



## New record of the non-native bivalve *Myoforceps aristatus* in SE Brazil

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### ABSTRACT

*Myoforceps aristatus* (Dillwyn, 1817) (Mytilidae) is an invasive species from the Western Atlantic currently reported from Ceará, Bahia, Rio de Janeiro, São Paulo and Santa Catarina states in Brazil. Recently, specimens of *M. aristatus* were sampled at abundances of up to 23 individuals per square meter on shallow reefs and exposed rocky shores of the northern coast of Rio de Janeiro and Espírito Santo states. *Myoforceps aristatus* occupies all shore levels over rocky and biogenic hard substrates including calcareous reefs, mollusk shells, dead corals and artificial structures. Since its invasion on the Brazilian coast has been discovered only recently, there is a pressing need to understand how *M. aristatus* occupies available niches and changes the structure and ecology of local intertidal and subtidal assemblages.

**Keywords:** Invasive species, Mollusca, range expansion.

### INTRODUCTION

Bioinvasion is the establishment of a species out of its natural environment, where it may become dominant and cause negative effects. The introduction of exotic species into natural communities is often mediated by human activity and can affect native biological diversity (EVERETT 2000; SOUZA *et al.* 2009), being exceeded only by habitat destruction (EVERETT 2000; CAIN *et al.* 2011). The introduction of species may affect local assemblages through: (i) species displacement or extinction (SAX & BROWN 2000; NISC 2001; CLAVERO & GARCÍA-BERTHO 2005); (ii) changes in the functioning of ecosystems (MARQUES *et al.* 2013); and (iii) impacting human health and economy (BREVES-RAMOS *et al.* 2010; SOUTO *et al.* 2011). Thus, the multiple impacts of species invasion is a phenomenon with broad ecological and evolutionary consequences to natural assemblages at multiple scales (MARQUES *et al.* 2013).

*Myoforceps aristatus* (Dillwyn, 1817) (Mytilidae) is a bivalve that bores into calcareous hard substrate, including shells of other mollusks (SIMONE & GONÇALVES 2006), and is easily identified by pointed tips on the posterior end of its valves (ABOUT 1974). *Myoforceps aristatus* naturally occurs in the Northwestern Atlantic, from the U.S. coast of North Carolina to Florida, the Gulf of Mexico and the northern Caribbean Sea (BREVES-RAMOS *et al.* 2010). *Myoforceps aristatus* was

first reported on the SE Brazilian coast from Arraial do Cabo (Rio de Janeiro state) to Ubatuba (São Paulo state) (SIMONE & GONÇALVES 2006). Later reports revealed the presence of this species on rocky shores further to north and south of its initial report, including Caucaia (Ceará state) and Morro de São Paulo (Bahia) in NE Brazil and Grande Island (Rio de Janeiro) and Santa Catarina Island (Santa Catarina) in southern Brazil (BREVES-RAMOS *et al.* 2010; AGUDO-PADRÓN 2011; CAVALLARI *et al.* 2012).

The present study aimed to check the occurrence of the non-native *M. aristatus* on the coast of Espírito Santo state to the northernmost coast of Rio de Janeiro state, in order to enrich and provide new data of its expansion and ecosystem colonization.

