1977

The Hognose Snake: A Prairie Survivor for Ten Million Years

M. R. Voorhies
University of Nebraska State Museum, mvoorhies1@unl.edu

R. G. Corner
University of Nebraska State Museum

Harvey L. Gunderson
University of Nebraska State Museum

UNL NEWS

Museum Notes
ANTHROPOLOGY · BOTANY · ENTOMOLOGY · GEOLOGY · HEALTH SCIENCES · PALEONTOLOGY · PARASITOLOGY · ZOOLOGY
No. 57

University of Nebraska State Museum and Planetarium 14th and U Sts.

VOLUME 56 NUMBER 15 JANUARY 12, 1977

Hognose snake hunting in sand. The snake uses its shovel-like snout to loosen the soil. Hognose snakes spend most of their time above ground, but burrow in search of food, primarily toads. Even when toads are buried a foot or more in sand, hognose snakes can detect them and dig them out. (Photos by Harvey L. Gunderson)

THE HOGNOSE SNAKE

A Prairie Survivor for Ten Million Years

Because they hiss and strike violently when aroused, he harmless little hognose snakes are often considered o be poisonous by people who encounter them. They re not venomous but are truly remarkable animals ith specialized behavior and anatomy unusually well uited for life in the grasslands of central North merica.

The University of Nebraska State Museum has re- ently acquired fossil evidence regarding the evolution- y history of these common Great Plains reptiles. We an now trace the record of the hognose snakes back to a me long before the arrival of man, the bison, or even e mammoth on the North American continent.

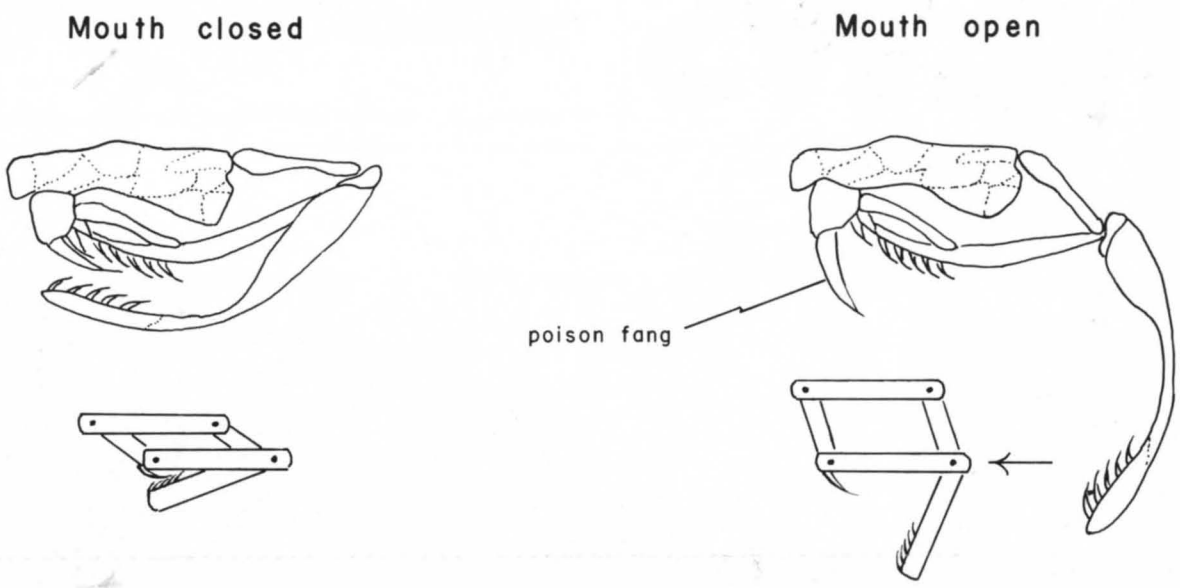
Modern Hognose Snakes

Two closely related species of hognose snakes live in ebraska today. Both are readily recognized by the ovel-like snout. The snout is noticeably upturned in e western hognose snake, *Heterodon nasicus*, while it more nearly horizontal in the eastern hognose snake, *Heterodon platyrhinos*. The snout is used in digging; hognose snakes are expert burrowers, the western species being nicknamed the "prairie rooter" by Sandhills ranchers.

The snakes burrow in pursuit of food which consists almost entirely of toads, although occasionally frogs or small birds and mammals may be eaten. Because toads have highly toxic skin glands they are avoided by most predators, but hognose snakes actively seek them out and show no ill effects from consuming large numbers of toads. Recent investigations of the physiology and biochemistry of hognose snakes have shown that secretions of the adrenal glands counteract the otherwise lethal effects of toad toxin.

