

EGG CAPSULES OF THE LITTLE SKATE, *Psammobatis extenta*
(GARMAN, 1913) (CHONDRICHTHYES, RAJIDAE)

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The elasmobranch Rajidae family, known usually as skates, is the most numerous group among cartilaginous fishes, having almost 245 species with very conservative morphology (EBERT and COMPAGNO, 2007). Elasmobranch egg capsules are widely recognised as important in species identification and provide relevant information concerning their reproductive biology (ODDONE *et al.*, 2004). The genus *Psammobatis* GÜNTHER, 1870 comprises eight species, four of them recorded in Brazil (PARAGÓ, 2001): *P. extenta* (GARMAN, 1913), *P. rutrum* JORDAN, 1890, *P. bergi* MARINI, 1932, and *P. lentiginosa* (BIGELOW and SCHROEDER, 1953). *Psammobatis extenta*, the little skate, is endemic to the continental shelf of the western South Atlantic, ranging from Cabo Frio, Rio de Janeiro, Brazil (22°56'S) to Patagonia, Argentina (~ 45°S) (PARAGÓ, 2001). Recent studies of *P. extenta* have focused mainly on its reproduction, morphology and feeding habits (BRACCINI and PEREZ, 2005; BRACCINI and CHIARAMONTE, 2002a; 2002b) and detailed information concerning its egg capsules is lacking. Only the egg capsules of *P. scobina* (PHILIPPI, 1857), from the Southeastern Pacific, have been accurately described (CONCHA *et al.*, 2009); short descriptions of the egg capsules of *P. rudis*, *P. normani* and *P. bergi* have been presented with their reproductive biology (MABRAGAÑA and COUSSEAU, 2004 and SAN MARTÍN *et al.*, 2005). The present study describes the egg capsules of *Psammobatis extenta*, a small common rajid species of the western South Atlantic.

Sixty-one egg capsules were removed directly from the 35 female *Psammobatis extenta* oviduct, thus avoiding species misidentification. The females were collected by bottom trawlers on the São Paulo continental shelf, at 30 to 50 m depths (between

24°12'S; 46°04' W and 24°08'S; 46°50'W), during 2002, except in autumn. The general morphology, color, texture, presence and number of eggs, presence and position of attachment fibrils, presence and shape of velum and keel and finally, presence, position and shape of ventilation fissures were all recorded. The measurements taken were: capsule length (without horns), maximum width, anterior and posterior horn lengths, capsule height, and thickness and width of lateral keel. Both the terminology and morphometrics follow TEMPLEMAN (1982), ODDONE *et al.* (2004) and TREOLAR *et al.* (2006). Only fully developed capsules were used in the calculations made and the terms 'anterior'/'posterior' and 'dorsal'/'ventral' refer to the position of the egg capsules in the female oviduct (TEMPLEMAN, 1982). Capsules were fixed in formalin and preserved in 70% ethanol. The total length of the females was measured from the tip of the snout to the tip of the tail. Differences between anterior and posterior horn lengths and between right and left egg capsules were verified with Student's *t*-test and the relationship between the females' total length and the body length of the capsules was investigated by linear regression (SOKAL and ROHLF, 1995).

The capsule measurements are presented in Table 1. Only one egg capsule was found in each female's oviduct and just one egg was found per capsule. Almost 75% of the gravid females had capsules in both oviducts and when only one capsule was present, it was in the left oviduct (except for one female, which had developing horns on the right shell gland). The fully developed egg capsules are rectangular, with a horny process on each corner and a brownish copper in color (Fig. 1). The capsule walls are symmetrically convex, with the highest point situated centrally. Both capsule walls present a

delicate longitudinal striation although they are rather smooth to the touch. The capsules have uniform keeled lateral margins (of less than 5% of the capsule's width). The anterior horns are of three-quarters of the capsule's length, while the posterior ones are of the length of the capsule. The horns, the keel and the ventral wall are covered by sticky attachment fibrils, which are pale yellow with gold bright in color. They were linked to the capsule by three adhesion plates of 2.08 mm (\pm 0.26 mm) in length, at the base of each horn and in the middle of the keel (Fig. 2). Four ventilation fissures were present, one in each horn. The anterior ventilation fissures had straight borders while the posterior ones began straight but changed to wavy (Fig. 3). The anterior ventilation fissures began in the middle of the horn, having half its length. The posterior ventilation fissures began between one-third and one-fourth of the posterior horns length, having two-thirds of their length. Only the posterior end of the capsule displays a velum, whose length was around 15% of the capsule's. The general morphology of the *P. extenta* egg capsule was extremely conservative among females. As a

result, no significant results were obtained in the linear regression study between total length of the female and the capsule length ($P > 0.01$), nor in the *t*-test between right and left egg capsule dimensions and measurements ($P > 0.01$). The proportion of the females carrying egg capsules did not increased with female total length (Fig. 4).

