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New data on *Rajella sadowskii* (Chondrichthyes: Rajidae) from the deep south-western Atlantic

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Six additional specimens (56–330 mm DW, 152–558 mm TL), including two embryos, of Brazilian deep-water skate, Rajella sadowskii*, were used to supplement the original description which was based on eight specimens. The original description is considered sufficient, however, the range of some characters are enlarged, including some diagnostic measurements and counts characters. The description of adult fresh specimen, embryos, egg capsules, scapulocoracoid and the pelvis of this species are reported here for the first time, all collected on the Campos Basin off south-eastern Brazil, at depths from 1067 to 1353 m.*

Keywords: *Rajella sadowskii*, Brazilian deep-water skate, south-western Atlantic, Rajidae

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INTRODUCTION

Rajella was described initially as a subgenus of *Raja* by Stehmann (1970) and recently received genus status by McEachran & Dunn (1998). It is identified by a mozaic of characters generally found in other genera such as *Raja*, *Breviraja*, *Malacoraja*, *Rhinoraja* and *Bathyraja*, suggesting that *Rajella* is based on unsatisfactory artificial characters mainly associated with polyphyletics and *Raja* and *Bathyraja* need revision (McEachran & Miyake, 1984, 1986, 1990; McEachran & Dunn, 1998). According to Stehmann (1970) and McEachran & Dunn (1998), the deep-water species of *Rajella* are mainly characterized by the following features: propterygium of pectoral girdle falls distinctly short of rostral node; preorbital processes degenerate; rostral cartilage is continuous with neurocranium and stout proximally but very slender and uncalcified distally; rostral appendices are broad, triangular-shaped, and connected to rostral cartilage at rostral node; malar thorns, derived from enlarged placoid scales, are located lateral to orbits and spiracles; thorns along the dorsal midline of disc are in several series, with thorns of lateral series as large as, or larger than, those of the medial series; triangular patch of thorns on the dorsal surface of the nuchal and scapular region of the disc; clasper glans (terminal aspect of clasper) is distinctly expanded in comparison to proximal section of clasper; clasper glans possess the component rhipidion (erectile tissue distal to hypopyle); ventral terminal cartilage has sharp, naked lateral margin, forming component shield; dorsal marginal cartilage lacks distal extension forming pseudorhipidion; clasper skeleton has four dorsal terminal cartilages; ventral terminal cartilage has proximo-medial expansion.

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Rajella includes sixteen valid species distributed worldwide: *R. annandalei* (Weber, 1913), from the western central Pacific off eastern Indonesia; *R. barnardi* (Norman, 1935), from the eastern Atlantic off Mauritania to South Africa; *R. bathyphila* (Holt & Byrne, 1908), from the North Atlantic; *R. bigelowi* (Stehmann, 1978), from the North and central Atlantic; *R. caudaspinosa* (von Bonde & Swart, 1923), from the south-east Atlantic off Namibia and South Africa; *R. challengeri* Last & Stehmann, 2008, from southern Australia; *R. dissimilis* (Hulley, 1970), from the eastern Atlantic off Western Sahara, Namibia and South Africa; *R. eisenhardti* Long & McCosker, 1999, from the Galapagos Islands; *R. fuliginea* (Bigelow & Schroeder, 1954), from the western Atlantic off French Guiana; *R. fyllae* (Lütken, 1887), from the northern North Atlantic; *R. kukujevi* (Dolganov, 1985), from the North Atlantic, known from the type locality, 49°50′N 29°33′W, Faraday Fracture; *R. leopardus* (von Bonde & Swart, 1923), from West Africa; *R. nigerrima* (de Buen, 1960), from the south-east Pacific off Peru and Chile; *R. purpuriventralis* (Bigelow & Schroeder, 1962), from the western central Atlantic, northern Gulf of Mexico and northern coast of South America; *R. ravidula* (Hulley, 1970), from the south-east Atlantic off Morocco and South Africa; and *R. sadowskii* (Krefft & Stehmann, 1974), from the south-east Pacific off Chile and south-west Atlantic off Brazil (Froese & Pauly, 2007).

Records of *Rajella* in Brazilian waters include three species: *R. sadowskii* from off Rio de Janeiro to Rio Grande do Sul (Krefft & Stehmann, 1974; Séret & Andreata, 1992), *R. fuliginea* from off Amapá (Soto *et al.*, 2006) and *R. purpuriventralis* from off Amapá and Bahia/Espírito Santo (Gomes & Gadig, 2003; Soto *et al.*, 2006), all species with material deposited in the Museu Oceanográfico Univali (MOVI). *Rajella sadowskii* was described from the continental slope off southern Brazil between 22°30′S and 28°34′S, from 800 to 1200 m, based on eight specimens collected by the FFS 'Walther

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Herwig' (Krefft & Stehmann, 1974). Posteriorly, three more specimens were collected off Espírito Santo, from 1320 to 1360 m, during the MD-55 Brazil Oceanographic Campaign of the RV 'Marion Dufresne' (Séret & Andreata, 1992). The species has also been recorded from the Chilean coast without specimens' data (Pequeño & Lamilla, 1993; Pequeño, 1997).

During the campaigns of the 'Campos Basin DeepSea Environmental Project' coordinated by Cenpes/Petrobras, additional specimens of *Rajella sadowskii* from the south-east Brazilian coast were collected aboard the RV 'Astro Garoupa' between 1067 and 1353 m depth. In this study, new data on *R. sadowskii* is presented, including a new range of counts and measurements for sub-adults, advanced embryos and egg capsule.

