New records and bathymetric distribution of deep-sea shrimps of the family Glyphocrangonidae (Decapoda: Caridea) from the Potiguar Basin, northeastern Brazil

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ABSTRACT

The caridean family Glyphocrangonidae Smith, 1884 is monotypic, including only the genus *Glyphocrangon* A. Milne-Edwards, 1881. The species of this genus are exclusively inhabitants of deep sea. The current contribution aims to enrich the knowledge of *Glyphocrangon* in the southwestern Atlantic, by reporting its occurrence and bathymetric distribution in the Potiguar Basin, northeastern Brazil. The samples were collected by R/V Luke Thomas and R/V Seward Johnson, with bottom trawling at isobaths of 400, 1,000 and 2,000 m, using an otter trawl semi-balloon. The specimens were identified and stored in the carcinological collection of the Museu de Oceanografia Prof. Petrônio Alves Coelho, in Recife, Brazil. A total of 810 specimens were examined from five species: *Glyphocrangon aculeata* A. Milne-Edwards, 1881, *G. alispina* Chace, 1939, *G. longirostris* (Smith, 1882), *G. sculpta* (Smith, 1882) and *G. spinicauda* A. Milne-Edwards, 1881. *Glyphocrangon spinicauda*

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was the most abundant with 334 individuals, and *G. sculpta* was the rarest, with only one individual. All species were recorded in the study area for the first time.

KEY WORDS

Continental slope, geographical distribution, *Glyphocrangon*, new occurrences, South Atlantic.

INTRODUCTION

Knowledge of deep-sea crustaceans in the southwestern Atlantic is still scarce, mainly due to logistic difficulties and the high cost for obtaining samples (Ramos-Porto *et al.*, 2000). However, some previous studies have contributed to our knowledge on decapod crustaceans inhabiting the continental slope to abyssal basin regions, e.g., D’Incao (1998), Ramos-Porto *et al.* (2000; 2003), Coelho *et al.* (2006), Komai (2004a), Cardoso (2006; 2010a; 2010b; 2011a; 2011b; 2013), Cardoso and Serejo (2007), Rego and Cardoso (2010), Cardoso and Fransen (2012), Anker *et al.* (2014), and Cardoso *et al.* (2014). These studies largely focused on taxonomic and distributional aspects, although the total inventory of the fauna is still far from complete.

The caridean family Glyphocrangonidae Smith, 1884 is monotypic, comprised of only the genus *Glyphocrangon* A. Milne-Edwards, 1881. Currently, 89 species of this genus have been recorded worldwide, inhabiting exclusively muddy bottoms in continental slope and abyssal plains as deep as 6,373 m (Holthuis, 1971; Rice, 1981; Chace, 1984; Kensley *et al.*, 1987; Burukovsky, 1990; 2004; Komai and Takeuchi, 1994; Brand and Takeda, 1996; Komai, 2004a; 2004b; 2005; 2006; 2007; 2010; 2011; Komai and Chan, 2008; 2013; Hendrickx, 2010; De Grave and Fransen, 2011). In the western Atlantic, along the Brazilian coast, eight species of *Glyphocrangon* have previously been recorded from off Amapá to São Paulo (Komai, 2004a).

Recently, the project “Avaliação da biota bentônica e planctônica da Bacia Potiguar e Ceará (Bpot)”, sponsored by the oil company “Petróleo Brasileiro S/A (Petrobrás)”, was conducted off the states of Rio Grande do Norte and Ceará, northeastern Brazil, as part of a monitoring program of the oil extraction area. This contribution reports the taxonomic composition, geographic distribution and ecological aspects of species of Glyphocrangonidae collected during the monitoring activities in the Potiguar Basin.

MATERIAL AND METHODS

The Potiguar Basin, situated in the extreme northeast of Brazil, between the states of Rio Grande do Norte (RN) and Ceará (CE) (Fig. 1), belongs to a group of mesocenozoic basins that form the coastal province of the Brazilian continental margin. It comprises approximately 38,500 km², distributed between the continental shelf and the continental slope, to the depth of 2,000 m (Bertani *et al.*, 1990; Alves-Júnior *et al.*, 2016a, b).

