PANAMJAS
Pan-American Journal of Aquatic Sciences

Scientific Note

Fish species list of coastal streams in southern Brazil, with notes on austral distribution limits of marine and freshwater endangered species

RODRIGO FERREIRA BASTOS[1*,2,3], MARIO VINICIUS CONDINI[1,4] & ALEXANDRE MIRANDA GARCIA[1,3,4]

[1]*Universidade Federal do Rio Grande, Instituto de Oceanografia, Laboratório de Ictiologia. Campus Carreiros, Base Oceanográfica, Av. Itália Km 8, Bairro Carreiros, Rio Grande, RS, Brazil. *Corresponding autor: rfbastos@furg.br*
[2]*Universidade Católica do Rio Grande do Sul, Faculdade de Biociências, Departamento de Biodiversidade e Ecologia, Laboratório de Ecologia Aquática, Pontifícia. Av. Ipiranga, 6681, Partenon, Porto Alegre, RS, Brazil.*
[3]*Universidade Federal do Rio Grande, Instituto de Ciências Biológicas, Programa de Pós Graduação em Biologia de Ambientes Aquáticos Continentais (PPG-BAAC).*
[4]*Universidade Federal do Rio Grande, Instituto de Oceanografia, Programa de Pós Graduação em Oceanografia Biológica (PPG-OB).*

Abstract. We studied three coastal streams (washouts) in southern Brazil. We found 41 fish species, of which, *Dormitator maculatus*, *Eleotris pisonis*, *Austrolebias minuano* (endangered) and *Lutjanus cyanopterus* (endangered) had their austral distribution limits extended.

Key words: coastal streams, ecotones, killifish, geographical distribution, conservation

Resumo. Lista das espécies de peixes dos riachos de planície costeira no sul do Brasil, com notas sobre os limites de distribuição austral de espécies marinhas e de água doce ameaçadas. Estudamos três riachos costeiros (sangradouros) costeiros no sul do Brasil. Encontramos 41 espécies, das quais, *Dormitator maculatus, Eleotris pisonis*, *Austrolebias minuano* (ameaçada) e *Lutjanus cyanopterus* (ameaçada) tiveram seus limites austrais de distribuição ampliados.

Palavras chave: riachos costeiros, ecótonos, peixe anual, distribuição geográfica, conservação

In aquatic environments, clear ecotones are formed at the interface between sea and freshwater, usually with the formation of estuarine regions. From an ecological perspective, coastal streams could be considered as marine-freshwater ecotones harboring fish assemblages composed of estuarine, marine and freshwater species. In fact, prior studies on coastal streams along the South African coast have shown that they support a diverse fish fauna, consisting of marine and freshwater fishes (Whitfield 1999, Vorwerk *et al.* 2003).

The coastline of Rio Grande do Sul (RS), the southernmost state in Brazil, is characterized by a long stretch of sand beaches (c.a. 620 km) associated with an extensive dune field. The foredunes ridges are nearly continuous along the coast, being interrupted by fluvial-lagoon discharges that form estuaries (Schwarzbold & Shafer 1984). Aside these well-studied estuaries, there are numerous coastal streams or washouts (locally known as 'sangradouros', *sensu* Figueiredo & Calliari 2006), that burst out the foredunes ridges, draining coastal wetlands and lagoons towards the coast.

In order to evaluate for the first time the fish species composition of coastal plain streams at southern Brazil, we investigated three coastal streams, hereafter code as S1 (32º17'23.5" S, 52º15'39.2" W), S2 (32º21'34.9" S, 52º18'39.9" W) and S3 (32º23'14.7" S; 52º19'26.7" W) (Fig. 1a). They were monthly sampled from April 2010 to March 2011, from their connection with the sea to upstream areas (c.a. 500 m), near the freshwater wetlands behind the foredunes (Fig. 1b, c). Fish were caught with three different sampling devices

aiming to capture the highest number of fish species. The three fishing devices were: a) a 9-m long beach seine (with meshes of 13 mm in the wings and 5 mm in the center) built with multifilament mesh and without bag, which was employed along the margins of each washout, b) a beam trawl with its mouth built with a square-shaped PVC rigid frame (0.8 x 0.8 m) coupled to a multifilament mesh bag (5 mm) and c) a dip net (39 cm diameter, 5 mm multifilament mesh), which was operated for 15 minutes at downstream and upstream reaches.

