The Venomous Snakes of Texas Health Service Region 8

Health Service Region 8 Counties

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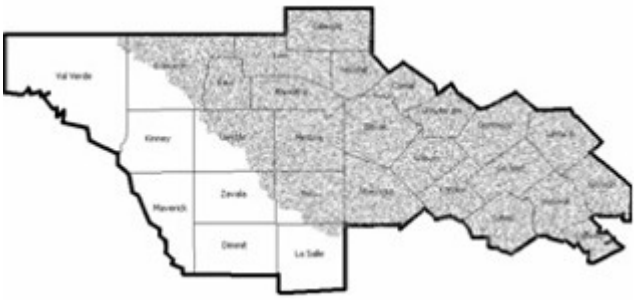
ABSTRACT: With onset of Spring, animal control officers, police officers, wildlife rehabilitators, animal rescue groups and others with animal interests or experience throughout the region will likely receive calls for assistance that involve snakes and at least some of these will involve medically significant venomous species. North America is home to 2 distinct families of venomous snakes, the Viperidae, which includes the rattlesnakes, copperheads and cottonmouths, and the Elapidae, which is represented only by the coral snakes. While some of these snakes are easily identified, some are not and many rank amongst the most feared and misunderstood animals on earth. This article specifically addresses all of the native venomous snakes that inhabit the region and is intended to serve as a reference for animal identification, field safety, safe capture and handling methods, and the currently recommended first aide measures for reptile envenomation.

Each year, numerous animal control officers, law enforcement officers, wildlife rehabilatators, special interest group members and others with snake experience are called upon to assist the general public with the capture and removal of snakes they perceive as dangerous in and around their yards, barns, garages, or houses and in at least some of these cases, the snake in question will have been involved in a bite and will be needed for identification. The State of Texas is home to approximately 120 varieties of snakes, 15 of which are medically significant venomous species.[1] Since the accurate identity of snakes involved in human bite cases can be a critical component of the case history and can greatly influence the course of therapy, prompt and accurate identification of the offending animal can be a critically important component of the case file.

Health Service Region 8 occupies a wide swath of land that traverses the south-central quadrant of the state and encompasses a variety of vegetation zones. Within this ecologically unique region are a diverse array of different habitats ranging from the humid gulf prairies and marshlands in the East, to the comparatively hot and dry Edwards Plateau in the western quadrant. [2,3] With the wide range of soil types and interdigitating vegetation zones that span the northeastern quadrant of the region, the diversity of snake species within the region is predictably large and the distribution of the more ecologically specialized species is somewhat complex.[3] This article addresses the identification, biology and distribution of all of the medically significant venomous species native to the region and frequency at which they are encountered, summarizes some of the species specific behavioral peculiarities, and assesses the relative risk that each species poses to human health and safety. The regional distribution maps included for each species are all original artwork and represent an approximated summation of data from several published field guides, monographs and personal field notes.[1,2,3,4,5,6,7]

Family Viperidae

Western cottonmouth *(Agkistrodon piscivorous leucostoma)*



Approximated regional distribution of *A.p. leucostoma*

The western cottonmouth or water moccasin (*A. p. leucostoma*) is a medium sized semiaquatic pitviper that is widely distributed throughout eastern and central Texas and is common throughout all but the western extreme of the Health Service Region 8. Adult western cottonmouths are stout bodied snakes that usually range from 2 to 4 feet in length with some exceptionally large specimens attaining a maximum length of 5 to 6 feet.[2] The dorsal pattern of the western cottonmouth usually consists of 10 to 15 broad to hourglass-shaped crossbands with darkly pigmented jagged edges and pale centers (Fig. 1A). The ground color and the degree of contrast in the dorsal pattern can vary widely in this species, often matching the dominant soil type in the site of origin. The head is spade-shaped and the top and sides of the snout are typically uniformly dark brown to black without any visible markings (Fig.1). Unlike their cousins the copperheads, the sides of the head of the cottonmouth are marked with a pair of dark longitudinally oriented cheek stripes (Figs. 1A & 1B).

Cottonmouths undergo substantial ontogenetic changes in color and appearance as they mature. The ground color of juvenile western cottonmouths is often much lighter than subadults and adults and they are often so strongly patterned that they are frequently mistaken for copperheads (Fig. 1C). Juvenile cottonmouths and copperheads both often have bright yellow or greenish colored tails that are often employed as lures for prey items such as small frogs and lizards (Figs. 1C and 2D respectively). At the other end of the extreme, older adults are often so heavily melanized that the dorsal pattern is obscured over much of the body, causing some individuals to appear almost entirely black.[4] Some of the morphologic and behavioral features that can be used to rapidly identify cottonmouths in the field include: 1) A spade-shaped head bearing large supraocular scales that overhang and effectively conceal the eyes when viewed from above and 2) The lack of vertical striping on the labial scales, and use of an open mouthed defensive pose (gaping) while simultaneously vibrating the tail when approached or disturbed. (Fig. 1A). Other less obvious morphologic features include; a crown of 9 plates on the dorsal head, a slightly "flattened" or "squared off" rostral profile when viewed from above, the presence of bilateral loreal heat-sensing pit organs, elliptical pupils, and the presence of third upper labial scales that extend from the mouth up to the ventral margins of the eyes.[1,2,4,5]

