# HABITAT, HABITS, AND VARIATION OF KINOSTERNON SUBRUBRUM IN SOUTHERN ILLLINOIS

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ABSTRACT. — Five years of observations on two populations of *Kinosternon subrubrum* in southern Illinois reveal that the species is abundant in temporary ponds of oak flatwoods. It has been rarely collected because it burrows into the ground when the ponds dry each spring. Dominant plants in the habitat are buttonbush, swamp cottonwood, cypress, black willow, swamp white oak, and pin oak. Dimensions are given for 22 adult, 5 hatchling, and 3 juvenile mud turtles. Variation is discussed.

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The eastern mud turtle, *Kinosternon s. subrubrum,* has been considered a rare reptile in southern Illinois. The only specimen Cahn (1937) had was a shell from near Cairo in Alexander County. Cagle (1942) reported three specimens, two from Williamson and one from Jackson counties; Cagle (1946) reported one specimen from near Dixon Springs in Pope County. Smith (1961) added a fifth locality in Saline County, and Klimstra and Hutchison (1965) reported it from Johnson County. We have seen two mud turtles from Freeman Spur in Williamson County, one from Sandusky in Alexander County, and several from Mermet in Massac County, where it is an abundant species. The observations reported here refer generally to mud turtles in southern Illinois but are based on two populations at Mermet, which were studied from the spring of 1962 to the spring of 1966. We feel that this turtle has been rarely collected because it inhabits mainly temporary woodland ponds. When the ponds dry up during the spring, the turtles burrow into the ground where they remain until the following year.

## HABITAT

The optimum habitat for the mud turtle in southern Illinois lies in sections of the Pin Oak Flatwoods that annually accumulate enough water to allow development of bald cypress (*Taxodium distichum*), buttonbush (*Cephalanthus occidentalis*), swamp cottonwood (*Populus heterophylla*), and black willow (*Salix nigra*). Other important trees are swamp white oak (*Quercus bicolor*), and pin oak (*Quercus pulustris*). Buttonbush and cottonwood are the most frequently encountered species. Each spring these areas contain standing water up to one meter deep, but more commonly 15 to 45 cm deep. The water is clear but becomes filmed with dust and algae by late April. The bottom is hard and covered by a thick layer of leaves. The vegetational aspect is of a lower layer of buttonbush and willow thickets, which give way to medium sized cottonwoods and larger oaks. Cypress is always in the crown.

The most abundant reptile in such areas is *Kinosternon subrubrum*. Despite the leaf litter and other cover, it was often possible to find 10 adults within an estimated 7 meter square area. The only other turtles seen were two common snapping turtles (*Chelydra s. serpentina*) in 1963. The only snakes seen were several large diamondback watersnakes (*Natrix r. rhombifera*) in 1963, and a single mud snake (*Farancia abacura reinwarti*) in 1964.

We have noticed a difference in the habitat of mud turtles and musk turtles (*Sternothaerus odoratus*) throughout southeastern United States. Musk

turtles prefer deeper, more permanent bodies of water, and the two species are rarely found together. We have not seen them together in Illinois.

## Habits

Spring emergence of the mud turtle takes place in mid-March (Schwegman; pers. comm.). We were able to find no turtles in late February of 1965. On March 28, we found 7 sluggish individuals, 4 males and 3 females. The water temperature was 8.8 C. The population was not yet fully active, and dates of relative activity probably vary from year to year depending on the temperature. As is typical of the species, the mud turtles of Massac County spend their time resting or foraging in shallow water. They were commonly seen in water too shallow to cover the carapace, and a few were seen on land. Many were hiding in the leaf litter below the surface and occasionally stretched to the surface for air. Basking was not observed. The only sunshine received by these turtles is that which filters through the tree branches in early spring.

The annual evaporation of water in the flatwoods forces the mud turtles to bury themselves in the ground. On April 21, 1963, the water was reduced to shallow pools surrounded by soggy ground. We first noticed a burrow when we saw a turtle trying to escape into a hole 13 cm deep. The shape and size of the opening were the same as that of the turtle in cross section. Three days later, openings to burrows were very numerous. Most were shaped like a mud turtle in cross section. Many were plugged with mud that had been pushed upward in the digging process. Some were filled with water. No burrow contained more than one turtle. Burrows ranged from 20 to 40 cm deep; deeper burrows terminated in a cavity. Activity of the turtles varied depending on what stage of desiccation their particular area had reached. In the wettest areas, individuals were at the mouth of the burrow facing outward. These tried to retreat when approached. Individuals in dryer areas were deep in the burrows but were easily pulled from them. These individuals were covered with mud and appeared to be very sluggish. They did not pull the head and limbs into the shell as mud turtles normally do.

