



Taxonomy and systematics

Macroparasites of silversides (Atherinopsidae: *Odontesthes*) in Argentina

Macroparásitos de pejerreyes (Atherinopsidae: *Odontesthes*) en Argentina

Verónica Flores^{a,*}, Liliana Semenas^a, Carlos Rauque^a, Rocío Vega^a,
Valeria Fernandez^a, María Lattuca^b

^a Laboratorio de Parasitología, Instituto de Investigaciones en Biodiversidad y Medioambiente del Consejo Nacional de Investigaciones Científicas y Técnicas – Universidad Nacional del Comahue, Quintral 1250, 8400 Bariloche, Río Negro, Argentina

^b Laboratorio de Ecofisiología, Centro Austral de Investigaciones Científicas (CADIC-CONICET), Bernardo Houssay 200, V9410BFD Ushuaia, Tierra del Fuego, Argentina

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Abstract

This study presents new geographical distribution records for the macroparasites of the marine *Odontesthes nigricans* (Richardson, 1848) (89 wild specimens), and for the freshwater silversides *Odontesthes bonariensis* (Valenciennes, 1835) (43 wild and 108 cultured specimens), and *Odontesthes hatcheri* (Eigenmann, 1909) (183 wild specimens) from Argentina. These data represent records of 12 parasite taxa for *O. nigricans*, 8 for *O. bonariensis*, and 19 for *O. hatcheri*, which include digeneans, monogeneans, cestodes, nematodes, acantocephalans, mollusks, copepods, and branchiurans. For cultured *O. bonariensis*, the records of the present study correspond to the first reports of parasites in the literature. This work provides also data on site of infection, parasite load, and development stages for the parasite species.

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Keywords: *Odontesthes nigricans*; *Odontesthes bonariensis*; *Odontesthes hatcheri*; Parasites; Argentina; Freshwater; Marine; Wild; Cultured

Resumen

Este estudio presenta nuevos registros de distribución geográfica de macroparásitos del pejerrey marino *Odontesthes nigricans* (Richardson, 1848) (89 especímenes silvestres), de los pejerreyes de agua dulce *Odontesthes bonariensis* (Valenciennes, 1835) (43 ejemplares silvestres y 108 cultivados) y de *Odontesthes hatcheri* (Eigenmann, 1909) (183 especímenes silvestres) en Argentina. Doce taxones parásitos se registraron para *O. nigricans*, 8 para *O. bonariensis* y 19 para *O. hatcheri*, incluyendo digéneos, monogéneos, cestodos, nematodos, acantocéfalos, moluscos, copépodos y branquiuros. Para los ejemplares de *O. bonariensis* de cultivo, los registros del presente estudio corresponden a los primeros sobre parásitos en la literatura. Además, se presentan datos sobre la localización del parásito, sus valores de infección y sus estados de desarrollo.

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Palabras clave: *Odontesthes nigricans*; *Odontesthes bonariensis*; *Odontesthes hatcheri*; Parásitos; Argentina; Agua dulce; Marinos; Silvestres; De cultivo

Introduction

The species of *Odontesthes* (silversides) compose the most representative genus of Atherinopsidae, containing 19 species

(Dyer, 2006). The silversides have great adaptability to different habitats and are distributed in marine, brackish, and freshwater environments (Dyer, 2006). Due to the flavor of the meat, these fishes are important in recreational fishery, commercial exploitation, and aquaculture (Grosman, 2001). *Odontesthes bonariensis* (Valenciennes, 1835) is the only cultured species, and has been widely used for repopulation purposes and have been introduced into Europe, Asia, and Africa (Tombari & Volpedo, 2008).

* Corresponding author.

E-mail address: veronica.flores@crub.uncoma.edu.ar (V. Flores).

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In Argentina, studies on freshwater silversides are mainly focused on culture, genetics, physiology, and ecology of *O. bonariensis* (Colautti, García, Balboni, & Baigún, 2010; Grosman, 2001), and of *Odontesthes hatcheri* (Eigenmann, 1909) (Ruiz, 2007). The information on the marine silversides is limited, based mainly on *Odontesthes nigricans* (Richardson, 1848) and focused on the physiology of the specimens (Lattuca et al., 2009).

Although silversides species are widely distributed, reports of parasites from wild fishes are scarce and scattered (Carballo, 2008; Carballo, Laurenti, & Cremonte, 2011; Carballo, Navone, & Cremonte, 2011; Carballo, Cremonte, Navone, & Timi, 2012; Drago, 2012; Mancini, Rodríguez, Prospero, Salinas, & Bucco, 2006; Mancini et al., 2008; Ortubay, Semenas, Úbeda, Quaggiotto, & Viozzi, 1994). Besides publications on rearing silversides, there is no published information on their parasites (Tanzola, Semenas, & Viozzi, 2009). The objective of the present work is to report the macroparasite fauna of the wild marine *O. nigricans* and the wild freshwater *O. bonariensis* and *O. hatcheri*, and the cultured *O. bonariensis*.

