AGKISTRODON PISCIVORUS, THE COTTONMOUTH.

By: Ton Steehouder, Theresiaplein 24, 5041 BJ Tilburg, The Netherlands.

Contents: The species - Description - Habitat and feeding habits - Breeding - Prey capture - Other behaviour - Terrarium - Toxicity - References.

THE SPECIES

The scientific name of this species means: 'the fish-eating Agkistrodon', which may be considered as an indication of its partially aquatic (water-bound) way of life. In Wright & Wright we find the species under the name of *Ancistrodon piscivorus*, divided in two subspecies: *Ancistrodon piscivorus piscivorus* and *Ancistrodon piscivorus leucostoma*. Since the original edition of this work (1957), the subspecies *piscivorus* has been divided in *Agkistrodon piscivorus piscivorus* and *Agkistrodon piscivorus conanti*.
The range is as follows: *Agkistrodon piscivorus conanti* (the Florida cottonmouth) is found in all of Florida, including virtually all the adjacent islands, in South Georgia and South East Alabama; *Agkistrodon piscivorus piscivorus* (the eastern cottonmouth) is found in South East Virginia to eastern-central Alabama; *Agkistrodon piscivorus leucostoma* (the western cottonmouth) inhabits the most southern part of Illinois, western and central Kentucky, Alabama, Oklahoma and central Texas, with an isolated population in Missouri.
Other common names, as given by Wright & Wright, are for instance : black moccasin, water moccasin, mangrove rattler (though it is not a rattler at all), or water viper.

DESCRIPTION

The ground colour of the back of adult specimens is generally olive, brown or black, with a somewhat lighter coloured belly. On the back there are crossbands with darker, more or less conspicuous borders. Especially in young specimens (which are much lighter and more strongly marked), the markings remind one of those on the copperhead (*Agkistrodon contortrix*). Older specimens tend to become darker. Characteristic is the heavy head, especially with the Florida cottonmouth, with a conspicuous dark brown cheek stripe, bordered above and below by a narrow light line. Along the chin there are two dark brown lines. The chin is often seen, for the characteristic position of this snake is with the head up at an oblique angle, which gives it a very alert, even somewhat unkind appearance. Yet it is not an aggressive snake, but rather a quiet watcher.
The differences between the subspecies are as follows. The Florida cottonmouth has reasonably conspicuous dorsal markings and more conspicuous head markings, even in most large, dark individuals. The western cottonmouth is smaller, darker and less well patterned. The snout has no clear-cut markings. The eastern cottonmouth looks very much like the Florida cottonmouth, but with less head markings. Young specimens often have a greenish or yellowish tail-tip.

HABITAT AND FEEDING HABITS

The habitat consists of marshes and lakes, ponds and streams with wooded shores, low country near water, roadside ponds, drainage ditches, coastal 'banks', or mangrove swamps. Old rice fields are also popular. It hunts mostly on land and suns on logs and bushes above the water.
In an article by Kofron (1978), the results of an

investigation are described on the foods and habits of seven species of aquatic snakes in a swamp in Louisiana, the Atchafalaya River Basin. This is one of the largest swamps of North America, an Alluvial flood plain, which gets its water from the Atchafalaya River (which originates from the Mississippi and the Red River). The vegetation is predominantly hardwood forest and swamp vegetation. The investigation took place in the following manner: captured specimens were massaged until the contents of the stomach were regurgitated, after which these could be examined.

The stomachs of the captured cottonmouths contained largely catfish (*Ictalurus melas*). Other fish included *Lepomis*, *Micropterus*, *Aplodinotus* and other unidentified fish. Besides, frogs (*Rana clamitans* and other unidentified specimens), snakes (*Nerodia fasciata*, *Nerodia rhombifera*, *Regina rigida* and *Thamnophis proximus*) and mammals (*Blarina brevicauda*) were eaten, and some unidentified prey. Most cottonmouths with stomach contents were captured on land. The cottonmouth had ingested the largest variety of food in comparison with other aquatic snakes.