The samplings were carried out from the R/V Luke Thomas in 2009 “Arrasto Malha Talude” (AR and ARMT samples) and from the R/V Seward Johnson in 2011 “Malha Talude” (MT samples). Bottom trawls of an approximately 30 minutes duration were conducted on the continental slope along the isobaths of 400 m, 1,000 m and 2,000 m, using a semi-balloon otter trawl with 50 mm mesh size and 18 m opening. The specimens were preserved in 70% ethanol.

In the laboratory, the specimens were sorted and identified following Holthuis (1971) and Komai (2004a). The morphological diagnosis of each species can be found in Komai (2004a). All material was deposited in the Carcinological Collection of the “Museu de Oceanografia Prof. Petrônio Alves Coelho (MOUFPE)” at the “Universidade Federal de Pernambuco”, Recife, Brazil. The station, date, geographic coordinates, depths, temperature and salinity of each sampling station are presented in Tab. 1. The material examined is presented as follows: total number of individuals (IN); sex [males (M), females (F), ovigerous females (OF)], campaign (Bpot-Talude), station (ARMT; AR; MT) and catalogue number (MOUFPE). Total and carapace lengths (without rostrum) (TL and CL, respectively) were measured to the nearest 0.1 mm and minimum, maximum and mean values are provided in Tab. 2. The terminology follows Holthuis (1971).

Figure 1. Location of the sampling stations between the states of Rio Grande do Norte and Ceará, northeast of Brazil.

Table 1. Stations list for the species of *Glyphocrangon* A. Milne-Edwards, 1881 with station number, sampling date, locality, initial and final coordinates of the trawl, initial and final depth of trawl and depth in the Potiguar Basin, northeastern Brazil.

Station	Date	Locality	Trawl Initial Coordinates	Trawl Final Coordinates	Initial Depth	Final Depth	Isobath	Temperature °C	Salinity
ARMT- 62	08.xii.2009	Bpot- Talude	04° 33'21" S / 036° 53'452" W	04° 33'5862" S / 036° 52'0435" W	389 m	480 m	400 m	8.71	34.70
ARMT - 65	08.xii.2009	Bpot- Talude	04° 33.21' S / 036° 53.45' W	04° 33.58' S / 036° 52.04' W	389 m	480m	400 m	8.32	34.66
AR- 75	08.xii.2009	Bpot- Talude	04° 27.56' S / 036° 53.72' W	04° 28.84' S / 036° 50.89' W	1068 m	996 m	1000 m	4.14	34.46
MT- 61	08.v.2011	Bpot- Talude	04° 47.8374' S / 036° 11.0289' W	04° 48.1933' S / 036° 9.6490' W	418 m	457 m	400 m	8.15	34.66
MT- 64	12.v.2011	Bpot- Talude	04° 36.2400' S / 036° 45.7395' W	04° 36.5247' S / 036° 44.5867' W	416 m	410 m	400 m	7.47	34.60
MT- 65	13.v.2011	Bpot- Talude	04° 33.3976' S / 036° 52.9938' W	S 04° 33.7317' / W 036° 51.7720'	390 m	480 m	400 m	8.58	34.70
MT- 71	05.v.2011	Bpot- Talude	04° 46.0360' S / 036° 8.9450' W	04° 46.2246' S / 036° 8.0126' W	937 m	1074 m	1000 m	4.30	34.47
MT 71-2	20.v.2011	Bpot- Talude	S 04° 45.9390' / W 036° 8.0415'	04° 45.6749' S / 036° 3808' W	1040 m	1110 m	1000 m	4.30	34.47
MT- 72	07.v.2011	Bpot- Talude	04° 40.1817' S / 036° 23.8647' W	04° 40.9363' S / 036° 22.7249' W	908 m	897 m	1000 m	4.25	34.45
MT- 72-2	20.v.2011	Bpot- Talude	04° 40.2981' S / 036° 23.7001' W	04° 41.2780' S / 036° 22.1763' W	960 m	1062 m	1000 m	4.25	34.45
MT- 73	05.v.2011	Bpot- Talude	04° 37.6640' S / 036° 30.5400' W	04° 38.1020' S / 036° 29.4490' W	957 m	938 m	1000 m	4.20	34.54
MT 73-2	16.v.2011	Bpot- Talude	04° 37.8519' S / 036° 30.0082' W	04° 38.6087' S / 036° 28.1616' W	955 m	1006 m	1000 m	4.20	34.54
MT- 74	07.v.2011	Bpot- Talude	04° 34.1484' S / 036° 41.6035' W	04° 33.9360' S / 036° 40.6900' W	902 m	1073 m	1000 m	4.23	34.52
MT 74-2	15.v.2011	Bpot- Talude	04° 33.9768' S / 036° 41.8026' W	04° 35.2912' S / 036° 43.3197' W	987 m	1080 m	1000 m	4.23	34.52
MT- 75	03.v.2011	Bpot- Talude	04° 28.8002' S / 036° 52.5554' W	04° 29.0224' S / 036° 51.6292' W	915 m	915 m	1000 m	4.20	34.53
MT 75-2	13.v.2011	Bpot- Talude	04° 28.9586' S / 036° 51.0590' W	04° 28.7678' S / 036° 52.9223' W	956 m	965 m	1000 m	4.20	34.53
MT- 82	06.v.2011	Bpot- Talude	04° 33.7020' S / 036° 14.7090' W	04° 34.4050' S / 036° 12.9730' W	2094 m	2068 m	2000 m	3.48	34.97
MT- 83	04.v.2011	Bpot- Talude	04° 28.3642' S / 036° 24.7602' W	04° 29.4352' S / 036° 24.1561' W	1950 m	1880 m	2000 m	3.45	34.97
MT- 83-2	04.v.2011	Bpot- Talude	04° 27.0256' S / 036° 25.6086' W	04° 24.4630' S / 036° 27.1544' W	1896 m	1931 m	2000 m	3.45	34.97
MT- 84	06.v.2011	Bpot- Talude	04° 25.8308' S / 036° 37.3678' W	04° 25.8720' S / 036° 36.4847' W	1964 m	2019 m	2000 m	3.37	34.96
MT- 85	04.v.2011	Bpot- Talude	04° 21.3580' S / 036° 44.2730' W	04° 22.0158' S / 036° 43.2930' W	2057 m	2025 m	2000 m	3.38	34.96

