ATLAS OF AMPHIBIANS & REPTILES IN VIRGINIA

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and Karen K. Reay

VIRGINIA DEPARTMENT OF GAME AND INLAND FISHERIES

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OF
AMPHIBIANS AND REPTILES
IN
VIRGINIA

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INTRODUCTION

Amphibians and reptiles are two groups of ectothermic vertebrates that utilize a wide variety of habitats. Most are able to withstand unfavorable weather or seasonal extremes by becoming inactive and simply waiting for conditions to improve. Since movement by some species may be limited during unfavorable conditions, the amount of information we have been able to accumulate on their distribution patterns has been profoundly affected. Indeed, several species are so secretive that only a few individuals have been brought to the attention of the scientific community. The patterns thus reflected in the distribution maps for each member of Virginia's herpetofauna have resulted from countless days of painstaking searches, chance encounters, and just plain luck. Some patterns are essentially complete, while others are very incomplete. The amphibians and reptiles in a state as well surveyed as Virginia still harbor a wealth of secrets that only additional surveys will reveal.

Virginia's herpetofauna consists of 74 species of amphibians and 61 species of reptiles. Of these, 25 are frogs and toads, 49 are salamanders, 22 are turtles (5 of which are sea turtles that occur here seasonally), 9 are lizards, and 30 are snakes. Systematics (the study of evolutionary relationships among species) and taxonomy (the process of identification and naming species) are dynamic scientific disciplines. Although many species in Virginia are relatively well-known, it is likely that new insights into populations and their genetics will reveal new species. Thus, the number of species and their distribution patterns included in this atlas should be considered a reflection of the current state of knowledge about these animals.

The distribution maps illustrate several integrated concepts. They illustrate where people, mostly scientists, have documented a species' occurrence with a voucher specimen in a museum collection or in an accepted scientific collection report record to the Virginia Department of Game and Inland Fisheries. They reflect whether the species has broad ecological tolerance limits and thus a broad distribution or relatively narrow tolerance limits with geographically-limited distributions. They illustrate a species' response to historical changes in the environment, such as the effects of Pleistocene glaciation (Delcourt and Delcourt, 1987; Fay, 1988) and extensive deforestation following colonization by Europeans (Williams, 1989; Walker, 1991; Whitney, 1994). The symbols on these maps represent locations known for each species since The Civil War. Some of the places that are indicated by a solid or shaded circle on these maps may no longer support a population of that species (e.g., Mitchell, 1996). Modern loss of habitat due to the rapid expansion of urban centers, suburban areas, and roads is proving detrimental for many species. Historical documentation of all populations will allow better understanding of how amphibian and reptile distributions change with time, and it may help with development of ways to better conserve and manage this fauna.

A BRIEF HISTORY OF HERPETOFAUNAL EXPLORATION IN VIRGINIA

The earliest recorded observations of amphibians and reptiles in Virginia were made by Captain John Smith (1612). He noted the use of rattlesnake rattles by Native Americans, the inclusion of turtles in their diet, the wearing of live greensnakes in men's earlobes for ornamentation, and the use of rattles on ornamental feathers. Other observations to the middle 1800s are scattered in additional early works. For example, John Lederer (1672) described finding a squirrel in the stomach of a large rattlesnake near what is now King William County. Beverley (1705) noted several species of snakes in the first description of Virginia's natural history, although some later authors suggest that he used information from other sources without due credit. Nevertheless, he mentions observations on rattlesnakes, blacksnakes, watersnakes, cornsnakes, and the "black-viper snake", probably a melanistic *Heterodon platirhinos* (eastern hog-nosed snake). He also noted the nighttime calls of frogs that "do no hurt except by the noise of their croaking notes." The Colonial Naturalist, Mark Catesby, lived in the Williamsburg area from 1712 to 1719. He is famous for his watercolors of plants and animals drawn after he departed the area (Frick and Stearns, 1961). No doubt, some of his illustrations of amphibians and reptiles were influenced by what he saw in Virginia. Little was published in the late 1700s and early 1800s. B.S. Barton published his observations on hellbenders during that time based in part on Virginia specimens (Barton, 1808, 1812).

The naturalist's era, exemplified by Catesby and others such as Audubon and Bartram, was brought to a close by the publication of the first series of books on North American herpetology (Holbrook, 1836, 1838a, 1838b, 1840, 1842). Holbrook was the first to use the species account format, thus setting the stage for modern publications of America's amphibians and reptiles. It is uncertain if he actually collected in Virginia during his travels between Charleston and Philadelphia (his library was burned by General Sherman's troops in the Civil War; Adler, 1979) but a careful reading of his accounts suggests that he may have obtained some specimens from this area.

Prior to the middle 1800s, specimens of amphibians and reptiles were collected for exhibition in museums. The practice of collecting specimens to be retained in permanent museum collections for scientific study developed at about that time. A milksnake (*Lampropeltis triangulum*) collected from Clarke County sometime before 1853 was described as a new species by Baird and Girard (1853), but that name was synonomyzed by later authors. The specimen still exists as number 2380 in the Smithsonian Institution's research collection. Another early specimen from Virginia is a six-lined racerunner (*Cnemidophorus sexlineatus*) collected during the Seven Days Battle in eastern Henrico County in 1862 by General George G. Meade or one of his staff (Tobey, 1991). The specimen (MCZ 570) is in the Museum of Comparative Zoology at Harvard University.

Specimens in collections such as these provide the historical and modern scientific documentation (like books in a library) that support what is known about regional herpetofaunas.

Few publications based on Virginia's amphibians and reptiles were published until after the turn of the century. Examples include Louis Agassiz's two volume treatise on embryonic development in turtles (Agassiz, 1857), Edward Drinker Cope's range extension of a rainbow snake from the Pamunkey River (Cope, 1895) and his massive volume on snakes, lizards, and crocodilians published after his death in 1897 (Cope, 1900), Hugh Smith's description of an *Amphiuma* from Virginia (Smith, 1899), G. S. Miller's record of a mole kingsnake in the state (Miller, 1902), and W.P. Hay's (1902) descriptions of the amphibians and reptiles of the District of Columbia and vicinity that included many observations from northern Virginia. Two books on amphibians and reptiles available to non-professionals at the time included various editions of Jordan (1878) and Ditmars (1907).

Modern treatment of the science of herpetology in Virginia began with the early works of Emmett Reid Dunn (e.g., 1915, 1916, 1918). Dunn (1894-1956, see Figure 2a in Mitchell, 1994a) was from northern Virginia and spent many summers at his family's farm in Nelson County along the James River. He was influenced by Leonard Stejneger, then curator of reptiles and amphibians at the Smithsonian Institution, to go to college and become a professional scientist. Dunn was the first to make sense of the plethodontid salamanders in North America, publishing his classic book in 1926. He was the first to assemble locality records for Virginia amphibians and reptiles from museum records, the literature, and his own observations (Dunn, 1918, 1936). His 1936 mimeographed list was never published but was circulated widely. In the 1920s, he became interested in Neotropical herpetology and spent most of his professional career teaching at Haverford College in Pennsylvania and studying tropical amphibians and reptiles. There were other authors who contributed to herpetology during Dunn's Virginia period (1915-1936). These contributions include Brady's lists of amphibians and reptiles from Dismal Swamp and Hog Island (Brady, 1925, 1927) and Allard's natural history of the box turtle (Allard, 1935, 1939). However significant these contributions may be, it was E.R. Dunn who put Virginia on the herpetological map.

As Dunn shifted his attention from Nearctic to Neotropical regions, several other people began their studies of the amphibians and reptiles of the Appalachian and Virginia herpetofauna. Neil D. Richmond (1912-1992), who became curator of amphibians and reptiles at the Carnegie Museum of Natural History in Pittsburgh, spent several years on a farm in southeastern New Kent County in the 1930s and 1940s. There he made a number of valuable contributions to the understanding of the ecology and behavior of several species of reptiles (e.g., Richmond, 1940, 1945a, 1945b, 1947, 1956; Richmond and Goin, 1938). Clifford H. Pope (1899-1974), author of several popular books about reptiles (Pope, 1937, 1939, 1957), graduated from the University of Virginia in 1921 and spent much of his career associated with the American Museum of Natural

History in New York and the Field Museum of Natural History in Chicago. He contributed several important papers on the ecology and systematics of Appalachian salamanders (Pope, 1950; Pope and Hairston, 1947; Pope and Pope, 1949). Roger Conant, well known for his popular field guides to eastern amphibians and reptiles in the Peterson field guide series (Conant, 1958b, 1975; Conant and Collins, 1991, 1998), initiated his field studies in Virginia in 1939 when he visited the Delmarva Peninsula. Several of his contributions provided important insights into the distribution, systematics, and phenotypic variation of several species of snakes in that area (Conant, 1943, 1945, 1946, 1958a). His long-standing interest in the Delmarva Peninsula led him to become senior author on an annotated checklist of the herpetofauna of the Virginia barrier islands (Conant *et al.*, 1990). Richard L. Hoffman, who has become a world renowned millipede taxonomist and is the current curator of invertebrates at the Virginia Museum of Natural History in Martinsville, started publishing in herpetology as a teenager. Most of his contributions in this area were, and continue to be, in the areas of distribution, systematics, and faunal assemblages (e.g., Hoffman, 1944a, 1944b, 1945, 1946, 1947, 1949, 1955, 1967, 1973, 1979, 1992; Hoffman and Hubricht, 1954, Hoffman and Kleinpeter, 1948). Clyde F. Reed was interested primarily in distribution records and published numerous lists of museum and personal records on the herpetofauna of Delmarva and the Northern Neck (e.g., Reed, 1956a, 1956b, 1957a, 1957b, 1958, 1960). John T. Wood (1919-1990), who later became a physician and psychiatrist and settled in Vancouver, Canada, embarked initially on a career as a biologist. Wood was especially interested in the behavior and reproduction of salamanders, publishing 14 papers in this area (e.g., Wood, 1950, 1953a, 1953c, 1955; Wood *et al.*, 1955; Wood and deRageot, 1955a, 1955b, 1963; Wood and Wilkinson, 1952a). He also published papers on the behavior of turtles (Wood, 1953b), snakebite in Virginia (Wood, 1954b), garter snake variation (Wood and Wilkinson, 1952b), and venomous snake distribution (Wood, 1954a; Goodwin and Wood, 1956). Much of Wood's herpetological research was conducted while he was a student at what is now the Virginia Institute of Marine Science, while he attended the University of Virginia School of Medicine, and during his years of practice in the Burkeville area.

Beginning in the late 1950s, the further development of Virginia herpetology can be followed along two paths. One started with the founding of the Virginia Herpetological Society (VHS), and the other was the continuation of field research conducted by professional biologists, largely from academic institutions. The VHS was founded in 1958 by a group of amateur herpetologists and professional biologists to enhance education (particularly through the media), conservation, and research of the state's herpetofauna. Its first President was John T. Wood and its long-time secretary and editor of the VHS Bulletin was Franklin J. Tobey, a public relations writer for a federal agency. W.L. (Les) Burger (1925-1988) published an expanded checklist of Virginia's amphibians and reptiles in the bulletin in 1958. Several other people joined the group and together they embarked on a course to produce the first comprehensive atlas of Virginia's amphibians and reptiles based largely on museum specimens and other documented records. Frank Tobey saw this

project to completion in 1985. The VHS bulletin was the sole means of communication to members; and Tobey saw the completion of some 90 issues into 1979. The Society changed structure in 1980 and began publishing a new journal, Catesbeiana, a name recommended by R.L. Hoffman to honor Mark Catesby, in 1981. Tobey (1988) provided a history of the VHS that documented much of its activities until this time. Throughout the history of this regional organization, the group has remained focused on the natural history of Virginia's native fauna. The society remains active after 40 years.

The two paths noted above were not entirely separate. Academic biologists often participated in the VHS and several young members of the group became professionals themselves (Mitchell, 1994a). Doctoral students interested in salamander biology naturally came to the Appalachian region to conduct their research. One example is James A. Organ, then of the University of Michigan, who published several papers on the behavioral ecology of these animals from the Mount Rogers area (Organ, 1958, 1960, 1961a, 1961b; Organ and Lowanthal, 1963). Richard Highton, himself a student in the late 1950s and now recently retired from the University of Maryland, began his long series of contributions on the systematics and evolution of salamanders in the genus *Plethodon* with studies in the southern Appalachians (e.g., Highton, 1959, 1962, 1972; Highton and Grobman, 1956; Highton and Webster, 1976). Highton and several of his students have continued the tradition of research on the salamanders in this region, often working at sites in Virginia (e.g., Fraser, 1976a, 1976b; Jaeger, 1970, 1971, 1980, Jaeger *et al.*,1995; Wise and Jaeger, 1998).

Throughout the period of the 1940s to the present, Mountain Lake Biological Station, a part of the University of Virginia located in Giles County, has been the site of many research projects on the area's herpetofauna. Salamanders have been the most common group studied (e.g., Bogert, 1952; Hutchison, 1958; Keen, 1982; Mathis, 1989; Resetarits, 1991, Wise and Jaeger, 1998), but snakes (Smyth, 1949) and frogs (Schroeder, 1976) have also received attention. Courses taught at the station that provided an introduction to the herpetology of the area included animal ecology, animal behavior, herpetology, and vertebrate biology. These summer courses were taught by such well known names in herpetology as E.R. Dunn (1935), C.M. Bogert (1949), H. G. Dowling (1954), H.G.M. Jopson (1960s and 1970s), and H.W. Wilbur (1980s). Professional herpetologists who have conducted research there include K. Adler, S.J. Arnold, R. Highton, R.G. Jaeger, and C.H. Pope. Intensive research continues at the station with a steady production of graduate students associated with several universities.

Since the 1960s when academic institutions expanded their biology faculties, research on various aspects of the biology of Virginia's amphibians and reptiles has intensified. The influx of new university faculty interested in amphibians and reptiles and the continued draw of the Appalachian biota ensured that many new areas, both geographic and topical, would be explored.

There are now active research programs at a number of Virginia's colleges and universities with graduate programs. Several of these are mentioned in Mitchell (1994a).

The most recent and fastest growing area of interest is conservation biology. Increased public awareness of declining populations, habitat loss, environmental pollution, and passage of the federal Endangered Species Act (ESA) and the Virginia Endangered Species Act has focused attention on the status of the state's native species. The first symposium in 1978 (Linzey, 1979) highlighted species that potentially needed protection in some way. In 1987, the state's Department of Game and Inland Fisheries, the regulatory authority over amphibians and reptiles, added several species to the state endangered and threatened species list. This was followed by the first agency-supported symposium in 1989 and the publication of the proceedings in book form (Terwilliger, 1991). At that time ten species of amphibians and reptiles were listed as endangered and one as threatened. Thirteen species were recognized as special concern and 18 others were listed as status undetermined due to lack of information (Virginia regulation section *4 VAC 15-360-60;* Mitchell, 1991). Prior to 1987, the state had recognized only those species, such as sea turtles, that were listed under the federal ESA in the 1970s. This recognition of amphibians and reptiles by federal and state authorities has led to a variety of studies on the ecology and current status of several of the listed species. For example, bog turtle populations have been evaluated from the perspective of movement ecology and landscape conservation (Buhlmann *et al.*, 1997; Carter, 1997; Carter *et al.*, 1999). Several other rare species have been evaluated by Virginia's biologists but several of the others need further attention. Continued interest in rare species will ensure that studies will be pursued well into the next century.

The future of human attention on the amphibians and reptiles of Virginia is likely to be a mix of academic pursuits, amateur contributions concerning distribution and natural history, development of management plans based on species inventories and applied studies of populations and communities on federal and state lands, and continued efforts on behalf of listed species. What will be the future of the amphibians and reptiles themselves? Growth of the human population in the Commonwealth and extensive loss of habitat in some areas will only contribute to the long-term decline in numbers of populations and shrinkage of species ranges. Acid precipitation may begin to affect some amphibian populations (Mitchell, 1998; Downey *et al.*, 1999; Kirk and Mitchell, 1999). Species that are considered common today may be uncommon or rare in the next several decades due to human activities. The challenge to people who work on Virginia herpetology is to find ways to ensure that there is no loss of species and no further decline in populations so that future generations will be able to enjoy and study these animals.

VIRGINIA'S ENVIRONMENT

The geographic position of the Commonwealth of Virginia along the Atlantic seaboard of North America ensures that a high diversity of amphibians and reptiles occurs in the state. Virginia's boundaries (Figure 1) encompass environments that range from coastal maritime with benign weather to montane boreal forests with harsh winters and short summers. Five physiographic regions of the more than 20 that occur in North America illustrate the Commonwealth's diverse topographic relief and directly influence climatic patterns. Imbedded in these systems are twelve major river drainages that serve to influence climate and provide avenues of dispersal for many species. A diverse array of ecological systems and vegetative communities are situated atop these surface features. These integrated systems within Virginia profoundly influence the distribution patterns of amphibians and reptiles.

Physiographic Provinces

The five modern day physiographic provinces (Figure 2) defined within Virginia's state boundaries originated from ancient geological processes. Each has its own history of rock formation, deformation, and erosion. The orientation of these regions is generally north-south and northeast-southwest largely because of the locations and directions of movement of the continental plates in the Paleozoic Era (570-250 million YBP [years before present]) (Woodward and Hoffman, 1991). Collisions of the North American and African plates during this time formed the Appalachian Mountains and their subsequent drifting apart allowed the formation of the Atlantic Ocean. The eastern margin of North America was along the present day Fall Line. Ensuing erosion over millions of years west of this margin produced the Piedmont and the mountain regions. Periodic deposition and erosion of sediment associated with sea level rise and fall created the Coastal Plain region east of the fall line (Hack, 1982). Thus, the geological underpinning of the Commonwealth has a long and varied history. These physical histories greatly influenced the occupational and evolutionary histories of each of the amphibian and reptile species. A brief description of the physiographic provinces provides a necessary background to understand the distributions of these animals.

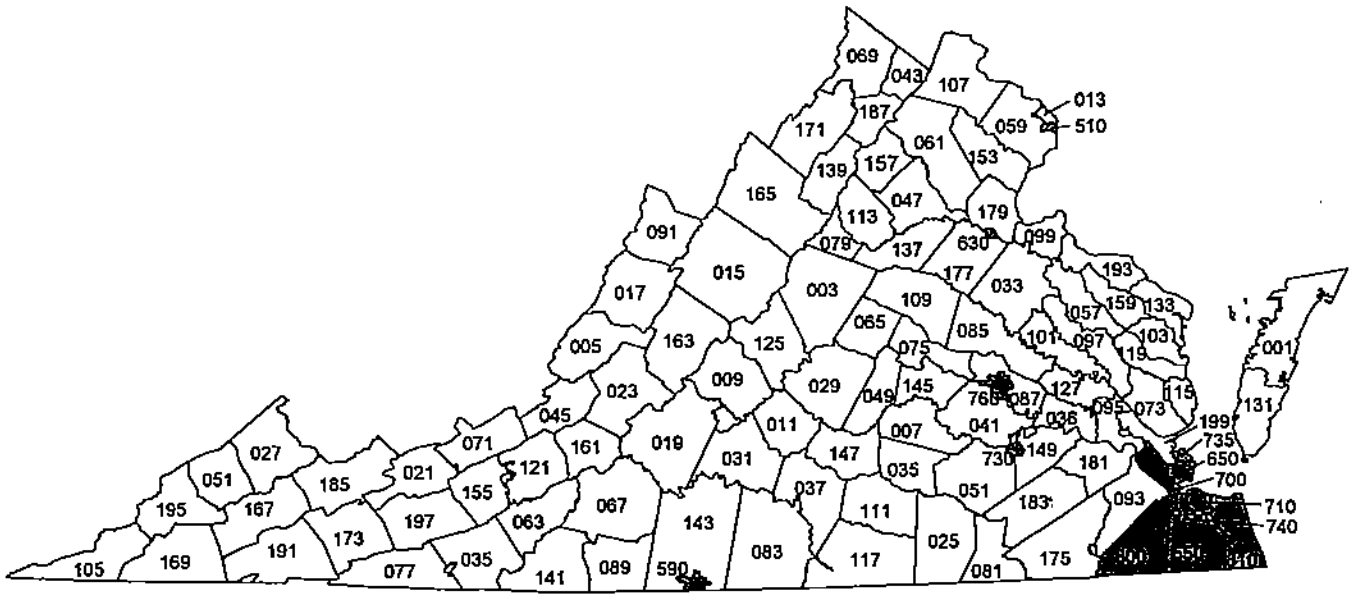


Figure 1. Virginia Counties and Selected Independent Cities

001 Accomack
003 Albemarle
005 Alleghany
007 Amelia
009 Amherst
011 Appomattox
013 Arlington
015 Augusta
017 Bath
019 Bedford
021 Bland
023 Botetourt
025 Brunswick
027 Buchanan
029 Buckingham
031 Campbell
033 Caroline
035 Carroll
036 Charles City
037 Charlotte
041 Chesterfield
043 Clarke
045 Craig
047 Culpeper
049 Cumberland
051 Dickenson
053 Dinwiddie
057 Essex
059 Fairfax
061 Fauquier
063 Floyd
065 Fluvanna
067 Franklin
069 Frederick
071 Giles
073 Gloucester
075 Goochland
077 Grayson
079 Greene
081 Greensville
083 Halifax
085 Hanover
087 Henrico
089 Henry
091 Highland
093 Isle of Wight
095 James City
097 King and Queen
099 King George
101 King William
103 Lancaster
105 Lee
107 Loudoun
109 Louisa
111 Lunenburg
113 Madison
115 Mathews
117 Mecklenburg
119 Middlesex
121 Montgomery
125 Nelson
127 New Kent
131 Northampton
133 Northumberlund
135 Nottoway
137 Orange
139 Page
141 Patrick
143 Pittsylvania
145 Powhatan
147 Prince Edward
149 Prince George
153 Prince William
155 Pulaski
157 Rappahannock
159 Richmond
161 Roanoke
163 Rockbridge
165 Rockingham
167 Russell
169 Scott
171 Shenandoah
173 Smyth
175 Southampton
177 Spotsylvania
179 Stafford
181 Surry
183 Sussex
185 Tazewell
187 Warren
191 Washington
193 Westmoreland
195 Wise
197 Wythe
199 York
510 Alexandria
550 Chesapeake
590 Danville
630 Fredericksburg
650 Hampton
700 Newport News
710 Norfolk
730 Petersburg
735 Poquoson
740 Portsmouth
760 Richmond
800 Suffolk
810 Virginia Beach

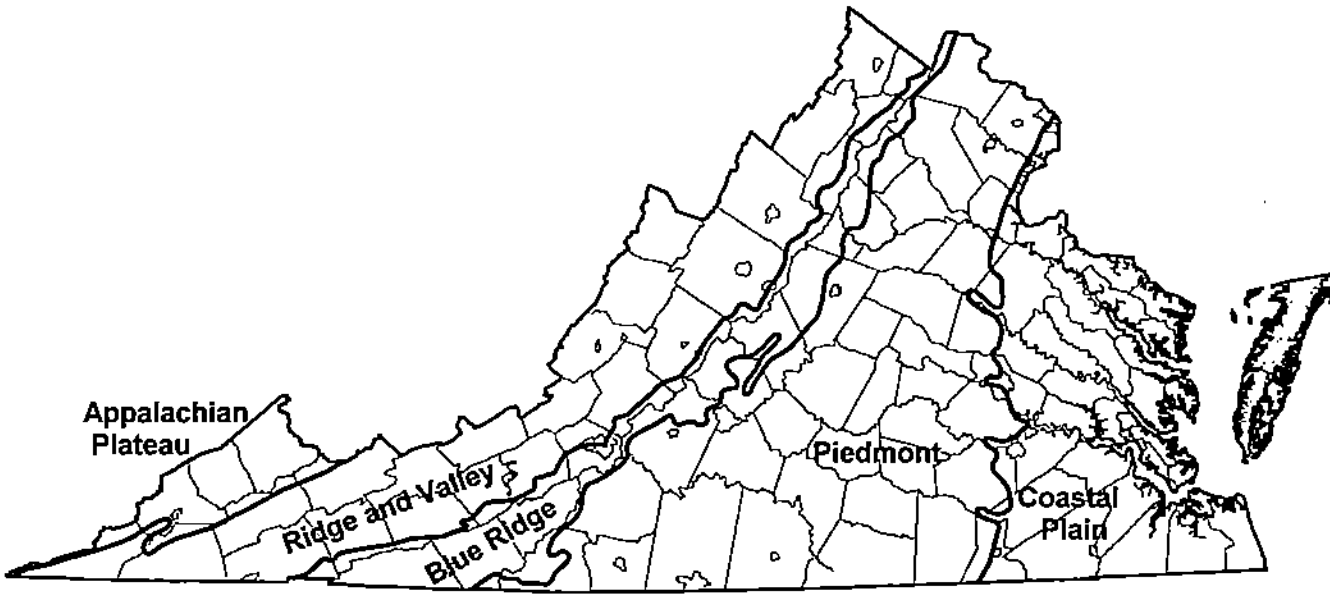


Figure 2: Physiographic Provinces in Virginia.

The Coastal Plain occupies roughly the eastern third of the state and encompasses the lower portion of the Delmarva Peninsula (called the Eastern Shore), the Chesapeake Bay and the lower tidal portions of several major rivers, and regions called Tidewater: the York-James Peninsula, Middle Peninsula, and Northern Neck. This is the youngest of the physiographic provinces and is comprised of sedimentary sands and beds of clay, marls, and gravels. Elevation ranges from Sea Level to about 60 meters (200 feet) (Hoffman, 1969). Structurally, the Coastal Plain is a series of terraces, the eastern margins of which mark ancient shorelines that were present during the Miocene and Pliocene (Frye, 1986). The lower Coastal Plain east of the Suffolk Escarpment derived from glacial advances and retreats during the Pleistocene (Oaks and Coch, 1963, 1973). The last glacial advance, the Wisconsinan, that ended about 10,000 YBP, caused sea level to drop some 122 meters and moved the Atlantic shoreline 80 kilometers east of its present position (Frye, 1986). Sea level rose following glacial melting and created the present-day shoreline and Chesapeake Bay. The major rivers draining into the Bay are influenced by tides that flow upstream as far as Richmond on the James River and Washington, DC on the Potomac River.

The eastern margin of the Piedmont is separated from the Coastal Plain by a narrow transition zone of resistant metamorphic rock to the west and sedimentary rock to the east. Streams and rivers cut through the softer sedimentary rock faster than the harder metamorphic rock and have created in many areas zones of falls and rapids. These zones are dispersal

barriers to some aquatic organisms. The Piedmont itself is a zone of gently rolling, well-drained uplands that is narrow to the north (about 65 km wide in northern Virginia) and wide to the south (about 250 km along the VA-NC line). It is underlain by igneous and metamorphic rocks over which were deposited erosional deposits from the western mountains. During the Mesozoic, the Piedmont was pulled apart by rifting of the continental plates that formed the Atlantic Ocean and faults formed in the surface crust (Woodward and Hoffman, 1991). These faults created long rift valleys that paralleled the mountains. Erosion deposits from the mountains during the Triassic filled these valleys and created extensive swamp-like wetlands, where dinosaur and early mammal fossils are being found today (Weems, 1987; Fraser and Olsen, 1996). Rapid erosion of the Piedmont since that time removed much of the softer surface material and left many small mounds of harder rock. These exist today as monadnocks, such as Willis Mountain in Buckingham County. The eastern Piedmont has less topographic relief than the western portion where steep valleys and xeric ridges create a complex mosaic of physical features that greatly affect local animal distributions.

The Blue Ridge Province is comprised of two sections, a narrow northern section and a wider southern section. The Blue Ridge Mountains resulted from faulting and lifting of the continental basement in the Cretaceous and middle Tertiary. Continental collisions thrust ancient igneous and metamorphic rocks to the surface and formed the mountain chain (Hack, 1982). Thus, the rocks in this region are older than those in the mountains to the west. High gradient streams north of the Roanoke River eroded these mountains quickly so that what remains is a narrow chain of peaks under 8 km wide. South of the Roanoke River stream gradients were lower and the Blue Ridge is largely an elevated, 600 meter plateau up to about 80 km wide. The southwestern margin of this area contains the highest mountains in the state, Mt. Rogers (1,746 meters) and Whitetop (1,682 meters).

The Ridge and Valley Province consists of a Paleozoic sea floor that was uplifted and folded in various ways by plate tectonic forces over 200 million years ago (Hack, 1982). These sedimentary rocks contain marine fossils. Much of the present day topography is the result of weathering. Karst is an important feature of this province; over 2,300 caves have been named so far (Douglas, 1964; Holsinger, 1975). This area has two distinct components, the Great Valley and the Alleghenies. The valley was formed by the action of numerous streams on soft limestone and shales (Hoffman, 1969). There are four recognized segments: the Shenandoah and Roanoke sections that drain to the Atlantic Ocean and the New and Holston sections that drain to the Ohio and Mississippi rivers. Water gaps through the narrow Blue Ridge Mountains connect the valley with the Piedmont. These act as dispersal corridors for some species. Conversely, the New River acts as a barrier to gene flow and dispersal for several amphibians and reptiles, especially salamanders. Most of the mountains to the west of the Great Valley are long ridges that border

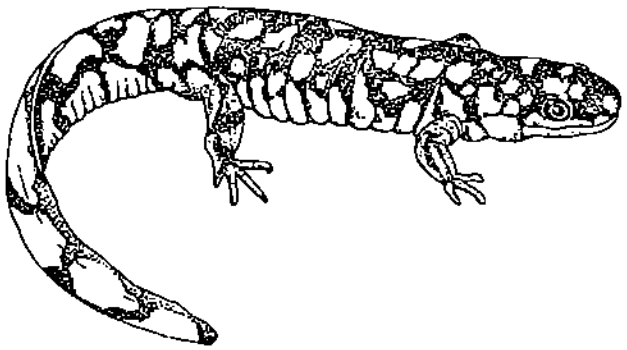
long, narrow valleys. These features affect amphibian and reptile distribution patterns in this province.

The smallest of the five physiographic provinces is the Appalachian Plateau, located in Buchanan and Dickenson counties and portions of Lee and Wise counties. The region has the same geological origin as the Ridge and Valley but it was not folded and compressed. Thus, the topography consists of rolling hills and valleys intricately dissected by streams into a dendritic pattern (Woodward and Hoffman, 1991). This is the location of much of the coal industry in the Commonwealth and is the least explored herpetologically.

Drainages

Surface drainage patterns in Virginia are determined largely by topography related to the physiographic provinces. A total of eleven major watersheds occur in Virginia (Figure 3) and most of these include several physiographic provinces. Each is drained by a series of rivers and streams. Major rivers whose names are commonly known characterize many of these watersheds (Figure 4). About three-fourths of the state is drained by rivers that flow eastward toward the Atlantic Ocean. The Shenandoah River and its tributaries drain the northern third of the Great Valley into the Potomac River. About a quarter of the state, mostly in the southwest, is drained by the Tennessee (Clinch, Holston, Powell rivers), and Big Sandy systems that flow west and southwest and the New River which flows north.

Rivers and their tributaries are important dispersal corridors for amphibians and reptiles. Species originating in the mid-continent dispersed into the Commonwealth via the Big Sandy, New, and Tennessee River drainages. Examples are northern map turtle (*Graptemys geographica)* and eastern spiny softshell (*Apalone spinifera).* Several species with more southern affinities enter the state via rivers that flow to the southeast, such as the Roanoke, Meherrin, Nottoway, and Blackwater rivers. Dwarf waterdog (*Necturus punctatus)* and Coastal Plain cooter (*Pseudemys concinna floridana)* exemplify this pattern. Species with Coastal Plain and Piedmont distributions enter the Ridge and Valley via the upper reaches of the James and Potomac rivers. The northern red-bellied cooter (*Pseudemys rubriventris)* is a prime example.



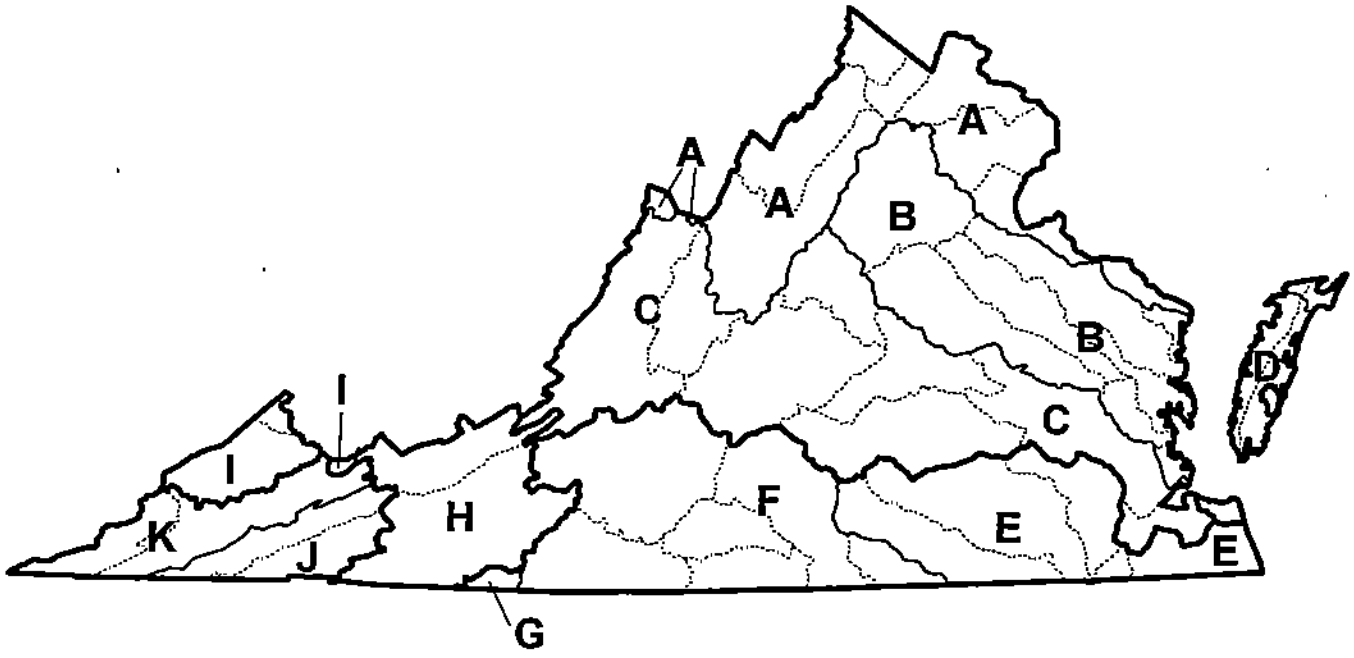


Figure 3. Major drainages in Virginia. A - Potomac, B - Rappahannock, C - James, D – Eastern Shore, E – Chowan, F - Roanoke, G - PeeDee, H - New, I - Big Sandy, J - Holston, and K - Clinch.

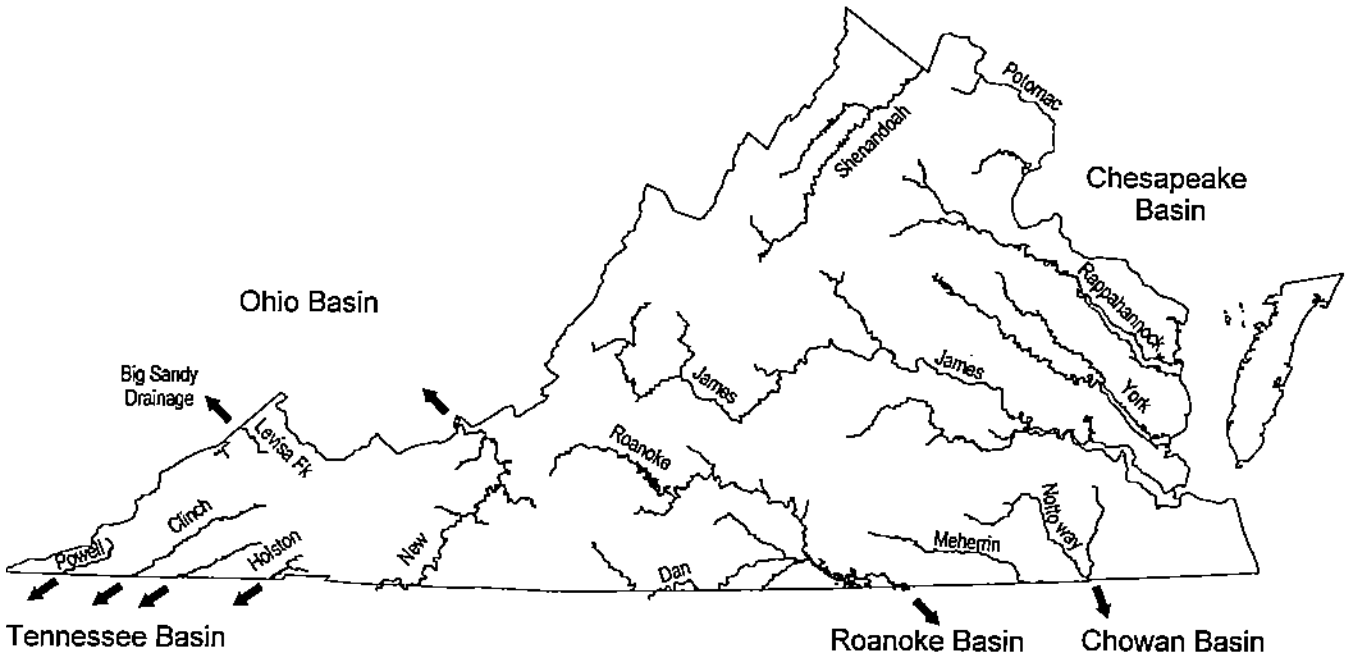


Figure 4. Major river systems in Virginia

Climate

As ectotherms, amphibians and reptiles are affected profoundly by the physical aspects of their environment. In no small way, the climatic features of Virginia influence the distribution patterns illustrated in this book. Climatic patterns in this region can be examined on several scales.

The climate of the Commonwealth is classified as humid subtropical. Geographic areas considered humid receive enough rainfall to support forests, and the term subtropical refers to the state's latitudinal position north of the tropics and the occurrence of warm summers and mild winters (Woodward and Hoffman, 1991). There are four usually distinct seasons: spring, summer, fall, and winter.

Considerable geographic variation occurs across the state in temperature. The southeastern Coastal Plain is characterized by warm winter temperatures and hot summers, whereas high elevation locations in the mountains typically experience cold winters and cool summers. Elevation affects ambient temperature in a straightforward way. For every increase of 1,000 meters, the average temperature decreases 6.4° C. Thus, lengths of growing seasons differ substantially, with mountain regions having about 50 days fewer than those in the southeast. The shortest recorded growing season is in Burkes Garden with 135 days and the longest is in the City of Virginia Beach with 259 days (Crockett, 1972). Temperatures are modified by rivers, lakes, other wetlands, and, especially, the Atlantic Ocean. South-facing slopes are warmer and drier than north-facing slopes, which are cool and wet. Such geographic and local variation in temperature directly affects natural habitats and influences where amphibians and reptiles can live.

Average annual precipitation in Virginia is about 1,150 mm (45.3 inches), but regions differ in total amounts and in distribution of precipitation events throughout the year. The Shenandoah Valley is generally the driest region, with an average of 850 mm (33.5 inches) annual precipitation, and Lee County has the highest averages of over 1,250 mm (49.2 inches) annually (Hayden, 1979). All regions experience droughts at varying frequencies and intensities. Precipitation patterns or lack thereof are controlled largely by continental air mass flow patterns, usually west to east. Frontal systems often bring precipitation in from the west. When the jet stream is north of the state, warm, moist air from the subtropics enters the region from the south and southwest. In summer, heating of the land surface creates convection currents that cause these moist air masses to rise. The result is localized thunderstorms and evening showers. The mountains modify precipitation patterns by intercepting westerly air masses, causing them to rise and release moisture on western slopes. The same phenomenon occurs with air masses coming up from the south; eastern slopes of the Blue Ridge Mountains are wetter than western slopes. Major rivers also influence the direction of moist airflow.

Other precipitation patterns, called northeasters, are low pressure systems with counterclockwise circulation that track up the coast and tropical storms and hurricanes that arrive from the Caribbean and the Deep South. Some of the storms can cause severe erosion, especially in the mountains, and substantial shoreline alteration. These are natural events that modify habitats used by amphibians and reptiles.

Ecoregions

Natural ecosystems are defined in a variety of ways and at different spatial scales, but include vegetation types, plant associations, natural communities, and habitats defined by floristics, structure, age, geography, condition, and other ecologically relevant factors (Noss *et al.*, 1995). Major determinants of a particular ecosystem are geographic location, geology, and climate that together produce characteristic vegetative structure. Recent and increasing interest in the conservation of biodiversity has led to the development of the ecoregion concept for the United States and other parts of the world (e.g., McNab and Avers, 1994; Bailey, 1995; Brown *et al.*, 1998), and its implementation by some governmental agencies into their management policies (e.g., Avers, 1992). Such an approach to viewing the natural features of a region, such as the state of Virginia, puts the distribution patterns of amphibians and reptiles into an ecological context and provides information on how we may approach landscape-level conservation.

Patterns of pre-settlement dominant vegetation of eastern North America were first described by Braun (1950), who visited most of the remaining tracts of virgin forest in the 1930s and 1940s. She described four forested regions for Virginia: mixed mesophytic, oak-chestnut, oak-pine, and southeastern evergreen. Mixed-mesophytic forest dominates the moist, well-drained soils in Buchanan, Dickenson, and Wise counties, all of which lie within the Appalachian Plateau physiographic region. The oak-chestnut forest formerly occupied the Ridge and Valley and Blue Ridge physiographic regions and extended well into the Piedmont in some areas. The chestnut blight introduced into North America in the early 1900s eliminated nearly all of the American chestnut trees (*Castanea dentata*) and resulted in a variety of oaks dominating the forest. Braun (1950) called this the oak-hickory forest but Monk *et al.* (1990) found that there was no evidence for a regional oak-hickory forest, instead recommending that a better designation would be oak or mixed oak forest. The oak-pine forest is a transitional habitat between the mixed oak forest and the southeastern evergreen forest. It occurs in the southern Piedmont and upper Coastal Plain and consists of various mixtures of pine (largely loblolly) and several species of hardwoods. The southeastern evergreen forest occurs in the Coastal Plain from about the eastern portion of the Middle Peninsula southward. Regions north of the James River were dominated by loblolly pine (*Pinus taeda*) but in a large area south of the river longleaf pine (*Pinus palustris*) was the dominant tree (Braun, 1950). This tree represented a unique ecosystem whose northernmost limits were in southeastern Virginia. It is now one of the most critically endangered ecosystems in

the United States (Noss *et al.*, 1995). Within these major forest types are imbedded maritime forests along the coast, grasslands and mountain balds, and a wide variety of ravine and wetland habitats. Most of these habitats and all the major forest types are illustrated and more completely described in Mitchell (1994a).

With the presettlement ecosystem patterns as background, one ecoregion scheme that allows herpetofaunal distribution patterns to be examined at a finer scale can now be described. The approach used here, following Keys *et al.* (1995), combines Braun's (1950) forest types with topographic features into 16 defined ecoregions (Figure 5). The mixed mesophytic: low mountains ecoregion corresponds well to Braun's mixed mesophytic forest. Likewise, the original oak-chestnut forest of Braun corresponds with the Appalachian oak forest used here with six topographic distinctions. The southeastern mixed forest incorporates the oak-pine and southeastern evergreen forests used by Braun. The geographic location and extent of these 16 ecoregions demonstrates that the region west of the Piedmont is the most complex. The Piedmont and the upper Coastal Plain are characterized by a mix of forest types on an irregular topography. The lower Coastal Plain is a generally flat region with little topographic relief dominated by pine trees. The southeastern mixed forest: irregular plains, slight relief ecoregion corresponds roughly to the location of the former longleaf pine ecosystem in Virginia, although the line should incorporate most of Isle of Wight County, the lower portion of Southampton County, and the western portion of the City of Suffolk.

A review of the distribution patterns of Virginia's amphibians and reptiles on the following maps from the ecoregion perspective reveals that few species fall neatly into any of these named regions. Many species occur in several ecoregions and some occur in all of them. Ecoregions allow for descriptions of the nature of Virginia but provide only coarse insights into the determinants of the distribution patterns exhibited by each species. Such determinants are likely to include ancient patterns of dispersal, historical interactions with other species, the range of physiological tolerance limits encoded in a species' gene pool, and the availability of appropriate microhabitats. Thus, historical factors and environmental features operating at scales finer than the ecoregion concept allows are the likely determinants of modern species distribution patterns.

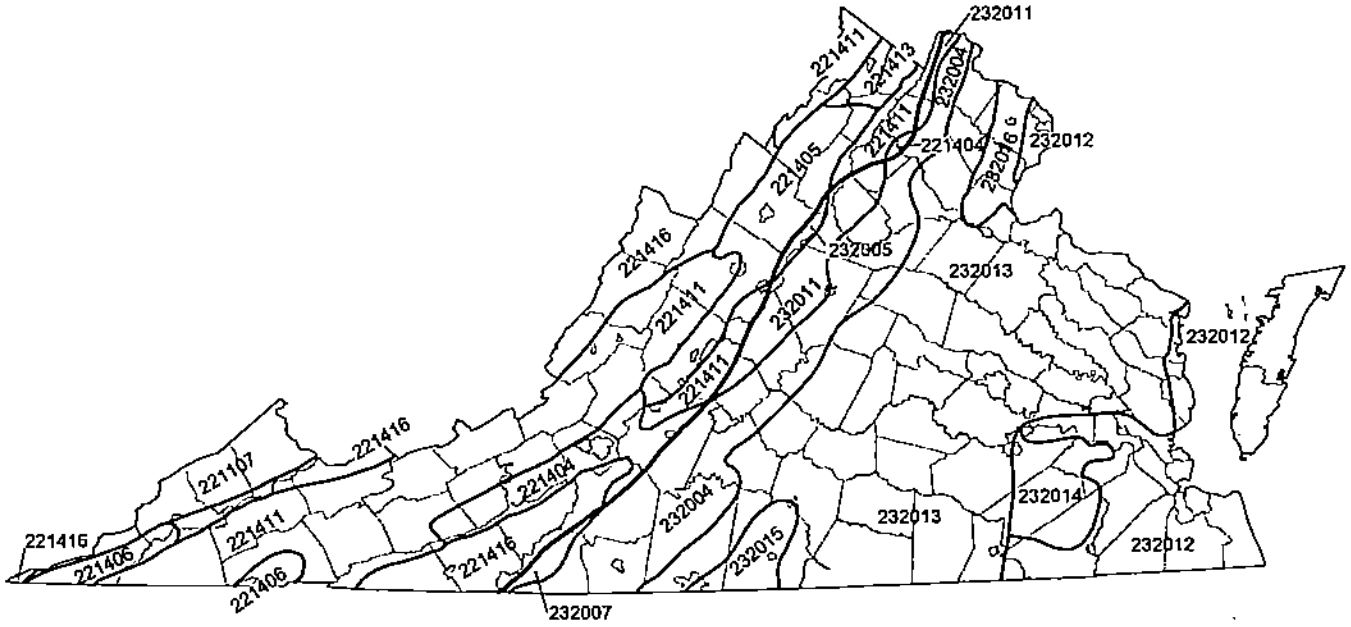


Figure 5. Ecoregions in Virginia. Area designations and terminology follow Keys *et al.* (1995).

221107 Mixed mesophytic Forest: Low Mountains

221404 Appalachian Oak Forest: Plains with High Hills

221405 Appalachian Oak Forest: Plains with Low Mountains

221406 Appalachian Oak Forest: Open Hills

221411 Appalachian Oak Forest: Open Low Mountains

221413 Appalachian Oak Forest: Irregular Plains

221416 Appalachian Oak Forest: Low Mountains

232004 Southeastern Mixed Forest: Plains with High Hills

232005 Southeastern Mixed Forest: Plains with Low Mountains

232007 Southeastern Mixed Forest: Open Hills

232011 Southeastern Mixed Forest: Open Low Mountains

232012 Southeastern Mixed Forest: Irregular Plains

232013 Southeastern Mixed Forest: Low Mountains

232014 Southeastern Mixed Forest: Irregular Plains, slight relief

232015 Southeastern Mixed Forest: Open Hills

232016 Southeastern Mixed Forest: Plains with Hills

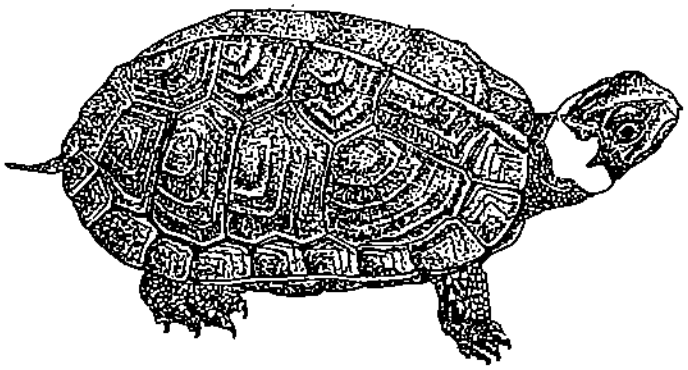
MATERIALS AND METHODS

The information on which this atlas is based was derived from two primary sources. Most of the localities illustrated on the maps are supported by a voucher specimen in a museum collection. Most of these were examined by Joseph Mitchell to verify their identification, as museums do not guarantee that the correct name is recorded in the collection information. A list of museum and university collections housing specimens collected in Virginia is appended below. The second source of locality information is the scientific collection permit reports submitted annually to the Virginia Department of Game and Inland Fisheries (DGIF). These records were accepted if they occurred within the range of a species defined by museum records. Outlying permit records were included only if they were backed up with a specimen that had been donated to a museum and verified. Unvouchered literature records are not included in this atlas. Thus, the distribution records depicted on each range map illustrate records that can be verified in two ways, by voucher museum specimens or report documentation. All locality coordinates are maintained by DGIF.

Museums and universities housing preserved collections of amphibians and reptiles obtained from Virginia locations are as follows: American Museum of Natural History, Academy of Natural Sciences of Philadelphia, Appalachian State University, Arizona State University, Bridgewater College, California Academy of Sciences, Carnegie Museum of Natural History, Cleveland Museum of Natural History, College of William and Mary (now in Carnegie Museum of Natural History and the Smithsonian), Cornell University, Duke University (now in North Carolina State Museum of Natural Sciences), Emory and Henry College, East Tennessee State University, Field Museum of Natural History, George Mason University, Illinois Natural History Survey, Museum of Natural History-University of Kansas, Los Angeles County Museum of Natural History, Lynchburg College, Lord Fairfax Community College, Museum of Comparative Zoology-Harvard University, Museum of Southwestern Biology-University of New Mexico, Museum of Vertebrate Zoology-University of California, North Carolina State Museum of Natural Sciences, Natural History Society of Maryland, National Museum of Natural Sciences-National Museums of Canada, New Mexico State University, New York State Museum, Northern Virginia Community College, Roanoke College, Randolph-Macon College, Savannah Science Museum (now at Georgia State University), Shenandoah National Park, Texas Cooperative Wildlife Collection-Texas A&M University, Florida State Museum-University of Florida, Museum of Natural History-University of Illinois, Museum of Zoology-University of Michigan, United States Biological Survey (now in the Smithsonian), National Museum of Natural History-Smithsonian Institution, University of Tennessee Vertebrate Museum, University of Richmond (now in Carnegie Museum of Natural History), University of Utah, Virginia Commonwealth University, Virginia Institute of Marine

Science (now in Carnegie Museum of Natural History), Virginia Museum of Natural History, and Virginia Polytechnic Institute & State University (now in American Museum of Natural History).

The shaded insert maps showing the range of the species or appropriate subspecies in the United States were based on Conant and Collins (1991). The insert maps for the gray treefrog (*Hyla versicolor*) and Cope's gray treefrog (*Hyla chrysoscelis*) were drawn from information in Ralin (1977), Placek *et al.* (1994), and this study. Localities illustrated on the species distribution maps are represented by solid circles or triangles (museum voucher records) and shaded circles (collection permit records). Subspecies are represented, where appropriate, by triangles. Maps for sea turtles include all solid circles that represent museum records, available stranding records, and observations based on Mitchell (1994a). For those species listed as state endangered and threatened, one solid circle per county is used to represent a less specific distributional location.



ERRONEOUS AND INTRODUCED SPECIES

The literature on Virginia herpetology contains references to several species that were reported to occur in the state but have been shown subsequently to be erroneous. Mitchell (1994a) described the literature for the following reptiles that have been incorrectly noted as a part of the state's herpetofauna: southern hog-nosed snake (*Heterodon simus*), eastern harlequin coralsnake (*Micrurus fulvius*), eastern diamond-backed rattlesnake (*Crotalus adamanteus*), pygmy rattlesnake (*Sistrurus miliarius*), and American alligator (*Alligator mississippiensis*). The green anole (*Anolis carolinensis*) was once thought to occur in the Dismal Swamp area but there are no verified records. The closest locality is in northeastern North Carolina (Palmer and Braswell, 1995). Burger (1958) listed several species of amphibians that were expected at the time to occur in the state have yet to be found. These include small-mouthed salamander (*Ambystoma texanum*), dwarf salamander (*Eurycea quadridigitata*), Cheat Mountain salamander (*Plethodon nettingi*), and pine barrens treefrog (*Hyla andersonii*). Of these, the dwarf salamander occurs closest to the North Carolina - Virginia state line (Conant and Collins, 1998).

Unlike the state of Florida into which numerous species have been introduced (Wilson and Porras, 1983), Virginia has few established populations of non-native amphibians and reptiles. Mitchell (1994a) listed seven species that have been found here but have not become established, including two turtles, one lizard, two snakes, and two crocodilians. One of the turtles, Mississippi map turtle (*Graptemys pseudogeographica kohni*), may now be established in the Hampton Roads area (JCM, pers. obs.). Populations of two species of turtles have become established in parts of the state, Gulf Coast spiny softshell (*Apalone spinifera aspera*) in Norfolk and the red-eared slider (*Trachemys scripta elegans*) in many ponds and lakes (Mitchell and Southwick, 1993; Mitchell, 1994a; Ernst *et al.*, 1994). A population of the African clawed frog (*Xenopus laevis*) was thought to have survived for several years in a nature center pond in northern Virginia in the 1980s but its status was never verified (C.H. Ernst, pers. comm.). Individuals of non-native species are occasionally imported into Virginia on horticultural plants from Florida. These include the brown anole (*Anolis sagrei*) (Mitchell, 1982) and the Cuban treefrog (*Osteopilus septentrionalis*) (Mitchell, 1999). Populations of some of the exotic species with broad tolerance limits may become established in the future due to the public's habit of releasing unwanted reptile and amphibian pets. Most will not survive in the state's climate, however, and such releases are illegal.

SCIENTIFIC NAMES, COMMON NAMES, AND SUBSPECIES

Scientific names of amphibian and reptile species reflect the scientific community's current understanding of the evolutionary relationships of these animals. These names are not static; they change as the understanding of relationships change and they change with concepts of what a species is. Techniques used over the past couple of decades that examine the structure of segments of DNA within genes have provided new insights into evolutionary relationships and resulted in the recognition of several new species (e.g., Highton and Worthington, 1966; Highton, 1972, 1984; Highton and MacGregor, 1983; Tilley and Mahoney, 1996) and elevation of subspecies to full species level (e.g., Seidel, 1994; Carlin, 1997). Use of molecular techniques and some of the results they provided has caused something of a revolution in the field of systematics and in evaluations of what constitutes a species (Avise, 1994). The result for users of species names, like ecologists and managers, is that many of the names learned from one source are likely to change one or more times during a lifetime. Such users should constantly read the herpetological literature to keep up to date or rely on the periodic publication of updated checklists that incorporate new changes.

Scientific names of species consist of two parts, a generic name followed by a species name. Examples are *Ambystoma maculatum* (spotted salamander), *Crotalus horridus* (timber rattlesnake), and *Terrapene carolina* (eastern box turtle). Scientific names are either underlined or italicized. Names are sometimes followed by the name of the person or persons (authority or authorities) who originally described the species and sometimes as well by the year of the publication. Using the same examples: *Ambystoma maculatum* (Shaw 1802), *Crotalus horridus* Linnaeus 1758, and *Terrapene carolina* (Linnaeus 1758). The lack of parentheses around the authority indicates that the generic name is the same one used today, whereas the use of parentheses indicates that the original genus name is a different one than that used today. Authorities and dates are not always used in zoology, especially for vertebrates whose names are in some cases more stable than those for invertebrates. The true unit of evolution that has a genetic history and, hopefully, a genetic future is the species (Mayr, 1963). All other names used in taxonomy represent human concepts or other categories of relationships. The species is the only natural unit, although some subspecies (see below) may be in the process of evolving to full species.

Scientists sometime use a third name attached to a species' scientific name to represent the concept of geographic and population variation in external phenotypes; humans use the term "race". This is the subspecies name: for example *Terrapene carolina carolina* (Linnaeus) (eastern box turtle) and *Virginia valeriae pulchra* (Richmond) (mountain earth snake). The authority in the

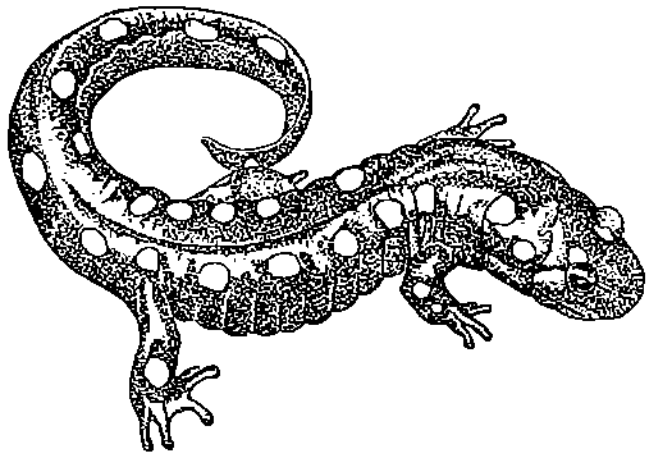
former case is the person who first described the full species. His name is retained for this race because it is the original race from which the specimens described in the original publication were taken. This is the nominant subspecies. The authority in the second case is the person who described that particular subspecies. The inclusion of a subspecies name in the Virginia list of amphibians and reptiles indicates that that subspecies occurs in the state. Other subspecies occur elsewhere in the range of the species.

