Parasites of the "Peladilla," *Aplochiton zebra* (Osmeriformes: Galaxiidae), from Patagonia (Argentina and Chile)

Author(s): Valeria Fernandez, Liliana Semenas, and Gustavo Viozzi
Source: Comparative Parasitology, 79(2):231-237. 2012.
Published By: The Helminthological Society of Washington
DOI: http://dx.doi.org/10.1654/4561.1
URL: http://www.bioone.org/doi/full/10.1654/4561.1

Comp. Parasitol.
79(2), 2012, pp. 231–237

Parasites of the "Peladilla," *Aplochiton zebra* (Osmeriformes: Galaxiidae), from Patagonia (Argentina and Chile)

Valeria Fernandez,[1] Liliana Semenas, and Gustavo Viozzi

Laboratorio de Parasitologia, INIBIOMA (Universidad Nacional del Comahue–CONICET), Quintral 1250, (8400) Bariloche, 8400 Argentina

ABSTRACT: *Aplochiton zebra* is found inhabiting lakes and rivers in Patagonia (Chile and Argentina) and the Malvinas Islands (Falklands Islands). The "peladilla" is not commercially fished; thus, not much is known about its biology. In previous studies, 7 parasite species were recorded from this fish species. The aim of the present work is to provide new data of *A. zebra* parasites from surveys in Argentinean Patagonia and to compile the published information from Argentina and Chile. A total of 217 *A. zebra* from 5 lakes were collected and 15 parasite species were found: 2 Protozoa, 1 Myxozoa, 6 Digenea, 1 Cestoda, 1 Acanthocephala, 3 Nematoda, and 1 Mollusca. This checklist contributes 11 new records of parasites from *A. zebra*.

KEY WORDS: "Peladilla", *Aplochiton zebra*, parasites, Patagonia.

The galaxiids (Galaxiidae) are scaleless freshwater fishes, some diadromous, which occur in cool temperate waters of the Southern Hemisphere (Oceania, South America, and Africa). The family Galaxiidae is comprised of 8 genera: *Galaxiella*, *Lovettia*, *Nesogalaxias*, *Neochanna*, *Paragalaxias*, *Aplochiton*, *Brachygalaxias*, and *Galaxias*. Species of *Brachygalaxias* and *Aplochiton* are found only in South America (McDowall, 2006). Only 4 species are known from Argentina: *Galaxias maculatus*, *Galaxias platei*, *Aplochiton zebra*, and *Aplochiton taeniatus*, with the latter only known from an estuary of Tierra del Fuego Island (Cussac et al., 2004; Lattuca, 2006).

Aplochiton zebra (common name: peladilla; Fig. 1) is distributed on both sides of the Patagonian Andes (Argentina and Chile) and in Malvinas Islands (Falkland Islands) between 36°4′S, 72°52′W and 54°22′S, 67°37′W, and has not been reported between 43°S and 48°S (Aigo et al., 2008), an area previously occupied by Pleistocene ice (Cussac et al., 2004). The records of *A. taeniatus* in Cholila and Epuyén lakes (Chubut Province, Argentina) recorded by Ortubay et al. (1994) were misidentifications of *A. zebra* (Cussac et al., 2004). Compared to *G. maculatus*, few studies have focused on the biology of *A. zebra* (e.g., Piacentino, 1999; Baigún and Ferriz, 2003; Lattuca, 2006; McDowall, 2006; Lattuca et al., 2008). *Aplochiton zebra* is not fished commercially and is a protected species in the Malvinas Islands under the Conservation of Wildlife and Nature Ordinance of 1999 (Ross, 2009) and is an endangered species in Chile (Habit et al., 2006). Although it was observed in Argentina from the Rio Negro basin (Atlantic watershed, Pozzi, 1945), recent surveys only report on the presence of *A. zebra* in the Pacific watershed (Aigo et al., 2008).

The peladilla can live up to 7 yr, measures between 40 and 290 mm in length, attains sexual maturity in freshwater, and has amphidromous and landlocked populations. It preys on invertebrates, feeding mainly on chironomid larvae and adults, copepods, amphipods, ostracods, and molluscs (McDowall, 2005; Lattuca, 2006; Lattuca et al., 2007, 2008; Ross, 2009). In Patagonia, *A. zebra* is found inhabiting lakes with other native *Galaxias platei*, *Diplomystes viedmensis*, *Odonthestes hatcheri*, and *Percichthys trucha* and with the introduced salmonid species *Salvelinus fontinalis*, *Salmo trutta*, *Salmo salar*, and *Oncorhynchus mikyss*. Except for in Lake Lacar, *A. zebra* has not been reported in sympatry with *G. maculatus* (Lattuca, 2006).