Table 1. Measurements (mm) of the *Psammobatis extenta* egg capsule.

	Mean	SD	range		n
Capsule length	26.28	0.74	27.45	- 24.80	22
Max. width	18.45	0.69	19.75	- 16.85	23
Anterior horn length	20.32	3.59	27.70	- 10.30	23
Posterior horn length	25.88	4.91	35.50	- 22.95	19
Capsule height	7.30	0.92	8.30	- 5.10	23
Keel thickness	0.83	0.25	2.05	- 0.40	26
Keel width	0.78	0.22	1.40	- 0.30	26

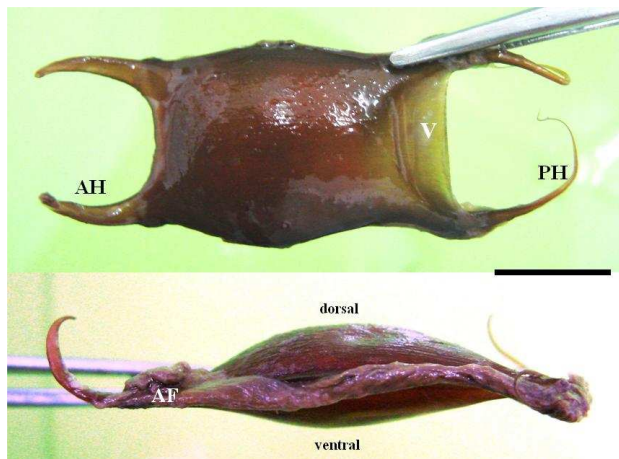
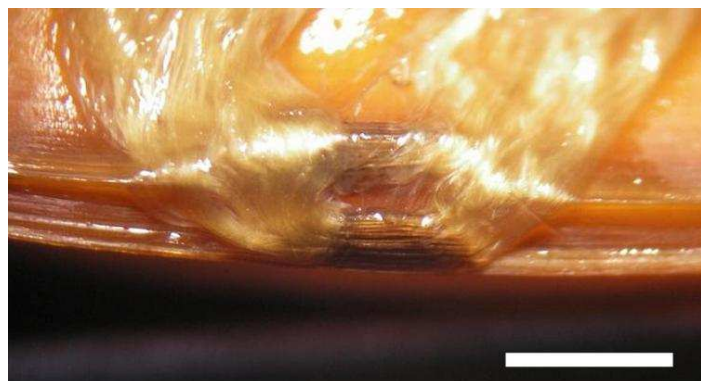


Fig. 1. The fully developed egg capsule of *Psammobatis extenta* in upper view (above) and lateral view (below). AH= anterior horns, PH= posterior horns, V= velum, AF= adhesion fibrils. Left side of the picture corresponds to the anterior end of the egg capsule. Black bar represents 10 mm.

Fig. 2. Adhesion plates of the attachment fibrils of the egg capsule of *Psammobatis extenta* in the middle of the keel. White bar represents 0.5 mm.



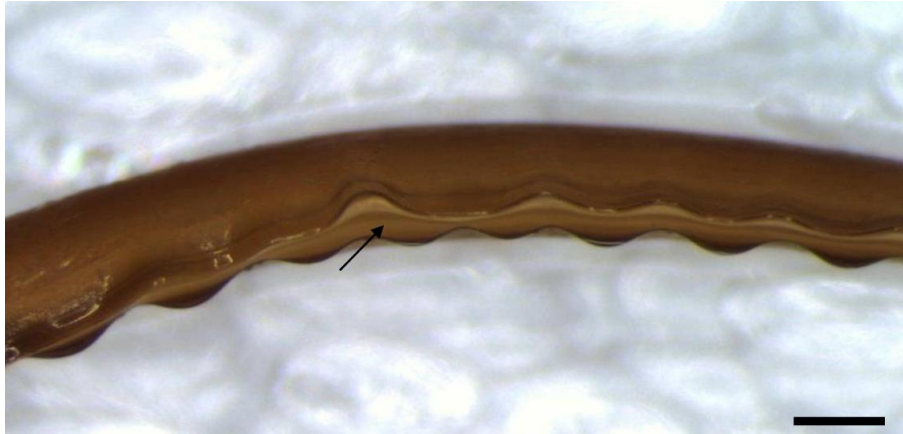


Fig. 3. Ventilation fissure of the posterior horn of the egg capsule of *Psammobatis extenta*. Right side of picture corresponds to the posterior end of the horn, near to the tip. Black bar represents 0.25 mm.

