Check List 10(3): 684–686, 2014

ISSN 1809-127X (available at *www.checklist.org.br*)

Check List
Journal of species lists and distribution

NOTES ON GEOGRAPHIC DISTRIBUTION

First records of the non-native bivalve *Isognomon bicolor* (C. B. Adams, 1845) rafting to the Uruguayan coast

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ABSTRACT: In the southwestern Atlantic Ocean, *Isognomon bicolor* is an invasive bivalve on rocky shores along the coast of Brazil. We report here records of this species rafting on floating debris in Uruguay (*ca.* 34° S). Rafting may be an important mechanism for the dispersal of *I. bicolor* on the coast of Uruguay and elsewhere in the Southernmost Atlantic Ocean and the presence of this invasive species on rocky shores should be monitored.

DOI: 10.15560/10.3.684

Passive dispersal of organisms rafting on artificial items floating over the sea surface may account for the transport of animals to areas otherwise unavailable by other natural dispersal mechanisms (Thiel and Gutow 2005). Rafting can be the main mechanism of dispersal for some species and an alternative for others (Donlan and Nelson 2003). Due to the growing amount of debris floating on the ocean, this process may be increasingly important as a mechanism for many species dispersal (Farrapeira 2011).

The bivalve *Isognomon bicolor* (C. B. Adams, 1845) is native to the Western Central Atlantic coast, living usually on intertidal rocky shores in Bermuda, Florida, the Gulf of Mexico, and the Caribbean Sea (Mikkelsen and Bieler 2008; Tunnell *et al*. 2010). It is also dominant in fouling communities on oil and gas platforms on the continental shelf off Louisiana (Gallaway and Lewbel 1982; Rouse 2009). *Isognomon bicolor* was first recorded in Brazil by Domaneschi and Martins (2002) and according to these authors the southward expansion of this species occurred during the early 1980s. Moreover, *I. bicolor* was probably introduced accidentally to the Brazilian coast on platforms or in ballast water (Oliveira and Creed 2008; Breves-Ramos *et al*. 2010a). Currently, *I. bicolor* occurs in many places on intertidal and subtidal rocky shores along the entire Brazilian coast (about 8000 km). It is considered an invasive species based on population size (Jacobucci *et al*. 2006; Oliveira and Creed 2008; Henriques and Casarini 2009; Breves-Ramos *et al*. 2010a; Zamprogno *et al*. 2010; Casarini and Henriques 2011) and changes in the native communities (Martinez 2012).

To date, the southern limit of occurrence of the invasive *Isognomon bicolor* on the coast of Brazil is Santa Catarina State (Domaneschi and Martins 2002). Here we report the first records of rafted individuals of *I. bicolor* washed ashore on the Uruguayan coast and the first record of rafting for this species.

During January 2003 and January 2007, non-native mollusks were surveyed on both rocky and sandy shores at two contiguous localities of the Uruguayan Atlantic coast: La Coronilla and Santa Teresa, both in Rocha Department. During that field work a total of *ca.* 120 person/hours were spent searching for mollusks on rocky shores and *ca.* 90 pieces of floating debris that had washed ashore were observed for the same objective. We found *I. bicolor* on floating debris (tennis shoes and slippers) (Figure 1) that had drifted ashore at two

FIGURE 1. Specimens of the non-native bivalve *Isognomon bicolor* (red arrows) rafting on debris.

sandy beaches between La Coronilla (Rocha) and Santa Teresa, Uruguay (Figure 2). *Isognomon bicolor* was not found on natural substrates at these or other locations studied.

We collected 9 living specimens of *Isognomon bicolor* from two pieces of floating debris. Based on shell characters and features such as external grayish brown color, interior nacreous and number of hinge teeth, we confirmed that all individuals collected are *I. bicolor*. Furthermore, the average length of the hinge of the individuals collected were 8.52 mm and total length 15.52 mm (n=9), as previously described by Domaneschi and Martins (2002). The specimens were deposited in the Malacological Collections in the Museu Nacional/ UFRJ (Rio de Janeiro, Brazil) (MNRJ18.992-18.993) and Museo Nacional de Historia Natural (Montevideo, Uruguay). These lots were collected respectively between Punta de la Coronilla and Cerro Verde (33°55′54.98″ S, 53°30′27.69″ W) (January 2003) and on La Moza beach, Santa Teresa (33°57′44.12″ S, 53°31′25.77″ W) (January 2007).

Although *Isognomon bicolor* has not been recorded yet at natural substrates along the coast of Uruguay (Scarabino *et al*. 2006), due to its success in colonizing the entire Brazilian coast, this species is potentially invasive in southernmost of the South Atlantic Ocean. We confirm the dispersal of *I. bicolor* to the coast of Uruguay and provide evidence that rafting can be a mechanism for dispersal for this species to the South Atlantic coast, especially because water masses usually flow from north to south along the coast of South America (Stramma 1999). Sessile organisms, when carried on their rafts into nearshore waters after a long oceanic journey, have only a limited capacity to detach and reattach. However, many organisms reproduce during the rafting journey, and it is very possible that rafters release offspring when approaching nearshore waters (Thiel and Gutow 2005).

