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SNAKE NOTES

J. E. GUTHRIE

During the past six years there has been a rather unusual opportunity at the Department of Zoology and Entomology of Iowa State College for the study of snakes in captivity. By capture, donation, exchange and purchase, many specimens of more than fifty species have at different times been occupants of our cages. Of these, twenty species were natives of this state and included all but a few rare species of our snake fauna.

One of the most interesting things learned has been the observed fact that while the strong feeling of repulsion toward snakes, sometimes thought to be as old as the human race or older, is apparently almost universal; yet many of our students, both men and women, as well as Boy Scouts, Camp-fire Girls and even some of our stenographers have voluntarily learned to handle harmless snakes in a surprisingly short time. After having seen some one handle them, the usual formula seems to be: "Just touch it once and see how it feels and then you won't be afraid of it any more." The terror and horror inspired by a snake is apparently overcome by most people who once touch it and find it not slimy or clammy or otherwise disagreeable or vicious as they had expected.

The common assumption is that there exists an *inborn* dread of snakes. There has been some opportunity to watch the effect upon young children of their first sight of a snake. Some children are at once timid when an animal moves, be it kitten, chicken, rabbit or snake; others reach out for a snake as they do for anything which appeals to them as pretty and interesting. Those young children, as yet unspoiled, who view the snake in the latter light, appear to be in the majority.

The writer having so recently acquired the freedom from most of his former jumpiness in the presence of a snake, may perhaps be pardoned the narration of personal experiences, as his case is perhaps rather typical of the way in which some so-called *inborn* reactions may be acquired.

In trying to account for my own former antipathy in this regard, I think back to a few early experiences. My first memory of a snake must date back to when I was about four years of age.

The snake was probably a common garter-snake. It appeared in the tall grass of our back yard and some one carried the news into the house. As no men were about, my mother and grandmother armed themselves with the fire shovel and tongs and sternly set out to slay it. The impression upon the child was that of a dreadful, menacing creature that must be destroyed at all hazards. Two or three years later when among a group of school children, I remember that a snake was located which the older children told us was a copperhead and very dangerous, and we were herded away from the vicinity. I know now that it was probably a milksnake, but the memory of the fright remains with me. A few years later I encountered a garter-snake, and still recall how angrily it flattened out its head and hissed and struck at me repeatedly. I remember that I had then no doubt that it was extremely venomous. Its very belligerent attitude and actions seemed to me to prove it so. As a half-grown boy, I recall my overwhelming desire to jump on a snake or to strike at as soon as I saw it.

Until 1903 I had never willingly handled a living snake. At that time Mr. C. E. Bartholomew, a laboratory assistant, brought one in. I brought myself to handle this one several times and found, to my surprise, that my feeling of horror was melting away. My next two experiences were with the gentle "banana boas" from Central America, and these heightened my regard for the creatures as pets.

Among the problems connected with keeping the reptiles are the selection of acceptable food, provision of fresh water for drinking and bathing, learning which species may be safely left together and which are cannibalistic, and finally the means of safely caring for poisonous species. Doubtless, the most interesting study is that of the characteristic habits of different species. Some, as the spreading adder, are rather inclined to be quiet and comfortable, while most blue racers remain always wild and nervous. The spotted chicken-snake and the pilot snake and many king-snakes and milk-snakes will occasionally turn and deliberately bite one's hand. Fox snakes and bullsnakes seldom resent being handled. The same is true of both the *Boa constrictor* and its Central American relative, the *Boa imperator* which occasionally arrive in our state in bunches of bananas. Watersnakes and garter-snakes, when hungry for frogs will sometimes seize one's hand by mistake but not in malice. Many individuals among the watersnakes, however, seem never to lose their viciousness. Even in a gentle species as among birds and mammals, some individuals always seem pugna-

cious. Thus, very young bullsnakes and fox-snakes often strike at the hand when approached.

Small snakes are hard to provide with suitable food such as very young mice, birds' eggs, insects, earthworms, small fish and very small frogs and toads, especially when one attempts to keep them indoors during the winter. Nature tells them to hibernate, but when kept in warm quarters they require some food.