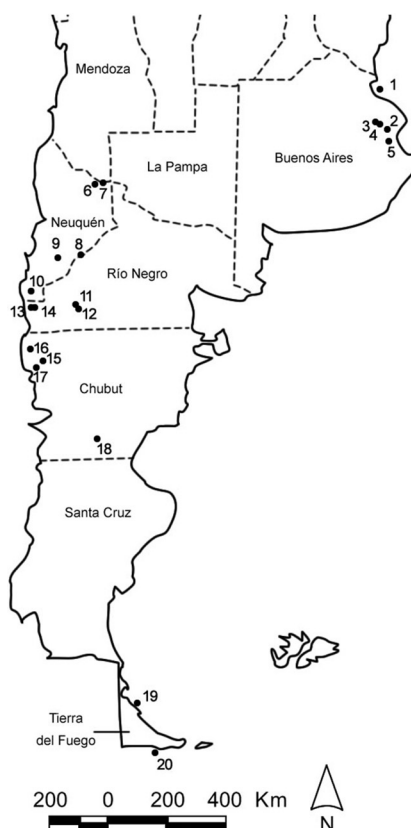
Materials and methods

A total of 89 *O. nigricans* were collected from 2 marine sites, 151 *O. bonariensis* were collected from 5 sites, and 183 *O. hatcheri* were collected from 13 sites, both the latter from freshwater environments (Fig. 1; Table 1). The fish were captured using gill and seine nets. Cultured *O. bonariensis*

were collected from outdoor man-made ponds and indoor fiberglass tanks located within the campus of INTECH (Instituto Tecnológico de Chascomús), which were supplied with underground waters, and from floating cages located in Lacombe and Chascomús Pampean Lakes (Fig. 1; Table 1). Specimens of *O. hatcheri* and *O. bonariensis* were transported fresh to the laboratory, and those of *O. nigricans* were slit opened and fixed in 5% formalin in the field. Fish were measured, and necropsied to examine fins, skin, eyes, gills, and all internal organs with the aid of a dissecting microscope. The parasites were collected, identified, and counted. Prevalence and mean intensity were calculated. New geographical record refers to the first date that a parasite is reported in a new biogeographic region, ecoregion or basin, and new host record refers to the first time that a parasite is cited for a new host species. Furthermore, we followed the classification proposed by Niewiadomska (2002) for the family Diplostomidae, who considered as valid the genera *Diplostomum*, *Austrodiplostomum*, *Tylodelphys*, and *Dolichorchis*. Measurements of specimens are given in μm . Voucher specimens of parasites were deposited in the Colección Helmintológica del Museo de La Plata, Argentina.

Results

The data obtained represent 15 new geographical records and 2 new host records for *O. nigricans* (Fig. 2; Table 2); 2 new geographical records, 1 new host record (*T. cardiophilus*), and a new species (*Gyrodactylus* sp.) for *O. bonariensis* (Fig. 3;



Odontesthes bonariensis

1. Wild fish from La Plata River (34°28' S 58°23' W)
2. Man-made Pond (INTECH) (35°37' S 57°59' W)
3. Cages from Chascomús Pampean Lake (35°37' S 58°00' W)
4. Wild fish Chascomús Pampean Lake (35°37' S 58°00' W)
5. Cages from Lacombe Pampean Lake (35°49' S 57°53' W)

Odontesthes hatcheri

6. Marimenuco Reservoir (38°32' S 69°25' W)
7. Neuquén River (38°34' S 68°23' W)
8. Piedra del Águila Reservoir (40°02' S 70°04' W)
9. Calefufu River (40°23' S 70°44' W)
10. Pond in Villa la Angostura (40°50' S 71°38' W)
11. Carrilafquen Lake (41°07' S 69°25' W)
12. Carrilafquen Chica Lake (41°12' S 69°25' W)
13. Morenito Lake (41°02' S 68°34' W)
14. Moreno Oeste Lake (41°06' S 71°32' W)
15. Lezana Lake (42°27' S 71°29' W)
16. Epuyen Lake (42°15' S 71°25' W)
17. Rivadavia Lake (42°36' S 71°39' W)
18. Musters Lake (45°25' S 69°11' W)

Odontesthes nigricans

19. Punta María (Atlantic Ocean) (53°57' S 67° 27' W)
20. Varela Bay (Atlantic Ocean) (54°52' S 67°16' W)

Figure 1. Location of the sampling sites of the silversides and their geographical coordinates in Argentina.

Table 1
Data of silversides, localities of collections, sample, date and size; § cultured fish.