Table 2. Minimum, mean and maximum values of biometric variables (TL and CL) in males, non-ovigerous females and ovigerous females from species of the genus *Glyphocrangon* A. Milne-Edwards, 1881 in the Potiguar Basin, northeastern Brazil.

Species	TL (mm)			CL (mm)		
	Min.	Mean	Max.	Min.	Mean	Max.
<i>Glyphocrangon aculeata</i>						
Males	60.3	77.5	94.8	17.2	28.9	40.6
Females	67.2	74.4	81.6	30.5	33.5	36.5
Ovigerous females	97.5	108.3	119.1	22.8	35.2	47.6
<i>Glyphocrangon alispina</i>						
Males	36.1	53.8	71.5	9.1	19.2	29.3
Females	44.6	60.1	75.7	8.3	18.9	29.6

Cont.

Table 2. Cont.

Species	TL (mm)			CL (mm)		
	Min.	Mean	Max.	Min.	Mean	Max.
Ovigerous females	44.8	64	83.2	13.5	19.8	26.1
<i>Glyphocrangon longirostris</i>						
Males	38.3	62.6	86.9	12.4	25.0	37.7
Females	48.6	56.5	65.3	21.1	25.9	30.7
Ovigerous females	63.6	80.2	96.8	14.1	27.9	41.8
<i>Glyphocrangon sculpta</i>						
Ovigerous female	-	98.2*	-	-	32.5*	-
<i>Glyphocrangon spinicauda</i>						
Males	55.5	69.3	83.2	11.0	23.0	35.1
Females	54.6	68.3	82.0	10.7	22.0	33.3
Ovigerous females	70.5	78.0	85.5	13.0	24.9	36.9

*only one specimen measured.