While garter-snakes will almost invariably accept earthworms, and watersnakes will struggle furiously with one another for the possession of a frog whenever it is offered to them, yet some of the species are very shy feeders while in captivity, going for many months without food and sometimes refusing it altogether. One of our copperheads ate nothing from the day when she was caught in the Kittatiny Hills of New Jersey, until a year and seventeen days later. Meanwhile, she bore a brood of young. A large banded rattler from Dubuque county went almost a year at one time and eight and one-half months at another time without food.

A very perplexing problem to cope with is that of parasites. One spreading adder from Indiana was literally riddled with lung flukes and intestinal round-worms. On some snakes from California and Arizona there developed a heavy infestation of a species of mite identified by Dr. H. E. Ewing, of the Division of Insects, United States National Museum, as *Serpenticola serpentium* (Hirst). This pest spread to all cages before we were aware of its presence and its attacks made heavy inroads upon the inmates. No adequate control methods have as yet been worked out.

One of the most persistent of the popular bits of misinformation concerning rattlesnakes is that their age is indicated by the number of rattles borne by the tail. It happened that a banded rattler supplied us with information on this point. A small white rat was given it for food. The snake was not hungry and would not even strike at the rat though it ran around over its writhing body without the least sign of fear. During the night the rat gnawed the rattles off the snake's tail and we found them chewed to bits in the cage. Within about a year from this time this snake had molted four times and had thus acquired four new rattles.

The rather regular shedding of poison fangs is a fact not apparently well known. Within a period of fifteen months this rattlesnake shed ten pairs of fangs, the fangs being swallowed and passed through the digestive tract and out with the feces. Sometimes when defecation was not frequent owing to failure to take food, there have been two pairs evacuated at one time, one pair

being white and evidently comparatively fresh; the other considerably blackened as though they had been in the intestine for a considerable time. Cotton-mouth moccasins and copperheads also shed their fangs but not so frequently nor with so great regularity.

There seems to be an impression abroad that rattlesnakes are becoming rare in Iowa. In an investigation into the subject it has been found that while the massasauga, *Sistrurus catenatus* (Raf.), called also the prairie rattler, is probably rare or even altogether absent in most parts of the state where it once abounded before the days of drained sloughs and burning stubble, and mowers and disk harrows — those agricultural terrors to snakes — yet the banded or timber rattlesnake *Crotalus horridus* Linné still maintains itself in considerable numbers in those parts of Iowa that are of the broken, rocky, timbered type, which are favorable for the protection of this species. They do not thus have to contend with agricultural activities.

In 1913, the state authorized the county supervisors of Iowa to pay a bounty of not over fifty cents apiece for rattlesnakes. In recent years ten counties have offered this bounty. In two counties, Dubuque and Delaware, the amount has been reduced to twenty-five cents.

In the year 1920 the total amount of rattlesnake bounties is reported as \$1,615.86. In 1921, Allamakee and Fayette counties, each of which had paid over \$500.00 in 1920, discontinued the payment of bounties so the total fell to \$409.20, rising to \$559.70 in 1922 and to \$807.25 in 1923. The ten counties listed as paying bounties at present or having paid them sometime within the past nine years with the amounts of bounties paid appear in the accompanying table. Of these counties Allamakee, Chickasaw, Clayton, Delaware, Dubuque and Fayette are in the northeastern corner of the state on or near the Mississippi River; Henry, Lee and Wapello in the

Rattlesnake Bounties Paid in Iowa

COUNTIES	1920	1921	1922	1923	1924	1925	1926	1927	1928
Allamakee	\$ 564.00	\$ 21.00	Bounty discontinued						
Chickasaw	52.50	42.50	52.00	69.50	134.50	93.00	87.00	82.50	64.00
Clayton	377.50	241.00	429.00	624.50	488.00	496.50	352.50	270.50	215.50
Delaware	89.50	22.00	32.00	34.50	32.50	76.50	11.50	19.55	13.75
Dubuque	6.50	13.70	13.20	18.25	32.75	24.50	35.00	34.25	23.75
Fayette	501.86	10.00	Bounty discon.		78.50	50.50	60.50	72.50	47.00
Henry				8.00	4.50				
Lee	10.50	33.00	19.00	30.50	16.50	18.00	23.50	28.25	26.50
Plymouth		2.00	7.00	6.50	4.50	14.50	4.00	2.50	9.50
Wapello	13.50	24.00	7.50	15.50	Bounty discontinued				
Totals	\$1615.86	\$409.20	\$559.70	\$807.25	\$791.75	\$773.50	\$574.00	\$510.05	\$400.00