The subspecies concept is often misunderstood, especially by lay persons. Some books written for the lay public describe subspecies with separate accounts for each one (e.g., Palmer and Braswell, 1995; Conant and Collins, 1998). Unfortunately, this is mistaken by some people to mean that named subspecies hold the same rank as species. Subspecies names are used to recognize races of a species in some portion of its geographic range whose populations exhibit different colors or patterns from the other populations elsewhere in the species' range (Mayr, 1963). These differences are a population phenomenon with a geographic component. Subspecies names are used by scientists to draw attention to the fact that some populations of the same species have differed slightly over time in response to local environmental factors or due to historical events. This population and geographic variation reflects the fact that subspecies have a slightly different portion of the species' gene pool.

For some species, two currently recognized subspecies occur in Virginia. In some cases, they occur in different parts of the state and do not come in contact (e.g., the kingsnakes, *Lampropeltis getula getula* and *L. g. nigra*), whereas in others, the two subspecies come in contact (e.g., ringneck snakes, *Diadophis punctatus punctatus* and *D. p. edwardsii*). In the first case, the ranges of these two subspecies are contiguous elsewhere in the species' range. In the latter case, the full species occurs statewide. In the geographic zone of contact (see the distribution map for reference), ringneck snake populations carry a mix of the genes for each subspecies. North and west of this zone, populations exhibit characteristics of the northern subspecies and south of this zone they have the phenotypes of the southern subspecies. Within the contact zone, populations carry a mixture of the genes for all of the phenotypic traits. Individuals may show any combination of these traits. One individual from the same population and perhaps even from the same parent may exhibit the northern phenotype, another the southern phenotype, and yet another may have one northern character (e.g., no spots on venter) and one southern character (e.g., broken neck collar). The characters obtained by an individual from its parents in the contact zone is simply determined by chance. Matings are possible among all members of the population and thus the genotype of an individual is based entirely on what his parents pass on. The species' gene pool in this geographic region has a higher diversity of genes than populations outside of this contact zone. This area is correctly called the zone of integration and the individuals showing a mix of characters are called intergrades. All of the individuals are

members of the same species and should be treated as such, not as individuals of some separate entity. The application of the subspecies concept breaks down here. In the case of two subspecies occupying different parts of the state, even though individuals from each area may exhibit separate subspecies phenotypes, they can mate and produce viable offspring if they should come in contact. This is, of course, because they belong to the same species. Despite the differing appearance of recognized subspecies, individuals of that species are functionally similar and occupy much the same niche throughout its range. Treating subspecies as different management units even though they are allopatric is a misapplication of the subspecies concept and shows a misunderstanding of species evolutionary biology. Only until they have been determined to be evolving separately should they be treated differently.

Common names (or artificial vernacular names) of amphibians and reptiles have been as dynamic as their scientific names. There are also regional differences in the names used for the same species, and there are numerous colloquial names provided by lay persons (see Wright and Wright, 1949, 1957 and Mitchell, 1994a for examples). Over the past four decades, lists of standardized common names have been proposed several times (e.g., Conant *et al.*, 1956; Collins *et al.*, 1978, 1982; Banks *et al.*, 1987; and Collins, 1990, 1997). Controversy over some of the names and the types of endings used has led to inconsistency in the application of common names in many publications. Most recently, the Society for the Study of Amphibians and Reptiles has produced a new standardized list of common names for North American amphibians and reptiles (Crother, in press) that is based on general consensus of committee members and others from the scientific community. This list is being followed in this atlas because it is the one most likely to be used consistently for at least the next several years.



CONSERVATION

The Virginia General Assembly gave the Department of Game and Inland Fisheries (DGIF) the legal authority to regulate and protect the Commonwealth's amphibians and reptiles. It does so through a variety of laws and regulations that manage numbers of individuals taken from wild populations for personal, educational, commercial, and scientific purposes. Some species receive full protection under the state's Endangered Species Act and others some limited protection through permit restrictions. The federal Endangered Species Act (ESA) lists several species that occur in Virginia as endangered or threatened, and DGIF recognizes these by cooperative agreement with the U.S. Fish and Wildlife Service (Endangered Species Act *16 U.S.C.§ 1531-1544*).

Species listed as Endangered under the Federal ESA are the sea turtles Atlantic green (*Chelonia mydas)*, leatherback (*Dermochelys coriacea)*, Atlantic hawksbill (*Eretmochelys imbricata)*, Kemp's Ridley (*Lepidochelys kempii)*, and the terrestrial salamander Shenandoah salamander (*Plethodon shenandoah)*. The loggerhead (*Caretta caretta)* is listed as Threatened. The bog turtle (*Clemmys muhlenbergii*) is listed as threatened by similarity of appearance, a designation that affords protection from take but does not provide habitat preservation. At the state level, the following species are listed as endangered: tiger salamander (*Ambystoma tigrinum tigrinum)*, bog turtle (*Clemmys muhlenbergii)*, canebrake rattlesnake (*Crotalus horridus atricaudatus)*, eastern chicken turtle (*Deirochelys reticularia)*, Shendandoah salamander (*Plethodon shenandoah)*, and the sea turtles listed above. Threatened species are Mabee's salamander (*Ambystoma mabeei)*, loggerhead (*Caretta caretta)*, wood turtle (*Clemmys insculpta)*, barking treefrog (*Hyla gratiosa)*, and eastern glass lizard (*Ophisaurus ventralis)*. In addition to listings under Endangered Species Acts, the U.S. Forest Service maintains a list of sensitive species that includes several Virginia amphibians and reptiles. These include northern coal skink (*Eumeces anthracinus)*, smooth greensnake (*Liochlorophis vernalis)*, northern pinesnake (*Pituophis melanoleucus)*, Peaks of Otter salamander (*Plethodon hubrichti)*, Cow Knob salamander (*Plethodon punctatus)*, and mountain earthsnake (*Virginia valeriae pulchra)*. Collection of any protected amphibian or reptile is prohibited unless the collector possesses an endangered species permit from DGIF. All others may be collected for educational and scientific purposes within specified limits with a DGIF permit available to qualified persons. Current regulations also allow for the possession of limited numbers of some species for personal use; however, it is best to check with DGIF regarding regulations that restrict collection and possession.

In contrast to the protection afforded some species for conservation purposes, other species may be harvested or sold commercially. Snapping turtles may be harvested for personal

or commercial use and bullfrogs may be caught for person consumption, all within limits. Virginia regulation prohibits the sale of any species of salamander with exception of non-native newts (Salamandridae) (Virginia regulation section *4 VAC 15-360-60*). The following species may be captive bred and sold under permit and within certain size restrictions: green treefrog (*Hyla cinerea)*, American bullfrog (*Rana catesbeiana)*, southern green frog (*Rana clamitans)*, southern leopard frog (*Rana sphenocephala)*, eastern snapping turtle (*Chelydra serpentina)*, cornsnake (*Elaphe guttata)*, mole kingsnake (*Lampropeltis calligaster)*, and common kingsnake (*Lampropeltis getula)*. The propagation and sale of captive albino amphibians and reptiles is not prohibited.

By regulation, several non-native exotic species have been declared "predatory or undesirable," in that their introduction into the state would be detrimental to the native wildlife resources (Virginia regulation section 4 VAC 15-30-40.A). These species include the giant or marine toad (*Bufo marinus*), tongueless or African clawed frog (*Xenopus* spp.), barred tiger salamander (*Ambystoma tigrinum mavortium*), gray tiger salamander (*A.t. diaboli*), blotched tiger salamander (*A.t. melanostictum*), all species in the family Alligatoridae, brown tree snake (*Boiga irregularis*), all species in the family Crocodylidae, and all species in the family Gavialidae. Permits are required from DGIF for possession, importation, or sale of these species. All other non-native exotic species may be possessed and sold, subject to all applicable laws, provided that they are not liberated within Virginia (Virginia regulation section 4 VAC 15-30-40.G). An overview of laws, regulations, and listings for Virginia and other states is found in Levell, (1997).

Regulations and laws and the species listed under them may change periodically after review and input from a variety of sources. Anyone interested in Virginia's amphibians and reptiles should check regularly with DGIF to determine if any of the regulations or species listings have changed. Regulations and laws pertaining to Virginia's amphibians and reptiles can be found on the Internet (www.dgif.state.va.us).

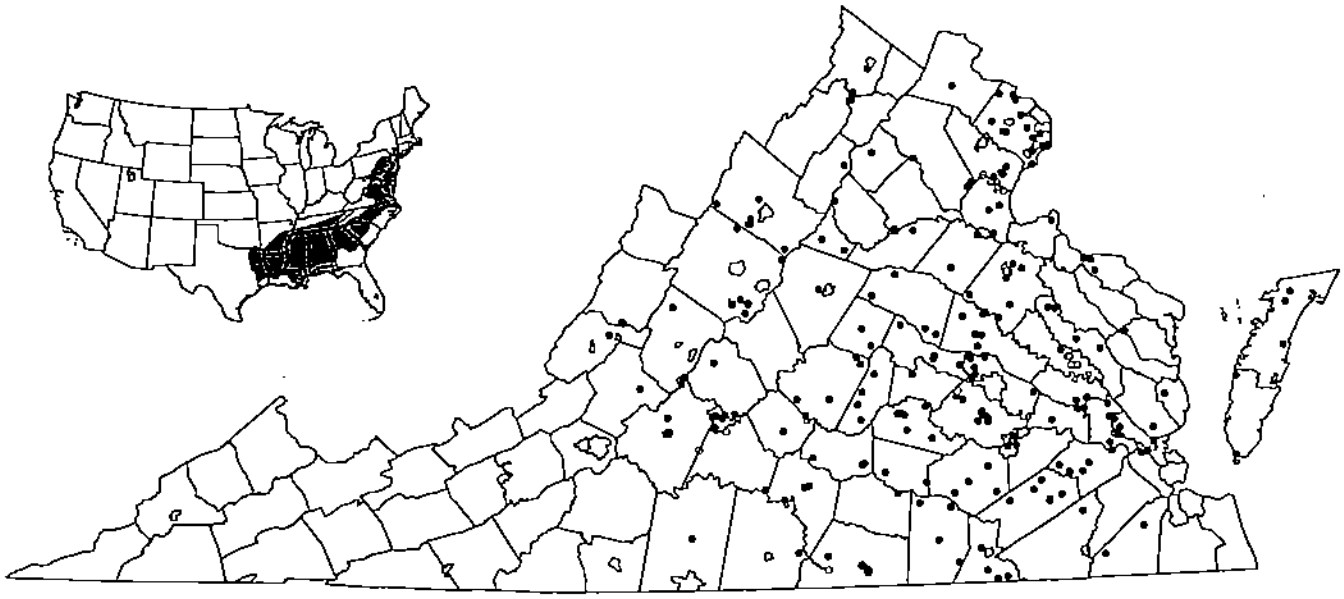
DISTRIBUTION MAPS

AND

SPECIES NOTES

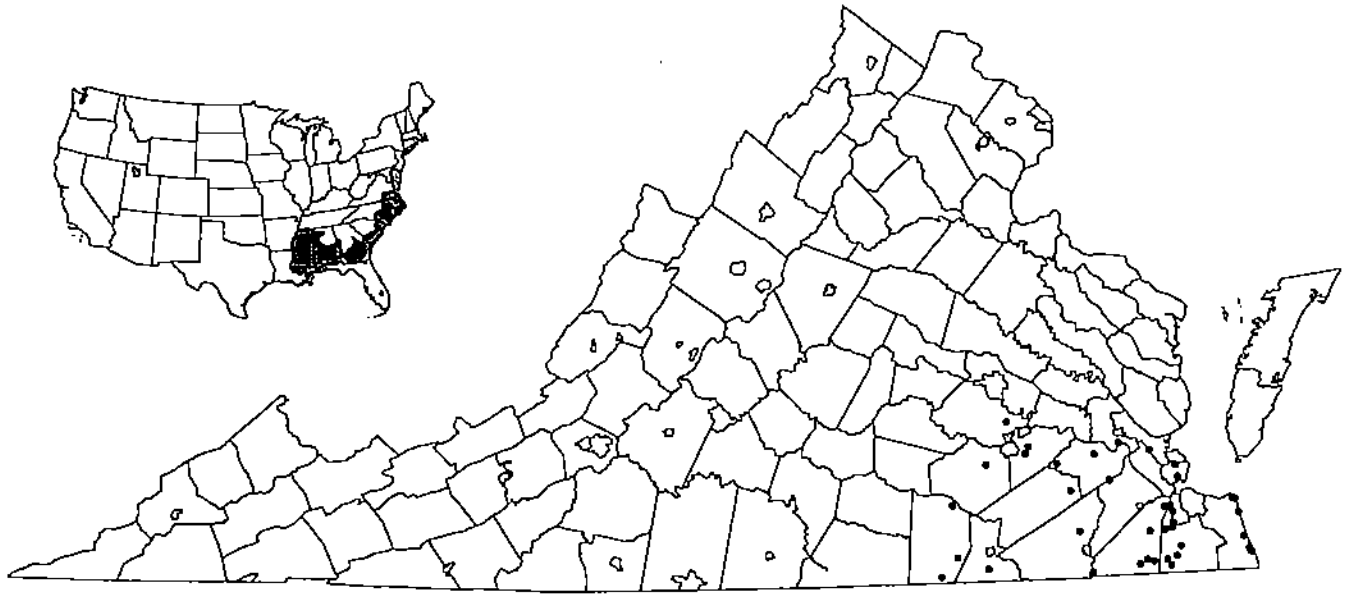
AMPHIBIANS

FROGS AND TOADS



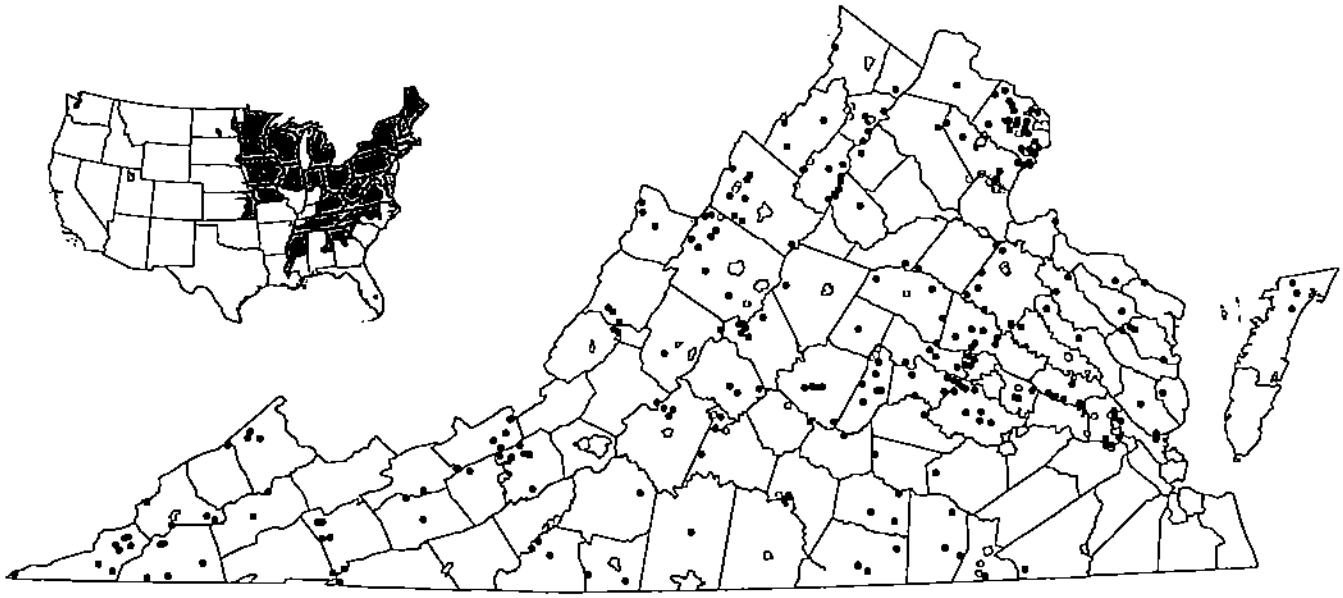
***Acris crepitans crepitans* Baird - Eastern Cricket Frog**

This is the common, colorful frog found along margins of ponds and lakes in much of the state east of Roanoke. It is replaced by *Acris gryllus* in far southeastern Virginia. Distributional limits in southwestern Virginia need to be better defined.



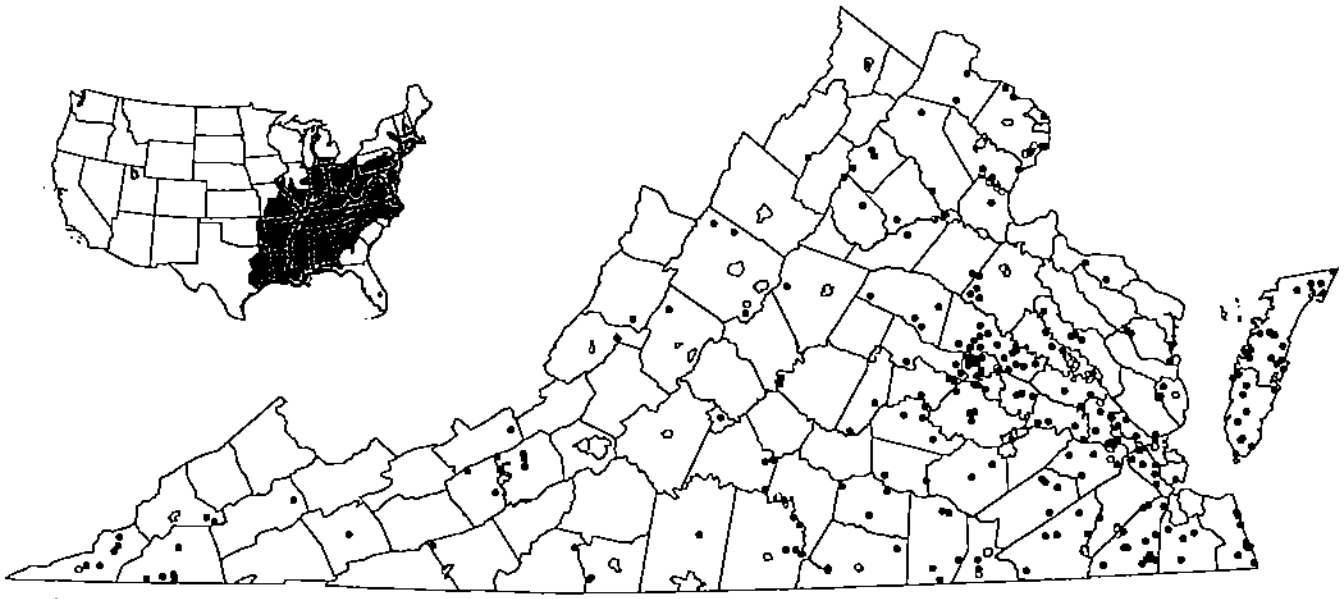
***Acris gryllus gryllus* (LeConte) - Coastal Plain Cricket Frog**

This small, slender frog occurs only in southeastern Virginia and can be difficult to distinguish from *Acris crepitans*. It is the only cricket frog in and east of the Dismal Swamp (Mitchell *et al.*, 1999). The western and northern limits of its range need to be more precisely defined.



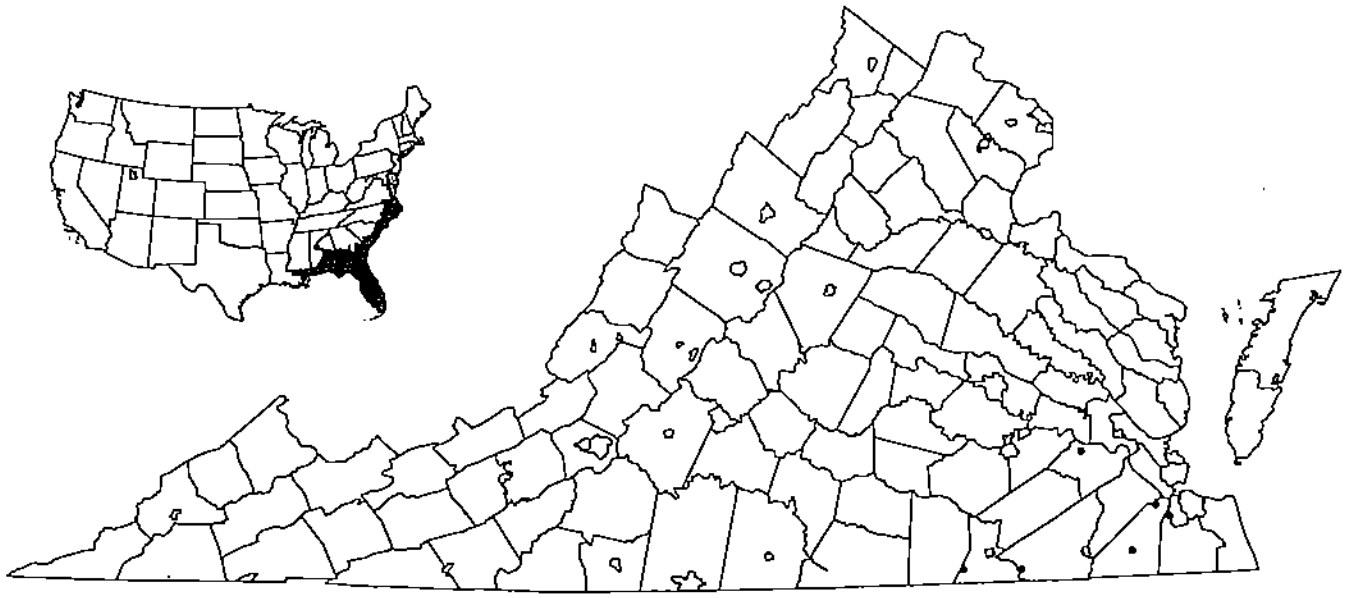
***Bufo americanus americanus* Holbrook - Eastern American Toad**

American toads are widespread in eastern North America. They occur throughout most of Virginia except for the southeastern portion of the state where they are replaced by *Bufo terrestris*. Eastern Shore counties and the Prince George-Southampton-Surry-Sussex county area need further exploration for this species.



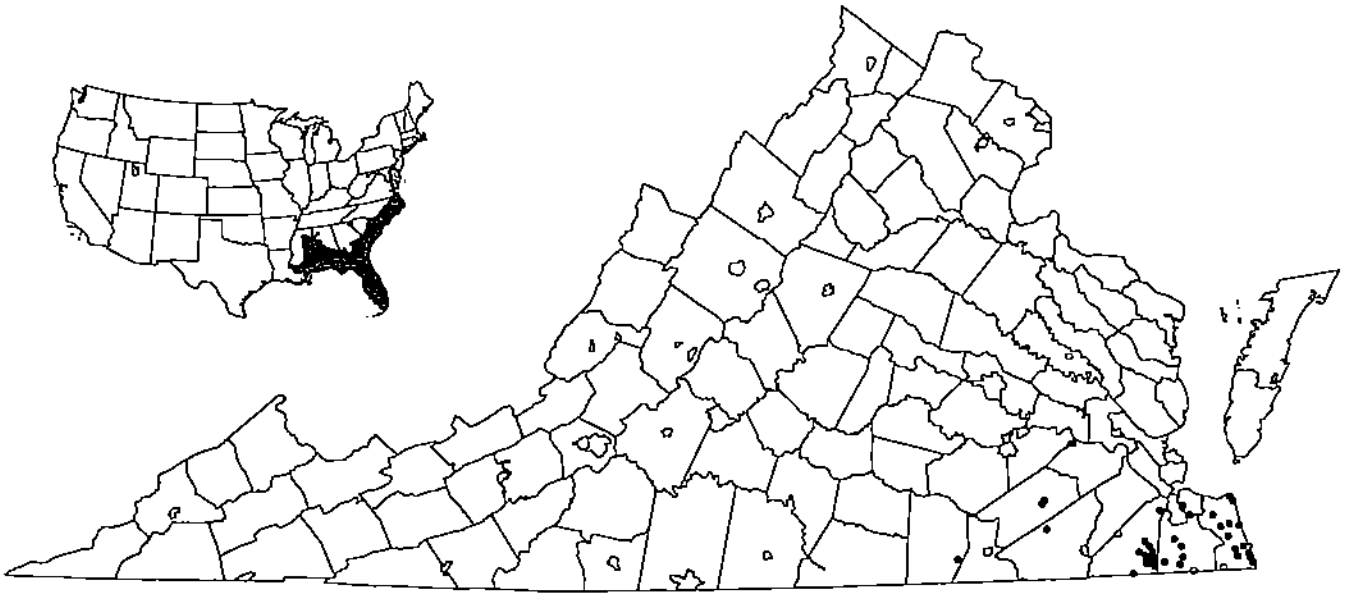
***Bufo fowleri* Hinckley - Fowler's Toad**

Fowler's toads occur statewide but are particularly common in the Coastal Plain. This species appears to be associated closely with sandy soils, which in turn may limit their distribution in physiographic regions outside the Coastal Plain. Fowler's toads are long recognized as a subspecies of *Bufo woodhousii*, however, Sullivan *et al.* (1996) recently provided convincing evidence that Fowler's toad should be a full species.



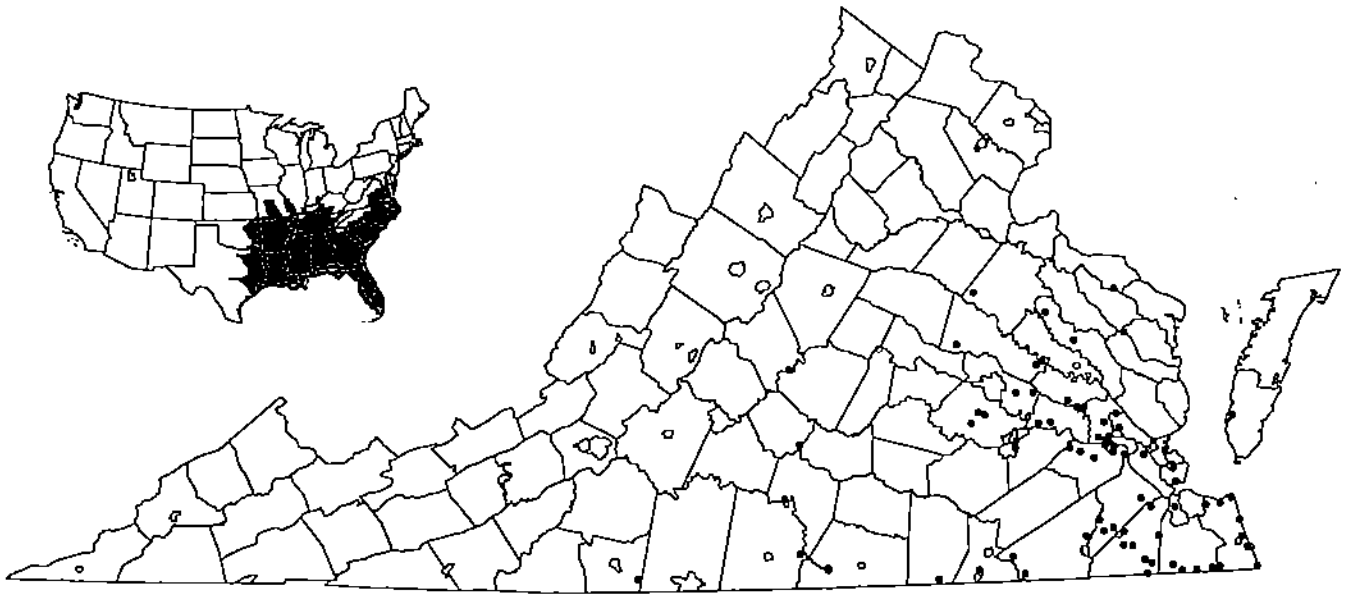
***Bufo quercicus* Holbrook - Oak Toad**

The few verified records of this small toad in the northernmost limits of its range in Virginia are all in the southeastern corner between the Fall Line and the Dismal Swamp south of the James River. Oak toad distribution may have been closely associated with the longleaf pine (*Pinus palustris*) ecosystem, only remnants of which remain in Virginia (Dodd, 1995; Noss *et al.*, 1995). It is a special concern species (Virginia regulation section *4 VAC 15-20-130*).



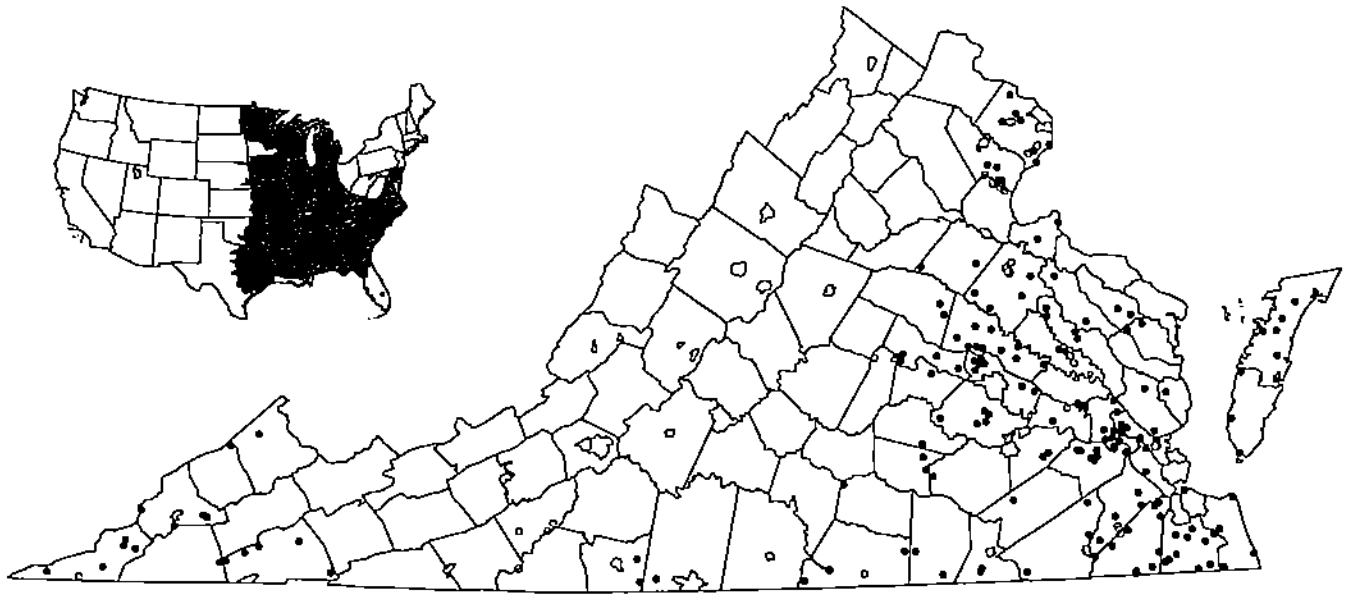
***Bufo terrestris* (Bonnaterre) - Southern Toad**

This is the common toad of southeastern Virginia. Its range overlaps completely with that of *Bufo fowleri* and marginally with *B. americanus*. The northernmost site is based on calls that were distinctly different from sympatric American toads (Mitchell, pers. obs.). The distributional relationship and patterns of hybridization between southern and American toads needs to be explored (Blem, 1979).



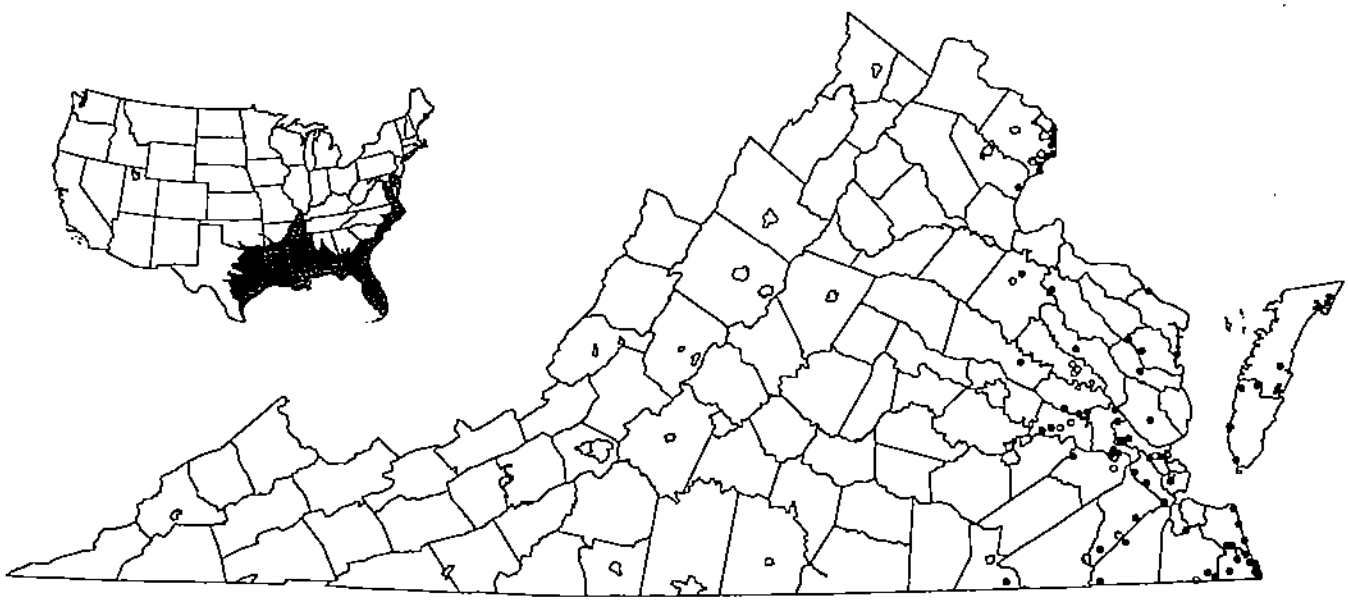
***Gastrophryne carolinensis* (Holbrook) - Eastern Narrow-mouthed Toad**

These fully terrestrial frogs occur in the Coastal Plain and scattered locations in the Piedmont. Only one location is vouchered for the Tennessee River drainage in far southwestern Virginia (Roble and Hobson, 1995). Distributions on the Eastern Shore and in southern portions of the Piedmont and Coastal Plain remain to be fully described.



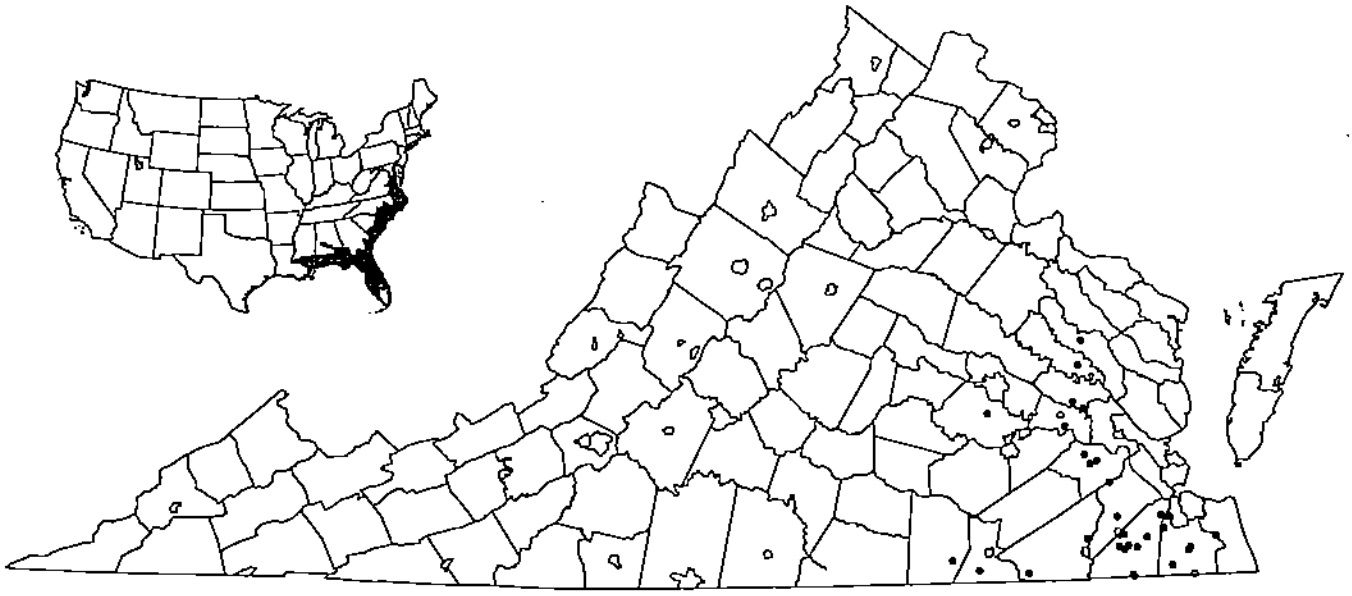
***Hyla chrysoscelis* Cope - Cope's Gray Treefrog**

This summer treefrog is identical morphologically to *H. versicolor* and can be distinguished by the number of chromosomes (2 sets of 24) and the higher frequency, irritating trill (Wasserman, 1970; Conant and Collins, 1998). Localities above the Blue Ridge Escarpment in Floyd County have only been discovered recently despite intensive searching in that area for several decades (Hoffman, 1996).



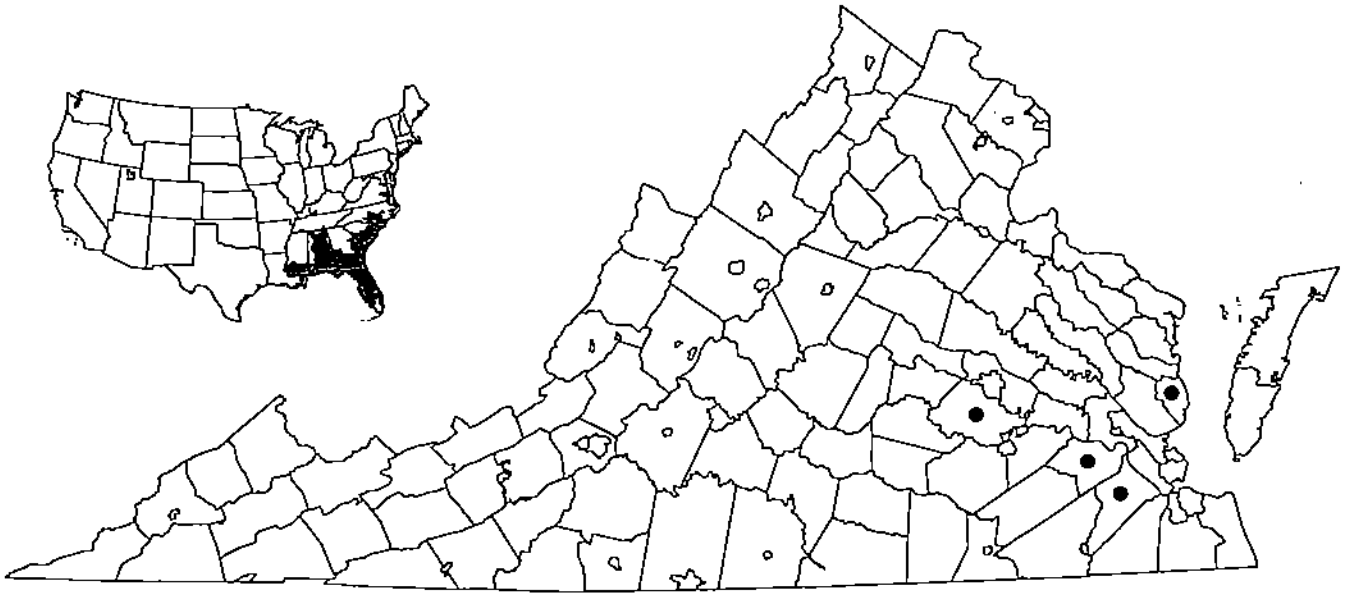
***Hyla cinerea* (Schneider) - Green Treefrog**

This bright green summer frog occurs in freshwater wetlands and brackish marshes in Virginia's Coastal Plain. It is especially common in some coastal areas, such as southeastern Virginia and the Eastern Shore. The western limits of its distribution in Virginia need to be clarified.



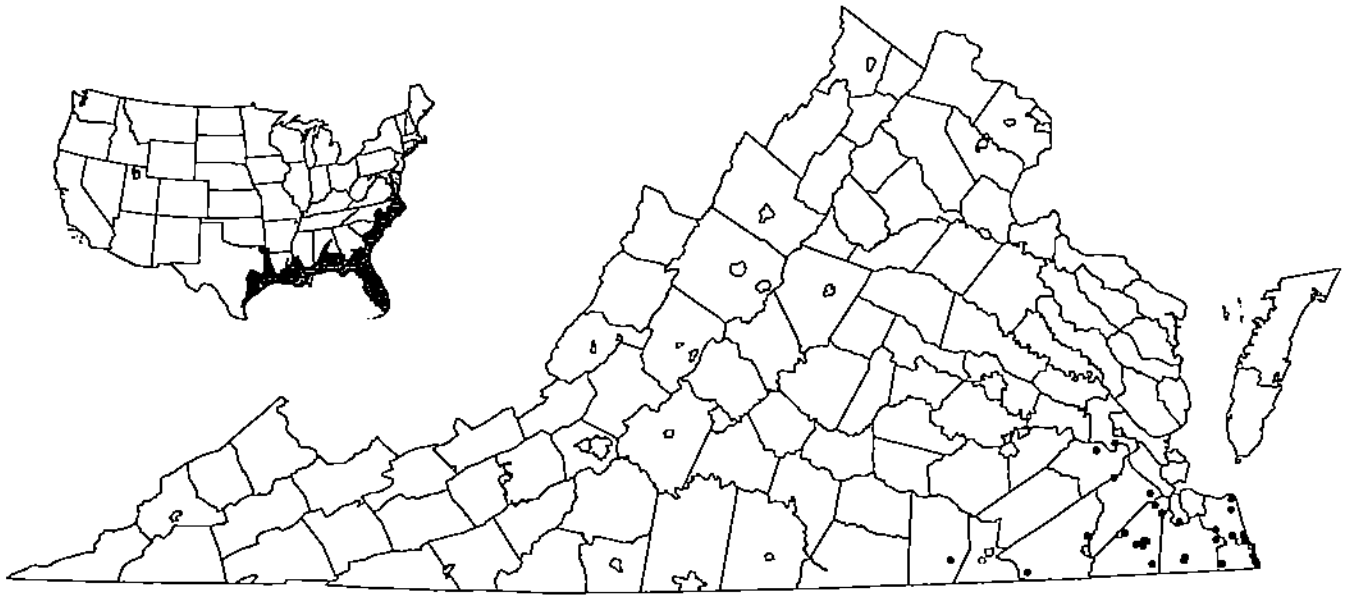
***Hyla femoralis* Bosc - Pine Woods Treefrog**

The species is also known as the "Morse Code" frog because its call is like a series of dots and dashes. It is a summer breeder that occurs in Coastal Plain habitats. Its distributional limits have not been well defined at the northern and western margins of its range in the Commonwealth.



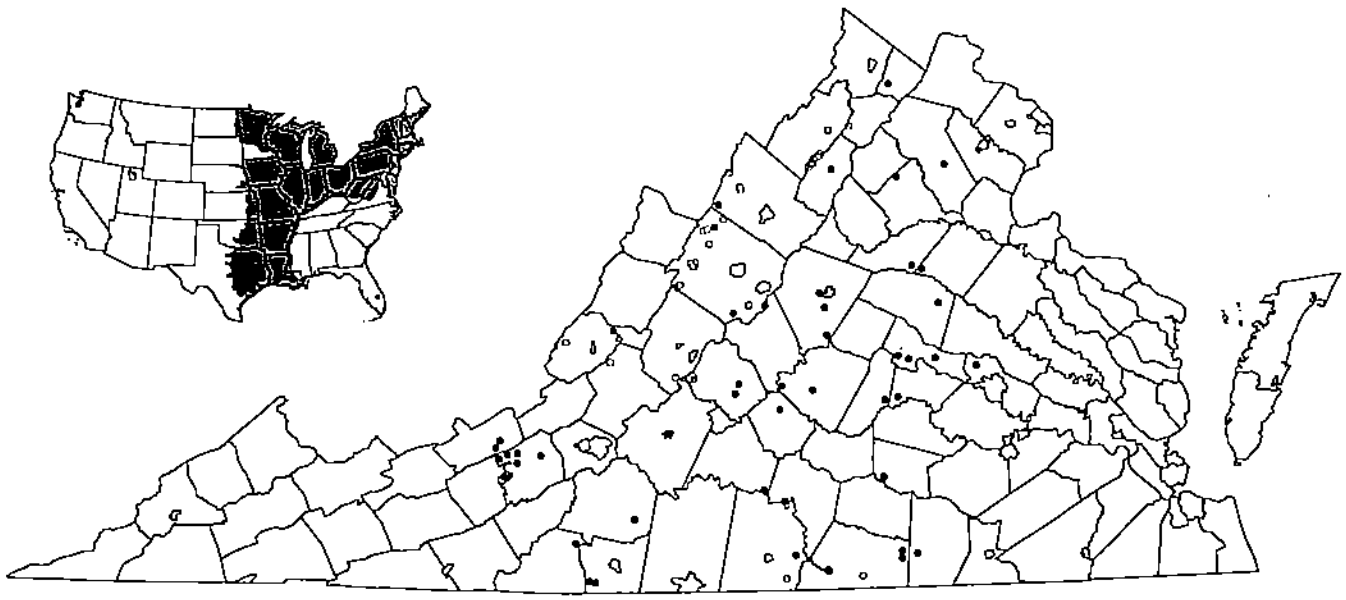
***Hyla gratiosa* LeConte - Barking Treefrog**

This is a threatened species in the state because of its limited distribution in the Coastal Plain and attractiveness in the pet trade (Virginia regulation section *4 VAC 15-20-130*). Additional distributional work is needed in Virginia to more precisely define its range.



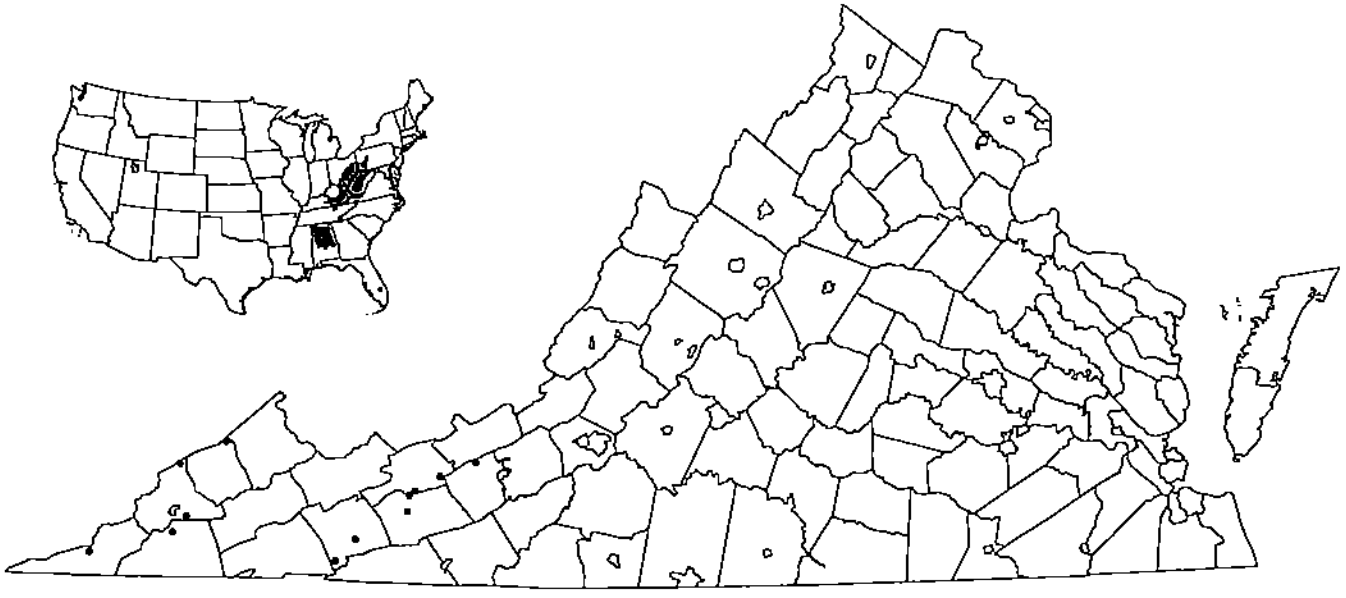
***Hyla squirella* Bosc - Squirrel Treefrog**

Squirrel treefrogs are small, color change artists that reach their northern distributional limits in southeastern Virginia. They occur in coastal habitats, along inland streams, and around temporary wetlands. The northern and western distribution limits of this species in Virginia need more precise definition.



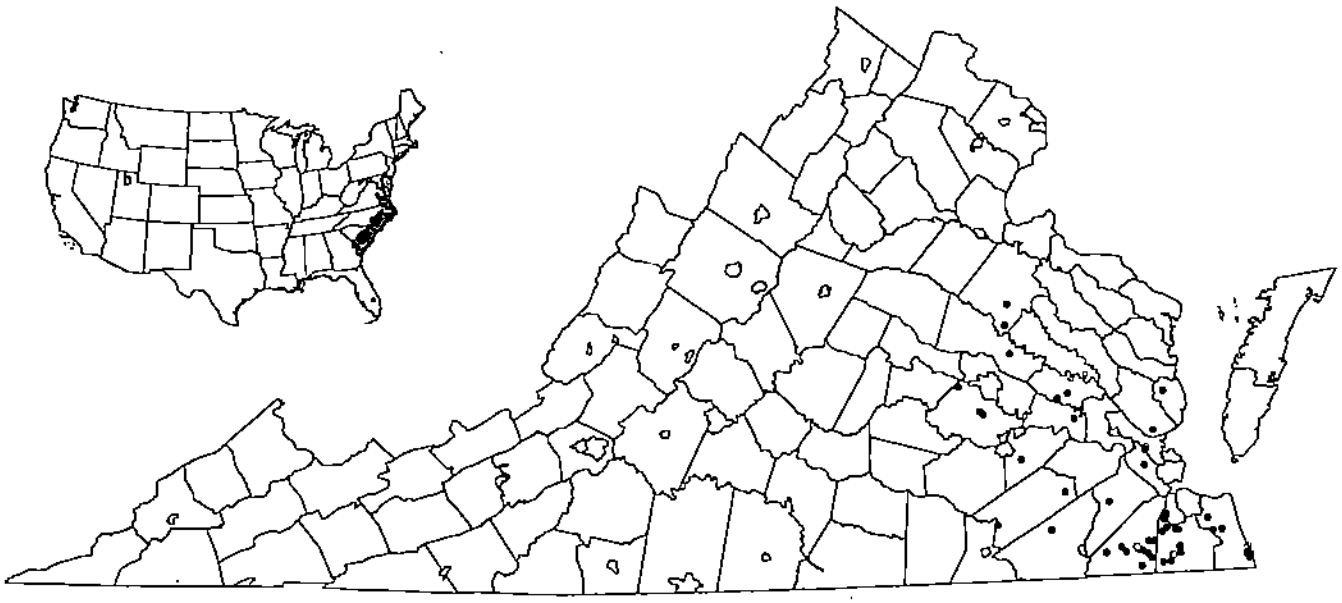
***Hyla versicolor* LeConte - Gray Treefrog**

This treefrog occurs in the Virginia mountains north of the New River watershed, the Blue Ridge, and the Piedmont. It cannot be distinguished from *H. chrysoscelis* except by the number of chromosomes (4 sets of 24) and its call - a low frequency, melodious trill (Wasserman, 1970; Conant and Collins, 1998). These two species are largely allopatric but occur together in some Piedmont locations.



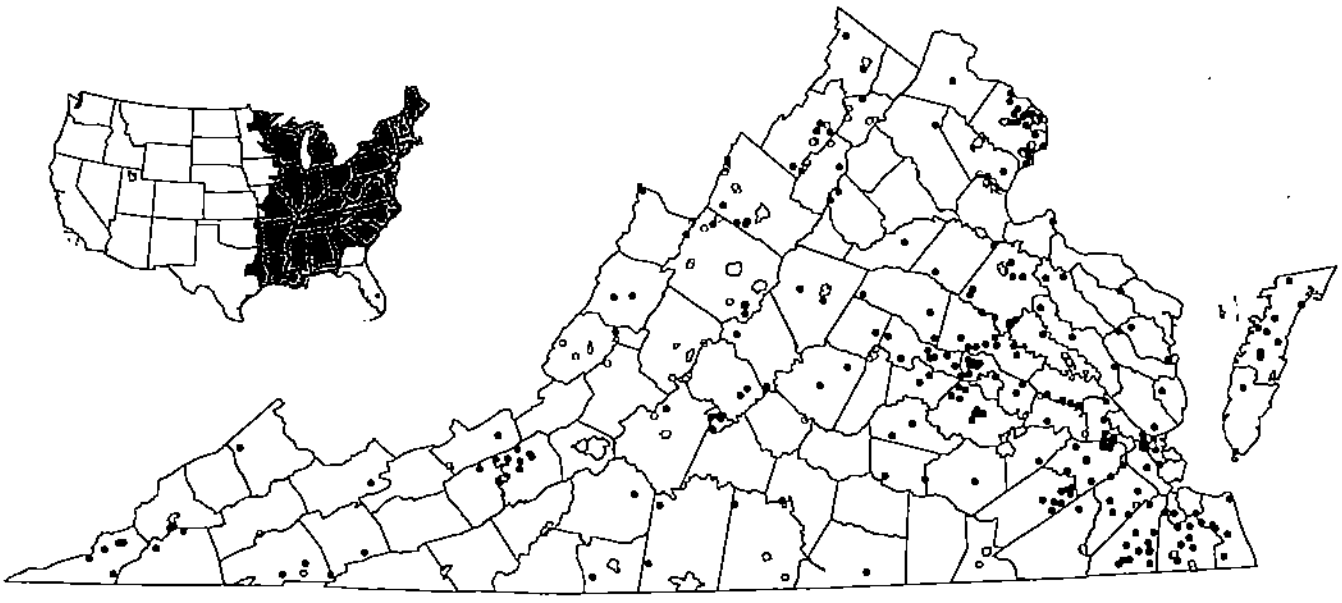
***Pseudacris brachyphona* (Cope) - Mountain Chorus Frog**

This chorus frog replaces the upland chorus frog in southwestern Virginia (Hoffman, 1980). It may be in decline because several places where they once occurred apparently no longer support populations (R.L. Hoffman, pers. comm.). Distribution surveys and monitoring programs would greatly improve knowledge of this species.



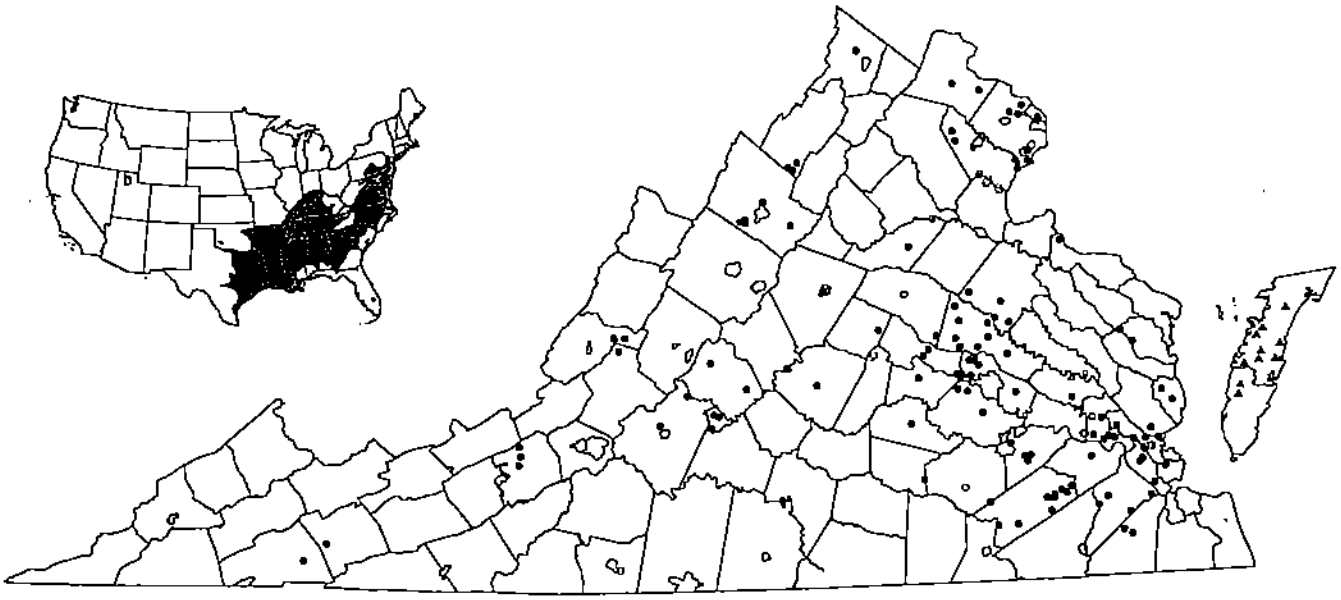
***Pseudacris brimleyi* Brandt and Walker - Brimley's Chorus Frog**

This small terrestrial frog is largely limited to the Coastal Plain of Virginia south of the Northern Neck. It is the only chorus frog in and east of the Dismal Swamp (Mitchell *et al.*, 1999a). Distributional patterns north and west of the illustrated range are imprecise and need refinement.