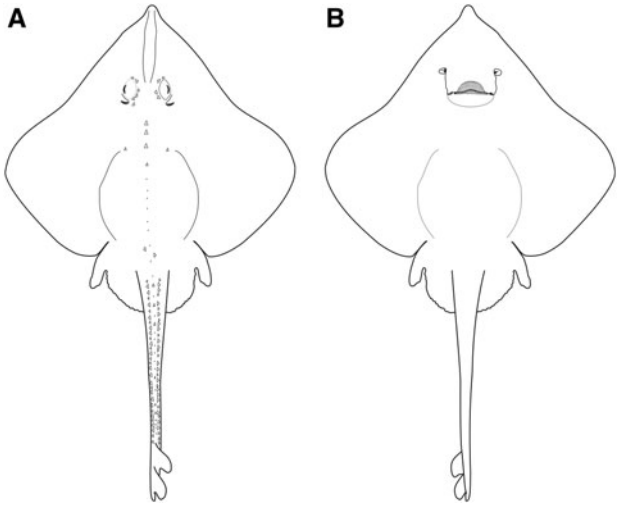


Fig. 2. Dorsal (A) and ventral (B) views of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL (by Marcelo Lanziotti).

MATERIALS AND METHODS

Samples from the RV 'Astro Garoupa' came from 19 to 21°S at depths from 1100 to 1600 m. Two cruises were made in 2003, using a small otter-trawl semi-balloon net (5.5 × 1.0 m) with the same dimensions as the OTSB No. 14, tipically used in the Gulf of Mexico's shrimp-trawl fishery. A total of 36 trawls and 59 hours trawling produced a smaller amount of fish (N = 478), and a swept-area of only 1.2 km^2. External measurements were taken in millimetres according to Stehmann (2005) and expressed as a percentage of disc width (DW) and total length (TL), except the snout angle, which follows McEachran & Carvalho (2002). Count of teeth was taken through a stereoscopic microscope. Count of vertebrae follows Krefft (1968) from radiographs. All specimens were deposited in the MOVI—Museu Oceanográfico Univali (Itajaí, Brazil), not included in institutional abbreviations listed in Leviton *et al.* (1985).

Specimens cited for *Rajella sadowskii*—holotype (ZMH 25262 (formerly ISH 1807/68)), male (507.0 mm TL), off

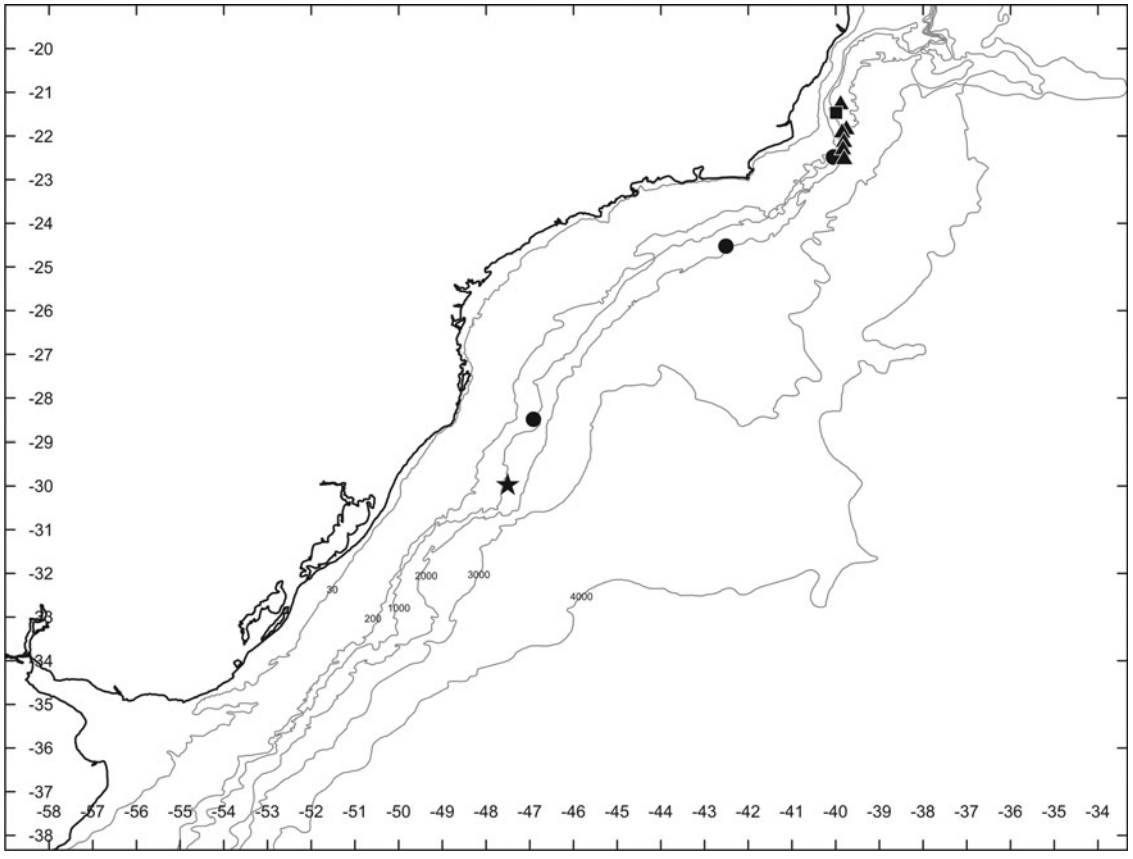


Fig. 1. Collection stations of *Rajella sadowskii* off the Brazilian coast. Holotype indicated by a star, paratypes by circles and additional specimens by a square (Séret & Andreata, 1992) and triangles (present paper).