southeastern quarter containing the broken country of the Mississippi and Des Moines rivers, while Plymouth county is on the western edge of the state.

From the county auditors of most of these counties, I have reports that the banded is the one presented for bounties. From Plymouth county, however, the county auditor writes that the snakes received are from the western edge of the county, near the South Dakota line, and that they are the "prairie rattlesnake." As this is west of the 96th meridian, it is within the range given for the true prairie rattler *Crotalus confluentus* Say, well known in the prairie dog villages of the great plains. This makes three species of rattlesnakes for the state, Iowa's only poisonous species.

In studying several of the snake collections of the state one species was found which is apparently unrecorded excepting for a brief notice in The Snakes of Iowa, Iowa Experimental Station bulletin No. 239, 1926.

Two small snakes in the museum of the Historical Department building in Des Moines bore the label: "Storeria dekayi, Keosauqua, Iowa, collected by G. A. Larson." Through the kindness of Professor Joseph Steppan and Director Edgar R. Harlan, I was permitted to make a careful study of these specimens which had evidently been wrongly identified. They proved to be *Virginia elegans* Kennicott, described by that author from southern Illinois in 1895. I have seen no other records of its occurrence so far north as Iowa, its range being given as from Virginia west into Arkansas.¹

Occasionally opportunities have been available for study of the development of the fox-snake and the bullsnake.

The fox-snake, *Elaphe vulpina* (Baird and Girard) is a spotted snake of the west central states, ranging from Lake Superior southward through Minnesota, Wisconsin, Iowa and Illinois and east

¹ These two little "Virginia's snakes" as they are called, have the dorsal scales smooth, in 17 rows; ventral plates 124 and 128 respectively, and wrostegees 43 and 42 respectively. The tail terminates in a rather abrupt sharp cone. The anal plate is divided; supra-labials six the third and fourth under middle of eye, fifth the largest; infra-labials six, fourth the largest post-oculars two; no pre-oculars; inter-nasals two; pre-frontals two; loreal present. The description of the head plates given above applies to the smaller of the two specimens, the larger being interestingly atypical in two respects: on the left side there are no pre-oculars, but on the right side there is a small one at the upper side, above where the loreal enters the orbit.

The right pre-frontal seems to lack just that much of its lower edge, where it would otherwise have touched the orbit. The other peculiarity of this larger snake is the fact that there is only a single inter-nasal where a pair would be expected. There is no visible median line to indicate a suture where fusion had occurred. The head is small. The color is seal brown or lighter above, yellowish or flesh color below. The dorsal scales are narrow. They appear lighter at their edges, the outer light edge being about as broad as the dark middle portion. This gives a peppered appearance on close examination. In speaking of this species, Professor Cope in his report on Crocodiles, Lizards and Snakes mentions considerable differences in the number of post-oculars, varying from one to three. The lengths of the two specimens were five and one-fourth and seven and three-fourths inches respectively.

to Michigan and Ohio. These snakes usually reach about four feet in length when fully grown and somewhat resemble the common bullsnake, for which they are often mistaken. These two snakes are alike valuable in their destruction of mice, rats, ground squirrels and other rodent pests.