The cottonmouth is probably the most frequently misidentified snake in North America, largely because it is often confused with the more numerous harmless, but often aggressive natricine water snakes that are commonly encountered around boat houses, parks and yards on populated lakes.[2] Contributing to this problem, is the fact that many species of the water snakes (*Nerodia* spp.) superficially resemble cottonmouths in body build and coloration and are capable of flattening and widening their head into a triangular conformation when alarmed (Fig. 1D). Some of the water snake species in Region 8 that are frequently misidentified as cottonmouths include; the diamondback water snake *Nerodia rhombifer rhombifer*, the broad banded water snake *Nerodia fasciata confluens*, and the blotched water snake *Nerodia erythrogaster transversa*.[2] With practice and learning to focus attention to subtle differences in coloration, morphology and behavior, cottonmouths can be reliably differentiated from non-venomous lookalikes in the field. The sudden change in head shape from a narrow profile to a triangular shape when alarmed, the

medial position of the eyes relative to the lateral margins of the head along with the round pupils, pointed snout profile, vertical striping on the labial scales, and failure to gape and vibrate the tail when approached are all features that can be used to rapidly distinguish harmless water snakes from cottonmouths.[3,5] In addition to these physical and behavioral differences, undisturbed water snakes and cottonmouths swim quite differently. Water snakes tend to swim with only their head resting on the surface and the remainder of the body at or slightly beneath the water surface.[2] Cottonmouths on the other hand, tend to swim with the whole body floating buoyantly and head and neck held above the surface.[2] When either species are disturbed or startled however, this subtle behavioral difference can rapidly become less apparent and is an unreliable indicator of speciation. When pushed or threatened, both species are capable of going underwater and despite myths, both can and will bite while underwater. Contrary to popular belief, cottonmouths will readily enter brackish and salt water and can be found in coastal salt marsh regions, on barrier islands and sometimes on offshore oil rigs.[4]

Although considered to be one of the most feared venomous snakes in North America, behavioral studies have demonstrated that cottonmouths often rely heavily on threat displays and other defensive (scare) tactics rather than offensive (bite) tactics when challenged or threatened by humans.[8] Only when grabbed, stepped on, or otherwise restrained, will cottonmouths readily employ their fangs and venom defensively.[8] Because of this and their preference for swamps, sluggish streams and other habitats that man typically finds undesirable, cottonmouths usually account for only a small percentage of the venomous bites reported annually that occur in the United States.[8,9]

Figure 1. Photographs of adult and juvenile western cottonmouths in comparison to a harmless blotched water snake (*Nerodia erythrogastor*). A. Adult western cottonmouth *Agkistrodon p. leucostoma* (Photo by E. J. Wozniak). B Subadult western cottonmouth (Photo by E. J. Wozniak). C. Juvenile western cottonmouth *Agkistrodon p. leucostoma* (Photo by Craig Howard). D. Head profiles of a western cottonmouth (D1) compared to a blotched watersnake (D2) while in a flattened (defensive) conformation (Photos by E. J. Wozniak). While the head of the alarmed water snake is distinctly triangular, it has a pointed snout in comparison to that of the cottonmouth, large protruding eyes with distinctly round pupils that are medial to the lateral margins of the head and vertical striping on the labial scales. All of these features are characteristic of the *Nerodia* spp. native to HSR 8.

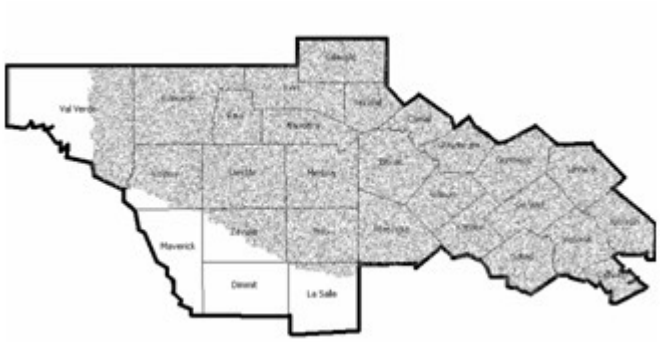
Copperheads

The copperheads are a highly adaptable, brightly colored group of pitvipers that are capable of surviving in and around human habitations including the wooded suburbs and parks in and around many of the larger cities in the Eastern and southeastern United States. [(2)] Behaviorally, copperheads are often classified as an "offensive" species due to their inclination to strike and bite when threatened.[(10)] Because of their high relative abundance, superb protective coloration and their propensity to bite, copperheads are responsible for a large portion of the reported annual human and domestic animal snake bite cases in North America [(8,9,12)]

Region 8 is home to two distinct copperhead subspecies, both of which are patterned with broad crossbands. [(1,2,4)] Unlike their more well known eastern and northern cousins, the crossband pattern on both of theses copperhead subspecies typically exhibit minimal to no narrowing at the dorsal midline.[(2,4,5)] As with other members of the species complex, the head morphology of both is characterized as being broad

and spade-shaped when viewed from above and bears a conspicuous pair of black spots on the parietal scales. Where the two subspecies ranges overlap in eastern Val Verde county, intergradation is common.[1,2,4]