Host	Localities	Sample date	Sample size	Standard fish size (cm)		
				Mean	Range	
<i>O. nigricans</i>	Punta María	Nov. 2010	67	16.8	9–25	
	Varela Bay	Sep. 2010				
		Jan. 2011	22	22.1	18–25	
<i>O. bonariensis</i>	La Plata River	Mar. 2011	11	18.5	10–27	
	Man-made Pond (INTECH) §	Nov. 2007	10	11.4	9–16	
	Chascomús Pampean Lake §	Mar. 2008	77	10.3	8–14	
	Chascomús Pampean Lake	Mar. 2008	32	14.6	9–24	
	Lacombe Pampean Lake §	Nov. 2007	21	14	13–15	
	Marimenuco Reservoir	Mar. 2001	7	14.0	3–31	
	Neuquén River	Oct. 2011	5	26.7	24–30	
	Piedra del Águila Reservoir	Feb. 1999	1	38.0	38	
	Caleufu River	Mar. 2006	3	7.0	6–8	
	Pond in Villa la Angostura	Jan. 2007	2	2.7	2–3	
	Carrilafquen Lake	Oct. 2005	10	21.1	20–22	
	<i>O. hatcheri</i>	Carrilafquen Chica Lake	Oct. 2004	58	14.6	8–30
			Aug. 2005			
Morenito Lake		Feb. 1999	10	25.4	17–31	
		Nov. 2000				
Moreno Oeste Lake		Mar. 1999	16	31.1	28–36	
		Aug. 2000				
Lezana Lake		Dec. 2010	31	6.9	6–9	
		Jan. 2011				
Epuyen Lake		Mar. 2003	3	25.3	22–27	
Rivadavia Lake		Feb. 2011	27	12.8	6–18	
Musters Lake	Oct. 2012	10	29.8	27–32		

Table 3); and 24 new geographical records and 1 new host record (*Steganoderma szidati*) for *O. hatcheri* (Fig. 4; Table 4). Prevalence and mean intensity for each parasite species, which include digeneans, monogeneans, cestodes, nematodes, acanthocephalans, mollusks, copepods and branchiurans, are given in Tables 2–4.

The marine silverside, *O. nigricans*, was parasitized by the digeneans *Diplostomum* sp., *Lecithaster* sp., *Proctotrema bartolii* Carballo, Laurenti, & Cremonte, 2011. The following nematodes *Acuariinae* gen. et sp., *Cosmocephalus* sp., *Contracaecum* sp., *Hysterothylacium* sp. and *Cucullanus* sp., the acanthocephalans *Hypochoerhynchus* sp. and *Corynosoma* sp., and the copepods *Caligus rogercresseyi* (Boxshall & Bravo, 2000) and *Peniculus* sp. were also recorded (Table 2). The specimens of *Diplostomum* were assigned to this genus since they are metacercariae of the “*Diplostomulum*” type (not encysted metacercariae), which were localized in the lens of fish. The metacercariae measured 260–701 in length × 144–326 width, had the anterior end of the body trilobate, with small lateral protuberances (lappets) on either side of the oral sucker (36–72 long × 36–65 wide); the ventral sucker (26–72 long × 29–65 wide) was located postequatorially and is similar in size to that of the oral sucker. Just behind the ventral sucker there is a longitudinal holdfast organ (65–168 long). The specimens of *Lecithaster* sp. collected presented a 4-lobed ovary and a vitellarium rosette-shaped with 7 lobes. The larvae 3 of *Acuariinae* gen. et sp. have well developed pseudolabia, but the lateral alae are absent, therefore they could not be assigned to any known

genus. The *Cucullanus* specimens collected in this study (1 male and 2 immature females) have the deirids located in the first third of the esophagus (182–193 from the anterior end), absence of papillae anterior to ventral sucker, presence of gubernaculum, and spicules reaching anterior end of ventral sucker. *Peniculus* sp. have a cephalothorax of 454 long × 511 wide; a neck of 227–284 long, a trunk 3,550–4,658 long × 880–1,227 wide, a ratio length to wide trunk of 3.6–4.0, with 4 swimming legs, with 3 and 4 further apart from legs 1 and 2.

The freshwater silverside *O. bonariensis* was parasitized by metacercariae of *Austrodiplostomum mordax* Szidat and Nani, 1951, *Tylodelphys cardiophilus* Szidat, 1969, *Ascocotyle* sp., and *Phagicola* sp., the monogenean *Gyrodactylus* sp., the cestode *Cangatiella macdonaghi* (Szidat & Nani, 1951), the nematode *Contracaecum* sp., and the branchiuran *Argulus* sp. (Table 3). *Odontesthes hatcheri* was parasitized by the digeneans *A. mordax*, *Diplostomum* sp., *Tylodelphys barilocheensis* Quaggiotto and Valverde, 1992, *T. cardiophilus*, *Tylodelphys destructor* Szidat and Nani, 1951, *Ascocotyle* sp., *Phagicola* sp., *Stephanoprora uruguayense* Holcman-Spector and Olagüe, 1989, *Steganoderma macrophallus* Szidat and Nani, 1951, and *Steganoderma szidati* Viozzi, Flores and Ostrowski de Núñez, 2000, the cestodes *C. macdonaghi*, the nematodes *Contracaecum* sp., *Hysterothylacium patagonense* Moravec, Urawa and Coria, 1997, and *Camallanus corderoi* Torres, Teuber and Miranda, 1990, the acanthocephalans *Acanthocephalus tumescens* (von Linstow, 1896) and *Pomphorhynchus patagonicus* Ortubay, Úbeda, Semenas and Kennedy, 1991, the mollusk

