



## Mysids from the Río de la Plata Estuary, with new record of *Mysidopsis rionegrensis*, Hoffmeyer 1993, and *Promysis atlantica* Tattersall, 1923 (Mysida: Mysidae)

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**Abstract.** We report four species of Mysida collected in open waters of the Río de la Plata Estuary (RPE) during spring and autumn 2001: *Neomysis americana*, *Mysidopsis tortonesei*, *M. rionegrensis* and *Promysis atlantica*; for the latter two this is the first report for RPE and represents an extension in their known distribution ranges.

**Keywords:** Mysidacea, South-Western Atlantic, distribution

**Resumen.** Misidáceos del estuario del Río de la Plata, incluyendo el nuevo registro de *Mysidopsis rionegrensis* Hoffmeyer 1993 y *Promysis atlantica* Tattersall, 1923: Se reportan cuatro especies de Mysidacea colectadas en aguas abiertas del estuario del Río de la Plata en otoño y primavera del 2001: *Neomysis americana*, *Mysidopsis tortonesei*, *M. rionegrensis* y *Promysis atlantica*. Para las dos últimas éste constituye el primer reporte para el Río de la Plata, y representa una extensión en el rango de distribución conocido.

**Palabras clave:** Mysidacea, Atlántico Sudoccidental, distribución

### Introduction

Mysids inhabit diverse aquatic habitats but are particularly abundant in estuaries and marine coastal waters (Mauchline & Murano 1977, Mauchline 1980, Morgan 1982, Wooldridge 1983, Cunha *et al.* 1999). They are core components in trophic webs which actively consume phytoplankton and zooplankton (Fulton III 1982a, b, Takahashi 2004) and transform organic detritus into biomass for higher consumers (Zagursky & Feller 1985, Corey 1988). In turn mysids are food for several fish and bird species (Moran & Fishelson 1971; McDermott, 1983, Wooldridge 1989; Carlson *et al.* 1997, Takahashi *et al.* 2004).

The Río de la Plata Estuary (RPE) is a large-scale, shallow (average ca. 10 m) and turbid estuarine environment (Guerrero *et al.*, 1997). It has

a mean annual fresh water flow of 23000 m<sup>3</sup> s<sup>-1</sup> that constitutes the main point source of fresh water input in the South Atlantic Ocean. General studies on the plankton of the RPE are scarce, and in particular the mysid fauna is poorly known (Murano 1999, Calliari *et al.* 2003, Miyashita & Calliari 2014). *Neomysis Americana* (Smith 1873) and *Mysodopsis tortonesei* (Bacescu 1968) are so far the two mysid species known to inhabit this ecosystem (Schiariti *et al.* 2004, 2006, Calliari *et al.* 2007). *N. americana* was the first species reported for this estuary nearly 40 years back (Gonzalez 1974), and since then only a handful of studies have focused on this group (Viñas *et al.* 2005, Schiariti *et al.* 2004, 2006, Calliari *et al.* 2007). Improved knowledge of the mysid fauna of the RPE is arguable needed in view of the significance of mysids in the diet of

small juvenile fish (Sardina & Lopez-Cazorla 2005, Rodríguez-Graña *et al.* 2008) and of their importance in this system which serves as nursery ground for several important fish species (Martínez & Retta 2001, Acha *et al.* 2008).

This study updates the knowledge of the order Mysida from the RPE with the inclusion of two further taxa to the species list, along with environmental information associated to their occurrence and a description of morphological features that can prove useful as a quick diagnosis tool for proper identification by aquatic ecologists without specific expertise in the taxonomy of this group of crustaceans.

### Materials and Methods

Two cruises were performed on board R/V Aldebarán from 17th to 19th May, 2001 (cruise 1, austral fall) and from 17th to 19th November, 2001 (cruise 2, spring) (Fig. 1). Depth of stations ranged between 6 and 36 m. Zooplankton samples were collected by oblique tows of a Bongo net (19 cm diameter) fitted with a 85  $\mu$ m pore-size; length and angle of the cable were manipulated to ensure the net sampled most of the water column, i.e. from 1-2 m above the bottom and upwards. Samples were preserved in buffered formaldehyde 5% final concentration. At the laboratory mysids were picked out from whole samples and identified based on Almeida-Prado (1974), González (1974), Mauchline (1980), Hoffmeyer (1993), and Murano (1999).

