A REVISION OF MALACLEMMYS, A GENUS OF TURTLES.

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INTRODUCTION.

During the summers of 1902 and 1903 the writer was engaged in conducting a series of experiments for the Bureau of Fisheries with the object of determining the life history of the diamond-back terrapin and its adaptability to artificial propagation. The field of work covered Chesapeake Bay and its tributary rivers, but the major portion of the time was spent at Solomons Island, a small town at the mouth of the Patuxent River, and at Crisfield, Maryland, the well-known oyster, crab, and terrapin depot on the "Eastern Shore." Both of these localities afford excellent facilities for study not only of the terrapin native to Chesapeake waters, but of those from other localities as well, for certain residents of these towns are extensively engaged in impounding the animals to fatten them for market, for this purpose buying them wherever they can be obtained. There have thus been brought together collections of diamond-back terrapin which are unsurpassed by the collections in any museum, and which have the added advantage of containing living instead of dead specimens.

In addition to the observations in these localities, the markets of Baltimore and Washington have been carefully watched; and the Bureau of Fisheries, through its agents in various southern cities, has secured a number of interesting specimens, from which the accompanying color drawings have been made. Through the courtesy of the American Museum of Natural History I have been enabled to study the terrapin in that collection, including types of Maximilian's *Emys pileata;* and the specimens in the United States National Museum were also placed at my disposal, through the kindness of Doctor Stejneger, who has assisted me in many ways.

An extensive series of photographs made by the writer from the living animals furnishes a part of the illustrations accompanying this paper. The remaining plates are taken from photographs by Mr. R. E. Coker, of the Beaufort (N. C.) laboratory of the Bureau of Fisheries, and from color drawings by Miss E. A. Woodbury; to whom, and to the dealers in terrapin who assisted me in my work, I return grateful acknowledgment, with special thanks to Mr. J. C. Webster, of Solomons, Maryland, and Messrs. H. Tawes, J. H. Riggin, and A. T. Lavallette, of Crisfield, who allowed me to prosecute investigations at their pounds and to study the shipments of terrapin as received.

GENERIC SYNONYMY AND DIAGNOSES.

The genus *Malaclemmys* was established in 1844 by Gray to receive the species described by Schoepff under the name *Testudo terrapin*.

The synonymy of the genus is as follows:

Emys, part, Dum., Zool. Anal., p. 76, 1806.
Emys, part, Dum. and Bibr., II, p. 232, 1835.
Clemmys, part, Wagler, Syst. Amphib., p. 136, 1830.
Clemmys, part, Strauch, Chelon. Stud., p. 28, 1862.
Terrapene (not of Merrem), part, Bonap., Osserv. s. sec. Ed. d. R. A., p. 135, 1830.
Malaclemmys Gray, Cat. Tortoises, &c., of the Brit. Mus., p. 28, 1844.
Malaclemmys Gray, Cat. Shield Rept. I, p. 37, 1855, and Suppl., p. 41, 1870.
Malacoclemmys Agassiz, Contrib. Nat. Hist. U. S., p. 437, 1857 (nom. emend.).
Euchyloclemmys Sclater, Ann. and Mag. Nat. Hist., I, p. 292, 1858 (name proposed as a substitute for *Malacoclemmys* Agassiz).

The genus is characterized by Boulenger (1889, p. 89) as follows: "Neural plates hexagonal, short-sided in front, plastron extensively united to the carapace by suture, with feeble axillary and inguinal peduncles, the latter anchylosed to the fifth costal plate; entoplastron anterior to the humero-pectoral suture. Skull with a bony temporal arch; alveolar surface very broad, without median ridge; choanæ behind the level of the eyes. Upper surface of head covered with undivided skin. Digits webbed. Tail short. North American." The species included are *M. terrapin* Schoepff, *M. geographica* (Lesueur), and *M. lesueurii* (Gray).

In 1890, Baur (Science, XVI, p. 262, Nov., 1890) added to this list two new species, *M. oculifera* and *M. kohnii*, but later he reestablished the genus *Graptemys* of Agassiz and removed to it *M. geographica*, *M. lesueurii*, *M. oculifera*, and *M. kohnii*, thus leaving *M. terrapin* of Schoepff the only species in the genus *Malaclemmys*.

The examination of the extensive series of diamond-back terrapin which have been available to me shows that instead of one there are at least four well-marked species and one subspecies: *M. centrata* (Latrielle), *M. centrata concentrica* (Shaw), *M. macrospilota* sp. nov., *M. pileata* (Max. zu. Wied), and *M. littoralis* sp. nov. The description of these will be found in this paper.

The genus *Malaclemmys* as recognized here and by Doctor Baur may be characterized as follows:

Emydoid chelonians with the plastron united to the carapace by wide but flat bridge; hind legs stouter than the fore legs and provided with a broad web extending beyond the articulation of the nail joint; distinct scales present only on the legs and feet; inguinal and axillary scales small or wanting; horny sheath of jaws straight, strong, and smooth; alveolar surface flat and broad, without ridges; alveolar margins meeting at an angle in the upper jaw and tapering to a triangle in the lower jaw. All the species are American and inhabit salt marshes along the Atlantic and Gulf coasts.

BIBLIOGRAPHY OF THE GENUS.

By practically all who in recent years have treated of the genus *Malaclemmys*, only a single species has been recognized, and although most of the authors have spoken of its extreme variability, but few of them have gone so far as to propose names for any of the forms.

The synonymy to be cited is as follows:

Testudo terrapin Schoepff, Hist. Test., p. 64, pl. xv, 1792 (not *T. terrapin* Gmel. 1788).
Testudo terrapin Schoepff, Naturgesch. der Schildkröten, parts 3 & 4, p. 71, 1793.

Testudo terrapin Bechstein, Lacepede's Naturgesch. der Amphib., I, 166, pl. IV, fig. 2, 1800.
Testudo centrata Latreille, Hist. Nat. des Rept., I, p. 145, 1802.
Testudo centrata Daudin, Hist. Nat. Gen. et Partic. des Rept., II, p. 153, 1803.
Testudo concentrica Shaw, Gen. Zool. III, p. 43, pl. IX, 1802.
Testudo palustris Le Conte (non Gmel.), Ann. Lyc. N. Y., III, p. 113, 1830.
Emys centrata Schweigger, Prodrom. Iconog. Chel., p. 32, 1814.
Emys centrata Say, Jour. Acad. Nat. Sci. Phila., Ser. I, IV, p. 205, 1825.
Emys concentrica Gray, Synop. Rept., part 1, p. 27, 1831.
Emys concentrica Bell, Monograph Test. 1834.*
Emys concentrica Duméril et Bibron, Érpétol. Gén., II, p. 261, 1835.
Emys terrapin Holbrook, North Am. Herpetol., I, p. 87, pl. XII, 1842.
Emys terrapin De Kay, Fauna N. Y., II, pl. XIII, fig. 63, 1842.
Emys terrapin Maximilian zu Wied, N. Acta. Acad. Leop. Carol. XXXII, I, p. 16, 1865.
Emys palustris De Kay, l. c., p. 10, pl. III, fig. 5.
Emys pileata Maximilian zu Wied, l. c., p. 17, pl. I, figs. 2 & 3, 1865.
Terrapene palustris Bonaparte, Osserv. sulla seg. Ed. Cuvier Reg. Anim., p. 157, 1830.
Malaclemmys concentrica Gray, Cat. Tort., &c., Brit. Mus., p. 28, 1844.
Malaclemmys concentrica Gray, Cat. Shield Rept. Brit. Mus., p. 37, 1855, and suppl., p. 42, 1870.
Malaclemmys var. *centrata* Gray, Cat. Shield Rept. Brit. Mus., p. 37, 1855.
Malaclemmys var. *tuberculifera* Gray, Cat. Tort., &c., Brit. Mus., p. 28, 1844.
Malaclemmys var. *areolata* Gray, Cat. Shield Rept. Brit. Mus., p. 37, 1855.
Malacoclemmys palustris Agassiz, Contrib. Nat. Hist. U. S., I, p. 437, pl. I, figs. 10 and 12, pl. 7a, figs. 11–14, 1857.
Clemmys terrapin Strauch, Chelon. Stud., p. 132, 1862.*
Clemmys terrapin Strauch, Verth. Schildkr., p. 90, 1865.*
Malacoclemmys terrapen Boulenger, Cat. Chelon. Brit. Mus., p. 89, 1889.
Malaclemmys concentrica Sowerby & Lear, Tortoises, &c., p. 8, pls. XXXIII–XXXVI, 1872.
Maldclemmys terrapin Bangs, Proc. Bost. Soc. Nat. Hist. XXVII, 159–161, 1896.
Malaclemmys centrata Jordan, Manual of the Vertebrates, 8th ed., p. 209, 1899.