Checklists of parasites open a window about biodiversity and provide a useful tool for research on ecology, zoogeography, aquaculture, biological tags, and environmental studies of hosts and their parasites (Brooks and Hoberg, 2000; Marcogliese, 2004). In South America, parasite surveys have only been published from 2 galaxiid fishes: *Brachigalaxias bullocki* (Viozzi et al., 2008) and *Galaxias maculatus* (Viozzi et al., 2009). The purpose of this work is to provide new data of *A. zebra* parasites from surveys in Argentinean Patagonia and to compile the published information from Argentina and Chile to increase knowledge of parasites of galaxiids from Patagonia.

MATERIALS AND METHODS

Samples of *A. zebra* were collected by seine net in the littoral zone of 5 lakes (Fig. 2, Table 1) during austral

[1] Corresponding author (e-mail: valeria.fernandez@crub.uncoma.edu.ar).

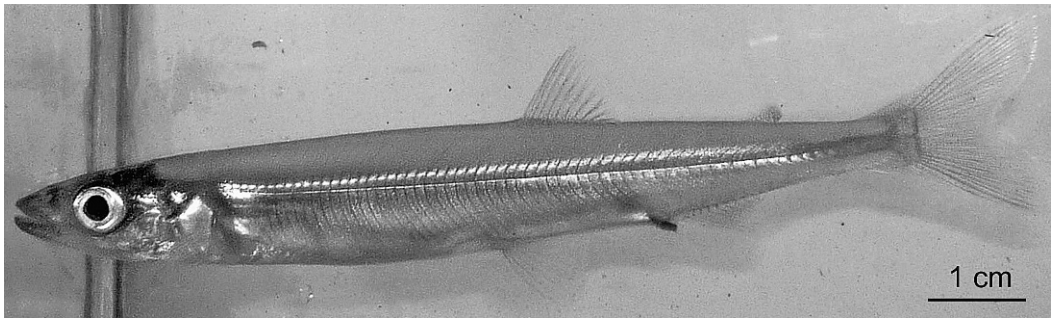

Figure 1. Adult specimen of *Aplochiton zebra*.

summers from December 2000 to February 2011. Captured fishes were transported to the laboratory and kept alive at 8°C until they were killed by severing the spinal cord. Total length was measured with a digital calliper (to the nearest 1 mm). The fish were dissected and fins, skin, eyes, brain, gills, heart, abdominal cavity, gastrointestinal tract, liver, gall bladder, gonads, and kidney were examined for parasites. The parasites were collected, identified, and counted. Prevalence and mean intensity were calculated following Bush et al. (1997). Voucher specimens of the majority of the species collected in our survey were deposited in the Parasite Collection of the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN-Pa).

In the checklist, families of parasites and the genera within are arranged alphabetically. Localities are arranged by latitude. The checklist also includes parasite stage, sites of infection, prevalence followed by mean intensity, accession numbers of specimens deposited, and previous records. Previous records determined at the family level or higher are not included in the list. Accession numbers of previously deposited material are included when possible.

RESULTS

A total of 217 *A. zebra* was collected from 5 localities between 40°09′S, 71°37′W and 42°36′S, 71°39′W covering the known northern distribution range of this fish in Argentinean Patagonia (Table 1). Fish length ranged from 37 to 153 mm. Below, we combined the results of our surveys with data from a literature review, resulting in 18 records of parasites, 14 of which were helminths. The maximum component community richness was 12 in Puelo Lake, the maximum infracommunity richness was 7 in one specimen from Epuyén Lake, and the average of infracommunity richness ranged between 0.6 to 3.8 (Table 1).

Ciliophora
Ichthyophthiriidae
Ichthyophthirius multifiliis (Fouquet, 1876)

Stage: Trophont.

Site of infection: Skin and gills.

Localities, prevalence: Puelo Lake (3%).

Trichodinidae
Trichodina sp.

Stage: Trophont.

Site of infection: Gills.

