

First report and description of a legskate, genus *Cruriraja*, from the southwestern Atlantic Ocean (Chondrichthyes: Rajidae)

by

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ABSTRACT. - A female 320 mm in TL and presumably immature is described here as the first specimen of legskate, genus *Cruriraja* Bigelow & Schroeder, 1948, collected in the western South Atlantic Ocean; the specimen was taken from the eastern Brazilian continental slope off the state of Bahia in a depth of 251 m. It is morphologically characterized and compared to all congeners, and is identified as *Cruriraja rugosa* Bigelow & Schroeder, 1958, a species that otherwise occurs in the western North Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Our specimen shares with *C. rugosa* features not present in congeners (e.g., a single clearly defined row of thorns on posterior dorsal disc and tail midline, absence of scapular thorns), but differs from typical *C. rugosa* in lacking a distinct caudal fin, in having fewer thorns on tail midline and sides, in lacking denticles on ventral tail surface, and in snout angle; these characters are considered insufficient, however, to describe the unique Brazilian specimen as a new species. Species of *Cruriraja* are otherwise restricted to the lower continental shelf and slope of the western North Atlantic Ocean, Gulf of Mexico, Caribbean Sea, Indian Ocean, and off South Africa. The Brazilian specimen reduces the distributional void between South African/Indian Ocean species of *Cruriraja* with those occurring in the Caribbean Sea, Gulf of Mexico and western North Atlantic Ocean.

RÉSUMÉ. - Première capture et description d'un spécimen de raie du genre *Cruriraja* de l'Atlantique sud-ouest.

Nous décrivons le premier spécimen d'une raie femelle, présumée immature, de 320 mm LT, du genre *Cruriraja* Bigelow & Schroeder, 1948, récolté dans l'Atlantique sud-ouest. Ce spécimen a été capturé sur la pente continentale brésilienne de l'état de Bahia par 251 m de profondeur. Les caractéristiques morphologiques du spécimen, comparées à celles de toutes les autres espèces du genre *Cruriraja*, permettent de l'identifier comme *Cruriraja rugosa* Bigelow & Schroeder, 1958, qui était connue jusqu'à présent en Atlantique nord-ouest, dans le golfe du Mexique et la mer des Caraïbes. Notre spécimen a en commun avec *C. rugosa* la combinaison des caractéristiques suivantes, non présentées par les autres espèces du genre : une seule rangée, bien définie, d'épines médiodorsales sur la partie postérieure du disque et le dessus de la queue ; absence d'épines scapulaires. Il diffère de la forme typique de *C. rugosa* par l'absence d'une nageoire caudale distincte, par un nombre légèrement plus petit d'épines sur le dessus et les côtés de la queue, par l'absence de denticules cutanés sur la face ventrale de la queue et par la valeur de l'angle du museau. Cependant, ces caractéristiques sont insuffisantes pour décrire cet unique spécimen brésilien comme une nouvelle espèce. Les espèces du genre *Cruriraja* sont circonscrites au plateau continental externe et à la pente continentale de l'Atlantique nord-ouest, du golfe du Mexique, de la mer des Caraïbes, de l'océan Indien et de l'Afrique du Sud. Le spécimen brésilien réduit le vide de distribution entre les espèces sud-africaines et indiennes, d'une part, et celles de la mer des Caraïbes, du golfe du Mexique et de l'Atlantique nord-ouest, d'autre part.

Key words. - Rajidae - *Cruriraja* - ASW - Caribbean Sea - Gulf of Mexico - Taxonomy - Distribution.

Skates of the genus *Cruriraja* Bigelow & Schroeder, 1948 have pelvic fins that are completely subdivided into two distinct lobes, which probably enable them to "walk" on the substrate by coordinated movements of the anterior lobes in a manner that mimics legs (Holst and Bone, 1993; Lucifora and Vassallo, 2002). Even though almost all skates (Rajidae) have pelvic fins subdivided to some degree and a certain predisposition to "walk", none approach *Cruriraja* and its sister-genus *Anacanthobatis* von Bonde & Swart, 1923 in having the anterior limblike lobes (*crurae* of Holst and Bone, 1993) completely detached from the pelvic fin

web (Bigelow and Schroeder, 1953). The eight valid species of *Cruriraja* occur in a wide depth range from approximately 100 to 1200 m, and were hitherto known from the western North Atlantic Ocean, Gulf of Mexico, Caribbean Sea, off the western, southern and eastern coasts of South Africa, and from the Indian Ocean (Lloyd, 1909; Bigelow and Schroeder, 1948, 1953, 1958, 1962; Smith, 1964; Wallace, 1967; Hulley, 1970, 1972, 1995; Stehmann, 1976; McEachran and Miyake, 1990a; Fischer *et al.*, 1990). We report here the first specimen of *Cruriraja* collected in the southwestern Atlantic Ocean; prior to this account the genus was known to occur in

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the western Atlantic only as far “south” as western Venezuela (Cervigón, 1993; McEachran and Fechhelm, 1998; McEachran and Carvalho, 2002). The specimen, first reported in an unpublished doctoral thesis (Gomes, 2002), was collected from the continental slope of the state of Bahia (Brazil) during fisheries surveys of the Federal REVIZEE Program (Central Coast region; Fig. 1). Our objectives here are to further characterize and compare this specimen to congeners.

MATERIALS AND METHODS

Measurements and counts follow Bigelow and Schroeder (1953) as modified by Hubbs and Ishiyama (1968), except for the following: internarial space is distance between exposed inner margins of nostrils; nasal curtain width was measured at posterior nasal curtain just anterior to mouth opening; base length of dorsal fins excludes their interconnecting membrane; and width of posterior lobe of pelvic fin was measured at its greatest width. Measurements are point-to-point (Hubbs and Ishiyama, 1968). Institutional abbreviations follow Leviton *et al.* (1985). Salient anatomical structures were observed by X-ray radiography, taken with Kodak mammography film (Min-R2000). Terminology for skeletal structures follows McEachran and Compagno (1979, 1982), for teeth Cappetta (1987), and for lateral line canals Chu and Wen (1979) and Maruska (2001) with the additional subdivision of the scapular canal into anterior and posterior segments. Lateral line canals were observed through transparency directly under a microscope, without injection of methylene blue or dissection (ampullary system was not studied). Abbreviations used throughout the text include DW for disc width, DL for disc length, TL for total length, Vtr for pre-transitional vertebrae (from first complete centrum in synarcual to mono-diplospondyly transition), and Vprd for pre-dorsal caudal vertebrae (from mono-diplospondyly transition to predorsal centrum).

Comparative material examined

Cruriraja andamanica. - ZMA 113.400, 179 mm TL, juvenile female, western Indian Ocean (near Dar es Salaam, Tanzania), ca. 07°S-040°E, 274-457 m, 26-28 Jun. 1974.

Cruriraja parcomaculata. - SAM 34345 (11 specimens), all females, South Africa, 34°47.9'S-023°49.6'E, 171 m. - SAM 34545 (18 spms), males and females, South Africa, 36°11'S-020°06'E, 178 m.

Cruriraja rugosa. - SAM 26627, 462 mm TL, adult male, Gulf of Mexico (near Leeward Island), 17°41.0'N-062°50.5'W, 300-320 fathoms (approx. 548-585 m), R/V Oregon I, Station 6695 (40' shrimp trawl), 18 May 1967. - TCWC 2704.01, 435 mm TL, female, 28°49'N-086°38'W. - TCWC 2705.01, 508 mm TL, female, 28°17'N-086°21'W. - TCWC 2736.01, 262 mm TL, male, 28°22'N-086°31'W. - TCWC 2739.01 (2 spms), 162 and 351 mm TL, females, 29°01'N-087°01'W. - TCWC 2810.01, 460 mm TL,

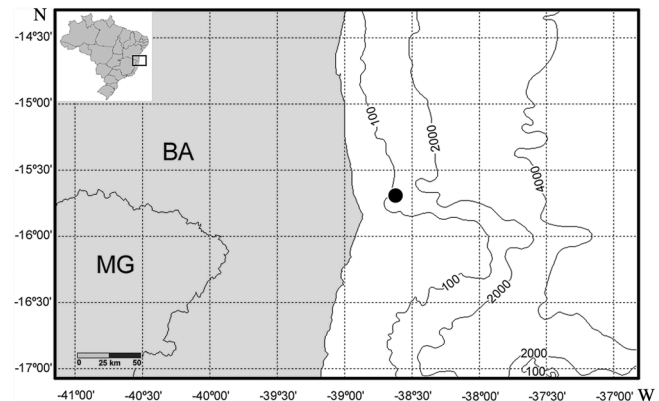


Figure 1. - Locality of the only known specimen of *Cruriraja rugosa* (MNRJ 28504) from the southwestern Atlantic Ocean. Abbreviations: BA, state of Bahia; MG, state of Minas Gerais. [Localisation du seul spécimen connu de *Cruriraja rugosa* de l'océan Atlantique sud-ouest.]

female, NE Gulf of Mexico, R/V Oregon II, Station 11481. - TCWC 6369.09, 493 mm TL, female, 27°55'N-090°23'W. - TCWC 6439.01, 383 mm TL, female, 27°45'N-090°48'W. - TCWC 6440.01 (2 spms), 295 mm TL, male, 195 mm TL, female, 27°53'N-090°05'W. - TCWC 6445.01, 384 mm TL, male, 28°13'N-086°06'W. - TCWC 7276.13 (2 spms), 256 mm TL, male, 196 mm TL, female, 16°43'N-082°38'W (all TCWC material from Gulf of Mexico and Caribbean Sea).

