Kinosternon iversoni sp. nov. (Testudines: Kinosternidae), a New Species of Mud Turtle from Sonora and Sinaloa, Mexico.

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ABSTRACT. – Following the neotype designation and sensu stricto redefinition of *Kinosternon integrum* Le Conte, 1854 by Joseph-Ouni *et al.* (2025), the populations of mud turtles in the northwestern Mexico coastal Pacific drainages formerly assigned to that taxon are currently examined here and found to constitute a distinct undescribed species in the *K. integrum* complex. The honorific patronym *Kinosternon iversoni* **sp. nov.** is dedicated to Dr. John B. Iverson for his lifelong work in spearheading and edifying *Kinosternon* research throughout the Americas. The new species is distinguished from *K. integrum* sensu stricto by a full suite of characters delimiting color, head and shell morphology and metrics and it appears to be endemic to the region from the lower Rio Yaqui and Rio Matape, Sonora south to the Rio Mocorito, Sinaloa, Mexico. This distribution partially corresponds to the drainage ranges 1A, 1B, and 2 expounded in Berry (1978). Sympatric freshwater turtle species are *Kinosternon alamosae*, *Trachemys yaquia* and *Trachemys nebulosa hiltoni;* it shares the same general type locality, Guírocoba, Sonora, with the latter taxon. We propose 85 of the 246 characters in the suite that differentiate male *Kinosternon iversoni* **sp. nov.** from *K. integrum* sensu stricto, and 77 characters for females.

Keywords: Testudines; Kinosternidae; new species; Sonora, Mexico*; Kinosternon integrum* complex.

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Figure 1.
A beautifully marked adult female Rio Yaqui Mud Turtle *Kinosternon iversoni* **sp. nov.** from Alamos, Sonora, Mexico.

INTRODUCTION

The Guanajuato Mud Turtle *Kinosternon integrum* LeConte, 1854 was previously considered to be the most widespread and morphologically variable kinosternid species in Mexico with a broad but endemic distribution (Iverson, 1981; Legler & Vogt, 2013). Because the original type specimen lacked reexaminable locality data and has been considered lost or unlocatable (Iverson *et al.,* 1998), taxonomic and morphological investigation of the populations that comprise the vast range of *K. integrum* has been stunted. Joseph-Ouni *et al.* (2025) designated a neotype specimen and presented a sensu stricto redefinition of the species as the initiation of a multiple-tiered effort to bring clarity and resolution to some of the formidable barriers that inhibit advances in kinosternid morphology and taxonomy research.

In this current contribution we offer the formal description and diagnosis of an undescribed species of mud turtle that comprises the northwesternmost Mexican populations within the *K. integrum* complex. The new species ranges from central and southern Sonora south along the western Mexico Pacific coastal drainages to the west-central seaboard of Sinaloa. The described distribution forms the majority of the basis of the drainage ranges 1A, 1B and 2 in the landmark thesis on the *Kinosternon scorpioides* complex (sensu lato) by Berry (1978). Berry's (1978):

1A. comprises the "range of *K. alamosae*; lower Rio Yaqui (south of Cerro de Guaymas) to Rio Sinaloa (Pacific), inclusive (Sonora, Sinaloa)."

1B. comprises the "lower Rio Yaqui (south of Cerro de Guaymas) to Rio Fuerte (Pacific), inclusive (*K. integrum*) (Sonora, Sinaloa, Chihuahua)."

2. comprises "Rios Sinaloa to Mocorito (Pacific), inclusive (Sinaloa).

The new species is represented by a series of historically collected, museum-preserved adult specimens as well as hatchlings, and high quality digital imagery of live specimens throughout the proposed range.

METHODOLOGY

See Joseph Ouni *et al.* (2025) for a full description of the *Kinosternon* diversity project and methodology used, including specimen pools and description and illustration of the suite of 246 numerical (140 enumerated) morphological character states used in these serial contributions. The new species here is directly compared to *Kinosternon integrum* sensu stricto, with which it forms a part of the *K. integrum* species complex. A full monograph comparing this new species to all other taxa in the *K. integrum* species complex as well as other *Kinosternon* species will be presented as a standalone production (*in prep.*). We expect genetic investigation will be conducted by other colleagues in the future to further assess the distinctiveness of these proposed species that may currently lack molecular data.

SYSTEMATICS

Order: Testudines Batsch, 1788
Suborder: Cryptodira Cope, 1869
Family: Kinosternidae Hay, 1892
Genus: *Kinosternon* Spix, 1824
Subgenus: *Kinosternon* Spix, 1824

RIO YAQUI MUD TURTLE

Kinosternon (Kinosternon) iversoni **sp. nov.**
(Figures 2 through 18)

ZOOBANK REGISTRATION
urn:lsid:zoobank.org:pub:81176FD9-D83A-4A06-9C45-9562BB076D6C
urn:lsid:zoobank.org:act:8EC1C369-ECD4-4F9E-A205-4F5694FF6326

Holotype.- An adult male, AMNH R63757 (Figure 2) collected by John W. Hilton between June 15, 1941 and October 15, 1941 from Guírocoba, Sonora, Mexico [= Rancho Guirocoba, approximately 18 miles southeast of Alamos].

Allotype.- Adult female, AMNH R63756 (Figure 5), same collection data as holotype.

Paratype.- Adult female, AMNH R63755 (Figure 6), same collection data as holotype; adult male, AMNH R82142 (Figure 7), collected from the Río Sinaloa at Guasave, Sinaloa, Mexico by Roger Conant on June 28, 1959.

Referred Specimens.- Figure 8: AMNH R64162, a hatchling collected by Charles M. Bogert from Alamos, Sonora, Mexico between August 27 and September 2, 1942; AMNH R106345 collected by Charles J. Cole and P. V. Colbert 5.8 mi (by rd) south of Alamos, Sonora, Mexico on August 24, 1970. An additional potential specimen AMNH R63758, same collection data as holotype, has been deaccessioned and unavailable for study.

Distribution.- From the lower Río Yaqui, Sonora south through the coastal drainages to the Río Mocorito, west-central Sinaloa, Mexico. Displaced (possibly transplanted) specimens have been noted as far south as Culiácan, Sinaloa. See comments regarding potential additional populations referable to this taxon.

Etymology.- A patronym named in honor of Dr. John B. Iverson, Earlham College, Indiana for his lifelong spearheading, dedication and contribution to the taxonomy, morphology, ecology and conservation efforts of turtle species in general, and kinosternids in particular. Dr. Iverson has also educated, inspired and supported generations of vertebrate researchers and generously and magnanimously given of his time, knowledge and resources.

Notes.- A specimen referred to *Kinosternon integrum* was reported by Enderson *et al.* (2007) from the west slope of the Sierra El Chinito, approximately 27km (airline) east of Baviácora, Municipio de Baviácora, Sonora, Mexico at 1400m elevation, seen on September 4, 2004. The habitat consisted of "a mosaic of oak woodland and foothills thornscrub". The specimen was image vouchered as UAZ 56547-PSV, with a dorso-lateral view of the carapace (reproduced here, Appendix 1, courtesy of The University of Arizona) but little else is available to allow identification to species (sensu stricto). The shape of the 2nd vertebral scute could suggest referral to the *K. hirtipes* complex (i.e. *K. sonoriense* - *pers. obs.* MJO) but this can be generally variable and makes any alternate identifcation uncertain without information on the plastron.

