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Southwestern United States and Adjacent Mexico:  
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## Turtles of the Family Kinosternidae in the Southwestern United States and Adjacent Mexico: Identification and Distribution

ROGER CONANT<sup>1</sup> AND JAMES F. BERRY<sup>2</sup>

### ABSTRACT

Two keys for the identification of the kinosternids of the United States–Mexican border region, one for adults and one for juveniles, are presented in an effort to alleviate the confusion that has long existed in attempting to distinguish among the members of the group. Taxa involved

are *Kinosternon flavescens flavescens*, *K. hirtipes murrayi*, *K. sonoriense*, *K. subrubrum hippocrepis*, *Sternotherus carinatus*, and *S. odoratus*. Numerous errors from the literature that were based on the misidentification of specimens are corrected.

### INTRODUCTION

The identification of kinosternid turtles, especially members of the genus *Kinosternon*, is often difficult. External form is similar from species to species, shell coloration is influenced by age and environmental factors, carapacial characters are often masked by dense masses of epizoophytic algae, and neither ontogenetic nor geographic variation has been adequately analyzed. Two western species, *K. hirtipes* and *K. sonoriense*, have long been confused, and certain others are notoriously troublesome. *Kinosternon integrum* is a good example, even though it is extralimital to our area. Adult males of that species are easily recognized by the absence of opposing roughened patches of skin on the hind limbs (the so-called stridulating organs), but females can be separated from females of *hirtipes* only with difficulty, even when large series of specimens are available for comparison.

During the course of our studies we found many mislabeled turtles of this family in museum collections, others were designated simply as "*Kinosternon* sp.?", and errors have appeared in the literature.

For the purposes of this paper we include all of the southwestern United States from southern California to the eastern border of Texas, Sonora (north of the range of *K. integrum* at roughly lat. 29°N), the central Mexican plateau south through the drainage system of the Río Conchos in Chihuahua, and northeastern Mexico south through most of Tamaulipas.

In their key to Mexican kinosternids, Smith and Taylor (1950, pp. 21-22) included *hirtipes*, whose presence complicates the identification of members of the group, but two earlier keys, intended for use in the United States (Pope, 1939, p. 36; Carr, 1952, pp. 89-90), did not.

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Pope's book appeared many years prior to the publication of the description of *Kinosternon murrayi* (= *K. hirtipes murrayi*) by Glass and Hartweg in 1951, and Carr's evidently was in press at the time. In the present paper we include characters useful in making identifications many of which were not employed in any of the above keys or in a more recent one by Ernst and Barbour (1972, pp. 10-18). We also provide a series of illustrations and distribution maps that should assist in distinguishing among the six members of the family that occur within our area. These are *Kinosternon flavescens flavescens* (Agassiz), *K. hirtipes murrayi* Glass and Hartweg, *K. sonoriense* Le Conte, *K. subrubrum hippocrepsis* Gray, *Sternotherus carinatus* (Gray), and *S. odoratus* (Latreille). We have no opinion on the validity of the name *Kinosternon flavescens stejnegeri* Hartweg (1938), which has been applied by some authors to populations of *K. flavescens* from northern Mexico. Further study may indicate whether or not *stejnegeri* represents a recognizable taxon. Meantime we have omitted it from our keys.

#### ACKNOWLEDGMENTS

We are deeply indebted to Dr. John M. Legler who had a large part in conceiving this paper and preparing its original draft. Because of pressure of other duties, he resigned from the project in favor of his graduate student, James F. Berry, but much of the information we have included is based on Dr. Legler's long experience with the Kinosternidae both in the field and laboratory.

We are also indebted to Dr. Frederick R. Gehlbach who helped with many details and who very kindly gave us permission to use data from his unpublished report on the status of *Kinosternon hirtipes murrayi* in Texas.

We are grateful to the following persons who permitted us to examine specimens in their collections, supplied us with information, reviewed our manuscript, or assisted in a variety of other ways: Drs. Charles M. Bogert, Bryce C. Brown, William G. Degenhardt, James R. Dixon, William E. Duellman, and James S. Findley, Mr. George W. Foley, Drs. John W. Forsyth, Howard K. Gloyd, Fred S. Hendricks, Donald F. Hoffmeister, John B. Iverson, and James S. Jacob.

Messrs. Edmond V. Malnate and Hymen Marx, Dr. Edward O. Moll, the late Dr. James A. Peters, Messrs. Floyd E. Potter, Jr., and David S. Riskind, Dr. Robert Rush Miller, Mrs. Margaret Shaw, Drs. Hobart M. Smith, Wilmer W. Tanner, Robert G. Webb, Kenneth L. Williams, George R. Zug, and Richard G. Zweifel.

The photographs of live turtles (figs. 9 and 10) are by the late Mrs. Isabelle Hunt Conant. Other photographs are by Dr. Legler and Mr. Berry. Mrs. Ellen Bowler executed some of the line drawings.

Conant's field work in Mexico was supported by the National Science Foundation (grants G-9040, G-22657, and GB-2177), the Zoological Society of Philadelphia, and with the kind cooperation of several Directors General de la Fauna Silvestre, Departamento de Conservación, who issued collecting permits.

Berry updated the keys from Dr. Legler's early drafts and Conant prepared most of the remainder of the text, but both authors have collaborated fully on all details.

#### MATERIAL EXAMINED

While preparing this paper we drew extensively on the collections of the American Museum of Natural History, the Museum of Southwestern Biology in the Department of Biology of the University of New Mexico, and the Department of Biology of the University of Utah; we have also examined scores of turtles from a dozen other institutions. We do not list all of this material, but we refer to pertinent specimens in the text and illustrations by using the following abbreviations:

AMNH, the American Museum of Natural History  
 BYU, Life Sciences Museum, Brigham Young University  
 FMNH, Field Museum of Natural History  
 KU, University of Kansas Museum of Natural History  
 SM, Strecker Museum, Baylor University  
 TCWC, Texas Cooperative Wildlife Collection, Texas A and M University  
 UIMNH, University of Illinois Museum of Natural History  
 UMMZ, Museum of Zoology, University of Michigan



UNM, Museum of Southwestern Biology, University of New Mexico

USNM, National Museum of Natural History, Smithsonian Institution

UU, University of Utah

With few exceptions all of the many turtles obtained by Conant in Mexico and the southwestern United States from 1949 to 1969, inclusive, have been deposited in the collection of the American Museum of Natural History, and the numerous kinosternids among them have been helpful in preparing the present paper.

The drawings (figs. 1-5) are semidiagrammatic and have been designed chiefly to show diagnostic characters.

### EXPLANATION OF KEYS

There is one key for adults and one for juveniles. Size at sexual maturity varies greatly from species to species, but, for the purposes of these keys, all specimens with a carapace length of 75 mm. or more are considered to be adults.

The head shield is a patch of thickened, cornified epithelium extending from the top of the rostrum a variable distance posteriorly on the dorsum of the head (fig. 2). Although head shields are poorly developed in juveniles, they have distinctive shapes in adults. To view the head shield properly, the top of the head should be wiped dry to prevent glare.

Carapace length (CL) and width (CW) are maximum straight-line measurements made with calipers or dividers (see Carr, 1952, p. 49, or Conant, 1975, rear end paper). Height is measured, vertically, from the lowest point of the midplastral lobe to the highest point of the carapace at the same level.

