# A NEW OCCURRENCE OF *Limnoperna fortunei* (DUNKER 1856) (BIVALVIA, MYTILIDAE) IN THE STATE OF SÃO PAULO, BRAZIL

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(With 2 figures)

## ABSTRACT

The freshwater mussel *Limnoperna fortunei* (Dunker 1856) (Bivalvia, Mytilidae) has been found in the Paraná river, near Rosana, São Paulo. This is the first record of this specie in São Paulo State. This population of *Limnoperna fortunei* seems to be young and in a colonization process.

*Key words*: Mollusca, Bivalvia, Mytilidae, *Limnoperna fortunei.*

## RESUMO

**Nova ocorrência de *Limnoperna fortunei* (Dunker 1856) (Bivalvia, Mytilidae) para o Estado de São Paulo, Brasil**

O molusco de água doce *Limnoperna fortunei* (Dunker 1856) (Bivalvia, Mytilidae) foi encontrado no rio Paraná, próximo à cidade de Rosana, São Paulo. Este é o primeiro registro dessa espécie no Estado. A população de *Limnoperna fortunei* encontrada parece ser jovem e em pleno processo de colonização.

*Palavras-chave*: Mollusca, Bivalvia, Mytilidae, *Limnoperna fortunei.*

## INTRODUCTION

In a recent study of benthic bivalves in São Paulo State, BIOTA/FAPESP project, samples were obtained from numerous localities in the Paraná river, from Três Fronteiras (20°04'11,4"S and 50°59'57,0"W) to Rosana (22°31'33,9"S and 53°00'08,9"W), in São Paulo State. In Rosana, examples of the freshwater mytilid bivalve *Limnoperna fortunei* (Dunker 1857) (Bivalvia, Mytilidae) were obtained from coarse sand banks as well as gravel banks.

*Limnoperna fortunei* is a freshwater bivalve, native to rivers of China and southeastern Asia. It was first recorded for the Americas in 1991 at Bagliardi beach in the Argentinian littoral zone of Rio de La Plata (Pastorino *et al.*, 1993). Introduction into South America is probably due to the discharged thousands of tons of ballast water with high bivalve larvae concentrations.

Along with *Corbicula fluminea* (Müller 1774) and *Corbicula largillierti* (Philippi 1811), *Limnoperna fortunei* (known as "golden mussel") is the third invading freshwater bivalve species to enter South America from southeastern Asia via the Rio de La Plata.

In 1993, the presence of this mussel was registered in the Rio de La Plata (from Punta Piedras to Punta Lara). The same occurred in 1996 in the Paraná river (Zárate, San Pedro, Rosário, Santa Fé),

Argentina, and in 1998 both in the Salado river (Santo Tomé), Paraguay, and the Paraguay river (Corumbá in Mato Grosso do Sul State), Brazil (Darrigran *et al.*, 2000).

The specie lives as marine mytilids and has a bissal attachment to solid substrata. In the subtropical region, it exhibits rapid growth, a short life span, and possesses planktonic (veliger) larvae. The adults are dioic, with two-thirds of the population being female and reproducing at least once or twice per year (Ricciardi, 1998; Magara *et al.*, 2001).

*L. fortunei* was already considered a pest when it invaded the Hong Kong area in the late 1960s. This specie in particular as well as those having bissal attachments have become serious threats to normal functioning of both aquatic ecosystems and water intake systems, as demonstrated by the recent invasion history of the Eurasian zebra mussel *Dreissena polymorpha* (Pallas 1771), which has caused profound ecological and technological impact in North America (Ricciardi, 1998; Boltovskoy & Cataldo, 1999). According to Darrigran *et al.* (1999), the principal problems relating to the invasion by *L. fortunei* into water distribution and irrigation systems are: pipe diameter reduction, pipeline blockages, water velocity decrease caused by friction, empty shell accumulation, water pipeline contamination by mass mortality, and filter occlusions. In addition, one must consider the ecological impact caused by this exotic specie, specially with regard to competition with native bivalves for space and food.

