Electronic Supplementary Material

How mollusk assemblages respond to different urbanization levels: Characterization of the malacofauna in subtropical Brazilian mangroves

Taxonomy

The species listed below correspond to the 15 species found in this project, seven of them belonging to Class Gastropoda and nine to Class Bivalvia. The sequence of presentation of species followed classification proposed by Bouchet and Rocroi (2005) for Class Gastropoda and Bieler et al. (2010) for Class Bivalvia.

Class Gastropoda

Subclass Caenogastropoda

Order Littorinimorpha

Family Littorinidae

Littoraria angulifera (Lamarck, 1822)

Figure 1

Diagnostic characterization: Presence of white irregular bands throughout the shell. Shell with sculptured surface with fine spiral grooves and opening length greater than the whorl.

Distribution: USA, Florida to Brazil, São Paulo.

Comments: The largest species belongs to family Littorinidae in Brazil, and may measure 30 mm of length. The color varies widely ranging from orange brown to dark brown, with white bands irregularly distributed across the shell (Rios 2009).

Superfamily Truncatelloidea

Family Cochliopidae

Heleobia australis (d'Orbigny, 1835)

Figure 2

Diagnostic characterization: Presence of hairy periostracum and carina in the middle portion of the last whorl.

Distribution: USA, Florida to Argentina.

Comments: Specimens of *Heleobia australis* analyzed in this study differ from *H. charruana* (d'Orbigny 1843) for presenting hairy periostracum and carina in the middle portion of the last whorl. Although the presence of the carina on the last whorl has not been approached by Marcus and Marcus (1963a, 1963b, 1965), this feature is easily seen and reported by Pilsbry (1911: 557, fig. 5-6) and Simone (2006: 89, fig. 228). The shell of this species has about 4.5 whorls, while *H. charruana* has about 3 whorls.

Heleobia charruana (d'Orbigny, 1840)

Figure 3

Diagnostic characterization: Translucent shell, low whorl and convex whorls.

Distribution: Uruguay, Montevideo to Brazil, Santos.

Comments: Although this species may be confused, it differs from species of the genus *Assiminea* by having wider whorl and no spacing of the inner lip. In addition, the specimens analyzed were all collected in muddy sediment and with strong tidal influence, which differ with the known habitat for species of the genus *Assiminae*, and occupy the supralittoral fringe (Marcus and Marcus 1963b). The shell of *Heleobia charruana* differs from *H. australis* by presenting translucent shell, lower whorl and convex whorls.

Family Thiaridae

Melanoides tuberculata (Müller, 1774)

Figure 4

Diagnostic characterization: Elongated shell, thin wall and spiral grooves.

Distribution: Species originally from Africa and introduced worldwide. In Brazil, it is found in all states of the Brazilian coast ranging from Ceará to Santa Catarina, as well as in Mato Grosso, Mato Grosso do Sul, Goiás, Pará, Tocantins and Distrito Federal (Fernandez et al. 2003).

Comments: Exotic species, firstly reported in Brazil in the city of Santos, São Paulo (Vaz et al. 1986). Although this species can be found in abundance (e.g., beaches of Santos, SP), only one shell was collected.

Subclass Heterobranchia

Family Pyramidellidae

Sayella hemphillii (Dall, 1884)

Figures 5–6

Diagnostic characterization: Glossy shell, with the last whorl elongated and presence of a fold in the inner lip.

Distribution: Only for the region sampled in this work.

Comments: The shell is small, not exceeding 2 mm of length, with marks showing teleoconch and protoconch with corrosion signs, thin outer lip and presence of a fold in the inner lip. Preliminary identifications indicated that it was a young specimen of *Ellobium pellucens*, a species relatively common in the region (Marcus and Marcus 1963b). However, the presence of a thin and translucent operculum and the fact that the shell opening is not elongated exclude the possibility of belonging to family Ellobiidae. The species originally from Florida (USA) is here reported for the first time to Brazil.

Order Pulmonata

Family Ellobiidae

Melampus coffea (Linnaeus, 1758)

Figure 7

Diagnostic characterization: Oval shell, elongated and narrow opening, low whorl, grayish color with white bands on the last whorl.

Distribution: USA, Florida to Uruguay.

Comments: A common species, which inhabits mangroves throughout Brazil and of easy identification.

Class Bivalvia

Order Mytiloidea

Family Mytilidae

Mytella charruana (d'Orbigny, 1842)

Figure 8

*Diagnostic characterization***:** Coloration varies from brownish to yellowish. Inside purple. This species is found predominantly in groups, with lighter coloration tending to yellow, with extremely tough byssus filaments. Usually with prominent dorsal angle.

Distribution: Mexico to San Antonio, Argentina.

Comments: Although considered by some authors as an invasive species (Carlton et al. 1996, Stenyakina et al. 2010), it is very abundant in Brazilian estuaries, many times considered as belonging to the local fauna, it is popularly called "Sururu" and used as food by coastal communities (Resgalla-Junior et al. 2008).