Diagnosis and Description.- A medium to large species of mud turtle in the *Kinosternon integrum* complex measuring to 200-210mm in adult males and 180-190mm in adult females; defined by the following combination of characters:

Carapace: (Figure 1a) - nuchal emargination absent, the anterior rim of the nuchal being rounded or relatively straight; carapace overall evenly oval in dorsal view, fawn brown to dark orangish brown in color, with length being approximately 1.67x width in males and 1.59x in females; carapace length approximately 2.58x that of depth in males and 2.32x in females; marginal curling moderately developed, beginning at posterior M4 and ending at anterior M9; posterior profile of carapace in lateral view shortened with steep drop off; M10 higher than M9 and M11, with moderate diagonal flaring; M9 equal in height to M8; anterior carapace profile in anterior view evenly rounded with flatter top and minimal-to-moderate trough present; posterior carapace in posterior view hemispherical with flattened top and minimal to moderate trough present; minor carapace tricarination, with central carination thin and sharp but lateral carination minimal; P1-V1 sulcus contacts M1-M2 sulcus; V1 length 87-90% width; V2 and V3 longer than wide; V1-V2 sulcus relatively straight, with V2-V3 and V3-V4 sulci minorly bilobed in females and stronger bilobed in males; anterior width of V2 much greater than width of V1-V2 shared sulcus; cervical scute lengthwise rectangle; widest point of V1 is 3x the V1-V2 width in males and 4x in females; M2 larger in size than M1; V5-P4 sulcus slightly inwardly-bowed; V2 wider than V1.

Plastron: (Figure 1b) - plastron yellow to yellowish brown in base color with darker sulci and brown radiations; ventral marginals base yellow with darker brown wash but not heavily muted; axillary scute ranging from posterior M4 to posterior M5 and is brown in color; inguinal scute ranging from poateriormost M5 to anteriormost M8 and is yellow in color with slight brown overwash; slight axillary-inguinal gap always present except in obvious inframarginal deformation; axillary scute is 6-7x gap; anterior plastral lobe longer than posterior lobe in males due to stronger anal scute notch, both lobes longer than fixed lobe in both sexes; posterioor plastral hinge with strong posterior bow; plastron almost entirely covers ventral shell opening; plastral midline sulcus formulae IPH>IAn>IGSL>IG>IF>IAH; moderate-to-minimal anal scute notch present in males, negligible in females; widest point of plastron occurring at approximately .36 anterior percent of the plastral midline; axillary notch absent, being entirely covered by anterior plastral lobe; inguinal notch minimal being covered nearly entirely by posterior plastral lobe.

Figure 2. Adult male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757 from Rancho Guirocoba, Sonora, Mexico.

Head and Limbs: (Figure 3) - head length approximately 1.6x depth in males and 1.26x in females; head length approximately 1.15x width in males, and 0.95x in females; maxillary beak sharp but overall moderately developed in males and nearly absent in females; overall head coloration is yellow to yellow-brown with heavy black webbing or mottling favored dorsally in males and with a similar pattern in females but base coloration is paler yellow to peachy-yellow; posteriormost point of maxillary rhamphotheca ends posterior to posterior orbit; dorsal terminus of madibular rhamphotheca ends slightly posterior to maxillary terminus in males, level in females; ventral terminus of manidbular rhamphotheca ends level to dorsal terminus in males, posterior in females; maxillary rhamphotheca yellow with short dorso-ventral black markings in males and pale yellow to peachy yellow in base in females with negligible black marks; mandibular rhamphotheca yellow with short diagonal-lateral black marks, sometimes coalescing into webs in males and pale to peachy yellow with minor dorso-ventral black marks in females; males with strong single premaxillary black stripe and strong single symphyseal black stripe, both reduced to absent in females; nasal scale strongly bell shaped with minor posterior emargination in males, length being nearly 10x emargination) and stronger emargination in females (length being only 3x emargination); nasal scale lateral termina end strongly posterior to posterior orbit and are thickly truncated in shape; nasal scale dark yellow with black webbing in males and brown-yellow with short lateral black marks, heavily muted overall in females; throat is pale yellow to pale brown in males with heavy black spotting in males typically scattered throughout and pale to peachy pale in females with minor black spotting typically; width across the nasal scale termina approximately 1.5x the preorbital width in males and larger at 1.8x in females; midline nasal scale length approximately 85% of width of nasal scale across termina in males and 60% in females; 1-2 pairs of small chin barbels present; dorsal coloration of the limbs and tail dark brown to dark gray/brown and paler shades of these ventrally; dorsal forelimb contains three laterally elongated scales relatively all even in shape and size, the dorsal two being closely placed and the third just above the carpals; phalangeal sclaes present but not well-developed.

The full suite of 246 numerical (140 enumerated) character states for male and female specimens is presented in Appendix A. Figure 4 presents live coloration and patterns of an adult female from Estrella Canyon, east-northeast of Obragon, Sonora, Mexico.

Figure 3. Additional images of adult male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757: A) left lateral head; B) direct dorsal head and nasal scale; C) direct ventral head and throat; D) scalation of dorsal right forelimb).

Figure 4. Live adult female *Kinosternon iversoni* sp. nov. from Estrella Canyon, east-northeast of Obragon, Sonora, Mexico.

Figure 5. Adult female allotype of *Kinosternon iversoni* **sp. nov.** AMNH R63756 from Rancho Guirocoba, Sonora, Mexico.

Figure 6. Adult female paratype of *Kinosternon iversoni* **sp. nov.** AMNH R63755 from Rancho Guirocoba, Sonora, Mexico.

Figure 7. Adult male paratype of *Kinosternon iversoni* **sp. nov.** AMNH R82142 from the Río Sinaloa, at Guasave, Sinaloa.

Figure 8. Hatchling *Kinosternon iversoni* sp. nov.: AMNH R64162 (left above, dorsal and ventral) collected by Charles M. Bogert from Alamos, Sonora, Mexico during visit from August 27 to September 2, 1942; AMNH R106345 (right above, dorsal and ventral) collected by Charles J. Cole and P. V. Colbert 5.8 mi (by rd) south of Alamos, Sonora, Mexico on August 24, 1970.

Figure 9. Image panoply of young adult male *Kinosternon iversoni* sp. nov. from Estrella Canyon, east-northeast of Obragon, Sonora, Mexico. Images courtesy of J.B. Iverson.

