BioInvasions Records (2012) Volume 1, Issue 2: 95–99
doi: http://dx.doi.org/10.3391/bir.2012.1.2.02

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Aquatic Invasions Records

Occurrence of the non-native sleeper *Butis koilomatodon* (Bleeker, 1849) (Perciformes: Eleotridae) in the Amazon coastal zone, Brazil

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Received: 17 November 2011 / Accepted: 2 March 2012 / Published online: 7 March 2012

Abstract

The eleotrid *Butis koilomatodon* (Bleeker, 1849) is native to estuarine waters of the Indo-Pacific Ocean, between China and Madagascar. This species has now been recorded at two sites on the Brazilian coastline (Espiríto Santo and Pará state) but so far there have been no published reports of this occurrence. The process through which the species was introduced into Brazil is unclear, although mechanisms such as the discharge of ballast water and biofouling are known to be important factors in the dispersal of marine organisms in Brazil.

Key words: mud sleeper, Pará, bioinvasion

Introduction

Bio-invasions are considered to be one of the biggest threats to biodiversity worldwide, by provoking changes in biological productivity, as well as interfering in habitat structure and community composition (Levine 2008). The introduction of exotic fishes also contributes to the loss of biodiversity in aquatic environments (Clavero and García-Berthou 2005). However, there have been few studies of such processes in estuarine/marine environments of the Brazilian Amazon coast. The exotic blenny *Omobranchus punctatus* (Valenciennes, 1836) was recently discovered in this region (Soares et al. 2011; Lasso-Alcalá et al. 2011), although there is still little information on the effects of this invasion on the local environment or the native species that occur in it.

The mud sleeper, *Butis koilomatodon* (Bleeker, 1849) (Perciformes: Eleotridae), is a small gobioid found naturally in coastal areas and estuaries throughout most of the Indo-Pacific Ocean between China, the Philippines, Australia, and Madagascar (Miller et al. 1989). The species has been recorded outside its natural distribution in Panama (Dawson 1973), Nigeria (Miller et al. 1989), Venezuela (Lasso-Alcalá et. al. 2005), and Brazil (Hercos 2006; Macieira 2005). This note reports on the occurrence of *Butis koilomatodon* in tidal pools at three localities on the Amazon coast of Brazil, where it co-exists with a number of native species and with the exotic blenny *O. punctatus*.

Methods

At Specimens of *Butis koilomatodon* (Figure 1) were collected in March 2011, from tidal pools on Maiandeua Island and Fortalezinha beach in the municipality of Maracanã, and Salinas beach, in the municipality of Salinópolis, in the Brazilian state of Pará. Specimens of *B. koilomatodon* deposited in the ichthyological collection of the Goeldi Museum (MPEG) in Belém (n=10; collected at Maiandeua Island in 2009) were also analyzed. All specimens were collected from tidal pools, which form during low tide by the retention of water in depressions located within the intertidal zone.

The specimens were identified in the Vertebrate Ecology and Zoology Laboratory of the Biological Sciences Institute of the Federal University of Pará (UFPA), using the diagnostic scheme proposed by Miller et al. (1989) for the identification of *B. koilomatodon*. All

Figure 1. Specimen of *Butis koilomatodon* collected in the Amazon coastal zone. Photograph by Luciano Montag.

Table 1. Physical-chemical parameters from the tidal pools in which the specimens of *Butis koilomatodon* were collected in several localities in the Brazilian state of Pará between 2008 and 2010.

Pool	Locality	MPEG	Salinity (ppt)	T (ºC)	pH	Length (m)	Width (m)	Depth (m)
RT01	Fortalezinha	MPEG 21772	-	32.5	8.4	8.6	2.5	0.1
RT02	Fortalezinha	MPEG 21773	-	36	8.2	6.3	2.5	0.2
RT03	Maçarico - Salinas	MPEG 21775	-	34.2	8.1	5	3.4	0.3
RT04	Maçarico - Salinas	MPEG 21776	-	36.9	8.2	5.5	3.7	0.13
RT05	Maçarico - Salinas	MPEG 21774	-	32.4	8.1	6.8	3.3	0.17
RT06	Maiandeua Island	MPEG 22408	10	28	7.8	6.25	3.2	0.11
RT07	Maiandeua Island	MPEG 22410	9	30	8	8	3.6	0.21
RT08	Maiandeua Island	MPEG 22409	24	35	8	5.6	2.0	0.15
RT09	Maiandeua Island	MPEG 22411	26	34	7.6	5.6	2.0	0.15
RT10	Maiandeua Island	MPEG 22407	16	36.1	8.7	8.08	2.84	0.23
RT11	Maiandeua Island	-	-	-	-	-	-	-

Table 2. Morphological and meristic data for the *Butis koilomatodon* specimens collected at three localities in the Brazilian state of Pará between 2008 and 2010.