Cruriraja triangularis. - SAM 33504 (4 spms), 3 males and 1 female, Mozambique, 26°19'S-033°09'E, 366 m, RS Algoa.

CRURIRAJA RUGOSA BIGELOW & SCHROEDER, 1958

Material

MNRJ 28504, immature female, 320 mm TL, continental slope of Bahia state (Brazil; Fig. 1), 15°42'41''S-038°37'18''W, 251 m, N/O Thalassa, sta. E-511, 12 Jun. 2000 (Tab. I, Figs 2-10).

Diagnosis

A species of *Cruriraja* distinct from congeners by presenting a single row of enlarged thorns on dorsal tail midline (multiple rows in *C. poeyi*, *C. atlantis*, *C. cadenati*, *C. parcomaculata*, and *C. triangularis*), and by lacking scapular thorns (present in *C. andamanica* and *C. durbanensis*, and in specimens above 250 mm TL of all congeners except *C. poeyi*). The following characters in combination further distinguish our specimen from congeners: a single thorn present in between dorsal fins (numerous interdorsal thorns in *C. atlantis*, two pairs of thorns in *C. poeyi*, four to eight thorns in *C. parcomaculata*, three to four thorns in *C. triangularis*, and interdorsal thorns absent in *C. durbanensis*); a naked middisc region from suprascapula to almost level of pelvic girdle (thorns present on disc midline in *C. atlantis*, *C.*

Table I. - Measurements (in mm and % of TL), meristic data, and other features for *Cruriraja rugosa* from the southwestern Atlantic Ocean (MNRJ 28504), Gulf of Mexico and Caribbean Sea. For morphometric comparisons, data are provided for a female *C. rugosa* from the Caribbean Sea off Honduras of about the same size (318 mm TL) as the MNRJ specimen (data taken from Bigelow and Schroeder, 1962; raw measurements for this specimen were not provided in original account). Abbreviations for ventral tail denticles are as follows: A: naked; B: sparse but uniform; C: moderately sparse but uniform; D: very sparse but present over length; E: moderately dense and uniform; F: moderately dense. [Mesures (en mm et % LT), données méristiques et autres caractéristiques pour *Cruriraja rugosa* de l'océan Atlantique sud-ouest, du golfe du Mexique et de la mer Caraïbe. Pour les comparaisons morphométriques, les données sont fournies pour une femelle *C. rugosa* de la mer Caraïbe au large du Honduras, de taille à peu près équivalente (318 mm LT) à celle du spécimen MNRJ (données prises chez Bigelow et Schroeder, 1962 ; les mesures de bases pour ce spécimen n'étaient pas données dans le rapport original). Abréviations pour les denticules de la queue ventrale : A : nu ; B : clairsemé mais uniforme ; C : modérément clairsemé mais uniforme ; D : très clairsemé mais présent sur toute la longueur ; E : modérément dense et uniforme ; F : modérément dense.]

Parameter	MNRJ 28504		Caribbean Sea <i>Cruriraja rugosa</i>	TCWC 2704.01		TCWC 2705.01		TCWC 2736.01		TCWC 2739.01		TCWC 2739.01		TCWC 2810.01	
	mm	% TL	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL
<i>Morphometric</i>															
Total length	320			435.0		508.0		262.0		351.0		162.0		460.0	
Disc width	185	57.8	56.7	239.0	54.9	280.0	55.1	152.0	58.0	203.0	57.8	94.0	58.0	263.0	57.2
Disc length	144	45.0	42.5	202.0	46.4	228.0	44.9	118.0	45.0	162.0	46.2	78.0	48.1	202.0	43.9
Snout to max. disc width	97	30.3		133.0	30.6	174.0	34.3	53.0	20.2	109.0	31.1	53.0	32.7	148.0	32.2
Eye diameter	15	4.7	3.8	17.0	3.9	16.0	3.1	9.1	3.5	11.7	3.3	5.7	3.5	16.0	3.5
Interorbital space	10	3.1	3.2	12.1	2.8	13.2	2.6	7.2	2.7	10.0	2.8	4.9	3.0	13.1	2.8
Spiracle length	8.5	2.7	2.0	6.6	1.5	7.3	1.4	3.3	1.3	3.4	1.0	1.4	0.9	6.2	1.3
Interspiracular width	23	7.2	6.3	24.8	5.7	28.4	5.6	14.9	5.7	20.8	5.9	9.6	5.9	25.7	5.6
Mouth width	22	6.9	5.5	24.2	5.6	27.2	5.4	13.1	5.0	19.8	5.6	9.0	5.6	24.8	5.4
Internarial space	19	5.9	5.5	23.1	5.3	27.3	5.4	13.7	5.2	19.4	5.5	8.6	5.3	25.6	5.6
Nasal curtain width	21	6.6		27.0	6.2	31.7	6.2	18.0	6.9	25.0	7.1	10.5	6.5	28.6	6.2
Preorbital length	32	10.0	11.6	50.3	11.6	60.5	11.9	28.9	11.0	42.8	12.2	19.5	12.0	54.2	11.8
Preoral length	40	12.5	14.2	53.6	12.3	65.3	12.9	33.6	12.8	47.3	13.5	21.5	13.3	54.3	11.8
Prenasal length	29	9.1		41.0	9.4	53.0	10.4	23.5	9.0	36.2	10.3	17.6	10.9	45.2	9.8
1 st branchial slit width	4	1.3	1.5	3.7	0.9	4.6	0.9	1.3	0.5	2.3	0.7	0.7	0.4	4.2	0.9
3 rd branchial slit width	3	0.9	1.6	4.7	1.1			1.9	0.7	2.4	0.7	1.0	0.6	4.7	1.0
5 th branchial slit width	2.5	0.8	1.3	3.3	0.8			0.9	0.3	1.2	0.3	0.5	0.3	2.6	0.6
Space between 1 st branchial slits	39	12.2	11.5	48.6	11.2	59.1	11.6	29.7	11.3	39.2	11.2	19.0	11.7	51.1	11.1
Space between 5 th branchial slits	22	6.9	6.1	25.2	5.8			14.9	5.7	21.7	6.2	11.2	6.9	29.1	6.3
Height 1 st dorsal	11	3.4	2.5	9.4	2.2	10.7	2.1	4.9	1.9	5.4	1.5	1.5	0.9	8.7	1.9
Base 1 st dorsal	12	3.8	3.8	15.3	3.5	18.3	3.6	9.8	3.7	13.9	4.0	5.8	3.6	15.0	3.3
Height 2 nd dorsal	12	3.8	2.8	7.5	1.7	9.9	1.9	4.9	1.9	6.3	1.8	2.4	1.5	9.0	2.0
Base 2 nd dorsal	13	4.1	4.1	11.9	2.7	17.2	3.4	8.3	3.2	11.6	3.3	4.9	3.0	14.9	3.2
Width pelvic ant. lobe	7	2.2		5.4	1.2	6.3	1.2	3.8	1.5	5.7	1.6	1.5	0.9	5.9	1.3
Length pelvic ant. lobe	45	14.1	12.0	62.2	14.3	70.2	13.8	35.4	13.5	49.7	14.2	22.2	13.7	59.9	13.0
Pelvic length	42	13.1		58.4	13.4	71.1	14.0	34.8	13.3	47.4	13.5	20.5	12.7	56.7	12.3
Width pelvic post. lobe	18	5.6		16.6	3.8	19.6	3.9	9.9	3.8	14.5	4.1	5.0	3.1	16.8	3.7
Snout to cloaca	119	37.2	37.1	164.0	37.7	218.0	42.9	98.3	37.5	133.0	37.9	64.4	39.8	177.0	38.5
Cloaca to tail tip	200	62.5	62.9	271.0	62.3	290.0	57.1	164.0	62.6	218.0	62.1	98.0	60.5	283.0	61.5
<i>Meristic</i>															
Pseudobranchial folds		7/8 (left/right)		7		7		?		7		8		7	
Snout angle		94°		87°		83°		90°		88°		89°		87°	
Tooth rows(upper jaw)		40		45		44		35		40		36		46	
Tooth rows(lower jaw)		36		44		38		?		?		?		42	
Rostral thorns		4		5		7		7		4		8		9	
Orbital thorns		8		6		8		5		4		4		3	
Nuchal thorns		2		2		2		2		2		1		3	
Scapular thorns		absent		0		0		2/0		0		2/2		0	
Predorsal midline thorns		32		47+1		59+1		30+0		44+1		26+1		46+2	
Ventral tail denticles		A	?	B		C		A		D		A		B	
Caudal fin		absent	present	present		present	dark	present	dark	present	dark	present	dark	present	dark
Tail folds		dark	?	dark		dark		dark		dark		dark		dark	
Propterygial radials		23													
Mesopterygial radials		6													
Metapterygial radials		30													
Total pectoral radials		59													
Pelvic radials		not discernible						no data available							
Vtr		23													
Vprd		92													
Total predorsal vertebrae		115													

cadenati, *C. parcomaculata*, *C. durbanensis*, and to a lesser extent, in *C. triangularis* and *C. andamanica*); extremity of anterior pelvic lobe tapering, not spatulate (anterior pelvic lobe not tapering, with a wide, spatulate tip in *C. cadenati*

and, to a lesser extent, in *C. parcomaculata*); distance between dorsal fins not greater than length of dorsal fin base (dorsal fins spaced apart by at least 1.5 times their base length in *C. atlantis*); and lateral tail folds, upper portions of

Table I. - Continued. [Suite.]

