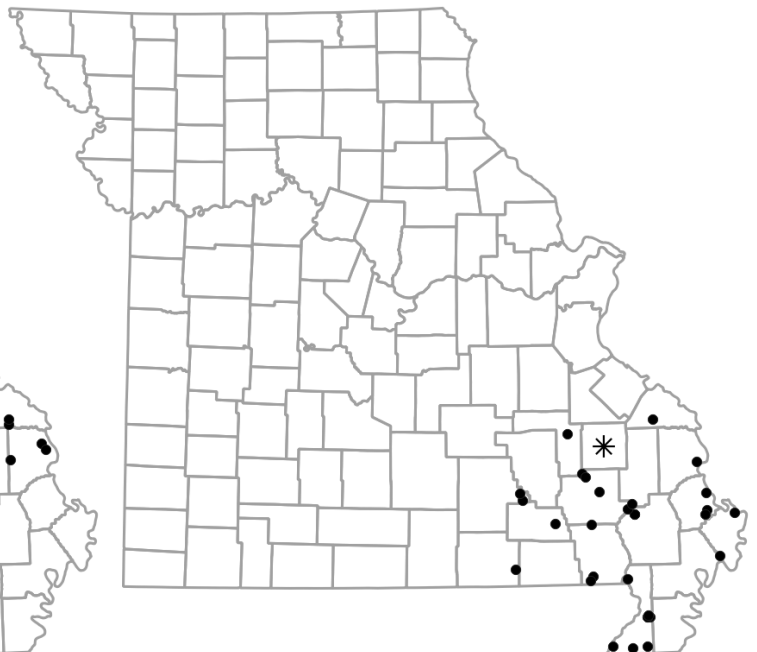
Hyla cinerea
Green Treefrog



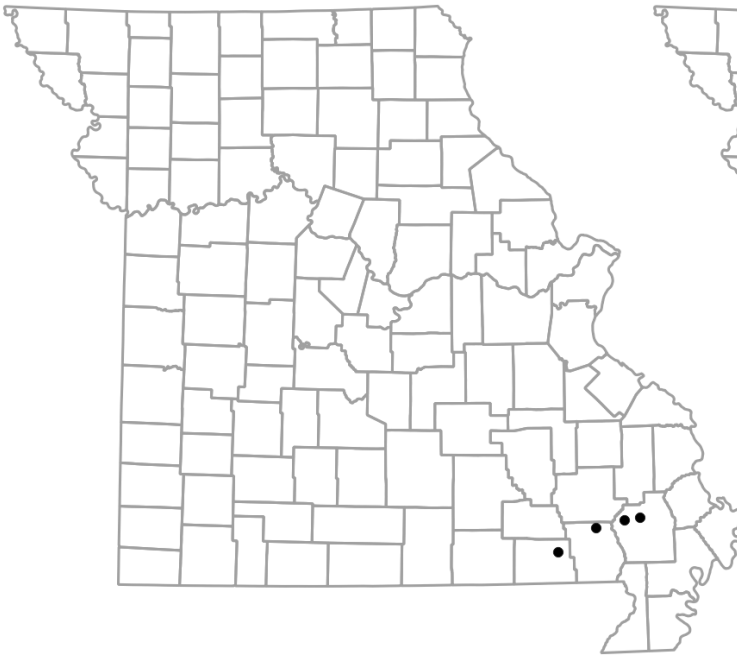
Hyla versicolor
Gray Treefrog



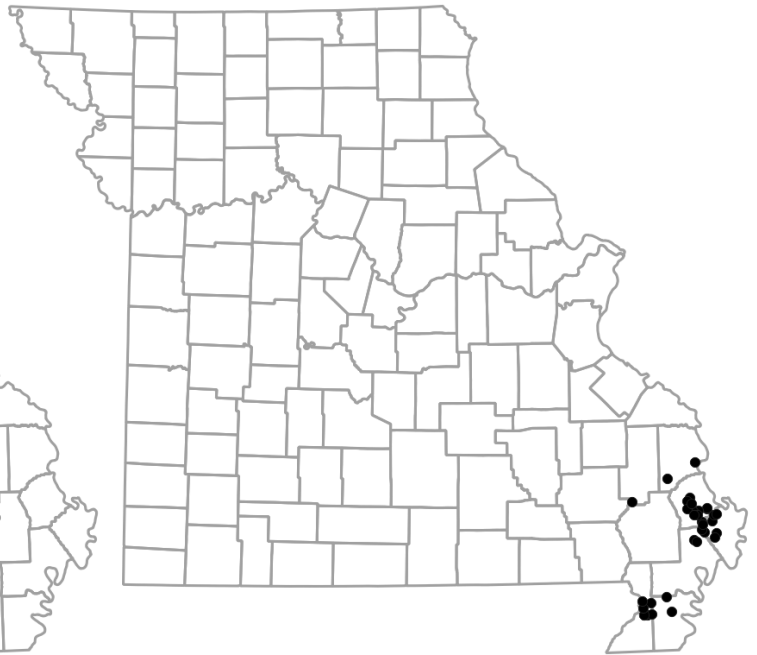
Pseudacris crucifer
Spring Peeper



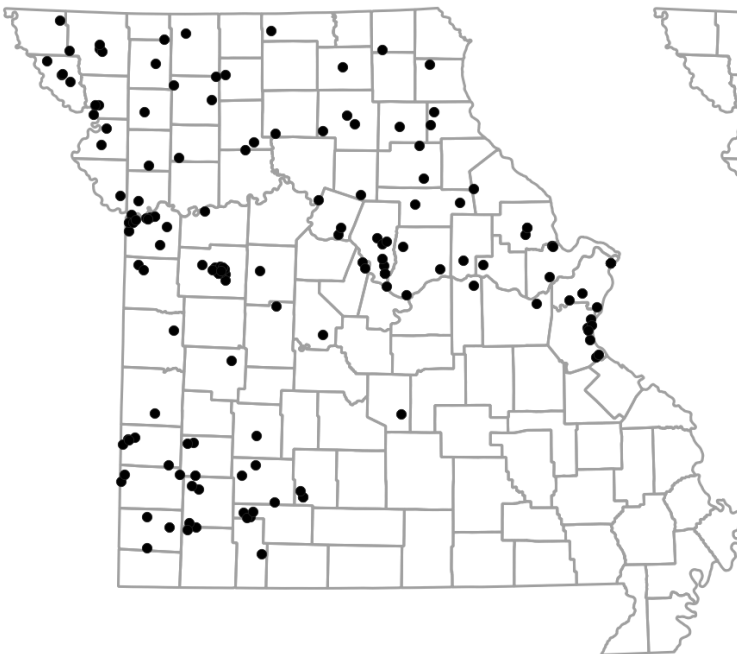
Pseudacris feriarum
Upland Chorus Frog



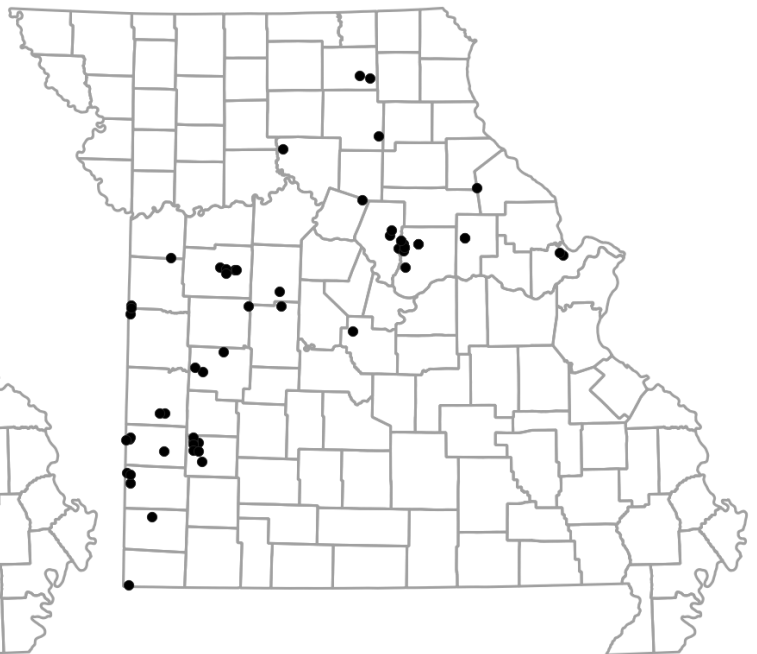
Pseudacris fouquettei
Cajun Chorus Frog



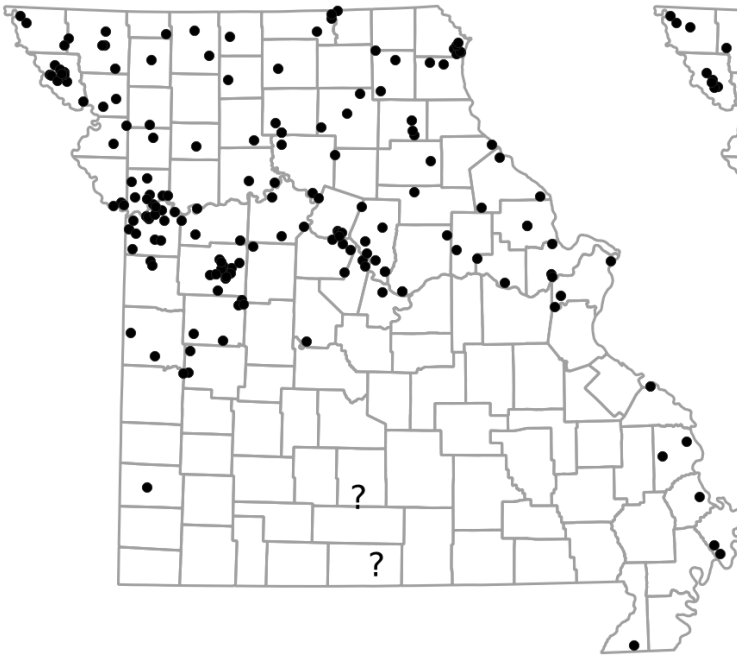
Pseudacris illinoensis
Illinois Chorus Frog



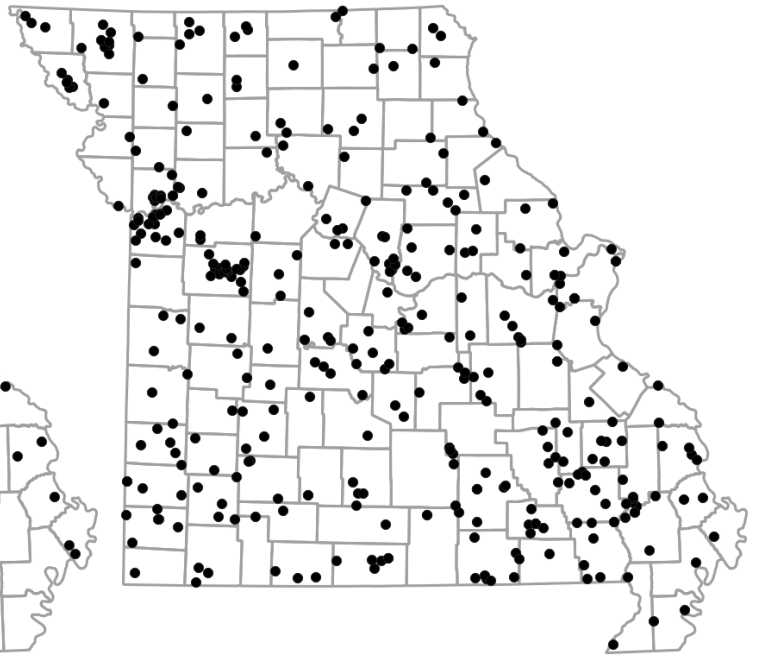
Pseudacris maculata
Boreal Chorus Frog



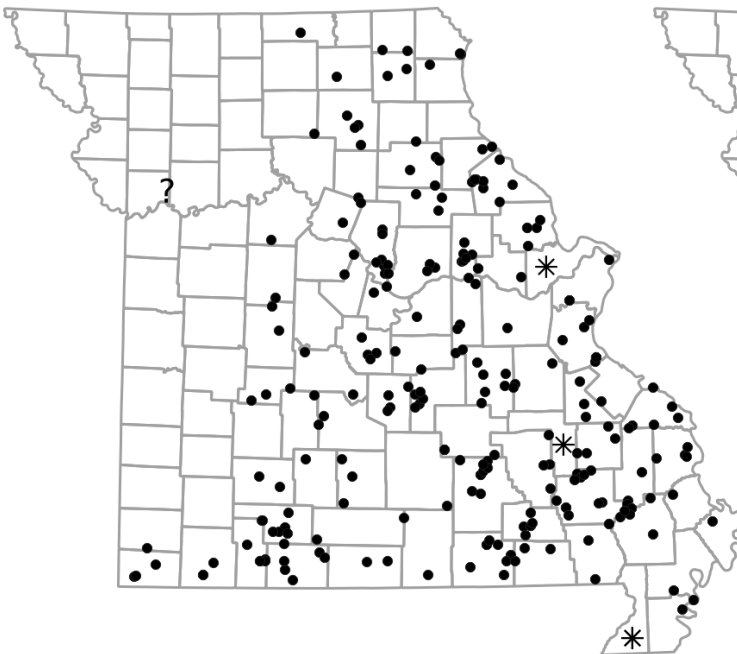
Lithobates areolatus
Northern Crawfish Frog



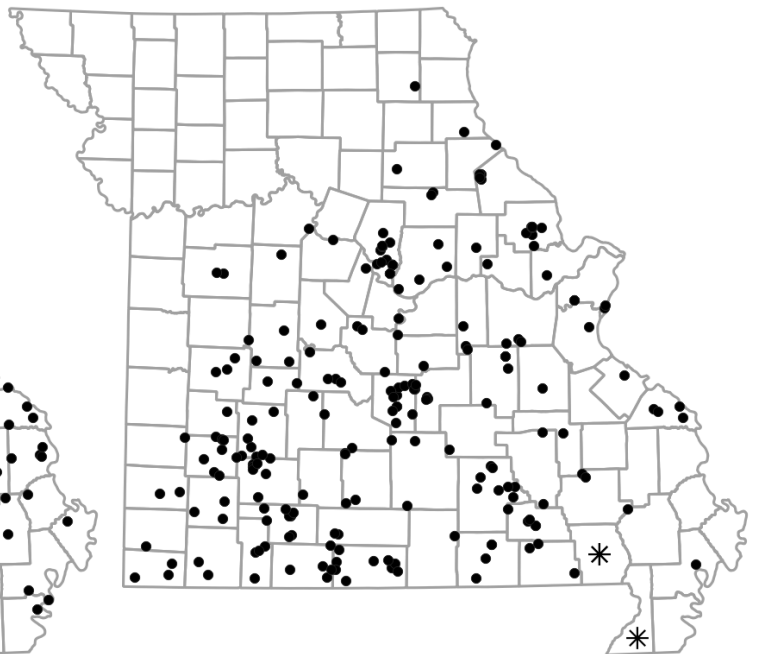
Lithobates blairi
Plains Leopard Frog



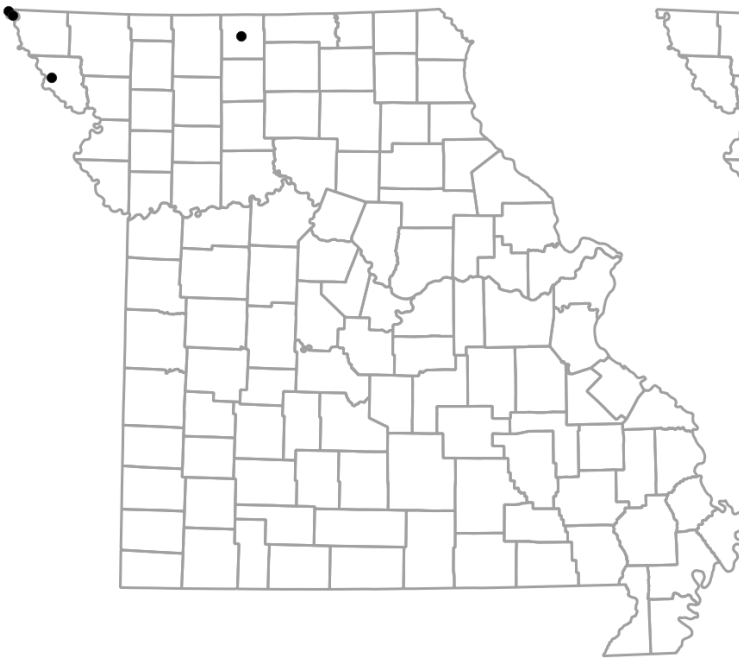
Lithobates catesbeianus
American Bullfrog



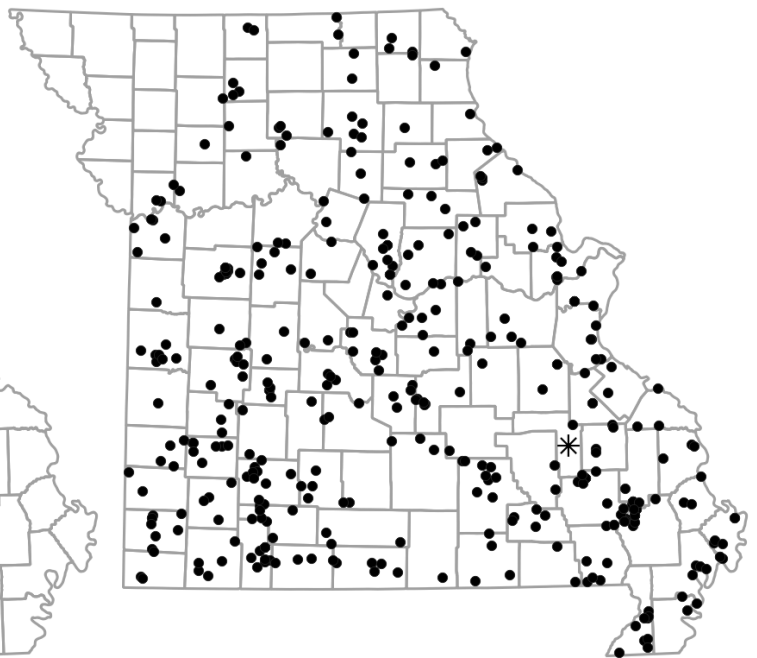
Lithobates clamitans
Green Frog



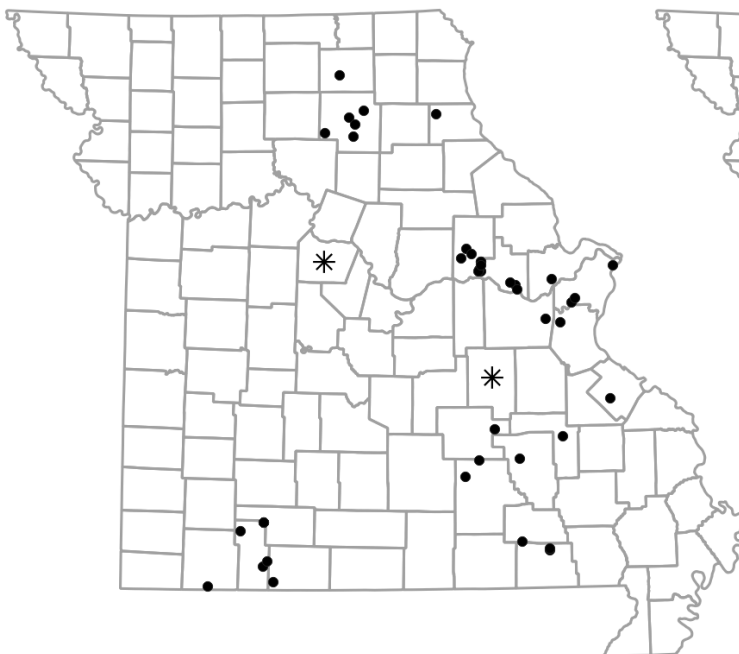
Lithobates palustris
Pickerel Frog



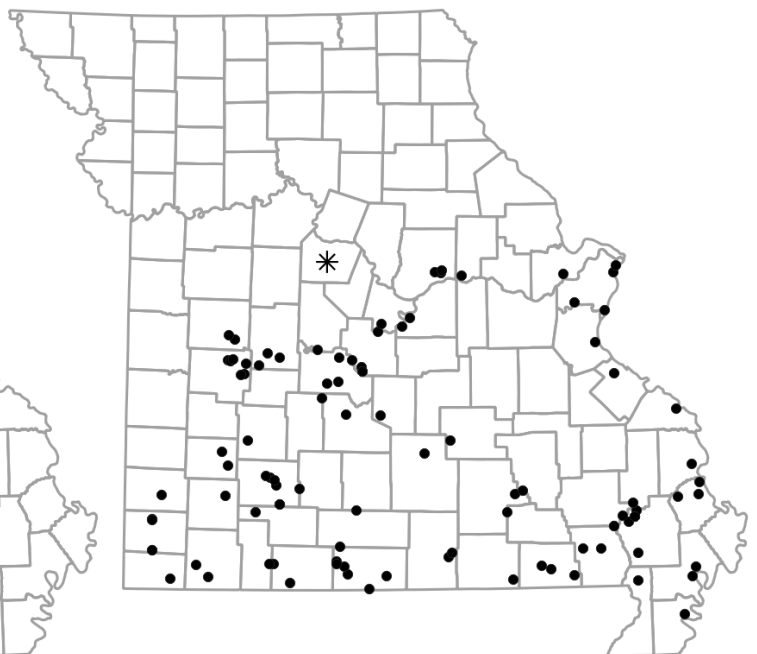
Lithobates pipiens
Northern Leopard Frog



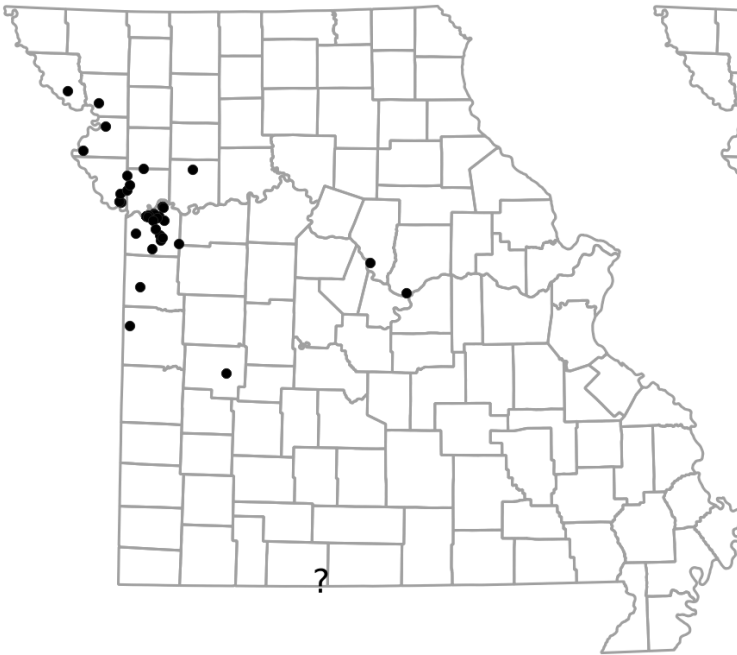
Lithobates sphenoccephalus
Southern Leopard Frog



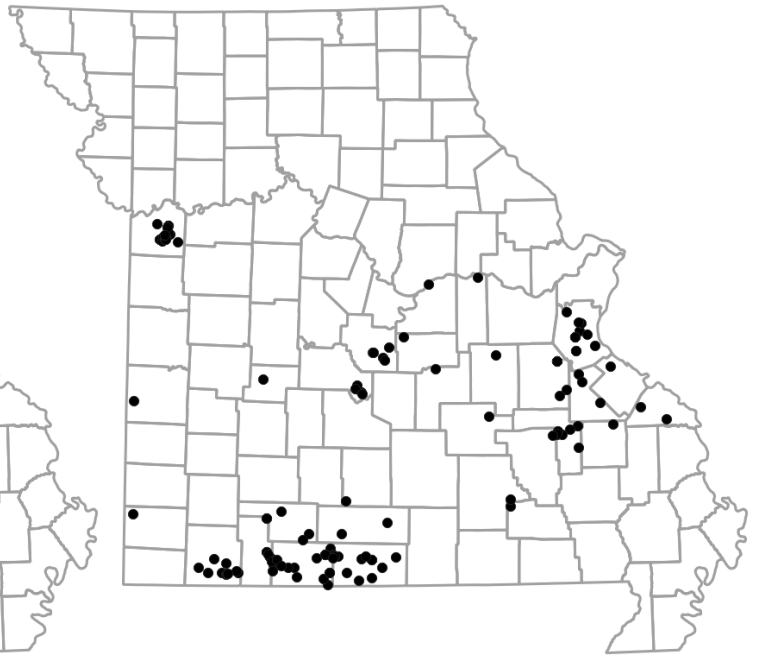
Lithobates sylvaticus
Wood Frog



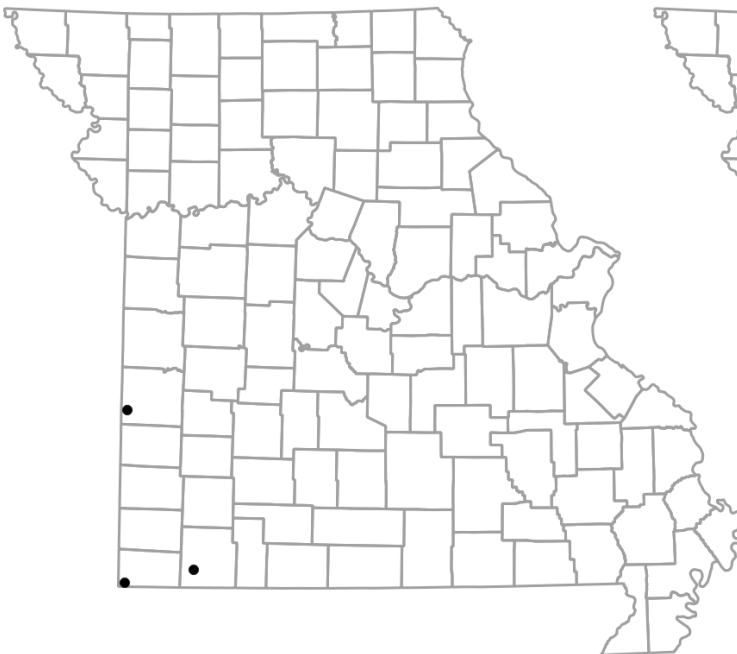
Gastrophryne carolinensis
Eastern Narrow-mouthed Toad



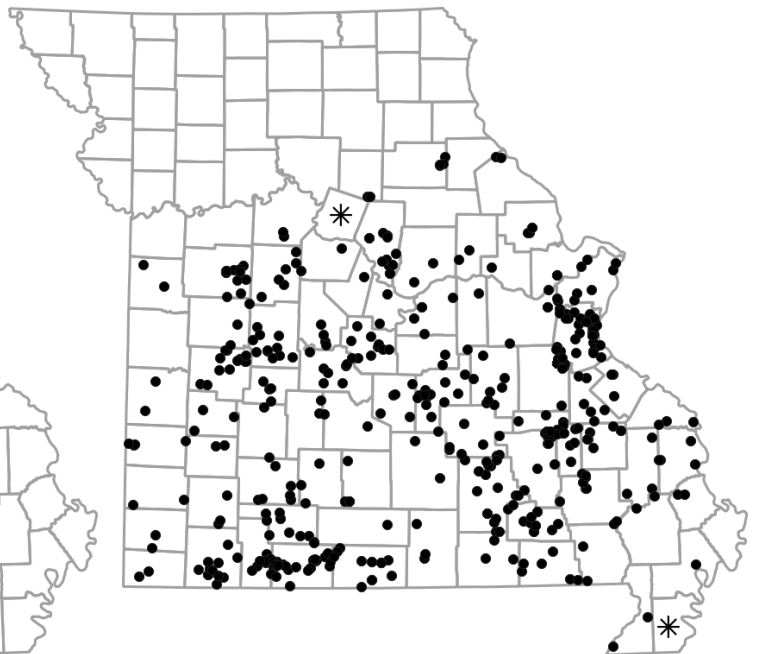
Gastrophryne olivacea
Western Narrow-mouthed Toad



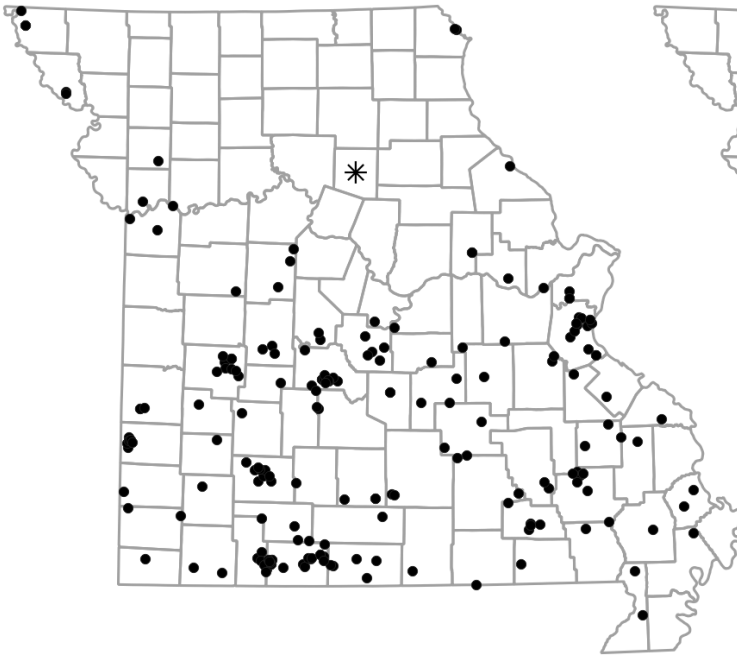
Crotaphytus collaris
Eastern Collared Lizard



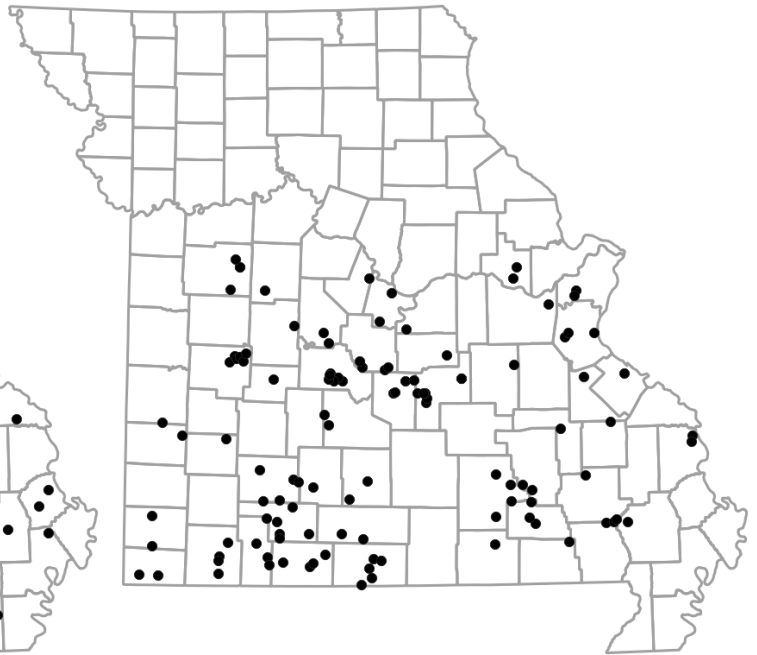
Phrynosoma cornutum
Texas Horned Lizard



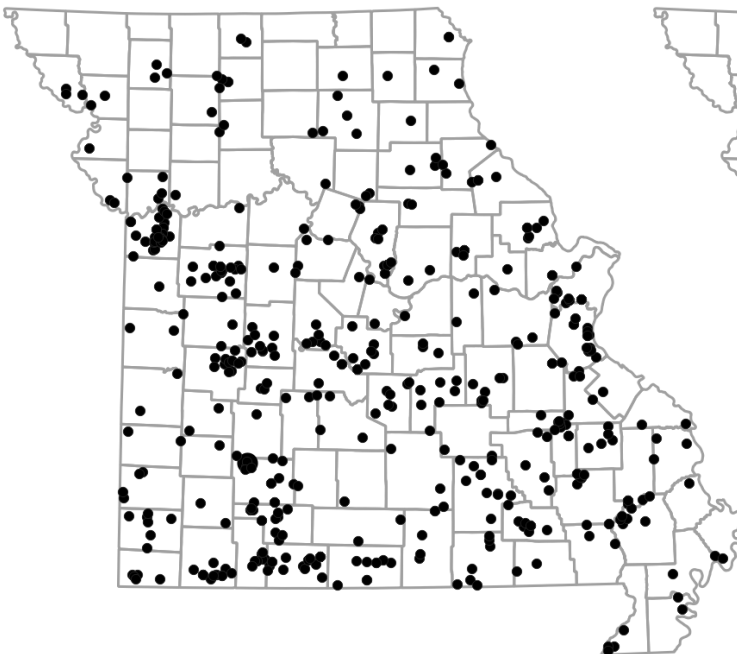
Sceloporus consobrinus
Prairie Lizard



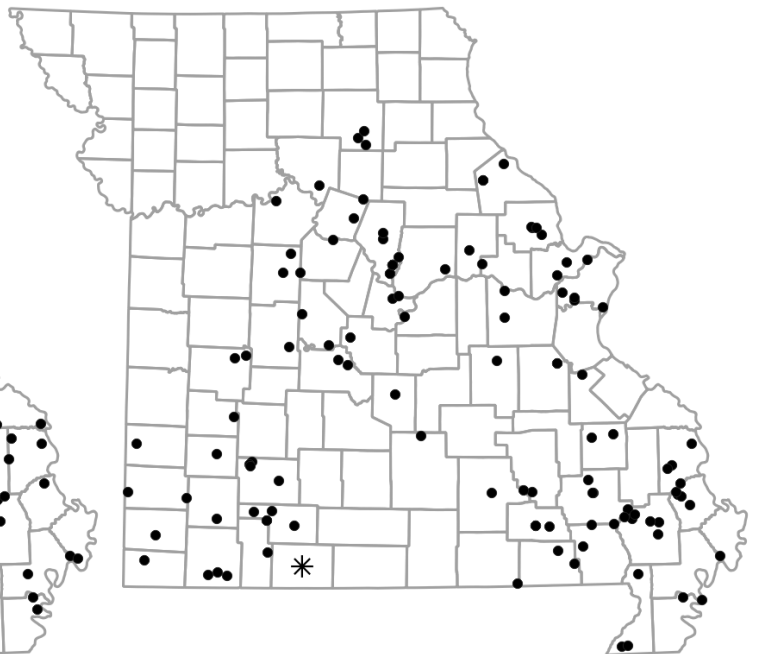
Aspidoscelis sexlineata
Six-lined Racerunner



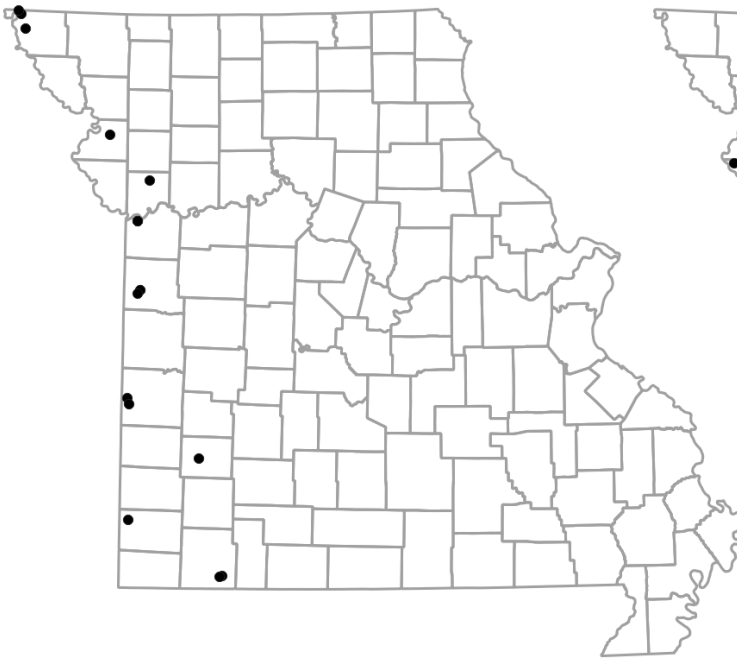
Plestiodon anthracinus
Southern Coal Skink



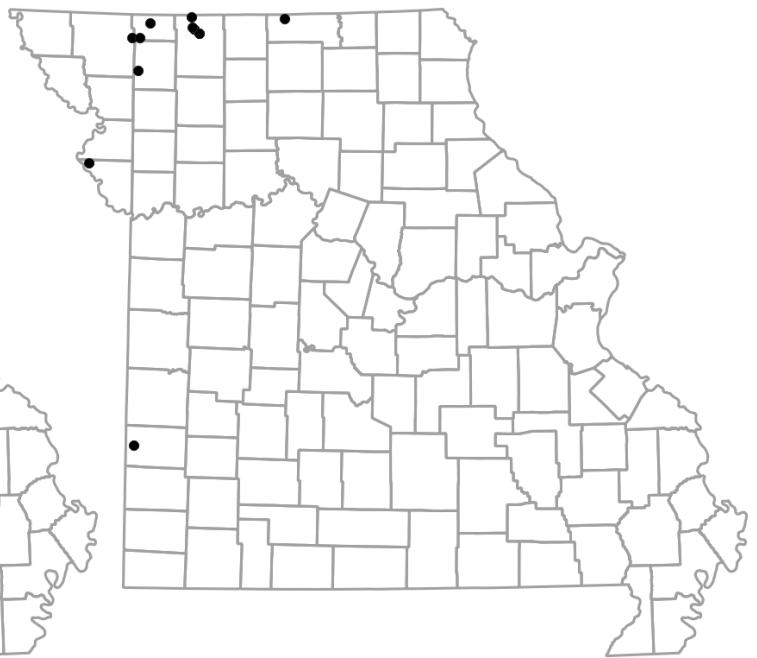
Plestiodon fasciatus
Common Five-lined Skink



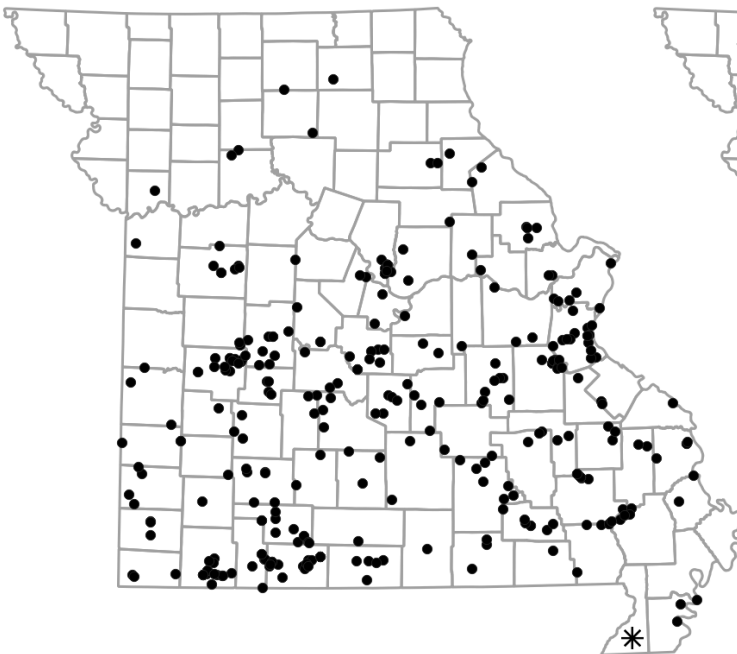
Plestiodon laticeps
Broad-headed Skink



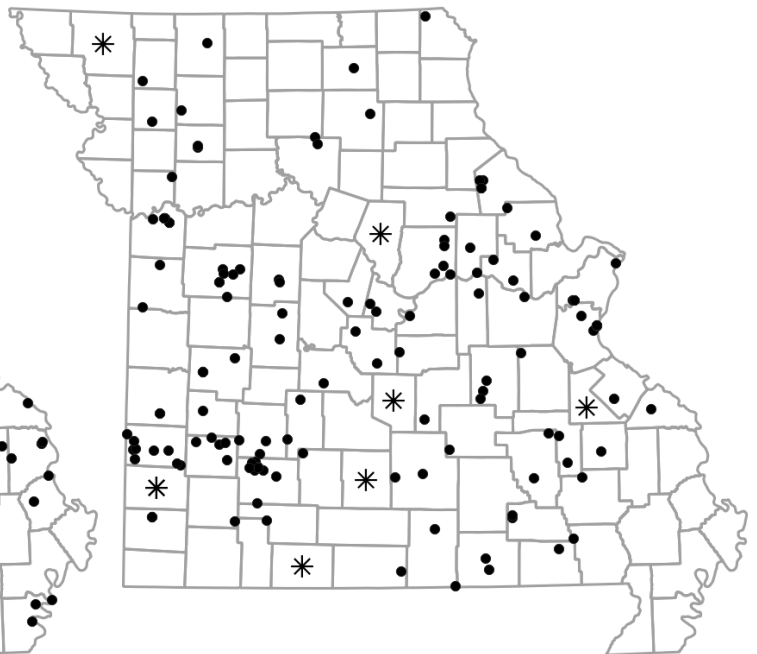
Plestiodon obsoletus
Great Plains Skink



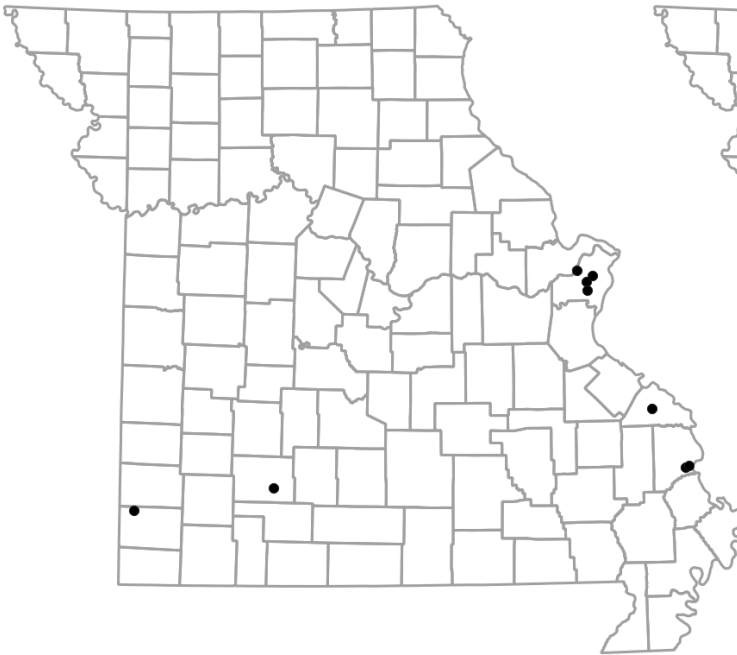
Plestiodon septentrionalis
Prairie Skink



