



KINOSTERNON INTEGRUM (TESTUDINES: KINOSTERNIDAE): NEOTYPE DESIGNATION, MORPHOLOGY AND DISTRIBUTION.

MEHDI JOSEPH-OUNI¹, PAUL VANDER SCHOUW², JAY FREWER³, DENNIS UHRIG⁴ & WILLIAM P. MCCORD⁵

¹ South Glastonbury, CT 06073 USA (elseyman@netscape.net) [corresponding author](#) ² Tampa Bay, FL 34221 USA

³ Lakeland, FL 33810 USA ⁴ Kissimmee, FL 34744 USA ⁵ Hopewell Junction, NY 12533 USA

ABSTRACT. – The widespread but endemic mud turtle species *Kinosternon integrum* Le Conte, 1854 currently ranges throughout most of Mexico, from southern Sonora in the northwest to and through western, central and southern Mexico at least to eastern Oaxaca. Broad and convincing evidence indicates that *Kinosternon integrum* actually represents a taxonomically complicated species complex; however, as the holotype has allegedly been lost for more than a sesquicentennial and the specimen's original collection locality data is lacking, a comprehensive systematic revision of the original concept of the species is required before convincing taxonomic subdivision of the complex can proceed. In this contribution we designate a neotype specimen, drawing from the species junior subjective synonym *Cinosternon rostellum* Bocourt, 1876 and subsequent junior objective synonym *Cinosternon guanajuatense* Dugès, 1888. We review nomenclatural history and application, argue for the ambit of locality data of the lost holotype collected during the Mexican-American War (1846-1848) and provide a sensu-stricto morphological redescription of *K. integrum* based on the museum accessioned and living specimens documented throughout the range. Even though this study now confines its distribution to the majority of states within central Mexico, *K. integrum* retains its honorific of the most vagile and widely distributed mud turtle in the country.

Keywords: Testudines; Kinosternidae; neotype designation, Mexico; *Kinosternon integrum*; *Cinosternon rostellum*; *Cinosternon guanajuatense*.

JOSEPH-OUNI, M., VANDER SCHOUW, P., FREWER, J., UHRIG, D. & MCCORD, W.P. 2025. *Kinosternon integrum* (Testudines: Kinosternidae): neotype designation, morphology and distribution. *Chelonological Contributions* 6: 43 pp. <http://doi.org/ChelContribfjds4937440264>

Published May 22, 2025
Special Series Editor: Anthony Pierlioni
©Joseph-Ouni *et al.* 2025

The Official Science Journal of

theturtleroom.org

OPEN ACCESS - CC BY-NC-SA 4.0
Chelonological Contributions ISSN: 3065-3290
DOI: 10.70661/ChelContribfjds4937440264

Figure 1.
An inquisitive female
Guanajuato Mud Turtle
Kinosternon integrum sensu stricto
emerges its head.



INTRODUCTION

The freshwater turtle species *Kinosternon integrum* Le Conte, 1854, variably known by the vernacular Jalisco Mud Turtle or Guanajuato Mud Turtle (Iverson *et al.* 1998), is currently recognized as the most widespread kinosternid in Mexico, being endemic despite its broad distribution. It ranges from southern Sonora south throughout Mexico to Jalisco in the west, Oaxaca in the south and Puebla in the central-east (TTWG 2021) but is not known to reach the eastern drainages on the Gulf, the Yucatan Peninsula nor the southeastern regions like Chiapas. It extends northeastward to at least extreme southern Nuevo Leon and has now been verified for Veracruz (de la Torre-Loranca *et al.*, 2020). The species' ceiling in the northwestern regions in Mexico seems to occur at the end of the Tropical Thorn Scrub vegetational community, a geographically delimiting factor that affects the ranges of many predominantly tropical vertebrate species (Stuart, 1964; Berry, 1978). Iverson (1981) considered that *K. integrum*'s success in the colonization of nearly all habitable environments stemmed from its broad vagility, being able to migrate within and from even the most temporary waterways, and its potential ability to aestivate. Estivation provides a key factor in that during unfavorable ecological conditions the vagrant species can simply pause in its travel, resuming expansion from the current new site when conditions become propitious again.

Kinosternon integrum was first described as *Kinosternum integrum* by Le Conte (1854) from "Mexico", who provided, amongst others, the following definitional characters:

head and neck brown spotted with yellow; upper jaw slightly hooked; forelegs with two folds on upper side (assumedly the dorsal foreleg scales, our comment); tail very short, unarmed; shell brown, regularly oval, very convex and elevated, without any carina; vertebral plates imbricate; sternum yellow, varied with dark brown, with numerous diverging striae on the hinder plates; bivalved, entirely closing the box (hinges close ventral opening of the shell entirely, our comment), axillary scutum long and narrow, joining by a point to the inguinal, which is likewise very long but much wider.

The specimen's shell measurements were given in inches by Le Conte (1854), as carapace length 4.6 inches, carapace width as 3.0 inches and the shell height (depth) as 1.7 inches.

Multiple lines of evidence indicate that the taxon *K. integrum* as conceived today actually represents a robust species complex (Smith & Smith, 1979; Sustaita Rodríguez (2012); Andrade Gómez (2023); however, the holotype specimen was never afforded a catalog number in the Academy of Natural Sciences, Philadelphia and it has apparently been lost for more than a sesquicentennial (Iverson *et al.*, 1998). No specific locality data for the collection of the specimen was documented. Researchers have been unable to confidently track detailed information for the specimen, probably because it never was recorded, as high specificity in the early 19th century was often omitted outside of that of large geographical entities such as country, states, cities and islands (Smith & Smith, 1979). No subsequent authors or researchers have noted any direct inspection of it, with all deliberate searches for the specimen being futile (*pers. comm.* Iverson). The morphological characters provided by Le Conte (1854), while useful, are now known to be absent of any exclusive diagnostic value that would unambiguously anchor his *K. integrum* to a strict specific population in Mexico. Therefore, a comprehensive morpho-nomenclatural resolution is required before enabling a *sensu stricto* morphological redescription and hence enaction of a convincing taxonomic subdivision of the complex.

Despite these obstacles, the original collector of the holotype, W. H. Pease, is fortunately known, though not well, but the circumstances and travel for his only visit to Mexico can be confidently documented. A re-tracement of his activities opens an opportunity to narrow the origin of *Kinosternon integrum*'s holotype.

ORIGINAL COLLECTION

William Harper Pease was born in Brooklyn, New York in January, 1824, though nothing is known about his parents or his childhood (Kay, 1975). While a member of the Lyceum of Natural History of New York in 1846, notice had been circulating through society that the Department of War was preparing both naval and military intervention against the fortress city of Vera Cruz, Mexico, then a strategic seaport on the Gulf of Mexico. The purview of his interests here remains clouded; whether Pease thought the circumstances fortuitous for the collection of natural history specimens from this poorly explored region of North America, or if he was deliberately approached by the Academy of Natural Sciences with which he was also a correspondent (Cassin, 1848-1849), is inapparent. Regardless, Pease was soon supported in his attachment to the military expedition and facilitated through the United States Army where he was placed under the boundaries of General Winfield Scott's campaign in early 1847.

With the Mexican-American War entering its 2nd year, the US Army conquered Vera Cruz City in March of 1847, subsequently marching on to Jalapa,

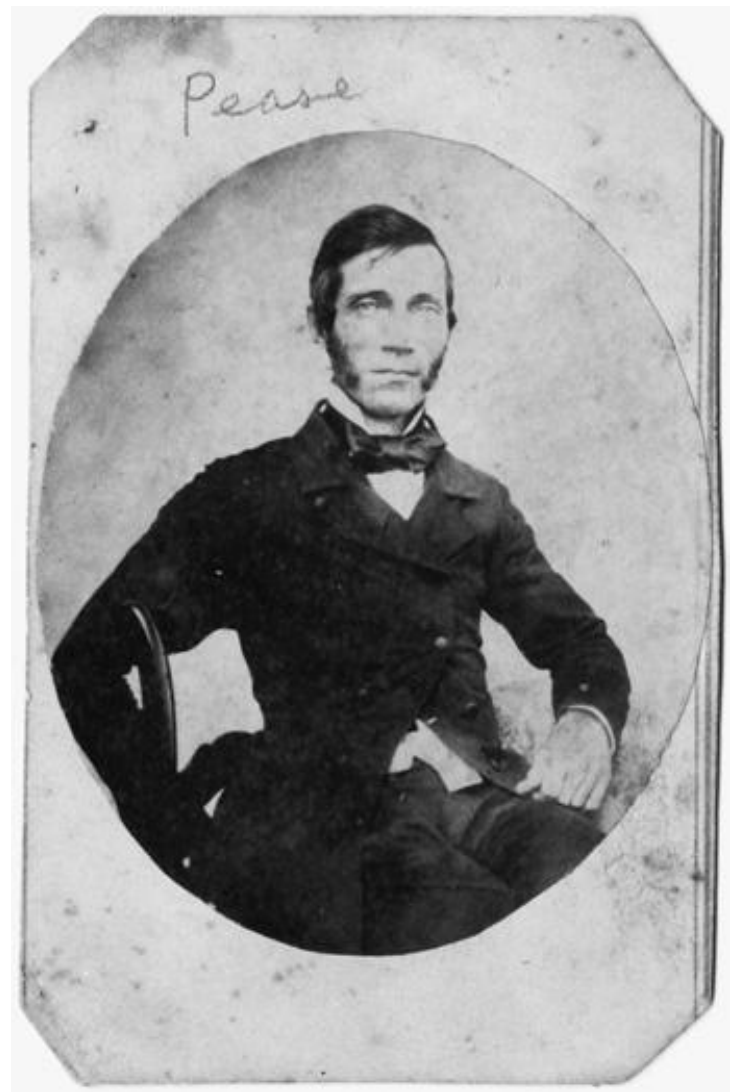


Figure 2. Reproduction of the first of the only two known images of William Harper Pease, an albumen silver print *carte-de-visite* from around 1860; card measures 5.8 × 9.0 cm, photographer unknown. Bishop Museum Archives, Honolulu. Album 1974.295.11, p. 4, People Pe-Pf, Image ID SP-216325. All information from Pietsch (2021). Reproduced from Wikipedia; image credit by Anonymous - doi:10.3366/anh.2021.0695, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=105478370>

Vera Cruz westward into Puebla and the Valley of Mexico (Smith, 1919). Mexico City fell in September, 1847, though Pease and his zoological specimens remained in Mexico for many months after. Pease relocated to Honolulu, Oahu, Hawaii in December, 1849, where he emerged as a renowned conchologist and malacologist, assembling both unique literature and spectacular specimen collections, prolifically describing hundreds of novel species of mollusks and shells (Greene, 1960; Clench, 1975). Until 2021, no image of Pease was thought to have existed, but two were serendipitously discovered in an album of Hawaiian personalities in the Bernice Pauahi Bishop Museum (Pietsch, 2021 – both of them being albumen silver print *carte-de-visite*, reproduced here in Figures 2 and 3 of this current study). He contracted a bronchial respiratory illness and passed away on June 29, 1871 in Honolulu (Kay, 1975), at only the age of 47.

For Pease's zoological collecting in Mexico, manavelins of travel data usefully circumscribe the orbit of his potential collection sites. A portion of the natural history spoils, the Mexican birds secured by Pease, were examined and catalogued by Cassin (1848-1849) and the locality data accompanying them reaffirming portions of Pease's path such as 'Jalafa' (=Jalapa, Veracruz). Pease himself in a later miscellaneous contribution in 1848 on the geology and natural

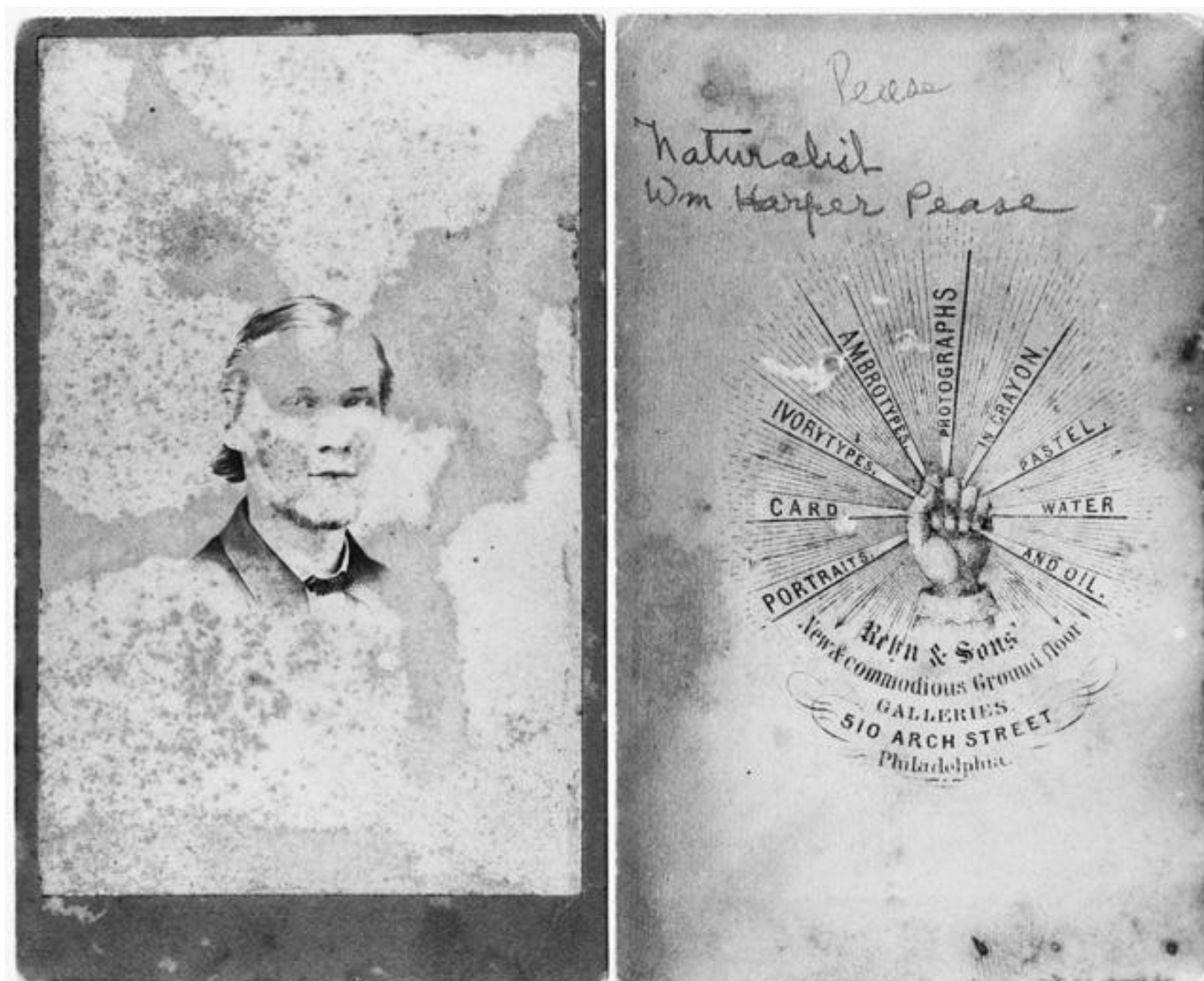


Figure 3. Reproduction of the front and back of the second of the only two known images of William Harper Pease, an albumen silver print *carte-de-visite* from the late 1860's; the right side of the image represents the back of the card with advertising backmark of the firm of Isaac A. Rehn & Sons, Philadelphia. Card measures 6.3×10.4 cm, Bishop Museum Archives, Honolulu, People Pe-Pf, Image ID SP-216326. All information from Pietsch (2021).

Reproduced from/ image credit: <https://picryl.com/media/william-harper-pease-carte-de-visite-anon-isaac-a-rehn-and-sons-a9e833>. Public domain. doi:10.3366/anh.2021.0695

history of Mexico provides retrospective details of his movements with the US Army, which entirely lay along the official military movements in eastern Mexico (Figure 4). Due to the ferocity of combat, Pease regrets the lack of opportunity for the collection of wildlife specimens, noting that he was afforded the ability to survey a region “bounding the plains of Perote and Puebla on the east, and the Gulf of Mexico, comprising the greater part of the State of Vera Cruz” and only under the protection of scouts at that. Pease records mammals such as fox, wolf, puma and deer, a nine-foot ‘iguano’, an ‘alligator’ in the San Juan and Antiqua rivers (=presumably *Crocodylus moreletii*) and marvels at a bizarre lizard walking erect across waters (=presumably *Basiliscus plumifrons*), “which has not been noticed before to my knowledge”. No mention of turtles is included in the report.

The most instructive knowledge of Pease’s exploration may therefore lie along the strict route of the army, which carries him from Vera Cruz City through the states of Vera Cruz and Puebla and into the Valley of Mexico for the siege of Mexico City (Smith, 1919, schematically represented in Figure 5). How long Pease was himself present for that penultimate chapter of the war in the Valley is unknowable; as late as February, 1848 he is still stranded in Mexico, lamenting in a letter to his colleague Dr. T.B. Wilson of the ANSP that his “quarters changed to this city [*Jalafal*” = Jalapa, Veracruz] in December...we are settled down...to remain I think until the close of the War” (Kay, 1975). He was evidently unaware that *the War* had already just closed.

Hence the evidence for the ambit of the holotype’s original collection can at least be confined to the Valley of Mexico and its eastern and southeastern vicinities; *Kinosternon integrum* has not been recorded in any other region along the Pease collection sites outside of those (however see de la Torre-Loranca *et al.*, 2020 and Joseph-Ouni & Vander Schouw, 2025 for Veracruz localities of *K. integrum*). A purchase, however, through a village market place, thereby severing the tie between field locality and Pease, cannot be ruled out.

Figure 4. Geographical representation of U.S. Army campaign path from Veracruz fort to the Valley of Mexico, including additional sites mentioned by Pease (1848; 1849) and Smith (1919).

