

A NEW SPECIES OF SKATE,
NEORAJA CAROLINENSIS, FROM OFF
THE SOUTHEASTERN UNITED STATES
(ELASMOBRANCHII: RAJOIDEI)

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Abstract.—*Neoraja carolinensis*, n. sp. is described from the continental slope of the southeastern United States. *Neoraja carolinensis* is very similar to its congeners, *N. caerulea* and *N. stehmanni*, and *Breviraja africana* recently described from off West Africa, but can be distinguished from them mainly by the extreme length of its anterior pelvic lobe and coloration. *Neoraja carolinensis* lacks cross-bars on the dorsal surface of the tail and possesses a uniformly dark abdominal region which is sharply marked off from the light colored interbranchial and cloacal regions. A key is given to the three congeners and *B. africana*, and their distribution is discussed.

In their revision of *Breviraja* and descriptions of *Neoraja*, n. gen., *N. (Neoraja)*, n. subgen. and *N. (Fenestraja)*, n. subgen., McEachran and Compagno (1982) briefly described and illustrated the skeletal anatomy of a new species of *Neoraja (Neoraja)* from off the coast of North Carolina. This species was not formally described, however, because of lack of adequate material. McEachran (1984) removed *N. (Fenestraja)* from *Neoraja* and placed it in *Gurgesiella* as a subgenus, thus restricting *Neoraja* to the two described species in the subgenus *Neoraja*. Since publication of the generic revision, four more specimens of the undescribed species were captured off the coast of the southeastern United States by the FRV *Anton Dohrn* which conducted a bottom trawl survey from George's Bank to Florida during October and November 1979 (Stehmann 1980). Herein the species is described and compared with its two congeners, and the eastern central Atlantic *Breviraja africana* Stehmann and Seret, 1983. The latter species appears closely related to those of *Neoraja* in several aspects, and one of us (JDM) feels it should be assigned to this genus.

Specimens of the new species were obtained from the National Marine Fisheries Service Systematics Laboratory, Smithsonian Institution, and the Aussenstelle Ichthyologie des Instituts für Seefischerei, Hamburg, (ISH). The former two specimens were donated to the National Museum of Natural History, Smithsonian Institution (USNM). External measurements were made according to Bigelow and Schroeder (1953) with the exception of the pelvic lobe measurements. The anterior lobe was measured from the proximolateral margin of the left prepelvic process (which can be felt externally) to the tip of the lobe. The posterior lobe was measured from the proximolateral margin of the left prepelvic process to the tip of the lobe. Two specimens were dissected to reveal the structure of the neurocranium and scapulocoracoids. The neurocranium of one specimen was stained with alcian blue to distinguish the distal section of the rostral shaft. Unfortunately, none of the specimens were mature males so clasper structure could not be determined.

All specimens were radiographed to verify the anatomical observations based on dissections and to count vertebrae and pectoral radials. Methods for making skeletal measurements followed Hubbs and Ishiyama (1968) and McEachran and Compagno (1979, 1982).

Neoraja carolinensis, new species

Figs. 1–6, Tables 1, 2

Neoraja, sp., McEachran and Compagno, 1982.

Holotype.—ISH 3650/79, 285 mm TL, adolescent male, collected off Cape Fear, North Carolina, 33°38'N, 76°04'W, 796 to 800 m, 4.56°C, 34.958‰, 8 Nov 1979, FRV *Anton Dohrn* station 6410/79, by M. Stehmann.

Paratypes.—ISH 3559/79, 280 mm TL, adolescent male, collected off the east coast of Florida, 29°11'N, 77°07'W, 1000 to 1008 m, 6.09°C, 35.035‰, 3 Nov 1979, FRV *Anton Dohrn* station 6385/79, by M. Stehmann.—ISH 3640/79 a+b, 143 mm TL, juvenile male, 232 mm TL, adolescent female, off Cape Fear, North Carolina, 33°27.5'N, 76°07'W, 990 to 1010 m, 4.18°C, 34.929‰, 8 Nov 1979, FRV *Anton Dohrn* station 6408/79, by M. Stehmann.—USNM 265013 (formerly Texas Cooperative Wildlife Collection, TCWC 2725.1), 247 mm TL, adolescent male, collected off Cape Fear, North Carolina, 33°56'N, 75°54'W, 695 m, 31 Jan 1972, RV *Oregon II* station 11757.—USNM 265014 (formerly TCWC 2740.1), 225 mm TL, juvenile female, collected off Cape Lookout, North Carolina, 34°22'N, 75°43'W, 805 m, 1 Feb 1972, RV *Oregon II* station 11765.