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Table 1. Measurements of *Rajella sadowskii* from the south-west Atlantic.

Reference	**Krefft & Stehmann (1974)**					**Present paper**												
Status	**Holotype**	**Paratypes**				**Additional specimens**												
Col. Number	**ISH 1807/68**	**ISH 1936/68, ISH1973/68a–e, ISH2004/68**				**MOVI 36984**			**MOVI 36987**			**MOVI 36988**			**MOVI 36993**			**Total**
Sex	♂	♂		♀		♀			♀			♀			♂			3♀ – 1♂
N	**1**	**4**		**3**		**1**			**1**			**1**			**1**			**4**
Disc width (DW) (mm)	–	–		–		**330**			**261**			**279**			**173**			**173–330**
Total length (TL) (mm)	**507.0**	**227.0–471.5**		**299.4–629.5**		**558**			**430**			**519**			**321**			**321–558**
Morphometrics	**% DW***	**Range % DW**	**Range % TL**	**Range % DW**	**Range % TL**	**mm**	**% DW**	**% TL**	**mm**	**% DW**	**% TL**	**mm**	**% DW**	**%TL**	**mm**	**% DW**	**% TL**	**Range % DW**
Disc length	87.2	82.3–89.1	42.3–47.2	91.1–91.8	43.9 (1)	284.0	86.1	50.9	217.0	83.1	50.5	241.0	86.4	46.4	156.0	90.2	48.6	83.1–90.2
Disc width	100.0	100.0	48.3–57.2	100.0	48.2 (1)	330.0	100.0	59.1	261.0	100.0	60.7	279.0	100.0	53.7	173.0	100.0	53.9	–
Snout length, preorbital	22.6	18.8–21.4	9.1–12.2	21.7–27.0	10.7(1)	85.8	26.0	15.4	66.7	25.6	15.5	79.2	28.4	15.3	43.4	25.1	13.5	25.1–28.4
Snout length, preoral	24.7	21.2–23.0	10.3–13.3	23.5–29.2	11.3(1)	86.0	26.1	15.4	76.0	29.1	17.7	80.0	28.7	15.4	43.0	24.9	13.4	24.9–29.1
Snout length, prenasal	–	–	–	–	–	76.0	23.0	13.6	59.0	22.6	13.7	76.0	27.2	14.6	34.0	19.7	10.6	19.7–27.2
Orbit, horizontal diameter	7.4	7.5–8.4	3.9–4.3	7.7–8.0	3.8 (1)	21.4	6.5	3.8	15.6	6.0	3.6	18.3	6.6	3.5	12.8	7.4	4.0	3.6–7.4
Eyeball, horizontal diameter	–	–	–	–	–	13.3	4.0	2.4	11.5	4.4	2.7	11.2	4.0	2.2	7.0	4.0	2.2	4.0–4.4
Interorbital width	6.2	6.3–7.3	3.2–3.7	6.6–7.1	3.2 (1)	23.4	7.1	4.2	17.6	6.7	4.1	18.9	6.8	3.6	12.6	7.3	3.9	6.7–7.3
Spiracle length	3.7	4.3–4.7	2.2–2.4	4.3–5.3	2.2 (1)	10.0	3.0	1.8	8.3	3.2	1.9	7.8	2.8	1.5	5.1	2.9	1.6	2.8–3.2
Interspiracular width	12.3	11.7–13.0	5.9–6.9	12.7–13.4	6.4 (1)	42.4	12.8	7.6	31.4	12.0	7.3	37.0	13.3	7.1	23.3	13.5	7.3	12.0–13.5
Orbit + spiracle length	–	–	–	–	–	24.4	7.4	4.4	21.0	8.0	4.9	24.3	8.7	4.7	15.0	8.7	4.7	7.4–8.7
D1, height	6.2	5.3–6.8	2.9–3.2	5.7–6.6	2.8 (1)	22.4	6.8	4.0	13.0	5.0	3.0	13.6	4.9	2.6	7.6	4.4	2.4	4.4–6.8
D1, base length	8.7	11.2–14.1	5.5–6.9	9.2–13.0	6.2 (1)	31.6	9.6	5.7	21.8	8.4	5.1	30.3	10.9	5.8	18.0	10.4	5.6	8.4–10.9
D2, height	6.5	5.7–7.5	2.9–3.7	5.5–6.5	3.0 (1)	17.5	5.3	3.1	14.1	5.4	3.3	14.4	5.2	2.8	8.5	4.9	2.6	4.9–5.4
D2, base length	8.8	9.9–13.1	5.0–6.6	8.8–13.8	6.5 (1)	25.5	7.7	4.6	23.0	8.8	5.3	29.0	10.4	5.6	18.7	10.8	5.8	7.7–10.8
C, base length	–	>4.7–8.2	>2.7–3.9	7.0 (1)	3.3 (1)	10.0	3.0	1.8	6.2	2.4	1.4	7.8	2.8	1.5	7.5	4.3	2.3	2.4–4.3
Tail, postdorsal length	–	>4.7–8.2	>2.7–3.9	7.0 (1)	3.3 (1)	9.8	3.0	1.8	6.4	2.5	1.5	8.8	3.2	1.7	7.0	4.0	2.2	2.5–4.0
Tail, height at V-tips	–	–	–	–	–	4.8	1.5	0.9	3.7	1.4	0.9	3.9	1.4	0.8	2.7	1.6	0.8	1.4–1.6
Tail, width at V-tips	–	–	–	–	–	7.7	2.3	1.4	5.2	2.0	1.2	5.5	2.0	1.1	3.0	1.7	0.9	1.7–2.3
Tail, height at D1-origin	–	–	–	–	–	5.5	1.7	1.0	4.7	1.8	1.1	5.0	1.8	1.0	3.6	2.1	1.1	1.7–2.1
Tail, width at D1-origin	–	–	–	–	–	14.0	4.2	2.5	6.2	2.4	1.4	8.2	2.9	1.6	5.2	3.0	1.6	2.4–4.2
Tail, lateral fold length	–	–	–	–	–	123.8	37.5	22.2	128.3	49.2	29.8	86.8	31.1	16.7	70.0	40.5	21.8	31.1–49.2
Head length, ventrally	44.3	42.3–45.9	21.3–24.2	46.2–48.7	23.0 (1)	153.8	46.6	27.6	121.9	46.7	28.3	140.8	50.5	27.1	82.0	47.4	25.5	46.6–50.5
Head length, dorsally	–	–	–	–	–	154.0	46.7	27.6	120.4	46.1	28.0	142.0	50.9	27.4	83.0	48.0	25.9	46.1–50.9
Mouth width	12.8	11.6–14.0	5.6–7.9	11.7–14.0	5.6 (1)	52.5	15.9	9.4	35.2	13.5	8.2	39.8	14.3	7.7	23.6	13.6	7.4	13.5–15.9
Internarial width	14.3	10.8–14.6	5.4–8.3	12.0–15.4	5.8 (1)	50.9	15.4	9.1	35.9	13.8	8.3	40.9	14.7	7.9	23.4	13.5	7.3	13.5–15.4
Nasal curtain, length	–	–	–	–	–	24.5	7.4	4.4	19.5	7.5	4.5	22.8	8.2	4.4	11.6	6.7	3.6	4.5–8.2
Nasal curtain, width each lobe	–	–	–	–	–	25.7	7.8	4.6	18.0	6.9	4.2	22.4	8.0	4.3	10.3	6.0	3.2	6.0–8.0
Gill slit length, 1st	2.5	2.4–3.2	1.1–1.7	2.6–2.9	1.2 (1)	8.9	2.7	1.6	6.2	2.4	1.4	8.2	2.9	1.6	3.6	2.1	1.1	2.1–2.9
Gill slit length, 3rd	2.4	2.4–3.0	1.3–1.7	2.8–3.2	1.4 (1)	10.4	3.2	1.9	7.5	2.9	1.7	8.7	3.1	1.7	4.2	2.4	1.3	2.4–3.2
Gill slit length, 5th	1.6	1.7–2.6	1.1–1.4	2.0–2.7	1.2 (1)	8.3	2.5	1.5	5.4	2.1	1.3	6.5	2.3	1.3	2.6	1.5	0.8	1.5–2.5
Interspace first gill slits	23.6	23.0–26.0	12.5–13.3	25.4–26.2	12.2 (1)	81.6	24.7	14.6	59.2	22.7	13.8	70.1	25.1	13.5	40.4	23.4	12.6	22.7–25.1