Dacrydium vitreum (Møller, 1842)

Figure 9

Diagnostic characterization: Small and fragile shell. Subtriangular shape valves, nearly straight dorsal margin, the dorsal portion being 2 times longer than the anterior portion.

Distribution: USA, Florida to Argentina.

Comments: The single specimen collected agrees with the description of *Dacrydium vitreum* by having glassy shell, high umbo, covered by thin and translucent periostracum, brown stains of irregular patterns in the ventral margin of the shell, adorned with growth lines and valve flap with ligament under the umbo and clusters of 5-10 irregular teeth. Animal common in shallow waters of Florida, like *D. elegantulum* Soot-Ryen (1955) which occurs in the Pacific Ocean, differing only in the valve flap and color of the periostracum (Salas and Gofas 1997). Animals often found in sand and mud.

Order Pteriidae

Family Isognomonidae

Isognomon sp.

Figure 10

Diagnostic characterization: Flat, irregular and thin shell with brownish purple to whitish green coloration.

Comments: Known as mangrove oysters, they are more common in mangroves of Florida, they can form large colonies and are replacing members of family Pteriidae used for human consumption in Jamaica (Mikkelsen and Rudiger 2008).

Order Ostreoidea

Family Ostreidae

Crassostrea mangle Amaral & Simone, 2014

Figure 11

*Diagnostic characterization***:** Shell with thick wall and valves of unequal size; the right valve is smaller and more uniform; the left valve is deeply concave. They are always found in colony.

Distribution: Southern Caribbean down to Uruguay.

Comments: Species widely marketed. They can reach up to 150 mm of length (Rios 2009).

Order Veneroidea

Family Cyrenoididae

Cyrenoida sp.

Figure 12

Diagnostic characterization: Rounded valves, slightly posteriorly pointed, flat and adorned with growth lines, covered with periostracum from light brown cream coloration.

Distribution: Florida, Brazil, Fortaleza to São Paulo.

Comments: This species was identified by the post-graduate student Barbara L. V. Romera from the Zoology Museum of USP, who is currently developing the review of the family Cyrenoididae in the western Atlantic Ocean. The genus comes from the Atlantic coast of Africa and the specimen collected corresponds to the third occurrence of the genus in the western Atlantic coast. Although easily confused with the genera *Diplodonta* and *Cyclinella*, when juveniles, they differ by having external ligament, corresponding to 20% of the animal's length, valve flap with heterodont teeth and presence of cardinal and laminar teeth. Barroso and Matthews-Cascon (2009) reported similar species (wrongly identified as *Diplodonta*) in brackish water areas of estuaries from the state of Ceará.

Family Tellinidae

"Tellinidae" spp

Diagnostic characterization: Small shell, elongated oval valves, wall thin, flat and polished with oblique grooves, yellowish white color.

Comments: The shells of this genus are notoriously fragile and the few specimens collected (= 4) were of small size (~ 1 mm). Despite showing poor conditions for specific identification, we could separate them into two morphotypes (in results as *Tellinadae* sp1 and sp.2), one (sp.1) longer than the other (sp.2).

Order Myida

Family Myidae

Sphenia sp.

Figure 13

Diagnostic characterization: Small and whitish shell. The region of the shell in which the inhalant and exhalant siphon is pronounced is more elongated and generally worn out.

Comments: The shells of this genus are notoriously fragile and the few specimens collected (= 2), of small size (~1 mm), had poor conditions for specific identification.

Family Teredinidae

Neoteredo reynei (Bartsch, 1920)

Figures 13–15

Diagnostic characterization: Single palette, oval edge, distal shell that is usually eroded. Long soft-bodied animals.

Distribution: Suriname to Brazil.

Comments: The larval recruitment occurs in in tree trunks, and as they grow, they build long galleries covered with limestone (Muller and Lana 2004). They have diminished shell (Fig. 16) and a change in the anterior portion called palette (Fig. 17), which feed on wood and is used as identification of species of this genus (Lopes and Narchi 1993).

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Figures 1-7 View of the opening of species of class Gastropoda. **1** *Littorina angulifera,* **2** *Heleobia australis*, **3** *Heleobia charruana*, **4** *Melanoides tuberculatus*, **5** *Sayella hemphillii*, **6** Same species, specimen slightly tilted to the left to show the inner lip fold, 7 *Melampus coffeus.* Scale bar = 1 mm.

Figures 9-17. Species of Class Bivalvia, scale bar value in parentheses. **8** *Mytella charruana* (= 10mm), **9** *Dacrydium vitreum* (= 1mm), **10** *Isognomon* sp. (= 1mm), **11** *Crassostrea mangle* (= 20mm), **12** *Cyrenoida* sp. (= 5mm), **13** *Sphenia* sp. (= 1mm), **14** *Neoteredo reynei*, side view (= 20mm), **15** Shells of *N. reynei* (= 8mm), **16** Patella of *N. reynei* (= 5mm).