Diagnosis.—Anterior lobe of pelvic fin nearly as long or longer than posterior lobe of fin; dorsal surface of tail without distinct cross-bars; abdominal area uniformly dark colored and sharply marked off from light interbranchial and cloacal regions.

Description.—Individual morphometrics and meristics given in Tables 1 and 2. Values of paratypes follow in parentheses those of holotype. Disc heart-shaped (Figs. 1, 2) 1.2 times (1.1–1.2 in paratypes) as broad as long; snout short, maximum angle in front of spiracles 120° (125°–136°); tip of snout with a small, flat, triangular process; anterior margin concave on either side of process, convex to level of orbits and concave from level of orbits to level of first gill slits (paratypes with less undulated anterior margin and smallest juvenile with almost convex margin); outer corners of disc broadly rounded; posterior margins and especially inner margins strongly convex. Axis of greatest disc width 0.76 (0.70–0.77) of distance from tip of snout to axil of pectoral fins. Pelvic fins deeply incised; anterior lobe long, narrow and tapering to acute tip; posterior lobe relatively short with convex lateral margin. Tail slender, little depressed, its width at mid-length about three-fourths eye diameter. Tail with lateral fold along each ventrolateral surface, extending from about mid-length of tail to near tip (originating from mid-length to posterior third of tail); lateral folds broaden posteriorly to width equal to one-half height of epichordal caudal lobe at level of dorsal fins. Length of tail from center of cloaca to tip 1.4 (1.3–1.5) times distance from tip of snout to center of cloaca.

Preorbital length 2.7 (2.4–2.7) times as long as orbit, 3.1 (2.9–3.2) times interorbital width; preoral length 1.7 (1.6–2.0) times internarial distance. Interorbital distance 0.9 (0.8–1.0) times length of orbit, orbit length 2.1 (1.9–2.4) times as



Fig. 1. *Neoraja carolinensis* ISH 3650/79, 285 mm TL (Holotype) adolescent male: a, Dorsal view; b, Ventral view.

Table 1.—Proportional measurements and meristic values for *Neoraja carolinensis*. Proportions expressed as percentage of total length. Measurements made to nearest 1 mm are given to nearest 1 mm and those made to nearest 0.1 mm are given to nearest 0.1 mm.