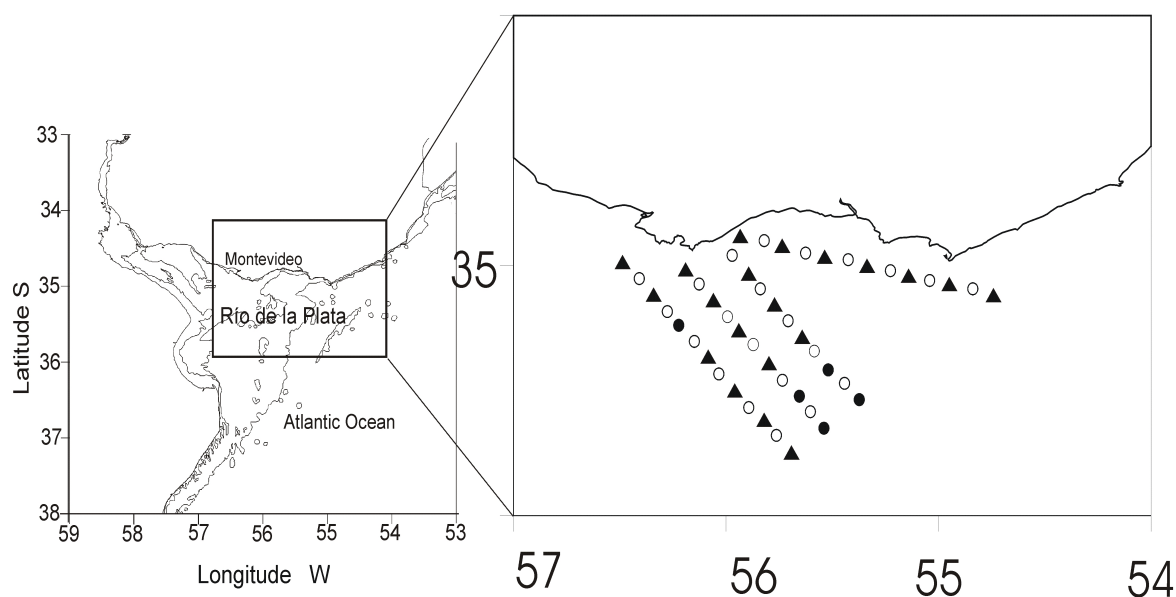
Specimens were dissected and observed under a dissecting microscope (7 – 40X) and at high magnification with an inverted microscope (40-200X).

### Results and Discussion

The analysis of whole samples corresponding to both cruises resulted in four mysids species identified (Table I). *N. Americana* was identified and described again, according to descriptions by Smith (1873) for *Mysis americana*, and Zimmer (1904), Cronin *et al.* (1962), Williams (1972), Calliari *et al.* (2001) and Schiariti *et al.* (2006) for *N. americana*. *Mysidopsis tortonesei* had a new description by Bacescu (1968a) for *M. californica*, and Bacescu (1968b), Brattegard (1969) and Almeida-Prado (1972) for *Mysidopsis tortonesei*. *Mysidopsis rionegrensis* was identified according description of Hoffmeyer (1993) and *Promysis atlantica* following description of Tattersall (1923, 1951), Illig (1930), Clarke (1956), Costa (1964) and Almeida Prado (1972).

*Neomysis americana* Smith 1873 (Fig. 2a)

*Diagnosis:* Our observations agreed closely with González (1974). Eyes elongated, ca. 1.5 times longer than wider with cornea representing about half of the eye surface. Antennal scale lanceolated, with small setae on both margins and 8-10 times longer than wider. Telson triangle-shaped, ca. 2.5 times longer than wider at the base and ending in



**Figure 1.-** Map of the study area showing location of sampling stations. Open circles correspond to hydrographic (CTD) stations; full circles correspond to hydrographic and plankton stations; full triangles correspond to positive stations with presence of mysids.

**Table I.-** Species of mysids found in the Rio de la Plata estuary during autumn and spring 2001.

Family	Subfamily	Genus	Species	Reference
Mysidae	Leptomysinae	<i>Mysidopsis</i>	<i>tortonesei</i>	Bacescu 1968
		<i>Mysidopsis</i>	<i>rionegrensis</i>	Hoffmeyer 1993
		<i>Promysis</i>	<i>atlantica</i>	Tattersall 1923
	Mysinae	<i>Neomysis</i>	<i>americana</i>	Smith 1873, fide Zimmer 1909

two strong external spines framing two smaller internal spines. Lateral margins of telson with one robust spine (longer and wider at its base) every 1-3 smaller spines (pattern most evident in the distal half of the telson). Uropods with setae on both margins; exopodite of uropods 1.5 times longer than endopodite. A conspicuous chromatophore present in the marsupium of brooding females.