Continued

Table 1. Continued

Morphometrics	% DW*	Range % DW	Range % TL	Range % DW	Range % TL	mm	% DW	% TL	mm	% DW	% TL	mm	% DW	% TL	Range % DW
Interspace fifth gill slits	14.7	14.6–15.4	7.1–9.2	14.4–16.8	6.8 (1)	51.8	15.7	9.3	37.7	14.4	8.8	45.0	16.1	8.7	26.2	15.1	8.2	14.4–16.1
V-length, anterior lobe	22.4	20.7–22.8	9.9–11.8	20.9–22.5	10.9 (1)	78.0	23.6	14.0	63.0	24.1	14.7	70.0	25.1	13.5	42.0	24.3	13.1	23.6–25.1
V-length, posterior lobe	–	–	–	–	–	101.0	30.6	18.1	82.0	31.4	19.1	92.0	33.0	17.7	53.0	30.6	16.5	30.6–33.0
Clasper postanus length (right only)	28.4	13.4–19.8	6.7–9.6	–	–	–	–	–	–	–	–	–	–	–	22.7	13.1	7.1	13.1
Clasper length, left/right–right	–	–	–	–	–	–	–	–	–	–	–	–	–	–	13.5	7.8	4.2	7.8
Snout tip to mid-anus	77.5	75.7–82.0	37.2–43.6	80.6–87.7	38.8 (1)	280.0	84.8	50.2	215.0	82.4	50.0	238.0	85.3	45.9	134.9	78.0	42.0	78.0–85.3
Snout tip to axis maximum disc width	81.1	76.1–80.9	–	73.5–77.2	–	208.0	63.0	37.3	147.0	56.3	34.2	186.0	66.7	35.8	100.0	57.8	31.2	56.3–66.7
Mid-anus to D_1	66.4	68.2–92.1	39.1–46.3	72.5–95.6	44.2 (1)	212.0	64.2	38.0	171.0	65.5	39.8	210.0	75.3	40.5	137.3	79.4	42.8	64.2–79.4
Mid-anus to D_2	74.6	80.4–104.7	46.0–52.6	81.8–107.0	49.9 (1)	238.0	72.1	42.7	195.0	74.7	45.3	240.0	86.0	46.2	157.0	90.8	48.9	72.1–90.8
Mid-anus to tail tip	–	96.3–124.6	55.2–61.2	124.9 (1)	60.4 (1)	280.0	84.8	50.2	222.0	85.1	51.6	277.0	99.3	53.4	182.0	105.2	56.7	84.8–105.2

Obs, in this species the dorsal fins are united for a membrane; there is no space among them. *, in the original description the percentages of the total length for the holotype were not mentioned.