Darrigran & Pastorino (1995) registered the occurrence of 80,000 mussels/m$^2$ in Bagliardi beach, Argentina. Since their introduction, the number of individuals has increased dramatically within a short period of time, reaching densities of more than 100,000 mussels/m$^2$ (Cataldo *et al.*, 2002).

Recently, many steps have been taken to try to control or decrease the effects caused by this invasive specie. These include: manual or mechanical removal, use of electric fields, temperature control, and anti-incrustation painting (Cataldo *et al.*, 2002).

The aim of the present work is to revise the distribution of *Limnoperna fortunei* in the Paraná river, as of November 2002 to include Rosana municipality, São Paulo State, Brazil.

## MATERIAL AND METHODS

The Paraná river, in western São Paulo State at the state line with Mato Grosso do Sul, was divided randomly into three collection regions: one upstream, another in the middle course of the river, and the third downstream near the city of Rosana.

At each collection point, many places along the river banks and in outcrops in the riverbed were visited, covering approximately 10 km. With a 30 min capture effort and the help of three people, many sites were chosen.

Sediment from the chosen sites and rocky outcrops were sifted by hand through a sieve (5 mm mesh size). The clams were found, collected, packed in duly labeled plastic bags, and transported in thermal boxes with ice. Aquatic plant roots were also analyzed. All animals captured in each collection were identified and preserved in 70% alcohol.

The coordinates of each site were registered with a GPS. At the site with coordinates 22°32'56,9"S and 53°02'48"W (municipality of Rosana) 118 specimens of *L. fortunei* were collected. Each clam was measured with a Vernier caliper to the nearest 0.05 mm for length (greatest anterior-posterior distance), width (greatest distance through the valves), and height (greatest dorso-ventral distance perpendicular to the hinge line). The appropriate statistical analyses were then performed.

## RESULTS AND DISCUSSION

Fig. 1 shows the occurrences of this specie in South America and the first record in São Paulo State, in the Parana river.

Fig. 2 shows specimens of *Limnoperna fortunei* that were found in the Paraná river in November 2002. All captured clams were measured. Their shell length varied from 8 to 22 mm; width, from 3 to 8.2 mm; and height, from 3.9 to 10.2 mm. High values were obtained for the correlation index (more than 0.9). This data shows an intimate relationship among the biometric measurements of the shells.

In the greatest percentage of the clams, the shell length varied from 12 to 13.5 mm. Boltovskoy & Cataldo (1999) verified that, during the first year, these animals reached 20 mm in length, and by the end of the second year they were 30 mm long, and the asymptotic or maximum theoretical length was 35 mm. According to Morton (1982), the maximum length can vary from 30 to 40 mm.

Using measurements made of the captured clams from the sites analyzed, we could infer that the population discovered is probably in the first

year of life and, therefore, a young population in a full-blown installation process.

The rapid expansion and great densities of the exotic specie *Limnoperna fortunei*, besides the economic damage caused to electric-power plants and irrigation systems, can greatly impact the aquatic ecosystem. Documented impacts suggest that filtration activity of a dense *Limnoperna fortunei* population reduces phytoplankton biomass and turbidity levels (and promoting prolific macrophyte growth); suppresses zooplankton populations, thus limiting food availability; increases sedimentation rates; and alters contaminant cycling in lentic habitats and large rivers, among other damage (Ricciardi, 1998).

The recent history of the invasion of *Limnoperna fortunei*, as well as its potential for colonization, has been encouraging studies about the biology of this pest in an effort to identify possible steps for its prevention and control.


**Fig. 1 —** Map of South America with registered occurrences of the exotic specie *Limnoperna fortunei* and the new occurrence in 2002.


**Fig. 2 —** Specimens of *Limnoperna fortunei* collected in Rosana (SP). View of the external side of the valve.

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