Considering that this species has rapidly expanded its range along the Brazilian coast and that there are gaps in our knowledge on the distribution and ecology of introduced species (Ignacio *et al*. 2010), monitoring of this species is strongly recommended. Furthermore, given that *Isognomon bicolor* is capable of fouling, ship hull or sea chest fouling were also possible mechanism for its introduction also to Brazil.

Another invasive bivalve in Brazil, *Myoforceps aristatus* (Dillwyn, 1817) is currently widely distributed on southeast of Brazil (Simone and Gonçalves 2006; Breves-Ramos *et al*. 2010b). As with *Isognomon bicolor*, *M. aristatus* has shown an extremely rapid range expansion, occupying the intertidal zone of the rocky shores. *Isognomon bicolor* and other key introduced species, whose distributional ranges are changing along the Atlantic coast, may be also ideal candidates for the study of climatic-driven biogeographic changes.

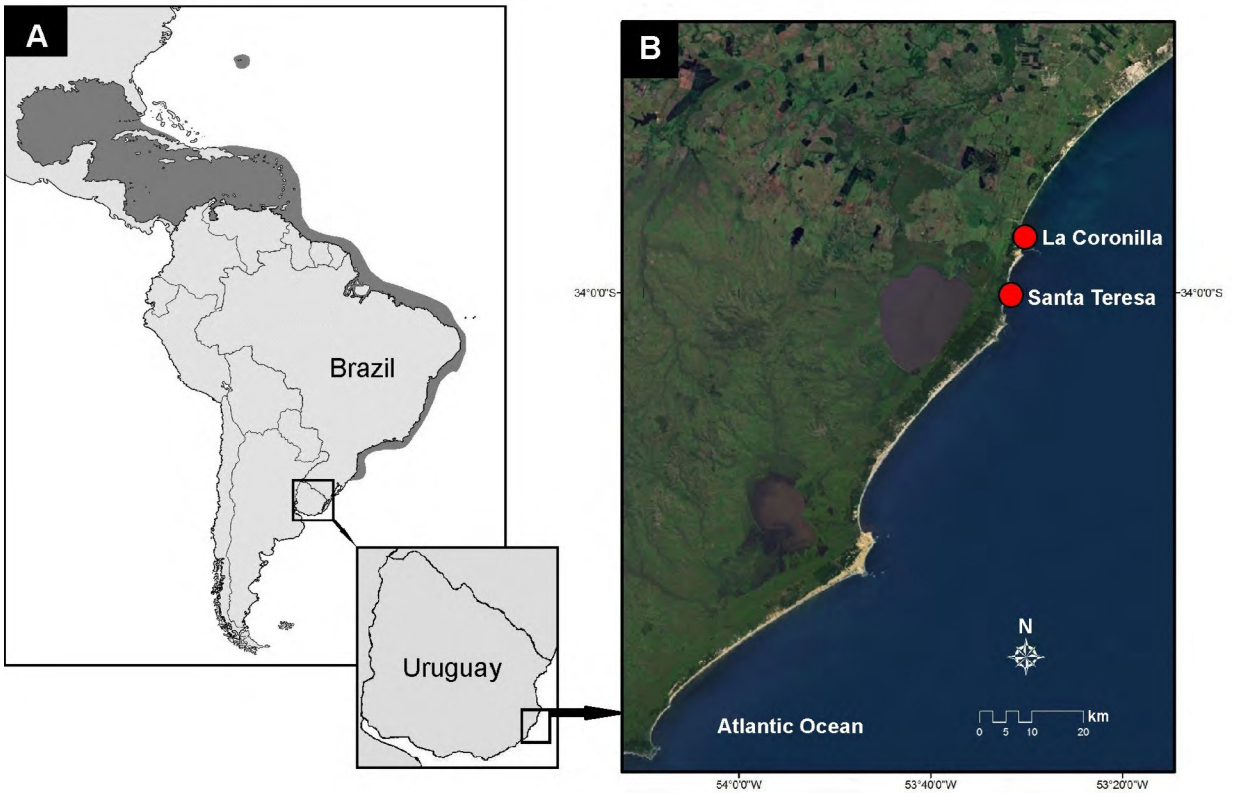

Figure 2. Map of (A) world distribution of the bivalve *Isognomon bicolor* (dark gray line) and (B) records of this species rafting in locations on the Uruguayan coast (red circles).

Acknowledgments: We deeply acknowledge the help of two non-governmental organizations, Karumbé and CECN that made possible the field work. Particularly, we thanks Cristhian Clavijo (Museo Nacional de Historia Natural y Antropologia, Montevideo, Uruguay) and Martín Laporta (formerly at Karumbé, now Dinara) for the great help offered. We also greatly acknowledge the two reviewers as well as to the subject editor for the valuable corrections and comments offered.

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Received: February 2014
Accepted: April 2014
Published online: July 2014
Editorial responsibility: Robert Forsyth