RESULTS

Order Decapoda Latreille, 1802

Infraorder Caridea Dana, 1852

Family Glyphocrangonidae Smith, 1884

Genus *Glyphocrangon* A. Milne-Edwards, 1881

Glyphocrangon aculeata A. Milne-Edwards, 1881 (Fig. 2A, B, Tab. 2)

Glyphocrangon aculeatum A. Milne-Edwards, 1881:
5. – A. Milne-Edwards, 1883, pl. 39.

Rhachocaris agassizii Smith, 1882: 43, pl. 5, fig. 2.

Glyphocrangon aculeata – Spence Bate, 1888: 521, pl. 94, fig. 1; – Holthuis, 1971: 323, fig. 10; – Coelho and Ramos, 1972: 156; – Chace, 1984: 6 (key); – Ramos-Porto and Coelho, 1998: 342; – Komai, 2004a: 32, fig. 1a, b; – Coelho *et al.*, 2006: 55; – Serejo *et al.*, 2007: 139; – Felder *et al.*, 2009: 1061; – Vázquez-Bader and Gracia, 2013: 371.

Material examined. 60 (IN); 21 (M), 37 (F), 2 (OF), Bpot-Talude #AR 75, MOUFPE 15.203. 4 (IN); 1 (M), 3 (OF), Bpot-Talude #MT 71, MOUFPE 15.149. 4 (IN); 4 (M), Bpot-Talude #MT 72, MOUFPE 15.148. 1 (M), Bpot-Talude #MT 72-2, MOUFPE 15.162. 2 (M), Bpot-Talude #MT 73, MOUFPE 15.156. 1 (IN); 1 (M), Bpot-Talude #MT 73-2, MOUFPE 15.150. 17 (IN); 10 (M), 6 (F), 1 (OF), Bpot-Talude #MT 74, MOUFPE 15.164. 5 (IN); 3 (M), 2 (OF), Bpot-Talude #MT 74-2, MOUFPE 15.184. 2 (M), Bpot-Talude #MT 75, MOUFPE 15.188. 1 (M), Bpot-Talude #MT 75-2, MOUFPE 15.169.

Distribution. Western Atlantic: USA (North Carolina), Gulf of Mexico, Caribbean Sea, Venezuela, Brazil (Ceará and Rio Grande do Norte – Potiguar Basin, Pernambuco, Bahia, Espírito Santo, Rio de Janeiro, São Paulo) (Spence Bate, 1888; Komai, 2004a; Felder *et al.*, 2009; this study).

Bathymetric distribution. The species has been recorded at depths of 443–1,760 m (Holthuis, 1971; Komai, 2004a; Felder *et al.*, 2009; Vázquez-Bader and Gracia, 2013). In the present study, the species was recorded between depths of 908–1,110 m.

Remarks. The examined specimens have the diagnostic characters of *G. aculeata* as described by Smith (1882), Holthuis (1971) and Komai (2004a). *Glyphocrangon aculeata* is easily recognized among the Atlantic species of the genus by the anterior fourth carina of the carapace forming a vertically compressed, acute lamina (wing-like spine).

Along the Brazilian coast, *G. aculeata* was first recorded by Spence Bate (1888) on the basis of material collected off Recife (state of Pernambuco), at a depth of 1,215 m. Komai (2004a) extended its distribution to the states of Bahia and Espírito Santo, between 707–1,760 m depth. The present record is the first from Potiguar Basin and fills a gap in the distribution of *G. aculeata* in the south Atlantic, suggesting that this species is much more widely distributed than currently assumed.

Females were more abundant and larger in size than compared to males (see Tab. 2).

Figure 2. *Glyphocrangon aculeata* A. Milne-Edwards, 1881, dorsal (A) and lateral (B) views, male (TL-75.5 mm; Bpot-Talude MT# 72-2; MOUFPE 15.162), northeastern Brazil.

***Glyphocrangon alispina* Chace, 1939**
(Fig. 3A, B, Tab. 2)

Glyphocrangon alispina Chace, 1939: 39; – Pequegnat, 1970: 105; – Holthuis, 1971: 347, fig. 15; – Chace, 1984: 9 (Key); – Ramos-Porto *et al.*, 2003: 98; – Komai, 2004a, 33, fig. 1 c, d; – Coelho *et al.*, 2006: 55; – Serejo *et al.*, 2007: 139; – Felder *et al.*, 2009: 1061; – Vázquez-Bader and Gracia, 2013: 373.

