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ECOMA - Coastal Ecology of the Maldonado Bay: Short communication on the studies carried out in 1980-1981

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ECOMA - Coastal Ecology of the Maldonado Bay, Uruguay

Short communication on the studies carried out in 1980-1981

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Abstract
Maldonado Bay is situated on the northeastern shore of the River Plate estuary. Some hydrological and biological characteristics of the area were investigated during a complete year. The survey encompassed the characterization and circulation of main water masses in the bay, water quality, zooplankton composition and dynamics, and settlement and growth of the mussel *Mytilus*. The sample strategy was designed to cope with the high spatial and temporal variability of the estuary.

Keywords
Punta del Este, estuary, hydrology, water masses, Mytilus, Cirripedia, Balanus, Chaetognatha, Sagitta, zooplankton, larvae, nauplii, growth, reproduction, time and spatial variability

Introduction
The ECOMA project (Coastal Ecology of Maldonado Bay) was carried out between 1980 and 1981, as a joint undertaking of the Oceanographic Institute of the University of São Paulo, Brazil, and the Department of Ecology of the Faculty of Science, University of the Republic, Uruguay. The project produced one seminar work, four Licenciate theses and one D.Sc. thesis. Only the D.Sc. thesis has been published in peer-refereed journals while most of the information collected and analyzed in the Licenciate theses has become almost lost. The goal of this short communication is to make that valuable information accessible.

Material and methods
Maldonado Bay is located on the northern shore of the the River Plate estuary, where it opens to the South-West Atlantic Ocean. The bay is partially enclosed by Gorriti Island (Fig.1) and is characterized by high spatial and temporal estuarine variability. The selected sampling strategy was designed to address this variability (Milstein, 1984).

Water samples were taken with a van Dorn bottle in two deep-water sites (bay and exterior stations) and five shore stations (Figs 1 & 2) from February 1980 to February

1981. Samples were collected in two consecutive months within each calendar season, and in two consecutive days within each sampling month. On the deep-water stations, samples were collected from (1) below the surface, (2) 1 m depth, (3) 1 Secchi disk depth, (4) 3 Secchi disks depth, and (5) just off the bottom. Meassured parameters were: (A) light penetration (Secchi disk), (B) dissolved oxygen, (C) phosphates, (D) nitrates, (E) nitrites, (F) silicates, and (G) phytoplankton biomass (as chlorophyll concentration). Temperature and salinity vertical profiles in the water column were measured with a Yellow Spring instrument. Zooplankton was sampled by oblique trawls with a 180-micron pore bongo-20 net, in the bay and exterior stations, totaling 59 plankton samples. Complementary phytoplankton samples were collected at the surface with a 75 micron pore net.

Sampling of *Mytilus* natural populations was performed at Mailhos Dock site (adjacent to Punta del Este port) 13 times between February 1980 and March 1981. Additionally, artificial substrate plates for settling of *Mytilus* larvae were submerged in the same area.

Fig. 1 - Studied area (image source: Google Earth Pro, accessed 09/2023)

