

LIST OF CONCHIFERA IDENTIFIED DURING A BEACH NOURISHMENT IN BALNEÁRIO CAMBORIÚ, BRAZIL

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ABSTRACT

Beltrão, M. C., Cunha, N. J. R. & Diehl, F. (2023). List of Conchifera identified during a beach nourishment in Balneário Camboriú, Brazil. *Braz. J. Aquat. Sci. Technol.* 27(1). ISSN 1983-9057. DOI: 10.14210/bjast.v27n1.18200. In 2021, a beach nourishment was carried out in Balneário Camboriú, during the process, it was found the presence of 53 taxa of Conchifera associated with the sediment dredged from the borrowing area. This source area is located 15 kilometers away from the Praia Central and has an average depth of 31m. The organisms were found on the beach without life, indicating that the borrow area consists in a bank rich of biodebris.

Key Words: Mollusca, Gastropoda, Bivalvia, Santa Catarina.

INTRODUCTION

In the municipality of Balneário Camboriú, located in the central-north part of the Santa Catarina coastline (Figure 1), the processes of urbanization changed the dynamics and balance of the beach, since they were not conducted at a safe distance from the sea and the sand dunes were replaced by sidewalks and buildings. In this scenario, in 2002

the first beach nourishment was carried out in Barra Sul. The incompatibility of the material used had several negative effects on the environment, changing the morphological and morphodynamic characteristics (Menezes, 2008) and causing a mass mortality of the mollusk *Tivela mactroides* (Born, 1778) (Pezzuto et al., 2006).

In order to bring more comfort, safety, and expand the existing leisure facilities, on August 22,