Parameter	TCWC 6369.09		TCWC 6439.01		TCWC 6440.01		TCWC 6440.01		TCWC 6445.01		TCWC 7276.13		TCWC 7276.13		range % TL		x % TL	SD	
	mm	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL	mm	% TL	min	max			
<i>Morphometric</i>																			
Total length	493.0		383.0		295.0		188.0		384.0		256.0		189.0		162.0	508.0			
Disc width	293.0	59.4	223.0	58.2	171.0	58.0	108.0	57.4	215.0	56.0	142.0	55.5	108.0	57.1	55.1	59.4	57.3	1.2	
Disc length	230.0	46.7	178.0	46.5	136.0	46.1	84.0	44.7	179.0	46.6	113.0	44.1	88.0	46.6	43.9	48.1	45.8	1.2	
Snout to max. disc width	160.0	32.5	105.0	27.4	85.0	28.8	53.0	28.2	124.0	32.3	67.0	26.2	54.0	28.6	20.2	34.3	29.5	3.9	
Eye diameter	15.8	3.2	13.4	3.5	11.0	3.7	6.8	3.6	13.1	3.4	8.3	3.2	7.4	3.9	3.1	3.9	3.5	0.2	
Interorbital space	13.2	2.7	10.3	2.7	8.4	2.8	5.5	2.9	10.7	2.8	6.2	2.4	5.6	3.0	2.4	3.0	2.8	0.2	
Spiracle length	6.0	1.2	5.9	1.5	3.7	1.3	2.7	1.4	5.5	1.4	2.4	0.9	2.6	1.4	0.9	1.5	1.3	0.2	
Interspiracular width	28.1	5.7	21.8	5.7	17.0	5.8	11.0	5.9	21.0	5.5	14.7	5.7	11.9	6.3	5.5	6.3	5.8	0.2	
Mouth width	24.8	5.0	17.8	4.6	16.1	5.5	9.9	5.3	20.6	5.4	13.7	5.4	9.6	5.1	4.6	5.6	5.3	0.3	
Internarial space	27.8	5.6	20.3	5.3	15.7	5.3	10.2	5.4	21.5	5.6	13.6	5.3	10.3	5.4	5.2	5.6	5.4	0.1	
Nasal curtain width	31.2	6.3	24.6	6.4	18.5	6.3	11.3	6.0	25.2	6.6	17.1	6.7	12.9	6.8	6.0	7.1	6.5	0.3	
Preorbital length	60.7	12.3	46.3	12.1	36.0	12.2	21.3	11.3	46.9	12.2	30.0	11.7	21.5	11.4	11.0	12.3	11.8	0.4	
Preoral length	68.6	13.9	52.4	13.7	38.7	13.1	23.0	12.2	51.8	13.5	33.6	13.1	19.2	10.2	10.2	13.9	12.8	1.0	
Prenasal length	54.1	11.0	40.0	10.4	32.5	11.0	18.8	10.0	42.2	11.0	24.4	9.5	18.3	9.7	9.0	11.0	10.2	0.7	
1 st branchial slit width	5.9	1.2	3.3	0.9	2.3	0.8	0.9	0.5	4.3	1.1	2.7	1.1			0.4	1.2	0.8	0.3	
3 rd branchial slit width	5.1	1.0	2.6	0.7	1.5	0.5	1.0	0.5	3.9	1.0	2.5	1.0			0.5	1.1	0.8	0.2	
5 th branchial slit width	5.0	1.0	1.9	0.5	0.5	0.2	0.4	0.2	2.2	0.6	2.0	0.8			0.2	1.0	0.5	0.3	
Space between 1 st branchial slits	54.2	11.0	43.8	11.4	31.2	10.6	20.7	11.0	41.9	10.9	30.7	12.0			10.6	12.0	11.3	0.4	
Space between 5 th branchial slits	31.2	6.3	23.5	6.1	17.2	5.8	13.1	7.0	20.9	5.4	17.7	6.9			5.4	7.0	6.2	0.5	
Height 1 st dorsal	11.7	2.4	5.9	1.5	7.0	2.4	2.2	1.2	6.0	1.6	3.5	1.4	2.6	1.4	0.9	2.4	1.7	0.5	
Base 1 st dorsal	19.6	4.0	14.5	3.8	10.7	3.6	6.4	3.4	14.8	3.9	9.2	3.6	6.9	3.7	3.3	4.0	3.7	0.2	
Height 2 nd dorsal	12.7	2.6	5.2	1.4	5.6	1.9	2.5	1.3	6.1	1.6	3.4	1.3	2.2	1.2	1.2	2.6	1.7	0.4	
Base 2 nd dorsal	15.1	3.1	11.6	3.0	10.6	3.6	5.6	3.0	14.3	3.7	8.4	3.3	6.4	3.4	2.7	3.7	3.2	0.3	
Width pelvic ant. lobe	6.4	1.3	4.9	1.3	3.8	1.3	2.4	1.3	4.9	1.3	2.1	0.8	2.1	1.1	0.8	1.6	1.2	0.2	
Length pelvic ant. lobe	74.2	15.1	54.1	14.1	39.0	13.2	24.4	13.0	51.2	13.3	33.0	12.9	23.0	12.2	12.2	15.1	13.6	0.7	
Pelvic length	72.5	14.7	51.3	13.4	37.1	12.6	20.4	10.9	48.0	12.5	30.9	12.1	20.6	10.9	10.9	14.7	12.8	1.1	
Width pelvic post. lobe	30.3	6.1	19.8	5.2	11.8	4.0	7.0	3.7	20.5	5.3		0.0	6.2	3.3	0.0	6.1	3.8	1.4	
Snout to cloaca	205.0	41.6	151.0	39.4	113.0	38.3	68.6	36.5	152.0	39.6	95.0	37.1	72.5	38.4	36.5	42.9	38.9	1.8	
Cloaca to tail tip	288.0	58.4	232.0	60.6	182.0	61.7	119.0	63.3	232.0	60.4	161.0	62.9	116.0	61.4	57.1	63.3	61.1	1.8	
<i>Meristic</i>																			
Pseudobranchial folds	7		7		6		7		7		7		7		6	8			
Snout angle	85°		90°		81°		85°		87°		88°		85°		81°	94°			
Tooth rows(upper jaw)	44		44		40		40		43		39				39	46			
Tooth rows(lower jaw)	?		40		35		37		40		?				35	44			
Rostral thorns	4		8		7		8		8		6				4	9			
Orbital thorns	5		6		5		4		5		5				3	8			
Nuchal thorns	2		1		3		1		2		1		1		1	3			
Scapular thorns	0		0		0		1/1		1/0				1/1		0	2			
Predorsal midline thorns	46+1		43+2		29+1		27+1		48+1		33+2		54+2		26+1	59+1			
Ventral tail denticles	E		F		D		A		B		A		A						
Caudal fin	present		present		present		present		present		present		present						
Tail folds	dark		dark		dark		dark		light		?		?						
Propterygial radials																			
Mesopterygial radials																			
Metapterygial radials																			
Total pectoral radials																			
Pelvic radials																			
Vtr									no data available										
Vprd																			
Total predorsal vertebrae																			

dorsal fins, and caudal extremity darker in colour (tail folds, dorsal fins, and caudal extremity not darker than disc and tail in *C. cadenati*, *C. parcomaculata*, *C. triangularis*, *C. andamanica* and *C. durbanensis*).

Description

Proportional measurements and counts are given in table I.

External morphology

Disc markedly triangular, much wider than long (DW 57.8% of TL, DL 45.0% of TL), with greatest posteri-

or to horizontal midline (Figs 2, 3). Snout triangular, extremity not protruding greatly beyond anterior disc margin. Anterior margin of disc slightly convex from level of orbits to snout tip. Disc apices rounded, with convex posterior margins. Posterior apex of disc extends caudally to beyond mid-length of posterior lobe of pelvic fin. Gill slits small and semicircular, situated medial to propterygia; fifth gill slits just anterior to coracoid bar; distance between last gill slits just greater than half of distance between first gill slits.