Broad-banded copperhead (*Agkistrodon contortrix laticinctus)*



Approximated regional distribution of *A.c.laticinctus.*

The broad-banded copperhead (*A. contortrix laticinctus)* is widely distributed within the region and is commonly encountered in many areas throughout. As its common name suggests, the dorsal body of *A. c. laticinctus* is patterned with a series of broad chestnut to reddish-orange crossbands that sharply contrast the light orange to tan ground color, (Figs. 2B and 2C). This pattern gives many broad-banded copperheads an alternating coppery red color, making it one of the most strikingly colorful members of the copperhead subspecies complex.[2,4,5] Throughout the region, the broad banded copperhead exhibits a distinct preference for areas with sandy soil that are covered with live oak trees and brush.[2,4] Within such areas, the leave-covered forest floor and orange-colored sandy soil provides nearly perfect camouflage for the snake's contrasting pattern and coloration. Interestingly, a light colored hypomelanistic variant of this copperhead subspecies is known from the eastern aspect of the region, most notably from Lavaca County (Figure 2B). In contrast to the closely related cottonmouths, copperheads seem to avoid salt water and are seldom found in coastal salt marsh regions or on barrier islands.[2,4]

Transpecos copperhead *(Agkistrodon contortrix pictigaster)*

Approximated regional distribution of *A. c. pictigaster.*

The transpecos copperhead (*A. c. pictigaster*) is one the most colorful and elusive copperhead subspecies and is the most xerically-adapted member of the species complex. Superfically resembling its broad banded cousin, the transpecos copperhead is patterned with 10 to 18 broad reddish-brown to chestnut colored crossbands that are nearly as wide at the dorsal apex as they are at the ventrolateral base (Figure 2D). The ventrolateral base of each crossband typically bears a conspicuous pale inverted U-shaped marking that highlights a dark central spot (Figures 2D). On the snake's belly, the crossbands extend onto the lateral scutes where the cranial and caudal margins and the central dark spots form a series of three conspicuous dark brown to black spots (triads).[4] The ventral triads and the presence of pale inverted U-shaped markings in the ventral margin of each crossband are two features that can be used distinguish the transpecos copperhead from *A. c. laticinctus.*[2,4]

Ranging throughout the Northern Chihuahuan Desert of southwestern Texas and adjacent northern Mexico, the transpecos copperhead exists primarily in isolated relict populations that are often nearby permanent springs and along the seasonally moist canyons and creek beds of the transpecos.[1,2,4] Although its distribution is characterized as spotty, dense populations of this species can often be found in or around piles of dead cane that accumulate on fence rows in close proximity to some West Texas rivers.[1,2,4] Its preference for riparian habitats makes *A. c. pictigaster* particularly vulnerable to being translocated by rapidly rising flood water.[4] The transpecos copperhead is the only member of the copperhead species complex that ranges across the Rio Grande into Mexico.[4] Although it is one of the smaller copperhead subspecies, the transpecos copperhead is an excitable and easily agitated snake that is quick to deliver a venomous bite if disturbed. Copperhead venom can be highly destructive to soft tissue and recent records on bites inflicted by this subspecies have documented some to result in severe necrosis and vascular compromise sometimes necessitating the need for amputation.[9,10,12]

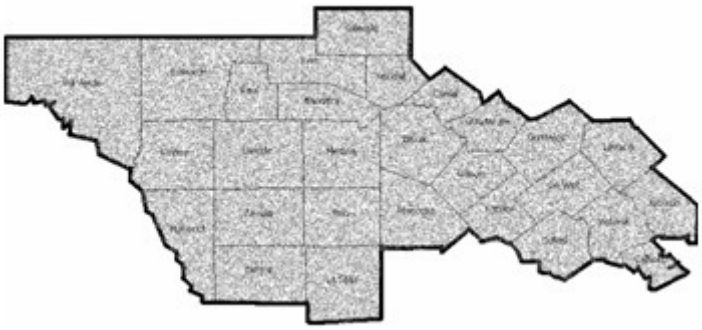
Figure 2. Photographs of broad-banded and transpecos copperheads. A. Adult broad-banded copperhead *Agkistrodon contortrix laticinctus* (Photo by E. J. Wozniak). C. Hypomelanistic broad-banded copperhead (Photo by E. J. Wozniak). C. Adult Transpecos Copperhead *Agkistrodon contortrix pictigaster* (Photo by E. J. Wozniak). Neonatal Transpecos Copperhead *Agkistrodon contortrix pictigaster.* (Photo by W.M Niederhofer).

Rattlesnakes

The rattlesnakes are a well-known group of pitvipers that are unique to the New World and are widely distributed in the State of Texas. Two distinct genera are recognized: 1) Crotalu*s* which includes all of the larger varieties and 2) Sistrurus which includes only the massasaugas and pygmy rattlesnakes.[13] Generic classification is largely based upon the morphology of the scales covering the crown of the head. The dorsal crown of *Crotalus* spp. is covered with small scales whereas the crown of *Sistrurus* spp. is covered with nine large plates similar to those observed on copperheads and cottonmouths.[13] Representative species from both genera can be found in Health Service Region 8.

Although they vary in size and the ability to produce the characteristic buzzing sound, both genera produce a rattle on their terminal tails that is composed of interlocking segments of hardened keratin. Being derived of epidermal keratin, a fresh segment is added to the base of the rattle each time the animal sheds its skin.[13] Because the number of molts per year per year can vary considerably and segments readily break from the structure, despite common myths, the number of buttons is not an accurate predictor of age.[13] It is important to note that rattlesnakes of any species do not reliably employ their rattle to give warning prior to delivering a defensive bite. It should also be noted that under damp or flooded conditions, the entry of water into the rattle can effectively silence it, making the characteristic buzz difficult to hear. [5] A comprehensive list of species native to the region is provided below.

