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LIST OF CONCHIFERA (MOLLUSCA) IDENTIFIED DURING A BEACH NOURISHMENT IN MATINHOS, PARANÁ, BRAZIL

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ABSTRACT

In 2022, a beach nourishment project was conducted in Matinhos, Paraná (Brazil). During the process, the presence of 25 Conchifera taxa was recorded, classified into six species of Gastropoda and nineteen species of Bivalvia. Most specimens still contained visceral mass, indicating that the material had not been transported over long distances and reflecting their local origin.

Keywords: Bivalvia. Gastropoda. Mollusca. Sandy beach.

1 Introduction and Methods

Matinhos is a tourist municipality in the central-south region of Paraná, with 25 km of beaches, notably Balneário Florida and Balneário de Caiobá (Município de Matinhos, 2022). The area has experienced intense storm surges and ongoing coastal erosion in recent decades, leading to environmental and social impacts (Sampaio, 2006; Novak, 2021). In the 1960s, erosion completely removed the sand from Praia Mansa, which had been over 120 meters wide (Angulo, 2000). Various structures, such as gabions, walls, and rockfills were built in response, and in 2021, the Beachfront Recovery Project was launched to revitalize the shoreline (Angulo et al., 2020; Novak, 2021).

Beach nourishment was carried out between June and October 2022, over 116 consecutive days (IAT 2022a). A 6.3 km stretch—from the Canal da Avenida Paraná to Balneário Florida (Fig. 1)—was widened by 100 meters, adding three million cubic meters of sand (IAT 2022b). The technique involves extracting compatible sediments from a borrow site and transporting them to the coast via barge, pipeline, or truck (Schipper et al., 2021) (Fig. 1A). In Matinhos, the borrow site was located 6 km offshore at a depth of 12 meters (Nogueira Filho, 2020). The project used the trailing suction hopper dredger *Galileo Galilei* (Fig. 1B), with a capacity of 18,000 m³ per cycle and one-month fuel autonomy, operating 24/7 (Jan de Nul, 2022).

Concerning the impacts related to the beach nourishment, the main one is associated with the loss of ecological characteristics, which occurs mainly due to changes in sediment grain size, water chemistry and the reduction of the number of species and individuals, most of them invertebrates buried in the sand (Schipper et al., 2021). Among these fauna are mollusks, which constitute the largest phylum of marine animals, with approximately two hundred thousand species (Ponder & Lindberg 2008).

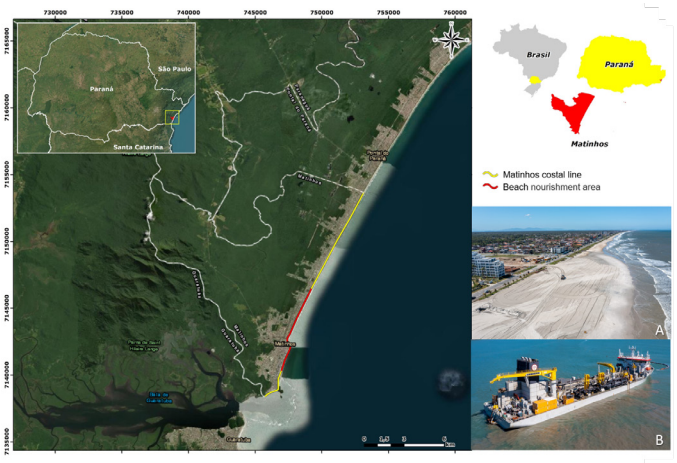

Figure 1. Map of the study area showing the coastline and the beach nourishment zone in Matinhos, Paraná, Brazil. (A) Beach nourishment activities in Matinhos; (B) The *Galileo Galilei* dredger.

According to Tauran et al. (2025), mollusks are more affected by beach nourishment due to their limited mobility, which increases their risk of burial. As a result, recolonization depends on larval dispersal and requires more stable environmental conditions compared to other groups.

Structurally, many mollusks have a calcareous shell in their bauplan, a characteristic which groups them into the Conchifera clade, which can be unique, as in Gastropoda, Scaphopoda and some Cephalopoda; or double, as in Bivalvia (Checa, 2018; Kocot, 2020).

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According to records available in the scientific literature, there are approximately 77 species of Gastropoda and 88 species of Bivalvia cataloged on the coast of the state of Paraná (Muller, 1986; Blankensteyn & Moura, 2002; Boehs et al., 2004; Lacerda et al., 2009; Brandini & Silva, 2011; Bumbeer et al., 2016; Belz et al., 2018; Gernet et al., 2018; SiBBr, 2023). In Matinhos, studies carried out by Lacerda et al. (2009) and Gernet et al. (2018) on rocky shores and sandy beaches indicated the occurrence of 55 gastropods species and 48 bivalves species, the highest species richness was observed in samples collected from rocky shores. According to the authors, the families Veneridae (S= 6 spp.), Olividae (S= 6spp.), Muricidae (S= 5 spp.), and Mytilidae (S= 5 spp.) were the most diverse and frequent.