## MATERIAL AND METHODS

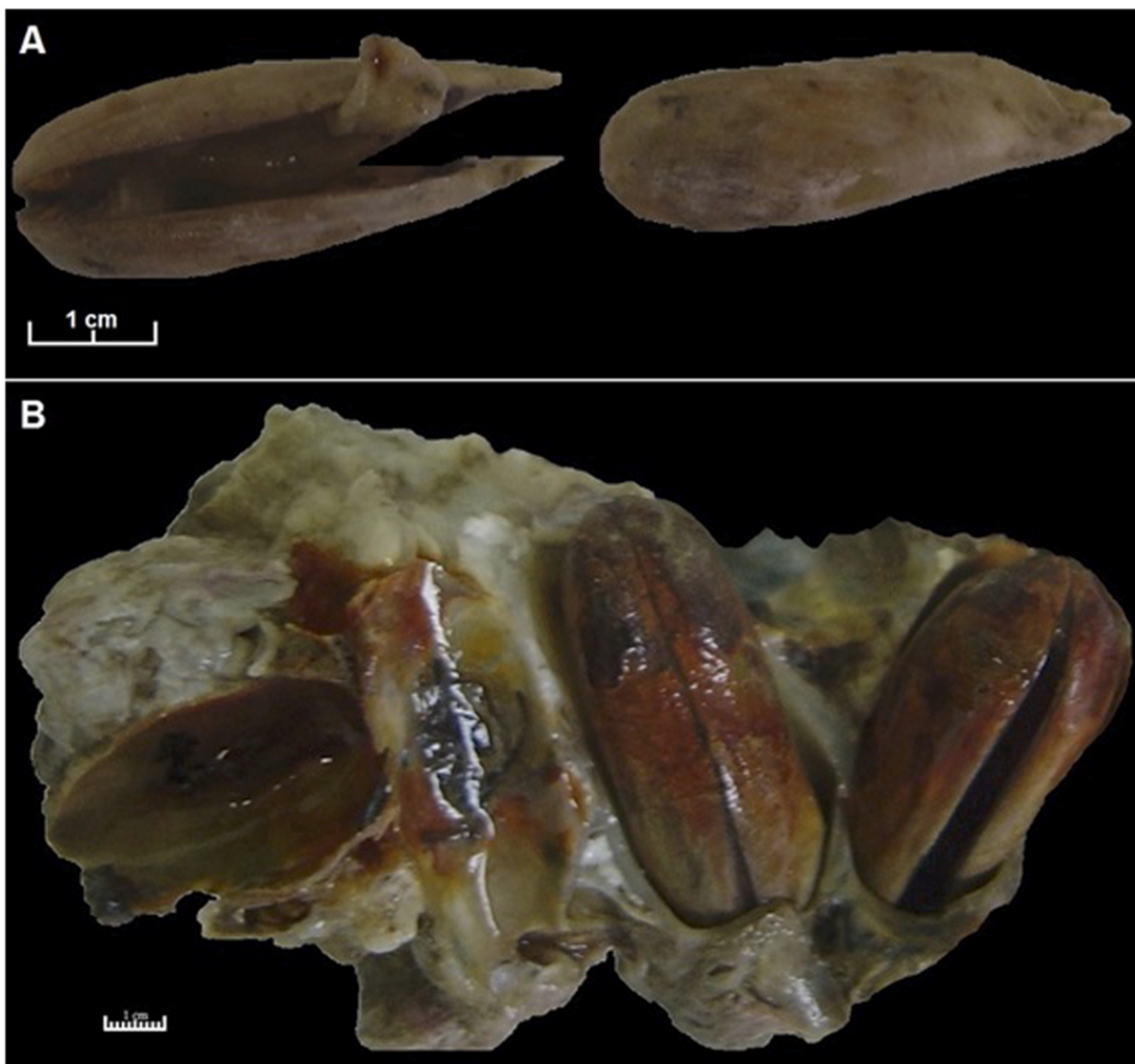
From January 2013 to February 2014, scuba dives on artificial reefs and reef shores, and sampling of exposed rocky shores were made from the central coast of Espírito Santo to the northern coast of Rio de Janeiro (Table 1). *Myoforceps aristatus* (Fig. 1) was found in three sites (Table 1): **Espírito Santo:** Maratáizes (21°02'36"S 40°49'23"W; L.B. Correa, col.; on rocky shore), Piúma (20°50'12"S 40°42'04"W; L.B. Correa col.; on rocky shore); **Rio de Janeiro:** Rio das Ostras artificial reef (22°32'42"S 41°50'92"W; L.B. Correa col.; boring into dead specimens of *Crassostrea* Sacco, 1897). Abundance was recorded in 100 cm<sup>2</sup> random quadrats. Photographs were taken and several individuals were collected and preserved in 10% formalin for laboratory analysis. Specimens are deposited in the collection of the Laboratory of Benthic Ecology of the Universidade Federal do Espírito Santo (Mollusks sector, lots numbers 05, 06 and 07).

**Table 1.** Sampling sites on the coasts of Espírito Santo (ES) and Rio de Janeiro (RJ) states, SE Brazil, with the occurrence of *Myoforceps aristatus*.

Site	State	Coordinates	Date	Occurrence	Substrate	Depth (m)
Rio das Ostras	RJ	22°32'42"S 41°50'92"W	08/jul/13	Yes	Artificial reef	23
Guarapari	ES	20°38'39.10"S 40°27'55.13"W	05/Sep/2013	No	Reef shore	0
Vila Velha	ES	20°19'57.50"S 40°16'15.10"W	08/nov/13	No	Reef shore	0
Vitória	ES	20°17'3.86"S 40°17'7.59"W	03/Dec/2013	No	Reef shore	0
Aracruz	ES	19°58'0.74"S 40° 7'59.56"W	02/Feb/2014	No	Reef shore	3
Maratáizes	ES	20°50'48.50"S 40°43'26.44"W	01/Oct/2013	Yes	Rocky shore	0
Piúma	ES	20°50'45.84"S 40°43'26.98"W	02/Oct/2013	Yes	Rocky shore	0
Guarapari	ES	20°40'40.62"S 40°21'54.75"W	03/Oct/2013	No	Rocky shore	0
Vila Velha	ES	20°21'53.15"S 40°16'43.29"W	04/Oct/2013	No	Rocky shore	0
Vitória	ES	20°18'9.49"S 40°16'57.30"W	01/Dec/2013	No	Rocky shore	0
Aracruz	ES	19°51'38.67"S 40° 4'5.23"W	29/jan/14	No	Rocky shore	0
Aracruz	ES	19°51'38.67"S 40° 4'5.23"W	17/jan/14	No	Rocky shore	0
Aracruz	ES	19°55'56.50"S 40°07'17.03"W	17/jan/14	No	Rocky shore	0