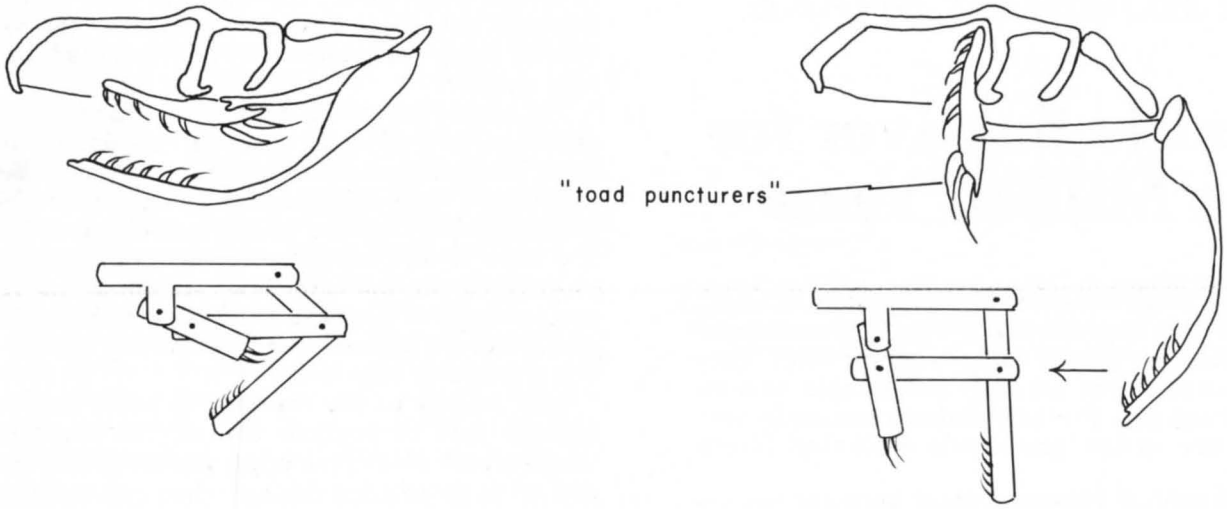
Also related to the toad-eating habit are the specialized jaws of hognose snakes; the two hindmost teeth on each side of the upper jaw are greatly enlarged and act as puncturing devices when captured toads, as they commonly do, inflate their bodies in an attempt to avoid being eaten.

One of the most intriguing aspects of the behavior of hognose snakes is their extensive repertoire of "bluffing" actions when annoyed by a potential enemy. The ribs behind the head are elongated and can be spread to form a hood which suddenly brings new colors into view. It is this inflation of the hood which has given hognose snakes another common nickname in Nebraska — "puff adder." If puffing and hissing fail to drive the enemy away, the hognose will usually "play dead;" the animal will slowly writhe onto its back with its mouth full of dirt and perhaps bloody. It is believed



A Rattlesnake (Crotalus) Skull

Skulls of two common Great Plains snakes showing feeding specialization. Rattlesnakes feed primarily on warm-blooded prey, rodents and other small mammals, which they can quickly immobilize by injecting venom from tubular fangs at the front of the upper jaw.