Given the above, considering that the calcareous material of Conchifera can be transported by currents and waves over long distances and that they could be allochthonous to the borrow area, the objective of this work is to carry out a qualitative study of the species deposited on the beach during the nourishment process in order to verify the occurrence of new taxa in Matinhos beach.

Shell collection was carried out manually, once a week during July, August, and September, along the entire length of the beach (6.3km). The sampling was exploratory and non-systematic, without the use of quadrats or fixed sampling points, and consisted of collecting visible shells from the surface of the sandy substrate, without excavation. At the beginning of the work, as much material as possible was collected, including shells of all sizes, complete or broken. As the study progressed and shells began to appear repeatedly, the sampling criteria became more restrictive: only new taxa were collected, or previously recorded taxa if the initial specimen showed damage that could impair its identification.

After sieving through a 500 µm mesh, the material was transported to the laboratory, cleaned, and stored in sealed containers. The identification of species and systematic ordering was carried out at the lowest possible taxonomic level based on the classification proposed by Rios (2009), followed by updating the names using the WORMS (2023) database.

2 Results and Discussion

During the period of beach nourishment in Matinhos, 6 species of gastropods and 19 species of bivalves were identified (Table 1 and Fig. 2). The shells were in excellent condition, and most still contained visceral mass, indicating that the material had not been transported over long distances and thus reflected a local origin. The majority of the shells belonged to shallow-water species and were likely sourced from the borrow deposit, with the exception of *Donax hanleyanus Philippi, 1847* and *Anomalocardia flexuosa* (Linnaeus, 1767), which inhabit the intertidal zone.

Table 1. Conchifera species identified during the beach nourishment, with corresponding natural habitat depth ranges

Gastropoda		
Family	**Specie**	**Habitat Depth**
Strombidae	1. *Strombus pugilis Linnaeus*, 1758	2-15m
Naticidae	2. *Polinices hepaticus* (Röding, 1798)	0-15m
Cassidae	3. *Semicassis granulata* (Born, 1778)	0-100m
Olividae	4. *Oliva fulgurator* (Röding, 1798)	0-60m
	5. *Olivancillaria urceus* (Röding, 1798)	0-30m
Conidae	6. *Conus clerii* Reeve, 1844	16-166m
Bivalvia		
Family	**Specie**	**Habitat Depth**
Nuculanidae	7. *Adrana electa* (A. Adams, 1856)	25-75m
Glycymeridae	8. *Glycymeris longior* (G. B. Sowerby I, 1833)	10-75m
Arcidae	9. *Anadara cf. brasiliana* (Lamarck, 1819)	15-75m
	10. *Anadara cf. chemnitzii* (Philippi, 1851)	20-75m
	11. *Lunarca ovalis* (Bruguière, 1789)	0-11m
Pinnidae	12. *Atrina seminuda* (Lamarck, 1819)	0-25m
Lucinidae	13. *Divalinga quadrisulcata* (d'Orbigny, 1846)	0-100m
Cardiidae	14. *Dallocardia muricata* (Linnaeus, 1758)	0-30m
	15. *Laevicardium brasilianum* (Lamarck, 1819)	0-75m
Mactridae	16. *Mactra petitii* d'Orbigny, 1846	15-55m
Tellinidae	17. *Temnoconcha galathaea* (Lamarck, 1818)	0-40m
	18. *Eurytellina nitens* (Born, 1778)	1-120m
	19. *Psammotreta brevifrons* (Say, 1834)	0-40m
Semelidae	20. *Semele proficua* (Pulteney, 1799)	0-75m
Donacidae	21. *Donax hanleyanus* Philippi, 1847	0m
Veneridae	22. *Ameghinomya antiqua* (P. P. King, 1832)	5-50m
	23. *Anomalocardia flexuosa* (Linnaeus, 1767)	0-5m
	24. *Tivela fulminata* (Bory de Saint-Vincent, 1827)	15-55m