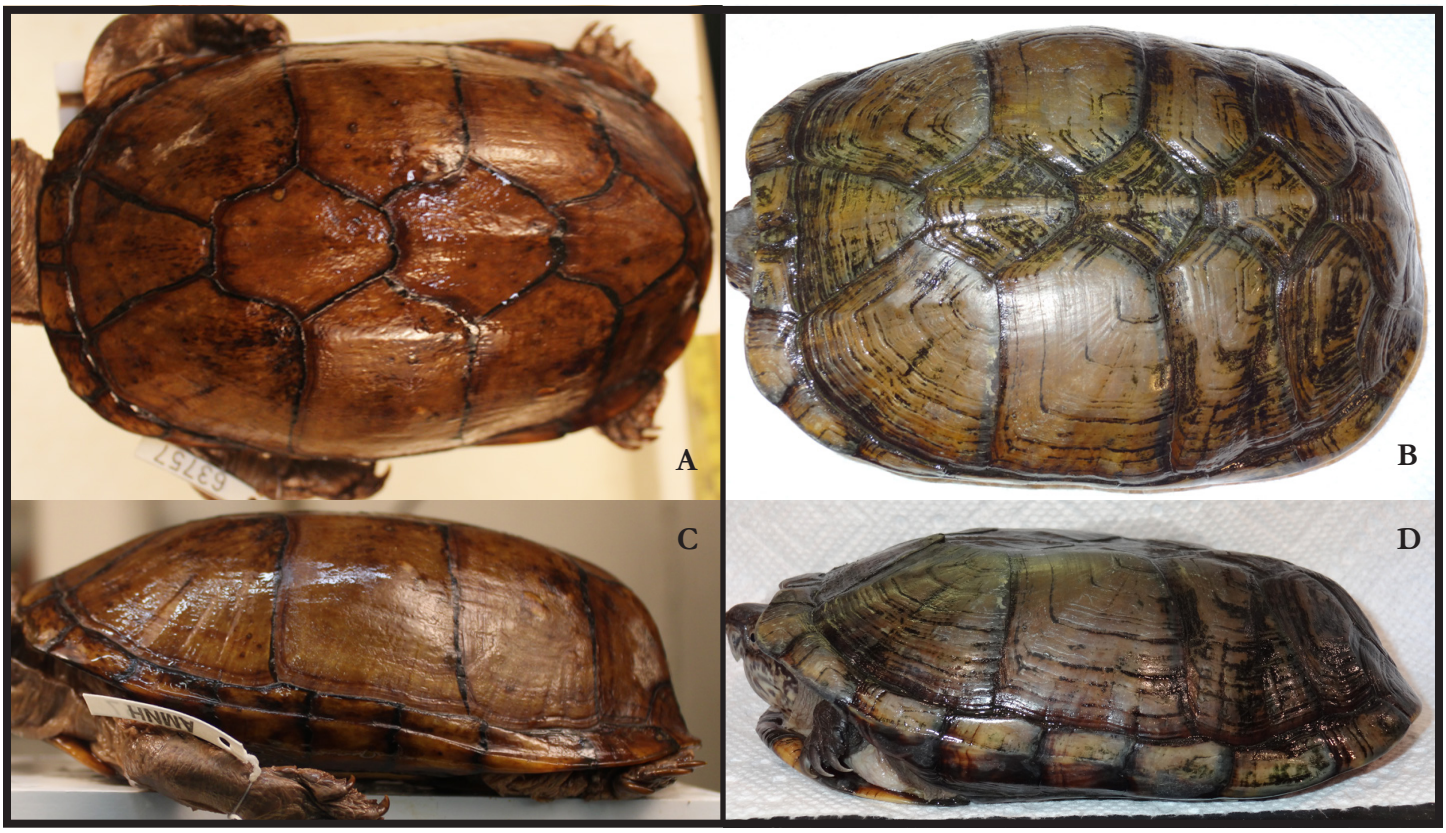

Figure 10. Comparison of the dorsal carapace (letter A) and lateral carapace (letter C) of the male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757 with that of a live male *K. integrum* sensu stricto (letters B and D).

SPECIES COMPARISONS

Kinosternon iversoni **sp. nov.** is morphologically differentiated from *Kinosternon integrum* sensu stricto by the following characters and character states:

In males: Carapace more narrowly oval (carapace length 1.67x width) in dorsal view, with both rounder anterior and posterior ends (versus a wider oval, with truncated anterior and posterior ends; carapace length 1.48x width in males); a lower carpace width vs shell depth (1.54x vs 1.74x); nuchal emargination absent (versus moderately present); carapace sculpture smooth with light pock-marking versus a strongly annulated texture; a minimal anal scute notch versus moderately stronger developed; a higher V1 length vs width (0.90 vs 0.77); a higher V5 length vs width (0.92 vs 0.65); a laterally shortened, steep dropoff of the posterior shell in lateral view (versus laterally and dorsally compressed, shallower dropoff); less extensive laterally curling of the marginals involving fewer marginals (versus stronger curling with more marginals); an evenly rounded anterior arch of the carapace (versus depressed); a lower carapace width vs V2 width (2.68x vs 3.11x); a lower carapace width vs V3 width (2.48x vs 3.14x); a higher carapace width vs V5 width (2.43x vs 2.09x); a slightly higher carapace length vs V1 width (4.66x vs 4.32x); a lower carapace length vs V3 width (4.15x vs 4.64x); a higher carapace length vs V5 width (4.07x vs 3.10x); a lower V1-P1 length vs V1-V2 width (2.47x vs 2.92x); a straighter V1-V2 sulcus shape (vs. typically posteriorly bilobed); V1-P1 sulcus typically in contact with M1-M2 shared sulcus (vs variably from M1-M2 shared sulcus to more typically the anterior 1/3 point of M2); M1 more narrowly rectangular (vs more squarish); a shorter P3-P4 vs P4-V4 sulcus length (0.97 vs 1.3); a V5-P4 sulcus shape that is stright to slightly inwardly bowed (vs outwardly curved); P3-P4 contact of M9 at the anterior 1/3rd point (vs anterior quarter); a V5-M11 shared sulcus vs V4-V5 shared sulcus width of nearly half (3.5x vs 6.84x); a higher V5 length vs M11 sulcus (3.41x vs 2.47x); a higher V5 plus M11 vs M10-M11-V5 sulcus length (2.74x vs 1.94x); a straight M10-V5 sulcus shape (vs

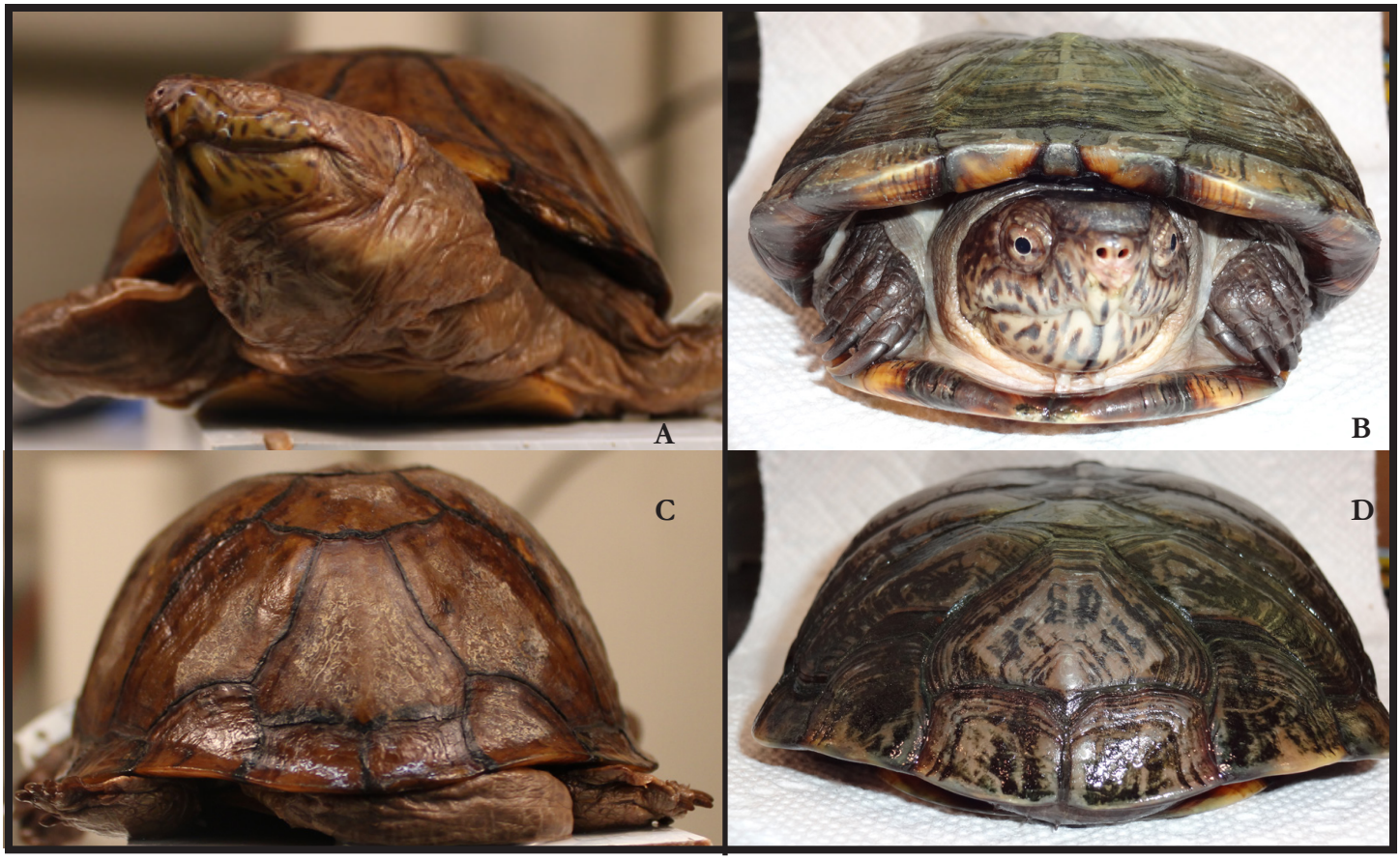

Figure 11. Comparison of the anterior view of carapace (letter A) and ventral view of carapace (letter C) of the male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757 with that of a live male *K. integrum* sensu stricto (letters B and D).