Western Diamondback Rattlesnake (*Crotalus atrox)*



Approximated regional distribution of *C. atrox*

The western diamondback rattlesnake (*C. atrox*) is a large grey to rust colored serpent that is widely distributed across the southwestern to south-central quadrant of the United States and has a long-standing status as a Texas icon. The dorsum of the typical *C. atrox* bears a series of dark rhomb-shaped markings that are highlighted by an inner row of darkly pigmented scales and an outer row of light cream to white colored scales that highlight the borders of each marking (Fig. 3A). The dorsal pattern is most prominent on the anterior half of the body and tends to fade into a series of less conspicuous crossbands caudally (Fig.

3A). The tail of *C. atrox* is conspicuously marked with a series of sharply contrasting black and white rings of roughly equivalent width, a feature that has earned the species the local name "coon tailed rattlesnake" in some localities.[2] The head of the western diamondback typically bears a dark gray mask that is bordered by prominent pair of white borders that runs diagonally across the cheeks (Fig. 4A). Unlike any other rattlesnake in its native range in Texas, the caudal margins of the mask run down to, rather than behind the corners of the mouth.[2]

The western diamondback thrives in a variety of different habitats including desert, prairie, thorn forest, woodlands and coastal sand dune areas and is an abundant species throughout Region 8 including the Gulf Coast and barrier islands.[2] Being a common and highly excitable and aggressive rattlesnake species, *C. atrox* is responsible for a large portion of the snake envenomation cases and most of the snake bite fatalities documented in the United States each year.[2,13] The venom is a complex mixture tissue destructive enzymes, hemotoxins and some neurotoxic peptides.[9,13] Pain, swelling, hemorrhage, local necrosis, lymphadenopathy, coagulopathy, dizziness, fainting, and hypovolemic shock are commonly reported with bites inflicted by this species.[2,9,13] Long term peripheral morbidity including permanent disfigurement and the loss of digits or limbs are common sequelae.[9,13]

Timber (Canebreak) Rattlesnake *(Crotalus horridus)*

Approximated regional distribution of *C. horridus*

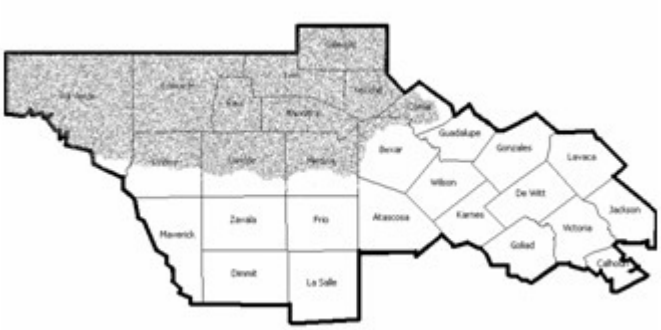
The timber rattlesnake (*Crotalus horridus*) is a large, heavy bodied, banded rattlesnake that ranges throughout a large portion of eastern and central North America and has remained an American icon since its illustration on the yellow Gadsden flag along with the infamous words "Don't Tread on Me". The ground color of this species varies somewhat, but is generally yellow to tan with variable amounts of black stippling.[2] The dorsal pattern of the timber rattlesnake is unlike that of any other North American rattlesnake and is best characterized as a series of black chevrons. In addition to the chevrons, individuals originating from the southern and western aspects of the snake's range (which includes Texas), typically have a prominent cinnamon colored mid-vertebral stripe that extends from the neck down to the level of the tail, and a pair of black cheek stripes that extend from the eyes caudoventrally to and beyond the corners of

the mouth on each side of the head.[1,2,13] The caudal body and tail are almost invariably black, a feature which gives the species the local name "velvet tailed rattler" in some localities (Fig. 3B).

Across its broad range, the timber rattlesnake inhabits a variety of different habitats including, but not limited to upland deciduous forests, rocky ridges, riparian corridors, cypress swamps, cane reed thickets and wet prairie regions.[2,13] Once an abundant species, timber rattlesnakes have been reported to be declining at an alarming rate in many areas. Within the State of Texas, it is classified as a threatened species and is protected by law.[1,2,11] .

Crotalus horridus is a large rattlesnake species that produces moderate to large amounts of moderate to highly toxic venom. Venom potency is reported to vary between populations and sometimes individuals within a given population, yielding a range of different LD_{50} values.[2] Certain populations of this species have been shown to produce deadly neurotoxic peptides.[2] Interestingly, both of the snakebite fatalities reported to the American Association of Poison Control Centers (AAPCC) in 2002 were attributable to *C. horridus* bites.[5]

Northern Black Tailed Rattlesnake (*Crotalus molossus molossus)*



Approximated regional distribution of C. m. molossus

The northern black tailed rattlesnake (*C. m. molossus*) is a medium to large, light gray to yellowish-green colored rattlesnake that ranges throughout a large portion of the arid southwestern United States (Texas, New Mexico and Arizona) and adjacent Mexico.[1,2,5,13] The ground color of this species varies predictably across its US distribution, ranging from light gray in Texas, to yellowish-green in Arizona.[2,13] The dorsal pattern of the black tailed rattlesnake consists of a series of black diamond-shaped blotches with light centers (Figure 3C). Posterior to the neck region, the lateral points of each diamond typically extend ventrally to the level of the first scale row, effectively forming a series of distinctive crossbands-like marking on the sides of the animal (Figure 3C). As with the pattern on the western diamondback, the markings become less prominent on the caudal progression and are often reduced to light centered crossbands on the caudal third of the body. A unique feature of *C. molossus* is its solid black tail, which sharply contrasts the light colored caudal body proximal to it (Figure 3C). Unlike the previously described

timber rattlesnake, which can also have a black tail, the black coloration on *C. m. molossus* does not extend anterior to the vent (Figure 3C). The head of this species typically bears a prominent solid black stripe that extends diagonally across the cheeks from just above the corners of the mouth, upward to and across the anterior crown.[1,2,13]