The posterior marginal scutes of individuals of most species in the genus *Kinosternon* are of differing heights. Normally the tenth marginal is distinctly higher than either the ninth or eleventh (fig. 3); it slopes upward from its contact with the ninth to the posterior border of the fourth costal scute and then drops vertically to the eleventh. Adults of *K. flavescens* are unique in exhibiting this arrangement in combination with a high peak on the ninth marginal where it meets the seam between the third and fourth costal scutes (fig. 3). The relative height of the poste-

rior marginals, which is characteristic of adult mud turtles, has been used successfully in most keys. Unfortunately, it is of little value for identifying hatchlings and juveniles, in which the marginals form a series of more or less even height.

### TAXONOMIC KEYS TO KINOSTERNID TURTLES OF THE SOUTHWESTERN UNITED STATES AND ADJACENT MEXICO

(For maps showing geographic ranges see fig. 11.)

#### ADULTS

(Carapace length greater than 75 mm.)

1. Plastron with two freely movable hinges; gular scute always present, never shortest scute on plastron at midline (fig. 10); carapace may be rugose and keeled, but keels never knobby . . . . . *Kinosternon* . . 3
  - Plastron with a single (anterior) freely movable hinge or none at all; gular scute absent, vestigial, or small; if present, usually shortest scute on plastron at midline (fig. 10); knobs often present on vertebral scutes . . . . . *Sternotherus* . . 2
2. Gular scutes absent or vestigial; carapace high, peaked, and nearly straight-sided in cross section (fig. 1) with a sharp, continuous middorsal keel; head marked with dark spots on a paler (gray to olive) background (fig. 9); no head stripes. . . . .
  - . . . . . *Sternotherus carinatus*  
(Streams and great river swamps of the mid-southern United States.)
  - Gular scutes usually present but small; carapace relatively low and rounded in cross section, lacking a distinct middorsal keel (fig. 1); head predominantly dark, sides usually marked with one or two pale longitudinal lines extending onto neck (fig. 9) . . . . . *Sternotherus odoratus*  
(Freshwater streams, ponds, and lakes of the central and eastern United States.)
3. Head shield at least slightly notched posteriorly (fig. 2) . . . . . 4
  - Head shield roughly triangular, rhomboidal, or bell-shaped, lacking a posterior notch (fig. 2). . . . . 5
4. Ninth marginal scute distinctly higher than eighth marginal, and distinctly peaked dorsally where it meets seam between

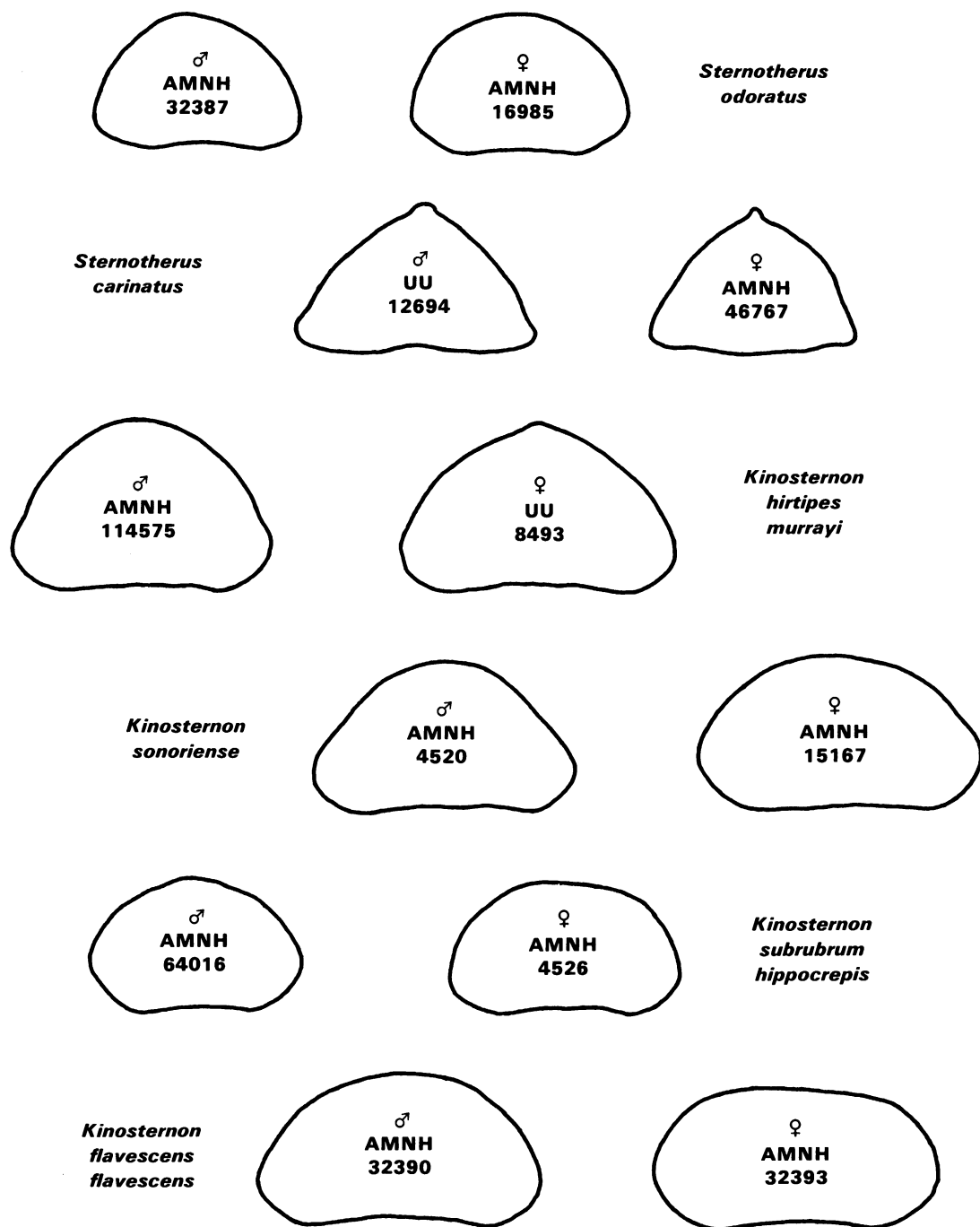


FIG. 1. Transverse cross sections at mid-bridge level through shells of six species of kinosternids, made with soft wire by the method of Mosimann (1955). Drawings not to scale.



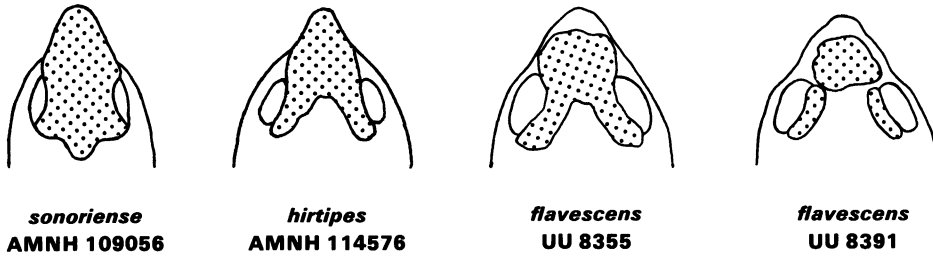


FIG. 2. Dorsal views showing head shields in three species of *Kinosternon*. Note shapes: no notch posteriorly in *sonoriense*; notched in *hirtipes*; notched or composed of a rostral and supra-orbital portions in *flavescens*.

fourth and fifth costals (fig. 3); head shield consisting of a narrow crescent over each orbit, sometimes joined to a nasal shield (fig. 2); shell relatively wide (CW 72-77% of CL), evenly rounded or flat-topped in cross section (fig. 1). . . . . *K. f. flavescens* (Shallow, usually muddy-bottomed bodies of water, including springs, intermittent streams, and cattle tanks of the southwestern and central United States and northern Mexico; a disjunct eastern subspecies.)