A total of 41 species belonging to seven orders and 19 families were collected in the coastal streams (Table I). Three of the families recorded (Eleotridae, Lutjanidae and Rivulidae) had species with austral distribution limits extended in this study. Helfman *et al.* (2009) considered Eleotridae as a peripheral freshwater family, *i.e.*, members of this family can spend most of their life cycle associated with freshwater habitats and typically occupy marine-freshwater ecotones. *Dormitator maculatus* and *Eleotris pisonis*, in particular, are relatively infrequent in southern Brazil, being more common at the northeast (Teixeira 1994) and southeast (Perrone & Vieira 1990) regions. They are found at downstream reaches of streams and rivers, associated with vegetated habitats (Perrone & Vieira 1990, Teixeira 1994). Loebmann & Vieira (2005) reported the occurrence of these species at the 'Lagoa do Peixe' National Park (31º26'37.3''S; 51º09'44.8''W and 31º14'0.8''S; 51º00'49.8''W) as its southernmost austral distribution. Volcan *et al.* (2010) reported the presence of *D. maculatus* in freshwater streams emptying into the northern reaches of Patos Lagoon estuary. Our study increases the southernmost distribution of *D. maculatus* and *E. pisonis* approximately 100 km south of that reported by Volcan *et al.* (2010) and 180 km south of that record by Loebmann & Vieira (2005).

Table I. Fish species list of coastal streams in southern coastline of Rio Grande do Sul state, Brazil. S1, S2 and S3 denote the studied coastal streams (see Fig. 1).

Taxa	S1	S2	S3	Taxa	S1	S2	S3
CHARACIFORMES				ATHERINIFORMES			
Crenuchidae				**Atherinopsidae**			
Characidium rachovii	X	X	X	*Atherinella brasiliensis*	X	X	X
Characidae				CYPRINODONTIFORMES			
Astyanax eigenmanniorum	X	X	X	**Rivulidae**			
Astyanax aff. *fasciatus*	X	X	X	*Austrolebias minuano*	X		X
Astyanax spp.	X	X	X	**Anablepidae**			
Cheirodon ibicuhiensis	X	X	X	*Jenynsia multidentata*	X	X	X
Cheirodon interruptus	X	X	X	**Poeciliidae**			
Hyphessobrycon anisitsi			X	*Cnesterodon decemmaculatus*	X	X	X
Hyphessobrycon bifasciatus	X	X	X	*Phalloceros caudimaculatus*	X	X	X
Hyphessobrycon boulengeri	X	X	X	SYNBRANCHIFORMES			
Hyphessobrycon luetkenii	X	X	X	**Synbranchidae**			
Hyphessobrycon meridionalis		X	X	*Synbranchus* spp.		X	
Mimagoniates inequalis	X	X	X	PERCIFORMES			
Oligosarcus jenynsii	X	X	X	**Carangidae**			
Erythrinidae				*Trachinotus marginatus*			X
Hoplias aff. *malabaricus*	X	X	X	**Lutjanidae**			
SILURIFORMES				*Lutjanus cyanopterus*	X		
Callichthyidae				**Gerreidae**			
Callichthys callichthys			X	*Eucinostomus melanopterus*	X	X	X
Corydoras paleatus	X	X	X	**Sciaenidae**			
Hoplosternum littorale	X	X	X	*Micropogonias furnieri*		X	
Heptapteridae				**Cichlidae**			
Heptapterus sympterygium	X	X	X	*Australoheros acaroides*	X	X	X
Pimelodella australis	X	X	X	*Cichlasoma portalegrense*	X	X	X
Rhamdia quelen	X	X	X	*Crenicichla lepidota*	X	X	X
Auchenipteridae				*Geophagus brasiliensis*	X	X	
Trachelyopterus lucenai		X		**Eleotridae**			
MUGILIFORMES				*Dormitator maculatus*		X	X
Mugilidae				*Eleotris pisonis*			X
Mugil curema	X	X	X	**Gobiidae**			
Mugil gaimardianus	X	X	X	*Ctenogobius shufeldti*	X	X	X
Mugil liza	X	X	X				