Sex	Head %	Pectoral Fin %	Anal Fin %	Second Dorsal Fin %	First Dorsal Fin	Second Dorsal Fin
Female	33.27 ± 1.67	29.21 ± 1.74	15.47 ± 0.98	15.23 ± 1.04	VI	I + 8
Male	33.4 ± 2.16	29.24 ± 1.44	17.44 ± 1.1	18.1 ± 1.22	VI	I + 8
Not identified	32 ± 2	31.02 ± 0.36	17.03 ± 1.76	17.5 ± 2.86	VI	I + 8

measurements were taken using 150 mm digital calipers with 0.01 mm precision. The diet of the species was analyzed based on the contents of the digestive tract of the 15 specimens collected during the study. Contents were identified and the frequency of occurrence (FOi%) of different food items was calculated. Physical-chemical properties of tidal pools from which the *B. koilomatodon* specimens were collected were also recorded (Table 1).

Results and discussion

A total of 30 specimens of *B. koilomatodon* were collected from 11 tidal pools on the island of Maiandeua, and from the beaches of Fortalezinha and Maçarico. Standard length (SL) varied from 3.19cm to 5.78cm (mean ± SD = 4.59±0.61cm). Males shared a mean length of 4.75±0.35cm (range: 4.28-5.32cm) and were generally larger than females (mean length of 4.40± 0.76cm;

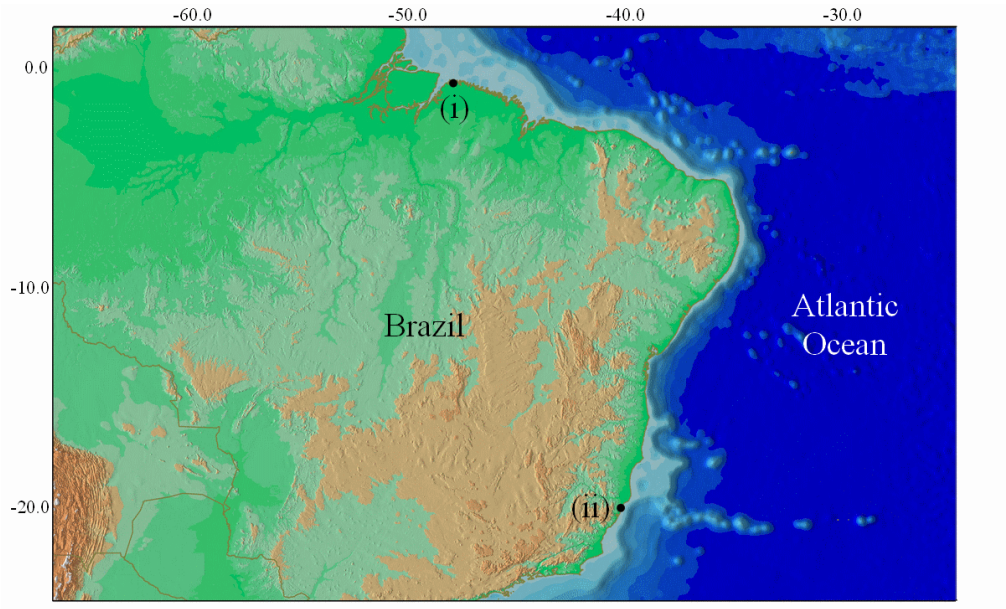

Figure 2. Locations on the coast of Brazil at which the exotic eleotrid *Butis koilomatodon* has been recorded: (i) Pará (present study and Hercos, 2006), (ii) Espírito Santo (Macieira, 2005).

Table 3. Localities at which the non-native mud sleeper, *Butis koilomatodon*, have been recorded on the Brazilian coast in published and unpublished reports, including the present study in the Amazon region.

Brazilian State	Year	Latitude, S	Longitude, W	Reference
Espírito Santo (ES)	2005	19º57′23″	40º09′17″	Macieira 2005
Pará (PA)	2006	00º42′19″	47º53′29″	Hercos 2006
Pará (PA)	2011	00º34′42″	47º34′46″	Present study

range: 3.19-5.78cm). Both morphological and meristic data (Table 2) were consistent with those presented for the species by Miller et al. (1989).