Interspiracular distance much greater than interorbital distance (Fig. 4); spiracles oval, elongated, extending anteriorly to posterior one-third of eye, and projecting obliquely

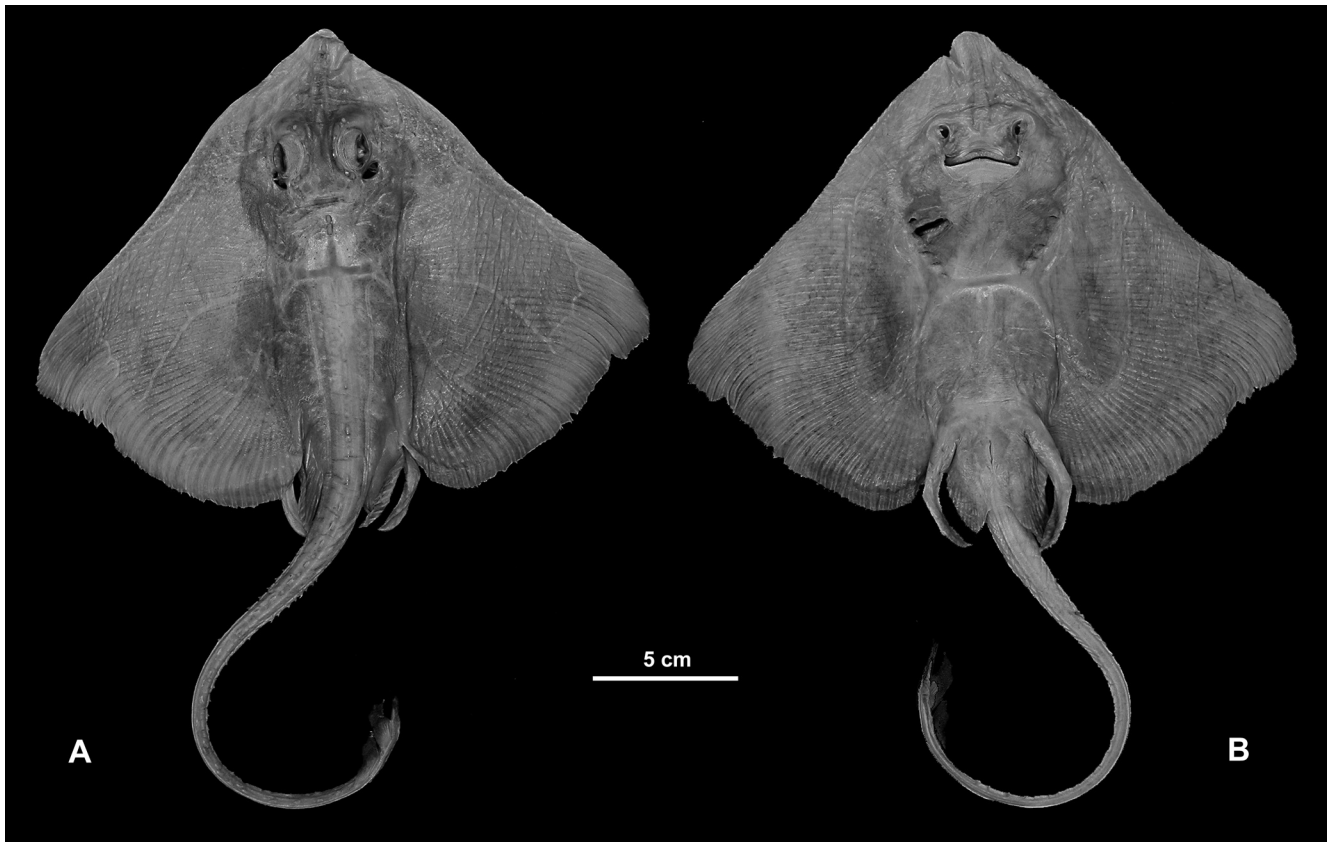


Figure 2. - Dorsal (A) and ventral (B) view of *Cruriraja rugosa* (MNRJ 28504) from the western South Atlantic. [Vues dorsale (A) et ventrale (B) de *Cruriraja rugosa* de l'Atlantique sud-ouest.]

from midline. Eyes relatively large; eye length much greater than spiracle length. Pseudobranchial folds short, situated cryptically on anteromedial spiracular wall. Prenasal snout length just shorter than preorbital snout length; preorbital snout length less than one-fourth of disc length. Nasal curtain, much wider than long, widest posteriorly, with concave, unfringed posterior margin and sigmoidal lateral margins (Fig. 5). Nostrils unfringed, small, semicircular, with tube-like nasal flaps. Distance between nostrils about equal to distance between mouth corners. Mouth situated at about midorbital level; mouth opening relatively straight across, only slightly indented at midwidth. Teeth set in quincunx, in 40/36 vertical rows. Crowns small, trapezoidal, and flattened, with slender, pointed cusps; crowns with a well developed uvula but weak apron. Roots large, about as wide as cusps; tooth base bilobed, with a shallow basal median groove; basal root ornamentation inconspicuous. Teeth covering jaw integument for full width of mouth opening, and anteroposteriorly arranged in a very slender tooth band (widest at symphysis), with about eight horizontal rows at symphysis.

Pelvic fins much wider than long, with morphologically very distinct and well separated lobes (Fig. 2B). Anterior

lobe limblike, slender and greatly elongated, extending posteriorly to about level of posterior lobe. Origin of anterior lobe anterior to pectoral axil, and inserting anterior to origin of posterior pelvic lobe at level of anterior cloaca. Anterior lobe with first articulation just posterior to its midlength and second articulation at about one-sixth of its length. Posterior lobe connected to pectoral disc at pectoral axil by thin integumental web; posterior lobe about twice the width of nasal curtain, and with convex, weblike posterior margins. Posterior lobes inserting on both sides of ventral tail base posterior to cloaca; axils separated by a small space. Width of pelvic fins with expanded anterior lobes about one-half of disc width.

Tail slender, tapering close to midsection but widening slightly toward its extremity. Cloaca to tail length much greater than snout to cloaca length and greater than disc length or width; tail clearly demarked from disc. Tail wider than high in cross-section throughout its entire length. Lateral tail folds moderately developed, originating posterior to tail midlength and extending to distal tail tip. Tail folds resemble ridges anteriorly, widening close to dorsal fins and confluent at distal tail extremity. Tail more dorsoventrally compressed at extremity as compared to its origin. Dorsal

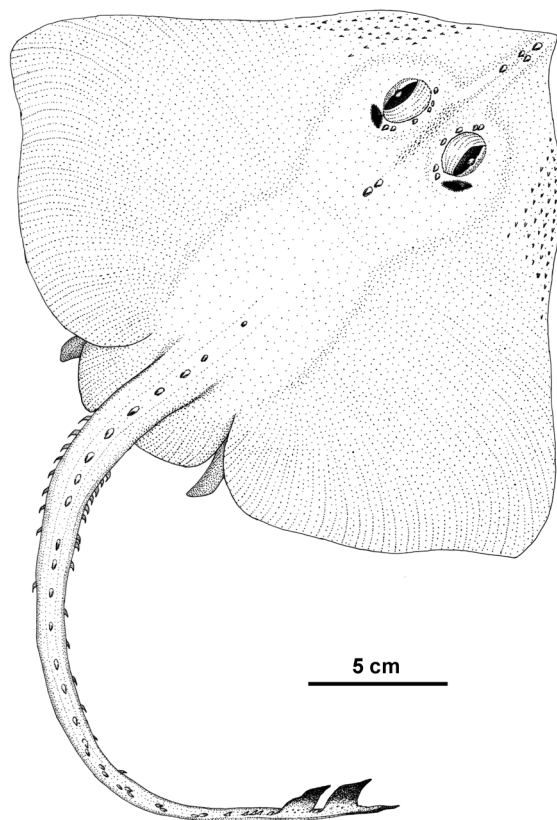


Figure 3. - *Cruriraja rugosa* (MNRJ 28504) from the western South Atlantic in dorsal view. [Vue dorsale de *Cruriraja rugosa*.]

fins situated on posterior-most aspect of tail, not fleshy and without robust bases. Dorsal fins not confluent at bases (Fig. 6), about as tall as long, similarly shaped, and sloping posteriorly. Both dorsal fins without conspicuous free posterior lobe. Second dorsal fin slightly greater than first. Distinct caudal fin absent.

Squamation

Dorsal surface of disc with widely scattered, very small denticles (prickles), more closely-packed lateral to midline of disc. Denticles present in between eyes and on integument covering eyes dorsally; few denticles inside spiracles. Small denticles present dorsally and laterally on tail, including posterior to dorsal fins; small denticles also covering dorsal fins (Fig. 6); denticles on lateral tail surface positioned slightly below lateral tail folds. Anterior pelvic lobes completely devoid of denticles; denticles on posterior dorsal pelvic lobe present only on caudal portion, but not as numerous as over disc. Denticles minute, with very erect, slender and pointed crowns, and flat, apparently multiradiate bases. Ventral disc and pelvic fins devoid of denticles, including rostrum. Denticles also absent from entire ventral tail region.

