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Short Communication

Composition of decapod larvae in a northeastern Brazilian estuarine inlet over a full tidal cycle

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ABSTRACT. Composition changes of decapod larvae in a neotropical estuarine inlet (Catuama inlet, northeast Brazilian coast) were studied in a complete tidal cycle in August 2001. Sampling was performed at three stations at two or three depth levels that were located along a transect across the inlet. The collections were performed in 3 h intervals under a neap tide regime. Samples were taken with a pump and the water was filtered through 300 μm plankton net. 27 planktonic decapod taxa were identified, which included the first larval stages of the coastal and oceanic shrimps *Lucifer faxoni* and *Acetes americanus*, besides larvae of the estuarine and coastal decapods *Pinnixa* spp., *Uca* spp., *Petrolisthes armatus*, *Upogebia* spp. and Alpheidae, which were the most frequent taxa. All of the planktonic larval stages were observed for most of the decapods, suggesting that the probable exportation from the estuary is to the inner adjacent shelf area, instead of the outer oceanic area.

Keywords: decapod larvae, meroplankton, tidal changes, neotropical estuary, northeastern Brazil.

Composición de larvas de decápodos en la desembocadura de un estuario del noreste brasileño durante un ciclo completo de marea

RESUMEN. Se analizaron los cambios en la composición de las larvas de decápodos en la desembocadura de un estuario neotropical durante un ciclo completo de marea en agosto de 2001. Las colectas se realizaron en 3 estaciones, en dos o tres profundidades, localizadas en una transecta interior. Los muestreos se realizaron a intervalos de 3 h durante la marea de cuadratura. Las muestras se colectaron con una bomba y se filtraron a través de una red de plancton (300 μm). Se identificaron 27 taxa de larvas de decápodos, incluyendo el primer estadio larval de los camarones costeros y oceánicos *Lucifer faxoni* y *Acetes americanus*, seguidos de las larvas de los decápodos estuarinos y costeros *Pinnixa* spp., *Uca* spp., *Petrolisthes armatus*, *Upogebia* spp. y Alpheidae, que fueron los taxa más frecuentes. Se observaron todos de los estadios larvales de la mayoría de los decápodos, lo que sugiere que probablemente la exportación del estuario es hacia el área interior de la plataforma adyacente, en vez de hacia el área oceánica exterior.

Palabras clave: larvas de decápodos, meroplancton, cambios de marea, estuario neotropical, noreste de Brasil.

INTRODUCTION

Many representatives of the estuarine meroplankton use the freshwater and/or marine flows as a means of transport to other locations (mainly to the adjacent continental shelf), where post-embryonic development often occurs. However, a few species have different migratory behaviors and exhibit retention strategies due to circulation and tidal regimes in the estuaries (Christy & Stancyk, 1982; Epifanio, 1988). As a consequence, the distribution of meroplankton in coastal waters is influenced by both behavioral and physical transport

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mechanisms (Christy & Stancyk, 1982; Butman, 1987; Melo Júnior *et al.*, 2012).

In several studies, the effects of tides and photoperiodic variations have focused on the dynamics of estuarine larval decapod, both in temperate areas (Morgado *et al.*, 2006) as well as in tropical (*e.g.*, Silva-Falcão *et al.*, 2007) and subtropical regions (Fernandes *et al.*, 2002; Koettker & Freire, 2006). Usually the synchronization of the larval release with photoperiod seems to be associated with susceptibility to predation (Morgan & Christy, 1995). Most of the time, inconspicuous larvae are released into the estuary regardless of photoperiod, while larvae more attractive to predators are released during the night tide, especially during the spring ebb tides (Morgan & Christy, 1995; Gove & Paula, 2000).

There is extensive information on estuarine and coastal planktonic decapod in neotropical Brazil (Schwamborn & Bonecker, 1996; Schwamborn, 1997; Porto-Neto *et al.*, 1999; Silva-Falcão *et al.*, 2007; Magris & Loureiro-Fernandes, 2011; Melo Júnior *et al.*, 2012; Oliveira *et al.*, 2012; Koettker & Lopes, 2013). However, the vertical distribution in relation to tidal cycles is known only for a few taxa. To our knowledge, this is probably the first published study in Brazil that explores the variability of composition of planktonic decapods in an estuarine system, considering its distribution in different layers of the water column. The present study examines the changes of planktonic decapod composition and occurrence of developmental stages over a full tidal and diel cycles in a northeastern Brazilian estuarine inlet.