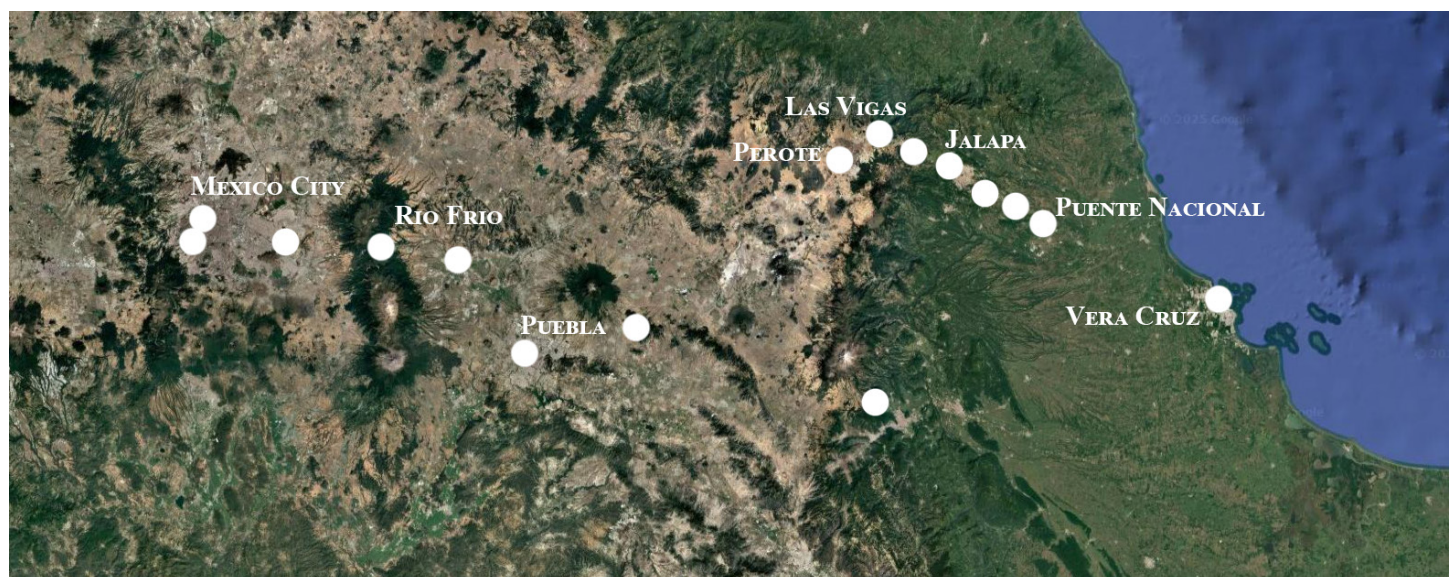
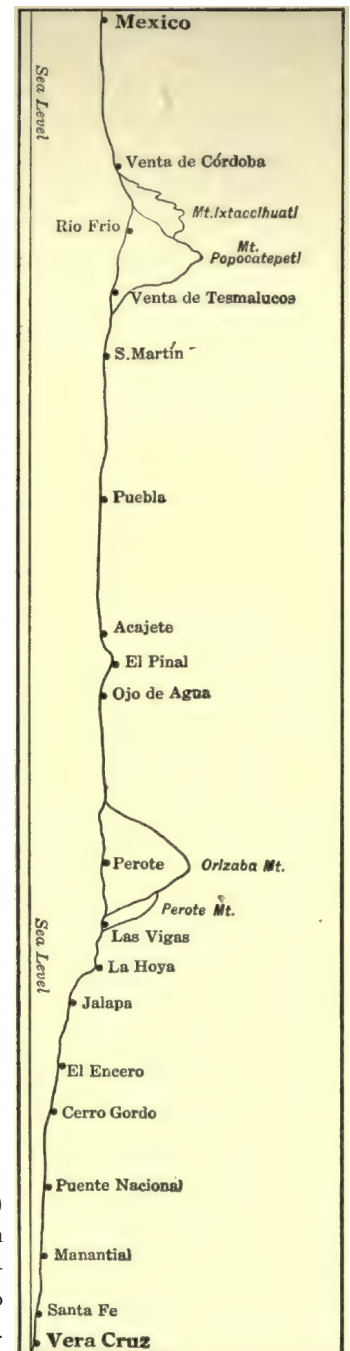


Figure 5. Schematic map (right) of U.S. Army campaign path from Veracruz fort to the Valley of Mexico (read bottom to top). Reproduced from Smith (1919).



EARLY TAXONOMIC HISTORY

More than twenty years were to pass after Le Conte's original description of *Kinosternon integrum* before the species conception received substantial attention. Based on a mud turtle specimen from the Mexican state of Guanajuato, Bocourt (1876) described a new species *Cinosternon rostellum*, erected on museum specimen MNHN 2112 (Figures 8a, 8b), a young adult female (*Cinosternon* being an amended spelling of the genus in the late 1800s). In contrast to specimens in the museum that Bocourt had assigned, at least in concept, to true *C. integrum*, he distinguished his new taxon with a number of characters, thereby retaining both *C. integrum* and *C. rostellum* as valid, distinct species. Those characters (see Appendix B for reproduction of the applicable portions of Bocourt (1876) along with our translation from the original French) are considered to fall under the variation of *K. integrum* now and *C. rostellum* landed in the synonymy of the former (also see Günther (1885) who doubted the distinctiveness of *C. rostellum* from *C. integrum*).

In his review of the reptiles of the Valley of Mexico, Alfredo Dugès (1888 - applicable portions of the publication reproduced here in Appendix C, along with our translation from the original Spanish) considered that the Mexican Valley mud turtles were all only varieties of *Cinosternon pennsylvanicum* (itself now a synonym of the Eastern Mud Turtle *Kinosternon subrubrum* - our comment) thereby questioning the validity of prior names, including Bocourt's *C. rostellum*. It was Dugès himself who had years earlier donated the holotype specimen of *C. rostellum* to the MNHN and here he introduces yet another novel mud turtle species name, that of *C. guanajuatense*. It is unknown whether the injection of this nominal species was inadvertent, a deliberate attempt at the recognition of a distinct taxon or simply colloquially descriptive (Smith, 1969).

Clearly Dugès was aware of Bocourt's *Cinosternon rostellum* from more than a decade earlier, not only questioning the variation of its characters but patently stating that it was he who had referred the type specimen to Bocourt and that the specimen "belongs to the species *guanajuatense*" [our translation]. If Dugès was unaware that Bocourt would proceed to create a new species based on his donated specimen and he was now trying to rectify it with his own authored name is speculative, and for nomenclatural transmission now irrelevant; both nominal taxa are tied to the same holotype specimen (MNHN RA2112) rendering *C. guanajuatense* Dugès, 1888 an objective junior synonym of *C. rostellum* Bocourt, 1876.

In 1904 and 1906, Siebenrock favored the recognition of *C. integrum* as only a subspecies of the Central and South American taxon *Cinosternum scorpioides* (= *Kinosternon scorpioides*) and in 1907 he embedded yet an additional new name in *K. integrum*'s sinuous history, that of *Cinosternum scorpioides integrum* forma *mexicana*. The localities of this novel taxon were given as both "Acapulco und Mazatlan" [=in the Mexican states of Guerrero and Jalisco, respectively], paradoxically as a species can only have a single holotype-restrained type locality and none was offered here. No holotype is identified, and the specimens on which Siebenrock (1907) created his forma *mexicana* are lost. Iverson *et al.* (1998) note that possible syntypes are potentially housed in the Vienna Museum "(e.g., NMW 1697 from "Acapulco," collected by F. Steindachner in 1874; see Grillitsch *et al.* 1996:93), although no types were identified by Tiedemann *et al.* (1994: 12)."

For almost a hundred years the absence of the holotype of *Kinosternon integrum* and the ambiguity of its collection site went unaddressed. Subsequently, Smith & Taylor (1950) restricted the type locality to 'Acapulco', Guerrero, Mexico. This restriction was at the time, and remains, entirely clerical, in that the restriction was not based on the evaluation of a holotype (which was long lost by then) nor based on any other specimen or comparison of populations. None of the travel history of the collector Pease was apparently considered at that time; had it been, it would have been clear that Pease in his short time in Mexico had no direct contact with any other Mexican regions, especially those along the Pacific coast of Guerrero. Both Cassin (1848-1849) and Pease himself (Pease, 1848-1849) make substantive note that his collecting of natural history specimens were perforce severely inhibited by the war and he had to restrain himself entirely to the escort of American soldiers.



Figure 6. Variation in the head shape, coloration and patterns of male and female specimens in the *Kinosternon integrum* complex throughout Mexico.

Though the strict nomenclatural concept of *Kinosternon integrum* lies fretfully untethered to a physical specimen, the chelonological acceptance of the species as a zoological entity has long been settled in herpetological arenas – a wide-ranging, medium-sized, variably-colored, variably-shaped and variably-patterned species of mud turtle with a distribution centered throughout central Mexico and with tentacular populations along many coasts. Gratefully there is a simple solution to harmonize the two.

As first revisers of the *Kinosternon integrum* complex, we formally designate specimen MNHN RA2112, the holotype of *Cinosternon rostellum* Bocourt, 1876, as the neotype replacement for the lost holotype of *Kinosternum integrum* Le Conte, 1854, housed in the Musée National d'Histoire Naturelle in Paris, France. '*Cinosternon rostellum*' has long been considered a synonym of *K. integrum* but carries more specific locality data, having been collected by Alfredo Dugès himself from Guanajuato, Mexico at a date in the early 1870s. This specimen, its locality and the known museum and living mud turtle specimens from the region also conform to the most parsimonious interpretation of the concept of *K. integrum* as conceived by Le Conte (1854) and interwoven with the travel data of its holotype's collector, W. H. Pease.

METHODOLOGY

See Joseph Ouni *et al.* (2025) for a full description of the *Kinosternon* diversity project and methodology used, including nomenclature, specimen pools and description and illustration of the suite of 246 morphological character states used in these continuous series of contributions (a table of these characters for male and female *K. integrum* sensu stricto is presented in Appendix A of this current study).

A full monograph comparing this species to all other taxa in the *K. integrum* complex as well as other *Kinosternon* species will be presented as a standalone production. Though not technically considered a distinct taxonomic species 'group' (traditionally subsumed under the formality of a '*K. scorioides* species group', see Hurtado-Gómez *et al.* (2024), we treat *K. integrum* as a distinct species *complex* and use that term extensively and accordingly.

The distribution map of *K. integrum* sensu stricto was based on TTWG (2021) and additional data provided by John B. Iverson (pers. comm.). The online resource *inaturalist.com* was used to compare live field specimens and localities to museum specimens and collection data and to the data in Iverson *et al.* (1998) and TTWG (2021), as well as to investigate localities not represented by accessioned specimens.

Neotype designations are governed by the International Code of Zoological Nomenclature (ICZN) under code Article 75: neotypes (<https://code.iczn.org/types-in-the-species-group/article-75-neotypes/?frame=1>.) All applicable provisions of the article were consulted and confirmed in this current contribution for the neotype designation of *Kinosternon integrum* Le Conte, 1854. Article 75 is reproduced in Appendix H (this current study).



Figure 7. Image of a live adult female Guanajuato Mud Turtle *K. integrum* sensu stricto. Image courtesy of E.J. Akaba.

SYSTEMATICS

Order: Testudines Batsch, 1788

Suborder: Cryptodira Cope, 1869

Family: Kinosternidae Agassiz, 1857

Genus: *Kinosternon* Spix, 1824

Subgenus: *Kinosternon* Spix, 1824

Guanajuato Mud Turtle

Kinosternon (Kinosternon) integrum Le Conte, 1854

Neotype nov. Figures 8a & 8b.



Figure 8a. Dorsal view of the head of the type of *Cinosternon rostellum* Bocourt, 1876, MNHN RA2112, showing the nasal scale (shape and outlined darkened for clarity). Base image courtesy of the Musée National d'Histoire Naturelle, Paris, France.

Neotype Designation: MNHN RA2112 (Figures 8a & 8b), by present designation, a young adult female collected by Dugès (specific date unrecorded but early 1870s) from “Guanajuato” (=Guanajuato, Mexico), as replacement for the lost holotype of *Kinosternon integrum* (ANSP, catalog number never assigned). It also serves as holotype of *Cinosternon rostellum* Bocourt, 1876 as objective junior synonym.

Description of Neotype: The neotype MNHN RA2112 (Figures 8a & 8b) is a young adult female, fluid preserved specimen, in overall good condition, dorsally missing the cervical scute, vertebral scutes 2, 3 and 4, all four right pleural scutes, marginal scute 8, and the entirety of the nasal scale; the full extent of the shape and reach of the nasal scale, however, is fully preserved by epidermal imprint (Figure 8a). Most of these missing scutes were present at one point (see Appendix G for older images) so these scutes may still be housed with the specimen. Accordingly, the central neural bones as well as the adjacent costal sutures are fully visible; these number only 4 fully formed, with a potential miniscule reduced 5th neural, which is seen frequently in central plateau specimens of *K. integrum* (MJO *pers. obs.*).

Ventrally, only the right anal scute is missing, all other scutes being present and intact, including the axillary and inguinal scutes on both sides. The skin is a washed out achromatic brownish white from time in preservation.

The shell is overall strongly depressed throughout its width and length. Approximate maximum width is 58mm occurring at the 5th-6th marginals, approximate maximum straight carapace length is 80mm and approximate maximum shell depth is 30mm occurring at V3. Length is 1.38x the depth.

In color the carapace is a dark tan to orange-brown, showing some darker areas and all scute sulci that remain present on the specimen are outlined in black. The former presence of the cervical scute is discernible and it is square in shape. The V1-P1 sulcus contacts the posterior point of M2 on the right and the M2-M3 sulcus on the left. V1 is longer than wide, with the V1-V2 sulcus being posteriorly bilobed. The outline of the nasal scale (which is missing) is discernible and the nasal scale was posteriorly furcated, with the lateral termini of the scale roundly truncated and reaching the posterior level of the orbits in dorsal view.

Both the maxillary and mandibular rhamphothecae are largely uniformly brown with darker areas along the tomial cutting surfaces. The maxillary extends beyond the level of the posterior orbit and is subequal to the level of the posterior mandible, in lateral head view.

In the plastron, the overall color is an orange-tan, being lighter than the carapace, and showing darker brown and black outlines along the anterior hinge and anterior hinge sulci, as well as the inter-femoroanal sulci. The gular scute is triangular, and shorter in length than the sum of the interhumeral and interpectoral sulci. The anal scute edge is roundly truncated, with slight anal scute notching. The axillary scute is narrow, stretching from contact at the underside of posterior marginal 4 to the anterior portion of the underside of marginal 6, thereby being longer than adjacent marginal 5. It narrows into a sharp apex



Figure 8b. Dorsal, right lateral and ventral views of the type of *Cinosternon rostellum* Bocourt, 1876, museum registration MNHN RA2112, a young adult female specimen collected by A. Dugès from Guanajuato, Mexico, designated herein the neotype of *Kinosternon integrum* sensu stricto. Images courtesy of the Musée National d'Histoire Naturelle, Paris, France.

and approaches but does not contact the anterior portion of the inguinal scute. The inguinal scute stretches from the midpoint of the underside of marginal 6, to the midpoint of marginal 8, thereby being longer than the sum of the straight lengths of marginals 6 and 7. At its widest point at the level of the exterior posterior lobe sulcus, the inguinal scute is 2-3x that of the width of adjacent marginal 7.

Enlarged scales are present on the heel of the hindlimbs and the tail is lightly papillated.

Species Diagnosis and Description: A medium-sized *Kinosternon* species that reaches to 180mm in males and 175mm in females (Figures 9 and 11), often showing sexual dichromatism, defined by the following combination of characters: an overall relatively depressed shell throughout its length and width; carapace truncated oval in shape, varies in color from medium-brown with darker areas to dark brown to dark orangish brown, with all carapacial scute sulci showing some degree of darker brown or black outline (Figure 9 and 11); nasal scale overall bellshaped, with a posterior furcation that is minimal to moderate (Figure 13), the lateral termini of the scale being broadly to roundly truncated and moderately extending past the posterior level of the orbits in dorsal view; nasal scale color and pattern range from dark brown to blackish brown with moderate show of yellow dots or squiggles in males, and more yellowish in base with darker markings in females; the V1-V2 sulcus is posteriorly bilobed and becomes relative straight in older specimens; dorsal head is dark brown to blackish brown in males with yellow to orangish pale vermiculations or spots; the side of the head is a paler brown with a series of interconnected dark brown to blackish brown webbings and short markings (Figure 11a) with dark black vertical barring on maxillary and dark brown to black laterally-oriented barring on the mandibular rhamphotheca (Figures 11a and 11e); V5 scute is broad with broadly curved lateral sulci (i.e. shared P4-V5 sulci) in males and females (Figure 11F), becoming straighter in old specimens; anterior plastral lobe length shorter than that of the posterior lobe; exterior edge of plastral lobe moderately to broadly rounded and plastron completely closes ventral opening of shell (Figure 10d); typical plastral scute



Figure 9. Four views of an adult female Guanajuato Mud Turtle *Kinosternon integrum* sensu stricto from Guanajuato, Mexico.