outward curved); a higher P4-V5 vs M5-M11 sulcus (1.99x vs 1.42x); a higher anterior lobe length vs IPH sulcus (1.29x vs 0.94); a higher posterior lobe length vs IPH sulcus (1.26x vs 1.01x); a higher IAn vs IPH sulcus length (0.97 vs 0.73); a higher IAn vs Inter-FemoroAnal sulcus (1.18x vs 0.98); an inguinal notch initiated posterior of the psterior hinge (vs coincident); a lower carapace vs anterior lobe length (2.94x vs 3.6x); a higher carapace vs fixed plastral length (3.73x vs 3.39x); a lower carapace vs posterior lobe length (2.99x vs 3.35x); a lower carapace width vs anterior lobe length (1.75x vs 2.44x); a lower carapace width vs posterior lobe length (1.79x vs 2.27x); a plastral lobe formulae where the fixed plastron is shorter than both the anterior and posterior lobes (vs typically longer than the anterior lobe); a lower carapace length vs IGSL (6.32x vs 7.94x); a lower carapace length vs IG sulcus length (6.88x vs 10.96x); a higher carapace length vs IAH (25.8x vs 18.62x); a higher carapce length vs IF (12.07x vs 10.69x); a lower carapace length vs IAn (3.91x vs 4.62x); a lower carapace vs bridge length (3.72x vs 4.2x); a lower carapace vs intergular scute width (2.85x vs 3.32x); a slightly lower carapace width vs bridge length (2.22x vs 2.84x); a lower carapace width vs IGSL (3.77x vs 5.37x); a lower carapace width vs IG sulcus length (4.11x vs 7.79x); a higher carapace width vs IAH (15.41x 10.33x); a lower carapace width vs IAn (2.33x vs 3.12); a slightly higher carapace length vs the anterior level of the fixed plastron (2.33x vs 2.06x); a higher carapace length vs width across the inter-femoroanal sulcus (3.06x vs 2.41x); a higher plastral midline length vs posterior hinge width (2.18x vs 1.81x). a slightly higher plastral midline length vs width at the femorals (1.98x vs 1.68x); a width of the inguinal scute vs adjacent marginals of almost half (1.29x vs 2.41x); an axillary-inguinal scute gap that is 5-6x vs 3-4x when present; a slightly lower plastral midline length vs anterior lobe (2.75x vs 3.15x);a slightly higher plastral midline length vs fixed plastron (3.49x vs 2.98x); a sliughtly higher plastral midline length vs inframarginal row (2.29x vs 1.99x); a lower inframarginal row length vs anterior lobe (1.2x vs 1.6x); a slightly lower inframarginal row length vs posterior lobe (1.22x vs 1.49x); a lower head length vs width (1.15x vs 1.53x); a higher head width vs anterior

Figure 12. Comparison of the plastron (left) of the male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757 with that of a live male *K. integrum* sensu stricto (the InterAnterohumeral sulcus is typically shorter than shown in this specimen).

carapace scutes (.96 vs .77); a higher head width vs head depth (1.4x vs 1.09x); a lower carapace length vs head width (4.84x vs 6.16x); a slightly lower carapace width vs head length (2.52x vs 2.73x); differentiable dorsal forelimb scales; a lower carapace width vs head width (2.89x vs 4.16x); a higher carapace width vs head width (4.06x vs 3.55x); a lower plastron length vs head width (4.54x vs 5.42x); a higher plastron length vs head depth (6.36x vs 5.89x); a lower plastron widthvs head width (2.55x vs 3.50x); a higher head length vs interorbital (3.10x vs 2.74x); a higher head width vs interorbital (2.69x vs 1.79x); and higher head depth vs interorbital (1.92x vs 1.65x.

Morphologically and colormetrically males differ as follows: eye coloration; lateral face pattern; maxillary and mandibular pattern; a ventral mandible terminus (slightly anterior vs posterior); nasal scale emargination; nasalscale pattern; dorsal head pattern; carapace and plastron coloration; and ventral neck color.

All other characters identified in the suite are considered shared characters or within reasonable variation of each other or characters potentially inherent to the genus itself.

In females, *Kinosternon iversoni* **sp. nov.** differs from *Kinosternon integrum* sensu stricto in characters 1, 3e 5a, 5c,

Figure 13. Comparison of the left lateral head (letter A) and the bridge, axillary and inguinal scutes (letter D) of the male holotype of *Kinosternon iversoni* **sp. nov.** AMNH R63757 with that of a live male *K. integrum* sensu stricto (letters B and C).

Figure 14. Comparison of the female neotype (above, left column) of *Kinosternon integrum* MNHN RA2112 (type of *Cinosternon rostellum* Bocourt, 1876) with live adult female *Kinosternon integrum* sensu stricto (above, center column) and female paratype of *Kinosternon iversoni* **sp. nov.** AMNH R63756 (above, right column).

5d, 5e, 8, 9, 10c, 20b, 21b, 21c, 21d, 21e, 23, 24a, 26, 27, 34, 42, 44, 46, 51, 52, 53, 55, 56, 57, 62a, 64d, 65, 66, 67, 68, 69, 70, 71, 72a, 72b, 72d, 72e, 72f, 76, 78a, 78b, 78f, 79a, 80, 84a, 88c, 90, 93a, 93b, 94b, 97, 98b, 100a, 100b, 100c, 100d, 101b, 101c, 111, 112, 113a, 113b, 120b, 121, 123, 125b, 126, 127, 128c, 129a, 130a, 130b, and 130c.

All other characters identified in the suite are considered shared characters or within reasonable variation of each other or characters potentially inherent to the genus itself.

Kinosternon iversoni **sp. nov.** is a distinct species of mud turtle from coastal Sonora and Sinaloa, Mexico in the *Kinosternon integrum* complex and we offer here differentiation from *K. integrum* sensu stricto by 85 characters in males and 77 characters in females out of the 246 character suite utilized in these studies.

Figure 15. Dorsal views of the head of the female type of *Cinosternon rostellum* Bocourt, 1876, MNHN RA2112 (above left), showing the nasal scale (shape and outlined darkened for clarity); adult live female *Kinosternon integrum* sensu stricto (center) and adult female paratype (above right) of *Kinosternon iversoni* **sp. nov.** AMNH R63756. Base image MNHN RA2112 courtesy of the Musee National d'Histoire Naturelle, Paris, France.