All snakes reproduce by means of eggs, but in many species the eggs are without shells and are not laid until the young snake is ready to hatch. The young thus bursts through the membranes exactly as does a chick when hatching from the egg but with this difference: there is no shell or shell membrane to be pierced by the emerging snake. In such a case, which is true of the rattlesnakes, watersnakes and garter-snakes it is commonly said that the young

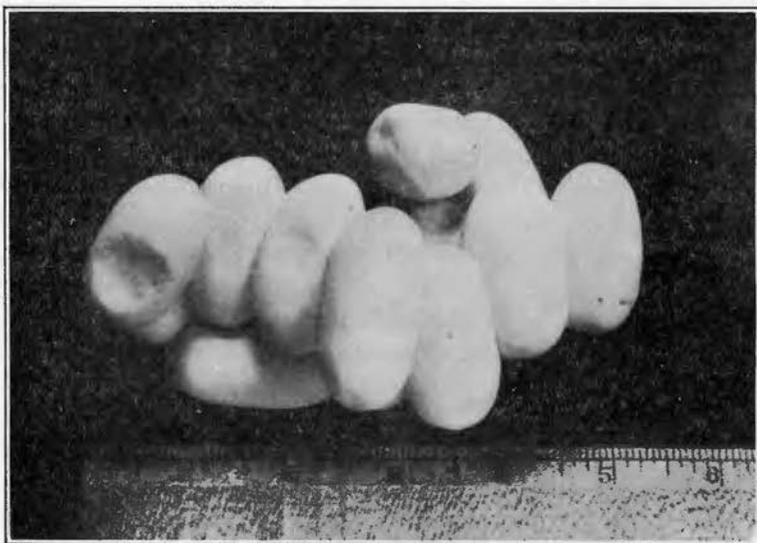


Fig. 1. Eggs of Fox-snake

are "born alive." In the case of bullsnakes, fox-snakes, milk-snakes, king-snakes, racers and green-snakes on the other hand, each egg is enclosed in a tough, fibrous, parchment-like shell before being laid. Ordinarily snakes lay their eggs in holes in the ground, in straw piles, under stones and in other places where they will remain somewhat moist. They are allowed to hatch at whatever temperature the surrounding medium supplies.

The time of incubation varies somewhat within a species but it has not been determined how much of this variation may be due to temperature. Not all of it, certainly, for of the same batch

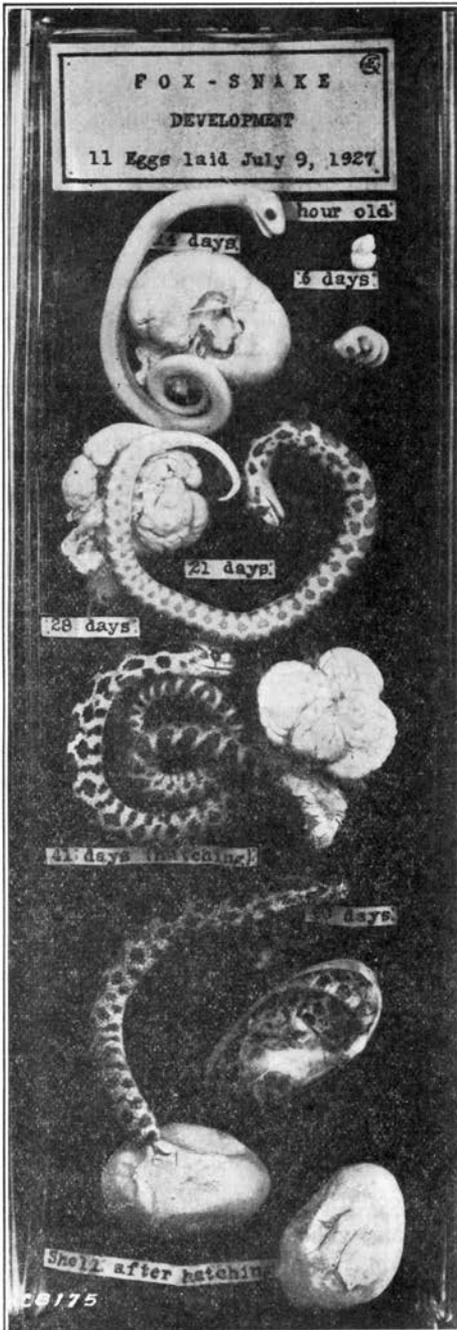


Fig. 2. Development of Fox-snake

of fox-snake eggs, laid at the same time and kept together until hatching, some have taken four days more than others.