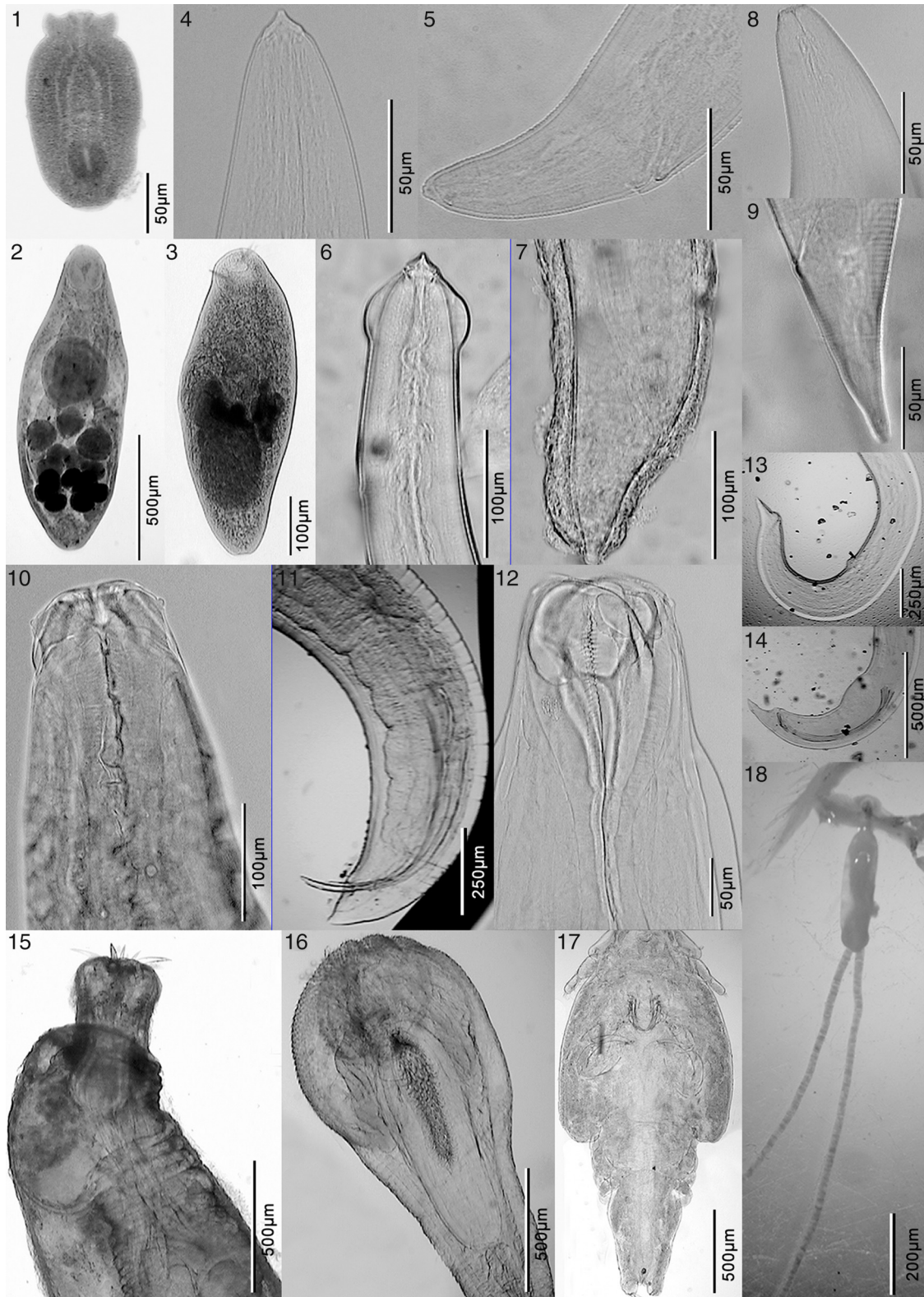


Figure 2. Microphotographs of *Odontesthes nigricans* parasites. 1, *Diplostomum* sp.; 2, *Lecithaster* sp.; 3, *Proctotrema bartolii*; 4, anterior end of *Acuariinae* sp.; 5, posterior end of *Acuariinae* sp.; 6, anterior end of *Cosmocephalus* sp.; 7, posterior end of *Cosmocephalus* sp.; 8, anterior end of *Contracaecum* sp.; 9, posterior end of *Contracaecum* sp.; 10, anterior end of *Hysterothylacium* sp.; 11, posterior end of *Hysterothylacium* sp.; 12, anterior end of *Cucullanus* sp.; 13, posterior end of a *Cucullanus* sp. female; 14, posterior end of a *Cucullanus* sp. male; 15, forebody of *Hypoechinorhynchus* sp.; 16, *Corynosoma* sp.; 17, *Caligus* sp.; 18, *Peniculus* sp.

Table 2

Parasites of *Odontesthes nigricans* with data on site of infection, parasitic stage, localities, prevalence (P), mean intensity (MI), voucher specimens (VS), and collection number (CN). A, adult; C, Cysthacanth; L3, Larva 3; M, Metacercaria. *New geographical record; †new host record; ‡cultured fish.

Parasite	Site	Stage	Locality	P (%)	MI	VS-CN
<i>Diplostomum</i> sp.†	Lens	M	Varela*	8.6	8.0	MLP-He 7125
<i>Lecithaster</i> sp.	Intestine	A	Varela*	30.0	11.6	MLP-He 7126
<i>Proctotrema bartolii</i>	Intestine	A	Punta María*	48.4	16.5	MLP-He 7127
Acuariinae gen. et sp.†	Liver and abdominal cavity	L3	Punta María*	12.9	1.8	MLP-He 7128
			Varela	15.7	1.9	
<i>Cosmocephalus</i> sp.	Liver and abdominal cavity	L3	Punta María*	9.7	4.0	MLP-He 7129
			Varela*	8.6	1.6	
<i>Contracaecum</i> sp.	Abdominal cavity	L3	Varela*	1.4	1.0	
<i>Hysterothylacium</i> sp.	Intestine	L3	Punta María	3.2	1.0	MLP-He 7130
<i>Cucullanus</i> sp.	Intestine	A	Varela*	2.9	1.0	
<i>Hypoechinorhynchus</i> sp.	Intestine	A	Varela*	2.9	1.5	MLP-He 7131
			Punta María*	9.7	4.0	
<i>Corynosoma</i> sp.	Mesenteries, liver	C	Varela*	7.1	1.0	MLP-He 7132
			Punta María*	35.5	3.4	