Material examined. 2 (F), Bpot-Talude #AR 75, MOUFPE 15211. 4 (IN); 2 (M), 2 (F), Bpot-Talude

#MT 71-2, MOUFPE 15.166. 1 (M), Bpot-Talude #MT 72-2, MOUFPE 15161. 4 (IN); 2 (M), 2 (F), Bpot-Talude #MT 74, MOUFPE 15.163. 14 (IN); 6 (M), 2 (F), 6 (OF), Bpot-Talude #MT 74-2, MOUFPE 15.186. 30 (IN); 17 (M), 9 (F), 4 (OF), Bpot-Talude #MT 75, MOUFPE 15.190. 9 (IN); 6 (M), 2 (F), 1 (OF), Bpot-Talude #MT 75-2, MOUFPE 15.182. 1 (OF), Bpot-Talude #MT 82, MOUFPE 15.193. 1 (OF), Bpot-Talude #MT 85, MOUFPE 15.187.

Distribution. Western Atlantic: USA (Florida), Gulf of Mexico (off Texas), northwestern Cuba (Matanzas

Province, Santa Clara Province), off Nicaragua, Caribbean Sea (Virgin Islands), Guyana, Brazil (Amapá, Ceará and Rio Grande do Norte – Potiguar Basin, Bahia) (Holthuis, 1971; Komai, 2004a; this study).

Bathymetric distribution. In the state of Florida, *G. alispina* was found between depths of 548–1,865 m (Holthuis, 1971), whilst in the southwest and southeast of the Gulf of Mexico, there are records between depths of 671, 9–1,144 m (Vázquez-Bader and Gracia, 2013). It has been recorded off the Brazilian coast between 421–900 m depths (Serejo *et al.*, 2007). However, in this study, the species was found between depths of 908–2,094 m, thus extending its known bathymetric distribution.

Remarks. The specimens examined are in agreement with the original description of Chace (1939) and the subsequent redescription of Holthuis (1971). Holthuis (1971) mentioned that *G. alispina* is very similar to *G. nobilis* A. Milne-Edwards, 1881. Further, Komai (2004a) showed some differences between the species, such as: the size of the eye being larger in *G. alispina* than in *G. nobilis*, and the fourth and fifth pereopods more elongate in *G. alispina* than in *G. nobilis*. The material examined herein fits well with these states of characters.

Glyphocrangon alispina is restricted to the western Atlantic, ranging from the Gulf of Mexico to Brazil (Holthuis, 1971; Ramos-Porto *et al.*, 2003; Komai, 2004a; Serejo *et al.*, 2007; Vázquez-Bader and Gracia, 2013). *Glyphocrangon alispina* has been recorded on the Brazilian coast as far south as Bahia and the states of Espírito Santo and Rio de Janeiro (Campos Basin) (Komai, 2004a; Cardoso and Serejo, 2007; Serejo *et al.*, 2007). Thus, the present record is the first from Potiguar basin.

Females were more abundant and larger in size when compared to males (see Tab. 2).

***Glyphocrangon longirostris* (Smith, 1882)** (Fig. 4A, B, Tab. 2)

Rhachocaris longirostris Smith, 1882: 51, pl. 5, fig. 1, pl. 6, fig. 1.
Glyphocrangon longirostris – Pequegnat, 1970: 106; –

Holthuis, 1971: 330, figs. 11–13; – Crosnier and Forest, 1973: 230, fig. 73a, b; – Chace, 1984: 8 (Key); – d’Udekem d’Acoz, 1999: 138; – Komai, 2004a: 35, fig. 2c, d; – Coelho *et al.*, 2006: 55; – Cardoso and Serejo, 2007: 40, fig. 1; – Serejo *et al.*, 2007: 139; – Felder *et al.*, 2009: 1061.