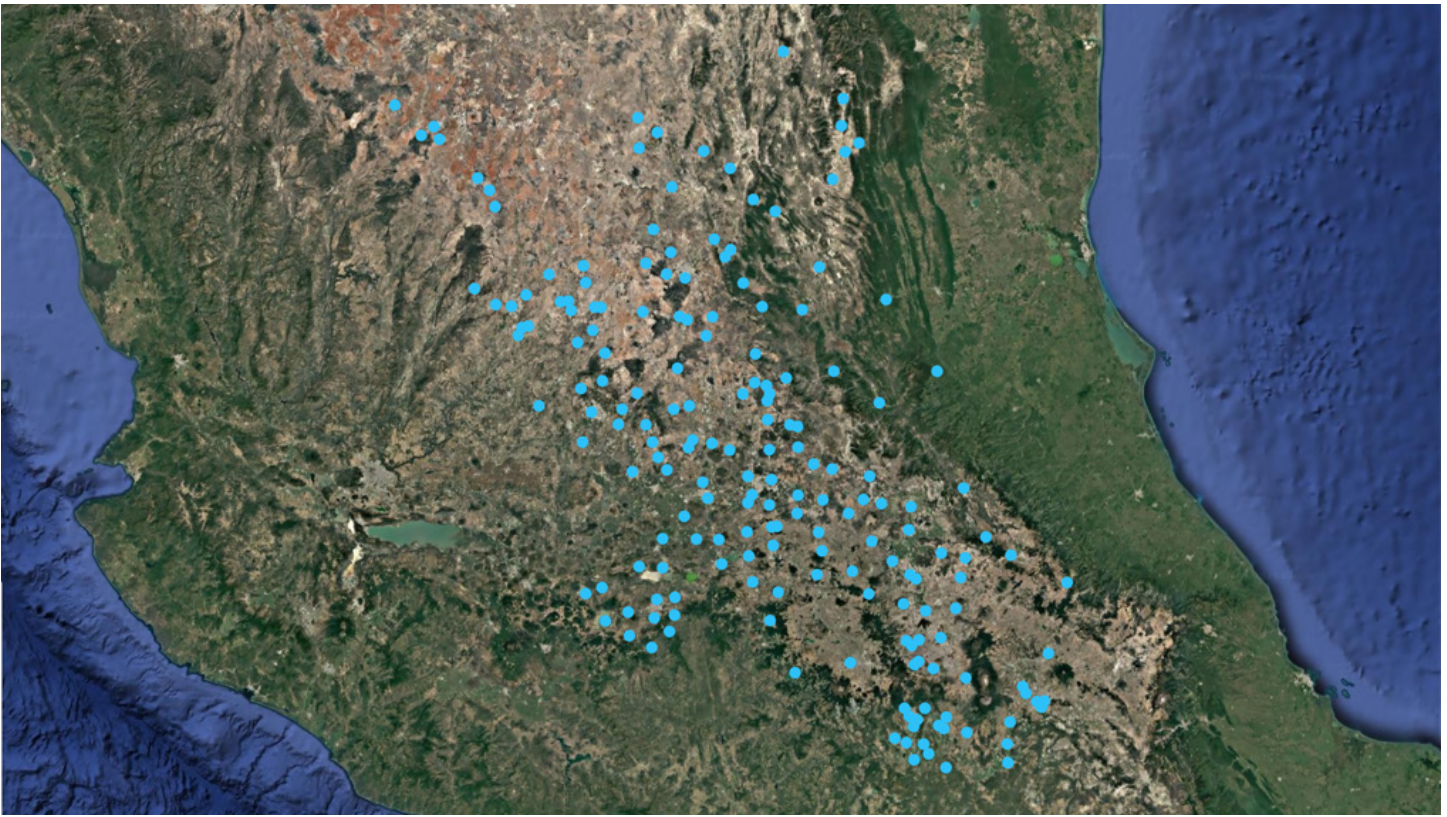


Figure 10. Distribution map of *Kinosternon integrum* sensu stricto throughout central Mexico which encapsulates the following states, from north to south in Mexico: Central Zacatecas east through San Luis Potosí to extreme southern Nuevo León and extreme southwestern Tamaulipas; south through Aguascalientes, northeastern Jalisco throughout Guanajuato, north-central Michoacán, Querétaro, Hidalgo, Mexico, Distrito Federal, Morelos, Tlaxcala and western Puebla. 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.

midline sulcus formula is $IPH > IAn > IGSL > IG > IF > IAH$ in both males and in females; the anal scute edge is roundly truncated, with slight to small anal scute notching.

The axillary scute is narrow, stretching from contact at the ventral side of posterior M4 to the middle portion of M5 or sometimes to anteriormost M6, thereby being longer than or equal to length of adjacent marginal 5 (Figure 11g). It narrows into a sharp apex and approaches but does not contact the anterior portion of the inguinal scute or contacts minimally. Inguinal scute stretches from the midpoint or posterior of the underside of marginal 6, to the anteriormost or midpoint of marginal 8, thereby being longer than the sum of the straight lengths of marginals 6 and 7 (Figure 11g). At its widest point at the level of the exterior posterior lobe sulcus, the inguinal scute is 2-3x that of the width of adjacent marginal 7 (Figure 11g). When present, the axillary scute is typically 3-4x the gap between the axillary and inguinal scutes in males and 2-3x in females.

The dorsal surface of the forelimb contains three relatively thin, elongated scales (the dorsal most and ventral most longer than the middle scale) and the phalanges all contain 2-3 enlarged scales (Figure 12). Enlarged staggered scales are present on the heel of the hindlimbs and the tail is lightly papillated (Figure 11h). Copulatory clasping organs absent in both sexes; horny spur present on tip of tail on both sexes (Figure 11i).

The full list of 246 numerical character states as delineated by Joseph-Ouni *et al.* (2025) that are observable in sensu stricto male and female specimens is tabulated in Appendix A.

Distribution: Based on direct museum and live specimens, we delimit the distribution of *Kinosternon integrum* sensu stricto as follows, from north to south in Mexico (Figure 10): Central Zacatecas east through San Luis Potosí to extreme southern Nuevo León and extreme southwestern Tamaulipas; south through Aguascalientes, northeastern Jalisco throughout Guanajuato, north-central Michoacán, Querétaro, Hi-



Figure 11. Panoply views of an adult male Guanajuato Mud Turtle *Kinosternon integrum* sensu stricto from Guanajuato, Mexico. See text for Letters.

dalgo, México, Distrito Federal, Morelos, Tlaxcala and western Puebla. It is highly likely additional localities will be aggregated as further field research progresses, as well as likely that genetics studies will uncover cryptic taxa or identify evolutionarily significant units (ESUs) or populations worthy of subspecific designation.

Etymology: The species epithet is an adjective derived from the Latin “*integra*” meaning ‘whole, complete’ and believed to refer to the ability of the taxon to close the entire ventral opening of the shell because of the full plastron (Iverson *et al.*, 1998).

Notes: Smith & Smith (1979: pg. 117) inadvertently give the date of description of *Cinosternon rostellum* Bocourt 1876 as 1868 (1868 being an earlier Bocourt work and predating the description of *C. rostellum*).

Bocourt (1876) also offered a description of the species concept of *K. integrum* based on adult specimens in the MNHN, to denote distinction between that taxon and his new ‘*Cinosternon rostellum*’. While it is clear from the description that Bocourt is describing adult specimens that are not referable to *Kinosternon birtipes* (‘absence of copulatory organs in the adult male’), it is unfortunate that the lack of locality and specimen data (being only recorded as ‘from Mexico’) precludes narrowing down the population he considered to be referable to the concept of Le Conte and Agassiz’ ideas of *K. integrum*. Bocourt is clearly not redescribing the specimen of Le Conte (1854) only his

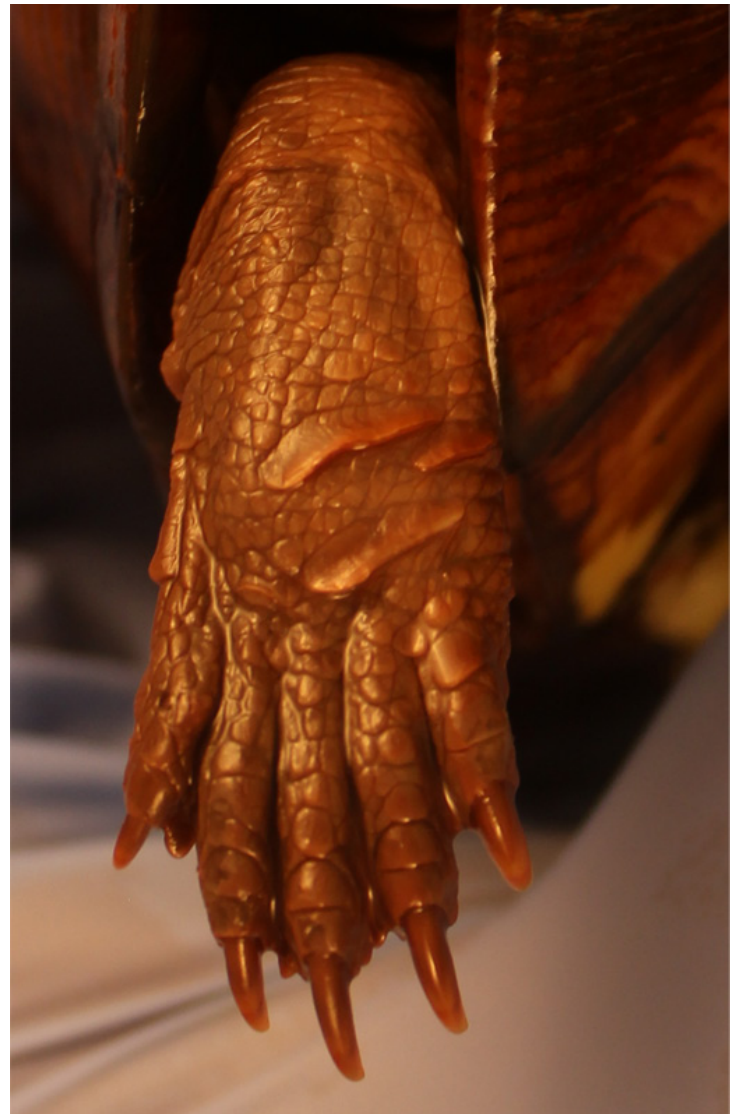


Figure 12. Right forelimb of an adult female *K. integrum* AMNH 117942 collected from Lago Xochimilco, southern Mexico City, Mexico showing the typical shape, size and arrangement of the dorsal forelimb and phalangeal sculation.



Figure 13. Dorsal view of the heads of preserved adult (AMNH R117948) and live adult *K. integrum* sensu stricto showing the typical variation on the shape, pattern and exposure of the nasal scale.



Figure 14. An adult female *K. integrum* AMNH 117942 collected from Lago Xochimilco, southern Mexico City, Mexico by James D. Anderson on August 9, 1967, showing signs of environmental or nutritional stress.

understanding of the taxon Le Conte conceived from specimens he is identifying as *K. integrum*.

Wermuth & Mertens (1977) reported the type locality of *C. guanajuatense* as “Valle de Mexico” which is clearly in error since, being a junior objective synonym of *C. rostellum*, it carries that species same locality of ‘Guanajuato’ (Smith & Smith, 1979).

The original descriptions of *Kinosternum integrum* Le Conte, 1854, *Cinosternon rostellum* Bocourt, 1876 and the pertinent contribution in which the name *Cinosternon guanajuatense* Dugès 1888 is introduced are all reproduced in the Appendices (B, C, D) of this current study, along with our translation of Bocourt (1876) and Dugès (1888) which were originally published in French and Spanish, respectively.

K. integrum sensu stricto overlaps and/or co-habitates numerous water bodies with *Kinosternon hirtipes* (Iverson, 1981) though clear hybrid specimens were undocumented Iverson (1981) and are unknown to the current authors (though specimens do show some clear characters of both species, *pers. obs.*).

Iverson (1981) considered that *K. integrum* was not native to the Valley of Mexico but was historically introduced or present through relatively recent range colonization, a point also made by Smith & Smith (1979), the latter considering market place escapees contributing to a possible source of introduction. While many factors such as habitat preference, interspecies competition or other ecological or physiogeographic impediments may have historically prevented *K. integrum* from population rooting, it is now established there (MJO *pers. obs.*). Images of specimens historically collected from Lago Xochimilco, southern Mexico City, Mexico are presented in Figures 13 and 14.

Mud turtle specimens referred to *K. integrum* have now been identified in Veracruz (de la Torre-Loranca *et al.*, 2020) from living specimens as well as from a historically collected specimen (Joseph-Ouni & Vander Schouw, *in prep.*); however we at least temporarily disclude those in the sensu stricto redefinition until further study.

Additional images of live adult female *K. integrum* sensu stricto are presented in Appendix E and images of museum specimens from Guanajuato, Queretaro, San Luis Potosi and Nuevo Leon are presented in Appendix F.

DISCUSSION & SUMMARY

The durative loss of the holotype of the mud turtle species *Kinosternon integrum* Le Conte, 1854 has hampered the studies of the variation of the species throughout its range from a taxonomic perspective, as multiple lines of evidence favor the interpretation of a complicated complex concealing potentially distinct additional taxa (Smith & Smith, 1979; Sustaita Rodríguez, 2012; Andrade Gómez, 2023). Further frustrating efforts is the lack of recorded locality outside of the broadly generic ‘Mexico’; the lacuna lies in that the type specimen, collected by W.H. Pease around 1847-1848 during the Mexican-American War, on which Le Conte



Figure 14. Dorsal and ventral views of a juvenile female *K. integrum* AMNH 117943 collected from Lago Xochimilco, southern Mexico City, Mexico by James D. Anderson on August 9, 1967.



Figure 15. Images of a live adult female Guanajauto Mud Turtle *K. integrum* sensu stricto. Images courtesy of E.J. Akaba.

(1854) authored the name, has little data surrounding it. It was clearly in Le Conte's care in the ANSP for his detailed inspection and characterization, but it was never afforded a catalog number, is bereft of any confirmation of any subsequent inspection by any researcher and has been ostensibly lost at least for a sesquicentennial now.

As such, in order to harmonize the loss of the holotype, our current understanding of the morphology and variation amongst the populations of *K. integrum*, the evidence of the travels of Pease and to refrain from the unnecessary proliferation of additional nomen, we elected as first revisers, the holotype of *Cinosternon rostellum* of Guanajuato, Mexico (museum registration MNH RA2112), a considered synonym of *K. integrum*, as the species' neotype to preserve stability.

While unsurprising that such a widely distributed species will inevitably accumulate synonyms in its nomenclatural history, it is surprising that *K. integrum*, with all its spectacular diversity amongst populations (Figure 6) has garnered so few in its more than 150 year scientific existence. The few that accumulated in the late 19th and early 20th century require address. Amongst these is the nominal taxon *Cinosternon rostellum* described by Bocourt (1876) based on the specimen from Guanajuato, Mexico. It has long been recognized as a junior subjective synonym of *K. integrum*; the question of the basis for such an action then arises, since to what specimen and/or known populations can confident comparative data be derived. The answer probably lies in the fact that Le Conte's characters are generally present across the enough of the populations of mud turtles, than many of these throughout the Central Mexican plateau and Valley of Mexico simply comfortable fit the application of the nomen *Kinosternon integrum*.

The holotype of *C. rostellum* was donated by Alfredo Dugès (Figure 16) and field collected by him in Guanajuato sometime in the early 1870s. Dugès was born Alfred Auguste Delsescautz Dugès in Montpellier, France on April 16, 1826. The son of renowned zoologist Louis Dugès, Alfredo emigrated in 1852 and emerged in Guanajuato in 1853 where he rose to prominence as a Mexican physician and where he would spend the remainder of his life until his passing on January 7, 1910 (Adler, 2014). He is justly remembered as the 'father of modern Mexican herpetology' as an accolade for his extensive studies of the Mexican reptilian and amphibian fauna (Figure 17); he founded the museum which later was renamed in his honor and that remains in existence to this day (Smith & Smith, 1969). It was in Dugès monograph of the herpetology of the Valley of Mexico (Dugès, 1888) where he introduced another name relevant to *K. integrum*, that of *Cinosternon guanajuatense*. As this name was made in definite reference to the type of Boucourt's (1876) *C. rostellum*, *C. guanajuatense* became an immediate objective synonym, being both based on the same type specimen.

Though *C. guanajuatense* has been referred to as a nomen nudum (TTWG 2021), Smith & Smith (1979) protested this moniker in that, being based on the holotype of *C. rostellum*, it was an available but occupied name; under Article 17(9) of the ICZN code, a name "is or remains available even though, before 1961, it was proposed as a 'variety' or 'form'. Dugès clearly met this criterion - he considered not only *C. guanajuatense* but also *C. rostellum* and *C. integrum* as only local varieties of a widespread *C. pennsylvanicum* (itself now a synonym of *Kinosternon subrubrum*) and relegated those to the synonymy thereof.

This same preservation of name availability potentially remains for the final synonym of *K. integrum* of any concern, that of that of *Cinosternum scorpioides integrum* forma *mexicana*, offered by Sieberock (1907) for a variety of mud turtle with localities dually given as "Acapulco und Mazatlan" [=in the Mexican states of Guerrero and Jalisco, respectively]. It was Smith & Taylor (1950) who would restrain the name *mexicana* to the choice of Mazatlan as type restriction for the populations of mud turtle there, though no justification was given. The type specimen was never identified by Sieberock and is now considered lost (Iverson *et al.* 1998). Under current ICZN code, quadrinomial names such as this one are invalid as 'infrasubspecific' entities; however, as described in 1907, such quadrinomials prior to 1961 are prevented from rejection solely on that ground, a point enunciated by Smith & Smith (1979). In this case however, despite the ICZN exception

for varieties, the point may be potentially muted in that nomen *mexicana* is possibly occupied by another of Le Conte's (1854) species, that of *Kinosternon mexicanum*, depending on modern interpretation of gender agreement between genus and species. This nomenclatural ambiguity is addressed in a forthcoming contribution covering the *Kinosternon integrum* complex (*sensu lato*) of western Mexico. A brief mention of the latter taxon however is warranted here.

Kinosternon mexicanum Le Conte (1854), a species in the *Kinosternon cruentatum* complex, was revalidated as a distinct species by Iverson & Berry (2024) following the genetic data of Hurtado-Gomez *et al.* (2024). Iverson & Berry (2024) concluded that the nomen *Kinosternon mexicanum* was to be the correct available name for the lineage of the *K. cruentatum* complex from the Pacific Versant of Mexico and Central America. Those authors, however, elected to maintain the type restriction by Smith & Taylor (1950) of San Mateo del Mar, Oaxaca, Mexico based on morphometric assessment, as *K. mexicanum* lacks locality data other than that of "Mexico", similar in situation to *K. integrum* but with a key difference - its holotype ANSP 90, an adult male, survived the centuries.

