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Omobranchus sewalli (Valenciennes, 1836) an established species in the South Brazil

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Research Article

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Abstract

Omobranchus sewalli is a native Indo-Pacific blenniid recently introduced and established along the Brazilian coast. The putative introduction was through ballast water and/or ship hull biofouling. Herein, we report the presence of the species for the first time inside of the Paranaguá Estuarine Complex (PEC) which is recognized as a RAMSAR site and listed as a Wetland of International Importance. The mature specimens of *O. sewalli* were found in intertidal and shallow subtidal waters in the mixture zone in the estuary, suggesting the establishment of the population. The presence of port terminals in this area indicates that *O. sewalli* colonize PEC using ship hull fouling or larval dispersal from the shallow inner shelf.

Introduction

The introduction of non-native species in marine and coastal ecosystems due to human activity can cause extinction of native populations, destroy biodiversity, permanently alter habitats and have economic impacts, leading to fundamental disruptions of the aquatic ecosystems (Ojaveer *et al.*, 2018; Vitule *et al.*, 2019). The establishment of non-native populations depends on a species' ability to adapt to new environmental forces, produce fertile offspring, and disperse recruits into the new environment (Richardson *et al.*, 2000; Wonham *et al.*, 2000; Olenin *et al.*, 2017). The number of registered non-native species has increased in marine and coastal environments (Tempesti *et al.*, 2020; Encarnação *et al.*, 2021). The increase of introduced species has also been documented in the Southwestern Atlantic and along the Brazilian Coast since the mid-2000s (Schwindt *et al.*, 2020). Many of these non-native species exhibit a benthic cryptic behaviour, such as species in the families Gobiidae and Blenniidae (Ferreira *et al.*, 2009).

The family Blenniidae is comprised of approximately 360 species across 56 genera, distributed in tropical and subtropical marine and estuarine habitats such as tide pools, rocky shores, mangroves, and salt marshes (Nelson, 2006). The muzzled blenny *Omobranchus sewalli* (Valenciennes, 1836) reaches 11 cm long with males typically larger than females, has a short life span (ca. 4 years) and feeds on algae and opportunistically on invertebrates (Ismail and Clayton, 1990). Additionally, their cryptic, sedentary, and territorial behaviour, oviparity and high parental care may directly affect the niche of native gobies and blennies (Ismail and Clayton, 1990; Gerhardinger *et al.*, 2006; Froese and Pauly, 2023). This species was registered as invasive in 1931 on the coast of Trinidad and Tobago (Cervigon, 1966). Afterwards, several specimens were collected in Panama and Venezuela (Cabezas *et al.*, 2020). In Brazil, *O. sewalli* was initially recorded under *O. punctatus* in 2002 on the Northeast coast (Gerhardinger *et al.*, 2006), and from 2004 to 2014 registered in the Southeast and South of Brazil (Cabezas *et al.*, 2022). The integrative taxonomy showed the occurrence of *Omobrancus sewalli* in the Western Atlantic Ocean and not *Omobranchus punctatus* using meristic and genetic data from specimens from the Caribbean, Northern and Northeastern Brazil (Cabezas *et al.*, 2022). In the present study we report the first record of mature adults of *O. sewalli* within the Paranaguá Estuarine Complex (PEC), a World Natural Heritage Site (UNESCO, 1999) and a recognized RAMSAR site, making it part of the List of Wetlands of International Importance (ICMBio, 2018; Ribeiro *et al.*, 2020). Herein, we also show the application of fish-specific autonomous reef monitoring structures (FARMS) (Brandl *et al.*, 2023) monitoring invasive cryptobenthic fishes.

Materials and Methods

Ethical statement

The capture of all specimens complied with animal welfare laws, guidelines and policies, approved by the national licensing authority the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) with licence number 87398 and Ethics Committee of Federal University of Paraná number 1561.