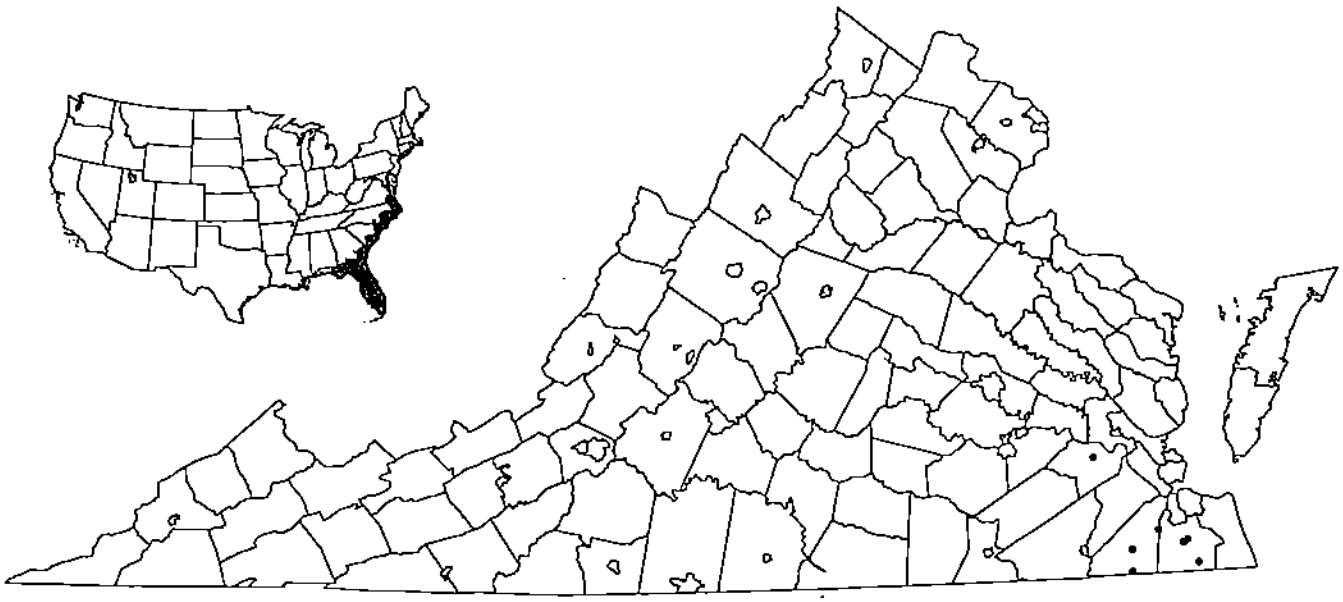
***Pseudacris crucifer crucifer* (Wied-Neuwied) - Northern Spring Peeper**

This frog is well known to anyone who ventures outside in rural areas in late winter and early spring throughout Virginia. It probably occurs in every county in the Commonwealth despite the lack of records for some counties. It is not known to occur on the barrier islands (Conant *et al.*, 1990).



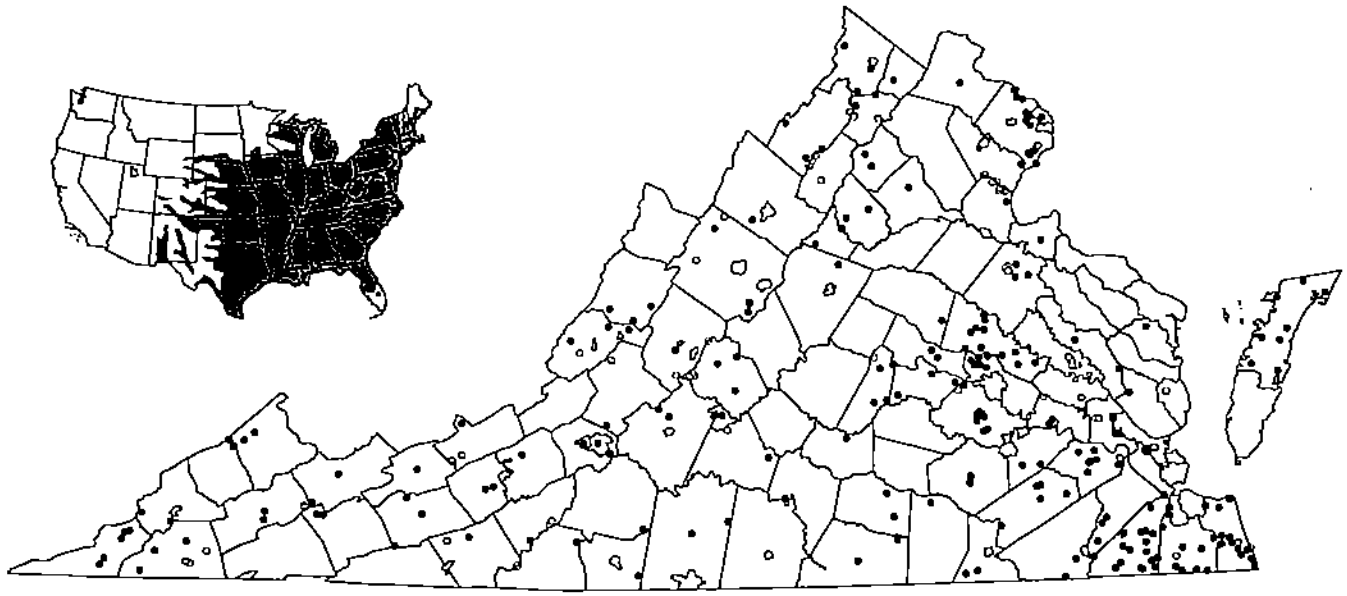
***Pseudacris feriarum* (Baird)- Southeastern Chorus Frog**

The upland chorus frog (*P. feriarum feriarum*) (•) occurs primarily in the Coastal Plain and Piedmont of the state with widely scattered populations in the mountains. It is does not occur in or east of the Dismal Swamp or in far southwestern Virginia. Populations on the Eastern Shore are referable to the New Jersey chorus frog (*P. feriarum kalmi* Harper) (▲), which Platz and Forester (1988) suggested should be considered a full species.



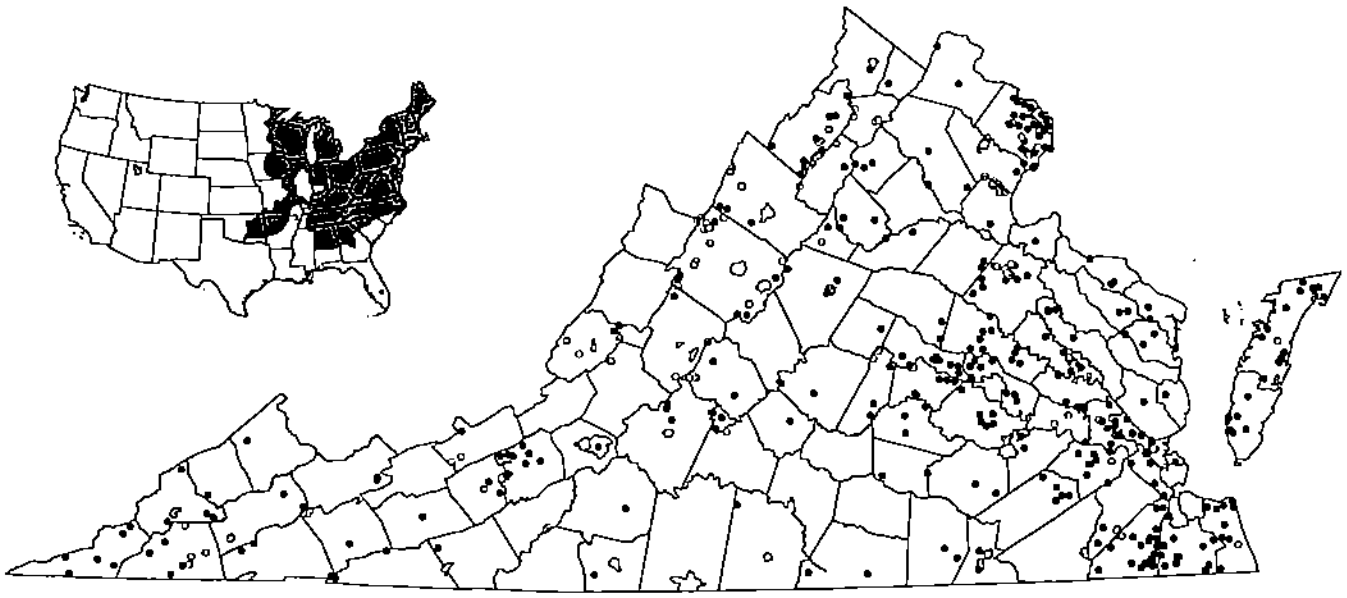
***Pseudacris ocularis* (Bosc and Daudin)- Little Grass Frog**

This is the smallest frog in North America (maximum body length 17 mm, Conant and Collins, 1998). It has been recorded from only a few localities in southeastern Virginia. Almost nothing is known about its life history and ecology at the northernmost edge of its range. The western limits of its distribution in Virginia need clarification.



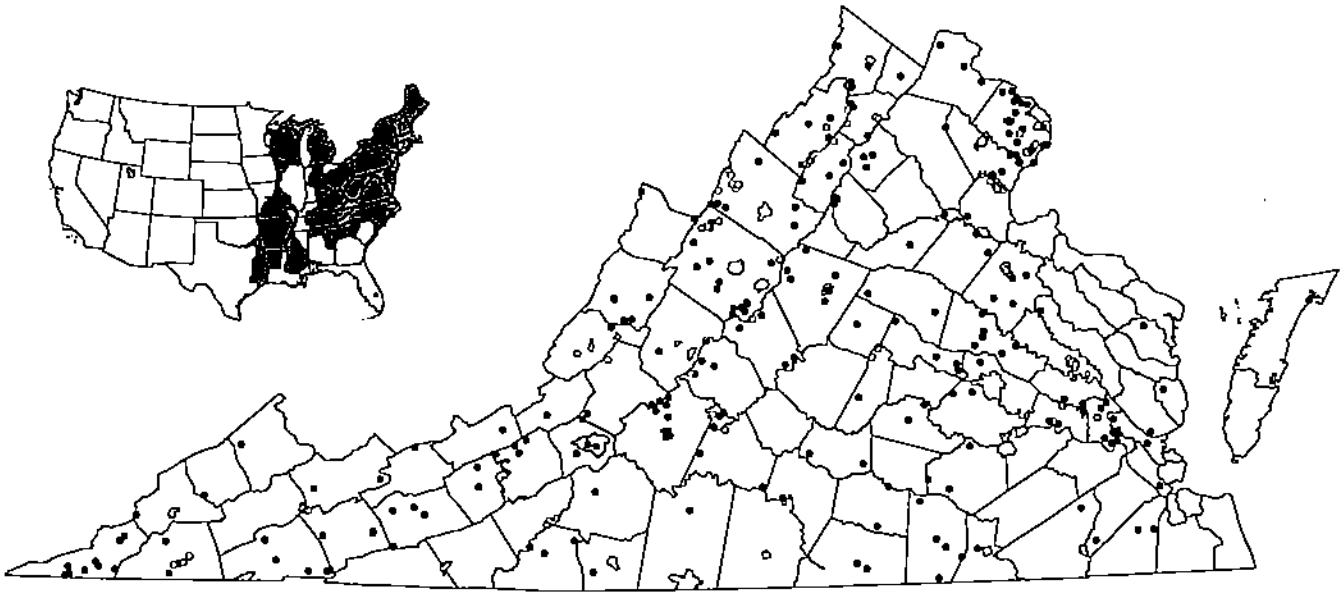
***Rana catesbeiana* Shaw - American Bullfrog**

Despite the fact that the largest frog in North America appears to occur statewide, there are a number of counties for which voucher specimens have not been collected. Bullfrogs are known from only one of the barrier islands where they are introduced (Conant *et al.*, 1990; Mitchell and Anderson, 1994).



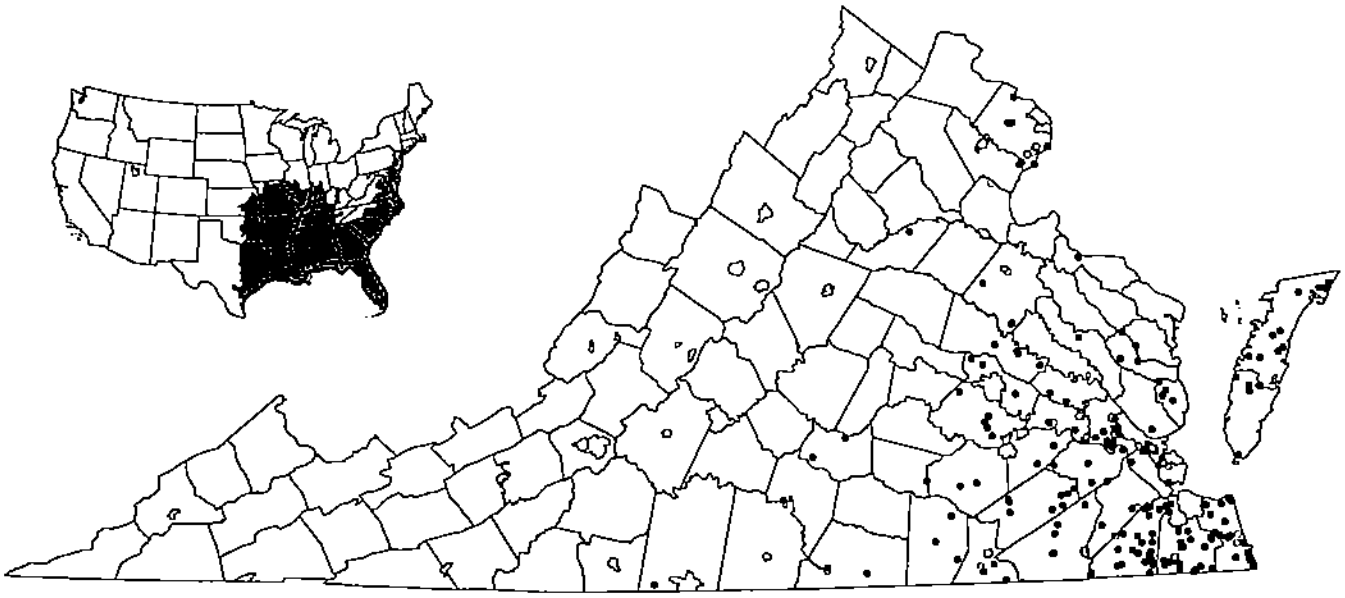
***Rana clamitans melanota* Rafinesque - Southern Green Frog**

Green frogs are widespread in Virginia in habitats from sea level to high elevations in the mountains. Despite its extensive distribution, several counties lack voucher specimens. This species occurs on only one barrier island (Conant *et al.*, 1990; Mitchell and Anderson, 1994).



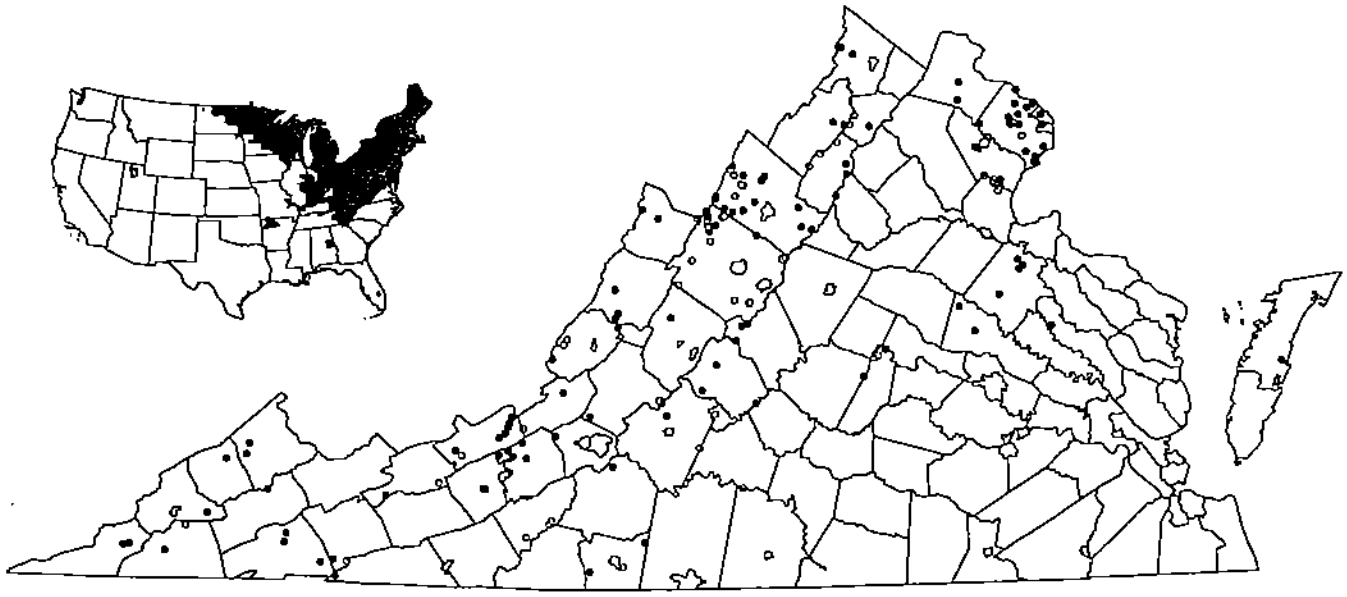
***Rana palustris* LeConte - Pickerel Frog**

Pickerel frogs occur throughout the state except for the extreme southeastern corner east of the Dismal Swamp (Mitchell *et al.*, 1999a). There is only one vouchered record for the Eastern Shore on Wallops Island (Conant *et al.*, 1990). Its distribution in the three counties in the southern Blue Ridge Mountains needs clarification.



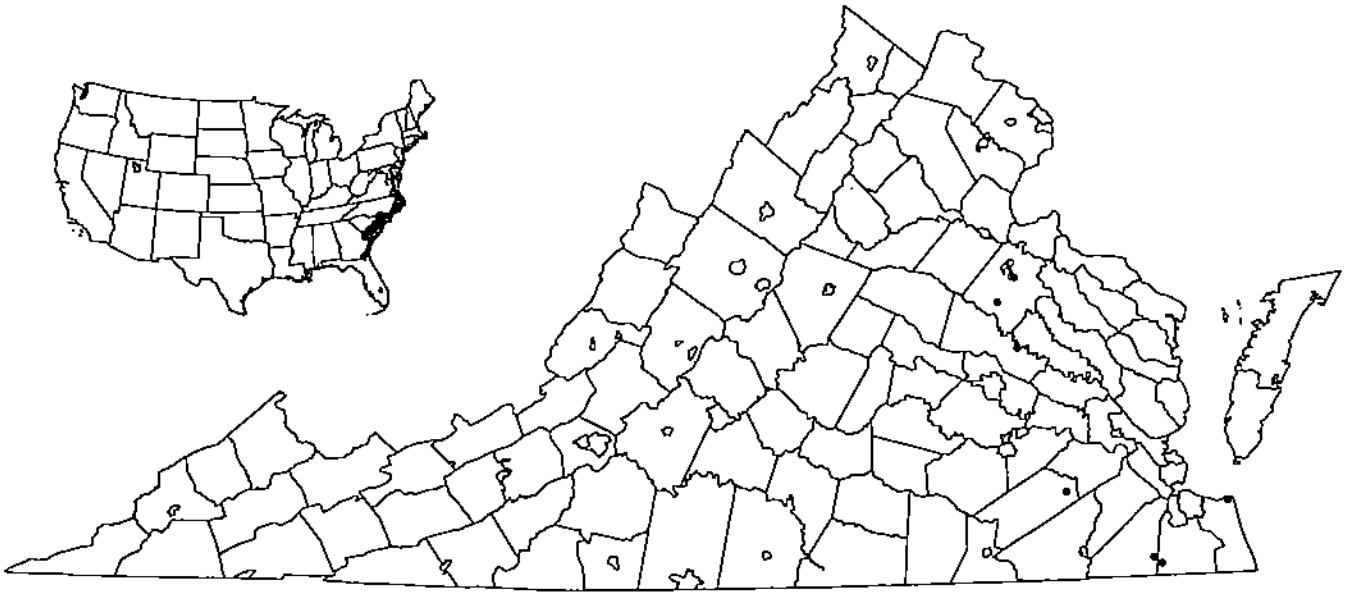
***Rana sphenocephala* Cope - Southern Leopard Frog**

This is an abundant frog in some places in the Coastal Plain and Eastern Shore but is uncommon in the Piedmont. The western margin of the range in Virginia needs to be more precisely defined. Its subspecific status is uncertain and in need of revision (Crother, in press).



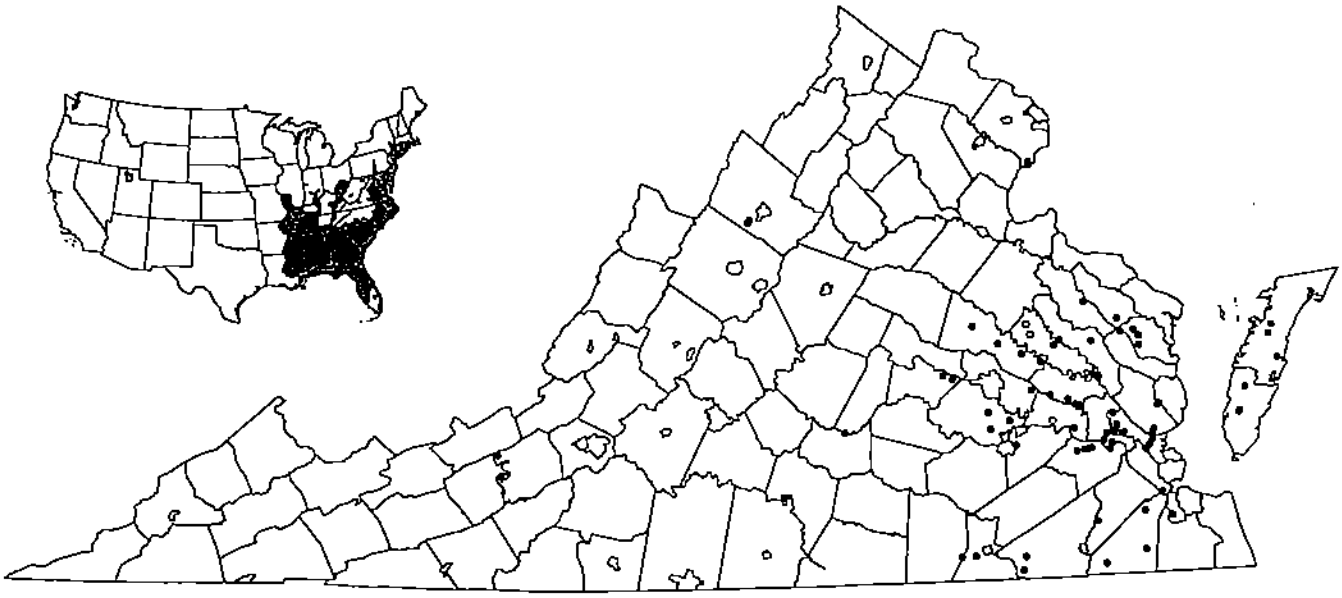
***Rana sylvatica* LeConte - Wood Frog**

Wood frogs occur in Virginia primarily in mountain, Piedmont, and several northern Coastal Plain counties. There is one extant record for the Eastern Shore. The southeastern range limit in the state appears to be in the form of an arc that extends from Henry County to the middle of the Northern Neck and the Eastern Shore.



***Rana virgatipes* Cope - Carpenter Frog**

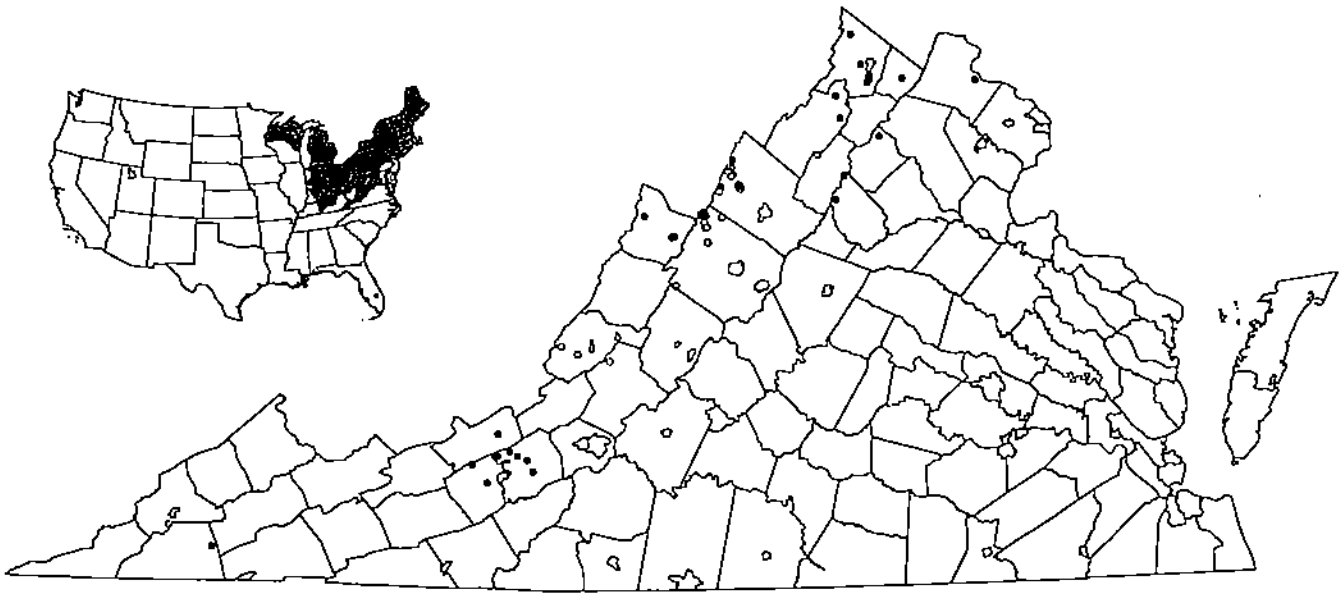
This frog is considered rare in Virginia, with only six counties and independent cities in the Coastal Plain containing known populations. It is recognized as a species of special concern (Virginia regulation section *4 VAC 15-20-130*). Additional information on its distribution in the Commonwealth is obviously needed.



***Scaphiopus holbrookii* (Harlan) - Eastern Spadefoot**

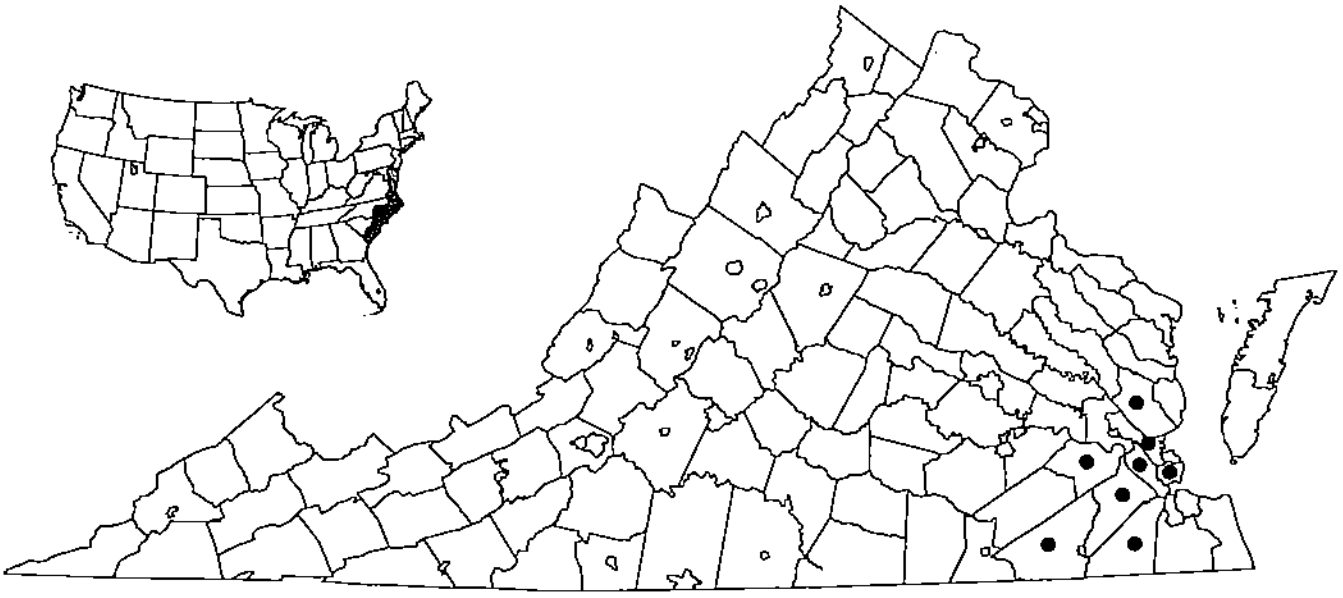
This fossorial frog occurs more commonly in the sandy soils of the Coastal Plain than in the rest of the state where occurrences are sporadic. Several records are known for the Eastern Shore and it apparently does not occur in the extreme southeastern corner of Virginia. All observations should be reported.

SALAMANDERS



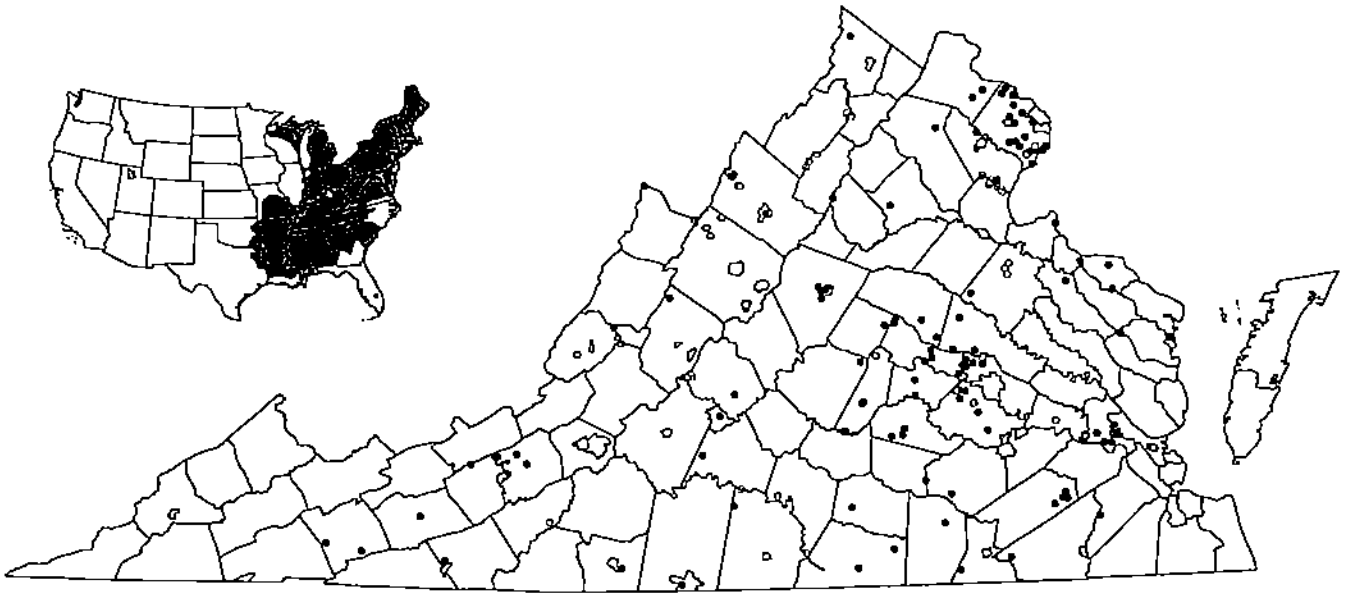
***Ambystoma jeffersonianum* (Green) - Jefferson Salamander**

This largely northern ambystomatid reaches its southern range limits in southwestern Virginia (Roble and Hobson, 1995) and southcentral Kentucky. Nearly all populations in the Commonwealth are confined to the mountains. The range of this species south of current records in the Blue Ridge Mountains needs clarification, as does the hiatus between the far southwestern record and those in Giles and Pulaski counties.



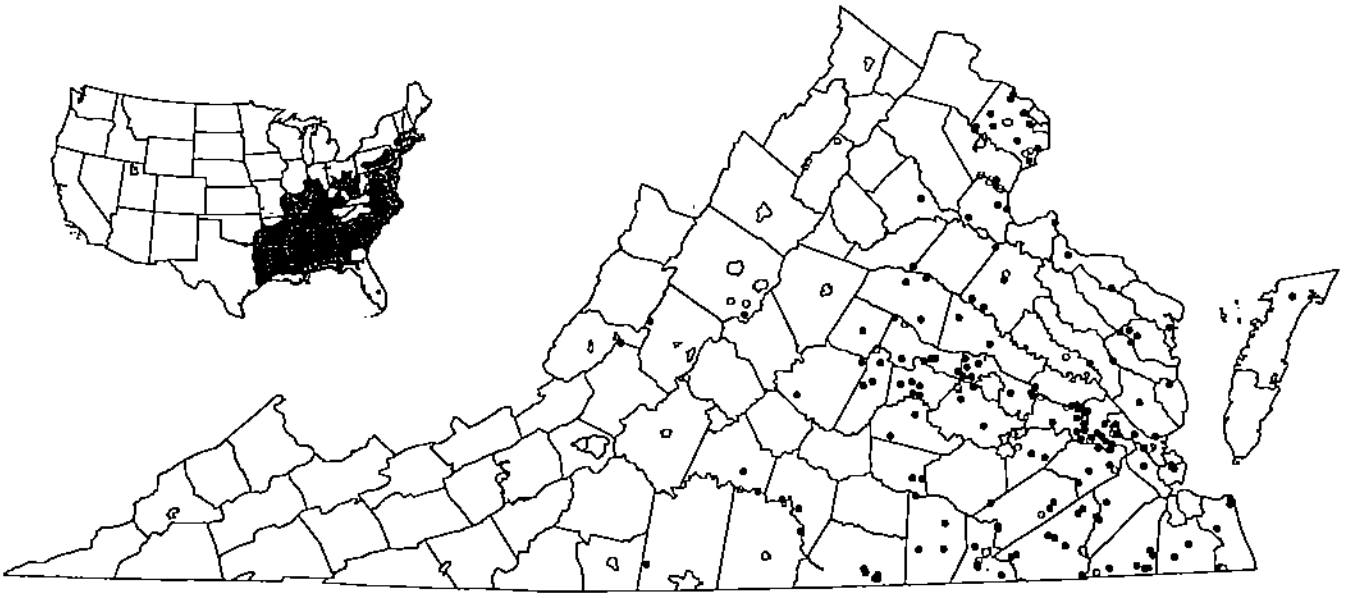
***Ambystoma mabeei* Bishop - Mabee's Salamander**

Mabee's salamanders were first found in Virginia by Mitchell and Hedges (1980) in Suffolk and are now known from six counties and cities. It is listed as state Threatened (Virginia regulation section *4 VAC 15-20-130*). This is a terrestrial forest species that breeds in temporary pools. Such habitat combinations in southeastern Virginia should be searched for additional populations.



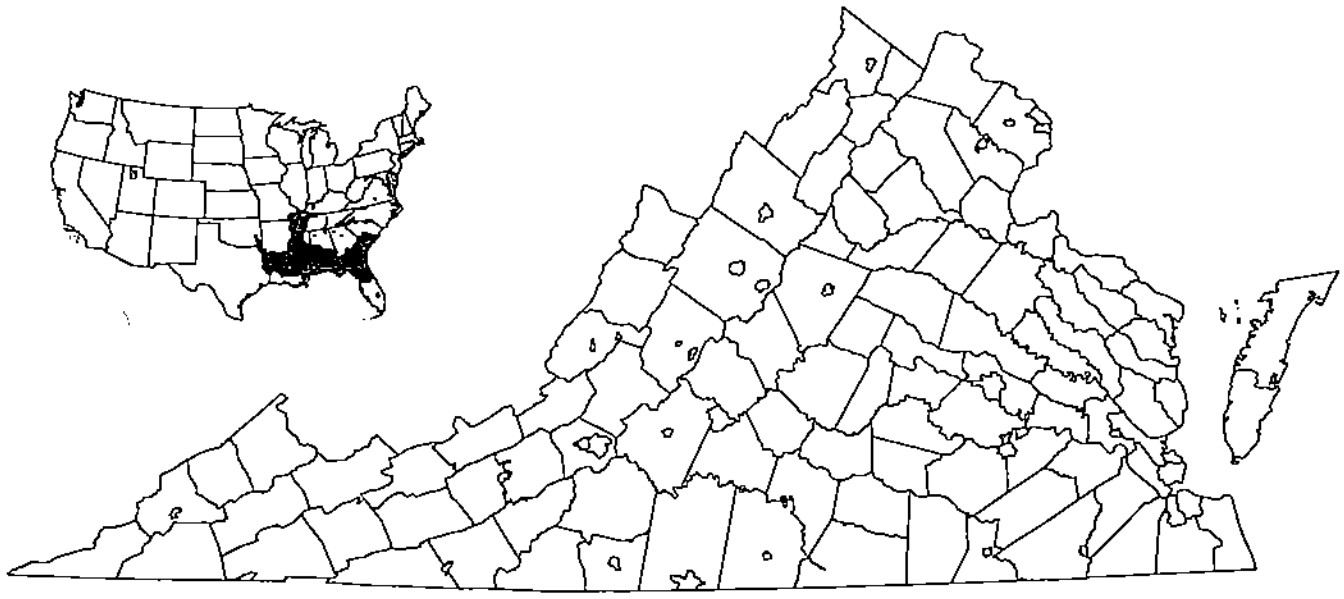
***Ambystoma maculatum* (Shaw) - Spotted Salamander**

This species occurs throughout most of the Commonwealth except for the Eastern Shore, the southeastern corner of the state, and apparently in far southwestern Virginia. The latter area needs further investigation. Voucher records are needed for several counties.



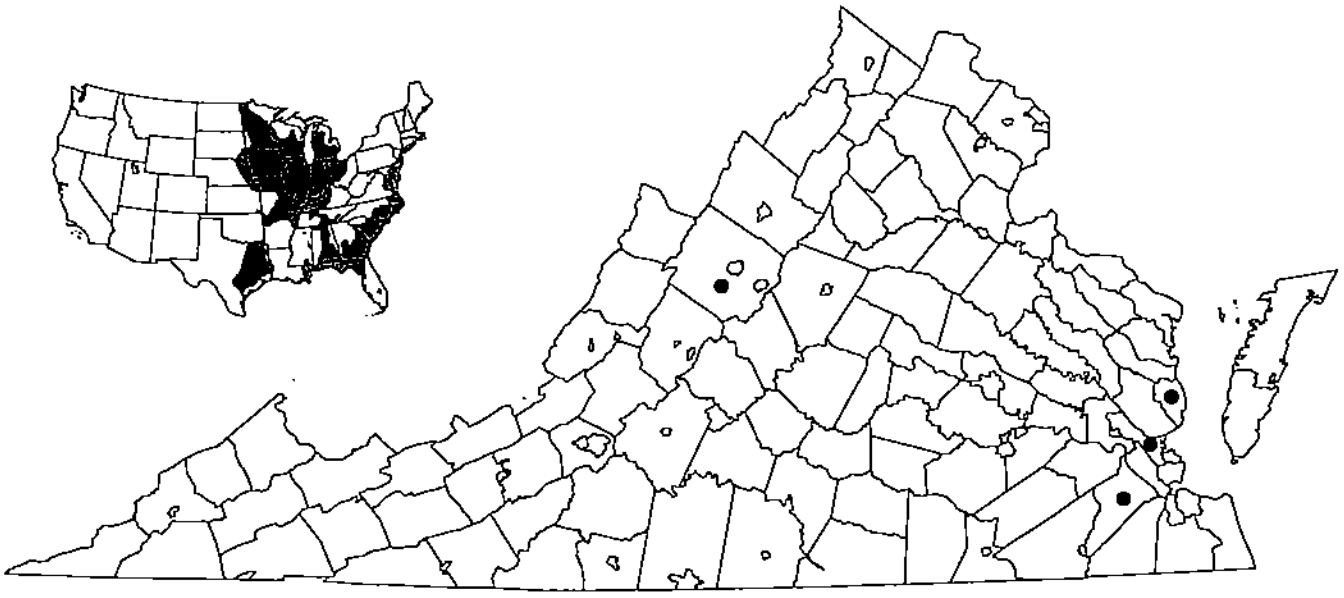
***Ambystoma opacum* (Gravenhorst) - Marbled Salamander**

Records for this fall-breeding ambystomatid indicate a general distribution east of the southwestern third of the state. Western records are scattered widely and more work needs to be done to define its western and southwestern range limits in the state.



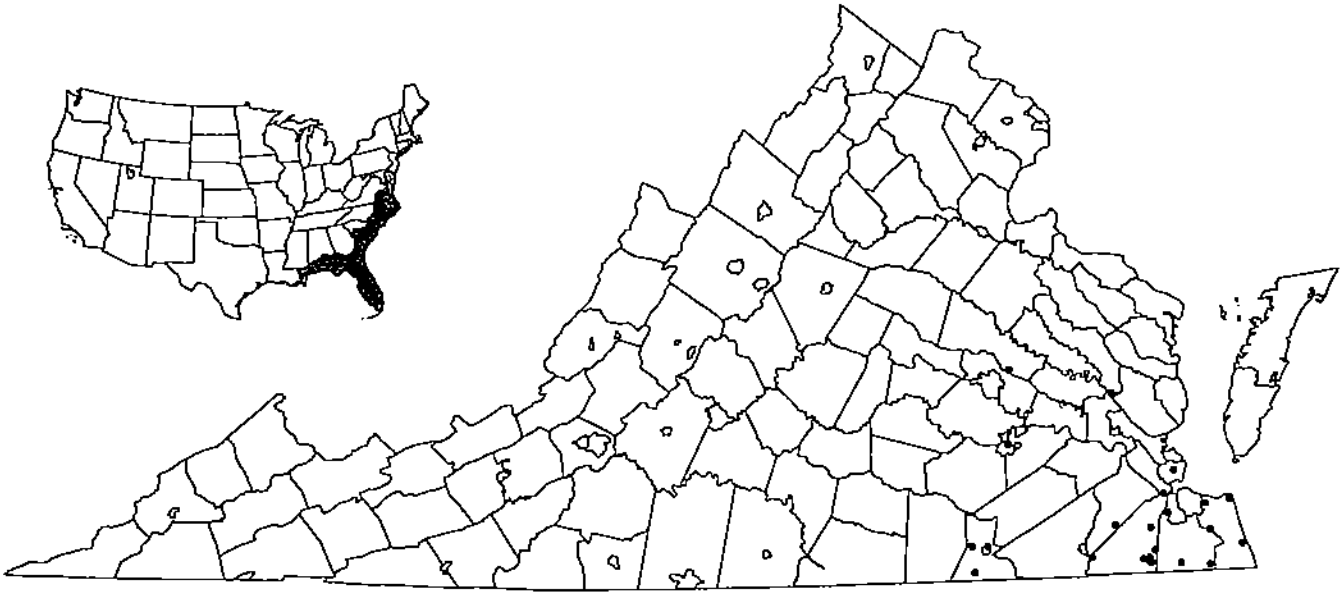
***Ambystoma talpoideum* (Holbrook) - Mole Salamander**

This is the rarest ambystomatid salamander in the state with populations known from only two counties. It was first recorded from Virginia by Bader and Mitchell (1982) in Charlotte County. Populations are currently unprotected on private land and in need of review. Mole salamanders are listed as special concern by DGIF (Virginia regulation section *4 VAC 15-20-130*).



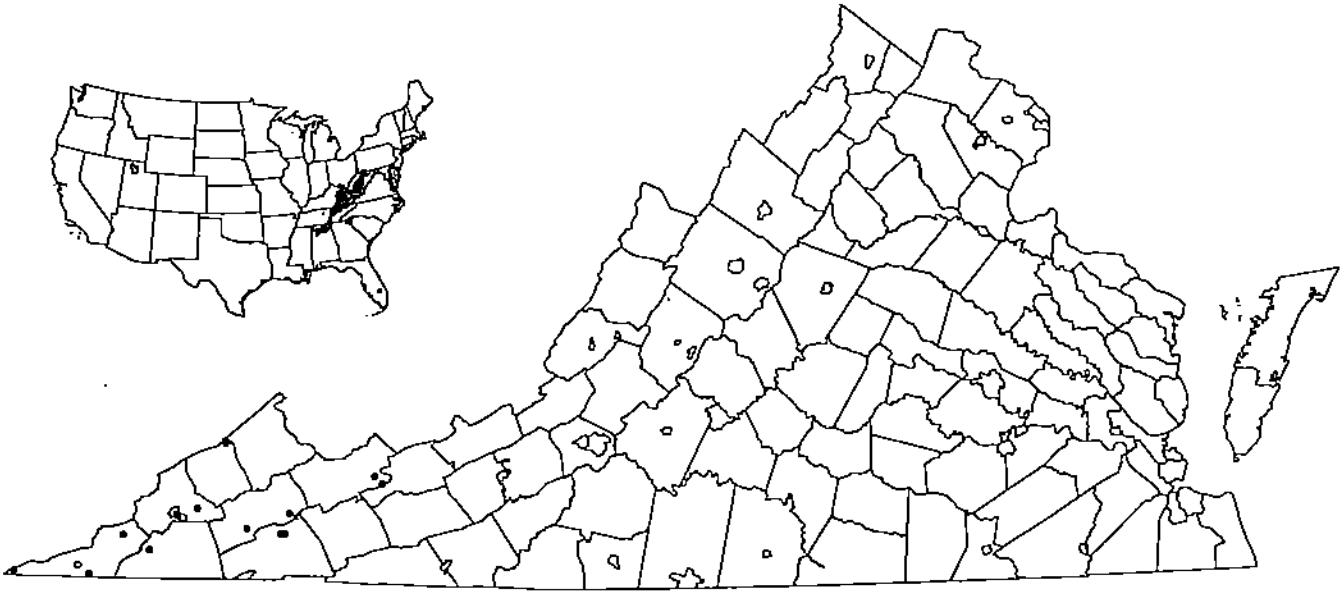
***Ambystoma tigrinum tigrinum* (Green) - Eastern Tiger Salamander**

This is a state Endangered species (Virginia regulation section *4 VAC 15-20-130*). Known records illustrate a restricted Coastal Plain and isolated Blue Ridge distribution. The literature record for Hanover County (Funderburg *et al.*, 1974) is based on an unidentifiable egg mass now in the Virginia Museum of Natural History. Additional records are obviously needed.



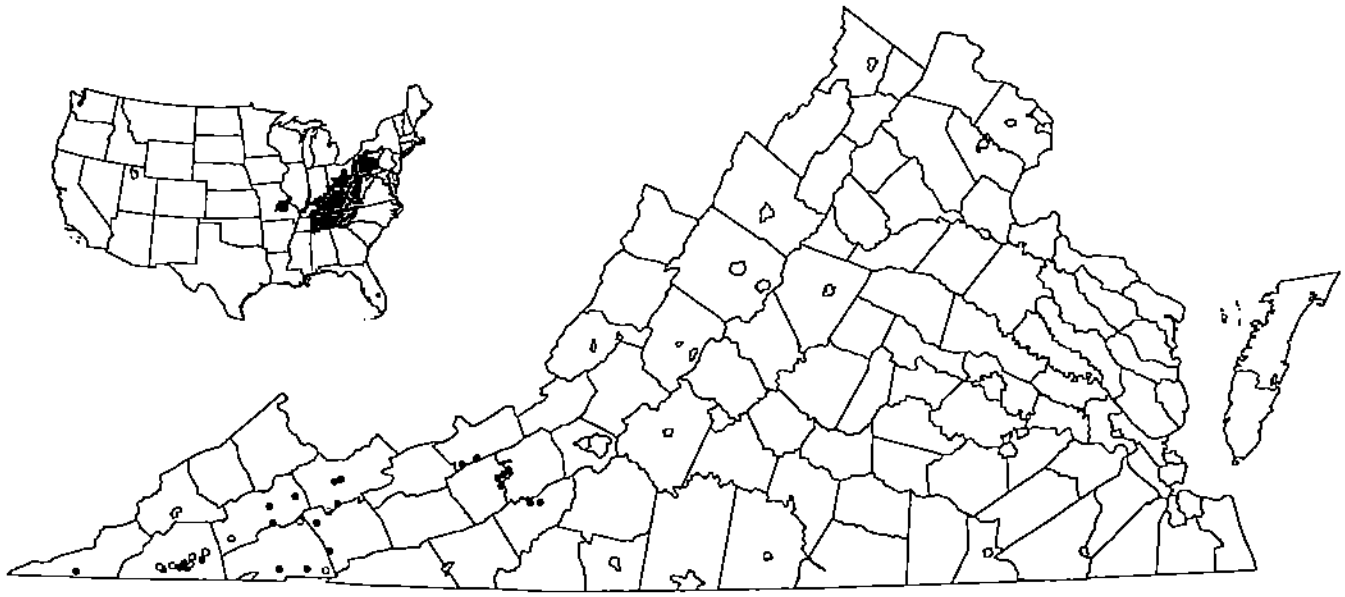
***Amphiuma means* Garden - Two-toed Amphiuma**

The amphiuma reaches its northern range limit in Virginia; the northernmost record is in Hanover County (Mitchell, 1974). All known records in Virginia are in the Coastal Plain. Records are spotty and widespread outside of the far southeastern corner of the state. The western and northern range limits of this species need clarification.



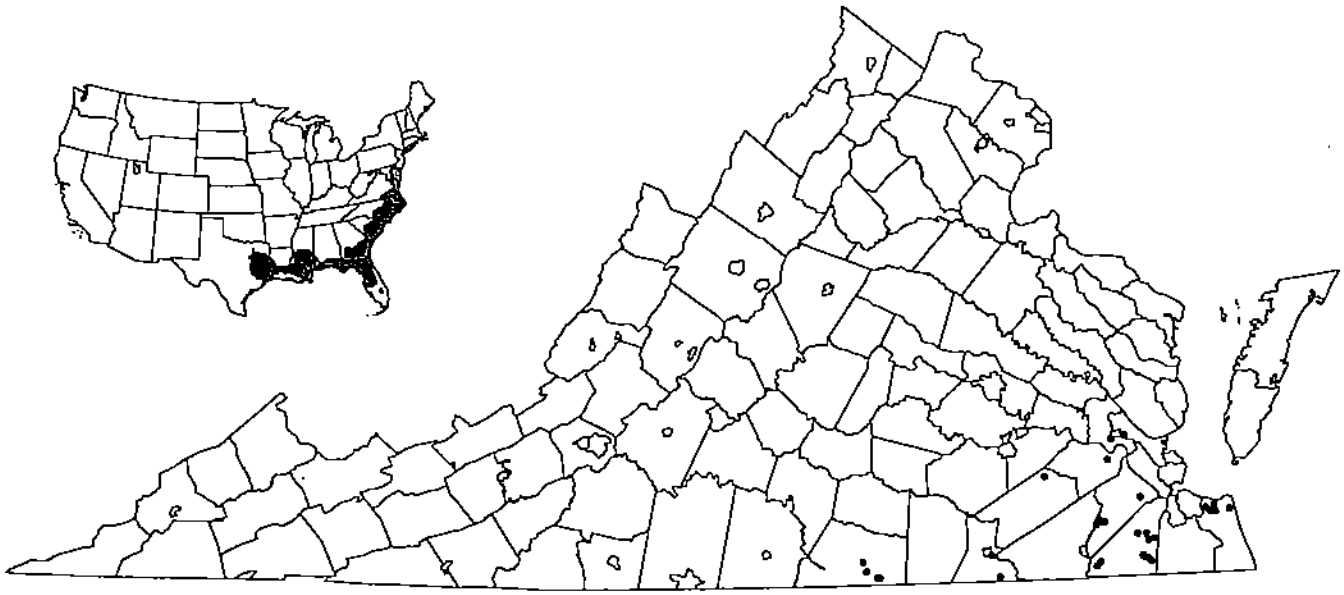
***Aneides aeneus* (Cope and Packard) - Green Salamander**

This unique salamander occurs in southwestern Virginia in the Appalachian Plateau and Ridge and Valley physiographic provinces. It largely inhabits rock crevices but may also be found in the adjacent forest. Its status in Virginia is unknown but populations have declined in North Carolina (Mitchell *et al.*, 1999b).



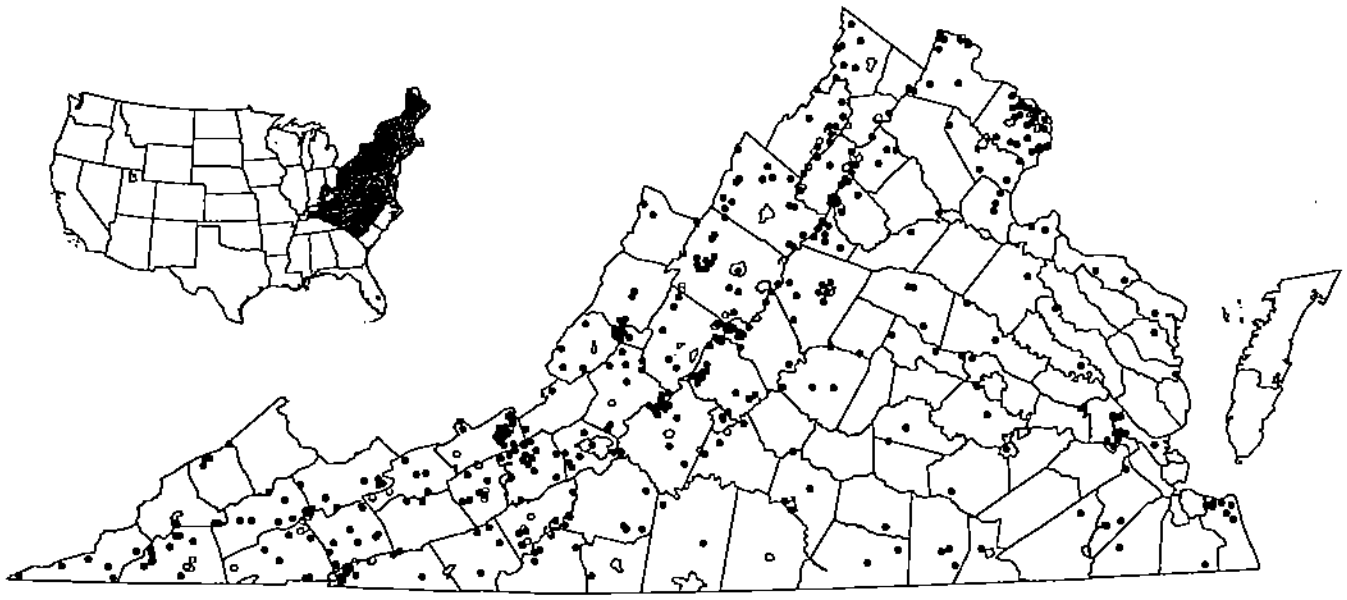
***Cryptobranchus alleganiensis alleganiensis* (Daudin) - Eastern Hellbender**

This is the largest species of salamander in Virginia and North America, reaching a total length of 29 inches (Conant and Collins, 1998). Hellbenders are known from rivers and streams only in the Tennessee and New River drainages where it was formerly abundant. It is a special concern species (Virginia regulation section *4 VAC 15-20-130*).



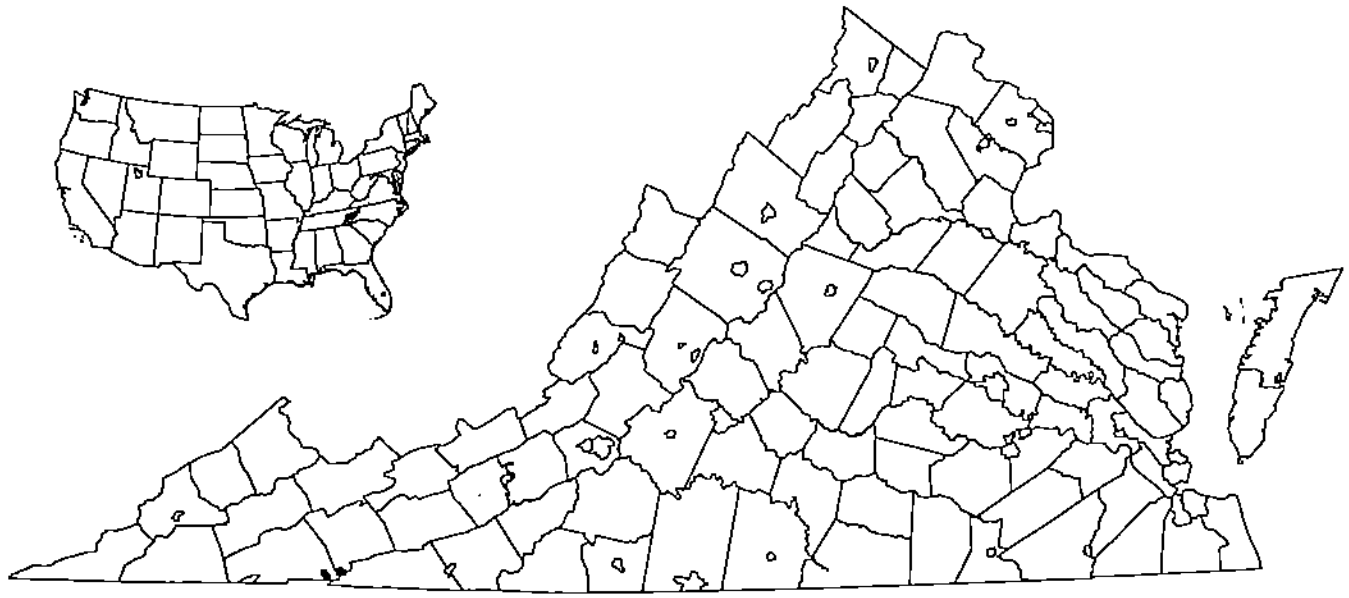
***Desmognathus auriculatus* (Holbrook) - Southern Dusky Salamander**

Southern dusky salamanders are widespread in the southeastern Coastal Plain but reach their northern range limit in southeastern Virginia. They are not frequently encountered in the field, so records are spotty in most areas. The northern and western distributional limits of this species in the state need clarification.



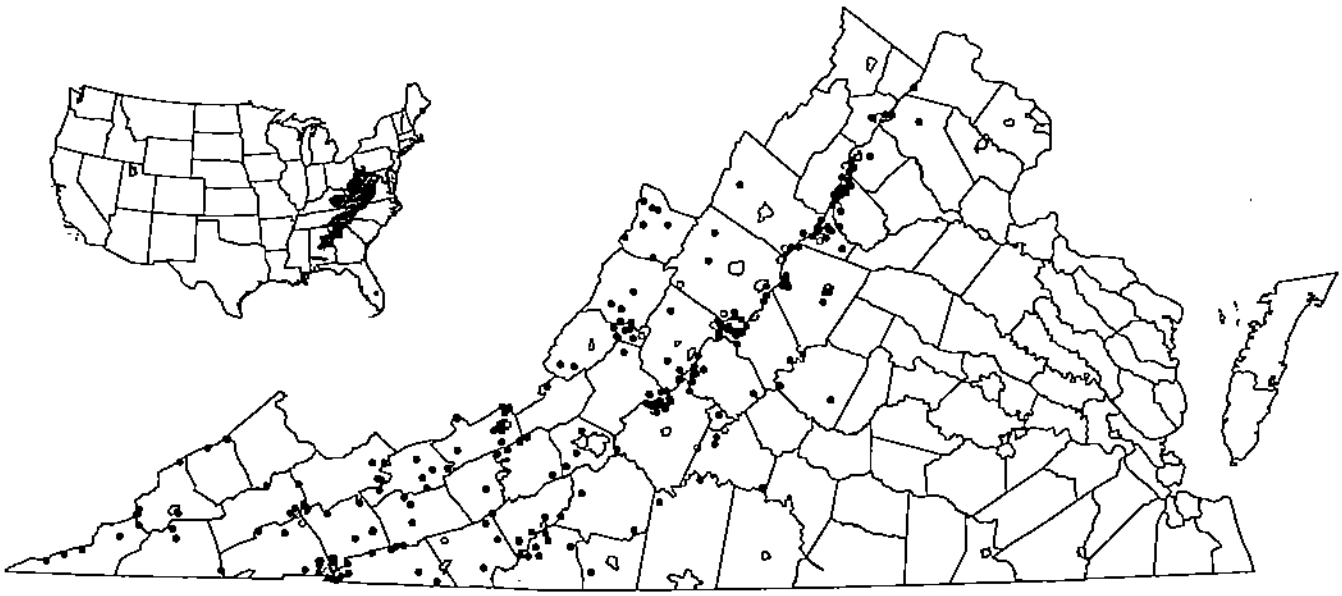
***Desmognathus fuscus* (Green) - Northern Dusky Salamander**

This stream and seepage salamander is the most widespread member of this genus in Virginia, occurring in all counties except those on the Eastern Shore. Harris (1975) cited a record for the Maryland portion of the Delmarva Peninsula. One or more new species may be described from this highly variable group in the future (S. Tilley, pers. comm.).