Intriguingly, this specimen was also collected by Pease during his sojourn with the US Army in Mexico in 1847-1848; Iverson & Berry (2024) did not expound on the contradiction between the known collecting sites of Pease which were con-

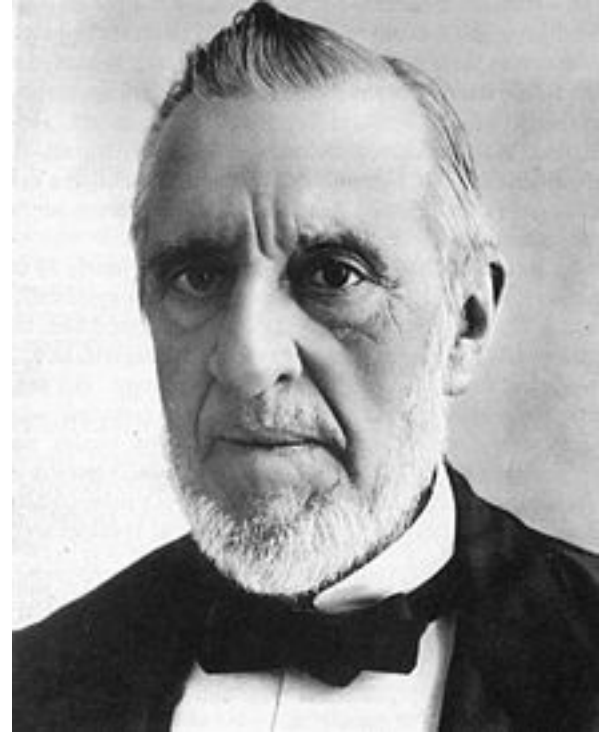


Figure 16.

Alfredo Dugès

(1826–1910).

Originally seen in

Martín del Campo (1937).

Public Domain, <https://commons.wikimedia.org/w/index.php?curid=116641>.

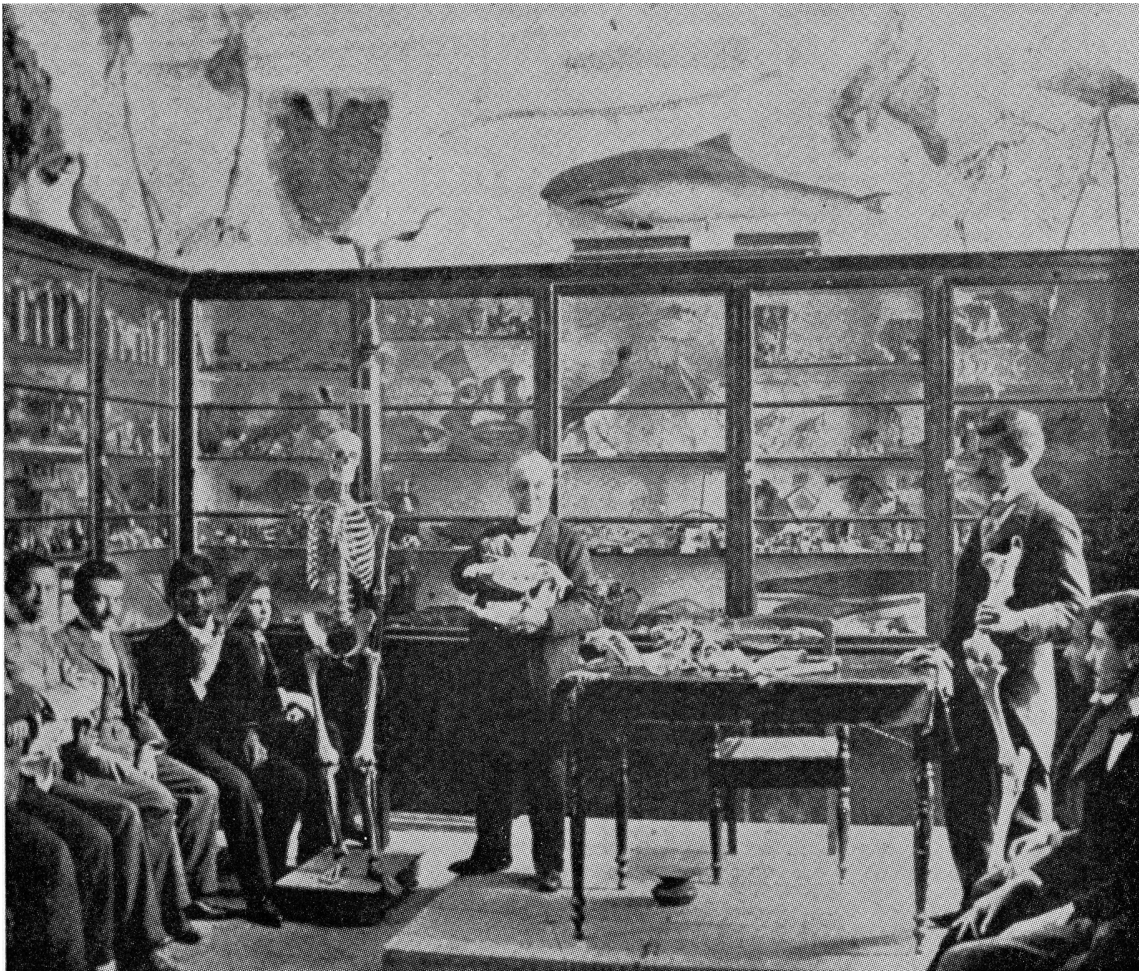


Figure 17.

Class lecture held by Alfredo Dugès (figure at center) in the museum at the University of Guanajuato.

Originally seen in Lanuza (1924). Public Domain.

fined to the Atlantic versant of Mexico and the morphological data of the *K. mexicanum* holotype which they placed the specimen with the Pacific versant populations pursuant to discriminant function analyses, other than to suggest it may have been purchased in a market. Joseph-Ouni (*in. prep.*) offers additional thoughts on this apparent paradox.

In an attempt to add nomenclatural stability, Smith & Taylor (1950) offered type restrictions for a litany of Mexican reptiles and amphibians that lacked type data, amongst these was *K. integrum*. Many of these type restrictions were perfunctory and unsubstantiable and would be proven erroneous or without justification, and such is the case for *K. integrum* which received the type restriction of ‘Acapulco’ in the Mexican state of Guerrero on the extreme southern coast. As discussed above, based on the preponderance of evidence, the most parsimonious interpretation of the travels of the collector Pease would narrow his opportunity for the specimen’s encounter to his travels in Veracruz, Puebla and the Valley of Mexico during the war.

The reasoning however for the type-restriction of *K. integrum* by Smith and Taylor seems to have a facile explanation resulting from that 1907 description by Siebenrock of forma *mexicana* from “Acapulco and Mazatlan”. It appears that Smith & Taylor (1950) in their type restriction proposal for *K. integrum* simply assigned one of Siebenrock’s localities (‘Mazatlan’) to forma ‘*mexicana*’ and the remaining one of ‘Acapulco’ for *K. integrum* without any further consideration.

As such it should be mentioned that Smith & Smith (1979) raised the infirmity of the Smith & Taylor (1950) type restriction of *K. integrum* to ‘Acapulco’ as follows: “Because of the wide range of this species and the possibility of ultimate recognition of geographic races, it would be of considerable interest to determine where Pease collected in Mexico, and thereby to assure restriction of the type-locality with the maximum degree of conformance with his itinerary and the geographic variation of the species.” It is this contingency regarding Pease that we have redressed in this contribution.

Lastly regarding the fallibility of type restrictions by Smith & Taylor (1950), it should be mentioned that Iverson & Berry (2024) invalidated the restriction of *Kinosternon cruentatum* through morphometric data which determined that the holotype of this taxon was from the Atlantic, not Pacific Versant, and in particular could be tied to the Yucatan Peninsula. *K. cruentatum*, based on a holotype (MNHN RA1759) lacks collection data; Smith & Taylor (1951) restricted the type locality to San Mateo del Mar, Oaxaca, Mexico which was to prove errant.

As raised by numerous authors, the labyrinth of lost and destroyed holotypes and syntypes, lack of locality data, confusion of morphological character states, and knotted strands of synonyms, nomina nuda and invalid names have formidably constrained morphological and taxonomic studies of the genus *Kinosternon* and its spectacular species diversity over the years (Joseph-Ouni *et al.*, 2025). The justifiable and parsimonious selection of the holotype of *Cinosternon rostellum* Bocourt, 1876 as the neotype for the lost holotype of *Kinosternum integrum* Le Conte, 1854 eases these challenges moving forward.

ACKNOWLEDGMENTS

The authors offer their appreciation and gratitude to David Kizirian, Lauren Vonnahme and David Dickey (Herpetology, Vertebrate Zoology, American Museum of Natural History); Stevie Kennedy-Gold and Joseph Martinez (Herpetology Department, Harvard Museum of Comparative Zoology) as well as the department’s curatorial assistants Matthew Gage and Tsuyoshi “Hashi” Takahasi and interns River Pfaff and Michael Maimone; Gregory Watkins-Colwell (Collection Manager in the Division of Vertebrate Zoology, Yale Peabody Museum); John B. Iverson (Earlham College); to the editor and reviewers Michael Lavoie and Jordan T. Donini for critical commentary and corrections that improved the manuscript.

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 (Smithsonian National Museum of Natural History); UAZ (University of Arizona); UF (University of Florida, Florida Natural History Museum); UMMZ (University of Michigan, Museum of Zoology); YPM (Yale Peabody Museum).

LITERATURE CITED

- Adler, K. 2014. Contributions to the History of Herpetology. Volume 1. Revised and Expanded Edition. 172pp. Ithaca, NY. SSAR.
- Andrade Gómez, C. 2023. Variación morfogeométrica del caparazón de la tortuga de fango mexicana *Kinosternon integrum* a lo largo de su distribución geográfica. Tesis. Facultad de Ciencias, Universidad Nacional Autónoma de México. Ciudad Universitaria, CD. MX. Unpub. 58pp.
- Berry, J.F. 1978. Variation and systematics in the *Kinosternon scorpioides* and *K. leucostomum* complexes (Reptilia: Testudines: Kinosternidae) of Mexico and Central America. Ph.D. dissertation. Univ. of Utah, Salt Lake City.
- Bocourt, M.-F. 1868. Descriptions de quelques chéloniens nouveaux appartenant a la faune Mexicaine. Annales des sciences naturelles. Zoologie (Ser. 5) 10 (Pts. 1-3), p. 121-122.
- Bocourt, M.-F. 1876. Note sur quelques reptiles de l'Isthme de Tehuantepec (Mexique) donne's par M. Sumichrast au Museum. J. Zool., Paris, 5(5/6): 386-411.
- Cassin, J. 1848-1849. Catalogue of birds collected by Mr. Wm. S. [sic] Pease, during the march of the Army of the United States from Vera Cruz to the City of Mexico. Proceedings of the Academy of Natural Sciences, Philadelphia 4: 87—90.
- Clench, W. J. 1975. A biobibliography of William Harper Pease, malacologist of Polynesia. Part 2. Catalogue of species and bibliography of William Harper Pease. Nemouria, Occasional Papers of the Delaware Museum of Natural History 16: 22–50.
- de la Torre-Loranca, M.A., R.G. Martínez-Fuentes, L. Canseco-Márquez, and U.O. García-Vázquez. 2020. New records of amphibians and reptiles from Sierra de Zongolica, Veracruz and Puebla, Mexico. Herpetological Review 51: 550–553.
- Dugès, A. A. D. 1888. Erpetologia del Valle de Mexico. La Naturaleza 2 (1) 97-146.
- Greene, K.W. 1960. William Harper Pease—100 years later. Hawaiian Shell News 8 (6): 1, 4–6; (7): 4–5; (8): 1, 3, 4, 8; (9): 5, 8; (10): 5, 8; (11): 5, 8; (12): 5, 6, 8.
- Günther, A.C.L.G. 1885. Reptilia and Batrachia. In: Godman, F.D. & Salvin, O. eds. Biologica Centrali-Americana, or, Contributions to the knowledge of the fauna and flora of Mexico and Central America. Porter, London. 326 pp. 76 plates.
- Hurtado-Gómez, J.P., Vargas-Ramírez, M., Iverson, J.B., Joyce, W.G., McCranie, J.R., Paetzold, C., & Fritz, U. 2024. Diversity and biogeography of South American mud turtles elucidated by multilocus DNA sequencing (Testudines: Kinosternidae). Molecular Phylogenetics and Evolution 197: 108083. 20pp. doi.org/10.1016/j.ympev.2024.108083.
- Iverson, J.B. 1981. Biosystematics of the *Kinosternon hirtipes* species group (Testudines: Kinosternidae) Tulane Studies in Zoology and Botany 23(1): 1-74.
- Iverson, J.B. & Berry, J.F., 2024. Morphometric variation in the Red-Cheeked Mud Turtle (*Kinosternon cruentatum*) and its taxonomic implications. Chelonian Conservation and Biology 23(1): 13–22 doi:10.2744/CCB-1589.1
- Iverson, J.B., Young, C.A. & Berry, J.F., 1998. *Kinosternon integrum*. Catalogue of American Amphibians and Reptiles 652: 6 pp.
- Joseph-Ouni, M. & Vander Schouw, P. 2025. Note on a historical specimen of '*Kinosternon integrum*' field collected from Jalapa, Veracruz, Mexico. *Chelonological Contributions* 9, CC Notae #3: 2 pp. <http://doi.org/ChelContribdp-wv9362284013> (*in. press*).
- Joseph-Ouni, M., Vander Schouw, P., Frewer, J., Mccord, W.P. & Uhrig, D. 2025. New faces, new names and old friends: an overview of the *Kinosternon* diversity project and illustrated guide to morphological characters. *Chelonological Contributions* 5: 59 pp. <http://doi.org/10.70661/ChelContriblmeo2003874021>
- Kay, E. A. 1975. A biobibliography of William Harper Pease, malacologist of Polynesia. Part I. A biography of William Harper Pease. Nemouria, Occasional Papers of the Delaware Museum of Natural History 16: 1–21.
- Le Conte, J. 1854. Description of four new species of *Kinosternum*. Proceedings of the Academy of Natural Sciences, Philadelphia 7: 180—190

- Lanuza, A. 1924. Historia del colegio del estado de Guanajuato. León Sánchez, México. 428 pp., 47 pls.
- Legler, J. M. & R. C. Vogt. 2013. The Turtles of Mexico: Land and Freshwater Forms. University of California Press. 402 pp. ISBN: 978-0-520-26860-9
- Martín del Campo (y Sánchez), R. 1937. Alfredo Augusto Delsescautz Dugès: ensayo biográfico. Anales del Instituto de Biología, 8 (3): 437-455, figs. 1-3.
- Pease, W.H. 1848-1849. Observations on the geology and natural history of Mexico. Proceedings of the Academy of Natural Sciences, Philadelphia 4: 91-94.
- Pease, W.H. 1849. Observations on the geology and natural history of Mexico. Annals and Magazine of Natural History Series 3(17): 427-431.
- Pietsch, T.W. 2021. Two unpublished photographic portraits of the American conchologist William Harper Pease (1824-1871). Archives of Natural History 48.1: 175-178.
- Siebenrock, F. 1904. Schildkroten von Brasilien. Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Wien 76: 1 - 28.
- Siebenrock, F. 1906. Schildkröten aus Sudmexiko. Zoologische Anzeiger 30: 94-102.
- Siebenrock, F. 1907. Die Schildkröten-Familie Cinosternidae. Sitzungsberichte der Akademie der Wissenschaften in Wien 116(1): 527-599.
- Smith, H.M. 1969. Two neglected Dugesian nominal taxa for Mexcian turtles and frogs. Journal of Herpetology 3 (1-2): 110-112.
- Smith, H.M. & Smith, R.B. 1969. Early Foundations of Mexican Herpetology. An annotated and indexed bibliography of the herpetological publications of Alfredo Dugès, 1826-1910. University of Illinois Press, Urbana, 85 pp.
- Smith, H.M. & Smith, R.B. 1979 (1980). Synopsis of the Herpetofauna of Mexico. Vol. VI. Guide to Mexican Turtles. Bibliographic Addendum III. John Johnson, North Bennington, Vermont, U.S.A. 1044pp.
- Smith, H.M. & Taylor, E.H. 1950. An annotated checklist and key to the reptiles of Mexico exclusive of the snakes. Bulletin of the Smithsonian Institution United States National Museum 199: 1-253.
- Smith, J.H. 1919. The War with Mexico. 2 volumes. The Macmillan Company, NY.
- Stuart, L.C. 1964. Fauna of Middle America. *in*: Wauchoppe, R. & West, R.C. eds. Handbook of Middle American Indians. 1: 316-362.
- Sustaita Rodríguez, V.H. 2012. Comparación morfológica y molecular de poblaciones de tortugas *Kinosternon* en la Cuenca del Río Balsas y Río Pánuco. Tesis. México, D.F. Posgrado en Ciencias Biológicas. 73pp.
- Turtle Taxonomy Working Group [Rhodin, A.G.J., Iverson, J.B., Bour, R., Fritz, U., Georges, A., Shaffer, H.B. & Van Dijk, P.P.]. 2021. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (9th Ed.). *In*: Rhodin, A.G.J., Iverson, J.B., van Dijk, P.P., Stanford, C.B., Goode, E.V., Buhlmann, K.A., and Mittermeier, R.A. (Eds.). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs 8:1-472. doi:10.3854/crm.8.checklist.atlas.v9.2021.
- Wermuth, H. & Mertens, R. 1977. Liste der rezenten amphibien und reptilien: Testudines, Crocodylia, Rhynchocephalia. Das Tierreich 100:1-174.

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 integrum*.

