

= Agkistrodon piscivorus =

*Agkistrodon piscivorus* is a venomous snake , a species of pit viper , found in the southeastern United States . Adults are large and capable of delivering a painful and potentially fatal bite . When antagonized , they will stand their ground by coiling their bodies and displaying their fangs . Although their aggression has been exaggerated , individuals may bite when feeling threatened or being handled . This is the world 's only semiaquatic viper , usually found in or near water , particularly in slow @-@ moving and shallow lakes , streams , and marshes . The snake is a strong swimmer and will even enter the sea . It has successfully colonized islands off both the Atlantic and Gulf coasts .

The generic name is derived from the Greek words *ancistro* ( hooked ) and *odon* ( tooth ) , and the specific name comes from the Latin *piscis* ( fish ) and *voro* ( to eat ) ; thus , the scientific name translates into ? hooked @-@ tooth fish @-@ eater ? . Common names include variants on water moccasin , swamp moccasin , black moccasin , cottonmouth , gapper , or simply viper . Many of the common names refer to the threat display , where this species will often stand its ground and gape at an intruder , exposing the white lining of its mouth . Three subspecies are currently recognized , including the nominate subspecies described here .

= = Description = =

This is the largest species of the genus *Agkistrodon* . Adults commonly exceed 80 cm ( 31 in ) in length , females grow up to be smaller than males . Total length , per one study of adults , was 65 to 90 cm ( 26 to 35 in ) . Average body mass has been found to be 292 @. @ 5 to 579 @. @ 6 g ( 10 @. @ 32 to 20 @. @ 44 oz ) in males and 201 @. @ 1 to 254 @. @ 1 g ( 7 @. @ 09 to 8 @. @ 96 oz ) in females . Occasionally , individuals may exceed 180 cm ( 71 in ) in length , especially in the eastern part of the range . According to Gloyd and Conant ( 1990 ) , the largest recorded specimen of *A. p. piscivorus* was 188 cm ( 74 in ) in length , based on a specimen caught in the Dismal Swamp region and given to the Philadelphia Zoological Garden . It should be noted , however , that this snake had apparently been injured during capture , died several days later and was measured when straight and relaxed . Large specimens can be extremely bulky , with the mass of a specimen of approximately 180 cm ( 71 in ) in length known to attain 4 @. @ 6 kg ( 10 lb ) .

The broad head is distinct from the neck , and the snout is blunt in profile with the rim of the top of the head extending forwards slightly further than the mouth . Substantial cranial plates are present , although the parietal plates are often fragmented , especially towards the rear . A loreal scale is absent . There are six to 9 supralabials and eight to 12 infralabials . At midbody , there are 23 ? 27 rows of dorsal scales . All dorsal scale rows have keels , although those on the lowermost scale rows are weak . In males / females , the ventral scales number 130 @-@ 145 / 128 @-@ 144 and the subcaudals 38 @-@ 54 / 36 @-@ 50 . Many of the latter may be divided .

Though the majority of specimens are almost or even totally black , ( with the exception of head and facial markings ) , the color pattern may consist of a brown , gray , tan , yellowish @-@ olive or blackish ground color , which is overlaid with a series of 10 ? 17 dark brown to almost black crossbands . These crossbands , which usually have black edges , are sometimes broken along the dorsal midline to form a series of staggered halfbands on either side of the body . These crossbands are visibly lighter in the center , almost matching the ground color , often contain irregular dark markings , and extend well down onto the ventral scales . The dorsal banding pattern fades with age , so older individuals are an almost uniform olive @-@ brown , grayish @-@ brown or black . The belly is white , yellowish @-@ white or tan , marked with dark spots , and becomes darker posteriorly . The amount of dark pigment on the belly varies from virtually nothing to almost completely black . The head is a more or less uniform brown color , especially in *A. p. piscivorus* . Subadult specimens may exhibit the same kind of dark , parietal spots characteristic of *A. contortrix* , but sometimes these are still visible in adults . Eastern populations have a broad , dark , postocular stripe , bordered with pale pigment above and below , that is faint or absent in western populations . The underside of the head is generally whitish , cream or tan .

Juvenile and subadult specimens generally have a more contrasting color pattern , with dark crossbands on a lighter ground color . The ground color is then tan , brown or reddish brown . The tip of the tail is usually yellowish , becoming greenish yellow or greenish in subadults , and then black in adults . On some juveniles , the banding pattern can also be seen on the tail . Young snakes wiggle the tip of their tail to lure prey animals .