Another species that had its austral distribution widened in the present study was the cubera snapper *Lutjanus cyanopterus*. This species belongs to the Lutjanidae family, which is widely distributed throughout the warm seas of the world. Juveniles of some species, especially *L. cyanopterus*, recruit into estuaries and lower reaches of rivers. The species is globally considered threatened, and has been classified in the vulnerable category by the IUCN (IUCN, 2011). The cubera snapper is distributed from Nova Scotia and Bermuda to southeast Brazil (Menezes & Figueiredo 1985, Carpenter 2002). However, a prior study on this species along the Brazilian coast (from northeast to southeast region) carried out by Begossi *et al.* (2011) recorded only one individual of *L. cyanopterus* at Copacabana beach (Rio de Janeiro municipality). Adults have been observed in fish landings in southern Brazil (Luciano Gomes Fischer, pers. com.), but up to now, there were no records of juveniles in southern Brazil states, such as Rio Grande do Sul (*e.g.*, data from site 'Patos Lagoon estuary' of the Brazilian-Long Term Ecological Research), Santa Catarina (Barreiros *et al.* 2009, Spach *et al.* 2010) and Paraná (Vendel *et al.* 2002, Contente *et al.* 2011). Hence, our current record of juveniles of this species in coastal streams increases in approximately one thousand kilometers the southernmost austral distribution of this species, and also suggests the possibility of a reproducing population in southern Brazil.