<i>Caligus rogercresseyi</i>	Dorsal, caudal fins	A	Varela*	11.4	1.8	MLP-Cr 27001
			Punta María*	29.0	1.0	
<i>Peniculus</i> sp.	Body surface, fins	A	Varela*	28.6	5.3	MLP-Cr 27002

Diplodon chilensis Gray, 1828 and the copepod *Ergasilus sieboldi* von Nordman, 1832 (Table 4). As mentioned above, the metacercariae collected from the lens of *O. hatcheri*, which were the diplostomulum type were assigned to the genus *Diplostomum*. They measured 509–701 in length \times 259–336 width. They also had the anterior end of the body trilobate, with small lateral lappets on either side of the oral sucker (53–82 long \times 48–72 wide); the ventral sucker (36–60 long \times 43–60 wide) is oval to round, located postequatorially and similar in size to that of the oral sucker. Just posterior to ventral sucker is the holdfast organ (96–144 long).

For cultured *O. bonariensis*, the parasite richness was 1 parasite species (*Gyrodactylus* sp.) taken from samples from indoor fiberglass tanks, and for those cultured outdoor in man-made ponds, 5 species (*A. mordax*, *T. cardiophilus*, *C. macdonaghi*, *Contracaecum* sp., and *Argulus* sp.) for fish reared in cages of Lacombe Pampean Lake, and also 5 species (*Ascocotyle* sp., *Phagicola* sp., *Gyrodactylus* sp., *C. macdonaghi*, and *Contracaecum* sp.) for those collected from cages of Chascomús Pampean Lake (Table 3).

Discussion

Specimens belonging to Digenea, Monogenea, Cestoda, Nematoda, Acanthocephala, Mollusca, Copepoda, and Branchiura are reported herein. Since larvae were the most common stages found in previous as well as, in the present work, the taxonomic identification at species level is difficult, considering that many of these parasites and their life cycles are not yet elucidated. All records reported in this study represent 41 new geographical records, 4 new host records and 1 new parasite species.