Larger thorns present on anterior dorsal snout region,



Figure 4. - Dorsal snout and head region of the Brazilian *Cruriraja rugosa* (MNRJ 28504). [Région dorsale du museau.]

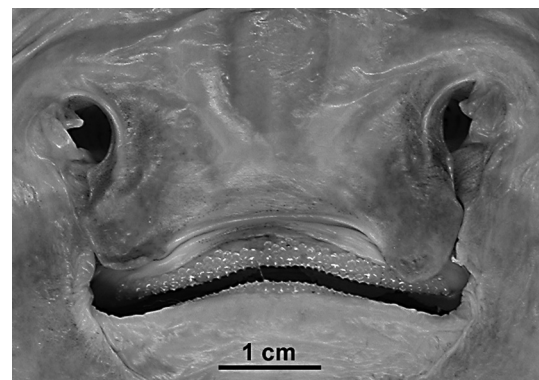


Figure 5. - Nasoral region of the Brazilian *Cruriraja rugosa* (MNRJ 28504). [Région nasorale.]

around eyes, anterior to scapulocoracoid (median nuchal thorns), on anterolateral disc margins, along midline of disc, and on dorsal and lateral surfaces of tail (Figs 3, 7, 8; see

Figure 6. - Dorsal fins and caudal extremity of the Brazilian *Cruriraja rugosa* (MNRJ 28504) in lateral view. [Vue latérale des nageoires dorsales et de l'extrémité caudale.]

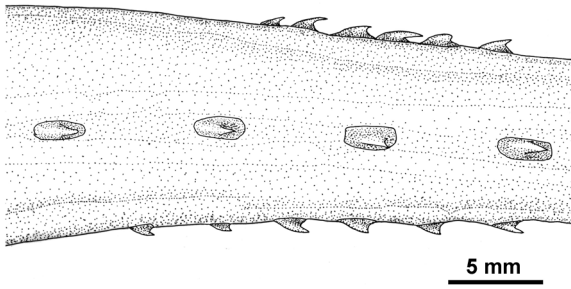
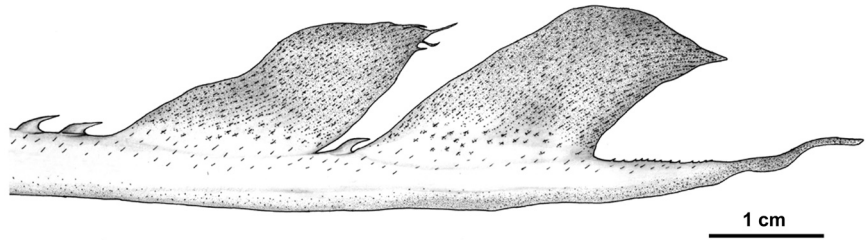


Figure 7. - Base of tail region showing distribution of thorns of the Brazilian *Cruriraja rugosa* (MNRJ 28504) in dorsal view. [Vue dorsale de la base de la queue montrant la distribution des épines.]

Tab. I for thorn counts). Thorns other than anterolateral disc thorns with large, oval bases and posteriorly inclined, acuminate crowns. Thorn bases varying from very high, elongate and slender to more rounded and less laterally compressed. Anterolateral disc thorns with distinct, multiradiate and more flattened bases. Anterolateral disc thorns small to moderate-sized, in greater number of rows anteriorly, and extending from anterior eye level to level of scapular region. Few rostral thorns present, slightly smaller than orbital thorns, and arranged asymmetrically with more thorns on left side. Orbital thorns (Fig. 8E) present in anterior, interorbital, posterior, and suprascapular position; some orbital thorns missing due to abrasion. Scapular thorns absent. Two closely set and large median nuchal thorns (Fig. 8B). Thorns on dorsal midline very few and widely spaced apart (only two present on trunk anterior to tail); first midline thorn very low and blunt, situated at middistance between scapulocoracoid and pectoral apex. Midline thorns more numerous over tail, with larger thorns as of pectoral axil and situated in a single row over most of tail length; thorns becoming somewhat irregularly arranged on posterior third of tail (Figs 3, 7, 8C, 8F). A lateral row of thorns present on each side of tail (Fig. 8D), originating posterior to pelvic fins and extending posteriorly to origin of lateral tail fold; individual thorns decreasing in size posteriorly, becoming more spaced apart. Distribution of lateral tail thorns assymetrical (Fig. 3). Midline thorns on dorsal and lateral tail relatively widely spaced apart. Lateral tail thorns smaller than dorsal midline thorns of tail. Thorns on tail with slightly more slender and slanted crowns compared to orbital and rostral thorns.

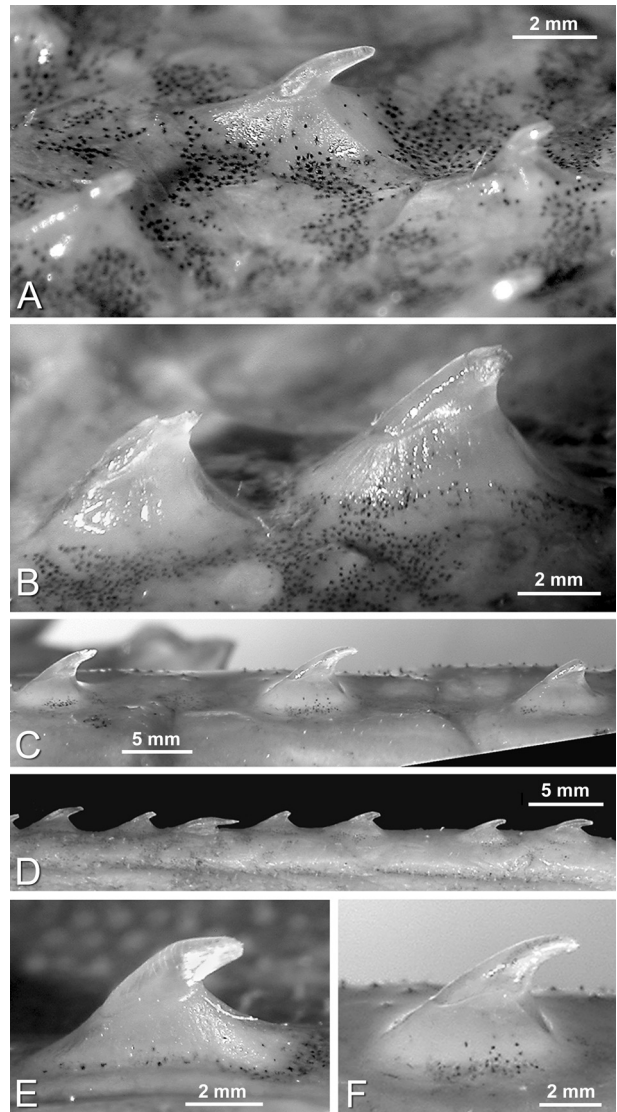


Figure 8. - Thorns of the Brazilian *Cruriraja rugosa* (MNRJ 28504). A : Anterolateral disc thorns; B : Midline nuchal thorns; C : Thorns over dorsal tail midline at tail base; D : Lateral tail thorns close to tail base; E : Enlarged view of orbital thorn; F : Enlarged view of dorsal midline thorn (from C, thorn in center). [Épines du *Cruriraja rugosa* brésilien. A : Épines du disque antérolatéral ; B : Épines nucales de la ligne médiane ; C : Épines dorsales à la base de la région médiane de la queue ; D : Épines latérales près de la base de la queue ; E : Gros plan de l'épine orbitale ; F : Gros plan de l'épine de la ligne médiane dorsale (épine au centre de la figure C).]

Sensory canal system

Dorsal canals of the lateral line system apparent through integument. Supraorbital canal originates from postorbital canal, inflects medially anterior to eyes, and extends to snout extremity slightly obliquely in relation to rostrum (Fig. 9A); lateral branches not observed. Infraorbital canal runs anterolaterally between spiracles and eyes from junction with supraorbital canal posterior to eyes, and inflects medially at mideye level to continue anteriorly to lateral snout margin; no lateral branches observed on infraorbital canal. Postorbital canal short, much smaller than eye length, extending posteriorly from junction of infra- and postorbital canals to supratemporal canal slightly posterior to spiracles, and ending at level of endo- and perilymphatic duct openings. Supratemporal canal slightly wider than interorbital space. Cranial loop (formed by supraorbital, postorbital and supratemporal canals) rather slender posteriorly but wider anteriorly. Dorsal hyomandibular canal extends laterally from infraorbital canal along anterior disc margin, and continues posteriorly to beyond level of shoulder girdle. Hyomandibular canal inflects posteromedially to connect with anterior scapular canal at posterior one-fourth of disc (canals not connected on left side), forming dorsal pleural loop. Hyomandibular canal weblike, with branches extending to outer disc margins (some 10 branches present). Anterior scapular canal broadly curved and convex, originating at level of shoulder girdle but curving to extend posterolaterally beyond central disc region (pores present distally at outer disc margins); branches of anterior scapular canal project into dorsal pleural loop (six short branches present). Posterior scapular canal curved, extending obliquely from lateral line canal and reaching posterior disc region (pores extend to outer disc margin); branches on posterior scapular canal short. Posterior lateral line canal extends caudally in a more or less straight line from scapulae to at least mid pelvic fin (lateral line on tail more concealed). Posterior lateral line canals with short branches projecting laterally.