	Holotype			Paratypes			\bar{x}
	ISH 3650/79	ISH 3559/79	ISH 3640/79	wSH 3640/79	USNM 265013	USNM 265014	
Sex	♂	♂	♀	♂	♂	♀	
Total length (mm)	285	280	232	143	247	225	
Disc width	55.0	56.0	57.0	52.0	55.0	52.0	55.0
Disc length	47.0	47.0	48.0	43.0	47.0	48.0	47.0
Snout length (preorbital)	11.5	10.0 ¹	11.3	9.7	10.4	11.4	10.8
Snout length (preoral)	12.9	11.9 ¹	12.7	12.9	11.6	13.0	12.4
Snout to maximum width	30.0	29.0	31.0	27.0	27.0	29.0	29.0
Prenasal length	9.4	7.6 ¹	9.1	9.6	9.0	9.0	8.9
Orbit diameter	4.2	4.3	4.5	3.8	4.9	4.2	4.3
Distance between orbits	3.7	3.5	3.8	3.7	3.4	3.6	3.6
Orbit and spiracle length	4.9	4.9	5.4	4.9	6.0	5.0	5.2
Spiracle length	2.0	2.0	1.9	2.0	2.7	1.9	2.1
Distance between spiracles	7.0	7.3	7.3	7.0	6.6	6.7	7.0
Mouth width	7.3	7.9	7.0	6.2	7.4	6.7	7.2
Nare to mouth	4.1	3.7	4.1	3.6	—	3.9	3.9
Distance between nostrils	7.6	7.5	7.9	6.9	7.2	6.5	7.3
Width of first gill opening	1.3	1.2	1.3	0.7	1.5	0.9	1.2
Width of third gill opening	1.4	1.2	1.4	1.0	1.6	1.0	1.3
Width of fifth gill opening	1.0	0.9	1.0	0.6	1.3	0.8	0.9
Distance between first gill openings	12.6	13.5	12.8	12.1	13.2	12.8	12.9
Distance between fifth gill openings	7.2	7.6	7.8	7.4	8.2	7.1	7.5
Length of anterior pelvic lobe	13.8	15.1	14.7	12.8	15.8	14.5	14.6
Length of posterior pelvic lobe	15.0	15.2	15.0	13.2	16.0	14.9	15.0
Tail width of axil of pelvic fins	4.2	3.0	4.4	3.4	3.7	3.8	3.8
Distance-snout to cloaca	42	41	43	40	42	41	42
Distance-cloaca to first dorsal fin origin	47	47	44	47	48	47	47
Distance-cloaca to 2nd dorsal origin	50	53	49	53	52	51	51
Distance-cloaca to caudal fin origin	55	56	54	57	53	56	55
Distance-cloaca to caudal fin tip	58	59	57	60	59	59	58
First dorsal fin, height	2.6	3.4	2.8	1.9	2.8	3.3	2.8
First dorsal fin, base length	5.7	6.0	5.8	6.6	5.8	5.6	5.9
Second dorsal fin, height	2.0	2.5	3.1	1.7	2.6	2.7	2.4
Second dorsal fin, base length	4.2	5.0	5.5	5.2	3.7	4.7	4.7
Tail at pelvic tips, height	2.6	2.5	2.7	2.5	2.6	2.6	2.6
Tail at pelvic tips, width	3.5	3.3	3.8	3.5	3.0	3.4	3.4
Tail at first dorsal origin, height	1.1	0.9	1.1	1.0	0.9	0.9	1.0
Tail at first dorsal origin, width	1.9	1.4	1.9	1.6	1.5	1.4	1.6
Head length, to 5th gill slits	25.4	24.3	25.4	24.7	—	24.9	24.9 (5)
Nasal curtain, length	5.1	4.6	4.8	4.3	—	4.6	4.7 (5)
Nasal curtain, width each lobe	3.2	2.6	3.0	2.8	2.8	2.7	2.9
Nasal curtain, distance between lobes	3.0	3.6	3.0	3.0	2.4	2.5	2.9
Clasper, postcloacal length	13.4	7.0	—	6.3	9.5	—	9.1 (4)
Angle of snout	120°	136°	136°	127°	125°	125°	128°
Pseudobranchial folds	8	10	9	9	8	10	9
Number of tooth rows (upper jaw)	44	45	46	40	42	42	43
Number of trunk vertebrae	24	24	25	24	26	26	25
Number of predorsal caudal vertebrae	73	70	65	70	72	70	70
Number of pectoral fin radials	64	64	62	63	65	66	64

¹ Snout slightly deformed.

Table 2.—Neurocranial and scapulocoracoid proportional measurements of *Neoraja carolinensis* expressed in percent of nasobasal length and greatest length respectively.

	ISH 3640/79 ^b 232 mm TL ♀	USNM 265013 247 mm TL ♂
Nasobasal length (mm)	25.1	24.6
Cranial length	178	183
Rostral cartilage length	77	80
Prefontanelle length	61	58
Cranial width	117	117
Interorbital width	34	33
Rostral base	17	15
Anterior fontanelle length	49	47
Anterior fontanelle width	14	12
Posterior fontanelle length	42	41
Posterior fontanelle width	12	10
Rostral appendix length	60	48
Rostral appendix width	20	20
Rostral cleft length	53	41
Cranial height	24	23
Width across otic capsules	58	60
Least width of basal plate	30	30
Greatest width of nasal capsules	49	49
Internarial width	15	15
Greatest length (mm)	11.7	11.4
Greatest height	84	77
Premesocondyle	44	43
Postmesocondyle	56	56
Postdorsal fenestra length	16	13
Postdorsal fenestra height	10	10
Anterior fenestra length	21	14
Anterior fenestra height	26	26
Height of rear corner	62	66

long as spiracle. Spiracle with 8 (8–10) pseudobranchial folds. Anterior nasal flap (nasal curtain) strongly undulated laterally, with distinct, short triangular loblet at mid-length and finely fringed posterior margin, posterior nasal flap poorly developed and very weakly fringed (smooth to weakly fringed) (Fig. 3). Mouth nearly straight, upper and lower jaws slightly arched on either side of symphysis (nearly straight in juveniles) and upper jaw slightly indented at symphysis. Teeth with very short pointed cusps near symphysis but with rounded cusps towards corners of jaws (juveniles with rounded cusps throughout); teeth in quincunx arrangement.