A review of the literature given in the above list, only those works marked (*) having been inaccessible to me, has brought out the following facts, which are presented in full:

1792. SCHOEPFF, J. D.—Historia Testudinum, pp. 64–66, pl. XV.

This author describes "the terrapin" under the name *Testudo terrapin*, and gives three figures of the animal, showing the carapace, plastron, and a front view (the first two figures colored). The habitat is given as North America.[a]

The figure shows a shell which must have come from the northern form, probably from Delaware Bay or northward. The carapace is brown with darker mottlings, and the concentric ridges on the plates are plainly visible. The greatest height is at the 3d vertebral plate. The plastron is light yellow with a large orange blotch and an irregular dusky ring or rectangle on each plate.

Unfortunately Schoepff seems to have been misled by the name *terrapin*, and accordingly regarded his species as identical with the species of Gmelin, which was based on the species described by Brown from Jamaica (Rept. Jamaica) under the name *Testudo terrapin* or *Testudo palustris*. The latter animal has nothing to do with the one in question and belongs to a distinct genus, *Pseudemys*.

1793. SCHOEPFF, J. D.—Naturgeschichte der Schildkröten, Abth. 3 u. 4, s. 71–74.

The description previously cited is given, though in German instead of Latin, with the additional statement that two of the shells upon which the species was based were brought by the author from North America. From the context we may infer that these two shells came from Long Island. The figure shown is the same as in the edition already referred to.

1800. BECHSTEIN, J. M.—Lacepede's Naturgeschichte der Amphibien, I, pp. 166–170, pl. IV, fig. 2.

Under the name *Testudo terrapin* the description of Schoepff is repeated. The plate is a reduced copy of Schoepff's figure, showing the shell from the side.

[a] "Habitat in America septentrionali. Duas inde mecum adportavi testas; duas minores misit Rev. Henr. Mühlenberg. *Terrapins* ibidem nuncupari solent, et hoc sub nomine in soris Philadelphiæ, et alibi, venales prostant. Licet capitis et extremitatum cognitione destitutus, aquaticam esse speciem pro certo tamen scio, nam maxima, quam possideo, hujus speciei testa, ex animali in aquis subdulcibus Insulæ Longæ capto, deprompta fuit."

In recentissime epistola, Rev. Mühlenberg sequentia addit: "Habitat in aquis salsis; ad pedis magnitudinem interdum excrescit. Pedes palmati; palmæ 5, plantæ 4-dactylæ, cauda brevis."

1802. LATREILLE, P. A.—Histoire Naturelle des Reptiles, Vol. I, p. 145, pl. VI, fig. 2.

A description of *Testudo centrata*, "la tortue à lignes concentriques." This description was communicated to Latreille in manuscript by Bosc, who had had an opportunity to study the diamond-back terrapin in the neighborhood of Charleston, S. C. It will be noticed that the specific name *centrata* is the earliest acceptable one, and the type locality may be fixed with almost perfect certainty as Charleston, S. C.

1802. SHAW, GEORGE.—General Zoology, vol. 3, pp. 43 and 44.

The author describes under the name *Testudo concentrica* a species which he says is sold in the markets of Philadelphia and elsewhere under the name of terrapin. It is a native of North America and was "apparently first described by Doctor Browne in his Natural History of Jamaica." Characterized as "tortoise with subdepressed, subcarinated, oval, yellow shell, with the scutella marked by concentric brown zones."

A varietal form of the species is figured on Plate IX, the carapace being shown in dorsal view, from "a fine specimen in the Leverian Museum, which is remarkable for having the dark zones on the several pieces of the shell double; being slightly separated by an intermediate line of pale or yellowish ground color." The figure shows the shell of the northern form of *M. centrata*. with the not uncommon character mentioned.

1803. DAUDIN, F. M.—Histoire Naturelle Générale et Particulière des Reptiles, Vol. II, pp. 153–158.

Under the name *la tortue à lignes concentriques*, this author describes a terrapin concerning which in a footnote on p. 153 he quotes as follows: "*Testudo centrata, lineis duabus aut quatuor atris, circulariter centratis, in scutellis loricæ superioris et marginis; sterno flavo immaculato, posticèque marginato.*" Bosc, description manuscrite communiquée.—Latreille, Hist. Nat. des Rept., I, p. 145, pl. VI, fig. 2.

Daudin doubts the validity of the new species, observing that it differs from Schoepff's only in having the plastron entirely yellow. His specimens came from Bosc, who reported them as coming from the sounds of Carolina. He describes three varieties, two based on color differences and one on the divided nuchal plate, but does not name them or assign localities.

1814. SCHWEIGGER, A. T.—Prodromi Iconographiæ Cheloniorum, p. 32.

In this pamphlet occurs the name *Emys centrata*, with references to Bosc, Nouvelle Dictionnaire d'Histoire Naturelle, vol. 22, p. 264, and to Shaw's General Zoology. In the description which follows there is nothing to indicate which form of the terrapin the author was describing except that it was based on six specimens in the Paris Museum and on those of Bosc, which, as before stated, probably came from the neighborhood of Charleston, S. C.

1825. SAY, THOS.—Journal Academy of Natural Sciences of Philadelphia, Ser. I, Vol. IV, p. 205.

In this paper the diamond-back terrapin is described as follows: *E(mys) centrata*. Shell somewhat ovate, carinate excepting on the last plate; plates with concentric circles, either simply colored or deeply impressed; posterior marginal scuta crenate; anterior one quadrate; skin whitish, with very numerous blackish spots; jaws simple.

1830. LE CONTE, J.—Annals of the Lyceum of Natural History of New York, III, p. 113.

Under the name *Testudo palustris*, this paper includes a description of *M. centrata*. The form is not identifiable. Three varieties are mentioned:

a. Smooth, with very few concentric striæ. Shell above gray, with concentric marks of black on each plate. Sternum yellow, spots on the skin larger.

b. Dark brown, somewhat varied with black; lateral and marginal plates more or less marked with concentric striæ; vertebral plates smooth.

c. With concentric striæ on all the plates and black concentric marks on some of them.

The distribution is stated to extend from New York to Florida and even to the West Indies, in salt water and always in the neighborhood of marshes.

1830. BONAPARTE, CARLO LUCIANO.—Testudinum Genera. Sulla Segonda Edizione del Regno Animale del Barone Cuvier Osservazioni di C.-L.-Bonaparte. 1830. Page 157, species 8.

Terrapene palustris. The description is in Latin and Italian and refers to *M. centrata* of all forms. The range is stated to extend from New York to Florida.

1831. GRAY, JOHN EDWARD.—Synopsis Reptilium. Part 1. Cataphracta, p. 27.

This author describes *Emys concentrica*, giving references to Bosc in Daudin's Histoire Naturelle des Reptiles, Schoepff, Latreille, Gmelin, and Schweigger. The following forms are described:

a. livida. Testa livida obscure annulata, *Emys livida* Bell, Mss.

b. polita. Testa margine revoluta, scutellis nigris politis profunde sulcatis, sterno lutescente maculis magnis nigris notatot.