Localities, prevalence: Puelo Lake (31%); Epuyén Lake (5%); Rivadavia Lake (1%).

Myxozoa
Myxobolidae
Myxobolus sp.

Stage: Myxospore.

Site of infection: Gills and abdominal organs.

Localities, prevalence: Puelo Lake (42%); Epuyén Lake (38%).

Deposited specimens: MACN-Pa 523/1–2.

Digenea
Cryptogonimidae
Acanthostomoides apophalliformis Szidat, 1956

Stage: Metacercaria.

Site of infection: Liver, abdominal cavity.

Localities, prevalence, mean intensity: Puelo Lake (81%, 6); Epuyén Lake (100%, 20); Cholila Lake (82%, 2.4); Rivadavia Lake (5%, 1).

Deposited specimens: MACN-Pa 524/132.

Previous records: Torres et al. (1988): Valdivia River (Chile), Ortubay et al. (1994): Epuyén Lake, Cholila Lake.

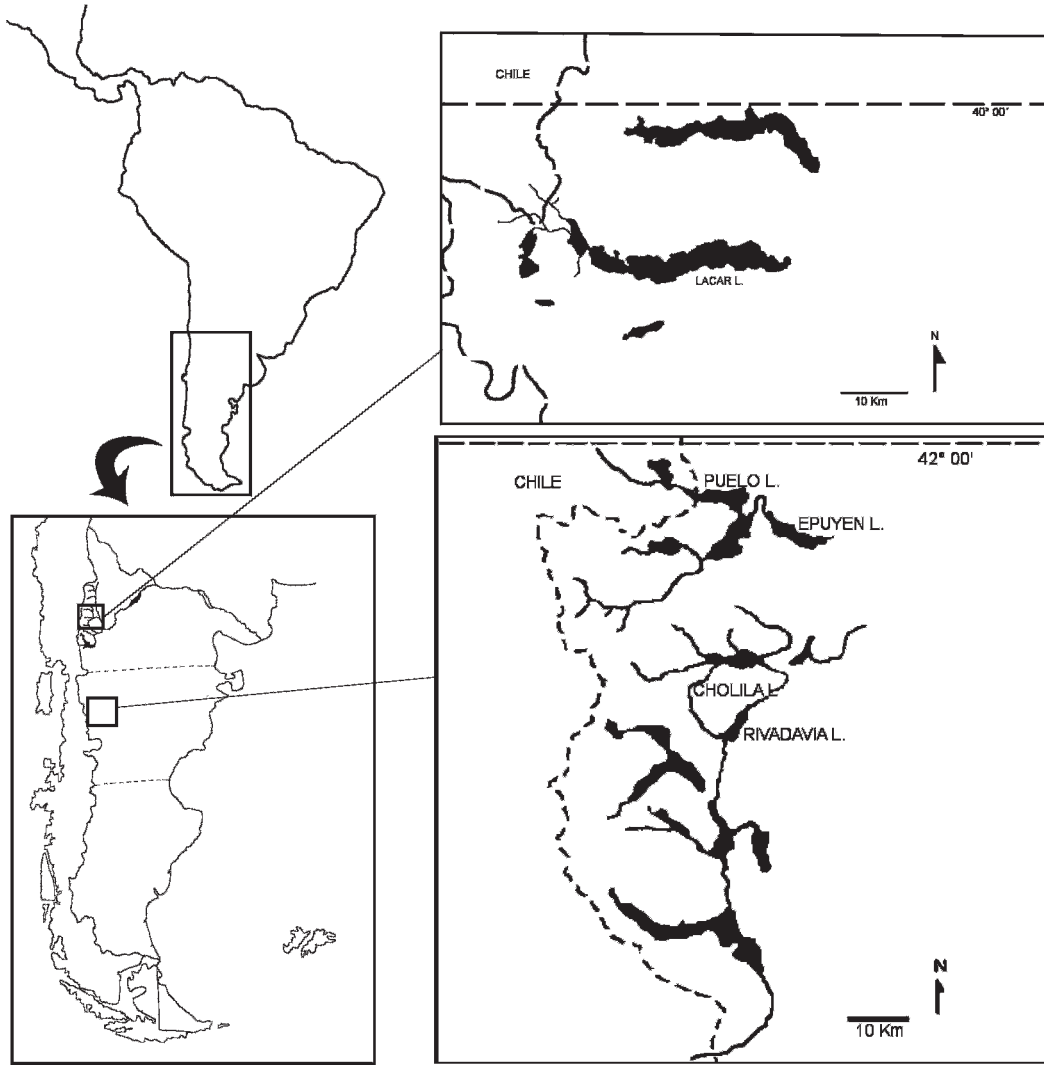

Figure 2. Geographic locations of sampled lakes in Argentinean Patagonia.