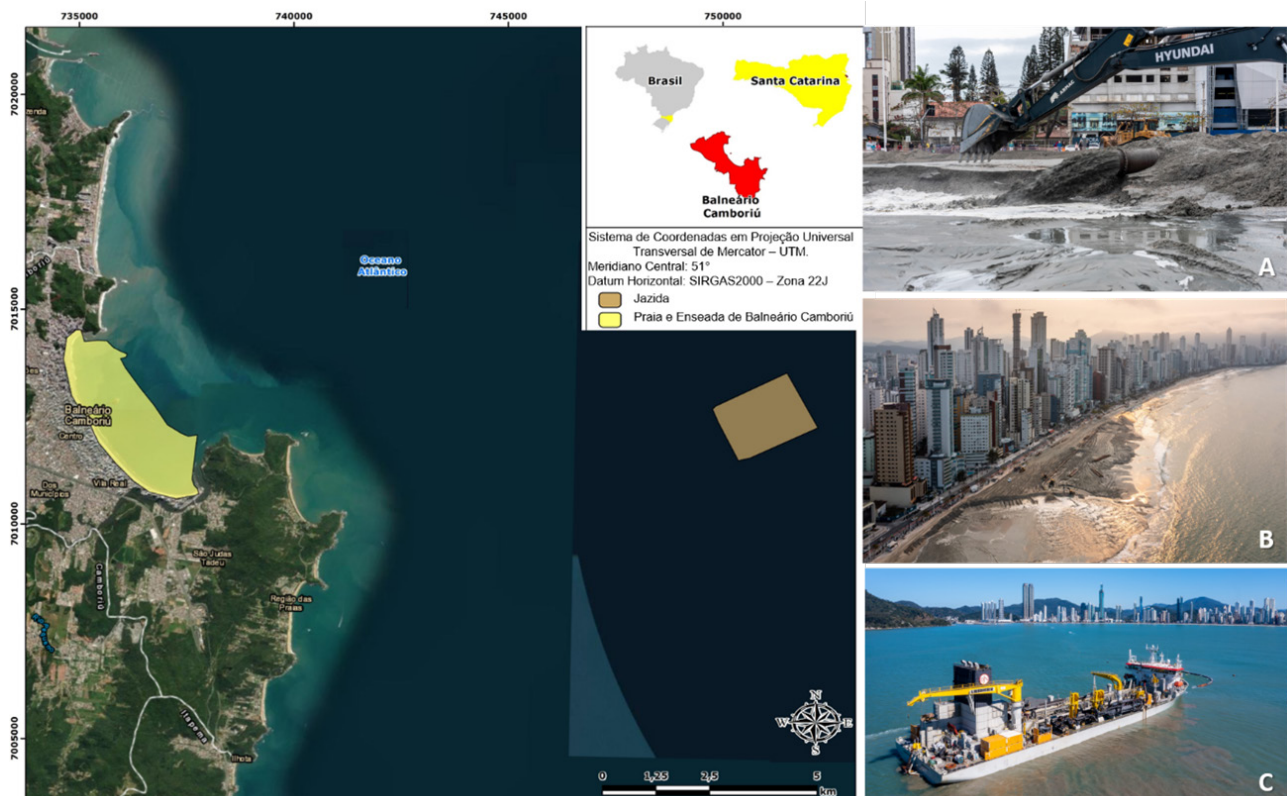


Figure 1 - Map of the study area indicating the beach of Balneário Camboriú and the sedimentary deposit. (A) The beach nourishment process; (B) Praia Central of Balneário Camboriú during the nourishment; and (C) Galileo Galilei dredge.

2021, a second beach nourishment started at the Praia Central of Balneário Camboriú. According to several authors, this instrument when properly carried out, is seen as environmentally friendly (Dankers et al., 1983; Hamm et al., 2002; Mielck et al., 2019). In recent decades, this methodology has proven to be one of the main approaches to coastal protection, being considered a viable alternative to the usual rigid structures such as dikes, breakwaters, groins and revetments (Hamm et al., 2002). However, as in Balneário Camboriú, it can also be applied with recreational and aesthetic purposes (USACE, 2003; Mielck et al., 2019).

The beach nourishment consists of adding sediment along the beach, from a sedimentary deposit (borrowing area), in order to maintain a desired width (Dean, 2002) (Figure 1A and B). The definition of the deposit represents one of the most important project steps, the sediment in this region must be compatible with the beach (similar characteristics and particle size composition) (GERCO, 2018). The source area of the sediment was located 15 kilometers away from the Praia Central of Balneário Camboriú and had an average depth of 31 m.