Junior, testa carinis continuis scutellis sterni nigro marginatis; cute albido cinereo nigro maculato, capite colloque lineis nigris notatis.

Habit in America Boreali.

Continuing he says: "The head of the living animal is very broad and depressed like the *Hydraspes*, and the neck thick; skin slate colored, black-speckled. In the young specimens the skin is bluish and black-speckled; the forehead is marked with concentric black lines, and there are three curved black lines over each ear; the neck is also marked with short black strokes. The polished variety appears very different, but I have seen specimens which unite it with the common state of the species."

The latter part of this description, at least, undoubtedly applies to some other turtle than the diamond-back, probably to some South American species. The forms described under *a* and *b* are indeterminable, as no localities are assigned, and the descriptions are such as to make it uncertain whether they belong to this species at all.

1834. BELL, THOS.—Monograph of the Testudinata.

No copy of this work has been accessible to me, and I am therefore unable to cite the page or plate referring to the present species. From the fact that four of the plates depicting *Emys concentrica* and intended for this work were published later, by Sowerby and Lear, it is probable that the matter in Bell's Monograph is of little value.

1835. DUMÉRIL, A. M. C. et BIBRON, G.—Erpétologie Générale ou Histoire Naturelle des Reptiles.

On pp. 261–266, Vol. II, is a detailed description of *Emys concentrica* Gray. The authors regard this species as one of the most variable known to them, and describe three varieties, A, B, and C, based on the colors of the head, neck, legs, shell, and the markings. The material evidently came from numerous localities, and the distribution of the species is given as extending from New York to Florida.

1842. HOLBROOK, J. E.—North American Herpetology. Second edition, Vol. I, pp. 87–91, pl. XII.

Emys terrapin Schoepff. The author gives a detailed description of *M. centrata*, in which he refers to the very large head and the frequent greenish color of the head and shell. The specimens were evidently from South Carolina. The distribution given is from Rhode Island to Florida and the Gulf of Mexico (northern shores), and this species is stated to be the only one common to both North and South America.

The plate gives two views of an animal which is unmistakably the Carolina terrapin, *M. centrata*. The predominating color is greenish; the head is large and heavy.

1842. DE KAY, J. E.—Fauna of New York, Part II, pp. 10, 11.

The species figured in plate 23 is the characteristic northern form of *Malaclemmys centrata concentrica*. The concentric markings on the plates of the carapace are strongly brought out. *Emys palustris* and *Emys terrapin* are described, the former being called the "salt-water terrapin" and the latter the "smooth terrapin."

Of *Emys palustris* the author says: "It is well distinguished as the salt-water terrapin, for it is found exclusively in salt or brackish streams near the seashore. They bury themselves in the mud during the winter, from which they are taken in great numbers, and are then very fat. The geographical limits of this species extend from the Gulf of Mexico along the Atlantic to New York. They are found along the northern shores of Long Island to its extremity, but I am not informed whether it occurs on the opposite main shore. Dr. Storer does not mention it in his valuable report on the Reptiles of Massachusetts. The Prince of Canino has introduced this species into Italy, but I have not learned with what success."

Of *Emys terrapin* he says: "I am indebted to Major Le Conte for a figure and note, pointing out the distinctive marks between this and the preceding species * * *. They are brought to our

markets at the same time and sold under the common name of *terrapin*. The specimens of the two species of the same size, examined by Major Le Conte, were both females. I had noticed the two, but supposed them to be sexual varieties. The market people say they are caught in the same localities; but as Schöepff derived his specimens (the present species) from Mühlenberg, I am inclined to believe that the *E. terrapin* inhabits indifferently fresh and salt water. Schoepff himself found one on Long Island in water which was almost fresh."

De Kay's conclusions regarding the above species must have been based on insufficient material, or possibly on the really distinct northern and southern forms of *M. centrata*. It would be quite easy at the present day to pick out a dozen individuals in a large series of *M. centrata concentrica* which would differ from each other quite as much as the two specimens just mentioned.

1844. GRAY, JOHN EDWARD.—Catalogue of the Tortoises, Crocodiles, and Amphisbænians in the British Museum, London, p. 28.

Malaclemmys.—Generic diagnosis. "Salt-water terrapin, *Maloclemys concentrica=Testudo concentrica* of Shaw," etc.

Following this is a description and list of specimens: A, b, c, d, e, f, g, h, and i. Under h is noted, "Shell only (young); the three central vertebral plates with a central tubercle, the hinder tubercle orbicular. *M. tuberculifera*, Gray, B. M. California. Mr. J. Drummond's collection."

As no *Malaclemmys* is known to inhabit any part of North America except the eastern and southern coastal regions it is impossible to say to what the name *M. tuberculifera* refers, although the description fits admirably the young of the species from the Gulf of Mexico; the locality given may be erroneous or the turtle may not be a *Malaclemmys*.

1855. GRAY, JOHN EDWARD.—Catalogue of the Shield Reptiles in the Collection of the British Museum, London, p. 37.

Malaclemmys. Generic diagnosis.

Malaclemmys concentrica, salt-water terrapin.

Var. 1. *concentrica.*, Head black-lined, limbs black-spotted; shield smooth; dorsal and sternal shields with well-defined dark rings.

Var. 2. Not named.

Var. 3. *centrata.* Head black, with small specks, etc.

Var. 4. *tuberculifera.* Characters given in preceding reference. Locality, California.

Var. 5. *areolata.* Head small, back elevated. Central America. Peten.

For varieties 1, 2, and 3 no more definite locality is given than North America, and the distinction is probably based on color variations such as are to be found among any considerable number of these animals. *M. areolata* is too insufficiently described to be identifiable with anything now known, but the record is of interest in that it shows that the genus extends to the neighborhood of Yucatan.

1857. AGASSIZ, L.—Contributions to the Natural History of the United States, I, pp. 437–438; II, pl. I, figs. 10–12, pl. 7a, figs. 11–14.

Gray's genus *Malaclemmys* is recognized as very distinct, but the name is altered on etymological grounds to *Malacoclemmys*. A single species, *M. palustris*, is mentioned and a short description is given. The range is stated to extend along the Atlantic coast, in salt marshes, from New York to Texas, and even to South America. Specimens from the States bordering on the Gulf of Mexico are said to be generally smaller than those of the Atlantic States and the edge of the carapace is more revolute; but such specimens occur even in the vicinity of New York. In all other respects, also, the species is said to be extremely variable. *Emys areolata* A. Dumeril, it is stated in a footnote (p. 437), was probably based on a specimen with strongly revolute marginal plates, from the Gulf of Mexico.

Emys macrocephalus Gray, is said (footnote, p. 438) to have been based on a large-headed variety of *M. palustris* (=*M. centrata*).

Figures show the young and the eggs of *M. centrata*.

1862. STRAUCH, A.—Chelonien Studien.

This work has not been accessible to me. I therefore cite the page reference given by Boulenger—*Clemmys terrapin*, p. 132.

1865. STRAUCH, A.—Vertheilungen der Schildkröten.

Like the preceding work, this has not been in my hands, and the reference is Boulenger's—*Clemmys terrapin*, p. 90.

1865. MAXIMILIAN, PRINZ ZU WIED. Verzeichniss der Reptilien welche auf einer Reise in Nördlichen America beobachtet werden; p. 16, pl. 1, figs. 2 and 3.

