

SHORT COMMUNICATION

FIRST RECORDS OF THE FRAGILE COCKLE *FULVIA FRAGILIS* (BIVALVIA: CARDIIDAE) IN BRAZIL

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ABSTRACT: This paper presents the first records of the fragile cockle *Fulvia fragilis* (Forsskål, 1775) in Brazil, based on shells collected at the Barequeçaba and Segredo beaches in São Sebastião, São Paulo state, southeastern Brazil. An additional record from Vitória, Espírito Santo state, was found through the iNaturalist citizen science platform. This species is presumably native to the Indian Ocean and a widespread non-native species across the Mediterranean Sea, which showcases the potential for its establishment in Brazil. Nonetheless, its introduction appears to be recent and the status of its populations and potential impacts in the country remains unknown.

KEYWORDS: biological invasions; bivalve; citizen science; species distribution

The fragile cockle *Fulvia fragilis* (Forsskål, 1775) is a cardiid bivalve presumably native to coastal waters in the Indian Ocean, known from the Persian Gulf to the southeastern African coast and from a single population located along the central-western African coast (VIDAL 1994, COSEL 1995, ANGELIDIS 2013, GVOZDENOVIĆ et al. 2019, RIZGALLA et al. 2019). In recent times, human activity has led to the spread of *F. fragilis* to additional areas and mostly to the Mediterranean Sea, becoming first established in the eastern part of it and then gradually expanding to its westernmost parts (ANGELIDIS 2013, CROSETTA et al. 2013, FORNER I VALLS 2018, GVOZDENOVIĆ et al. 2019, RIZGALLA et al. 2019). Its expansion into the Mediterranean Sea seemed to be influenced both by Lessepsian migration through the Suez Canal, supported by its initial reports coming from inside the canal (MOAZZO 1939, RIZGALLA et al. 2019), and further dispersal through ship ballast water, as evidenced by its frequent occurrence in and around ports (ZENETOS et al. 2004, GOUD & MIFSUD 2009, RIZGALLA et al. 2019). Despite its increasing distribution, *F. fragilis* had not yet been reported in Brazil

by previous assessments of its bivalve fauna (PASSOS et al. 2024).

From May to July 2025, numerous shells identified as *Fulvia fragilis* were found washed up on Barequeçaba beach in São Sebastião, São Paulo state, southeastern Brazil (23°49'39.432"S, 45°26'09.204"W). A sample of 11 shells was collected for analysis (Figs 1–4). In July 2025, an additional shell was found at Segredo beach (23°49'40.728"S, 45°25'23.192"W), which is located within the Center for Marine Biology of the University of São Paulo (CEBIMar/USP) and relatively near Barequeçaba (circa 1 km), indicating the presence of *F. fragilis* in that area as well. The specimens appeared recently dead as their shells were intact and showed no signs of erosion (Figs 1–4). Following the discovery of the shells, efforts were made to find live *F. fragilis* specimens in the intertidal and shallow subtidal zones of both Barequeçaba and Segredo beaches, but these attempts were unsuccessful, and no further dead shells were found in subsequent months. The species was identified as *Fulvia fragilis* based on its morphology following the description by REEVE (1843). Diagnostic characters

included an obliquely ovate outline, very delicate and papyraceous thickness, smooth radial ribs, and a color pattern that is white with irregular orange stripes externally and a purple posterior margin internally. All collected shells were deposited in the Mollusca collection at the Museum of Zoology of the University of São Paulo (MZSP; São Paulo, Brazil) under the lot number MZSP 171368. A survey on the iNaturalist citizen science platform has revealed one additional record of *Fulvia fragilis* from Vitória, Espírito Santo state (20°18'13.3"S, 40°17'25.0"W), dating from March 2024, which shows the external view of an empty shell washed ashore (REIS 2024).

The species was not reported by previous surveys at São Sebastião (e.g., MIGOTTO et al. 1993,

TALLARICO et al. 2014, AMARAL et al. 2024), suggesting a recent introduction. As São Sebastião has a large port, ship ballast water is the likely vector for the introduction of *F. fragilis* in Brazil too. However, it is currently unknown if a population of *F. fragilis* has formed in São Sebastião and whether the specimens found originated from native populations in the Indian Ocean and West Africa or from the non-native populations in the Mediterranean Sea. On the other hand, the record found on iNaturalist, which may be the earliest record of *F. fragilis* in Brazil, was likely from an independent introduction since Vitória is also home to a large port and quite distant from São Sebastião (circa 740 km; Fig. 5). This finding further highlights the potential of social media platforms and



Figs 1–4. Shells of *Fulvia fragilis* collected in Barequeçaba beach, São Sebastião, São Paulo state, Brazil (MZSP 171368): 1 – specimen #1, external view; 2 – same, internal view; 3 – specimen #2, external view; 4 – same, internal view. Scale bar 10 mm



citizen science to track biological invasions, as previously reported for various other non-native molluscs in Brazil (ROSA et al. 2022, 2025, AKIRA-UMENO et al. 2025, BARBIERI et al. 2025).