*Neomysis americana* was the most abundant mysid species recorded in both spring and autumn cruises. It occurred in oligo- to polyhaline conditions in the range <1 to 33.37, but was most abundant at salinities <28, with a clear preference for salinities between 15 and 20 (Calliari *et al.* 2007); spatial distribution of *N. americana* in the RPE has been shown to be associated with the bottom salinity front (Schiariti *et al.* 2006).

*N. americana* was present in 55% of samples and 77% of individuals found were juveniles. Sex ratio (female:male) was skewed towards females (71%, F:M ratio = 2.4), similarly to findings by Viñas *et al.* (2005) on the Argentinean sector of the estuary (Samborombón Bay), although the fraction of brood-carrying females was higher in our study (77%) compared to the former one (20%). In the present study spawners were nearly always present in samples corresponding to middle and upper estuarine stations.

This species appears to have a disjunct distribution along the Atlantic coast of the Americas (Miyashita & Calliari 2014): it is found in coastal waters from Canada (ca. 46° N, Prouse 1986) and the USA down to ca. 41° N (Brown *et al.* 2005), 37° N (Hulburt 1957, Herman 1963), 35° N (Williams 1972), and 30° N (Williams *et al.*, 1974). It is absent from Mexican, Central America and northern South American coastal waters, but found again at lat. ca 30°S (Tramandaí, Brazil). On South Atlantic waters *N. americana* is a cryptogenic species (*sensu* Orensanz *et al.* 2002); it is not known whether it is endemic or if it was introduced from the North Atlantic in the late 60's or early 70's, as it was first reported in South America in 1973 at Montevideo

harbour (Gonzalez 1974). *N. americana* has been recently reported as invasive on the Eastern Atlantic, in coastal waters from the Netherlands (Wittmann *et al.* 2012).

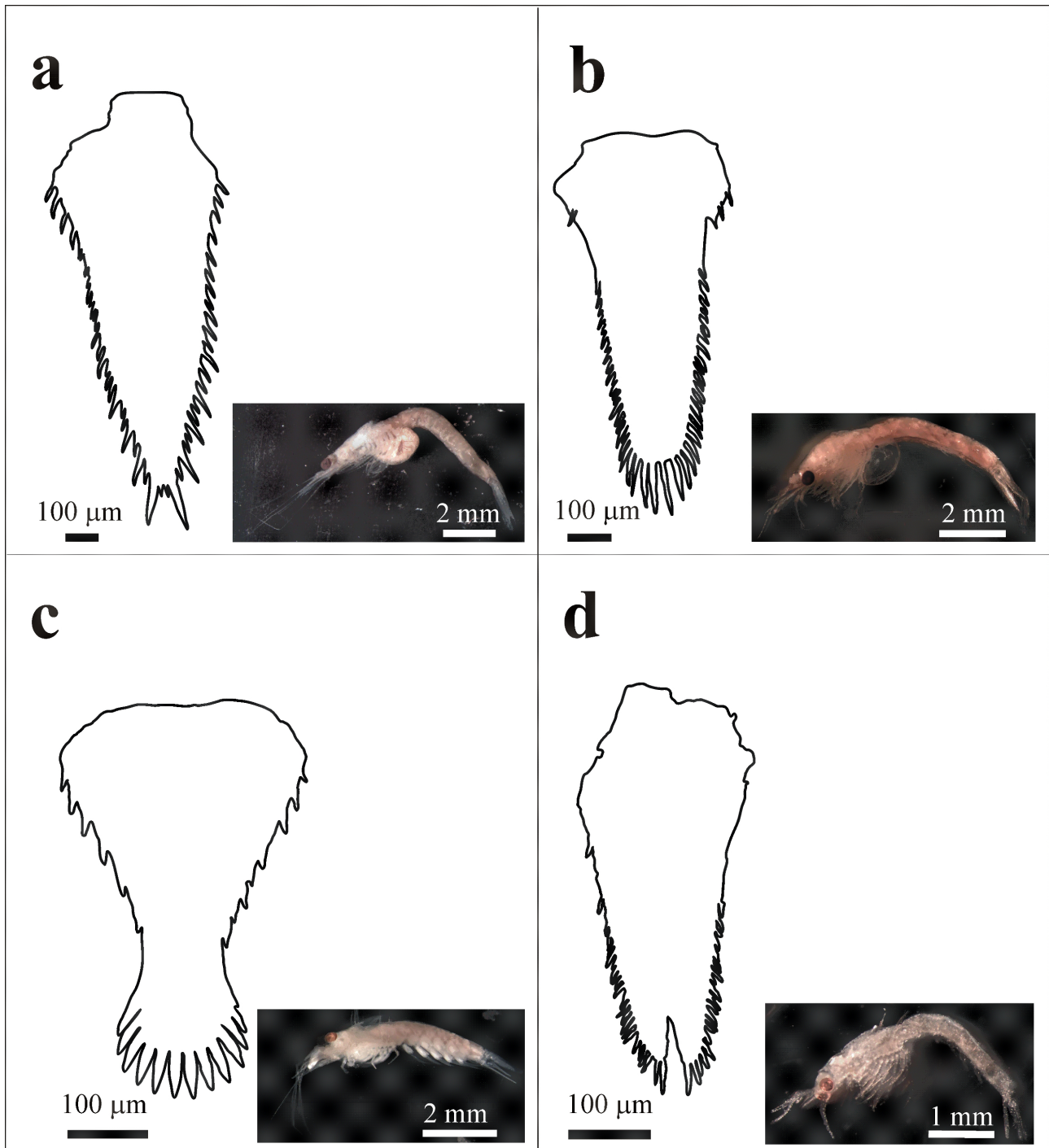
In South America, *N. americana* is currently common in southern Brazilian, Uruguayan and northern Argentinean coasts (Hoffmeyer 1990, Viñas *et al.* 2005; Calliari *et al.* 2001; Schiariti *et al.* 2004, Cervetto *et al.* 2006, Calliari *et al.* 2007, Cardelli *et al.* 2006).