Contains several paragraphs on *E. terrapin* Schoepff, which are evidently condensations of the more lengthy descriptions of other authorities. The author mentions having seen the animals in the markets of New York and Pittsburg and states that he received in the winter of 1832–33, while at New Harmony, Ind., a lot of nine terrapins from New Orleans which appear to show constant differences from *E. terrapin* of the more northern waters, and which he will describe as *Emys pileata*, "die Emyde mit schwarzen Scheitel." "*E. pileo* nigro splendente; corpore cinereo, maculis nigris; testa immaculata aterrima, margine subtus aurantiaco, subrevoluto." Then follows the description of "an apparently female animal:"

"A thick, rounded emyd, with thick head, massive, strong shell, which, when looked at from above, has a rounded, elliptical form, only slightly convex; somewhat depressed in front and behind; seen from the side, is higher in front than behind; all the marginal plates somewhat revolute, and all the vertebral plates with a strong knob or carina, so that the upper line in profile has almost a saw-toothed appearance. The head of the animal is thick, broad, flat above, very smooth skinned, or covered with a smooth, horny shield, which on the top of the head forms a diamond-shaped surface, and is concave, in so much as the sides of the head are somewhat swollen. The eyes are not prominent. * * * The horny covering of the lips is very wide, extending to just below the eyes. The neck is smooth skinned, of medium length * * * Tail rather short.

"Color: Head and neck ash gray, washed with greenish on the sides of the top of the head. Upper side of neck clear olive brown, but everywhere with small black or dark-brown specks. Legs and body darker gray than the head, everywhere strongly spotted; an olive-yellow streak from the eye to behind the nose (often wanting). A constant character is the black-brown rhomboidal field which covers the top of the head, extending from the nose to the back of the head and from eye to eye. Carapace uniform black, sometimes brown-black, but without any markings except the clear orange on the uprolled marginal plates. The plastron is uniform dusky yellow, or clear gray-yellow, with an occasional clouding of brown or dusky, usually uniform, however. Lips reddish white, claws grayish yellow, hind legs and tail dark gray with the dark speckling obscure, iris olive yellow with small gold specks.

"The male similar, but with a black mustache; plastron clouded with brownish black.

"These emyds occur throughout the Southern States, especially in the salt marshes at the mouth of the Mississippi, near New Orleans, whence they were brought to me alive. They are brought to market by the fishermen, especially the negroes and Indians."

Maximilian thinks that Duméril and Bibron had this species for examination. The plate shows a male with the above characters.

1872. SOWERBY and LEAR.—Tortoises, Terrapins, and Turtles drawn from life by James de Carle Sowerby, F. L. S. and Edward Lear.

A series of plates made under the superintendence of Mr. Thomas Bell to illustrate his Monograph of the Testudinata, but owing to the interruption of that work not published with it. Bell declined to furnish text with these plates and it was supplied by John Edward Gray.

Emys concentrica, No. 22, p. 8, pls. XXXIII, XXXIV, XXXV, and XXXVI. The text is of no value. The description is confined to two lines, and then follow quotations from Agassiz and Holbrook. The distribution is stated to be from Rhode Island to Florida, also along the shores of the Gulf of Mexico. "This seems to be the only *Emys* common to North and South America, and it does not appear to be found in the West India Islands."

Pl. XXXIII, a dorsal view of *Emys concentrica; a* represents a rather large-headed form of *centrata*, but with the concentric markings prominent. Female.

Pl. XXXIV represents the under side of the shell only.

Pl. XXXV, dorsal view of *E. concentrica; c* represents an individual with a much-pitted shell. Male.

Pl. XXXVI, dorsal view of *E. concentrica; b* represents an individual probably a Carolina male.

1889. BOULENGER, G. A.—Catalogue of the Chelonians of the British Museum.

On page 89 this author gives a diagnosis of the genus *Malacoclemmys* and describes *M. terrapin*. The full synonymy is the most valuable part of this reference.

1896. BANGS, OUTRAM.—Proceedings Boston Society of Natural History, XXVII, 159–161, Oct., 1896.

Records the occurrence of *M. terrapin* in the headwaters of Buzzards Bay, at Eastham, on Cape Cod. "After careful study we came to the conclusion that the terrapin from the whole Atlantic coast is one species. It is subject to the most extraordinary range of individual variations, however, not only in color, markings, and roughness of shell, but in the more important structural features, such as size and shape of skull, of the horny portions of the mouth and the alveolar region. All these variations are purely fortuitous and do not depend on age, sex, or locality. It is hard to find two terrapin alike." The author does not believe the species was introduced into Buzzards Bay. An 8-inch terrapin, he thinks, is 50 years old.

1899. JORDAN, DAVID STARR.—Manual of the Vertebrates, 8th edition, p. 209.

This work contains a short description of *Malaclemmys centrata* Latreille. Under this name all the diamond-back terrapin are included, but the work is of interest as being the first in which the proper combination of generic and specific names occurs.

GENERAL NATURAL HISTORY.

Diamond-back terrapins, so well known to connoisseurs and purveyors of sea food, are distributed more or less continuously along the eastern coast of North and Central America from Buzzards Bay, Massachusetts, to Yucatan.[a] All the species are lovers of salt or brackish water and find their most congenial homes in low-lying swamps and protected bays or inlets; but they also occur more or less abundantly in nearly all the rivers that empty into the sea within the limits given, and they ascend these rivers to points where the water is quite sweet. In the James River *M. centrata* is found considerably above Jamestown; in the York River it was formerly abundant at West Point; in the Potomac individuals have been taken within 4 miles of Washington.

Of the habits of *M. littoralis*, *M. pileata*, and *M. macrospilota*, absolutely nothing is known except as observed in individuals transported to the pounds near Crisfield, Maryland. Here they act much like *M. centrata*, but go early into hibernation and emerge late in the spring.

The northern species, *M. centrata*, is well known, and its habits have been carefully studied. Its period of hibernation begins soon after the advent of cold weather, but for some weeks it emerges whenever there is a warm day. Eventually, however, it buries itself completely at the bottom of some pool or stream and remains until spring. Very soon after the winter sleep is over it seeks out others of its kind and the process of reproduction begins. Conjugation usually takes place at night or in the very early hours of morning, and always in the water, the diminutive male being carried about on the back of the female. The eggs are laid during May or June, for the most part. For a nest the female, with her hind legs, digs a hole in some convenient bank, and at a depth of 5 or 6 inches deposits from 5 to 12 eggs. She then crawls out, carefully covers up the nest, effaces every trace of her work, and departs. The eggs hatch in about six weeks, if the weather is warm, but may require twice as long if the season is a cold one. The young soon after hatching go to the marsh and dig into the ground, where they spend the first winter and possibly a part of the second summer. The growth is, for a turtle, fairly rapid, the average increase in length being about 1 inch a year until 5 inches or thereabouts is reached, when it becomes slower. Growth probably continues throughout the life of the individual but in old age is so slow as to be almost imperceptible. Twenty-five or thirty years is apparently the limit of life.

[a] Their occurrence in Yucatan has been recorded by Gray (1855). It is quite possible that the range extends farther to the southward, but Professor Agassiz's statement that it reaches some point on the coast of South America is not supported by any evidence. The genus *Malaclemmys* does not appear in Cope's list of the reptiles of Mexico.

The food of the diamond-back terrapin consists largely of such crustaceans and mollusks as it is able to catch and crush, but as its jaws are rather weak it is compelled to feed upon the smaller and softer animals of these groups. During exceptionally high tides it sometimes follows the water into the grassy lowlands, and may be seen to catch and eat insects. The tender shoots and rootlets of some of the marsh plants are also eaten, and undoubtedly at times form a very considerable portion of the food. Fresh water seems to be a necessity to the well-being of the diamond-back terrapin, though it can live for a long time without it.