Despite the currently widespread distribution of *F. fragilis* across the world, information about its biology and potential ecological impacts in newly invaded areas is scarce (RIZGALLA et al. 2019), with the sole exception that it is a simultaneous hermaphroditic species, known to spawn continuously throughout the year, which likely contributes to its ability to

quickly establish populations in new areas where it is introduced (RIFI et al. 2011).

Since *F. fragilis* appears to have reached the Brazilian coast recently, it is still uncertain whether it will form established populations and have any impacts on local ecosystems. This report of yet another introduced species highlights the need for further monitoring of non-native molluscs in Brazil, as the country has been increasingly affected by biological invasions in recent years (CARRANZA et al. 2023, MACHADO et al. 2023, DARRIGRAN et al. 2025).



Fig. 5. Localities with records of *Fulvia fragilis* in Brazil. Records from São Sebastião (SP) refer to the specimens studied herein, while the record from Vitória (ES) is sourced from iNaturalist (<https://www.inaturalist.org/observations/201964471>). State abbreviations: BA – Bahia; DF – Distrito Federal; ES – Espírito Santo; GO – Goiás; MG – Minas Gerais; MS – Mato Grosso do Sul; MT – Mato Grosso; PR – Paraná; RJ – Rio de Janeiro; RS – Rio Grande do Sul; SC – Santa Catarina; SP – São Paulo



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REFERENCES

- AKIRA-UMENO M., CIRILLO L., SILVA A. R. 2025. The expansion of *Perna viridis* towards South Brazil: Bridging the gap with traditional scientific surveys and citizen science. *Austral Ecology* 50(4): e70071. <https://doi.org/10.1111/aec.70071>
- AMARAL A. C. Z., CUNHA B. P., CHECON H. H., GODOY A. S. D., SILVA C. F. D., CORTE G. N., NOGUEIRA J. M. M., FUKUDA M. V., STEINER T. M., KAWAUCHI G. Y., TURRA A., DENADAI M. R., FERREIRA L., MENDONÇA J. B., TAVARES M., LEITE F. P. P., COSTA M. F. B., SIQUEIRA S. G. L., VIEIRA L. M., DIAS G. M., TEIXEIRA J. A., ROCHA R. M., GUSMÃO L. C., BORGES M., ALITTO R., MACHADO F. M., PASSOS F. D., CUNHA C. M., SIMONE L. R. L., ARAUJO A. P. G., CARBAYO F., BAHIA J., BULNES V. N., CASTELLO-BRANCO C., HAJDU E., VILAS-BOAS A. C., GARRAFFONI A. R. S., SCHOCKAERT E., FONSECA G., DOMENICO M., CURINI-GALLETI M., SORENSEN M. V., HOCHBERG R., OLIVEIRA A. J. F. C., ZAMPIERI B. B., CHINELATTO R. M., MIGOTTO A. E. 2024. The high biodiversity of benthic organisms in a coastal ecosystem revealed by an integrative approach. *Biota Neotropica* 24(2): e20231583. <https://doi.org/10.1590/1676-0611-BN-2023-1583>
- ANGELIDIS A. 2013. *Fulvia fragilis* (Forsskal in Niebuhr, 1775) (Bivalvia: Cardiidae), first record of an alien mollusk in the Gulf of Thessaloniki (inner Thermaikos Gulf, North Aegean Sea, Greece). *Journal of Biological Research* 20: 228.
- BARBIERI E., CASTRO I. B., CAVALLARI D. C., MARQUES R. C., OLIVERA E. B. 2025. Green mussel *Perna viridis* (L.) on the Brazilian coast: a fast-spreading invasive species reaching protected areas. *Marine Biology* 172(4): 1–9. <https://doi.org/10.1007/s00227-025-04606-7>
- CARRANZA A., AGUDO-PADRÓN I., COLLADO G. A., DAMBORENEA C., FABRES A., GUTIÉRREZ GREGORIC D. E., LODEIROS C., LUDWIG S., PASTORINO G., PENCHASZADEH P., SALVADOR R. B., SPOTORNO P., CARVALHO THIENGO S., VIDIGAL T. H. D. A., DARRIGRAN G. 2023. Socio-environmental impacts of non-native and transplanted aquatic mollusc species in South America: What do we really know? *Hydrobiologia* 850(5): 1001–1020. <https://doi.org/10.1007/s10750-023-05164-z>
- COSEL R. 1995. Fifty-one new species of marine bivalves from tropical West Africa. *Iberus* 13(1): 1–115.
- CROCETTA F., BITAR G., ZIBROWIUS H., OLIVERIO M. 2013. Biogeographical homogeneity in the eastern Mediterranean Sea. II. Temporal variation in Lebanese bivalve biota. *Aquatic Biology* 19: 75–84.
- DARRIGRAN G., BELZ C., CARRANZA A., COLLADO G. A., CORREOSO M., FABRES A. A., GUTIÉRREZ GREGORIC D. E., LODEIROS C., PASTORINO G., PENCHASZADEH P., SALVADOR R. B., BARBOSA DOS SANTOS S., CARVALHO THIENGO S., DAMBORENEA C. 2025. What do we know about non-native, invasive, and transplanted aquatic mollusks in South America? *Biology* 14(2): 151. <https://doi.org/10.3390/biology14020151>
- FORNER I VALLS E. 2018. Primer registre d'una espècie indo-pacífica a Benicarló: *Fulvia fragilis* (Mollusca: Bivalvia). *Nemus* 8: 142–147.
- GOUD J., MIFSUD C. 2009. *Fulvia fragilis* (Forsskal in Niebuhr, 1775) (Bivalvia: Cardiidae), an alien species new to the Maltese malacofauna. *Aquatic Invasions* 4(2): 389–391.
- GVOZDENOVIC S., NIKOLIĆ M., PEŠIĆ V., PERAŠ I., MANDIĆ M. 2019. First data on the alien mollusc *Fulvia fragilis* (Forsskal in Niebuhr, 1775) (Cardiida: Cardiidae) from the Adriatic Sea. *Acta Zoologica Bulgarica* 71(2): 267–272.
- MACHADO F. M., MIRANDA M. S., SALVADOR R. B., PIMENTA A. D., CÔRTEZ M. O., GOMES J. A., MIYAHIRA I. C., AGUDO-PADRÓN I., OLIVEIRA C. D. C., CAETANO C. H. S., COELHO P. R. S., D'ÁVILA S., DE ARRUDA E. P., DE ALMEIDA S. M., GOMES S. R., ALVIM J., GALVÃO-FILHO H., FERREIRA-JÚNIOR A. L., MARQUES R. C., MARTINS I., DE SOUZA L. S., ARRUDA J. O., CAVALLARI D. C., DOS SANTOS S. B., PEDRO N. C., DE A. SALLES A. C., DORNELLAS A. P. S., DE LIMA T. C., DO AMARAL V. S., SILVA F. S., PASSOS F. D., THIENGO S. S., LEITE T. S., SIMONE L. R. L. 2023. How many species of Mollusca are there in Brazil? A collective taxonomic effort to reveal this still unknown diversity. *Zoologia (Curitiba)* 40: e23026.
- MIGOTTO A. E., TIAGO C. G., MAGALHÃES A. R. M. 1993. Malacofauna marinha da região costeira do Canal de São Sebastião, SP, Brasil: Gastropoda, Bivalvia, Polyplacophora e Scaphopoda. *Boletim do Instituto Oceanográfico* 41(1/2): 13–27.
- MOAZZO P. G. 1939. Mollusques testaces marins du Canal de Suez. *Mem. Inst. Egypte, Cairo* 38: 1–283.
- PASSOS F. D., BATISTAO A. R., LIMA L. L. C. 2024. Checklist of marine Bivalvia (Mollusca) from Brazil, with descriptive analyses of their bathymetric and geographical distribution. *Zootaxa* 5488(1): 1–94. <https://doi.org/10.11646/zootaxa.5488.1>
- REEVE L. A. 1843. *Conchologia Iconica: or, illustrations of the shells of molluscous animals: II.* Reeve, London.
- REIS C. 2024. iNaturalist observation: <https://www.inaturalist.org/observations/201964471>. Accessed on 23 November 2025.