Santa Catarina, Brazil, 29°57′S 47°35′W, 1200 m depth, 27 February 1968, Station 65/68; paratype (ZMH 25263 (formerly ISH 1936/68)), female (629.5 mm TL), off Rio de Janeiro, Brazil, 24°33′S 42°32′W, 1200 m depth, 2 March 1968, Station 92/68; paratypes (ZMH 25264 (formerly ISH 1973/68a–e)), 3 males (227.0–388.2 mm TL) and 2 females (299.4–333.8 mm TL), off Rio de Janeiro, Brazil, 22°30′S 40°07′W, 800 m depth, 9 March 1968, Station 104/68; paratype (ZMH 25265 (formerly ISH 2004/68)), male (471.5 mm TL), off Santa Catarina, Brazil, 28°34′S 46°53′W, 1200 m depth, 13 March 1968, Station 120/68. All specimens collected with bottom trawl by Gerhard Krefft, aboard the FFS 'Walther Herwig'. MNHN 1989.344, male (542 mm TL) and female (582 mm TL), off Espírito Santo, Brazil, 21°24.16′S 39°56.19′W, 1320–1360 m depth, 9 May 1987, Station 03CP04, collected with bottom trawl by Bernard Séret and José V. Andreata, aboard the RV 'Marion Dufresne'.

New additional specimens of *Rajella sadowskii*—MOVI 36984, female (330 mm DW, 558 mm TL), off Rio de Janeiro, Brazil, 21°50.958′S 39°47.981′W–21°47.011′S 39°50.485′W, 1353 m depth, 21 August 2003; MOVI 36987, female (261 mm DW, 430 mm TL), off Rio de Janeiro, Brazil, 22°16.071′S 39°51.556′W–22°12.441′S 39°49.501′W, 1298 m depth, 24 August 2003, Oceanprof Station 17(2); MOVI 36988, female (279 mm DW, 519 mm TL), off Espírito Santo, Brazil, 21°15.790′S 39°53.145′W–22°12.903′S 39°52.148′W, 1138 m depth, 13 February 2003, Oceanprof Station 16/7975; MOVI 36991, female (99 mm DW, 215 mm TL), off Rio de Janeiro, Brazil, 22°27.080′S 38°54.706′W–22°24.471′S 39°52.781′W, 1310 m depth, 8 February 2003, Oceanprof Station 05; MOVI 36993, male (173 mm DW, 321 mm TL), off Rio de Janeiro, Brazil, 21°53.608′S 39°51.280′W–21°50.845′S 39°52.087′W, 1067 m depth, 14 February 2003, Oceanprof Station 13; MOVI 36996, female (56 mm DW, 152 mm TL), off Rio de Janeiro, Brazil, 22°11.929′S 39°49.123′W–22°09.113′S 39°48.846′W, 1331 m depth, 13 February 2003, Oceanprof Station 11. All specimens collected with bottom trawl by Paulo A.S. Costa, aboard the RV 'Astro Garoupa'.

RESULTS AND DISCUSSION

Samples from RV 'Astro Garoupa' came from 21°15′S to 22°16′S at depths from 1067 to 1353 m, within the horizontal and vertical ranges previously reported in the literature (Krefft & Stehmann, 1974; Séret & Andreata, 1992) (Figure 1). A technical drawing of the species is presented for the first time (Figure 2), showing great similarity with *R. bathyphila* and *R. kukujevi*. The morphometry presents 13 new measurements for this species and 17 with new ranges (Table 1). The discrepancy of the results obtained from the snout angle, between Krefft & Stehmann (1974) and the present paper was certainly due to differences among the applied methods. In the first it probably crossed the line of the spiracles.

Photographs of a fresh specimen showing the natural colour of the species are presented for the first time: violet-grey in the back, with the pectorals and pelvics margins more violet than greyish; dorsal and caudal fins dark; a small black spot in the centre of each pectoral fin, which tends to disappear on preserved specimens; ventral face with a white patch on the ventral cavity extending to the scapulo-coracoid; greyish ventral margins of the pectorals and

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Fig. 3. Fresh specimen of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL. Dorsal and ventral view.

pelvics, becomes clearer and abruptly light about of the half of the fins towards the centre of the disc; ventral portion of the tail greyish with whitish tip, just below the dorsal and caudal fins (Figure 3).

Meristic data are given in Table 2. The thorns are hyaline and strongly curved (Figure 4) and highly variable in number when compared with the original description. Teeth orange, hyaline and notably functional, with slightly worn

Table 2. Counts of *Rajella sadowskii* of the south-west Atlantic.