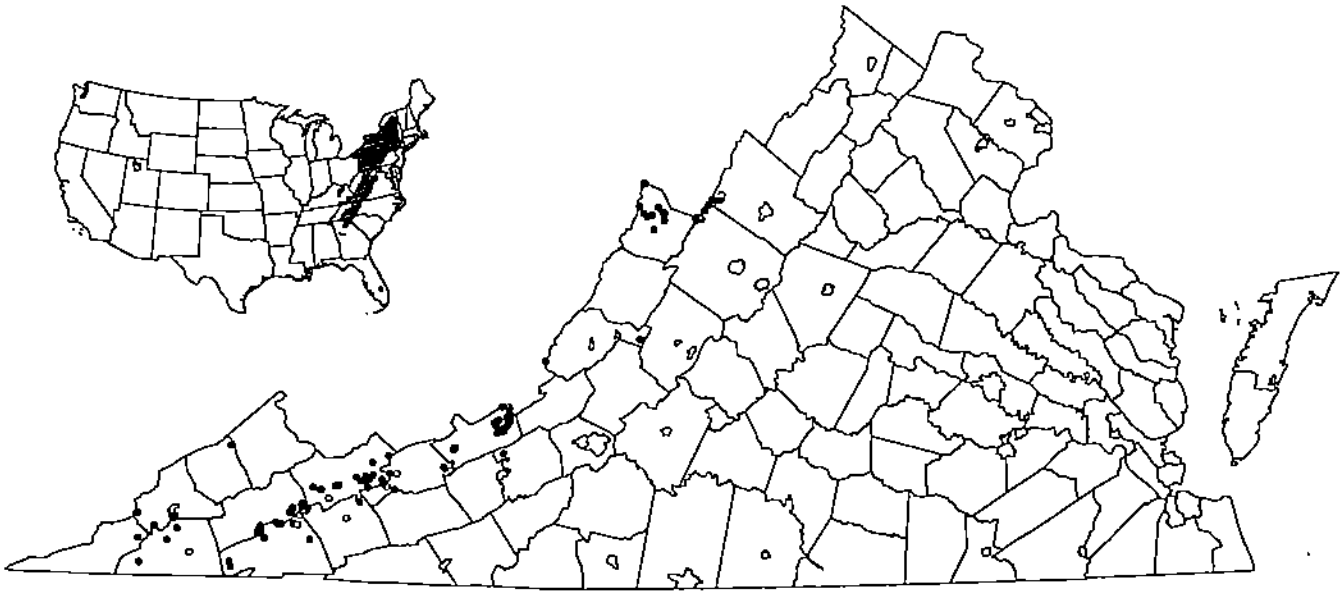
***Desmognathus marmoratus* (Moore) - Shovel-nosed Salamander**

This species has an extremely limited distribution in the Mt. Rogers and Whitetop Mountain area of southwestern Virginia. It is listed as a species of special concern (Virginia regulation section *4 VAC 15-20-130*). Most of the literature on this species uses the generic name *Leurognathus* but Crother (in press) follows the name change suggested by Titus and Larson (1996).



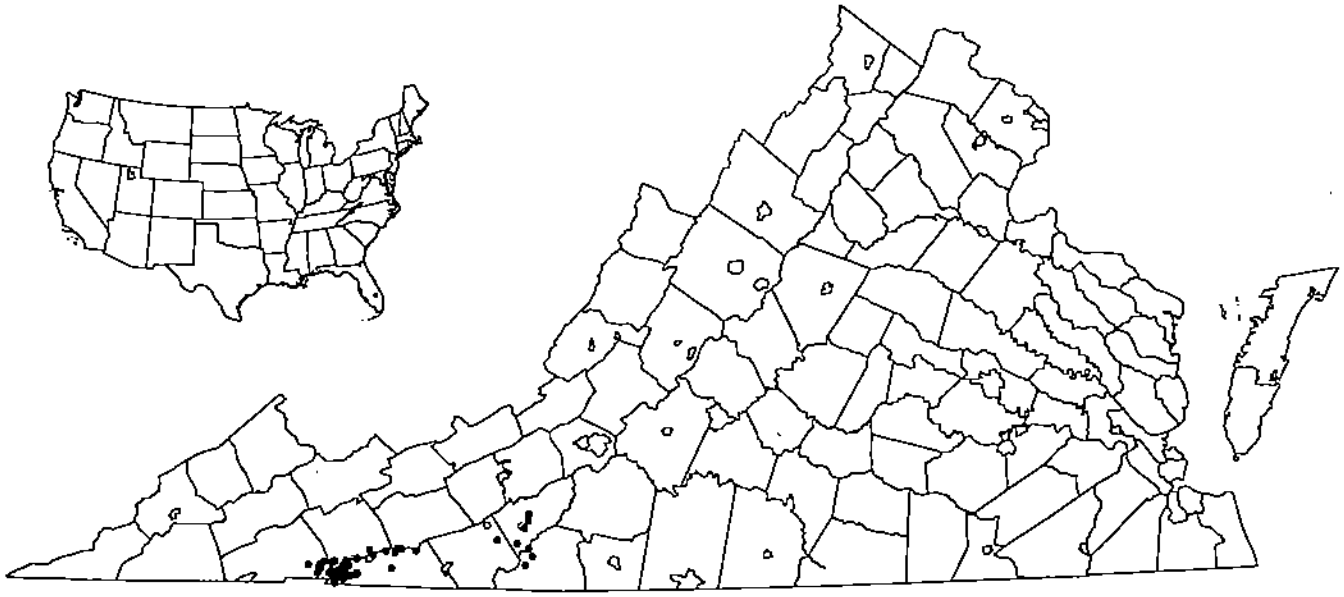
***Desmognathus monticola* Dunn - Seal Salamander**

Two subspecies have been recognized previously in Virginia: *D. m. jeffersoni* Hoffman and *D. m. monticola* Dunn. However, Petranka (1998) showed that variation in this species does not allow distinguishing the Blue Ridge race. The distribution of seal salamanders in the upper Ridge and Valley and western Piedmont counties needs to be better delineated.



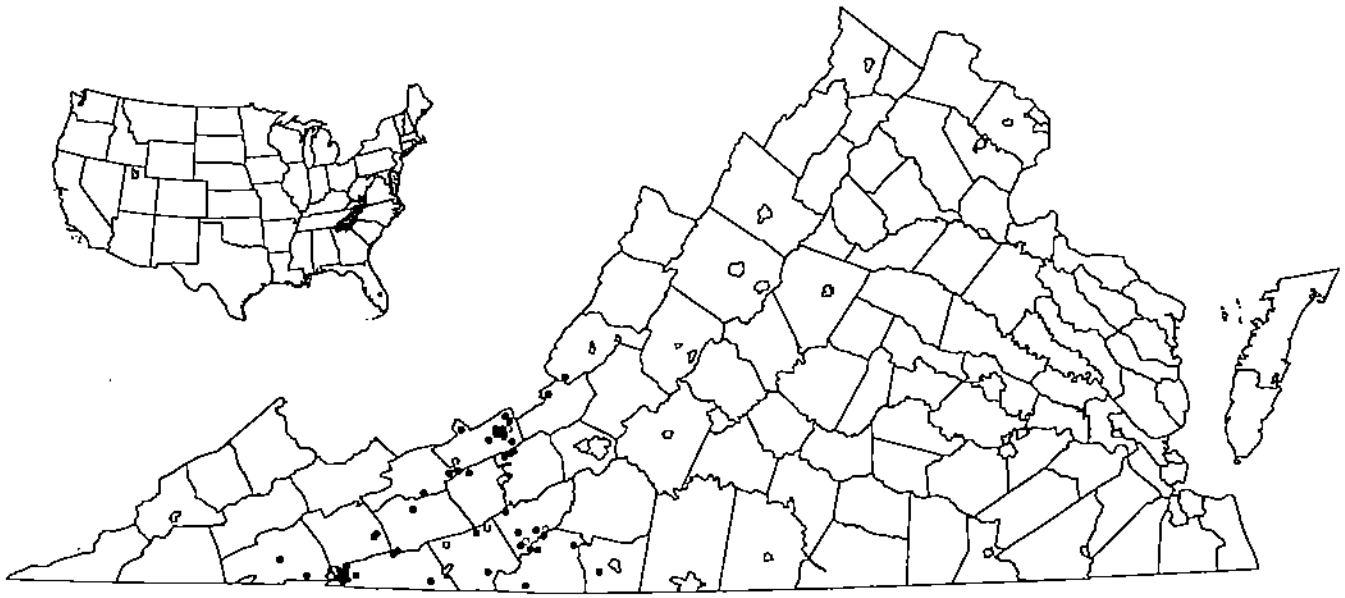
***Desmognathus ochrophaeus* Cope - Alleghany Mountain Dusky Salamander**

This highly variable salamander occurs primarily in the Ridge and Valley physiographic province in western Virginia. Few records are available for the Appalachian Plateau. The margins of its distribution in Virginia need to be clarified; records between Giles and Highland counties are especially needed.



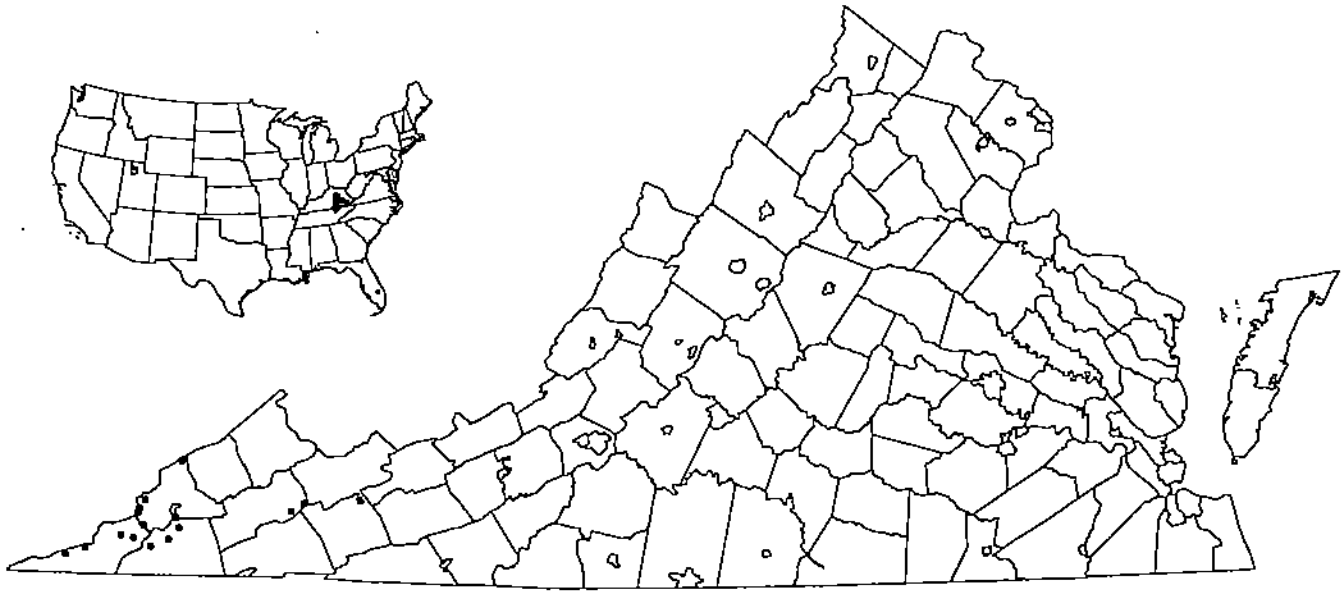
***Desmognathus orestes* Tilley and Mahoney - Blue Ridge Dusky Salamander**

This species was recently described by Tilley and Mahoney (1996) in their review of the genetics of the *D. ochrophaeus* complex. Its range in Virginia is limited to the southern Blue Ridge Mountains northward into Floyd County. Additional records are needed to clarify its distribution along the Blue Ridge Escarpment.



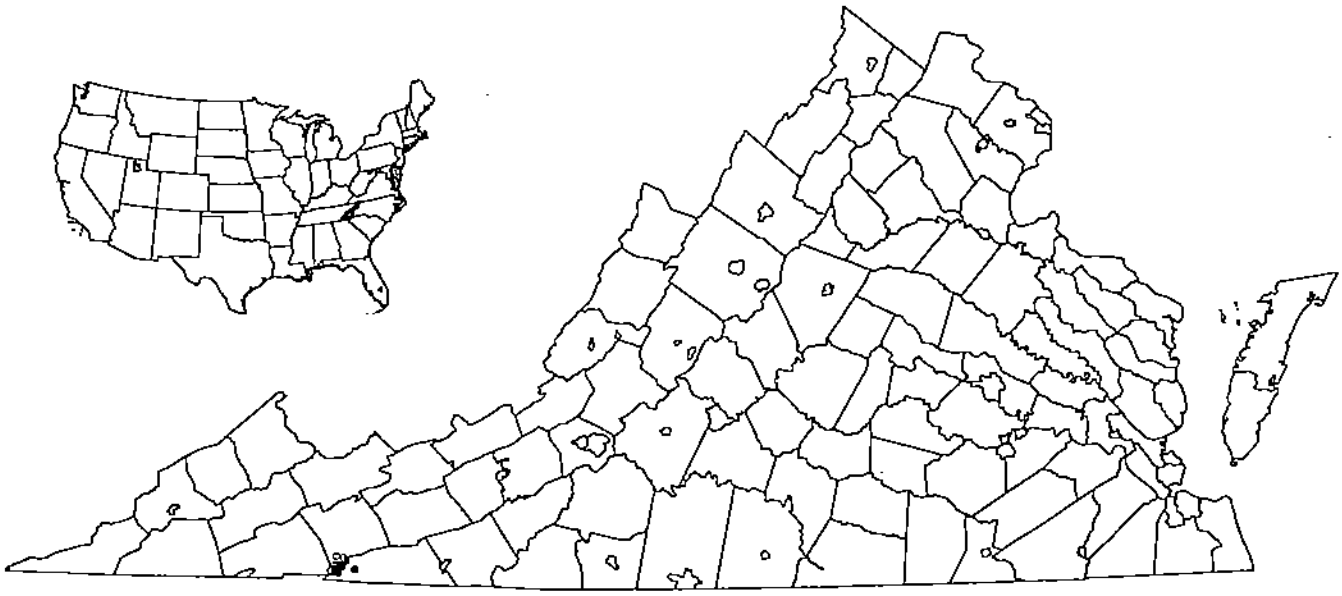
***Desmognathus quadramaculatus* (Holbrook) - Black-bellied Salamander**

This large aquatic salamander has a range that spans the western edge of the Piedmont, southern Blue Ridge, and Ridge and Valley north and south of the New River basin. It was used extensively as fish bait ("spring lizards") and it is suspected that fishermen have moved it around the southern Appalachians.



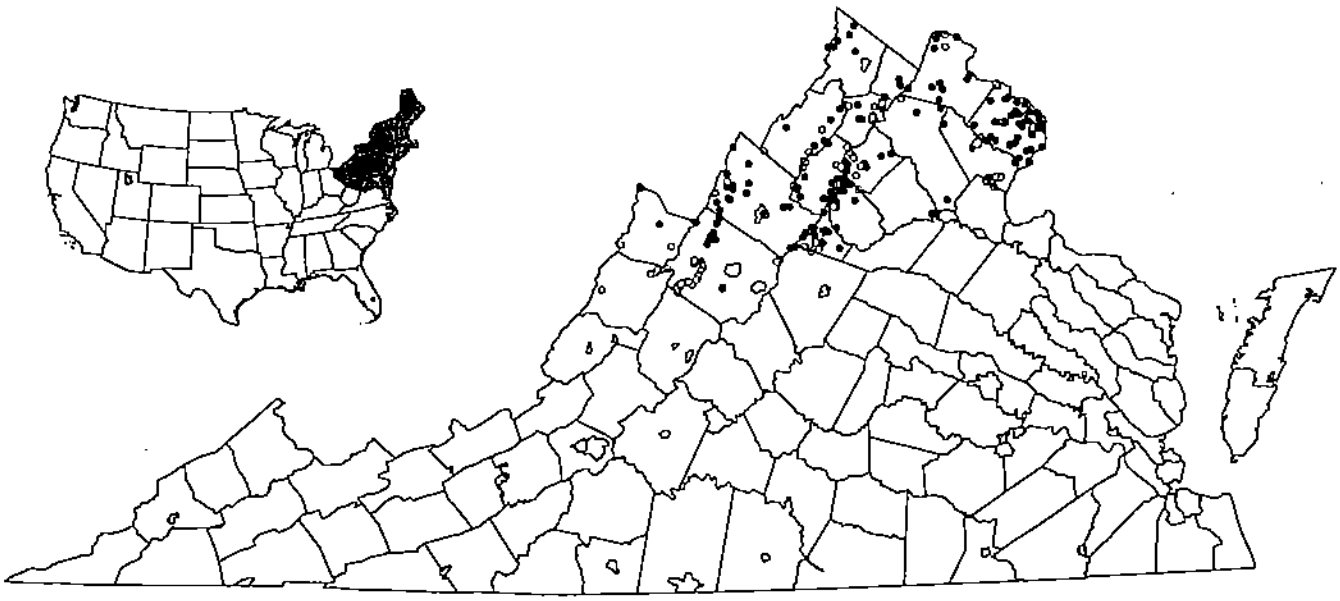
***Desmognathus welteri* Barbour - Black Mountain Salamander**

This desmognathine salamander is mostly confined to the Appalachian Plateau and nearby regions in southwestern Virginia. Its easternmost locality in the state is in Smyth County. The range of this species in southwestern Virginia needs refinement.



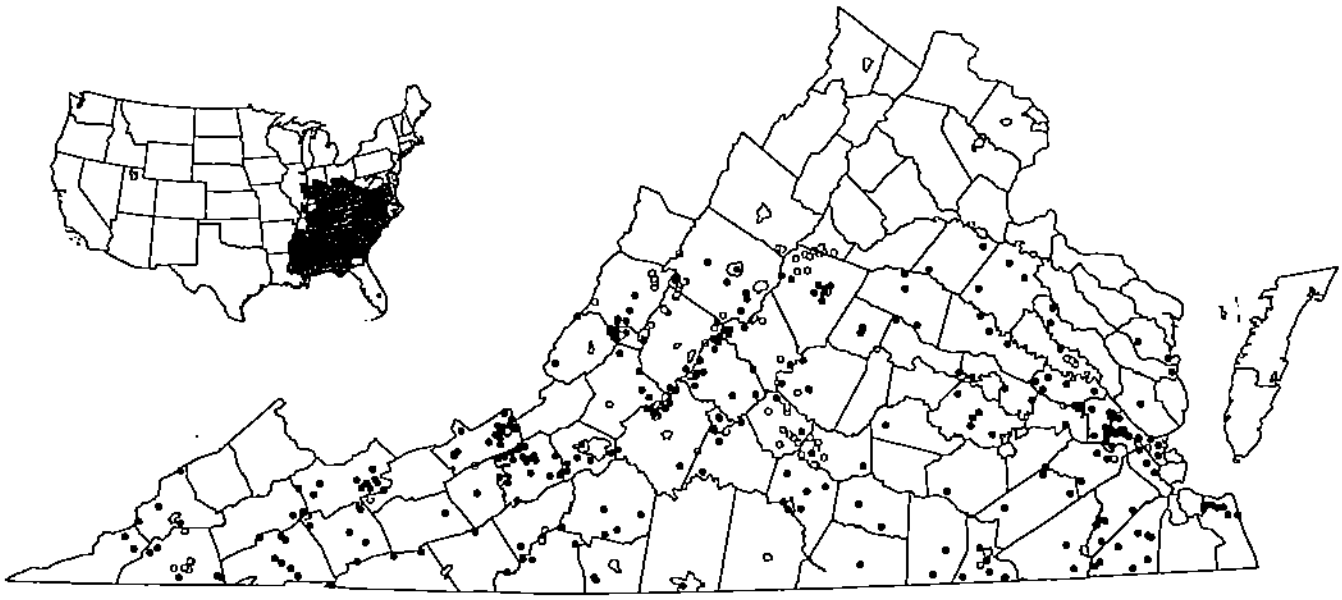
***Desmognathus wrighti* King - Pygmy Salamander**

Pygmy salamanders are the most terrestrial members of the genus *Desmognathus* and have a limited range in the southern Blue Ridge Mountains. It occurs only on Mt. Rogers, Whitetop, and Pine Mountain in Virginia, all within the Jefferson National Forest Mt. Rogers Recreational Area. It is a special concern species (Virginia regulation section *4 VAC 15-20-130*).



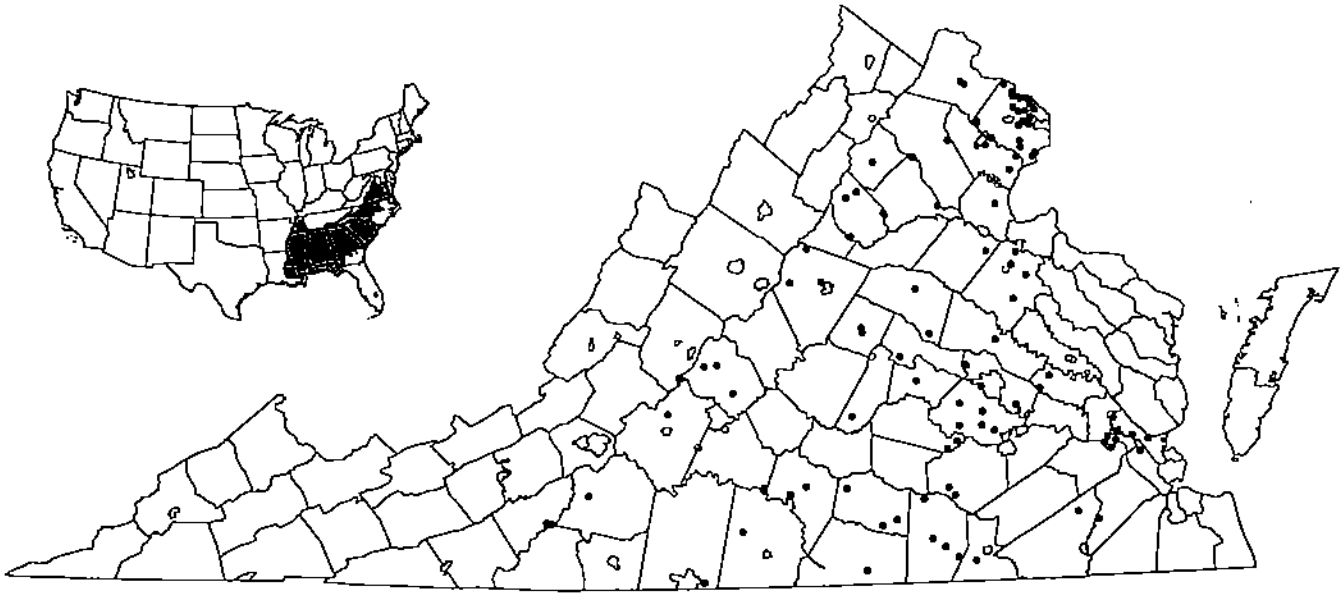
***Eurycea bislineata* (Green) - Northern Two-lined Salamander**

Three subspecies of two-lined salamanders were recognized until Jacobs (1987) elevated all three to full species based on genetic analyses. This classification is still controversial (Petranka, 1998). Until the problems have been worked out, rely on geographic location for identification. The range of this species is limited to northern Virginia.



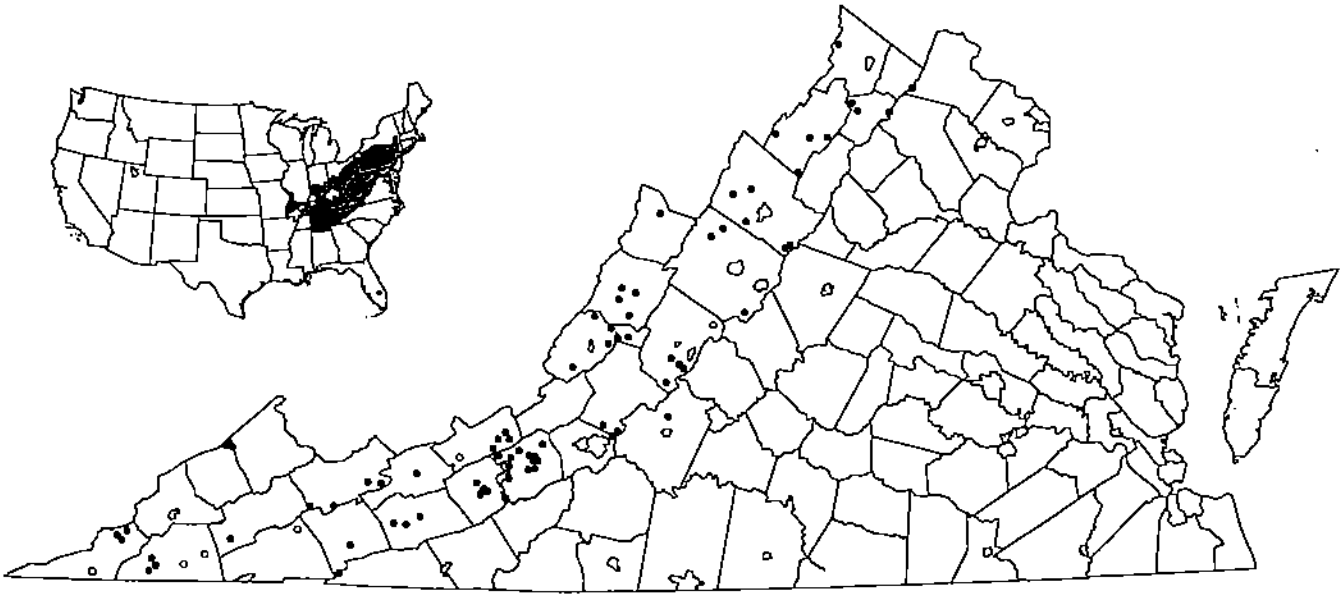
***Eurycea cirrigera* (Green) - Southern Two-lined Salamander**

This species cannot be distinguished from *E. bislineata* by external characters. The two come in contact in some streams along the presumed northern edge of the range of this species in Virginia. Paul Sattler (pers. comm.) provided genetic information that allows depiction of the ranges of these two species of two-lined salamanders.



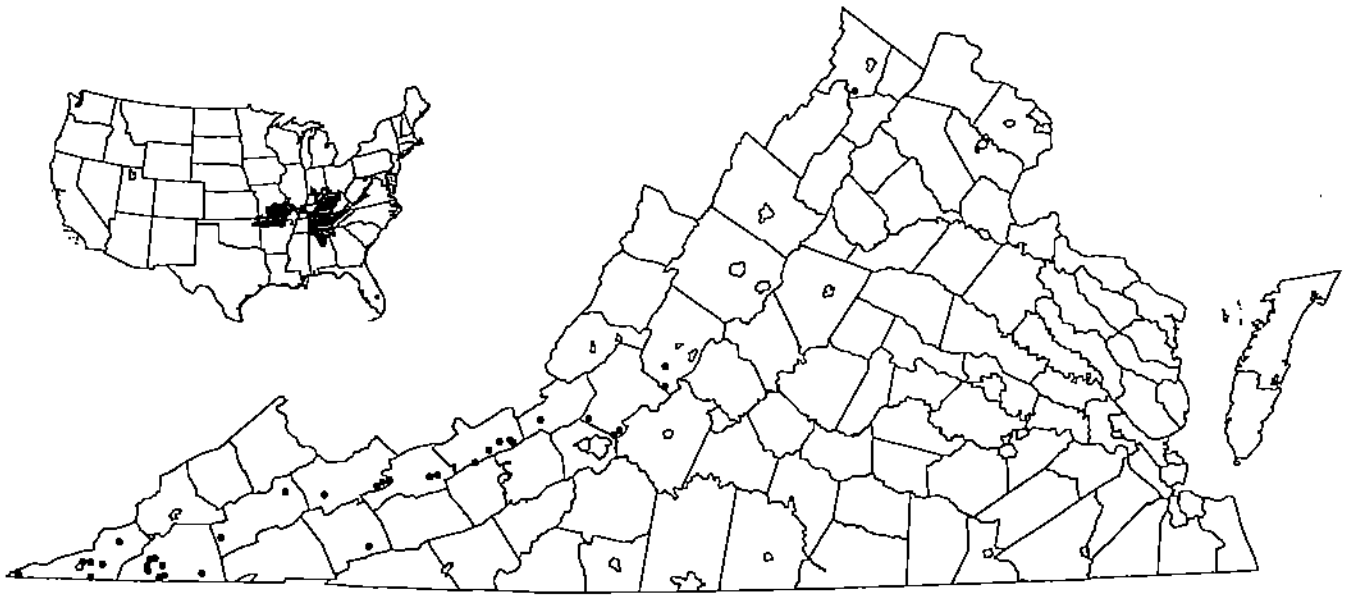
***Eurycea guttolineata* (Holbrook) - Three-lined Salamander**

This salamander originally described as a full species was long considered a subspecies of *E. longicauda* until Carlin (1997) returned it to full species status. Nearly all known populations occur east of the Blue Ridge Mountains. Unusual phenotypes or potential hybrids with *E. longicauda* occur in some streams in Fairfax County. The eastern margin of its range needs better definition.



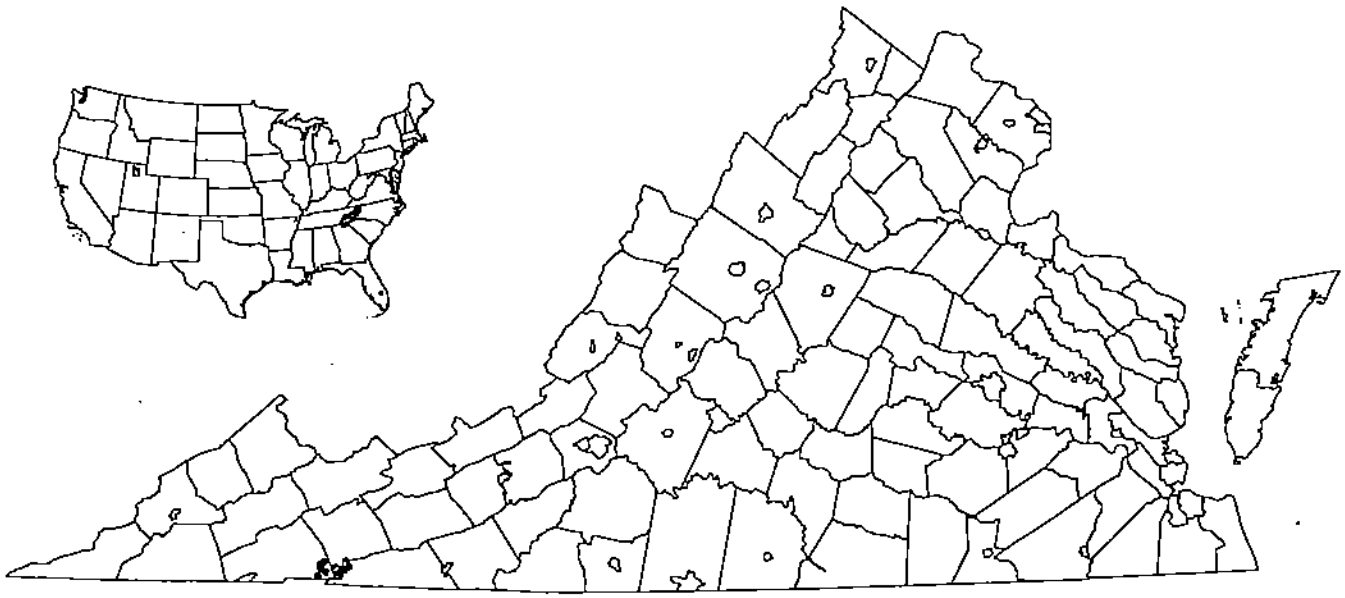
***Eurycea longicauda longicauda* (Green) - Long-tailed Salamander**

Most populations of this salamander occur in the Ridge and Valley but there are also several known locations in the Blue Ridge Mountains. It is apparently absent from the southern Blue Ridge. The few records on the eastern side of the Blue Ridge need verification.



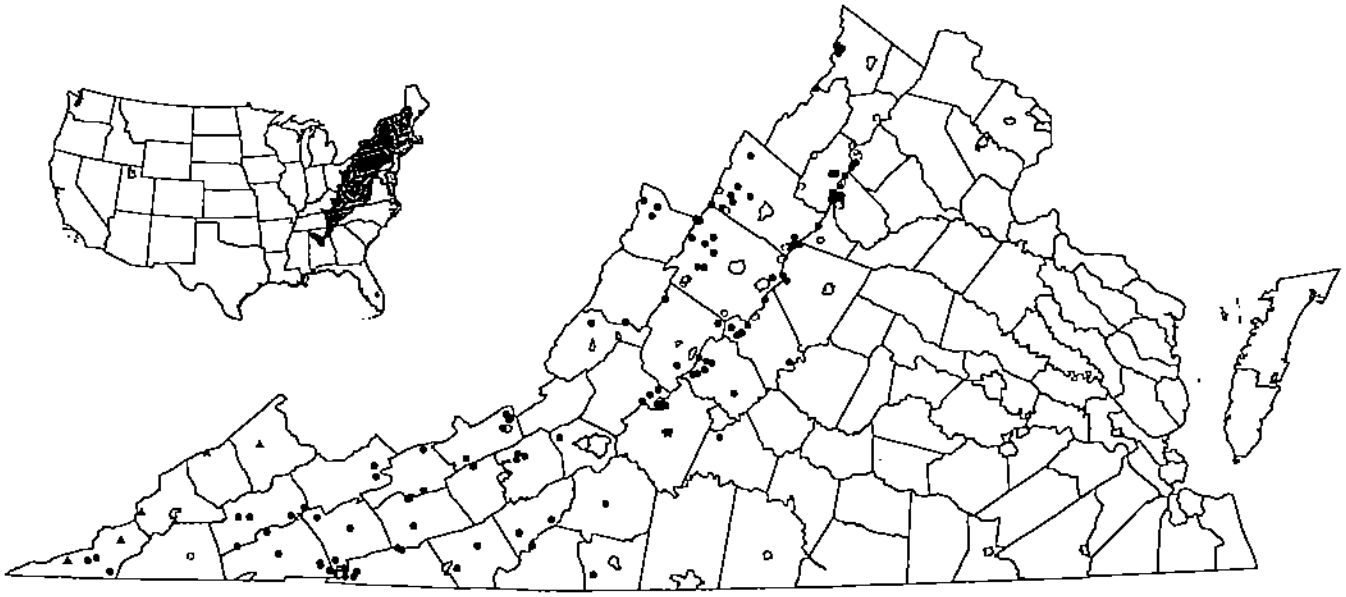
***Eurycea lucifuga* Rafinesque - Cave Salamander**

The cave salamander occupies cave-like habitats, including natural caves and man-made tunnels and mines in the Ridge and Valley. Most localities are in the southwestern Virginia mountains but several occur in the Blue Ridge Mountains. The northernmost known locality for this species in southern Frederick County needs reverification.



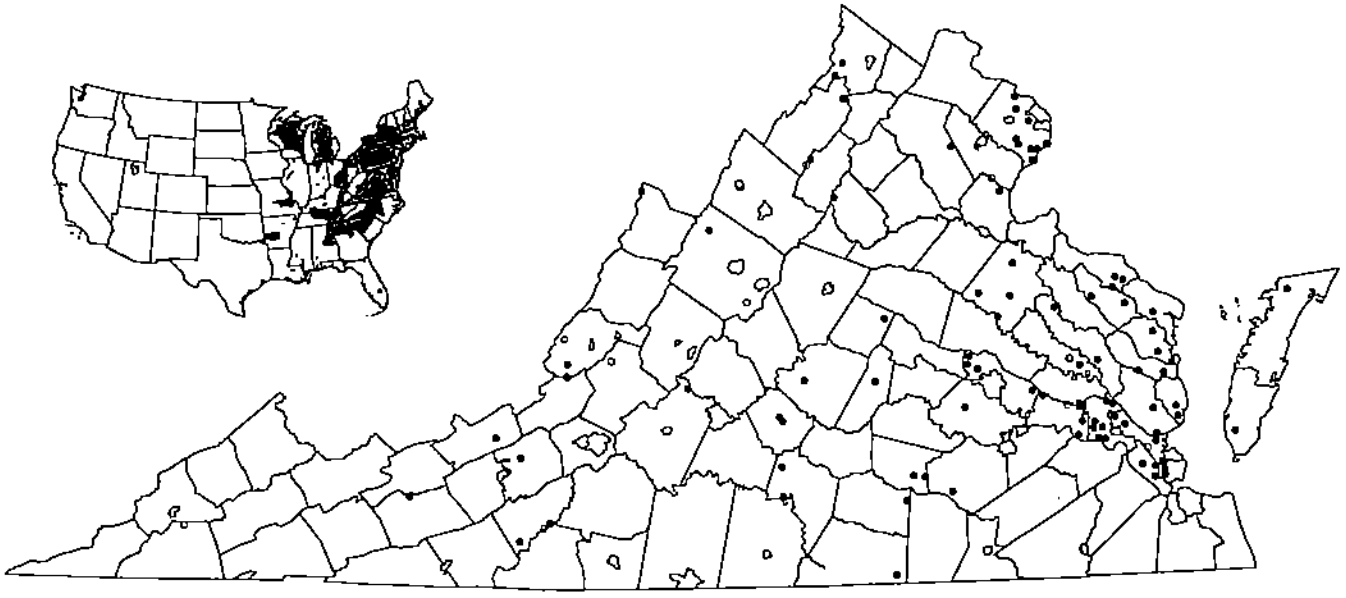
***Eurycea wilderae* Dunn - Blue Ridge Two-lined Salamander**

This Appalachian, high elevation salamander occurs in Virginia only in the Mt. Rogers and Whitetop Mountain area. It was formerly a subspecies of *E. bislineata* (Jacobs, 1987). This southern Appalachian endemic should be monitored on a regular basis.



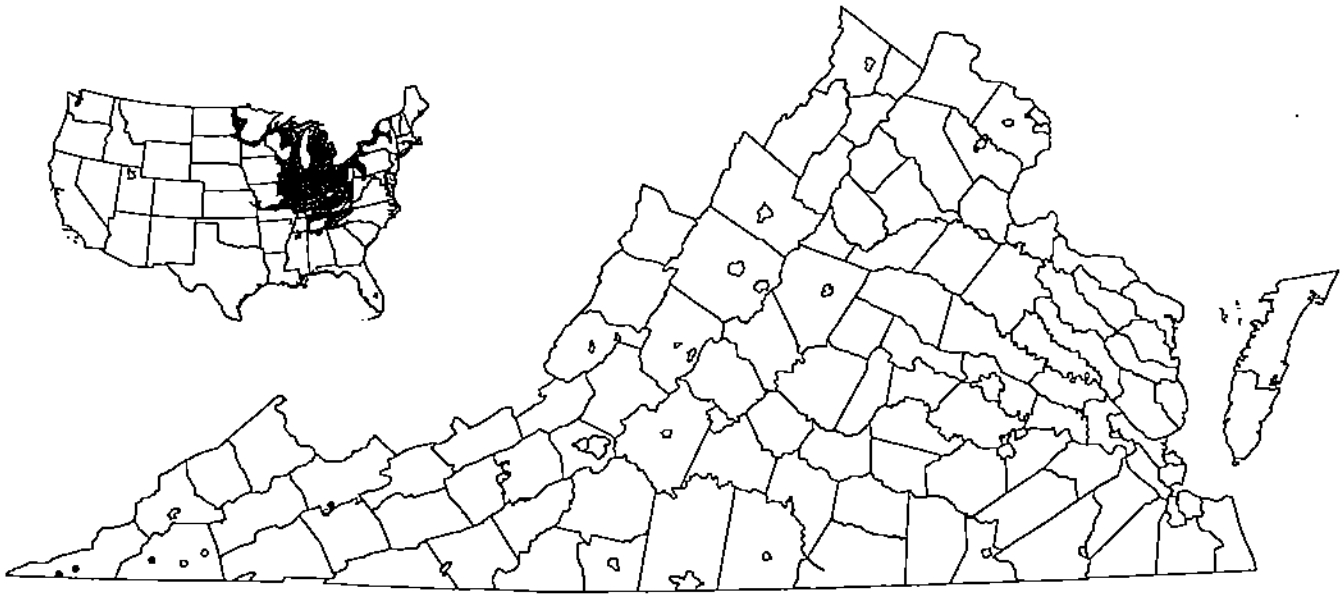
***Gyrinophilus porphyriticus* (Green) - Spring Salamander**

Two recognized subspecies occur in Virginia: *G. p. duryi* (Weller), the Kentucky spring salamander (▲) limited to the Appalachian Plateau region, and *G. p. porphyriticus* (Green), the northern spring salamander (•), widespread in the Blue Ridge Mountains and Ridge and Valley. Outlying ridges in the western Piedmont could harbor other populations.



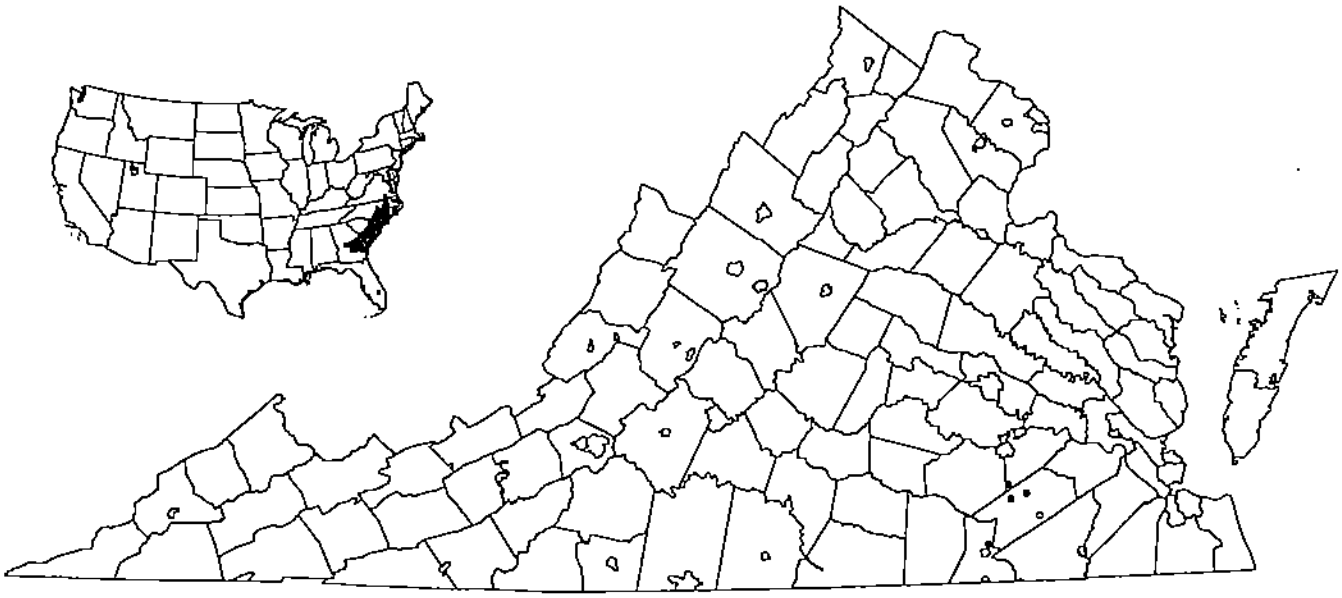
***Hemidactylium scutatum* (Schlegel) - Four-toed Salamander**

Most records for this secretive species are concentrated in the Coastal Plain north of the James River; others are widely scattered. It is absent from extreme southeastern Virginia. Opportunities to discover new populations are in the southwest and additional surveying effort should yield many county records.



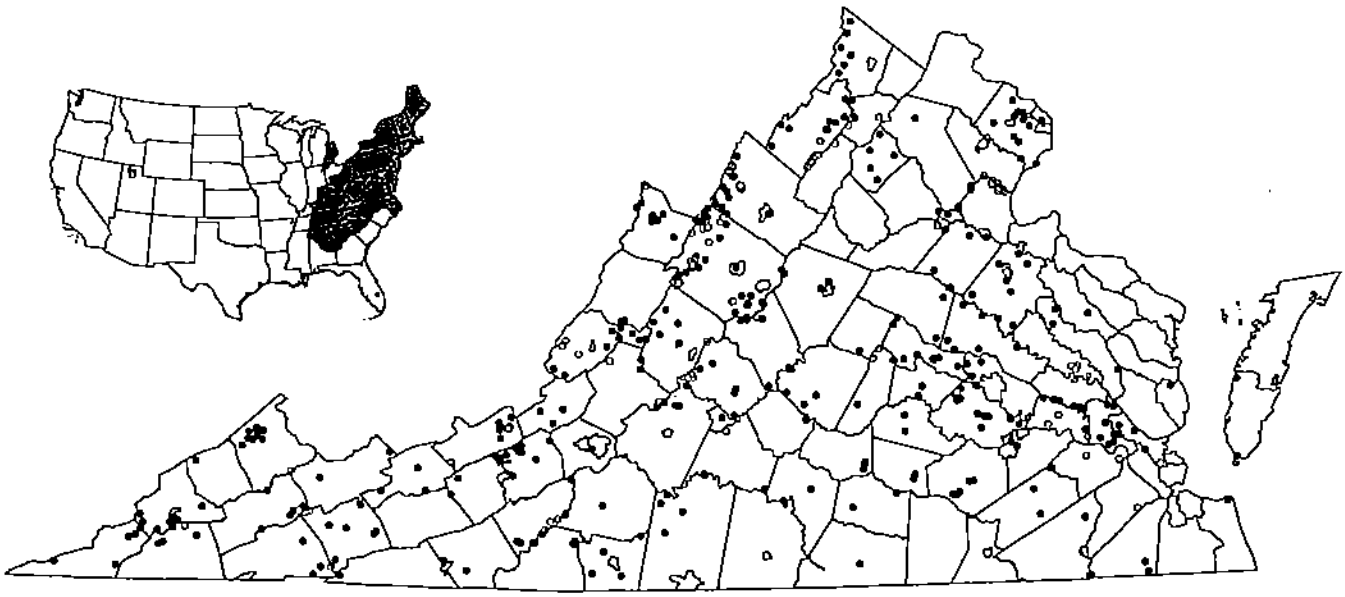
***Necturus maculosus maculosus* (Rafinesque) - Common Mudpuppy**

Mudpuppies occupy stream habitats in the Tennessee River drainage in southwestern Virginia. Almost nothing is known of its ecology in the state and its distribution is yet to be worked out. Its conservation status is unknown due to a lack of sufficient observations (Mitchell, 1991; Mitchell *et al.*, 1999b).



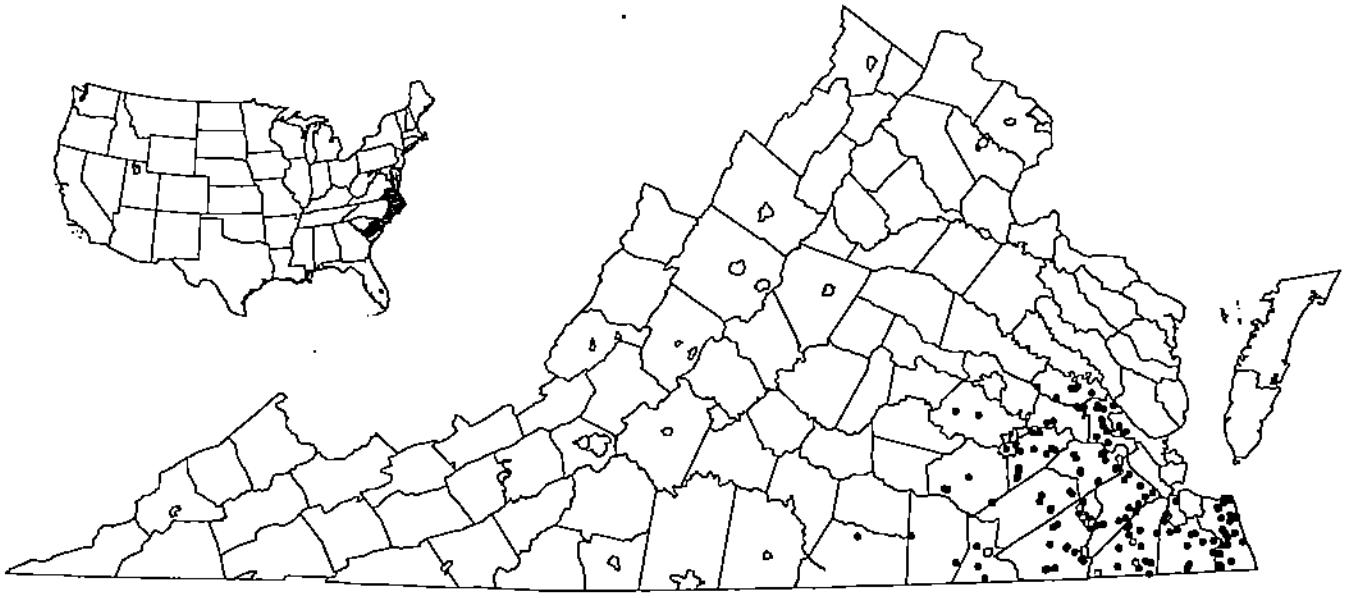
***Necturus punctatus* (Gibbes) - Dwarf Waterdog**

Only a few localities are known for this aquatic species in Virginia, all at the northern edge of its range in the southeastern Coastal Plain. This species occupies slow-moving Coastal Plain streams but little is known of its ecology in this area. Its status is undetermined in the Commonwealth (Mitchell, 1991).



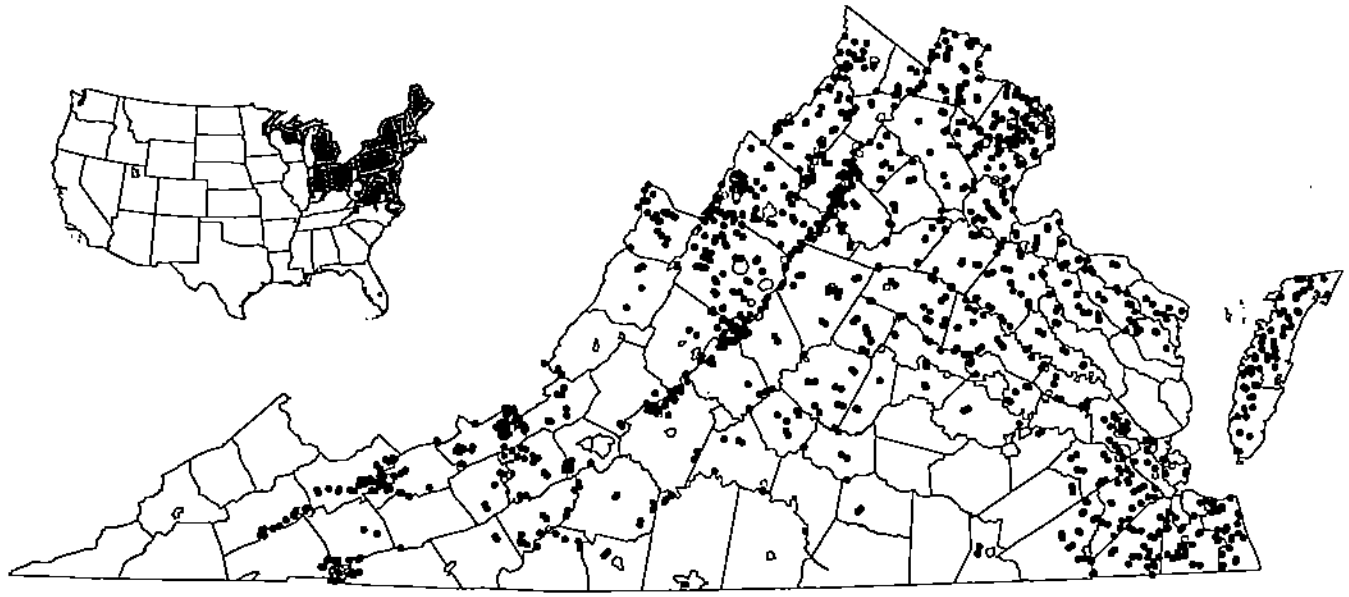
***Notophthalmus viridescens viridescens* (Rafinesque) - Red-spotted Newt**

Red-spotted newts are widespread in Virginia and are known from nearly every county, including the Eastern Shore. However, they appear to be rare to absent in the extreme southeastern corner of the state (Mitchell *et al.*, 1999a).



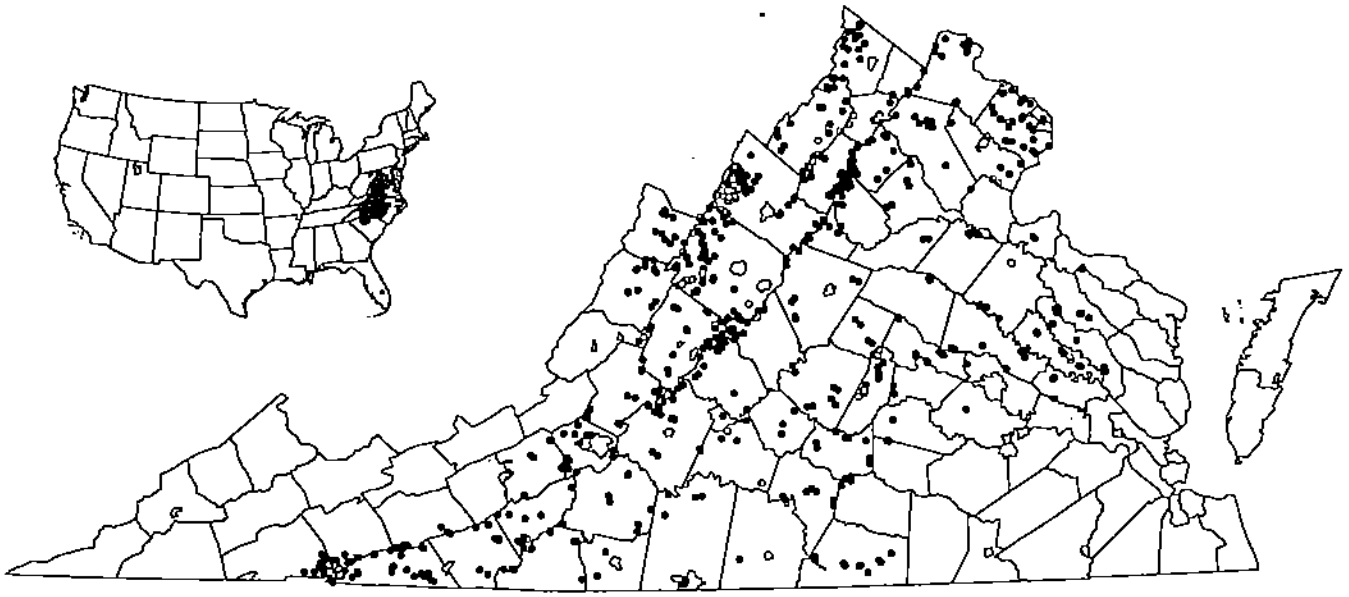
***Plethodon chlorobryonis* Mittleman - Atlantic Coast Slimy Salamander**

Highton *et al.* (1989) recognized this as one of 16 species in the slimy salamander complex. It was originally described as a subspecies by Mittleman (1951). This species is limited to southeastern Virginia. Individuals in the western locations may be hybrids with *P. cylindraceus* (Highton *et al.*, 1989).



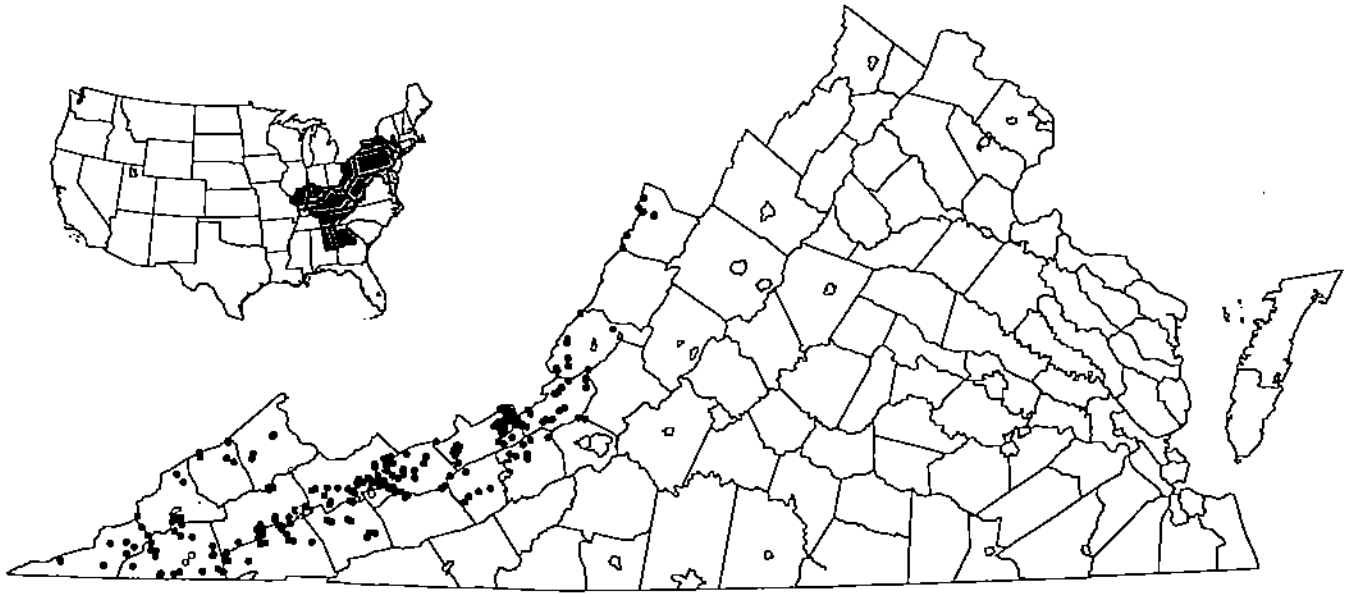
***Plethodon cinereus* (Green) - Red-backed Salamander**

This is a common, sometimes abundant, terrestrial forest salamander widespread in Virginia. They have not been found in the Middle Peninsula and parts of Southside Virginia despite extensive searching (R. Highton, pers. comm.). Red-backed salamanders are replaced by other woodland salamanders in far southwestern Virginia.