Although it is a common belief in many places where this turtle is found that it is nomadic, moving restlessly from place to place, and that it is able to make considerable journeys in a very short space of time, there is no evidence to support these notions. On the contrary, the individual born in or accidentally transported to a favorable locality probably stays there indefinitely; no other theory will explain the numerous local races and the stories of the reappearance of certain marked terrapins season after season. The former abundance of the diamond-back is a matter of record. At one time hundreds could be seen in a single day where now perhaps only one or two can be found in a season. Thanks to lax laws and ruthless hunters, the species is on the verge of extinction, and before long, unless proper measures are taken, must be numbered among the great host of animals that man has exterminated.

SEXUAL DIFFERENCES.

The sexual differences in the genus *Malaclemmys*, aside from the genital parts, are greater than in any other group of turtles known to me. The females are much larger than the males, they alone attaining the sizes usually cited in descriptions. Their heads are heavier and less pointed, their bodies deeper, and their tails shorter. The males seldom, if ever, reach a greater length than 5 inches[a]; the shell is flatter

[a] Terrapins are usually sold in market by length instead of weight, the measurement being made along the middle line of the lower shell, or plastron, from the lowest point in front to the bottom of the posterior notch. Throughout this paper I follow the popular method of measurement, and such citations of length as are made must be so understood. The length of the carapace exceeds that of the plastron, sometimes slightly, sometimes considerably, varying with the age and the species of the individual; but so far as I have been able to determine the proportion does not possess sufficient constancy to be of value as a character. The following table shows the variations for a number of specimens in this and certain other respects:

Locality.	Sex.	Bottom shell.	Top shell.	Weight.	Supposed age.
		Inches.	*Inches.*	*Ounces.*	*Years.*
Chesapeake Bay	♀	4 6/8	5 1/4	16	7
	♀	4	4 1/2	10	5
	♀	4 5/16	5 1/4	16	6
	♀	4 13/16	5 5/16	16	8
	♀	5 3/8	6 1/4	24	6
	♀	6 3/8	7 1/4	48	9
	♀	7 3/16	8 1/4	48	10
	♂	4 3/4	5 1/16	17	6
	♂	3 11/16	4 3/8	11	5
North Carolina	♂	4 7/16	5 3/16	15	5
	♀	4 1/2	4 3/4	12	6
	♀	4 1/2	4 3/4	14	7
	♀	4 1/16	4 9/16	11	5
	♀	4 1/16	5 3/8	16	5
Florida	♂	4 1/4	4 13/16	13	(?)5
	♀	4 3/4	5 7/16	16	5
	♀	4 1/4	5 1/16	12	6
Texas	♂	4 7/16	5 1/2	.....	.....
	♀	7	8 1/16	(?)	(?)
	♀	6 9/16	7 1/4	.....	8
	♂	4 11/16	5 9/16	.....	8

than that of the female, and posteriorly more triangular; the marginal plates are apt to be revolute, the head is smaller, the nose sharper, and the tail longer. All these characters, except the difference in size, are shown in the illustrations accompanying this paper. In the descriptions the female has in every case been placed first, as the material available consists almost entirely of this sex. The laws of several states where the industry is conducted forbid the sale of terrapin less than 5 or 6 inches in length, and therefore only females are caught and sent to market, the males being thrown aside as worthless. Largely on this account the collections of terrapin, in museums as well as in the terrapin pounds, contain very few males. Furthermore, in the pounds the males are thrown together regardless of the locality from which they came. If possible, this sex is more variable than the other and is really not as satisfactory for the purposes of the present paper.

Of the Georgia and the Louisiana terrapins, the writer has not seen perfectly satisfactory male specimens, but males of all the other species have been examined and will be dealt with in their proper places.

DIFFERENCES DUE TO AGE.

Aside from the natural increase in size and weight the turtles of this genus exhibit some very interesting and important changes in form and sculpture as they advance in age. The young of the northern species, *M. centrata*, and its subspecies resemble the female parent very closely, with the shell perhaps a little rounder and the head proportionally a little larger. The color, however, in every case among the large number I have seen, was a dark blackish-brown, the soft skin being everywhere so thickly speckled with black as nearly to obliterate the ground color. The top of the head and the lips were always dark. The carapace and plastron were more or less flexible and the covering plates, while finely pitted, never showed concentric ridges, and only occasionally the concentric markings so conspicuous in the adult. As the young animal increases in size the plates of the shell are spread apart. To fill the space thus left new shell is developed, underlying the original plates and extending beyond their margins, where it appears in the first year as the first concentric ridge. Presumably this growth takes place periodically, as Agassiz (1857, pp. 260, 290) observed in several species of turtles, and the age of the turtle can be approximated by counting the ridges. For the first six or seven years the growth appears to be quite uniform, the ridges being well separated and usually quite easily counted. Later in life the growth is much slower and the ridges are so close together and so narrow that it becomes impossible to distinguish them. The determination of the age of a very large and old terrapin is rendered still more difficult by the fact that the shell becomes worn off so as to obliterate all but the last-formed ridges. The sexual differences in the young terrapin are apparent after the second or third year.

The striking differences between the young and the adult of the Texas terrapin are described in the paragraphs devoted to that species. Of the Florida species, I have seen individuals ranging from 3½ to 7 inches in length. The very young are still unknown. There is, however, some indication of an increasing roughness of the shell with advancing age up to the fifth or sixth year, when the inevitable wearing away of the older ridges begins.

MALFORMATIONS.

During my investigations I have met with a very considerable number of specimens of diamond-back terrapin which in one way or another were malformed, either congenitally or as the result of some injury or disease. Malformations of the latter character are of no special interest, except in so far as they show the ability of the animal to recover from its injuries and the futile effort on the part of nature to regenerate the lost parts. In any large collection of terrapin it is easy to find individuals that have lost a foot. Occasionally both the feet on one side or both feet of one pair will be missing and I saw one individual in which all four feet were gone. After such an injury the stump usually heals over smoothly, but occasionally irregular growths, not at all like the missing member, appear, and the result may be a curiously branched, stumpy termination. I have never seen a specimen which showed even an approximately perfect regeneration of any lost part. Injuries to the body, unless too severe, are often survived. One individual I observed in a pound at Crisfield, Md., had lost about one-third of the posterior half of its body, including its left hind leg. The wound, which must have exposed the body cavity, had healed, and the animal was apparently none the worse for the injury.

A disease similar to necrosis of the bone has been observed in a large number of terrapins, especially those confined in pounds. The first appearance of the disease is a small white spot on the plastron. This gradually enlarges, pushing its way through the scale, and a cheesy nodule from the size of a pin head to that of an almond kernel drops out, leaving a more or less deep cavity in the bone. Usually this cavity speedily becomes covered with scar tissue, but in some instances it grows until eventually a large area of the shell is eaten away. In severe cases death results, but I saw one individual which had recovered after more than half the plastron had disappeared. In quite a number of terrapin from South Carolina and in a few from Chesapeake Bay I have found similar cheesy nodules in the skin of the neck and legs. There was always an aperture in the skin, but no amount of pressure could force out the contents. When the tumor was opened a nodule dropped out which on examination showed a concentric structure. The skin surrounding it was considerably inflamed, but there was no suppuration and the wound healed quickly.

The congenital malformations, with one exception, affected the plates of the carapace and were of the most varied character. The most common was the appearance of supernumerary plates, one or more small scales being intercalated among the costal plates. Another, and a very common malformation in one species, was the longitudinal division of the nuchal or the vertebral plates. This seldom led to any rearrangement of the scales, but in one case, on a terrapin from Chesapeake Bay, there was a double series of perfectly formed vertebral plates arranged alternately down the full length of the carapace. The exception mentioned above was a dwarfed animal, which had a very broad and short shell slightly twisted to one side; there was no trace of injury and the terrapin was apparently very old.

THE AGE THAT TERRAPIN MAY ATTAIN.