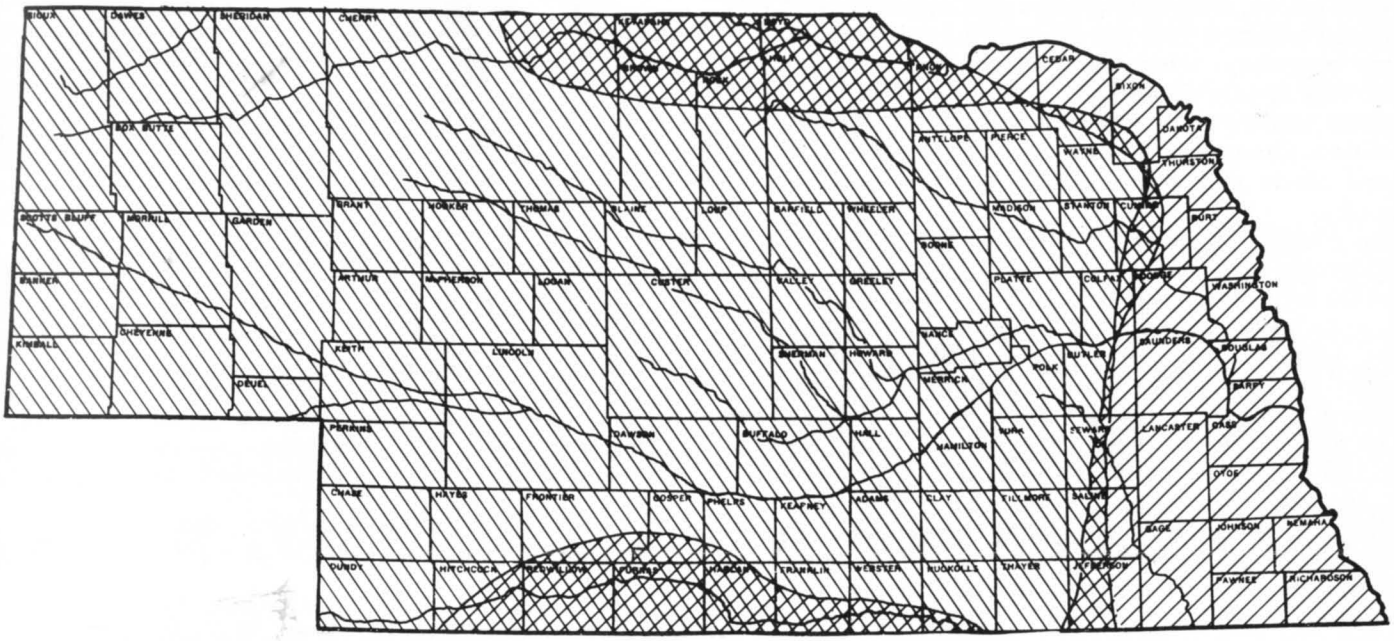


B Hognose Snake (Heterodon) Skull

Figures drawn by J. Voorhies

Hognose snakes, in contrast, specialize in cold-blooded prey, especially toads. The enlarged teeth at the rear of the upper jaw in the hognose snake are used to deflate swollen toads.

The small schematic drawings show the operation of the complex system of joints in the jaws. Nebraska fossils indicate that both the hognose and rattlesnake feeding methods had evolved more than 10 million years ago.



From Hudson (1958) and J. D. Lynch (unpublished)

Hognose snakes live throughout Nebraska and over most of the Great Plains.

hat the alterations of body chemistry associated with oad eating are related to the hognose snake's ability to play 'possum."

Unable to kill its prey by constriction like the bull-nake or with venom like the prairie rattlesnake, the ognose snake has yet managed to flourish in the rigor-us semiarid habitat of the Great Plains. It is one of the ost common snakes in the plains, especially in sandy reas such as the Nebraska Sandhills. We are only now eginning to appreciate how ancient the lineage of the ognose snake is.

An Ancestral Hognose Snake From Webster County, Nebraska

The rocks of Nebraska are best known for the fossil ammal remains contained in them: elephants, hinoceroses, camels and so forth. It is less well known hat fossil forms from cold-blooded animals such as ogs, toads, lizards, and snakes also occur. One of the ost remarkable fossil snake skeletons ever found on e Great Plains was uncovered by a Museum field arty in 1973 in Webster County near Red Cloud.

Snakes are not well represented in the fossil record ecause their bones are small, delicate, and easily over-oked — complete skeletons are very rare. The Webster ounty fossil was, therefore, especially welcome and was placed in the hands of one of the few paleontologists actively studying fossil snakes, Dr. J. Alan Holman of Michigan State University. Holman found that the specimen represents an ancestral hognose snake, *Paleoheterdon tiheni*, which was previously known only from a few vertebrae found in fossil deposits in northern Nebraska. Snake vertebrae have very distinctive shapes which allow species identification in many cases but unless the jaws are found, the feeding mechanism of extinct species must remain in doubt.

A particularly interesting feature of the newly discovered specimen, therefore, was its enlarged (toad-puncturing) rear teeth in the upper jaw similar to those in modern hognose snakes. The presence of these specialized teeth in *Paleoheterodon* permits us to infer that the snake's dietary preference for toads was probably already established. Furthermore, fossil toad remains also occur in the fossil quarry which yielded the snake and in all other deposits where *Paleoheterodon* is known to occur. The skull of *Paleoheterodon* had somewhat different proportions than modern *Heterodon*.

The age of the *Paleoheterodon* skeleton, as determined from the associated fossils (over 100 species of fossil vertebrates were identified from the deposit) is Miocene, approximately 13 million years old. The Red Cloud quarry yielded some of the earliest mastodon remains known in North America. A skeleton of one of these early migrants from Asia, the Red Cloud mastodon, is on display in the Museum's Elephant Hall.