In older reports, birds, squirrels and young turtles are given as food items. It is clear that *Agkistrodon piscivorus* is no food specialist.

In places where the cottonmouth was abundant, *Nerodia rhombifera* and *Nerodia cyclopion* were strikingly absent, a phenomenon that was also indicated by an earlier investigation with reference to *Nerodia* species which did occur in surrounding areas. This could indicate that these species are preyed upon by the cottonmouth. However, this was not confirmed in other investigations. Accidental circumstances, like the abundant availability of other prey, may be of influence here.

As for the habitat: the cottonmouth was abundant only in bottomland forest, and not in swampy areas. During the summer it was captured along a grass

and shrub-covered dirt road that extended through the forest, in an area with deep pools of muddy water and a dense overstory of hardwood trees. On other roads cottonmouths were also found. It seems clear that older specimens as well as juveniles move overland. In the Atchafalaya River Basin the cottonmouth definitely is a habitat specialist, preferring the dry areas.

BREEDING

Agkistrodon piscivorus is ovoviviparous. Males generally grow somewhat larger than females (males 65-155 cm; females 63.5-122.5 cm). With live-bearing snakes it is often difficult to indicate the exact length of the gestation, but this must be somewhere between four and six months, depending on the temperature. The number of young lies between 1 and 15, with a length of 21-27 cm. In nature they are born in August and September, most often in the period from 15 August until 15 September.
In captivity, breeding is not difficult. According to Trutnau, one can expect offspring every other year from healthy adults. I am in the possession of two specimens which were bred by Walter Getreuer of the snake exposition Serpo. Two years old, they are about 80 cm long and (to give an impression) about the format of a normal adult *Vipera aspis* in too good a feeding condition.

PREY CAPTURE

In 1975 K. Kardong published an article in which he gave a detailed description of the prey capture activity of the cottonmouth. He filmed the capture of the prey by cottonmouth snakes in captivity, and analysed the pictures he made. This made it possible to identify six continuous

phases in this activity. He then postulated a seventh phase (phase 1), not observable in the terrarium. The phases are as follows:

1. search; even in snakes that are usually to be found in one and the same spot, like the cottonmouth, it is likely that they will actively search for prey or for a place to lie in ambush. *Agkistrodon contortrix* for instance has been observed to 'travel' over a distance of 15 m.
2. approach; when prey is placed in the cage, a previously motionless snake will begin to tongue flicking and its breathing rate increases. The presence of prey is determined by different senses, depending on the circumstances. The approach-phase begins, when the snake moves its entire body in the direction of the prey. It can be interrupted by pauses. Near the end of this phase the loose curves of the body tend to become tighter and broader.
3. glide; by slightly opening (straightening) the body curves, the snake slowly moves its head in the direction of the prey. If the prey withdraws, the snake will return to the approach-phase. During this gliding-phase, the snake brings the head in a better striking position by shortening the striking distance, which will improve the visual perception of the prey and also augment the accuracy of the strike.
4. strike; by rapid straightening of the curves in the neck and trunk, the snake is able to strike with great speed. The mouth is opened and the fangs swung forward, so that they at the end of the strike can form almost a 90^0 angle with the upper jaw. Not always is there a maximum jaw gape: the strike seems to be adapted to the size and position of the prey. The anterior tips of the mandibles make contact with the prey first, after which the upper jaw immediately begins to close on the prey.

This starts the next phase:

5. bite; during this phase the teeth and fangs are rapidly pressed into the prey. During the bite, correction of incorrectly placed fangs is possible. As the fangs are independently moveable, one fang can be lifted and pressed again in the prey, while the other fang remains embedded. During the bite, venom is injected. It has been proved that on the average more venom was injected into large than into small prey. The duration of the bite can be very short (1/50 second has been measured), or quite long, the snake retaining its grasp on the prey for several minutes.
6. release; by rapid opening of the upper and lower jaws, the snake can release its prey and withdraw quickly. Kardong observed on several occasions venom squirting from one or both fangs during the release. If the prey is retained in the jaws until its death, the release is much more calm. It happens often that the snake starts to swallow its prey immediately without releasing it first.
7. post-release; during this phase, the snake often uses its tongue to flick foreign debris from its mouth. Also, 'yawns' can be observed, in which the jaws are spread wide and the fangs are simultaneously or alternately protracted and then folded back again, which can be observed in other viperids and crotalids too. After this, the snake starts to draw near to the prey and to tongue-flick it, whereafter the swallowing can start, often only after some 'false starts'.