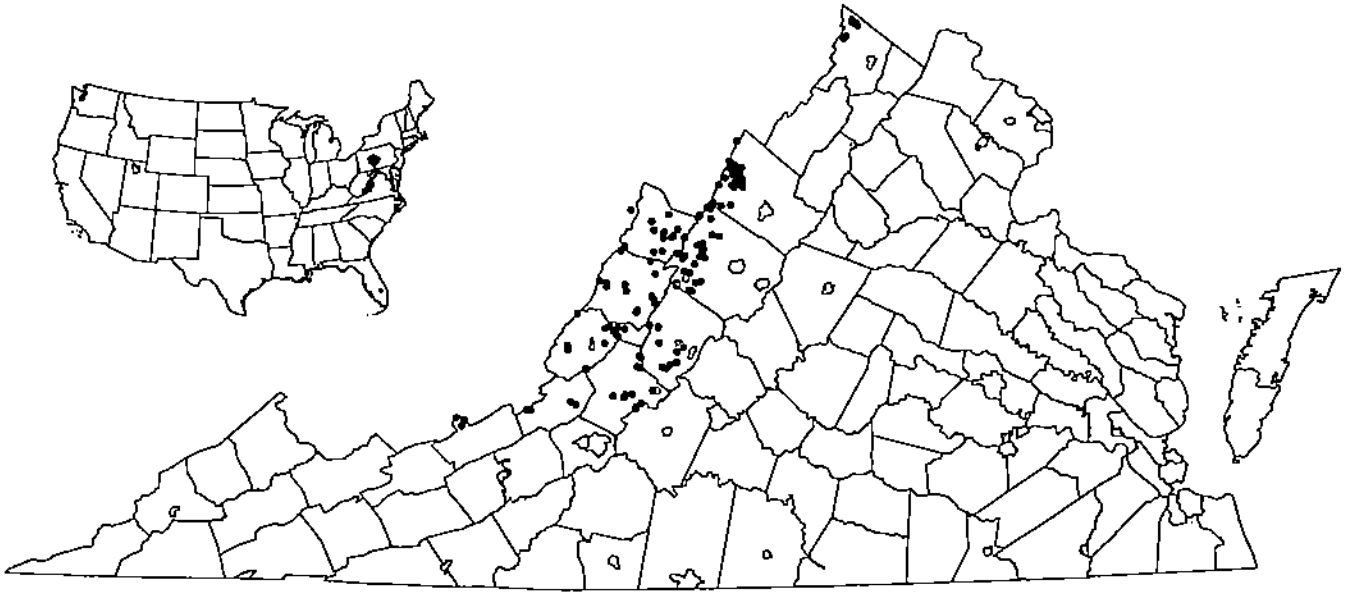
***Plethodon cylindraceus* (Harlan) - White-spotted Slimy Salamander**

This is another member of the slimy salamander complex formally recognized as a full species by Highton *et al.* (1989). It is the most widespread of the slimy salamanders in Virginia. Lower Coastal Plain counties north of the James River could yield new records.



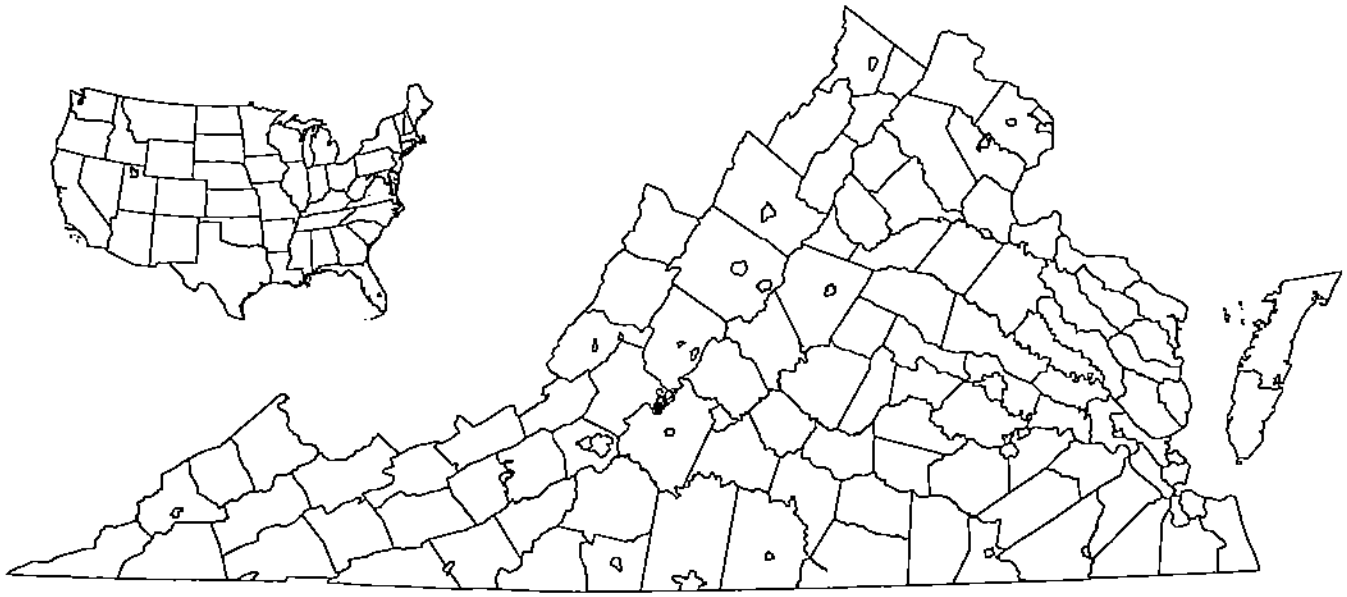
***Plethodon glutinosus* (Green) - Northern Slimy Salamander**

Of the 16 species in the slimy salamander complex (Highton *et al.*, 1989), this one has the largest range. In Virginia, however, it is limited to western and southwestern counties in the Ridge and Valley physiographic province where it overlaps extensively with *P. kentucki*.



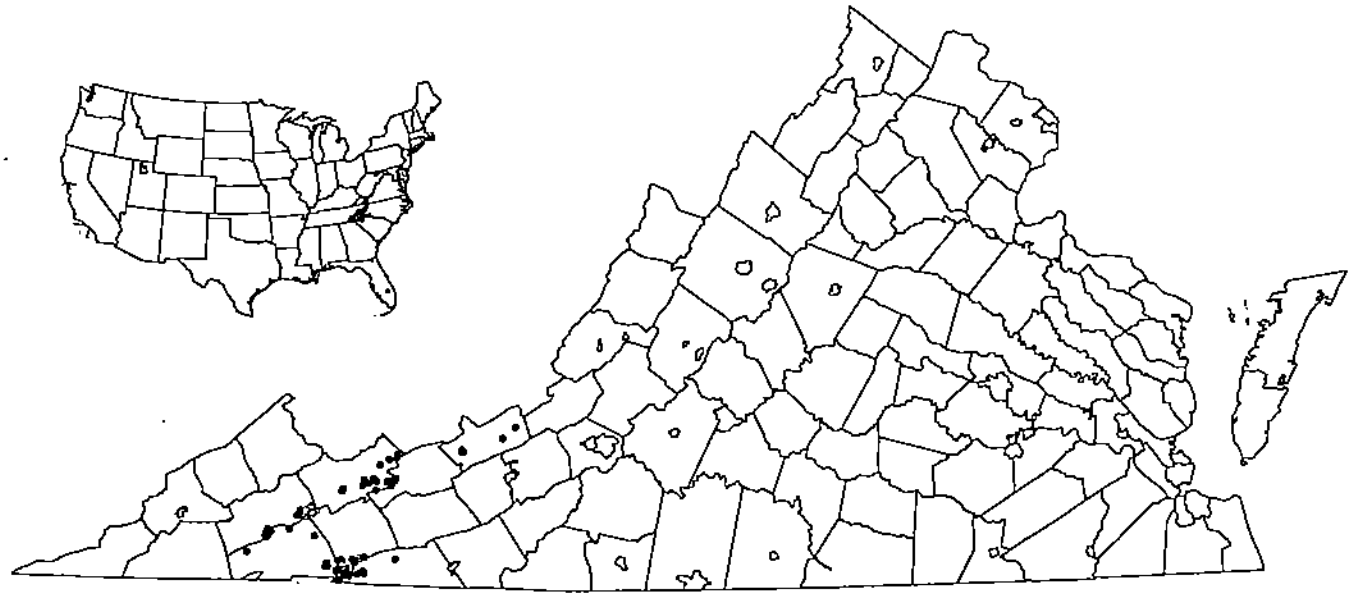
***Plethodon hoffmani* Highton - Valley and Ridge Salamander**

The type locality for this small Appalachian forest salamander is near Clifton Forge, Alleghany County, where specimens were first collected by R.L. Hoffman. It occurs north of the New River in the Ridge and Valley and extends into the Blue Ridge Mountains in Botetourt County. R. Highton (pers. comm.) believes there may be two species in this complex.



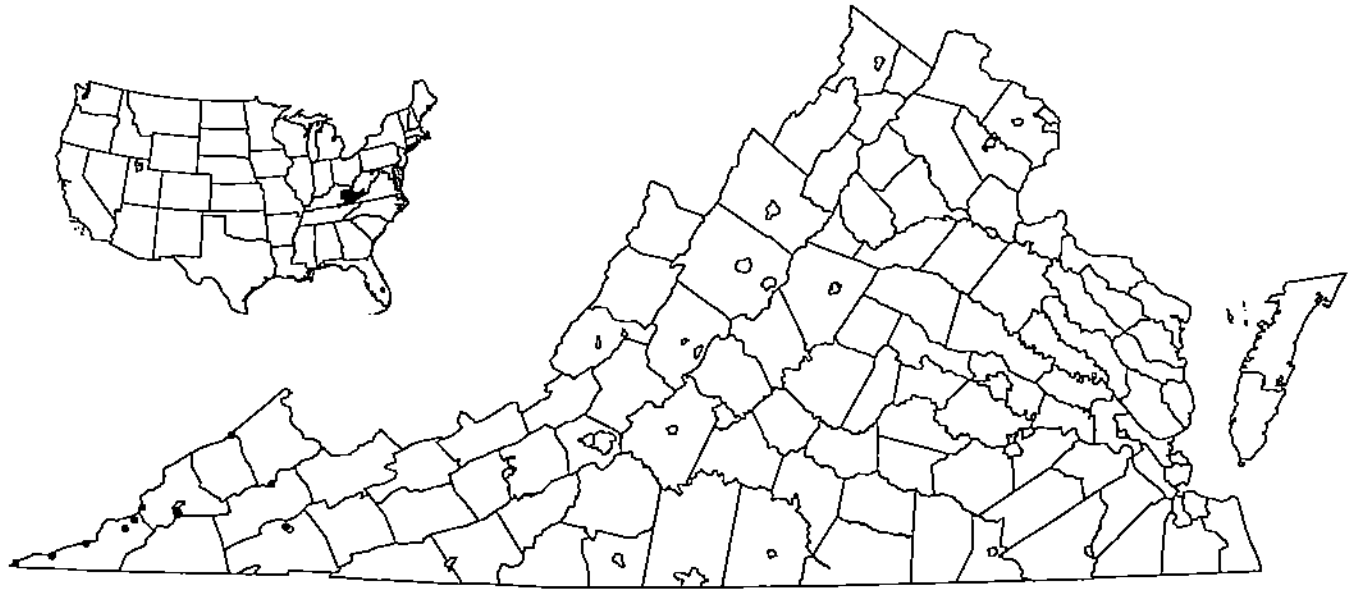
***Plethodon hubrichti* Thurow - Peaks of Otter Salamander**

The entire range of this terrestrial plethodontid is limited to a small portion of the Blue Ridge Mountains in Bedford and Botetourt counties. Populations are severely impacted by complete removal of forest cover but can exist with less intensive timbering techniques (Mitchell *et al.*, 1996; Sattler and Reichenbach, 1998). The exact elevational limits of this Virginia endemic have not been clarified.



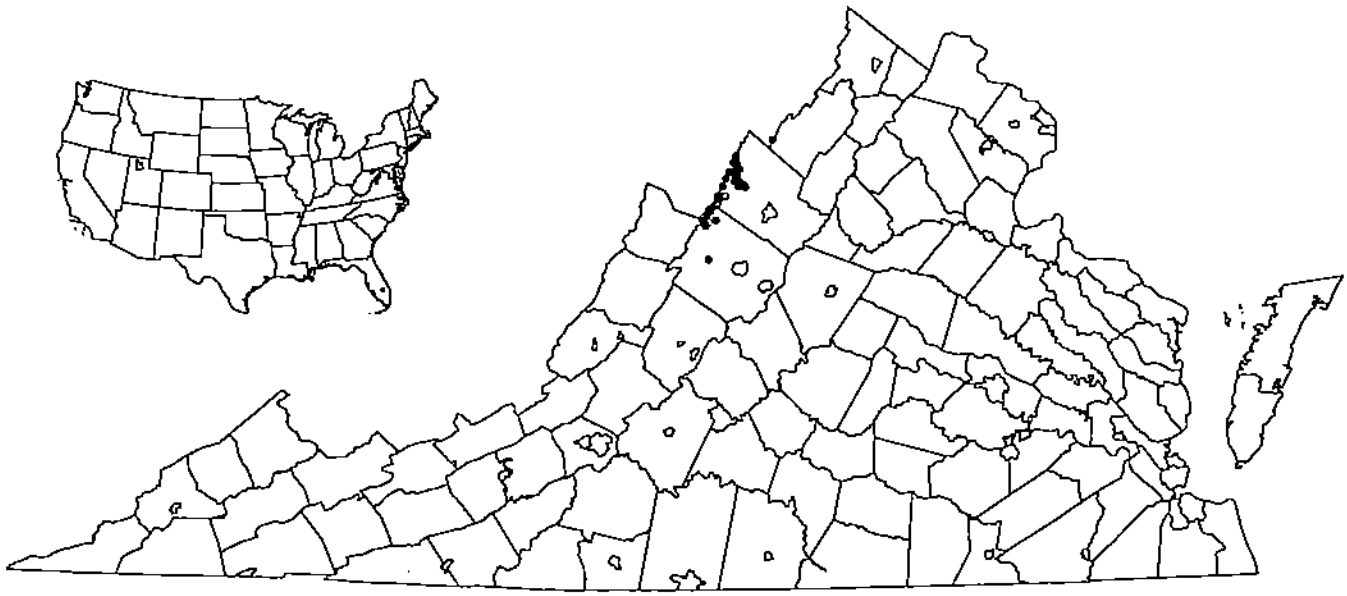
***Plethodon jordani* Blatchley - Jordan's Salamander**

Jordan's salamanders inhabit hardwood forests in parts of southwestern Virginia. The population at Mountain Lake north of the New River in Giles County may have been introduced via transplantation of animals from the Mt. Rogers area (Hoffman, 1967). R. Highton (pers. comm.) is currently working on the systematic relationships of the *jordani* complex .



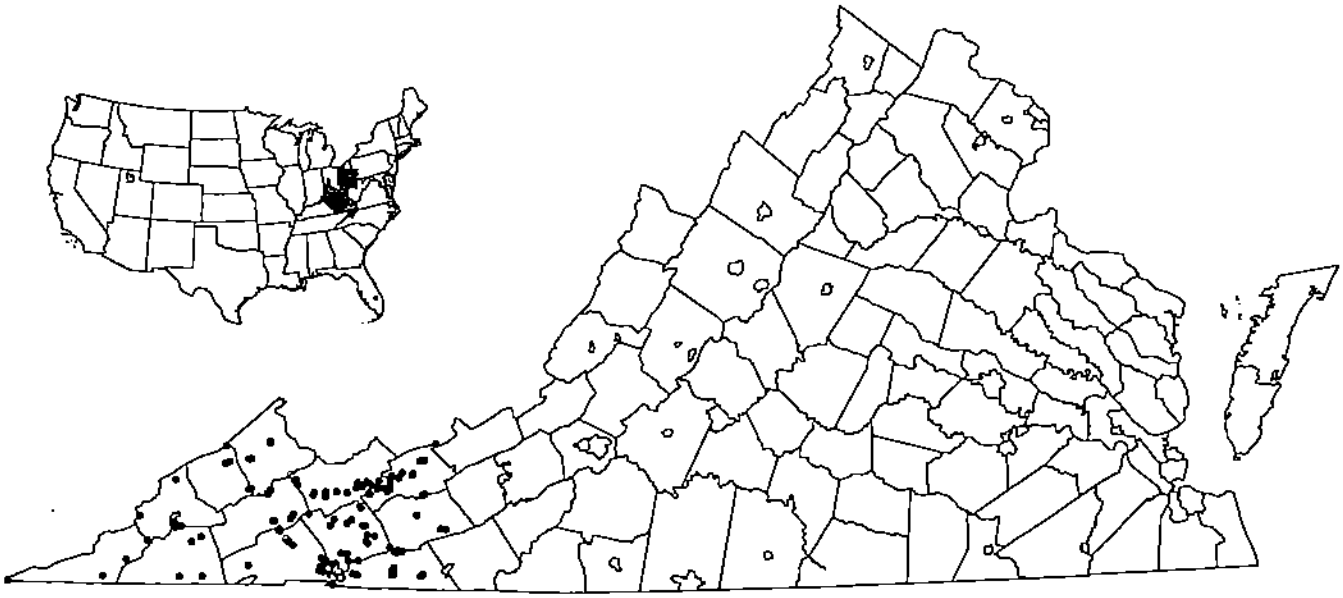
***Plethodon kentucki* Mittleman - Cumberland Plateau Salamander**

Mittleman (1951) first described this terrestrial species but other authors thought it was not distinguishable from *P. glutinosus*. Highton and MacGregor (1983) resurrected the name and the species based on genetic data. Its eastern distribution in southwestern Virginia needs refinement; Hayter's Gap in Washington County is the easternmost known locality.



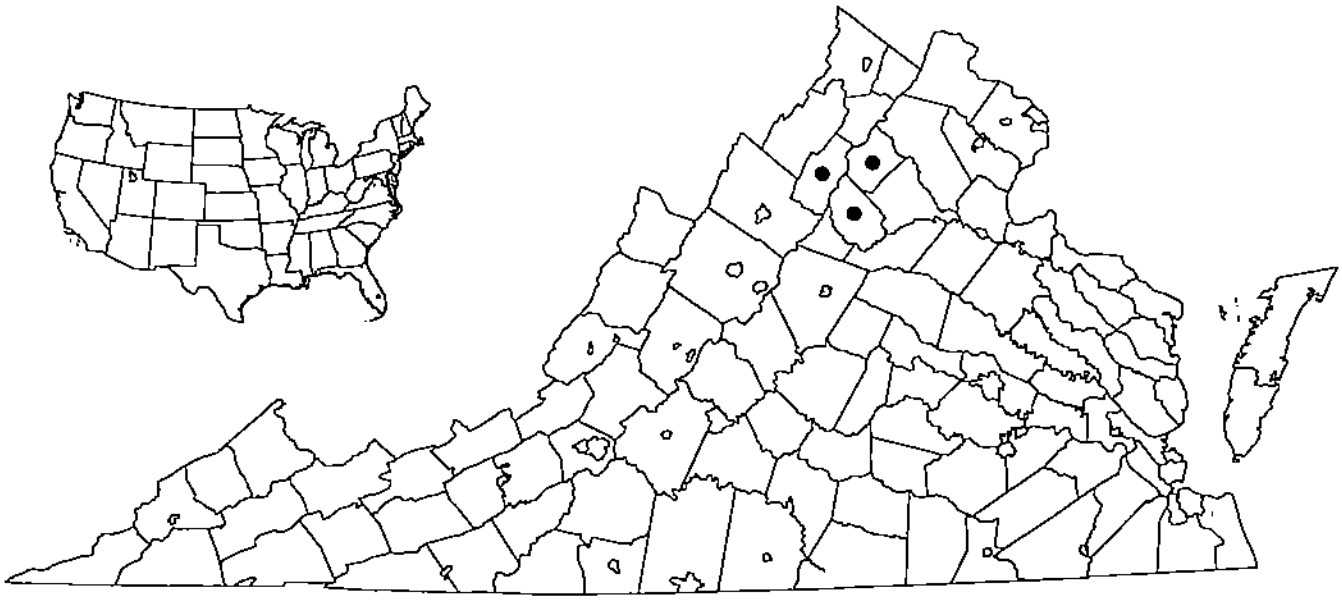
***Plethodon punctatus* Highton - Cow Knob Salamander**

Most of the range of this salamander is on Shenandoah Mountain in Rockingham County, Virginia, and Pendleton County, West Virginia (Green and Pauley, 1987; Highton, 1988b). It is a species of special concern (Virginia regulation section *4 VAC 15-20-130*). Much of its range has been protected by a special biological area in the George Washington National Forest (Mitchell, 1994b).



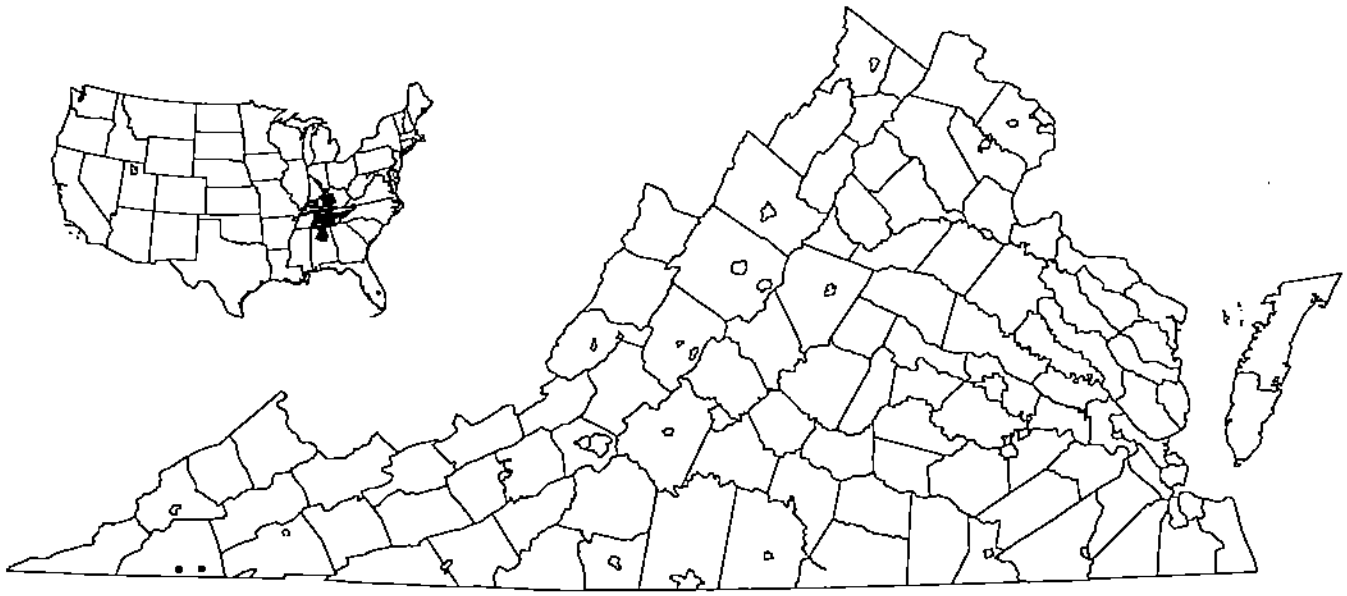
***Plethodon richmondi* Netting and Mittleman - Ravine Salamander**

Populations of this terrestrial salamander occur south of the New River in southwestern Virginia, in the Appalachian Plateau, and in portions of the southern Blue Ridge Mountains. Its distribution in Virginia is well defined. Additional effort is not likely to yield important new records.



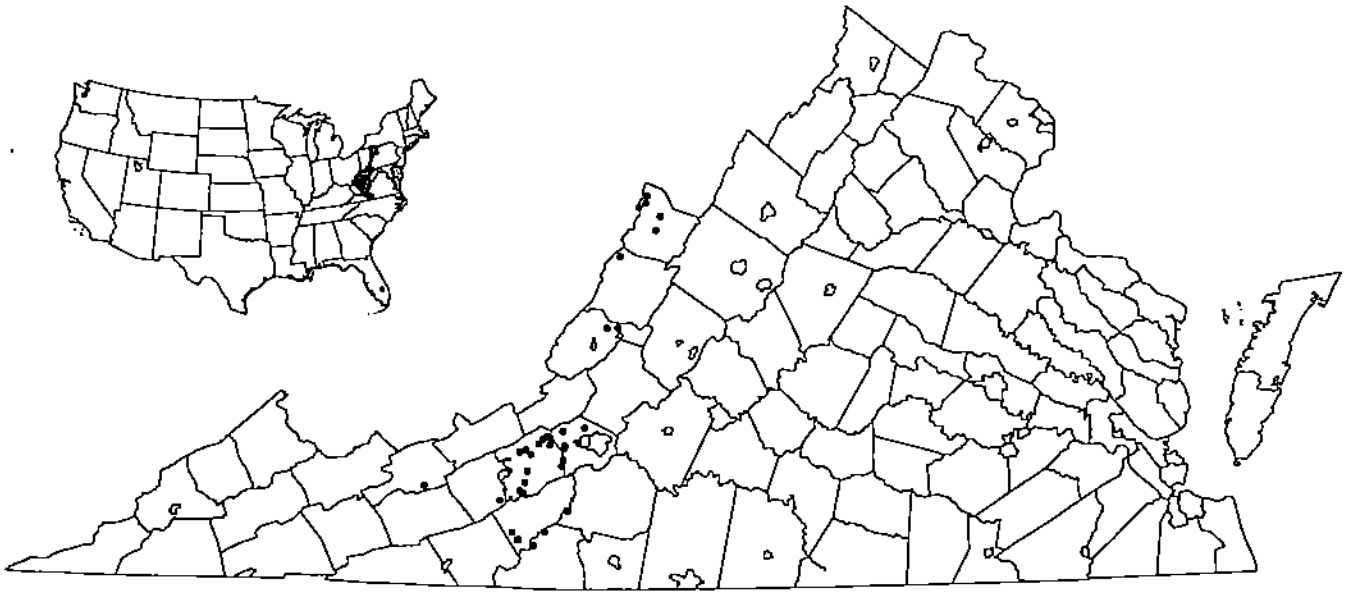
***Plethodon shenandoah* Highton and Worthington - Shenandoah Salamander**

This species is limited to small areas on three mountain slopes in Shenandoah National Park (Highton, 1988a) and is listed as Endangered under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*). Its sympatric congener, *Plethodon cinereus*, is a superior competitor and keeps *P. shenandoah* confined to talus slopes (Jaeger, 1970, 1971, 1980; Griffis and Jaeger, 1998).



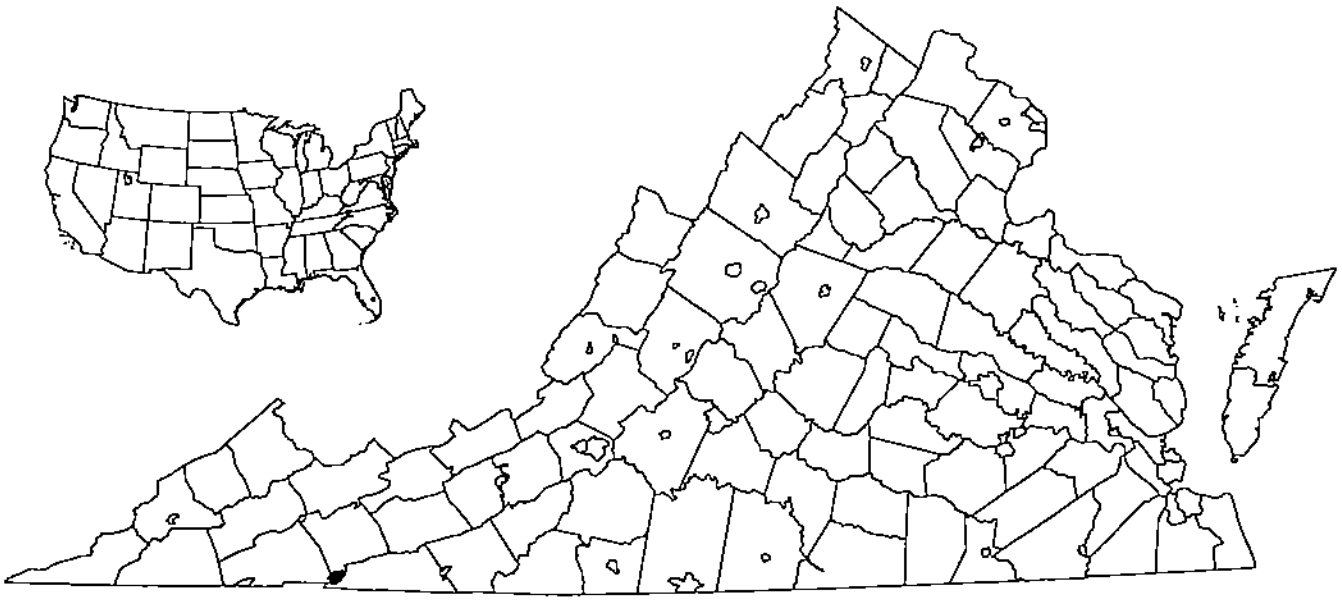
***Plethodon ventralis* Highton - Southern Zigzag Salamander**

Highton (1997) recently described eastern populations of the former *P. dorsalis* as a new species. Only Highton has found this species in Virginia in the three known localities. Its ecology and conservation status are unknown (Mitchell, 1991). Additional work on its distribution in the state is needed.



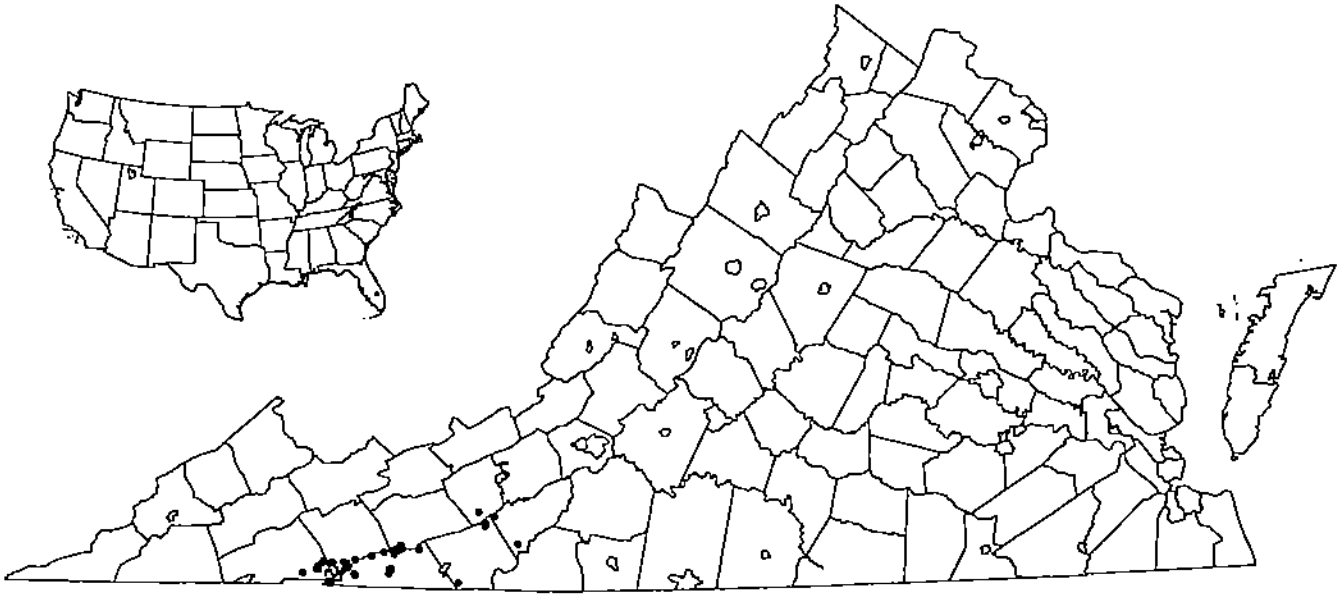
***Plethodon wehrlei* Fowler and Dunn - Wehrle's Salamander**

This salamander occurs in Virginia from the Blue Ridge Escarpment at Floyd County northward through Highland County. A single, apparently isolated, population occurs at Burkes Garden in Tazewell County. Additional surveying is needed to determine if the apparent disjunct populations between Floyd and Highland counties represent the true range in Virginia.



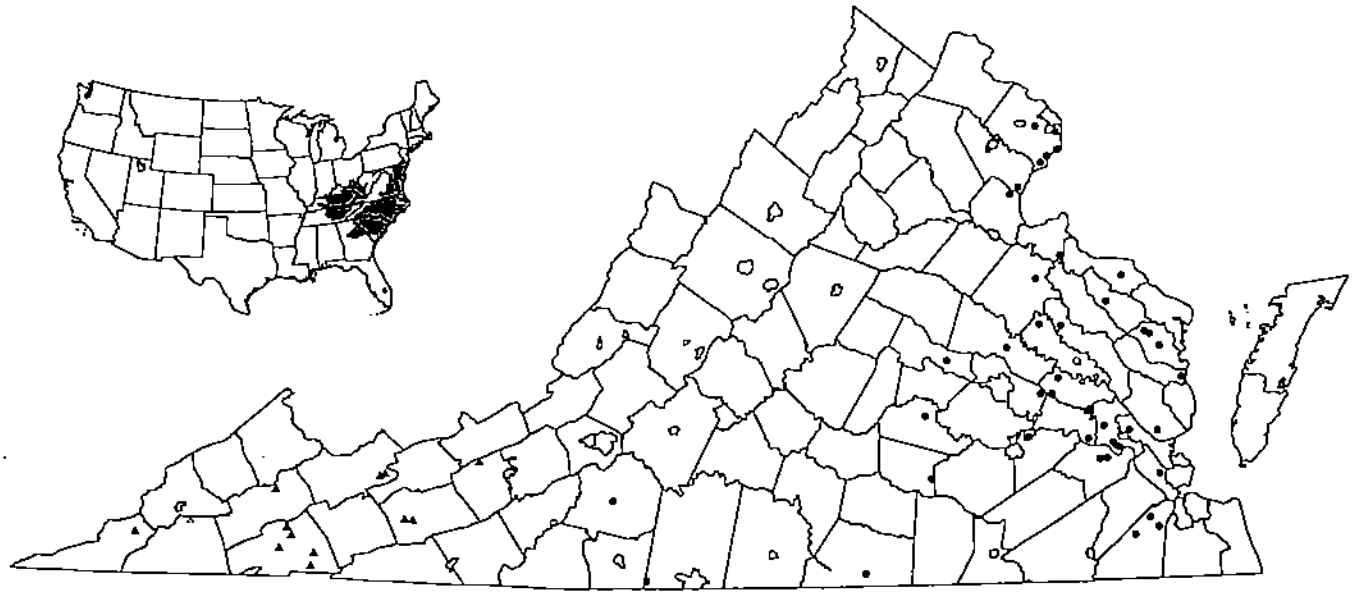
***Plethodon welleri* Walker - Weller's Salamander**

This terrestrial salamander was known from only the vicinity of Mt. Rogers and Whitetop mountains until R. Highton found a population at Hayter's Gap. This high elevation species is associated with declining spruce forests in the Appalachians. It is a species of special concern (Virginia regulation section *4 VAC 15-20-130*).



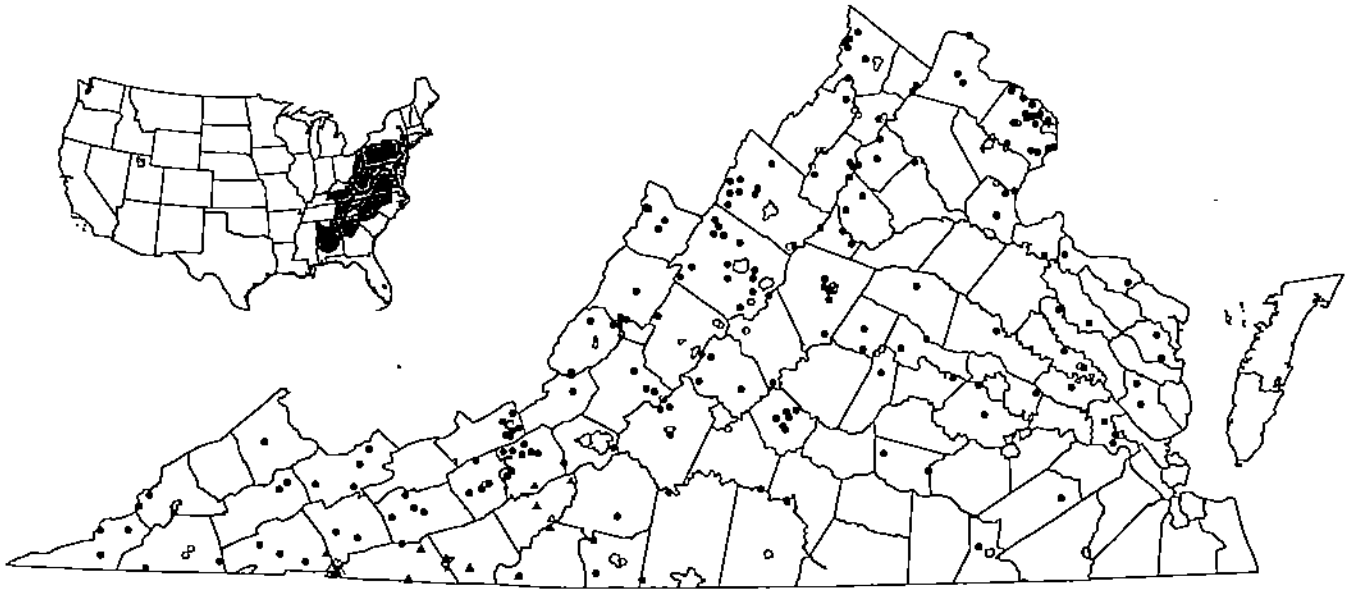
***Plethodon yonahlossee* Dunn - Yonahlossee Salamander**

This handsome salamander occurs in Virginia in the southern Blue Ridge Mountains and reaches its northern range limit in Floyd and southern Pulaski counties. Its optimal habitat is high elevation, mature hardwood forests. Hoffman (1992) reviewed the distribution of this species.



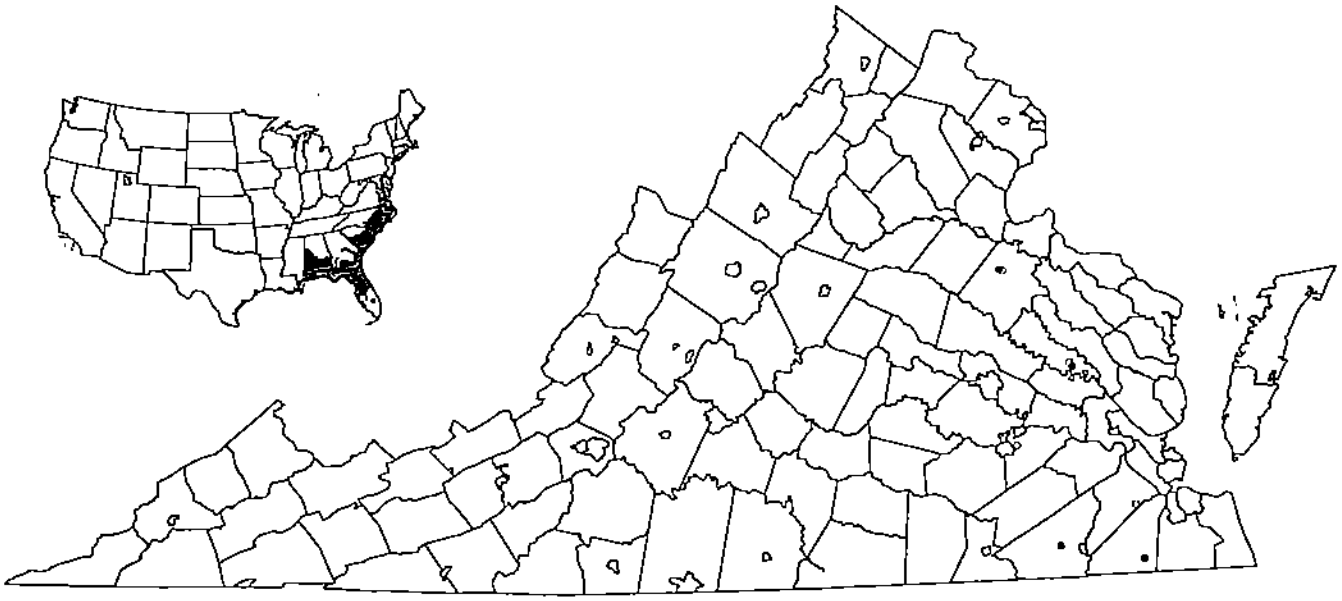
***Pseudotriton montanus* Baird - Mud Salamander**

Two recognized subspecies occur in Virginia: *P. m. diastictus* Bishop, midland mud salamander (▲), and *P. m. montanus* Baird, eastern mud salamander (•). The former occurs west of the New River and the latter occurs in the southern Blue Ridge Mountains and eastward. The range of this species in the Commonwealth needs clarification.



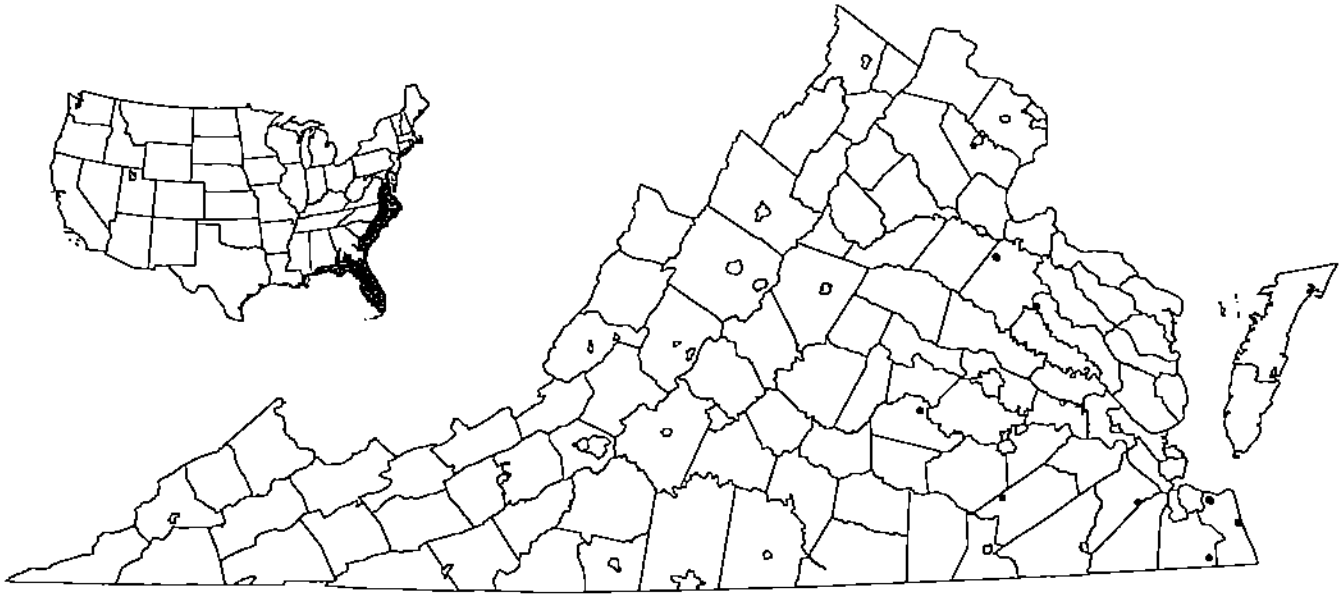
***Pseudotriton ruber* (Latreille) - Red Salamander**

Two recognized subspecies occur in Virginia: *P. r. nitidus* Dunn, Blue Ridge red salamander (▲), and *P. r. ruber* (Latreille), northern red salamander (•). The former is limited to the three counties in the southern Blue Ridge Mountains and the latter is otherwise statewide in distribution, except in southeastern Virginia and the Eastern Shore.



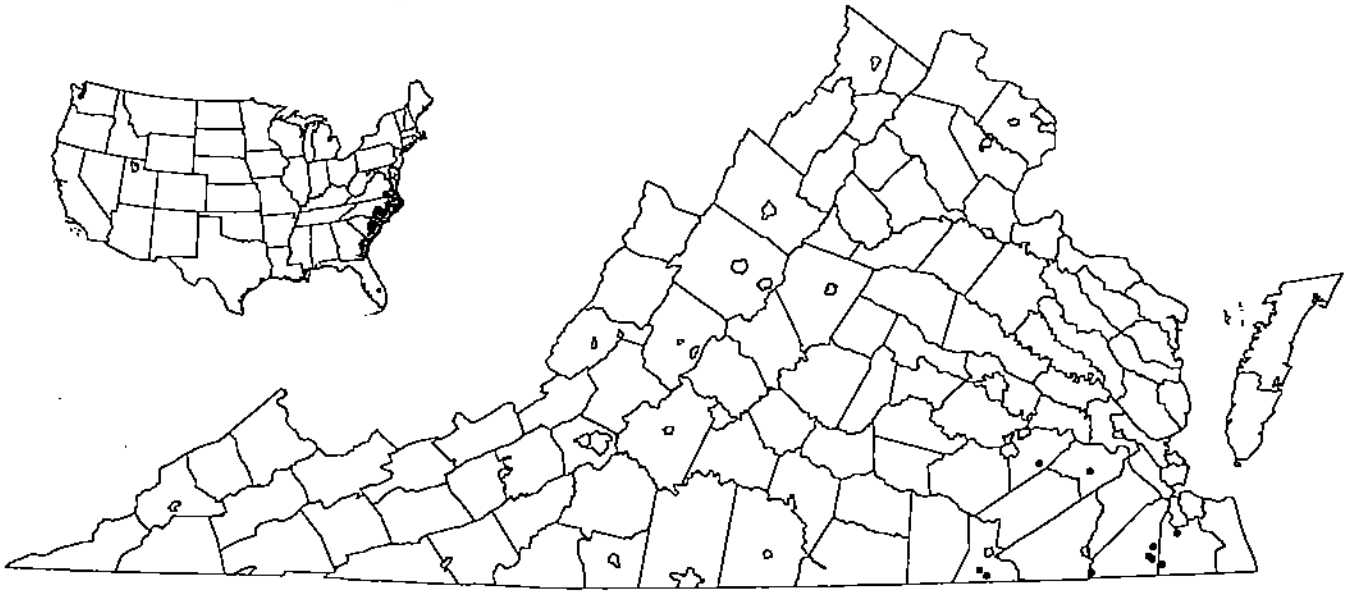
***Siren intermedia intermedia* Barnes - Eastern Lesser Siren**

This aquatic species was first discovered in Virginia west of the Dismal Swamp in Suffolk by Padgett and Lane (1986), and the northernmost locality in its range was subsequently extended into Caroline County (Roble, 1995). Its conservation status is undetermined (Mitchell, 1991).



***Siren lacertina* Linnaeus - Greater Siren**

Known populations of this large, aquatic salamander are few and widely scattered. Most are limited to the Coastal Plain. A possible locality in Amelia County parallels an old record for the eastern mud snake (*Farancia abacura*), but it needs verification. Its conservation status is undetermined (Mitchell, 1991).

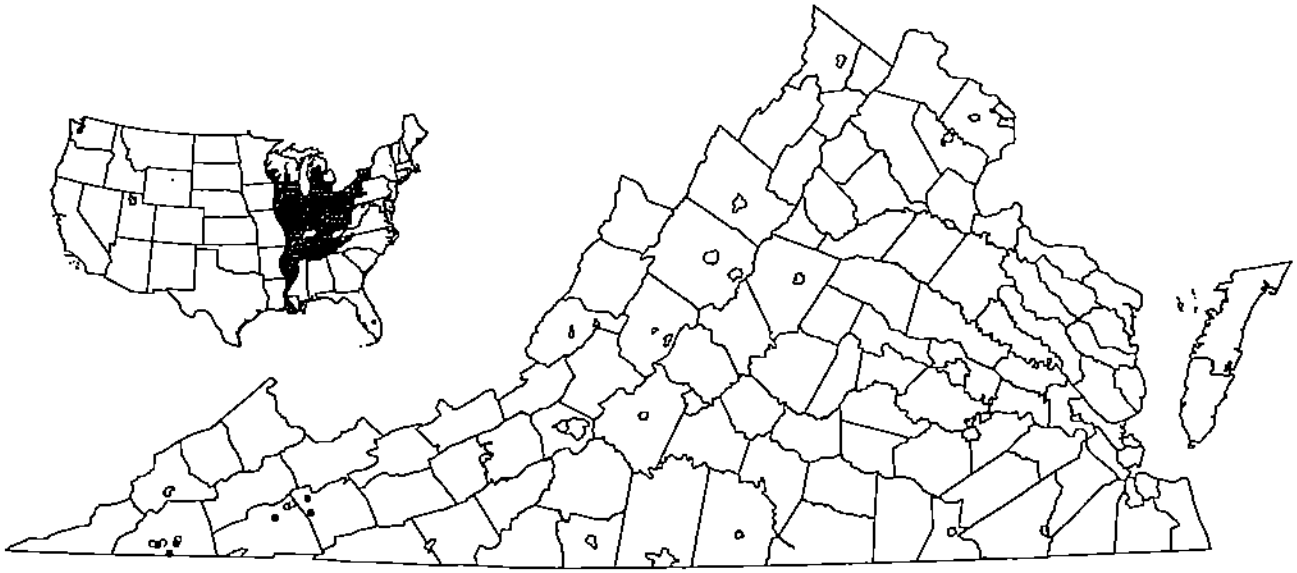


***Stereochilus marginatus* (Hallowell) - Many-lined Salamander**

This salamander appears to be limited to swamp habitats in southeastern Virginia. Little is known of its biology in the Commonwealth (Wood and deRageot, 1963). Its conservation status is undetermined (Mitchell, 1991). Additional surveying is needed to more precisely define the northern portion of its range.

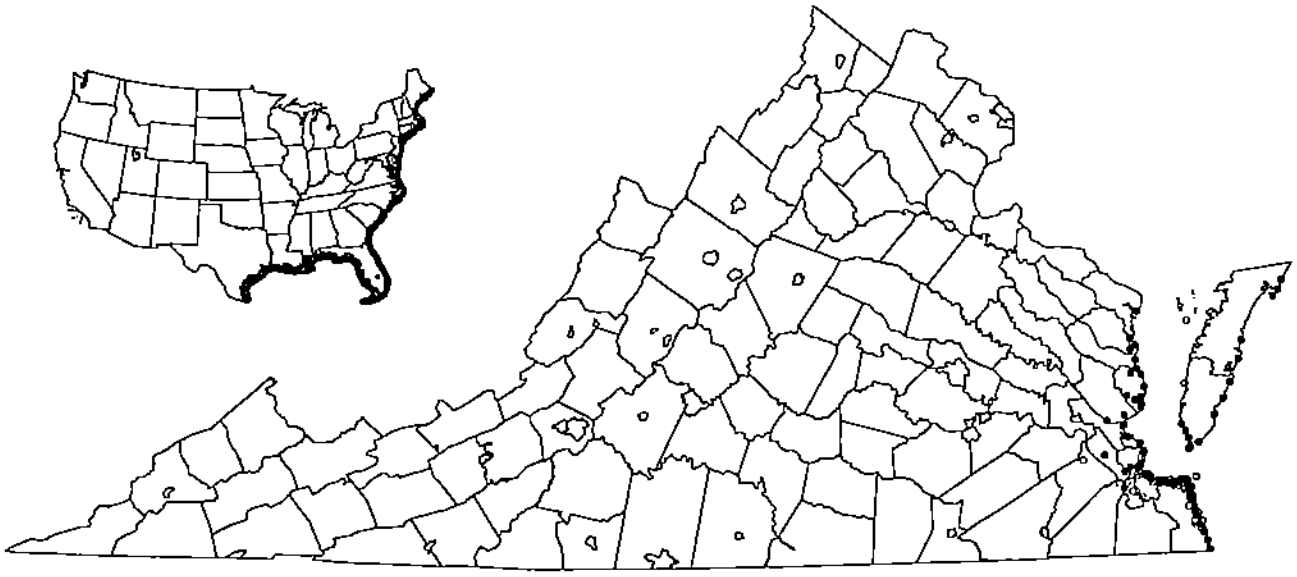
REPTILES

TURTLES



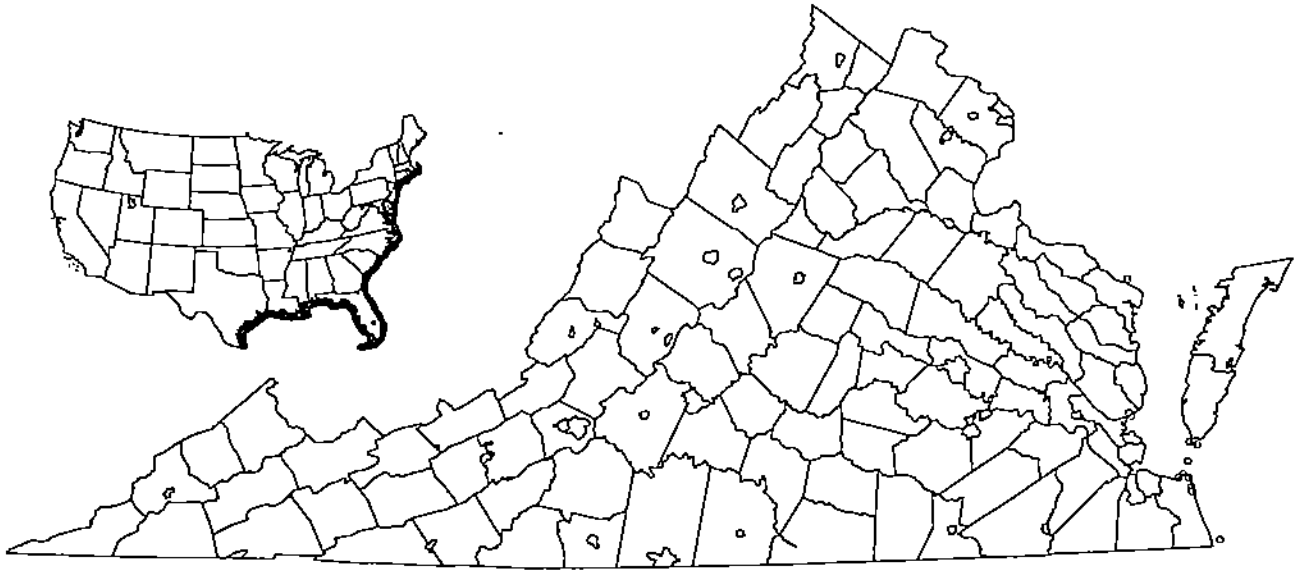
***Apalone spinifera spinifera* (LeSueur) - Eastern Spiny Softshell**

All known localities of this highly aquatic turtle occur in Tennessee River tributaries in Scott, Washington, and Smyth counties. Its conservation status in Virginia is undetermined (Mitchell, 1991) and little is known about its biology in this part of the range.



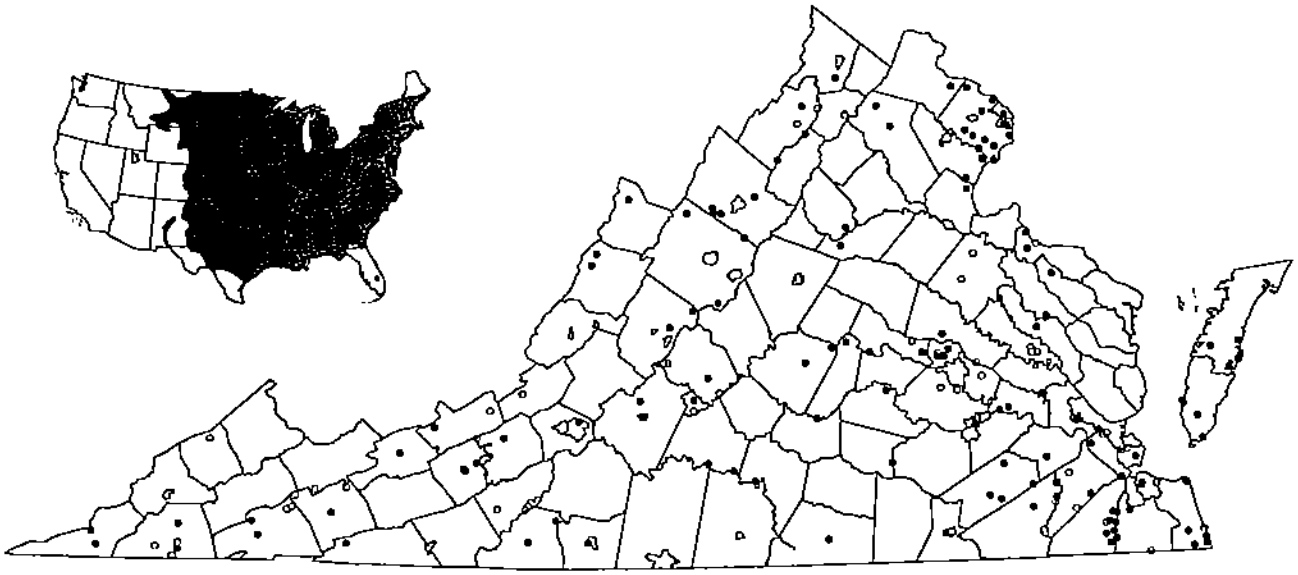
***Caretta caretta* (Linnaeus) - Loggerhead**

Loggerheads are seasonal users of the Chesapeake Bay (Lutcavage and Musick, 1985; Keinath *et al.*, 1987). They also occur along the Virginia barrier islands. Many of the records illustrated along the shoreline represent strandings of dead turtles. This species is listed as Threatened under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*).