Ninth marginal scute not distinctly peaked dorsally where it meets seam between fourth and fifth costals (fig. 3); head shield V-shaped (fig. 2), both branches always

joined to nasal shield; shell narrower (CW 66-71% of CL), posterior half at least slightly peaked in cross section. . . . .  
 . . . . . *K. hirtipes murrayi* (Desert streams, springs, and other bodies of water from Presidio County, Texas, southward through the drainage system of the Río Conchos in Chihuahua; southern subspecies.)

5. First vertebral scute relatively narrow (width 50% or less of length), usually not in contact with second marginal scute (fig. 4); shell relatively wide (CW 69-74% of CL), generally dark dorsally and paler but unmarked ventrally; head predominantly dark with paler markings which tend to be ar-

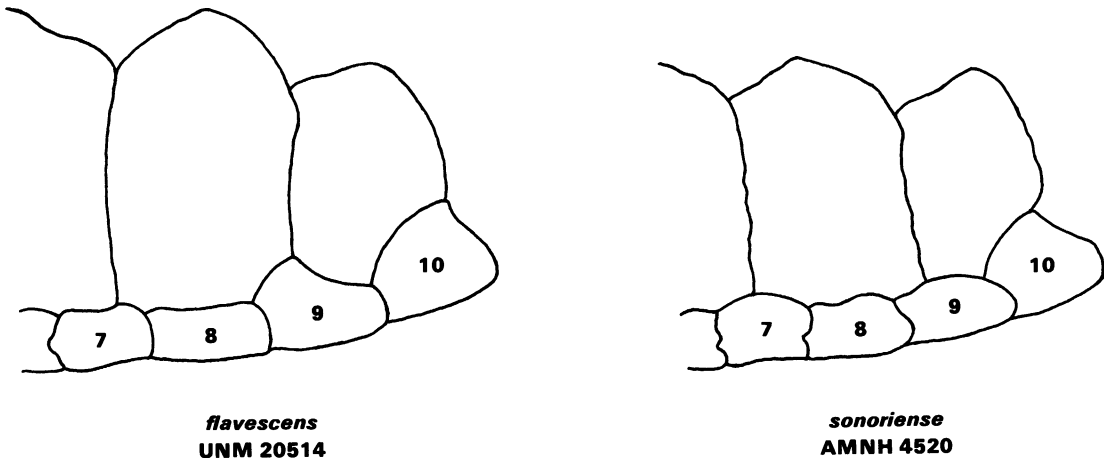


FIG. 3. Condition of the ninth marginal in *Kinosternon flavescens* and other species of the genus *Kinosternon* from the southwestern United States and adjacent Mexico (as typified by *sonoriense*). In *flavescens* the ninth marginal is peaked upward where it meets the seam between the fourth and fifth costal scutes. The ninth marginal is not peaked and is approximately as high as the eighth marginal in the others.



FIG. 4. Relative positions of the first vertebral and the anterior marginal scutes in *Kinosternon subrubrum hippocrepis* and *K. sonoriense*. The first vertebral is in contact with the second marginal or aligned with the seam between the first and second marginals in *sonoriense*; it is separated from the second marginal in 91 percent of the specimens of *subrubrum* examined.

ranged in one or more lateral stripes, but no bold marbling on top of head (fig. 9); usually four small barbels, the longest less than half vertical diameter of orbit . . . . .

. . . . . *K. subrubrum hippocrepis* (Bayous, lagoons, and great swamps of the lower Mississippi Valley; eastern Texas to the tip of the Florida panhandle; eastern subspecies.)

First vertebral scute in contact with second marginal or its edges aligned with seam between first and second marginals (fig. 4), width and length subequal; shell narrower (CW 66-70% of CL); carapace pale to dark brown, plastron yellowish or brown, all scutes distinctly dark-edged, bearing dark radial markings (especially in adult males); entire head boldly reticulate, marbled, or spotted in males, but predominantly pale brown in females with fine, pale marbling and a few darker spots dorsally (fig. 7); usually four distinct, large barbels, the longest about half vertical diameter of orbit . . . . . *K. sonoriense* (Streams and other bodies of water, chiefly in upland areas; southeastern California to southwestern New Mexico and south into the highlands of Sonora and Chihuahua.)

#### JUVENILES

(Carapace length 75 mm. or less)

1. Gular scute present, never shortest scute on plastron at midline; greatest width of posterior plastral lobe usually greater than 50 percent of carapace width at same level . . . . . *Kinosternon* . . . 3

Gular scute absent or shortest scute on plastron at midline; greatest width of posterior plastral lobe usually less than 50 percent of carapace width at same level . . . . .

- . . . . . *Sternotherus* . . . 2
2. Gular scute absent or vestigial; carapace high, peaked, and nearly straight-sided in cross section; dorsal keel distinct, dorsolateral keels weak or absent; shell and soft parts pale gray to pale olive with brown dots; plastron lacking bold marbled pattern . . . . . *S. carinatus*
- Gular scute usually present; carapace not so high, not peaked, but bearing three distinct knobby keels; soft parts dark slate to black; pattern of dots usually lacking; head bearing pale stripes; plastron with bold marbled pattern . . . . . *S. odoratus*
3. Least interorbital distance considerably less than vertical diameter of orbit (fig. 5); dorsal keel low and rounded; no distinct dorsolateral keels; carapace olive to gray in hatchlings with darker flecks 10-20 per scute (lost in juveniles over 30 mm. CL); posteriormost part of each carapacial scute with a distinct dark spot (uniform pale olive with dark borders in older juveniles); head darker above than below, often lacking distinct dark markings . . . *K. f. flavescens*
- Least interorbital distance equal to or greater than vertical diameter of orbit (fig. 5); carapacial scutes never uniformly pale with single dark spots or distinct dark borders; head always bearing distinct markings of some kind . . . . . 4
4. Shell relatively high (height 52-70% of CL); ground color of carapace dark brown to black, markings indistinct (except on su-



pramarginal surfaces); head dark with light markings arranged in one or more lateral stripes; never a wide, low dorsal keel; dorsolateral keels lost in individuals over 50 mm. CL. . . . *K. subrubrum hippocrepis* Shell lower (height 36-56% of CL); ground color of carapace pale to medium brown; carapacial scutes often tipped with darker brown; a low, wide dorsal keel and two dorsolateral keels usually present in hatchlings, variable in older specimens; soft parts olive to dark brown, head with distinctive pattern of pale lateral stripes (gradually replaced by adult pattern of marbling, figs. 7, 8) . . . . . 5

5. Always two pairs of barbels of subequal size, posterior pair at level of midtympanum; irises often uniformly unpigmented in juveniles, gradually replaced by pigmented irises of adults (fig. 8). . . . . *K. sonoriense* Usually a single pair of barbels just behind mandibular symphysis, or posterior pair much smaller and situated anterior to level of midtympanum . . . . *K. hirtipes murrayi*

#### COMMENTS AND CORRECTIONS

The long-standing confusion concerning the turtles of the genus *Kinosternon* of the southwestern United States and Mexico has arisen largely from two related causes: (1) the absence of a modern definitive work on the group as a whole; and (2) an oversimplification of keys for the identification of individual specimens.