Study area

The Itamaracá Estuarine System (IES) is located at 7º34'00"-7º55'16"S and 34º48'48"-34º52'24"W, about 50 km north from Recife City, in the state of Pernambuco, northeast Brazil. It consists of a U-shaped channel (Santa Cruz Channel, 20 km in length) with two connections to the South Atlantic Ocean (Catuama and Orange inlets) and five main tributaries draining into the channel. Mangrove forests (~28 km^2) occupy the lowlands along the inner portion of the Santa Cruz Channel and the lower part of its tributaries. The dominant species is the red mangrove (*Rhizophora mangle*), which its litter is responsible by 7 ton of dry weight of organic matter ha^{-1} year^{-1} (Medeiros *et al.*, 2001). This research was developed in Catuama Inlet (Fig. 1). Sampling was conducted on board of a small vessel during neap tide (August 11-12, 2001) in 3-h intervals over 24 h.

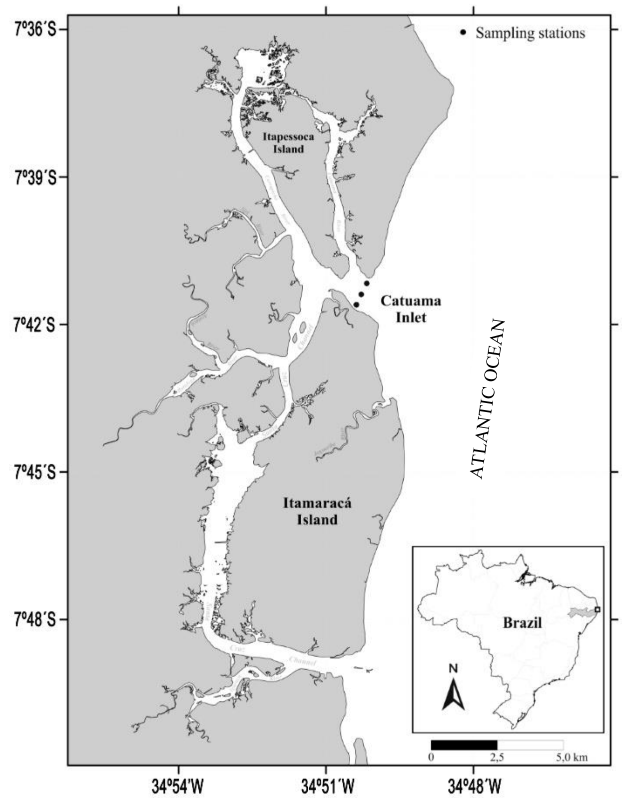

Figure 1. Itamaracá estuarine system (Pernambuco, Brazil) showing the Catuama Inlet and the sampling stations.

Sampling and laboratory methods

Plankton samples were collected with a pump at three stations along a transect that crosses the inlet. At the central station (Center), three depth levels were sampled (50 cm below the surface, at mid-water, and 50 cm above the bottom, 12-15 m), while at the lateral stations (Continent and Island stations) samples were taken only at the subsurface and above the bottom (8-10 m). Water samples were pumped on board through a conical 300 µm plankton net for 3 to 5 min per sample at approximately 100 L per minute. Immediately after sampling, all samples were fixed in 4% buffered seawater formaline (n = 56).

In the laboratory, planktonic decapods were counted and identified *in toto*, considering the lowest feasible taxonomic unit by optical analysis. The identification of organisms was made following Gurney (1942), Kurata (1970), Boschi (1981), Calazans (1993), Schwamborn (1997), Pohle *et al.* (1999), among others. The larval stages for each taxa were determined by characteristics specified mainly by Gurney (1942), Boschi (1981), Calazans (1993) and Pohle *et al.* (1999). The quantitative data (ind m^{-3}) is not presented here, but is documented elsewhere (Melo Júnior, 2005).