Reference	**Krefft & Stehmann (1974)**			**Present paper**				
Status	**Holotype**	**Paratypes**		**Additional specimens**				**Range**
Col. Number	**ISH 1807/68**	**ISH 1936/68, ISH1973/68a–e, ISH2004/68**		**MOVI 36984**	**MOVI 36987**	**MOVI 36988**	**MOVI 36993**	
Sex	♂	♂	♀	♀	♀	♀	♂	3♀ – 1♂
N	**1**	**4**	**3**	**1**	**1**	**1**	**1**	**4**
Disc width (DW) (mm)	–	–	–	**330**	**261**	**279**	**173**	**173–330**
Total length (TL) (mm)	**507.0**	**227.0–471.5**	**299.4–629.5**	**558**	**430**	**519**	**321**	**321–558**
Meristics								
Snout angle	91.5°	95.8°–127.5°	91.5°–119.5°	83.5°	86.5°	81.5°	87.2°	81.5°–87.2°
Pseudobranchial folds l./r.	12/11	11–12/11–12	10–13/10–12	10/11	10/10	9/10	11/11	9–10/10–11
Trunk vertebrae, Vtr	29	26–31	25–32	32	31	32	–	31–32
Predorsal tail vertebrae, Vprd	65	60–71	67–71	64	67	66	–	64–67
Pectoral radials 1./r.	64/64	61–67/61–64	64–72/64–70	65/64	64/65	64/64	62/64	62–65
Pelvic radials 1./r.	–	–	–	19/17	20/19	22/22	18/18	17–22
Tooth rows, upper jaw	37	38–42	37–43	41	40	44	42	40–44
Tooth rows, lower jaw	37	34–41	35–39	36	34	36	36	34–36
Tail thorns (dorsal)	21	27–29		8(16)*	28	25	30	8(or 24)–30
Tail thorns (lateral left)	45	29–34		35	11	36	0	0–36
Tail thorns (lateral right)	50	27–35		31	12	39	0	0–39
Scapular thorns 1./r.	2/2	1–2		1/1	2/2	2/2	2/1	1–2
Spiracular thorns 1./r.	–	–		1/0	2/2	2/2	2/2	0–2
Orbital thorns 1./r.	2/3	2–5		5/4	2/4	2/2	2/2	2–5
Nucal thorns	2	2–4		3	3	5	3	3–5

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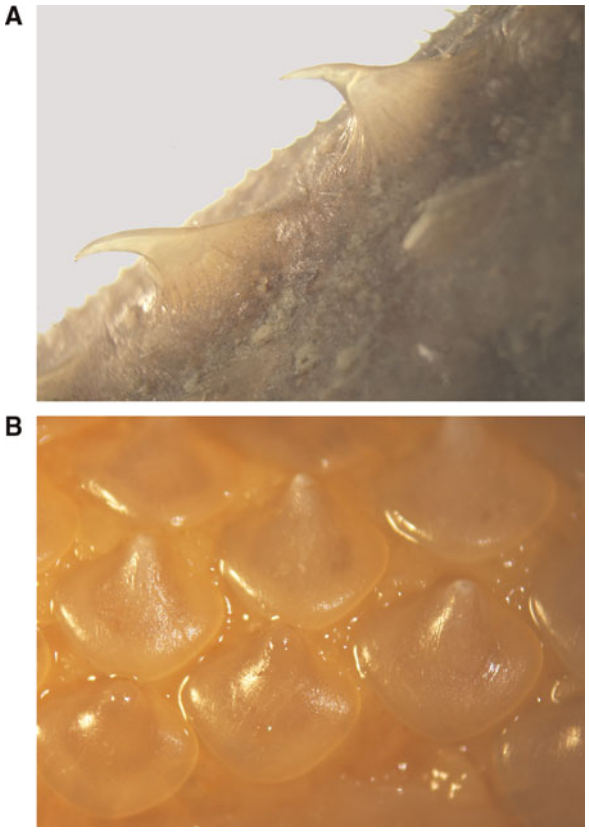


Fig. 4. Caudal thorns (A) and tooth rows of the lower jaw (B) of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL.

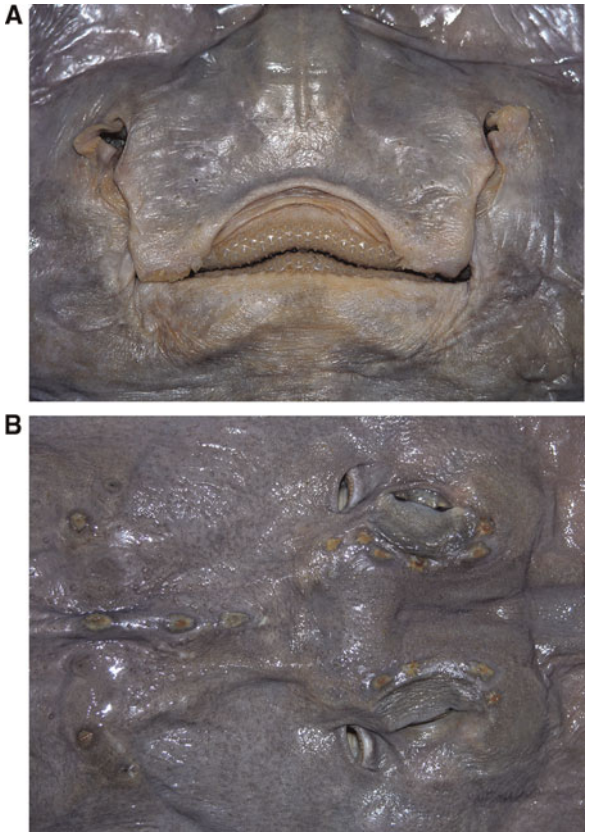


Fig. 5. Mouth–nasal region (A) and orbital, nucal and scapular thorns (B) of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL.



Fig. 6. Tip of tail with lateral finfold, dorsal and caudal fins of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL.