I add to this the following: if captive snakes are fed with dead prey, we can only observe the phases 2, 3 and 7 (if the snake is not mistaken). This is less interesting, but it often prevents hungry snakes from becoming very disturbed by each others capture behaviour, and bite each other in-

stead of the prey, which can lead to serious injuries or even the death of one of the animals. I once lost a young bamboo viper (*Trimeresurus albolabris*) because of a head bite by one of the other specimens in the cage.

OTHER BEHAVIOUR

When the weather is warm, *Agkistrodon piscivorus* is active not only during the day, but also during the evening and the night, if one could speak of activeness with this rather indolent snake. Mostly it is lying in the same place, or slowly withdrawing when disturbed. When there seems to be serious trouble, it raises its head even a little higher than normal, tightening the neck muscles and opening the mouth widely, so that the whitish inside of the mouth can be seen. Furthermore, it vibrates the tip of the tail violently, which -depending on the materials against which the tail beats - can cause a very loud 'rattle': hence maybe the vernicular name 'mangrove rattler'. If this threatening behaviour does not work out, the snake strikes rapidly.
In captivity, cottonmouths tend to tame quickly. Their behaviour is quiet. They like to remain somewhat hidden in a comfortable hiding place and choose to withdraw when the owner has to do some work in the cage. After some time, they take food from the tweezers.

TERRARIUM

Cottonmouths can best be kept in a large terrarium with a hiding place in which the animals feel safe, but in which the owner can always detect them, so that he always knows exactly where they are when he has to work in the cage. This hiding place consequently is even more important for the owner's

safety than for the snake's comfort.
The floor of the cage can be covered with (woodland) soil or peat dust or a mixture of those, or sand, with some branches or stubs or stones, and preferably a water basin in which the animals can fully submerge. It is unnecessary (see above for the habitat) and not advisable to make a real moist terrarium, for the same reasons as for almost all snakes: a moist soil can easily be the cause of skin diseases ('pocks') and anyhow forms too good a breeding place for all kinds of bacteria.
Temperature can best be kept around 25 degrees C, with a warmer spot under a lamp. During the night, the terrarium may cool down to room temperature or even lower.
A real hibernating period is not necessary for specimens of the more southern populations (subspecies *conanti*): for them it is sufficient to arrange a somewhat cooler period by turning off the light and heating for some months or weeks.

TOXICITY

Bites occur frequently in the area of distribution, but they seldom end fatally. Nevertheless, the cottonmouth belongs to the very dangerous poisonous snakes, so one should be very careful. The character of the venom is haemotoxic, which means that it principally affects the blood: the red blood cells are destroyed and there is coagulation around the bitten area.

REFERENCES

Kardong, K.V., 1975. Prey Capture in the Cottonmouth Snake (*Agkistrodon piscivorus*). Journ. of Herp. 9 (2): 169-175.

Kofron, C.P., 1978. Foods and Habitats of Aquatic Snakes (*Reptilia, Serpentes*) in a Louisiana Swamp. Jour. of Herp. 12 (4): 543-554.

Conant, R., 1975. A Field Guide to the Reptiles and Amphibians of Eastern/Central North-America.

Trutnau, L., 1982. Schlangen im Terrarium. Stuttgart 1982, Band 2: Giftschlangen, 2e Aufl.

Wright, A.H. & A.A. Wright, 1970. Handbook of Snakes of the United States and Canada, Vol II: 916-925.