Table 1. Lakes, sampling, and community parasitological data of *Aplochiton zebra*.

Lakes		Fish		Parasites	
Name	Coordinates	*n*	Range of total length (mm)	Component community richness	Average infracommunity richness
Lacar	40°09′S, 71°37′W	1	142	1	1
Puelo	42°10′S, 71°40′W	36	36.6–114.6	12	2 ± 1.29
Epuyen	42°15′S, 71°25′W	81	58.7–153.4	11	3.8 ± 1.21
Cholila	42°27′S, 71°40′W	22	56.3–70.6	7	3 ± 1.02
Rivadavia	42°36′S, 71°39′W	77	39.4–104.4	8	0.6 ± 1.04

Remarks: *Stephanostomum* sp. recorded by Torres et al. (1988) is a misidentification of *Acanthostomoides apophalliformis* (Torres, 1990, personal communication).

Allocreadidae
Allocreadium sp.

Stage: Adult.

Site of infection: Intestine.

Localities, prevalence, mean intensity: Rivadavia Lake (2%, 2).

Diplostomidae
Austrodiplostomum mordax Szidat and Nani, 1951

Stage: Metacercaria.

Site of infection: Brain.

Previous records: Ortubay et al. (1994): Cholila Lake.

Diplostomum sp.

Stage: Metacercaria.

Site of infection: Eye lens.

Localities, prevalence, mean intensity: Epuyén Lake (1%, 1).

Deposited specimens: MACN-Pa 525.

Previous records: Ortubay et al. (1994): Cholila Lake.

Tylodelphys sp.

Stage: Metacercaria.

Site of infection: Brain.

Localities, prevalence, mean intensity: Puelo Lake (19%, 6.4); Epuyén Lake (30%, 47.2); Cholila Lake (4%, 3); Rivadavia Lake (9%, 1.8).

Deposited specimens: MACN-Pa 526.

Previous records: Ortubay et al. (1994): Foyel Lake, Cholila Lake.

Echinostomatidae
Stephanoprora uruguayense Holcman-Spector and Olagüe, 1989

Stage: Metacercaria.

Site of infection: Gills.

Localities, prevalence, mean intensity: Puelo Lake (3%, 1).

Zoogonidae
Steganoderma oviformis Szidat, 1962

Stage: Adult.

Site of infection: Intestine.

Previous records: Szidat (1962): Patagonian freshwater environments.

Previously deposited material: MACN-Pa 113/a–c.

Remarks: Although Szidat (1962) recorded this species in Patagonian freshwater environments, the slides of deposited specimens indicates Valdivia (Chile) as locality.

Steganoderma szidati Viozzi, Flores and Ostrowski de Núñez, 2000

Stage: Adult.

Site of infection: Intestine.

Localities, prevalence, mean intensity: Epuyén Lake (5%, 1); Cholila Lake (4%, 3).

Deposited specimens: MACN-Pa 527.

Cestoda
Triaenophoridae
Ailinella mirabilis Gil de Pertierra and Semenas, 2006

Stage: Adult.

Site of infection: Intestine.

Localities, prevalence, mean intensity: Puelo Lake (53%, 9); Epuyén Lake (31%, 22.7); Cholila Lake (32%, 2.8).

Deposited specimens: MACN-Pa 528/1–2.

Previous records: Ortubay et al. (1994): Cholila Lake.

Remarks: The records of *Nippotaenia* sp. recorded by Ortubay et al. (1994) are misidentifications of *A. mirabilis* (Gil de Pertierra and Semenas, 2006).

Acanthocephala
Echinorhynchidae
Acanthocephalus tumescens (Von Linstow, 1896)

Stage: Adult.

Site of infection: Intestine.

Localities, prevalence, mean intensity: Puelo Lake (19%, 1); Epuyén Lake (19%, 4.4); Cholila Lake (27%, 1.2); Rivadavia Lake (9%, 2.6).