In the bullsnakes observed, the young emerged from the eggs at about sixty days after laying. In the fox-snake, the time has varied from forty to fifty-four days for individuals in different lots. The snakes were captured after having mated. Snakes will seldom mate in captivity. In three cases the number of eggs produced varied from ten to thirteen; and the dates for laying were July 9 and 12. The eggs are at first plump and are sticky so that if allowed to dry while in contact, they adhere firmly together as a mass. The fox-snake eggs measured, Figure 1, varied in length from 32 to 45 mm. and in width from 17.5 to 26 mm., the size increasing somewhat by stretching as incubation proceeded. They vary somewhat in shape as well as in size. In color they are creamy white. Examination of an embryo removed within twenty minutes after the egg was laid showed that development had already begun and had proceeded to a stage comparable to that of a chick embryo after five or six days incubation, as judged by appearance of brain and allantois. The eggs of the bullsnake show the same stage of growth at time of deposition.

Figure 2. The embryo is colorless excepting for the blood, and the body is coiled in a close spiral of about four whorls. If straightened out the fox-snake embryo at this time would measure 35 mm. in length. The head is strongly developed, with plainly marked eyes, brain flexures and brain vesicles. The mid-brain is very prominent. The second embryo examined was from an egg opened on the sixth day. In this the embryo had increased to several times its former bulk and measured 65 mm. The lower jaw was noticeable and the eye dark. No evidence of scalation was yet visible. At fourteen days the embryo had lengthened to 170 mm. and the rapid jaw growth caused the head to appear somewhat snake-like in contour. The projecting scale papillae were well formed and showed plainly, as well as the broad ventral plates or gastrosteges. The dermal development was greater at the anterior end of the body than on the tail. The faintest suggestion of color was also apparent as slight shadows anteriorly, but the body was so clear that the heart-beat could be plainly seen. The umbilicus, where the stalks of allantois and yolk sac enter the body, was only about 8 mm. anterior to the cloacal opening.

At 21 days of incubation the color pattern, though light brown, was distinct excepting on the tail. The length was 203 mm. and the contents of the yolk sac had distinctly diminished in size. At 28

days the color pattern was complete to the tip of the tail, the yolk was further reduced and the length was 261 mm. At 40 days several of the egg shells began to show tiny split places through which the liquid albumen leaked out under pressure from within. The openings were made by the snouts of the young snakes. There is no egg-tooth in the fox-snake or bullsnake, but the tip of the head is somewhat pointed. In some cases several attempts were made, the head bursting through in one place and then being withdrawn and a new place being ruptured. An individual killed in the egg at

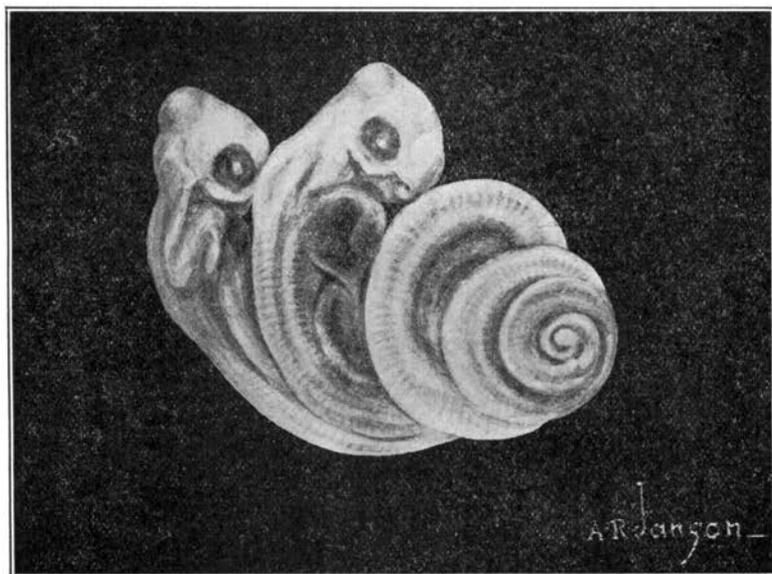


Fig. 3. Two-headed embryo of Bullsnake
Pituophis sayi (Schlegel)

40 days showed a small yolk sac still attached; and one killed during hatching was preserved as in the act of emerging as shown in the figure.