Distance between first gill slits 1.6 (1.6–1.8) times as great as distance between nares; distance between fifth gill slits 0.9 (1.0–1.1) times as great as between nares; length of first gill slits 1.3 (1.1–1.4) times length of fifth gill slits and 0.2 (0.1–0.2) times mouth width. First dorsal fin about equal in size and shape to second, their bases confluent and second dorsal confluent with short and low epichordal caudal lobe; hypochordal caudal lobe poorly developed. Not fully formed claspers extending distal to posterior pelvic lobe (not exceeding pelvic lobe in paratype males), inner dorsal lobe of glans with two proximal clefts or slits, ventral lobe with elongate shield.

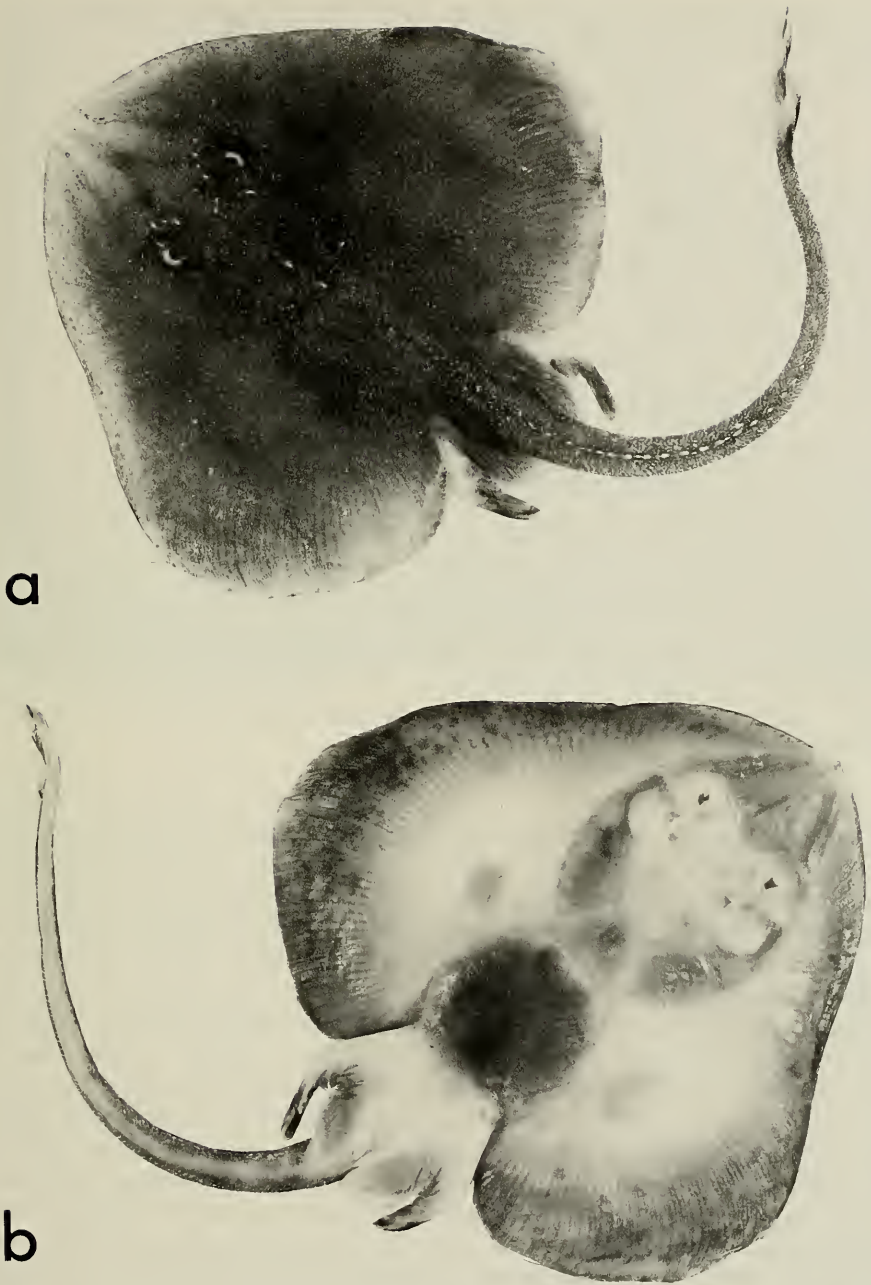


Fig. 2. *Neoraja carolinensis* ISH 3640/79_a, 143 mm TL (Paratype) juvenile male: a, Dorsal view; b, Ventral view.