Character	Character Description	Adult Male <i>K. integrum</i>	Adult female <i>K. integrum</i>
1	Overall Carapace Shape	truncated oval	truncated oval
2a	Carapace Length vs Width	1.48	1.49
2b	Maximum width occurrence (marginal)	M6	middle M6
3a	Vertebral Length vs Width V1	0.77	0.80
3b	Vertebral Length vs Width V2	1.03	1.04
3c	Vertebral Length vs Width V3	0.92	1.10
3d	Vertebral Length vs Width V4	0.75	1.01
3e	Vertebral Length vs Width V5	0.65	0.91
4a	Carapace Length vs Depth	2.57	2.15
4b	Maximum depth occurrence (vertebral)	middle V2	middle V3
4c	Carapace Width vs Shell Depth	1.74	1.44
5a	Profile Posterior Lateral Shell	laterally compressed, dorsal depressed	laterally moderately compressed, dorsal depressed
5b	Lateral Marginal Curling	minor to moderate	minor to moderate
5c	Marginal Curling Count	7	5
5d	Initial Marginal Curling	M2	M4
5e	Final Marginal Curling	M8	M8
6	M10 Flaring	diagonal	moderately diagonal
7a	Carapace Length vs Posterior Length	3.02	2.82
7b	Carapace Length vs P3 Length	3.41	2.91
8	Anterior Arch of Carapace	depressed	rounded depressed
9	Posterior Arch of Carapace	rounded depressed	rounded depressed
10a	Vertebral Width vs Carapace Width V1	2.92	3.08
10b	Vertebral Width vs Carapace Width V2	3.11	3.10
10c	Vertebral Width vs Carapace Width V3	3.14	2.98
10d	Vertebral Width vs Carapace Width V4	2.97	3.13
10e	Vertebral Width vs Carapace Width V5	2.09	2.78
11a	Vertebral Width vs Carapace Length V1	4.32	4.59
11b	Vertebral Width vs Carapace Length V2	4.60	4.62
11c	Vertebral Width vs Carapace Length V3	4.64	4.44
11d	Vertebral Width vs Carapace Length V4	4.41	4.67
11e	Vertebral Width vs Carapace Length V5	3.10	4.14
12a	Vertebral Length vs Carapace Length V1	0.18	0.17
12b	Vertebral Length vs Carapace Length V2	0.22	0.22
12c	Vertebral Length vs Carapace Length V3	0.20	0.25
12d	Vertebral Length vs Carapace Length V4	0.17	0.22
12e	Vertebral Length vs Carapace Length V5	0.21	0.22
13a	Vertebral Length vs Carapace Width V1	0.23	0.22
13b	Vertebral Length vs Carapace Width V2	0.22	0.22
13c	Vertebral Length vs Carapace Width V3	0.22	0.23
13d	Vertebral Length vs Carapace Width V4	0.02	0.21
13e	Vertebral Length vs Carapace Width V5	0.32	0.24
14	Carapace Carination	minor to moderately tricarinate	insignificant lateral carination, moderately unicarinate
15	Carination vs V-P Conjunction	coincident	NA
16	Carination Origination P1	anterior P1	NA
17	Carination Vector P1	parallel	NA
18	Carination Origination V1	anterior V1	anterior V1
19a	Carination Termination P4	anterior P4	NA
19b	Carination Termination V5	posterior V5	posterior V5
20a	V1-P1 Length vs V1 Width	0.92	0.73
20b	V1-P1 Length vs V1-V2 Width	2.92	2.57
21a	Width V1 vs V1/V2	3.18	3.52
21b	Width V2 vs V1/V2	2.99	3.50
21c	Width V3 vs V2/V3	2.84	3.79

21d	Width V4 vs V3/V4	3.01	3.41
21e	Width V4 vs V4/V5	5.13	6.41
22a	Size of V2 vs V3	larger or smaller	smaller
22b	Size of V3 vs V4	larger	larger
22c	Size of V2 vs V4	larger	smaller or larger
23	P1-V2 vs P2-V2 Sulcus Length	1.01	0.81
24a	V1-V2 Sulcus Shape	posterior bilobed	posterior bilobed
24b	V2-V3 Sulcus Shape	mildly concave	mildly concave to mildly bilobed
24c	V3-V4 Sulcus Shape	straight	straight to minorly bilobed
24d	V4-V5 Sulcus Shape	straight	straight
25	Nuchal Emargination	moderate	minor to moderate
26	Cervical Scute Shape	longitudinal rectangle	squarish to polygonal
27	V1 Contact Marginals	anterior M2	anterior M2
28a	Shape 1st Marginals	trapezoidal	trapezoidal
28b	Shape 2nd Marginals	rounded rectangular	rounded rectangular
28c	M1 vs M2 Size	smaller	smaller
29	V1-P1 Sulcus Shape	straight	straight
30	V1 vs V2 Width	shorter	slightly shorter
31	V2-P1 Sulcus Shape	slightly recurved	slightly recurved
32	V4-P3 Sulcus Shape	straight to slight curve	recurved
33	P3-V4 vs P4-V4 Sulcus Length	1.30	0.97
34	V5-P4 Sulcus Shape	outwardly curved	outwardly curved
35	M11 Sulcus Shape	slightly dorsally curved	slightly dorsally curved to straight
36	M11 Shape	squarish	squarish
37	P3-P4 Contact Marginal 9	anterior quarter	anterior third
38	M9 vs M8 Height	even	even
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	6.84	3.44
43	M10/M11 vs M10/V5 Sulci	1.52	1.69
44	V5 Length vs M11 Sulcus	2.47	4.54
45	M10/V5 Sulcus vs V4-P3-P4 Conjunction	exterior of	exterior of
46	V5+M11 vs M10-M11-V5 Sulcus Length	1.94	2.00
47	M11 Sulcus vs M10/M11 Sulcus	0.95	0.62
48	M10-V5 Sulcus Shape	outwardly curved	outwardly curved
49	M10-V5 Sulcus Vector	outwardly curved	outwardly curved
50	P4-V5 vs V5-M11 Sulci	1.42	1.88
51	Carapace Sculpture	strongly annulated	strongly annulated
52	Length Anterior Lobe vs InterPosterohumeral Sulcus	0.94	0.77
53	Length Posterior Lobe vs InterPosterohumeral Sulcus	1.01	0.88
54	Plastral Midline Sulcus Formulae	IPH>IAN>IGSL>IG>IF>IAH	IPH>IAN>IGSL>IG>IF>IAH
55	Length Anterior vs Posterior Lobes	0.93	0.88
56	Length vs Width Gular Scute	0.62	0.46
57	Bridge Length vs InterAnal Sulcus	1.10	1.55
58	Length Gular vs Intergular/InterAnterohumeral Sulci	0.81	0.75
59	Inguinal vs Antero Posterior Lobe	strongly posterior	strongly posterior
60	Inter-Femoral-Anal Sulcus vs Marginal	anterior	M9-M10
61a	Anal Scute Notch	moderate	minimal to negligible
61b	Anal Scute Tip Shape	uneven slightly rounded	uneven slightly rounded
62a	InterAnal vs InterPosterohumeral Sulcus	0.73	0.62
62b	InterAnal vs Inter-FemoroAnal Sulcus	0.98	1.09
63	Shape of Posterior Plastral Hinge	posteriorly concave	posteriorly concave
64a	Plastral Coverage	virtually complete	complete
64b	Axillary Notch Opening	0.95	1.01
64c	Inguinal Notch Opening	0.95	1.01
64d	Inguinal Notch vs Posterior Hinge	coincident	coincident
65	Carapace Length vs Anterior Length	3.60	3.76
66	Carapace Length vs Fixed Length	3.39	2.87
67	Carapace Length vs Posterior Length	3.35	3.30
68	Carapace Width vs Anterior Length	2.44	2.52
69	Carapace Width vs Fixed Length	2.29	1.92
70	Carapace Width vs Posterior Length	2.27	2.21
71	Plastral Lobe Formulae	Posterior>Fixed>Anterior	Fixed>Posterior>Anterior
72a	Carapace Length vs Intergular Scute Length	7.94	8.72
72b	Carapace Length vs Intergular Sulcus Length	10.96	13.54

72c	Carapace Length vs InterAnterohumeral Length	18.62	14.09
72d	Carapace Length vs InterPosterohumeral Length	3.38	2.89
72e	Carapace Length vs Interfemoral Length	10.69	12.49
72f	Carapace Length vs Interanal Length	4.62	4.64
73	Carapace Length vs Bridge Length	4.20	2.99
74	Carapace Length vs Plastron Length	1.14	1.06
75	Carapace Width vs Plastron Length	0.77	0.71
76	Carapace Width vs Intergular Scute Width	3.32	2.70
77	Carapace Width vs Bridge Length	2.84	2.01
78a	Carapace Width vs Intergular Scute Length	5.37	5.85
78b	Carapace Width vs Intergular Sulcus Length	7.79	9.08
78c	Carapace Width vs InterAnterohumeral Length	10.33	9.45
78d	Carapace Width vs InterPosterohumeral Length	2.28	1.94
78e	Carapace Width vs Interfemoral Length	7.23	8.38
78f	Carapace Width vs Interanal Length	3.12	3.11
79a	Carapace Length vs Anterior Lobe A	2.30	2.07
79b	Carapace Length vs Anterior Lobe B	1.93	1.88
80a	Carapace Length vs Fixed Lobe A	1.87	1.61
80b	Carapace Length vs Fixed Lobe B	2.06	1.93
81a	Carapace Length vs Posterior Lobe A	1.91	1.83
81b	Carapace Length vs Posterior Lobe B	2.41	2.84
82a	Carapace Width vs Anterior Lobe A	1.55	1.39
82b	Carapace Width vs Anterior Lobe B	1.31	1.26
83a	Carapace Width vs Fixed Lobe A	1.27	1.08
83b	Carapace Width vs Fixed Lobe B	1.39	1.29
84a	Carapace Width vs Posterior Lobe A	1.29	1.23
84b	Carapace Width vs Posterior Lobe B	1.63	1.91
85a	Anterior Hinge vs Fixed Width	0.97	0.86
85b	Anterior Hinge vs Posterior Hinge Width	1.06	1.03
86	Anterior Hinge Width vs InterPosterohumeral Sulcus	1.80	1.79
87	Posterior Hinge Width vs InterPosterohumeral Sulcus	1.64	1.50
88a	Plastral Midline Length vs Anterior Hinge Width Anterior Lobe	1.70	1.77
88b	Plastral Midline Length vs Anterior Hinge Width Fixed	1.65	1.52
88c	Plastral Midline Length vs Posterior Hinge Width	1.81	1.82
89	Plastral Midline Length vs Femoral Width	1.68	1.73
90	Width of Inguinal vs Adjacent Marginal	2.41	2.28
91	Shape of Exterior Plastral Lobe	broadly rounded	broadly rounded
92	M5 Expansion	minimal	minimal
93a	Marginal Start Axillary	mid M4	mid M4
93b	Marginal End Axillary	mid M5	anterior M5
94a	Axillary Inguinal Contact	absent to minute pointed contact	absent to minute pointed contact
94b	Axillary-Inguinal Gap	NA when absent; 3-4x when present	NA when absent; 2-3x when present
95a	Marginal Start Inguinal	mid-posterior M5	mid-posterior M5
95b	Marginal End Inguinal	anterior M8	anterior M8
96	Length of Inguinal vs Axillary Scute	2.37	2.83
97	Length of Axillary vs M5	0.88	1.16
98a	Length of Inguinal vs M6/M7	1.19	1.26
98b	Length of Interposterohumeral Sulcus vs M6/M7	1.19	1.41
99	Axillary-Inguinal Contact vs M5-M6 Sulcus	mid M5 when present	mid M5 when present
100a	Plastral Midline vs Anterior Lobe Length	3.17	3.55
100b	Plastral Midline vs Fixed Length	2.98	2.71
100c	Plastral Midline vs Posterior Lobe Length	2.95	3.11
100d	Plastral Midline vs Inframarginal Row Length	1.99	2.06
101a	Inframarginal Row Length vs InterPosterohumeral Sulcus	1.50	1.32
101b	Inframarginal Row Length vs Anterior Lobe	1.60	1.72
101c	Inframarginal Row Length vs Posterior Lobe	1.49	1.51
102	Plastral Intersection	0.38	0.31
103	Posterior Hinge vs Marginal 7	anterior M7	middle M7
104	Bridge Grooves	absent	absent to minimal
105a	Number of Scales	three	three
105b	Shape of Scales	two thin elongated, on interpolated thin short	two thin elongated, on interpolated thin short
106a	Finger Scales	all	all
106b	Number Present	2-3 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	brown to range brown sclera; pale pupil; 3-4 dark bars	dark yellow to orange brown sclera; pale pupil; 3-4 dark bars
112	Lateral Face Pattern	dark brown to black irregular mottling; pale brown to yellow base	brown to darker brown irregular blotches; pale brown to yellow base
113a	Maxillary Pattern	short dorso-ventral dark brown to black mottling/ striping	uniformly pale yellow to pale gray base; short darker blotches possible
113b	Mandible Pattern	short to moderate length dark brown to black lateral striping	uniformly pale yellow to pale gray base; short darker spots possible
114	Nasal Scale Bulge	moderate	moderate
115a	Male Beak	moderate	moderate
115b	Female Beak	minimal to absent	minimal to absent
116	Orbital-Rostral Width	shorter	subequal
117	Orbital Width Beak	subequal	subequal
118	Orbital Width Maxillary	longer	longer
119	Maxillary Terminus	strongly posterior	strongly posterior
120a	Mandible Terminus, Dorsal	equal	equal
120b	Mandible Terminus, Ventral	posterior	posterior
121	Nasal Scale Shape	bell-shaped with minor posterior emargination	bell-shaped with minor posterior emargination
122	Nasal Scale Terminus Shape	truncated round	truncated round
123	Terminus Width vs preorbital	1.61	1.58
124	Lateral Nasal Scale Terminus	strongly posterior	strongly posterior
125a	Midline Nasal Scale Terminus	NA	#VALUE!
125b	Nasal Scale Emargination	4.78	5.35
125c	Nasal Scale Anterior	1.47	1.65
125d	Midline Nasal vs Nasal Width	0.71	0.81
126	Nasal Scale Pattern	muted light brown to pale yellow mottling	muted light brown to pale yellow with dark irregular mottling
127	Posterior Head Pattern	heavily muted light brown to pale yellow mottling	heavily muted light brown to pale yellow mottling, darker brown base
128a	Head Length vs Head Width	1.53	1.21
128b	Head Width vs Anterior Scutes	0.77	0.89
128c	Head Length vs Head Depth	1.66	1.60
128d	Head Width vs Head Depth	1.09	1.32
129a	Carapace Length vs Head Length	4.03	4.21
129b	Carapace Length vs Head Width	6.16	5.09
129c	Carapace Length vs Head Depth	6.68	6.71
130a	Carapace Width vs Head Length	2.73	2.82
130b	Carapace Width vs Head Width	4.16	3.42
130c	Carapace Width vs Head Depth	4.52	4.50
131a	Plastron Length vs Head Length	3.55	3.97
131b	Plastron Length vs Head Width	5.42	4.81
131c	Plastron Length vs Head Depth	5.89	6.34
132a	Plastron Width vs Head Length	2.29	2.71
132b	Plastron Width vs Head Width	3.50	3.28
132c	Plastron Width vs Head Depth	3.80	4.33
133	Color Carapace	dark brown to blackish-brown to black	dark brown to blackish-brown
134a	Color Plastron	yellow with thin black sulci; brown to dark brown	yellow with thin to thick black sulci
134b	Pattern Plastron	varies no pattern to one of dark brown to black radiations	varies no pattern to one of dark brown to black radiations
134c	Color Ventral Marginals	yellow base heavily muted with dark brown or black	yellow base heavily muted with dark brown or black
134d	Color Axillary Scute	yellow base heavily muted with dark brown or black	heavily muted with dark brown or black
134e	Color Inguinal Scute	yellow base heavily muted with dark brown or black	yellow base heavily muted with dark brown or black
135a	Throat Color	pale yellow to pale brown, uniform or with darker spotting	pale yellow to pale brown, uniform or with darker spotting
135b	Dorsal Neck Color	dark brown to dark gray	dark brown to dark gray
135c	Ventral Neck Color	pale yellow to pale brown,	pale yellow to pale brown,
136a	Dorsal Forelimb Color	dark grayish brown	dark grayish brown
136b	Ventral Forelimb Color	pale grayish brown	pale grayish brown
136c	Dorsal Hindlimb Color	dark grayish brown	dark grayish brown
136d	Ventral Hindlimb Color	pale grayish brown	pale grayish brown
137a	Dorsal Tail Color	dark grayish brown or dark gray	dark grayish brown or dark gray
137b	Ventral Tail Color	pale grayish brown	pale grayish brown
138a	Head length vs interorbital	2.74	3.10
138b	Head width vs interorbital	1.79	2.56
138c	Head depth vs interorbital	1.65	1.94
139	Autapomorphy/ Unique Character	NA	black premaxillary & black symphyseal stripes present often both sexes
140	Chin & Throat Barbels	1-2 pairs chin, small; 1 pair throat variably present	1-2 pairs chin, small; 1 pair throat variably present

Appendix B

Le Conte, J. 1854. Description of four new species of *Kinosternon*. Proceedings of the Academy of Natural Sciences, Philadelphia 7: 180—190.

1854.]

183

caudals right angled triangular; wings very short; inguinal plate long and narrow, not joining the axillary.

Length 4.4, breadth 3.0, height 2.3, sternum length 4.2, tail 1.4.

Shaw's figure and description referred to above are both very bad.

K. integrum. Testa fusca, regulari-ovali, convexa, carinata, declivi, margine postice dispanso, laterali perpendiculari, sterno magno bivalvi, cistam omnino occludente, antice rotundato, postice paulo emarginato. Cauda brevissima mutica.

Habitat. Mexico.