No general treatise on the Kinosternidae has been published since Siebenrock's (1907) review.

Cope's big posthumous volume on North American herpetology (1900) did not include the turtles, but Leonhard Stejneger, of the United States National Museum, had planned to produce a companion work on the testudines. For many years he kept the types and unique specimens from the national collection in his office, but he never completed the project. At the time of his death in 1943 "the only section that might be said to be in publishable form," according to Thomas Barbour who wrote a prefatory note for it, appeared posthumously as a review of the American softshell turtles (Stejneger, 1944). Norman E. Hartweg, of the University of Michigan and an outstanding authority on turtles who died in 1964, did much work on the genus *Kinosternon*, but he deferred to Stejneger's wishes and published only a few short papers on the group. It is regrettable that so much of the knowledge of those two men never appeared in print, but research currently in progress by several investigators should provide information that has long been lacking.

Two of the most useful characters for separating *K. sonoriense* from *K. hirtipes*, the shape of the head shields in adults and the condition of the barbels in juveniles, have not been stressed in previously published keys. Individual variation, often dependent on the age of the animal, tends to obscure shell shapes or the presence or absence of carapacial keels, features on which many persons have relied for distinguishing between the two species.

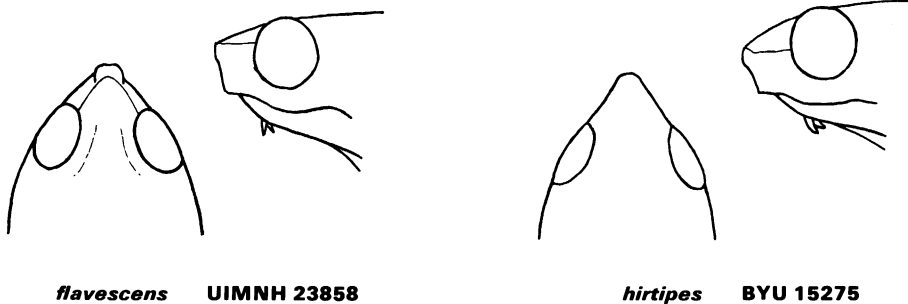


FIG. 5. Interorbital distances in juvenile *Kinosternon flavescens* and other species of the genus *Kinosternon* from the southwestern United States and adjacent Mexico (as typified by *hirtipes*). The distance between the dorsalmost points of the orbital rims is considerably less than the vertical diameter of the orbit in *flavescens*. The interorbital distance is approximately the same as or greater than the vertical diameter of the orbit in the other species. (Dorsal and lateral views in each pair of drawings.)

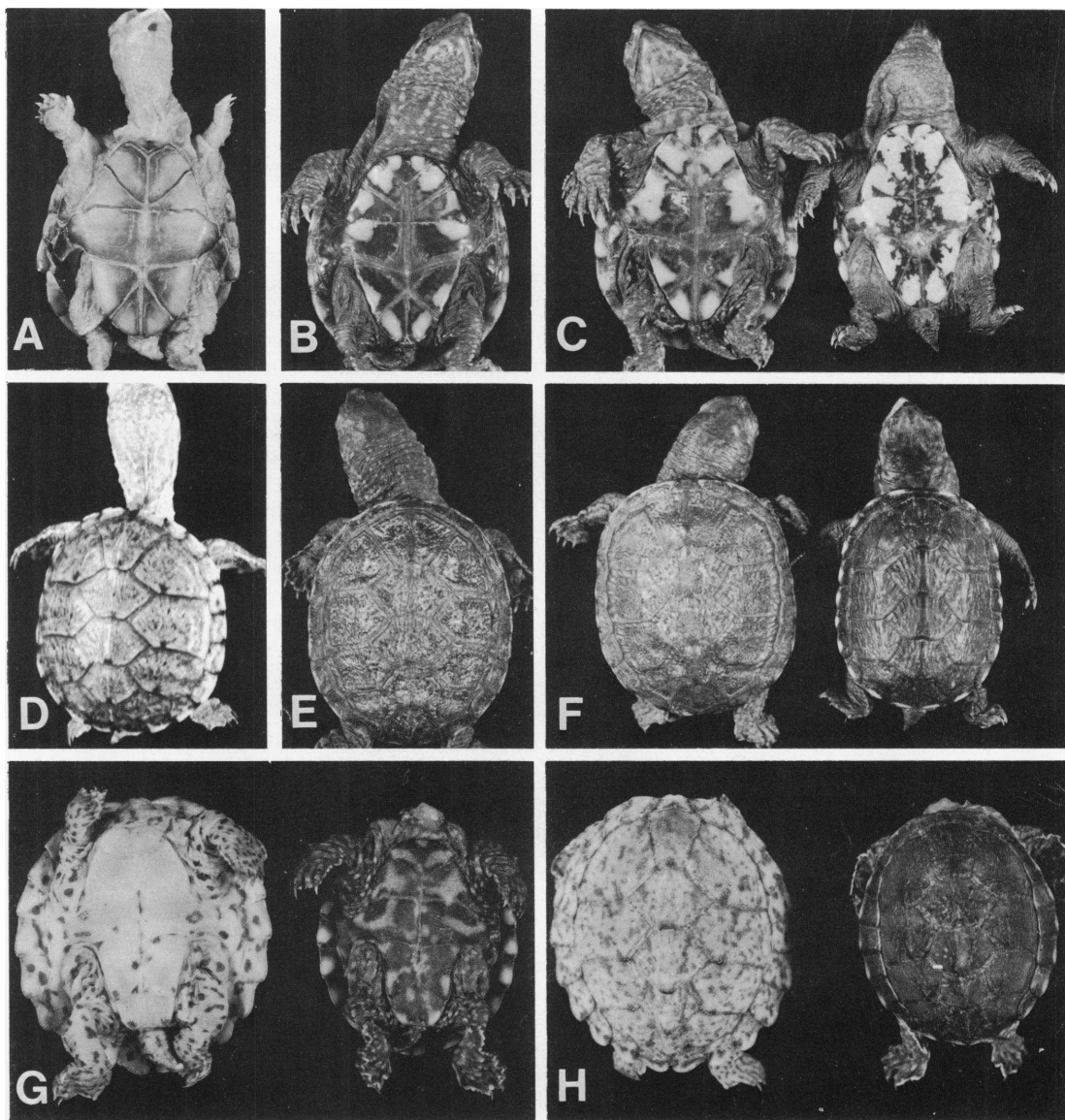


FIG. 6. Ventral and dorsal views of hatchlings of six species of kinosternids. Species and carapace lengths are indicated. A. *Kinosternon flavescens flavescens*, UU 12516, 32 mm. B. *K. hirtipes murrayi*, BYU 15276, 27 mm. C. (Left) *K. sonoriense*, BYU 14134, 27 mm. and (right) *K. subrubrum subrubrum*, UU 11215, 25 mm. D. *K. flavescens flavescens*, UU 17417-2, 29 mm. E and F. Dorsal views of same turtles that are shown in ventral views directly above them. G. (Left) *Sternotherus carinatus*, UU 11950, 27 mm. and (right) *Sternotherus odoratus*, UU 11809, 22 mm. H. Same specimens as in F, but dorsal views.