Upper surface of disc except narrow posterior margins densely and uniformly covered with denticles bearing slender spines with recurved tip; anterior pelvic lobes naked; posterior pelvic lobes sparsely covered with denticles from origin to center with broadly smooth outer margins; distomedial aspect of claspers sparsely

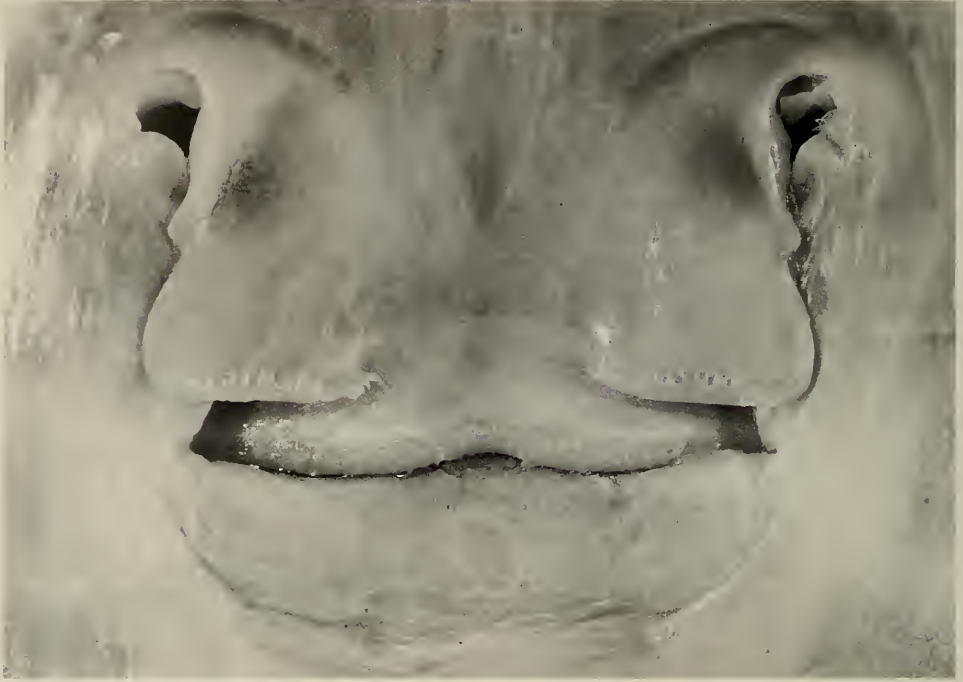


Fig. 3. *Neoraja carolinensis*, ISH 3650/79 285 mm TL (Holotype) adolescent male, mouth and nasal region.

covered with denticles (naked in male paratypes). Ventral surface naked except for denticles along lateral aspects of tail to level of first dorsal fin (some paratypes with lateral denticles only on posterior half of tail). Orbital thorns small, set in an almost continuous inner half-ring consisting of: 5 preorbital, innermost two being largest, and 3 postorbital, plus 2 supraorbital, of which 1 on left and both on right side broken off; 1 supra- and 1 interspiracular thorn on each side, right interspiracular broken off (paratypes with 3–5 pre-, 0–2 supra-, and 1–4 postorbital, 0–1 supra- and 0–1 interspiracular thorns). An irregular median row of 6 thorns over nape/shoulder area, smaller posterior two in suprascapular position; 2 thorns on each shoulder, left outer one broken off (paratypes with 2–5 median nuchal, 1–2 suprascapular, and 1–2 scapular thorns). About 75–80 small thorns from about level of maximum disc width along midline onto mid-length of tail in irregular row, on origin of tail in narrow band of two or three irregular rows; remaining tail section to origin of first dorsal fin without median thorns, but with longitudinal groove also lacking denticles (paratypes with 40–50 thorns in irregular midrow originating at posterior third of body, or at level of pectoral or pelvic axils; smallest paratype with 40 thorns in almost regular midrow along body and tail to origin of first dorsal and lacking smooth longitudinal groove on tail (Fig. 2a). Thorns with roundish bases and recurved tips bearing small lateral keels. Dorsal and upper caudal fins sparsely covered with denticles.