This species is often confused with the copperhead , *A. contortrix* . This is especially true for juveniles , but there are differences . *A. piscivorus* has broad , dark stripes on the sides of its head that extend back from the eye , whereas *A. contortrix* has only a thin dark line that divides the pale supralabials from the somewhat darker color of the head . The watersnakes of the genus *Nerodia* are also similar in appearance , being thick @-@ bodied with large heads , but they have round pupils , no loreal pit , a single anal plate , subcaudal scales that are divided throughout and a distinctive overall color pattern .

#### = = Common names = =

This is a list of common names for *Agkistrodon piscivorus* , some of which also refer to other species :

cottonmouth  
black water viper  
black snake  
water pitviper  
worm @-@ tailed pitviper  
water copperhead  
cotton @-@ mouthed snake  
mangrove rattler  
moccasin snake  
water moccasin  
North American water viper  
water rattlesnake

#### = = Geographic range = =

This species is found in the eastern US from the Dismal Swamp in southeast Virginia , south through the Florida peninsula and west to Arkansas , eastern and southern Oklahoma , and western and southern Georgia ( excluding Lake Lanier and Lake Allatoona ) . A few records exist of the species being found along the Rio Grande in Texas , but these are thought to represent disjunct populations , now possibly eradicated . The type locality given is " Carolina " , although Schmidt ( 1953 ) proposed this be restricted to the area around Charleston , South Carolina .

Campbell and Lamar ( 2004 ) mentioned this species as being found in Alabama , Arkansas , Florida , Georgia , Illinois , Indiana , Kentucky , Louisiana , Mississippi , Missouri , North Carolina , Oklahoma , South Carolina , Texas , and Virginia . Maps provided by Campbell and Lamar ( 2004 ) and Wright and Wright ( 1957 ) also indicate its presence in Western and Middle Tennessee and extreme southeastern Kansas , and limit it to the western part of Kentucky .

In Georgia , it is found in the southern half of the state up to a few kilometers north of the fall line with few exceptions . Its range also includes the Ohio River Valley as far north as southern Illinois , and it inhabits many barrier islands off the coasts of the states where it is found .

#### = = Conservation status = =

This species is classified as Least Concern ( LC ) on the IUCN Red List of Threatened Species ( v3.1 , 2007 ) . Species are listed as such due to their wide distribution , presumed large population , or because they are unlikely to be declining fast enough to qualify for listing in a more threatened category . When last assessed in 2007 , the population trend was stable .

Constant persecution of the species and drainage of wetland habitat prior to development has taken a heavy toll on local populations . Despite this , it remains a common species in many areas . In Indiana , the cottonmouth is listed as an endangered species .

#### = = Habitat = =

This is the most aquatic species of the genus *Agkistrodon* , and is usually associated with bodies of water , such as creeks , streams , marshes , swamps and the shores of ponds and lakes . The U.S. Navy ( 1991 ) describes it as inhabiting swamps , shallow lakes and sluggish streams , but it is usually not found in swift , deep , cool water . Behler and King ( 1979 ) list its habitats as including lowland swamps , lakes , rivers , bayheads , sloughs , irrigation ditches , canals , rice fields and small , clear , rocky , mountain streams .

It is also found in brackish water habitats and is sometimes seen swimming in saltwater . It has been much more successful at colonizing Atlantic and Gulf coast barrier islands than the copperhead , *A. contortrix* . However , even on these islands , it tends to favor freshwater marshes . A study by Dunson and Freda ( 1985 ) describes it as not being particularly salt @-@ tolerant .

The snake is not limited to aquatic habitats , however , as Gloyd and Conant ( 1990 ) mentioned large specimens have been found more than a mile ( 1 @. @ 6 km ) from water . In various locations , the species is well @-@ adapted to less moist environments , such as palmetto thickets , pine @-@ palmetto forest , pine woods in East Texas , pine flatwoods in Florida , eastern deciduous dune forest , dune and beach areas , riparian forest and prairies .

#### = = Behavior = =

The aggressiveness of these snakes has been greatly exaggerated . In tests designed to measure the various behavioral responses by wild specimens to encounters with people , 23 of 45 ( 51 % ) tried to escape , while 28 of 36 ( 78 % ) resorted to threat displays and other defensive tactics . Only when they were picked up with a mechanical hand were they likely to bite .

When sufficiently stressed or threatened , this species engages in a characteristic threat display that includes vibrating its tail and throwing its head back with its mouth open to display the startling white interior , often making a loud hiss while the neck and front part of the body are pulled into an S @-@ shaped position . Many of its common names , including " cottonmouth " and " gaper " , refer to this behavior , while its habit of snapping its jaws shut when anything touches its mouth has earned it the name " trap @-@ jaw " in some areas . Other defensive responses can include flattening the body and emitting a strong , pungent secretion from the anal glands located at the base of the tail . This musk may be ejected in thin jets if the snake is sufficiently agitated or restrained . The smell has been likened to that of a billy goat , as well as to a genus of common flood plain weeds , *Pluchea* , that also have a penetrating odor .