Ventral canals of lateral line system more concealed. Prenasal, nasal and hyomandibular canals present (Fig. 9B); supraorbital and infraorbital canals not visible ventrally and may not extend to ventral surface. Prenasal canals very wide, forming a loop in between nostrils and extending forward to anterior snout margin. Nasal canals short but wide, extending laterally from posterior loop of prenasal canals to outer nasal curtain margins (posterior prenasal and nasal canals form an "x"-shaped figure on nasal curtain). Hyomandibular canal forms a slender loop over middisc region, extending posteriorly to almost origin of anterior pelvic fin lobe. Outer branch of hyomandibular canal more or less straight, inflecting medially at level of jaws, and extending anteriorly to snout margin just medial to propterygium.

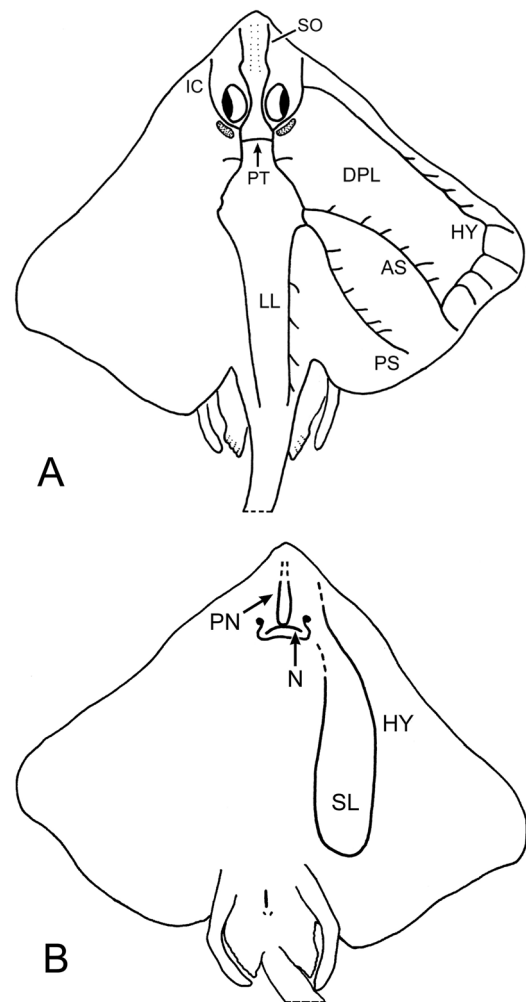


Figure 9. - Dorsal (A) and ventral (B) lateral line canals of the Brazilian *Cruriraja rugosa* (MNRJ 28504). Only canals of right (A) and left (B) sides are shown. Abbreviations: AS: anterior scapular canal; DPL: dorsal pleural loop; HY: hyomandibular canal; IC: infraorbital canal; LL: posterior lateral line canal; N: nasal canal; PN: prenasal canal; PS: posterior scapular canal; PT: posttemporal canal; SL: subpleural loop; SO: supraorbital canal. Note that in B mouth is omitted. [Canaux dorsal (A) et ventral (B) de la ligne latérale. Seuls les canaux des côtés droits (A) et gauche (B) sont montrés. Abréviations : AS : canal antérieur scapulaire ; DPL : boucle pleurale dorsale ; HY : canal hyomandibulaire ; IC : canal infraorbital ; LL : canal postérieur de la ligne latérale ; N : canal nasal ; PN : canal pré-nasal ; PS : canal scapulaire postérieur ; PT : canal post-temporal ; SL : boucle sous-pleurale ; SO : canal supra-orbital. Noter que la bouche est omise en B.]

Coloration

Alcohol preserved specimen with faded coloration both dorsally and ventrally, with scattered residual pigmentation. Remaining dorsal coloration light pinkish brown, with dorsal tail region yellowish and middisc regions dusky brown or grey. Lateral tail fold, apices of dorsal fins and caudal extremity darker brown. Both lobes of pelvic fins with dark-

er posterior margins. Ventral coloration mostly pinkish brown, with darker blotches at middisc. Original coloration was a more or less uniform light or dark brown, with darker dorsal fins and caudal extremity, and with about equal intensity on both dorsal and ventral surfaces.

Anatomical features

Neurocranium with slender rostral cartilage tapering to anterior snout margin. Propterygia extending forward to level of anterior one-third of rostrum. Rostral appendices short, extending posteriorly to less than one third of rostral length, and slightly longer than wide. Anterior fontanelle with straight lateral borders, tapering abruptly anteriorly, and extending well beyond nasal capsules to about posterior third of rostrum; posterior fontanelle shorter and teardrop-shaped. Antorbital cartilages relatively wide, directed posteriorly, with straight anterior margin and concave posterior margin; antorbitals articulate with posterolateral aspect of nasal capsules. Nasal capsules large, with slender ventral internasal space. Propterygia subdivided into six segments with second segment from shoulder girdle the longest; mesopterygia small and triangular; metapterygia slender; small gap present between pro- and mesopterygium and between meso- and metapterygium. Coracoid bar very slender; scapular elements more elongate posteriorly than anteriorly. Synarcual cartilage longest anterior to scapulocoracoid; first synarcual centrum present just posterior to coracoid bar. Pectoral radials subdivided at approximately seventh outermost segment. Pelvic girdle strongly arched posteriorly but with relatively straight anterior margin (Fig. 10); lateral prepelvic processes short, triangular, and massive; iliac processes anteromedially directed. A single, large obturator foramen present on each side. Anterior pelvic radial greatly enlarged, with three segments, first segment about twice length of second; anterior pelvic lobe with at least two other radials posterior to enlarged first radial. Basipterygia anteriorly with small gap lacking radials.

Comparisons with congeners

Our specimen, identified as *C. rugosa* Bigelow & Schroeder, 1958, is easily distinguished from congeners. Compared to other North Atlantic, Gulf of Mexico, and Caribbean *Cru-*

riraja species (*C. atlantis* Bigelow & Schroeder, 1948, *C. poeyi* Bigelow & Schroeder, 1948, and *C. cadenati* Bigelow & Schroeder, 1962), our specimen is unique in presenting a single row of enlarged thorns on the tail. *Cruriraja cadenati* and adult males of *C. atlantis* may present a single row on tail base (Bigelow and Schroeder, 1948, 1953, 1962), but multiple rows are present posterior to pelvic fins (our specimen has a single row from pelvic girdle to dorsal fins). Among western Atlantic *Cruriraja* species, only *C. cadenati* lacks distinctly darker dorsal fins and caudal tip, and is further distinguished from our specimen by the spatulate extremities of its anterior pelvic fin lobes, and by the presence of numerous darker brown spots of various sizes (usually not greater than eye diameter) on dorsal surface (even though faded in preservative, the dorsal coloration in our specimen was probably uniform). *Cruriraja cadenati* is very restricted in distribution, occurring between 457-896 m off the east coast of Florida and western Puerto Rico (Bigelow and Schroeder, 1962; McEachran and Carvalho, 2002). *Cruriraja atlantis* is readily distinguished from our specimen due to the presence of numerous scapular thorns, a generally more denticulate and thorny disc, faded crossbands at levels of dorsal fins, and by the great space in between its dorsal fins (at least 1.5 times as long as base of first dorsal). This species has been recorded in depths ranging from 512-777 m from the east coast of Florida, Florida Keys, Bahamas, and Cuba (McEachran and Carvalho, 2002). Our specimen cannot be confused with *C. poeyi*, which also lacks scapular thorns, because this species has large dark brown spots (greater than eye diameter) on dorsal disc, anterior parts of dorsal and tip of caudal membrane black, more thorns on middisc region anterior to pelvic fins, and thorns on midline of tail in irregular, multiple rows at least on anterior half of tail. *Cruriraja poeyi* has a wider distribution than either *C. atlantis* or *C. cadenati*, occurring off southern Florida, in the Florida Keys, Bahamas, Cuba, and in the southern Gulf of Mexico, in depths from 366-870 m (McEachran and Carvalho, 2002). The above species are further characterized in Bigelow and Schroeder (1948, 1953, 1958, 1962, 1965), McEachran and Fechhelm (1998) and McEachran and Carvalho (2002).