***Mysidopsis tortonesei*** Bacescu 1968 (Fig. 2b)

**Diagnosis:** Morphology in accordance with description by Almeida-Prado (1974). Globular round eyes with small lateral projection over peduncular structures. Antennal scale lanceolated with setae all along the margin. First five abdominal segments with conspicuous chromatophores. Telson almost twice as long as wide at the base, quickly narrowing near the base but then narrowing very smoothly until the distal. At its base, the telson presents three spines on each side, then a short naked segment of the margin follows, after which a number of ca. 20 spines are present which increase in length and width from proximal to distal extremes. The distal end of telson is round shaped and with two pairs of strong and long spines. Exopod of uropods with setae along the whole margin. Endopod of uropod with spines along the whole margin.

*Mysidopsis tortonesei* has been found in several sites along the Brazilian coast including Paraíba, Sao Paulo, Parana, and Rio Grande do Sul (Miyashita & Calliari 2014 and references therein). For the RPE it was first reported in 2004 (Schiariti *et al.* 2004).

In the current sets of samples *M. tortonesei* was most abundant during the autumn cruise when it represented 35% of total mysids collected, being found in 41% of samples. Juvenile individuals amounted to 55%, sex ratio was 1.5 and 40% of adult females had broods developed. These results match observations by Almeida-Prado (1973) during April at Cananea estuary, Brazil, (25°30' S) in terms



**Figure 2.-** Drawings of telsons and photographs of whole animals corresponding to the four mysid species collected in the Rio de la Plata waters during 2001. a.- *Neomysis americana*, b.- *Mysidopsis tortonesei*, c.- *Mysidopsis rionegrensis*, d.- *Promysis atlantica*.

of juvenile to adult, and sex ratios. The fraction of brood-carrying females in samples from the RPE was comparable to the maximum found by Almeida-Prado (1973) at Cananea, also during autumn. During our study *M. tortonesei* was found in stations closer to the outer limit of the estuary and its abundance positively correlated with salinity,

evidencing a preference for salinities > 28 (Calliari *et al.*; 2007), which suggested complementary spatial distribution in relation to *N. americana* (i.e. almost non-overlapping). Salinity preferences at the RPE were broadly consistent with previous studies from Brazil and the one available for this same ecosystem (Almeida-Prado 1973, Schiariti *et al.*;

2004). At the RPE *M. tortonesei* was found in the salinity range 16 – 31, while in Cananea low numbers occurred at salinity ca. 14 and increased strongly at salinity >25.

***Mysidopsis rionegrensis*** Hoffmeyer 1993 (Fig. 2c)

**Diagnosis:** Morphology of animals examined corresponded closely to description by Hoffmeyer (1993). Large and laterally inclined eyes. Antennal scale lanceolated and slightly rounded, with the internal margin concave and the external slightly convex. Telson widest at its base, stretching to ca. 1/3 of maximum width near the distal end, but then slightly widening until the distal end; a pair of chromatophores are present at the basal region. Margins of telson result concave-shaped and have short spines. Distal region of telson rounded and with robust spines. Exopod of uropod with long setae on both margins, endopod of uropods with short setae on both margins and large statocyst.