To execute the project in Balneário Camboriú, it was used the hopper dredge Galileo Galilei, which navigates under a Luxembourg flag (Figure 1C). The vessel has a cistern with a capacity for 18000 m³ of sediment per cycle, however, due to the depth of the area, the dredger operated with an average of 10120 m³. With fuel autonomy to work for one month, 24 hours a day, the operation was carried out with three daily cycles and concluded after 71 days (Jan De Nul, 2022).

Dredging activity can cause hydraulic and sedimentological changes in the ecosystem, directly affecting the organisms that live in the sediment (Bolam, 2012). Among the main components of benthic communities are the mollusks (Utrilla et al., 2020), comprising the second largest phylum of animals, with nearly two hundred thousand living species, represented mainly by gastropods and bivalves (Ponder & Lindberg, 2008).

Most mollusks species belong to the group called Conchifera, which presents as a unifying characteristic the production of a shell, that serves as protection against predators and support for internal organs (Furunashi et al., 2009; Song et al., 2019). It is estimated that in Brazil there are about

1600 Conchifera species (Thomé et al., 2010). For the state of Santa Catarina, 785 taxa were cataloged, including native, exotic and threatened species (Agudo-Padron, 2008, 2015, 2017).

Conchifera Registered in Balneário Camboriú

During the beach nourishment of Balneário Camboriú, the presence of 53 mollusks taxa associated with the dredged sediment from the borrow area was identified (Table 1, Figure 2, Figure 3 and Figure 4). The registration of the shells occurred only during a few dredging cycles, therefore, the deposition was not verified during the entire process. These shells were found without life, only the calcareous exoskeletons were observed, no other associated phyla were identified.