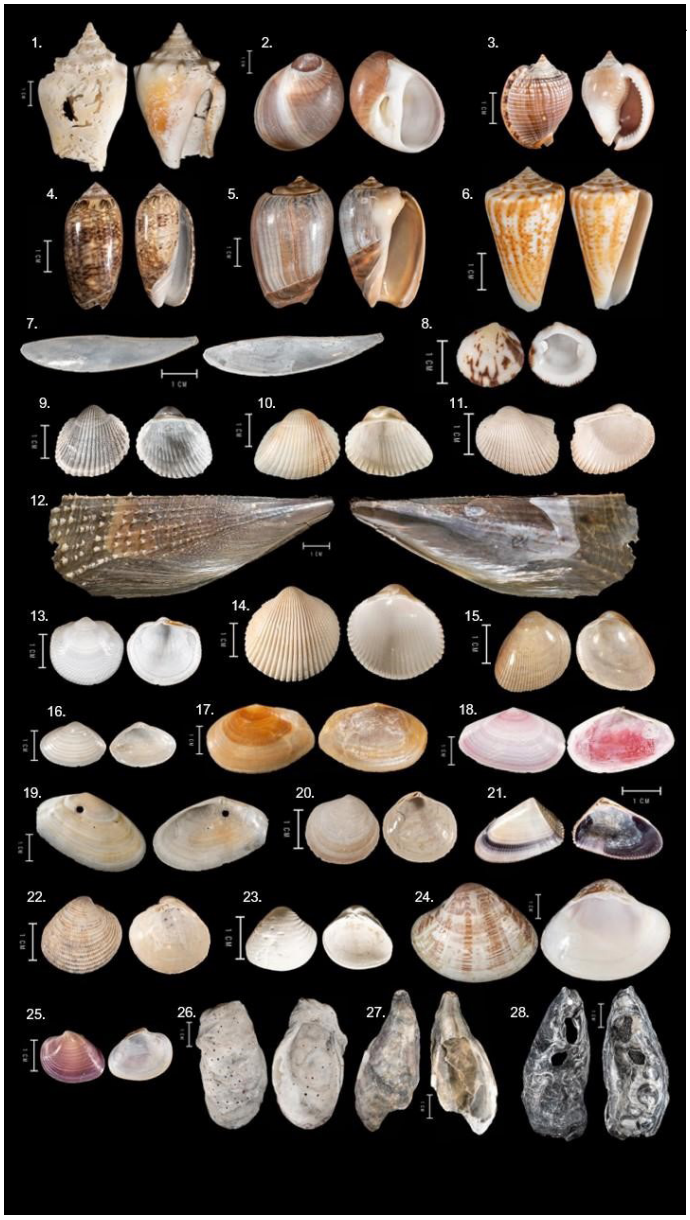

Figure 2. 1.: *Strombus pugilis*; 2.: *Polinices hepaticus*; 3.: *Semicassis granulata*; 4.: *Oliva fulgurator*; 5.: *Olivancillaria urceus*; 6.: *Conus clerii*; 7.: *Adrana electa*; 8.: *Glycymeris longior*; 9.: *Anadara* cf. *brasiliana*; 10.: *Anadara* cf. *chemnitzii*; 11.: *Lunarca ovalis*; 12.: *Atrina seminuda*; 13.: *Divalinga quadrisulcata*; 14.: *Dallocardia muricata*; 15.: *Laevicardium brasilianum*; 16.: *Mactra petitii*; 17.: *Temnoconcha galathaea*; 18.: *Eurytellina nitens*; 19.: *Psammotreta brevifrons*; 20.: *Semele proficua*; 21.: *Donax hanleyanus*; 22.: *Ameghinomya antiqua*; 23.: *Anomalocardia flexuosa*; 24.: *Tivela fulminata*; 25.: *Eucallista purpurata*;. 26., 27. and 28.: *Crassostrea* spp. Scale bar: 1 cm.

During the sampling, specimens of *Crassostrea* Sacco, 1897 were also collected, however, their identification was compromised due to the poor state of preservation of the shells, combined with the high plasticity in shape, size, and color exhibited by the species (Lodeiros et al., 2020). Consequently, due to the difficulty of classifying these organisms at lower taxonomic levels, this genus was not included in the list of recorded species (Table 1), but it is represented in Fig. 2.

Regarding the study conducted by Gernet et al. (2018) in the same area, the family Veneridae presented the highest species richness, as also observed in the present study. In agreement with the findings of Gernet et al. (2018), the species *Anomalocardia flexuosa* (Linnaeus, 1767) and *Eucallista purpurata* (Lamarck, 1818) were identified. Although the other species recorded in this study were not observed by Gernet et al. (2018), they had previously been reported in the state of Paraná (Klein et al., 2001; Boehs et al., 2004; Bumbeer et al., 2016; Belz et al., 2018; Absher et al., 2020).

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Only the specie *Oliva fulgurator* (Röding, 1798) was not previously recorded in the literature for the state of Paraná. However, there is a reference to *Oliva circinata* Marrat, 1871, which is considered by some authors to be a local form of *O. fulgurator.* In this study, the specimen was identified as *O. fulgurator*, since *O. circinata* is not described in Rios (2009). Furthermore, *O. circinata* has been treated as a synonym for several other species, namely *Oliva sayana* Ravenel, 1834; *Oliva graphica* Marrat, 1870; *Oliva figura* Marrat, 1870 *e Oliva lignaria* Marrat, 1868 (Tursch et al., 1998). Therefore, this is probably a case of species synonymy rather than the recording of a new species.

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