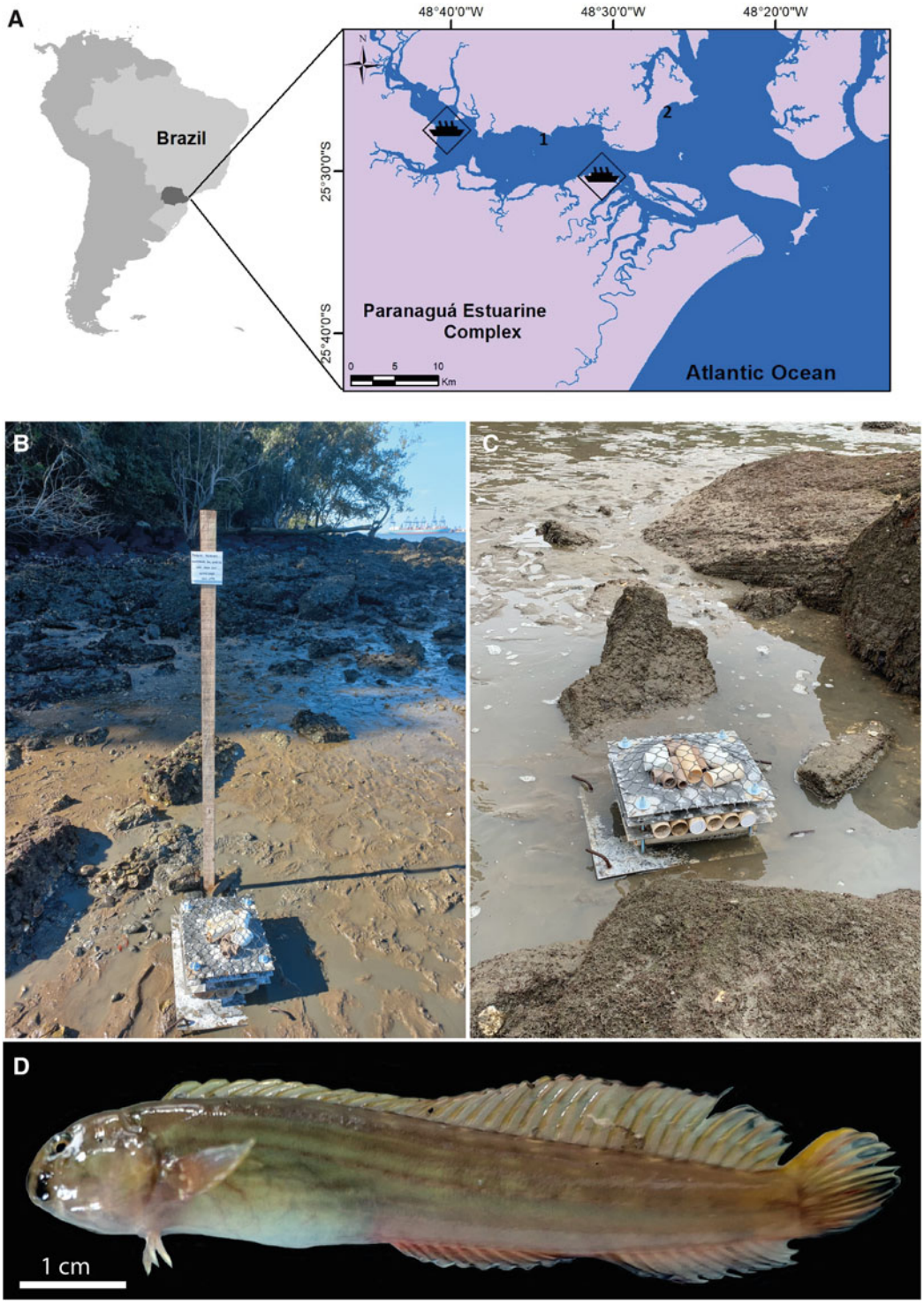

Figure 1. (A) Sampling sites of *Omobranchus sewalli* in the Paranaguá Estuarine Complex in the Subtropical Southwestern Atlantic Ocean. The number refers to the sampling site: (1) Amparo village community and (2) São Miguel village. The ship symbols indicate the position of the Antonina and Paranaguá Port. (B) FARMS deployed in Amparo Village, (C) FARMS deployed in São Miguel Village, (D) Photographs of captured specimens in São Miguel in November 2023.

Study sites and data acquisition

The Paranaguá Estuarine Complex (PEC – 25°26′ 43″S 48° 39′ 58″W, Figure 1), with an area of ~551.8 km^2, is a subtropical environment composed of mangroves, salt marshes, and shallow waters. Salinity and temperature vary seasonally from 0 to 32 g l^{-1} and from 18–30°C, respectively (Lessa *et al.*, 2018). It has a mosaic of restricted and sustainable-use conservation units, including marine and terrestrial units (Paula *et al.*, 2018). In addition, it houses two ports on the East–West axis, the port of Antonina and the port of Paranaguá, considered one of Brazil's largest grain ports in South America with one of the largest port infrastructures on the continent (Marone *et al.*, 2005).

Five FARMS were installed in August 2023 (winter) among rocky shore area in the Amparo and São Miguel communities with the contribution of the local students. The FARMS were built according to Brandl *et al.* (2023). Two fishing campaigns were carried out, one in the first week of October 2023 (early spring) and the second in the last week of November 2023 (late

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Table 1. Total length (TL, cm), weight (TW, g), female (F) and male (M), and stage of maturation of specimens of *Omobranchus sewali* by site collected in Paranaguá Estuarine Complex, south Brazil

No	Site	Date	TL (cm)	TW (g)	Sex	Stage Maturation
1	Amparo	02/10/2023	8.5	4.72	M	Developing
2	Amparo	02/10/2023	5.6	1.46	F	Spawning-capable
3	São Miguel	03/10/2023	6.8	3.15	M	Developing
4	São Miguel	03/10/2023	7.3	3.12	F	Spawning-capable
5	São Miguel	30/112023	7.5	3.66	–	–

spring). Specimens were identified (Williams, 2002; Rangel and Guimarães, 2010), measured for total length (TL, cm) and weighed (TW, total weight in grams). The table of meristic characters was created according to Williams (2002) and Cabezas *et al.* (2022). The sex and maturation stage of the specimens was macroscopically verified according to Vazzoler (1996). We measured the environmental parameters of salinity ($g\,l^{-1}$) and water temperature (°C) in the site.