Material examined. 69 (IN); 12 (M), 8 (F), 49 (OF), Bpot-Talude #AR 75, MOUFPE 15.210. 2 (IN); 1 (F), 1 (OF), Bpot-Talude MT #71-2, MOUFPE 15.167. 6 (IN); 6 NI; 1 (M), 5 (OF), Bpot-Talude MT #72-2, MOUFPE 15.159. 4 (IN); 1 (M), 3 (OF), Bpot-Talude #MT 73, MOUFPE 15.158. 16 (IN); 2 (M), 14 (OF), Bpot-Talude #MT 74, MOUFPE 15.165. 8 (IN); 3 (M), 5 (OF), Bpot-Talude #MT 74-2, MOUFPE 15.185. 5 (IN); 5 (OF), Bpot-Talude #MT 75, MOUFPE 15.189. 3 (OF), Bpot-Talude #MT 75-2, MOUFPE 15.183. 3 (IN); 2 (M), 1 (F), Bpot-Talude #MT 82, MOUFPE 15.168. 5 (IN); 3 (M), 2 (F), Bpot-Talude #MT 83, MOUFPE 15.154. 14 (IN); 14 NI; 8 (M), 3 (F), 3 (OF), Bpot-Talude #MT 83-2, MOUFPE 15.157. 2 (IN); 1 (M), 1 (F), Bpot-Talude #MT 84, MOUFPE 15.171. 8 (IN); 6 (M), 2 (F), Bpot-Talude #MT 85, MOUFPE 15.180.

Distribution. Western Atlantic: USA (Massachusetts), Brazil (Ceará and Rio Grande do Norte – Potiguar Basin, Bahia, Espírito Santo, Rio de Janeiro). Eastern Atlantic: Ireland to South Africa (Holthuis, 1971; Komai, 2004a; Serejo *et al.*, 2007; this study).

Bathymetric distribution. The species was previously recorded in depths of 1,280–2,500 m (Holthuis, 1971). In southeastern Brazil it has been recorded between depths of 1,402–2,076 m (Serejo *et al.*, 2007), with the current specimens found between the depths of 908–2,094 m.

Remarks. The present specimens adhere closely to the descriptions of Smith (1882), Holthuis (1971), Komai (2004a) and Cardoso and Serejo (2007). *Glyphocrangon longirostris* shares a character with *G. nobilis* and *G. alispina*, such as the anterior lateral carina of the carapace armed with only one terminal spine (Komai, 2004a). However, the absence of short setae on the carapace and abdomen, and the presence of a dorsal rugosity on the rostrum easily distinguish *G. longirostris* from those species.

Figure 3. *Glyphocrangon alispina* Chace, 1939, dorsal (A) and lateral (B) views, male (TL-68.5 mm; Bpot-Talude MT# 75-2; MOUFPE 15.182), northeastern Brazil.

Glyphocrangon longirostris has a wide geographical distribution in the Atlantic Ocean (both western and eastern) (Holthuis, 1971). However, this species was only recorded from Brazil rather recently by Komai (2004a). Later, Cardoso and Serejo (2007) recorded the species from the Campos Basin, off the coast of Rio de Janeiro. This study reports the occurrence of the species in the Potiguar Basin for the first time.

Females were more abundant and larger in size when compared to males (Tab. 2).

***Glyphocrangon sculpta* (Smith, 1882)**
(Fig. 5A, B, Tab. 2)

Rhachocaris sculpta Smith, 1882: 49, pl. 5, fig. 3, pl. 6, fig. 3–3d.

Glyphocrangon sculptus – Smith, 1886: 608, 655, pl. 8, fig. 3, pl. 9, figs. 1, 2.

(?) *Glyphocrangon sculptus* – Pequignat, 1970: 109.

Glyphocrangon sculpta – Holthuis, 1971: 279, figs. 2, 3; – Komai, 2004a: 39, fig. 4a, b; – Coelho *et al.*, 2006: 55; – Serejo *et al.*, 2007: 140.

Figure 4. *Glyphocrangon longirostris* (Smith, 1882), dorsal (A) and lateral (B) views, male (TL-70 mm; Bpot-Talude MT # 74; MOUFPE 15.165), northeastern Brazil.