Deposited specimens: MACN-Pa 530/1–2.

Pomphorhynchidae
Pomphorhynchus patagonicus Ortubay, Semenas, Úbeda and Kennedy, 1991

Stage: Adult.

Site of infection: Intestine.

Previous records: Ortubay et al. (1994): Cholila Lake.

Nematoda
Anisakidae
Contracaecum sp.

Stage: Larva.

Site of infection: Abdominal cavity.

Localities, prevalence, mean intensity: Lácar Lake (100%, 1); Puelo Lake (17%, 1); Epuyén Lake (5%, 1); Cholila Lake (100%, 5); Rivadavia Lake (14%, 3.6).

Deposited specimens: MACN-Pa 529.

Hysterothylacium patagonense Moravec, Urawa and Coria, 1997

Stage: Larva.

Site of infection: Abdominal cavity.

Localities, prevalence, mean intensity: Puelo Lake (3%, 1).

Camallanidae
Camallanus corderoi Torres, Teuber and Miranda, 1990

Stage: Larva.

Site of infection: Intestine.

Localities, prevalence, mean intensity: Puelo Lake (11%, 2.5); Epuyén Lake (2%, 2); Rivadavia Lake (1%, 8).

Deposited specimens: MACN-Pa 531.

Mollusca
Hyriidae
Diplodon chilensis Gray, 1828

Stage: Glochidium.

Site of infection: Gills and fins.

Localities, prevalence, mean intensity: Puelo Lake (50%, 2.2); Epuyén Lake (84%, 5.1); Rivadavia Lake (17%, 1.2).

DISCUSSION

At least 20 yr have passed since the last report of parasites of *A. zebra* in Argentina and Chile, and only 7 parasite species were reported: *A. apophalliformis*, *Diplostomum* sp., *A. mordax*, *Tylodelphys* sp., *S. oviformis*, *A. mirabilis*, and *P. patagonicus* (Szidat, 1962; Torres et al., 1988; Ortubay et. al., 1994). This checklist contributes to our knowledge of the parasite fauna of *A. zebra* with 11 new records: *Trichodina* sp., *Ichthyophthirius multifiliis*, *Myxobolus* sp., *Allocreadium* sp., *Stephanoprora uruguayense*, *Steganoderma szidati*, *Acanthocephalus tumescens*, *Contracaecum* sp., *Hysterothylacium patagonense*, *Camallanus corderoi*, and *Diplodon chilensis*. This parasite fauna is characterized by 15 macro- (14 helminth) and 3 microparasites. Digeneans (8) dominated the component communities which also included ciliophorans (2), myxozoans (1), cestodes (1), nematodes (3), acanthocephalans (2), and mollusks (1). An unidentified acanthocephalan species from the intestine of *A. zebra* recorded for Malvinas Island (McDowall, 2005) must be added.

In Patagonia, the other small prey galaxiids, *G. maculatus* and *Brachygalaxias bullocki*, harbor 35 and 7 metazoan parasite species, respectively (Bravo et al., 2007; Viozzi et al., 2007, 2008, 2009). The parasite richness of *A. zebra* is not as high as that of *G. maculatus*; however, there is no information on parasites of *A. zebra* in the southern part of its geographic range. Even so, the larger range of distribution of *G. maculatus* (38°50′S, 72°20′W–54°25′S, 67°37′W) and the diversity of freshwater environments included in this range may contribute to this higher richness.

Although *G. maculatus* has a richer parasite fauna (Viozzi et al., 2009), distribution of richness by lake is similar, as the component community richness of *A. zebra* for the 5 sampled lakes ranged from 1 to 12 (mean = 7.8) and the component community richness of *G. maculatus* for 35 lakes (unpublished data) varied between 3 and 14 (mean = 9.17). Parasite communities of *A. zebra* and *G. maculatus* are also similar because both are dominated by digenean larvae, suggesting an important role of these prey fishes as intermediate hosts in Patagonian Andean lakes.