Professor Agassiz was of the opinion that most of our turtles, the present species included, may attain a very great age and continue to grow almost indefi-

nitely. It is true that there is almost indisputable evidence to support this assertion in regard to some species, but for nearly all there is a limit, in size at least.

For the diamond-back terrapins the maximum size is about 9 inches, very rarely exceeding 8, and is attained probably at the age of 15 or 20 years. It is quite possible, of course, that the turtles live for many years after attaining their growth, but in this event we should expect to find the plates of the shell worn perfectly smooth, a condition I have never observed in any species except the Texas terrapin, which, probably as a result of the warmer and more uniform climate of its habitat, seems to grow more continuously than its relatives. I am therefore led to believe that from 20 to 25 years is the average duration of life for the turtles of this genus.[a]

DISCUSSION OF SPECIES.

Key to the species and subspecies of the genus Malaclemmys.

a. Carinæ of vertebral plates never tuberculate. Atlantic coast species.
  b. Head large to medium size; sides of carapace subparallel; southern form ranging north about to Cape Hatteras ..... *M. centrata.*
  bb. Head medium to small; carapace widest posteriorly; northern form ranging from about Cape Hatteras to Buzzards Bay ..... *M. centrata concentrica.*
aa. Carinæ of vertebral plates more or less tuberculate, at least in the young. Gulf coast species.
  c. Each plate of the carapace with a large central yellow or orange blotch ..... *M. macrospilota.*
  cc. Plates of carapace without yellow blotch.
    d. Carapace uniform black or dark brown, top of head and upper lip dark ..... *M. pileata.*
    dd. Carapace uniform light brown or with traces of concentric markings; upper lip and top of head nearly always white ..... *M. littoralis.*

Malaclemmys centrata (Latreille). The Carolina Terrapin. Pls. II, III, X (fig. 1), and XII (fig. 1).

1802. *Testudo centrata* Latreille, Hist. Nat. des Rept., I, p. 145.
1803. *Testudo centrata* Daudin, Hist. Nat. Gen. et Partic. des Rept., II p., 153.
1814. *Emys centrata* Schweigger, Prodrom. Iconog. Chelon., p. 32.
1825. *Emys centrata* Say, Jour. Acad. Nat. Sci. Phila., IV, p. 205 (part).
1830. *Terrapene palustris* Bonaparte, Test. Gen., p. 157.
1830. *Testudo palustris* LeConte, Ann. Lyc. N. Y., III, p. 113 (part).
1831. *Emys centrata* Gray, Synopsis Rept., pt. 1, p. 27 (part).
1834. *Emys concentrica* Bell, Monog. Test. (part?). (This work not examined).
1835. *Emys concentrica* Dumeril & Bibron, Érpétol. Gén., p. 261 (part).
1842. *Emys terrapin* Holbrook, North Am. Herp., I, p. 87, Pl. XII (part).
1842. *Emys terrapin* DeKay, Fauna N. Y., II (part).
1844. *Malaclemmys concentrica* Gray, Cat. Tort. &c., Brit. Mus., p. 28 (part).
1857. *Malacoclemmys palustris* Agassiz, Contr. Nat. Hist. U. S., I, p. 437, pls. 1 and 7a (part).
1862. *Clemmys terrapin* Strauch, Chelon. Studien, p. 132 (part?), not examined.
1865. *Clemmys terrapin* Strauch, Vertheil. Schildkr., p. 90 (part?), not examined.
1865. *Emys terrapin* Maximilian, N. A. Acad. Leop. Carol., XXXII, I, p. 16.
1889. *Malacoclemmys terrapen* Boulenger, Cat. Chelon. Brit. Mus., p. 89 (part).
1899. *Malaclemmys centrata* Jordan, Man. Vert. 8th ed., p. 209 (part).

Type locality.—Bosc's material, on which Latreille's description was based, probably came from the neighborhood of Charleston, South Carolina.

Distribution.—Littoral region of the eastern United States from the neighborhood of Cape Hatteras southward to the coast of Florida.

Characters.—When looked at from above, the shell of this terrapin is ovoid in outline, the greatest width being behind the middle and across the fourth vertebral plate; the front is not very deeply, sometimes scarcely at all, notched. From the side view the shell is seen to be highest near the middle, the tops of the crests of the second and third vertebral plates usually being the highest points, from which the curve downward is gradual, both backward and forward; the lower margin of the carapace slopes gently downward from the front to a point near the suture between the seventh and eighth marginal plates,

[a] In this connection see Bangs (1896), in which article the occurrence of *M. centrata* ("*M. terrapin*") in Buzzards Bay, Massachusetts, is recorded and remarks are made on the variations observed in a large series of the species.

then flares upward and outward a little and descends again behind; vertical and horizontal measurements of the marginal plates above the bridge—the fifth, sixth, and seventh—approximately equal; edges of marginal plates from the sixth backward often sharp and conspicuously revolute; inguinal and axillary plates may be well developed or small, or one of them may be wanting; keels of vertebral plates rather low and rounded, those of the third and fourth only being at all trenchant; plates of the carapace usually concentrically ridged, although in large individuals they are apt to be almost perfectly smooth. The plastron is comparatively broad, slightly notched or truncate in front, thence curving outward and backward to the bridge; behind the bridge the sides of the plastron are subparallel to the posterior margin of the femoral plate, where there is a prominent notch, and are then rather strongly convergent to the ends of the anal plates, between which, on the median line, there is a rather deep notch; epidermal plates of the plastron usually smooth.

The head is large and heavy, its sides behind the eyes being more or less swollen; nose short and blunt; jaws strong and provided with a broad horny covering; eyes somewhat prominent, but not so markedly so as in the species from the Gulf of Mexico.

The legs and feet are strong, provided with stout claws; hind feet broadly webbed. Tail short and weak.

The male differs very markedly from the female in the shape of the carapace; the margins from a little behind the bridge to near the posterior end of the shell are nearly straight, so that they meet at an angle instead of together forming an arc; the marginal plates from a little in front of the bridge to the posterior end are nearly always strongly revolute. The head is proportionally much smaller and lacks altogether the heavy, blunt appearance just described in the case of the female; the tail is longer and stronger.

The coloration is extremely variable and offers no diagnostic characters of value. A series of 85 terrapin from Enterprise, North Carolina, showed the following variation: 13 females, 5 inches long and under (measured on the middle line of the plastron), ranged from rather light slate-green individuals, very slightly marbled with darker, to some in which the scales of the carapace were black with more or less wide slate-green margins; the plastrons ranged from a rather pronounced orange yellow, through honey yellow, to greenish gray; in some cases the plastrons were uniformly colored, in others they were more or less blotched or clouded with dusky; the lips were white and the top of the head was white or light greenish. Eight females, 5 inches long and under, had the carapace entirely black and the plastron yellow orange much blotched and clouded with black; the upper lip and the top of the head were black, and the skin of the neck, legs, and tail was gray-green with many short crooked black lines and small specks. Five females, of about the same size as those just mentioned, were almost perfectly intermediate in coloration, having brownish carapaces with more or less strong traces of green marbling, and plastrons varying from green-gray to orange yellow, some plain and others clouded. Of 8 females about 6 inches long, 2 were very light colored, the scales being marked with concentric lines of greenish gray or brown on a darker background; 2 were very dark brown, the others were intermediate; the plastron was yellowish gray-green, almost uniform in the light colored individuals, but clouded with black in the darker colored specimens. Of the males 20 had the scales of the carapace broadly margined with greenish gray, around a center of black or light brown; the lips and the top of the head were white or whitish; the plastrons were as variable as in the females described above, but the dusky markings had the form of small specks rather than indefinite cloudings. Eighteen males varied from uniform black to specimens in which the scales had a large black center and a margin of dark greenish-gray; the top of the head was black and in all but one case the lips were black; in 11 males the color was like those just described, except that the upper lip was white; in 2 males the color was dark, like those just described, but both the top of the head and the upper lip were white.