## RESULTS AND DISCUSSION

We report the extended presence of *M. aristatus* on the northern coast of Rio de Janeiro state (Rio das Ostras artificial reef) and on the southern coast of Espírito Santo state (on rocky shores at

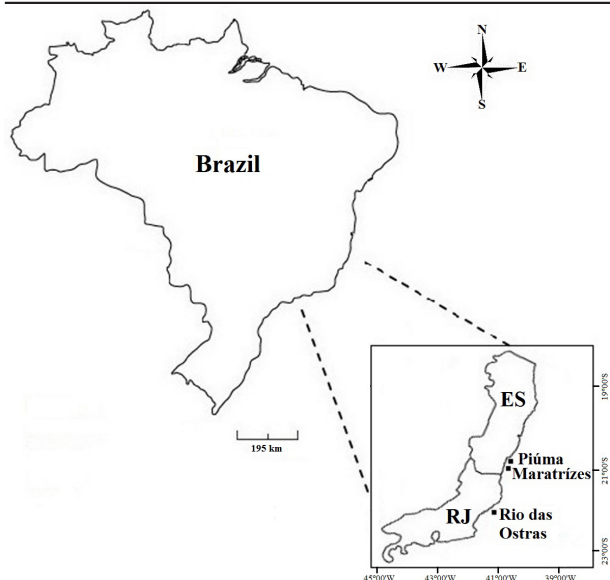


**Figure 1.** *Myoforceps aristatus* (Dillwyn, 1817): (A) from Rio das Ostras artificial reef and (B) on a calcareous hard substrate.

Marataízes and Piúma) (Fig. 2). *Myoforceps aristatus* reportedly lives in intertidal and subtidal habitats, on natural and artificial substrates (IGNACIO *et al.* 2012), at shallow depth ranges of 0 to 15 meters (SIMONE & GONÇALVES 2006; CAVALLARI *et al.* 2012), but we encountered individuals down to 23 meters over metals of Rio das Ostras artificial reef.

We found a low abundance of *M. aristatus* on intertidal rocky shores at Marataízes and Piúma (3 to 5 individuals per 100 cm<sup>2</sup> and 3 ind / 100 cm<sup>2</sup>, respectively), but higher abundances of 16 ind / 100 cm<sup>2</sup> in the deeper site of Rio das Ostras. These densities are significantly lower if compared to densities found on some intertidal shores in Arraial do Cabo bay (385 ± 140 ind/m<sup>2</sup>) and subtidal reefs on Grande Island (143.3 ± 26.1 ind/m<sup>2</sup>) (IGNACIO *et al.* 2012). These differences suggest that local condition can be the key to the invasion success of *M. aristatus*, since types of substrate, depth and wave exposure did not indicate a clear association with density, as found by Smith (2009) and Ignacio *et al.* (2012).

*Myoforceps aristatus* occupies all intertidal and subtidal hard substrates such as bivalve and gastropod shells (BREVES-RAMOS *et al.* 2010) and dead corals (CAVALLARI *et al.* 2012), but we also observed its occurrence on sandstone and granite rocky shores that are common on the southern coast of Espírito



**Figure 2.** New records (black squares) of the non-native bivalve *Myoforceps aristatus* (Dillwyn, 1817) reported herein for the Brazilian southeastern coast. **ES**, Espírito Santo state; **RJ**, Rio de Janeiro state.

Santo. The wide acceptability of *M. aristatus* for mollusk shells, dead corals, rock and sandstone shores and other inorganic substrates suggests that this species has a strong invasive capability in the south, southeast and northeast coasts of Brazil.

Non-native bioerosive animals, such as *M. aristatus*, can cause serious damage to biogenic reefs, such as coral reefs and mytilid beds, and also to oyster farms (SCOOT 1988; CAVALLARI *et al.* 2012), possibly being responsible for threats in coral-structure communities (IGNACIO *et al.* 2012) and economic loss (SIMONE & GONÇALVES 2006; BONDAD-REANTASO *et al.* 2007).