At emergence, the young snakes were lively at once and would hiss and strike at the finger. They then measured from nine and one-half to eleven inches in length. Their bodies were soft and puffy with fat derived from the yolk on which they were nourished while in the egg.

In examining a number of embryos taken from the eggs of bullsnakes, *Pituophis sayi* (Schlegel), it was found that one specimen was a two-headed monster, its two heads and necks completely separate. This one Fig. 3, was from an egg incubated five days. It appeared from the literature that bicephaly is not very unusual among

snakes of several species. One figured by Mr. A. R. Jansen for the American Museum of Natural History was a copperhead. On August 30, 1923, a young double-headed plains garter-snake *Thamnophis radix* (Baird and Girard) was brought in alive from the college farm. Fig. 4. In this specimen the head was only partly double. It made some attempts to eat an earthworm but got it badly tangled and finally failed in the attempt and died of starvation. In a very old book of travels in America which the writer once owned the author mentioned a two-headed snake which was found by the exploring party, and naively remarked that "it is not known whether this is a distinct species or merely a deformed individual." A two-headed bullsnake 18 inches in length. Fig. 5 was recently



Fig. 4. Partly double head of Plains Garter-snake
Thamnophis radix (Baird and Girard)

exhibited in Stillwater, Okla. In *The Reptile Book* by Dr. R. L. Ditmars, the author mentions a specimen of the common garter snake, *Thamnophis sirtalis*, which was born with two perfectly formed necks and heads on one body. It died within a few hours. He also speaks of having obtained such creatures from hatching broods of hog-nosed snakes (*Heterodon platyrhinus*) king-snakes (*Ophibolus getulus*) and milksnakes (*Coluber doliatus triangulus*).

Conclusion: The supposedly inborn dread of snakes is probably largely the result of the mental attitude and actions of older persons early impressed upon the child. This repulsion is nearly universal but is very easily overcome. Contact with many hundreds of snakes of over 50 different species has given opportunity for the study of their individual dispositions, species, characteristics, and feeding habits; in all of which they differed widely.

Among the problems of keeping snakes are the obtaining of proper foods through the winter, and the finding out experimen-

tally the food preferences of the various species. Both banded rattlesnakes and copperheads have gone about a year without food and then begun to eat. Control of the snake mite, *Serpenticola serpentium* (Hirst), has been a serious problem. A banded rattlesnake has molted four times in a year and thus gotten four new rattles. The poison fangs are shed regularly and swallowed, passing out with the feces. Ten pairs have been observed shed by a banded rattlesnake in fifteen months. Cottonmouth moccasins (*Agkistrodon piscovorus*) and copperheads *Agkistrodon mokasen* apparently shed less regularly and less often, but in similar manner.

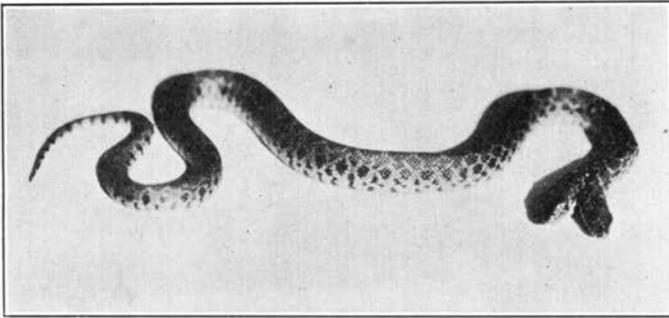


Fig. 5. Double-headed Bullsake, 18 inches long

Iowa still pays a considerable amount for rattlesnake bounties each year.

Virginia elegans Kennicott is reported from southern Iowa and a description is given. The development of the fox-snake is described as requiring from 40 to 54 days for incubation and that of a bullsnake as about 60 days. Two-headed snakes are not infrequent and figures are given of a garter-snake and bullsnake.

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