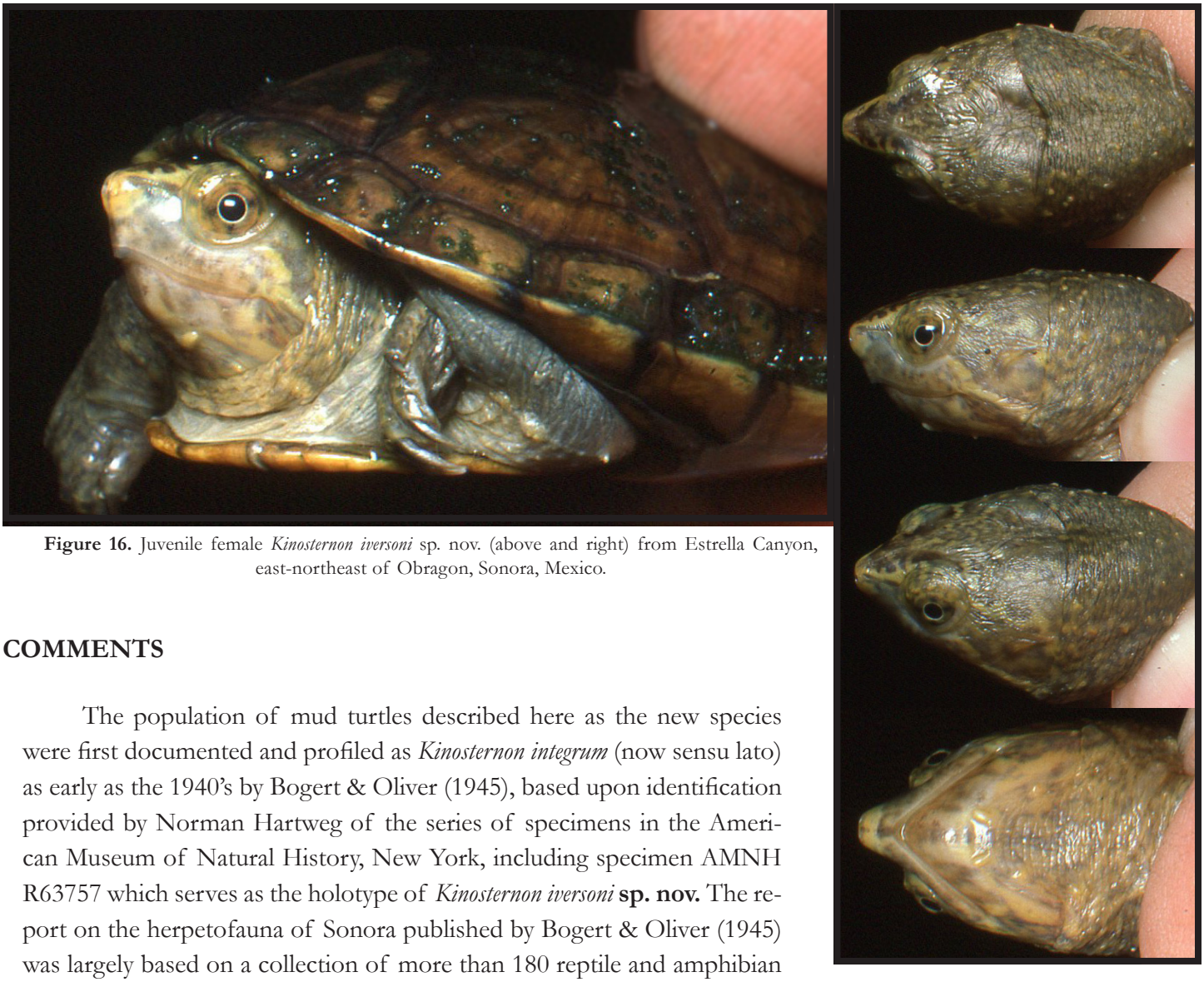

Figure 16. Juvenile female *Kinosternon iversoni* sp. nov. (above and right) from Estrella Canyon, east-northeast of Obragon, Sonora, Mexico.

COMMENTS

The population of mud turtles described here as the new species were first documented and profiled as *Kinosternon integrum* (now sensu lato) as early as the 1940's by Bogert & Oliver (1945), based upon identification provided by Norman Hartweg of the series of specimens in the American Museum of Natural History, New York, including specimen AMNH R63757 which serves as the holotype of *Kinosternon iversoni* **sp. nov.** The report on the herpetofauna of Sonora published by Bogert & Oliver (1945) was largely based on a collection of more than 180 reptile and amphibian specimens personally field collected from Guirocoba by John W. Hilton of Thermal, California between June 15 and October 15, 1941; Hilton had offered his services to the museum specifically for the purposes of assembling it. Hilton reported that the mud turtles were the commonest species of turtles and tortoises at Guirocoba, being taken primarily "from old wells and pools along the edges of the arroyo" by the native people.

These specimens of '*Kinosternon integrum*' were based upon four specimens from Guirocoba (AMNH R63755-63758, see Systematics section above for notes on these); an additional series of eight specimens (AMNH R64161-64168) were collected from the vicinity of Alamos, Sonora by Charles Bogert between August 27 and September 2, 1942. This latter series however was to emerge as a commixture of sympatric mud turtles species: *Kinosternon integrum*

Figure 17. Paratype AMNH R82142 illustrates the distinguishing steep drop off in the posterior shell of male *Kinosternon iversoni* **sp. nov.**

(sensu lato) and a new species latter described by Berry & Legler (1980) as *Kinosternon alamosae*. AMNH R64162 is a hatchling/yearling offered here as a referred specimen of *K. iversoni* **sp. nov.**; AMNH 64161 is a large skeletonized specimen of *K. iversoni* **sp. nov.** that is analyzed in a forthcoming work; all other specimens in that series were designated as paratypes of *K. alamosae* by Berry & Legler (1980). The pertinent profile of *Kinosternon integrum* (sensu lato) from Bogert & Oliver (1945) is reprinted here as Appendix C.

Under *Kinosternon integrum* (sensu lato), Rorabaugh (2008) listed this species as occuring in thornscrub, foothill ponds and stream habitat in Sonora, with a northern limit of the Sierra el Chinito east of Baviácora (which is the record provided by Enderson *et al.* (2007) - see notes section and Appendix B, this current paper) though no specimens were illustrated.

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Museum acronyms: AMNH (American Museum of Natural History); ANSP (Academy of Natural Sciences, Philadelphia; CAS (California Academy of Sciences); MCZ (Museum of Comparative Zoology); MNHN (Muséum National d'Histoire Naturelle); USNM (Smithonian National Museum of Natural History); YPM (Yale Peabody Museum).

Figure 18. Skeletal specimen of *Kinosternon iversoni* **sp. nov.**, AMNH R64161 from the vicinity of Alamos, Sonora, Mexico profiled in a separate upcoming contribution.

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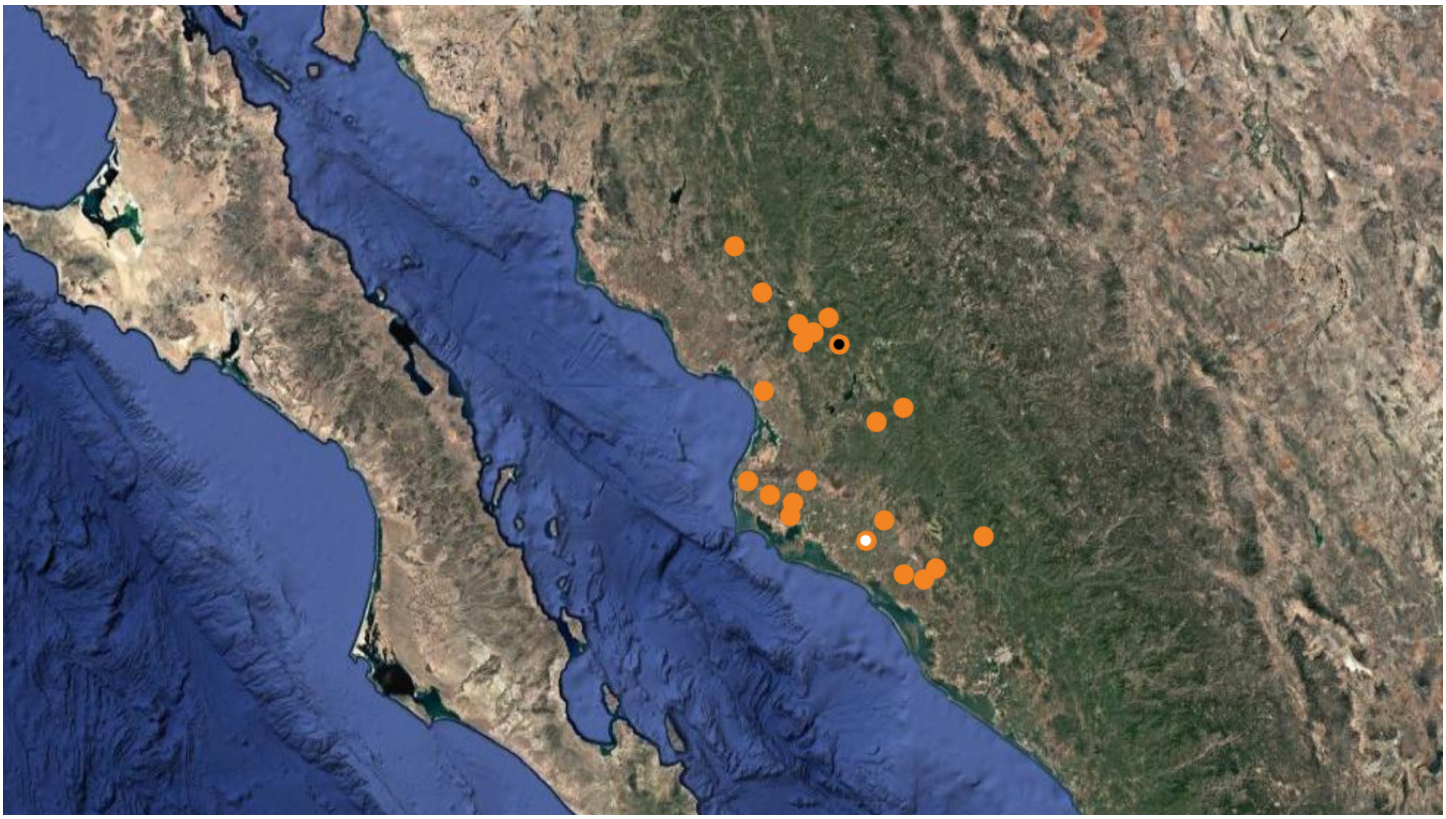