Color.—After preservation in formalin and storage in alcohol, dorsal surface (Figs. 1a, 2a) uniformly grayish-brown, except area on either side of rostrum,

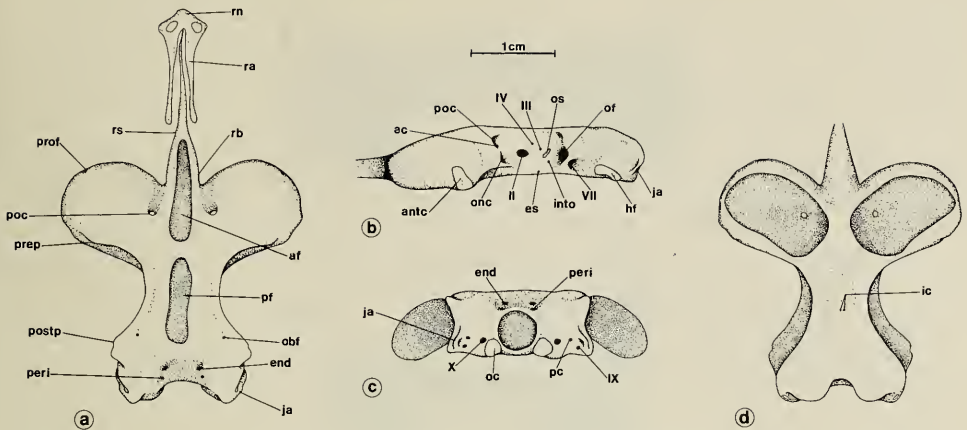


Fig. 4. Neurocranium of *N. carolinensis*, ISH 3640/79_b, 232 mm TL (Paratype) adolescent female: a, Dorsal view; b, Lateral view; c, Posterior view; d, Ventral view. ac— anterior cerebral vein foramen, af— anterior fontanelle, antc— antorbital condyle, end— endolymphatic foramen, es— efferent spiracular artery foramen, hf— hyomandibular facet, ic— internal carotid artery foramen, into— interorbital vein foramen, ja— jugal arch, obf— otic branch of facial nerve foramen, oc— occipital condyle, of— orbital fissure, onc— orbitonasal nasal canal foramen, os— optic stalk, pc— posterior cerebral vein foramen, peri— perilymphatic foramen, pf— posterior fontanelle, poc— preorbital canal foramen, postp— postorbital process, prep— preorbital process, prof— profundus nerve foramen, ra— rostral appendix, rb— rostral base, rn— rostral node, rs— rostral shaft, II— optic nerve foramen, III— oculomotor nerve foramen, IV— trochlear nerve foramen, VII— hyomandibular branch of facial nerve foramen, IX— glossopharyngeal nerve foramen, X— vagus nerve foramen.

posterior pectoral and outer margins of posterior pelvic lobes and apices of dorsal fins semitransparent and lighter; anterolateral margin of anterior pelvic lobes and claspers yellowish-white, but distolateral margin of left ventral clasper lobe brown; lateral tail folds marbled brown and white, almost yellowish-white in distal section; tail colored like remainder of disc with several light spots on left side in its posterior third. Ventral surface yellowish-white, except for margins of disc posterior to first gill slits, area lateral to gill slits, transverse axis of disc, abdomen, area lateral to cloaca, and margin of posterior pelvic lobes, all of which more or less spotted, blotched, or clouded grayish-brown; abdomen uniformly grayish-brown and sharply marked off from predominantly whitish interbranchial and cloacal areas; claspers yellowish-white, except for brown distolateral margin and pale brown cross-bar distally on left; origin of tail whitish, remaining section pale brown with scattered darker spots, and tip of tail whitish except for two grayish-brown cross-bars at level of dorsal fins. Paratypes similarly colored, except that tail may have vague dark cross-bars in anterior third and at dorsal fins (ISH 3559/79, 3640/79_b, USNM 265013) and some variation in extension of brownish spots and blotches ventrally; ventral surface varying from predominantly whitish in smallest paratype (Fig. 2b), with abdomen thus appearing distinctly darker than remainder of ventrum, or predominantly dark with only few pale areas as in USNM 265014; ventral side of tail varying from entirely whitish with few dark spots, to brown on anterior and white on posterior half, or to completely light brown with white tip, with cross-bars at dorsal fins less evident. Freshly caught four ISH specimens showed brown color more intensively on both surfaces.