By the end of April, the area was virtually dry, and no turtle was seen. Dry flatwoods are a most unlikely looking habitat for a population of aquatic turtles, and no evidence, save possibly a shell, indicates their presence. In 1963 the population was active for an estimated 6 weeks. The forest floor was hard and dry throughout the summer, and water did not begin to accumulate till winter. The situation was similar in the following three years, although burrowing occurred in early May rather than in April.

Drying of the flatwoods ponds in Massac County is a natural, yearly occurrence to which the mud turtles apparently are adapted. We have found no other report on this type of annual activity in turtles. Reports on the reactions of this and other species due to pond drying vary. Wetmore and Harper (1917) reported the spring emergence of *Kinosternon pennsylvanicum* (*K. subrubrum*) from a hole 46 m from a marsh in Virginia. This may not have been related to pond drying. Cahn (1937) stated that this species has been found in dry soil, but he gave no further details. Carr (1952) reported a mass migration of *K. s. hippocrepis* from a drying lake in Texas. Cagle (1944) observed snapping turtles buried in the bottom of a drying lake. Klimstra (1951) reported movements of snapping turtles, probably due to water loss in the normal habitat. Carr (1952) stated that the Florida snapping turtle (*Chelydra s. osceola*) either buries in the mud or moves when ponds dry. We have seen snapping turtles that did not burrow and that did not survive abnormally dry conditions. Some turtles (*Chrysemys*, *Pseudemys*) are not prone to bury in the ground as the habitat dries but wander in search of more water. We have seen hundreds of turtles (*Pseudemys* and others) in southern Florida that were unable to survive the loss of water in canals they inhabited. In the early spring of 1964, we observed 30 shells of *Sternothaerus* and 5 of *Chrysemys* that did not survive the partial drying in 1963 of the LaRue Swamp in southern Illinois. Most of the musk turtles appeared to have been killed by some predator. Three individuals, however, were found alive under a log, where they probably had been since the previous summer. Nemuras (1966) discussed temporary water bodies in Maryland which contained

TABLE 1.—Dimensions (mm) of Adult Mud Turtles, *Kinosternon subrubrum*, from Mermet, Massac County, Illinois.

| Character | Specimen | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males (1-7) | | | | | | | Females (8-22) | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| CARAPACE | | | | | | | | | | | | | | | | | | | | | | |
| Length | 104 | 85 | 85 | 89 | 90 | 88 | 99 | 113 | 88 | 88 | 98 | 89 | 94 | 78 | 83 | 93 | 93 | 95 | 88 | 88 | 95 | 101 |
| Width | 75 | 60 | 61 | 70 | 66 | 65 | 70 | 82 | 65 | 66 | 68 | 60 | 68 | 61 | 62 | 68 | 69 | 69 | 67 | 60 | 72 | 74 |
| Height | 37 | 38 | 31 | 36 | 32 | 34 | 39 | 42 | 37 | 40 | 43 | 40 | 40 | 33 | 36 | 38 | 39 | 37 | 39 | 33 | 40 | 42 |
| PLASTRON | | | | | | | | | | | | | | | | | | | | | | |
| Length | 95 | 77 | 76 | 87 | 81 | 78 | 86 | 103 | 83 | 81 | 89 | 76 | 92 | 75 | 80 | 86 | 84 | 84 | 83 | 80 | 86 | 91 |
| Width | 59 | 49 | 49 | 53 | 52 | 50 | 52 | 63 | 53 | 54 | 56 | 46 | 56 | 49 | 49 | 54 | 49 | 53 | 53 | 45 | 56 | 63 |
| Gular Section | 32 | 30 | 28 | 32 | 32 | 29 | 32 | 39 | 30 | 30 | 31 | 28 | 32 | 27 | 30 | 31 | 32 | 32 | 31 | 30 | 30 | 33 |
| Abdominal Section | 25 | 17 | 19 | 22 | 17 | 19 | 21 | 25 | 21 | 20 | 21 | 17 | 25 | 17 | 20 | 20 | 19 | 21 | 21 | 21 | 21 | 24 |
| Anal Section | 34 | 28 | 29 | 32 | 31 | 30 | 30 | 39 | 32 | 31 | 34 | 31 | 35 | 28 | 29 | 33 | 28 | 31 | 28 | 29 | 34 | 34 |
| BRIDGE | 17 | 13 | 14 | 14 | 15 | 14 | 16 | 23 | 17 | 15 | 18 | 14 | 16 | 13 | 14 | 16 | 13 | 17 | 16 | 16 | 19 | 18 |

bog and spotted turtles (*Clemmys*). He stated that, as the ponds dry in late summer, the turtles would "have to estivate to keep alive." Mud and snapping turtles also occurred in the area, and one of the latter was found in a hole when the pond was dry.

## Variation

Approximately 75 mud turtles were collected and examined during the course of this study. The collections were made from two populations in the vicinity of Mermet. The dimensions of 22 adults collected in a single day in April of 1963 are given in Table 1. The following remarks on variation refer to these specimens and to juveniles and hatchlings collected from the same populations but on different dates.