Previous records of *Mysidopsis rionegrensis* restrict its distribution to the location of first description, the San Matías Gulf (Hoffmeyer 1993) and Nuevo Gulf (Menendez *et al.* 2011), as well as to Buenos Aires Atlantic coastal waters (Schiariti *et al.*, 2004).

In the present set of samples *M. rionegrensis* was found during the spring cruise when only three specimens were collected in the outermost region of the RPE. Individuals found corresponded to 1 male and 2 females.

This species was first described for the San Matias Gulf (41°S, Argentina) during the spring season (Hoffmeyer 1993). The location of first description suggested this was a primarily marine species living under high salinities and moderately cold waters. More recently *M. rionegrensis* was found during a spring cruise at a location slightly north of Golfo de San Matías (El Rincón, ca. 39° S; Schiariti *et al.* 2004) in a temperature range of 13 to 18 °C and salinities from 33.7 to 33.9.

This is the first report of the occurrence of *M. rionegrensis* in the RPE, which extends its known distribution range nearly 5° latitude northwards. During our study *M. rionegrensis* occurred at temperatures between 16.8 - 18.2 °C and salinities between 23.2 - 29.7. These are similar thermal conditions to those observed by Schiariti *et al.* (2004); however, in RPE *M. rionegrensis* occurred at salinities much lower than previously reported for this same species, suggesting it has important tolerance to relatively diluted salinities. The low number of specimens collected precludes definite statements, though. The same holds as regards the

nature of its occurrence in the RPE ecosystem: whether individuals found here were part of a population from the outskirts of the RPE, or if they represented individuals occasionally advected from a population further south. In the latter case, another issue regards the frequency and extension of such incursions. These are aspects that deserve further attention in next studies.

***Promysis atlantica*** Tattersall 1923 (Fig. 2d)

**Diagnosis:** Observations of individuals from the RPE closely resembled descriptions by Almeida-Prado (1974), unless otherwise noted. Conic eyes on a long cylindrical pedunculum, in a position nearly perpendicular to the main antero-postero body axis. Lanceolated scale with fine setae along the whole margin. Telson linguiform ca. 2.5 times as long as broad and with a cleft without spinules or setae nearly one sixth the length of the telson; spines present along external margins of the telson which increase in robustness from proximal to distal end, finishing with two strongest spines. The number of spines (22-25) corresponded with that described by Almeida-Prado and diverges from Tattersall (1923; *vide* Almeida-Prado 1974) and Clarke (1956), differences already discussed by Almeida-Prado (1974). A slight difference between our observations and Almeida-Prado is that in our specimens the series of spines on the margins of the telson do not start from the base but in the proximal third of the telson length. Endopod of uropod with large statocyst and inner margin armed along its length with spines of varying size. Exopod of uropods with setae along its whole length.

The known distribution of this species is also of a discontinued type with occurrences on the Atlantic coast of both North America (North and South Carolina, ca. 32 -35° N, Clarke 1956, Wigley & Burns 1971, Williams 1972; and Texas, ca. 28°N Price 1982) and South America (Rio de Janeiro, Governador Island, Tramandaí, latitudinal range 23 - 30° S; Tattersall 1923, Costa 1964, Almeida-Prado 1973, 1974, Tavares & Bond-Buckup 1990), and Lagoa dos Patos estuary (Gama 2008) .

In the current set of samples *Promysis atlantica* was found during the autumn cruise, also in very low abundances, mostly adult males and one juvenile. The present study is the first report on *P. atlantica* in the RPE and represents an extension of ca. 5° latitude to the south of its formerly known southernmost occurrence. At the RPE *P. atlantica* was found at a salinity range of 20 – 21 and temperatures from 14 to 15 °C, well below the temperature range reported for this same species in

Brazilian waters (19 – 27°C, Almeida-Prado 1973). As commented for *M. rionegrensis*, further information is necessary in order to establish the temporary vs. permanent character of *P. atlantica* occurrence in RPE waters.

This work adds two new species to the list of mysids from the RPE, which also implies an extension of their biogeographical distribution. One interesting aspect to note is the fact that for three out of four currently known mysids inhabiting RPE (*Mysidopsis tortonesei*, *Mysidopsis rionegrensis* and *Promysis atlantica*), this large scale estuary represents (so far) either the southern or the northern limit of their biogeographical distribution. That would suggest a role of the RPE as an ecological barrier for the distribution of mysid species in South Atlantic coastal waters, a pattern already documented for other littoral or inner shelf taxa (Escofet *et al.* 1979, Gianuca 1983, Spivak 1997, Boltovskoy *et al.* 1999).

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