All the *A. zebra* parasites are not host-specific, as they can also be found parasitizing other small prey galaxiids like *A. taeniatus*, *G. maculatus*, and *B. bullocki* (Torres et al., 1988; Bravo et al., 2007; Viozzi et al., 2008, 2009). Some *A. zebra* parasite species (*A. mordax*, *Tylodelphys* sp., *Diplostomum* sp., *Allocreadium* sp., *S. szidati*, and the two species

of acanthocephalans) also parasitize other native fishes (e.g., *P. trucha* and *O. hatcheri*), while others (*Allocreadium* sp., *Contracaecum* sp., and *D. chilensis*) can be found in introduced salmonids (Torres et al., 1988; Ortubay et. al., 1994; Moravec et al., 1997; Ostrowski de Núñez et al., 2004; Viozzi et al., 2009).

Salmonids were introduced in Argentina and Chile at the beginning of the 20th Century; in this scenario, these introduced fish species have the potential to modify native host–parasite dynamics by acting as parasite reservoirs (spillback) or sinks (spillover). These changes were observed for species of acanthocephalans, which include galaxiids as hosts in New Zealand and Patagonia with the introduction of brown trout (*S. trutta*) and rainbow trout (*O. mikyss*), respectively (Úbeda et al., 1994; Rauque et al., 2006; Paterson et al., 2011). The same processes may have occurred for *A. zebra*, but population studies to assess these changes are still lacking.

Characteristics of parasite fauna of *A. zebra* suggest that this fish is mainly a generalist and an intermediate host occupying nearly the same role as *G. maculatus* in the parasite cycles of Andean Patagonian lakes.

ACKNOWLEDGMENTS

Financial support was provided by the Universidad Nacional del Comahue, Grant B 165, a doctoral grant from CONICET-Chubut Province and PIP CONICET No. 112-200801-01738, Argentina. Sampling was carried out with the permission of the Argentina National Parks and the Secretaría de Pesca de la provincia de Chubut.

LITERATURE CITED

Aigo, J., V. Chusca, S. Peris, S. Ortubay, S. Gómez, H. López, M. Gross, J. Barriga, and M. Battini. 2008. Distribution of introduced and native fish in Patagonia (Argentina): patterns and changes in fish assemblages. Reviews in Fish Biology and Fisheries 18:387–408.

Baigún, C., and R. Ferriz. 2003. Distribution patterns of native freshwater fishes in Patagonia (Argentina). Organisms Diversity and Evolution 3:151–159.

Bravo, S., C. Almonacid, C. Oyarzo, and M. T. Silva. 2007. The parasite fauna of *Galaxias maculatus* in the estuary of Maullin River, Chile. Bulletin of the European Association of Fish Pathologists 27:10–17.

Brooks, D. R., and E. P. Hoberg. 2000. Triage for the biosphere: the need and rationale for taxonomic inventories and phylogenetics studies of parasites. Comparative Parasitology 67:1–25.

Bush, A. O., K. Lafferty, J. Lotz, and A. Shostak. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. Journal of Parasitology 83:575–583.

Cussac, V., S. Ortubay, G. Iglesias, D. Milano, M. E. Lattuca, J. P. Barriga, M. Battini, and M. Gross. 2004. The distribution of South American galaxiid fishes: the role of biological traits and post-glacial history. Journal of Biogeography 31:103–121.

Gil de Pertierra, A., and L. G. Semenas. 2006. *Ailinella mirabilis* gen. n., sp. n. (Eucestoda: Pseudophyllidea) from *Galaxias maculatus* (Pisces: Galaxiidae) in the Andean–Patagonian region of Argentina. Folia Parasitologica 53:276–286.

Habit, E., B. Dyer, and I. Vila. 2006. Estado de conocimiento de los peces de agua dulceacuícolas de Chile. Gayana 70:100–113.

Lattuca, M. E. 2006. Ecología e historia de vida de *Aplochiton zebra* (Osmeriformes, Galaxiidae) en aguas patagónicas. Ph.D. Dissertation. Universidad Nacional del Comahue,Bariloche, Argentina. 180 pp.

Lattuca, M. E., D. Brown, L. Castiñeira, M. Renzi, C. Luizón, J. Urbanski, and V. Cussac. 2008. Reproduction of landlocked *Aplochiton zebra* Jenyns (Pisces, Galaxiidae). Ecology of Freshwater Fish 17:394–405.

Lattuca, M. E., S. Ortubay, M. A. Battini, J. P. Barriga, and V. E. Cussac. 2007. Presumptive environmental effects on body shape of *Aplochiton zebra* (Pisces, Galaxiidae) in northern Patagonian lakes. Journal of Applied Ichthyology 23:25–33.