Scincella lateralis
Little Brown Skink



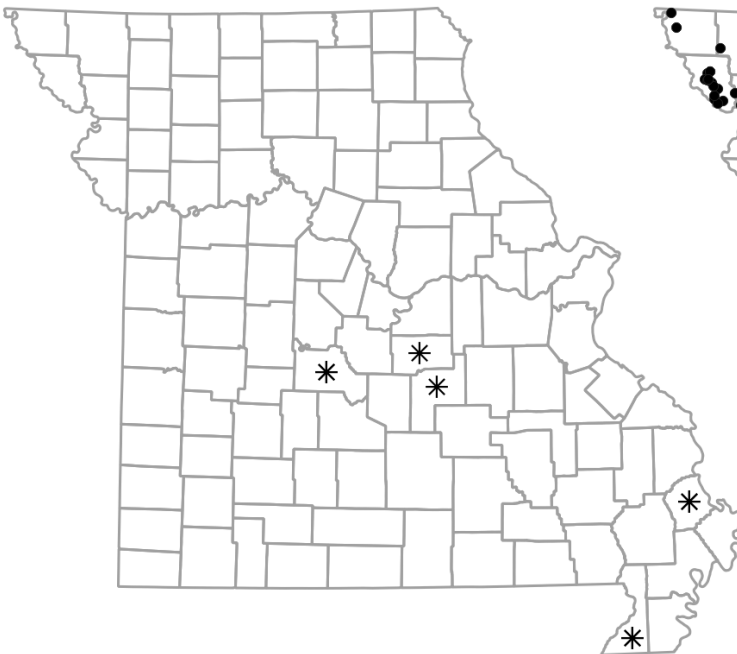
Ophisaurus attenuatus
Western Slender Glass Lizard



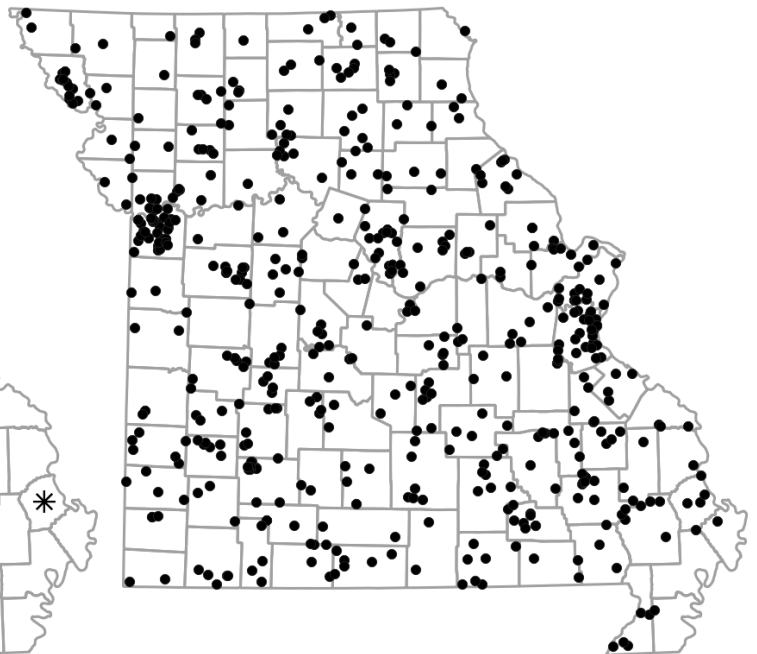
Hemidactylus turcicus
Mediterranean Gecko



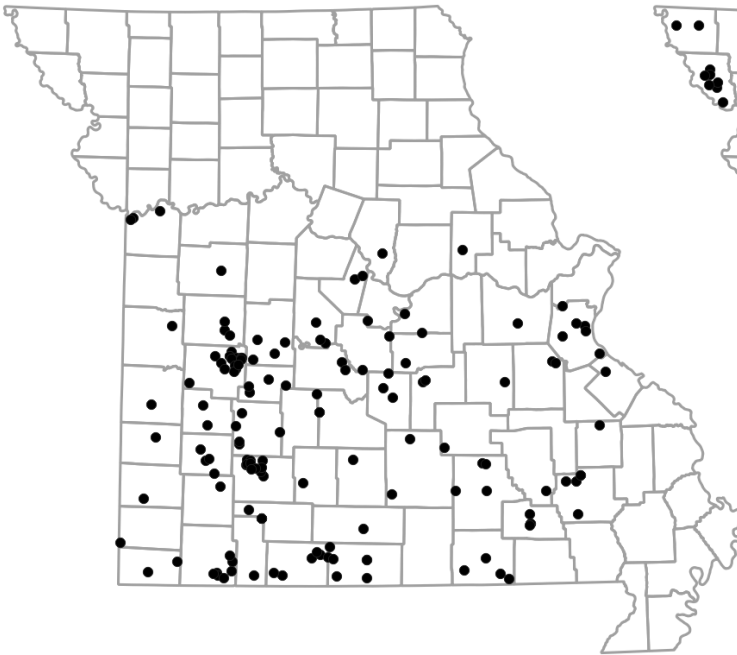
Podarcis siculus
Italian Wall Lizard



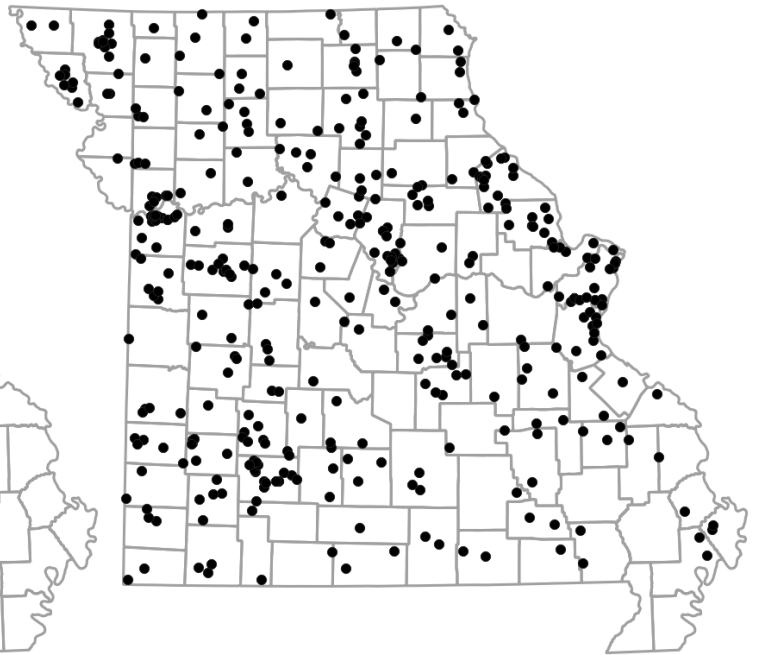
Cemophora coccinea
Northern Scarletsnake



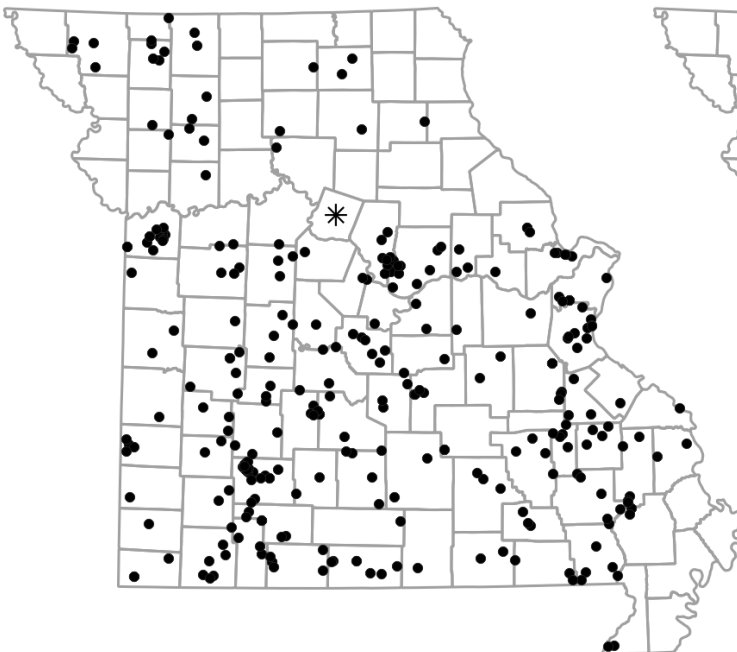
Coluber constrictor
North American Racer



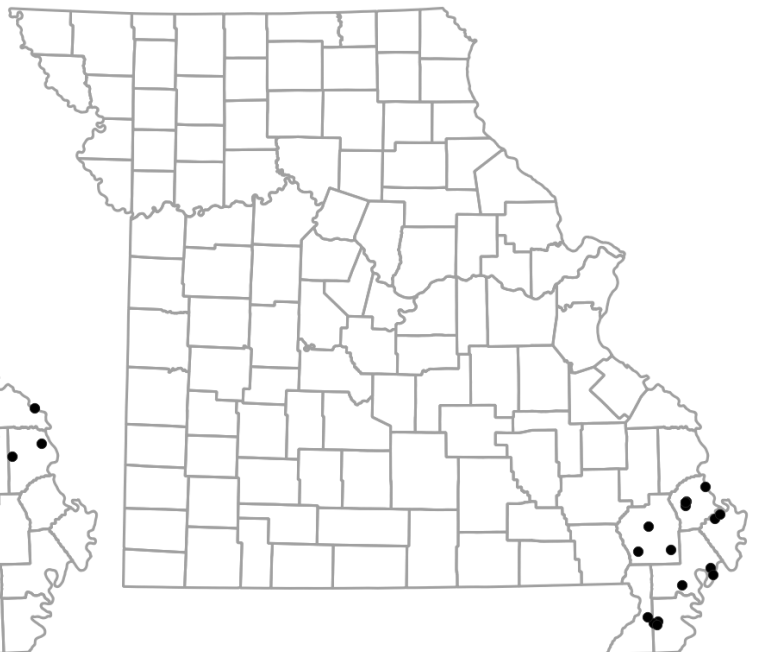
Coluber flagellum
Eastern Coachwhip



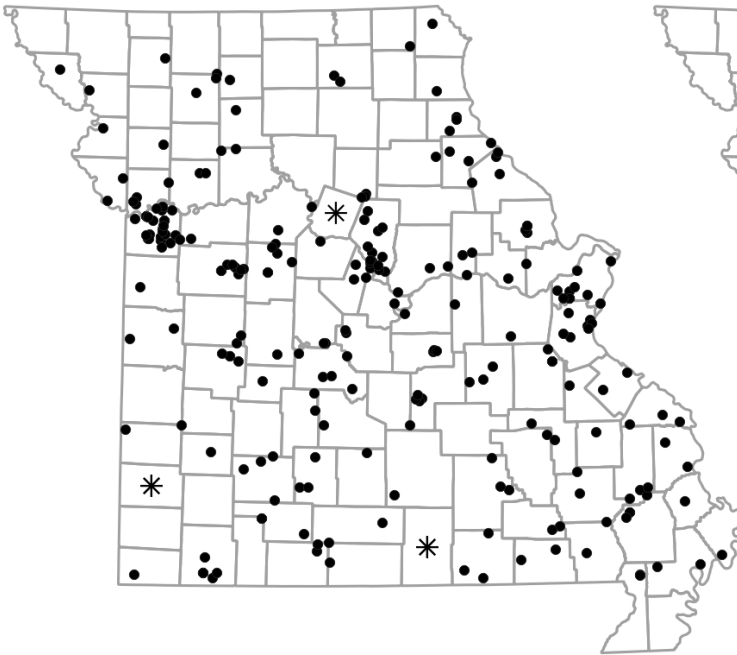
Lampropeltis calligaster
Prairie Kingsnake



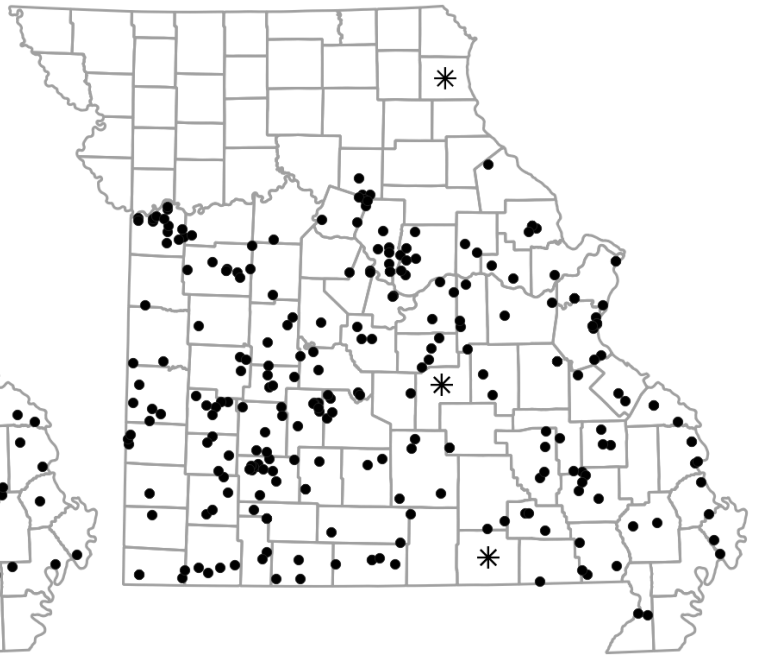
Lampropeltis holbrooki
Speckled Kingsnake



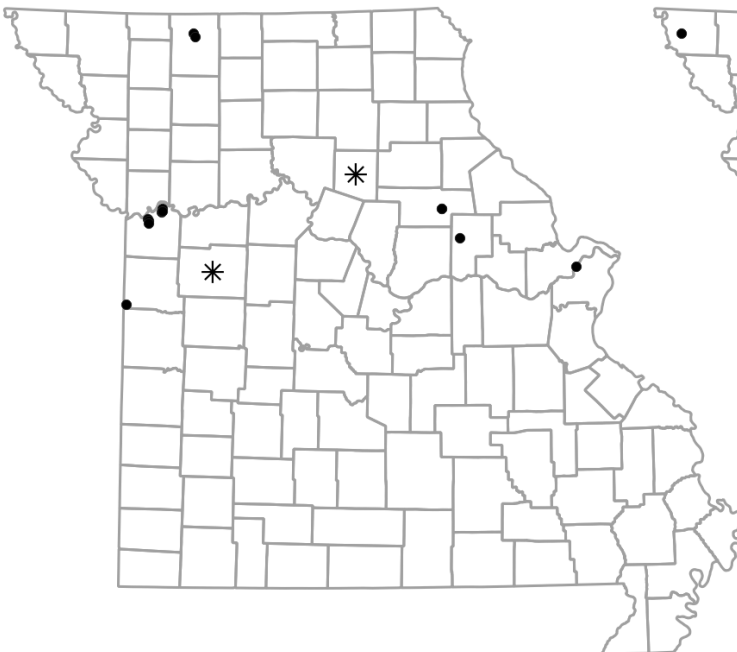
Lampropeltis nigra
Eastern Black Kingsnake



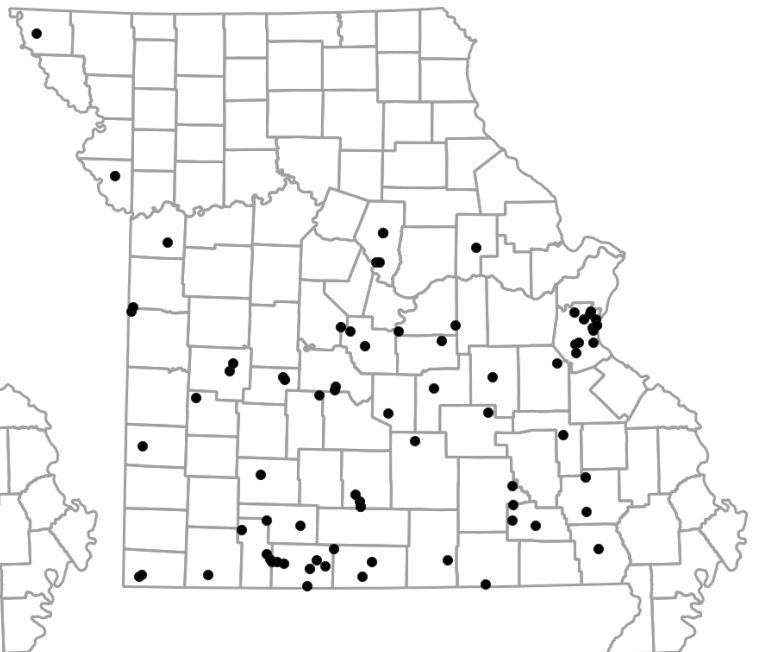
Lampropeltis triangulum
Eastern Milksnake



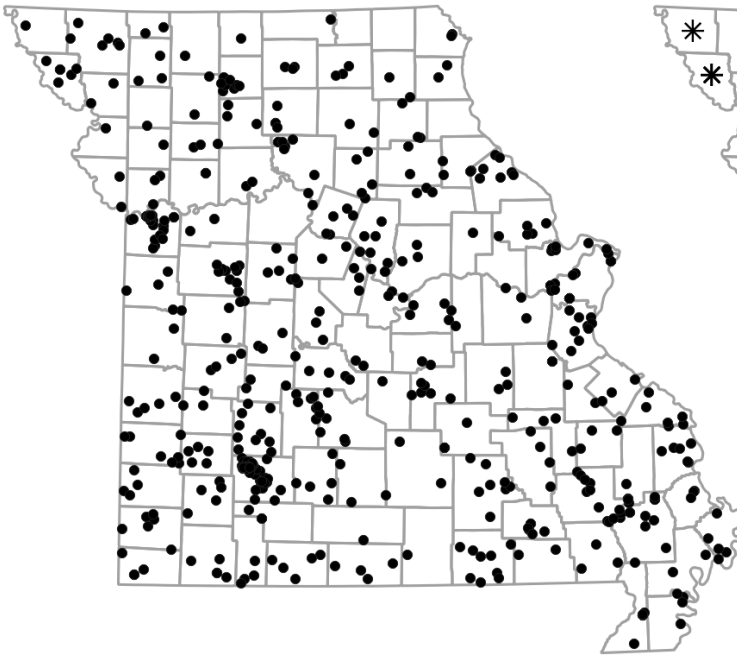
Opheodrys aestivus
Northern Rough Greensnake



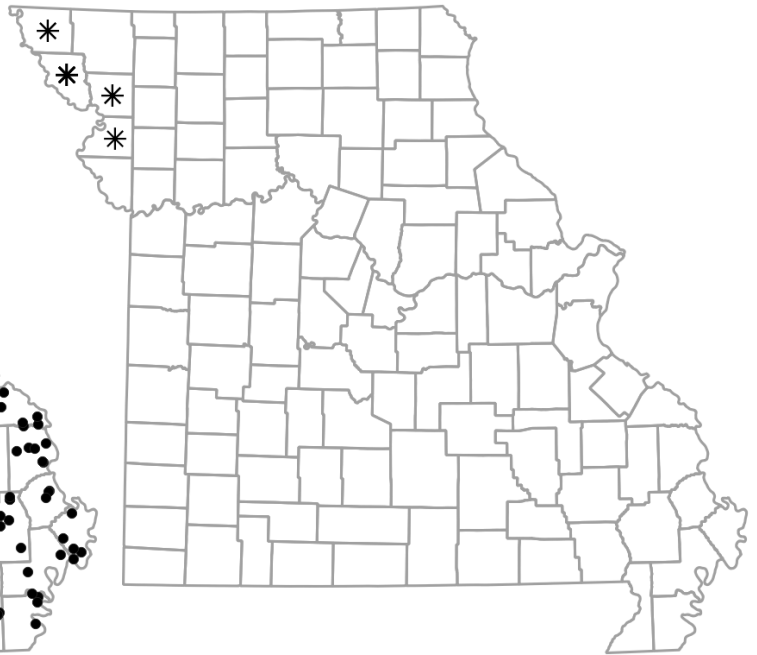
Opheodrys vernalis
Smooth Greensnake



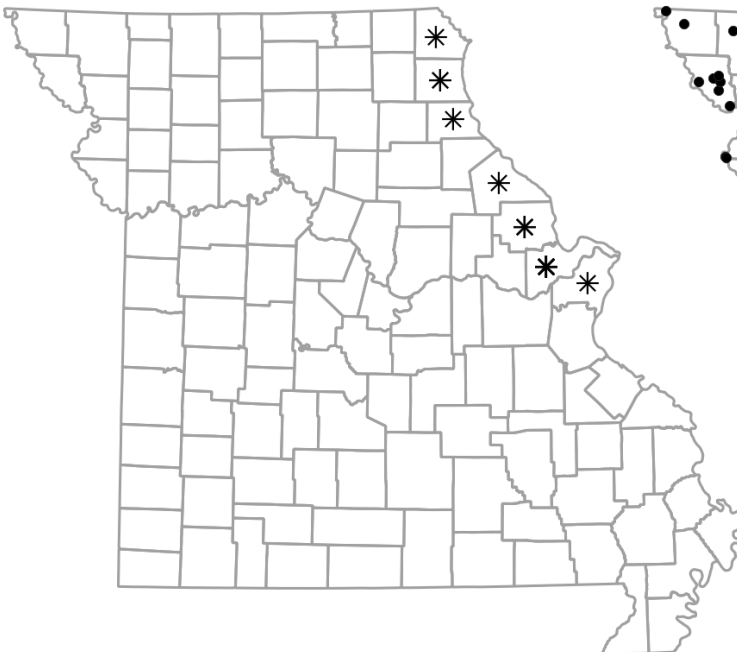
Pantherophis emoryi
Great Plains Ratsnake



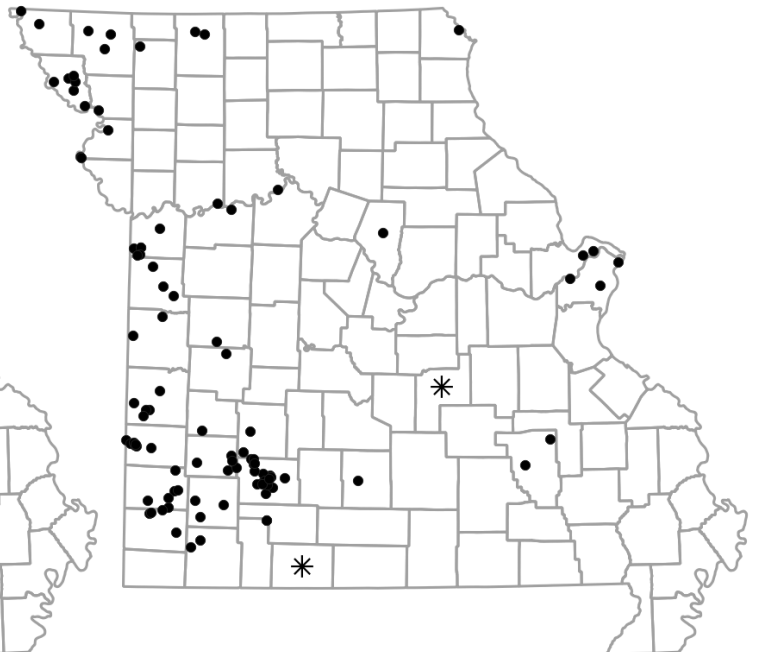
Pantherophis obsoletus
Western Ratsnake



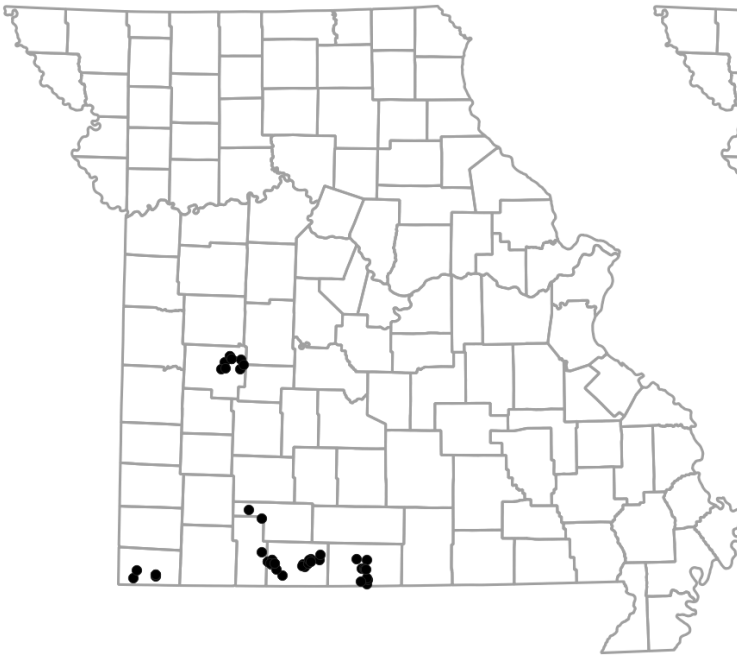
Pantherophis ramspotti
Western Foxsnake



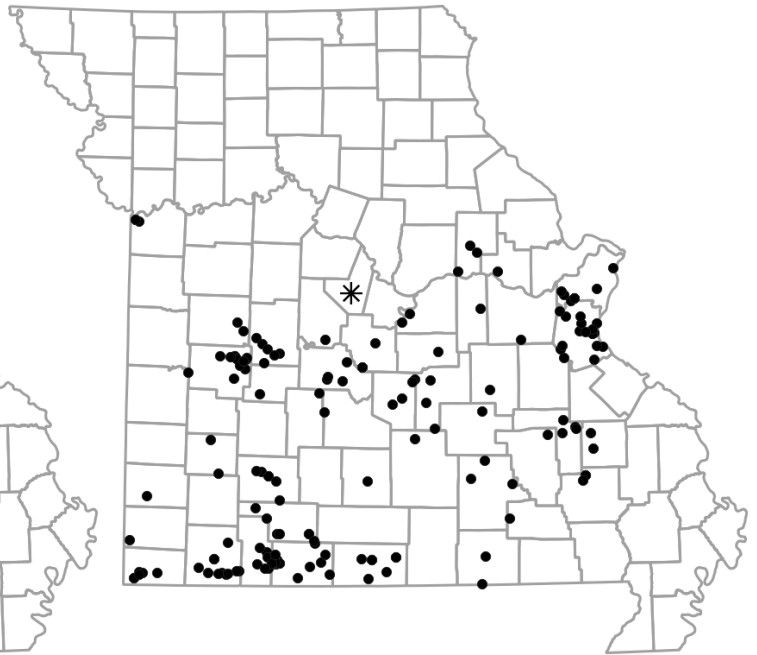
Pantherophis vulpinus
Eastern Foxsnake



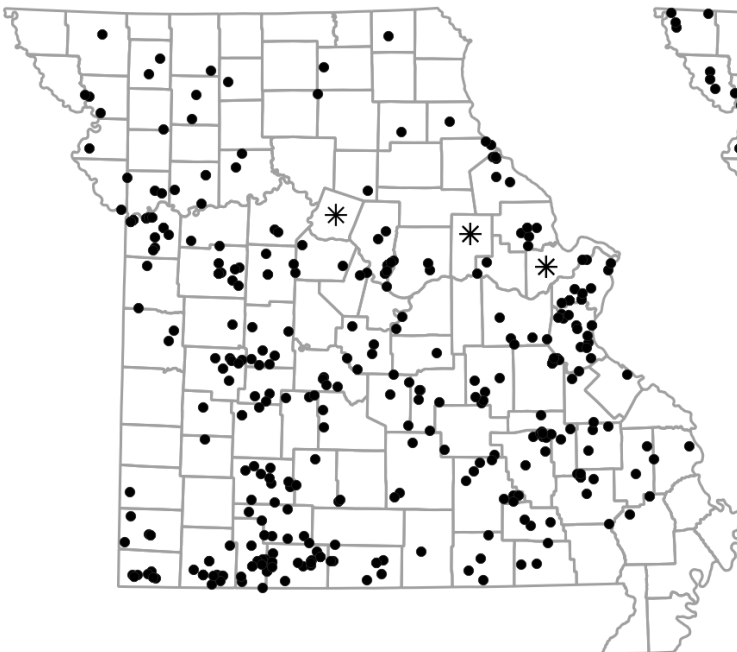
Pituophis catenifer
Bullsnake



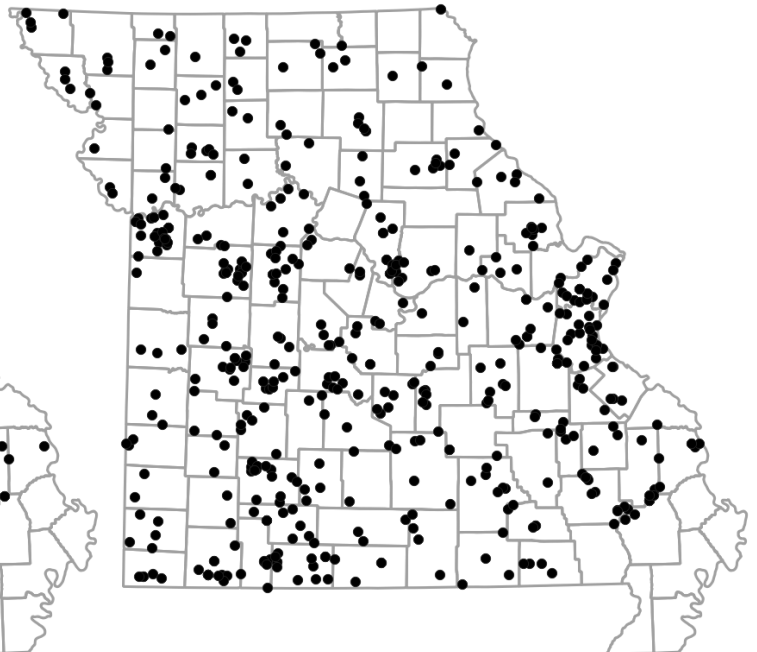
Sonora semiannulata
Variable Groundsnake



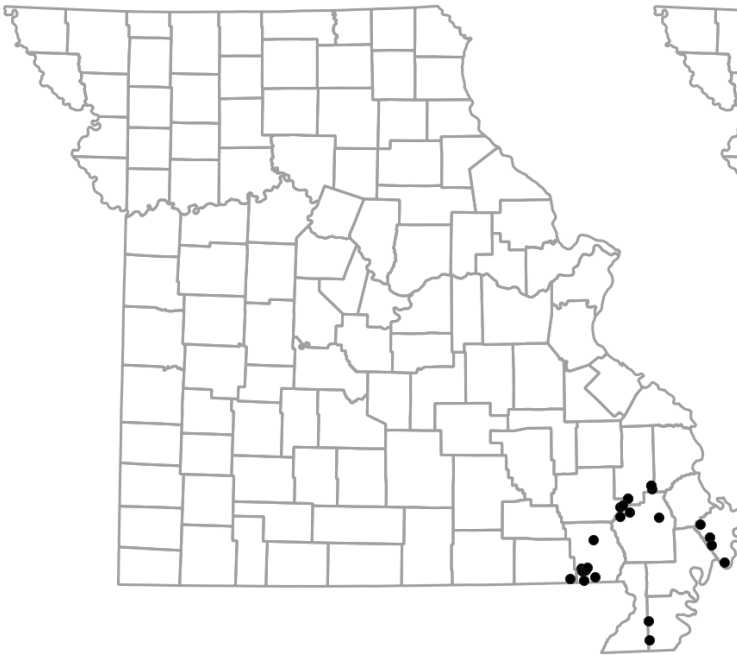
Tantilla gracilis
Flat-headed Snake



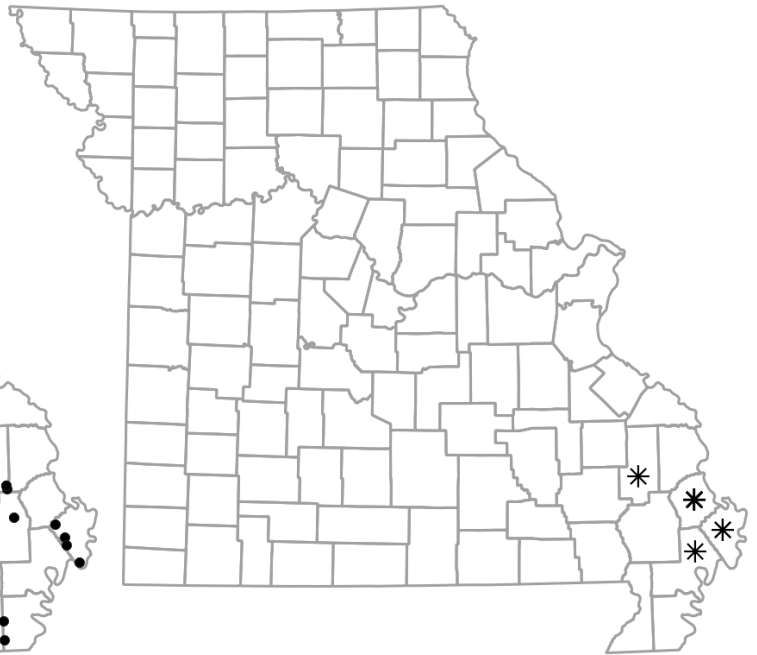
Carphophis vermis
Western Wormsnake



Diadophis punctatus
Ring-necked Snake



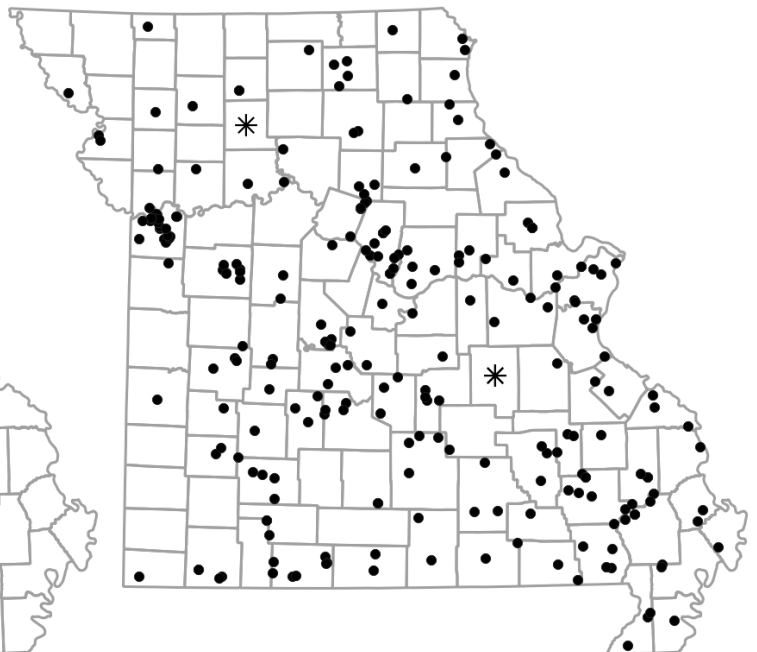
Farancia abacura
Western Mudsucker



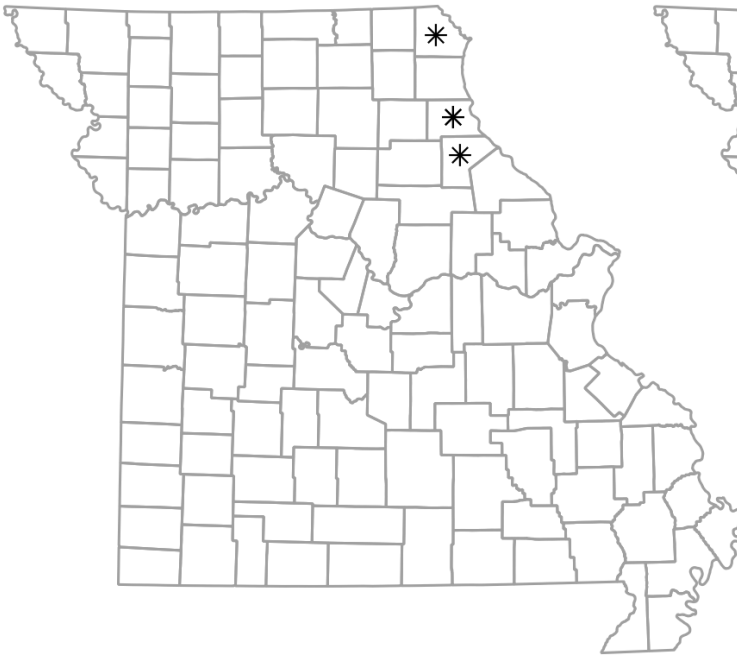
Heterodon gloydi
Dusty Hog-nosed Snake



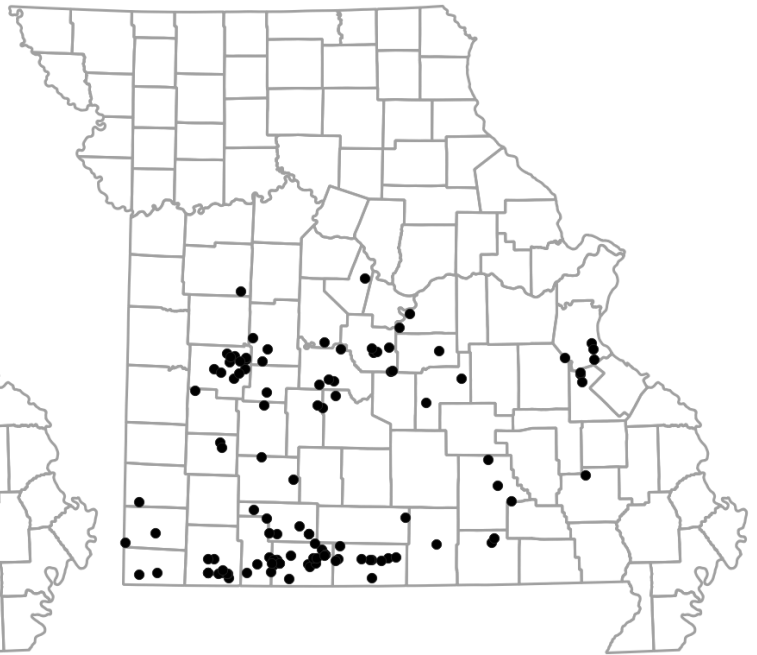
Heterodon nasicus
Plains Hog-nosed Snake



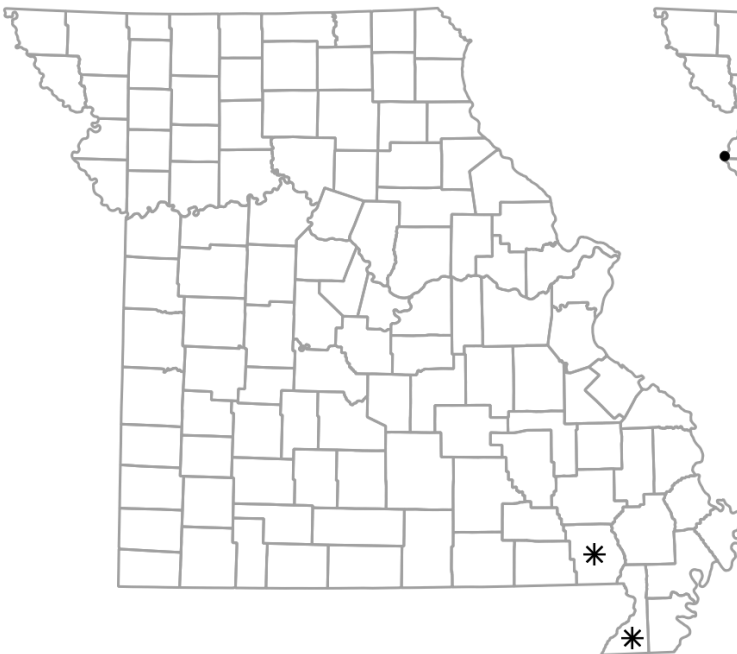
Heterodon platirhinos
Eastern Hog-nosed Snake