*Myoforceps aristatus* is now encountered in several coastal areas from NE to S Brazil, indicating that it may colonize most tropical and subtropical shores. Although its invasive pattern is largely uncertain, high abundances in some sites and wide substrate preference may suggest a strong invasive adaptability (KLEUNEN *et al.* 2010). Therefore, there is urgent need to investigate ecological aspects of *M. aristatus* and its effects on native biota and on the functioning of benthic assemblages and to assess potential economic loss.

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## REFERENCES

- Abbott R.T.** (1974) *American Seashells. Second edition.* Van Nostrand Reinhold Company, New York.
- Agudo-Padrón A.I.** (2011) Exotic molluscs (Mollusca, Gastropoda et Bivalvia) in Santa Catarina State, Southern Brazil region: check list and regional spatial distribution. *Biodiversity Journal* 2(2): 53–58.
- Bondad-Reantaso M.G., McGladdery S.E. & Berthe F.C.J.** (2007) Pearl oyster health management: a manual. *FAO Fisheries Technical Paper* 50: 1–120.
- Breves-Ramos A., Pimenta A.D., Széchy M.T.M. & Junqueira A.O.R.** (2010) Mollusca, Bivalvia, Mytilidae, *Myoforceps aristatus* (Dillwyn, 1817): distribution and new record localities at Ilha Grande Bay, Brazil. *Check List* 6(3): 408–409.

- Cain M.L., Bowman W.D. & Hacker S.D.** (2011) *Ecology. Second Edition*. Sinauer Associates, Sunderland.
- Cavallari D.C., Gonçalves E.P. & Amaral V.A.** (2012) New occurrences of *Myoforceps aristatus* (Bivalvia: Mytilidae) in the Brazilian coast. *Strombus* 19(1–2): 23–27.
- Clavero M. & García-Berthou E.** (2005) Invasive species are a leading cause of animal extinctions. *Trends in Ecology and Evolution* 20(3): 110.
- Dillwyn L.M.** (1817) *A Descriptive Catalogue of Recent Shells, Arranged According to the Linnean Method*. John & Arthur Arch, London.
- Everett R.A.** (2000) Patterns and pathways of biological invasions. *Trends in Ecology and Evolution* 15: 177–178.
- Ignacio B.L., López M.S. & Silva J.S.V.** (2012) Colonization plasticity of the boring bivalve *Lithophaga aristata* (Dillwyn, 1817) on the Southeastern Brazilian coast: considerations on its invasiveness potential. *Aquatic Invasions* 7(4): 475–482.
- Kleunen M., Weber E. & Fischer M.** (2010) A meta-analysis of trait differences between invasive and non-invasive plant species. *Ecology Letters* 13: 235–245.
- Marques A.C., Klôh A.S., Migotto A.S., Cabral A.C., Rigo A.P.R., Bettim A.L., Razzolini E.L., Cascon H.M., Bardi J., Kremer L.P., Vieira L.M., Bezerra L.E.A., Haddad M.A., Filho R.R.O., Gutierre S.M.M., Miranda T.P., Franklin W. Jr. & Rocha R.M.** (2013) Rapid assessment survey for exotic benthic species in the São Sebastião Channel, Brazil. *Latin American Journal of Aquatic Research* 41(2): 265–285
- NISC (National Invasive Species Council).** (2001) Meeting the Invasive Species Challenge: National Invasive Species Management Plan. Available from: <http://www.team.ars.usda.gov/invasivespecieschallenge.pdf> (Date of access: 02/ii/2014).
- Sax D.F. & Brown J.H.** (2000) The paradox of invasion. *Global Ecology & Biogeography* 9(5): 363–371
- Scoot P.** (1988) Initial settlement behavior and survivorship of *Lithophaga bisulcata*. *Journal of Molluscan Studies* 54: 97–108.
- Simone L.R.L. & Gonçalves E.P.** (2006) Anatomical study on *Myoforceps aristatus*, an invasive boring bivalve in S. E. Brazilian coast (Mytilidae). *Papéis Avulsos de Zoologia* 46(6): 57–65.
- Smith L.D.** (2009) The Role of Phenotypic Plasticity in Marine Biological Invasions. In: Rilov G., Crooks J.A. (Eds.) *Biological Invasions in Marine Ecosystems: Ecological, Management, and Geographic Perspectives*. Springer-Verlag Publisher, Berlin. Pp. 177–202.
- Souto L.S., Brito M.F.G. & Rosa L.C.** (2011) *Melanoides tuberculatus* (Müller, 1774): a new threat to the conservation of aquatic native species in Sergipe, Brazil. *Scientia Plena* 7(4):1–6.
- Souza R.C.C.L., Calazans S.H. & Silva E.P.** (2009) Impacto das espécies invasoras no ambiente aquático. *Ciência e Cultura* 61(1): 35–41.