Harmless watersnakes of the genus *Nerodia* are often mistaken for it . These are also semiaquatic , thick @-@ bodied snakes with large heads that can be aggressive when provoked , but they behave differently . For example , watersnakes usually flee quickly into the water , while *A. piscivorus* often stands its ground with its threat display . In addition , watersnakes do not vibrate their tails when excited . *A. piscivorus* usually holds its head at an angle of about 45 ° when swimming or crawling .

Brown ( 1973 ) considered their heavy muscular bodies to be a striking characteristic , stating this made it difficult to hold them for venom extraction owing to their strength .

This species may be active during the day , as well as at night . However , on bright , sunny days , they are usually found coiled or stretched out somewhere in the shade . In the morning and on cool days , they can often be seen basking in the sunlight . They often emerge at sunset to warm themselves on warm ground ( i.e. , sidewalks , roads ) and then become very active throughout the night , when they are usually found swimming or crawling . Contrary to popular belief , they are capable of biting while underwater .

In the north , they hibernate during the winter months . Niell ( 1947 , 1948 ) made observations in Georgia and noted they were one of the last species to seek shelter , often being found active until

the first heavy frosts . At this point , they moved to higher ground and could be found in rotting pine stumps by tearing away the bark . These snakes could be quite active upon discovery and would then attempt to burrow more deeply into the soft wood or escape to the nearest water . In southeastern Virginia , Wood ( 1954 ) reported seeing migratory behavior in late October and early November . During a period of three or four days , as many as 50 individuals could be seen swimming across Back Bay from the bayside swamps of the barrier islands to the mainland . He suggested this might have something to do with hibernating habits . In the southern parts of its range , hibernation may be short or omitted altogether .

= = Feeding = =

Raymond Ditmars ( 1912 ) described this species as " omnivorous " . Its diet includes mammals , birds , amphibians , fish , snakes , small turtles and small alligators . Cannibalism has also been reported . Normally , though , the bulk of its diet consists of fish and frogs . On occasion , juvenile specimens feed on invertebrates . Catfish are often eaten , although the sharp spines sometimes cause injuries . Toads of the genus *Bufo* are apparently avoided .

Many authors have described the prey items taken under natural circumstances . Although fish and frogs are their most common prey , they will eat almost any small vertebrate . Campbell and Lamar ( 2004 ) provided an exhaustive list of species that have reportedly been preyed upon by *A. piscivorus* , including cicadas , caterpillars , land snails ( *Euglandina rosea* ) , catfish ( *Ictalurus furcatus* ) , pike ( *Esox* spp . ) , sunfishes ( *Lepomis* spp . ) , bass ( *Micropterus* spp . ) , sirens ( *Siren* spp . ) , eastern newts ( *Notophthalmus viridescens* ) , brook salamanders ( *Eurycea* spp . ) , Ouachita dusky salamanders ( *Desmognathus brimleyorum* ) , spadefoot toads ( *Scaphiopus* ) , eastern narrowmouth toads ( *Gastrophryne carolinensis* ) , northern cricket frogs ( *Acris crepitans* ) , West Indian treefrogs ( *Osteopilus septentrionalis* ) , treefrogs ( *Hyla* spp . ) , true frogs ( *Rana* spp . ) , green anoles ( *Anolis carolinensis* ) , skinks ( *Eumeces* spp . ) , eastern glass lizards ( *Ophisaurus ventralis* ) , ground skinks ( *Scincella lateralis* ) , mudsnakes ( *Farancia abacura* ) , hog @-@ nosed snakes ( *Heterodon platirhinos* ) , kingsnakes ( *Lampropeltis* spp . ) , watersnakes ( *Nerodia* spp . ) , crayfish snakes ( *Regina* spp . ) , brown snakes ( *Storeria dekayi* ) , gartersnakes and ribbonsnakes ( *Thamnophis* spp . ) , other cottonmouths ( *A. piscivorus* ) , rattlesnakes ( *Crotalus* spp . ) , common snapping turtles ( *Chelydra serpentina* ) , mud turtles ( *Kinosternon* spp . ) , common musk turtles ( *Sternotherus odoratus* ) , Florida cooters ( *Pseudemys floridana* ) , sliders ( *Trachemys scripta* ) , eastern box turtles ( *Terrapene carolina* ) , Florida softshell turtles ( *Apalone ferox* ) , baby American alligators ( *Alligator mississippiensis* ) , wood thrushes ( *Hylocichla mustelina* ) , chickadees ( *Parus* spp . ) , cardinals ( *Cardinalis cardinalis* ) , unidentified passerines , small ducks , juvenile anhingas ( *Anhinga anhinga* ) , common egrets ( *Ardea alba* ) , egrets , glossy ibises and their eggs ( *Plegadis falcinellus* ) , tricolor herons ( *Egretta tricolor* ) , herons and their eggs , pied @-@ billed grebes ( *Podilymbus podiceps* ) , short @-@ tailed shrews ( *Blarina brevicauda* ) , least shrews ( *Cryptotis parva* ) , southeastern shrews ( *Sorex longirostris* ) , eastern moles ( *Scalopus aquaticus* ) , muskrats ( *Ondatra zibethicus* ) , rice rats ( *Oryzomys palustris* ) , hispid pocket mice ( *Perognathus hispidus* ) , black rats ( *Rattus rattus* ) , squirrels ( *Sciurus* spp . ) , rabbits ( *Sylvilagus* spp . ) and bats .