- RIFI M., LE PENNEC G., SALEM M. B., SOUSSI J. B. 2011. Reproductive strategy of the invasive cockle *Fulvia fragilis* in the Bay of Tunis (Tunisia). *Journal of the Marine Biological Association of the United Kingdom* 91(7): 1465–1475.
- RIZGALLA J., SHINN A. P., CROSETTA F. 2019. First documented record of the invasive cockle *Fulvia fragilis* (Forsskal in Niebuhr, 1775) (Mollusca: Bivalvia: Cardiidae) in Libya. *BioInvasions Records* 8(2): 314–319.
- ROSA R. M., CAVALLARI D. C., MIRANDA M. S., SILVA F. S., SALVADOR R. B. 2025. Citizen science reveals alarming update on the invasion of the Asian mantle slug *Meghimatium pictum* in Brazil. *PLoS One* 20(9): e0330518.
<https://doi.org/10.1371/journal.pone.0330518>
- ROSA R. M., SALVADOR R. B., TEIXEIRA L., BORNSCHEIN M. R., CAVALLARI D. C. 2022. The rapid expansion of the jumping snail *Ovachlamys fulgens* in Brazil. *Diversity* 14(10): 815.
<https://doi.org/10.3390/d14100815>
- TALLARICO L. F., PASSOS F. D., MACHADO F. M., CAMPOS A., RECCO-PIMENTEL S. M., INTROÍNI G. O. 2014. Bivalves of the São Sebastião Channel, north coast of the São Paulo state, Brazil. *Check List* 10(1): 97–105.
<https://doi.org/10.15560/10.1.97>
- VIDAL J. 1994. A review of the genus *Fulvia* Gray, 1853 (Mollusca, Cardiidae). *Apex* 4: 93–118.
- ZENETOS A., GOFAS S., RUSSO G., TEMPLADO J. 2004. CIESM atlas of exotic species in the Mediterranean. Vol. 3. Molluscs. CIESM Publishers, Monaco.

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