*Kinosternon sonoriense* is a western and upland form that ranges eastward to southwestern New Mexico (Degenhardt and Christiansen,

1974, p. 29) and western Chihuahua (Iverson, 1976). *Kinosternon hirtipes* occurs chiefly in lowlands of the Chihuahuan Desert region where



it is relict in trans-Pecos Texas but less severely restricted in Chihuahua and farther south (fig. 11). Currently we are aware of no localities in which the two species occur together, but their ranges may overlap slightly, especially in areas where the water resources have been manipulated by mankind and the turtles have occupied new or artificial habitats. Legler and Webb (1970, p. 163) implied that *K. h. hirtipes* and *K. sonoriense* were found together in the upper Río Yaqui in western Chihuahua, but Legler (in conversation with the junior author) has stated that they were never collected at the same locality.

Probably nowhere is the confusion between these two species more evident than in range statements that have appeared in keys, handbooks, and elsewhere. Many authors have placed *sonoriense* in western Texas where it does not occur (Brown, 1950, p. 228; Cagle, 1957, p. 282; Carr, 1952, p. 99; Cochran and Goin, 1970, p.

136; Hambrick, 1976, p. 293; Mertens and Wermuth, 1955, p. 338; Pritchard, 1967, p. 37; Schmidt, 1953, p. 91; Smith and Taylor, 1950, p. 26; Stebbins, 1966, p. 83; Stejneger and Barbour, 1917, p. 112, and in all four of their subsequent editions; and Wermuth and Mertens, 1961, p. 27). Pope (1939, p. 56) and Stebbins in an earlier work (1954, p. 169) were skeptical about the presence of *sonoriense* in Texas and suggested that confusion with *K. flavescens* may have been responsible for erroneous reports. Van Denburgh (1922, p. 969) was also cautious; he stated that *sonoriense* is "Said to range across New Mexico to southwestern Texas." Carr's distribution map (1952, p. 102), however, also erroneously showed *sonoriense* extending into Coahuila, and Pritchard (1967, p. 37) included "northern Coahuila" in his range statement for the species.

Conversely, several authors have incorrectly

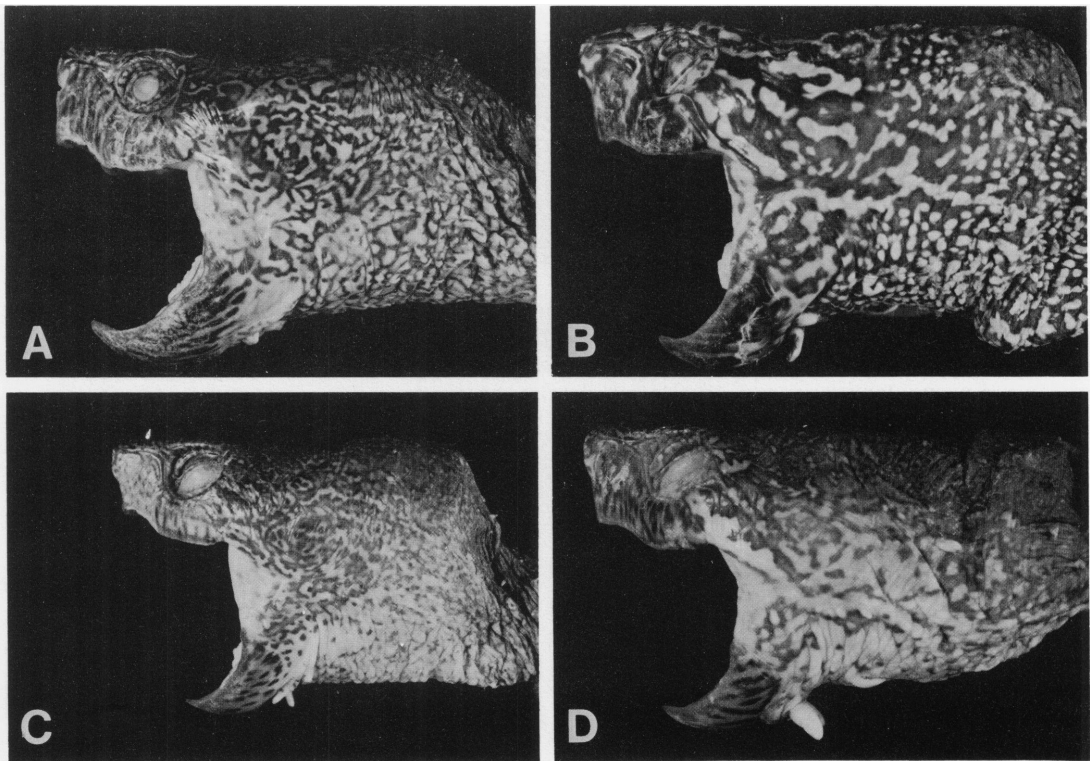


FIG. 7. Lateral views of heads (approximately actual size) to show sexual pattern dimorphism in adults of two species of *Kinosternon*. A. *K. hirtipes murrayi*, male, KU 51302. B. *K. sonoriense*, male, KU 51311. C. *K. h. murrayi*, female, KU 51307. D. *K. sonoriense*, female, KU 51313.

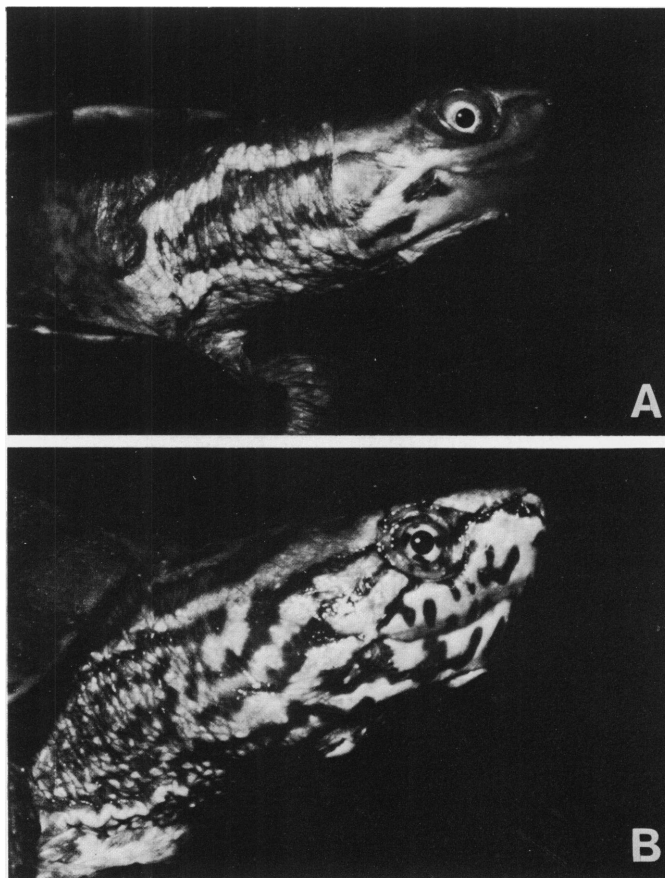


FIG. 8. Specimens of *Kinosternon sonoriense* from the Verde River near Clarkdale, Yavapai County, Arizona. A. UU 17448, juvenile, carapace length 61 mm., showing juvenile head pattern and unpigmented iris. B. UU 17447, subadult male, carapace length 98 mm., indicating subadult head pattern and pigmented iris.

included southern Arizona in the range of *hirtipes*, although some of them qualified their statements with “perhaps” or “possibly” (see Cagle, 1957, p. 282, and 1968, p. 218; Cochran and Goin, 1970, p. 135; and Ernst and Barbour, 1972, p. 67).