Material examined. 1 (OF), Bpot-Talude #MT 82, (Holthuis, 1971; Komai, 2004a; 2010; this study). MOUFPE 15.193.

Distribution. Western Atlantic: East coast of USA (Massachusetts, Delaware), Caribbean Sea, Brazil (Potiguar Basin - Rio Grande do Norte, Bahia, Rio de Janeiro). Eastern Atlantic: from Iceland to Nigeria

Bathymetric distribution. Serejo *et al.* (2007) obtained specimens in Brazilian waters from 1,718–2,137 m depth. The present specimen came from exclusively at 2,094 m.

Figure 5. *Glyphocrangon sculpta* (Smith, 1882), dorsal (A) and lateral (B) views, ovigerous female (TL-98.2 mm; Bpot-Talude MT# 82; MOUFPE 15.193), northeastern Brazil.

Remarks. Holthuis (1971) diagnosed *G. sculpta* as having three teeth on the fifth pleonal pleuron as does the present specimen. However, Pequegnat (1970) and Komai (2004b) stated that the armature is variable, sometimes having only two teeth. As shown by previous authors (Holthuis, 1971; Komai, 2004a), *G. sculpta* is easily recognizable among the Atlantic species by the spiny intercarinal spaces of the carapace, the clearly bidentate anterior fourth carina on the carapace and subcylindrical dactyli of the fourth and fifth pereopods, with the distal part horizontally cleft in females.

Glyphocrangon sculpta was assumed to exhibit amphi-Atlantic distribution (Komai, 2004a), but the southern African records of *G. sculpta* in Stebbing (1908), Barnard (1950) and Kensley (1968; 1981) were referred to *Glyphocrangon africana* Komai, 2010 by Komai (2010). Thus, the distribution records of *G. sculpta* in the eastern Atlantic range from the Bay of Biscay to Nigeria (Komai, 2010).

In the western Atlantic *G. sculpta* has a disjunct distribution, occurring along the east coast of the United States, between Massachusetts and Delaware, to the Caribbean (Holthuis, 1971) and in Brazil, off

the coast Rio Grande do Norte (present study), Bahia and Rio de Janeiro (Komai, 2004a). The material studied herein is the second record of the species along the Brazilian coast, filling a gap in its geographical distribution.

***Glyphocrangon spinicauda* A. Milne-Edwards, 1881**
(Fig. 6A, B, Tab. 2)

Glyphocrangon spinicauda A. Milne-Edwards, 1881: 3 – Pequegnat, 1970: 110; – Holthuis, 1971: 295, figs. 6–7; – Coelho and Ramos, 1972: 157; – Chace, 1984: 7 (Key); – Forest and Holthuis, 1997: 56, pl. 40, fig. 1, 1a; – Ramos-Porto and Coelho, 1998: 342; – Ramos-Porto *et al.*, 2000: 80; 2003: 99; – Komai, 2004a: 40, fig. 4c, d; – Coelho *et al.*, 2006: 55; – Serejo *et al.*, 2007: 140; – Silva *et al.*, 2007: 166; – Felder *et al.*, 2009: 1061; – Vázquez-Bader and Gracia, 2013: 378.

Material examined. 132 (IN); 72 (M), 22 (F), 38 (OF), Bpot-Talude #MT 61, MOUFPE 15.206. 8 (IN); 1 (F), 7 (OF), Bpot-Talude #ARMT 62, MOUFPE 15.205. 26 (IN); 7 (M), 6 (F), 13 (OF), Bpot-Talude #ARMT 65, MOUFPE 15.204. 20 (IN); 3 (F), 17 (OF), Bpot-Talude #MT 65, MOUFPE 15.188. 36 (IN); 13 (M), 3 (F), 20 (OF), Bpot-Talude #MT 64, MOUFPE 15.191. 112 (IN); 74 (M), 8 (F), 30 (OF), Bpot-Talude #MT 65, MOUFPE 15.192.