Results

A total of five specimens were collected after one month and two months of FARMS were installed. The specimens analysed presented two interorbital pores, between 29 and 33 total dorsal fin elements, between 13 and 14 rays in the pectoral fin and between 12 and 14 rays in the caudal fin. Four specimens of *O. sewalli* were collected in October 2023 and ranged from 5.6 to 8.5 cm (TL), and 1.46–4.72 g (TW). One specimen was collected in November 2023 (Table 1). In October, the water temperature in Amparo and São Miguel was 20°C and the salinity was 28 $g\,l^{-1}$ in Amparo and 32 $g\,l^{-1}$ in São Miguel. The water temperature in São Miguel was 27.8°C in November 2023. Other species associated with *O. sewalli* in the FARMs were the fishes *Bathygobius soporator*, *Orthopristis ruber*, *Parablenius pilicornis*, and *Opsanus beta* and several other invertebrates *as Pseudobranchiomma paulista.*

Discussion

In the present study, *Omobranchus sewalli* was reported for the first time within the PEC. The population expansion into the estuary may be a natural dispersal or facilitated by human activities. *Omobranchus sewalli* was first introduced to the Western Atlantic Ocean on slave boats from the Bay of Bengal (Cervigon, 1966) and now has been recorded in several regions along the Brazilian coast (Cabezas *et al.*, 2022), reinforcing the hypothesis that colonization of new environments by introduced species is facilitated by the dispersal of pelagic larvae (Wonham *et al.*, 2000). *Omobranchus sewalli* larvae were recorded in Babitonga Bay (SC) between 2004 and 2008 and in Currais Archipelago (near 16 km from the mouth of the PEC – PR) between 2011 and 2012 (Costa *et al.*, 2011; Alegretti *et al.*, 2021). The population of *O. sewalli* in PEC may have been established by the settlement of larvae transported by longitudinal drift (or tide) currents from the Currais Archipelago into the PEC. This process of establishing new populations via longitudinal drift has also occurred in the Caribbean Sea (Lasso-Alcalá *et al.*, 2011).

The occurrence of the *O. sewalli* in Amparo and São Miguel villages in front of the Paranaguá Port also emphasizes the hypothesis of species introduction through ballast water and fouling on the ship hull (Lasso-Alcalá *et al.*, 2011). Along the Brazilian coast, the cabotage service is responsible for transporting products between ports in the Southeast-South regions, and the Brazilian legislation does not determine as mandatory the disposal of maritime cabotage service ballast water in oceanic areas before docking at ports (NORMAM, 2014; Cutrim *et al.*, 2017). Therefore, the presence of larvae and juveniles of *O. sewalli* can be dispersed by ballast water, favouring the establishment of population in new environments such as the PEC. Also, *O. sewalli* has been frequently associated with fouling communities of artificial structures, such as boats and aquaculture fish cages, and natural substrates, such as under rocks in tidal pools. Most of these are located near major ports and seaways (Lasso-Alcalá *et al.*, 2011). Considering the behaviour and preferred habitat of this species, another hypothesis for the dispersion of *O. sewalli* is their use of using mollusc valves for spawning. During the benthic phase of the larvae, they can be dispersed due to their attachment to fouling organisms by commercial transport ships (Lasso-Alcalá *et al.*, 2011).

Since the mature specimens indicate an established population in the mixture zone of PEC together with the native community of fish, it is imperative to understand the impact of the introduction of *O. sewalli* on native populations of intertidal fish, such as the goby *Bathygobius soporator*. The impact of the non-native cryptobenthic species on the detritus food web may directly affect biodiversity and benthic habitats and lead to fundamental disruptions of the aquatic ecosystem and economic activities such as oyster aquaculture (Vieira *et al.*, 2021). Our results indicate a good application of FARMS as a monitoring tool for the rapid detection of invasive cryptobenthic fish, since we retrieved the *O. sewali* after one month. So the FARMs showed a valuable tool for future use in integrative taxonomical studies to answer whether there was only one introduction event of *O. sewalli* or multiple introductions on the Southeast-South Brazilian coast.

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Aron Davi – sampling and writing;
Maikon Di Domenico – writing and revision.

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