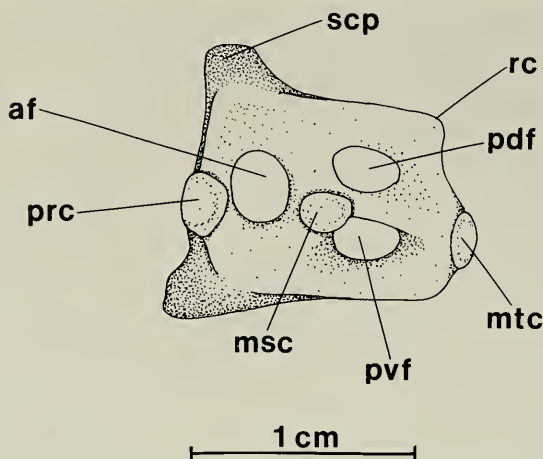


Fig. 5. Lateral view of left scapulocoracoid of *N. carolinensis*, ISH 3640/79_b, 232 mm TL (Paratype) adolescent female: af—anterior fenestra, msc—mesocondyle, mtc—metacondyle, pdf—postdorsal fenestra, prc—procondyle, pvf—postventral fenestra, rc—rear corner, scp—scapular process.

Neurocranium (mainly based on paratypes ISH 3640/79b and USNM 265013) with very slender, unsegmented rostral shaft tapering to filament abutting against but free of rostral node and appendices (Fig. 4a); rostral node consisting of narrow bridge joining rostral appendices at tip of snout; rostral appendices plate-like anteriorly with large elliptical foramina, posteriorly extending nearly to anterior fontanelle and conical in cross section, 60–80% of rostral length; propterygia of pectoral girdle terminating lateral to anterior margin of appendices; rostral base narrow, 18–23% of cranial width; nasal capsules ovoid-shaped, greatly laterally expanded and set at about 33° angle to transverse axis and at 67°–75° angle to longitudinal axis of neurocranium; profundus nerve with two foramina on leading edge of each nasal capsule; interorbital region moderately narrow 26–31% of cranial width (Table 2); preorbital processes poorly developed, separated from incised supraorbital crests by narrow groove; anterior fontanelle narrow, tapering anteriorly, with rounded anterior and posterior margins; posterior fontanelle narrow and constricted at about mid-length; foramen for anterior cerebral vein on vertical with dorsal rim of optic nerve foramen and on line with foramina for preorbital and orbitonasal canals (Fig. 4b); jugal arches very slender (Fig. 4c); basal and nasal plates moderately narrow (Fig. 4d).

Scapulocoracoids moderately expanded (Fig. 5; and Fig. 13c McEachran and Compagno 1982), with postdorsal and anterior fontanelles little expanded, those of female more expanded than those of male (Table 2); scapular process directed dorsomedially; anterodorsal margin (anterior to rear corner) straight to slightly concave, rear corner little elevated, if at all; posterodorsal margin concave and steeply sloping to metacondyle.

Pelvic girdle with relatively slender puboischiadic bar, nearly straight anteriorly; strongly concave posteriorly, more deeply concave in males than in females (Fig. 6a, b); prepelvic processes short and oriented laterally; iliac processes long, strongly curved and directed anteromedially; two obturator foramina.

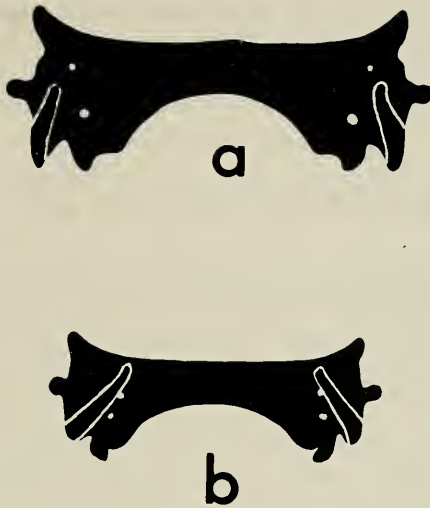


Fig. 6. *Neoraja carolinensis* pelvic girdles: a, ISH 3650/79, 285 mm TL (Holotype) adolescent male; b, USNM 265014, 225 mm (Paratype) juvenile female. Drawn from radiographs.

Etymology.—Named after the type-locality, the Carolinian Province of the western North Atlantic.