In the State of Texas, *C. m. molossus* inhabits the wooded canyons, cliffs and rock piles in the west-central Edwards Plateau and the adjacent Chihuahuan Desert and is therefore present only in the western half of HSR 8.[12] Although often regarded as a mild tempered rattlesnake, *C. m. molossus* packs moderate to large amounts of potent venom and is unquestionably a dangerous species. Because of apparent antigenic differences between black tailed rattlesnake venom and the venoms of the North American pitvipers employed in the production of the anti-venom CroFab, treatment of *C .m. molossus* bites with this product can sometimes require larger than expected quantities of the anti-toxin to achieve effective neutralization of the venom. [14]

Mottled Rock Rattlesnake *(Crotalus lepidus lepidus)*

Approximated regional distribution of *C. l. lepidus*

The mottled rock rattlesnake (*C. l. lepidus*) is a small rattlesnake species that is uniquely patterned with a series of jagged edged dark crossbands (Figure 3D). Unlike any other rattlesnake in its range, the pattern of crossbands of *C. lepidus lepidus* start out pale on the neck and anterior body become and become increasingly darker and more prominent caudally (Figure 3D). A serpent of many colors, the ground color of mottled rock rattlesnake varies considerably across its range, often matching the predominant soil type and rock color from the area where the specimen originated. [1,2,15] Ground color in this species can range from bluish-gray to pink to greenish-yellow in different localities.[1,2,15] Regardless of the ground color, the tail of *C. l. lepidus* is typically tan and bears a series of several thin widely spaced brown to black rings (Figure 4D). The head of the mottled rock rattlesnake usually bears a pair of dark diagonal cheek stripes that extend from the back of each eye to the caudal margins of the mouth.[1,2,15]

Rock rattlesnakes inhabit the limestone canyons, rock outcroppings, bluffs and mountain woodlands throughout parts of the Edwards Plateau and the Transpecos region of Texas, a small portion of

southeastern New Mexico and southward through an extensive area of adjacent Mexico.[2,13,15] *Crotalus lepidus* is generally considered to be a reclusive, but excitable rattlesnake species. Certain populations of this species have been documented to produce a potent neurotoxic peptide, similar to that produced by the deadly Mojave rattlesnake (*C. scutulatus scutulatus*).[16]

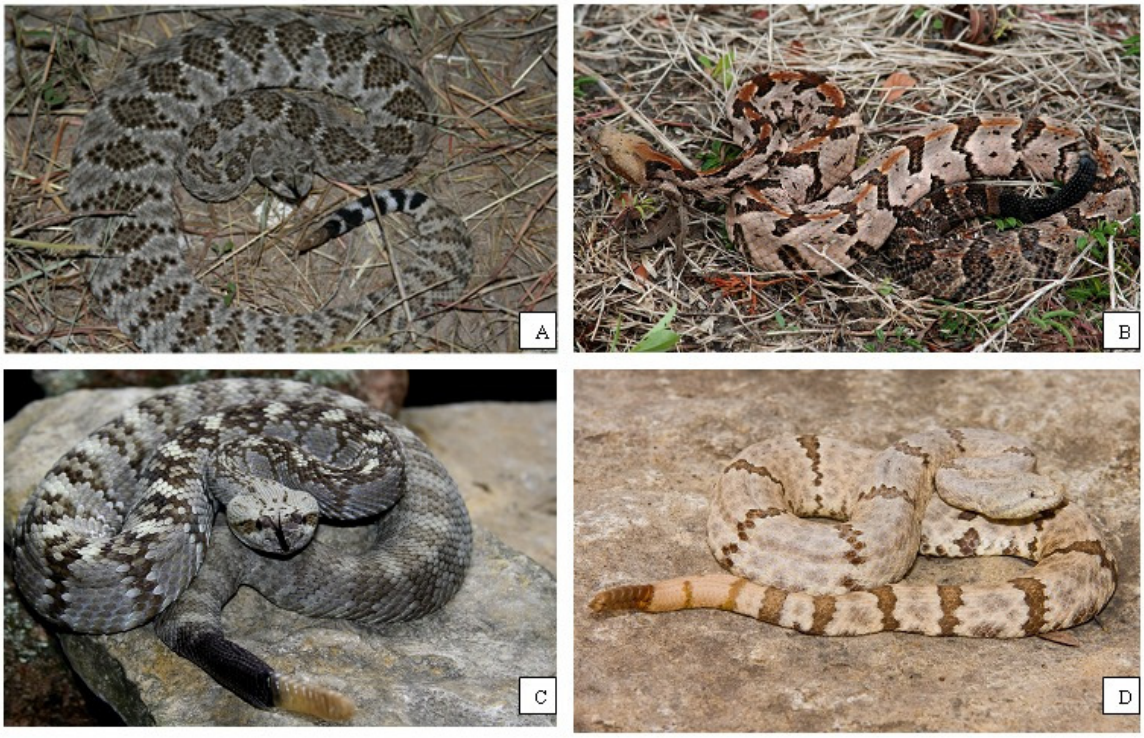


Figure 3. Rattlesnakes (*Crotalus* spp.) native to Health Service Region 8. A. Western Diamondback Rattlesnake *Crotalus atrox* (Photo by E.J. Wozniak) B. Timber (Canebreak) Rattlesnake *Crotalus horridus* (Photo by E.J. Wozniak). C. Northern Black Tailed Rattlesnake *Crotalus molossus* (Photo by E.J. Wozniak). D. Mottled Rock Rattlesnake *Crotalus lepidus lepidus* (Photo by D.L. Wozniak).

