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Biofouling of the golden mussel *Limnoperna fortunei* (Dunker, 1857) over the Anomura crab *Aegla platensis* Schmitt, 1942.

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Abstract .This note reports the first occurrence of golden mussel *Limnoperna fortunei* (Dunker, 1857) colonizing (biofouling) the surface body of the anomuran crab *Aegla platensis* Schmitt, 1942 on the São Gonçalo channel, Mirim Lagoon, Brazil. One live individual of *A. platensis* (25.5 mm tail to head; 2.8 g) was colleted at São Gonçalo channel carrying 62 individuals (30.4 g) of *L. fortunei*, with total length ranging from 7 to 23 mm. The total weight recorded for the crab was 10 times lower than the total weight of the bivalves incrusted, which suggest that this could be a new factor affecting the preservation of this endemic South America crab that is already in a vulnerable state of conservation in the Rio Grande do Sul, state. Like *A. platensis*, other benthic invertebrates could be also negatively affected by *L. fortunei*, and further investigation is currently needed to assess the potential ecological negative effects on the local biodiversity.

Key-words: Biodiversity, biofouling, *Limnoperna fortunei*, South America.

Resumo. **Bioincrustação de mexilhão dourado *Limnoperna fortunei* (Dunker, 1857) sobre o caranguejo Anomura *Aegla platensis* Schmitt, 1942.** Esta nota relata a primeira ocorrência da colonização de mexilhão dourado *Limnoperna fortunei* (Dunker, 1857) sobre a superfície do corpo (biofouling) do crustáceo Anomura *Aegla platensis* Schmitt, 1942 no canal São Gonçalo, Lagoa Mirim, RS, Brasil. Um exemplar vivo de *A. platensis* (25,5 milímetros de comprimento total; 2,8 g de peso) foi coletado no Canal São Gonçalo com 62 indivíduos de *L. fortunei* (30,4 g) fixados sobre sua carapaça, com comprimento total variando de 7 a 23 mm. O peso total registrado para o crustáceo foi aproximadamente 10 vezes menor do que o peso total dos bivalves incrustados, o que sugere que este fator seria um novo agravante ao estado de conservação destes crustáceos, endêmicos da América do Sul, que já se encontram em estado vulnerável de conservação na região do Rio Grande do Sul. Assim como *A. platensis*, outros invertebrados bentônicos podem estar sendo ameaçados pelo *L. fortunei*, sugerindo a necessidade de futuras investigações sobre bioincrustação no sistema.

Palavras-chave: Biodiversidade, bioincrustação; *Limnoperna fortunei*, América do Sul.

Although species distribution changes naturally over time, human activities greatly increase the rate and the spatial scale of these changes by accidentally or deliberately moving organisms across the world (Ricciardi & MacIsaac 2000). The introduction of invasive species threatens native biodiversity, ecosystem functioning, animal and plant health, and human economies.

Limnoperna fortunei (Dunker 1857), the Asian golden mussel, is an invasive freshwater species that shares several features with the zebra mussel *Dreissena polymorpha* (Pallas 1771), arguably the most influential animal to ever invade North American fresh waters (Thorp *et al.* 1998). Both have filter-feeding habits, are epifaunal and attach to hard substrates by means of a byssus and have fast growth rates (Boltovskoy & Cataldo 1999, Boltovskoy *et al.* 2006, Karatayev *et al.* 2007a). Its veliger larvae allows a quick dispersal through several mechanisms including water currents, animal and ship transport (ballast waters), and fishing activities (Morton 1977, Garcia & Protogino 2005), although the attachment to vessels is by far the most important dispersion mechanism of golden mussel

(Boltovskoy *et al.* 2006, Karatayev *et al.* 2007b).

The golden mussel was first found in South America in the coast of Río de la Plata, Buenos Aires province (Pastorino *et al.* 1993). Its occurrence has been reported in the main hydrologic systems of the region: coastal zones of Río de la Plata (Darrigran *et al.* 1998), Paraguay, Paraná, Salado and Uruguay Rivers (Darrigran & Ezcurra de Drago 2000, Darrigran 2002). It was first recorded in Patos Lagoon in 1999 by Mansur *et al.* (1999, 2003) and in 2005 was found at the adjacent Mirim Lagoon, probably through a dispersion via the São Gonçalo channel that connects both lagoons (Langone 2005, Burns *et al.* 2006a, 2006b).

The combination of early sexual maturity, high fecundity, semelparity and wide environmental tolerance probably allow *L. fortunei* to be a successful invader into new environments. The high densities of golden mussel and their fixation to the substrate by its byssal threads result in the formation of a new continuous microenvironment, which provide a new substrate by some epifaunal species and, at the same time, can lead to the displacement of other organisms (Darrigran 2002). Colonization is not restricted to man-made structures, such as revetments, piers, rock armors, gabions, boat hulls and others, since the golden mussel also settles on biogenic material such as debris, driftwood, reed roots (Boltovskoy *et al.* 2006). Among the potential impacts associated with the presence of this invasive bivalve, the rapid change produced in benthic communities should be noted. Since its invasion of the Plata Basin, *L. fortunei* has modified the natural occurrence and abundance of several native macroinvertebrates species (Martin & Darrigran 1994, Darrigran *et al.* 1998).

In the area of Guaíba lake at Patos Lagoon system, Mansur *et al.* (2003) reported that the golden mussel attaches to at least 6 species of mollusks in numbers up to ca. 300 individuals per host. In several cases this overgrowth may hinder the host's normal displacement and valve mobility. Darrigran *et al.* (2002), in Argentina, also reported the settlement of the golden mussel on other bivalve species, as well as in the anomuran crab *Aegla platensis* Schmitt, 1942. The present paper reports the first occurrence of *L. fortunei* colonizing the surface body of *A. platensis* in the São Gonçalo channel.