The tidal pools in which the specimens of *B. koilomatodon* were captured were also inhabited by native species, such as *Bathygobius soporator* (Valenciennes, 1837) (Perciformes: Gobiidae), *Mugil hospes* (Jordan and Culver, 1895) (Mugiliformes: Mugilidae), *Lutjanus jocu* (Bloch and Schneider, 1801) (Perciformes: Lutjanidae), *Atherinella* aff. *brasiliensis* (Quoy and Gaimard, 1824) (Atheriniformes: Atherinidae), *Colomesus psittacus* (Bloch and Schneider, 1801) (Tetraodontiformes: Tetraodontidae), *Batrachoides surinamensis* (Bloch and Schneider, 1801) (Batrachoidiformes: Batrachoididae), and *Amphichthys cryptocentrus* (Valenciennes, 1837) (Batrachoidiformes: Batrachoididae). In addition to these native species, a second exotic fish – *Omobranchus punctatus* (Valenciennes, 1836) (Perciformes: Blenniidae) – was also observed. This species was firstly reported to the Amazon coast by Soares et al. (2011) and Lasso-Alcalá et al. (2011).

Grosholz (2002) has emphasized the importance of studying the impacts of colonization by a group of invasive species, rather than individual cases, given that, theoretically, an environment becomes progressively more vulnerable to bio-invasions as the number of exotic species present in this environment increases. Simberloff and Von Holle (1999) have also discussed the importance of the interactions between exotic species, which may be crucial for the establishment of their populations. It is suggested that there is possibility of interaction between the two non-native species, *B. koilomatodon* and *O. punctatus*, in the Amazon coastal zone based on the use of crevices by gobies and blennies for reproduction and occupation of refuges (Wonham et al. 2000).

The introduction of exotic species into aquatic environments is almost always the result of anthropogenic impacts, such as those caused by aquaculture and shipping. The discharge of ballast water and biofouling are the most common mechanisms of introduction of exotic species, including fishes (Carlton 1985; Ferreira et al. 2008). Nevertheless, the mechanism through which *B. koilomatodon* was introduced into Brazilian waters remains unclear. While ballast water has long been considered the principal vector of marine invasions, biofouling is increasingly thought to be one of the most important mechanisms (Godwin 2003). The importance of biofouling as a vector for bio-invasions was emphasized by Ferreira et al. (2006) in their survey of the region of Arraial do Cabo, on the eastern Brazilian coast. Biofouling has been suggested as the mechanism for the invasion of the blenny *Omobranchus punctatus* (Valenciennes, 1836) at a number of locations on the Brazilian coast (Gerhardinger 2006; Loebmann et al. 2010).

The physical-chemical parameters (Table 1) collected from the rock tide pools in the Amazon coastal zone show a wide range of salinity levels, to the data from the other localities where the species was recorded (Miller et al. 1989; Macieira 2005). Miller et al. (1989) suggest that the apparent euryhalinity of *B. koilomatodon* is an advantage for a successful establishment. The temperature observed is similar to that recorded on other localities where specimens were found, where it was found a range of 27-31ºC in Nigeria (Miller et al. 1989) and 21.8-35ºC in Espírito Santo, Brazil (Macieira 2005), and this data could indicate the range of environmental water temperature for the species. It is important to notice the significant role of temperature and salinity in the distribution and survival of fishes or other aquatic animals, and that high levels of environmental stress are related to a smaller habitat invasibility (Alpert et al. 2000; Bishai 1961; Lahdes and Karjala 2007).

Only two items were identified in the digestive tract of the specimens analyzed – mollusk shells (13.33%) and fragments of crustacean exoskeletons (53.33%). The hyperbenthic fauna plays an important role in the diet of small-bodied estuarine fishes (Sorbe 1981; Wakabara et al. 1996), including those of the Amazon coastal zone (Krumme et al. 2007; Oliveira-Raiol 2011), indicating a possible dietary overlap between the exotic *B. koilomatodon* and the native Amazonian species. While the occurrence of *B. koilomatodon* has only been confirmed at two localities on the Brazilian coast (Figure 2, Table 3), there is a clear need for further research. In particular there is a need to know whether a permanent recruiting population has been established, and to establish the possible impacts generated by the introduction of this species on the native fauna of the Amazon coast and other regions of the country.

Acknowledgements

We are grateful to our colleagues at the UFPA Vertebrate Ecology and Zoology Laboratory, who provided valuable assistance in the field, and Oscar Lasso, who shared essential references. Stephen Ferrari revised the English text.

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