Massasaugas and Pygmy Rattlesnakes

Desert Massasauga *(Sistrurus catenatus edwardsi)*

Approximated regional distribution of *S. c. edwardsi*

The massasaugas (*S. catenatus*) are a group of small to medium blotched rattlesnakes that range throughout a large portion of the Midwest and southwestern prairie regions of the United States.[2,5,13] The ground color of this small to medium sized rattlesnake is typically gray to tan and the dorsum typically bears a series of round to irregularly shaped dark blotches (Fig. 4B & 4C). The sides of the head are marked with a dark, white edged mask that runs diagonally across the cheeks, extending from the crown, across the eyes to an area just posterior to the corners of the mouth. Two recognized subspecies are native to the State of Texas, the western massasuaga (*Sistrurus c. tergeminus*) which inhabits the long grass prairies of north central quadrant and northern gulf region of the state, and the desert massasauga (*Sistrurus c. edwardsi*) which inhabits the short grass prairies of west Texas and mesquite/prickly pear savanna and grass covered sand dune areas in the southern Rio Grande Valley.[2] Subspecific differentiation of the two, is largely based upon subtle differences in coloration, the number of dorsal blotches, the distance between blotches in the dorsal pattern, and the lack of gray mottling on the ventral scutes.[2,13] In South Texas, most massasaugas are keyed out as *S. c. edwardsi* which is thought to range from City of Palacios southward along the Gulf coast and its barrier islands and westward throughout most of South Texas brush country. [2] Where the ranges of the two subspecies overlap however, intergradation is common.[1,2,7] Within HSR 8, the distribution of massasaugas is limited to a small portion of the eastern counties where they exist primarily as either the desert form or as western/desert intergrades. Throughout their range, massasaugas tend to occur in small localized populations that are vulnerable to development and agricultural practices and are now classified as uncommon in most regions in the State.[2] Because of their blotched patterns and small rattles, massasaugas are prone to being misidentified as harmless Great Plains rat snakes (*Elaphae gutatta emoyri*) (Fig. 4D) and/or prairie king snakes (*Lampropeltis calligaster*), a mistake that could have dire consequences if the animal is picked up an handled. Despite their small size and comparatively short

fangs, massasauga venom is characterized as moderately potent and is capable of causing significant localized tissue destruction and hematological disturbances.[9,13]

Western Pygmy Rattlesnake *(Sistrurus miliaris streckeri)*

Approximated regional distribution of *S.m. streckeri*

The western pygmy rattlesnake (*Sistrurus miliaris streckeri*) is a small pinkish-colored rattlesnake that ranges throughout most of Mississippi, Arkansas and Louisiana, eastern Texas and southeastern Oklahoma.[2,13] The ground color of this species is typically light pink to tan and the dorsum is marked with rust colored longitudinal stripe and a series of contrasting black blotches that are often laterally extended into transversely oriented bar-like spots (Fig. 4A). Each side of the body is patterned with a row of black spots that sometimes extend onto the snakes pale ventral scutes. The head is boldly marked with black stripes on both the crown and the sides, the later of which forms a thin mask.[1,2,13] Like other members of the pygmy rattlesnake species complex, the rattle of the western pygmy rattlesnake is tiny and inconspicuous compared to those of other Texas rattlesnakes and is at best, audible from only a few feet away.[2,13]

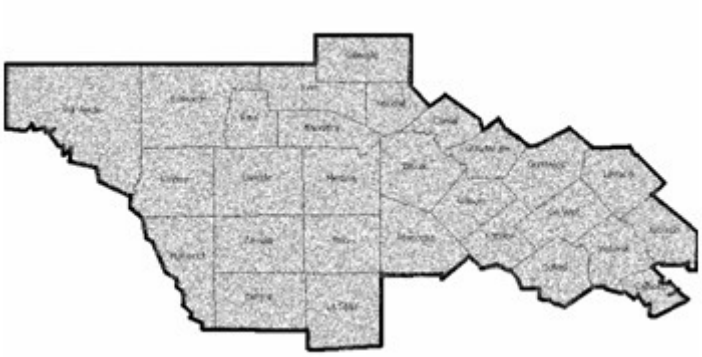
Throughout its range, the western pygmy rattlesnake is known from a variety of different habitats including pine-oak and river bottom hardwood forests, palmetto scrub lowlands and wet saw grass prairies.[1,2,6,13] Because of this, it preference for areas with abundant ground cover and its rather secretive nature, the western pygmy rattlesnake is seldom encountered in the wild.[1,2,6] Within HSR-8, *S. m. streckeri* is at best, uncommon and is known only from a few of its eastern counties.