Comparisons of our specimen with *Cruriraja* species from off the western, southern and southeastern coasts of South Africa (*C. durbanensis* von Bonde & Swart, 1923 and *C. parcomaculata* von Bonde & Swart, 1923), and from the Indian Ocean [*C. andamanica* (Lloyd, 1909) and *C. triangularis* Smith, 1964], reveal even greater differences. *Cruriraja durbanensis* was described on the basis of two specimens collected from the southeastern Atlantic Ocean (to the northwest of Cape Town; holotype from 859 m), which are now lost (Hulley, 1970); this species has not been collected since. Nevertheless, the original account (von Bonde and Swart, 1923) makes it clear that *C. durbanensis* is fairly distinct

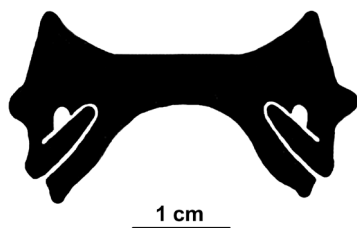


Figure 10. - Schematic representation of pelvic girdle of the Brazilian *Cruriraja rugosa* (MNRJ 28504) in dorsal view (from radiograph). [Représentation schématique de la ceinture pelvienne en vue dorsale (à partir d'une radiographie).]

from our material, with small eyes (the only species of *Cruriraja* with eyes smaller than interorbital distance), and lacking thorns in between dorsal fins and on rostral surface (see also Hulley, 1970, 1995). *Cruriraja parcomaculata* is known from abundant material, occurs from Namibia to around South Africa (it does not occur off northeastern South Africa though, being replaced there by *C. triangularis*; Hulley, 1970), in about 260-620 m, and is distinguished from our specimen by presenting robust thorns with enlarged bases in semiparallel rows over dorsal middisc and tail, scapular thorns (midscapular thorns very large), enlarged nuchal thorns, dorsal fins separate by a space about equal to their bases, four to eight interdorsal thorns, spatulate extremities of its anterior pelvic fin lobes, by its dorsal coloration which in adults presents darker blotches, and by its uniform white ventral coloration (Smith, 1964; Hulley, 1970, 1995; SAM specimens). *Cruriraja parcomaculata* also has fewer vertebrae than our specimen [66-69 total precaudal vertebrae, vs. 115 (92 post-transitional) in the Brazilian *Cruriraja*; data on *C. parcomaculata* from Hulley, 1970: 160]. *Cruriraja triangularis*, occurring in the southwestern Indian Ocean from southern Mozambique to Durban (in about 220-420 m), cannot be confused with the Brazilian *Cruriraja* as it also has scapular thorns, multiple irregular rows of thorns on posterior half of tail, two well-defined rows of rostral thorns, a proportionally longer tail, and a uniform white ventral coloration (Smith, 1964; Wallace, 1967; Hulley, 1995; SAM specimens). *Cruriraja andamanica* is poorly known (only two specimens reported, the holotype from the Andaman Sea in about 502 m, and a second specimen collected off Tanzania in 274-457 m; Stehmann, 1976; McEachran and Fehhelm, 1982), and is distinguished from our material by presenting, according to Lloyd (1909: 140) and Fischer *et al.* (1990), more rostral thorns (15, vs. four in our specimen), more anterolateral disc thorns, a single series of thorns from nuchal region to middisc region, scapular thorns, and an irregular row of thorns on the tail.

Even though we have identified our specimen as *C. rugosa*, it presents distinctions from representative material of this species. *Cruriraja rugosa* was described by Bigelow and Schroeder (1958: 226) on the basis of a single immature male (367 mm TL) from the northeastern Gulf of Mexico (collected in 360-540 m). These authors subsequently provided further descriptive details on the basis of considerably more material: 39 specimens 90-465 mm TL from the Atlantic coasts of Nicaragua and Honduras (366-640 m; Bigelow and Schroeder, 1962), 63 specimens 90-485 mm TL from the north coast of Panama, Nicaragua, Honduras, Belize, Jamaica, the Straits of Florida, and the northern Gulf of Mexico (439-915 m; Bigelow and Schroeder, 1965), and 19 more specimens 100-404 mm TL from the above localities plus the north coast of Haiti, Colombia, Curaçao, and Grenada (Bigelow and Schroeder, 1968; this species is also known

from Mexico; Castro-Aguirre and Espinosa-Pérez, 1996). Their extensive descriptions, coupled with our material of *C. rugosa* from the Gulf of Mexico (Tab. I), allow for precise comparisons with the Brazilian specimen, which differs from the holotype of *C. rugosa* (Fig. 11) in lacking a distinct dorsal fold on caudal extremity (caudal fin; Fig. 6), in lacking denticles on ventral surface of tail (presence of ventral tail denticles was originally used to distinguish *C. rugosa* from congeners), in presenting much fewer thorns over tail midline (58 in holotype of *C. rugosa* vs. 32 in the Brazilian specimen) and on lateral aspects of tail, and in the darker coloration of the dorsal fins, lateral tail fold, and caudal extremity (Fig. 6).

Cruriraja rugosa, however, is variable in the coloration of its dorsal and caudal fins, ranging from "somewhat darker brownish to dusky" (Bigelow and Schroeder, 1962: 208),

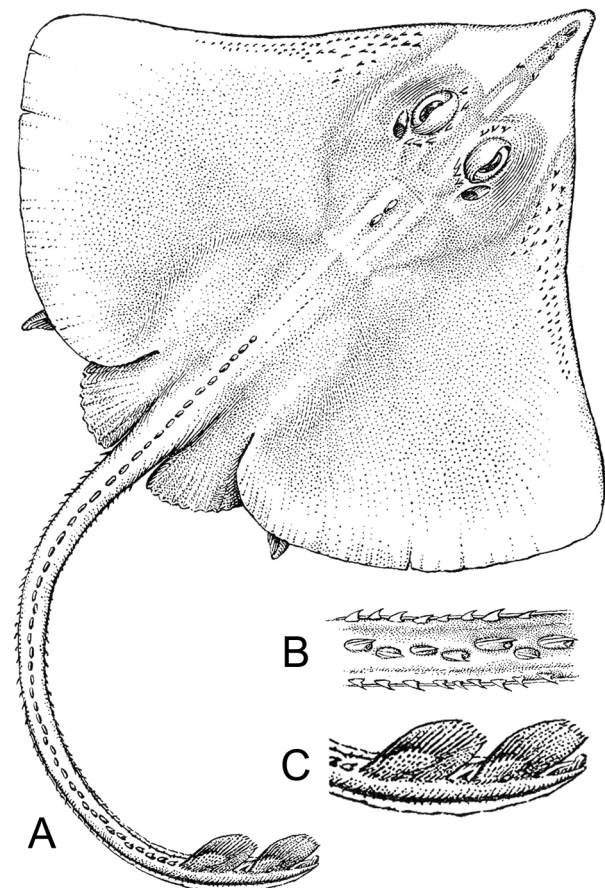


Figure 11. - Holotype of *Cruriraja rugosa* (USNM 156713, 367mm TL immature male), taken from the northeastern Gulf of Mexico (modified from Bigelow and Schroeder, 1958: p. 228, fig. 10). **A**: Entire specimen in dorsal view; **B**: Detail of the midtail region in dorsal view; **C**: Enlarged view of caudal extremity showing small caudal fin. [Holotype de *Cruriraja rugosa* capturé dans le nord-est du golfe du Mexique (modifié d'après Bigelow et Schroeder, 1958). **A**: Vue dorsale du spécimen entier; **B**: Détail de la région médiane de la queue en vue dorsale; **C**: Vue agrandie de l'extrémité de la queue montrant une petite nageoire caudale.]

which is confirmed in the material examined (Tab. I). The Brazilian specimen has fewer thorns over tail midline and lateral tail compared to *C. rugosa* from farther north (compare Figs. 3, 7 and 8C with Figs 11A, 11B), but this character is also variable in the latter (50 midline thorns are present in a specimen 186 mm TL, while 39 are present in another of 420 mm TL; Bigelow and Schroeder, 1962: 207; see table I). Note that two specimens almost equal in size have very different thorn counts (27 thorns in a female 188 mm TL and 54 in another female 189 mm TL). The 32 midline thorns in the Brazilian material (320 mm TL) is slightly greater than the 29 thorns present in a specimen that is smaller (295 mm TL), and is concordant with higher numbers of thorns present in specimens greater than 350 mm TL (Tab. I). Small specimens of *C. rugosa* also have scapular thorns, but these are present on only one specimen larger than the Brazilian individual (a single scapular thorn on left side in TCWC 6445.01; Tab. I); scapular thorns are therefore lost during ontogeny at some stage smaller than at least 295 mm TL.

More reliable differences exist between the Brazilian specimen and conspecific individuals from the Gulf of Mexico and Caribbean Sea. In the latter, ventral tail denticles occur in larger individuals and are absent only from specimens smaller than 250-270 mm TL (Bigelow and Schroeder, 1962: 208; material examined); the caudal fin is also invariably present (Bigelow and Schroeder, 1962, 1965, 1968; material examined; see Fig. 11c). The Brazilian specimen also has a greater snout angle compared to material from the Gulf of Mexico and Caribbean Sea (Tab. I). We presently consider these distinctions, however, insufficient to describe the Brazilian *Cruriraja* record as a new species given that it is known from a single, presumably immature specimen. Measurements of a female *C. rugosa* from the Caribbean Sea off Honduras (Bigelow and Schroeder, 1962: 206), very close in size (318 mm TL) to the Brazilian specimen, reveals how similar both are morphometrically (Tab. I). *Cruriraja rugosa* has the greatest distribution of all *Cruriraja* species except *C. andamanica* (McEachran and Fehhelm, 1982; Hulley, 1995; McEachran and Carvalho, 2002), and its presence in the western South Atlantic Ocean is therefore not entirely unanticipated. The occurrence of *Cruriraja* off Brazil alleviates to a small degree the immense gap in distribution between South African/Indian Ocean species of *Cruriraja* with those occurring in the Caribbean Sea, Gulf of Mexico and western North Atlantic Ocean. Nevertheless, if more specimens are collected confirming the absence of the caudal fin and ventral tail denticles, then we strongly suspect that a new species would be warranted for the Brazilian *Cruriraja* material.