For the frequency of occurrence, we used the formula F_o (%) = Ta*100 * TA^{-1} where *Ta*: number of samples where the taxon occurs; and *TA*: total samples. For the interpretation of the result of the frequency of occurrence we used the following scale: >70% very frequent; 70-40% frequent; 40%-10%: infrequent and ≤10% sporadic. For the relative abundance, we calculated the percentage of individuals in diurnal and nocturnal photoperiod and at ebb and flood tides. To show the abundance distribution of the individuals in the three depth levels, we used the formula *RA* (%) = N*100 * TN^{-1} where: *N*: number of individuals of the taxon in a determinate depth level; and *TN*: total number of individuals considering the three depth levels.

To detect non-random distributions of decapod larvae between the tidal conditions, photoperiod and depth layers (vertical distribution), the Indicator Species Analysis (Dufrêne & Legendre, 1997) was used. This method is based on an indicator value index (IndVal), which combines both the larval relative abundance with its relative frequency of occurrence in defined conditions. The values ranged from 0% (no indication) to 100% (perfect indication). The statistical significance of the IndVal was evaluated using a Monte Carlo test (permutation number = 1,000). The level of significance was set at $P < 0.05$ for this analysis, and only indicator value indices of more than 70% were considered. Additionally, a clustering analysis was elaborated to establish the main decapod larvae assemblages, based on the Bray-Curtis dissimilarity coefficient and using the density matrix transformed by the UPGMA method. Cophenetic analysis was conducted to measure the fitness of the data. The analyses were run on software R, using the vegan package (Oksanen *et al.*, 2010).

Planktonic decapods in the Catuama Inlet were represented by 27 taxa (Table 1), being distributed in 13 families: Sergestoida (2), Caridea (2), Anomura (2), Thalassinidea (2) and Brachyura (5), besides of non-identified taxa in Hippidea and Stenopodidea. This ecosystem showed a variety of planktonic decapod compared with other coastal and estuarine systems of Brazil (Sankarankutty *et al.*, 1995; Schwamborn *et al.*, 2001; Fernandes *et al.*, 2002; Negreiros-Fransozo *et al.*, 2002; Silva-Falcão *et al.*, 2007). The high number of detected taxa is even more intriguing, since the period examined in this study was inferior than most of surveys conducted at the Brazilian coast. This richness could be even greater if we consider that the pump suction is not one of the most widely used sampling equipments for qualitative analysis of zooplankton, even this technique being adequate for quantitative data at exactly depths (Melo Júnior *et al.*, 2015). For example, a study using simultaneous plankton net (300 µm) at the same area (Schwamborn, R. unpublished data), recorded two genera of the complex *Penaeus (Litopenaeus* sp. and *Farfantepenaeus* sp.) (Penaeoidea) and the families Galatheidae (Anomura) and Portunidae (Brachyura), which were not collected by pump suction in our sampling.

The number of planktonic decapod species recorded here was below (<10%) the number of species (around 117-all potentially producers of planktonic larvae) inhabiting the IES (Coelho, 2000). This pattern seems to be common in many estuaries and has been observed in many studies of decapod larvae in other Brazilian (Sankarankutty *et al.*, 1995; Schwamborn *et al.*, 2001; Fernandes *et al.*, 2002; Negreiros-Fransozo *et al.*, 2002; Silva-Falcão *et al.*, 2007) and other world estuaries (Dittel & Epifanio, 1990; Dittel *et al.*, 1991; Criales & McGowan, 1994; Paula *et al.*, 2004). Most of the authors attribute this pattern to a lack of knowledge about larvae taxonomy, and is associated with the dominance of a few species in the ecosystems studied or the different reproductive periods of the occurring species.