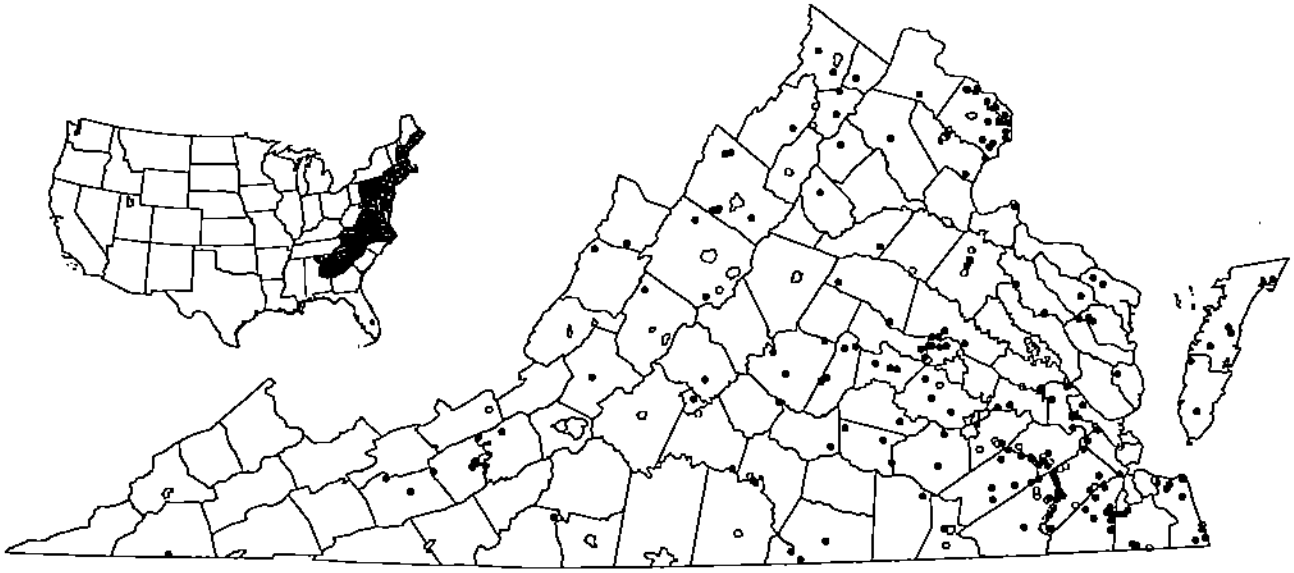
***Chelonia mydas* (Linnaeus) - Green Turtle**

Juveniles of this primarily tropical sea turtle occasionally enter the Chesapeake Bay in summer to forage (Keinath *et al.*, 1987; Musick, 1988). Several have been found in the lower Bay and on the Eastern Shore (Keinath and Musick, 1991b). This species is listed as Endangered under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*).



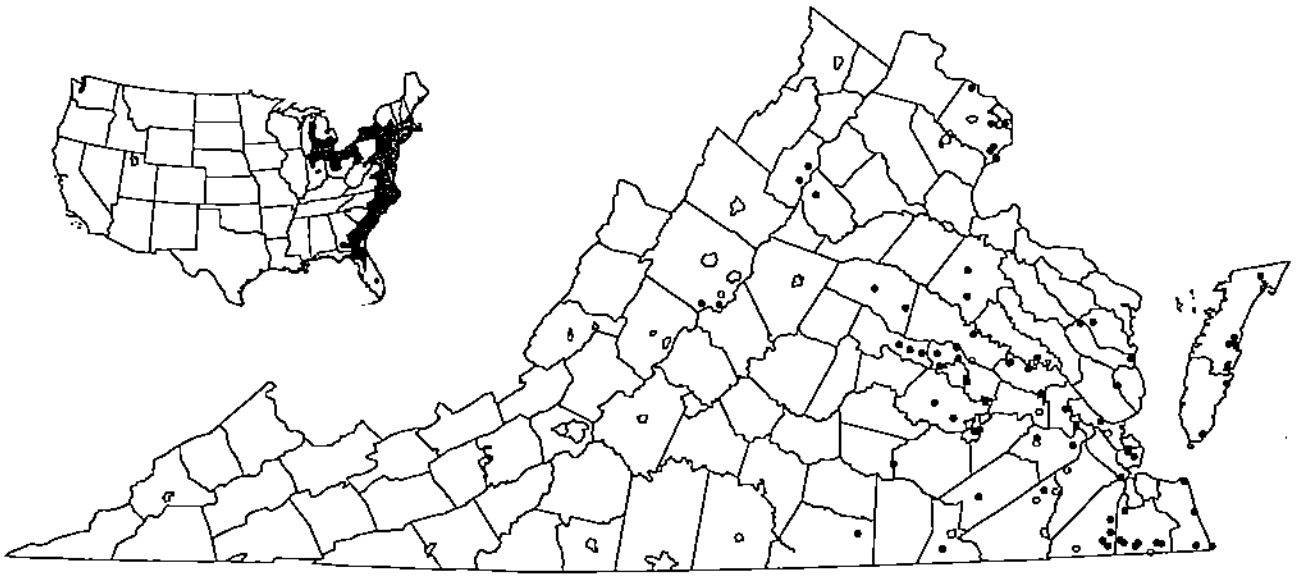
***Chelydra serpentina serpentina* (Linnaeus) - Eastern Snapping Turtle**

The largest freshwater turtle in Virginia occurs statewide, including several of the barrier islands (Conant *et al.*, 1990). The lack of records in some counties is probably an artifact of surveying effort. This is the only turtle that may be harvested, within limits, for personal consumption and the commercial market.



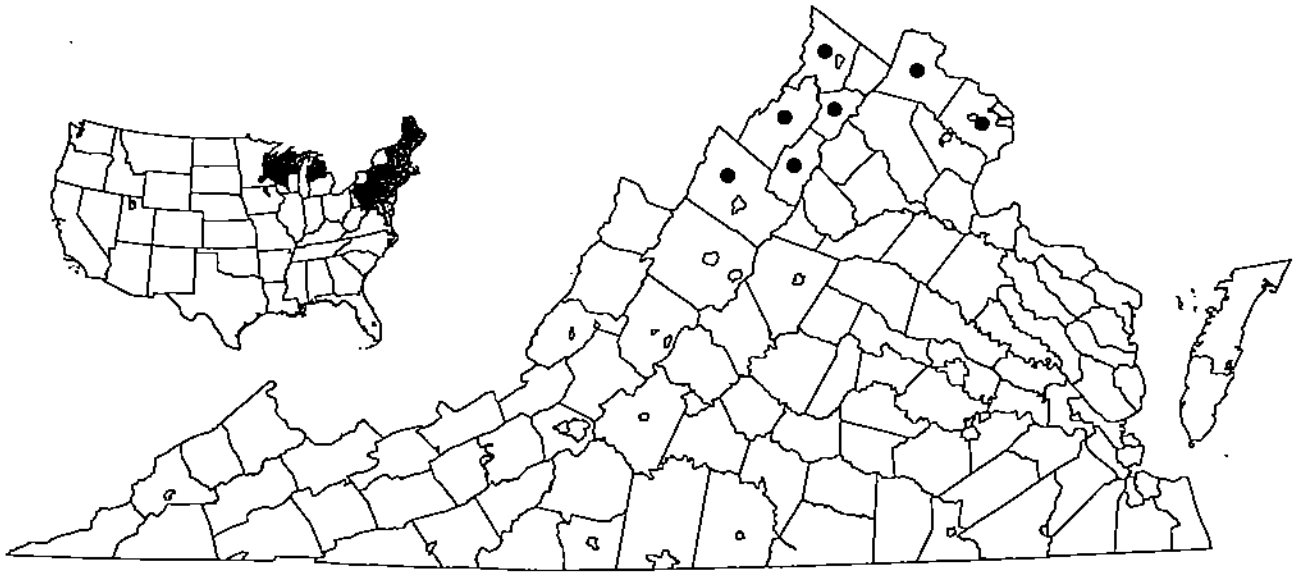
***Chrysemys picta picta* (Schneider) - Eastern Painted Turtle**

This may be the most abundant freshwater turtle in the Commonwealth. It occurs throughout much of Virginia, but is apparently rare in the Tennessee River drainage. It has not been confirmed for the southern Blue Ridge Mountains. The distribution of painted turtles in southwestern Virginia needs to be clarified.



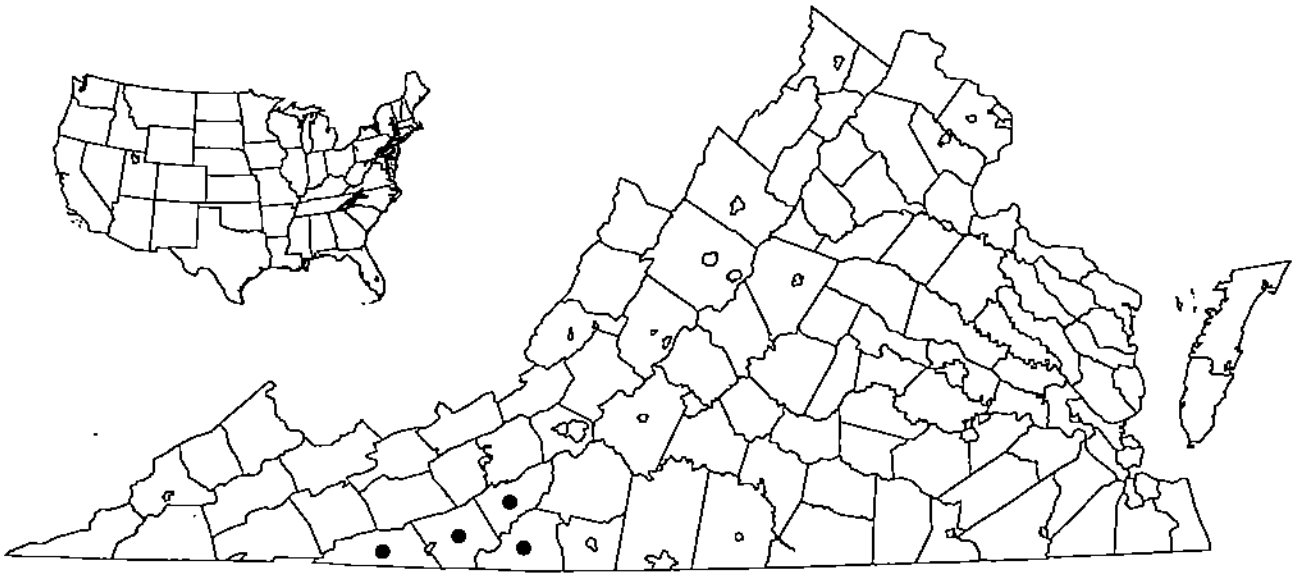
***Clemmys guttata* (Schneider) - Spotted Turtle**

Spotted turtles are closely tied to freshwater wetlands and are vulnerable to habitat loss and over-collection. They occur throughout the Coastal Plain and parts of the Piedmont and Blue Ridge Mountain physiographic provinces. The range in the Piedmont needs to be better defined.



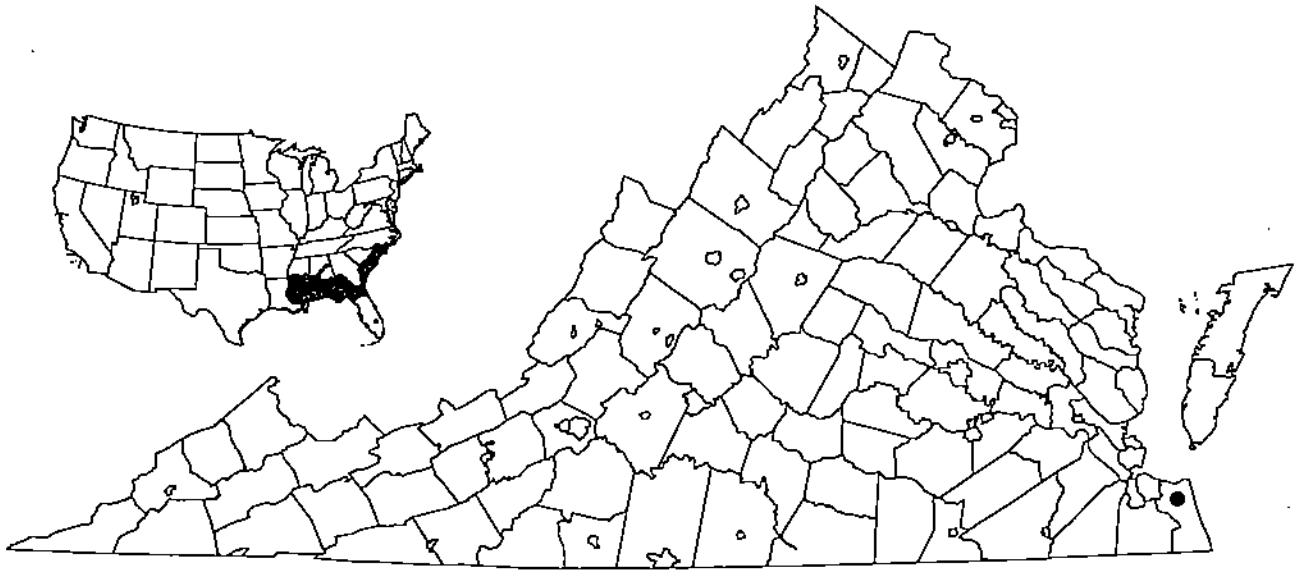
***Clemmys insculpta* (LeConte) - Wood Turtle**

The southern margin of the range of this species extends into northern Virginia. Populations have been documented from Fairfax County to Rockingham County (Buhlmann and Mitchell, 1989; Mitchell, 1994a). It is vulnerable to habitat loss and illegal collection. This is a Threatened species in Virginia (Virginia regulation section *4 VAC 15-360-60*).



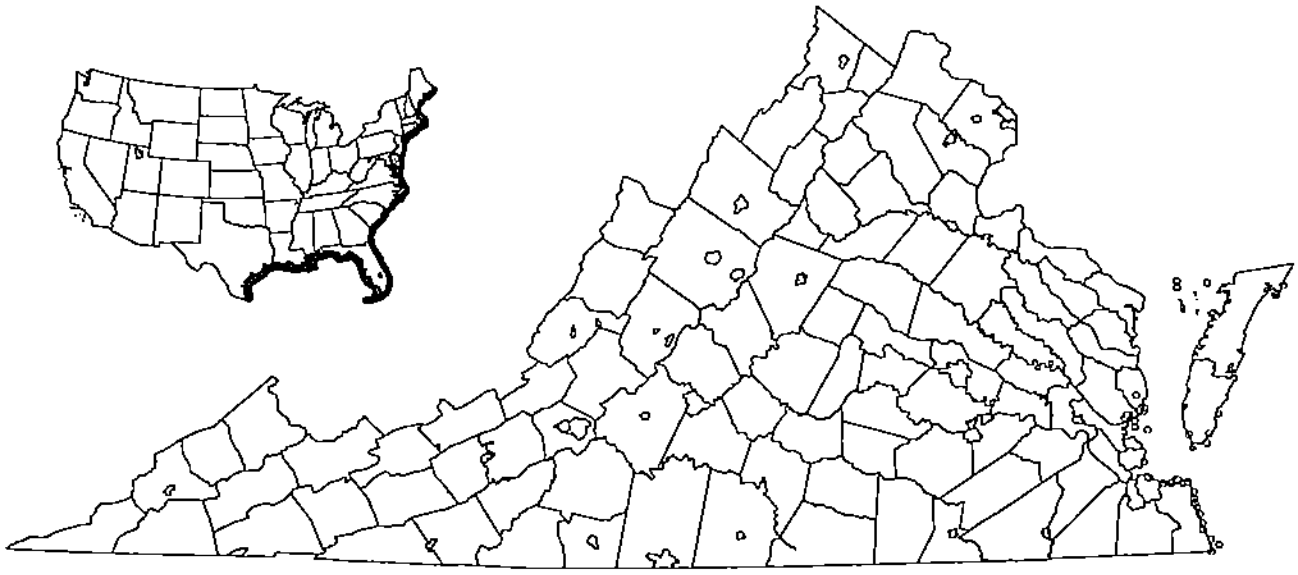
***Clemmys muhlenbergii* (Schoepff) - Bog Turtle**

This wetland-dependent species occurs in Virginia only in the southern Blue Ridge Mountains. It is listed as Endangered in Virginia (Virginia regulation section *4 VAC 15-360-60*) and Threatened by Similarity of Appearance under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*). Both laws prohibit collection for private and commercial use.



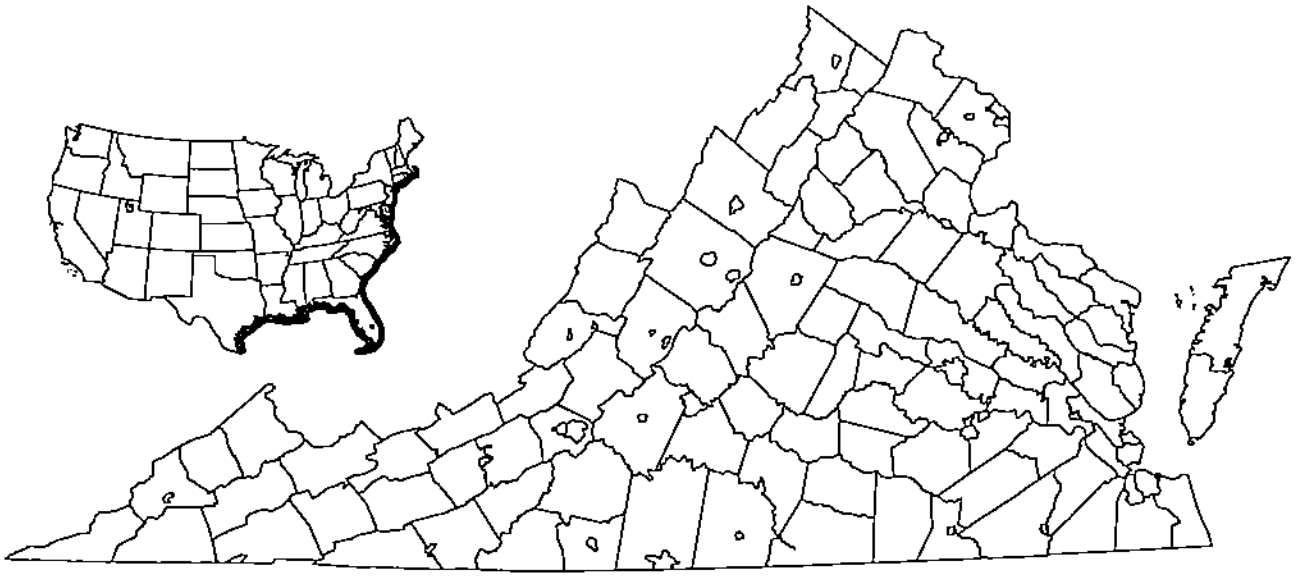
***Deirochelys reticularia reticularia* (Latreille) - Eastern Chicken Turtle**

A single, small population of this species has been confirmed in Virginia at the northern edge of the City of Virginia Beach (Mitchell, 1994a; Buhlmann, 1995). This is a relic population and in danger of extinction. Chicken turtles are listed as Endangered in Virginia (Virginia regulation section *4 VAC 15-360-60*).



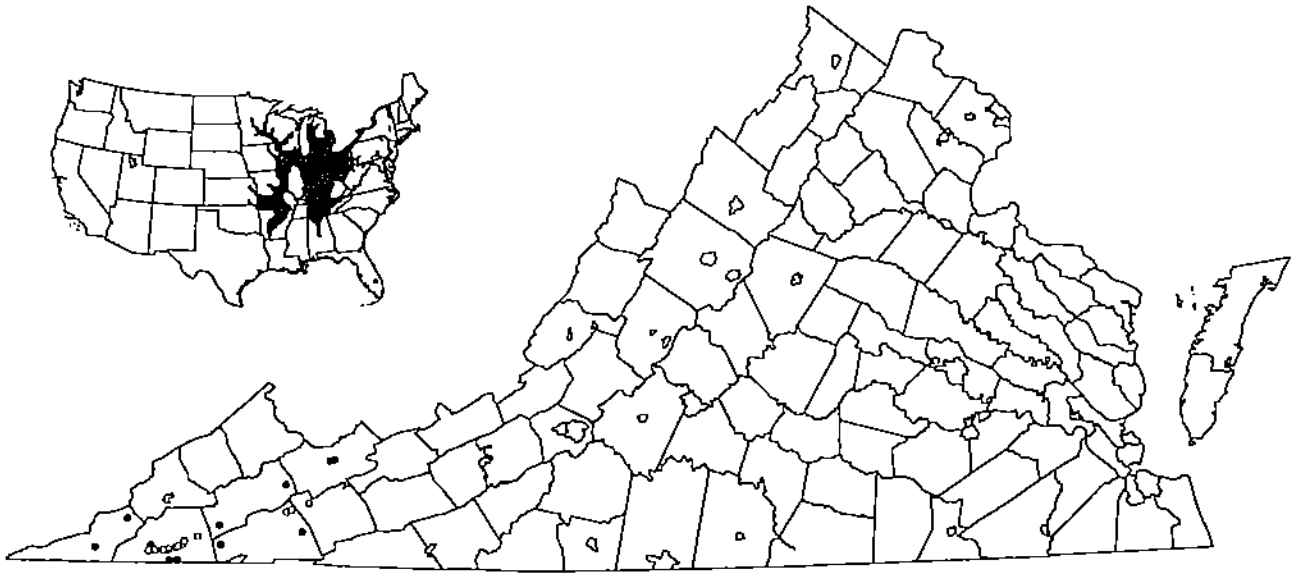
***Dermochelys coriacea* (Vandelli) - Leatherback**

The largest sea turtle in the world is observed routinely during the spring and summer months in the mouth of the Chesapeake Bay where they presumably feed on jellyfish (Keinath *et al.*, 1987; Musick, 1988). Several have been found in the Bay and along the Atlantic side of the barrier islands (Keinath and Musick, 1991e). The species is listed as Endangered under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*).



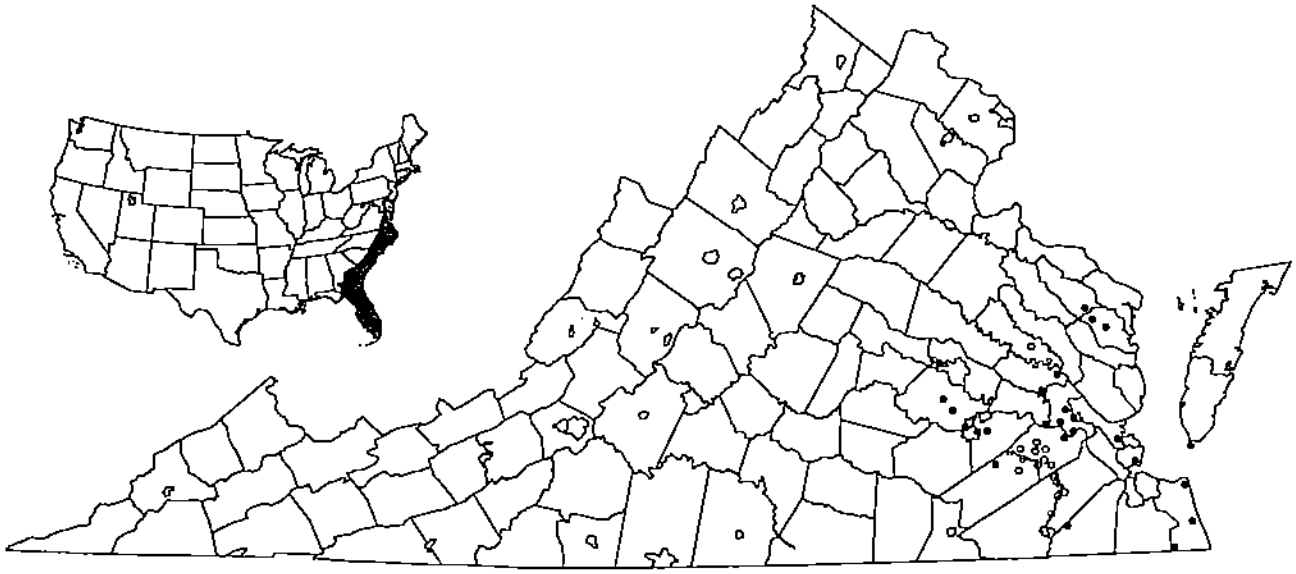
***Eretmochelys imbricata imbricata* (Linnaeus) - Atlantic Hawksbill**

The first live hawksbill in Virginia was discovered at the southern end of the Chesapeake Bay at the mouth of the James River in November 1990 (Keinath *et al.*, 1991; Keinath and Musick, 1991c). It was a juvenile found incidentally by a local waterman. This is an Endangered species under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*).



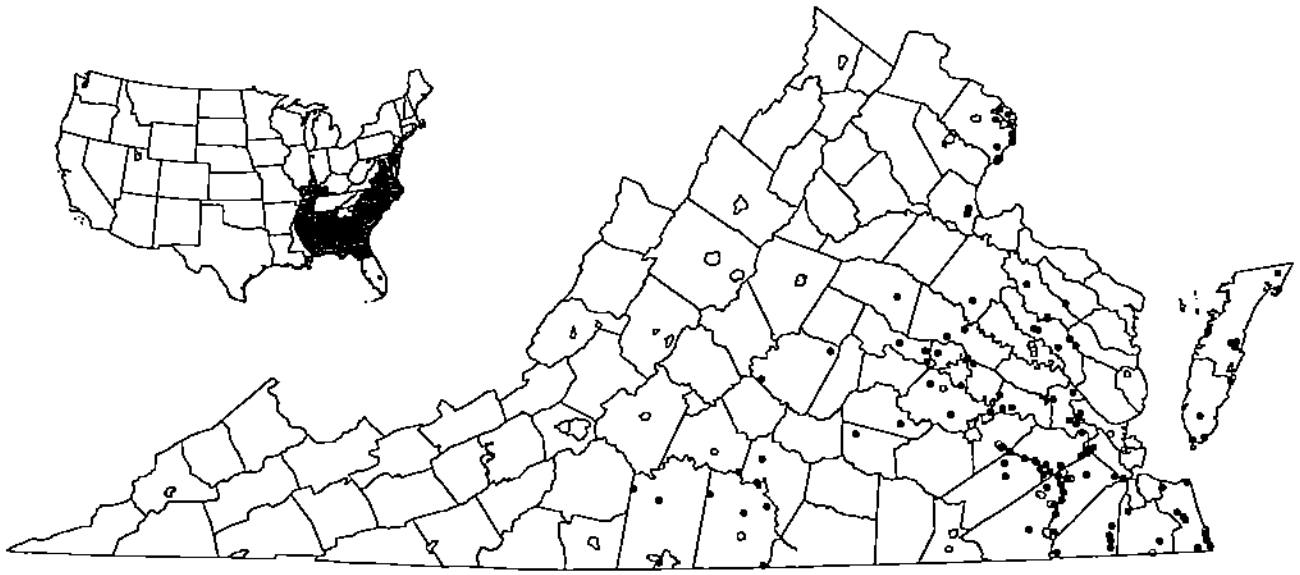
***Graptemys geographica* (LeSueur) - Northern Map Turtle**

This largely midwestern species occurs in all three major river systems of the Tennessee River drainage in southwestern Virginia. It appears to be locally common, although its population status is unknown. Additional surveying and observations are needed to better clarify the range of this species in Virginia.



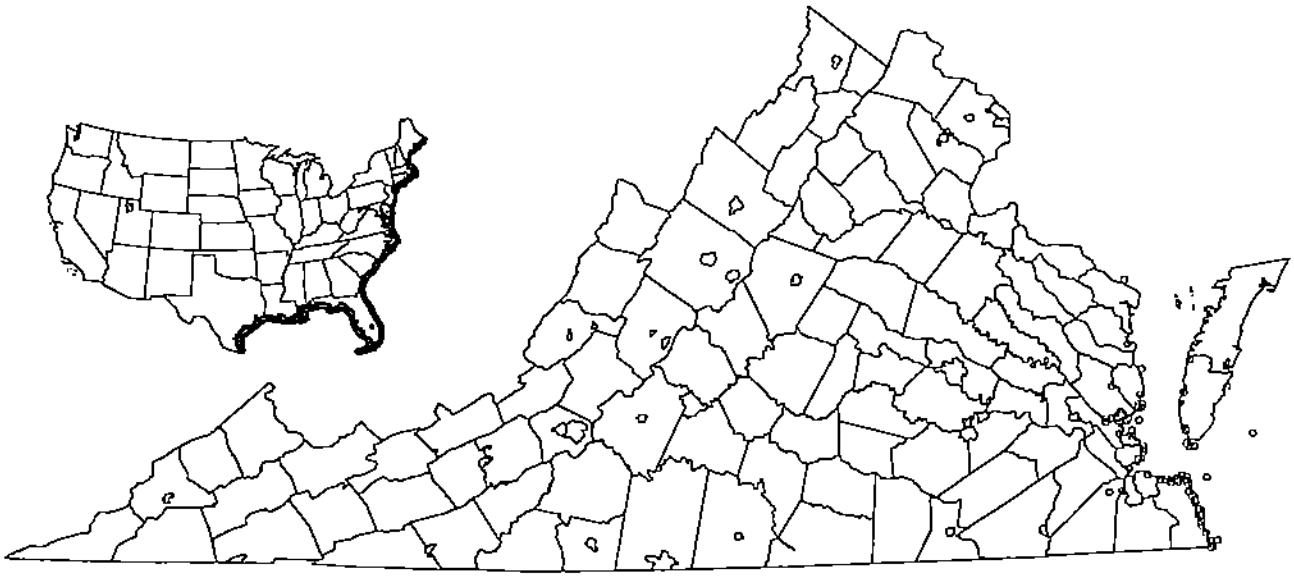
***Kinosternon baurii* (Garman) - Striped Mud Turtle**

Lamb and Lovich (1990) determined via statistical techniques that this species occurs as far north as the Middle Peninsula in Virginia. It is difficult to distinguish from the eastern mud turtle (*K. subrubrum*); the distribution illustrated here is conservative. The systematic relationships of mud turtles need revision (Walker *et al.*, 1998; J.B. Iverson, pers. comm.)



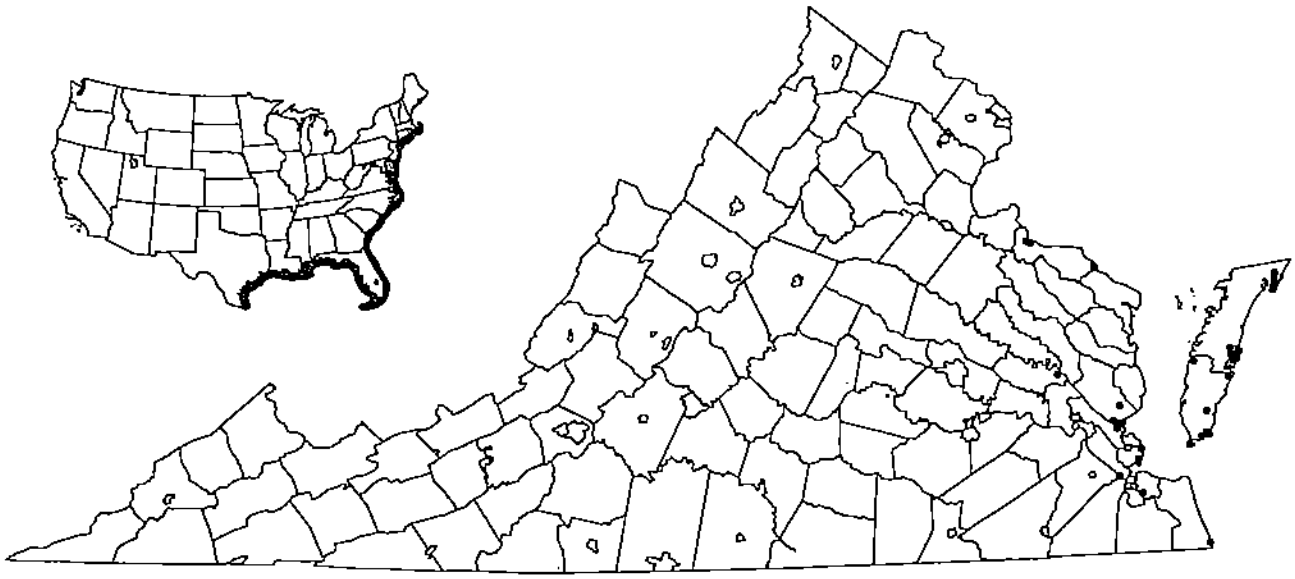
***Kinosternon subrubrum subrubrum* (Lacépède) - Eastern Mud Turtle**

This species occurs east of the Blue Ridge Mountains in Virginia, but populations in the Piedmont are apparently less widespread than in the Coastal Plain. It is tolerant of brackish water and occurs on several of the barrier islands (Conant *et al.*, 1990). Also see notes under *K. baurii*.



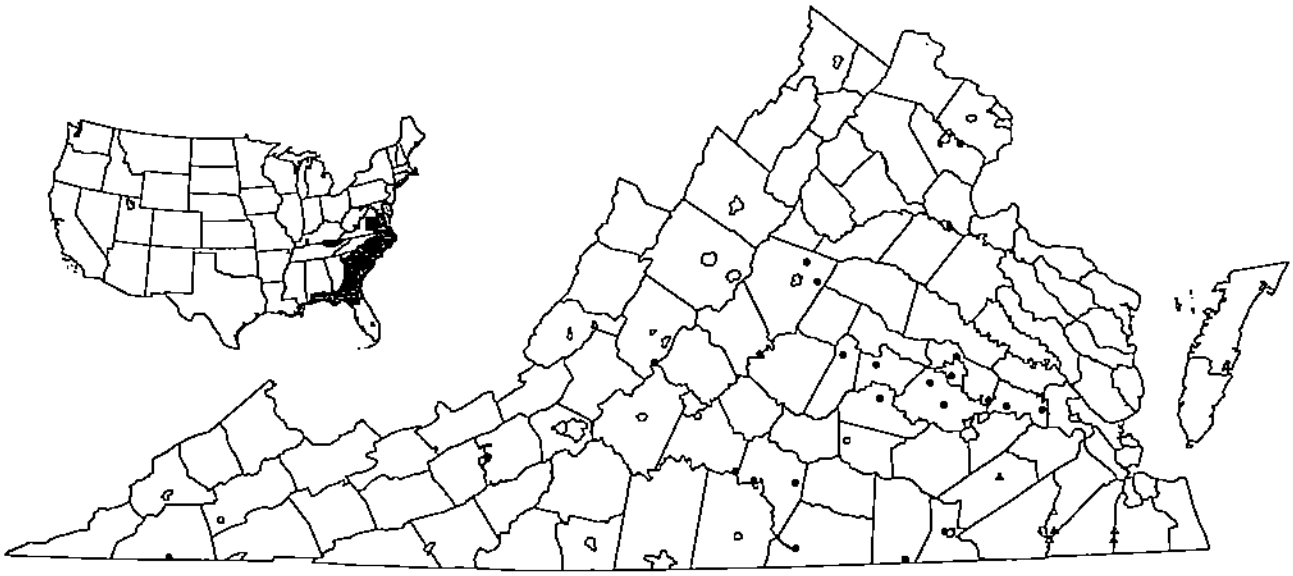
***Lepidochelys kempii* (Garman) - Kemp's Ridley**

This species is the world's most endangered sea turtle and the second most abundant species in the Chesapeake Bay in the summer (Keinath and Musick, 1991d). Most individuals in the Bay and along the Eastern Shore are juveniles (Keinath *et al.*, 1987). The species is listed as Endangered under the U.S. Endangered Species Act (Endangered Species Act *16 U.S.C.§ 1531-1544*).



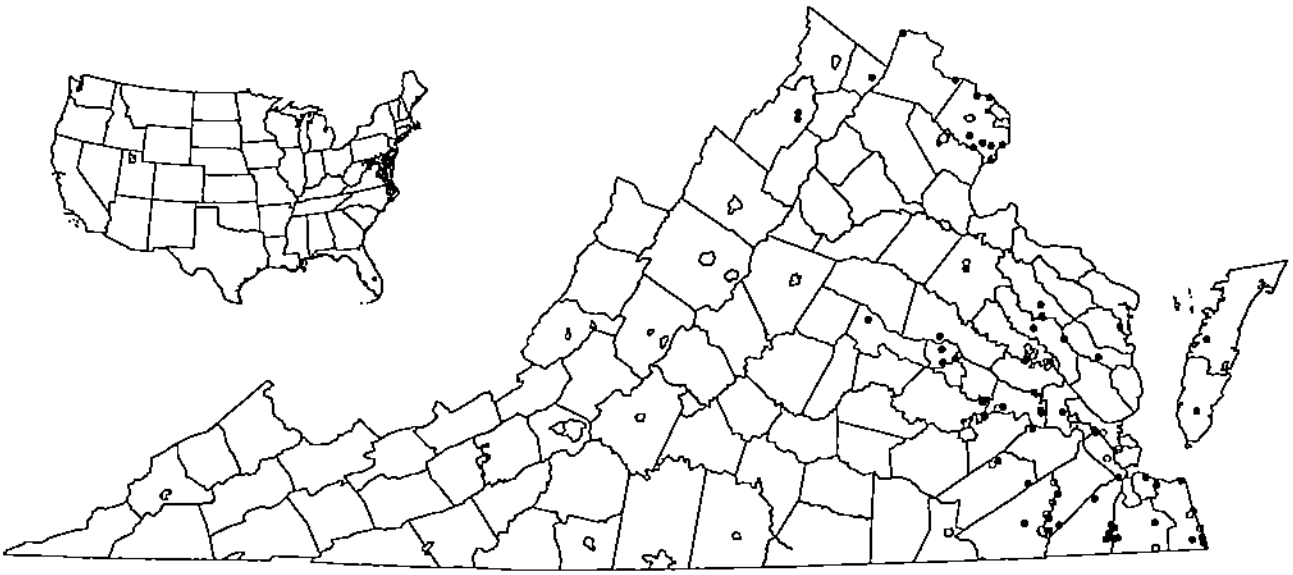
***Malaclemys terrapin terrapin* (Schoepff) - Northern Diamond-backed Terrapin**

This is the only truly estuarine reptile in Virginia. It occurs in the Chesapeake Bay, tidal portions of its tributaries, and along the Atlantic side of the Eastern Shore. Its conservation status in the Bay is unknown (Mitchell, 1991), however, populations appear to be healthy around the barrier islands (Conant *et al.*, 1990; Mitchell, 1994a). The Suffolk locality is on the James River.



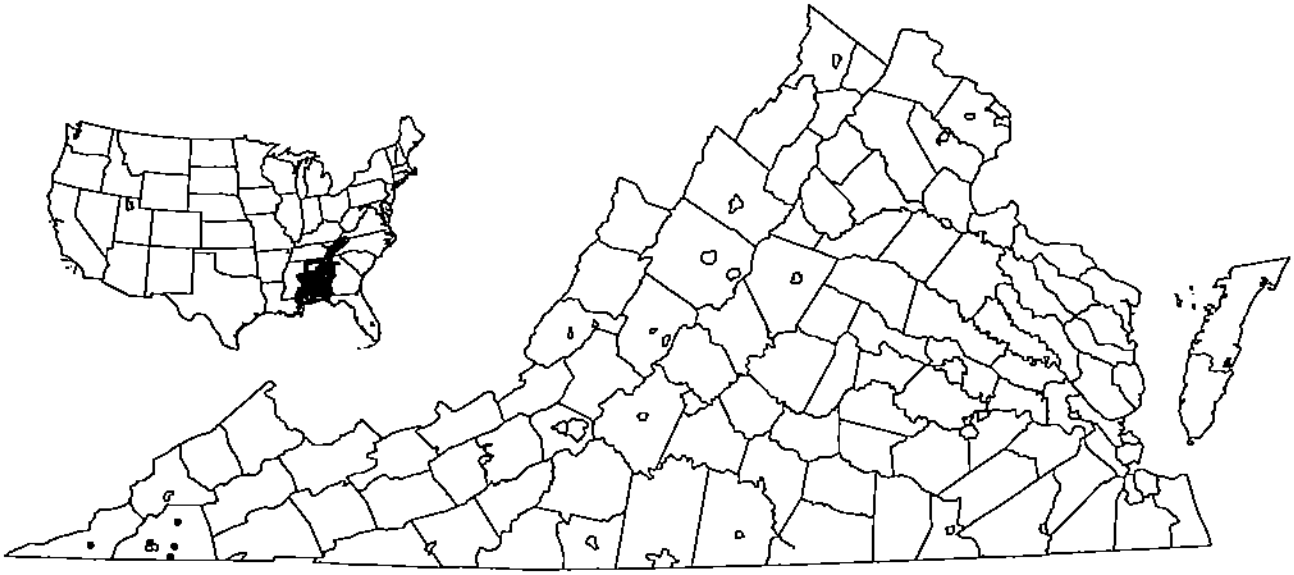
***Pseudemys concinna* (LeConte) - River Cooter**

Two subspecies occur in Virginia: *Pseudemys concinna concinna* (LeConte), eastern river cooter (•), and P*seudemys concinna floridana* (LeConte), Coastal Plain cooter (▲)(Crother, in press). Seidel (1994) determined that *P. floridana* was a subspecies of *P. concinna* instead of a full species. Populations east of the Fall Line in southeastern Virginia are *P. c. floridana* (Mitchell, 1994a). *Pseudemys c. hieroglyphica* is no longer recognized.



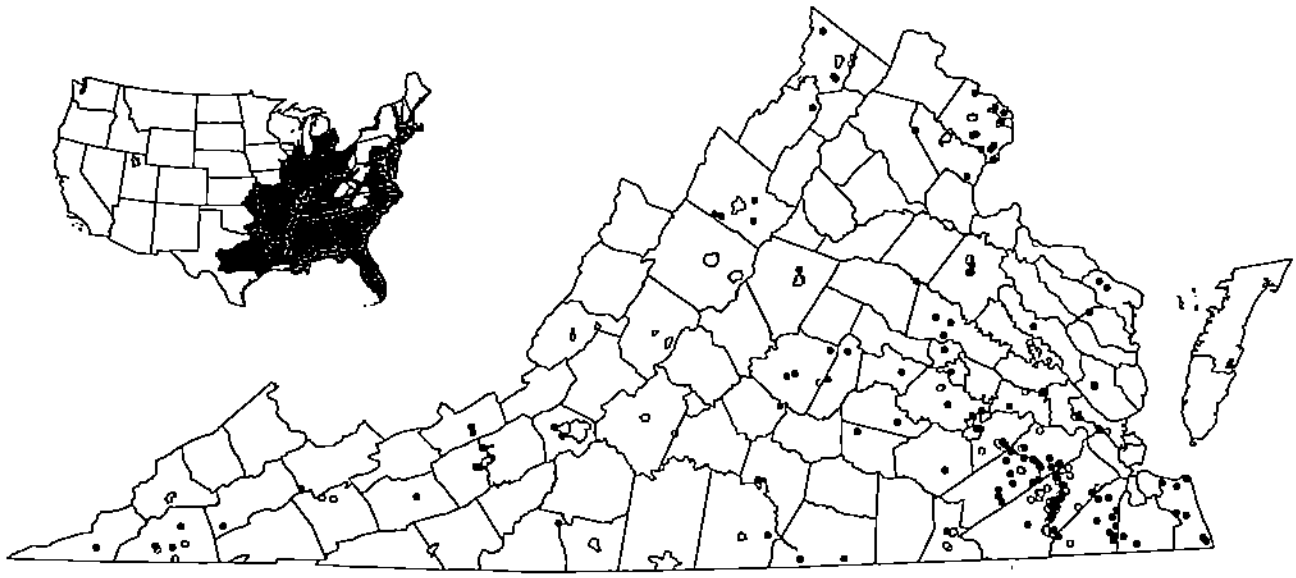
***Pseudemys rubriventris* (LeConte) - Northern Red-bellied Cooter**

This large, freshwater turtle occurs throughout the Coastal Plain. Other populations occur in portions of the eastern Piedmont and Shenandoah Valley. It also occurs on the Eastern Shore. Its distribution along the Fall Line and eastern Piedmont needs clarification.



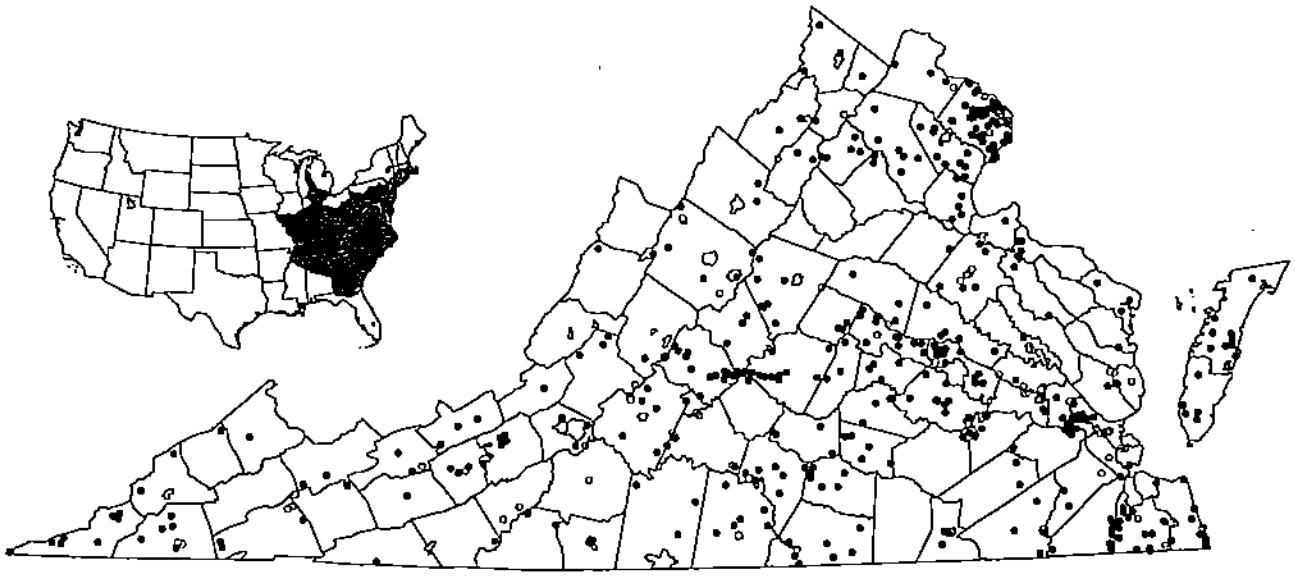
***Sternotherus minor peltifer* Smith and Glass – Stripe-necked Musk Turtle**

Only a few populations of this freshwater turtle are known for Virginia, all in Lee and Scott counties in the Tennessee River drainage. The conservation status of this turtle is undetermined (Mitchell, 1991). Its distribution in the Commonwealth needs clarification.



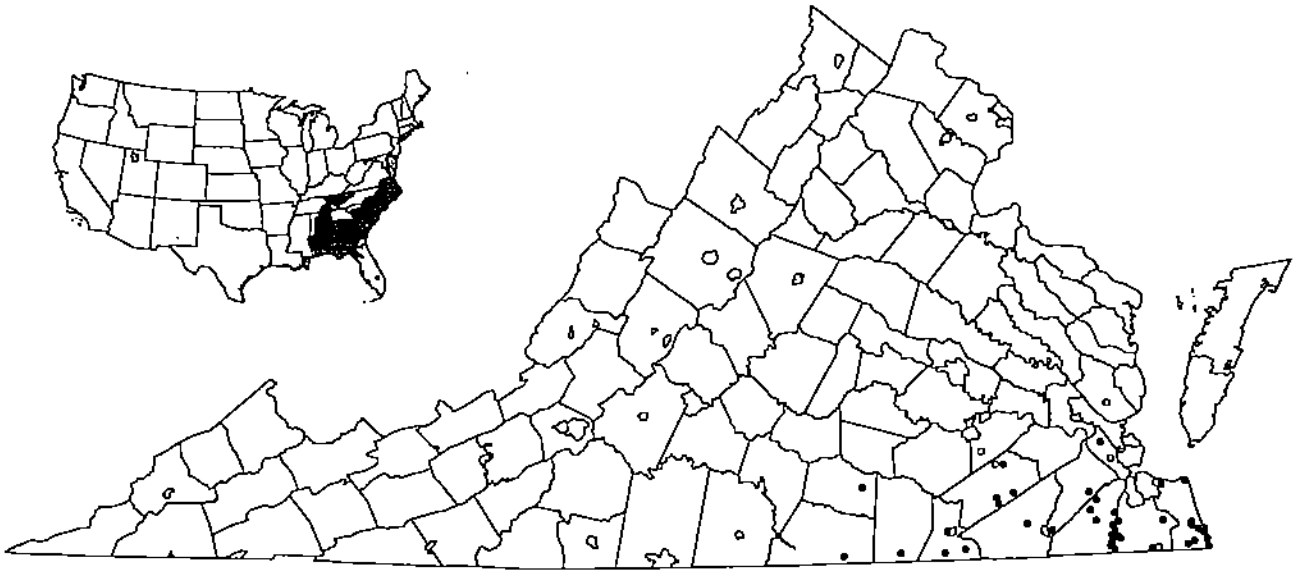
***Sternotherus odoratus* (Latreille) - Eastern Musk Turtle**

This freshwater turtle, also called stinkpot, may occur throughout most of the state, except for the Appalachian Plateau, southern Blue Ridge Mountains, and Eastern Shore of Virginia. Populations occur in Maryland counties on the Delmarva Peninsula (Harris, 1975). Additional surveying efforts should yield many new county records.



***Terrapene carolina carolina* (Linnaeus) - Eastern Box Turtle**

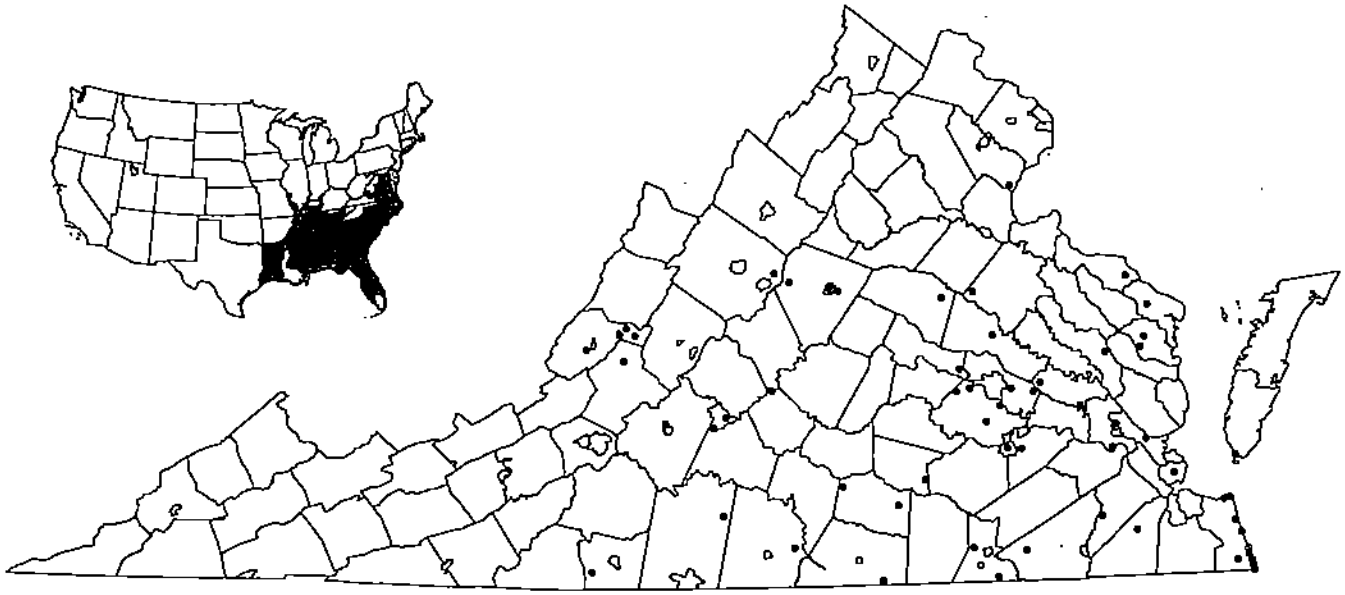
This terrestrial turtle occurs statewide and has been documented in nearly every county in the Commonwealth. It is known from two barrier islands (Conant *et al.*, 1990; Mitchell and Anderson, 1994). It is vulnerable to road mortality, habitat loss due to urban sprawl, and illegal collection for the pet trade.



***Trachemys scripta* (Schoepff) - Slider**

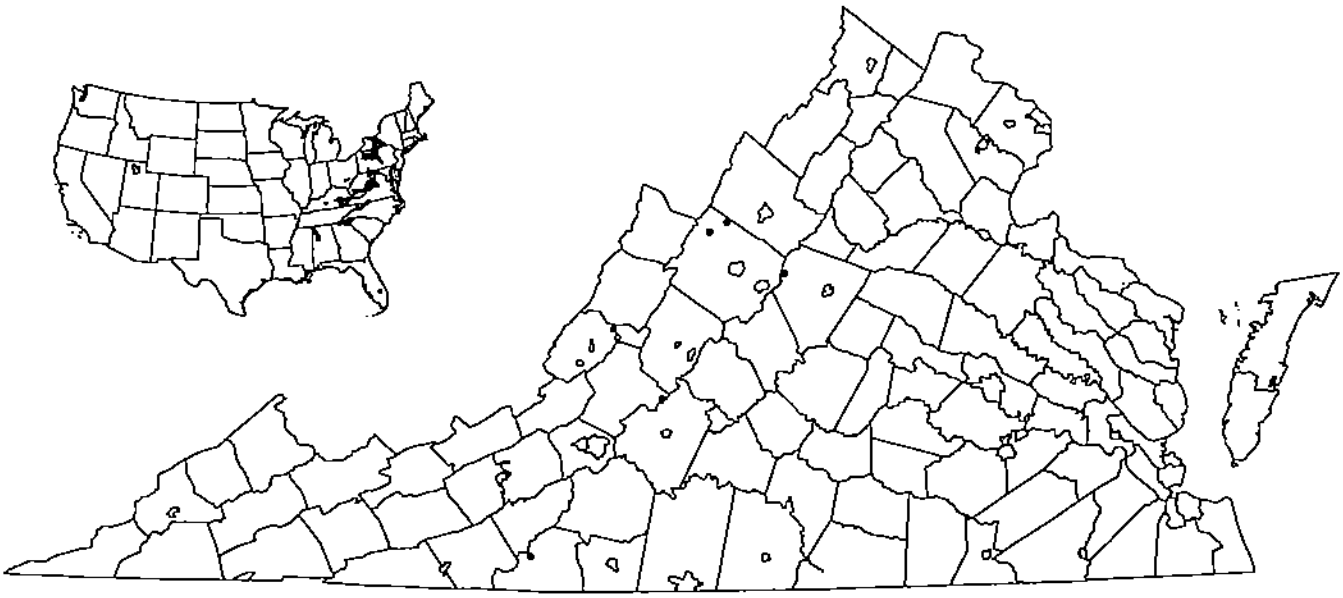
Two native subspecies occur in Virginia: *Trachemys scripta scripta* (Schoepff), yellow-bellied slider (•), and *Trachemys scripta troostii* (Holbrook), Cumberland slider (▲)(Crother, in press). The status of the latter is undetermined (Mitchell, 1991). The introduced red-eared slider (*T. s. elegans*) intergrades with native sliders in the southeast and erodes native gene pools (Mitchell, 1994a).

LIZARDS



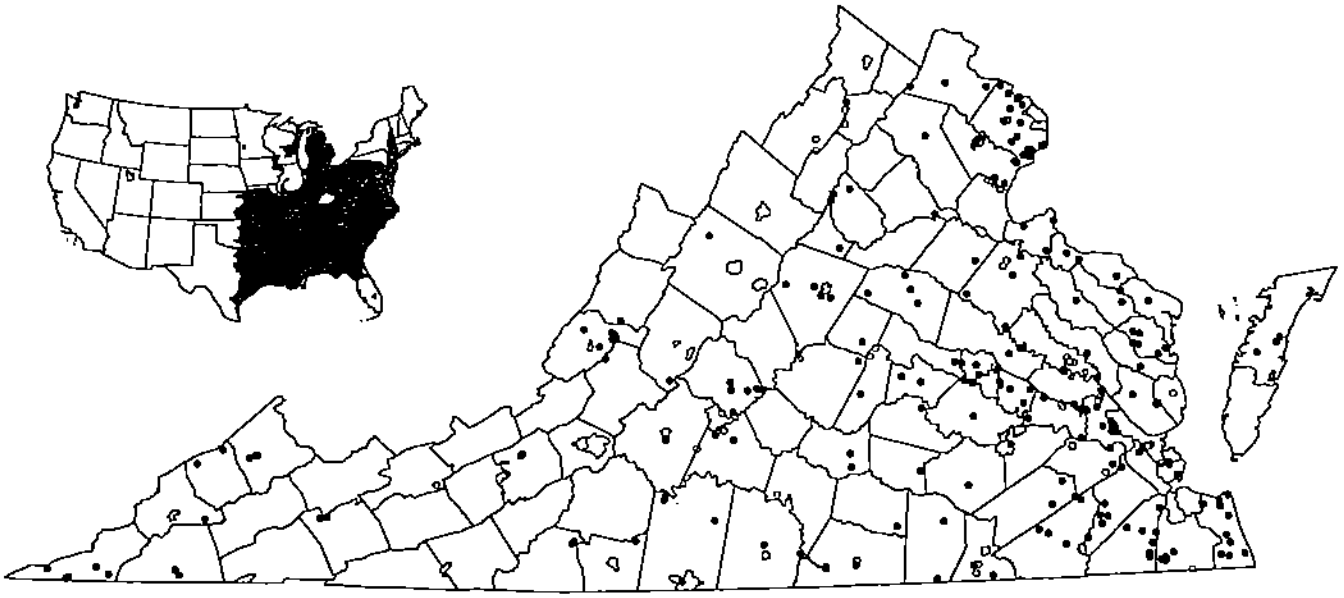
***Cnemidophorus sexlineatus sexlineatus* (Linnaeus) – Eastern Six-lined Racerunner**

The distribution of six-lined racerunners is apparently spotty but widespread east of the Blue Ridge Mountains in Virginia. Ridge and Valley locations may have been colonized via the Roanoke-James River corridor. Dispersal of individuals along railroad tracks may have allowed establishment of the Augusta County population (Mitchell, 1994a). Populations may also occur in far southwestern Virginia along the Clinch River (C.A. Pague, pers. comm.).