One may draw the conclusion from this plethora of incorrect range statements that many of the authors simply repeated what had been written by others and that they avoided the time-consuming chore of attempting to examine museum specimens. Even if they had adopted the latter procedure it is likely they might have misidentified many animals unless they had undertaken a detailed study of the entire group.

The additional comments and corrections in the following sections should help to clarify the confusion that has existed for many years.

#### ALLEGED TEXAS RECORDS FOR *KINOSTERNON SONORIENSE*

Among the numerous persons who placed the range of *K. sonoriense* in Texas, Brown (1950, p. 228) was the only one who listed definite localities, and they were based on museum specimens he examined while preparing a lengthy report on the herpetology of his state.

Recent field work conducted in trans-Pecos Texas by several persons has produced many



specimens of *Kinosternon*, but none of *sonoriense*. In an effort to clarify the distributions of all turtles occurring in Texas (for inclusion in the 1975 edition of his field guide), Conant sought further information on the localities listed by Brown. Dr. Brown helpfully supplied the following data for three specimens from Texas:

AMNH 62982—Tornillo Creek, 10 miles north of San Vicente, Mexico, but in Brewster County; USNM 20670—Belen, El Paso County; and USNM 45789—Paisano, Presidio County.

We have examined these specimens and one other (USNM 20669 from Belen, a dry shell with the skull separate) that Brown did not see. All are small (carapace lengths 42-82 mm.) and we identify them as *K. f. flavescens*. We have found no other evidence indicating that *sonoriense* occurs in Texas, and the species should be dropped from the state list. For comments on the Belen and Paisano localities see pp. 15-16.

In view of the errors in identification involving *K. flavescens* and the scarcity of *K. hirtipes* in Texas, as indicated below, we cannot agree with Iverson's statement (1976) that "The numerous reports of Texan *K. sonoriense* are based on *K. hirtipes* records."

#### KINOSTERNON HIRTIPES MURRAYI IN TEXAS

In their paper describing *Kinosternon murrayi*, Glass and Hartweg (1951) included two collecting localities and supporting data:

(1) Harper Ranch, 37 miles south of Marfa, Presidio County, Texas (TCWC 650, the holotype, taken on August 12, 1941, by S. H. Wheeler; UMMZ 101294 and UMMZ shell 1083, both paratopotypes, on June 12, 1950, by Hernon G. Dowling).

(2) Marfa, Presidio County, Texas (USNM 15860, paratype, by Vernon Bailey. The date for this specimen is January 24, 1890, according to the USNM catalogue).

Frederick R. Gehlbach investigated these localities during 1971 in conjunction with his review of changes in the flora and fauna of the Mexican boundary region between 1850 and the present. Much of the information in the following three paragraphs has been abstracted from an unpublished summary of his findings.

First he consulted the field notes of Vernon

Bailey, which are on deposit at the National Museum of Natural History. From them it is obvious that Bailey's turtle was not taken at Marfa, despite the catalogue entry for USNM 15860. It was collected on January 22 or 23, 1890, "35 miles southwest of Marfa." It is possible that Bailey may have been at or near what was eventually designated as the type locality (37 miles south of Marfa). Considering the fact that he, as well as all the other persons who obtained specimens at later dates, traveled along dirt roads that made many turns, estimates of distances or direction or both may have varied. Gehlbach found that the road from Marfa to Presidio, Texas, now follows a different course than it did previously, but he believes that the type locality can best be stated as Jack Brown Spring on the Ted and Francis Harper Ranch, approximately 30 miles south of Marfa.

Gehlbach made a careful search for extant populations of *murrayi* in 1971, but he found only two: (1) in stockponds (some are modified springs) at and near the presumed type locality; and (2) in a stockpond 16 miles farther south. He collected a few voucher specimens at the Jack Brown Spring locality (AMNH 114574-114576, SM 12634, and USNM 198055 and 201617) and he marked and released several others for a continuing population study. His failure to find these turtles elsewhere after searching many other stockponds of the region and examining water holes and free-running portions of the otherwise normally dry Alamito, Cibolo, and Cienega creeks, would indicate that *murrayi* is a rare animal in Texas. It was placed on that state's list of protected nongame species on July 18, 1977.

In his summary, Gehlbach speculated that "As in southern Arizona, where the once extensive marshes (*ciénegas*) have disappeared with the lowering of the water table, the same seems to have happened in Texas, but it is not so well documented, because the marshes were not so extensive." Scudday (In press) presents evidence of many changes in water levels in trans-Pecos Texas.

Another possibility is that *murrayi*, at one time, may have occurred along streams of the region that formerly supported gallery forests, but which became intermittent or dry after the

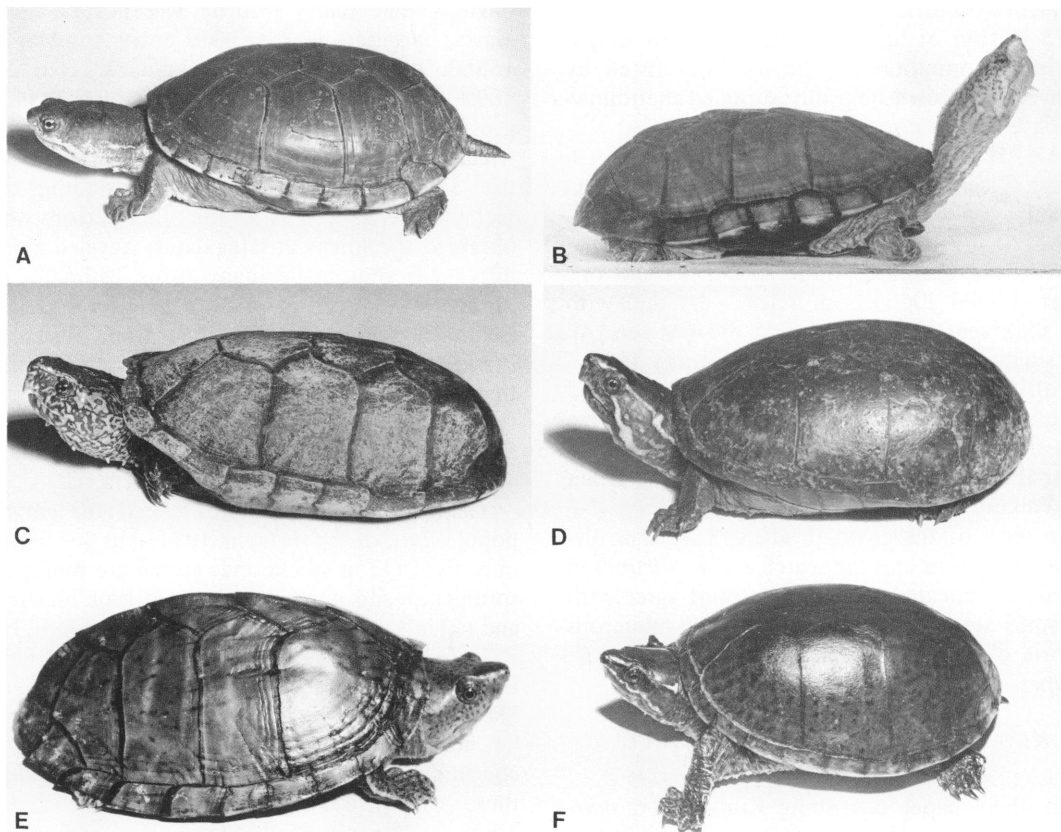


FIG. 9. Live specimens of six species of kinosternids. A. *Kinosternon flavescens flavescens*, immature male, Comal County, Texas. B. *K. hirtipes murrayi*, immature male, Río Conchos west of Ojinaga, Chihuahua. C. *K. sonoriense*, male, Montezuma's Well, 40 miles south of Flagstaff, Yavapai County, Arizona. D. *K. subrubrum hippocrepsis*, male, Avery Island, Iberia Parish, Louisiana. E. *Sternotherus carinatus*, male, Pearl River near Varnado, Washington Parish, Louisiana. F. *S. odoratus*, female, Ockanickon, Burlington County, New Jersey.