The venom of this species is characterized as moderately potent, but due to the snakes small size, is produced in small quantities in comparison to the other native pitviper species.[2,9,13]

Figure 4. Massasauga amd Pygmy Rattlesnakes (*Sistrurus* spp.) native to Texas Health Service Area 8. A. Western pygmy rattlesnake *Sistrurus m. streckeri* (Photo by E.J. Wozniak). B. Desert massasauga *Sistrurus c. edwards,* gray color phase (Photo by E. J. Wozniak). C. Juvenile Desert massasauga *Sistrurus c. edwardsi, t*an color phase (Photo by E. J. Wozniak). D. Emory's rat snake *Elaphae guttata emoryi*, a harmless sympatric species that superficially resembles the western and desert massasaugas (Photo by E. J. Wozniak).

Family Elapidae

Texas Coral Snake *(Micrurus tener tener)*



Approximated regional distribution of *M. t. tener*

Coral snakes are small brightly colored members of the family Elapidae and represent the only members of this family that are native to North America.[2] The Texas Coral snake *Micrurus tener tener* is the only coral snake species native to the State of Texas. Formerly classified as a subspecies of *Micrurus fulvius*, *M. tener* is similarly patterned the characteristic wide red and black rings that are separated by thinner yellow rings and can be readily differentiated from the similarly-colored harmless Mexican (*Lampropeltis triangulum annulata*) and Louisiana milk snakes (*Lampropeltis triangulum amaura*) and the Texas scarlet snakes (*Cemophora coccineia lineri*) that share portions of its range by the infamous rhyme, "red on yellow kill a fellow"(Figs. 5Aand 5B).

In contrast to the vipers which all have long fangs that are situated on rotating maxillary bones that enable them to be folded back when the mouth is closed, the fangs of the coral snakes and other elapids are rigidly fixed in position on the anterior maxilla and out of necessity, are notably shorter. Despite their small size, with their surprisingly wide bite radius and strong jaws, coral snakes can easily pinch out and puncture a fold of skin almost anywhere on the human body and can instantly deposit a lethal dose of venom through short hollow fangs.[2] Because of their inoffensive nature, small size and short fangs, North American coral snakes pose little risk to individuals wearing appropriate clothing and footwear.[2] Most coral snake bites in humans occur on the hands and usually involve a coral snake that was intentionally picked up and handled.[2,17] Defensive bites inflicted on humans in which there is little to venom injection have been reported to be common with this species.[2] A recent retrospective study documented that only 7.3% of the reported *M. tener* bite cases between 2000 and 2004 resulted in serious systemic poisoning.[18] None the less, toxicological evaluation of coral snake venom has shown its potency to be similar to some cobras [2] and all bites should be considered to be medically significant events that are worthy of prompt medical attention.[17,19]

Micrurus tener tener is widely distributed in south-central Texas and is known from all the counties comprising HSR 8.[1,2,5] Being a secretive and largely fossorial species, coral snakes are seldom seen, even in areas that harbor dense populations.[2] Within the greater San Antonio area, the coral snake is an abundant species where it is commonly encountered under flagstones near homes.[7]

Figure 5. Texas coral snake and a harmless sympatric mimic, the Mexican milksnake. A. Texas coral snake *Micrurus tener tener* (Photo by E.J. Wozniak). B. The harmless Mexican milk snake *Lampropeltis triangulum annulata* (Photo by E.J. Wozniak). Note the difference in the sequence of colored bands between these two species.

Bite Victim First Aid

Pitviper bites

The current recommendations for pit viper envenomation are to place the victim at rest and keep calm and warm. [5,9] The injured part of the body should be immediately freed of any constricting jewelry, immobilized with a loose fitting dressing and if possible, maintained at the level of the heart.[5] Paramedical attention should be directed towards the maintenance of a patent airway, administration of oxygen, establishment of intravenous access in an unaffected limb, and prompt transportation to the nearest medical facility.[5,17] Immediate hypersensitivity reactions to venom are possible in some cases and may require epinephrine and antihistamines.[5,17] The progression of swelling should be closely monitored during transport. Marking the advancing edge of the swelling with a marker at 15 to 20 minute intervals can provide the treating physician with valuable information on gauging the severity of the bite[5,12] The dated "cut and suck" method recommended in the 1960's and 70's, the use of venom extraction devices, chill methods, electroshock therapy and tourniquets have all been shown to have the potential to worsen the outcome of a bite and are now strongly discouraged.[5,17]

Once at a medical facility, victims of snakebite should be promptly evaluated by a qualified physician. Aggressive supportive care including pain management, local wound care, updating tetanus prophylaxis if needed, and anti-venom therapy are often required for effective treatment.[17] The only FDA-approved antivenom for North American crotalid bites that is currently being manufactured is CroFab (Protherics – Altana division of Savage Laboratories, Brentwood, TN). Consultation with a medical toxicologist at a regional poison control center (National Hotline (800) 222-1222) is recommended for the treatment of pit viper envenomation cases.