Bottom trawl sampling was carry out in São Gonçalo channel in waters 3 to 6 m deep (Fig. 1) on June 13th, 2008. Sampling was conducted using a fishermen wood boat (10.9 m long, with a 60 Hp motor). Five minutes sample (approximately 400 m beginning at 32º7'40.86" S; 52º36'41.91") were performed using an 10.5 m (head rope) shrimp trawl (1.3 cm bar mesh wings and body with a 0.5 cm bar mesh cod end liner, and a pair of weighted outer doors.

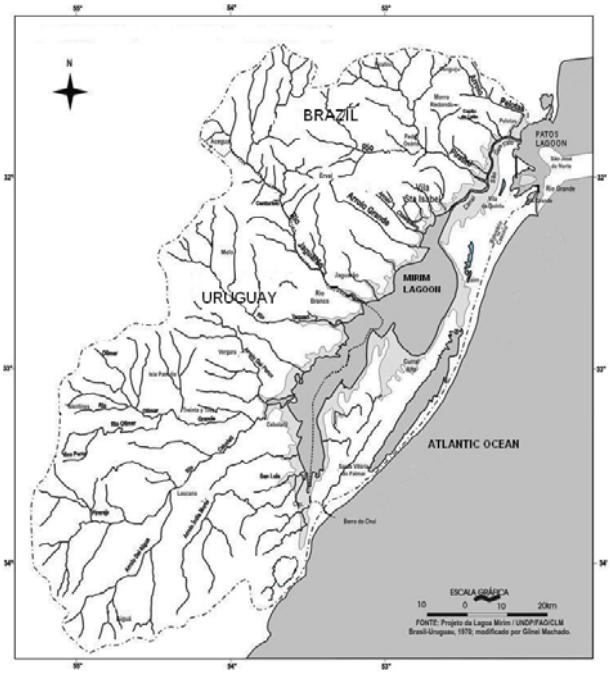

Figure 1. Mirim Lagoon and its drainage basin (62.250 Km^2), showing the São Gonçalo channel that connecting it with the Patos Lagoon. The red dot represent the location (32º7'40.86" S; 52º36'41.91" O) where *A. platensis* was collected. Modified from Machado (2007).

One live individual of *A. platensis* (25.5 mm tail to head; 2.8 g) was colleted carrying 62 individuals (30.4 g) of *L. fortunei*, with total length (TL) ranging from 7 to 23 mm (Fig. 2). In addition to the golden mussel, 28 live gastropods (*Heleobia* spp.) were also observed trapped into the byssus net.

Figure 2. Specimen collected, showing the fouling of *L. fortunei* on *A. platensis*.

Comparing the size ranges of the golden mussels with those reported on the literature (Magara *et al.* 2001, Maroñas *et al.* 2003) it is possible to suggest that the majority of the golden

mussel individuals found attached to *A. platensis* can be considered adults with more than 2 years (>17mm TL; Fig. 3), suggesting that the colonization started long time before the sampling date. The total weight recorded for the crab (2.8 g) was 10 times lower than the total weight of the bivalves incrusted (30.4 g), which could suggest that this infested crab would have more difficulties in finding shelter and/or avoiding predation and increased rates of energy consumption.

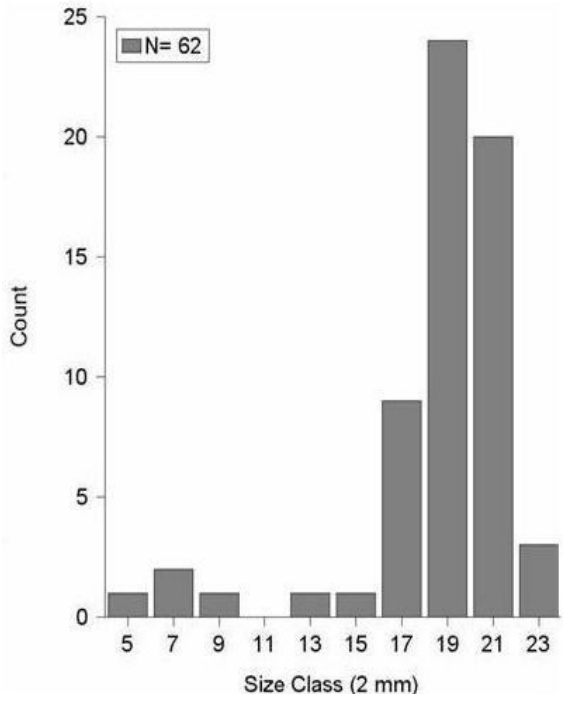

Figure 3. Size range of *L. fortunei* observed at *A. platensis*.

The aeglids are a peculiar group of crustaceans because they are the only Anomura that occurs on fresh waters. They are endemic to South America and occur in streams, rivers, lakes and currents. They show nocturnal activity and sheltered under rocks, leaf litter and plant debris during the day. They are vulnerable to changes on their habitat, and they are under serious risks to become extinct even before they had been properly studied (Bond-Buckup & Buckup 1994). Thus, the macrofouling of *L. fortunei* on *A. platensis* on São Gonçalo Channel reported here could be another potential factor leading to the population decline of this crab, which is already in a vulnerable conservation state (Bond-Buckup & Buckup 1994). Like *A. platensis*, other benthic invertebrates could be also negatively affected by *L. fortunei*. Further investigation is currently needed to assess the current finding and its potential ecological negative effects on the local biodiversity, including eventual indirect effects in the community structure and local food webs.

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