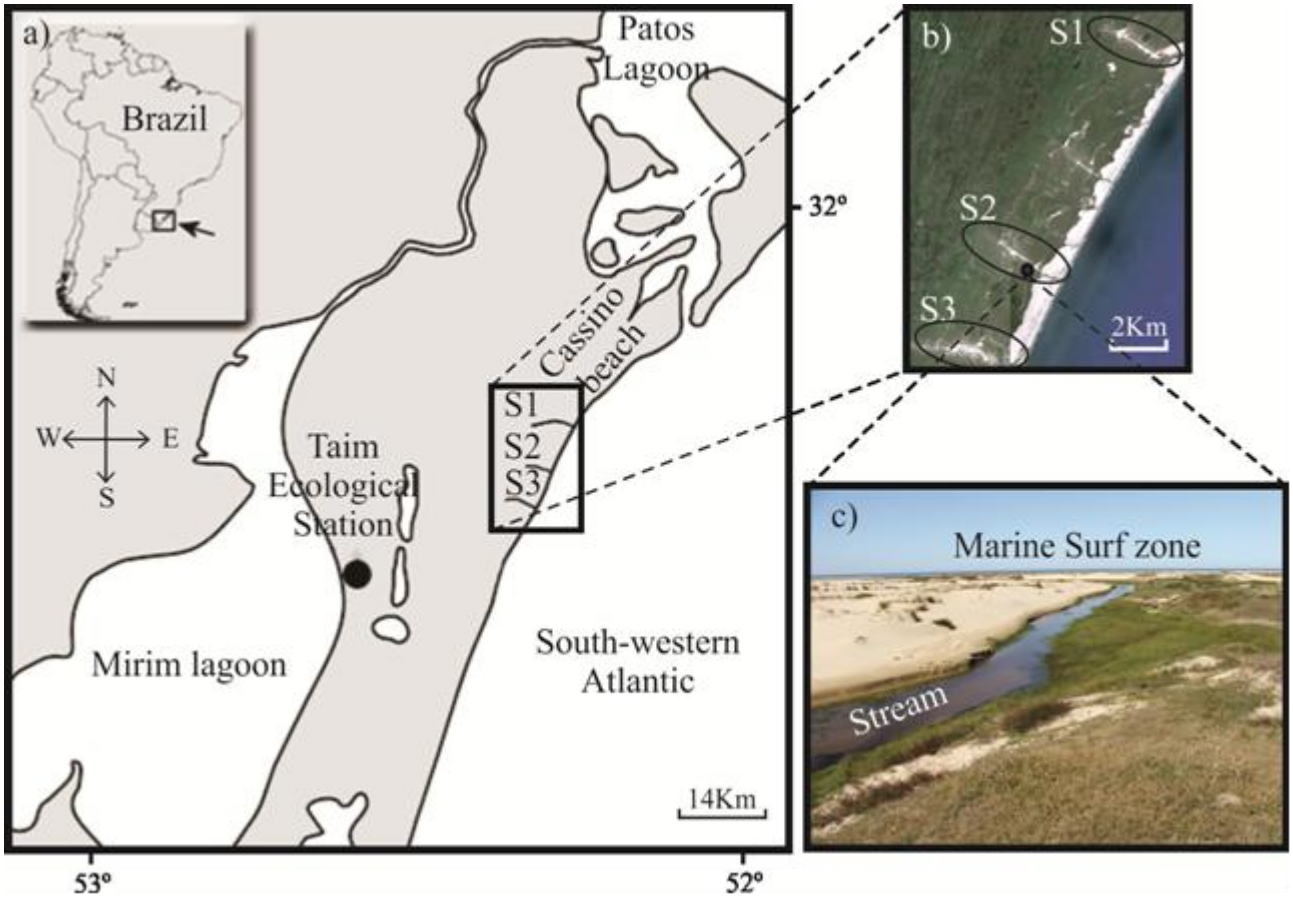

Figure 1. Study area (a) showing the studied coastal streams (S1, S2, S3) (a, b). Picture taken by one of the authors (AMG) in the middle portion of the washout S2, showing in the horizon the adjacent marine surf zone area (c).

It is also worth noting the occurrence of the Rivulidae *Austrolebias minuano* in our study. Rivulida species are known as killifishes and they represent the freshwater fish family with the largest number of endangered species in Brazil (Machado *et al.* 2008). The genus *Austrolebias* is conspicuous to coastal plains of southern Brazil, Uruguay, Paraguay and northern and northeastern of Argentina. They typically occur in shallow areas that usually dry out during summer and are there sheltered from predators. During such drought periods, adults die and their eggs remain buried into the sediment in a

state of diapause. Later, when the environment is again flooded, the eggs hatch and their life cycle continues (Costa 2006). Individuals registered in our study were collected at the flooded margins of studied streams (S1 and S3) during winter months, when there are higher rates of precipitation in the region (Krusche *et al.*, 2003). *Austrolebias minuano* is considered as an endangered species in Brazil (Machado *et al.* 2008). Our current record of *A. minuano* in the flooded margins of the coastal streams represents the southernmost austral distribution limit for this species, increased in approximately 40 km in relation to previous records (Porciúncula *et al.* 2006, Quintela *et al.* 2007).

In summary, the present research shows that coastal streams in southern Brazil are transitional environments (ecotones) between marine and freshwater ecosystems that harbor a diverse fish fauna, composed of freshwater and marine/estuarine species. Furthermore, it is important to emphasize that the occurrence of endangered species in the coastal streams (e.g. cubera snapper *Lutjanus cyanopterus* and killifish *Austrolebias minuano*) reinforces the need to protect these unique and poorly investigated coastal ecosystems from the increasing anthropogenic pressure (e.g. exotic pine-trees cultivation, urbanization of littoral areas, heavy tourism, stablishment of wind farms, etc.) currently occurring in the coastal plain of southern Brazil.

Acknowledgements

We thank numerous colleagues of the Laboratório de Ictiologia, Instituto de Oceanografia, Universidade Federal do Rio Grande (FURG) who have assisted in the field collection and in the laboratory work. We also thanks João Paes Vieira, Daniel Loebmann and Nelson Ferreira Fontoura for review early version of this manuscript. RFB thanks MSc. grant received from the *Comissão de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) and *Programa de Reestruturação das Universidades Federais* (REUNI).

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Received February 2013
Accepted November 2013
Published online December 2013