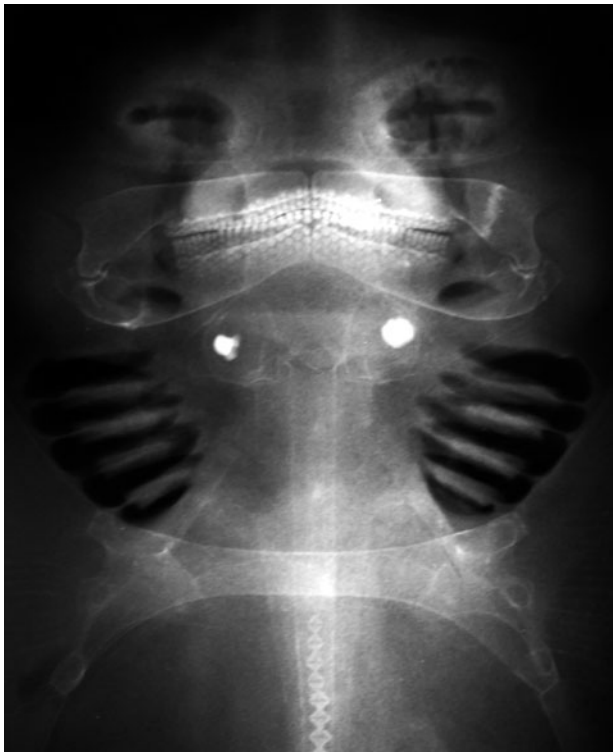


Fig. 7. Radiograph of the scapulocoracoid and mouth in dorsal view of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL.

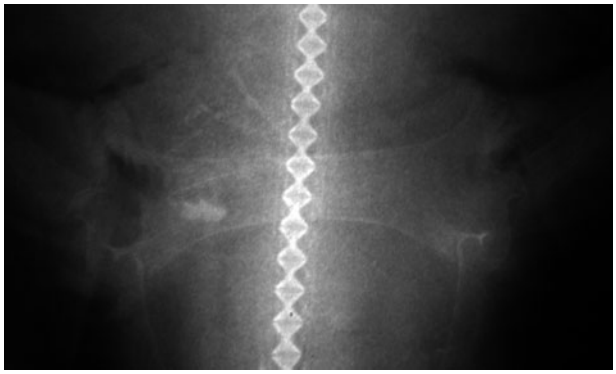


Fig. 8. Radiograph of the pelvis in dorsal view of *Rajella sadowskii*, MOVI 36984, female, 330 mm DW, 558 mm TL.

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Table 3. Measurements of the embryos of *Rajella sadowskii* of the south-west Atlantic.

Col. Number	MOVI 36991			MOVI 36996		
Sex	♀			♀		
Disc width (DW) (mm)	**99**			**56**		
Total length (TL) (mm)	**215**			**152**		
Morphometrics	**mm**	**% DW**	**% TL**	**mm**	**% DW**	**% TL**
Disc length	86.2	87.1	40.1	53.1	94.8	34.9
Disc width	95	96.0	44.2	56.3	100.5	37.0
Snout length, preorbital	21.5	21.7	10.0	12	21.4	7.9
Snout length, preoral	21.5	21.7	10.0	14.1	25.2	9.3
Snout length, prenasal	18	18.2	8.4	12	21.4	7.9
Tail, postdorsal length	32.3	32.6	15.0	25.2	45.0	16.6
Interdorsal space	4	4.0	1.9	3.6	6.4	2.4
Head length, ventrally	42	42.4	19.5	29.2	52.1	19.2
Head length, dorsally	41.1	41.5	19.1	28.3	50.5	18.6
Mouth width	11.5	11.6	5.3	7.4	13.2	4.9
Internarial width	12.5	12.6	5.8	7.1	12.7	4.7
Snout tip to mid-anus	78.2	79.0	36.4	48.3	86.3	31.8
Snout tip to axis maximum disc width	74	74.7	34.4	48.1	85.9	31.6
Mid-anus to D1	78.3	79.1	36.4	63.2	112.9	41.6
Mid-anus to D2	90	90.9	41.9	74.3	132.7	48.9
Mid-anus to tail tip	130.1	131.4	60.5	150.2	268.2	98.8

single cusp without evident sexual dimorphism (Figure 4). Mouth–nasal region and the thorns of head and nucal region are diagnostic and illustrated in detail (Figure 5). Dorsal fins united by a membrane, without space among them; caudal fin distinctively black; a conspicuous caudal finfold laterally to dorsal and caudal fins is illustrated too (Figure 6). The scapulocoracoid and the pelvis of this species are illustrated from radiographs for the first time (Figures 7 & 8). Prepelvic processes little calcified and their tips not depicted in the radiographs.