Among the recorded taxa, 27.8% were very frequent (Table 1), especially the protozoea of *Lucifer faxoni* and *Acetes americanus* with 91.7% each, followed by zoea of *Pinnixa* sp. 1 (78.6%), *Uca* spp. (76.8%), and *Panopeus* spp. and the Ocypodidae morphotype A (both with 75%). The zoea of Caridea (others), mysis of *Lucifer faxoni*, zoea of *Petrolisthes armatus*, and Alphaeidae were also very frequent. Other decapods were frequent (19.4% of the 27 registered taxa), especially the zoea of *Upogebia* spp. (64.6%) and Paguridae (62.5%). The 19 remaining decapods were infrequent (25% of them) or sporadic (27.8% of them).

Concerning the quantity of developmental stages, Sergestoida and Brachyura were the two more representative groups of decapod (Fig. 2). However, no evident tidal variation was observed to the distribution of the larval stages in relation to the main groups of decapod larvae. Considering all decapods, we found higher numbers of developmental stages (>40) during flood and high tides, with a maximum of 60 stages at the nocturnal flood tide. Lower numbers were observed during the diurnal low tide (Fig. 2). A greater range among Sergestoida was observed, and a unique adult stage among all planktonic decapod was recorded (*Lucifer faxoni*). There were occurrences of larvae in early stages of development in all families, and more advanced stages, such as post-larvae, zoea IV or more, megalopa, and glaucothoe were recorded in almost every groups, except in Stenopodidea and Hippidea (Tables 2-3).

Table 1. Composition, description of larval stages and frequency of occurrence of planktonic decapods registered during a 24 h study, in Catuama Inlet (northeastern Brazil), in August 2011. P: protozoea, M: mysis, J: juvenile, A: adult, Z: zoea, PL: post-larvae, G: glaucothoe, ME: megalopa. I, II, III, IV, V, VI: stages of development. ****very frequent; ***frequent; **infrequent; *sporadic.

Decapod larvae	Larval stages	Frequency (%)
Sergestoida		
Family Luciferidae Dana, 1852		
Lucifer faxoni Borradaile, 1915	PI, PII, PIII, MI, MII, MIII, J, A	91.66****
Family Sergestidae Dana, 1852		
Acetes americanus Ortmann, 1893	PI, PII, PIII, MI, MII, MIII	91.66****
Stenopodidea	ZI	02.08*
Caridea		
Family Hippolytidae Bate, 1888	ZI, ZII, ZIII	02.08*
Family Alpheidae Rafinesque, 1815	ZI, ZII, ZIII, PL	68.75***
Caridea (others)	ZI, ZII, ZIII, PL	70.83****
Anomura		
Family Porcellanidae Haworth, 1825		
Petrolisthes armatus Gibbes, 1850	ZI, ZII	68.75***
Porcellanidae (others)	ZI, ZII	10.41**
Family Paguridae Latreille, 1803	ZI, ZII, ZIII, G	62.50***
Thalassinidea		
Family Callianassidae Dana, 1852	ZI, ZII	04.16*
Family Upogebiidae Borradaile, 1903		
Upogebia spp.	ZI, ZII, ZIII	64.58***
Hippidea	ZI	02.08*
Brachyura		
Family Dromiidae De Haan, 1833	ZI	10.45**
Family Leucosiidae Samouelle, 1819	ZI, ZII, ZIII	06.25*
Family Xanthidae MacLeay, 1838		
Menippe nodifrons Stimpson, 1859	ZI, ZII	06.25*
Panopeus spp.	ZI, ZII, ZIII, ZIV, ZV	75.00****
Xanthidae Morphotype A	ZI, ZII, ZIII, ZIV	29.16**
Xanthidae Morphotype B	ZI	04.16*
Family Pinnotheridae De Haan, 1833		
Pinnixa sp. 1	ZI, ZII, ZIII, ZIV, ZV, ZVI	78.57****
Pinnixa sp. 2	ZI, ZII, ZIII, ZIV	27.08**
Pinnixa sp. 3	ZI, ZII, ZIII, ZIV, ZV, ZVI	58.33***
Zaops ostreum (Say, 1817)	ZI, ZII, ZIII, ZIV	39.58**
Pinnotheridae Morphotype A	ZI, ZII, ZIII, ZIV, ZV	47.91***
Family Ocypodidae Rafinesque, 1815		
Uca maracoani Latreille, 1802	ZI	06.25*
Uca spp.	ZI, ZII, ZIII, ZIV	76.79****
Ocypodidae Morphotype A	ZI, ZII, ZIII, ZIV	75.00****
Ocypodidae Morphotype B	ZI, ZII, ZIII, ZIV, ZV	16.66**
Brachyura (others)	ZI, ZII, ZIII, ZIV, ZV, ME	56.25***