This form, although variable, can readily be recognized by its large head, smooth carapace, and low dorsal ridge. From North Carolina northward it begins to intergrade with the northern form, *M. centrata concentrica*, and is displaced altogether before the mouth of Chesapeake Bay is reached. The absence of concentric markings, usually mentioned as characteristic of the species, is apparently the common condition in typical *M. centrata*, although now and then an individual is found which shows them quite as plainly as the northern form. The usual coloration seems to be dark brownish or greenish black with a border of lighter green gray around each scale of the carapace. It is not exceptional to find individuals of this species with the transverse diameters of the shell before and behind the bridge nearly equal and the sides straight, the outline of the carapace thus a long oval.

Dealers in terrapin regard *Malaclemmys centrata* with little favor, and it commands a much lower price in the markets than the northern form. The reasons for this unpopularity are variously stated to be toughness and coarseness of the flesh, large size of the bones, lack of flavor, uninviting appearance, and it would seem that all the disagreeable qualities are found combined in the terrapin from South Carolina and Georgia; those from North Carolina are more esteemed, probably owing to the fact that among them are to be found numerous individuals which can be made to pass muster as genuine "Chesapeakes".

By Agassiz (1857, p. 438), and by Boulenger (1889, p. 89), *Emys macrocephalus* of Gray (1844, p. 26), is regarded as a synonym of *M. centrata*. Agassiz states that the species was based on a large-headed specimen of the diamond-back terrapin. An examination of Gray's description shows *E. macrocephalus* to be indeterminable, as it does not apply to any one turtle more than to another, and even the locality is doubtful.

Malaclemmys centrata concentrica (Shaw). The Chesapeake Terrapin. Pls. I, IV, V, and X (fig. 2).

1792. *Testudo terrapin* Schoepff, Hist. Testud., p. 64, pl. xv (name preoccupied).
1802. *Testudo concentrica* Shaw, General Zool., III, p. 43.
1825. *Emys centrata* Say, Jour. Acad. Nat. Sci. Phila., IV, p. 205 (part), &c. Numerous other authors as cited under *M. centrata*.

Type locality.—Both Schoepff and Shaw obtained their specimens from the markets of Philadelphia, and we may therefore fix the type locality somewhere in that region, probably Delaware Bay, as in that early day practically all the sea food handled in Philadelphia came from those waters.

Distribution.—The littoral region of the eastern United States from Buzzards Bay, Massachusetts, to Virginia or North Carolina; Long Island Sound, Delaware and Chesapeake bays, &c.

Characters.—The carapace has in general the form of that of *M. centrata*, but is broader posteriorly and the marginal plates behind the bridge are seldom revolute; the plastron, also, is less convergent posteriorly; the plates of the carapace bear conspicuous concentric ridges, but those of the plastron are smoother, nearly always, however, except in some old individuals, showing at least traces of the lines of growth; the head is small, narrow, and neatly formed, the top of it flat, giving the nose a sharper appearance than is to be seen in the other form of this species.

The color varies from uniform black to light brown, the latter always marked with darker concentric lines on each plate of the carapace and more or less blotched with darker on the plastron; the skin of the head, legs, and tail varies from nearly pure black to a very light green-gray, the latter more or less marked with specks and short, crooked lines of black; the lips and top of the head are usually dusky, but individuals may be found with either or both white.

The males resemble the females in the shape of the carapace, except that they are a little sharper posteriorly and the marginal plates are frequently a little revolute; the nose is much sharper than in the females.

It seems very probable that some of the types of coloration indicate local variation, but the species has been so thoroughly mixed by the shipping of large consignments from one place to another that it is doubtful whether anything of this kind could be proved. All the specimens from Connecticut and other northern localities, so far as I have seen, are very light in color, with conspicuous concentric markings, but very smooth shells; Potomac River specimens are similar, but have rougher plates; those from the ocean and inclosed bays of the Atlantic coast of the Maryland-Virginia peninsula are, in more than 75 per cent of the specimens, very dark and without markings of any kind. The terrapin from Delaware Bay are more like those of more northern localities, but usually present very little contrast in the color markings on the plates of the carapace.

Many varieties are recognized by the dealers in terrapin—"Chesapeakes," "Delaware Bays," "Long Island terrapin," "Connecticuts," &c.—but in most cases the determinations are nothing more than guesswork.

Malaclemmys macrospilota, sp. nov. The Florida Terrapin. Pls. VI, VII, and XI (fig. 1).

Type.—U. S. National Museum No. 33917, an adult female from Charlotte Harbor, Florida, secured at the Washington market, December, 1902, by W. P. Hay.

Distribution.—Salt marshes of the western coast of Florida, the limits of the range as far as known being from Charlotte Harbor northward to Sand Key.

Characters.—The carapace does not differ greatly in outline from that of *M. centrata concentrica*, but is nearly always a little less full along the sides between the shoulders and the hips, the sides in most cases being nearly straight: marginal scales behind the bridge revolute; carinæ of the vertebral plates always well developed and, except in very old individuals, often more or less expanded at their tips into roundish knob-like excrescences. Notch in front of shell, above the neck, deeper than in the forms previously described. Plastron usually rounded in front, its sides behind the bridge more nearly parallel and the notch between femoral and anal plates deeper than in *M. centrata*. Epidermal plates of both carapace and plastron strongly marked with concentric ridges. Head large and blunt and, owing to greater development of the masseter muscles, apparently swollen back of the jaws; horny covering of the lips strong; eyes protuberant, more so than in *M. centrata*; top of head flat. Legs and feet perhaps a trifle smaller proportionally than in *M. centrata*.

The coloration in this species is very characteristic and will serve to distinguish it at a glance. The ground color of the carapace is a deep blue-black, but near the middle of each plate and covering about two-fifths of its area is a conspicuous orange-yellow spot; the marginal plates are largely orange yellow both above and below and as these plates are revolute, a chain of color encircles the body; the plastron is largely yellow or orange yellow, this color having nearly displaced the dusky brown ground color; head and neck a peculiar whitish flesh color, the head almost unmarked but the neck with numerous small black spots; lips and top of the head white; legs and feet light grayish green with many small specks and spots of dark brown or black; tail grayish and usually unmarked.

The males are essentially like the females, though much smaller, of course, and with longer tails, but the knobs on the carinæ of the vertebral plates seem to be more persistent.

In the specimens of *M. macrospilota* examined by me, about 100 in number, I have observed little variation. Two specimens were almost entirely black, but a close examination of these showed traces of the characteristic orange blotches. In a few individuals the lips and the top of the head were dusky. When handled, this terrapin shows more readiness to bite than any of the others, and its strong jaws enable it to inflict a painful wound. In one case a piece was cut cleanly out of the palm of an incautious investigator.

It is quite surprising that this beautiful species has escaped the notice of naturalists for so many years, but perhaps the growing scarcity of diamond-back terrapin in northern waters has only recently led to the appearance of this animal in our markets. My first specimens were selected from a barrelful which had been sent from Charlotte Harbor, Florida, to a dealer in Washington. In the summer of 1903 I noticed a considerable number of both males and females in one of the pounds at Crisfield, where they had been received from Sand Key, Florida.

In the markets the "Florida terrapin" does not meet with a ready sale. Its peculiar coloration proclaims it at once as different from the Chesapeake article, and by those who have eaten it, its flesh is said to be somewhat gelatinous and entirely lacking in the qualities which have made the northern species famous.

Malaclemmys pileata (Maximilian zu Wied). The Louisiana Terrapin. Pl. XI, fig. 2.

1865. *Emys pileata* Maximilian, Prinz zu Wied, Verzeichniss der Reptilien welche auf einer Reise in Nördlichen America beobachtet werden, pp. 16, 17; pl. I, figs. 2, 3.