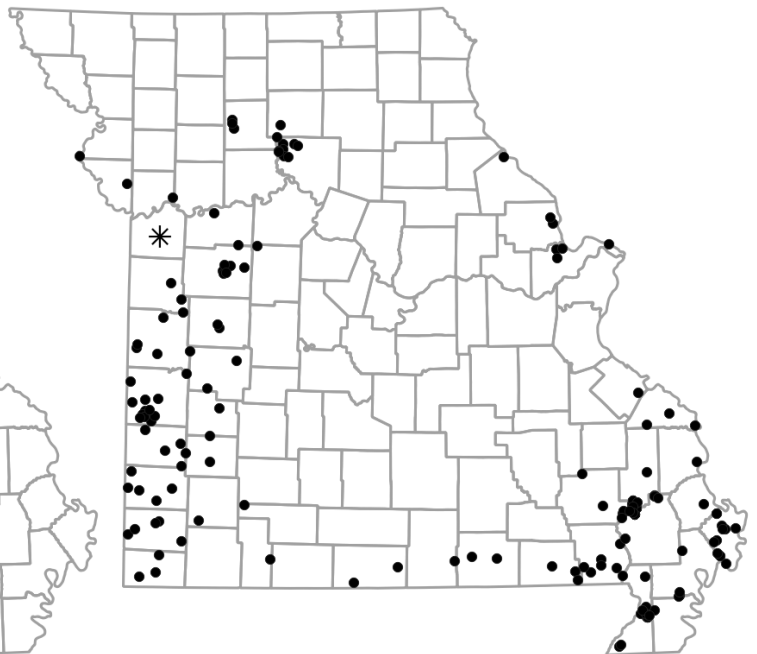
Clonophis kirtlandii
Kirtland's Snake



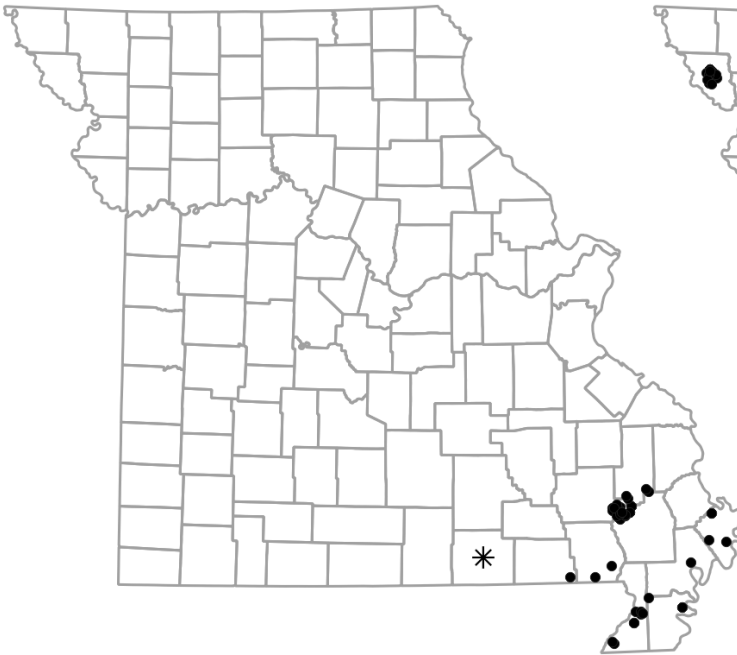
Haldea striatula
Rough Earthsnake



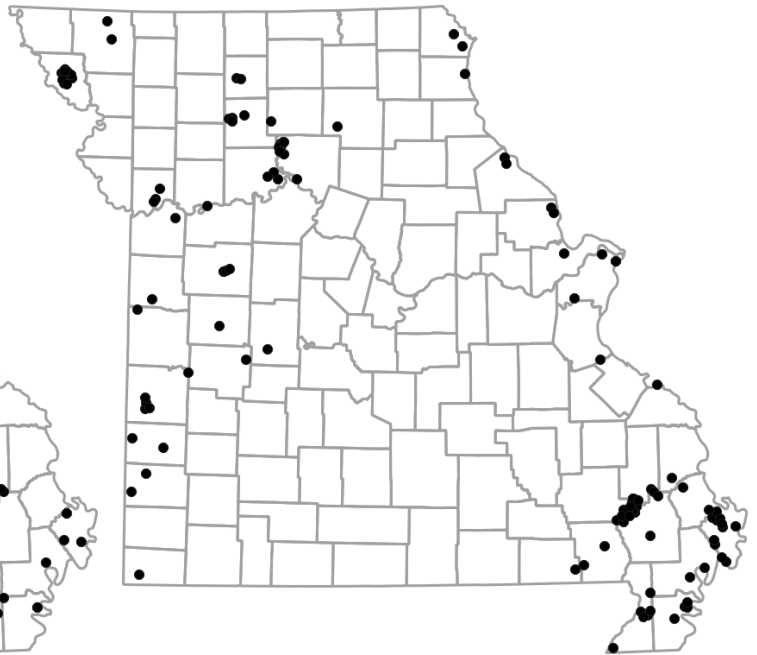
Nerodia cyclopion
Mississippi Green Watersnake



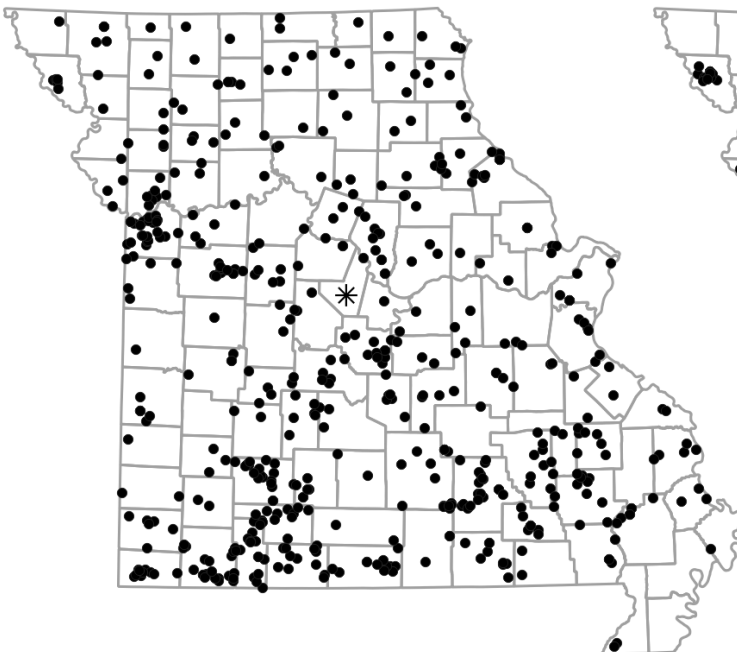
Nerodia erythrogaster
Plain-bellied Watersnake



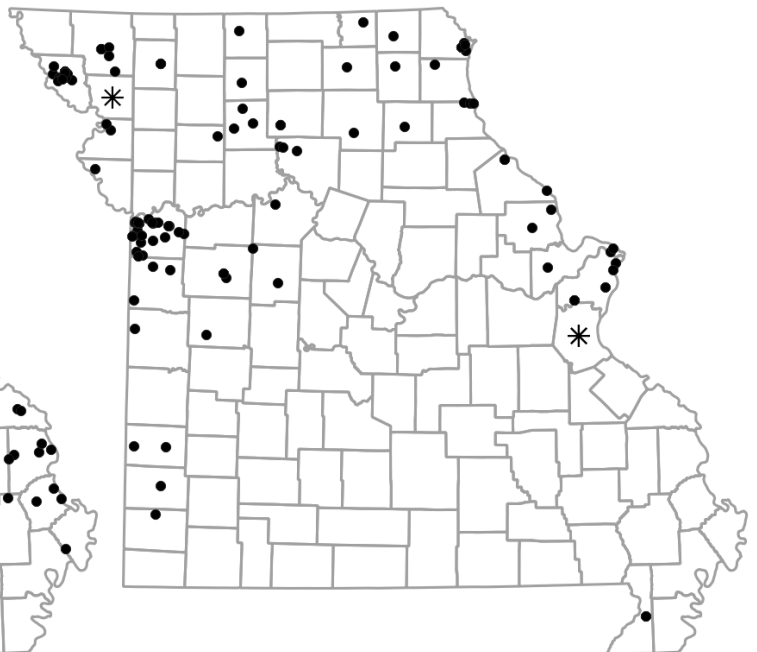
Nerodia fasciata
Broad-banded Watersnake



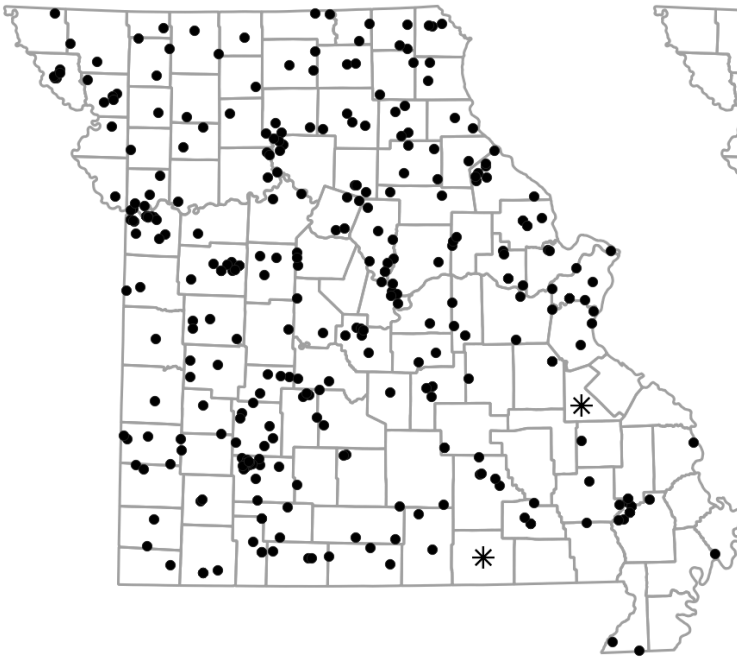
Nerodia rhombifer
Diamond-backed Watersnake



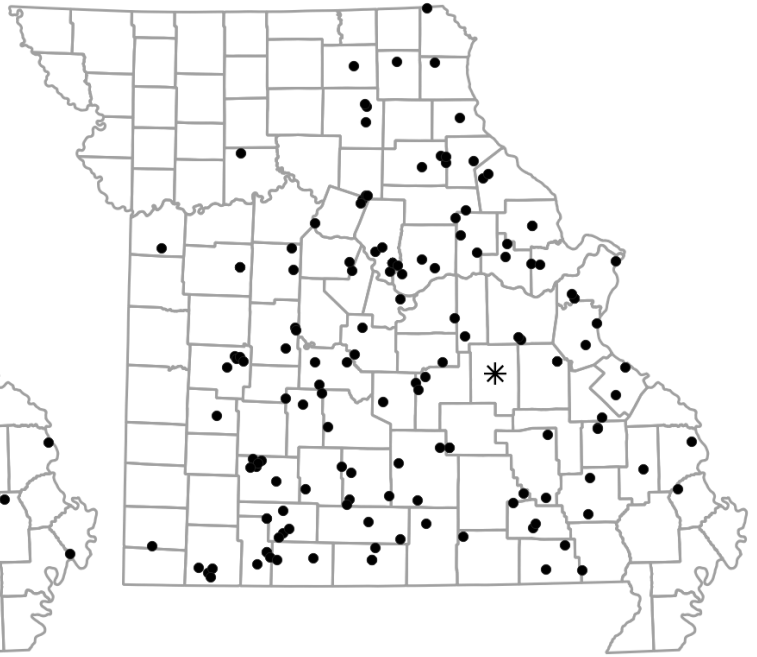
Nerodia sipedon
Common Watersnake



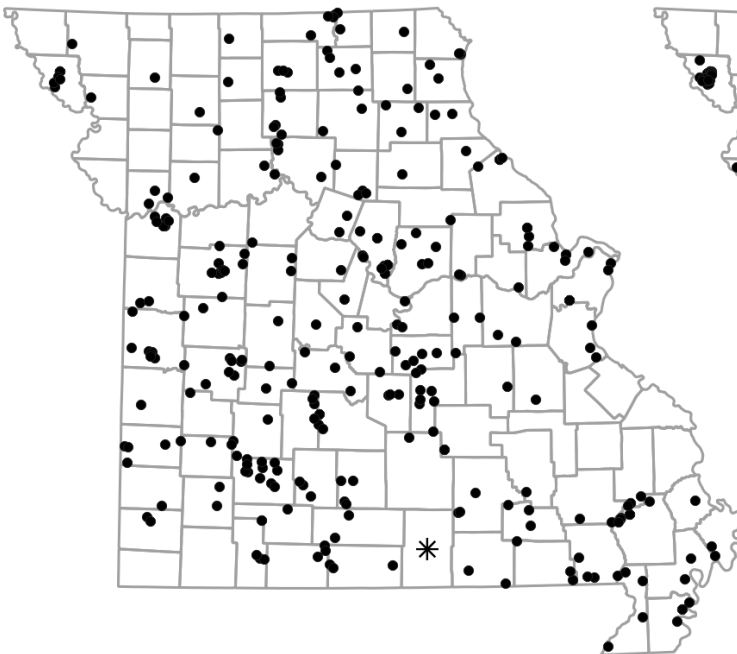
Regina grahamii
Graham's Crawfish Snake



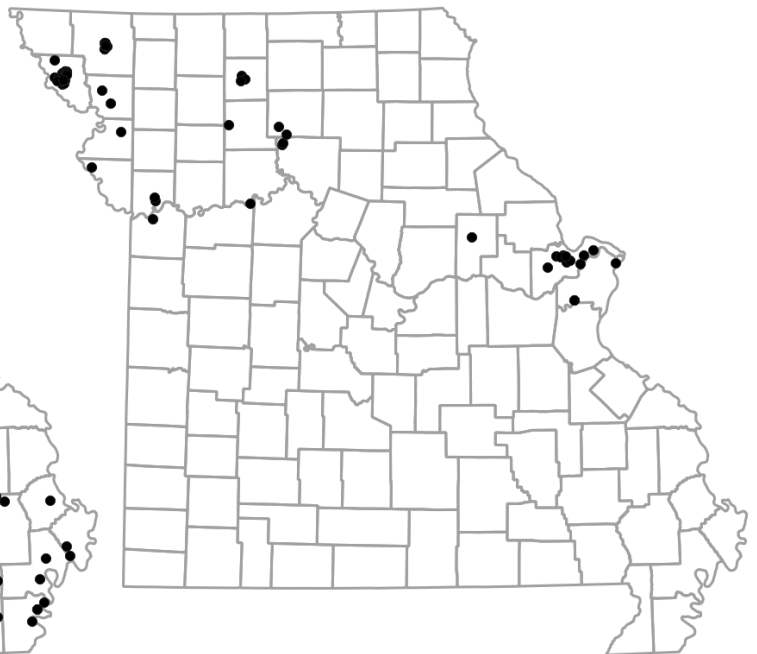
Storeria dekayi
DeKay's Brownsnake



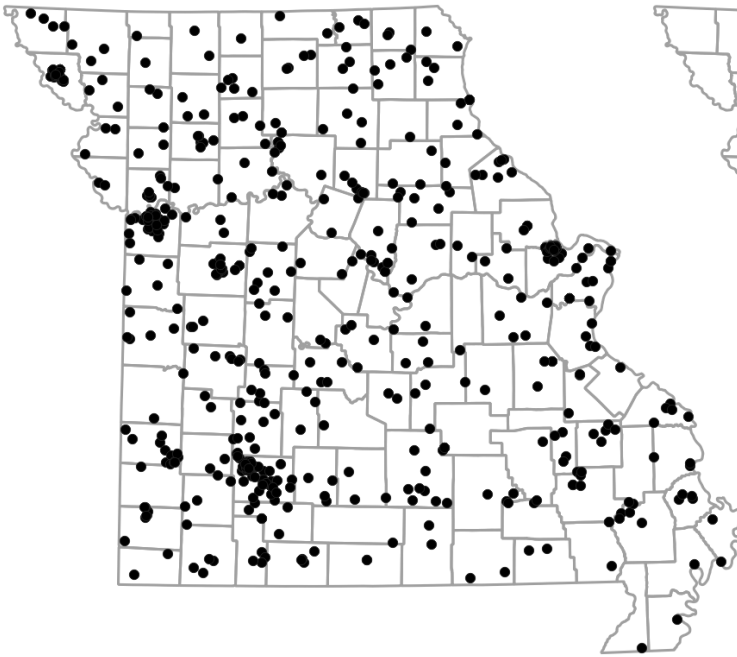
Storeria occipitomaculata
Northern Red-bellied Snake



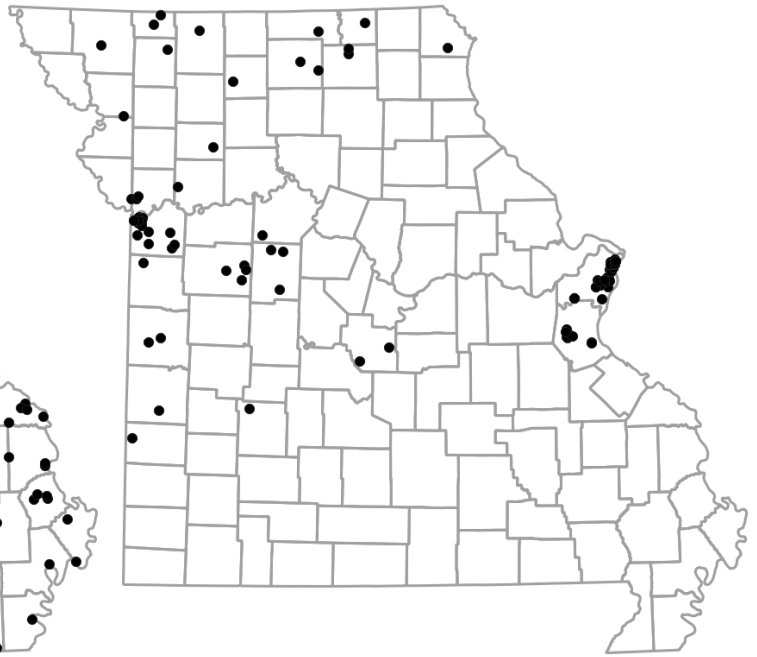
Thamnophis proximus
Orange-striped Ribbonsnake



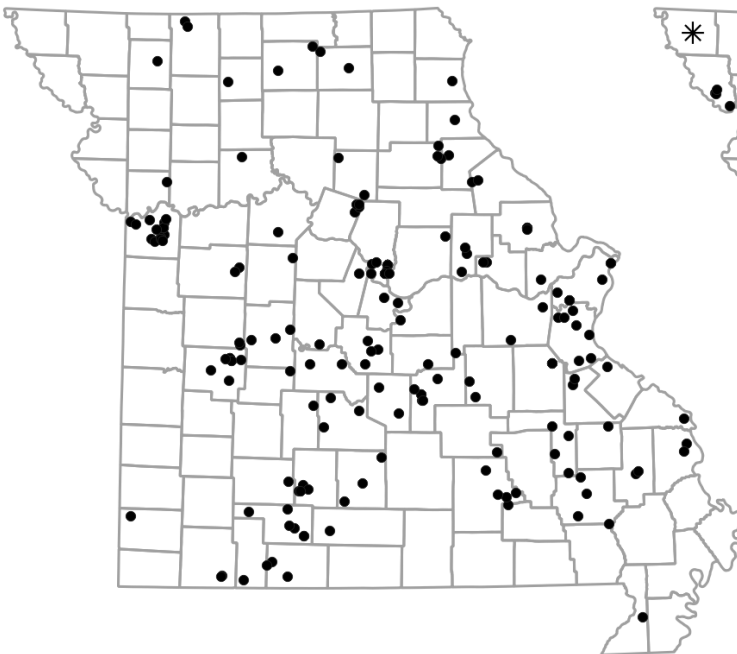
Thamnophis radix
Plains Gartersnake



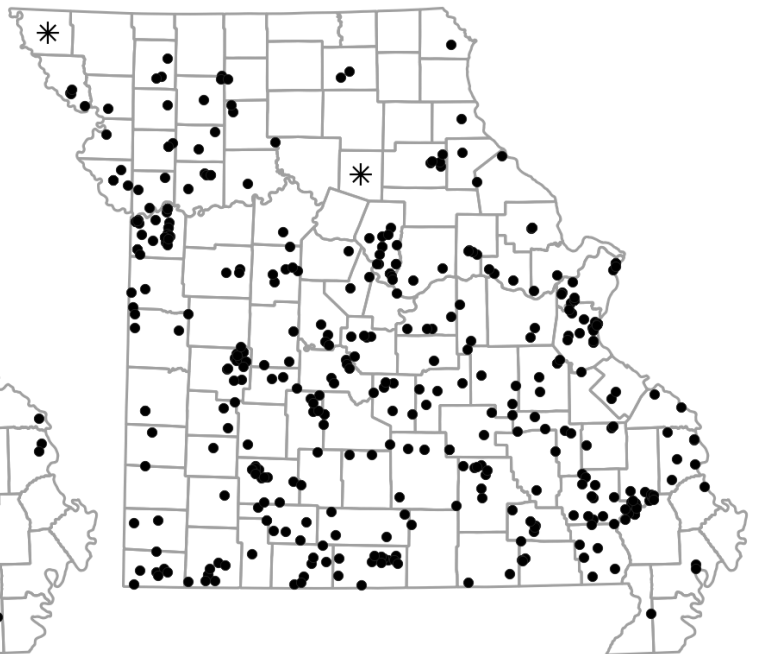
Thamnophis sirtalis
Common Gartersnake



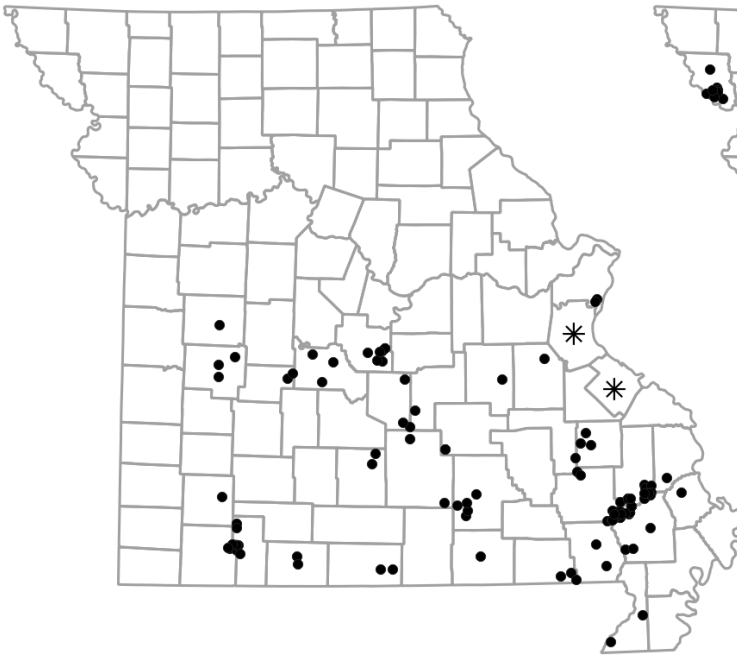
Tropidoclonion lineatum
Lined Snake



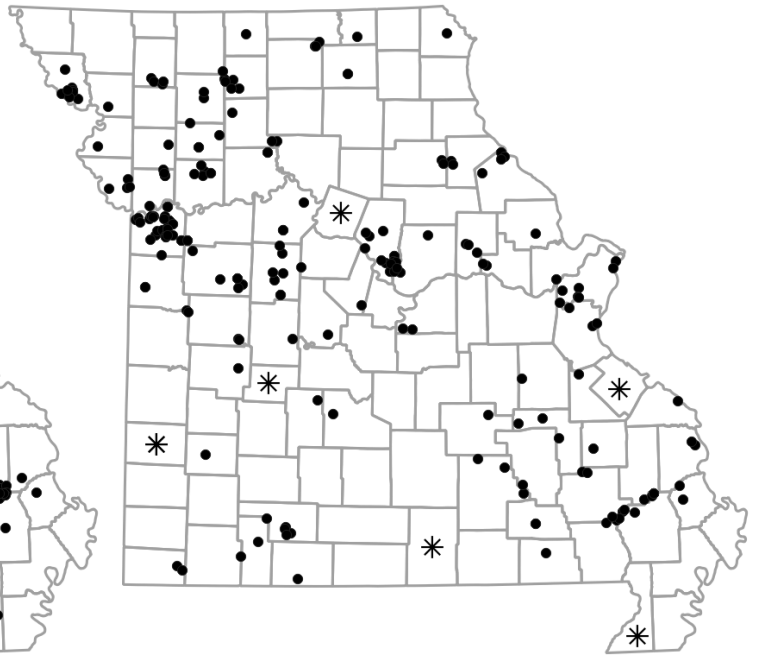
Virginia valeriae
Western Smooth Earthsnake



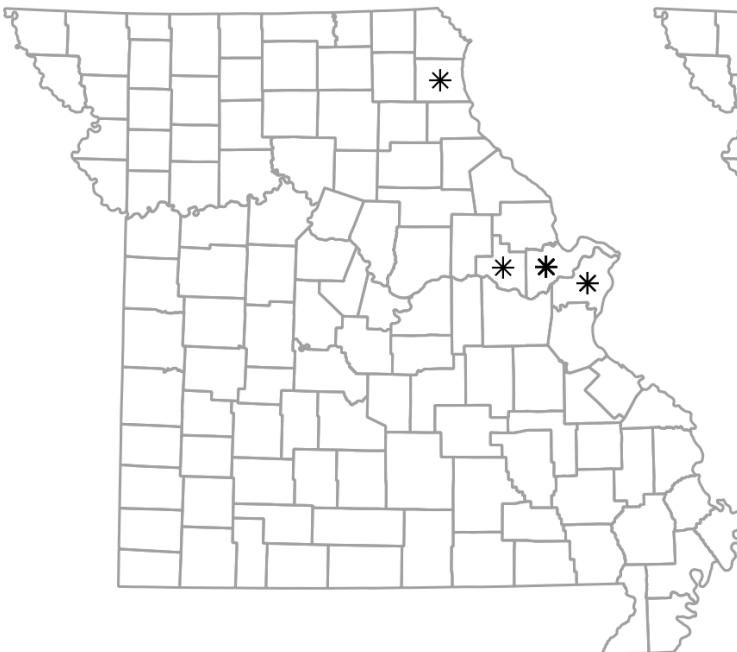
Agkistrodon contortrix
Copperhead



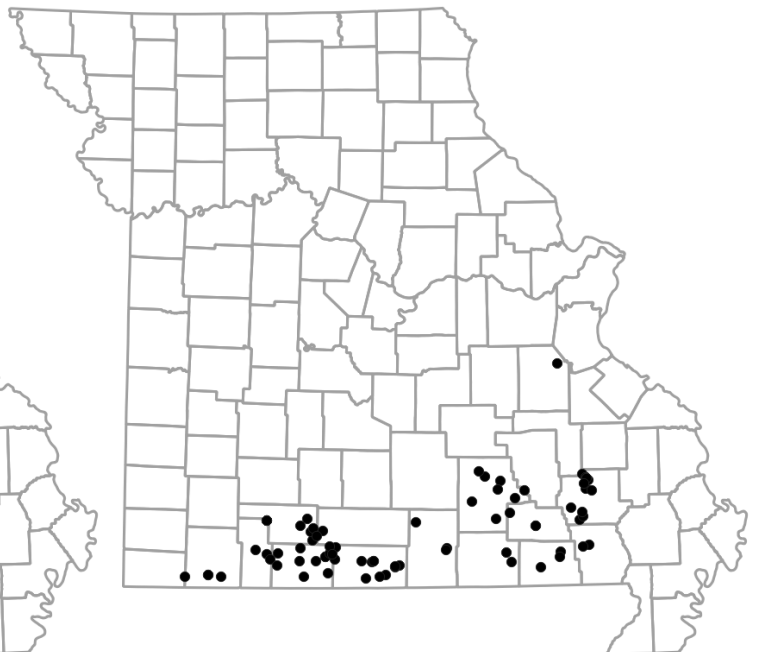
Agkistrodon piscivorus
Western Cottonmouth



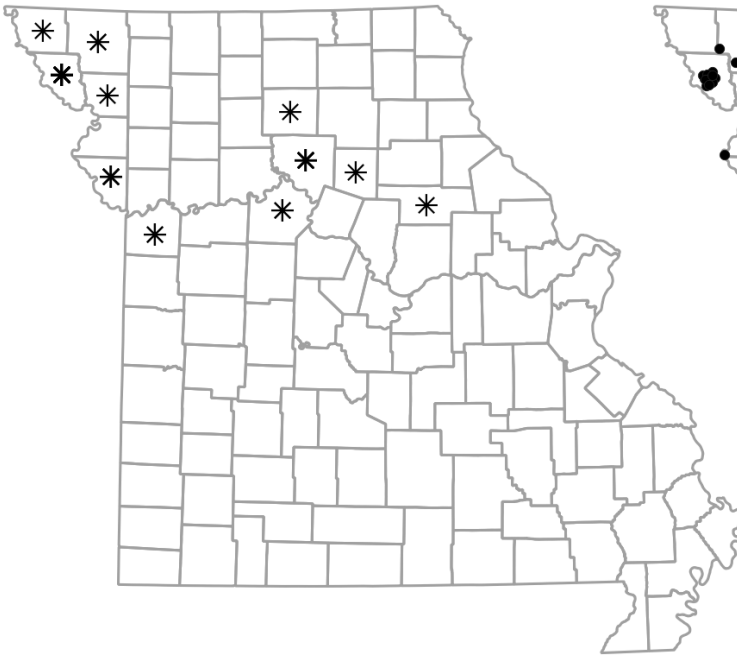
Crotalus horridus
Timber Rattlesnake



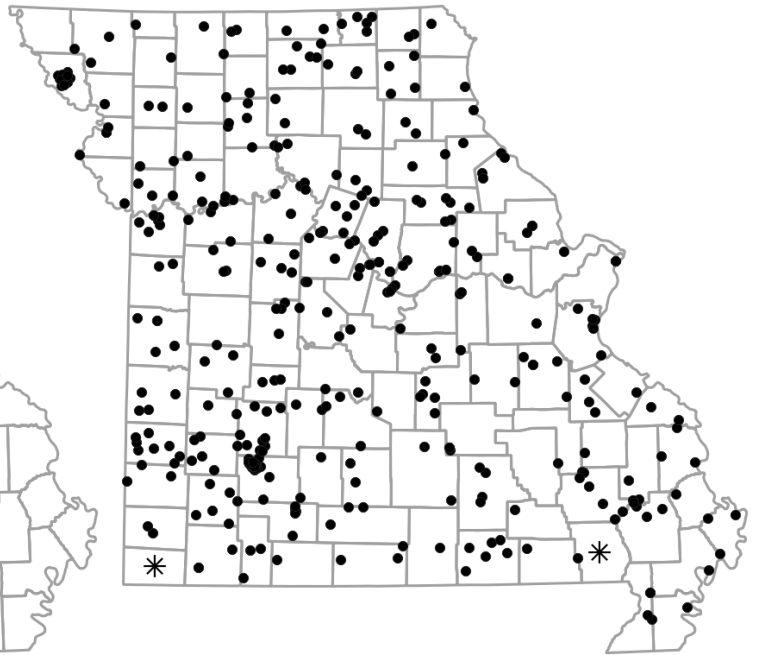
Sistrurus catenatus
Eastern Massasauga



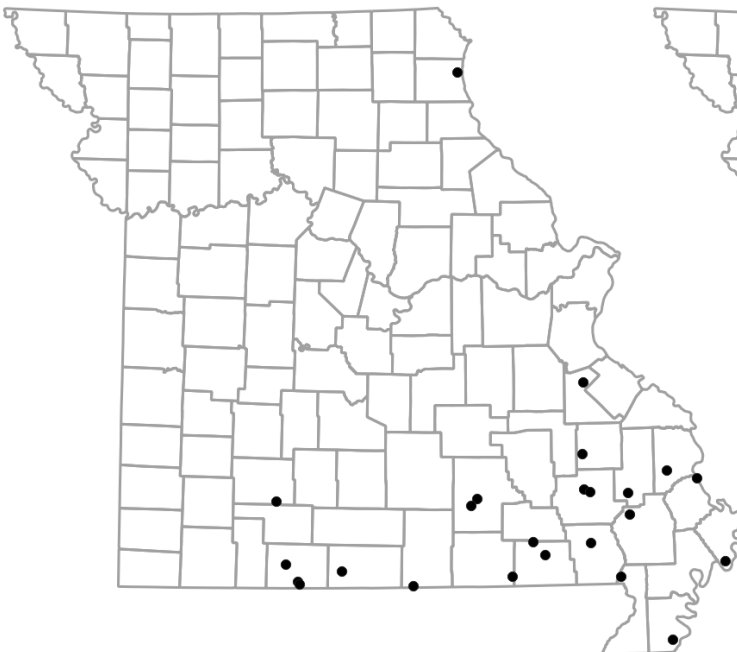
Sistrurus miliarius
Western Pygmy Rattlesnake



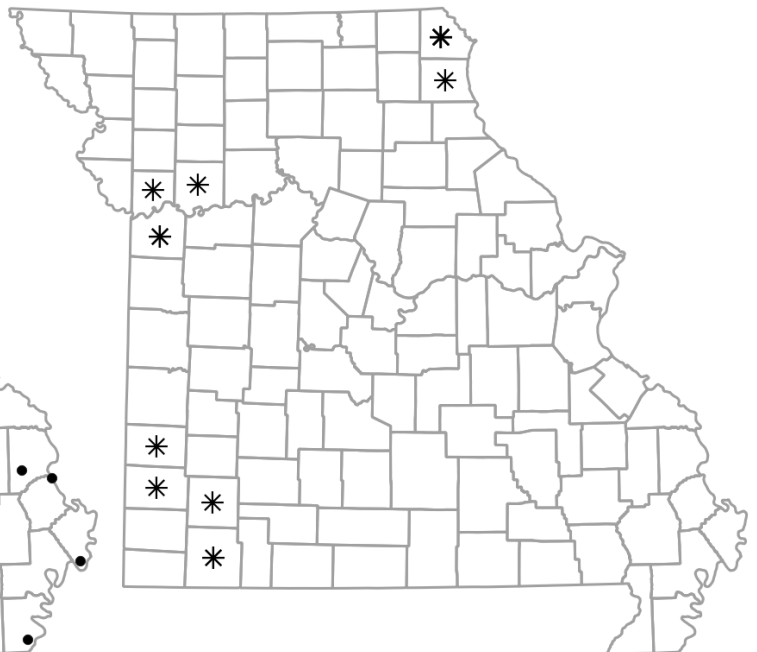
Sistrurus tergeminus
Prairie Massasauga



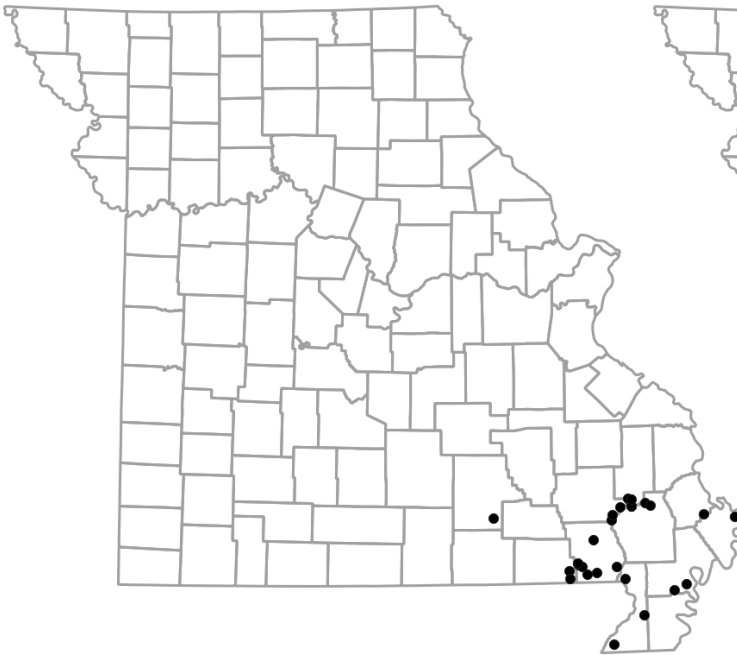
Chelydra serpentina
Snapping Turtle



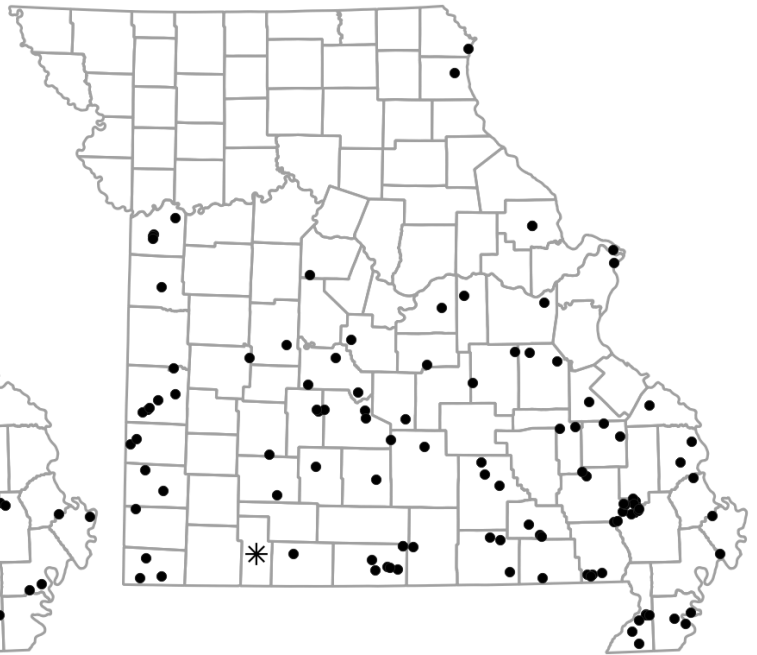
Macrochelys temminckii
Alligator Snapping Turtle



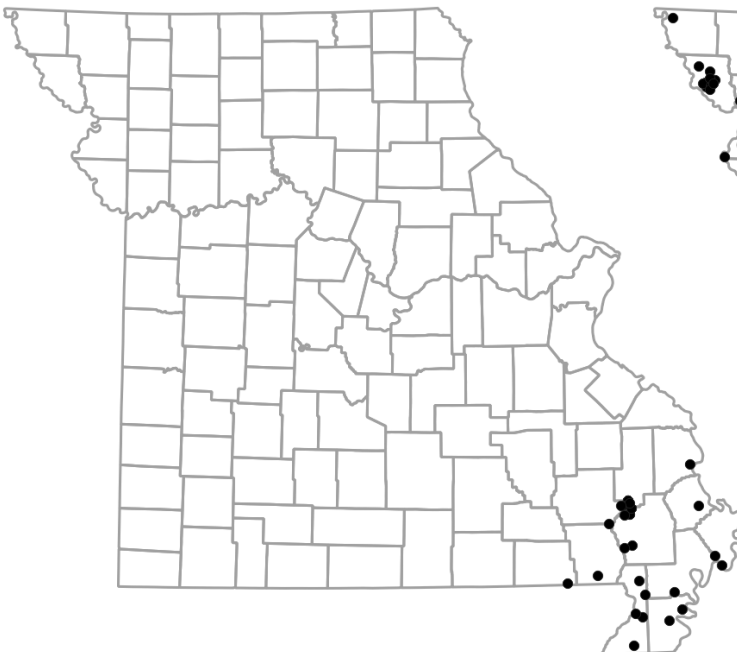
Kinosternon flavescens
Yellow Mud Turtle



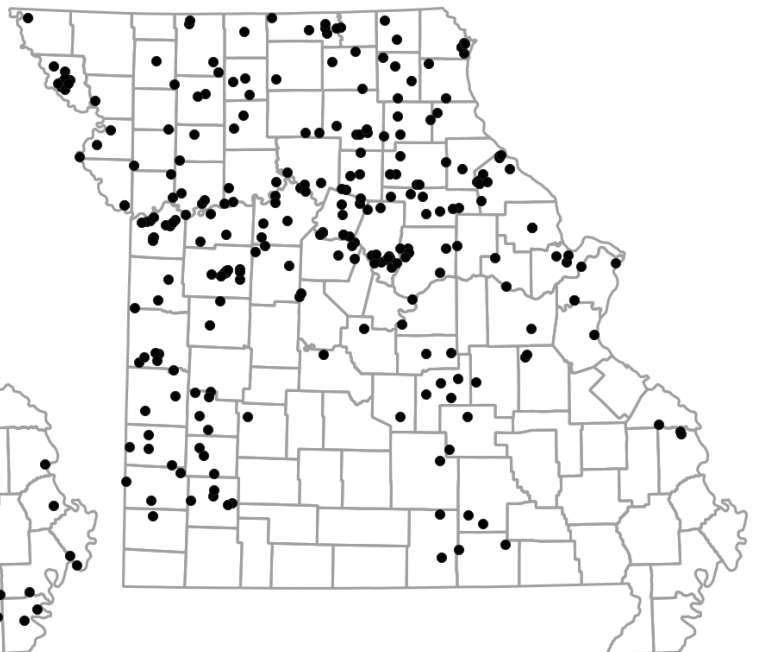
Kinosternon subrubrum
Mississippi Mud Turtle



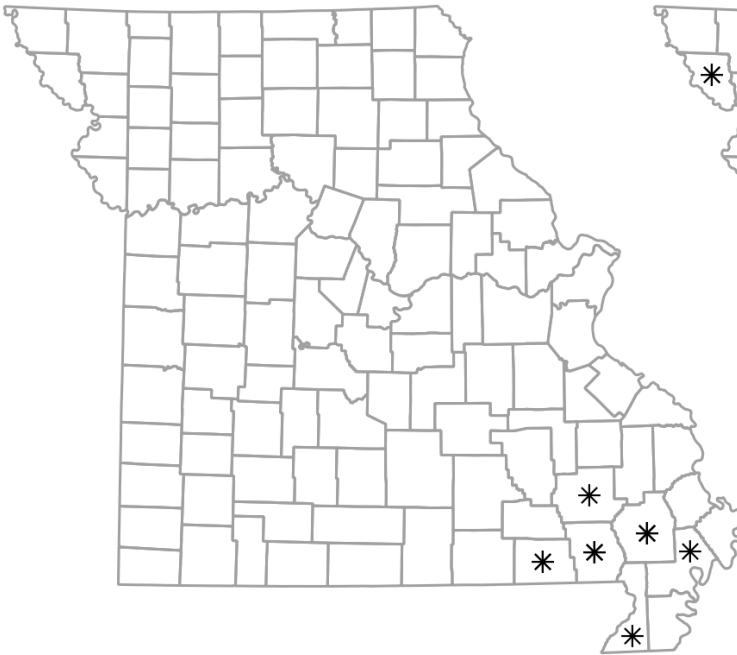
Sternotherus odoratus
Eastern Musk Turtle