We found two main groups of planktonic decapods (Fig. 3): i) an assemblage of mainly infrequent and sporadic larval stages, with variables peaks. Most of these larvae are represented by advanced stages of all decapod taxa; ii) Assemblage of very frequent larval stages, represented by initial and intermediate stages of all registered groups. Twenty larval stages were found to be significant indicators (IndVal > 70%; $P < 0.05$) of some tidal (mainly, flood) and photoperiod (mainly, night) conditions (Fig. 3). The larvae of *Zaops ostreum*, Pinnotheridae and *Lucifer faxoni* were good indicators of flood tides, while the larval stages of Caridea (Alphaeidae and others), Paguridae, Pinnotheridae and Luciferidae, of nocturnal period. These taxa were also associated with other decapod larvae, as is shown in the cluster analysis (Fig. 3).

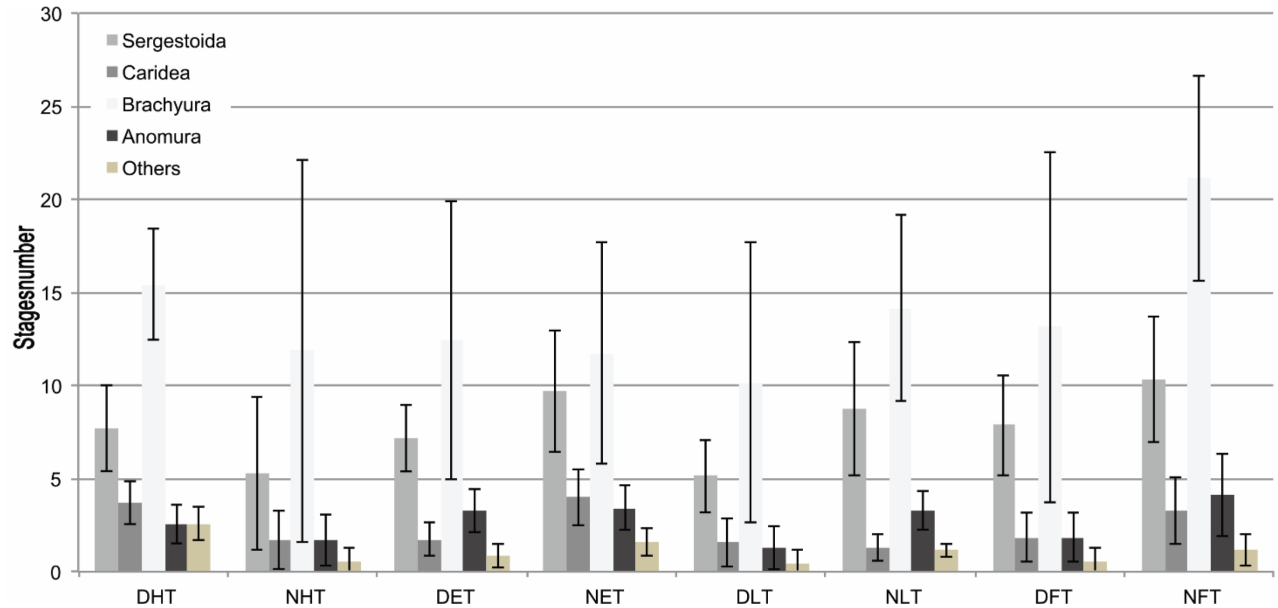

Figure 2. Number of developmental stages of planktonic decapods registered during a 24-h study, in Catuama Inlet (northeastern of Brazil), in August 2011. D: diurnal, N: nocturnal, HT: high tide, ET: ebb tide, LT: low tide, FT: flood tide.