For *O. nigricans*, the parasites *Diplostomum* sp. and Acuariinae gen. et sp. were reported for the first time, and *Cucullanus* sp. may be a new parasite species. With regard to the *Diplostomum* metacercaria, we assumed that the metacercariae of *O. nigricans* and *O. hatcheri* belong to the same species as they show similar morphometric characteristics. *Diplostomum* species that have been found in the Antarctic region are *D. minutum* Szidat, 1964; *D. antarcticum* Freiler, 1986; and *D. dominicanum* Freiler, 1986 recorded from the kelp gull *Larus*



Figure 3. Microphotographs of *Odontesthes bonariensis* parasites. 19, *Tylodelphys cardiophilus*; 20, *Gyrodactylus* sp.; 21, scolex of *Cangatiella macdonaghi*; 22, proglotids of *Cangatiella macdonaghi*.

Table 3
Parasites of *Odontesthes bonariensis* with data on site of infection, stage, localities, prevalence (P), mean intensity (MI), voucher specimens (VS), and collection number (CN);[§]cultured fish; A, adult; L3, Larva 3; M, Metacercaria. *New geographical record; ¥ new host record.

Parasite	Site	Stage	Locality	P (%)	MI	VS-CN
<i>Austrodiplostomum mordax</i>	brain	M	Lacombe [§]	100	13.8	
<i>Tylodelphys cardiophilus</i> [¥]	pericardic cavity	M	Lacombe ^{§*}	28.5	1.3	MLP-He 7133
<i>Ascocotyle</i> sp.	heart	M	Chascomús [§]	42.9	3.3	
			Chascomús	31.3	10.6	
<i>Phagicola</i> sp.	gills	M	Chascomús [§]	5.2	2.0	
<i>Gyrodactylus</i> sp.	gills and fins	A	fiberglass tanks	28.6	6.7	MLP-He 7134
			man made pond	60.0	3.4	
			Chascomús [§]	90.5	4.5	
			Chascomús	31.3	10.6	
<i>Cangatiella macdonaghi</i>	intestine	A	Lacombe [§]	85.7	13.8	
			Chascomús [§]	10.4	9.1	MLP-He 7135
			Chascomús	96.9	66.7	
<i>Contraecum</i> sp.	abdominal cavity	L3	La Plata River	9.1	1.0	
			Lacombe [§]	14.3	1.7	
			Chascomús [§]	3.9	1.0	
			Chascomús	25.0	1.6	
<i>Argulus</i> sp.	tegument	A	Lacombe ^{§*}	4.7	1.0	

dominicanus (González-Acuña et al., 2009). The metacercariae of *Diplostomum* found in *O. nigricans* and *O. hatcheri* could possibly correspond to *D. minutum* since adults of this species have been reported in *L. dominicanus* in Chubut and in Antarctica (Niewiadomska, Zdzitowiecki, & Ostrowski-de Núñez, 1989), near the site of the present study. It has been pointed out that lens metacercariae of *Diplostomum* have a low specificity (Locke et al., 2015), so the marine silverside could be infected with cercariae of *Diplostomum* when they ascend the rivers in the Magellan Strait (Dyer, 2000).

Lecithaster australis Prudhoe and Bray, 1973 and *L. micropsi* Zdzitowiecki, 1992 were recorded in several species of nothotenids and gadiids in the South West Atlantic Ocean (Suriano & Sutton, 1981; Zdzitowiecki, 1992). The specimens of *Lecithaster* collected in the present study could not be assigned to any of those species, due to morphometric differences with the known species. The specimens are similar to those collected from *O. nigricans* and *O. smitti* in Nuevo and San José Gulfs, Chubut Province (Argentina), but the identification has not been determined (Carballo, 2008). The larva 3 of

Cosmocephalus sp. most likely belongs to *Cosmocephalus obvelatus* (Creplin, 1825), since this species was recovered in the Chubut Province from *O. nigricans* parasitizing the same infection site (Carballo, Navone, et al., 2011). Four *Cucullanus* species have been described in the Argentinean Sea. *Cucullanus marplatensis* Daniel, Timi, and Sardella, 2002 was reported for *Odontesthes* species (Carballo, Laurenti, et al., 2011; Daniel et al., 2002). The *Cucullanus* specimens collected in this study differ from all the species of *Cucullanus* reported in Argentinean Sea. This finding would constitute a new parasite species. *Peniculus fistula* von Nordmann, 1832 was first recorded in the Strait of Magellan in an unknown host (Stuardo & Fagetti, 1961). Later, *Peniculus* sp. was registered in *O. nigricans* and *O. smitti* in the North Patagonian Gulfs (Carballo, Navone, et al., 2011). The specimens recovered in this work from *O. nigricans*, have a smaller length to width ratio (3.6–4.0) than *P. fistula*, which shows a trunk more than 6 times longer than wide (Alexander, 1983). They are similar to *P. ostracientis* Yamaguti, 1939 and *P. truncates* Shiino, 1956 considering the distribution of swimming legs; however, our specimens cannot be assigned to any of these