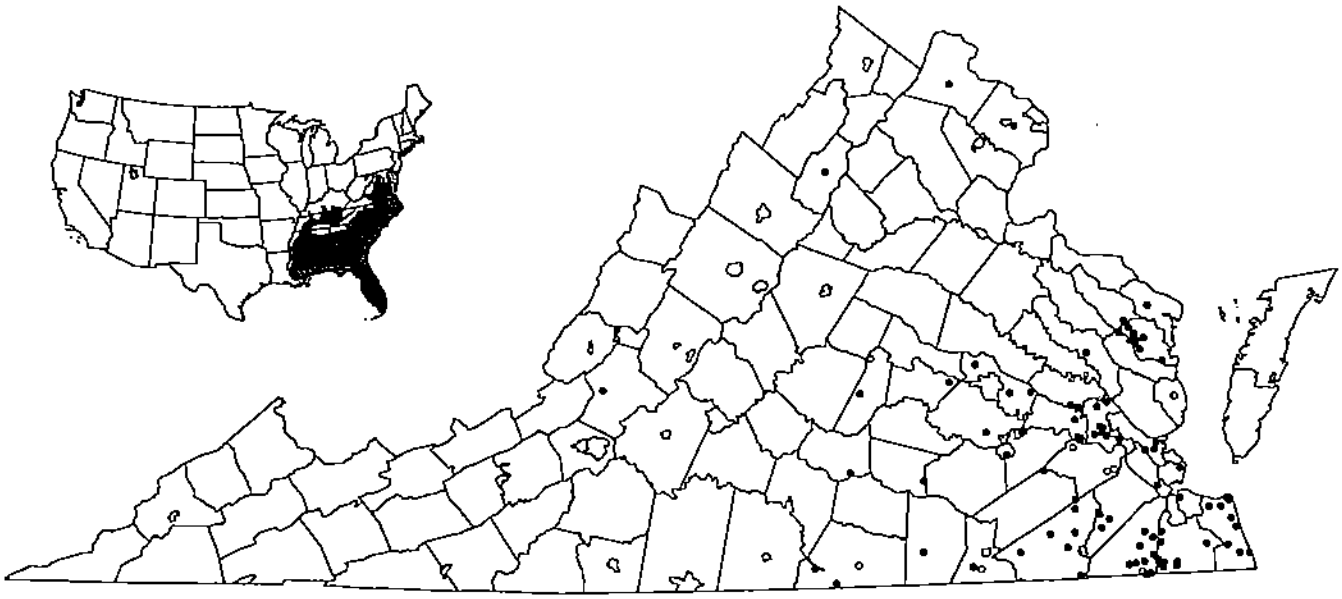
***Eumeces anthracinus anthracinus* (Baird) - Northern Coal Skink**

Coal skinks are known from widely scattered locations in western Virginia. They are only rarely encountered. Information on the three locations in far southwestern Virginia illustrated by Walley (1998) is currently unavailable. Roble *et al.* (1998) reported additional records for Alleghany and Bath counties. The status of this lizard is undetermined (Mitchell, 1991).



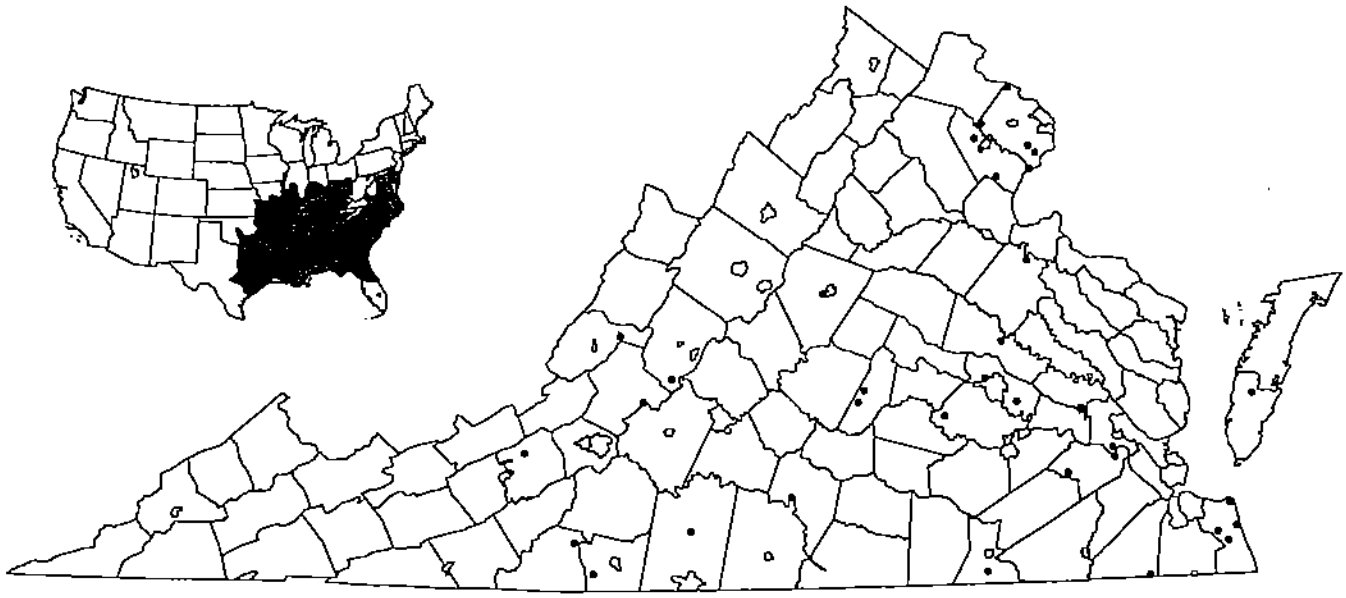
***Eumeces fasciatus* (Linnaeus) - Five-lined Skink**

This is the most widespread skink in Virginia. Additional surveying effort should reveal several new county records. Only the southern Blue Ridge Mountains are devoid of records. Palmer and Braswell (1995) illustrate localities on the periphery of this physiographic province in North Carolina.



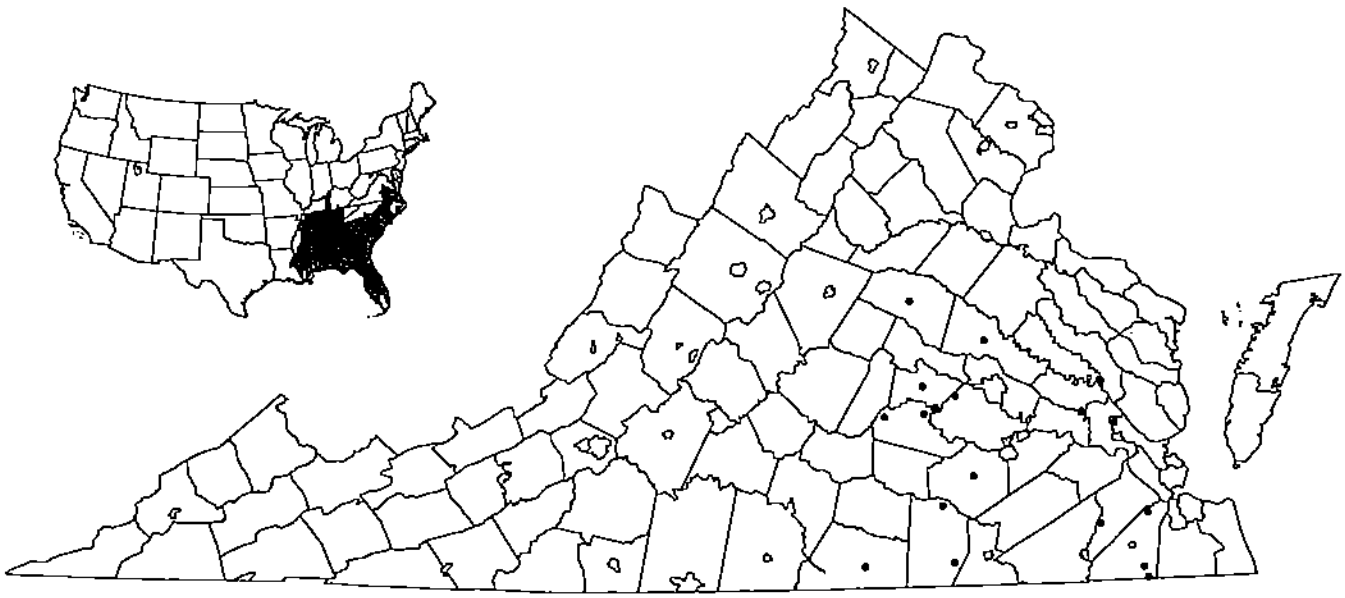
***Eumeces inexpectatus* Taylor - Southeastern Five-lined Skink**

Most records for this skink are in the Coastal Plain. Populations in the eastern Piedmont and Shenandoah Valley are scattered widely. The record for Alleghany County is based on Hoffman (1945) and a specimen in the Smithsonian Institution. The distribution pattern in northern Virginia and the western Piedmont needs better clarification.



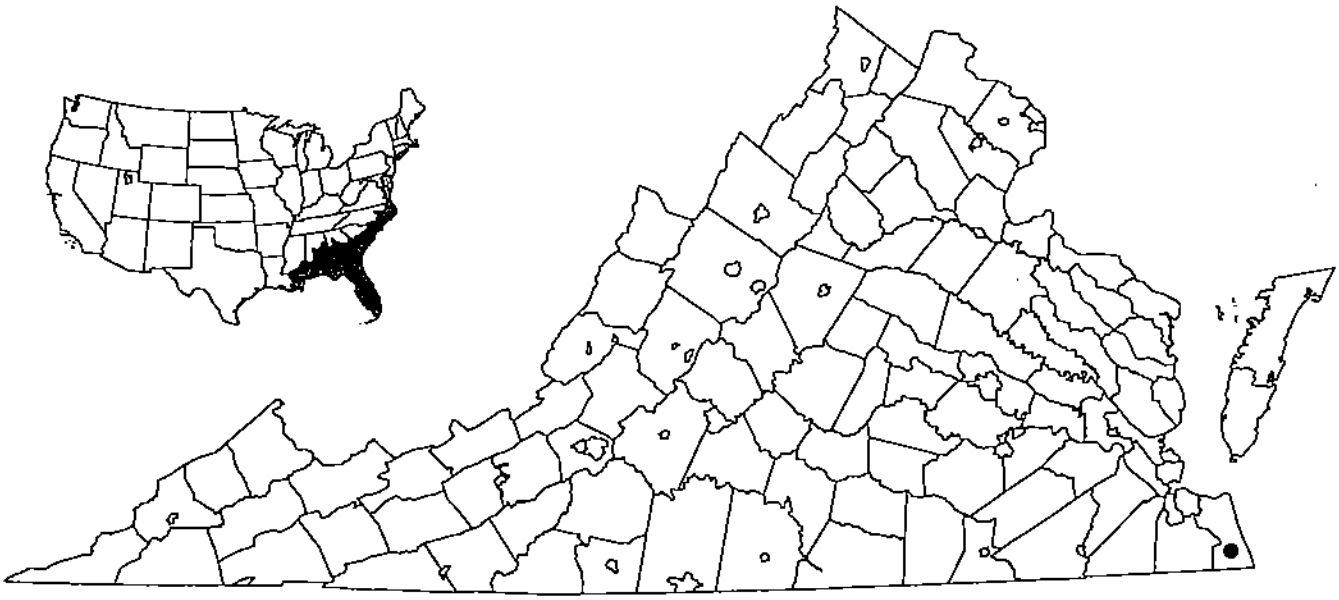
***Eumeces laticeps* (Schneider) - Broad-headed Skink**

This large, arboreal skink does not appear to be abundant anywhere in the state. Most records are based on a single specimen or observation. Known occurrences are scattered widely. Distribution records are needed to better define the range of this lizard in the Commonwealth.



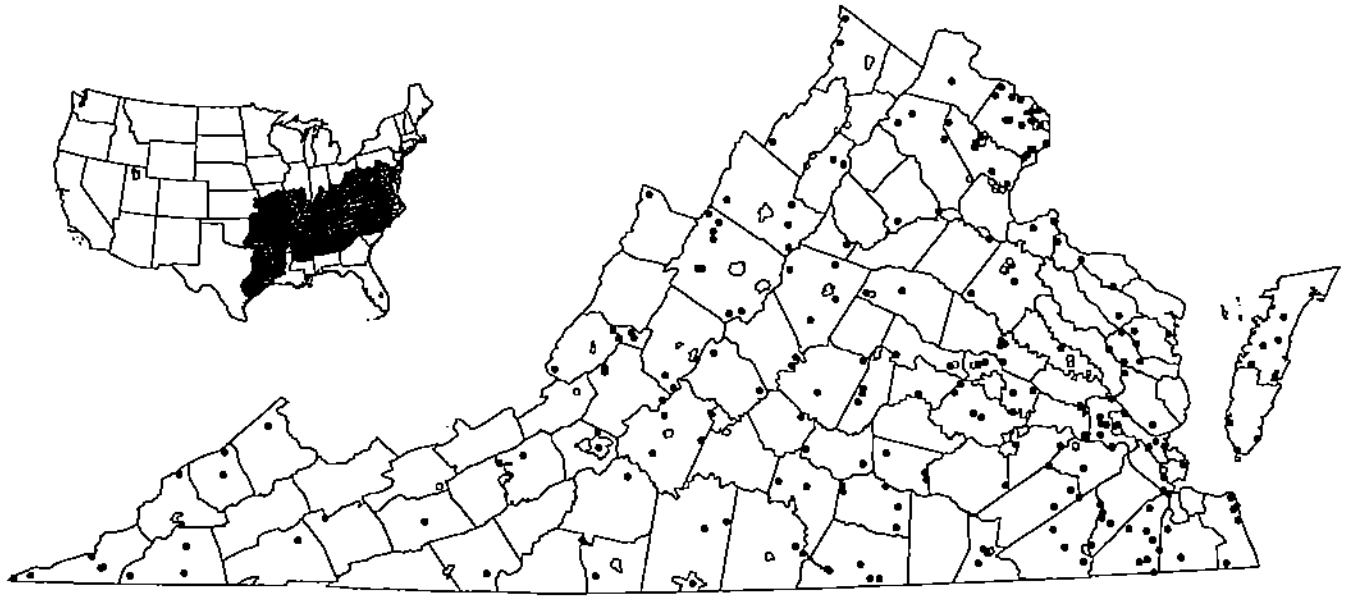
***Ophisaurus attenuatus longicaudus* McConkey - Eastern Slender Glass Lizard**

This legless lizard is known from the southeastern third of Virginia. The northern and western margins of its range in the Commonwealth need to be better defined. It apparently does not occur east of the Suffolk Escarpment and the Dismal Swamp (Mitchell *et al.*, 1999a).



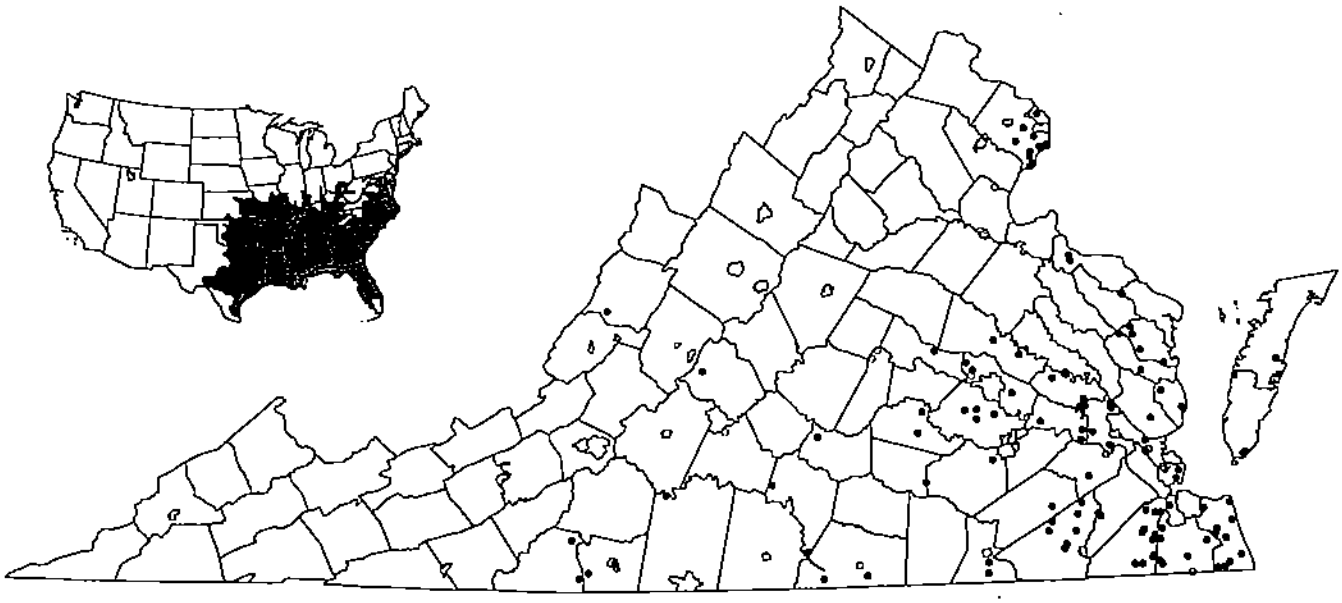
***Ophisaurus ventralis* (Linnaeus) - Eastern Glass Lizard**

The northernmost portion of the range of this legless lizard is in extreme southeastern Virginia. Most records are from Back Bay National Wildlife Refuge and False Cape State Park. One record in the Florida State Museum is from "Norfolk" but lacks specific locality data (Mitchell, 1994a). This species is listed as Threatened in the Commonwealth (Virginia regulation section *4 VAC 15-360-60*).



***Sceloporus undulatus hyacinthinus* (Green) - Northern Fence-Lizard**

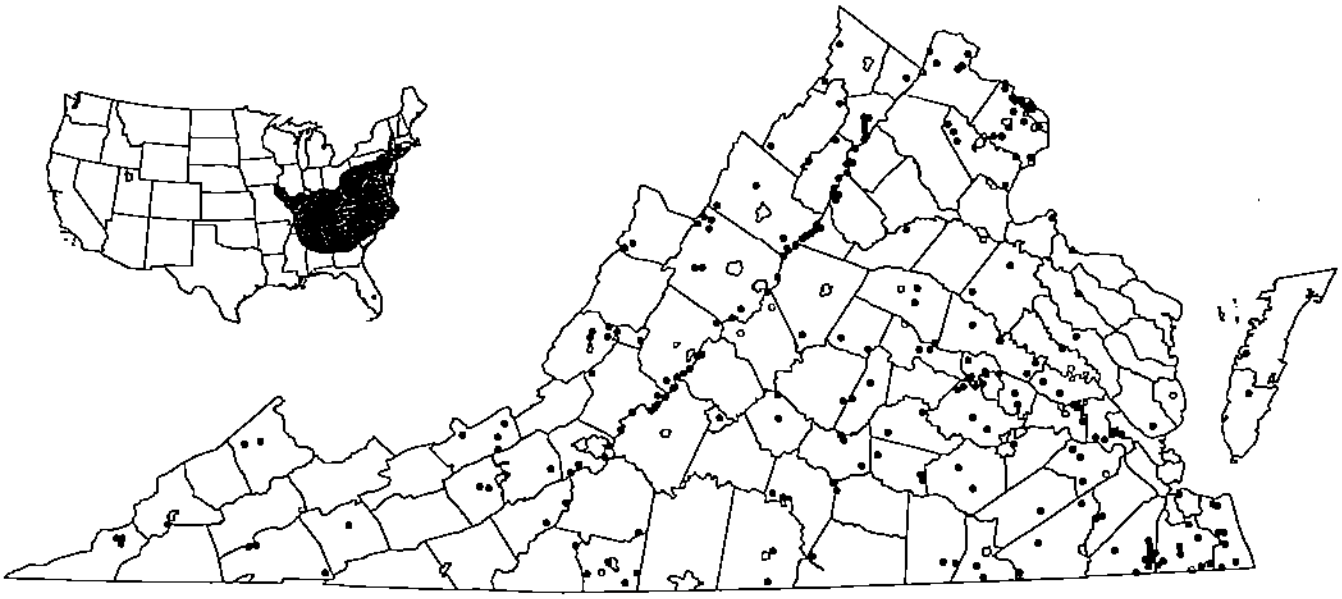
Fence lizards are widespread in Virginia and are known from nearly every county, most independent cities, and two barrier islands (Conant *et al.*, 1990; Mitchell, 1994a; Mitchell and Anderson, 1994). Populations in southwestern Virginia are scattered widely. Only one known population occurs in the southern Blue Ridge Mountains.



***Scincella lateralis* (Say) – Little Brown Skink**

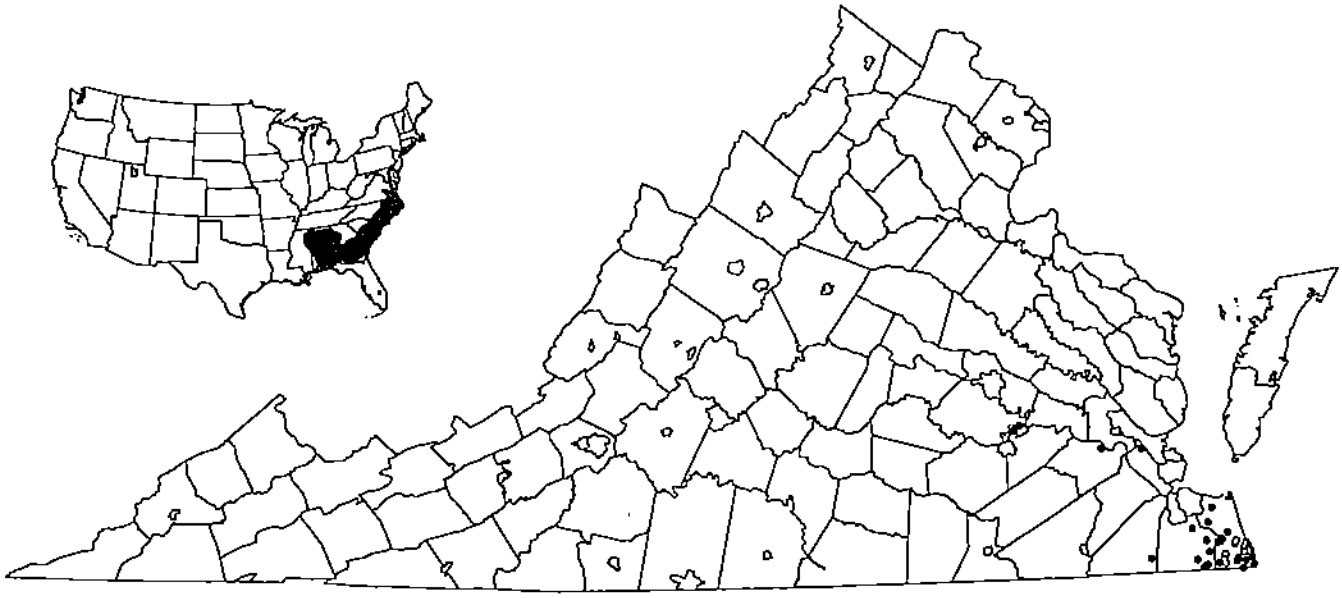
Most populations of this small, forest skink occur primarily on the Coastal Plain. Populations in the Piedmont are scattered widely. The location in Alleghany County is based on a specimen in the Smithsonian Institution (Hoffman, 1986b). Records between this location and those in the Piedmont are needed to fill the gap.

SNAKES



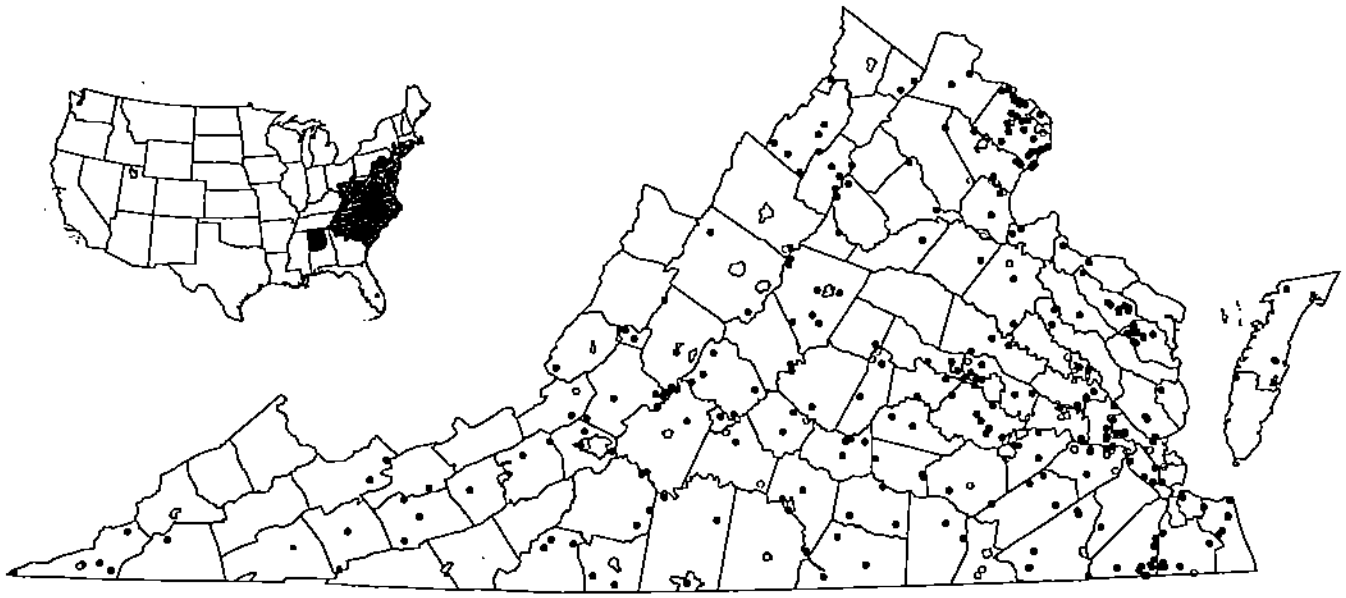
***Agkistrodon contortrix mokasen* Palisot de Beauvois - Northern Copperhead**

The copperhead is the only venomous snake that occurs statewide in Virginia. Museum and permit records illustrated here and literature records in Mitchell (1994a) cover nearly every county. Copperheads are occasionally found in riparian corridors of cities but they have been mostly extirpated in highly urbanized areas.



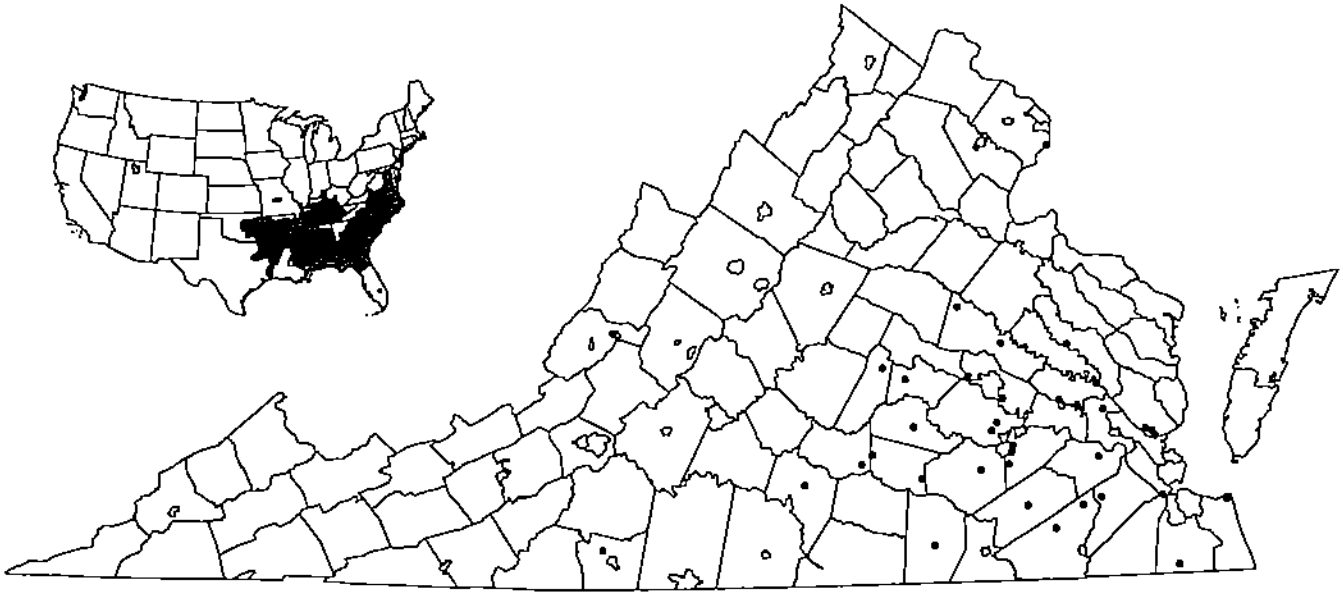
***Agkistrodon piscivorus piscivorus* (Lacépède) - Eastern Cottonmouth**

The cottonmouth, sometimes called "water moccasin," occurs primarily in extreme southeastern Virginia. Three, apparently isolated, populations in Chesterfield and Surry counties and in the City of Newport News and York County area represent the northernmost limits of the range of this species. The distribution west of the Dismal Swamp needs clarification.



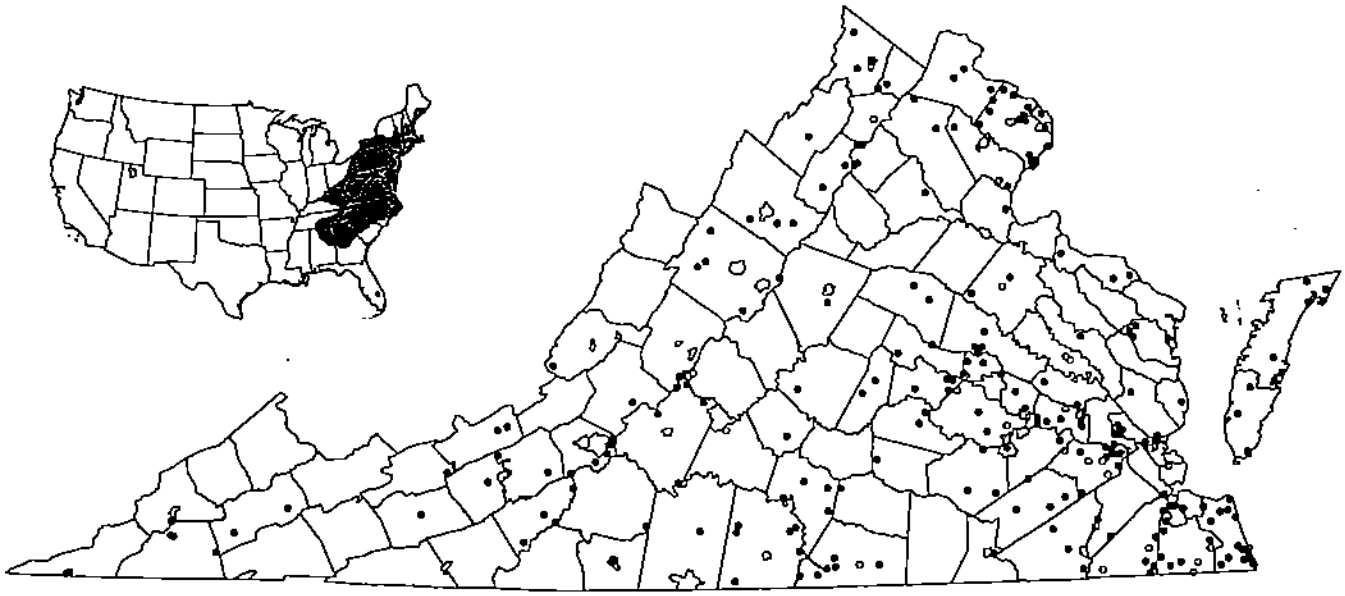
***Carphophis amoenus amoenus* (Say) - Eastern Wormsnake**

Wormsnakes occur in hardwood forests statewide, but not on any of the barrier islands (Conant *et al.*, 1990; Mitchell and Anderson, 1994). They also apparently do not occur in the southern portion of the city of Virginia Beach. Urban woodlot populations are severely impacted by urban sprawl.



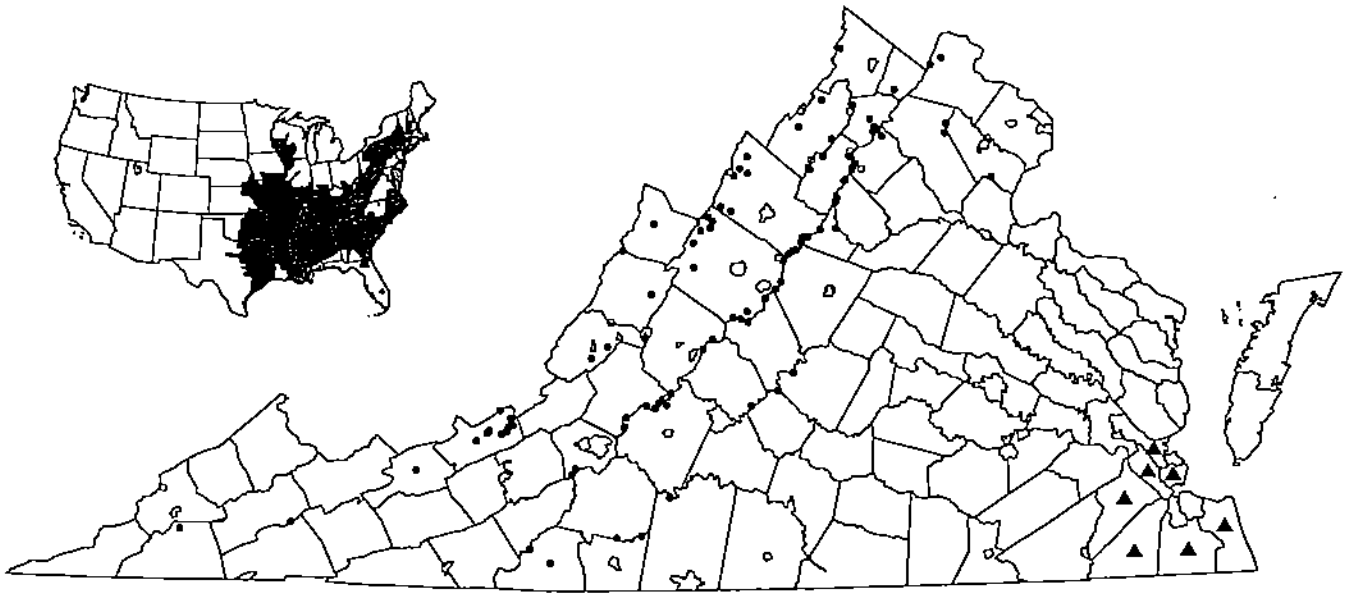
***Cemophora coccinea copei* Jan - Northern Scarletsnake**

Most populations of this colorful, secretive snake are in the Coastal Plain south of the Rappahannock River. Eastern Piedmont populations are scattered widely. The record in Alleghany County (Hoffman, 1986a) is based on a specimen in the Smithsonian Institution. The record in Fairfax County at Mt. Vernon is based on Fowler (1945).



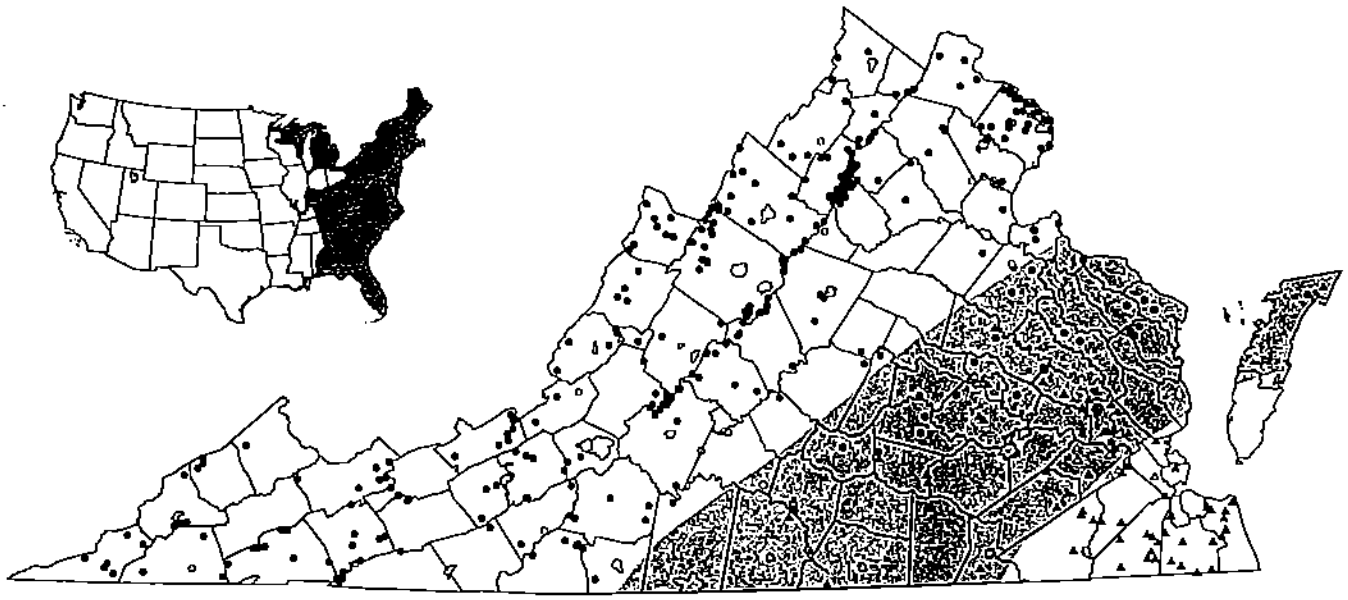
***Coluber constrictor constrictor* Linnaeus - Northern Black Racer**

Black racers occur widely in Virginia perhaps due to the proliferation of open fields and edge habitats. Records in the Ridge and Valley are widely spaced; this area of the state needs additional surveying effort. Several of the barrier islands support populations (Conant *et al.*, 1990).



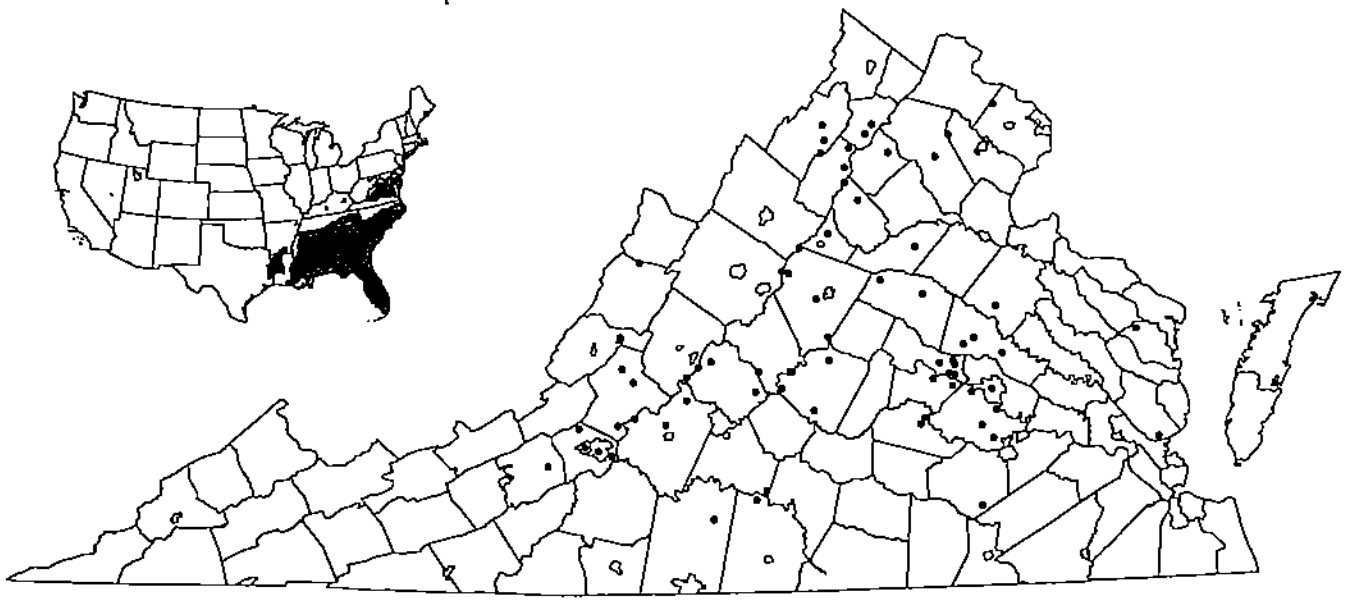
***Crotalus horridus* Linnaeus - Timber Rattlesnake**

Two subspecies have been recognized in Virginia: *C. h. atricaudatus* Latreille, canebrake rattlesnake (▲), and *C. h. horridus* Linnaeus, timber rattlesnake (•). Crother (in press), however, does not recognize *atricaudatus*. This species once occurred statewide but is now limited to mountainous regions (*horridus*) and the southeastern corner of the state (*atricaudatus*). Populations in southeastern Virginia are listed as Endangered (Virginia regulation section *4 VAC 15-360-60*).



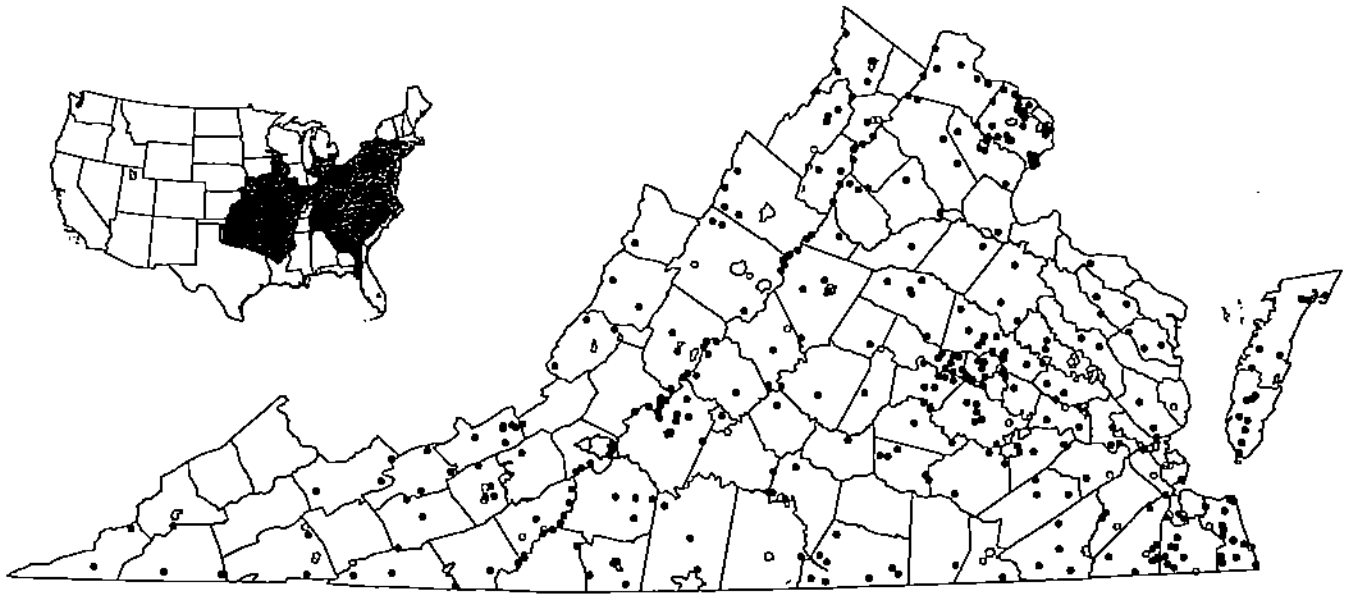
***Diadophis punctatus* (Linnaeus) - Ring-necked Snake**

Two subspecies occur in Virginia: *D. p. edwardsii* (Merrem), northern ring-necked snake (•), north and west of the shaded area, and *D. p. punctatus* (Linnaeus), southern ring-necked snake (▲), south of the shaded area. This species occurs statewide, although not all counties are represented by specimens. Populations in the shaded putative intergrade zone possess characteristics of both subspecies.



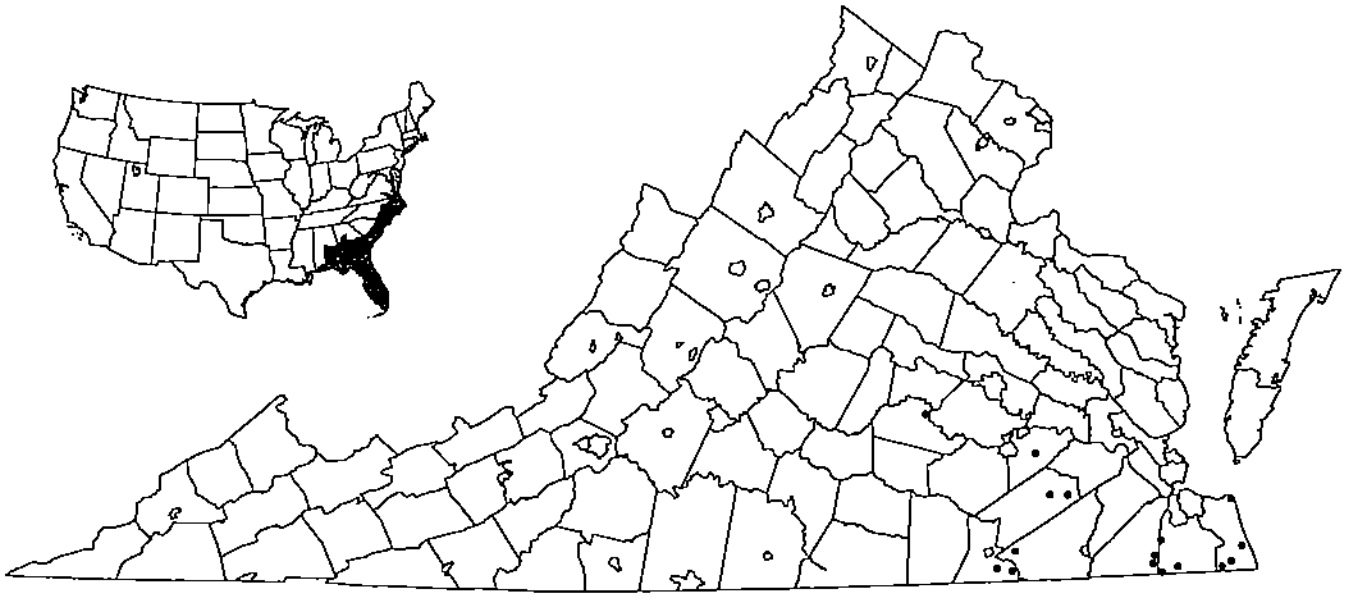
***Elaphe guttata* (Linnaeus) - Cornsnake**

Cornsnakes occur in all physiographic provinces in Virginia except for the Appalachian Plateau and the southern Blue Ridge Mountains. None has been reported from along the Virginia - North Carolina state line, and the Eastern Shore. This species is doubtless more widespread than current records indicate.



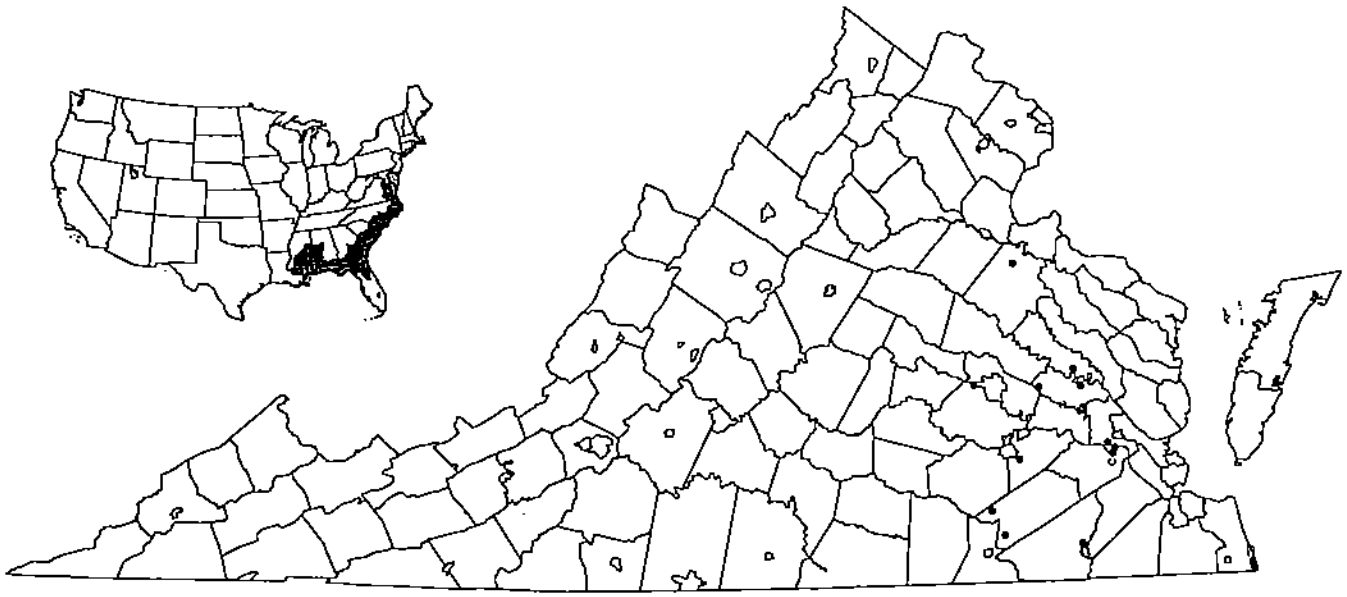
***Elaphe obsoleta obsoleta* (Say) - Black Ratsnake**

Black ratsnakes may be the most common snake in the Commonwealth. They occur in a variety of hardwood forest types and edge habitats in every county, at high elevations, and on several barrier islands (Conant *et al.*, 1990; Mitchell and Anderson, 1994). High annual mortality occurs on the state's roads.



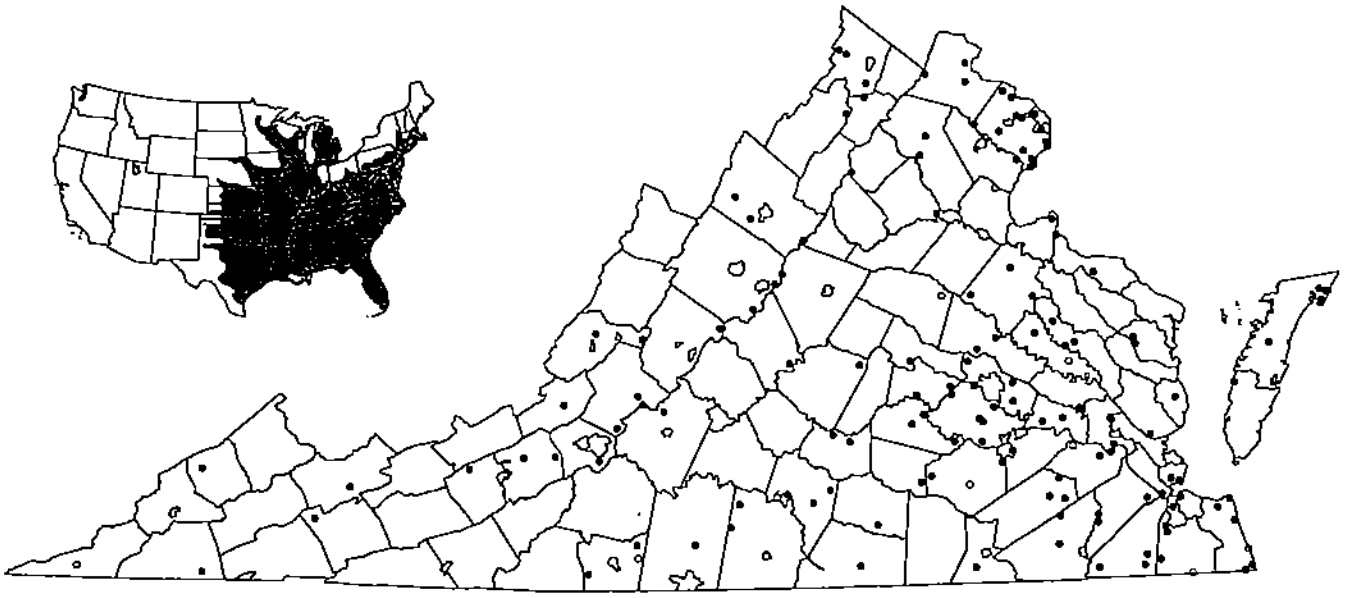
***Farancia abacura abacura* (Holbrook) - Eastern Mudsnake**

This is a southeastern Coastal Plain species that reaches its northern range limits in Virginia. The range of this snake coincides with that of its major prey, the amphiuma. Available records are scattered widely and based primarily on road kills. The Amelia County record is based on an 1878 specimen in the Smithsonian Institution.



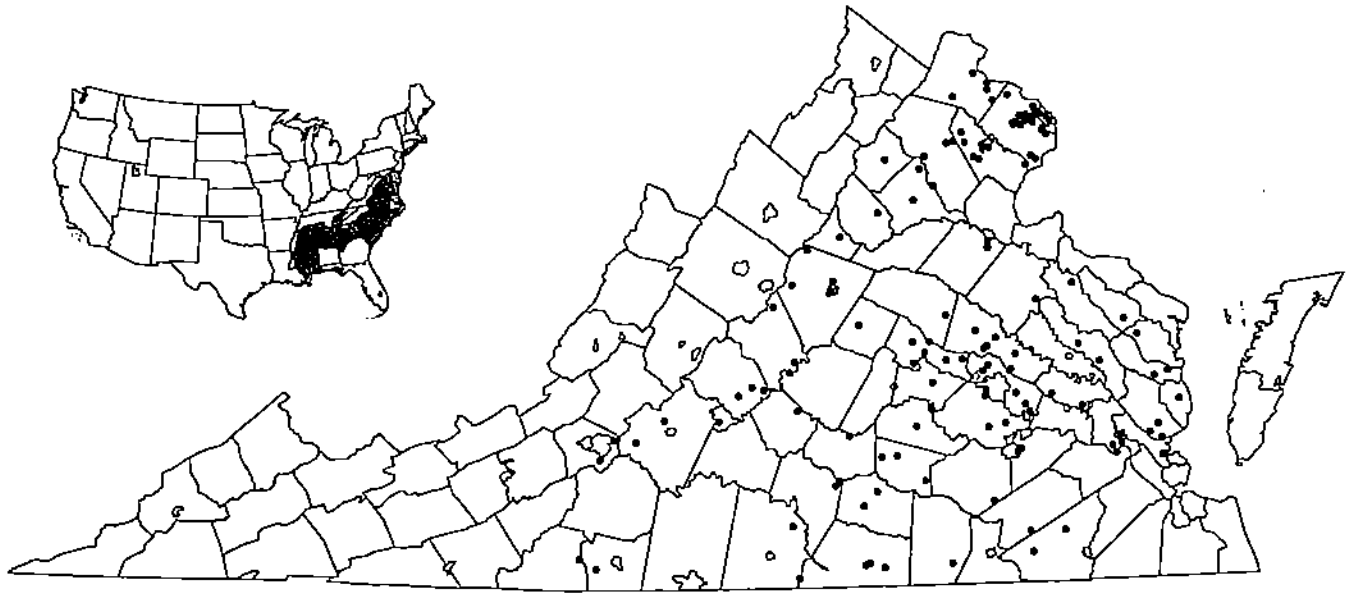
***Farancia erytrogramma erytrogramma* (Latreille) - Common Rainbow Snake**

This secretive, Coastal Plain wetland species is known from several widely scattered locations in Virginia. The northernmost known localities are in Maryland (Harris, 1975). Additional surveying should reveal that it occurs in most counties in the Coastal Plain of Virginia.



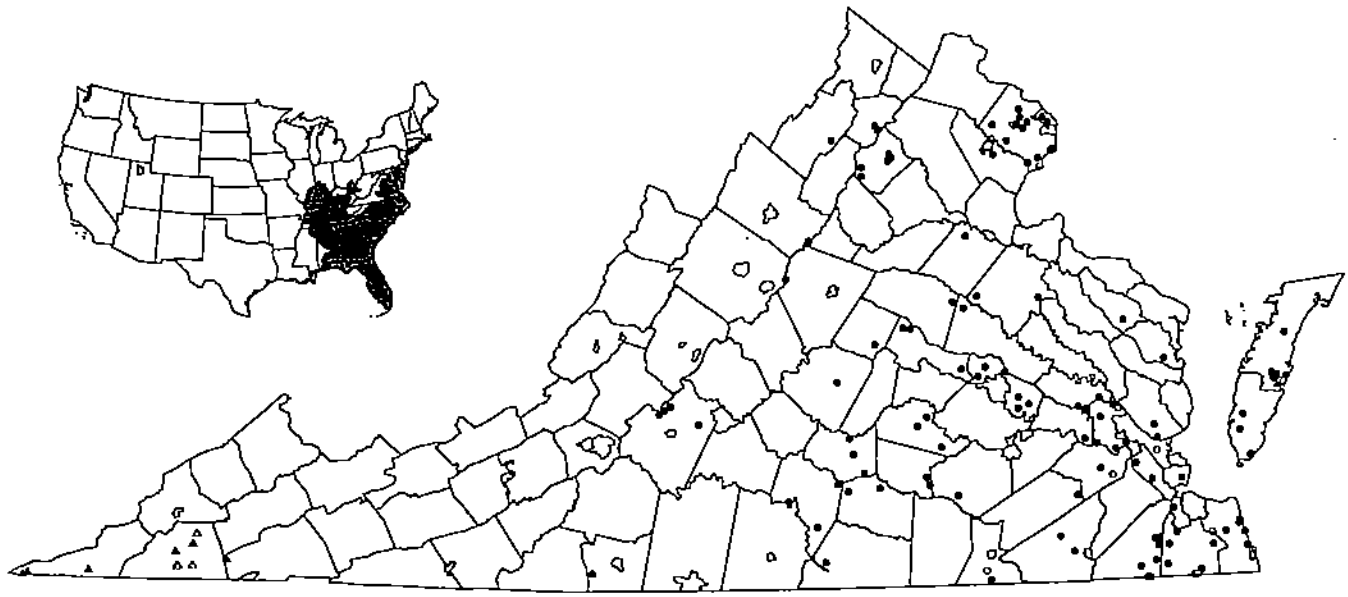
***Heterodon platirhinos* Latreille - Eastern Hog-nosed Snake**

Hog-nosed snakes apparently occur throughout the state but records for most areas are scattered widely, especially in the southwest. Most sites where these snakes have been found include sandy substrate, especially in the Piedmont and mountain regions. No records are available for the southern Blue Ridge Mountains.