Remarks.—*Neoraja carolinensis* is very similar to its two congeners, *N. caerulea* and *N. stehmanni*, and to *Breviraja africana* in external morphology, squamation, coloration, and skeletal structure but differs from them in the several characters. In *N. caerulea*, *N. stehmanni* and *B. africana* the anterior lobe of the pelvic fin is about 70 to 80% of the length of the posterior lobe (lobes are about equal in length in *N. carolinensis*). *Neoraja caerulea* has 47 to 55 ($\bar{x} = 50$) and *B. africana* 45 to 49 ($\bar{x} = 47$) tooth rows in the upper jaw (*N. carolinensis* has 40 to 46 ($\bar{x} = 43$)). Both *N. caerulea* and *N. stehmanni* have 6 to 9 distinct cross-bars on dorsal surface of tail (*N. carolinensis* either lacks or has indistinct cross-bars on tail). Abdominal region of *N. caerulea*, *N. stehmanni* and *B. africana* is light colored or light with dark blotches (*N. carolinensis* has a uniformly dark abdominal region). *Neoraja carolinensis* also differs from its two congeners in several aspects of its neurocranial and scapulocoracoid structure (McEachran and Compagno 1982). *Neoraja caerulea* and *N. stehmanni* neurocrania possess shorter rostral shafts, shorter rostral appendices and less laterally expanded nasal capsules. The scapulocoracoids of *N. caerulea* and *N. stehmanni* possess an elevated rear corner and a more concave dorsal margin than that of *N. carolinensis*.

Material examined in the course of this study necessitates several changes in McEachran and Compagno's description of *N. (Neoraja)*. McEachran and Compagno (1982) stated, that species of *N. (Neoraja)* possess a single row of thorns along the proximal midline of the tail, that the rostral shaft of *N. sp. nov.* (= *N. carolinensis*) is distally segmented and that the anterodorsal margin of the scapulocoracoids is concave with the rear corner elevated. However, the holotype and larger paratypes of *N. carolinensis* possess a narrow band of two or three irregular rows of thorns on the proximal aspect of the tail unlike the smaller specimens or

the three other species. Staining one of the dissected neurocrania of *N. carolinensis* revealed that the rostral shaft is not distally segmented. Apparent segmentation of the rostral shaft in the previous study is an artifact of dissection. The rostral shafts of *N. caerulea* and *N. stehmanni* are probably also unsegmented. While the scapulocoracoids of *N. caerulea* and *N. stehmanni* possess a concave anterodorsal margin and an elevated rear corner, those of *N. carolinensis* and *B. africana* are straight to slightly concave, without or at most with a slightly elevated rear corner.

Key to Species of *Neoraja* and *Breviraja africana*

1. Anterior and posterior pelvic lobes of about equal length, dark cross-bars on dorsal surface of tail indistinct to absent, abdomen uniformly grayish-brown and marked off from light interbranchial and cloacal regions *N. carolinensis*
- Anterior pelvic lobe at most 70 to 80% of posterior pelvic lobe length, dark cross-bars on dorsal surface of tail usually distinct, abdomen uniformly light colored to light with dark blotches but not uniformly dark colored nor marked off from interbranchial and cloacal regions 2
2. Dorsal surface of disc and pelvic fins grayish with irregular pattern of dark blotches and light spots, 38 to 44 tooth rows in upper jaw . . . *N. stehmanni*
- Dorsal surface of disc and pelvic fins plain brown to bluish-violet, without blotches, 45 to 55 tooth rows in upper jaw 3
3. Dorsal surface of disc and pelvic fins bluish-violet, dorsal side of tail light colored, dark cross-bars on dorsal surface of tail distinct *N. caerulea*
- Dorsal surface of disc, pelvic fins and tail uniformly brown (faint bluish shade centrally when newly dead), dark cross-bars on dorsal surface of tail indistinct *B. africana*

Distribution.—The three species of *Neoraja* and *Breviraja africana* are allopatrically distributed but occur in similar habitats. *Neoraja carolinensis* was captured along the continental slope off the southeastern United States, 34° 22'N to 29° 11'N, at 695 to 1010 m, at temperatures of 4.18° to 6.09°C. *Neoraja caerulea* was captured on the slopes of the Rockall Basin, west of Scotland and Ireland, 61° 06'N to 55° 44'N, at 600 to 1262 m, at temperatures of 6.41° to 9.10°C (Stehmann 1976). *Neoraja stehmanni* was captured along the continental slope off the west coast of South Africa, 33° 53.7'S to ca. 34°S, at 292 to 640 m, at temperatures of 5.55° to 5.70°C (Hulley 1972). Another very small specimen of *N. stehmanni* reported from off northern Mauritania, 22° 50'N, at 1490 to 1620 m, by Golovan (1978) probably represents another species (Stehmann, in press). *Breviraja africana* was captured on the continental slope off Gabon, 2° 41'S to 3° 25'S, at 900 to 1030 m, at temperatures of 4.35° to 4.66°C (Stehmann and Seret 1983).

Acknowledgments

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