One embryo (MOVI 36996) and another embryo with egg capsule (MOVI 36991) are described. The morphometric analysis (Table 3) indicated a balanced growth and allometry compatible with the relationship length of the tail (decreasing) and width of the disc (growing), already well known for the batoids. In the embryos, the colour pattern is very similar to the adults (Figure 9), except by the bi-colour pattern of the dorsal fins in the embryos, whitish on the base and dark on the tip. The thorns of the dorsal tail are conspicuous and easy to count in the two embryos. Complementary spinulation absent in the small embryo but is observed in MOVI 36991, with 25/28 lateral tail thorns and a great number of spinules in the dorsal anterior margin of the disc. In both embryos a space between the dorsal fins was observed, including a single thorn in MOVI 36991. The egg capsule is typical of

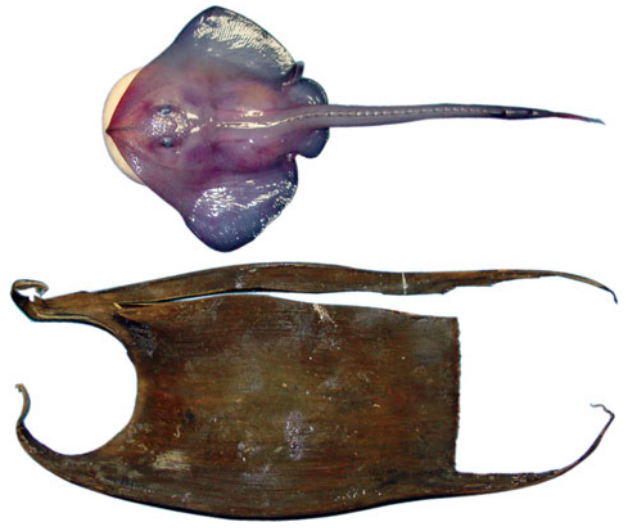


Fig. 9. Egg capsule with fresh advanced embryo of *Rajella sadowskii*, MOVI 36991, female, 99 mm DW, 215 mm TL.

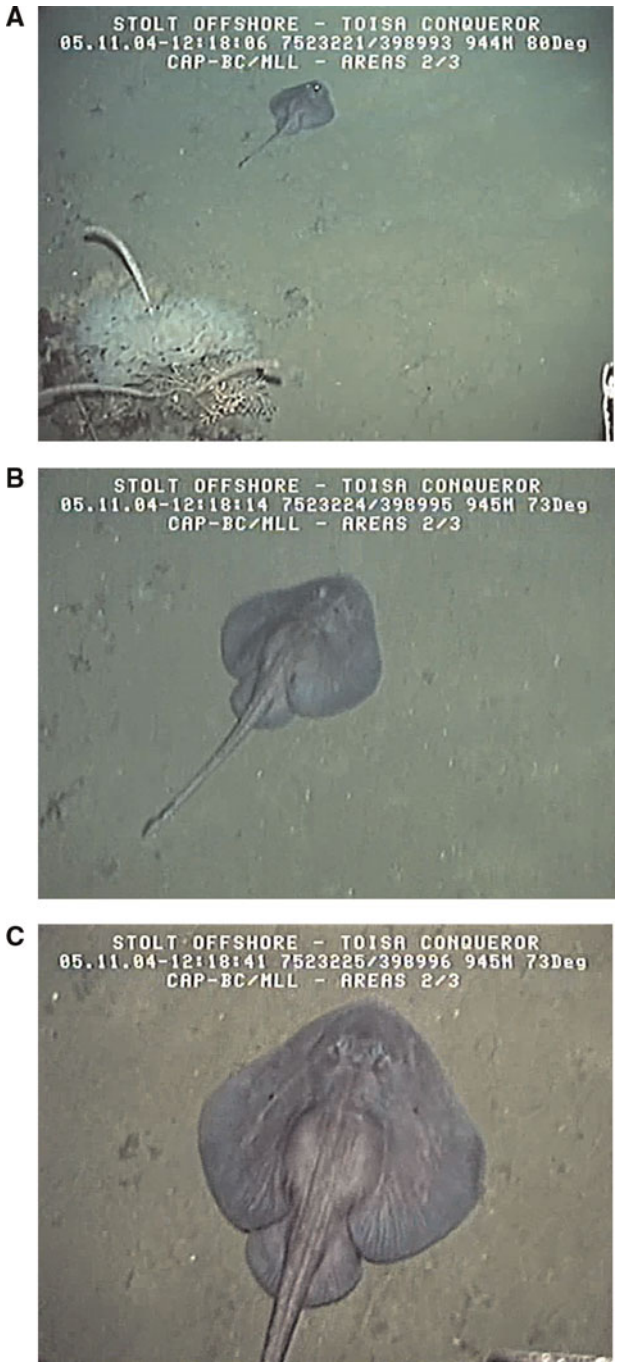


Fig. 10. Underwater scenes of living specimen of *Rajella sadowskii* obtained from the ROV Submersible SCV 3000 (Remotely Operated Vehicle) on the bottom at 945 m off Rio de Janeiro, Brazil (MOVI 39172).

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the family Rajidae (with four horns well defined), olive-brown with texture striated longitudinally, parallel low fibrous lamellae and moderate size of horns (Figure 9). The size of the yolk sac suggests that the largest embryo was still far from the size at birth.

An additional video (MOVI 39172) obtained by the ROV Submersible SCV 3000 (Remotely Operated Vehicle) in the Campos Basin, off Rio de Janeiro, show for the first time a living specimen of *R. sadowskii*. The extracted frames show the two conspicuous black spots in the pectoral fins, the blackish dorsal and caudal fins and the natural violet-grey colour on the dorsum (Figure 10).

According to Krefft & Stehmann (1974), Séret & Andreata (1992) and the present paper, in the south-west Atlantic the species occur off south-eastern and southern Brazil, off Espírito Santo to Santa Catarina, on the lower continental slope, between 945 and 1360 m depth. Accompanying fauna taken near the locations of capture, revealed a deep mood and reef habitat (Figure 9) on the slope with deep-water gorgonians, hard corals, tube sponges, crinoids, ophiuroids and other batoids *Malacoraja spinacidermis* and *Bathyraja* sp.

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