Distribution. Western Atlantic: USA (east coast of Florida), Gulf of Mexico (Yucatan), northwest of Cuba, Caribbean Sea, south of Jamaica, Honduras, Nicaragua, off Guadeloupe, Dominica, Barbados, Brazil (Amapá, Pará, Maranhão, Ceará and Rio Grande do Norte – Potiguar Basin, Bahia) (Holthuis, 1971; Ramos-Porto *et al.*, 2000; Komai, 2004a; Felder *et al.*, 2009; Vázquez-Bader and Gracia, 2013; this study).

Bathymetric distribution. Lemaitre (1984) recorded the species in the Bahamas, between depths of 446–453 m, whilst Holthuis (1971) recorded the species between 256–692 m, similar to the depths reported by Pequegnat (1970) and Ramos-Porto *et al.* (2000). In the present study, the species was found between the depths of 389–480 m.

Remarks. The material examined corresponds to the descriptions in Holthuis (1971) and Komai (2004a). Komai (2004a: 41) assumed the first record of this species from Brazilian waters based on material collected by the project REVIZEE Score Central off Bahia coast. This author pointed out that *G. spinicauda* has been cited on an unpublished conference abstract record by Ramos-Porto & Silva (2000). However, Komai (2004a) probably overlooked that Holthuis (1971) had already recorded this species in Brazil on the basis of eight ovigerous females collected at station of “Oregon” St. 2081 off the outfall of the Amazon River in the state of Pará. This record was cited by both Coelho and Ramos (1972) and Ramos-Porto and Coelho (1998). Also, Ramos-Porto *et al.* (2000; 2003) recorded this species in Amapá, Pará and Maranhão, based on the material collected by the project “REVIZEE/Pesca” in the northern region of Brazil. The present record is the first from the study area.

Females were more abundant and larger in size when compared to males (see Tab. 2).

ABUNDANCE AND BATHYMETRIC DISTRIBUTION

The species of *Glyphocrangon* were represented in three out of seven sampling stations in 2009, and 18 out of 31 stations in 2011 (ranging in depths between 400–2,000 m) (Tab. 1). A total of 810 shrimps were examined, belonging to five species: *G. aculeata*, *G. alispina*, *G. longirostris*, *G. sculpta* and *G. spinicauda* (Fig. 7). The most abundant species was *G. spinicauda*, which is usually found as a fishery by-catch in the north of Brazil (Ramos-Porto *et al.*, 2000).

The specimens of *G. aculeata* were found only around 1,000 m, while *G. sculpta* was registered only at a depth of 2,000 m. Both records are included in the bathymetric distribution limits known for the species (Komai, 2004a; Serejo *et al.*, 2007; Vázquez-Bader and Gracia, 2013). The highest abundance of individuals of *G. spinicauda* was recorded around 400 m depth, although the previous records by Holthuis (1971) and Ramos-Porto *et al.* (2000) have registered this species deeper as far as 692 m. The wide bathymetric range of *G. alispina* and *G. longirostris* has also been observed by Wenner (1978) and Komai (2004a), indicating a better tolerance to high variations of pressure, temperature and salinity compared to the others species of the genus.

Figure 6. *Glyphocrangon spinicauda* A. Milne-Edwards, 1881, dorsal (A) and lateral (B) views, female (TL-62.5 mm; Bpot-Talude MT# 65; MOUFPE 15.188), northeastern Brazil.

The larger proportion of ovigerous females was observed in four out of the five species reported in this study with ovigerous females being larger in size than non-ovigerous females and males. Thompson (1963) studied species of *Glyphocrangon* in the north Atlantic and suggested that spawning occurs all year long, due

to a large proportion of sexually mature individuals in the population.

Thus, due to the low sampling effort in deep waters beyond the continental slope, the record of these species in the southwestern Atlantic (Potiguar Basin) is an important advancement to foster the knowledge

Figure 7. Number of specimens of *Glyphocrangon* A. Milne-Edwards, 1881 based on the depth in Potiguar Basin, northeastern Brazil.

of the geographic and bathymetric distribution of the deep-water shrimps of the genus *Glyphocrangon*. However, in Brazilian waters, the inventory of deep marine fauna is still far from complete, requiring further investigations to the knowledge of deep-sea biodiversity.

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