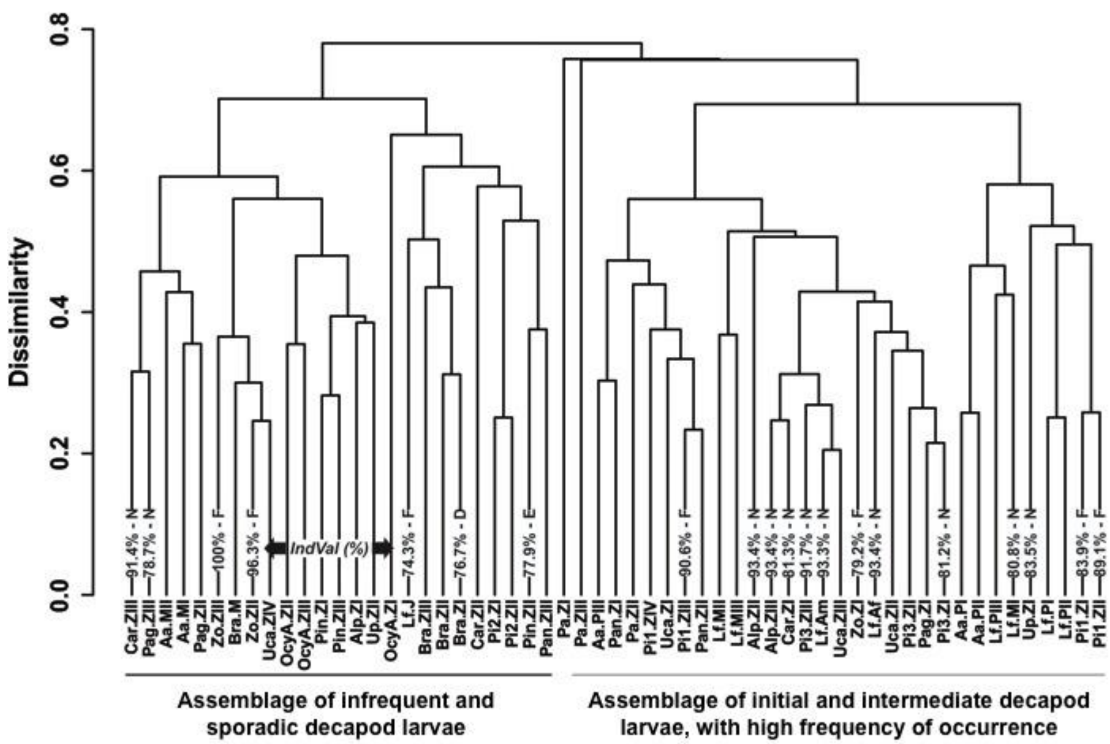

Figure 3. Cluster analysis based in Bray-Curtis dissimilarity coefficient, using the transformed abundance matrix by the UPGMA method, and significant Indicator Values (IndVal, %) of some taxa in relation to tidal and diel conditions. Car: Caridea (others), Pag: Paguridae, Aa: *Acetes americanus*, Zo: *Zaops ostreum*, Bra: Brachyura (others), Uca: *Uca* spp., OcypA: Ocypodidae A, Pin: Pinnotheridae, Alp: Alphaeidae, Up: *Upogebia* spp., Lf: *Lucifer faxoni*, Pi: *Pinixa* sp. 1, 2 or 3, Pa: *Petrolisthes armatus*, Pan: *Panopeus* spp., P: protozoea, M: mysis, J: juvenile, A: adult, Z: zoea. I, II, III, IV, V, VI: stages of development. IndVal legends: N: nocturnal period, F; flood tide, D: diurnal period, E: ebb tide.

Table 2. Occurrence and relative abundance (%) of larval stages of planktonic decapods (except Brachyura) registered during a 24 h study, in Catuama Inlet (northeastern Brazil), in August 2011, considering the tides, photoperiod and the depth. S: 50 cm below the surface, m: mid-water, b: 50 cm above the bottom (8-15 m); - no occurrence; PL: post-larvae; G: glaucothoe.