Secondary sexual differences have been discussed by Carr (1952), Grant (1935), and by Smith (1961). The shell shape, color, and size are similar in both sexes, but the female generally has a proportionately higher carapace and a longer plastron. Old males have a moderately enlarged head and an anteriorly widened carapace in which the widest point is at the suture of the first and second laterals.

The carapace length of hatchlings varies from 20 to 25 mm (Table 2). The carapace and soft parts are black. The plastron is black at the center with a broad, irregular, red-orange to orange periphery, which fades to pale yellow during the first year. The carapace width and height are greater in proportion to its length in hatchlings (Table 2). The plastron length is proportionately shorter than the carapace making protection of the soft parts impossible in very young mud turtles.

The characteristically bright color of hatchlings quickly fades. After 60 days in captivity, the black carapace of five individuals faded to light or dark brown with traces of black remaining in two specimens. The orange coloration faded to light orange or to pale yellow. Nine months later no orange or yellow color remained.

Young mud turtles approximate the shape and color of adults during the second or third year, although several years are needed before they reach sexual maturity. The major feature that persists in juveniles is that the carapace remains widest at the posterior end rather than at the middle or the anterior end.

Most adults range from 85 to 95 mm in carapace length. The largest specimens are a male 104 mm long and a female 113 mm long. The carapace is usually flattened on top with the high-

Table 2.—First Year Growth of Five Captive Mud Turtles, *Kinosternon subrubrum*, from Mermet, Massac County, Illinois.

| | Specimen | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Carapace Length | | | | | |
| May 4, 1962 | 20 | 23 | 23 | 21 | 25 |
| June 29, 1962 | 23 | 25.5 | 27.5 | 27.5 | 28.5 |
| April 4, 1963 | 26 | 27 | 30 | 29 | 30 |
| Carapace Width | | | | | |
| May 4, 1962 | 16 | 18 | 19.5 | 17 | 20 |
| June 29, 1962 | 18.5 | 21 | 22 | 24 | 24 |
| April 4, 1963 | 22 | 22 | 26 | 24 | 26 |
| Carapace Height | | | | | |
| May 4, 1962 | 11.5 | 13 | 14 | 12 | 14.5 |
| June 29, 1962 | 12 | 14 | 14 | 15 | 15 |
| April 4, 1963 | 13 | 14 | 15.5 | 15 | 16.5 |

Table 3.—Dimensions (mm) of Three Juvenile Mud Turtles, *Kinosternon subrubrum*, from Mermet, Massac County, Illinois.

| | Specimen | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Carapace | | | |
| Length | 59 | 39 | 27.5 |
| Width | 45 | 33 | 24 |
| Height | 25 | 17 | 13 |
| Plastron | | | |
| Length | 54 | 34 | 23 |
| Width | 38 | 27 | 17 |
| Gular Section | 20 | 12 | 8.5 |
| Abdominal Section | 13 | 8 | 6 |
| Anal Section | 21 | 13 | 8.5 |
| Bridge | 10 | 6 | 2.5 |

est point being at the center or at the suture of the fourth and fifth centrals. The shell is uniformly brown or olive-brown. The plastron is usually light brown to creamy tan at the margin becoming brown to dark reddish brown or black at the center. Some individuals have either a uniformly dark brown or a mostly tan plastron. Margins of the scutes are black. The head is patterned with bold yellow markings on a brown or olive-brown background. Confluence of the markings sometimes forms a line from the eye to the angle of the jaws, but distinct lines typical of *K. s. hippocrepis* are absent. Illinois specimens are similar to those we have seen from Alabama and Georgia.

## Reproduction

On April 12, 1964, we found two copulating pairs of mud turtles in shallow water at Mermet. Although no nests were found, it is probable that nesting takes place in April or in early May before the drying of the ponds. It would seem necessary for the young to remain in the nest till the following spring. This is supported by the discovery in 1962 and in 1963 of five hatchlings in a roadside ditch. In both years the individuals were within three meters of each other indicating that they had recently emerged from a nest. According to Nichols (1947), spring emergence of hatchlings is the rule on Long Island, New York.

Two eggs laid in captivity by a 113 mm individual measured 30.5 by 16.5 mm and 28 by 17 mm.

## Disposition

In nature, mud turtles are timid and inoffensive. As Grant (1935) observed, newly captured individuals do not attempt to bite, and there is little or no odor given off by this species as there is by certain other species of *Kinosternon* and by *Sternothaerus odoratus*. When captured, individuals attempt to hide in leaf litter, under a log, or in a burrow; when picked up, they simply withdraw into the shell. The temperament of some mud turtles changes in captivity; these become less prone to withdraw into the shell and commonly try to bite.

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