Chrysemys dorsalis
Southern Painted Turtle



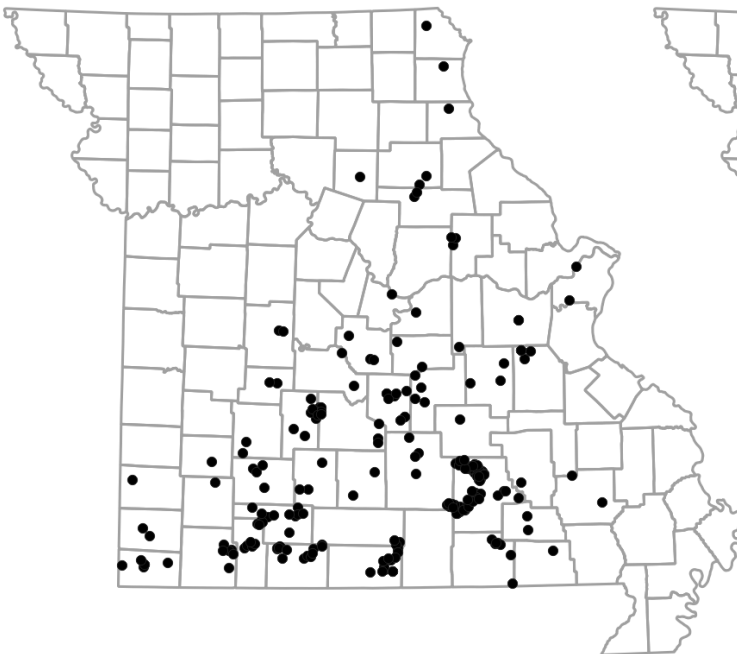
Chrysemys picta
Western Painted Turtle



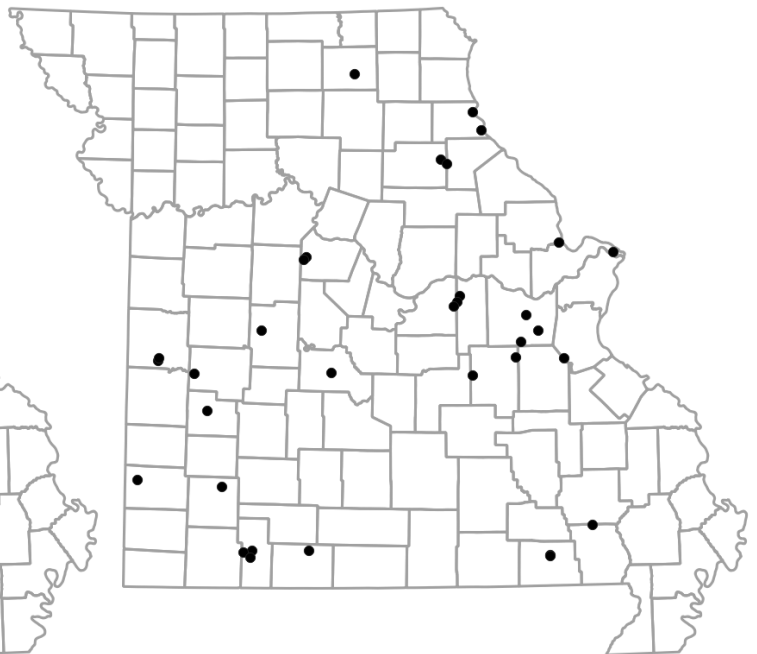
Deirochelys reticularia
Western Chicken Turtle



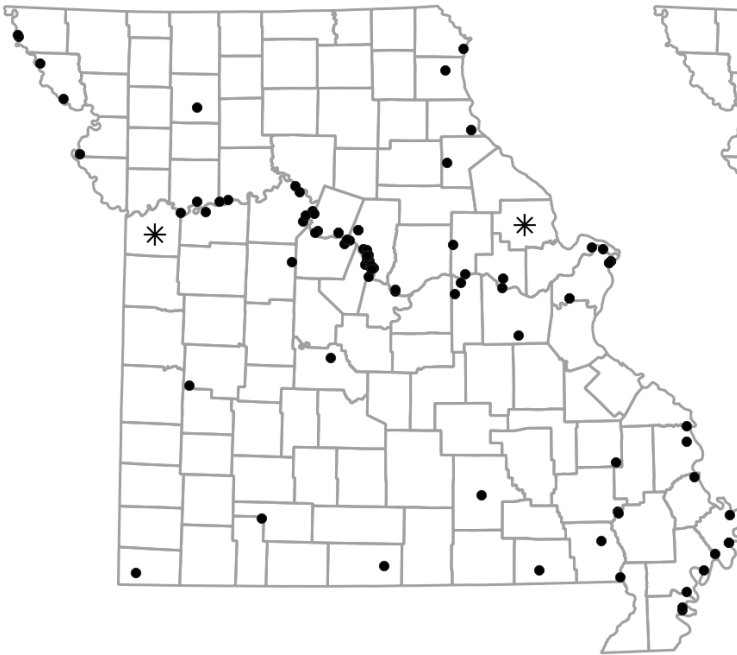
Emydoidea blandingii
Blanding's Turtle



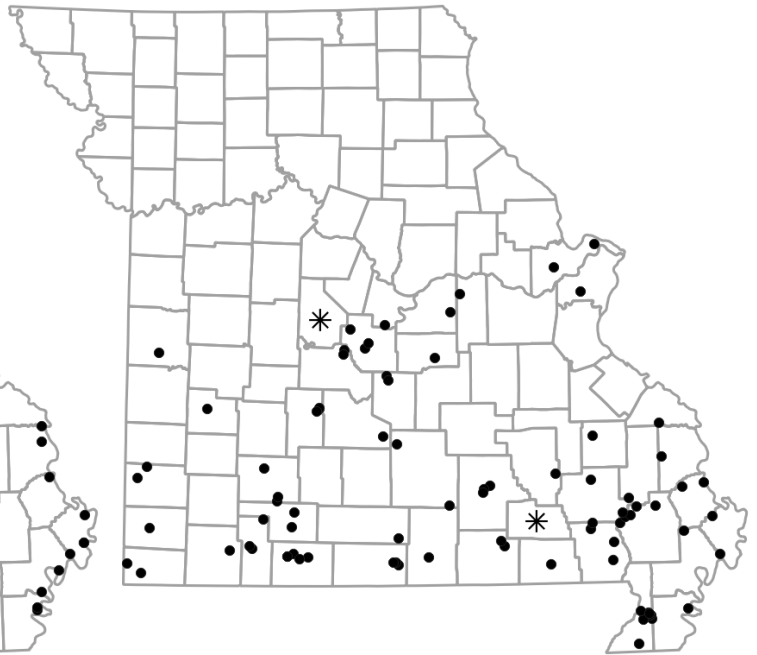
Graptemys geographica
Northern Map Turtle



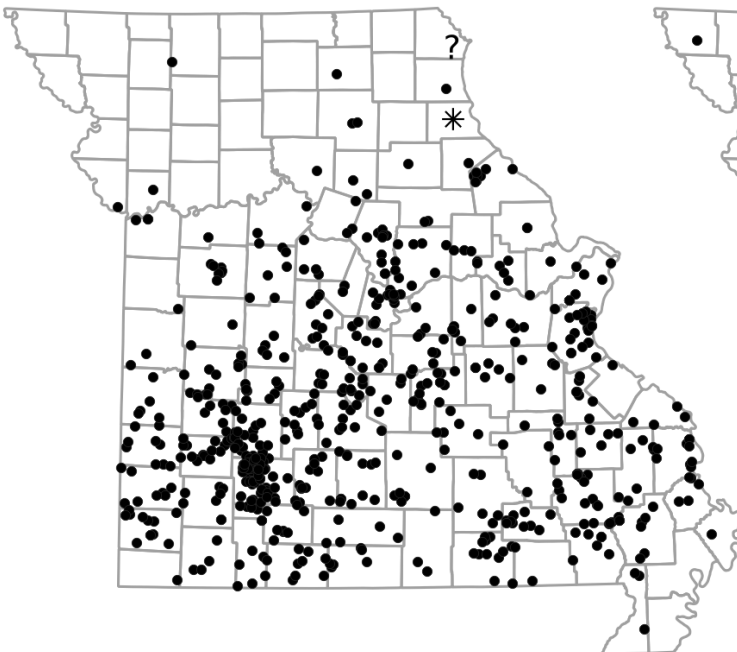
Graptemys ouachitensis
Ouachita Map Turtle



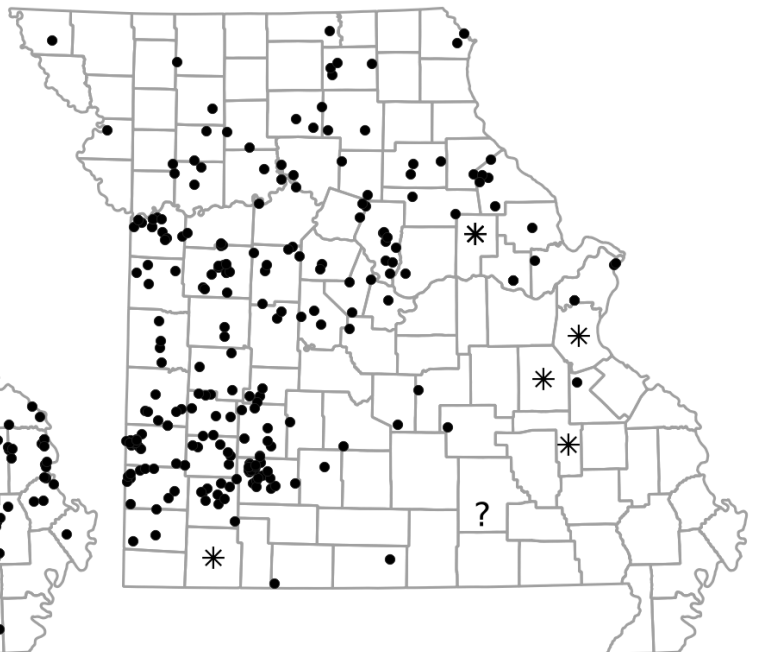
Graptemys pseudogeographica
False Map Turtle



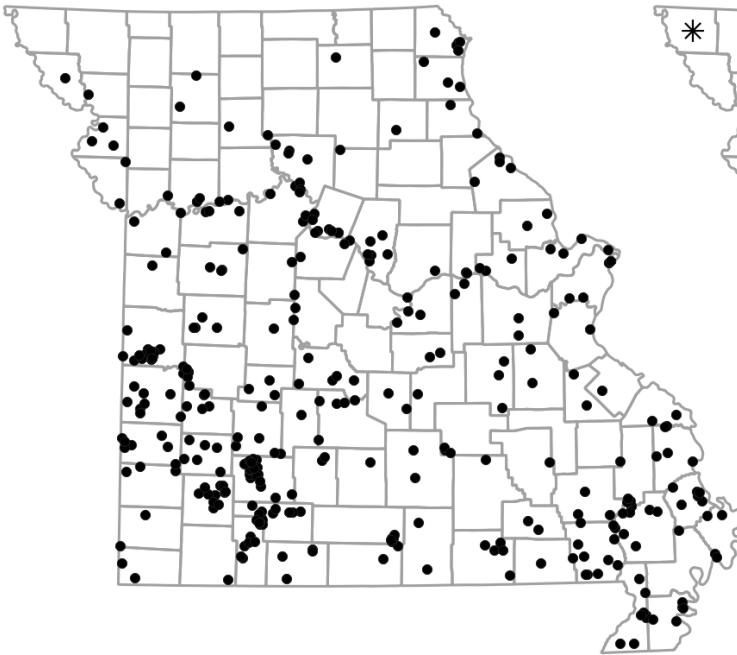
Pseudemys concinna
River Cooter



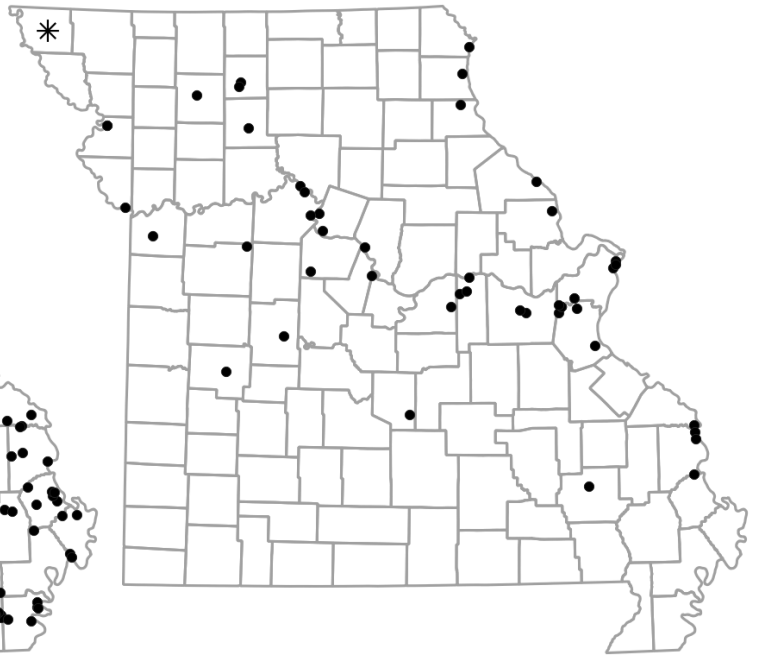
Terrapene carolina
Three-toed Box Turtle



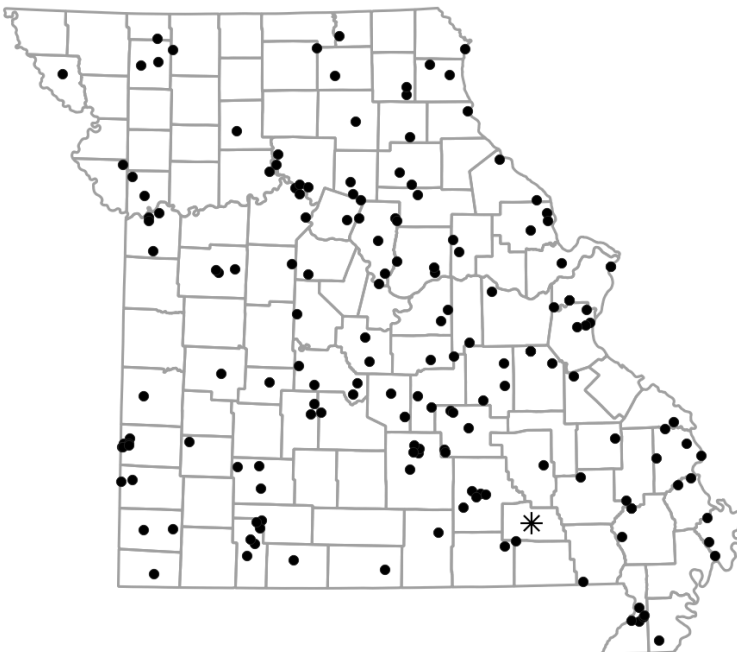
Terrapene ornata
Ornate Box Turtle



Trachemys scripta
Red-eared Slider



Apalone mutica
Midland Smooth Softshell

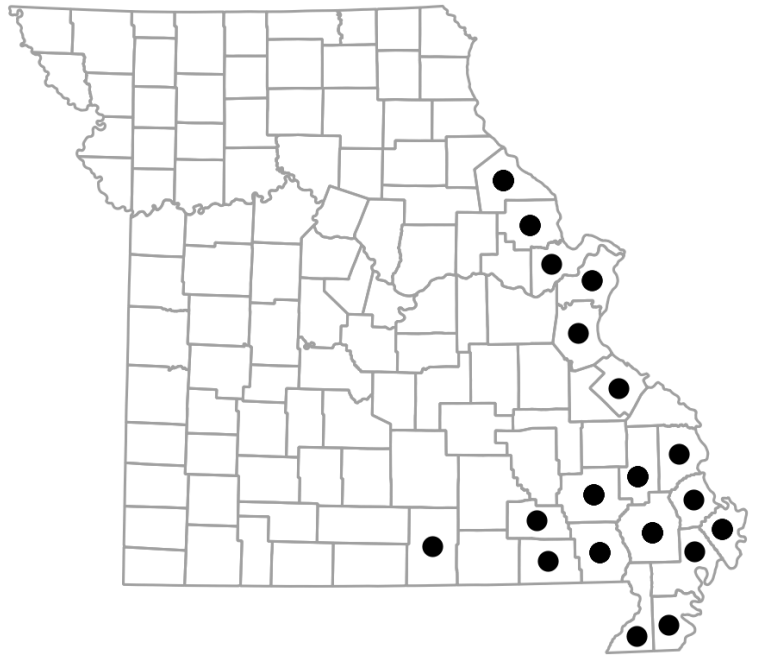


Apalone spinifera
Eastern Spiny Softshell

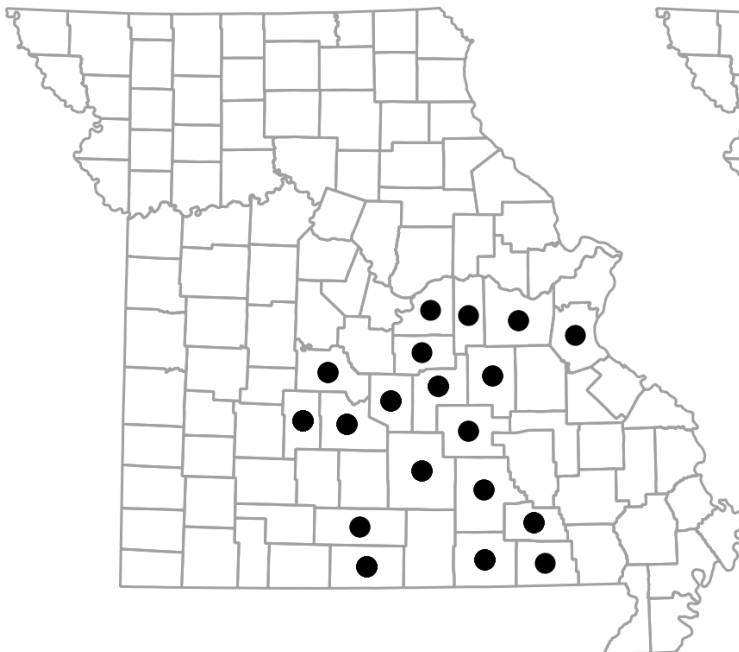
County Records Maps

Key:

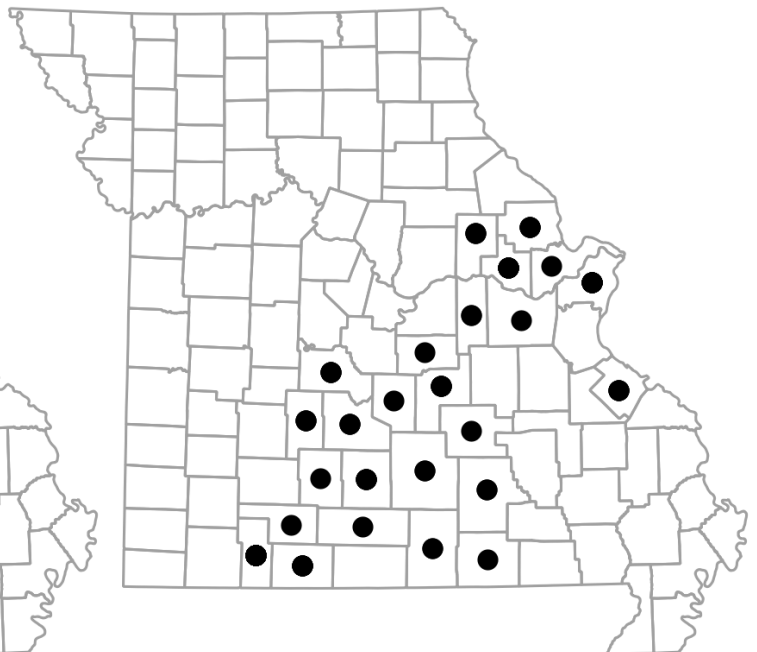
- Valid vouchered county record



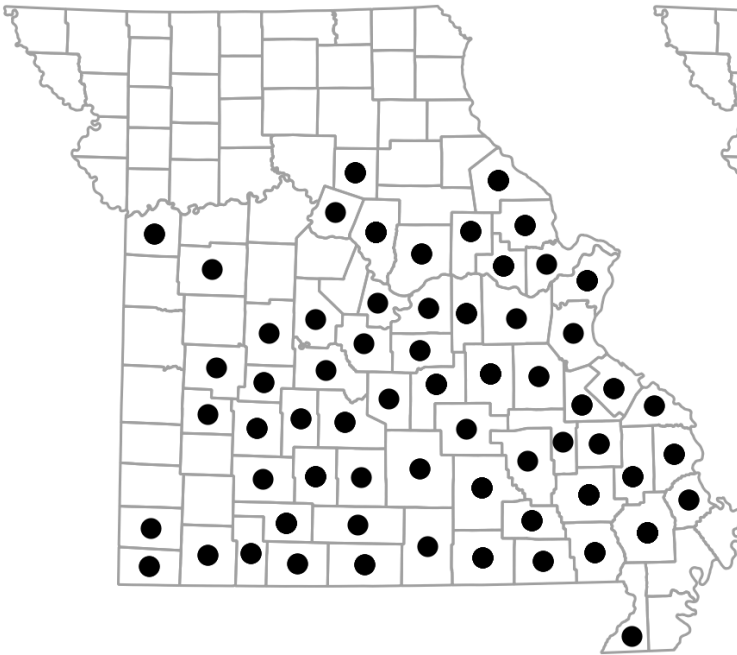
Siren intermedia
Western Lesser Siren



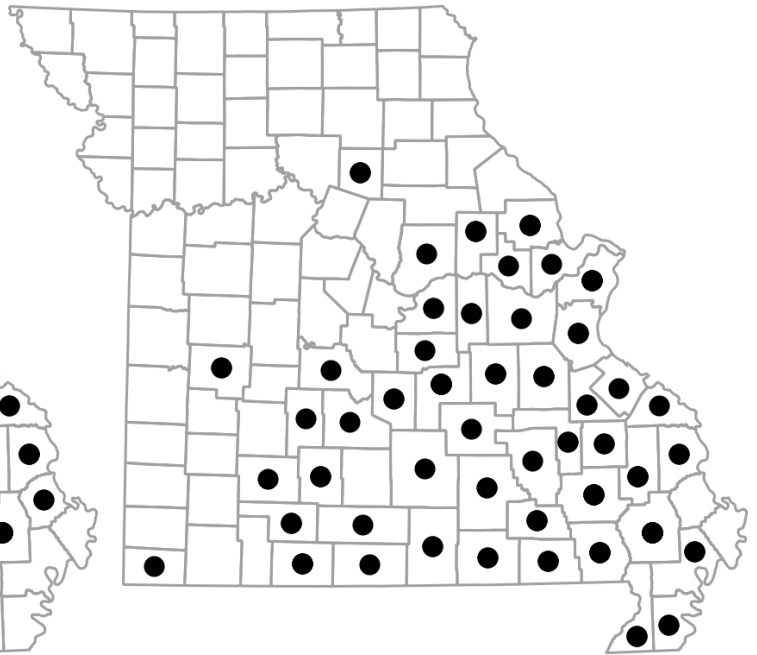
Cryptobranchus alleganiensis
Hellbender



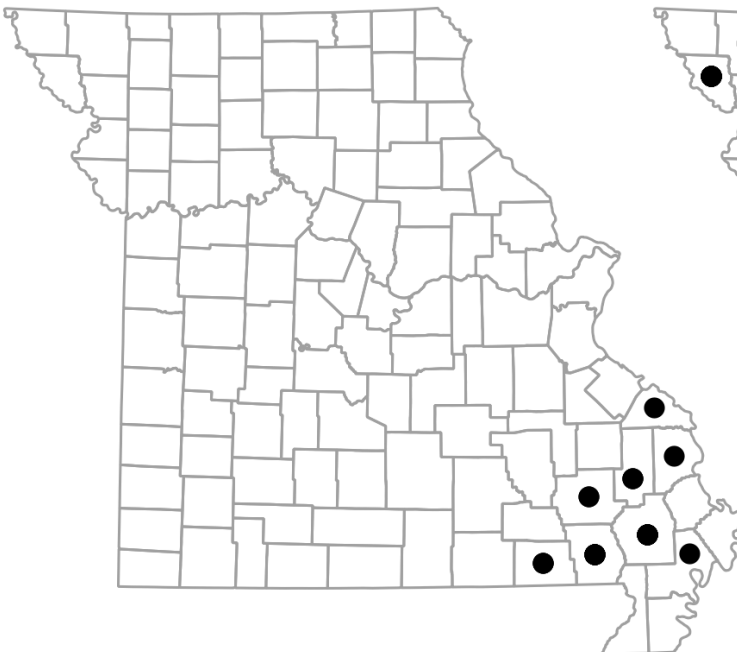
Ambystoma annulatum
Ringed Salamander



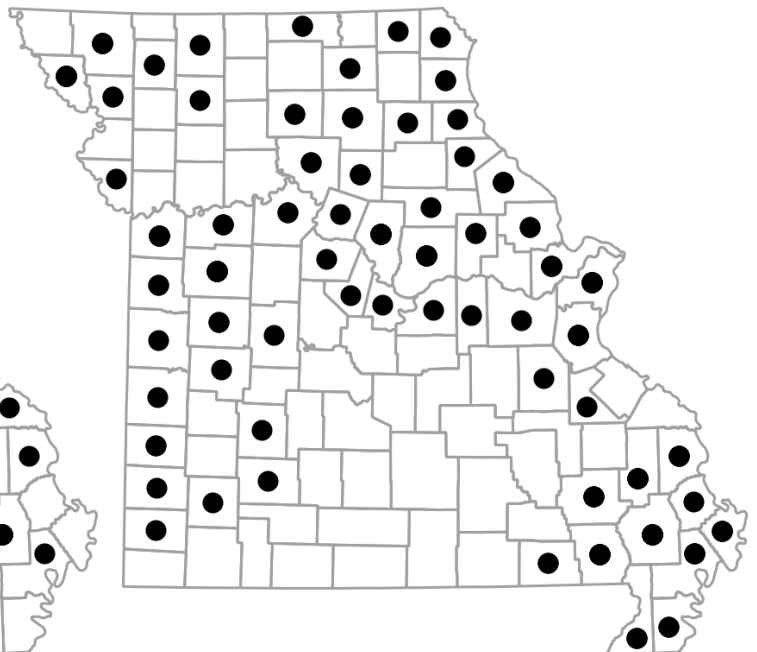
Ambystoma maculatum
Spotted Salamander



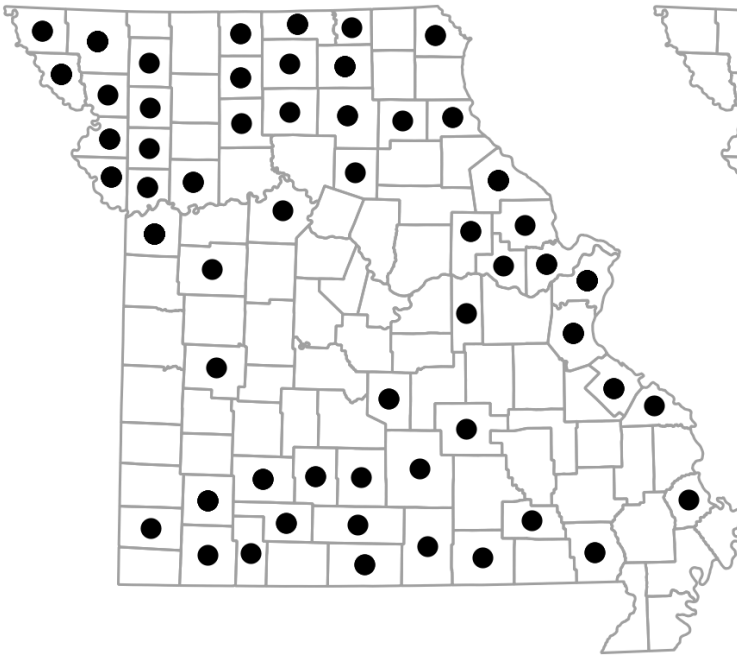
Ambystoma opacum
Marbled Salamander



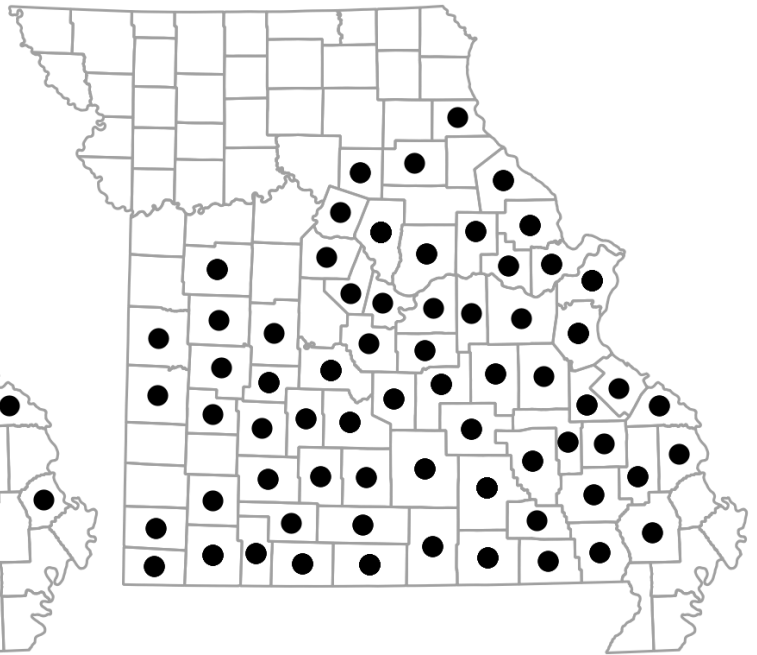
Ambystoma talpoideum
Mole Salamander



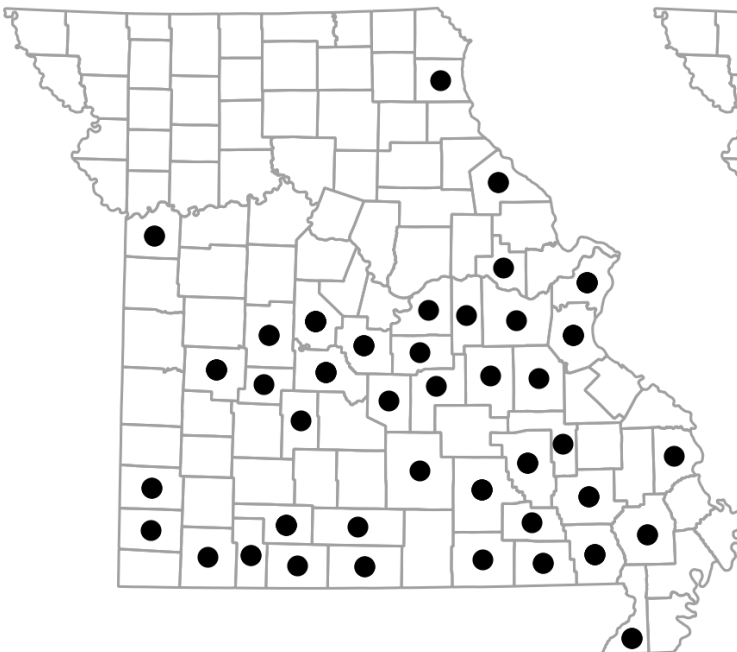
Ambystoma texanum
Small-mouthed Salamander



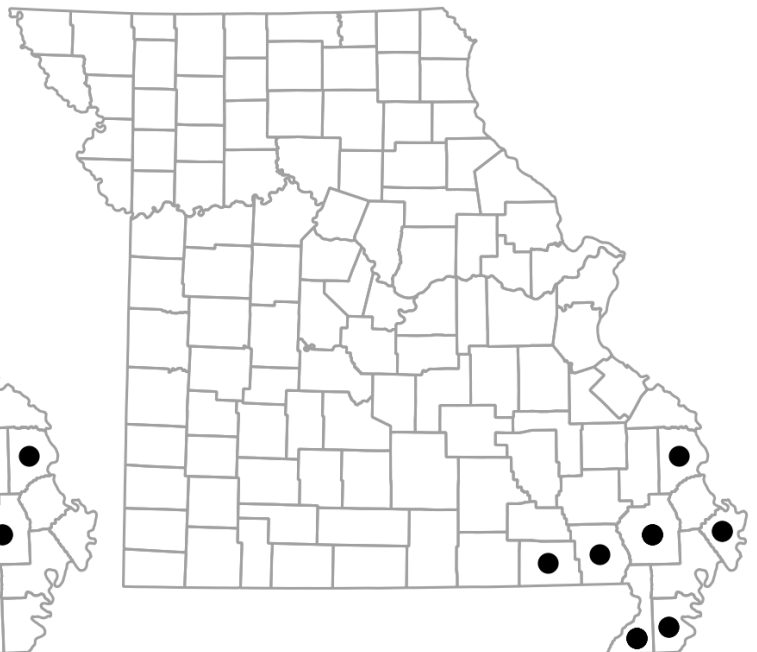
Ambystoma tigrinum
Eastern Tiger Salamander



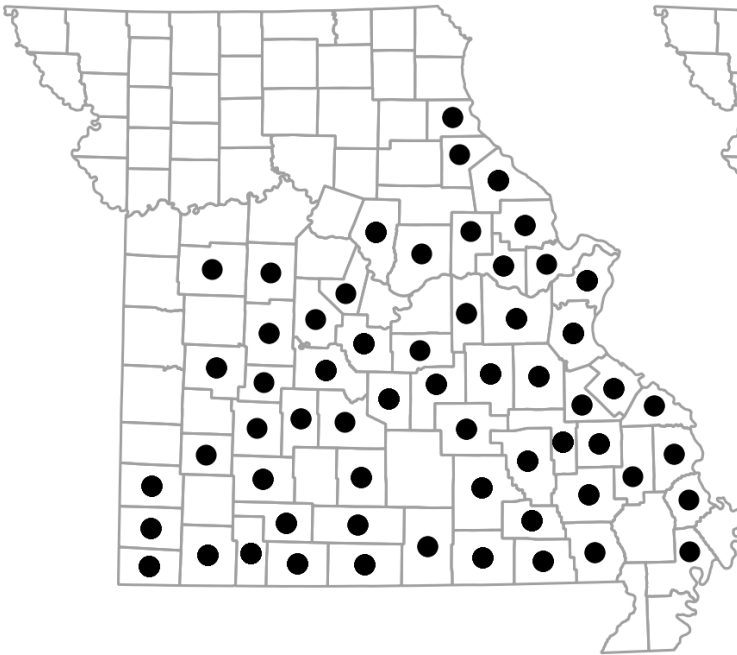
Notophthalmus viridescens
Central Newt



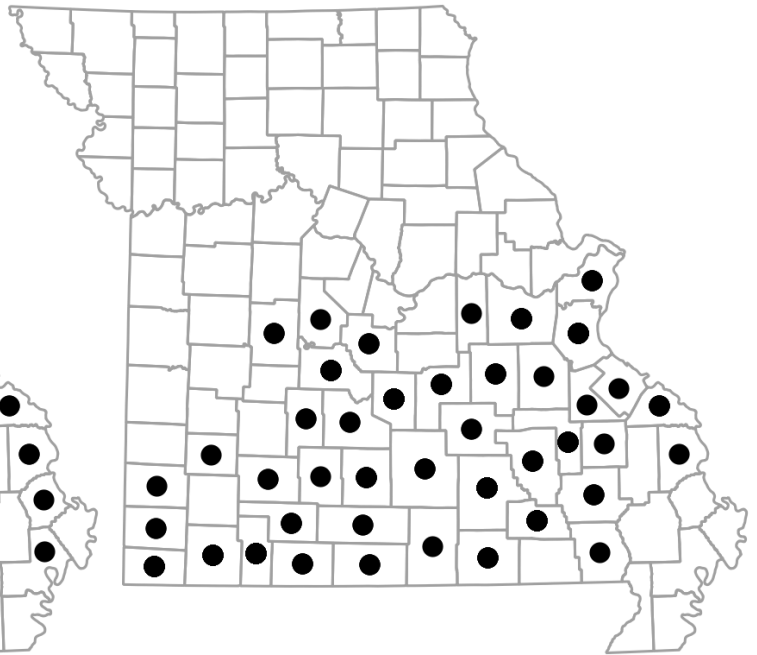
Necturus maculosus
Mudpuppy



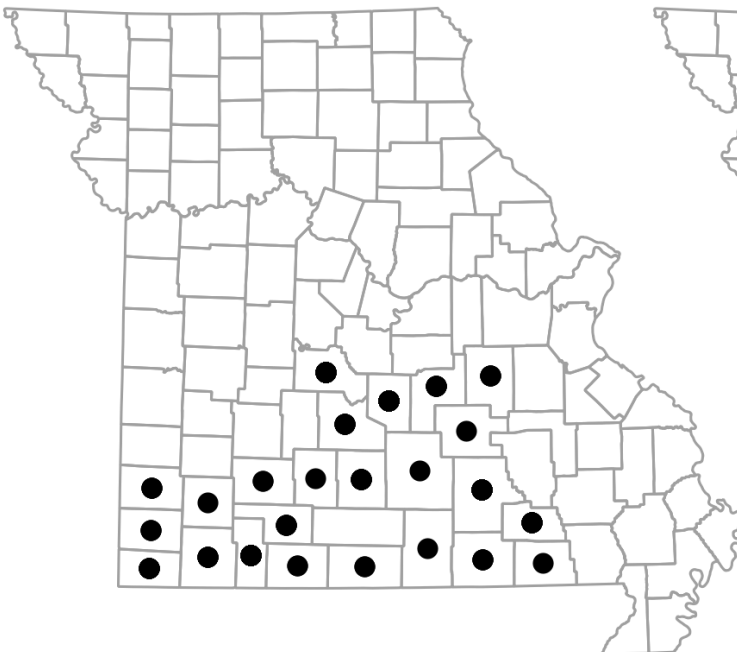
Amphiuma tridactylum
Three-toed Amphiuma



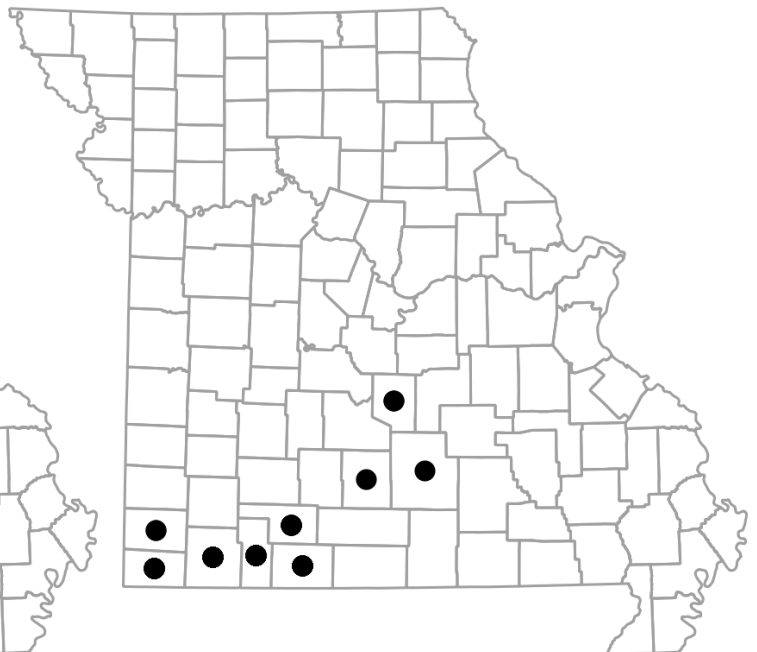
Eurycea longicauda
Long-tailed Salamander



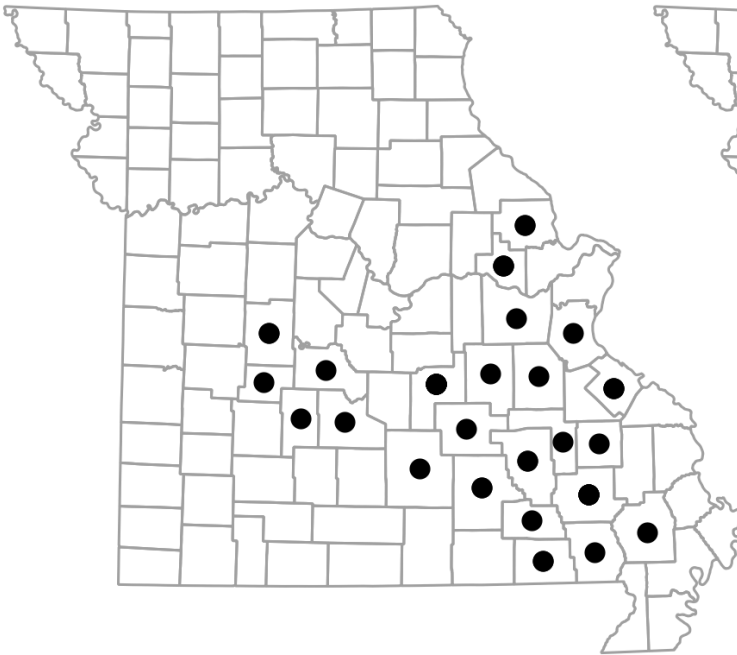
Eurycea lucifuga
Cave Salamander



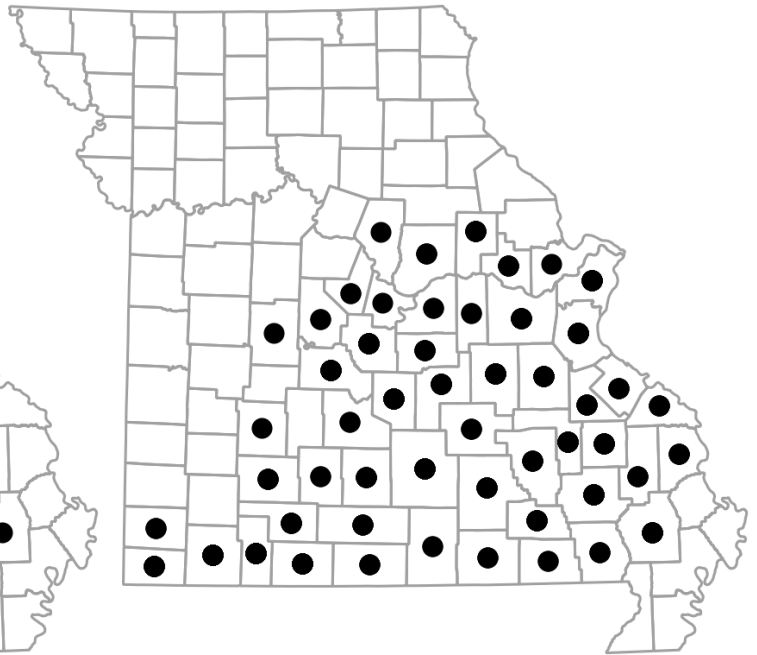
Eurycea spelaea
Grotto Salamander



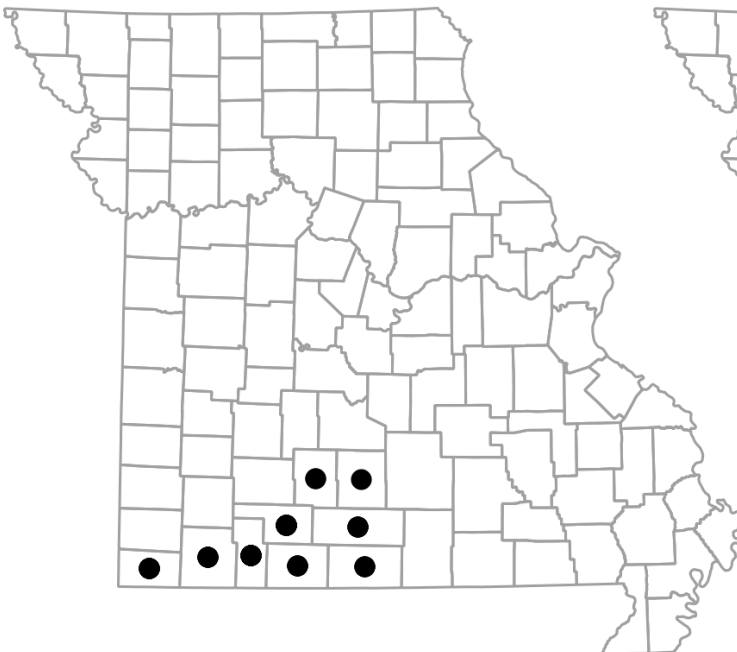
Eurycea tynerensis
Oklahoma Salamander



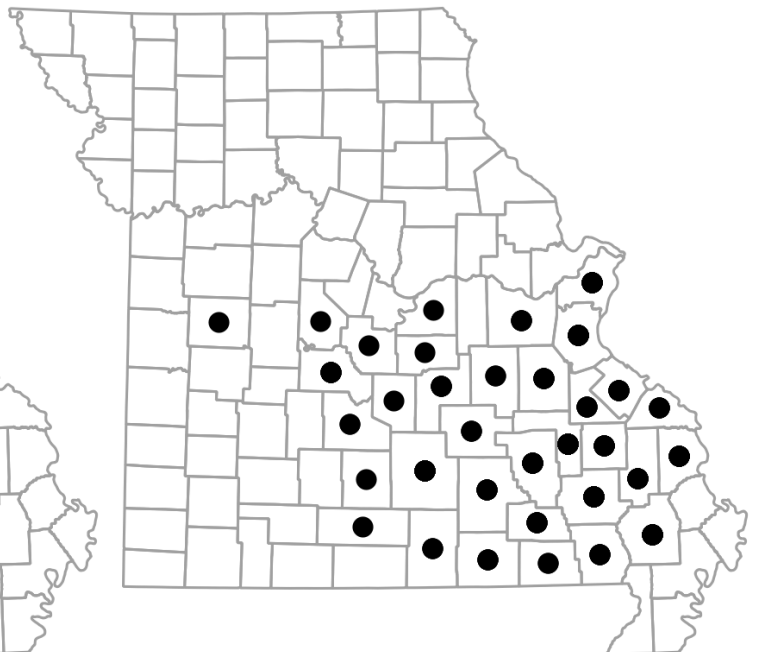
Hemidactylium scutatum
Four-toed Salamander