Figure 19. Distribution map of *Kinosternon iversoni* **sp. nov.** in Sonora and Sinaloa, Mexico. Orange dot with black center = holotype, allotype collection site; orange circle with white center = paratype collection site. Data points based on examination of museum specimens, live specimens, TTWG (2021) and supplemented data from J.B. Iverson (pers. comm.) and *inaturalist.com*. Base satellite map from Google.

Appendix A

Table of 246 numerical (140 enumerated) character states considered to be typical, in variation or on average for adult male and female *Kinosternon iversoni* **sp. nov.**

No.	Character Description	Adult male *K. iversoni* sp. nov.	Adult female *K. iversoni* sp. nov.
1	Overall Carapace Shape	oval	oval
2a	Carapace Length vs Width	1.67	1.59
2b	Maximum width occurrence (marginal)	middle M6	middle M6
3a	Vertebral Length vs Width V1	0.90	0.87
3b	Vertebral Length vs Width V2	1.12	1.11
3c	Vertebral Length vs Width V3	1.01	1.13
3d	Vertebral Length vs Width V4	0.98	0.97
3e	Vertebral Length vs Width V5	0.92	0.73
4a	Carapace Length vs Depth	2.58	2.32
4b	Maximum depth occurrence (vertebral)	V2/V3 sulcus	V2/V3 sulcus
4c	Carapace Wdith vs Shell Depth	1.54	1.46
5a	Profile Posterior Lateral Shell	laterally shortened, deep, steep drop off	laterally shortened, deep, steep drop off
5b	Lateral Marginal Curling	moderate	moderate
5c	Marginal Curling Count	6.00	6.00
5d	Intial Marginal Curling	M4	M4
5e	Final Marginal Curling	M9	M9
6	M10 Flaring	moderate diagonal	moderate diagonal
7a	Carapace Length vs Posterior Length	2.96	2.96
7b	Carapace Length vs P3 Length	3.51	3.17
8	Anterior Arch of Carapace	evenly rounded with flatter top	evenly rounded with flatter top/ slight trough present
9	Posterior Arch of Carapace	hemispherical with short flattened top	hemispherical with short flattened top/ slight trough present
10a	Vertebral Width vs Carapace Width V1	2.78	2.99
10b	Vertebral Width vs Carapace Width V2	2.68	2.75
10c	Vertebral Width vs Carapace Width V3	2.48	2.58
10d	Vertebral Width vs Carapace Width V4	3.01	2.89
10e	Vertebral Width vs Carapace Width V5	2.43	2.59
11a	Vertebral Width vs Carapace Length V1	4.66	4.76
11b	Vertebral Width vs Carapace Length V2	4.49	4.37
11c	Vertebral Width vs Carapace Length V3	4.15	4.10
11d	Vertebral Width vs Carapace Length V4	5.04	4.59
11e	Vertebral Width vs Carapace Length V5	4.07	4.12
12a	Vertebral Length vs Carapace Length V1	0.19	0.18
12b	Vertebral Length vs Carapace Length V2	0.25	0.25
12c	Vertebral Length vs Carapace Length V3	0.24	0.28
12d	Vertebral Length vs Carapace Length V4	0.19	0.21
12e	Vertebral Length vs Carapace Length V5	0.23	0.18
13a	Vertebral Length vs Carapace Width V1	0.21	0.21
13b	Vertebral Length vs Carapace Width V2	0.22	0.23
13c	Vertebral Length vs Carapace Width V3	0.24	0.24
13d	Vertebral Length vs Carapace Width V4	0.20	0.22
13e	Vertebral Length vs Carapace Width V5	0.25	0.24
14	Carapace Carination	minorly tricarinate	minorly tricarinate
15	Carination vs V-P Conjunction	coincident	coincident
16	Carination Origination P1	anterior P1	anterior P1
17	Carination Vector P1	parallel	slight convergence
18	Carination Orgination V1	anteriormost V1	anteriormost V1
19a	Carination Termination P4	anterior P4	middle P4
19b	Carination Termination V5	posterior V5	posterior V5
20a	V1-P1 Length vs V1 Width	0.84	0.94
20b	V1-P1 Length vs V1-V2 Width	2.47	3.58
21a	Width V1 vs V1/V2	2.96	3.82
21b	Width V2 vs V1/V2	3.07	4.16
21c	Width V3 vs V2/V3	2.65	2.27
21d	Width V4 vs V3/V4	2.52	2.20
21e	Width V4 vs V4/V5	3.02	4.14
22a	Size of V2 vs V3	smaller	smaller
22b	Size of V3 vs V4	larger	larger
22c	Size of V2 vs V4	larger	subequal
23	P1-V2 vs P2-V2 Sulcus Length	1.08	1.02
24a	V1-V2 Sulcus Shape	straight	straight

24b	V2-V3 Sulcus Shape	posteriorly bilobed	minor posteriorly bilobed
24c	V3-V4 Sulcus Shape	posteriorly bilobed	minor posteriorly bilobed
24d	V4-V5 Sulcus Shape	slightly bilobed	straight
25	Nuchal Emargination	absent	absent
26	Cervical Scute Shape	long rectangular	long rectangular
27	V1 Contact Marginals	M1/M2 sulcus	M1/M2 sulcus
28a	Shape 1st Marginals	long rectangular	long rectangular
28b	Shape 2nd Marginals	long rectangular	long rectangular
28c	M1 vs M2 Size	smaller	smaller
29	V1-P1 Sulcus Shape	slight inward bowing	slight inward bowing
30	V1 vs V2 Width	shorter	shorter
31	V2-P1 Sulcus Shape	slight inward curve	slight outward curve
32	V4-P3 Sulcus Shape	strongly inward bow	strongly inward bow
33	P3-V4 vs P4-V4 Sulcus Length	0.97	0.99
34	V5-P4 Sulcus Shape	slight inward bowing	slight inward bowing
35	M11 Sulcus Shape	relatively straight	slight anterior bow
36	M11 Shape	short rectangular	short rectangular
37	P3-P4 Contact Marginal 9	anterior 1/3rd	anterior 1/3rd
38	M9 vs M8 Height	equal	equal
39	M10 vs M9 Height	higher	higher
40	M10 vs M11 Height	higher	higher
41	Shape V5-M11 Midline Sulcus	posterior dip	posterior dip
42	V5-M11 width vs V4-V5 Sulci	3.50	4.54
43	M10/M11 vs M10/V5 Sulci	1.50	1.86
44	V5 Length vs M11 Sulcus	3.41	3.38
45	M10/V5 Sulcus vs V4-P3-P4 Conjunction	slightly exterior of	exterior of
46	V5+M11 vs M10=M11-V5 Sulcus Length	2.74	2.30
47	M11 Sulcus vs M10/M11 Sulcus	1.01	0.75
48	M10-V5 Sulcus Shape	straight	exterior bow
49	M10-V5 Sulcus Vector	diverging anteriorly	diverging anteriorly
50	P4-V5 vs V5-M11 Sulci	1.99	1.65
51	Carapace Sculpture	smooth with slight raised texture	smooth with slight raised texture
52	Length Anterior Lobe vs InterPosterohumeral Sulcus	1.29	1.15
53	Length Posterior Lobe vs InterPosterohumeral Sulcus	1.26	1.14
54	Plastral Midline Sulcus Formulae	IPH>IAn>IGSL>IG>IF>IAH	IPH>IAn>IGSL>IG>IF>IAH
55	Length Anterior vs Posterior Lobes	1.02	1.01
56	Length vs Width Gular Scute	0.75	0.80
57	Bridge Length vs InterAnal Sulcus	1.05	1.26
58	Length Gular vs Intergular/InterAnterohumeral Sulci	0.87	0.89
59	Inguinal vs Antero Posterior Lobe	strongly posterior	strongly posterior
60	Inter-Femoral-Anal Sulcus vs Marginal	anterior of	anterior of
61a	Anal Scute Notch	minimal	negligible
61b	Anal Scute Tip Shape	slight rounded triangular	slight rounded triangular
62a	InterAnal vs InterPosterohumeral Sulcus	0.97	0.87
62b	InterAnal vs Inter-FemoroAnal Sulcus	1.18	1.19
63	Shape of Posterior Plastral Hinge	strong posterior curve	strong posterior curve
64a	Plastral Coverage	almost entire	almost entire
64b	Axillary Notch Opening	0.98	1.03
64c	Inguinal Notch Opening	0.87	0.94
64d	Inguinal Notch vs Posterior Hinge	posterior of hinge	posterior of hinge
65	Carapace Length vs Anterior Length	2.94	2.94
66	Carapace Length vs Fixed Length	3.73	3.42
67	Carapace Length vs Posterior Length	2.99	2.97
68	Carapace Width vs Anterior Length	1.75	1.85
69	Carapace Width vs Fixed Length	2.23	2.15
70	Carapace Width vs Posterior Length	1.79	1.87
71	Plastral Lobe Formulae	anterior> posterior> fixed	posterior>anterior> fixed
72a	Carapace Length vs Intergular Scute Length	6.32	6.27
72b	Carapace Length vs Intergular Sulcus Length	6.88	9.51
72c	Carapace Length vs InterAnterohumeral Length	25.80	14.62
72d	Caraapce Length vs InterPosterohumeral Length	3.78	3.38
72e	Carapace Length vs Interfermoral Length	12.07	13.32
72f	Carapace Length vs Interanal Length	3.91	3.90
73	Carapace Length vs Bridge Length	3.72	3.10