Type.—No. 916, American Museum of Natural History (?) the carapace and plastron of an adult male or immature female from New Orleans, Louisiana, collected by Maximilian.

Distribution.—So far as is known, the range of this terrapin is along the Gulf coast from the region about the mouth of the Mississippi River eastward as far as Mobile Bay, and possibly well along the coast of Florida.

Characters.—This species is very similar to *M. macrospilota* in form and sculpture of carapace, size and shape of head, and proportion of parts, but it differs in coloration. The carapace is entirely black or very dark brown, except for the clear orange or dark yellow of the upturned marginal plates; the plastron is yellow, more or less inclined to dusky or olive, and sometimes with cloudings of brown or dusky. The ground color of the head and neck is a gray or green gray, very clear and light on the sides and lower part of the head, but gradually shading into dark olive brown or dusky on the neck, and everywhere thickly strewn with black or dark brown spots and specks; a large rhomboidal blackish patch on top of the head covers the entire area from nose to occiput, and touches the eyelid on each side; the horny covering of the upper lip is very broad and usually white, but often is strongly

marked with dusky; between the upper lip and the black rhomboidal patch on top of the head and extending from nose to front of eye there is usually a streak of olive. The legs, tail, and soft skin of the body are nearly black, owing to the great quantity of black spots which practically cover the surface.

The male is similar to the female, but the crests of the vertebral plates are nearly always knob-like, and the size is, of course, much smaller than the adult female. The black marking on the upper lip seems to be constantly present in the male, and has been compared by Maximilian to a moustache. The plastron is nearly always quite strongly clouded with brownish black.

Maximilian's specimens were received from New Orleans while he was at New Harmony, Indiana. Since then no specimens have been obtained until two years ago, when Dr. H. M. Smith, of the Bureau of Fisheries, received two or three from the same locality. These fit Maximilian's description in every way and place the species on a firm basis. Of the nine specimens mentioned by Maximilian, six seem to have disappeared; the three others are in the collection ot the American Museum of Natural History (Nos. 799, 800, 916). No. 916 is labeled in Maximilian's handwriting, "*Emys pileata* mihi, *Emys concentrica* var. Dum. et Bibr." The original number of this specimen appears to have been 65; the other two were numbered 66 and 67. The locality as given on the labels is "Texas, New Orleans." The specimens are small, and probably represent males from 5 to 7 years old.

It has been possible to examine only three or four specimens of this turtle from the type locality, but I have seen large numbers of females from Biloxi, Mississippi, and Mobile, Alabama. They appear in the markets under the name of Biloxi terrapin or Gulf terrapin, and, next to the northern form of *M. centrata*, command the highest prices. They are said to be rather tough, however, and according to some opinions are not so delicately flavored as the "genuine Chesapeakes." In one or two instances among the Mobile specimens there was the faintest possible indication of a large whitish blotch on each plate of the carapace, and subsequent investigation may show that the present species and *M. macrospilota* intergrade at some point on the Florida coast. At present, however, the indications of this are so slight that the two must be regarded as distinct.

Malaclemmys littoralis, sp. nov. Pls. VIII, IX, and XII (figs. 2 and 3).

Type.—U. S. Nat. Mus. No. 33913, an adult female from Rockport, Texas, secured at Crisfield, Md., in August, 1904, by W. P. Hay.

Distribution.—Salt marshes and channels along the coast of Texas and outlying islands.

Characters.—Carapace oval in outline, but of nearly equal width at shoulders and hips, the sides convex, straight, or even slightly concave; notch above the neck usually deeper than in the species previously described; carapace much more vaulted, greatest height usually farther back than in the other species, being at top of third vertebral plate; marginal plates in front of the bridge blunt at the edges, behind the bridge sharper and rather strongly revolute; margin of carapace rounded just above the bridge, so that the sharp longitudinal ridge, so prominent in all the other species, is almost wanting; bridge high; plastron narrower proportionally than in the other species; posterior lobe with more convergent sides. Plates covering the shell thin with old age, often becoming so worn away as to expose the bone beneath them; plates on the plastron usually quite smooth, on the carapace sometimes smooth, but usually concentrically ridged or roughly pitted.

Head large, the nose blunt. In the male the carapace is flatter than in the female marginal plates from near front of the shell backwards strongly revolute; plates of the carapace much pitted.

The coloration is variable. Of the 250 specimens examined the few males were all dark brown; there were a few females which were almost black, with dark heads, necks, and legs; others were so light a greenish gray as to appear almost white; the majority, however, were brown, varying from rather light yellowish brown to dusky. The upturned marginal plates in the darker colored individuals were orange, but in light-colored specimens were light greenish gray or nearly white; the plastron was usually yellowish, but if the carapace was very light colored, the plastron was nearly white with a faint greenish tint; the markings on the plates of the carapace were always indistinct, but occasionally there was a faint indication of one or two concentric bands near the centre; usually, however, the plates were only slightly and irregularly clouded, or unmarked. The top of the head was usually dusky, but sometimes white, and the upper lip was white in every individual. The soft skin was everywhere a pronounced green-gray, but thickly marked and more or less obscured by small, nearly circular, black or brown spots.

All the terrapin of this species that I have seen alive came from Rockport, Texas, but they are said to occur southward as far as Brownsville, at least, and northward as far as Galveston. In the American Museum of Natural History there are four specimens of this turtle, Nos. 801, 802, 804, and 805, which were probably collected by Maximilian; no locality is given for them other than Texas. It is quite possible that the range of this species and that of *M. pileata* merge somewhere between Galveston and New Orleans, and it may be that the two will be shown to be more closely akin than is indicated by the classification adopted here. The very dark brown individuals of *M. littoralis* are very similar in general appearance to the Mobile Bay specimens of *M. pileata*, but may usually be distinguished by the higher and heavier body and the white upper lip.

A very interesting malformation, consisting in the longitudinal division of one or more of the vertebral plates, was observed in many individuals of this species, a condition so common that it was really difficult to pick out a full-grown specimen which did not show it in some degree. As to the possession of the inguinal plate, these terrapin were variable; of 50 specimens examined for this character, 26 had it and in 24 it was wanting.

The young of *M. littoralis* are very remarkable, and in the absence of any other distinctive characters would serve to separate the species from *M. centrata*. I have secured a good series of the young from eggs laid in one of the terrapin pounds near Crisfield, Maryland. They are much larger than the young of *M. centrata*, having probably twice the bulk, and seem much more vigorous and lively. The first vertebral plate is raised on the middle line to form a broad, low carina; on the second plate the elevation is greater, and stands out as a smooth boss on the otherwise finely wrinkled plate; the elevation on the third plate has the form of a hemispherical button with a well-marked constriction around the posterior half of the base, so that it stands up prominently above the plate posteriorly but anteriorly slopes into it; on the fourth plate the elevation rises into a knob-like protuberance from a base which is constricted all around; the tubercle of the third plate is usually the broadest, but the one on the fourth plate is the highest and most conspicuous of the three; all are smooth and polished, while the plate upon which they rest is finely wrinkled. The fifth vertebral plate is flat or with only a trace of an elevation. The color of these young specimens is brownish yellow or horn color, and the margins of all the plates of the carapace are thickened and darker than the remainder of the plate. The centres of the costal plates usually bear a small dark dot, around which there is sometimes a narrow dark ring.

Attention has already been called to the knob-like tubercles observable on many specimens of *M. macrospilota* and *M. pileata*, and these unquestionably have their origin in structures such as those just described in *M. littoralis*. In the latter species they seem to disappear with age, but in *macrospilota* and *pileata* they persist, in the males at least, for many years, increasing in size very little, if at all, but very conspicuous when present. In the hundreds of adult and young terrapin from the Atlantic coast which have come under my observation, nothing approaching this character has been found, and it will therefore serve to divide the genus into two distinct groups.