



Estuarine use and composition of fish species in the Solís Grande sub-estuary, Uruguay

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Abstract. A total of 1,298 fish representing estuarine, freshwater, marine migrants, anadromous and catadromous species were caught. Dominance of postlarvae and juveniles was observed. *Mugil liza* was the most abundant species. *Jenynsia multidentata*, *Pogonias cromis* and *Cyprinus carpio* were new records of species for the Solís Grande sub-estuary.

Keywords: fish assemblage, juvenile area, functional diversity, *Mugil liza*, Río de la Plata, South American coastal ecosystem

Resumen. Uso estuarial y composición de las especies de peces en el sub-estuario Solís Grande, Uruguay. Fueron capturados un total de 1.298 peces, representando especies estuariales, dulciacuícolas, marino migrantes, anádromas y catádromas. Fue observada una dominancia de post-larvas y juveniles. *Mugil liza* fue la especie más abundante. *Jenynsia multidentata*, *Pogonias cromis* y *Cyprinus carpio* fueron nuevos registros de especies en el subestuario Solís Grande.

Palabras clave: asamblea de peces, área juvenil, diversidad funcional, *Mugil liza*, Río de la Plata, ecosistema costero de Sudamérica

Estuaries have been defined as important ecological areas for a wide variety of fish species, recognising the nursery, feeding and migration functions they provide, particularly for juveniles (Beck *et al.* 2001, Elliott & Hemingway 2002). Fish species can be assigned to functional guilds denoting the primary estuarine use made by them. Furthermore, spatial differences in functional use by species along an estuary are well-known and typically depend on the connection between the estuary and areas downstream and upstream of the estuarine environment (Elliott *et al.* 2007). The Solís Grande sub-estuary constitutes one of the largest estuaries on the Uruguayan coast. Different studies

were conducted in the Río de la Plata estuary (its main stream) (Jaureguizar *et al.* 2003, Jaureguizar *et al.* 2004, García *et al.* 2010, Lorenzo *et al.* 2011); however only a couple of studies were undertaken in the Solís Grande and limited to the estuary mouth (Giménez *et al.* 2003, Gurdek *et al.* 2011). The present study aimed to describe the fish composition along the Solís Grande sub-estuary as well as to provide results on estuarine use functional guilds of the ichthyofauna.

The Solís Grande sub-estuary (34°47'19" S, 055°23'40" W) (Figure 1) is a small microtidal estuarine system with an average flow of 14.5 m³/s (Cayssials *et al.* 2000), where brackish waters from

the Río de la Plata reach at least 10 km upstream (Muniz & Venturini 2001). Fish were collected at three replicate sites by seine net (12 m long, 2 m high, 12 mm knot-to-knot) at five sampling stations along a 10 km longitudinal transect of the estuary (Figure 1), in winter (1st September, 2012) and spring (25th November, 2012). Additionally, gill nets (40 m long, 1.7 m high, each one with four different mesh sizes: 20, 35, 55 and 80 mm knot-to-knot) were placed in the uppermost (station 1), middle (station 3) and lowest (station 5) portions of the estuary (Figure 1), in winter, spring and summer (2nd March, 2013). Fish were identified to species according to Ringuelet *et al.* (1967), Figueiredo & Menezes (1978), (1980), Menezes & Figueiredo (1980), Menni *et al.* (1984), Menezes & Figueiredo (1985), Figueiredo & Menezes (2000), Ghedotti *et al.* (2001) and Dyer (2006), counted and measured to the nearest 0.1 cm. Additionally, considering the way fish use the estuary during their whole life cycle (based on the available literature), species were categorised by functional guilds according to Franco *et al.* (2008a) and each species was assigned to an estuarine use functional guild (Table I). The estuarine use functional guilds considered were marine stragglers, marine migrants, estuarine species, freshwater species, catadromous species and anadromous species. The percentage contribution of each functional guild to the total number of species was calculated.

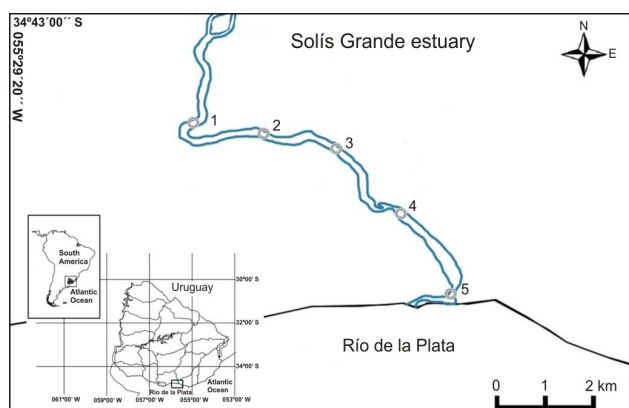


Figure 1. Study area of the Solís Grande sub-estuary, Uruguay. Grey circles indicate fish sampling stations along the sub-estuary. Fishing gears: beach seine net (stations 1 to 5, during winter-spring 2012) and gill nets (stations 1, 3 and 5, during winter-spring 2012 and summer 2013).