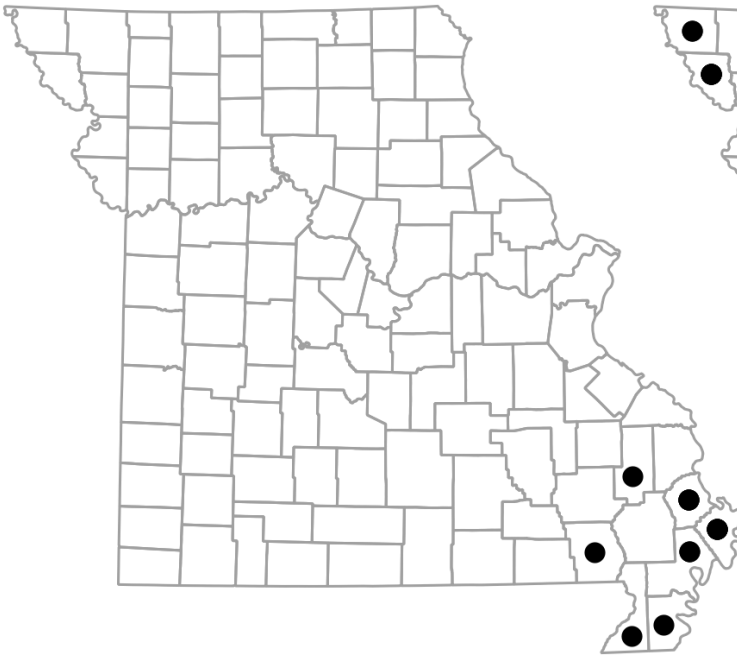
Plethodon albagula
Western Slimy Salamander



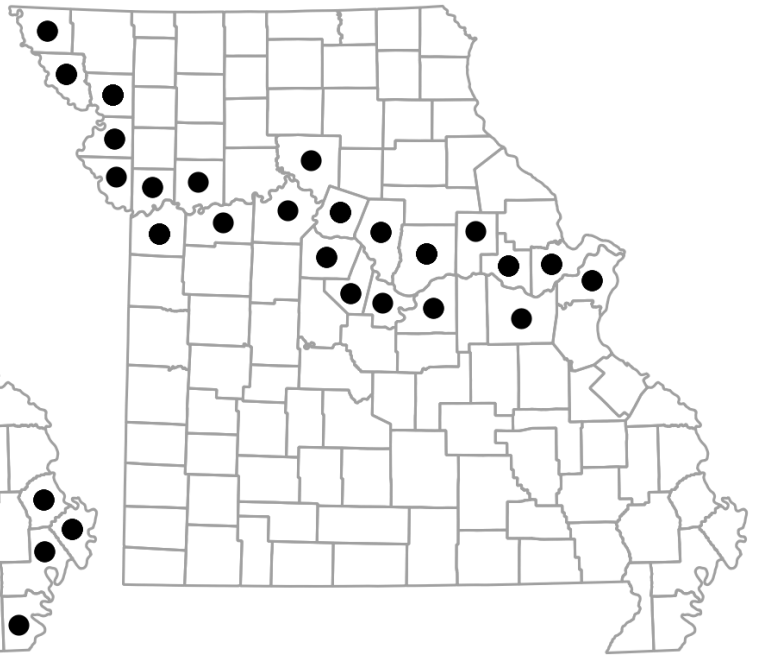
Plethodon angusticlavius
Ozark Zigzag Salamander



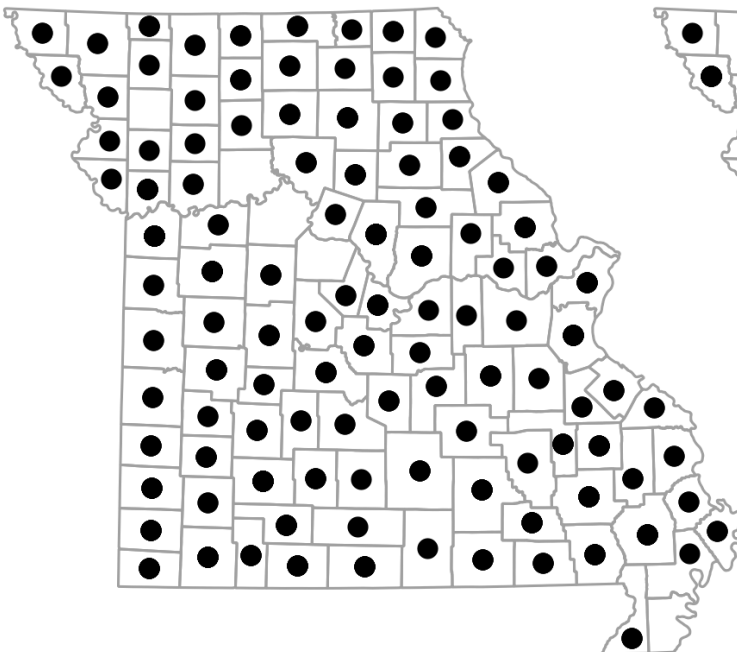
Plethodon serratus
Southern Red-backed Salamander



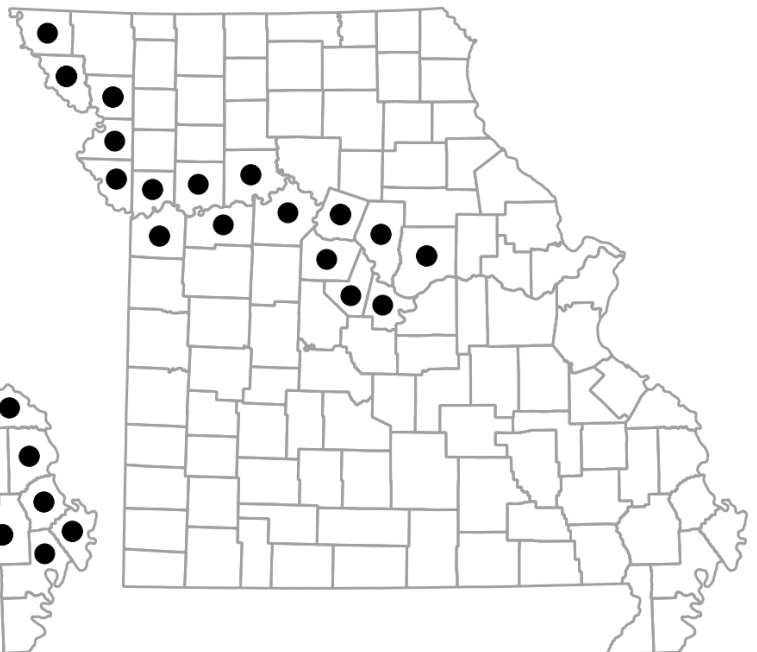
Scaphiopus holbrookii
Eastern Spadefoot



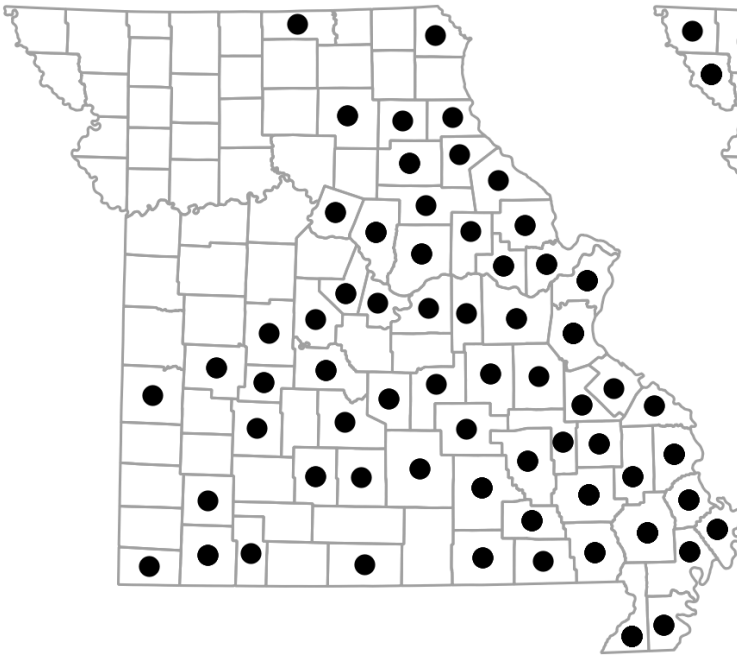
Spea bombifrons
Plains Spadefoot



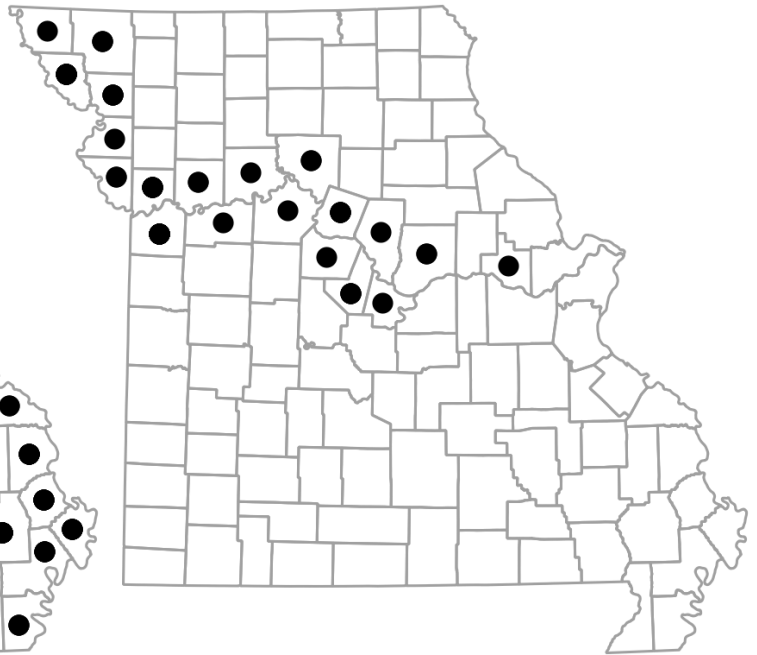
Anaxyrus americanus
American Toad



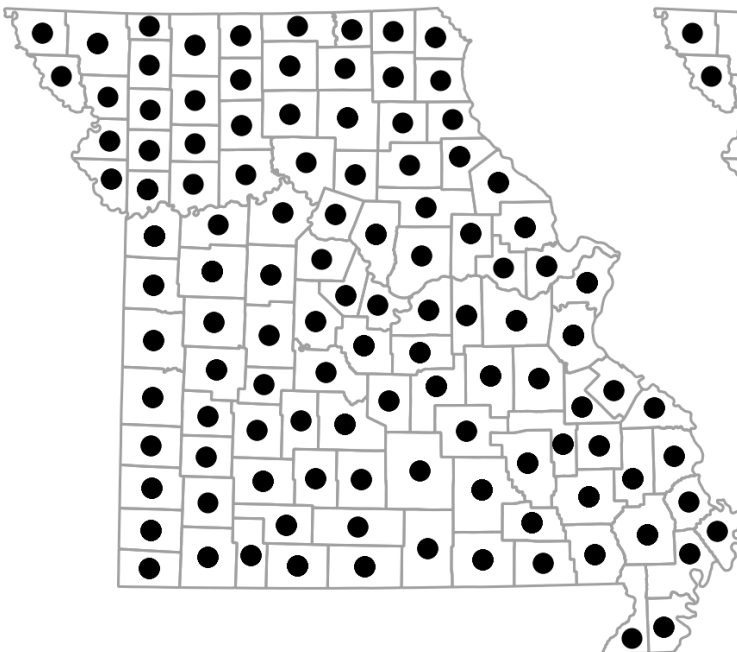
Anaxyrus cognatus
Great Plains Toad



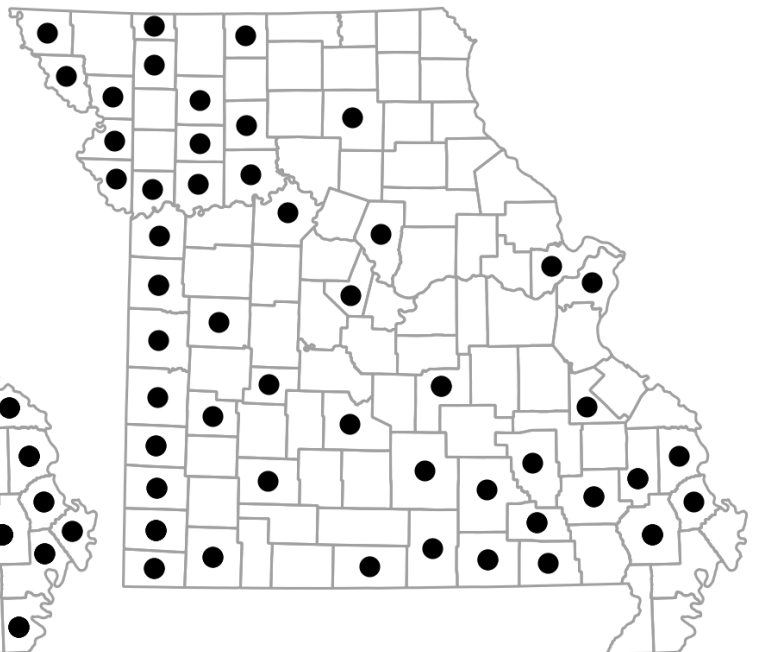
Anaxyrus fowleri
Fowler's Toad



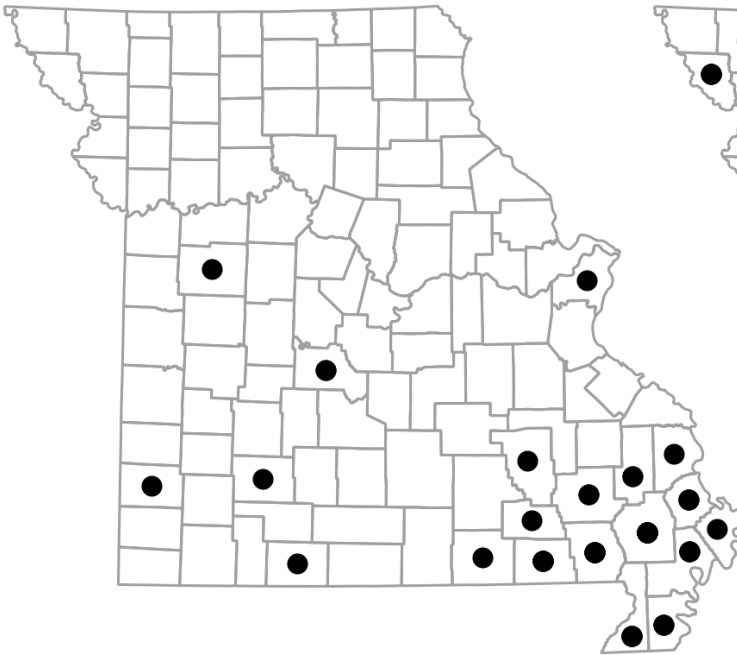
Anaxyrus woodhousii
Woodhouse's Toad



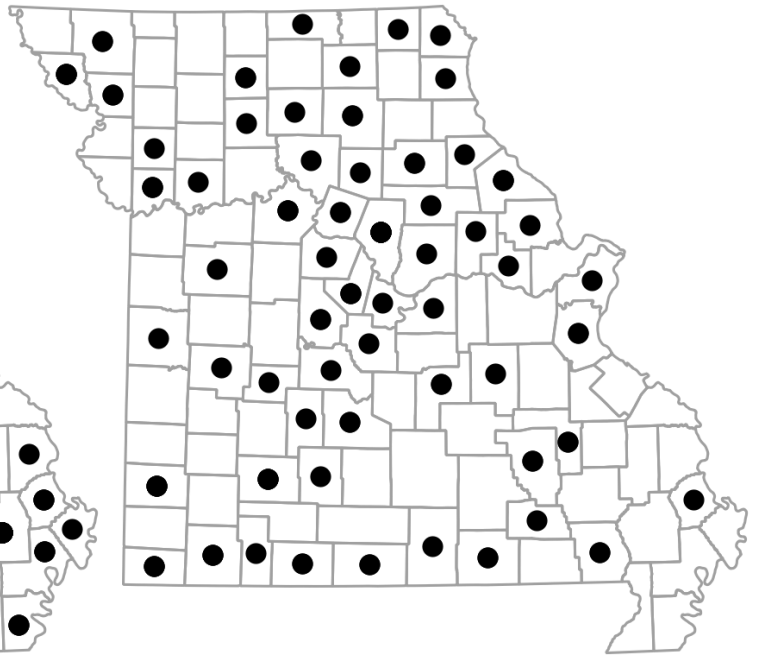
Acris blanchardi
Blanchard's Cricket Frog



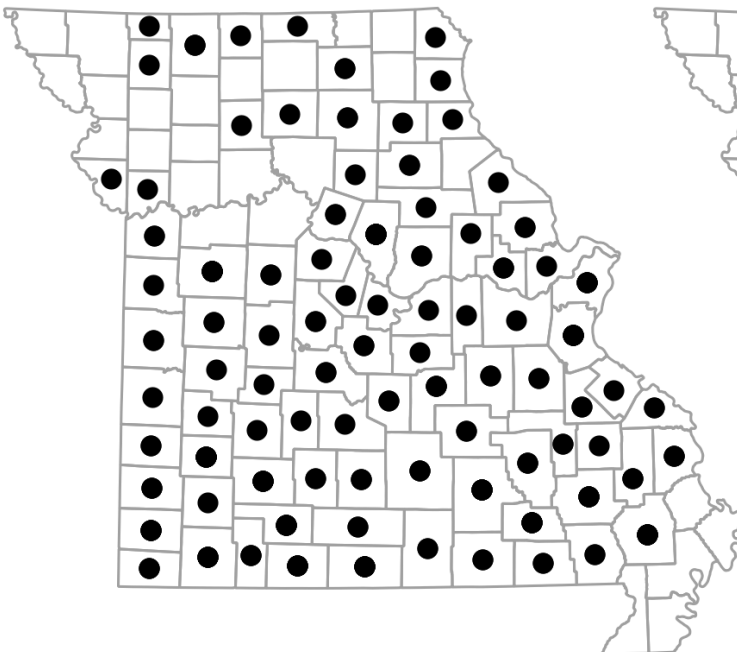
Hyla chrysoscelis
Cope's Gray Treefrog



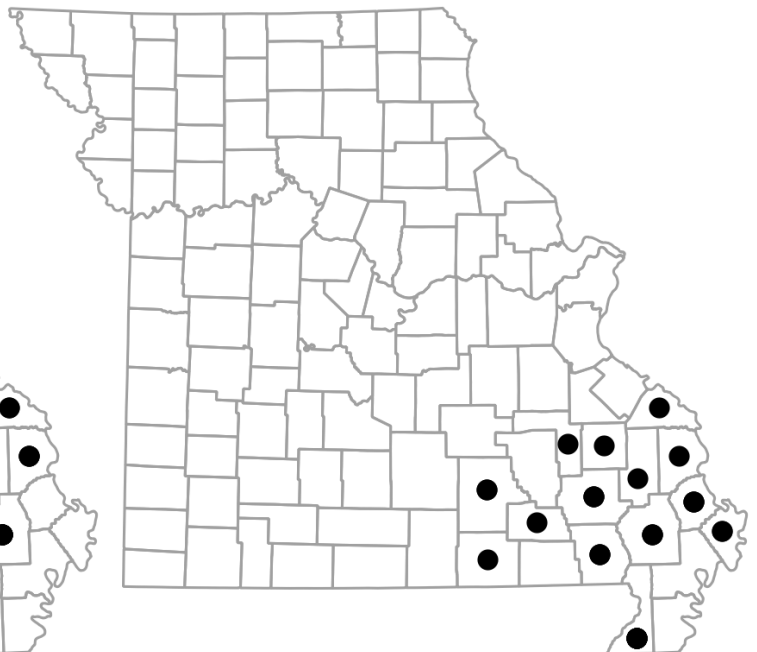
Hyla cinerea
Green Treefrog



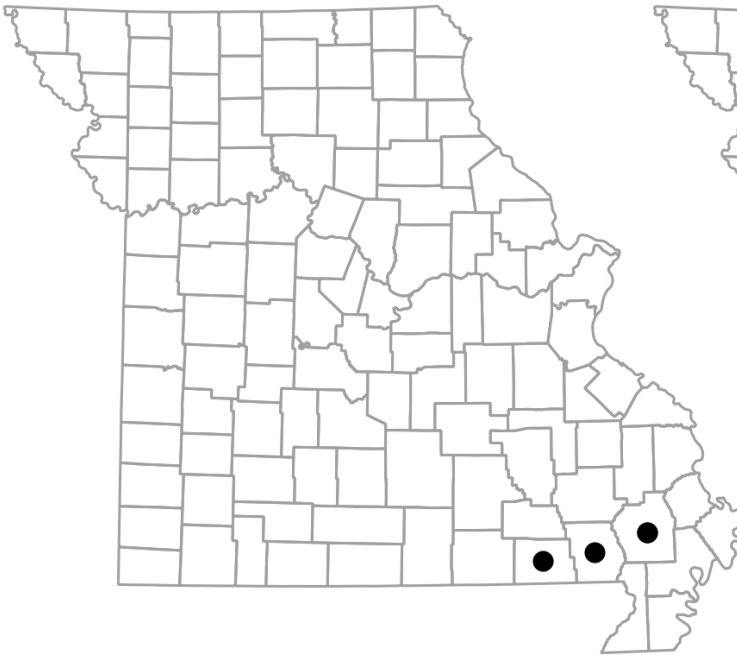
Hyla versicolor
Gray Treefrog



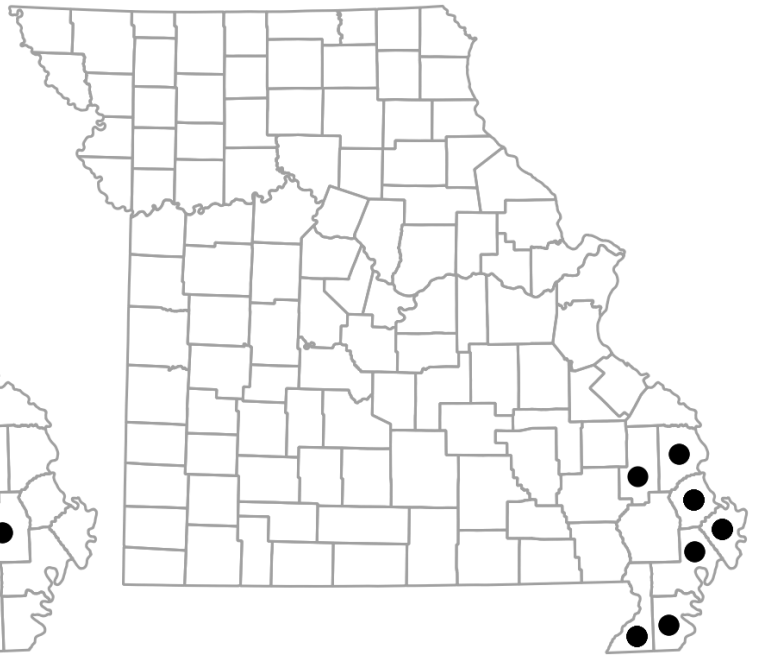
Pseudacris crucifer
Spring Peeper



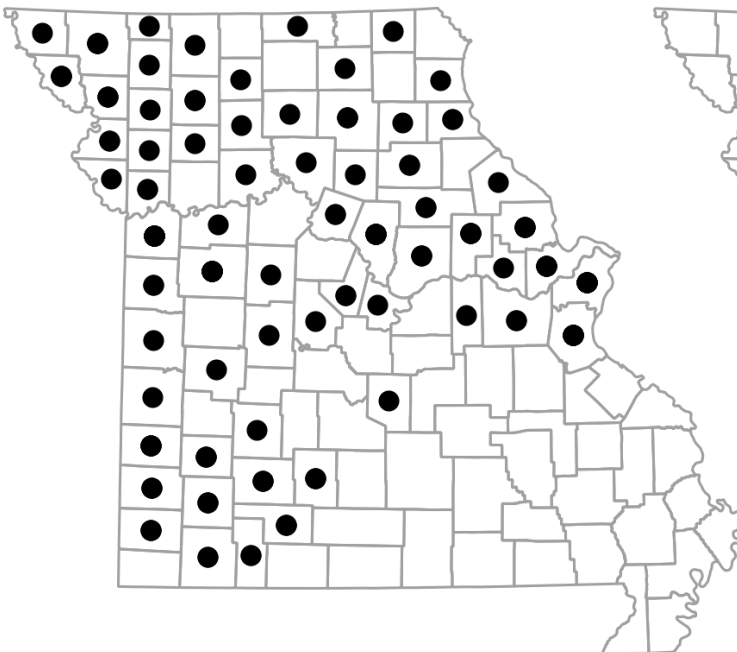
Pseudacris feriarum
Upland Chorus Frog



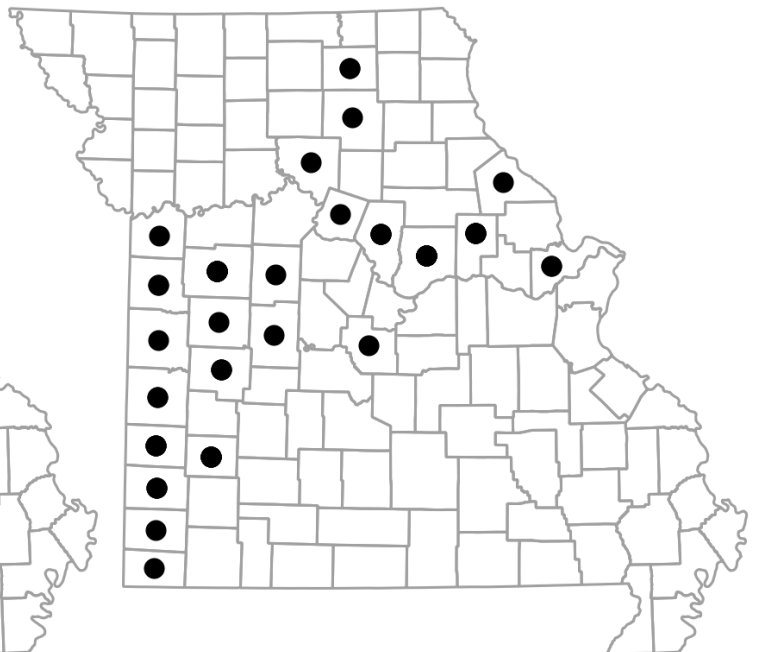
Pseudacris fouquettei
Cajun Chorus Frog



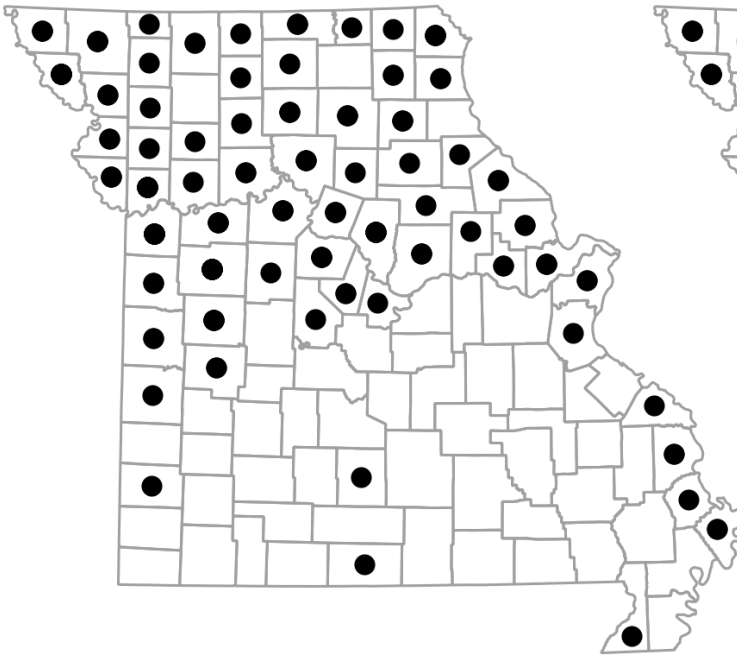
Pseudacris illinoensis
Illinois Chorus Frog



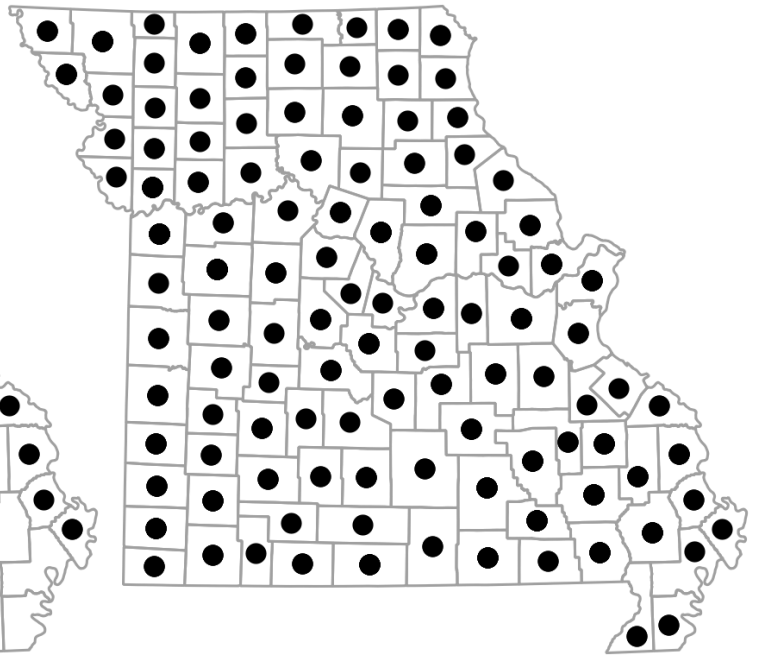
Pseudacris maculata
Boreal Chorus Frog



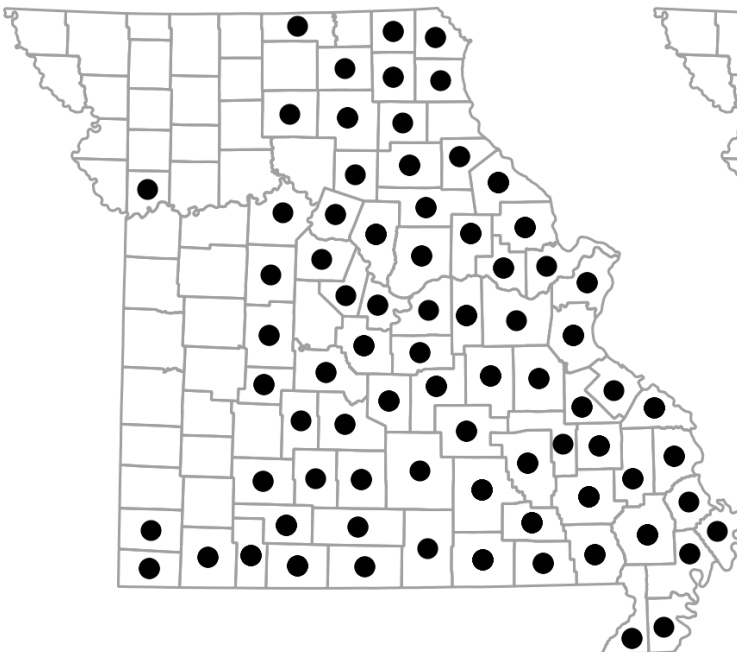
Lithobates areolatus
Northern Crawfish Frog



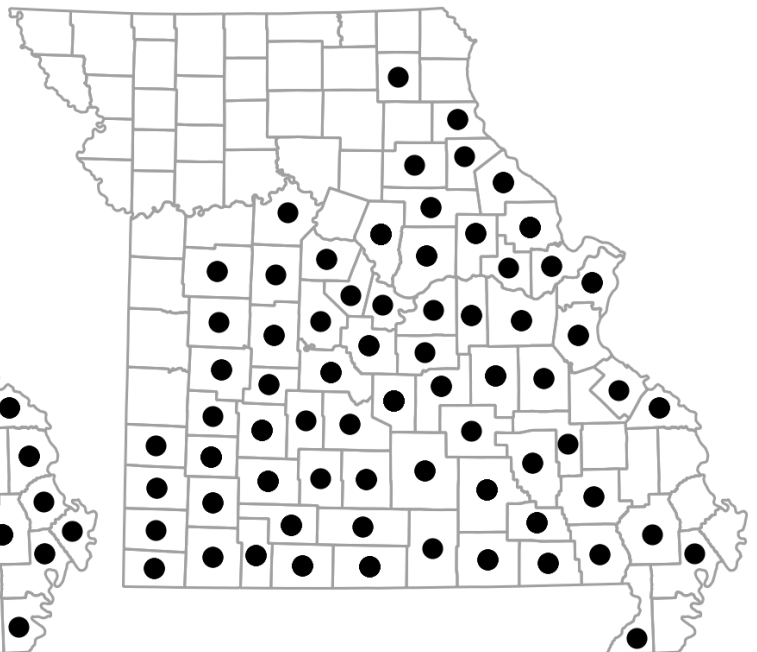
Lithobates blairi
Plains Leopard Frog



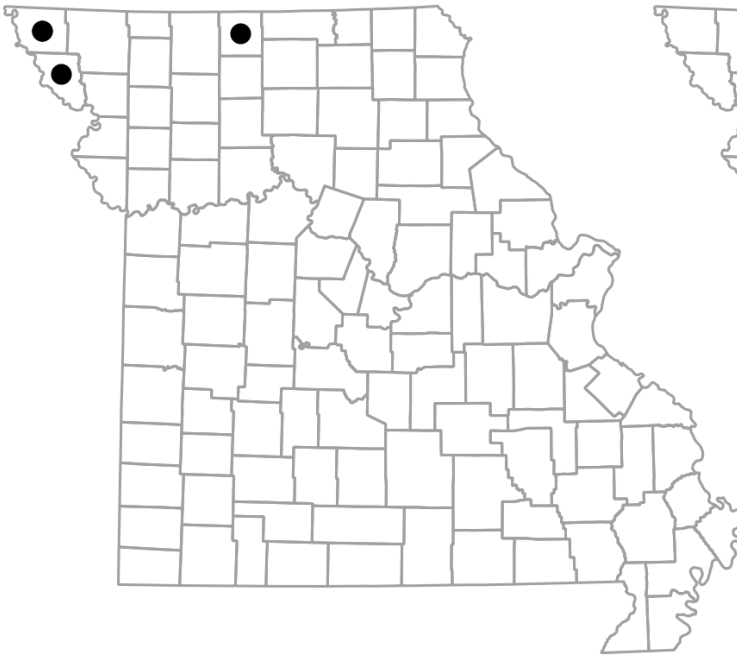
Lithobates catesbeianus
American Bullfrog



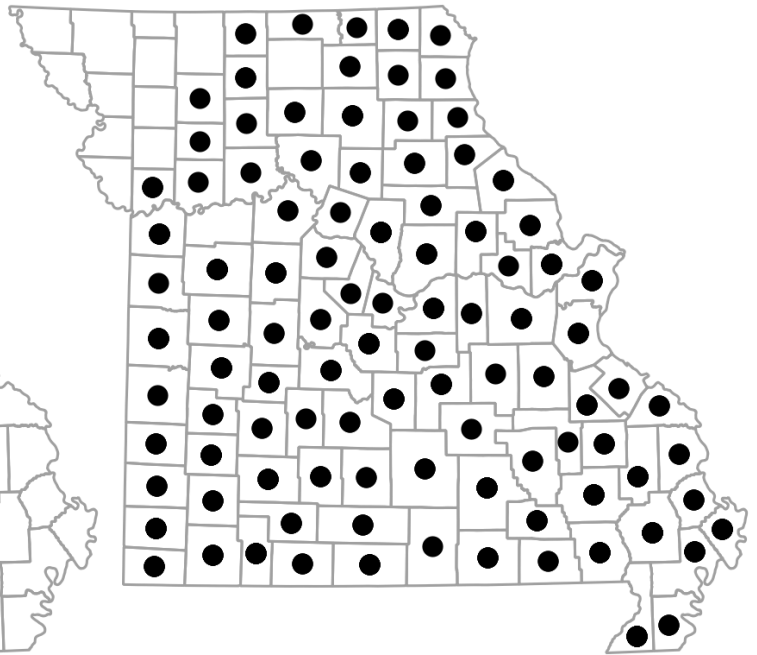
Lithobates clamitans
Green Frog



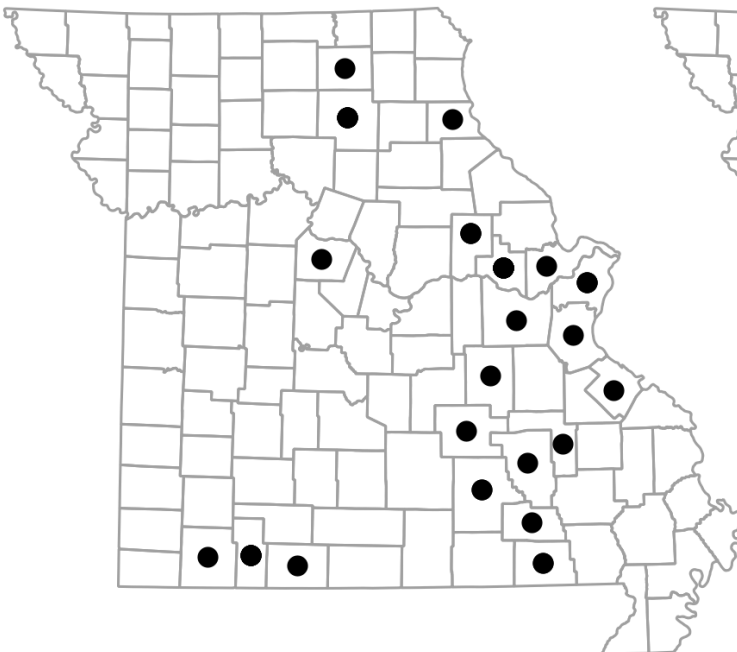
Lithobates palustris
Pickerel Frog



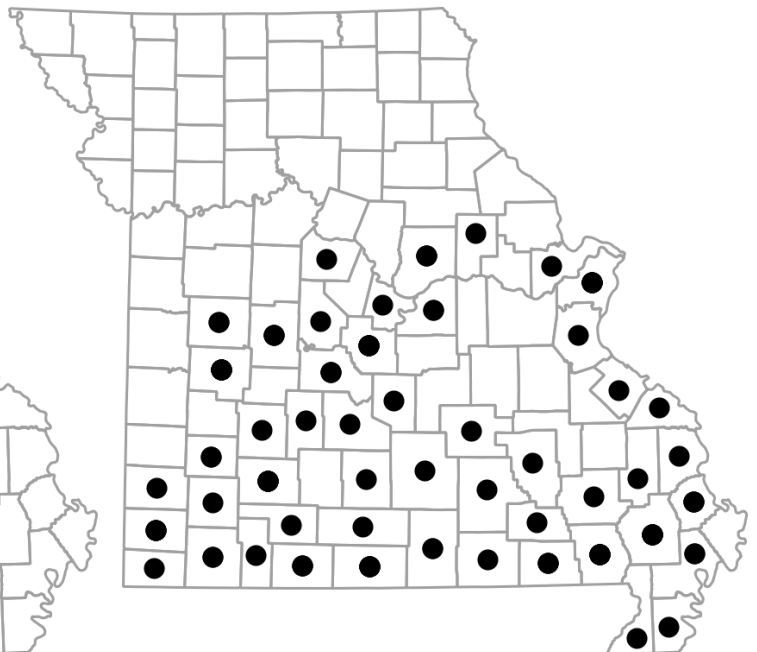
Lithobates pipiens
Northern Leopard Frog