Marcogliese, D. J. 2004. Parasites: small players with crucial roles in the ecological theater. EcoHealth 1: 151–164.

McDowall, R. M. 2005. Making a living in Red Pond: a snapshot of the diet of a population of *Aplochiton zebra* (Teleostei: Galaxiidae) at the Falkland Islands. New Zealand Journal of Zoology 32:23–27.

McDowall, R. M. 2006. Crying wolf, crying foul, or crying shame: alien salmonids and a biodiversity crisis in the southern cool-temperate galaxioid fishes? Reviews in Fish Biology and Fisheries 16:233–422.

Moravec, F., S. Urawa, and C. O. Coria. 1997. *Hysterothylacium patagonense* n. sp. (Nematoda: Anisakidae) from freshwater fishes in Patagonia, Argentina, with a key to the species of *Hysterothylacium* in American freshwater fishes. Systematic Parasitology 36:31–38.

Ortubay, S., L. Semenas, C. Úbeda, A. Quaggiotto, and G. Viozzi. 1994. Catálogo de peces dulceacuícolas de la Patagonia Argentina y sus parásitos metazoos. Dirección de Pesca. Subsecretaría de Recursos Naturales. Viedma, Provincia de Río Negro, Argentina. 110 pp.

Ostrowski de Núñez, M., V. Flores, G. Viozzi, and A. Kreiter. 2004. *Stephanoprora uruguayense* Holcman-Spector et Olagüe, 1989 (Digenea, Echinostomatidae) from Argentina, and comments on species of *Stephanoprora* from birds of the Neotropical Region. Acta Parasitologica 49:292–299.

Paterson, R. A., C. R. Townsend, R. Poulin, and D. M. Tompkins. 2011. Introduced brown trout alter native acanthocephalan infections in native fish. Journal of Animal Ecology 80:990–998.

Piacentino, G. L. M. 1999. New geographic localities of *Aplochiton* species (Salmoniformes: Aplochitonidae) in the Argentinean Patagonia. Cybium 23:209–211.

Pozzi, A. J. 1945. Sistemática y distribución de los peces de agua dulce de la República Argentina. Gaea Buenos Aires 7:239–292.

Rauque, C., L. Semenas, and G. Viozzi. 2006. Seasonality of recruitment and reproduction of *Acanthocephalus tumescens* (Acanthocephala) in fishes from Lake Moreno (Patagonia, Argentina). Journal of Parasitology. 92:1265–1269.

Ross, K. 2009. Freshwater fish in the Falklands. Conservation of native zebra trout. A report for the Falkland Islands Government and Falklands Conservation. 36 pp.

Szidat, L. 1962. *Steganoderma oviformis* n. sp. (Trematoda) del intestino de *Aplochiton zebra* Jenyns. Neotrópica 8:67–72.

Torres, P., R. Franjola, V. Cubillos, J. C. Miranda, and R. Vera. 1988. Parasitismo en ecosistemas de agua dulce de Chile. 1. Presencia de metacercarias del género *Stephanostomum* (Digenea: Acanthocolpidae) en peces. Zentralblatt für Veterinaemedizing Rehibe B. 35:169–177.

Úbeda, C., A. Trejo, L. Semenas, and S. Ortubay. 1994. Status of three different fish hosts of *Pomphorhynchus patagonicus* Ortubay, Úbeda, Semenas et Kennedy, 1991 (Acanthocephala) in Lake Rosario (Argentina). Research and Reviews in Parasitology 54:87–92.

Viozzi, G., V. Flores, S. L. Marín, M. Mancilla, and J. Carvajal. 2008. Parasites of the red jollytail, *Brachygalaxias bullocki* (Osmeriformes: Galaxiidae), from Maullín River, Patagonia, Chile. Comparative Parasitology 75:326–328.

Viozzi, G., S. L. Marín, J. Carvajal, N. Brugni, and M. Mancilla. 2007. A new genus of dactylogyrid from the gills of *Galaxias maculatus* (Osmeriformes: Galaxiidae) in Maullín Basin, Patagonia, Chile. Journal of Parasitology 93:542–544.

Viozzi, G., L. Semenas, N. Brugni, and V. Flores. 2009. Metazoan parasites of *Galaxias maculatus* (Osmeriformes: Galaxiidae) from Argentinean Patagonia. Comparative Parasitology 76:229–239.