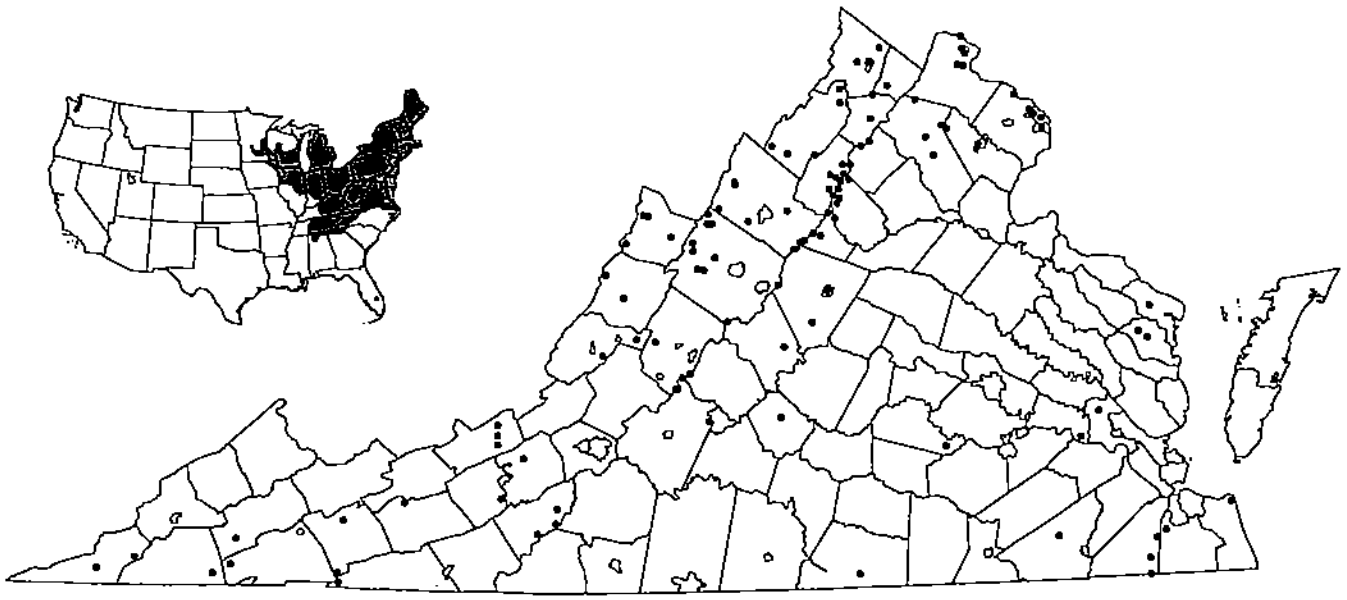
***Lampropeltis calligaster rhombomaculata* (Holbrook) - Mole Kingsnake**

The distribution pattern for this secretive snake is unique in Virginia. All known records occur east of the Blue Ridge Mountains and west of the Dismal Swamp region in the Coastal Plain. Records from Isle of Wight and Surry counties would confirm the eastern margin. The only exception to the pattern is a record on the Blue Ridge Parkway in the Roanoke River drainage.



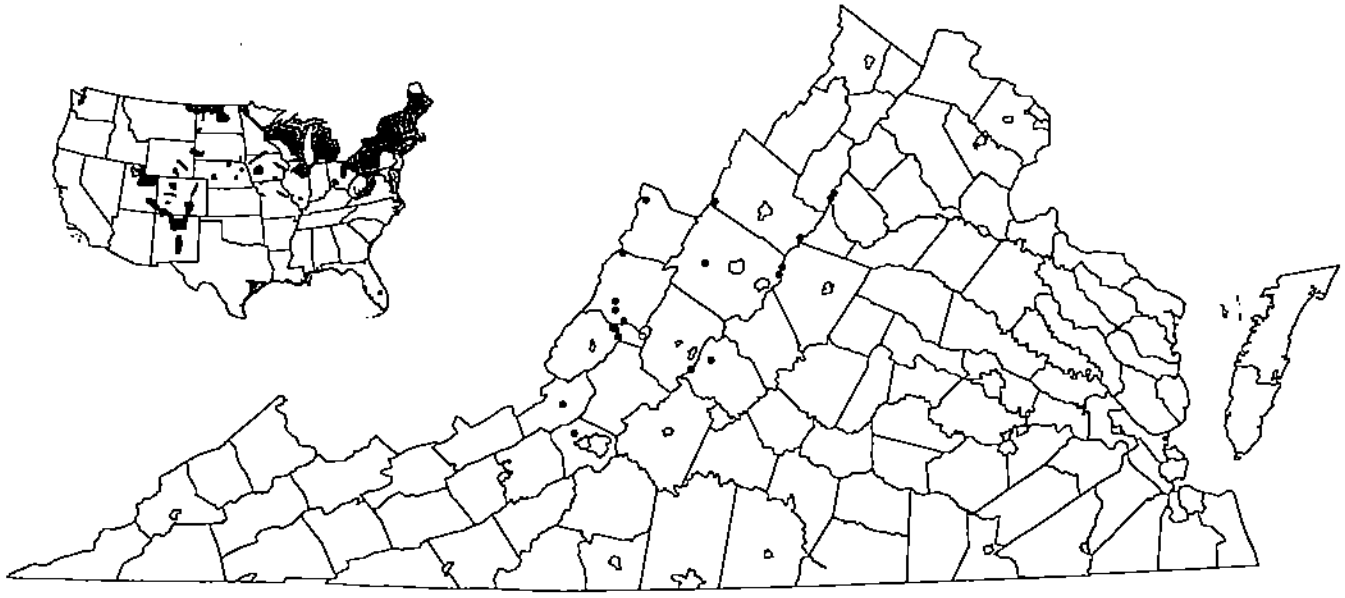
***Lampropeltis getula* (Linnaeus) - Common Kingsnake**

Two subspecies occur in Virginia: *L. g. getula* (Linnaeus), eastern kingsnake (•), and *L. g. nigra* (Yarrow), eastern black kingsnake (▲). Most records for the former occur east of the Blue Ridge; three records exist for the Blue Ridge and the Shenandoah Valley. The black kingsnake occurs only in far southwestern Virginia. No areas of overlap are known in Virginia, but Palmer and Braswell (1995) report one intergrade in North Carolina. The black kingsnake is included in the status undetermined list (Mitchell, 1991).



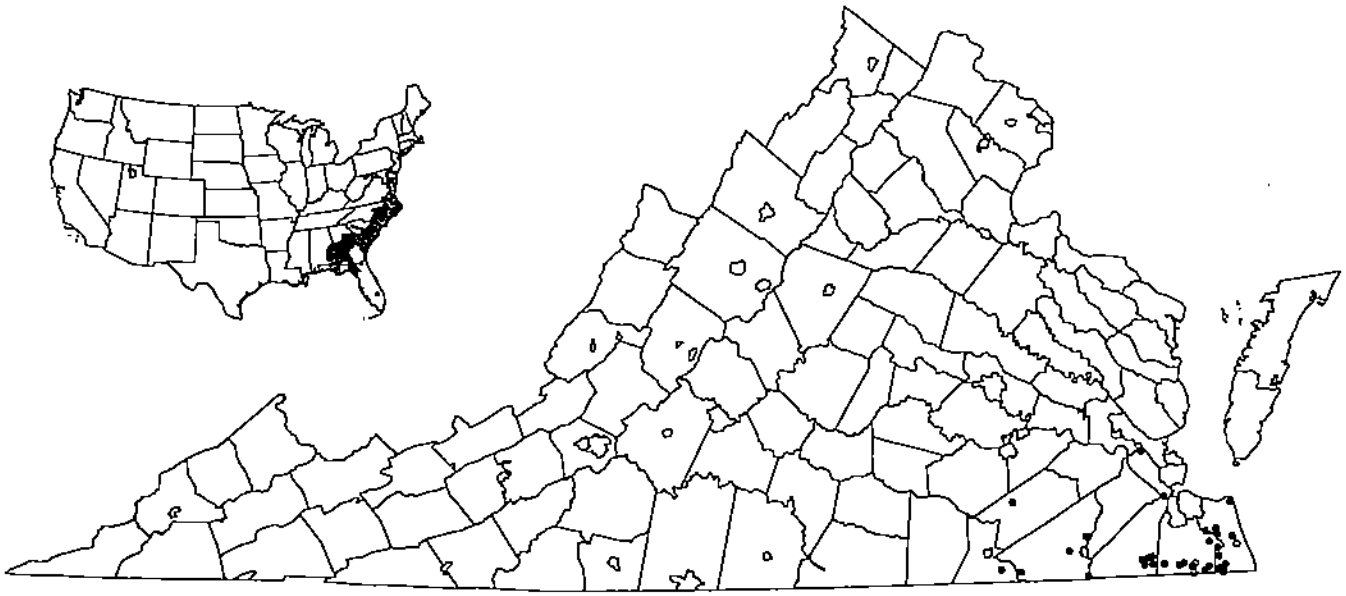
***Lampropeltis triangulum triangulum* (Lacépède) - Eastern Milksnake**

This species exhibits remarkable variation in color and pattern across the state. Snakes in southeastern localities resemble scarlet kingsnakes (*L. t. elapsoides*) but are intergrades with eastern milksnakes (Mitchell, 1994a). Locality records in the Coastal Plain and Piedmont are few in number and this snake may be largely extirpated from much of the area east of the mountains.



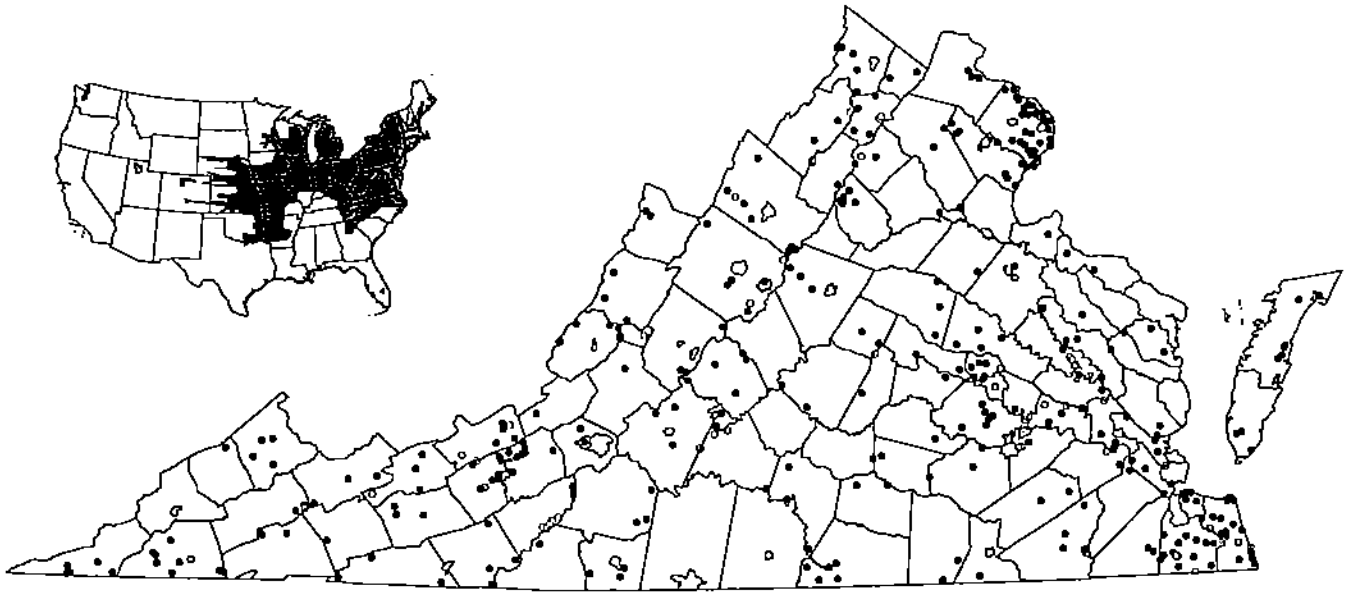
***Liochlorophis vernalis* (Harlan) - Smooth Greensnake**

Smooth greensnakes occur in the Blue Ridge and Ridge and Valley physiographic provinces in the Commonwealth. All localities occur at high elevations. Relatively little is known about this species and evidence suggests that some southern populations have been extirpated (Palmer and Braswell, 1995) or going extinct locally by natural causes. Mitchell (1991) includes this snake in the status undetermined category.



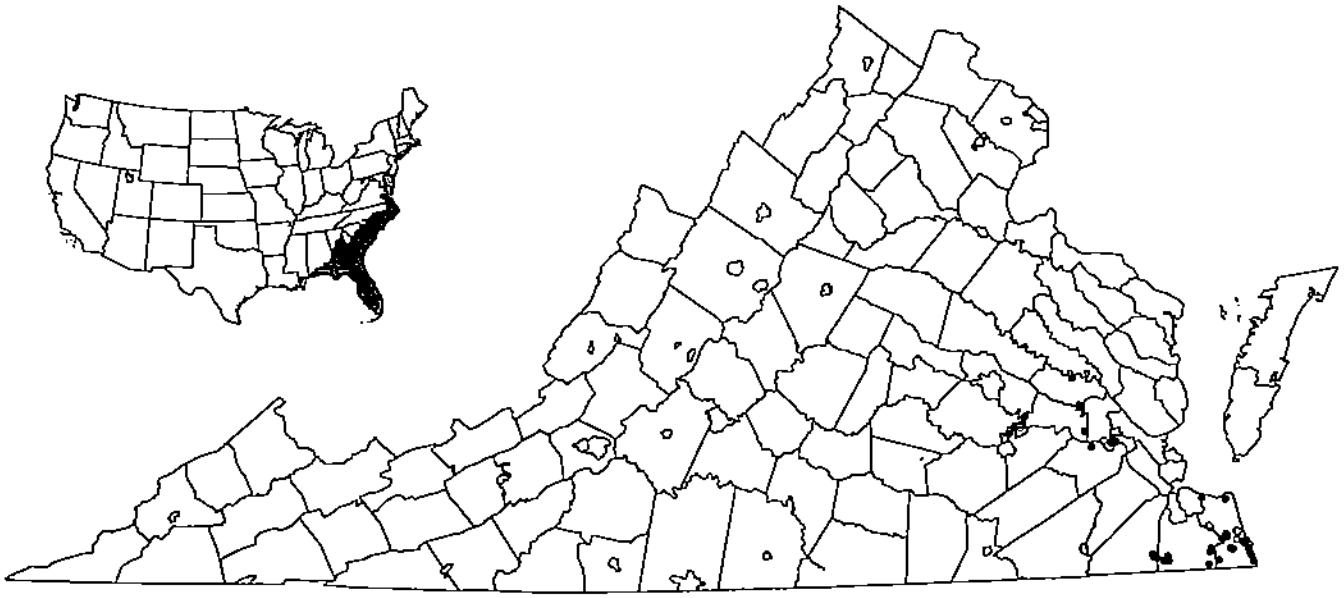
***Nerodia erythrogaster erythrogaster* (Forster) - Red-bellied Watersnake**

The northern end of the range of this southeastern Coastal Plain watersnake occurs in southeastern Virginia. Although this can be a common species at some sites, the distributional boundaries to the north and west of the known localities have yet to be determined.



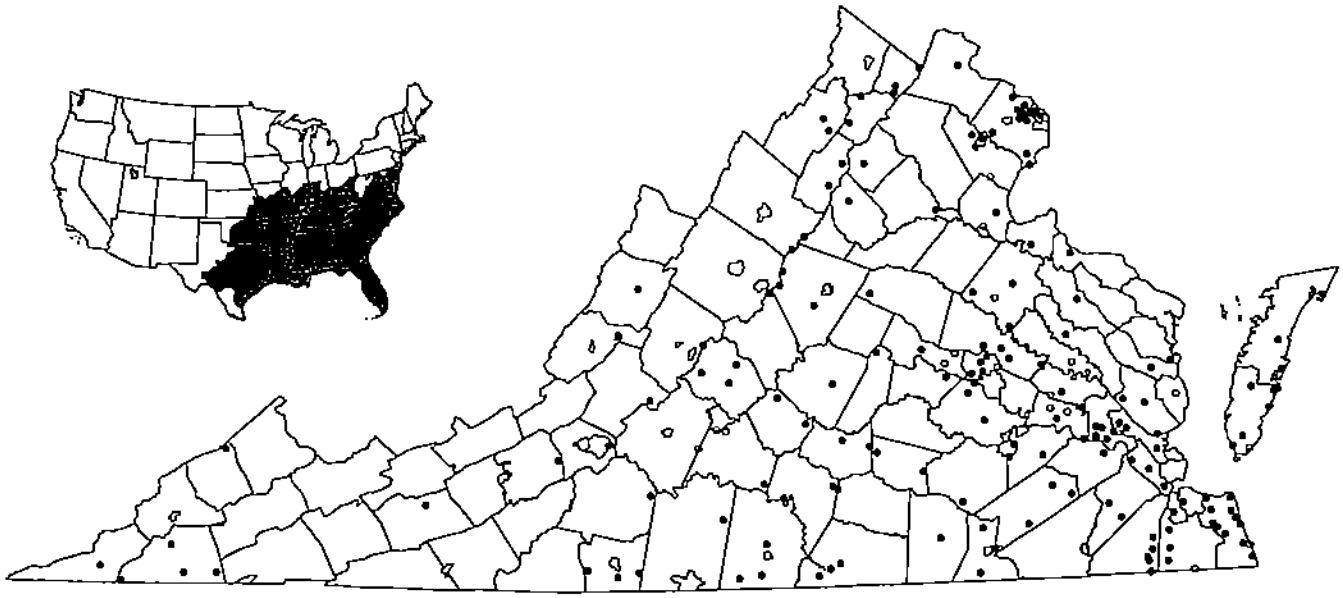
***Nerodia sipedon sipedon* (Linnaeus) - Northern Watersnake**

Northern watersnakes occur statewide and have been found in nearly every county and on several barrier islands (Conant *et al.*, 1990). This nonvemonous snake is almost universally in its wide range called "water moccasin" and considered venomous.



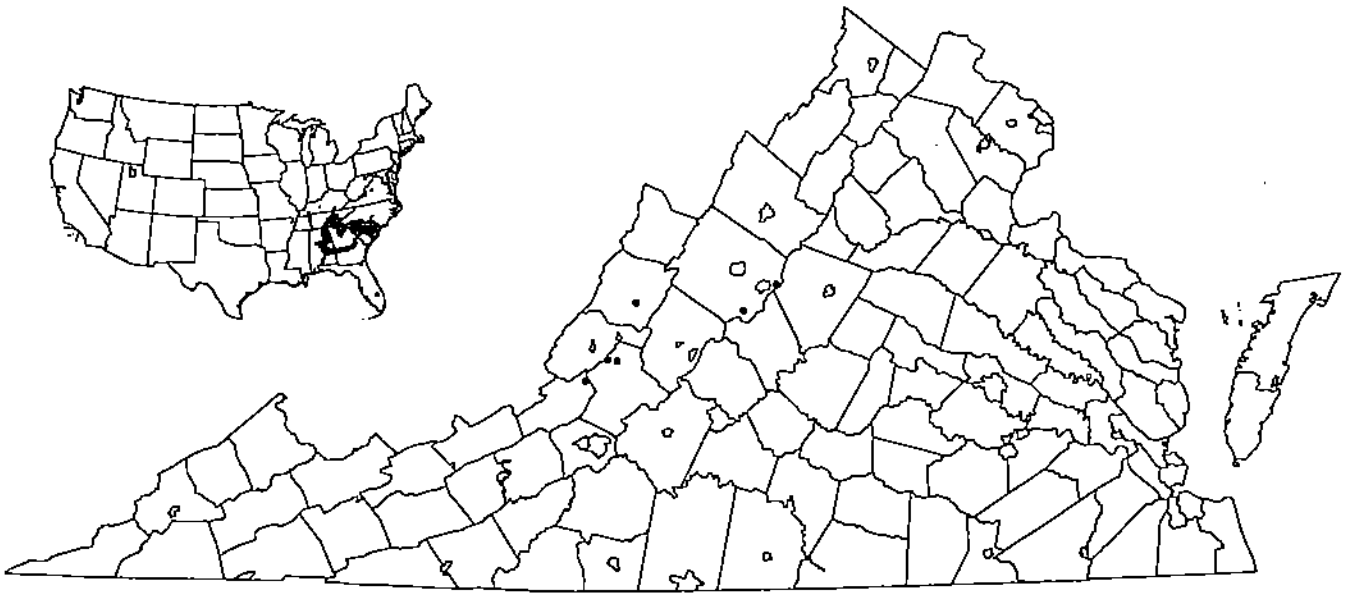
***Nerodia taxispilota* (Holbrook) - Brown Watersnake**

This large watersnake reaches its northernmost range limit in the Pamunkey River in the Virginia Coastal Plain. There appears to be two generalized areas of distribution, one in far southeastern Virginia and the other in the central Coastal Plain. This may be an artifact of surveying effort.



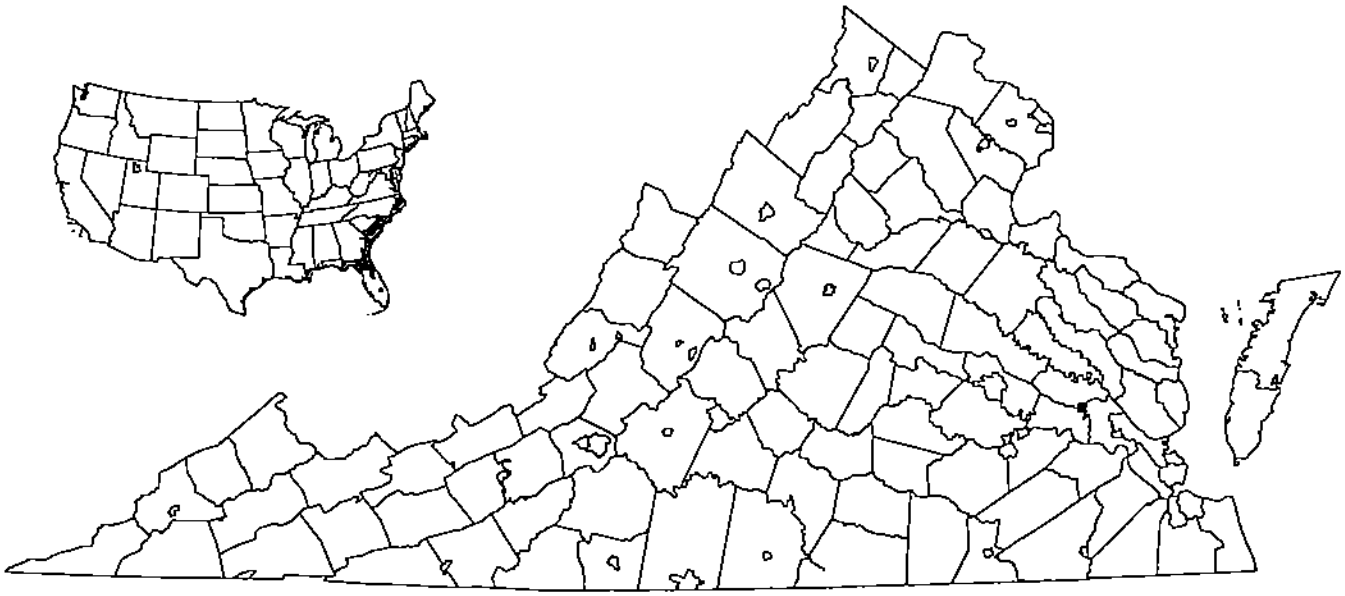
***Opheodrys aestivus* (Linnaeus) - Rough Greensnake**

Rough greensnakes occur throughout most of Virginia, although locality records are lacking for substantial portions of the Ridge and Valley and the southern Blue Ridge Mountains. They occur on many of the barrier islands (Conant *et al.*, 1990). Rough greensnakes apparently do not coexist with smooth greensnakes in Virginia.



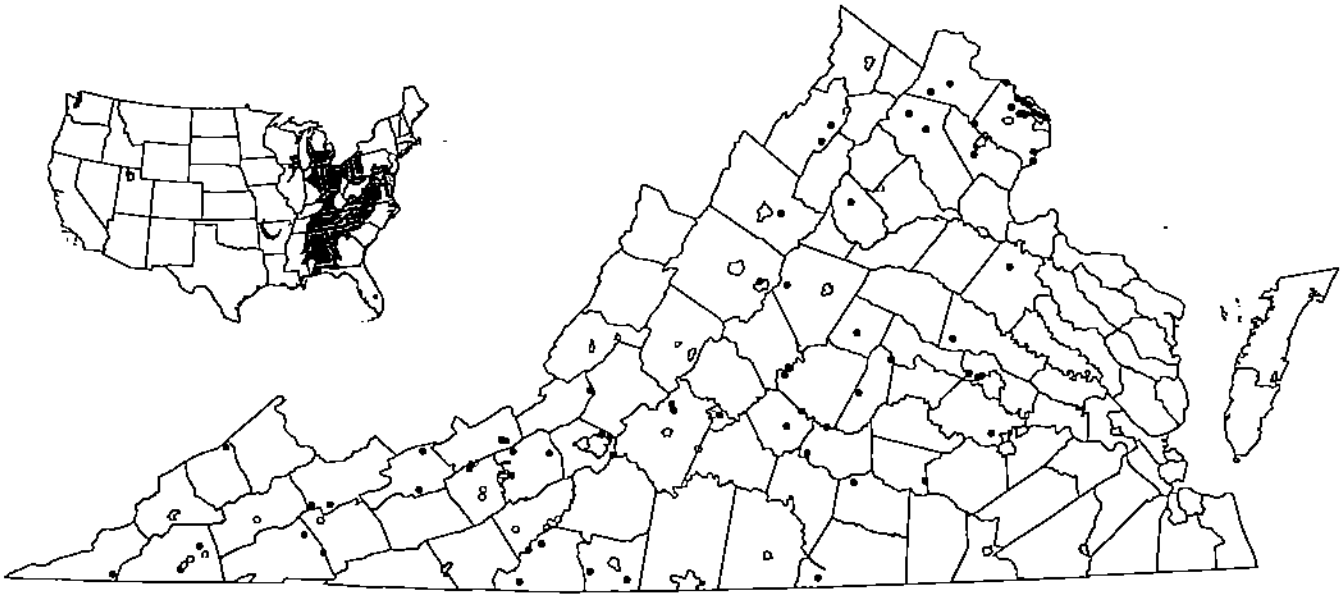
***Pituophis melanoleucus melanoleucus* (Daudin) - Northern Pinesnake**

This terrestrial snake is rarely seen in Virginia despite its large size. It is included in the status undetermined list (Mitchell, 1991). Six localities are confirmed with voucher specimens or photographs. Mitchell (1994a) added another nine localities from literature sources.



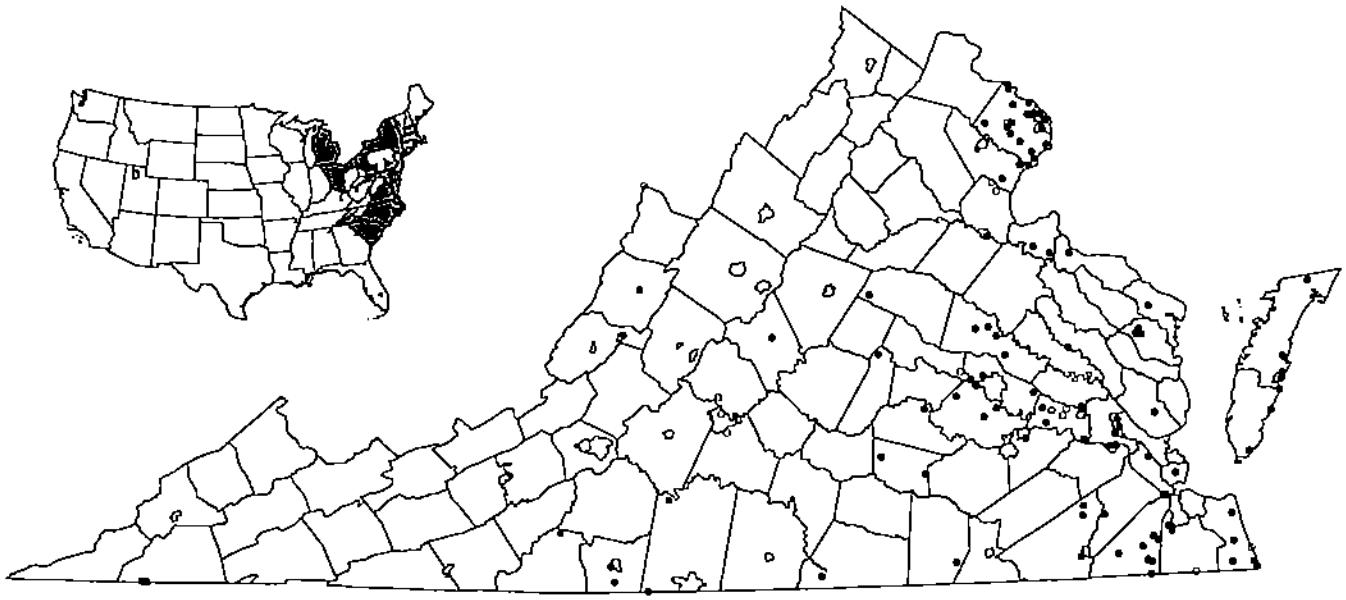
***Regina rigida rigida* (Say) - Glossy Crayfish Snake**

The glossy crayfish snake was first recorded for Virginia by Richmond (1940), who found it in Diascund Creek in New Kent County in the 1940s. Buhlmann *et al.* (1993) rediscovered it there in 1991. It has not been found anywhere else in the state. This is a secretive snake that is apparently rarely caught (Palmer and Braswell, 1995).



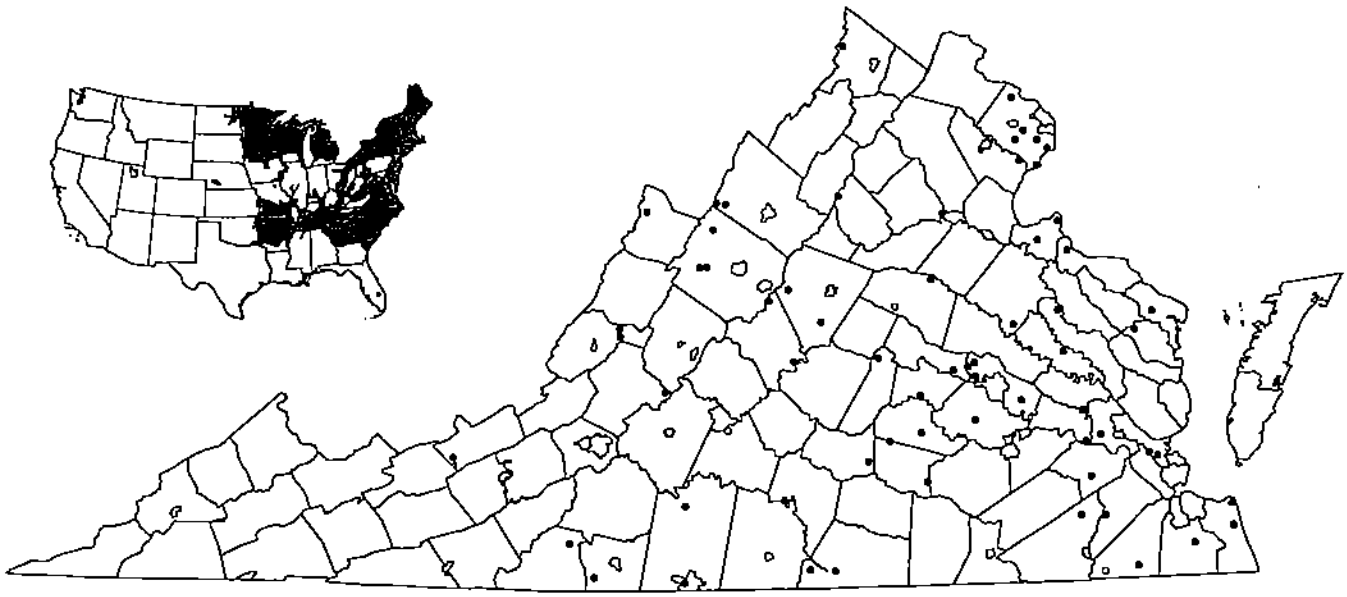
***Regina septemvittata* (Say) - Queen Snake**

Most known localities for this snake in Virginia are west of the Fall Line, although it occurs in all physiographic provinces. It is not known from the eastern Coastal Plain or Eastern Shore. The distributional limits of this stream-dwelling snake need to be refined, especially in the eastern portion of the state.



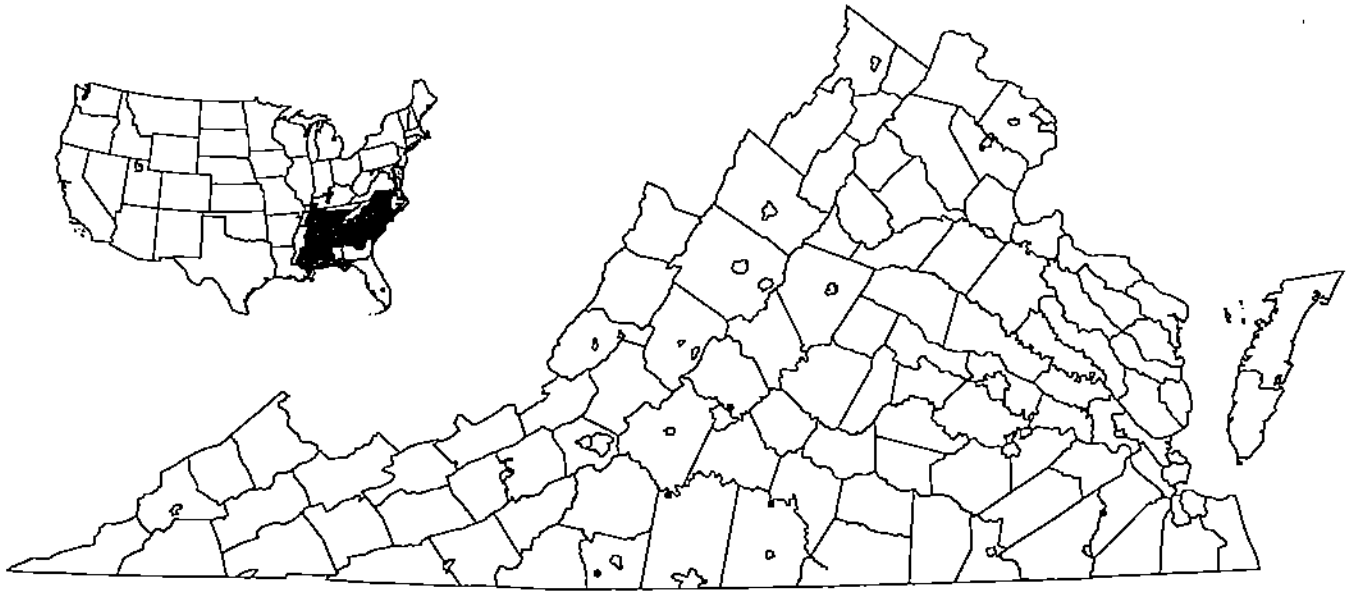
***Storeria dekayi dekayi* (Holbrook) - Northern Brownsnake**

This is a widespread snake in eastern North America, but in Virginia the majority of the known localities occur in the Coastal Plain. Sites harboring this species are scattered widely in the Piedmont and Ridge and Valley. There are no records for the Appalachian Plateau in Virginia or adjacent Kenlucky and West Virginia (Barbour, 1971; Green and Pauley, 1987).



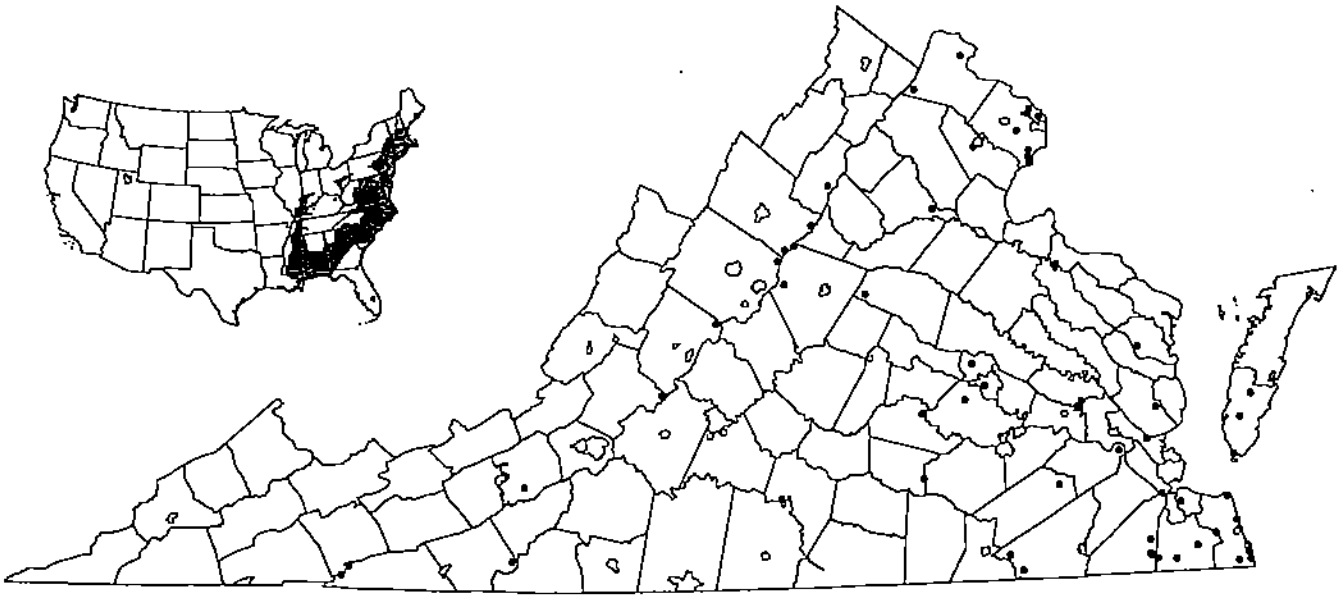
***Storeria occipitomaculata occipitomaculata* (Storer) - Northern Red-bellied Snake**

Most known locations for this secretive snake in Virginia are separated widely. Large areas lack county records, including the Eastern Shore and southwestern Virginia. Records exist for the Maryland portion of the Eastern Shore (Harris, 1975) and most of North Carolina (Palmer and Braswell, 1995) and West Virginia (Green and Pauley, 1987), suggesting that this species may be statewide.



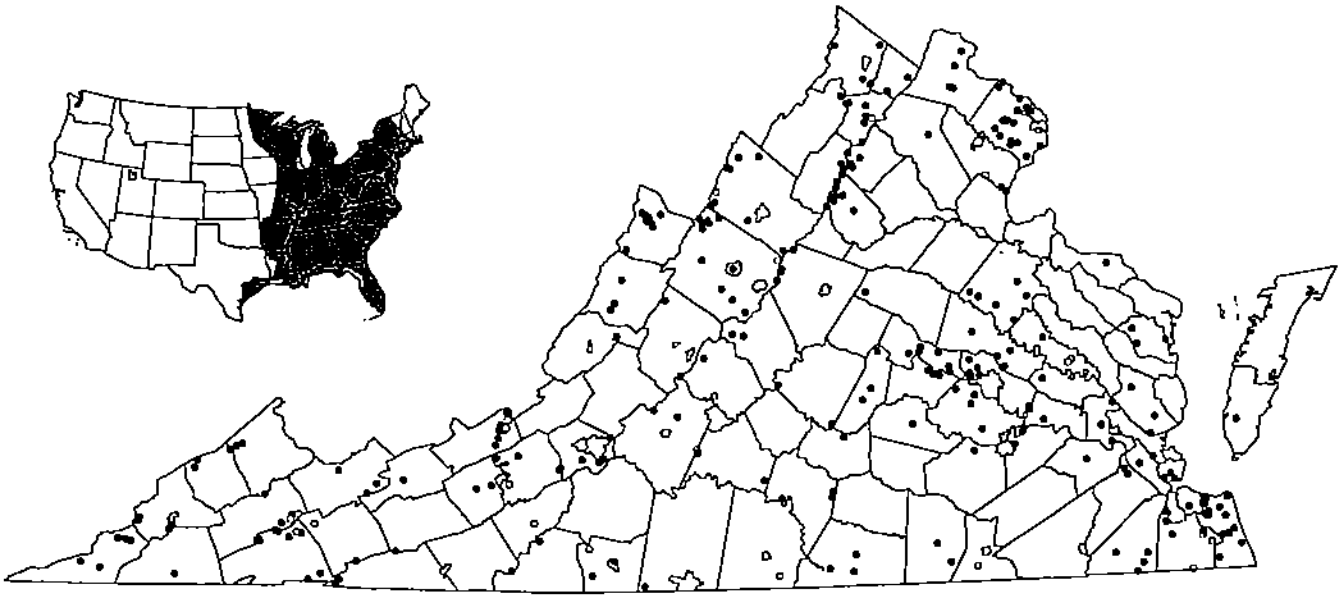
***Tantilla coronata* Baird and Girard - Southeastern Crowned Snake**

This small, terrestrial snake reaches its northern distributional limits in Virginia but is known from only five widely scattered locations in the state. All but one are in the Piedmont. Mitchell (1994a) cited a literature record from Buckingham County. The distributional limits of this species need clarification. It is included in the status undetermined category (Mitchell, 1991).



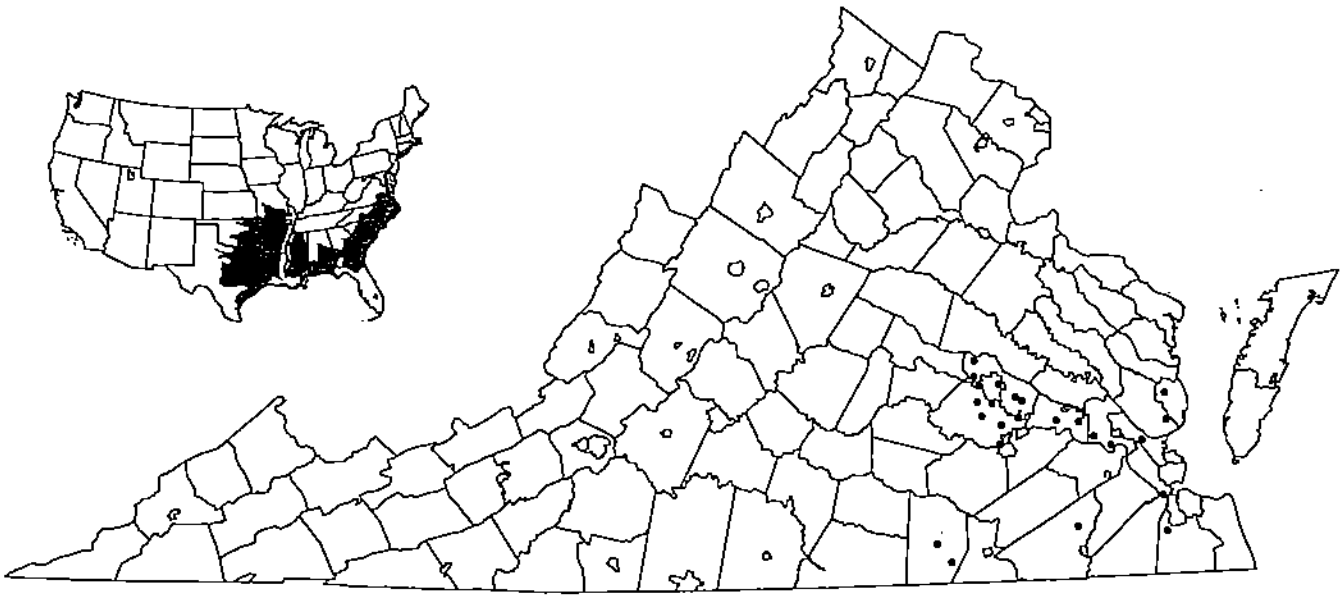
***Thamnophis sauritus sauritus* (Linnaeus) - Eastern Ribbonsnake**

Ribbonsnakes occur throughout most of the state east of the Ridge and Valley physiographic province. Most known locations are widely separated and based on a single specimen. Records from eastern West Virginia (Green and Pauley, 1987) suggest that this snake occurs widely north of the New River drainage. The lack of records for southwestern Virginia and surrounding areas suggests that this species does not occur there.



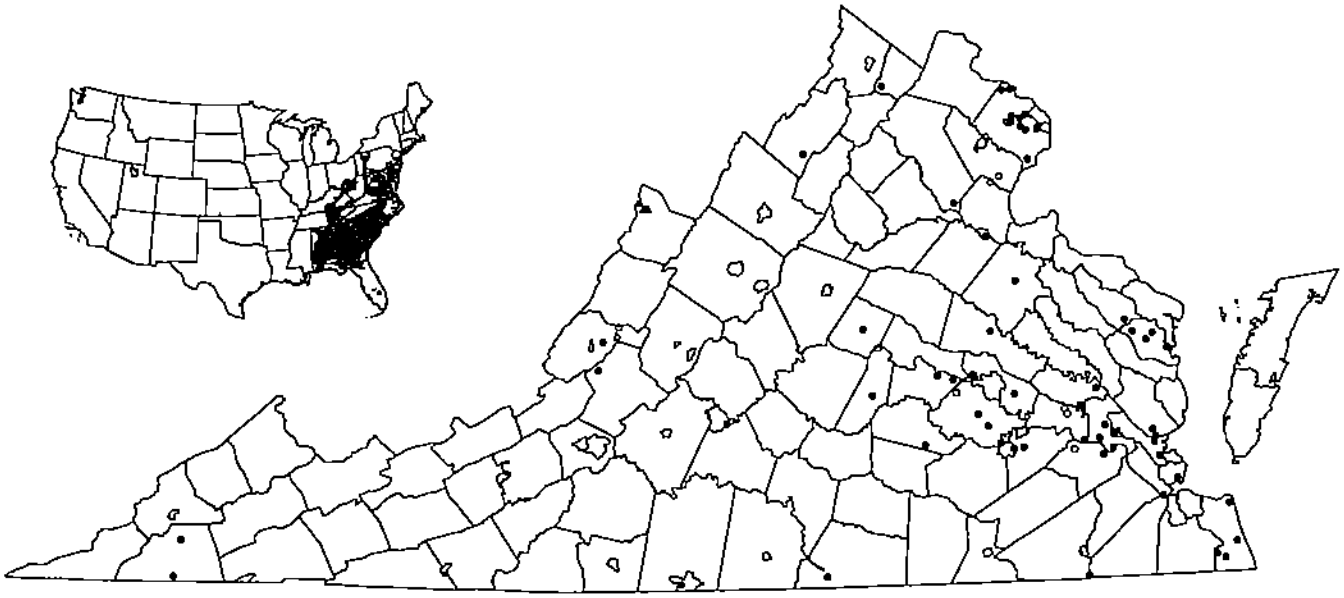
***Thamnophis sirtalis sirtalis* (Linnaeus) - Eastern Gartersnake**

Eastern gartersnakes occur statewide in Virginia from sea level to the highest elevations. Records for several counties could be generated with additional surveying. There are no verified records for the barrier islands (Conant *et al.*, 1990; Mitchell and Anderson, 1994), although Lee (1972) reported one observation.



***Virginia striatula* (Linnaeus) - Rough Earthsnake**

The northernmost limit of the range of this species is in Henrico County, Virginia. Only one locality is known for the vicinity of the Dismal Swamp east of the Suffolk Escarpment (Mitchell *et al.*, 1999a). The western and northern margins of the range of this species in the Commonwealth need to be clarified.



***Virginia valeriae* Baird and Girard - Smooth Earthsnake**

Two subspecies occur in Virginia: *V. v. pulchra* (Richmond), mountain earthsnake (▲), and *V. v. valeriae* Baird and Girard, eastern smooth earthsnake (•). The latter occurs widely north and east of about Roanoke County and in far southwestern Virginia. Records for the Eastern Shore are lacking. The former subspecies is known only from northwestern Highland County, and is listed as a species of special concern (Mitchell, 1991).

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Juvenile copperhead ©Joseph Mitchell

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Mission Statement: To manage Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; to provide opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation; to promote safety for persons and property in connection with boating, hunting and fishing.

Virginia's Nongame Wildlife Fund
Please continue to support the future of our wildlife resources by making a tax-deductible contribution to: Nongame Program, P.O. Box 11104, Richmond, VA 23230-1104. Make checks payable to: Nongame Program, Treasurer of Virginia.

Virginia Department of Game and Inland Fisheries Programs Associated with Amphibians and Reptiles

Survey and Inventory:

Local, regional and statewide surveys remain a critical component of comprehensive management for reptiles and amphibians in Virginia. Annually, Department biologists identify specific needs and target areas for inventory. The Anuran Monitoring Program was established as a part of a national effort to monitor the distribution and relative abundance of frogs and toads. Volunteers use scientifically selected survey routes and monitor these routes several times during each year's frog and toad calling season.

WildlifeMapping: This outreach program provides citizens of the Commonwealth an opportunity to collect wildlife-related information that will then be available through the agency's web site. This program will assist the Department in determining where species occur, aid in filling in data gaps, provide a basis for student research, and help keep common animals common.

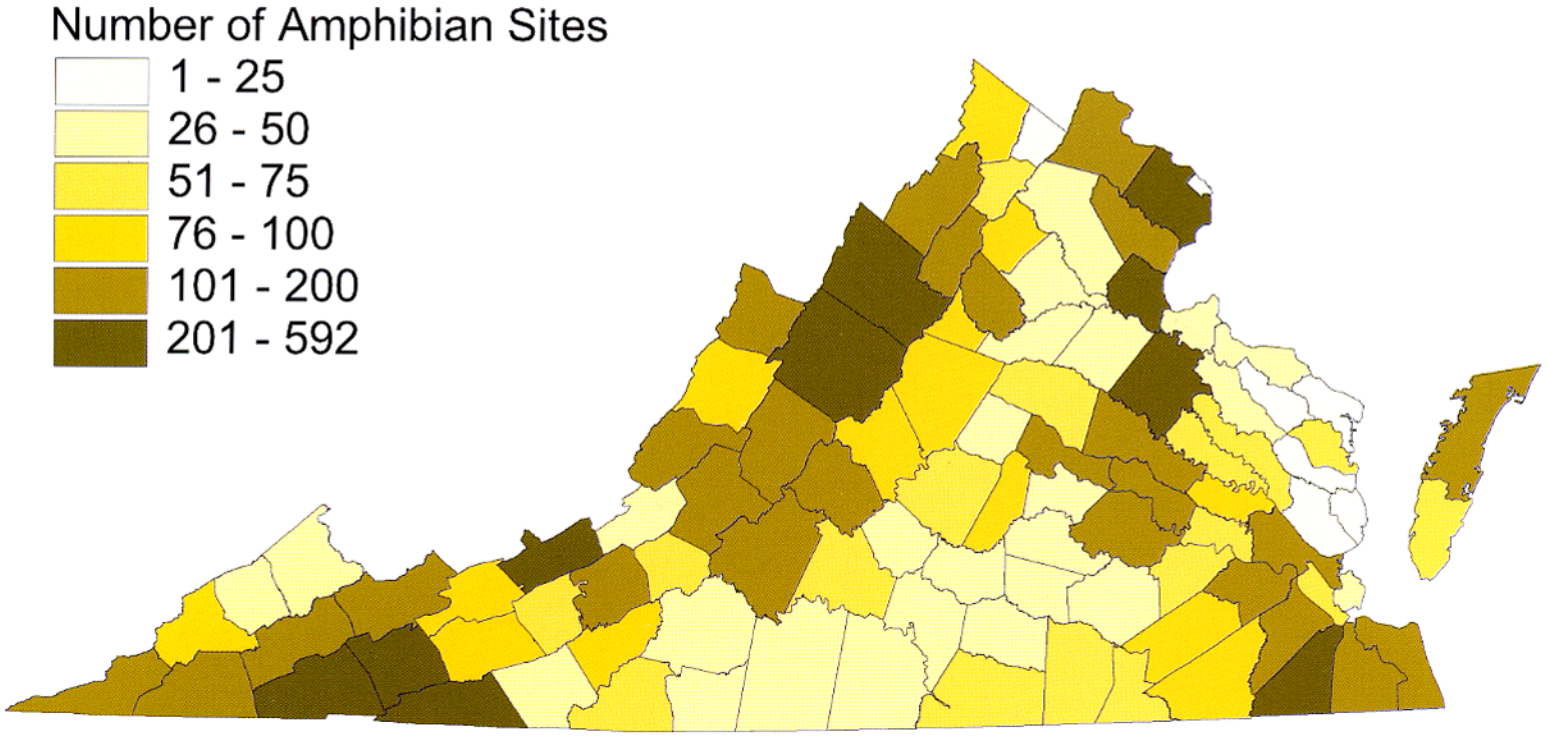
Web Site: The Department's web site provides information about agency programs and activities, boating and wildlife-recreational opportunities, regulations, and Virginia's wildlife resources. The site can be found at http://www.dgif.state.va.us.

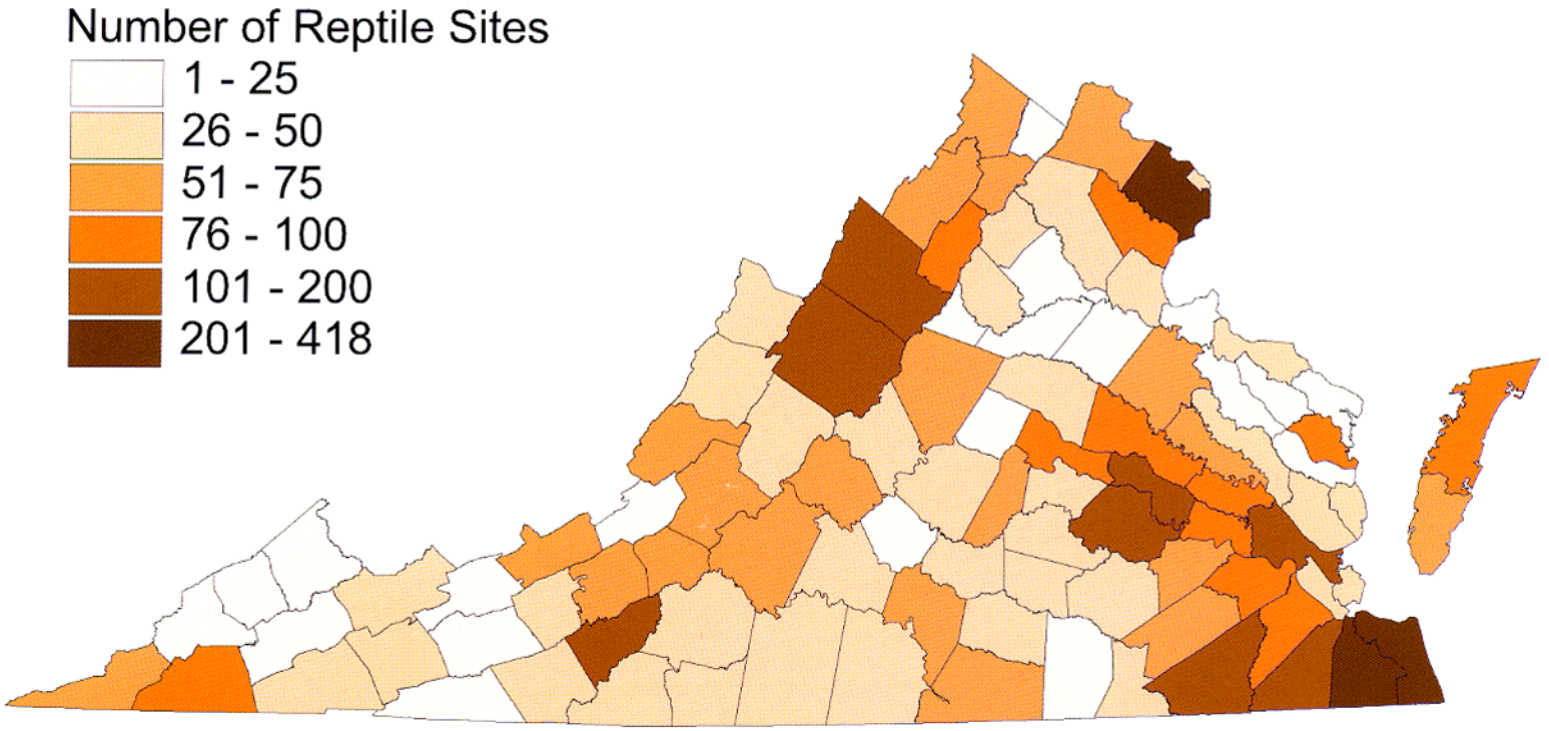
Information Management: Department biologists manage an extensive set of wildlife-related databases. The combined comprehensive system, the Wildlife Information Online Service, is publicly available through the agency's web site. It provides taxonomy, status, distribution, habitat, and life history information about each of Virginia's wildlife species, maps, and mechanisms for developing species lists by geographic area. Geographic information systems play a key role in evaluating and predicting species distributions and occurrences, and impacts of activities to wildlife resources.

Research, Management and Consultation:

Department biologists and cooperators collaborate on a wide range of research projects to examine the life histories of Virginia's reptiles and amphibians, and the intricate relationships between species and environmental factors, including man. This knowledge is then applied through land management activities to protect critical habitats and populations on publicly-owned lands; through consultation to public and private landowners seeking technical assistance in managing wildlife on their lands, and through provision of site or project-specific recommendations to federal, state or local agencies involved in land or water resource development projects.

Herpetological Collection Density (by county)





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