trees were felled for use in smelting operations in conjunction with local mines (Conant, 1969, p. 30). Similar streams in Chihuahua support large populations of *murrayi* (Smith, Williams, and Moll, 1963) and as Conant has ascertained during field work conducted from 1974 through 1976, inclusive. This turtle occurs in the Río Conchos near Ojinaga (Legler, 1960, and Conant, documented by AMNH 113858 and 113859 taken during personal field work), which is very close to the Río Grande, but it has not yet been taken

in the latter stream, to the best of our knowledge. (Legler [personal commun.] stated that he obtained no specimens of *murrayi* along the Río Grande at Lajitas, Presidio County, Texas, even though his paper, *op. cit.*, may be interpreted as so implying.) Conant failed to find *murrayi* during intensive trapping efforts in and near the Big Bend National Park during the summers of 1966, 1967, and 1969; traps were set both in the river and in ponds and impoundments near the stream. Nor did he find this turtle in the lower

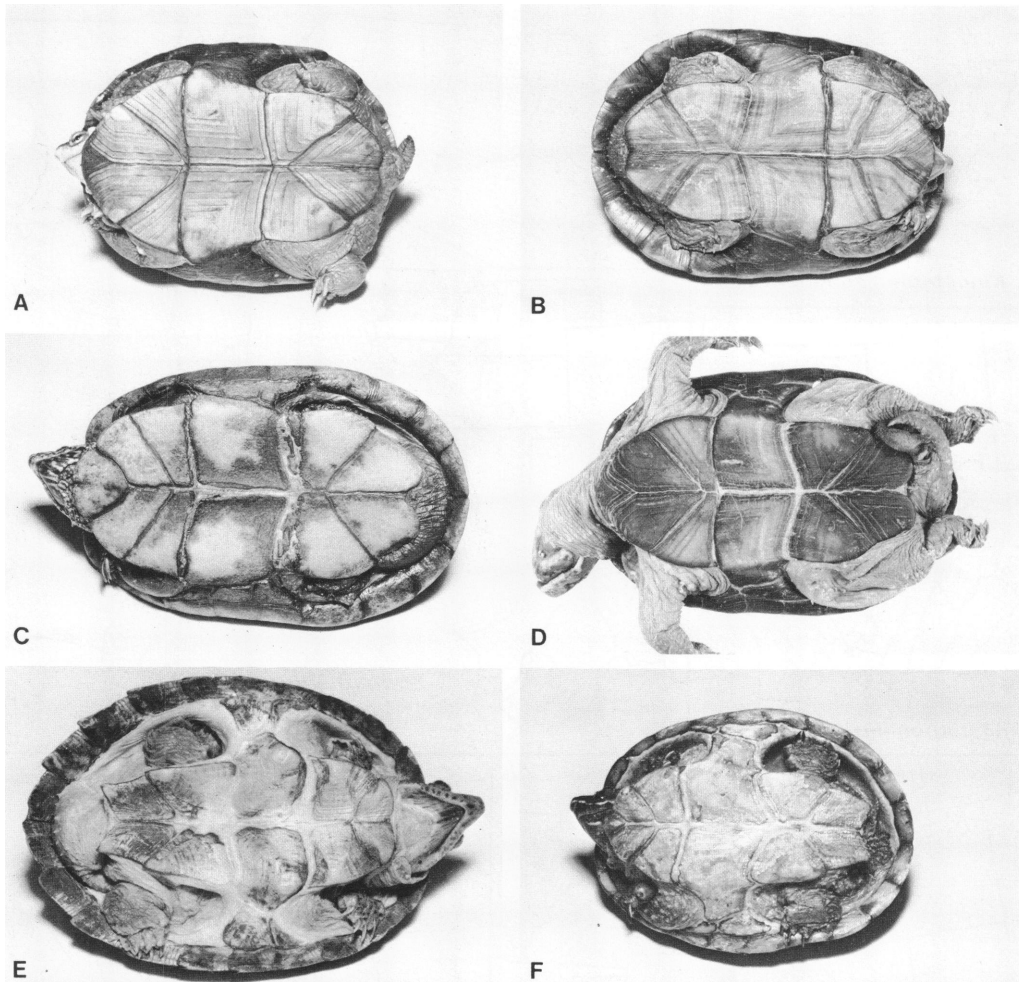


FIG. 10. Ventral views of six species of kinosternids. These are the same specimens as those shown in figure 9, with the exception of D, which is a preserved specimen (AMNH 64106, male) from Chemin aux Tigre, Vermilion Parish, Louisiana.

portions of Alamito Creek or in Cibolo Creek at Shafter, Texas, at which latter locality residents emphatically stated that no water turtles occur. John B. Iverson (personal commun.) also failed to obtain turtles during trapping operations near the mouths of Alamito and Cibolo creeks in May 1974.

Unless the presence of *murrayi* can be demon-

strated in the Rio Grande, which is a distinct possibility, this turtle occurs, insofar as we know, in only two localities in the United States, both of which are in the Chihuahuan Desert Region in western Texas.

Although he did not mention this species, Milstead (1960) marshaled evidence on relict populations of reptiles and amphibians of the