Fish are captured by cornering them in shallow water , usually against the bank or under logs . They take advantage when bodies of water begin to dry up in the summer or early fall and gorge themselves on the resulting high concentrations of fish and tadpoles . A study by Savitsky ( 1992 ) found they were surprisingly unsuccessful at seizing either live or dead fish underwater .

They are opportunistic feeders and will sometimes eat carrion . Campbell and Lamar ( 2004 ) described having seen them feeding on fish heads and viscera that had been thrown into the water from a dock . Heinrich and Studenroth ( 1996 ) reported an occasion in which an individual was seen feeding on the butchered remains of a feral hog ( *Sus scrofa* ) that had been thrown into Cypress Creek .

Conant ( 1929 ) gave a detailed account of the feeding behavior of a captive specimen from South Carolina . When prey was introduced , the snake quickly became attentive and made an attack .

Frogs and small birds were seized and held until movement stopped . Larger prey was approached in a more cautious manner ; a rapid strike was executed after which the snake would withdraw . In 2 @. @ 5 years , the snake had accepted three species of frogs , including a large bullfrog ; a spotted salamander , water snakes , garter snakes , sparrows , young rats and three species of mice . Brimley ( 1944 ) described a captive specimen that ate copperheads ( *A. contortrix* ) , as well as members of its own species , keeping its fangs embedded in its victims until they had been immobilized .

Young individuals have yellowish or greenish tail tips and engage in caudal luring . The tail tip is wriggled to lure prey , such as frogs and lizards , within striking distance . Wharton ( 1960 ) observed captive specimens exhibiting this behavior between 07 : 20 and 19 : 40 hours , which suggests it is a daytime activity .

#### = = Predators = =

These snakes are preyed upon by snapping turtles ( *Chelydra serpentina* ) , American alligators ( *Alligator mississippiensis* ) , horned owls ( *Bubo virginianus* ) , eagles , red @-@ shouldered hawks ( *Buteo lineatus* ) , loggerhead shrikes ( *Lanius ludovicianus* ) , and large wading birds , such as herons , cranes and egrets .

They are also preyed upon by ophiophagous snakes , including their own species . Humphreys ( 1881 ) described how a 34 @-@ inch ( 860 mm ) specimen was killed and eaten by a 42 @-@ inch ( 1 @, @ 100 mm ) captive kingsnake . On the other hand , Neill ( 1947 ) reported captive kingsnakes ( *Lampropeltis getula* ) were loath to attack them , being successfully repelled with " body blows " . Also called body @-@ bridging , this is a specific defensive behavior against ophiophagous snakes , first observed in certain rattlesnake ( *Crotalus* ) species by Klauber ( 1927 ) , that involves raising a section of the middle of the body above the ground to varying heights . This raised loop may then be held in this position for varying amounts of time , shifted in position , or moved towards the attacker . In the latter case , it is often flipped or thrown vigorously in the direction of the assailant . In *A. piscivorus* , the loop is raised laterally , with the belly facing towards the attacker .

#### = = Reproduction = =

This species is ovoviviparous , with females giving birth to one to 16 live young and possibly as many as 20 . However , litters of six to eight are the most common . Neonates are 22 ? 35 cm in length ( excluding runts ) , with the largest being *A. p. conanti* and *A. p. leucostoma* the smallest . If weather conditions are favorable and food is readily available , growth is rapid and females may reproduce at less than three years of age and a total length of as little as 60 cm . The young are born in August or September , while mating may occur during any of the warmer months of the year , at least in certain parts of its range .