Fossil horses, camels, and other grazing animals have also been collected from the deposit, indicating that the grassy vegetation which now characterizes the Great Plains was already present in Webster County when the hognose snakes were evolving toward their modern condition. Direct evidence of grass is provided by fossilized seeds and stems which occur in the same deposits.

The climate of southern Nebraska, however, was considerably warmer than at present. Frost-free conditions are indicated by the presence of giant tortoise remains. In addition, the great variety of forest-adapted fossil mammals such as tapirs and flying squirrels suggest more extensive tree cover than is present in southern Nebraska today.

The remains of ten other species of fossil snakes were found in the same quarry as the *Paleoheterodon* skeleton. Modern relatives of three of these snake species live in much warmer climates today: two kinds of boas and a coral snake. Relatives of the rattlesnake, patchnose snake, garter snake, and several kinds of water snakes were also identified by J. Alan Holman in the collection of snake remains from Red Cloud.

Major changes in the Great Plains environment have occurred since Miocene times, including the great Pleistocene Ice Age of the last million years. Many common Miocene animals (mastodons, oreodonts, sabercats) have no descendants which survived into recent times. A few (tapirs, rhinoceroses, camels, giant tortoises) live on, elsewhere in the world. Fewer still have survived by remaining on the Great Plains. The hognose snake is one of those survivors.

M. R. VOORHIES
Associate Curator
Vertebrate Paleontology

R. G. CORNER
Paleontologist, Highway
Paleontology Salvage

Selected References

Bragg, Arthur N. 1960. Is *Heterodon* venomous? *Herpetologica* Vol. 16, No. 2: 121–123.

Conant, Roger. 1975. *A field guide to reptiles and amphibians o eastern and central North America*, 2nd Ed. Houghton Mifflin Co., Boston.

Ditmars, Raymond L. 1936. *The reptiles of North America* Doubleday, Doran and Co., Inc., Garden City, New York 476 pp.

Grogan, William L., Jr. 1974. Effects of an envenomation from the saliva of the eastern hognose snake, *Heterodon platyrhinos*. *Herpetologica*, Vol. 30, No. 3: 248–249.

Hudson, George E. 1958. The amphibians and reptiles of Nebraska. *Nebraska Conservation Bull.*, No. 24: 1–146.

Kapus, Edward J. 1964. Anatomical evidence for *Heterodon* being poisonous. *Herpetologica*, Vol. 20, No. 2: 137–138.

McAlister, Wayne H. 1963. Evidence of mild toxicity in the saliva of the hognose snake *(Heterodon)*. *Herpetologica*, Vol. 19, No. 2: 132–137.

McDonald, Harry S. 1974. Bradycardia during death feigning of *Heterodon platyrhinos* Latreille. *J. Herpetol.*, Vol. 8, No. 2 157–164.

Shaw, Charles E. and Sheldon Campbell. 1974. *Snakes of the American West*. Alfred A. Knopf, New York, 330 pp.

Smith, Hobart M. 1956. *Handbook of amphibians and reptiles o Kansas*. Univ. Kansas Mus. Nat. Hist., Misc. Publ. No. 9 2nd Ed.: 3–356.

Smith, Hobart M. and Fred N. White. 1955. Adrenal enlargement and its significance in the hognose snakes *(Heterodon)*. *Herpetologica*, Vol. 11, No. 2: 137–144.

Stebbins, Robert C. 1966. *A field guide to western reptiles an amphibians*. Houghton Mifflin Co., Boston, 279 pp.

Underwood, G. 1967. *A contribution to the classification o snakes*. Br. Mus. Nat. Hist. 653 pp.

HARVEY L. GUNDERSON — Editor
University of Nebraska State Museum

UNL NEWS

Published once in July, Dec., May, and June, twice in Aug., Oct., and Feb., 3 times in Sept., Nov., and Jan., and 4 times in Mar. and April by The University of Nebraska–Lincoln, Dept. of Publications Services & Control, 209 Nebraska Hall, Lincoln, NE 68588. Second-class postage paid Lincoln, Nebraska.

Publications Services & Control
University of Nebraska–Lincoln
Nebraska Hall—City Campus 5U
Lincoln, Nebraska 68588

Museum Notes
ANTHROPOLOGY · BOTANY · ENTOMOLOGY · GEOLOGY · HEALTH SCIENCES · PALEONTOLOGY · PARASITOLOGY · ZOOLOGY

No. 57