74	Carapace Length vs Plastron Length	1.07	1.03
75	Carapace Width vs Plastron Length	0.64	0.65
76	Carapace Width vs Intergular Scute Width	2.85	3.16
77	Carapace Width vs Bridge Length	2.22	1.95
78a	Carapace Width vs Intergular Scute Length	3.77	3.95
78b	Carapace Width vs Intergular Sulcus Length	4.11	5.99
78c	Carapace Width vs InterAnterohumeral Length	15.41	9.20
78d	Carapace Width vs InterPosterohumeral Length	2.26	2.13
78e	Carapace Width vs Interfemoral Length	7.21	8.38
78f	Carapace Width vs Ineranal Length	2.33	2.46
79a	Carapace Length vs Anterior Lobe A	2.49	2.46
79b	Carapace Length vs Anterior Lobe B	2.02	1.93
80a	Carapace Length vs Fixed Lobe A	1.94	1.93
80b	Carapace Length vs Fixed Lobe B	2.33	2.29
81a	Carapace Length vs Posterior Lobe A	2.12	2.14
81b	Carapace Length vs Posterior Lobe B	3.06	2.87
82a	Carapace Width vs Anterior Lobe A	1.49	1.55
82b	Carapace Width vs Anterior Lobe B	1.21	1.21
83a	Carapace Width vs Fixed Lobe A	1.16	1.21
83b	Carapace Width vs Fixed Lobe B	1.39	1.44
84a	Carapace Width vs Posterior Lobe A	1.26	1.35
84b	Carapace Width vs Posterior Lobe B	1.83	1.81
85a	Anterior Hinge vs Fixed Width	0.96	1.00
85b	Anterior Hinge vs Posterior Hinge Width	1.15	1.19
86	Anterior Hinge Width vs InterPosterohumeral Sulcus	1.95	1.76
87	Posterior Hinge Width vs InterPosterohumeral Sulcus	1.62	1.48
88a	Plastral Midline vs Anterior Hinge Width Anterior Lobe	1.90	1.88
88b	Plastral Midline Length vs Anterior Hinge Width Fixed	1.82	1.87
88c	Plastral Midline Length vs Posterior Hinge Width	2.18	2.22
89	Plastral Midline Length vs Femoral Width	1.98	2.08
90	Width of Inguinal vs Adjacent Marginal	1.29	1.74
91	Shape of Exterior Plastral Lobe	rounded	rounded
92	M5 Expansion	moderate	minor
93a	Marginal Start Axillary	posterior M4	posterior M4
93b	Marginal End Axillary	middle M5	posterior M5
94a	Axillary Inguinal Contact	absent	absent
94b	Axillary-Inguinal Gap	5-6x	5-6x
95a	Marginal Start Inguinal	posteriormost M5	posteriormost M5
95b	Marginal End Inguinal	anterior M8	anterior M8
96	Length of Inguinal vs Axillary Scute	2.64	2.49
97	Length of Axillary vs M5	0.76	0.81
98a	Length of Inguinal vs M6/M7	1.12	1.00
98b	Length of Interposterohumeral Sulcus vs M6/M7	1.16	1.06
99	Axillary-Inguinal Contact vs M5-M6 Sulcus	absent	absent
100a	Plastral Midline vs Anterior Lobe Length	2.75	2.86
100b	Plastral Midline vs Fixed Length	3.49	3.33
100c	Plastral Midline vs Posterior Lobe Length	2.80	2.89
100d	Plastral Midline vs Inframarginal Row Length	2.29	2.42
101a	Inframarginal Length vs InterPosterohumeral Sulcus	1.55	1.36
101b	Inframarginal Row Length vs Anterior Lobe	1.20	1.18
101c	Inframarginal Row Length vs Posterior Lobe	1.22	1.19
102	Plastral Intersection	0.37	0.35
103	Posterior Hinge vs Marginal 7	middle M7	middle M7
104	Bridge Grooves	absent	absent
105a	Number of Scales	3.00	3.00
105b	Shape of Scales	1 thin elongated, 2 thin short	2 thin elongated, 1 thin short
106a	Finger Scales	all	all
106b	Number Present	3-4 per	2-3 per
107	Heel Scales Present	present	present
108	Presence of Copulatory Organs	absent	absent
109a	Terminal Spur Present	present	present
109b	Spur in Both Sexes	present	present
110	Tail Papillae	sparse	sparse
111	Eye Color	dark yellow sclera with darker brown barring; dark brown iris	dark yellow sclera with darker brown barring; dark brown iris