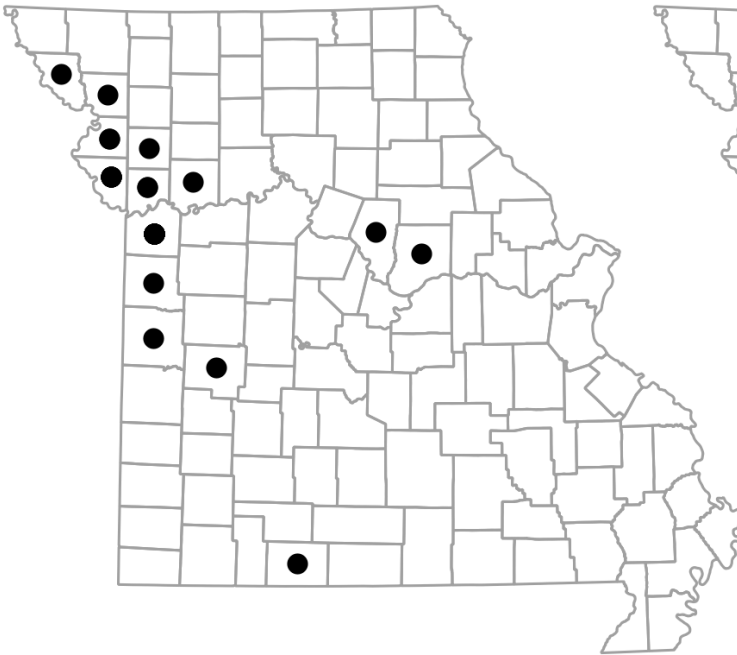
Lithobates sphenoccephalus
Southern Leopard Frog



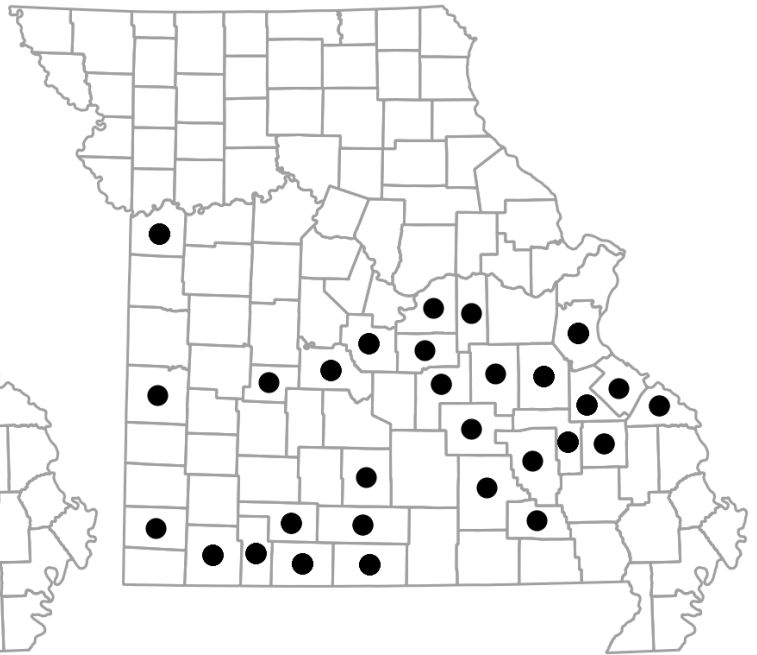
Lithobates sylvaticus
Wood Frog



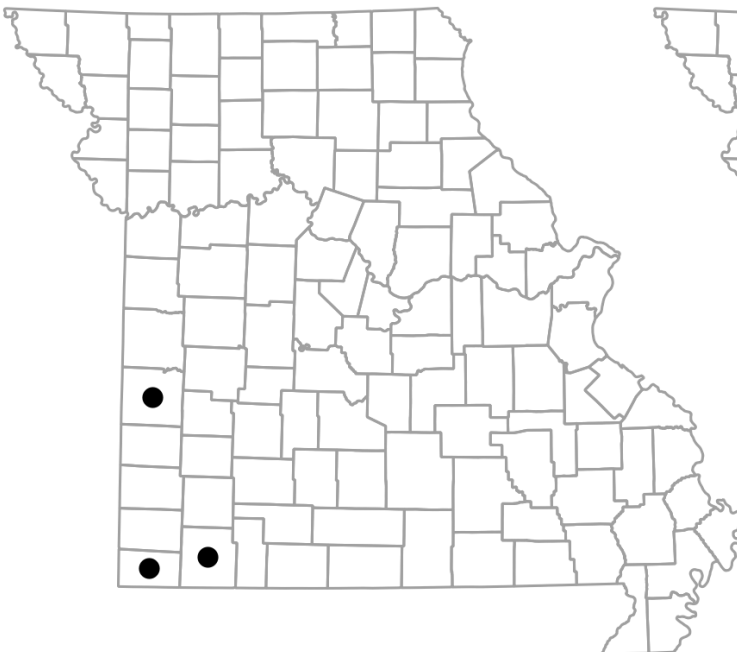
Gastrophryne carolinensis
Eastern Narrow-mouthed Toad



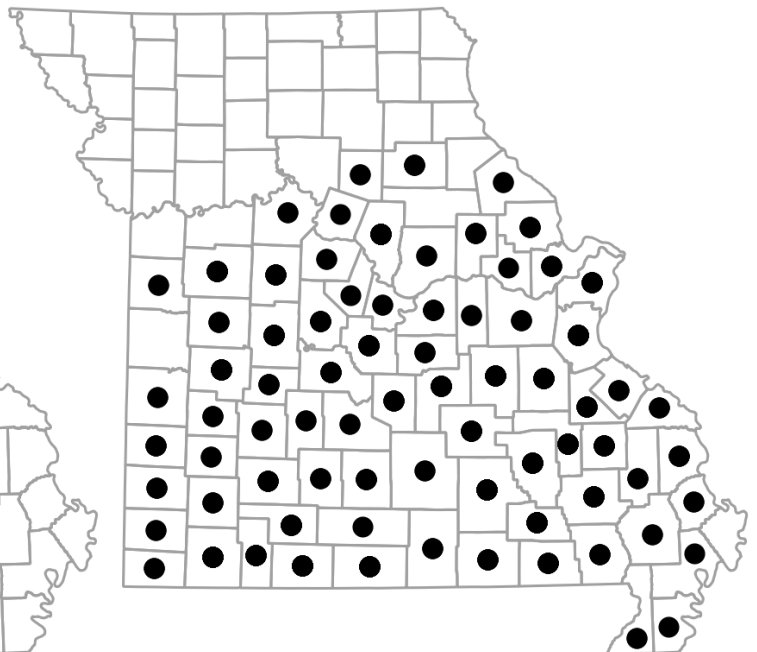
Gastrophryne olivacea
Western Narrow-mouthed Toad



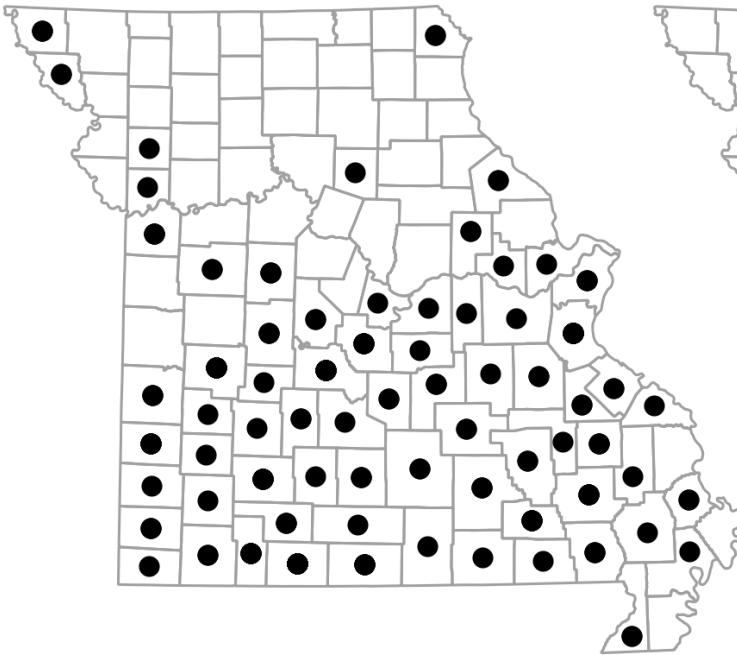
Crotaphytus collaris
Eastern Collared Lizard



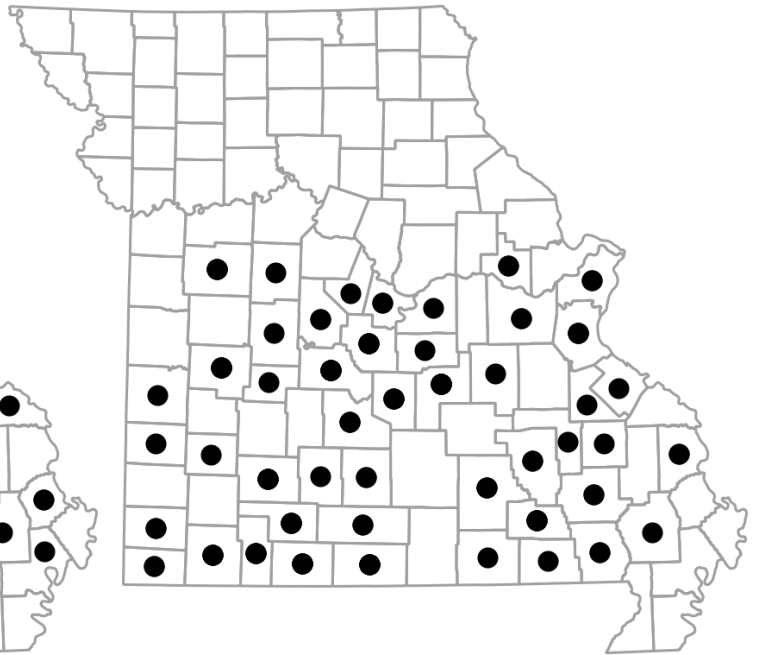
Phrynosoma cornutum
Texas Horned Lizard



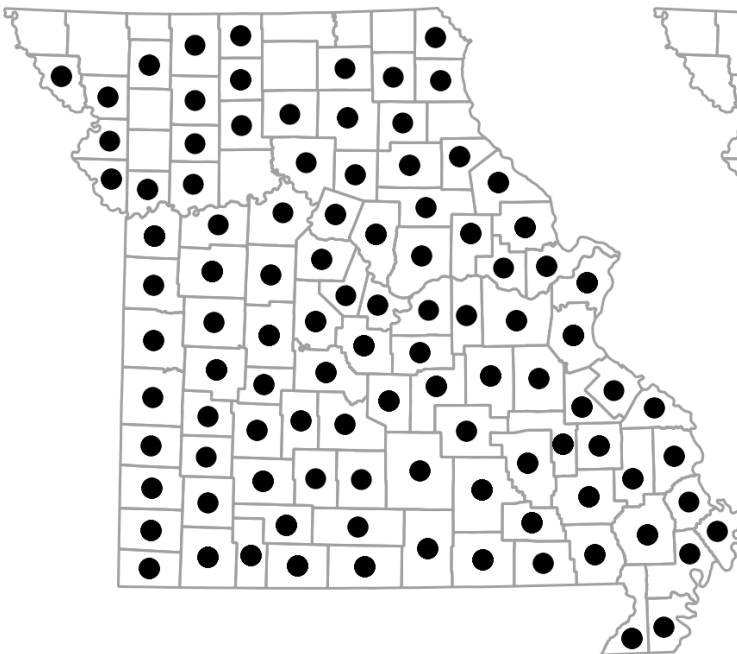
Sceloporus consobrinus
Prairie Lizard



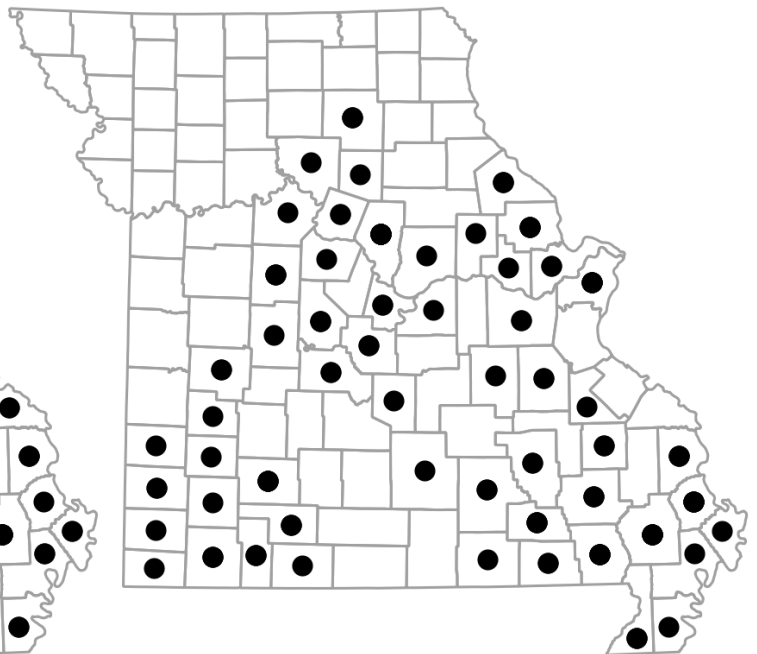
Aspidoscelis sexlineata
Six-lined Racerunner



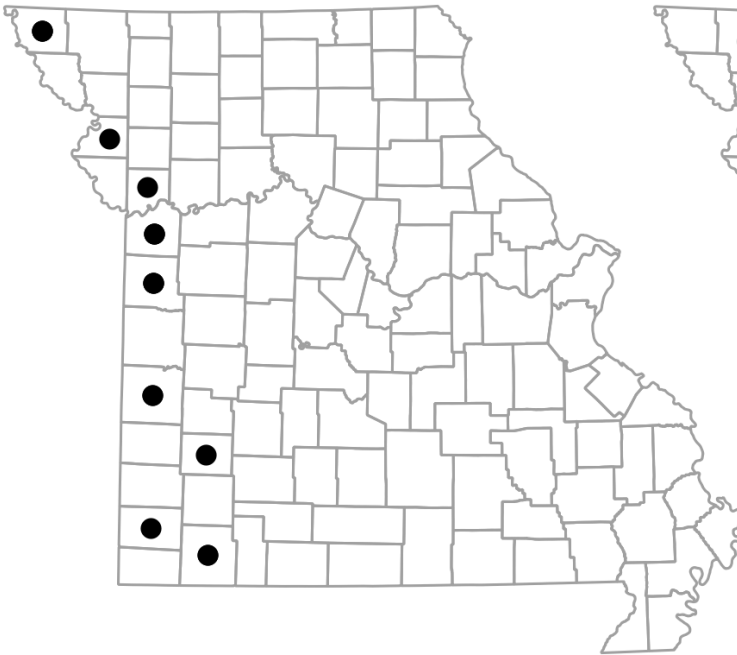
Plestiodon anthracinus
Southern Coal Skink



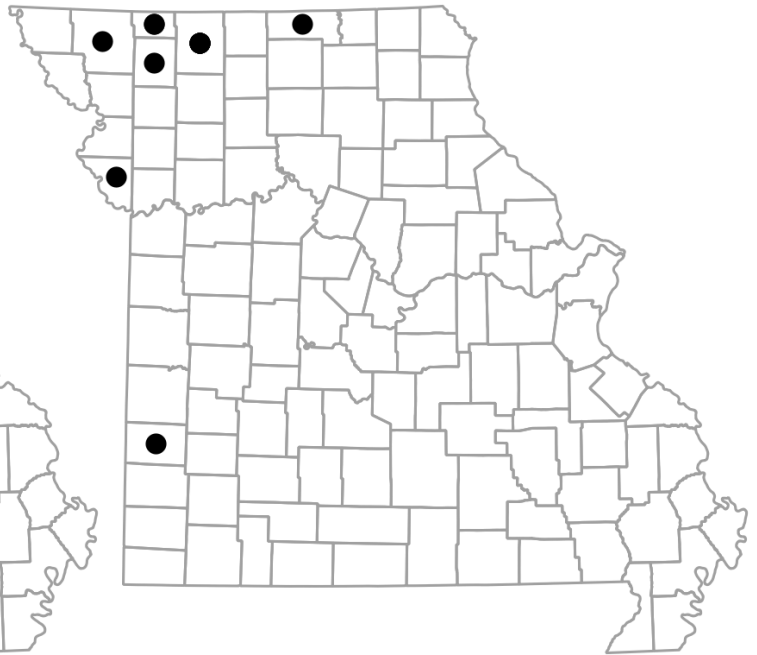
Plestiodon fasciatus
Common Five-lined Skink



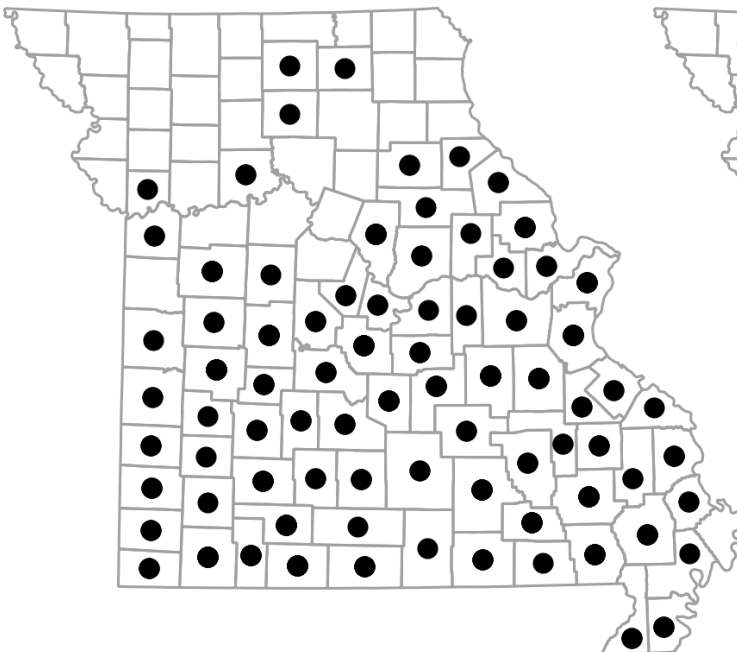
Plestiodon laticeps
Broad-headed Skink



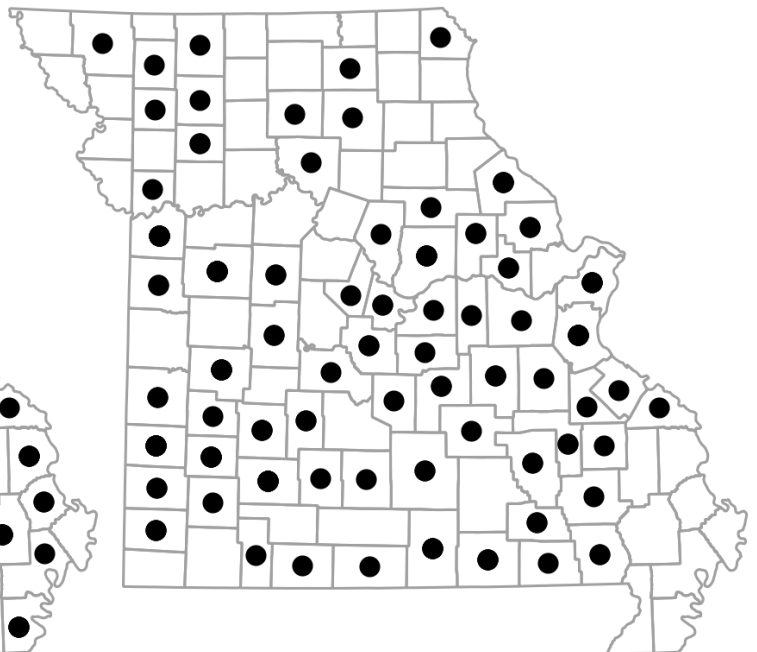
Plestiodon obsoletus
Great Plains Skink



Plestiodon septentrionalis
Prairie Skink

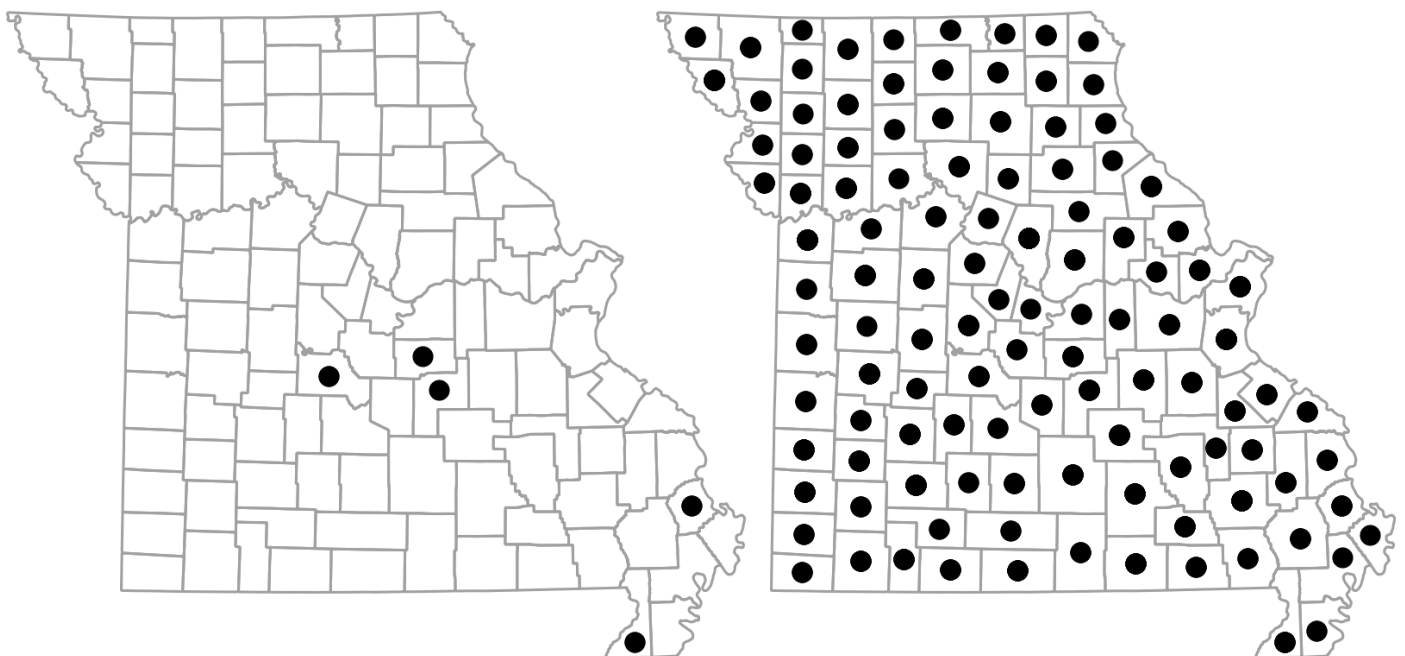


Scincella lateralis
Little Brown Skink

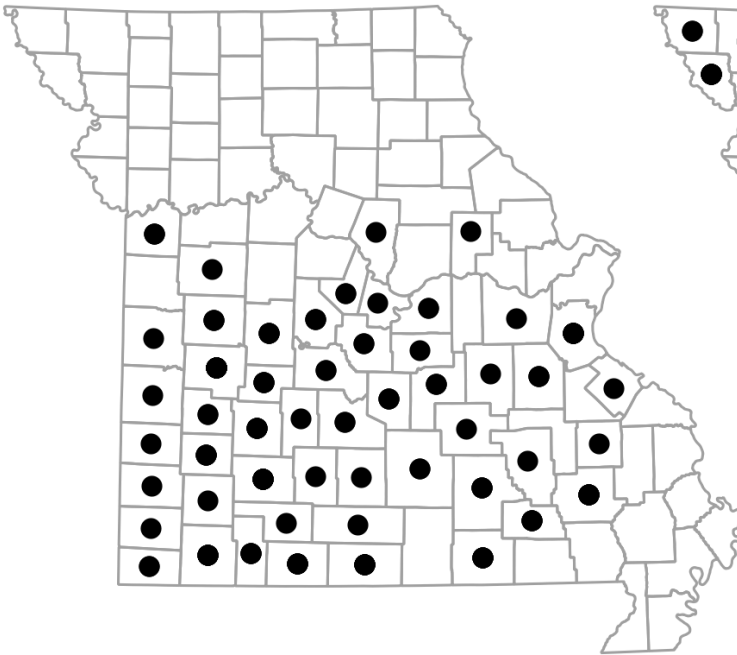


Ophisaurus attenuatus
Western Slender Glass Lizard

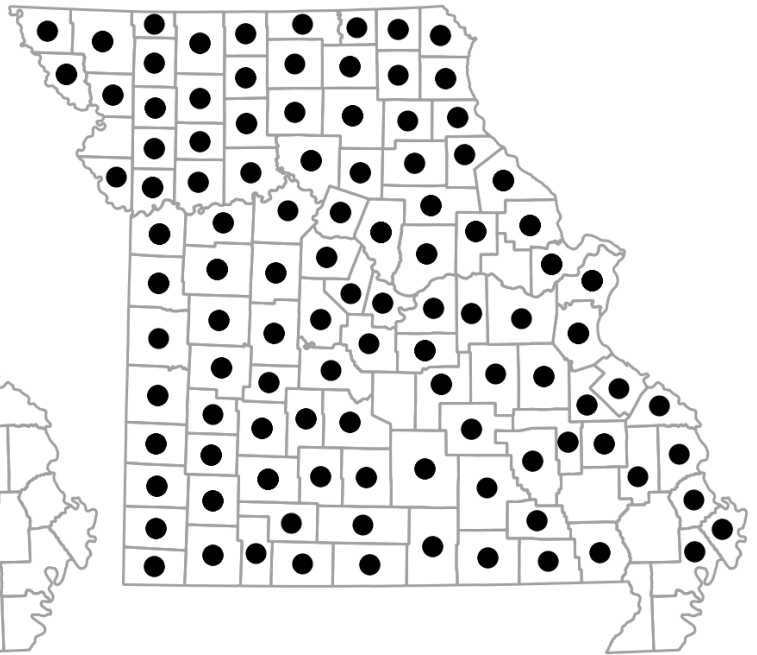
Podarcis siculus
Italian Wall Lizard



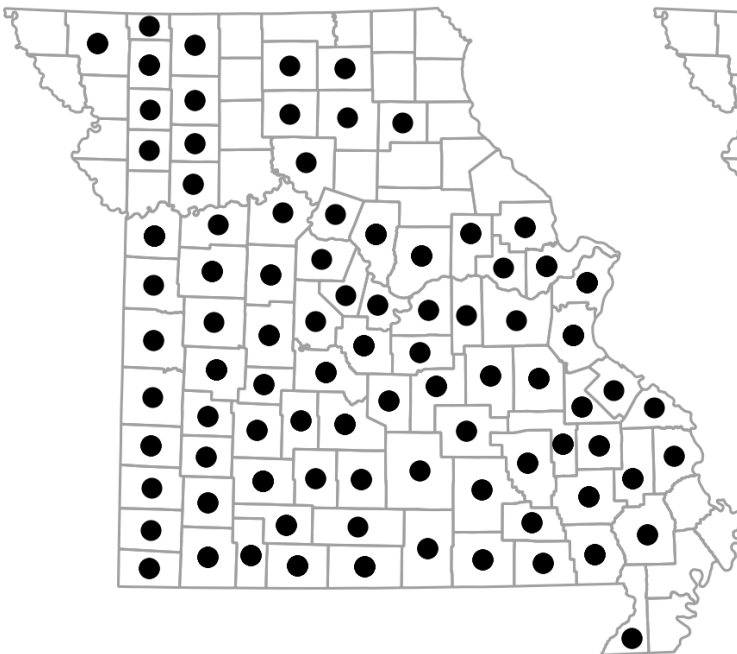
Coluber constrictor
North American Racer



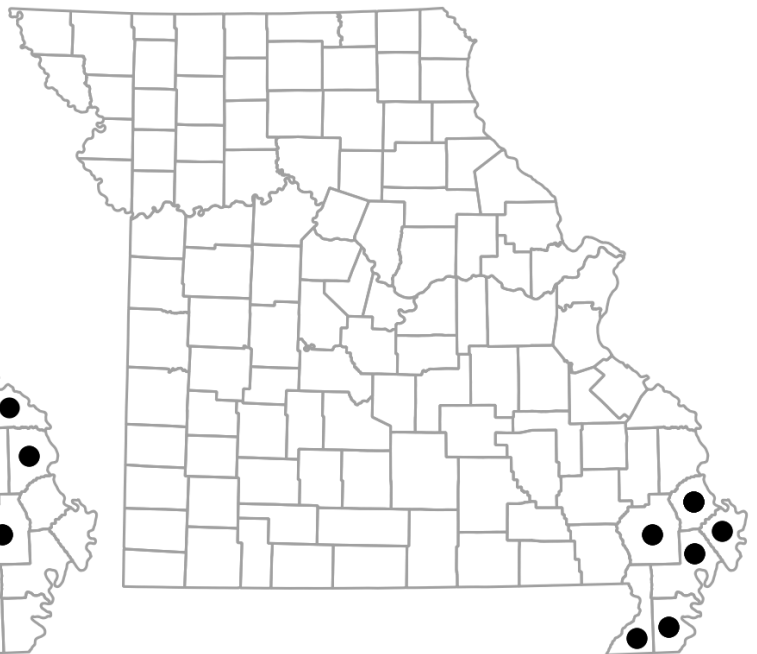
Coluber flagellum
Eastern Coachwhip



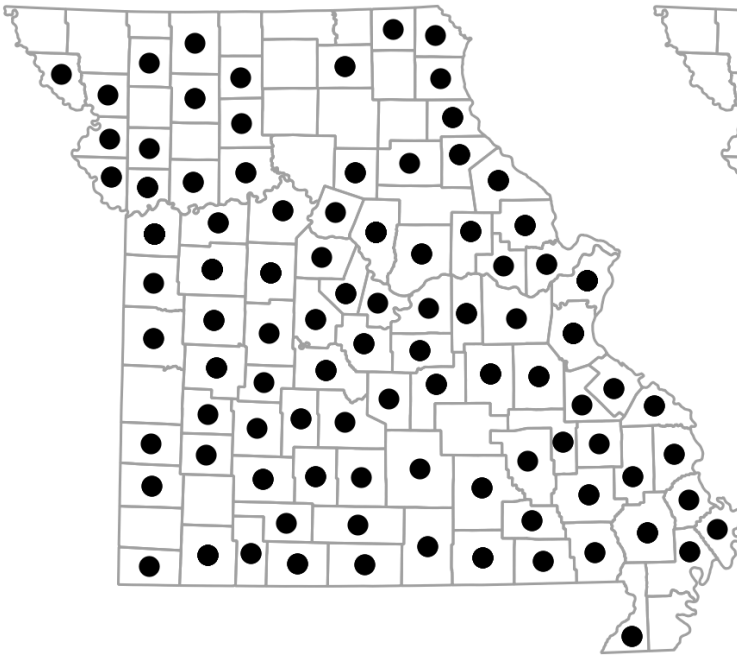
Lampropeltis calligaster
Prairie Kingsnake



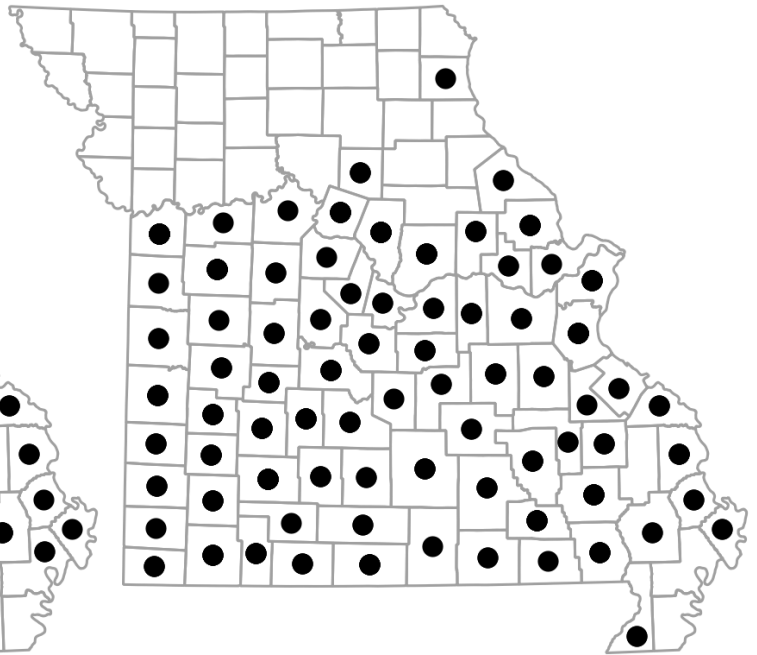
Lampropeltis holbrooki
Speckled Kingsnake



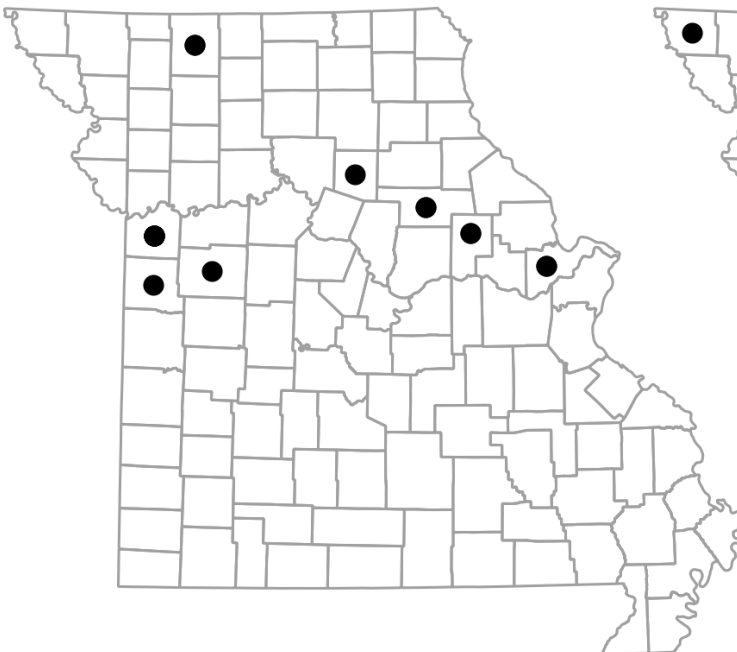
Lampropeltis nigra
Eastern Black Kingsnake



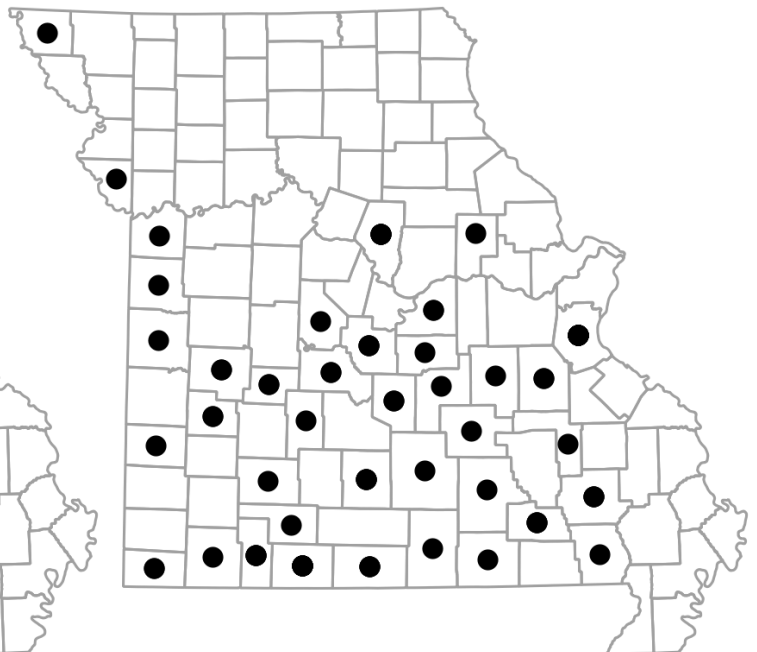
Lampropeltis triangulum
Eastern Milksnake



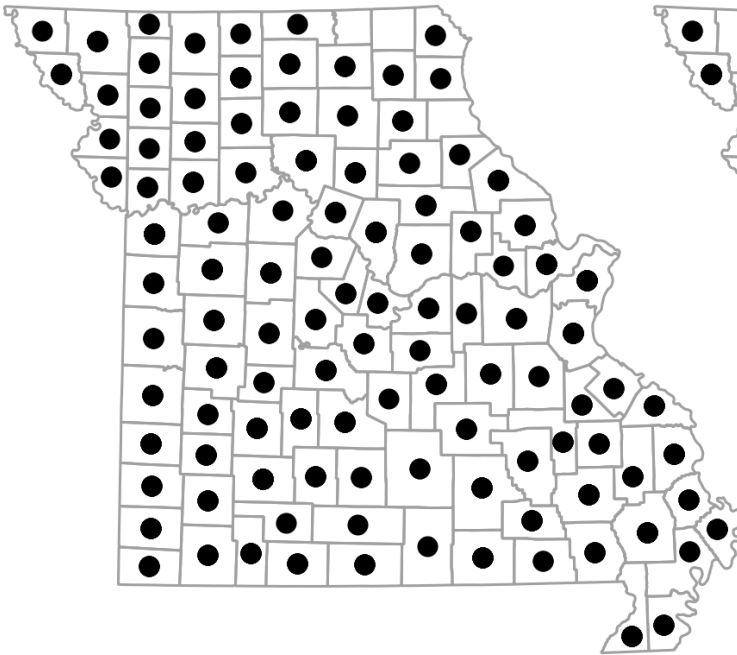
Opheodrys aestivus
Northern Rough Greensnake



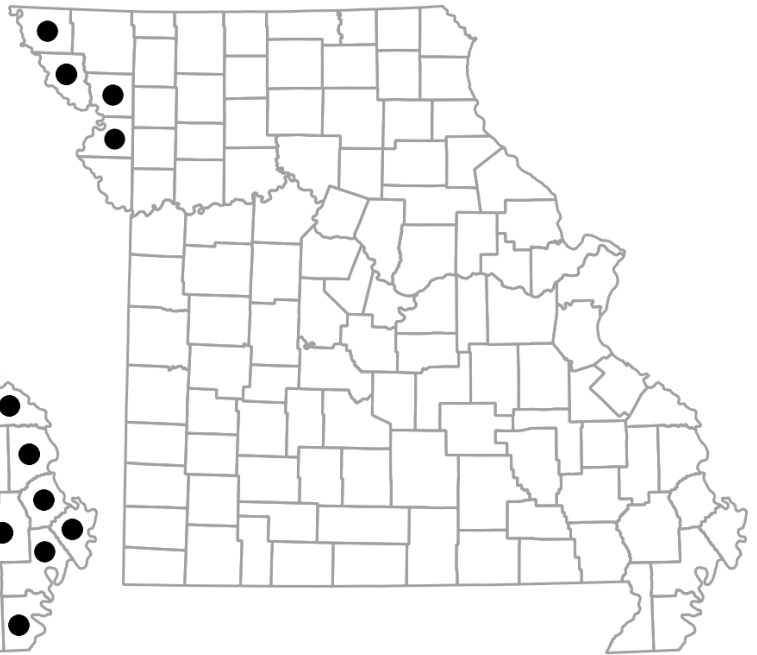
Opheodrys vernalis
Smooth Greensnake



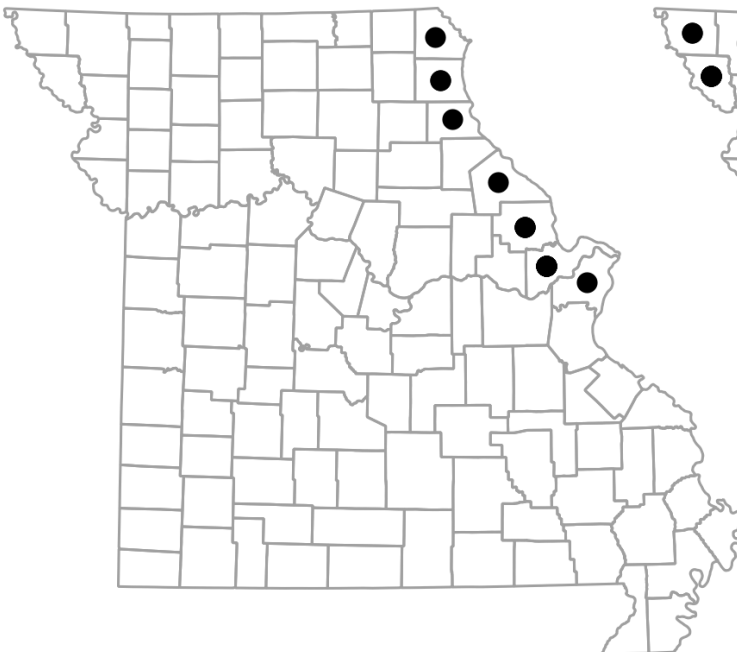
Pantherophis emoryi
Great Plains Ratsnake