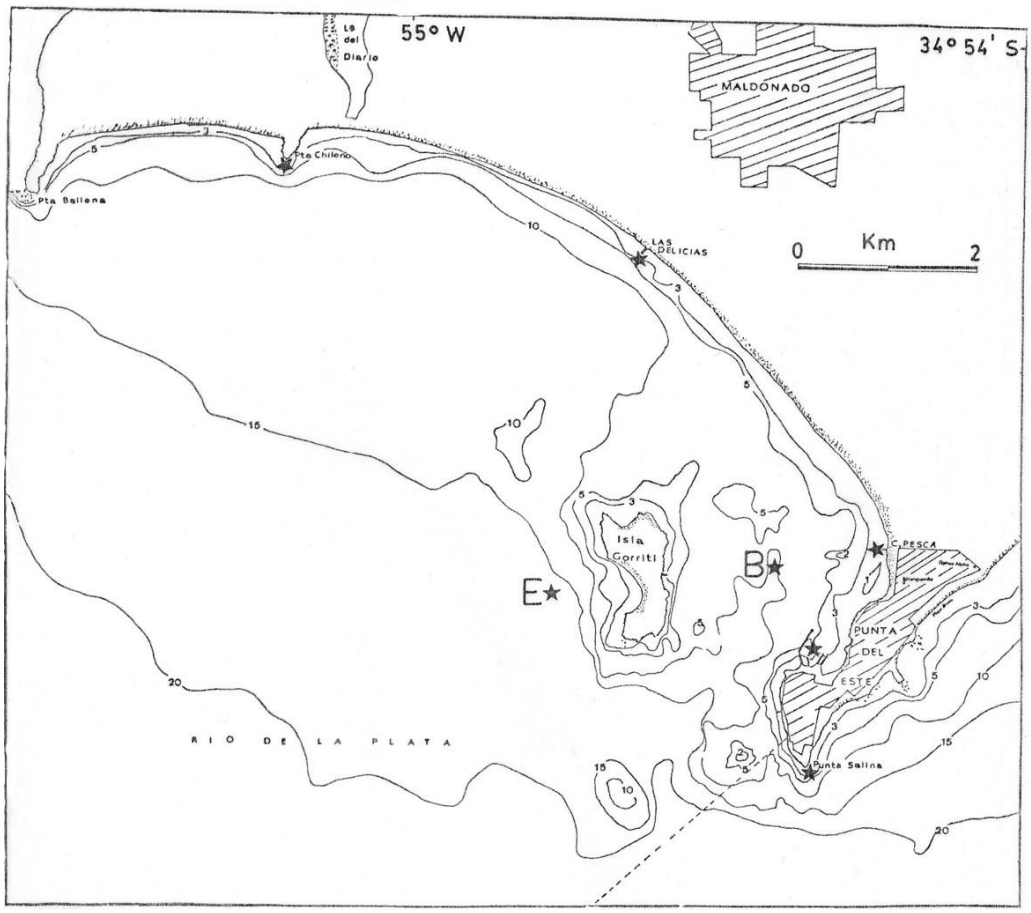

Fig. 2 - Bathymetry and sampling points

Results and discussion

The hydrology and water quality in the bay were described in detail by Urruti (1981) and Ajup (1981). Results indicate a complex estuarine environment (Fig. 3), highly variable, and affected by human activity as revealed by the very variable phosphate concentrations. The bay is dominated by an estuarine circulation pattern during the Autumn (April - May) (estuarine waters at the surface and marine waters at the bottom) and by an oceanic circulation pattern during the Summer (January-February). Three main different hydrological scenarios were found depending on where the salt wedge was located: (a) within the River Plate, (b) in open sea, or (c) just in front of the bay. The associated water masses were identified by the nitrite/silicates correlation. The bay itself is relatively isolated from the River Plate due to a combination of its bathymetry (being shallower than its surroundings), coastal morphology, and the presence of the Gorriti Island. Water circulation is freer in the center of the bay than along the shore. Only a few simple correlations were found between the biological and the hydrological parameters.

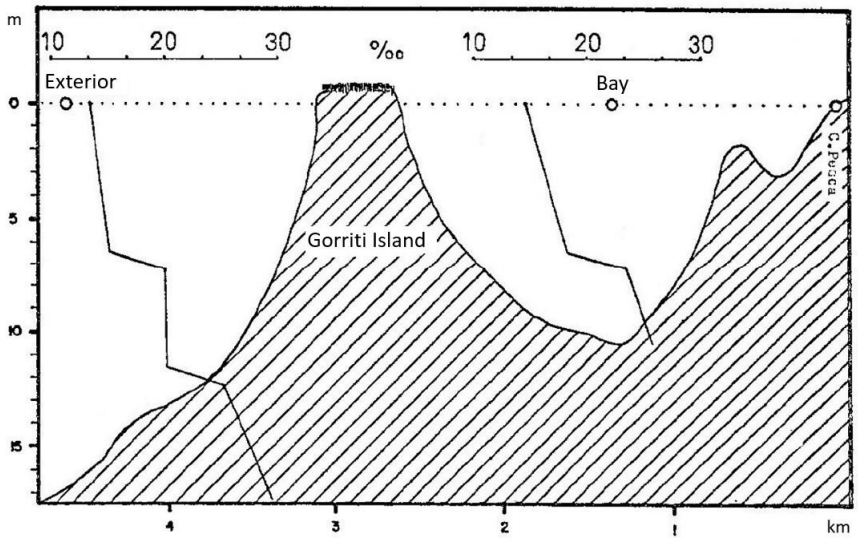

Fig. 3 - Salinity haloclines on 26-Nov.-1980

Planktonic barnacle larvae (*Balanus improvisus* and *Balanus venustus*) were studied in detail by Baliño (1981). Over 500 larval individuals of each species (stages II to VI) were examined, measured, and the typical larval morphology was described. This work presents the first recording of *B. venustus* in Uruguayan waters. Abundance of larvae of both species fluctuated considerably throughout the year, exhibiting peaks in Autumn (Apr-May) and Winter (Jul-Aug), with an overall maximum in Summer (Jan-Feb). Both species also showed large abundance fluctuations between two consecutive sampling days. These variations in abundance were not always correlated with chlorophyll concentration nor with hydrographical parameters. Stages II-III were always more abundant than stages IV-V-VI. The salinity range for *Balanus improvisus* was 13-34.9 ‰ while *Balanus venustus* was not present at salinities below 15 ‰.

Chaetognaths were studied in detail by Pereyra-Lago (1981). *Sagitta friderici*, *S. helenae*, *S. hispida* and *S. bipunctata* were found in the area. *S. friderici* constituted 92% of all the chaetognaths captured, the other species appearing only sporadically. Abundance followed an annual cycle with a maximum in summer and very low minimum in winter and only in deep marine waters. *S. friderici* was studied in detail, including categorization of gonad development stages, size distribution, and stomach content, as well as spatial variability and correlation with environmental variables. Strong differences in abundance between the two nets of the bongo (separated by 35 cm) suggest the existence of micro-distribution patterns (aggregation). The evolution of the gonadal stages indicates that *S. friderici* is a protandric species.

Mytilus larvae settling and adult growth were analyzed in detail by Abdala (1981) using the von Bertalanffy equation. Larvae settled from June to February but successful settlement only occurred between September and February (Spring-Summer) due to high mortality in Winter. Mussels reached 39 mm overall length during the first growth year. Comparison between this value and those quoted in other regions indicates large variability of growth rate among regions.

Zooplankton dynamics, associated environmental conditions and the main sources of variability in the Maldonado Bay were analyzed in detail by Milstein (1981, 1986) and Milstein and Juanico (1985) using Principal Component Analysis.

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Authors contribution: All the authors contributed in a similar way.

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