The sampling of specimens was carried out continuously during the nourishment process in the area adjacent to the mouth of the pipe in the middle of sediment deposition, and along the beach. At the beginning of the work, as much material as possible was collected, including shells of all sizes, complete or broken. As the work progressed and the shells began to appear duplicated, the sampling criteria became more restrictive, it was sampled only new taxa or a new specimen of an already cataloged, just if the previously one presented any damage that would impair its identification.

After being sampled by sieves with a mesh opening of 500 µm, the material was sent to the laboratory, cleaned, and kept in closed packages. The determination of species and systematic ordering, was carried out at the lowest possible taxonomic level the classification proposed by Rios (2009), followed by later updating of the names using the WORMS database (2022). Despite the excellent state of conservation of the specimens, some individuals had little damage, small size, or only one of the valves, which made it impossible to identify them at genus or species level.

The high taxa richness recorded and the presence of species that colonize consolidated bottom, as well as organisms that inhabit unconsolidated bottom, indicate that the borrow area consists in a bank rich of biodebris brought in by waves and currents. The shells were in excellent condition, which indicates that it is not a material that was transported over a long distance, reflecting its relationship with the region.

Table 1 - Conquifera registered in Praia Central of Balneário Camboriú during the beach nourishment.

| Class | Family | Species |
|--|---|---|
| Gastropoda | Tegulidae | <i>Tegula viridula</i> (Gmelin, 1791) |
| | Calliostomatidae | <i>Calliostoma</i> sp. |
| | | <i>Calliostoma jucundum</i> (Gould, 1849) |
| | Vermetidae | Vermetidae sp. |
| | Cerithiidae | Cerithiidae sp. |
| | Strombidae | <i>Strombus pugilis</i> Linnaeus, 1758 |
| | Calyptraeidae | <i>Crepidula</i> sp. |
| | Ovulidae | Ovulidae sp. |
| | Naticidae | <i>Notocochlis isabelleana</i> (d'Orbigny, 1840) |
| | | <i>Sinum maculatum</i> (Say, 1831) |
| | Cymatiidae | <i>Monoplex parthenopeus</i> (Salis Marschlins, 1793) |
| | Epitoniidae | <i>Cirsotrema</i> sp. |
| | Muricidae | <i>Siratus senegalensis</i> (Gmelin, 1791) |
| | | <i>Stramonita haemastoma</i> (Linnaeus, 1767) |
| | Buccinanopsidae | <i>Buccinanops cochlidium</i> (Dillwyn, 1817) |
| | Fascioliariidae | <i>Apertifusus frenguelli</i> (Carcelles, 1953) |
| | Volutidae | <i>Odontocymbiola americana</i> (Reeve, 1856) |
| | Olividae | <i>Oliva fulgurator</i> (Röding, 1798) |
| | | <i>Olivancillaria urceus</i> (Röding, 1798) |
| | | <i>Olivancillaria vesica</i> (Gmelin, 1791) |
| | | <i>Olivella</i> sp. |
| | | <i>Agaronia travassosi</i> Morretes, 1938 |
| | Marginellidae | <i>Prunum martini</i> (Petit de la Saussaye, 1853) |
| | Conidae | <i>Conus</i> sp. |
| | Turridae | <i>Polystira formosissima</i> (E. A. Smith, 1915) |
| | Drilliidae | <i>Fusiturricula</i> sp. |
| | Terebridae | <i>Neoterebra dislocata</i> (Say, 1822) |
| <i>Terebra taurina</i> (Lightfoot, 1786) | | |
| Architectonicidae | <i>Architectonica nobilis</i> (Röding, 1798) | |
| Scaphopoda | Dentaliidae | Dentaliidae sp. |
| Arcidae | <i>Anadara brasiliiana</i> (Lamarck, 1819) | |
| | <i>Anadara chemnitzii</i> (Philippi, 1851) | |
| | <i>Anadara notabilis</i> Röding, 1798 | |
| Glycymerididae | <i>Glycymeris longior</i> (G. B. Sowerby I, 1833) | |
| | <i>Tucetona pectinata</i> (Gmelin, 1791) | |
| Pinnidae | Pinnidae sp. | |
| Ostreidae | Ostreidae sp. | |
| | <i>Chlamys</i> sp. | |
| Pectinidae | <i>Argopecten gibbus</i> (Linnaeus, 1758) | |
| | <i>Nodipecten nodosus</i> (Linnaeus, 1758) | |
| Bivalvia | | <i>Pecten</i> sp. |
| | Lucinidae | <i>Divalinga quadrisulcata</i> (d'Orbigny, 1846) |
| | Chamidae | <i>Arcinella brasiliiana</i> (Nicol, 1953) |
| | Cardiidae | <i>Laevicardium</i> sp. |
| | Tellinidae | <i>Tellina</i> sp. |
| | Veneridae | <i>Ventricolaria rigida</i> (Dillwyn, 1817) |
| | | <i>Chione pubera</i> (Bory Saint-Vincent, 1827) |
| | | <i>Lirophora paphia</i> (Linnaeus, 1767) |
| | | <i>Anomalocardia brasiliiana</i> (Gmelin, 1791) |
| | | <i>Tivela mactroides</i> (Born, 1778) |
| | | <i>Pitar palmeri</i> (Fischer-Piette & Testud, 1967) |
| | | <i>Megapitaria maculata</i> (Linnaeus, 1758) |
| | <i>Dosinia concentrica</i> (Born, 1778) | |