Regarding *A. p. piscivorus* , an early account by Stejneger ( 1895 ) described a pair in the Berlin Zoological Garden that mated on January 21 , 1873 , after which eight neonates were discovered in the cage on July 16 of that year . The young were each 26 cm in length and 1 @. @ 5 cm thick . They shed for the first time within two weeks , after which they accepted small frogs , but not fish .

Combat behavior between males has been reported on a number of occasions , and is very similar in form to that seen in many other viperid species . An important factor in sexual selection , it allows for the establishment and recognition of dominance as males compete for access to sexually active females .

A few accounts exist that describe females defending their newly born litters . Wharten ( 1960 , 1966 ) reported several cases where females found near their young stood their ground and considered these to be examples of guarding behavior . Another case was described by Walters and Card ( 1996 ) in which a female was found at the entrance of a chamber with seven neonates crawling on or around her . When one of the young was moved a short distance from the chamber , she seemed to be agitated and faced the intruder . Eventually , all of her offspring retreated into the

chamber , but the female remained at the entrance , ready to strike .

### = = Facultative parthenogenesis = =

Parthenogenesis is a natural form of reproduction in which growth and development of embryos occur without fertilization . *A. piscivorus* can reproduce by facultative parthenogenesis , that is , they are capable of switching from a sexual mode of reproduction to an asexual mode . The type of parthenogenesis that likely occurs is ? automixis with terminal fusion ? , a process in which two terminal products from the same meiosis fuse to form a diploid zygote ( see Figure ) . This process leads to genome wide homozygosity , expression of deleterious recessive alleles and often to developmental failure ( inbreeding depression ) . Both captive @-@ born and wild @-@ born *A. piscivorus* appear to be capable of this form of parthenogenesis .

### = = Venom = =

*A. piscivorus* venom is more toxic than that of *A. contortrix* ( the copperhead ) and is rich with tissue @-@ destructive enzymes . It is a powerful cytotoxic venom that destroys tissue . Although deaths are rare , the bite could leave scars and , on occasion , require amputation . Absent an anaphylactic reaction in a bitten individual , however , the venom does not cause systemic reactions in victims and does not contain neurotoxic components that are present in numerous rattlesnake species . Bites can be effectively treated with CroFab antivenom ; this serum is derived using venom components from four species of American pit vipers ( the eastern and western diamondback rattlesnakes , the Mojave rattlesnake , and the cottonmouth ) .

Bites from the cottonmouth are relatively frequent in the lower Mississippi River Valley and along the coast of the Gulf of Mexico , although fatalities are rare . Allen and Swindell ( 1948 ) compiled a record of *A. piscivorus* bites in the state of Florida from newspaper accounts and data from the Bureau of Vital Statistics : 1934 , eight bites and three fatalities ( no further fatalities were recorded after this year ) ; 1935 , 10 ; 1936 , 16 ; 1937 , 7 ; 1938 , 6 ; 1939 , 5 ; 1940 , 3 ; 1941 , 6 ; 1942 , 3 ; 1943 , 1 ; 1944 , 3 , 1998 ; 1 . Wright and Wright ( 1957 ) report having encountered these snakes on countless occasions , often almost stepping on them , but never being bitten . In addition , they heard of no reports of any bites among 400 cypress cutters in the Okefenokee Swamp during the entire summer of 1921 . These accounts suggest that the species is not particularly aggressive .

Brown ( 1973 ) gave an average venom yield ( dried ) of 125 mg , with a range of 80 ? 237 mg , along with LD50 values of 4 @. @ 0 , 2 @. @ 2 , 2 @. @ 7 , 3 @. @ 5 , 2 @. @ 0 mg / kg IV , 4 @. @ 8 , 5 @. @ 1 , 4 @. @ 0 , 5 @. @ 5 , 3 @. @ 8 , 6 @. @ 8 mg / kg IP and 25 @. @ 8 mg / kg SC for toxicity . Wolff and Githens ( 1939 ) described a 152 cm ( 60 in ) specimen that yielded 3 @. @ 5 ml of venom during the first extraction and 4 @. @ 0 ml five weeks later ( 1 @. @ 094 grams of dried venom ) .

Symptoms commonly include ecchymosis and swelling . The pain is generally more severe than bites from the copperhead ( *A. contortrix* ) but less so than those from rattlesnakes ( *Crotalus* spp . ) . The formation of vesicles and bullae is less common than with rattlesnake bites , although necrosis can occur . Myokymia is sometimes reported . On the other hand , the US Navy ( 1991 ) states the venom has strong proteolytic activity that can lead to severe tissue destruction .

### = = Subspecies = =