Head and neck brown spotted with yellow; front pale brown, a large orange spot behind the eye, somewhat varied with black. Jaws yellow, upper one very slightly hooked. Chin with four small warts. Legs above dusky, beneath pale brown; fore legs with two folds on the upper side; hind legs beneath squamose with four folds. Tail very short, unarmed. Shell brown, regularly oval, very convex and elevated, without any carina, very declivous on the sides and behind, the lateral margin perpendicular, the posterior expanded. Vertebral plates imbricate; the first triangular with the apex truncate, applied to the nuchal the first marginal and half the second; second, third, and fourth urceolate; the second and third hexagonal; the fourth four-sided, the anterior side one-third the length of the base, which is rounded; the fifth triangular, the apex broadly truncate, the base angled, and applied only to the last marginal. First lateral unequally four-sided, the base rounded, with four facets, second and third pentagonal, fourth four-sided, the posterior basal angle deeply and roundly emarginate by the penultimate marginal. Nuchal plate small, linear, all the other marginals oblong and four-sided, those on the sides perpendicular, the four last on each side wider and expanded, the penultimate one being higher than all the rest, and rounded on the upper side. Sternum yellow, varied with dark brown, with numerous diverging striæ on the hinder plates, and concentric ones on the anterior, rounded at both ends and a little emarginate behind; bivalved, entirely closing the box. Gular plate small, triangular, nearly equilateral; pectorals irregularly four-sided, the anterior face very short; brachials four-sided, the interior side half the length of the exterior; abdominals exactly quadrate, wings short, axillary scutum long and narrow, joining by a point to the inguinal, which is likewise very long but much wider; femorals four-sided, the interior side one-third the length of the exterior; caudals right angled triangular, with the base rounded.

Length 4.6, breadth 3.0, height 1.7, tail 1.3, sternum length 3.0, breadth 2.0.

Brought by Mr. Pease from Mexico.

K. leucostomum. Testa elliptica, convexa, postice subcarinata. Scutis vertebralibus elongatis, primo ad nuchale, primum marginale et secundi partem apposito, quinto ad marginale postremum solo apposito; margine medio subcompresso, postice dispanso. Sterno integro medio paulo angustato, cistam pæne occludente. Cauda late et obtuse unguiculata, maxillis albidis superiore valde hamata.

Habitat. ———. A fine specimen in the collection of the Academy, received from the Jardin des Plantes of Paris. It is described under the name of *leucostomum* by Dumeril, Cat. Reptil. Mus. I. des.

Group II. Anterior valve of the sternum joined to the abdominal portion partly by a ligament and partly by a suture, the posterior by suture alone; wings tolerably long, with a deep and wide groove on the anterior part.

K. pennsylvanicum. Testa elliptica, convexa, dorso depressiuscula, postice retusa; margine angusto, minime dispanso. Scutis vertebralibus subimbricatis, primo ad nuchale et primum marginale apposito, quinto ad marginale postremum solum apposito; scuto marginali penultimo multo cæteris latiore et altiore. Sterno testa angustiore, postice emarginato. Cauda acute unguiculata.

Hab. From Canada to Florida. Has a musky odor.

A young one of this species, about an inch long, had the shell perfectly round, dark brown, with a yellow spot on each of the marginal scuta, scuta of the shell a little roughened with transverse wrinkles and short elevated spots. Sternum yellowish, black in the middle. Another one much younger and smaller was of an oval form, with three very obscure and slightly developed carinæ.

Figure 18. Reproduction of page 16 from Le Conte (1854) with original type description of '*Kinosternon integrum*'. Imaged from www.archive.org

Appendix C

Bocourt, M.F. 1876. Note sur quelques reptiles de l'isthme de Tehuantepec (Mexique) données par M. Sumichrast au Museum. Journal de Zoologie, Paris 5 (5/6) : 386—411.

REPTILES DE L'ISTHME DE TEHUANTEPEC.

391

1. *CINOSTERNON ROSTELLUM*, n. sp.

Caractères. — Carapace peu élevée, ovale, unicarénée et recouverte de plaques imbriquées et sillonnées. Mâchoire supérieure non crochue et à extrémité légèrement échancrée. Charnière du lobe postérieur du sternum dirigée de chaque côté, obliquement en arrière. Plaque gulaire égalant par son diamètre longitudinal la moitié de la longueur du premier lobe sternal. Ecailles axillaire et inguinale larges et non en contact.

Description. — La boîte osseuse de cette petite espèce est surmontée d'une faible carène et représente un ovale assez parfait; sa largeur égale les 5/7 de sa longueur et sa hauteur les 3/8 de cette dernière dimension. Elle est recouverte de plaques imbriquées, bossuées et largement striées concentriquement; la première plaque dorsale plus large que longue, subtriangulaire comme chez toutes les espèces, est largement articulée avec la suivante; celle-ci, ainsi que les deux suivantes, ont six pans presque égaux; la cinquième à peine plus petite représente un pentagone subtriangulaire. La plaque costale antérieure est relativement de petite dimension, mais offre, ainsi que les trois suivantes, les mêmes formes que celles des autres espèces appartenant à ce genre. On compte également vingt-trois écailles lombaires; la nuchale, plus haute que large, est rectangulaire, toutes offrent quatre pans et les deux avant-dernières paires sont un peu plus larges que les autres; l'animal de profil, on voit les scutelles qui recouvrent la région margino-latérale, leur partie inférieure étant sur le même plan vertical que leur partie supérieure. Le plastron, aussi large en avant qu'en arrière, est arrondi, mais très-légèrement échancré postérieurement; plaque gulaire subtriangulaire plus large que longue et égalant au moins par cette dernière dimension la moitié du diamètre longitudinal du premier lobe; la partie fixe ou abdominale est d'un cinquième plus courte que les portions mobiles, les deux plaques qui la recouvrent sont subrhomboidales et chacune présente un angle aigu, formé par la réunion de la suture médiane avec la charnière du deuxième lobe; cette charnière, de

Rept. Coll. Brit. Mus., part. I, 1855, fig. 3-4 et 5-6. Ces deux dernières espèces ont le plastron assez étroit en arrière et ressemblent beaucoup au *Cinost. sonoriense*, surtout le *Cinost. hippocrepsis*, qui paraît s'y rapporter entièrement.

Characters. — Shell not very high, oval, unicarinate and covered by interlocking and furrowed plates [carapacial scutes]. Upper jaw not hooked and with slightly notched tip [typical of female specimens such as the holotype]. Hinge of the posterior lobe of the sternum [plastron] directed obliquely backwards on each side. Gular plate [=intergular scute in modern terminology] equal in its longitudinal diameter [length of the scute] to half of the length of the first sternal [plastral] lobe. Axillary and inguinal scales broad and not in contact.

Description. — The skeletal frame of this small species is surmounted by weak keel [single carina] and represents a fairly perfect oval; its width is equal to 5/7 of its length and its height to 3/8 of the latter dimension. It is covered with interlocked, humped and wide plates [carapacial scutes] concentrically striated; the first dorsal plate [vertebral 1] is wider than long, subtriangular as in all species, is broadly articulated with the following [vertebral scute 2]; This, as well as the two following ones [vertebral scutes 3 and 4], have six sides almost equal; the fifth [vertebral scute 5], slightly smaller, represents a subtriangular pentagon. The anterior costal plate [pleural scute 1] is relatively small in dimension but shows, as well as the following three [pleural scutes 2, 3, 4], the same forms as those of the other species belonging to this genus [*Kinosternon*]. There are also twenty-three lumbar scales [summation of the cervical scute plus 11 marginal scutes on each side]; the nuchale [cervical scute], more high and wide, is rectangular, all [marginals] have four sides and the two penultimate pairs are a little wider than the others [marginal scutes 10]; the animal in profile, we can see the scutes that cover the lateral margin region their lower part [ventral] being on the same vertical plane as their top [dorsal]. The breastplate [plastron] as wide in front as in the back, is rounded, but very slightly indented posteriorly [slight anal scute notch]; gular plate [=intergular scute in modern terminology] broader than long, and equal at least in this last dimension [length] to half the longitudinal diameter of the first lobe [anterior or plastral lobe]; the fixed or abdominal [=posterohumeral scutes in modern terminology] part is one-fifth shorter than the movable portions [the two plastral lobes], the two plates which cover it are sub rhomboidal and each presents an acute angle, formed by the union of the median suture [midline sulcus] with the hinge of the second lobe [posterior plastral lobe]; this hinge, from (...cont.)

Figure 19a. Reproduction of page 391 (left above) from Bocourt (1876) with original type description of '*Cinosternon rostellum*' and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

chaque côté, se dirige obliquement en dedans d'avant en arrière, formant au milieu un angle très-ouvert; les autres plaques du plastron sont semblables à celles que l'on remarque chez le *Cinost. pensylvanicum*; écailles axillaire et inguinale séparées l'une de l'autre par un espace court, la dernière est moins étroite et de forme losangique.

Tête large au niveau des tempes, à museau moins proéminent que chez les autres espèces, la mâchoire supérieure ne présente pas un bec crochu, l'inférieure seulement est recourbée; le crâne est recouvert d'une large plaque cornée, transparente et de forme rhomboïdale; le menton est garni de deux petits barbillons. On voit au-dessus du pouce trois écailles parallèles, disposées obliquement sur la face extérieure du bras; d'autres écailles à peu près semblables ornent le bas de la jambe et le talon; ailleurs la peau des membres est plissée et entre-semée de petits tubercules. Les ongles sont courts et recourbés, les membranes inter-digitales sont denticulées.

Coloration. — Les parties supérieures offrent une teinte de terre de Sienne naturelle mélangé de brun. Le plastron est jaune avec les sutures brunes; les mâchoires et le dessous du cou sont blanchâtres.

Longueur de la carapace 0^m,080; largeur 0^m,058; hauteur 0^m,030.

Cette petite espèce qui a le sternum moins échancré en arrière que celui du *Cinost. pensylvanicum*, est placée la première, parce qu'elle offre par la disposition des plaques qui protègent la boîte osseuse, quelque ressemblance avec les Emydes.

On peut reconnaître le *Cinost. rostellum* de ses congénères par les particularités suivantes: 1° Museau un peu moins proéminent et mâchoire supérieure moins crochue; 2° la charnière du lobe postérieur ne traverse pas en ligne droite le sternum, mais est dirigée d'avant en arrière jusqu'à la suture médiane, où elle forme un angle très-ouvert; 3° première plaque costale relativement plus petite que chez les autres espèces.

Le Muséum possède un seul exemplaire ♀ de cette espèce, qui peut-être, n'était pas encore arrivé à son entier développement; il a été donné par M. le D. Alfred Dugès, qui l'a recueilli à Guanajuato.

2. *CINOSTERNON PENSYLVANICUM.* — *Test. pens.*, Gmelin, *Syst. nat.*, t. I, p. 1042, spec. 26. — *Thyrosternum pensylvanicum*, Agassiz, *loc. cit.*, 1857, p. 420. — ? *Kinoster-*

(...) each side runs obliquely inwards from front to back, for in the middle a very open angle [the posterior plastral hinge is concave, apex posterior]; the other plates of the breastplate [plastron] are similar to those found in *Cinost. pensylvanicum* [= *Cinosternon pensylvanicum*, a synonym of the Eastern Mud Turtle *Kinosternon subrubrum subrubrum*]; axillary and inguinal scales separated from each other by a short space, the last one [inguinal scute] is less narrow and lozenge in shape.

Head broad at the level of the temples, with a snout less prominent than in other species, the upper jaw does not have a beak hooked [typical in female specimens], the lower one only is curved; the head [rostrum] is covered a broad, transparent, rhomboidal plate [=nasal scale]; the chin is furnished with two small barbels. We can see above the thumb three parallel scales [dorsal forelimb scales above the carpal bones], arranged obliquely on the outer surface of the arm; other scales of more or less the same size adorn the lower leg and the heel; elsewhere the skin of the limbs is wrinkled and strewn with small tubers [=tubercles]. The nails are short and curved, the membranes inter-digital are denticulated [interphalangeal webbing].

Coloration. — The upper parts offer a tinge of Sienna mixed naturally with brown. The breastplate [plastron] is yellow with brown sutures; the jaws and the underside of the neck are whitish.

Length of the carapace 80 mm; width 58mm; height 30 mm.

This small species, which has the sternum [plastron] less indented posteriorly than that of *Cinost. pensylvanicum* [= *Cinosternon pensylvanicum*, a synonym of the Eastern Mud Turtle *Kinosternon subrubrum subrubrum*] is placed first [profiled first in Bocourt's study], because it shows by the arrangement of the plates that protect the bone case [skeletal shell], some resemblance to the Emydes [pond turtles, family Emydidae].

We can recognize the *Cinost. rostellum* of its congeners by the following peculiarities: 1: Muzzle a little less prominent and upper jaw less hooked; 2: the hinge of the posterior lobe does not cross the sternum in a straight line, but is directed from front to rear to the median suture, where it forms a very open angle [description of the concave 2nd plastral hinge as discussed previously]; 3: first costal plate relatively smaller than in the other species.

The Museum has only one female specimen of this species [=MNHN RA2112], which had not yet reached its full development [young adult/juvenile specimen]; it was given by Dr. Alfred Dugès, who took him in Guanajuato [=state of Guanajuato, Mexico].

Figure 19b. Reproduction of page 392 (left above) from Bocourt (1876) with original type description of '*Cinosternon rostellum*' and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

4. CINOSTERNON INTEGRUM. — Le Conte, *Proc. Acad. nat. sc.*

4. CINOSTERNON INTEGRUM. — Le Comte, *Proc. Acad. nat. sc. Philad.*, 1854, p. 183. — *Thyrosternum integrum*, Agas SZ Not. 11851, p.420

394

F. BOCOURT.

Philad., 1854, p. 183. — *Thyrosternum integrum*, Agassiz, *loc. cit.*, 1857, p. 429.

Caractères. — Carapace presque lisse, convexe et assez élevée chez les femelles, surmontée d'une faible carène à peine visible sur la deuxième et la troisième plaque vertébrale; son contour est ovale, un peu émarginé au-dessus des membres et légèrement rétréci sur les côtés; la première plaque vertébrale est plus large que longue; les deux suivantes sont hexagonales; la quatrième est de même forme ou bien pentagonale; la cinquième plus étroite que la précédente offre cinq pans. Ecaïlles du limbe rectangulaires: la nuchale assez haute est plus large en arrière qu'en avant; la margino-collaire et les margino-brachiales et fémorales sont également bien développées, surtout la postérieure, qui par son contour supérieur qui est arrondi, s'articule avec la dernière plaque costale. Plastron arrondi à chaque extrémité, sa partie fixe ou abdominale recouverte de plaques carrées, est presque d'un quart moins longue que les portions mobiles; plaque gulaire n'atteignant pas par son diamètre longitudinal la moitié du lobe dont elle fait partie; plaque axillaire et inguinale finement en contact. Mâchoire inférieure rayée longitudinalement de brun. Nous n'avons pas vu chez le mâle, les tubercules particuliers, placés derrière les cuisses que l'on remarque chez le *Cenost. pensylvanicum*.

Longueur de la carapace 0^m,439; largeur 0,088; hauteur 0,058.

Le *Cinost. integrum* est représenté au Muséum par deux exemplaires ♂ ♀ adultes, provenant du Mexique, que l'on peut facilement distinguer du *Cinost. pensylvanicum*, par les particularités suivantes: 1° plastron non échancré en arrière; 2° écaïlle nuchale, margino-collaire, brachiales et fémorales plus développées; 3° enfin ils offrent des dimensions plus grandes.

5. CINOSTERNON LEUCOSTOMUM. — A. Duméril, *Cat. méth. Coll. Rept.*, 1851, p. 17. — *Id.*, *Arch. Mus. Hist. nat.*, 1855, p. 239, pl. xvii, fig. 1-2-3. — *Cinost. (Swanka) maculata*? Gray, *Proc. zool. Soc. Lond.*, 1869, p. 181.

Caractères. — Carapace assez allongée, recouverte de plaques striées et surmontée d'une faible carène disparaissant avec l'âge, mais ordinairement visible sur la quatrième et sur la cinquième plaque verté-

Characters. — Carapace nearly smooth, convex and rather elevated in females, surmounted by a weak keel barely visible on the second and third vertebral plate; its outline is oval, a sparsely emarginate [mild anterior carapace emargination] above the limbs and slightly narrowed on the sides; the first vertebral plate is wider than it is long; Both [subsequent, V2 and V3] are hexagonal; the fourth is of the same form or Pentagonal; the fifth, narrower than the previous one, offers five sides. Scales of the limbs rectangular: the nuchal is quite high and wider backwards than forwards; the neck and the brachials and femoral are also well developed, especially the posterior one, which by its upper contour, which is rounded, is articulated with the last costal plate [marginal scutes]. Rounded breastplate [plastron] at each end, its fixed part or abdominal covered with square plates, is almost a quarter less long than the movable portions [plastral lobes]; gular plate [=intergular scute in modern terminology] not reaching by its longitudinal diameter half the lobe of which it is a part [=intergular scute less than half length of anterior plastral lobe]; axillary and inguinal plates finely in contact. Lower jaw streaked longitudinally with brown. We have not seen in the male, the peculiar tubercles, placed behind the thighs which are noticed in the *Cenost. pensylvanicum* [*Cenost.* is misspelling of the abbreviation of *Cinost. (Kinosternon)*; describing here the absence of copulatory organs].

Length of the carapace	139mm;
width 88mm; height	58mm.

The *Cinost. integrum* is represented in the Museum by two adults, female and male, from Mexico, which can be easily distinguished from *Cinost. pensylvanicum* by the following particularities: 1: breastplate [plastron] not indented in back [lack of anal scute notch]; 2; nuchale scale [cervical scute], neck, brachial, and femoral more developed [marginal scutes]; 3: finally they offer larger dimensions.

[Current authors's note: While it is clear from the description that Bocourt is describing adult specimens that are not referable to *Kinosternon birupes* ('absence of copulatory organs in the adult male'); it is unfortunate that the lack of locality data (being only recorded as 'from Mexico') precludes narrowing down the population he considered to be referable to the concept of Le Conte and Agassiz' idea of *K. integrum*. Bocourt is clearly not redescribing the specimen of Le Conte (1854) only his understanding of the taxon Le Conte conceived].

Figure 19c. Reproduction of bottom portion of page 393 and full page 394 (left above) from Bocourt (1876) with his species concept description of '*Cinosternon integrum*' and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

Appendix D

Dugès, A. A. D. 1888. Erpetologia del Valle de Mexico. La Naturaleza 2 (1) 97-146.

104

LA NATURALEZA

animal en la casa desde este tiempo y que había sido adquirido ya grande; y sin embargo las escamas no llevan más que una docena de estrias de crecimiento contando desde el centro granuloso que fué el del primer año y se ve todavía muy bien.