Figure 2 - (1) *Tegula viridula*; (2) *Calliostoma* sp.; (3) *Calliostoma jucundum*; (4) *Vermetidae* sp.; (5) *Cerithiidae* sp.; (6) *Strombus pugilis*; (7) *Crepidula* sp.; (8) *Ovulidae* sp.; (9) *Notocochlis isabelleana*; (10) *Sinum maculatum*; (11) *Monoplex parthenopeus*; (12) *Cirsotrema* sp.; (13) *Siratus senegalensis*; (14) *Stramonita haemastoma*; (15) *Buccinanops cochlidium*; (16) *Apertifusus frenguelli*; (17) *Odontocymbiola americana*; (18) *Oliva fulgurator*; (19) *Olivancillaria urceus*; (20) *Olivancillaria vesica*; and (21) *Olivella* sp.

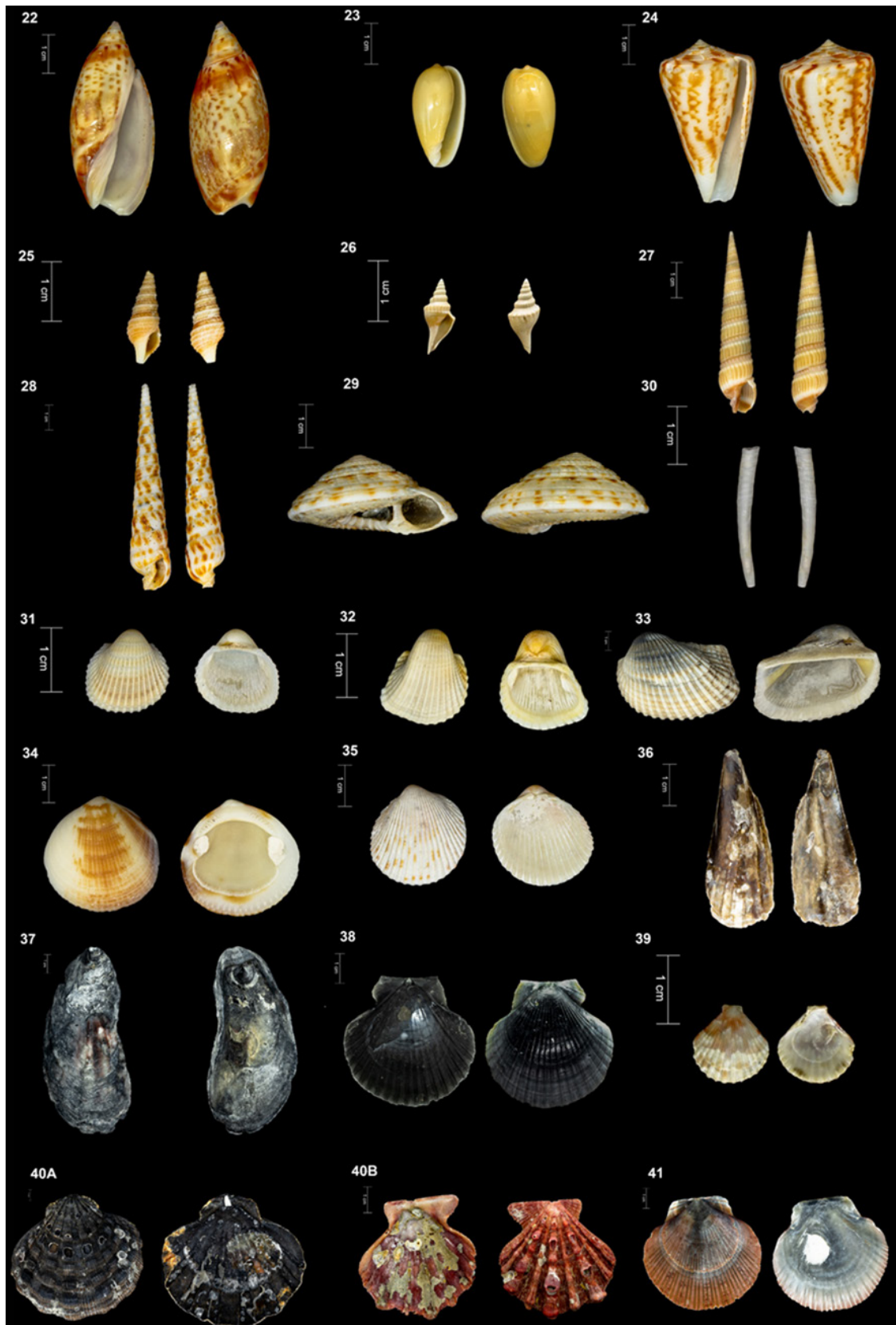


Figure 3 - (22) *Agaronia travassosi*; (23) *Prunum martini*; (24) *Conus* sp.; (25) *Polystira formosissima*; (26) *Fusiturricula* sp.; (27) *Neoterebra dislocata*; (28) *Terebra taurina*; (29) *Architectonica nobilis*; (30) *Dentaliidae* sp.; (31) *Anadara brasilliana*; (32) *Anadara chemnitzii*; (33) *Anadara notabilis*; (34) *Glycymeris longior*; (35) *Tucetona pectinata*; (36) *Pinnidae* sp.; (37) *Ostreidae* sp.; (38) *Chlamys* sp.; (39) *Argopecten gibbus*; (40A) and (40B) *Nodipecten nodosus*; and (41) *Pecten* sp.;



Figure 4 - (42) *Divalinga quadrisulcata*; (43) *Arcinella brasiliana*; (44A) and (44B) *Laevicardium* sp.; (45) *Tellina* sp.; (46) *Ventricolaria rigida*; (47) *Chione pubera*; (48) *Lirophora paphia*; (49) *Anomalocardia brasiliana*; (50) *Tivela mactroides*; (51) *Pitar palmeri*; (52) *Megapitaria maculata*; and (53) *Dosinia concentrica*.

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