A total of 1,298 fish, representing 11 species and 9 families were caught over the study period (Table I). Among them 45.5% were estuarine species, 27.3% freshwater species, 9.1% marine

migrants, 9.1% catadromous species and 9.1% anadromous species. Juveniles were largely represented in the community (90.9%) (Table I). *Mugil liza* Valenciennes, 1836 (55%), *Jenynsia multidentata* (Jenyns, 1842) (18%), *Platanichthys platana* (Regan, 1917) (11.3%), *Brevoortia aurea* (Spix & Agassiz, 1829) (3.9%) and *Micropogonias furnieri* (Desmarest, 1823) (4.2%) contributed to more than 90% of the total capture (Table I). Differences were observed regarding estuarine use when the spatial distribution of species was considered. Freshwater species *C. carpio* Linnaeus, 1758, *J. multidentata* and *P. platana* and anadromous *Lycengraulis grossidens* (Spix & Agassiz, 1829) occurred in the upper and middle zones of the estuary (Table I). Estuarine species *B. aurea*, *M. furnieri*, *Odontesthes argentinensis* (Valenciennes, 1835) and *Pogonias cromis* (Linnaeus, 1766) were caught along the entire estuary. On the other hand, catadromous *M. liza* was caught along the estuary with the exception of the mouth, and estuarine *Paralichthys orbignyanus* (Valenciennes, 1839) and marine migrant *Pomatomus saltatrix* (Linnaeus, 1766) were limited to the lower portions (Table I). Neither strictly freshwater nor strictly marine species were caught during the study period along the Solís Grande sub-estuary.

Collected species in the present study coincided with those collected by Gurdek *et al.* (2011) and Giménez *et al.* (2003) in the lowest portion of the Solís Grande; however *J. multidentata*, *P. cromis* and the invasive species *C. carpio* represented new records of species for the Solís Grande sub-estuarine area. On the other hand, fish species registered in the Solís Grande area, with the exception of *Jenynsia multidentata*, coincided with those collected in the Pando sub-estuary, a similar estuarine system on the Uruguayan coast (Acuña *et al.* 2010). Most specimens caught in the Solís Grande were previously described by Jaureguizar *et al.* (2004) and García *et al.* (2010) in the Río de la Plata estuary. Moreover, most estuarine species found in Solís Grande estuary, largely represented by juveniles, present their spawning grounds in the Río de la Plata estuary (Macchi *et al.* 1996, Acha & Macchi 2000, Macchi *et al.* 2002, Militelli *et al.* 2007). Thus, it is suggested that the Solís Grande sub-estuarine system has an important role in the life cycles of fishes that use the Río de la Plata as spawning ground. Also, abundance, distribution and length range of the catadromous *M. liza* in the Solís Grande sub-estuary advise on the

utilisation of the system as a potential nursery area by post-larvae and juveniles of these migrant species. Dominance by juveniles in estuarine fish populations is a common pattern found in sub-estuaries along the Uruguayan coast (Retta *et al.* 2006; Acuña *et al.* 2015), as well as in estuaries around the world due to nursery functions they provide, i.e. feeding and refuge grounds (Potter &

Hyndes 1999, Cardoso *et al.* 2011, Martinho *et al.* 2012). Another common pattern found in Solís Grande was the existence of only a few dominant species. In this sense, only a range of species are able to thrive and grow in highly dynamic systems encountered in estuaries (Elliott & Hemingway 2002).

Table I. Fish assemblage collected along the Solís Grande sub-estuary, Uruguay. St: sampling station (St1: uppermost, St5: lowest); N%: percentage contribution to total number of fish; J%: percentage of juveniles; LR: length range; EUG: estuarine use guild; ES: estuarine species; FW: freshwater species; MM: marine migrants; A: anadromous species, C: catadromous species.

Family	Species	St1	St2	St3	St4	St5	N%	J%	LR (cm)	EUG
Clupeidae	<i>Brevoortia aurea</i>	26	-	13	2	10	3.9	52.9	6-31.5	ES
	<i>Platanichthys platana</i>	17	93	-	37	-	11.3	100	1.7-6.9	FW
Engraulidae	<i>Lycengraulis grossidens</i>	-	1	-	-	-	< 0.1	100	8.6	A
Cyprinidae	<i>Cyprinus carpio</i>	5	-	1	-	-	0.5	0	45-75	FW
Atherinopsidae	<i>Odontesthes argentinensis</i>	3	1	7	11	34	4.3	89.3	2.2-32.5	ES
Anablepidae	<i>Jenynsia multidentata</i>	172	4	15	42	-	18	73.8	1.6-7.2	FW
Mugilidae	<i>Mugil liza</i>	136	-	33	545	-	55	100	2-36.7	C
Pomatomidae	<i>Pomatomus saltatrix</i>	-	-	-	-	1	< 0.1	100	32.9	MM
Sciaenidae	<i>Micropogonias furnieri</i>	20	1	11	19	3	4.2	87	3.7-49	ES
	<i>Pogonias cromis</i>	3	-	10	-	-	1	7.7	22.7-51.3	ES
Paralichthyidae	<i>Paralichthys orbignyanus</i>	-	-	-	18	4	1.7	90.9	5-75.6	ES

Larger representation of estuarine species in the Solís Grande sub-estuary differed to those found in European and Brazilian estuaries by Franco *et al.* (2008a,b), Selleslagh *et al.* (2009), Nicolas *et al.* (2010), Reis-Filho *et al.* (2010), Cardoso *et al.* (2011) and Passos *et al.* (2013), where fish assemblages were mostly represented by marine species. On the other hand, a similar situation was registered in the Pando sub-estuary by Acuña *et al.* (2010), with a dominance of estuarine and freshwater species. This contrast could be attributed to the own environmental nature of sub-estuaries, which flow into estuarine systems (e.g., Río de la Plata estuary) rather than oceanic waters. Longitudinal distribution of estuarine fish in the study area was similar to those found by Nicolas *et al.* (2010) and Breine *et al.* (2011) in temperate estuaries from Europe, suggesting salinity as a main controlling factor of estuarine fish distribution. Similarly, Acuña *et al.* (2010) and Bruno *et al.* (2013) defined the salinity, temperature, fluvial discharge and winds as relevant factors influencing the composition and distribution of estuarine fish communities.

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