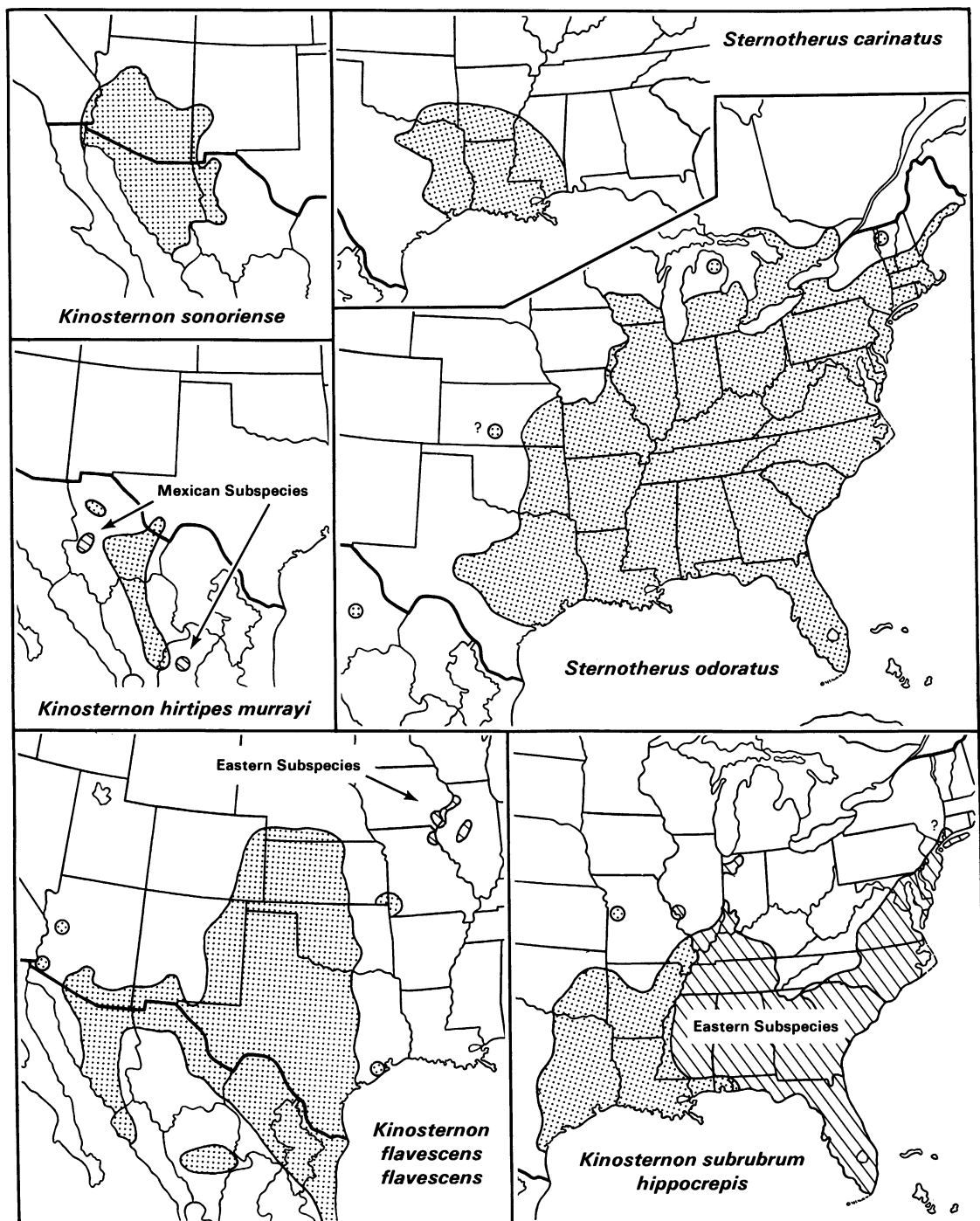


FIG. 11. Approximate ranges of six species of kinosternids. Map of *Kinosternon sonoriense* adapted from Iverson (1976). All others adapted from Conant (1975).

region, and his arguments and conclusions would apply equally well to *murrayi*.

#### RECORDS FOR *STERNOTHERUS* *ODORATUS* IN THE CHIHUAHUA DESERT REGION

Several papers have appeared recently on the western limits of the range of *Sternotherus odoratus* (Moll and Williams, 1963; Raun, 1965; Burkett, 1966; and Raun and Gehlbach, 1972, p. 12, map 47). Among these Moll and Williams reported on a specimen collected at Sauz, Chihuahua, in 1903 by Seth Eugene Meek, of the Field Museum of Natural History. They suggested, in view of the Mexican locality, that the dubious record for *odoratus* from Presidio County, Texas, mentioned by Brown (1950, p. 230) was also very likely valid. Unfortunately, they did not examine the specimen on which Brown based his comment (Kenneth L. Williams, personal commun.), and they also inadvertently stated that it was in the Texas Christian University collection. Brown (personal commun. through Dr. Gehlbach) has advised us that the turtle in question is no. 650 in the Texas Cooperative Wildlife Collection. The turtle catalogued as TCWC 650, however, is the holotype of *Kinosternon murrayi* Glass and Hartweg (1951).

Brown was handicapped at the time he misidentified this specimen as *Sternotherus odoratus*. *Kinosternon murrayi* had not yet been described, and information on *S. odoratus* in Texas was relatively meager. Suffice it to say that there is no record for *odoratus* from trans-Pecos Texas.

The old specimen from Chihuahua (FMNH 1404) is of special interest. As Moll and Williams (*op. cit.*) pointed out, "The locality is given on each of three cloth tags, each sewn through the skin of a separate leg, seemingly in the field." Meek made a practice of attaching field tags in that manner. For the moment we must assume that the locality is valid and that *S. odoratus* is another of the many semiaquatic reptiles and amphibians that have survived as relicts in the Chihuahuan Desert (Conant, In press). A second specimen (FMNH 1403) with the same locality data and catalogued as "*Aromochelys*," apparently is no longer extant.

Meek (1904, p. xxxiii) described the Río Sauz as "a small stream about fifteen miles in length,

situated a short distance north of the City of Chihuahua. At Sauz, about the middle of its course, it contains a small amount of running water during the dry season." Meek, who in a sense was pioneering at the time and no doubt working with relatively primitive maps, was unaware that the river has a much longer course than he supposed.

According to the topographic map of Mexico (Ex-Comisión Intersecretarial, 1958) the Río Sauz rises in a gap between the Sierra de los Almireces and the Sierra del Paporin and then flows in a generally easterly direction past the Ejido Bellavista and close to the Estación Sauz where it turns almost abruptly northward and continues on through Peñol and past the Estación Encinillas before disappearing into a small playa. From source to mouth it traverses a distance in excess of 70 km. Throughout much of its course it is dry during most of the year, but some water is impounded behind a series of small dams in various parts of this small watershed (Contreras-Balderas, 1975). It was evidently one of these, along an intermittent tributary, that Minckley and Koehn (1965) and their party visited on June 1, 1964, and where they found three of the four species of fishes that Meek (*op. cit.*, p. xxix) had collected at Sauz on May 29, 1903. Contreras-Balderas (*op. cit.*) also listed the same three species as having been obtained in 1968 in addition to a member of the genus *Gila* that had not previously been reported from the basin. Edward O. Moll (personal commun.) visited the stream at Sauz in June 1964, at which time there were a number of pools a meter or more in depth that he believed could hold water the year round. In one night's trapping he obtained only *K. hirtipes*. *Thamnophis eques* was also collected at the same locality.

If these aquatic and semiaquatic vertebrates have survived, *Sternotherus* may still be present.

#### OBSCURE LOCALITIES

We have had difficulty in finding certain localities, an almost inevitable experience when data are used from specimens collected a great many decades ago. For the benefit of future workers we review what we have ascertained.

Paisano, Presidio County, Texas, the locality for a *Kinosternon flavescens* (USNM 45789), was

a railroad stop east of Marfa and close to the Brewster County line. The turtle was collected in 1890 and was credited to "W. Lloyd." It may have been found at or near Paisano, but that locality may well have been the shipping point rather than the actual collecting site. The paratype of *K. murrayi* (USNM 15860) likewise was probably shipped from Marfa, thus accounting for the entry in the catalogue of the National Museum of Natural History, even though, according to Bailey's notes, it actually was taken "35 miles southwest of that town."

Belen, El Paso County, Texas, the locality for two specimens of *K. flavescens* (USNM 20669 and 20670), was a stop along the Southern Pacific Railroad where Mearns (1907, p. 79) did field work during June 1893. The two turtles are credited to him as collector. Belen, which appears on the Ysleta quadrangle (United States Geological Survey, 1967), is about a mile southeast of Ysleta and within the present city limits of El Paso.

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