ESPECIES.

He aquí el punto más difícil de la historia de los cinosternos, á lo menos de los que habitan el Valle de México, con los cuales se pueden comparar los del Estado de Guanajuato. Si consultamos á Bocourt (Journal Zool. Gervais, T.V, 1876), que es el autor que admite el mayor número de ellos, veremos que funda sus divisiones sobre la consideración de las quillas dorsales, la escotadura esternal posterior, la separación ó el contacto de las placas axilar é inguinal, la forma del contorno del carapacho, etc.—A estos caracteres Günther (Biol. centr. amer.) agrega el color de las mandíbulas. Examinando con cuidado un buen número de carapachos ó de individuos enteros frescos ó conservados, he reconocido muy pronto la variabilidad y la incertidumbre de los caracteres sacados de estas varias modificaciones: en efecto, las quillas dorsales, muy señaladas en los animales jóvenes que tienen tres, se embotan con la edad, y en la mayor parte de los adultos que tengo á la vista es imposible distinguir si ha habido una ó tres quillas, muchos individuos teniendo la región vertebral plana y aun un poco cóncava: cuando la salida mediana existe, ella es muy señalada en toda su longitud y el dorso es un poco bombeado transversalmente. El pico es más ó menos ganchudo según la edad y los machos viejos lo tienen prolongado en punta robusta, mientras lo es poco en las hembras y es casi mocho y se puede decir escotado en los jóvenes. El color de las mandíbulas varía de un individuo á otro y es rara vez uniforme sin que el sexo intervenga como elemento, y lo mismo sucede con el color del peto. En los cinosternos cogidos en la misma localidad y copulando entre sí, la escotadura posterior del esternón es más ó menos profunda, mucho más en los machos que en las hembras, y en los jóvenes llegan á borrarse completamente; esto es tan cierto que Agassiz (loc. cit., Pl. IV, figs. 9 y 10) representa el joven cinosterno pensilvánico sin la escotadura tan marcada del adulto. La anchura de las valvas del peto es variable, siendo muy grande en unos, muy angosta y casi *estaurotipoide* en otros, aunque raros con las transiciones entre estos dos extremos. El carácter sacado del apartamiento ó del contacto de las láminas axilar é inguinal es tal vez algo más constante (en general hay contacto), y sin embargo, yo he visto un individuo en el cual las dos disposiciones se presentaban una de cada lado. La forma de la charnela ó sutura de la válvula posterior con la pieza mediana fija, parece más general, pero este único carácter es muy poco importante para distinguir una especie. En resumidas cuentas diré que se ven cinosternos con caracteres pertenecientes á diferentes especies, y que no se pueden referir exactamente á ninguna de las admitidas. El carapacho en los machos es ordinariamente plano por encima en la región vertebral, algunas veces en forma de techo deprimido, y su contorno tiene los costados subparalelos, un poco ensanchado en las axilas y mucho en las ingles; en las hembras, el carapacho es más

SPECIES.

Here is the most difficult point in the history of the cynosternos [*Kinosternon*], at least those which inhabit the Valley of Mexico, with which those of the State of Guanajuato can be compared. If we consult Bocourt (Journal Zool. Gervais, T.V, 1876), who is the author who admits the greatest number of them, we will see that he bases his divisions on consideration of the dorsal keels, the posterior sternal notch [anal scute notch], the separation or the contact of the axillary and inguinal plates [scutes], the shape of the contour of the carapace, etc.—To these characters Günther (Biol. centr. amer.) adds the color of the jaws. Carefully examining a good number of carapaces or individuals in fresh or preserved whole, I have very quickly recognized the variability and uncertainty of the characters derived from these various modifications: in effect, the dorsal keels, very marked in young animals that have three [tricarination], become dull with the age, and in most of the adults that I have in sight it is impossible to distinguish if there have been one or three keels, many individuals having a flat vertebral region and even a little concave: when the median outline exists, it is very marked along its entire length and the back is a little transversely domed. The peak is more or less hooked depending on the age and the older males have it extended in a blunt point, while it is not very long in the females and is almost short and can be said to be low-cut in the young ones [juveniles]. The color of the jaws varies from one individual to another and is rarely uniform without sex intervening as an element, and the same happens with color of the breastplate. In cynosternos caught in the same locality and copulating with each other, the posterior notch of the sternum is more or less deep, much more so in males than in females and in young ones [juveniles] they become completely erased; this is so true that Agassiz (loc. cit., Pl. IV, figs. 9 and 10) represents the young Pennsylvanian cynostern without the marked notch of the adult. The width of the breastplate valves [anterior plastral lobe] is variable, being very large in some, very narrow and almost staurotypic [similar to the genus *Staurotypus*] in others, although rare with the transitions between these two extremes. The character taken from separation or contact of the axillary and inguinal plates is perhaps somewhat more constant (in general there is contact), and yet, I have seen an individual in which the two provisions were presented one on each side. The shape of the hinge or its suture of the posterior valve [posterior plastral lobe] with the fixed median piece, seems more general, but this as a single character is very unimportant in distinguishing a species. In short, I will say that cynosternos are seen with characters belonging to different species, and that they cannot refer exactly to any of those admitted. The carapace in males is usually flat above in the vertebral region, sometimes in the form of a depressed roof, and its outline has subparallel sides, a little widened in the armpits [axillary notch] and much in the groin [inguinal notch]; in females, the carapace is more (cont..)

Figure 20a. Reproduction of page 104 (left above) from Dugès (1888) with his evaluation of the species of kinosternids in the Valley of Mexico, and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

LA NATURALEZA

405

redondeado como globuloso, con el dorso poco deprimido y el contorno regularmente ovalado. La placa gular llega por lo común hasta la mitad de la longitud de la valva anterior del peto, y esta valva es siempre más larga que la región fija.

Considerando un tipo general, podremos describir como sigue los cinosternos del Valle de México así como los del Estado de Guanajuato, cuyos caracteres generales conocemos ya.

MACHO.—Carapacho alargado, bastante alto, de costados paralelos, un poco más ancho por delante y mucho más en la región femoral: dorso plano, con ó sin quilla longitudinal media: esternón cóncavo en su tercio posterior, bien escotado posteriormente: escamas axilar é inguinal en contacto, la última bien desarrollada: lámina gular poco más ó menos de la longitud de la mitad de la valva anterior: esta valva más larga que la región fija. Pico ganchudo, con bordes filosos seguidos por una superficie interna plana: cuando la boca está cerrada, estas dos superficies no se tocan, pero el filo de la mandíbula inferior viene á apoyarse sobre el fondo de la ranura superior, de manera que divida, más bien que masque los alimentos. Cola grande y fuerte rematando en una uña robusta, plana por debajo y trunca: la piel de este órgano está sembrada de tuberculitos que forman dos ó tres series longitudinales en la parte superior. Patas anteriores bien palmeadas, con cinco uñas fuertes y curvas; su piel está dividida en pequeños rombos, y delante de la muñeca se ven dos láminas transversales córneas, mientras el borde externo del antebrazo lleva un repliegue con seis escamas que llega hasta la base de la quinta uña. Patas posteriores con anchas escamas en el talón, cuatro uñas y un repliegue lateral conteniendo un dedo externo sin uña.

Todas las uñas tienen en su base dos escamitas. Parte superior del cráneo lisa, el resto de la cabeza y el cuello cubiertos por una piel muy laxa que se puede arrugar considerablemente y está dividida en pequeños exágonos y lleva tubérculos entre los cuales unos forman una especie de cresta longitudinal de cada lado del cuello. Oreja externa apenas visible. Párpados bien desarrollados. Debajo de la barba se ven dos, algunas veces cuatro y aun tres apéndices cónicos cortos. Mandíbulas amarillentas, rayadas de negro; rarísima ocasión de un blanco amarillo sin manchas, y en un caso la superior llevaba rayas mientras la inferior era inmaculada. Parte superior de la cabeza pardo negruzca con puntos ó líneas amarillas; por grados se va borrando lo pardo hacia los lados, y las partes inferiores son amarillas con puntos negros: el cuello y los miembros son de un color gris negruzco ó pardo-oscuro. El iris amarillo ó gris tiene un círculo aplomado en derredor de la redonda pupila, y cuatro puntos negros en cruz sobre el fondo amarillo. Dorso pardo verdoso ó leonado, á veces color de chocolate con las escamas rodeadas de negro. Peto amarillo y sus láminas ordinariamente provistas de una faja negruzca en sus contornos; pocos individuos tienen esta región amarilla sin manchas, y en otros es enteramente parda.

HEMBRA.—Carapacho más convexo, más globuloso, de periferie regularmente ovalada, y poco plana por debajo. Esternón poco escotado ó entero hacia atrás. Pico poco

14

(...) rounded as globular, with the back slightly depressed and the contour regularly oval. The gular plate [intergular scute] usually extends up to half the length of the valve [anterior plastral lobe] anterior of the breastplate, and this valve is always longer than the fixed region.

Considering a general type, we can describe the cynosterns of the Valley of Mexico as well as those of the State of Guanajuato, whose general characteristics we already know.

MALE.—Carapace elongated, quite high, with parallel sides, a little more wide in front and much more in the femoral region: flat back, with or without medial longitudinal keel: sternum concave in its posterior third, well notched posteriorly: axillary and inguinal scales in contact, the last one well developed: the gular scale a little more or less the length of half of the anterior valve; this valve longer than fixed region. Hooked bill, with sharp edges followed by a flat internal surface: when the mouth is closed, these two surfaces do not meet or touch, but the edge of the lower jaw comes to rest on the bottom of the slot superior, so that it divides, rather than chews, food. Big tail and strong ending in a robust nail, flat below and truncated [keratinous spur on end of tail]: the skin of this organ is planted with tubercles that form two or three longitudinal series in the upper part [tail papillae]. Front legs well webbed, with five strong and curved nails; skin is divided into small rhombuses, and in front of the wrist you can see two transverse horny plates [dorsal forelimb scales], while the external edge of the forearm has a fold with six scales that reach the base of the fifth nail. Hind legs with wide scales on the heel, four nails and a lateral fold containing an external toe without a nail.

All nails have two scales at their base. Smooth top of skull, the rest of the head and neck covered by very lax skin that may wrinkle considerably and is divided into small hexagons and has tubercles between, some of which form a kind of longitudinal ridge on each side of the neck. Ear barely visible external. Well developed eyelids. Under the beard [chin] you can see two, sometimes four and even three short conical appendages [chin barbels]. Yellowish jaws, radiations of black; very rare occasion of a whitish-yellow without spots, and in one case the upper part was striped while the lower part was immaculate. Upper part of head blackish brown with yellow dots or lines; By degrees the brown is erased towards the sides, and the lower parts are yellow with black dots: the neck and the limbs are blackish gray or dark brown. The yellow or gray iris. It has a plumb circle around the round pupil, and four black dots in a cross on the yellow background. Greenish brown or fawn back, sometimes chocolate color with the scales surrounded by black. Yellow breastplate and its plates usually provided with a blackish stripe around their contours; few individuals have this region yellow without spots, and in others it is entirely brown.

FEMALE.—Carapace more convex, more globular, with a regularly oval periphery, and slightly flat below. Sternum not very low or all the way back. Little peak [cont...]

Figure 20b. Reproduction of page 105 (left above) from Dugès (1888) with his evaluation of the species of kinosternids in the Valley of Mexico, and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

ganchudo. Cola corta, pequeña aunque fuerte y con una uña chica en la extremidad. Lo demás como en el macho.

JOVEN DE DOS Ó TRES MESES.—Longitud del carapacho 0^m025; anchura 0^m020; altura 0^m013, contorno casi discoidal, cosa de una quinta parte más largo que ancho: dorso en forma de techo aplastado con una cresta longitudinal media, filosa, y otras dos interrumpidas en lo alto de las placas costales: toda esta región granulosa. Esternón siempre cortado transversalmente por detrás, sin escotadura sea cual fuere el sexo, y demasiado estrecho para que el animal pueda ocultar en él sus partes blandas. Iris blanquecino con cuatro puntos negruzcos. Piel gris de hierro obscuro: no se notan algunas jaspeaduras sino en las mandíbulas. Peto amarillo subido ó anaranjado con una gran mancha negra central. Se distingue claramente el punto de inserción del cordón umbilical.

Insertaremos aquí el cuadro sinóptico diferencial de las especies admitidas por F. Bo-court (Journ. Zool. Gervais, t. V, 1876), para discutirlo después y ver lo que podemos aplicar de él á los cinosternos de México.

Dorso.	con una quilla única. Esternón.....	escotado por detrás: lóbulo anterior más largo que la región fija; placa gular igual en longitud.....	á la mitad de la primera porción del peto: axilar é inguinal no en contacto... al tercio de esta porción: axilar é inguinal al contacto: nuca.....	} ROSTELLUM.
	sin escotadura: su región fija.....	menos larga que el primer lóbulo: inguinal y axilar.....	muy chica. nula.....	} PENNSYLVANICUM.
	con tres quillas. Esternón.....	escotado por detrás, y su región fija tan larga como el lóbulo anterior; axilar é inguinal ligeramente en contacto.....	en contacto: mandíbulas rayadas de pardo..... separadas: boca blanca..... en contacto: primera vertebral tan larga como ancha..... separadas: primera vertebral más ancha que larga.....	} INTEGRUM.
	sin escotadura: inguinal y axilar....	separadas: placa vertebral anterior.....	más larga que ancha; escamas del disco casi lisas: región fija del esternón más corta que la primera porción..... tan larga como ancha: escamas del disco fuertemente estriadas: parte fija del esternón tan larga como su primera parte..... en contacto: primera placa vertebral más larga que ancha; porción fija del esternón menos larga que el lóbulo anterior.....	} LEUCOSTOMUM.
				} BERENDTIANUM.
				} EFFELDTH.
				} SHAVIANUM.
				} CRUENTATUM.
				} ALBOGULARE.

El mismo autor conviene (pág. 4, loc. cit.) en que «al examinar con atención los «cinosternos se ve que las especies hasta hoy conocidas se refieren á tres formas específicas, representadas por el *C. pennsylvanicum*, *C. leucostomum* y *C. scorpioi-*

[...] hooked. Short tail, small but strong and with a small nail at the end. The rest as in the male.

YOUNG TWO OR THREE MONTHS.—Length of carapace 25mm; width 20mm; height=ra 13mm, almost discoidal contour, about a fifth longer than it is wide: back in the form of a flattened roof with a median, sharp longitudinal ridge, and others two interrupted at the top of the costal plates: this entire granular region. The ternon is always cut transversely from behind, without a notch regardless of the sex, and too narrow for the animal to hide its soft parts in it. Whitish iris with four blackish dots. Dark iron gray skin: there are only some mottles on the jaws. Bright yellow or orange bib with a large central black spot. The insertion point of the umbilical cord clearly distinguished.

We will insert here the differential synoptic table of the species admitted by F. Bo-court (Journ. Zool. Gervais, t. V, 1876), to discuss it later and see what we can apply from it to the cynosterns of Mexico.

[Table of *Kinosternon* species as in original publication, reprinted here but not translated].

The same author agrees (p. 4, loc. cit.) that “when carefully examining the cynosterns it is seen that the species known to date refer to three specific forms, represented by *C. pennsylvanicum*, *C. leucostomum* and *C. scorpioi-* [cont...]

Figure 20c. Reproduction of page 106 (left above) from Dugès (1888) with his evaluation of the species of kinosternids in the Valley of Mexico, and our English translation (right above; our comments presented in square brackets = []). Middle table not translated. Imaged from www.archive.org

«des: estas especies siendo así repartidas en tres grupos, es difícil, sin un estudio comparativo de todas sus partes, asignar á cada una de ellas caracteres propios para distinguirlas de los individuos típicos que se acaban de citar.»

Esta dificultad proviene de que las diferencias son tan poco señaladas y tan variables que Gray mismo (Synopt. catal. rept., tortoises: 1844, p. 32) da por sinónimos del *Cin. scorpioides* los siguientes: *C. Shavianum*, *longicaudatum*, *brevicaudatum*, *pennsylvanicum*, var. de Shaw, *tricarinata* y *Retzii*. Agassiz (loc. cit.) considera *C. oblongum*, *Doubledayi* y *leucostomum* como var. de *pennsylvanicum*. Podríamos multiplicar las citaciones, mas nos limitaremos á las reflexiones siguientes: considerando el *hirtipes* como simple anomalía del *pennsylvanicum* sin placa nuchal, nos quedan el *rostellum*, *pennsylvanicum* y *leucostomum* para los que se parecen más á los individuos del Valle de México; pero el *rostellum* es una hembra joven aún no bien caracterizada que yo mismo remití á Bocourt y pertenece á la especie *guanajuatense*; el *leucostomum* se confunde por transiciones con el *pennsylvanicum*; en fin, el *Shavianum* se distingue de otros vecinos únicamente porque el carapacho no tiene hacia atrás una inclinación rápida.

Nos queda, pues, por vía de exclusión, la especie *Cinosternon pennsylvanicum*, Gmelin (*Thyrosternum* de Agassiz), á la que parecen referirse como variedades todos los individuos del Valle de México y los del Estado de Guanajuato. En cuanto á las otras especies que campean en el cuadro de Bocourt, ellas son tan poco caracterizadas, que yo he visto ejemplares con caracteres reunidos del *pennsylvanicum* y *rostellum*; otros entre *rostellum* y *leucostomum*; otros, en fin, participando de las distintivas de *rostellum*, *leucostomum* y *Effeldti*, sin que fuese posible decir exactamente á cuál de estas formas se debían referir. El *C. Berendtianum*, Cope, de Tabasco, parece, sin embargo, una buena especie.

ONYCHOTRIA MEXICANA.

Pasemos ahora á la familia de las Emidoideas, Ag., á que pertenece el segundo que- lonio que tuvo á bien comunicarme con su acostumbrada benevolencia y amabilidad mi amigo el Prof. Jesús Sánchez, Director del Museo Nacional de México.