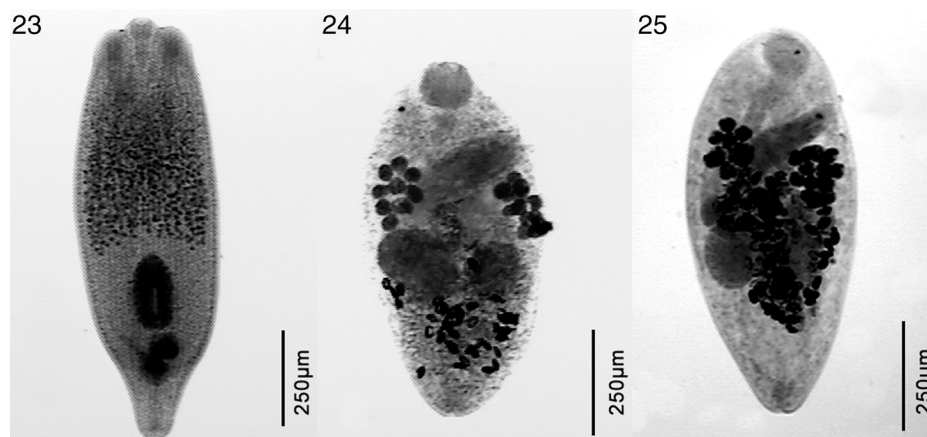


Figure 4. Microphotographs of *Odontesthes hatcheri* parasites. 23, *Austrodiplostomum mordax*; 24, *Steganoderma macrophallus*; 25, *Steganoderma szidati*.

Table 4

Parasites of *Odontesthes hatcheri* with data on site of infection, stage, localities, prevalence (P), mean intensity (MI), voucher specimens (VS), and collection number (CN); A, adult; G, Glochidium; L3, Larva 3; M, Metacercaria. *New geographical record; †new host record.

Parasite	Site	Stage	Locality	P (%)	MI	VS-CN
<i>Austrodiplostomum mordax</i>	Brain	M	Carrilafquen Chica	50	6.3	MLP-He 7136
			El Chañar	60	5.0	
			Marimenuco	14.3	41.0	
<i>Diplostomum</i> sp.	Eyes	M	Musters	80	80.5	
<i>Tylodelphys bariloensis</i>	Brain	M	Moreno	5.9	1.0	
<i>Tylodelphys cardiophilus</i>	Pericardicavity	M	Carrilafquen Chica	3.8	1.0	MLP-He 7137
<i>Tylodelphys destructor</i>	Brain	M	Carrilafquen Chica	17.0	1.0	MLP-He 7138
			El Chañar	40.0	2.0	
<i>Tylodelphys bariloensis</i>	Brain	M	Morenito	6.3	4.0	
			Epuyén	66.6	3.0	
			Lezana	22.6	4.6	
			Marimenuco	14.3	4.0	
<i>Stephanoprora uruguayense</i>	Gills	M	El Chañar	100.0	57.4	
<i>Steganoderma macrophallus</i>	Intestine	A	Marimenuco	42.9	2.3	MLP-He 7139
			El Chañar	40.0	2.0	
			Musters	30.0	224.0	
<i>Steganoderma szidati</i>	Intestine	A	Moreno	5.9	40.0	MLP-He 7140
<i>Cangatiella macdonaghi</i>	Intestine	A	El Chañar	80.0	10.8	
			Marimenuco	57.1	4.5	
			Morenito	43.8	20.3	
			Moreno	64.7	27.7	
			Musters	30.0	9.6	
			El Chañar	20.0	2.0	
<i>Contraecum</i> sp.	Intestine wall	L3	Carrilafquen Chica	3.8	1.0	
			Morenito	6.3	1.0	
			Moreno	23.5	1.3	
			Musters	40.0	2.0	
			Caleufu	33.3	1.0	
			Morenito	6.3	3.0	
			Moreno	23.5	5.8	
			Epuyen	33.3	1.0	
<i>Hysterothylacium patagonense</i>	Intestine	L4	Morenito	6.3	3.0	
			Moreno	23.5	5.8	
			Epuyen	33.3	1.0	
			Marimenuco	42.9	1.3	
<i>Camallanus corderoi</i>	Intestine	A	Morenito	31.3	18.8	
			Moreno	47.0	12.1	
			Lezana	3.2	1.0	
			Musters	10.0	3.0	
<i>Acanthocephalus tumescens</i>	Intestine	A	Carrilafquen Chica	14.3	3.7	
			Morenito	6.3	2.0	
			Rivadavia	11.1	3.7	
<i>Pomphorhynchus patagonicus</i>	Intestine	A	Lezana	3.2	1.0	
<i>Diplodon chilensis</i>	Gills, fins	G	Musters	90.0	12.8	
			Carrilafquen	28.6	2.8	
			Morenito	12.5	28.5	
			Moreno	58.8	35.9	
			Epuyen	100.0	13.6	
<i>Ergasilus sieboldi</i>	Gills	A	Rivadavia	22.2	2.8	
			Marimenuco	42.9	2.3	
			El Chañar	40.0	3.0	
			Piedra del Águila	100.0	2.0	
			Morenito	56.3	6.0	
			Moreno	88.2	19.7	
			Musters	100.0	46.0	

species since they have an intermediate length to width ratio of the trunk (*P. truncatus* 3.3 and *P. ostraciontis* 4.3) (Alexander, 1983).