Coral snake bites

Because of their short fangs and venom that is primarily a systemic neurotoxin, the triage and treatment of victims bitten by coral snakes (*Micrurus* spp.) is quite different from that recommended for pitvipers. Studies on elapid snakebites with similar venoms have shown that pressure immobilization bandaging the affected limb can effectively impede the egress of toxins from the bite site and delay systemic involvement.[20,21] Experimental evidence has shown that this method can be highly effective with coral snake bites.[23] The recommended technique is to start the wrap at the bite site and cover the entire extremity which is subsequently immobilized with a splint or sling. The goal in applying the wrap is to impede lymphatic flow by attaining pressures of 40 to 70 mm Hg in upper extremities and 55 to 70 mm Hg on the lower limbs.[21] Experimental studies have documented that attaining these prescribed pressures is technically difficult and suggest that the effective use of this method may require extensive training and experience.[22] Because of this, properly training emergency response personnel on the application of pressure immobilization bandages is recommended in areas were elapid snakes are common. All coral snake bite victims should be transported to the nearest medical treatment facility as soon as possible.[17,19] Case studies have demonstrated that the onset of neurological signs and symptoms of envenomation can be delayed for as long as 12 hrs.[19] Because of this, all suspected coral snake bite victims should be admitted and closely monitored for signs of neurotoxicity, oxygen saturation and ventilatory function for a minimum of 12 hrs.[17] Consultation with a regional poison control center (National Hotline (800) 222-1222) is recommended. The only FDA approved anti-venom product available for the treatment of American coral snake bites is Wyeth anti-*Micrurus fulvius* antivenin (Wyeth-Ayerst, Marietta, PA). The formerly described pitviper anti-venom product (Cro-Fab), is not effective against *Micrurus* spp. venoms and is not indicated in coral snake bite cases.[5]

Snake bite prevention

There are a number of things that field and emergency response personnel can do to prevent snake related accidents. First off, potential responders should familiarize themselves with all of the indigenous species, their habits and their medical significance. When traversing of working in snake inhabited areas, personnel should avoid putting their hands and feet in places that can not be visually inspected for snakes. The safest way to cross obstacles such as fallen trees or other large pieces of debris is to step up onto the structure, check for snakes on the opposite side and then carefully stepping into the visually cleared area. When traversing flooded areas, great care should be taken to avoid blind contact with brush or limbs projecting over or out of the water.[5,24]) Snakes displaced by high water will often climb onto such structures and may be concealed by foliage.[5,24] Appropriate protective clothing should be worn at all times when venturing into areas likely to harbor venomous snakes. Minimally this should include; loose fitting trousers, long-sleeved shirts and boots.[24] For added protection against the entry of snakes and/or arthropods into pant legs, the trousers should be bloused. Wearing clothing in this manner confers several protective features to the individual including, providing mechanical protection against bites, limiting the

heat signature of the body, diverting fangs away from the skin, and limiting the depth of fang penetration if bitten.[24]

In the event that a venomous or unidentified snake is encountered in the field, it is best to slowly move out of the snakes strike range without making any sudden or erratic strike-provoking movements. As a general rule of thumb, the maximal strike distance of most snakes is approximately one half of their body length so maintaining a distance of approximately one body length should provide an adequate margin of safety in most circumstances.

Conservational concerns

Recent studies have documented reptile venoms to be highly complex mixtures of proteins that are rich sources of unique peptides and other potentially valuable biomolecules that can be isolated and employed in the treatment chronic human diseases such as diabetes, cancer and heart disease.[25,26,27] In addition to being a potential source of valuable pharmaceuticals, snakes are highly efficient predators of pestiferous rodent species and play a vital role in their control. Because of these and other reasons, snakes encountered in their native habitat should be treated with respect and left alone.

With the ongoing expansion of urban development, encounters with displaced wildlife are on the increase including those involving venomous snakes. The needless killing of snakes and other animals should be discouraged under any conditions. Many places now recommend the safe capture and relocation of snakes to prevent their unnecessary destruction. To meet these new expectations, animal control officers and other personnel responding to calls involving snakes should become proficient with safe reptile capture and handling methods.

Safe capture and handling methods

In any situation involving a snake, venomous or not, maintaining an awareness of your surroundings is of the utmost importance. In searching an area for snakes, it should be noted that snakes can and will take refuge in almost any "hide spot" available, including the smallest and most inconspicuous of places, often requiring a meticulously thorough search for their successful recovery. Once a snake is located, the responder should use a hook or pair of tongs to safely maneuver it to an area away from potential escape points and then capture it. Unless the snake can be positively identified, it should be handled using a venomous animal handling protocol with operator always maintaining a safe distance between themselves and the animal.

Figure 6. Illustration of a safe capture method for snakes using a hook. The snake is picked up mid-body with a hook or tongs and is gently placed in a container (Photo by T. J. Wozniak). With the snake safely on the floor of the container, the lid should be lowered and secured in place. Venomous or unidentified snakes should be placed individually in bite proof containers that have a secure lid. Five-gallon plastic buckets with screw capped lids that are perforated for ventilation and a centrally positioned handle in the lid work well for most applications. Having a handle on the center of the lid protects the handler in the event of an upward strike. Note the back-up tongs on the ground behind the capture bucket just in case the animal becomes unruly or goes out of control.

Minimally, the tools needed to safely capture and handle snakes should include a set of hooks and tongs and some capture buckets with secure lids that have centrally positioned handles (Fig. 6) a first aid kit equipped with bandage materials, appropriate protective clothing, and some form of eye protection. While none of the native venomous snakes can spit venom, pitvipers on occasion, will eject and 'throw' venom when striking and hitting capture tools, cage lids or other objects and can cause some level of keratitis (and panic) if it gets into the eyes. Generally speaking the use of a hook and balancing the snake on it is much less likely elicit defensive behavior from the snake than tongs, but the later should always be readily available for those 'just in case' instances. Some species are notorious for not staying on a hook very well (e.g. *Crotalus atrox*) and often require the use of tongs. Once the snake is safely contained, the collector should make sure that the bucket is clearly labeled "VENOMOUS SNAKE" to warn any unsuspecting people of its contents. After capture, the disposition of the snake should be determined by the departmental or agency standard operating procedures.

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