Decapod larvae	Diurnal ebb			Nocturnal flood			Nocturnal ebb			Diurnal flood		
	s	m	b	s	m	b	s	m	b	s	m	b
Sergestoida												
Lucifer faxoni												
Protozoea	53	23	24	61	8	31	53	44	3	17	58	26
Mysis	8	84	8	10	22	68	65	30	6	2	28	71
Juvenile	-	-	-	32	33	35	22	66	13	-	43	57
Adult	-	-	-	11	53	37	6	67	27	21	17	62
Acetes americanus												
Protozoea	30	53	16	27	38	36	78	14	8	4	78	17
Mysis	-	30	70	-	92	8	59	-	41	-	-	-
Caridea												
Hippolytidae												
Zoea I	-	-	-	-	-	-	-	-	-	-	72	28
Alpheidae												
Zoea I + II	42	50	8	38	57	5	76	19	5	13	26	61
Zoea III + PL	-	-	100	11	79	11	15	80	5	-	47	53
Caridea (others)												
Zoea I + II	8	18	74	31	23	46	64	28	8	19	47	34
Zoea III + PL	-	-	100	10	69	21	11	28	61	-	-	100
Anomura												
Petrolisthes armatus												
Zoea I	25	40	35	-	97	3	5	26	69	43	48	9
Zoea II + III	5	52	42	-	93	7	3	17	80	74	26	-
Porcellanidae (others)												
Zoea I	-	-	-	8	83	10	-	-	-	100	-	-
Paguridae												
Zoea I	1	90	9	18	44	38	41	43	16	6	38	56
Zoea II + III + G	-	96	4	15	26	59	73	18	9	-	20	80
Anomura (others)												
Glaucothoe	-	-	-	-	100	-	-	-	-	-	100	-
Thalassinidea												
Callianassidae												
Zoea I	-	-	-	50	50	-	-	-	100	-	-	-
Upogebia spp.												
Zoea I	14	81	5	45	32	23	34	19	47	2	84	14
Zoea II + III	-	100	-	26	30	44	-	71	29	-	100	-
Hippidea												
Zoea I	-	-	-	100	-	-	-	-	-	-	-	-

No difference on planktonic decapod composition or developmental stages was observed in relation to the stations. On the other hand, the vertical distribution of the percentage of the larval stages was variable between the decapod taxa, with evident concentration of individuals in determined layers (Tables 2-3). Even so, no larval stage was indicator of a depth layer (surface, mid-water or bottom), suggesting that the low depth of the inlet (maximum of 15 m) is probably not sufficient to promote patterns of vertical aggregations of the larvae.

Most of the planktonic decapods from Catuama Inlet presented many larval stages (some occurring with four or more developmental stages), suggesting that part of the most larvae develop next to the inlet (Epifanio, 1988; Paula *et al.*, 2004). This pattern is common in euhaline estuarine systems where the development of these species occurs, since the zoea I

Table 3. Occurrence and relative abundance of larval stages of planktonic Brachyura registered during a 24 h study, in Catuama inlet (northeastern Brazil), in August 2011, considering the tides, photoperiod and the depth. Depth: s: 50 cm below the surface, m: mid-water, b: 50 cm above the bottom (8-15 m), - no occurrence, Morph: morphotype.