For cultured *O. bonariensis*, the records herein correspond to the first reports of any parasites. The species richness of

silversides collected from floating cages of Lacombe and Chascomús Pampean Lakes, were similar to those collected from wild silversides (Drago, 2012). Although richness was similar between cultured and wild specimens of Lacombe Pampean Lake the composition of the parasite community was different,

for example *T. cardiophilus* and *Argulus* sp. were found only in cultured fish, and *Hysterothylacium* sp. and *Wolffhuggelia matercula* only in wild fish (Drago, 2012). This difference can be attributed to the life cycle of the parasites, meanwhile *T. cardiophilus* and *Argulus* sp. are transmitted by motile larvae (cercariae and juveniles), *Hysterothylacium* sp. and *W. matercula* require the consumption of an infected crustacean which are not available for cultured fishes. Silversides cultured in cages, which are located in the Pampean Lakes, acquired parasites from the environment, being of interest to human health *Contracaecum* sp., which is zoonotic, and for fish health *Gyrodactylus* sp. and *Argulus* sp., which could be pathogenic for fish if intensities of infection are increased (Woo, 1995).

Both freshwater silversides species were parasitized by the diplostomids *A. mordax* and *T. cardiophilus*, and were recorded in 6 new localities. Besides, *Tylodelphys* sp., *T. destructor*, *T. barilochensis* and *Diplostomum* sp. were recorded for *O. hatcheri* in 8 new localities. Both freshwater silversides species were parasitized by the heterophyids *Ascocotyle* sp. and *Phagicola* sp. constituting 4 new localities, and by the cestodes *C. macdonaghi* representing 7 new localities. Finally, the anisakid larvae *Contracaecum* sp., were found in *O. bonariensis* and *O. hatcheri*, while *Hysterothylacium* sp. was found only in *O. hatcheri*; these findings constitute 12 new localities. The following parasites: *S. uruguayense* (2 records), *S. macrophallus* (2), *S. szidati* (1), *C. corderoi* (5), *A. tumescens* (3), *P. patagonicus* (2), and *D. chilensis* (5) were recovered in new localities for *O. hatcheri*; and *Gyrodactylus* sp. (1) and *Argulus* sp. (1) represent new localities for *O. bonariensis*. The copepod *E. sieboldi* was first reported in Patagonia for *Percichthys trucha* (Cuvier & Valenciennes) (Szidat, 1956). Additionally larval stages and male specimens of *E. sieboldi* were reported from an Andean Patagonian lake (Modenutti & Balseiro, 1989). According to Szidat (1956), the Patagonian specimens showed scarce differences with specimens from Europe. Our specimens showed no differences with those collected from *P. trucha* from Pellegrini Lake and Limay River (Szidat, 1956). As the identity is dubious, we prefer to be conservative and assigned them to *E. sieboldi*, but molecular studies are needed to confirm the identity of the specimens.

The specimens of *O. nigricans* collected in this study showed a similar richness value (12 species) than those collected in Nuevo and San José gulfs (13 species in both gulfs). Although differences in the composition of parasite communities were observed, both populations share *P. bartolii*, *Lecisthaster* sp., *Cosmocephalus* sp., *Hypoechinorhynchus* sp., and *Corynosoma* sp., and differ in the presence of *Diplostomum* sp., *Hysterothylacium* sp., and *C. rogercresseyi* found in this study, and *Prosorhynchoides* sp., *Huffmanella moravecii* Carballo and Navone, 2007, *Anisakis* sp., *Pseudoterranova* sp., and *Bomolochus globiceps* (Vervoort and Ramírez, 1968) which were found only in the North Patagonian gulfs (Carballo, Navone, et al., 2011). These differences could be attributed to the fact that Nuevo and San José gulfs are in the ecotone between the Argentine and Patagonian ichthyogeographical provinces, while our samples were collected in Tierra del Fuego, in the southernmost part of Patagonian province. Although *O. bonariensis* and

O. hatcheri were collected from 2 different ichthyogeographical provinces, Paranoplatensean Province and Patagonian Province, respectively; both share the metacercariae of *A. mordax* and *T. cardiophilus* and the cestode *C. macdonaghi*. The species of *Odontesthes* are mainly intermediate hosts for larval stages of Digenea and Nematoda, indicating that silversides in freshwater and marine environments are predominantly prey in the food chains.

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