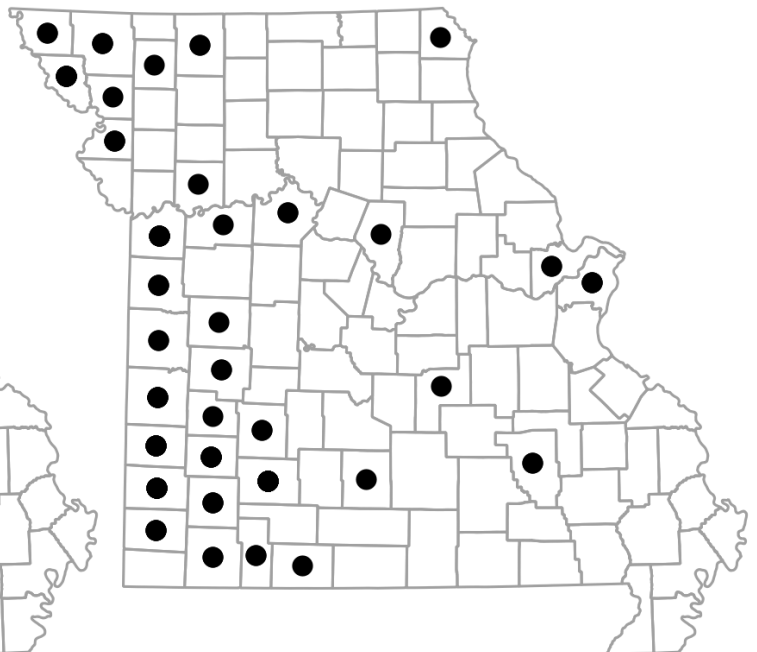
Pantherophis obsoletus
Western Ratsnake



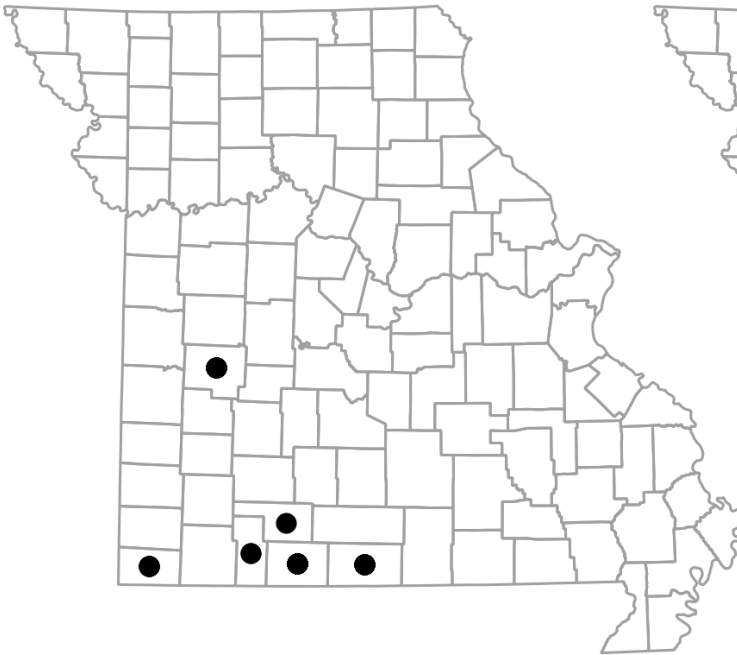
Pantherophis ramspotti
Western Foxsnake



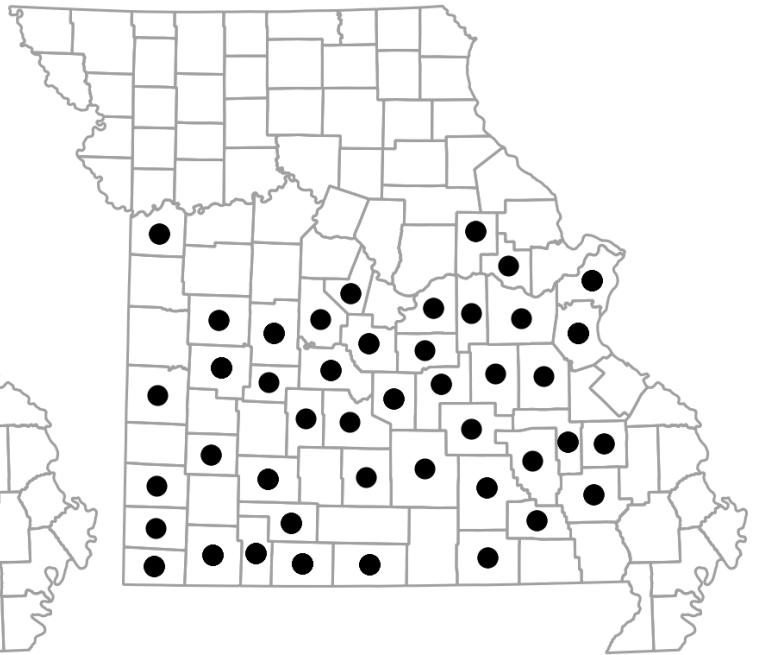
Pantherophis vulpinus
Eastern Foxsnake



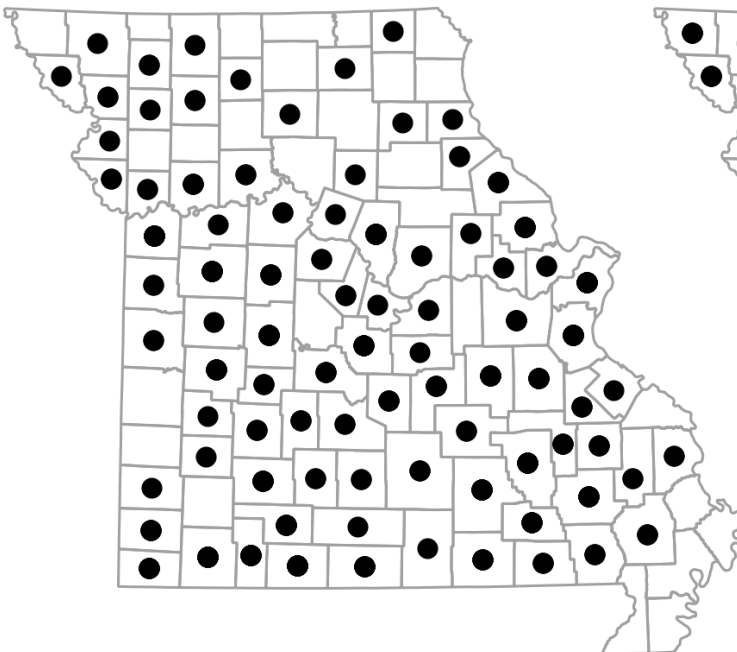
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Bullsnake



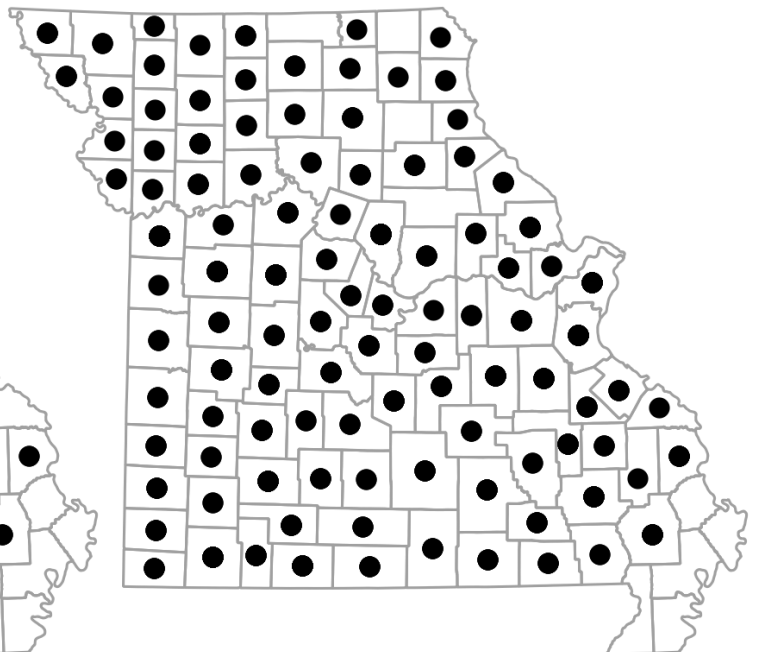
Sonora semiannulata
Variable Groundsnake



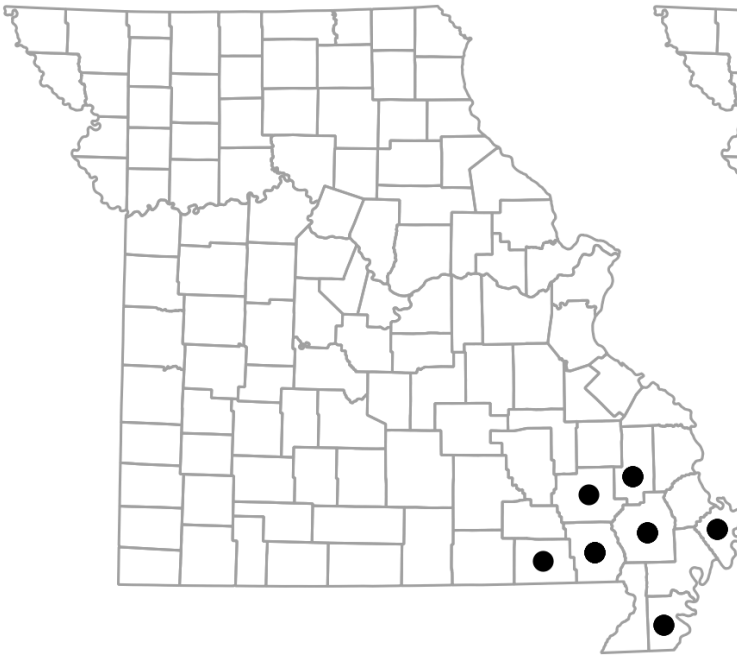
Tantilla gracilis
Flat-headed Snake



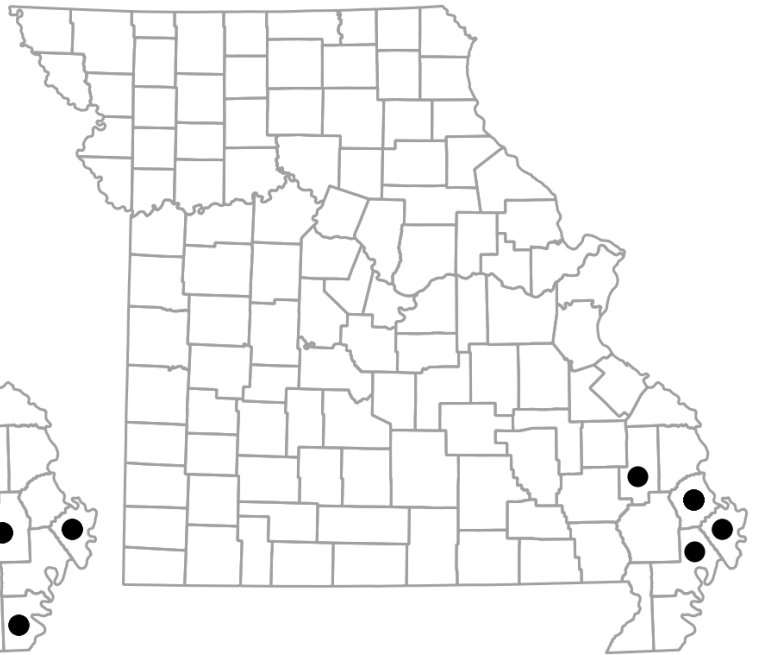
Carphophis vermis
Western Wormsnake



Diadophis punctatus
Ring-necked Snake



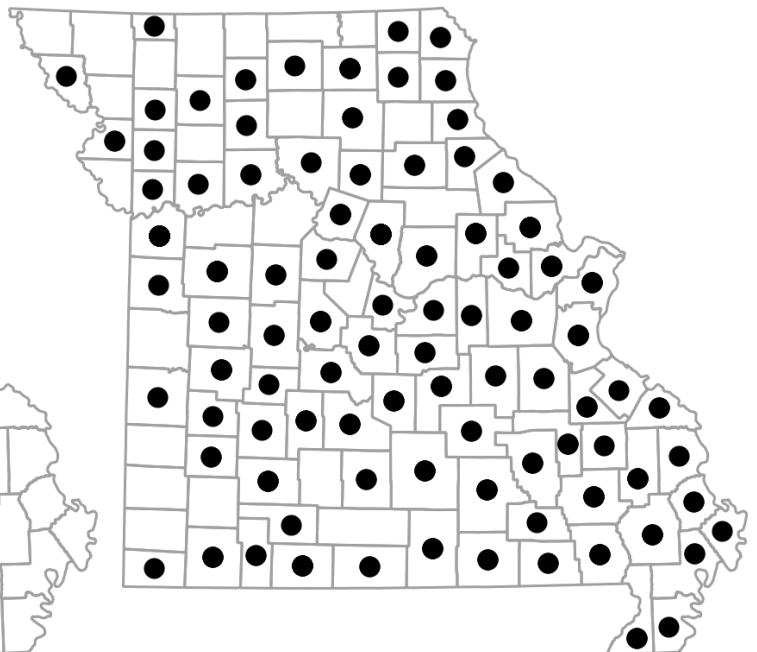
Farancia abacura
Western Mudsucker



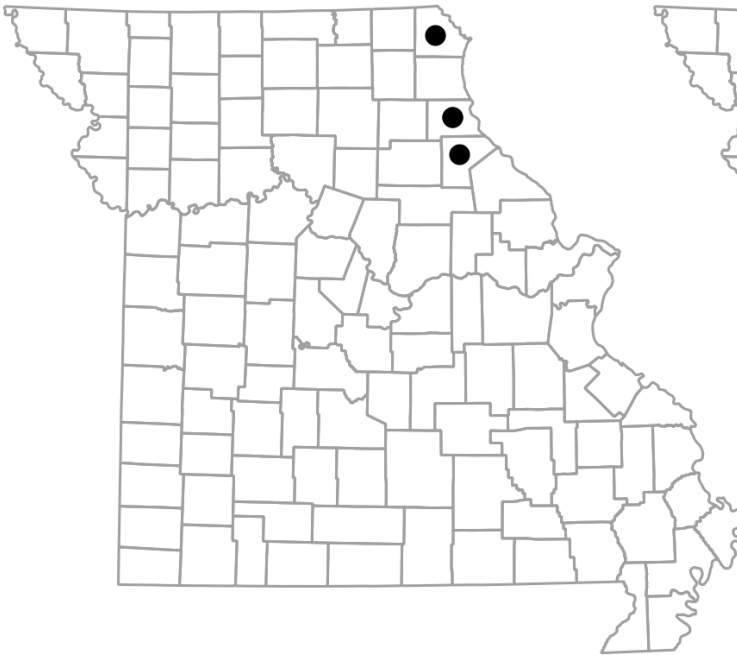
Heterodon gloydi
Dusty Hog-nosed Snake



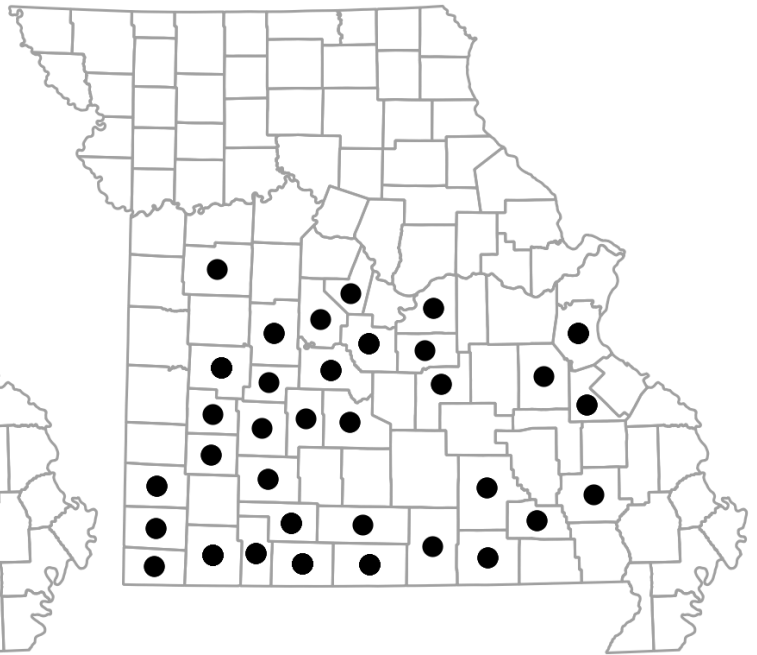
Heterodon nasicus
Plains Hog-nosed Snake



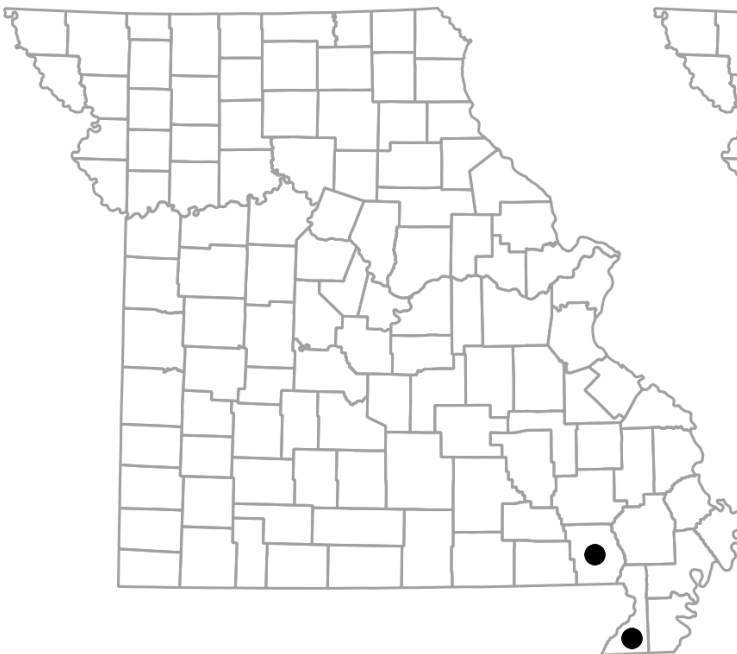
Heterodon platirhinos
Eastern Hog-nosed Snake



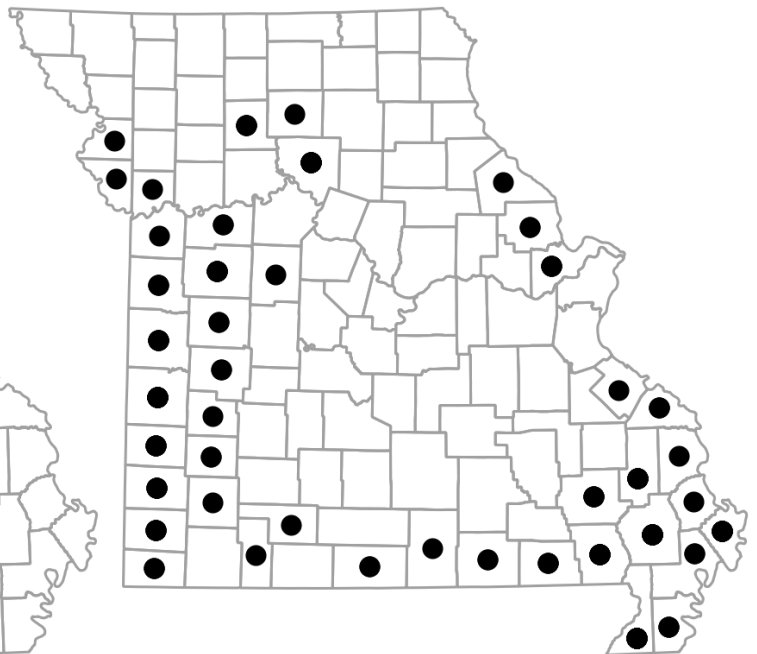
Clonophis kirtlandii
Kirtland's Snake



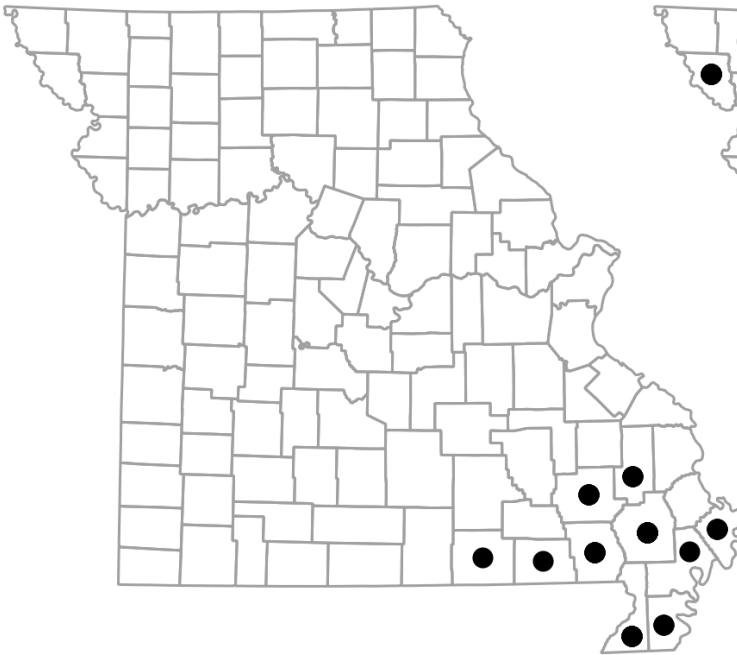
Haldea striatula
Rough Earthsnake



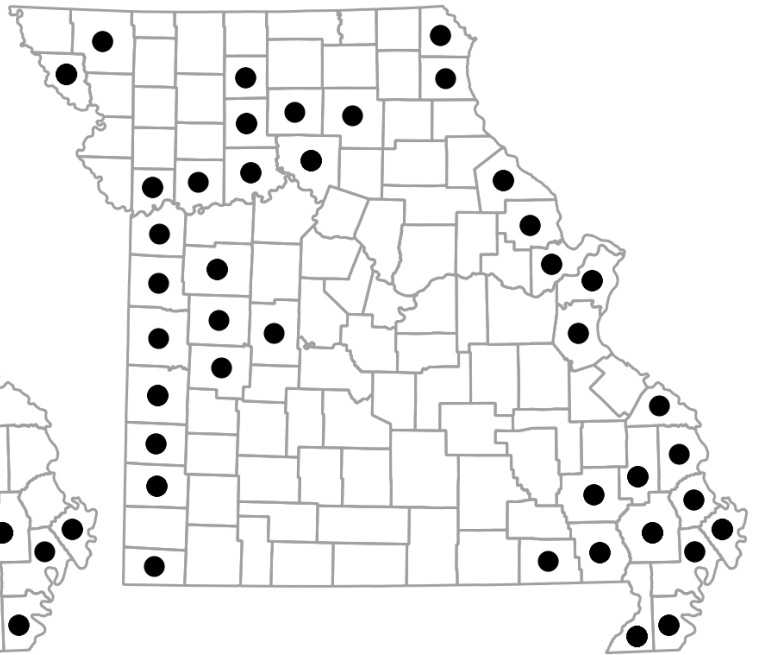
Nerodia cyclopion
Mississippi Green Watersnake



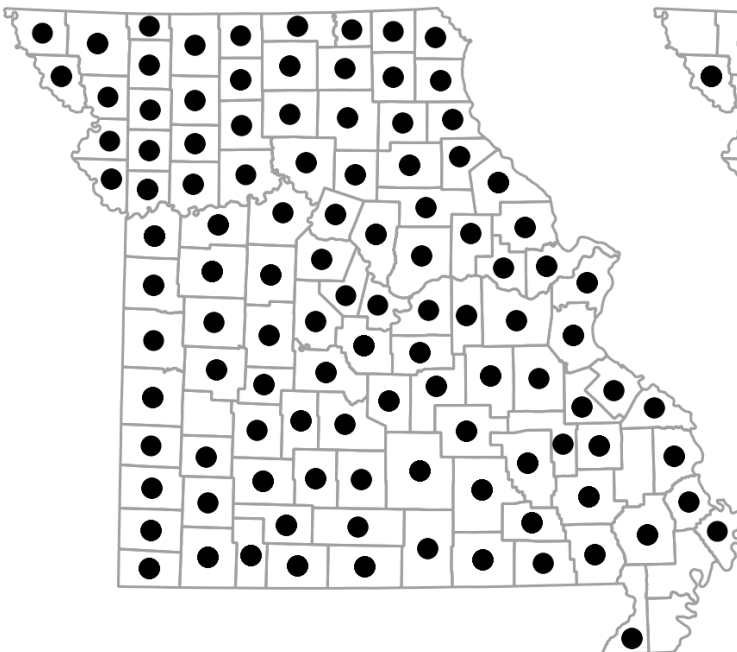
Nerodia erythrogaster
Plain-bellied Watersnake



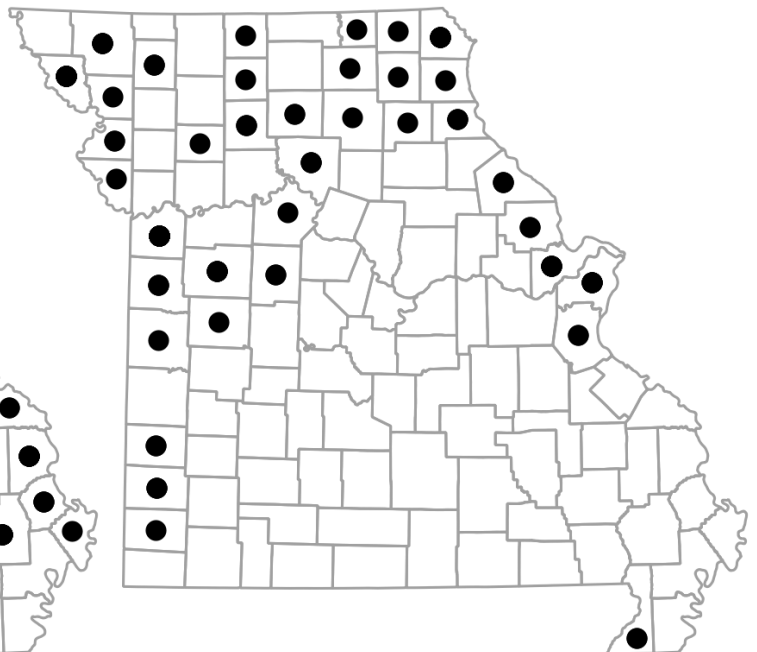
Nerodia fasciata
Broad-banded Watersnake



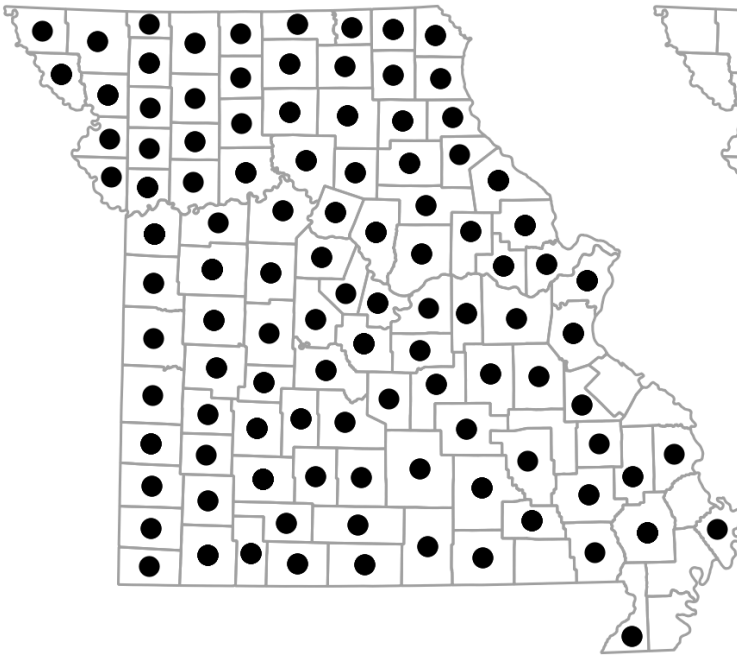
Nerodia rhombifer
Diamond-backed Watersnake



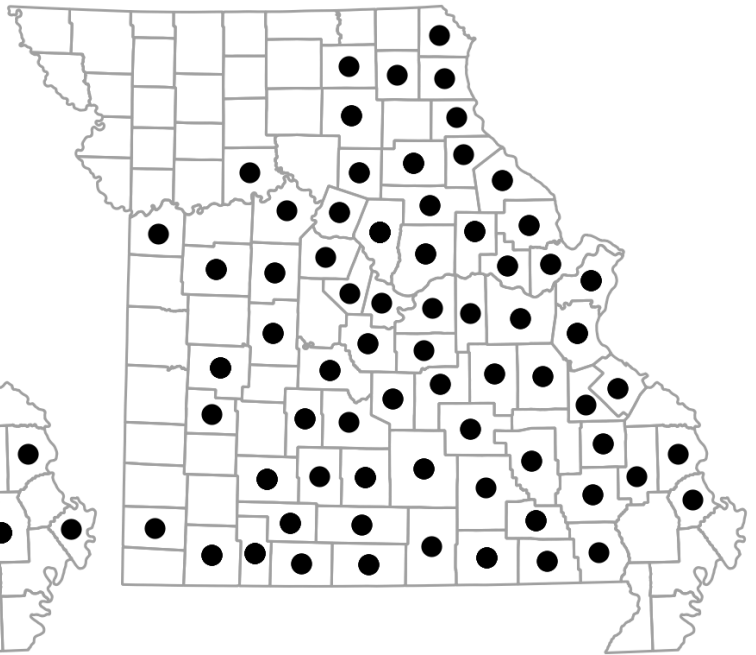
Nerodia sipedon
Common Watersnake



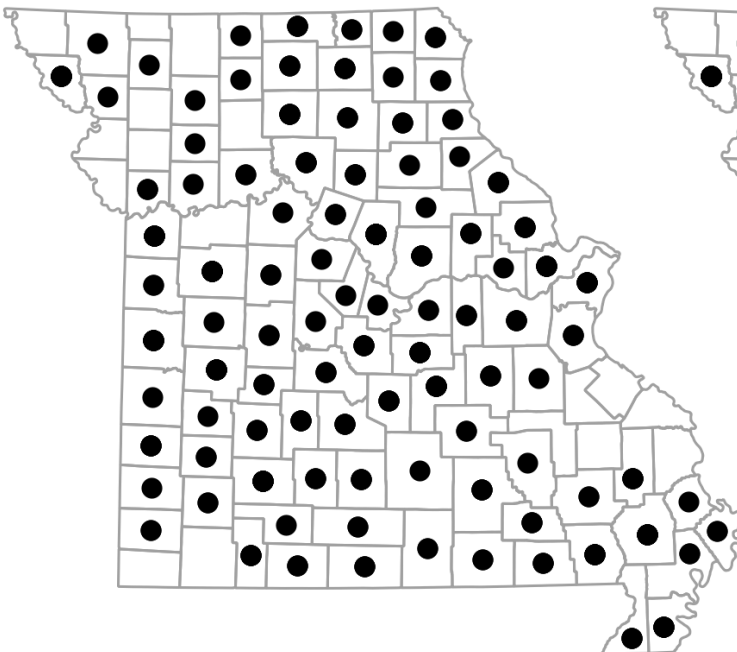
Regina grahamii
Graham's Crawfish Snake



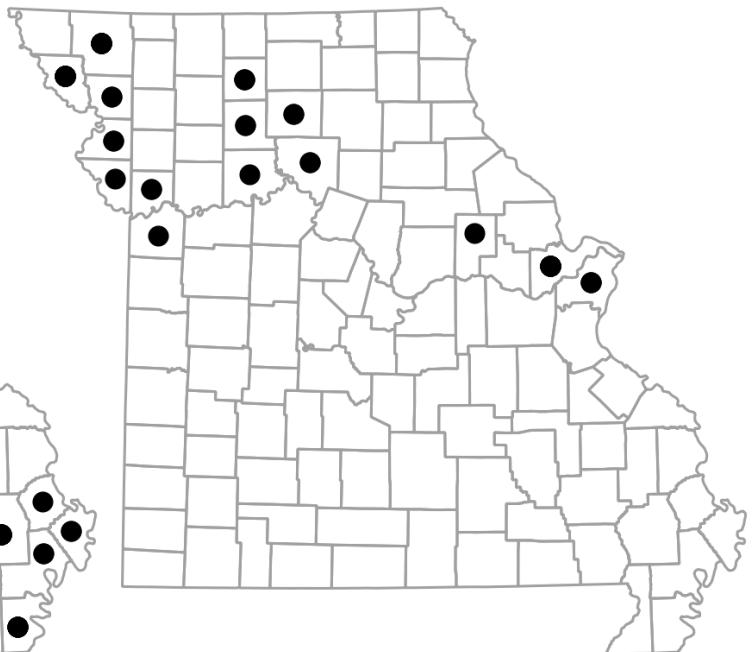
Storeria dekayi
DeKay's Brownsnake



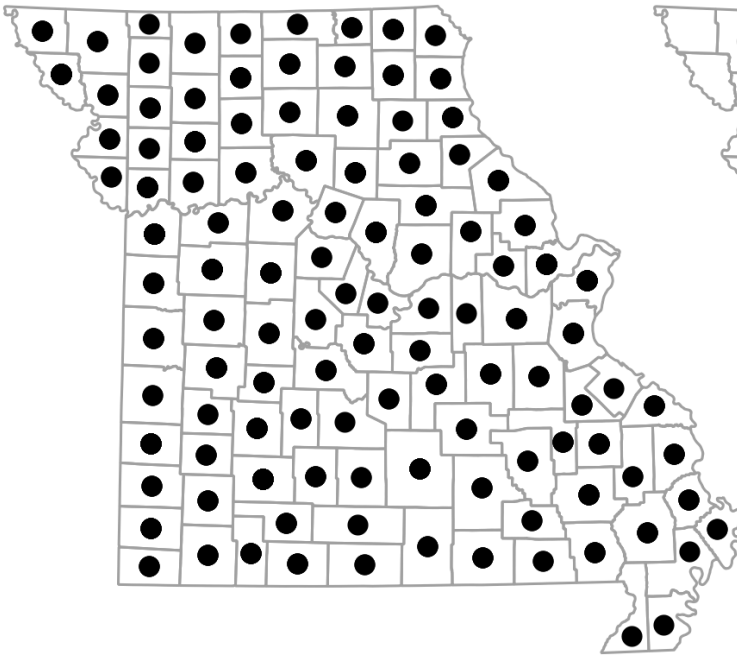
Storeria occipitomaculata
Northern Red-bellied Snake



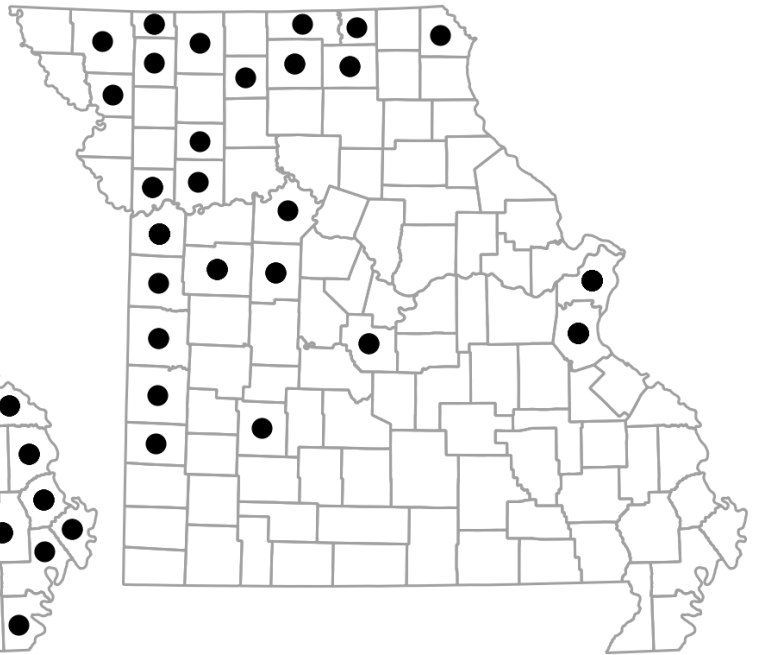
Thamnophis proximus
Orange-striped Ribbonsnake



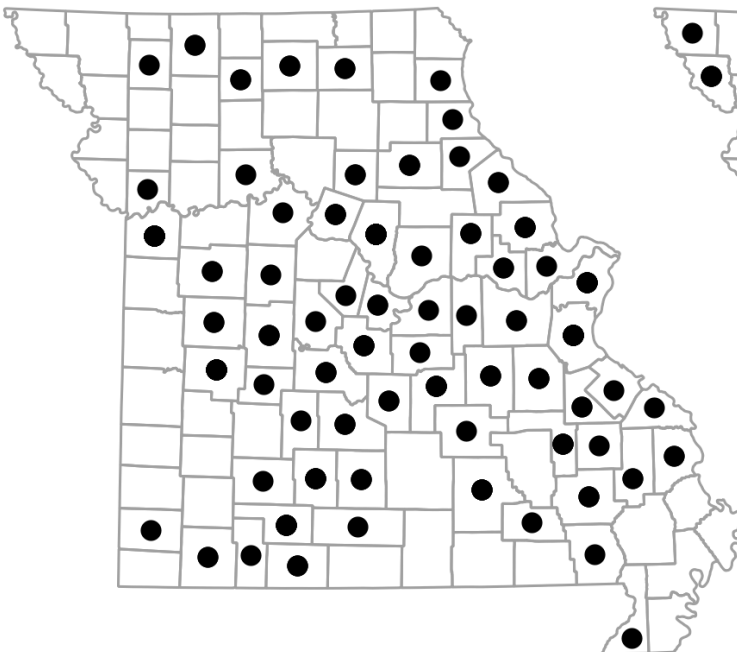
Thamnophis radix
Plains Gartersnake



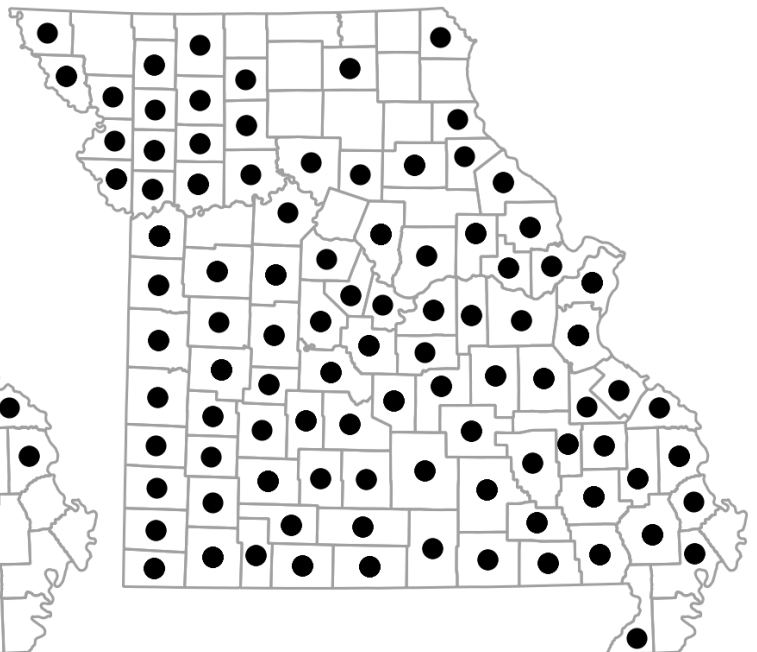
Thamnophis sirtalis
Common Gartersnake



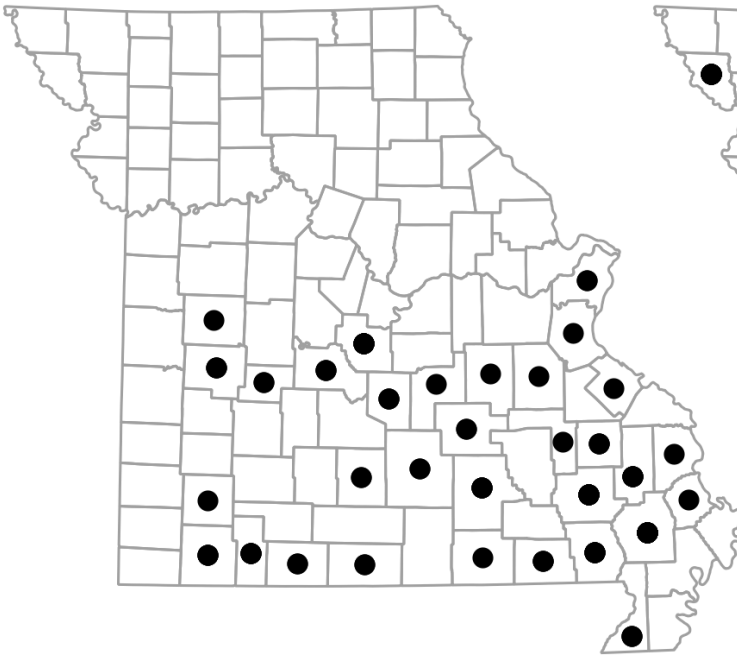
Tropidoclonion lineatum
Lined Snake



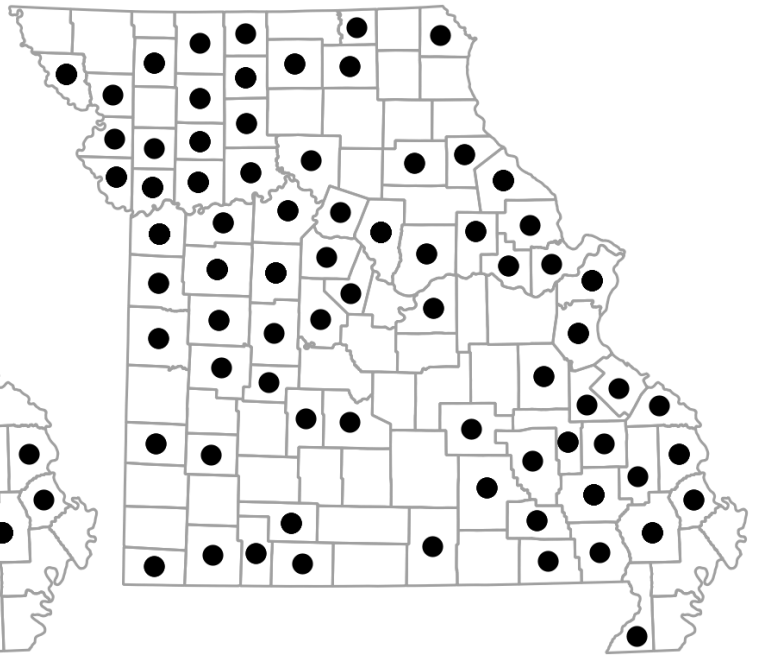
Virginia valeriae
Western Smooth Earthsnake