Decapod larvae	Diurnal ebb			Nocturnal flood			Nocturnal ebb			Diurnal flood		
	s	m	b	s	m	b	s	m	b	s	m	b
Brachyura												
Dromiidae												
Zoea I	-	-	-	53	17	29	-	-	-	-	-	-
Leucosiidae												
Zoea I	-	100	-	15	85	-	-	-	-	-	-	100
Zoea II + III	100	-	-	-	-	-	-	-	-	-	100	-
Menippe nodifrons												
Zoea I	-	-	-	65	-	35	-	-	-	-	-	-
Zoea II	-	-	-	100	-	-	-	-	-	-	-	-
Panopeus spp.												
Zoea I + II	4	60	36	5	70	25	20	50	30	13	63	24
Zoea III + IV + V	3	16	81	5	-	95	-	56	44	50	23	27
Xanthidae Morph A												
Zoea I + II	-	38	62	19	37	44	26	70	4	10	40	50
Zoea III + IV	-	-	-	3	61	36	50	42	8	100	-	-
Xanthidae Morph B												
Zoea I	48	-	52	-	-	-	-	-	-	-	-	-
Pinnixa sp. 1												
Zoea I + II	9	78	12	19	25	56	54	38	8	19	30	51
Zoea III + IV	-	47	53	2	66	31	18	38	44	9	22	69
Zoea V + VI	-	-	-	-	88	12	-	-	-	-	-	100
Pinnixa sp. 2												
Zoea I + II	10	78	13	69	-	31	18	21	60	10	84	5
Zoea III + IV	-	32	68	-	-	100	-	-	100	-	89	11
Pinnixa sp. 3												
Zoea I + II	6	82	12	4	55	40	23	36	41	14	55	32
Zoea III + IV + V	-	-	-	1	35	64	10	9	81	25	15	59
Zaops ostreum												
Zoea I + II	7	82	11	5	37	58	21	79	-	21	39	40
Zoea III + IV	-	-	-	3	19	77	-	-	-	60	30	10
Pinnotheridae Morph A												
Zoea I + II	16	46	38	3	45	51	27	25	48	11	47	42
Zoea III + IV + V	-	27	73	-	100	-	9	13	78	100	-	-
Uca maracoani												
Zoea I	-	-	-	100	-	-	-	-	-	-	100	-
Uca spp.												
Zoea I + II	23	60	17	20	38	42	54	24	23	23	55	22
Zoea III + IV	2	37	60	5	62	33	13	11	76	9	17	74
Ocypodidae Morph A												
Zoea I + II	11	79	10	59	34	7	-	-	-	-	-	-
Zoea III + IV + V	-	33	67	2	93	6	-	-	-	-	-	100
Ocypodidae Morph B												
Zoea I + II	26	59	15	20	18	62	73	2	25	19	28	53
Zoea III + IV	-	94	6	21	29	49	-	-	100	23	18	60
Brachyura (others)												
Zoea I + II	18	68	14	91	-	9	50	-	50	9	17	74
Zoea III + IV + V	14	40	46	88	-	12	-	100	0	34	3	63
Megalopa	-	80	20	12	28	60	-	-	100	28	-	72

that remains in the estuary is associated with tidal flooding (Freire, 1998). Since salinity in IES vary from euhaline to mesohaline (Macedo *et al.*, 2000), it is likely that most of the taxa use the region near Catuama inlet as a growth area. This hypothesis was in part confirmed in a study on the transport of decapod larvae by the IES plumes (Schwamborn *et al.*, 2001). In this study, authors observed that larvae dispersion reached only a few kilometers from the coast, suggesting that larvae are retained in estuarine plumes due to the convergence areas formed when the IES's water bodies meet marine water masses.

Considering the classification of Anger (2001), most taxa are larvae of exporting species, while only a small group (formed by *Lucifer faxoni*, *Acetes americanus*, and *Petrolisthes armatus*) seems to have mechanisms for retaining at least one of the larval stages in the IES (Table 2). These three taxa, mainly the initial stages, were grouped in the cluster analysis (Fig. 3). Nevertheless, the high number of larval stages from different taxa indicates that probable mechanisms of retention in the areas adjacent to the inlet should not be discarded. These findings are reinforced by the fact that seven developmental stages were perfect indicators (IndVal > 70%) of flood tide, while just one (Pinnotheridae, zoea II) was indicator of ebb tide.

The role of mangroves in IES as a source of decapod larvae is reinforced by this study. Thus, it is observed that Catuama inlet represents a real corridor for energy exchange in the form of planktonic decapods between the IES and its adjacent coastal shelf. Areas nearby estuaries and mangroves have large densities of decapod larvae at certain times (Neumann-Leitao *et al.*, 1999; Schwamborn *et al.*, 1999, 2001) and one of the main trophic functions of these larvae is to transfer energy to higher links of the food chain (Robertson & Blaber, 1992), including economically important fish. Changes in the tidal cycles and photoperiod, with high numbers of developmental stages during flood and high tides and during the night, promoted a set of variations in the planktonic decapod composition. Besides, the high variability of developmental stages in most of the taxa identified suggests that the development of thesespecies really occurs in the region near to the Catuama inlet.

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