Hemos dado ya la definición de la familia: ésta en la clasificación de L. Agassiz (loc. cit.) contiene las subfamilias siguientes: *Nectemidoideas*, *Deiroquelioides*, *Eremidoideas*, *Clemmidoideas* y *Cistudininas*: en esta última división se coloca el individuo de que se va á tratar. Las Cistudininas se reconocen en que el cuerpo es muy corto y alto, ligeramente oblongado, casi redondo; el peto es ancho y plano, movable en su punto de unión con el carapacho, y sobre sí mismo por la sutura transversal mediana; la comisura es angosta; las patas son apenas palmeadas. Según Agassiz, esta subfamilia consta de un solo género, *Cistudo*, Flem. La tortuga de que hablamos presenta algunas particularidades que han parecido á Gray de bastante importancia para colocarla en un género nuevo al que ha impuesto el nombre de *Onychotria*. Agassiz (loc. cit., pág. 445) le llama *Cistudo triunguis* y rechaza el género creado

[...] -des: these species being thus divided into three groups, it is difficult, without a comprehensive study comparative of all its parts, assign to each of them its own characters to distinguish them from the typical individuals just mentioned.”

This difficulty arises from the fact that the differences are so little marked and so variable that Gray himself (Synopt. catal. rept., tortoises: 1844, p. 32) considers synonyms of the *Cin. scorpioides* the following: *C. Shavianum*, *longicaudatum*, *brevicaudatum*, *pennsylvanicum*, var. [variety] of Shaw, *tricarinata* and *Retzii*. Agassiz (loc. cit.) considers *C. oblongum*, *Doubledayi* and *leucostomum* as var. [variety] from *pennsylvanicum*. We could multiply the citations, but we will limit ourselves to the following reflections: considering *hirtipes* as a simple anomaly of the *pennsylvanicum* without nuchal plate, we have the *rostellum*, *pennsylvanicum* and *leucostomum* for those who look alike more to the individuals of the Valley of Mexico; but the *rostellum* is a young female not yet well characterized, which I myself referred to Bocourt and belongs to the species *guanajuatense*; *leucostomum* is confused by transitions with *pennsylvanicum*; Finally, the *Shavianum* is distinguished from other neighbors only because the carapace does not have a rapid backward inclination.

We are left, therefore, by way of exclusion, with the species *Cinosternon pennsylvanicum*, Gmelin (*Thyrosternum* of Agassiz), which seems to be referred to as varieties by all individuals from the Valley of Mexico and those from the State of Guanajuato. As for the other species that feature in Bocourt's painting, they are so little characterized, that I have seen specimens with combined characters of *pennsylvanicum* and *rostellum*; others between *rostellum* and *leucostomum*, others, in short, participating in the distinctive features of *rostellum*, *leucostomum* and *Effeldti*, without it being possible to say exactly which of these forms were to be referred to. The *C. Berendtianum*, Cope, from Tabasco, seems, however, a good species.

Figure 20d. Reproduction of page 107 (left above) from Dugès (1888) with his evaluation of the species of kinosternids in the Valley of Mexico, and our English translation (right above; our comments presented in square brackets = []). Imaged from www.archive.org

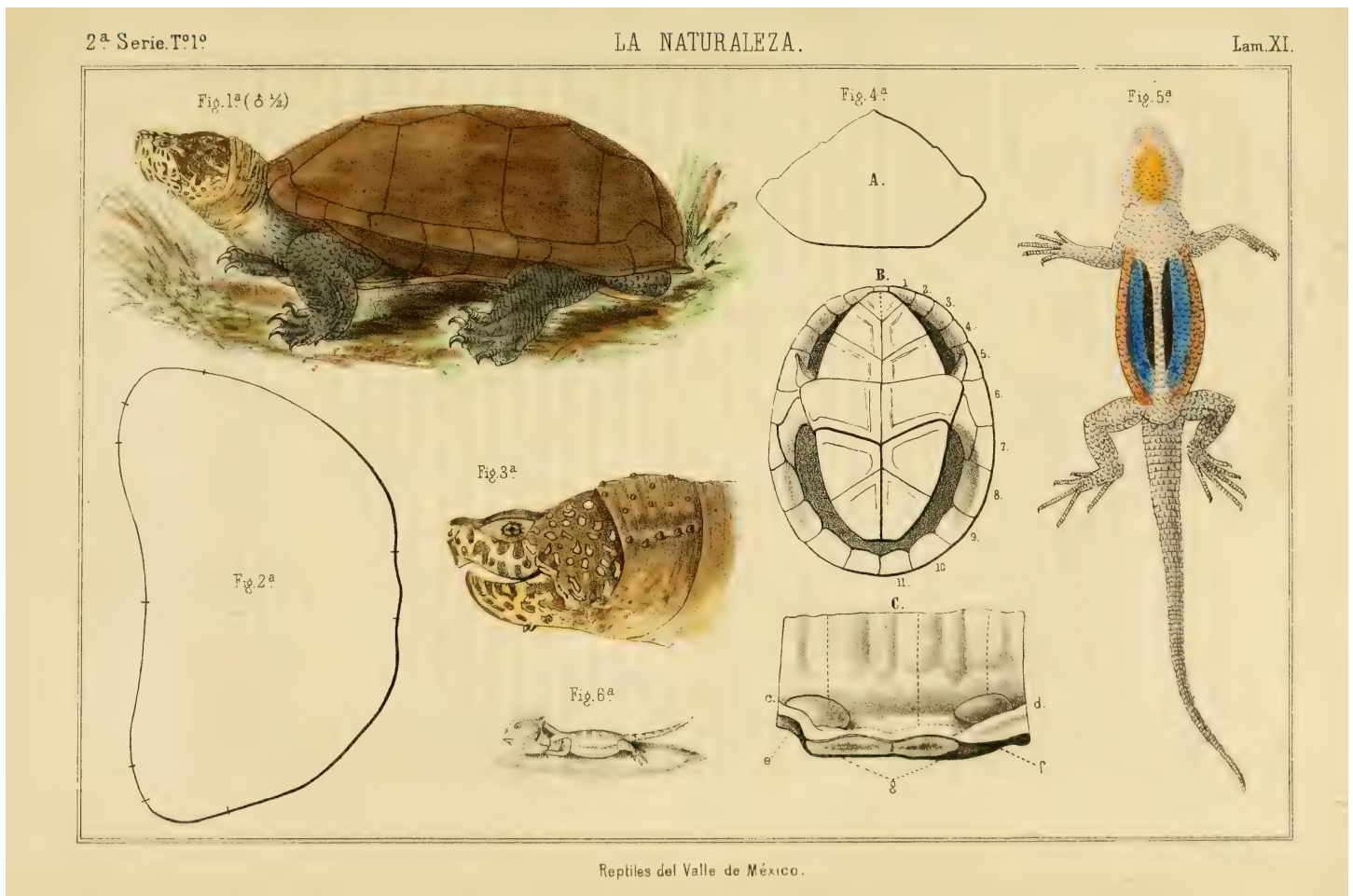


Figure 20e. Reproduction of Plate 11 from Dugès (1888) illustrating a male specimen of what is today considered *Kinosternon integrum*, in color. The line illustration of the juvenile specimen (labelled Fig. 4a, 4b, 4c) may appear to represent a *Kinosternon hirtipes* but the arrangement of the bridge, inframarginal scutes and plastral lobes argue for a juvenile *K. integrum*. Smith & Smith (1979) considered that Dugès (1888) was unable to distinguish *K. integrum* from *K. hirtipes*. Imaged from www.archive.org

Appendix E

Additional images of live adult female *Kinosternon integrum* sensu stricto.



Figure 21a. Anterior (top) and posterior (bottom) views of two adult female Guajalato Mud Turtles *Kinosternon integrum* sensu stricto.



Figure 21b. Dorsal and ventral views of two adult female Guanajuato Mud Turtles *Kinosternon integrum* sensu stricto.

Appendix F

Additional images of museum preserved *Kinosternon integrum*.



Figure 22a. AMNH R117948, a male *Kinosternon integrum* sensu stricto from Tungitiro, Michoacán, Mexico; collector J. D. Anderson, July 8, 1967.



Figure 22b. Young adult and juvenile female specimens of *Kinosternon integrum* *sensu stricto* all from Guanajuato, Mexico.
From top to bottom: AMNH R117944; AMNH R117946; AMNH R117945; AMNH R158037.



Figure 22c. Hatchling and juvenile *Kinosternon integrum* sensu stricto all from San Antonio de las Alamitos, Nuevo Leon, Mexico.
From top to bottom: AMNH R158065; AMNH R172776; AMNH R172775; AMNH R158064.



Figure 22d. *Kinosternon integrum* sensu stricto, juvenile female, AMNH R158057 from San Antonio de las Alamos, Nuevo Leon, Mexico.

Appendix G

Additional images of MNHN RA2112, the holotype of *Cinosternon rostellum* Bocourt, 1876

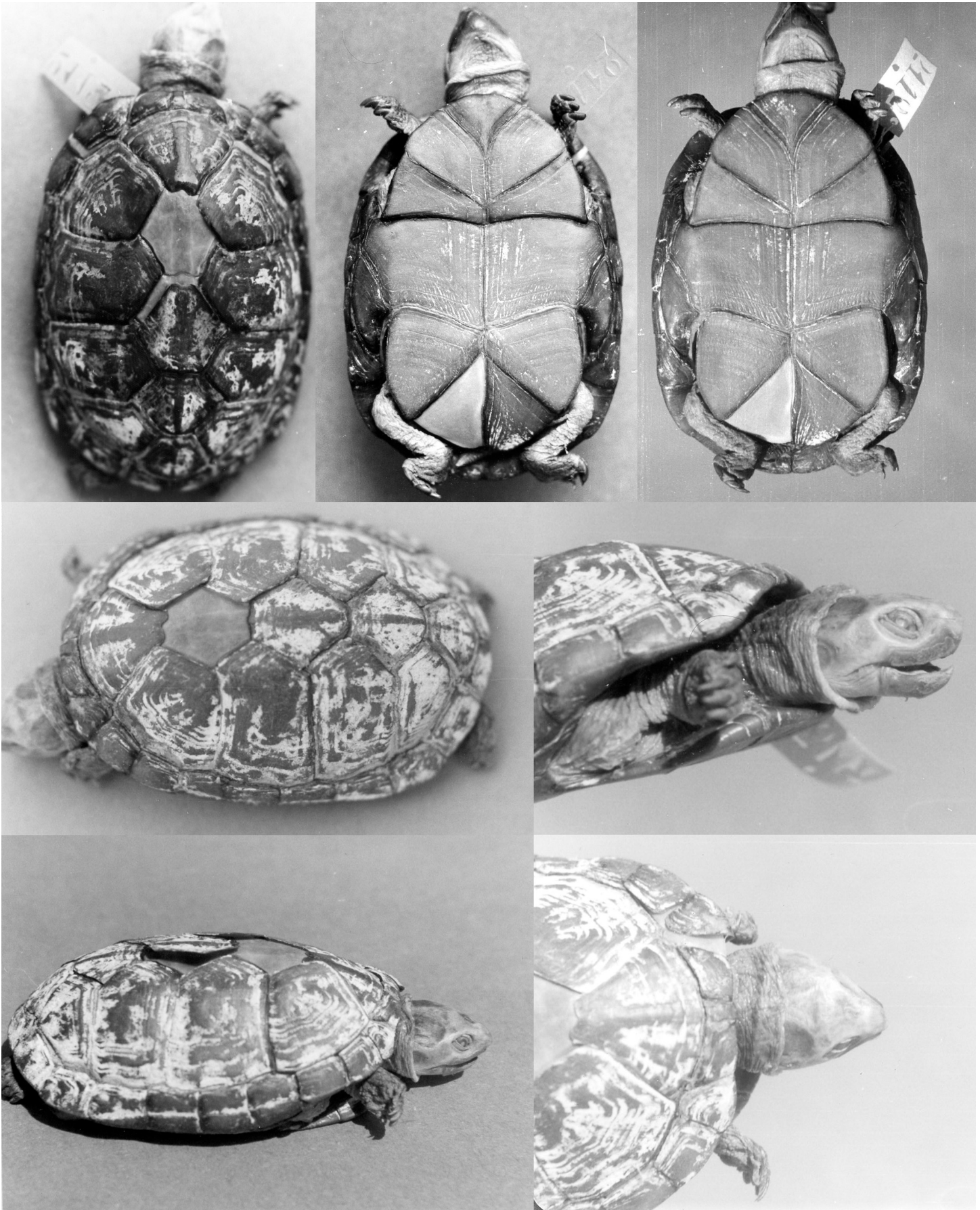


Figure 23. Additional images dating from the 1970s of MNHN RA2112, the holotype of *Cinosternon rostellum* Bocourt, 1876. Photos courtesy of J.B. Iverson.

Appendix H

Article 75: Neotypes, of the International Code of Zoological Nomenclature

Article 75. Neotypes

75.1. Definition

A neotype is the name-bearing type of a nominal species-group taxon designated under conditions specified in this Article when no name-bearing type specimen (i.e. holotype, lectotype, syntype or prior neotype) is believed to be extant and an author considers that a name-bearing type is necessary to define the nominal taxon objectively. The continued existence of paratypes or paralectotypes does not in itself preclude the designation of a neotype.

75.2. Circumstances excluded

A neotype is not to be designated as an end in itself, or as a matter of curatorial routine, and any such neotype designation is invalid.

Example. If an author designates a neotype for *Xus albus* Smith, a species about whose identity there is no doubt and which is not involved in any complex zoological problem at the time at which it was designated, the purported "neotype" has no name-bearing status.

75.3. Qualifying conditions

A neotype is validly designated when there is an exceptional need and only when that need is stated expressly and when the designation is published with the following particulars:

75.3.1. a statement that it is designated with the express purpose of clarifying the taxonomic status or the type locality of a nominal taxon;

75.3.2. a statement of the characters that the author regards as differentiating from other taxa the nominal species-group taxon for which the neotype is designated, or a bibliographic reference to such a statement;

75.3.3. data and description sufficient to ensure recognition of the specimen designated;

75.3.4. the author's reasons for believing the name-bearing type specimen(s) (i.e. holotype, or lectotype, or all syntypes, or prior neotype) to be lost or destroyed, and the steps that had been taken to trace it or them;

75.3.5. evidence that the neotype is consistent with what is known of the former name-bearing type from the original description and from other sources; however, a neotype may be based on a different sex or life stage, if necessary or desirable to secure stability of nomenclature;

75.3.6. evidence that the neotype came as nearly as practicable from the original type locality [Art. 76.1] and, where relevant, from the same geological horizon or host species as the original name-bearing type (see also Article 76.3 and Recommendation 76A.1);

75.3.7. a statement that the neotype is, or immediately upon publication has become, the property of a recognized scientific or educational institution, cited by name, that maintains a research collection, with proper facilities for preserving name-bearing types, and that makes them accessible for study.

75.4. Priority

The first neotype designation published for a nominal species-group taxon in accordance with the provisions of this Article is valid and no subsequent designation, except one made by the Commission under the plenary power [Art. 78.1], has any validity (also see Article 75.8 for the status of a neotype if a former name-bearing type is rediscovered).

75.4.1. If a validly designated neotype is lost or destroyed, a new neotype, if one is designated to replace it, must satisfy the provisions of this Article.

Recommendation 75A. Choice of neotypes. Authors are advised to choose neotypes from any surviving paratypes or paralectotypes unless there are compelling reasons to the contrary, such as data inadequate to meet taxonomic requirements, the poor condition of the specimens, or probable mixture of taxa. All things being equal, topotypic specimens (see Glossary) from the type series should be given preference.

Recommendation 75B. Consultation with specialists. Before designating a neotype, an author should be satisfied that the proposed designation does not arouse serious objection from other specialists in the group in question.

75.5. Replacement of unidentifiable name-bearing type by a neotype

When an author considers that the taxonomic identity of a nominal species-group taxon cannot be determined from its existing name-bearing type (i.e. its name is a *nomen dubium*), and stability or universality are threatened thereby, the author may request the Commission to set aside under its plenary power [Art. 81] the existing name-bearing type and designate a neotype.

Example. The holotype of the ammonite species *Cycloceras laevigatum* McCoy, 1844 lacked important diagnostic features. Upon request the Commission under its plenary power set aside the type status of this specimen and designated a neotype (Opinion 1720 (1993)).

75.6. Conservation of prevailing usage by a neotype

When an author discovers that the existing name-bearing type of a nominal species-group taxon is not in taxonomic accord with the prevailing usage of names and stability or universality is threatened thereby, he or she should maintain prevailing usage [Art. 82] and request the Commission to set aside under its plenary power [Art. 81] the existing name-bearing type and designate a neotype.

Example. On discovering that the only existing type specimen of *Aradus caucasicus* Kolenati, 1857 (Heteroptera) was a specimen of another species, Kerzhner & Heiss (1993) proposed that the prevailing usage of the names of both species should be conserved by the designation of a neotype for *A. caucasicus* under the Commission's plenary power, and this was accepted in Opinion 1783 (1994).

75.7. Status of neotypes designated before 1961

A neotype designation published before 1961 takes effect from its date of publication if it then fulfilled all the provisions of this Article; it is invalid if it did not fulfil them.

Recommendation 75C. Invalid designations. An author who published an invalid neotype designation before 1961 should if possible be given an opportunity to make it valid before another author designates a neotype for the same nominal species-group taxon.

Recommendation 75D. Preference for earlier invalid "neotypes". If an invalid neotype designation was published before 1961, the specimen then designated should be given preference when a neotype for the same nominal species-group taxon is validly designated.

75.8. Status of rediscovered former name-bearing types

If, after the designation of a neotype, the name-bearing type (holotype, syntypes, lectotype or previous neotype) of the nominal species-group taxon that was (were) presumed lost is (are) found still to exist, on publication of that discovery the rediscovered material again becomes the name-bearing type and the neotype is set aside (unless, following an application, the Commission rules that the neotype is to be retained as the name-bearing type).

Figure 24. Reproduction of Article 75 of the ICZN governing the designation of neotype specimens (from (<https://code.iczn.org/types-in-the-species-group/article-75-neotypes/?frame=1>)).