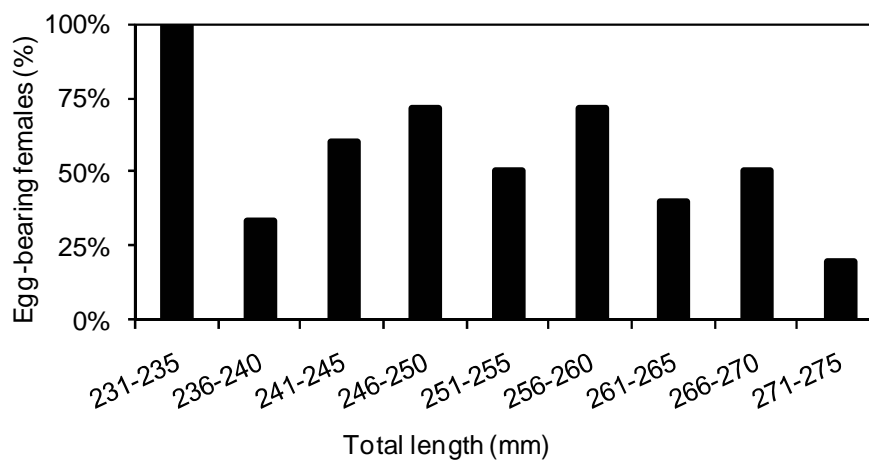


Fig. 4. Proportion of egg-bearing females and female total length (mm).

Just as with other rajids, *P. extenta* showed single oviparity and the majority of the gravid females had capsules in both oviducts (e.g. BRACCINI and CHIARAMONTE, 2002a and MABRAGAÑA and COUSSEAU, 2004). When there was only one capsule, it was in the left oviduct, showing that the right capsule is deposited first as observed by many authors in other rajid species (e.g. McEACHRAN, 1970; BRACCINI and CHIARAMONTE, 2002a and EBERT, 2005). In addition to the measurements, observations on rajid egg capsule features distinguish among species by such characters as degree of development of the fibrils' mass and the location of the ventilation fissures (HUBBS and ISHIYAMA, 1958 and ISHIYAMA, 1958). As regards size, *P. extenta* capsules are smaller than the other rajid

capsules already described, which could be a supporting character for identification. As in this study, SAN MARTIN *et al.* (2005) found no relationship for *P. bergi* between female total length and the proportion of egg-bearing females such as was found for *P. extenta* by BRACCINI and CHIARAMONTE (2002a). Nor did those authors detect any significant difference in morphology between egg capsules from the right and left oviducts. The capsule of *P. extenta* has only the posterior velum whereas the capsules of *P. scobina*, *P. rudis* and *P. normani* have both anterior and posterior vela (MABRAGAÑA and COUSSEAU, 2004 and CONCHA *et al.*, 2009). *Psammobatis scobina* and *P. rudis* had longer posterior than anterior horns, while in *P. normani* they were of the same length

(MABRAGAÑA and COUSSEAU, 2004 and CONCHA *et al.*, 2009) exactly as in *P. extenta*. Only McEACHRAN (1970) has detailed the ventilation fissures of skates' egg capsules in *Raja garmani*, but this feature is well known and has been studied in Scyliorhinidae sharks (*e.g.* GOMES and CARVALHO, 1995). Those fissures are responsible for a great part of the water circulation inside the egg capsule. EBERT and DAVIS (2007) state that the fibrous covering and the attachment fibrils of egg capsules vary a lot among skate species, which, according to ODDONE *et al.* (2004), may be closely related to the way in which each species attaches their egg capsules to the sea bottom. In *P. scobina*, the attachment fibrils had only two attachment points (CONCHA *et al.*, 2009), while *P. extenta* had three, just like *Bathyraja kincaidii*, *R. rhina* and *R. stellulata* (EBERT and DAVIS, 2007), but the authors give no details as to their adhesion to the capsule, whether it occurred in plates.

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