112	Lateral Face Pattern	bright yellow with dark brown to black webbing	pale to peachy yellow with dark brown to black webbing/ mottling
113a	Maxillary Pattern	yellow with short dorso-ventral black marks	pale to peachy yellow with minor dorso-ventral black marks
113b	Mandible Pattern	yellow with short lateral black marks, sometimes coalescing into webs	pale to peachy yellow with minor dorso-ventral black marks
114	Nasal Scale Bulge	minimal	minimal
115a	Male Beak	moderate	moderate
115b	Female Beak	minimal	minimal
116	Orbital-Rostral Width	shorter	longer
117	Orbital depth Beak	subequal	subequal
118	Orbital Width Maxillary	longer	longer
119	Maxillary Terminus	posterior	posterior
120a	Mandible Terminus, Dorsal	equal	equal
120b	Mandible Terminus, Ventral	slightly anterior	slightly anterior
121	Nasal Scale Shape	laterally compressed bell shape with minor posterior emargination	laterally compressed bell shape with strong posterior emargination
122	Nasal Scale Terminus Shape	thick truncated	thick truncated
123	Terminus Width vs preorbital	1.54	1.80
124	Lateral Nasal Scale Terminus	posterior	posterior
125a	Midline Nasal Scale Terminus	#DIV/0!	NA
125b	Nasal Scale Emargination	9.68	3.05
125c	Nasal Scale Anterior	1.30	1.88
125d	Midline Nasal vs Nasal Width	0.85	0.61
126	Nasal Scale Pattern	dark yellow with black webbing	brown-yellow with short lateral black marks, heavily muted
127	Posterior Head Pattern	dark brown to dark gray brown with yellow webbing or blotching	dark brown to dark graybrown with muted yellow webbing or blotching
128a	Head Length vs Head Width	1.15	0.95
128b	Head Width vs Anterior Scutes	0.96	1.05
128c	Head Length vs Head Depth	1.61	1.26
128d	Head Width vs Head Depth	1.40	1.33
129a	Carapace Length vs Head Length	4.21	5.04
129b	Carapace Length vs Head Width	4.84	4.78
129c	Carapace Length vs Head Depth	6.79	6.34
130a	Carapace Width vs Head Length	2.52	3.01
130b	Carapace Width vs Head Width	2.89	3.01
130c	Carapace Width vs Head Depth	4.06	3.99
131a	Plastron Length vs Head Length	3.94	4.90
131b	Plastron Length vs Head Width	4.54	4.65
131c	Plastron Length vs Head Depth	6.36	6.17
132a	Plastron Width vs Head Length	2.22	2.72
132b	Plastron Width vs Head Width	2.55	2.58
132c	Plastron Width vs Head Depth	3.58	3.42
133	Color Carapace	fawn brown to dark orangish brown	fawn brown to dark orangish brown
134a	Color Plastron	orangish-yellow with dark sulci	orangish-yellow with dark sulci
134b	Pattern Plastron	dark brown radiations along anterior margins	minimal dark brown radiations along anterior and posterior margins
134c	Color Ventral Marginals	yellow with darker brown muting	yellow with minimal to moderate darker brown muting
134d	Color Axillary Scute	dark brown	dark brown
134e	Color Inguinal Scute	yellow with dark brown margins	yellowish-brown with moderate dark brown margins
135a	Throat Color	light brown with dark spotting	pale gray to yellowish-gray with minor dark spotting
135b	Dorsal Neck Color	dark brown to gray brown	dark brown to gray brown
135c	Ventral Neck Color	lighter brown with darker spotting	lighter yellowish-gray withmoderate darker spotting
136a	Dorsal Forelimb Color	dark brown to gray brown	dark brown to gray brown
136b	Ventral Forelimb Color	pale brown to pale gray-brown	pale brown to pale gray-brown
136c	Dorsal Hindlimb Color	dark brown to gray brown	dark brown to gray brown
136d	Ventral Hindlimb Color	pale brown to pale gray-brown	pale brown to pale gray-brown
137a	Dorsal Tail Color	dark brown to gray brown	dark brown to gray brown
137b	Ventral Tail Color	pale brown to pale gray-brown	pale brown to pale gray-brown
138a	Head length vs interorbital	3.10	2.88
138b	Head width vs interorbital	2.69	3.04
138c	Head depth vs interorbital	1.92	2.29
139	Autapomorphy/ Unique Character	thick black premaxillary and symphyseal stripes present	minor to absent black premaxillary and symphyseal stripes present.
140	Chin & Throat Barbels	1-2 pairs chin barbels; small	1-2 pairs chin barbels; small

Appendix B

Referred specimen of *Kinosternon integrum* sensu lato

Figure 20. Image-vouchered specimen UAZ 56547-PSV referred to *Kinosternon integrum* by Enderson *et al.* (2007) from the west slope of the Sierra El Chinito, approximately 27km (airline) east of Baviácora, Municipio de Baviácora, Sonora, Mexico at 1400m elevation, seen on September 4, 2004. See text for additional comments. Courtesy of The University of Arizona.

Appendix C

Bogert, C.M. & Oliver, J.A. 1945. A preliminary analysis of the herpetofauna of Sonora. Bulletin of the American Museum of Natural History 83 (6): 297-426.

TESTUDINATA

KINOSTERNIDAE

Kinosternon integrum Le Conte

Kinosternum integrum Le Conte, 1854, Proc. Acad. Nat. Sci. Philadelphia, p. 183; "Mexico."
Alamos, 8 (A.M.N.H. Nos. 64161–64168).
Guirocoba, 4 (A.M.N.H. Nos. 63755–63758).

Dr. Norman Hartweg, who has long been engaged in studies of the genus *Kinosternon*, generously examined the specimens listed above. He reports them to be referable to the species *integrum* which has hitherto been reported from no farther north than central Sinaloa.

The series taken at Alamos comprises specimens of various ages, including a juvenile. The largest specimen in the series is A.M.N.H. No. 64161 which has been skeletonized. Dimensions of the carapace are as follows: length 164 mm., width 112 mm., depth 63 mm., greatest diameter of skull 63 mm.

With the addition of *integrum* to the fauna of Sonora, no fewer than three species of the genus appear to be represented in that state, *sonoriensis* in the north, *K. flavescens stejnegeri* (Hartweg, 1938) in the central part of the state, and *integrum* in the Río Fuerte drainage. It may be anticipated that *integrum* will also be found to inhabit the Río Mayo river system, especially because the Alamos specimens were taken near the divide between the two drainages.

Hilton records that this species was far the commonest turtle at Guirocoba, and a similar abundance characterized the species in the Alamos region. Natives brought them in from a variety of sources, principally from old wells and pools along the edges of the arroyo.

EMYDIDAE

Pseudemys scripta hiltoni Carr

Pseudemys scripta hiltoni Carr, 1942, Amer. Mus. Novitates, no. 1181, pp. 1–4, figs. 1–3; Guirocoba, Sonora, Mexico.
Guirocoba, 4 (A.M.N.H. Nos. 63747–63750).

These specimens were referred to Dr. A. F. Carr, Jr., whose studies of the genus *Pseudemys* have contributed so much to our knowledge of these turtles. His description and discussion of the specimens leave little need for comment, although for the purposes of this paper it may be added that the genus has hitherto been known from the mainland in Sinaloa, and from the cape region of Baja California. These specimens represent the first Sonoran record. A male in the series, A.M.N.H. No. 63750, has been transferred to the Museum of Comparative Zoölogy.

At Guirocoba, for an inexplicable reason, these turtles are known as "tortuga Juan" according to John W. Hilton. We failed to secure the species at Alamos, perhaps because of the somewhat smaller stream and the consequent absence of larger pools of running water.

Geoemyda pulcherrima pulcherrima (Gray)

Emys pulcherrima Gray, 1855, Catalogue of shield reptiles in . . . the British Museum (Natural History), pt. 1, Testudinata, p. 25, figs. 1–2; Mexico; Günther, 1885, Biologia Centrali-Americana, Reptilia and Batrachia, p. 6, pls. 7–8.
Geoemyda pulcherrima pulcherrima Wettstein, 1934, Sitzber. Akad. Wiss. Wien, Math.-naturwiss. Kl., div. 1, vol. 143, p. 18.
Guirocoba, 6 (A.M.N.H. Nos. 63759–63761, 64520a, 64520b, 64520c).

Six specimens of this handsome turtle were secured by Hilton who states that the species is known as "tortuga colorado," doubtless having reference to the coral red markings on the head. A.M.N.H. Nos. 63759–63761 are preserved, and A.M.N.H. No. 64520 has been skeletonized; two specimens were exhibited alive in the Philadelphia Zoological Garden. The specimens agree in all details with the excellent colored plates in Günther's work (*supra cit.*). They constitute the first Sonoran record for the species which appears to occupy an extensive range on the west coast of Mexico.

These turtles while still alive were shipped to New York City where they were maintained for a period of several months. They fed readily when offered lettuce, and when given a choice of land or water they remained on land most of the time, despite the fact that they were capable swimmers. Two eggs were laid by one of the specimens on December 25. One was destroyed before it was discovered, but the other measured 37 mm. by 21 mm., and it had a leathery shell. In Colima the junior author noted that this

Figure 21. Pertinent profile of *Kinosternon integrum* (sensu lato) from Sonora, Mexico reprinted from Bogert & Oliver (1945). Imaged from *archive.org*.