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REFERENCES

- BIGELOW H.B. & W.C. SCHROEDER, 1948. - New genera and species of batoid fishes. *J. Mar. Res.*, 7: 543-566.
- BIGELOW H.B. & W.C. SCHROEDER, 1953. - Fishes of the Western North Atlantic. Part 2: Sawfishes, guitarfishes, skates and rays. *Mem. Sears Found. Mar. Res.*, 1(2): 1-558.
- BIGELOW H.B. & W.C. SCHROEDER, 1958. - Four new rajids from the Gulf of Mexico. *Bull. Mus. Comp. Zool.*, 119(2): 201-233.
- BIGELOW H.B. & W.C. SCHROEDER, 1962. - New and little known batoid fishes from the Western Atlantic. *Bull. Mus. Comp. Zool.*, 128(4): 161-244.
- BIGELOW H.B. & W.C. SCHROEDER, 1965. - A further account of batoid fishes from the western Atlantic. *Bull. Mus. Comp. Zool.*, 132(5): 443-477.
- BIGELOW H.B. & W.C. SCHROEDER, 1968. - Additional notes on batoid fishes from the western Atlantic. *Breviora*, 281: 1-23.
- CAPPETTA H., 1987. - Chondrichthyes II. Mesozoic and Cenozoic Elasmobranchii. In: Handbook of Paleichthyology, Vol. 3B (Schultze H.P., ed.), pp. 1-193. Stuttgart: Gustav Fischer Verlag.
- CASTRO-AGUIRRE J.L. & H. ESPINOSA-PÉREZ, 1996. - Listados faunísticos de México. VII. Catálogo sistemático de las rayas y especies afines de México. (Chondrichthyes: Elasmobranchii: Rajiformes: Batoideiomorpha). 75 p. Mexico City: Universidad Nacional Autónoma de México.
- CERVIGÓN F., 1993. - Rajidae. In: Field Guide to the commercial marine and brackish-water Resources of the northern Coast of South America (Cervigón F., Cipriani R., Fischer W., Garibaldi L., Hendrickx M., Lemus A.J., Márquez R., Poutiers J.M., Robaina G. & B. Rodríguez, eds), pp. 205-207. Rome: Food and Agriculture Organization of the United Nations.
- CHU Y.T. & M.C. WEN, 1979. - A Study of the Lateral-Line Canal Systems and that of Lorenzini Ampullae and Tubules of Elasmobranchiate Fishes of China. Monograph of Fishes of China 2. 132 p. Shanghai: Shanghai Science and Technology Press.
- GOMES U.L., 2002. - Revisão taxonômica da família Rajidae no Brasil (Chondrichthyes, Elasmobranchii, Rajiformes). Unpublished doctoral thesis. 286 p. Rio de Janeiro: Universidade Federal do Rio de Janeiro.
- FISCHER W., SOUSA I., SILVA C., FREITAS A. de, POUTIERS J.M., SCHNEIDER W., BORGES T.C., FÉRAL J.P. & A. MASSINGA, 1990. - Guia de Campo das Espécies comerciais marinhas e de Águas salobras de Moçambique. Fichas FAO de Identificação de Espécies para Atividades de Pesca. 424 p. Rome: Organização das Nações Unidas para a Agricultura e a Alimentação.

- HOLST R.J. & Q. BONE, 1993. - On bipedalism in skates and rays. *Phil. Trans. Roy. Soc., Lond. B*, 339: 105-108.
- HUBBS C.L. & R. ISHIYAMA, 1968. - Methods for the taxonomic study and description of skates (Rajidae). *Copeia*, 3: 483-491.
- HULLEY P.A., 1970. - An investigation of the Rajidae of the west and south coasts of southern Africa. *Ann. S. Afr. Mus.*, 55(4): 151-220.
- HULLEY P.A., 1972. - The origin, interrelationships and distribution of southern African Rajidae (Chondrichthyes, Batoidei). *Ann. S. Afr. Mus.*, 60(1): 1-103.
- HULLEY P.A., 1995. - Rajidae. In: Smiths' Sea Fishes (Smith M.M. & P.C. Heemstra, eds), pp. 115-128. 1st edit., 3rd impression. Johannesburg: Southern Book Publishers.
- LEVITON A.E., GIBBS Jr. R.H., HEAL E. & C.E. DAWSON, 1985. - Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 3: 803-832.
- LLOYD R.E., 1909. - A description of the deep-sea fishes caught by the R.I.M.S. ship "Investigator" since the year 1900, with supposed evidence of mutation in *Malthopsis*. *Mem. Indian Mus.*, 2(3): 139-180.
- LUCIFORA L.O. & A.I. VASSALLO, 2002. - Walking in skates (Chondrichthyes, Rajidae): anatomy, behaviour and analogies to tetrapod locomotion. *Biol. J. Linn. Soc.*, 77: 35-41.
- MARUSKA K.P. 2001. - Morphology of the mechanosensory lateral line system in elasmobranch fishes: ecological and behavioral considerations. In: The Behavior and Sensory Biology of Elasmobranch Fishes: An Anthology in Memory of Donald Richard Nelson (Tricas T.C. & S.H. Gruber, eds). *Env. Biol. Fish.*, 60(1-3): 47-75.
- McEACHRAN J.D. & M.R. de CARVALHO, 2002. - Rajidae. In: The Living Marine Resources of the Western Central Atlantic. Volume 1: Introduction, Molluscs, Crustaceans, Hagfishes, Sharks, Batoid Fishes and Chimaeras. FAO Species Identification Guide for Fisheries Purposes (Carpenter K.E., ed.), pp. 531-561. Rome: Food and Agriculture Organization of the United Nations (FAO) and American Society of Ichthyologists and Herpetologists, Spec. Publ. no. 5.
- McEACHRAN J.D. & L.J.V. COMPAGNO, 1979. - A further description of *Gurgesiella furvescens* with comments on the interrelationships of Gurgesiellidae and Pseudorajidae (Pisces, Rajoidei). *Bull. Mar. Sci.*, 29(4): 530-553.
- McEACHRAN J.D. & L.J.V. COMPAGNO, 1982. - Interrelationships of and within *Breviraja* based on anatomical structures (Pisces, Rajoidei). *Bull. Mar. Sci.*, 32(2): 399-425.
- McEACHRAN J.D. & J.D. FECHHELM, 1982. - A new species of skate from the western Indian Ocean, with comments on the status of *Raja* (Okamejei) (Elasmobranchii: Rajiformes). *Proc. Biol. Soc. Wash.*, 95(3): 440-450.
- McEACHRAN J.D. & J.D. FECHHELM, 1998. - Fishes of the Gulf of Mexico. Vol. 1. Myxiniformes to Gasterosteiformes. 1112 p. Austin: Univ. Texas Press.
- McEACHRAN J.D. & T. MIYAKE, 1990a. - Zoogeography and bathymetry of skates (Chondrichthyes, Rajoidei). In: Elasmobranchs as Living Resources: Advances in the Biology, Ecology, Systematics and the Status of the Fisheries (Pratt H.L., Gruber S.H. & T. Taniuchi, eds), pp. 305-326. NOAA Techn. Rep. 90.
- McEACHRAN J.D. & T. MIYAKE, 1990b. - Phylogenetic interrelationships of skates: a working hypothesis (Chondrichthyes, Rajoidei). In: Elasmobranchs as Living Resources: Advances in the Biology, Ecology, Systematics and the Status of the Fisheries (Pratt H.L., Gruber S.H. & T. Taniuchi, eds), pp. 285-304. NOAA Techn. Rep. 90.
- SMITH J.L.B., 1964. - Fishes collected by Dr. Th. Mortensen off the coast of South Africa in 1929, with an account of the genus *Cruriraja* Bigelow and Schroeder, 1954 in South Africa. *Vidensk. Meddel. Dansk Natur. Forening*, 126: 283-300.
- STEHMANN M., 1976. - Revision des Rajoiden - Arten des nördlichen Indischen Ozean und Indopazifik (Elasmobranchii, Batoidea, Rajiformes). *Beaufortia*, 24(315): 133-175.
- von BONDE C. & D.B. SWART, 1924. - The Platosomia (skates and rays) collected by the S.S. "Pickle". *Fish. Mar. Biol. Surv.*, Report no. 3 for the year 1922, Spec. Rep. no. 5: 1-22.
- WALLACE J.H., 1967. - The batoid fishes of the east coast of southern Africa. Part 3: skates and electric rays. *Invest. Rep. Oceanogr. Res. Inst. Durban*, 17: 1-62.

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