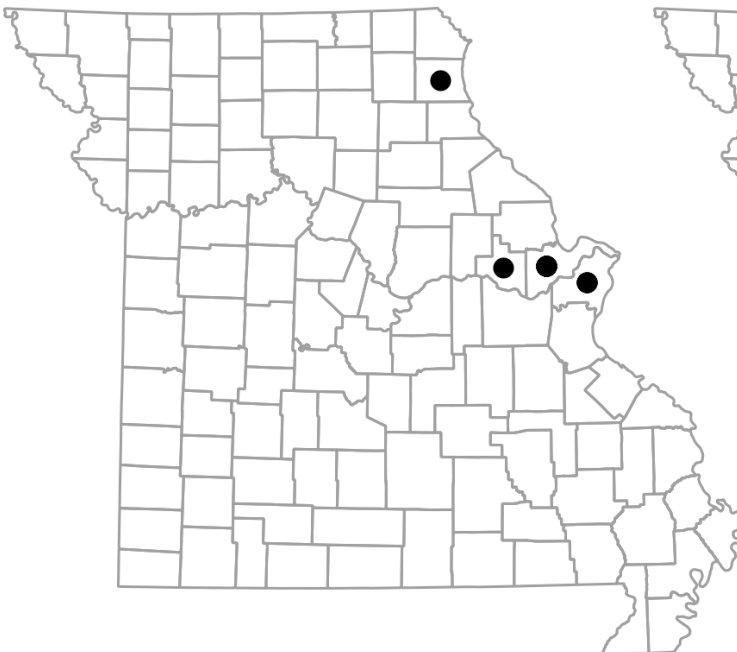
Agkistrodon contortrix
Copperhead



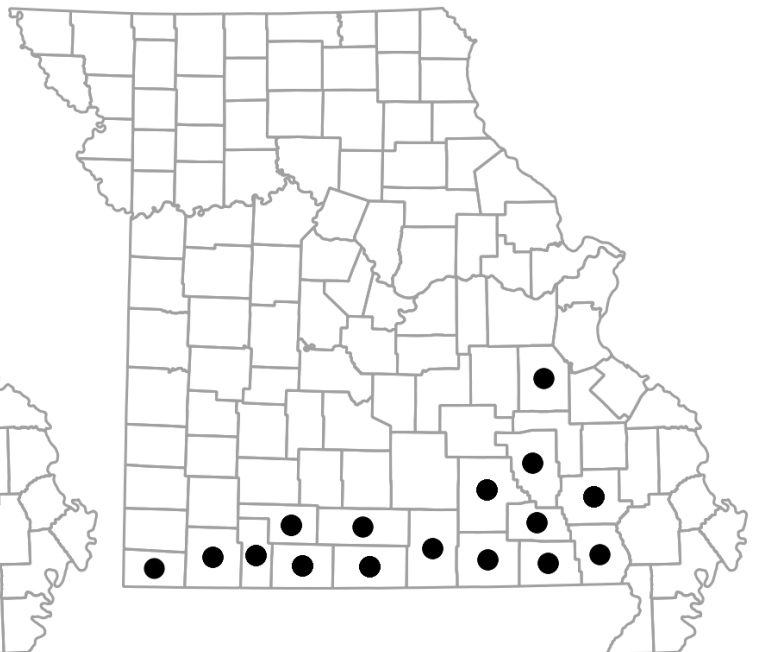
Agkistrodon piscivorus
Western Cottonmouth



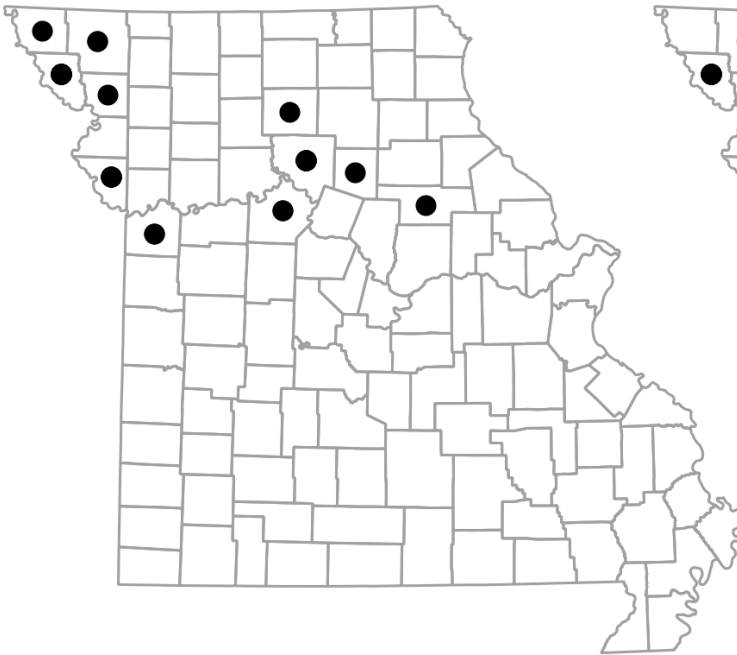
Crotalus horridus
Timber Rattlesnake



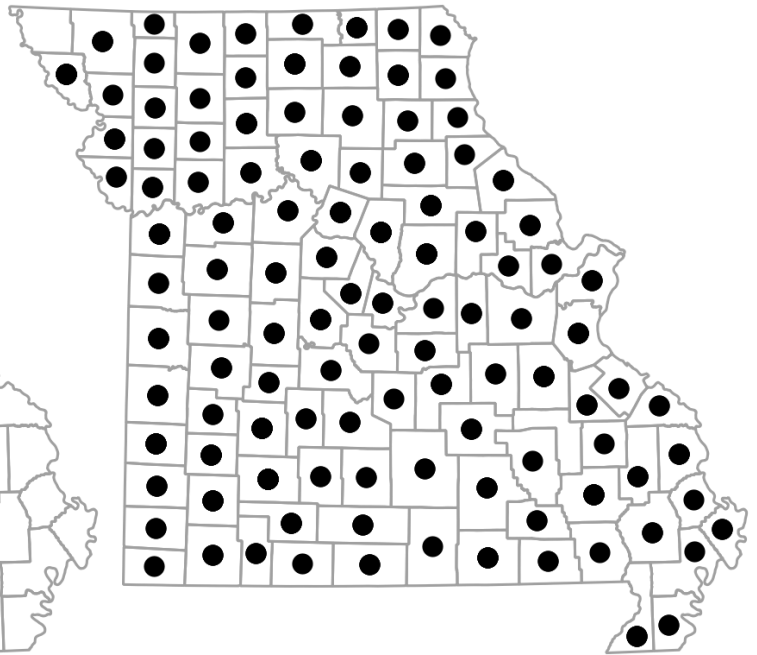
Sistrurus catenatus
Eastern Massasauga



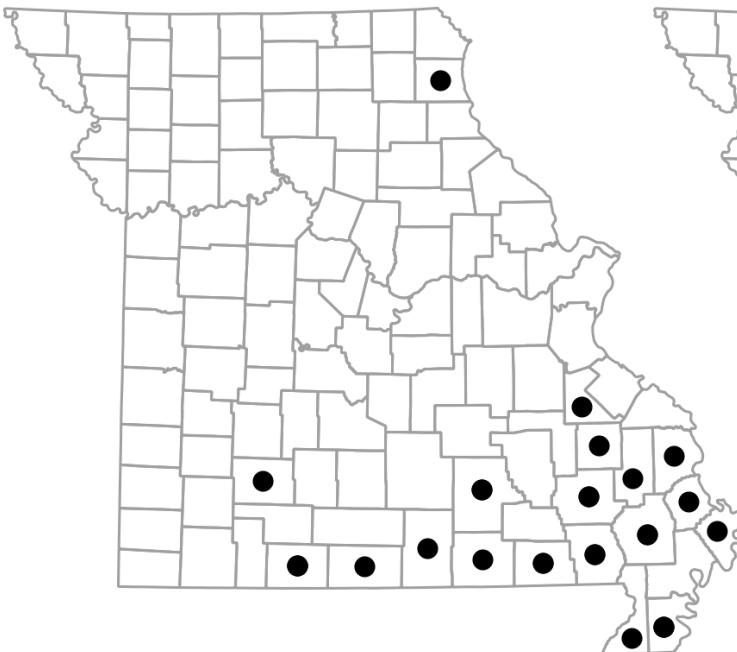
Sistrurus miliarius
Western Pygmy Rattlesnake



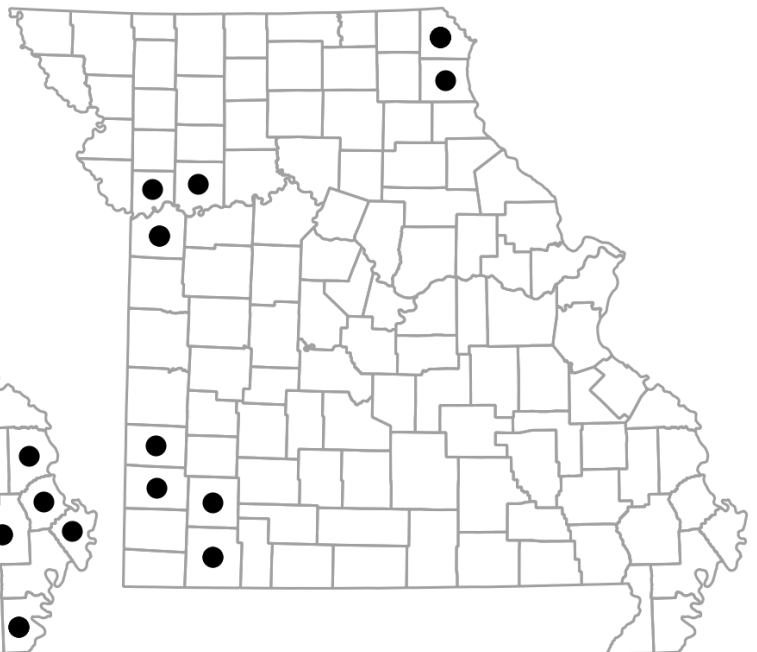
Sistrurus tergeminus
Prairie Massasauga



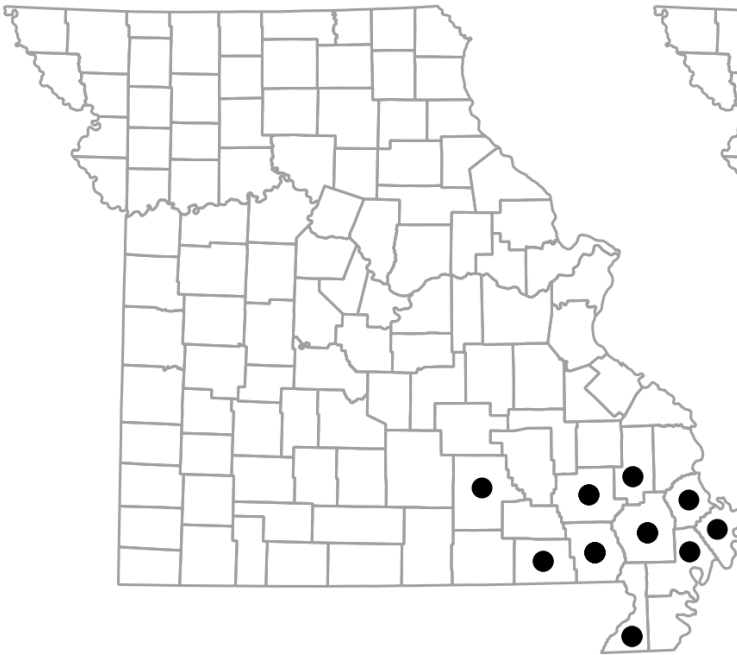
Chelydra serpentina
Snapping Turtle



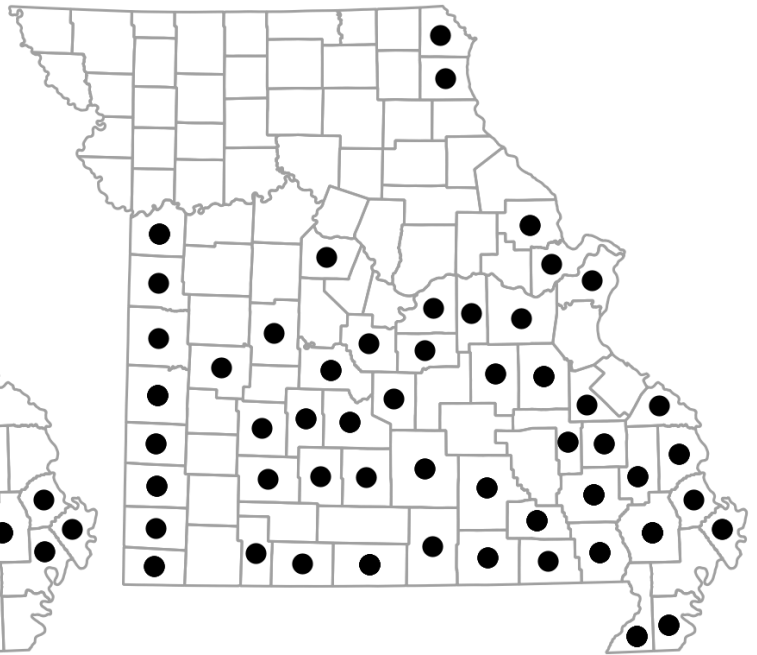
Macrochelys temminckii
Alligator Snapping Turtle



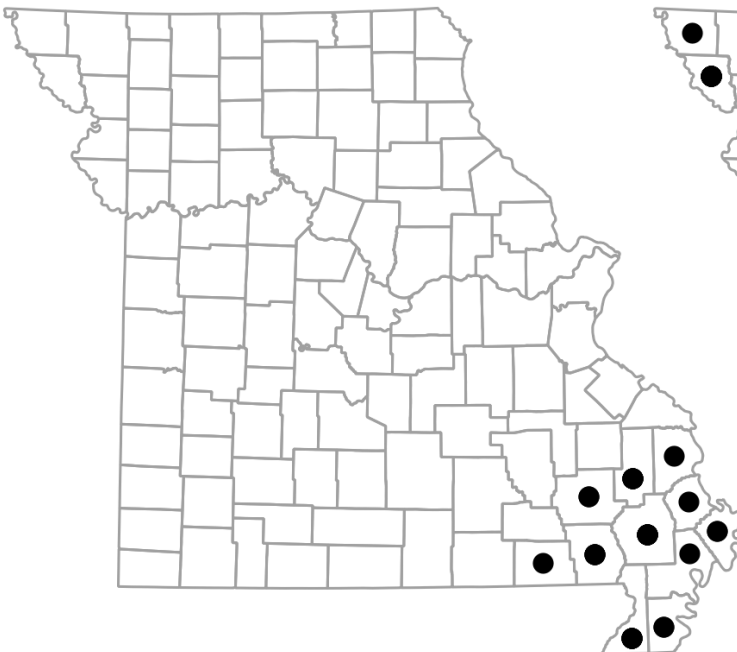
Kinosternon flavescens
Yellow Mud Turtle



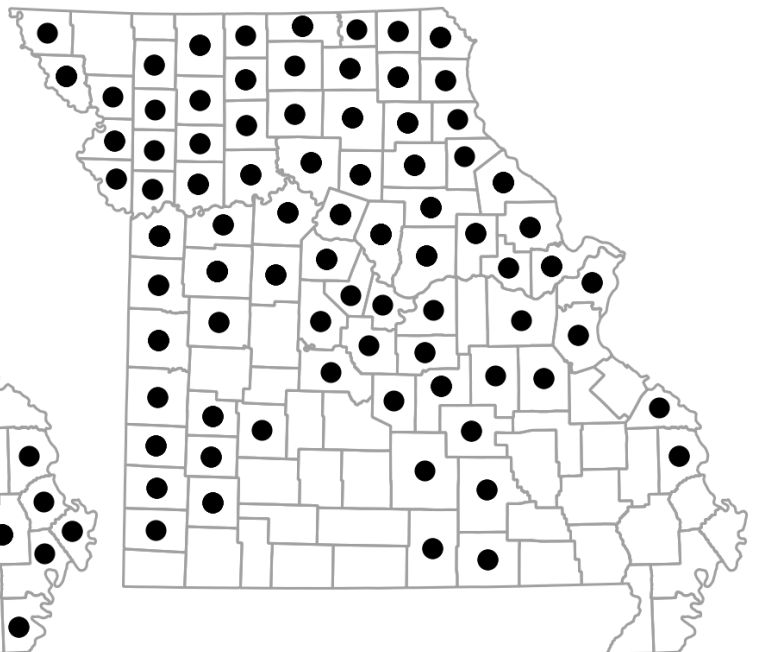
Kinosternon subrubrum
Mississippi Mud Turtle



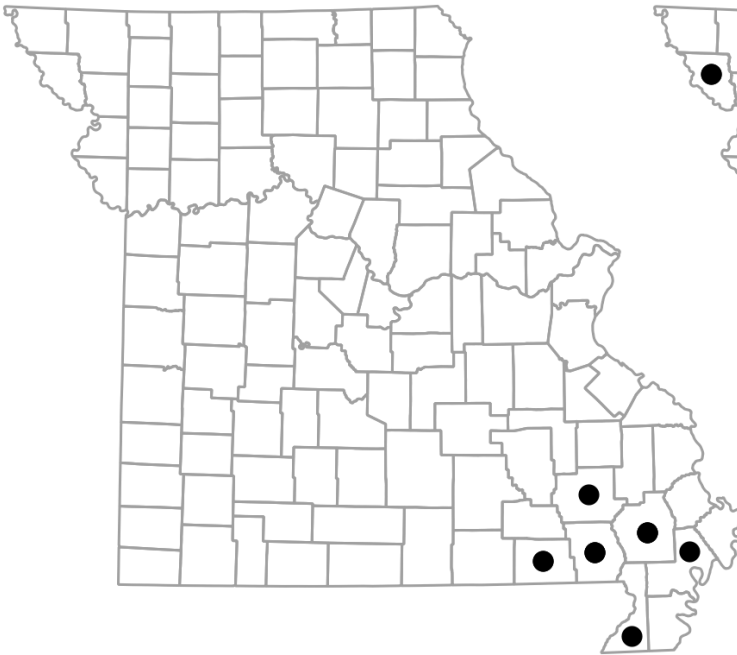
Sternotherus odoratus
Eastern Musk Turtle



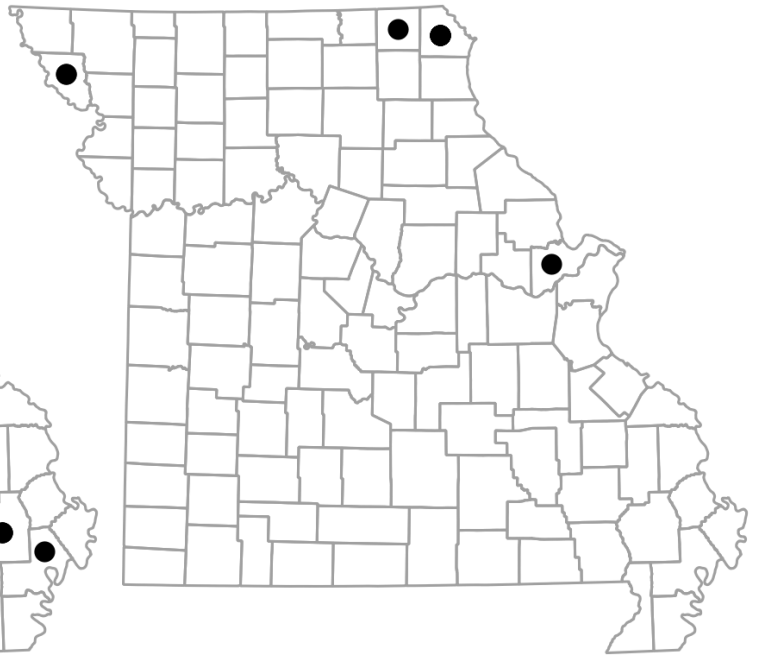
Chrysemys dorsalis
Southern Painted Turtle



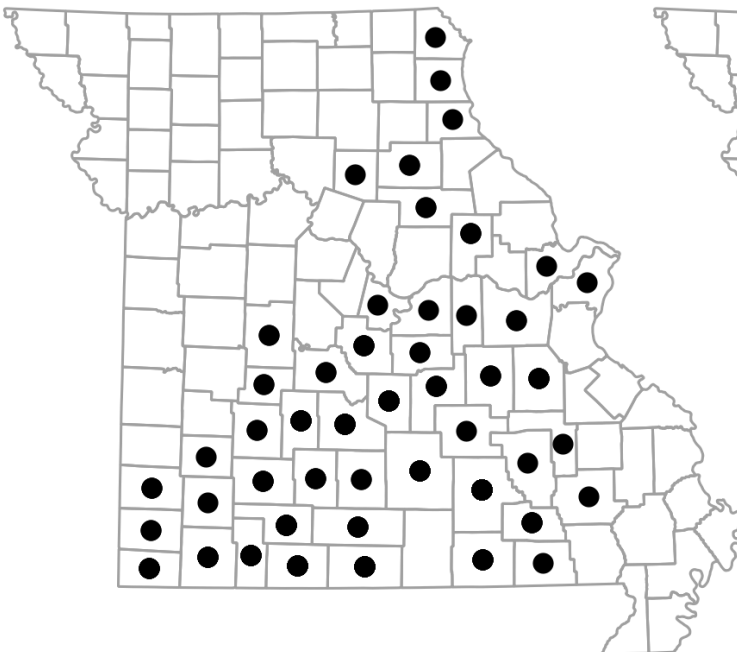
Chrysemys picta
Western Painted Turtle



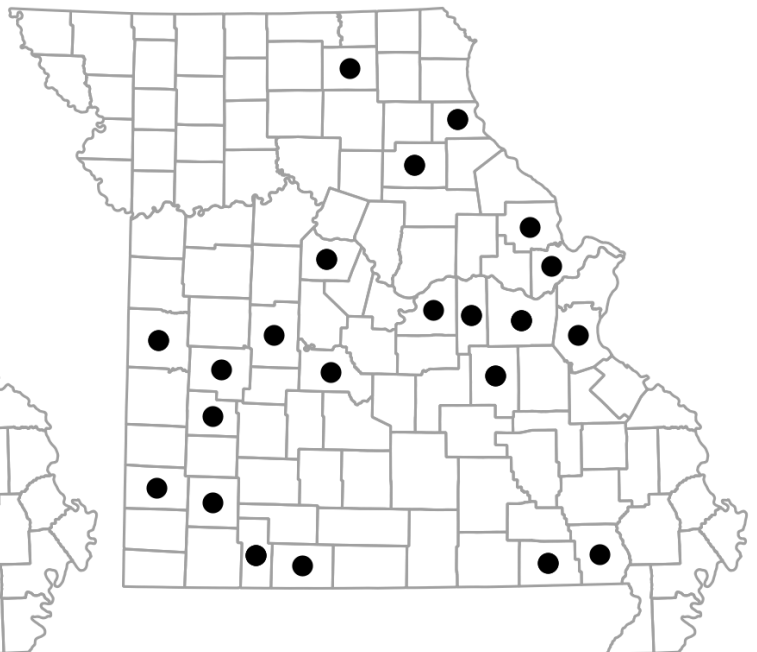
Deirochelys reticularia
Western Chicken Turtle



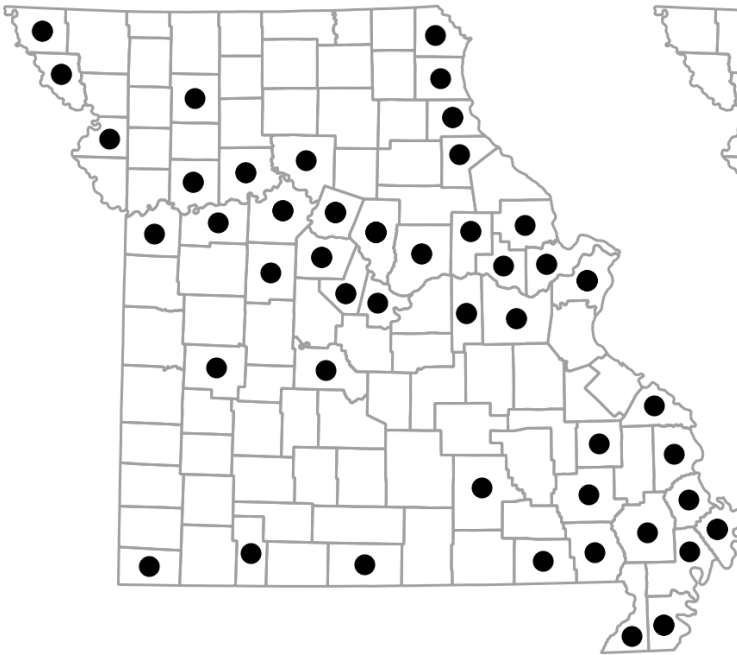
Emydoidea blandingii
Blanding's Turtle



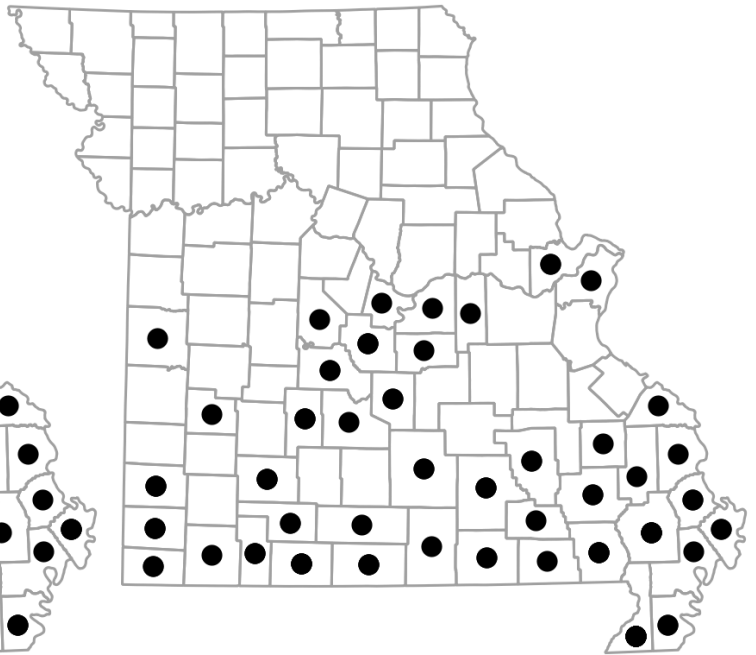
Graptemys geographica
Northern Map Turtle



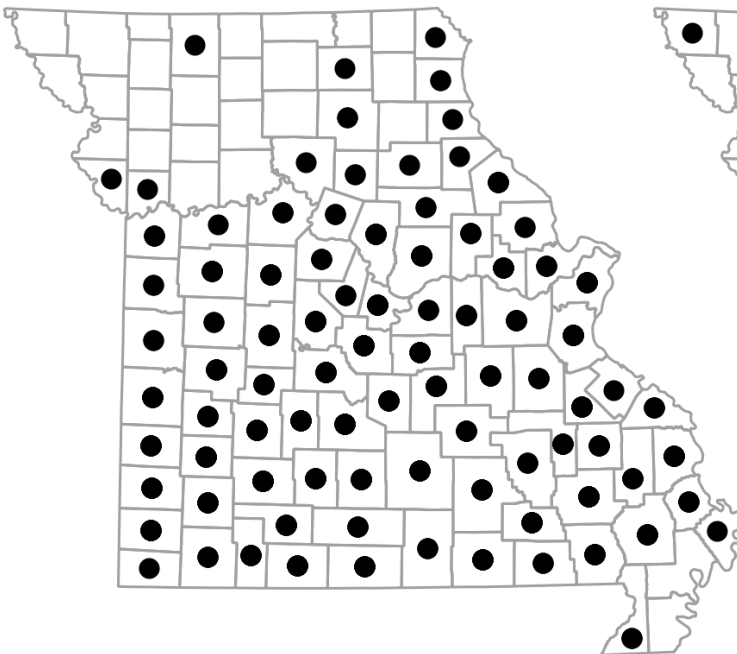
Graptemys ouachitensis
Ouachita Map Turtle



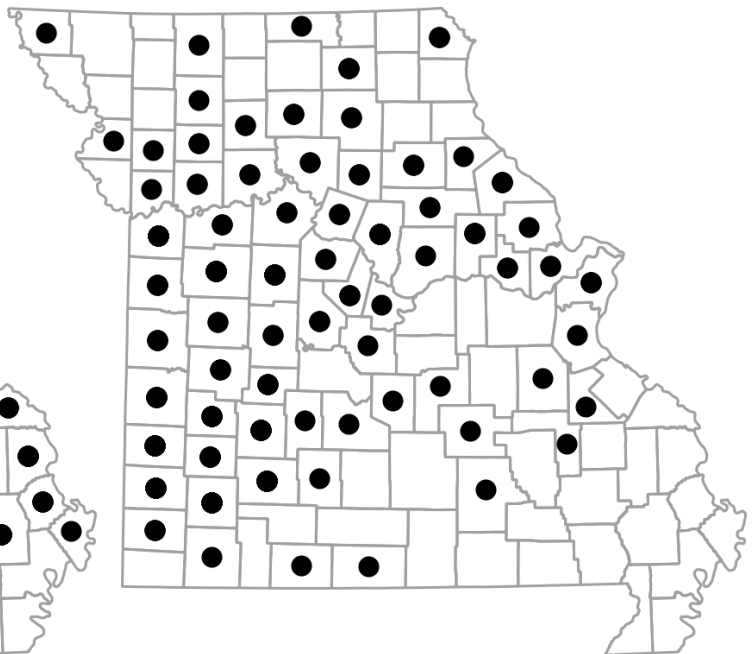
Graptemys pseudogeographica
False Map Turtle



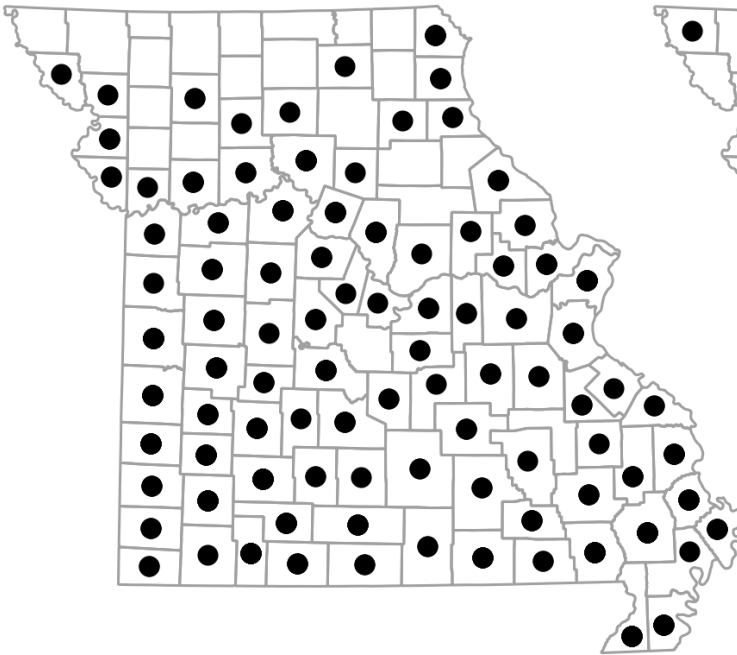
Pseudemys concinna
River Cooter



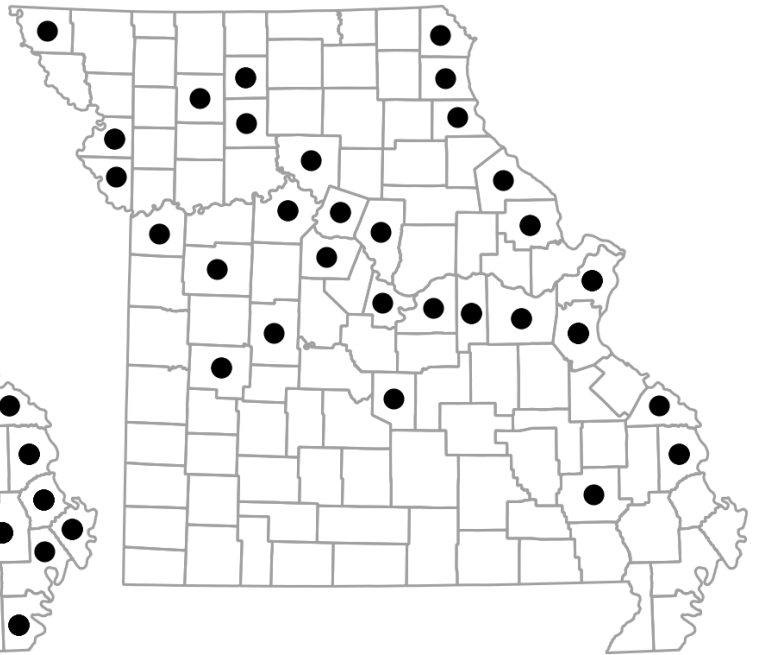
Terrapene carolina
Three-toed Box Turtle



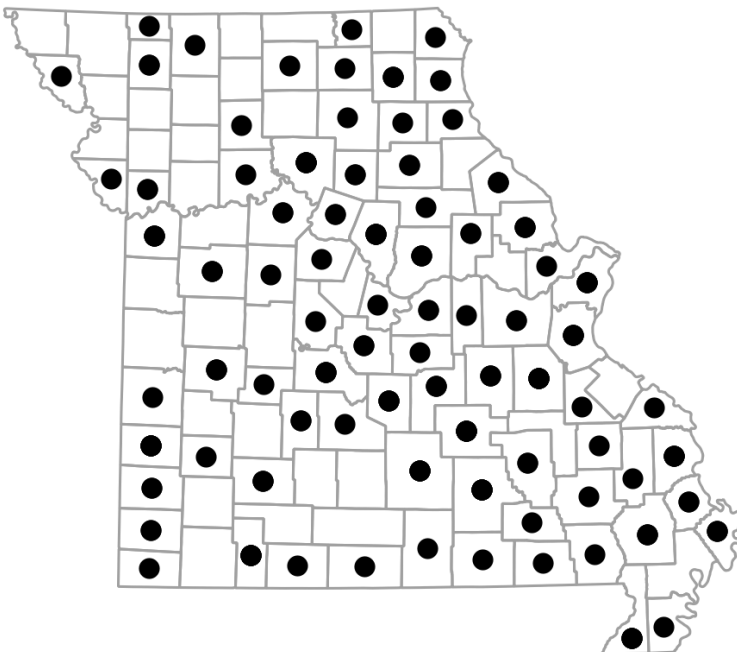
Terrapene ornata
Ornate Box Turtle



Trachemys scripta
Red-eared Slider



Apalone mutica
Midland Smooth Softshell



Apalone spinifera
Eastern Spiny Softshell

Acknowledgements

Data for the base county maps for the locality and county distributions, the labeled county map, and the ecological drainage units and aquatic subregions were generously provided by the Missouri Spatial Data Information Service (MSDIS 2009a, 2009b, 2009c). Data for the major rivers were provided by the United States Geological Survey (USGS 1994) and supplemented with data from the Missouri Department of Conservation (MDC 2007). Data for Missouri natural divisions and sections (based on Thom and Wilson (1980)) were generously provided by the Missouri Department of Conservation (MDC 2007). Data for watershed boundaries were provided by the Natural Resources Conservation Service (NRCS 2002). Data for ecoregions were provided by the US Environmental Protection Agency (EPA 2003). Base map data for surrounding states were provided by the National Atlas of the United States (National Atlas 2001).

All technology-related aspects of the Missouri Herpetological Atlas Project are supported by a suite of open source software that is both *gratis* (free as in beer) and *libre* (free as in speech). Kubuntu Linux is used as the operating system to host and execute all processes related to the project. Atlas, checklist, and GIS data are stored in a PostgreSQL database, which has been spatially enabled using PostGIS. Project documentation and database scripts are written with PHP and displayed using an Apache web server. QGIS is used to produce all base maps, distribution, county records, and other maps. The programming language Python is used to create GIS plug-ins for map exports. The open source Python library, ReportLab, is used to create the final *Atlas* publication in portable document format (PDF), an ISO standard.

Most importantly, a project of this magnitude cannot be accomplished without the contributions of many individuals. We would like to thank the following for specimen information, feedback, and technical assistance on the project:

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Frank Durbian, Eric East, David Easterla, Amber Edwards, T. Enright, Rick Essner, Pete Eyheralde, Susan Farrington, E. Field, Amanda Fisher, Z. Fratto, G. Frazier, Mark Frazier, Dillon Freiburger, Paul Frese, Darrell Frost, Bonnie Gardner, C. Gemming, Carl Gerhardt, Matt Gifford, Mark Gihring, Brian Gilbert, Bob Gillespie, T. Girard, Brad Glorioso, Steve Gotte, Millie Graham, Brian Greene, Greg Gremaud, Adam Guerich, Brad Hadley, Adam Hamlin, D. Harrison, Kevin Hedgpeth, AJ Hendershott, Robert Henderson, Mary Hennen, John Hess, Joshua Hill, Dan Hocking, Colby Hodges, Dana Hoisington, Ethan Hollender, Terry Holtsclaw, E. Hooper, Emily Horner, Ann Horsman, Brian Hubbs, Jamie Hubert, James Hunt, Seth Ince, Adam Ivey, Thomas Jay, Matt Jeppson, Linda Jepson, Tom Jessen, Tom Johnson, Joe Jones, Mike Jones, Kayl Kapral, John Karel, Tim Kavan, Kate Kelly, Robert Kipfer, William Kirby, Arnold Kluge, Kent Korthas, Robert Krager, Jim Lamer, Alek Lantar, Mike Leahy, Joseph Lemen, Kevin Lewis, Stephanie Liebi, Day Ligon, Elicia Ligon, Kenton Lohraff, Alexandria London, Peter Lowther, Beth Lynch, Jennifer Maag, Glenn Manning, Nicholas March, Dexter Mardis, Kevin Martie, Gina Martin, Terrell Martin, Frank Martinez, Rebecca Maxfield, Christine Mayer, Amy McClure, Roy McDiarmid, Elizabeth McGhee, B. McKeage, Paul McKenzie, Don McKnight, Arianne Messerman, Dean Metter, C. Meyer, Brian Miller, Danielle Miller, J. Miller, N. Mitchell, Chad Montgomery, Nathan Montgomery, D. Moore, T. Moore, L. Moree, Denise Morgan-Irish, Nathanael Morris, K. Morrow, Sarah Moss, Nathan Muenks, Tom Nagel, Kevin Narum, L. Neuman-Lee, Chris Newbold, Abigail Nicholson, Krista Noel, Laurel Norton, Jim Oehmke, Tyler Olcott, Matt Ormsby, Seth Otto, Cheryl Palmer, Peter Paplanus, John Par, Ben Parnell, Caleb Pemberton, Bill Peterman, M. Peterson, Katie Petrie, Tim Pettinelli, Chris Phillips, Nick Pieroni, Gregory Pinson, G. Pitchford, P. Pitts, Jon Pollock, Crystal Poole, Robert Powell, Tracey Prenger, Yarrow Price, B. Probst, Keith Pulles, Holly Quinn, Hugh Quinn, Corey Raimond, Alan Resetar, Joe Ridings, Daren Riedle, Rhonda Rimer, Tony Robyn, Bernard Ross, Douglas Rossman, David Rostollan, Chad Runco, B. Russell, Greg Schneider, Tim Schoppenhorst, E. Schott, Bruce Schuette, Jeremy Schumacher, C. Scott, K. Scott, John Severson, Alex Sharp, Chris Shelton, Chris Shulse, Dustin Siegel, Carri Silman, John Simmons, Rachel Simmons, Carl Smith, Geoff Smith, Isaac Smith, Madeline Smith, S. Smith, Steven Snow, Leon Spring, Marianne Stanley, Clarissa Starbuck, Andy Starostka, Shane Staten, Brandon Stehl, Jeff Stewart, Greg Stoner, James Studdard, Kelly Sulkowski, Mercedes Summers, Becky Swearingen, Travis Taggart, Jeremiah Terrell, Wendell Tharp, Ryan Thies, M. Thompson, A. Thorn, Bart Tibbs, Mark Tovar, Sean Tracy, Stan Trauth, Angelina Trombley, T. Trombone, Linda Trueb, Joe Twardowski, Chad Wallis, Sammy Wentz, J. West, Steve Westin, Amber Wiewel, Brian Willey, Bethany Williams, Linda Williams, Myki Williamson, Matt Wishard, Rod Wittenberg, N. Woodland, Nathan Woolery, Reese Worthington, Patricia Yates, Nico Yoch, Elizabeth Yohe

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Appendix A: Collection Sources

American Museum of Natural History
Arkansas State University
Austin Peay State University *
Bobby Witcher Memorial Collection, Avila College (KU)
Carnegie Museum of Natural History
Chicago Academy of Sciences
Cornell University Museum of Vertebrates
Culver-Stockton College
Dallas Museum of Natural History *
Field Museum of Natural History
H. Carl Gerhardt Audio Recording Collection (Cornell)
Illinois Natural History Survey
Milwaukee Public Museum
Missouri Department of Conservation *
Missouri State University
Museum of Comparative Zoology, Harvard University
Museum of Natural Science, Louisiana State University
Museum of Southwest Biology (New Mexico) *
National Museum of Natural History
Natural History Museum of Los Angeles County *
Pittsburg State University
Saint Louis Academy of Sciences
Southeast Missouri State University
Southern Illinois University--Carbondale
Southern Illinois University--Edwardsville
Sternberg Museum of Natural History, Fort Hays State University
Texas Natural History Collection *
University of Arkansas--Fayetteville
University of California--Berkeley Museum of Vertebrate Zoology
University of Central Missouri
University of Florida at Gainesville *
University of Georgia, Museum of Natural History
University of Illinois Natural History Museum
University of Kansas, Museum of Natural History
University of Michigan, Museum of Zoology
University of Missouri--Columbia Dean E. Metter Memorial Herpetology Collection
William Jewell College

* Collection sources marked with an asterisk (*) are included from published accounts only and are presumed to represent only part of the collection's Missouri records. All Missouri material from these sources has not been included in the database or the printed atlas.

Appendix B: Literature Sources

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