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ANIMAL SCIENCE

Parasitological survey of coastal birds from the Magellanic coast, Southwestern Atlantic Ocean

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Abstract: Ecto and endoparasites of four species of coastal birds, *Haematopus ater*, *Larus dominicanus*, *Leucophaeus scoresbii* (Charadriiformes), and *Lophonetta specularioides* (Anseriformes), are reported from Puerto Deseado on the Patagonian coast, Argentina. Only *H. ater* was infested with lice (Phthiraptera), belonging to 2 species (Ischnocera, Amblycera). A total of 19 helminth species were found parasitizing the coastal birds studied: 4 cestodes (1 Tetrabothriidae, 3 Cyclophyllidea); 11 trematodes (2 Gymnophallidae, 3 Microphallidae, 2 Notocotylidae, 1 Philophthalmidae, 2 Renicolidae, 1 Schistosomatidae); 3 nematodes (1 Anisakidae, 2 Acuariidae); and 1 acanthocephalan (Polymorphidae). Although some isolated records have been previously reported for these birds, the present work provides a parasitofauna study for *H. ater, L. scoresbii*, and *L. specularioides* for the first time. Endoparasites reflected the feeding habits of the birds; the parasite assemblage of *L. dominicanus* was the richest, indicating their wide prey spectrum and the diversity of the habitats frequented. A great species richness of trematodes, whose life cycles are partially known, suggests that *L. specularioides* feeds upon crustaceans and small bivalves. The blackish oystercatcher *H. ater* preys upon the limpet *Nacella magellanica* which hosts two larval trematodes corresponding to the adults found parasitizing it.

Key words: lice, helminthes, Kelp gull, Dolphin gull, Crested duck, Blackish oystercatcher.

INTRODUCTION

The shoreline of the Argentine Patagonian coast is an important feeding and breeding area for several coastal birds (Favero & Silva Rodríguez 2005) where 17 species, including penguins, shags, gulls, terns, ducks, oystercatchers, skuas, and petrels, breed (Yorio et al. 2005) and prey over the abundant diversity of invertebrates and vertebrate inhabiting the marine littoral and sublittoral zones (Diaz et al. 2011). In the marine ecosystems, the helminths assemblage of coastal birds (definitive hosts) reflects the presence of fish and invertebrates that are involved in their life cycle, which act as intermediate hosts and are mostly transmitted through trophic interactions, making parasites natural markers of changes in biodiversity (Marcogliese 2005).

In contrast with birds in general, studies concerning parasitic lice on aquatic birds in South America are scarce. In Argentina, Daciuk et al. (1981) presented some records of ectoparasites in birds from Península Valdés, providing the first record for lice in the Kelp Gull *Larus dominicanus* Lichtenstein (Laridae). Recently, Leonardi & Quintana (2017) and Leonardi et al. (2018) reported parasitological data for lice from the Imperial Shag *Leucocarbo atriceps* (King) (Phalacrocoracidae). However, there is no information available for the majority of marine and shorebird lice.

On the other hand, the birds´ helminth communities and the factors which structured them are still poorly known in South America. One of the most studied host-parasite-environment models in the Patagonian coast is that of *L. dominicanus*, one of the most abundant coastal bird species found throughout the Argentinean coast (Bertellotti & Yorio 1999, Yorio et al. 2005) which is characterized by a great parasitic richness because of its generalist and opportunistic habits (Diaz et al. 2011). Thirteen (13) adult helminths taxa were recognized parasitizing the *L. dominicanus* population from Península Valdés, including cestodes, trematodes, nematodes, and acanthocephalans (Cremonte 2001, 2004, Diaz & Cremonte 2004, 2010, Diaz et al. 2001, 2004, 2011, 2012). Besides, there are several isolated reports of parasites in different coastal birds, like nematodes from the Steamer Duck, *Tachyeres leucocephalus* Humphrey & Thompson, the Crested Duck, *Lophonetta specularioides* (King), the Black-necked Swan, *Cygnus melancoryphus* (Molina) (Anatidae) (Agüero & Diaz 2013, Agüero et al. 2015) and from the Imperial Shag *P. atriceps* and the Red-legged Shag *Phalacrocorax gaimardii* (Lesson & Garnot) (Phalacrocoracidae) (Garbin et al. 2008, 2014). Also, trematodes like *Bartolius pierrei* Cremonte, 2001 were recorded in the Red Knot *Calidris canutus rufa* Linnaeus (Cremonte 2004), and *Maritrema formicae* Diaz, Gilardoni & Cremonte 2012, *Levinseniella cruzi* Travassos 1921, and *Odhneria odhneri* Travassos, 1921 parasitizing the Baird's Sandpiper *Calidris bairdii* Coues (Scolopacidae) (Capasso et al. 2019). *Odhneria odhneri* was also recorded in the Two-banded Plover *Charadrius falklandicus* Latham (Scolopacidae) (Capasso et al. 2017). Finally, two species of Acanthocephala, *Arhythmorhynchus comptus* Van Cleave & Rausch, 1950 and immature *Profilicollis* sp., were reported in *C. bairdii* and the White-rumped Sandpiper *Calidris fuscicollis* (Vieillot) (Scolopacidae) (Capasso & Diaz 2016).

Knowledge on richness and diversity of bird parasites in littoral areas may provide important information about interactions, trophic webs, and compound community structure, mainly in those regions where the coastal birds abundance (mostly gulls) is increasing as a result of human activities such as fishing (Galaktionov & Skirnisson 2000, Diaz et al. 2011). Therefore, baseline information on the parasitofauna is very important to understand possible modifications in a changing world. The aim of the present work is to report both ecto and endoparasites for some of the most abundant coastal bird species from the Patagonian coast.

MATERIALS AND METHODS

Ten coastal birds, 2 Blackish Oystercatcher *Haematopus ater* Vieillot & Oudart (Charadriidae), 4 Kelp Gulls *Larus dominicanus*, 2 Dolphin Gulls *Leucophaeus scoresbii* Traill (Laridae), and 2 Crested Duck *Lophonetta specularioides* (Anatidae) were captured and collected from the rocky littoral near the estuary of the Deseado River, in Puerto Deseado, Santa Cruz Province, Argentina (47° 45' S, 65° 55' W) during May 2016. Birds were captured with an airsoft gun under permits provided by the Wildlife Secretary of the Santa Cruz province (Resolution Number 861/08); then they were euthanized with carbon dioxide and inspected for ectoparasites by observing all the surface of the body underneath the feathers. Lice were collected using forceps and fixed in 96% ethanol. Finally, they were dissected and searched for endoparasites under a stereomicroscope. The gastrointestinal tract was separated into esophagus, stomach, and intestine; this last organ was divided into three equal sections. The body cavity, liver, pancreas, biliary vesicle, gall bladder, gonads, lungs, heart,

bursa of Fabricius, cloaca, and kidneys were also examined for parasites. Helminths recovered from each section were counted, fixed in 5% hot formalin, and preserved in 70% ethanol. Cestodes were stained in Harris hematoxylin, and digeneans with Semichon's carmine or Gomori´s trichrome, dehydrated in a graded ethanol series, cleared in methyl salicylate, and mounted in Canada balsam. Nematodes and acanthocephalans were cleared in lactophenol or in 25% glycerine-ethanol. All species were studied using a light microscope and identified at the most precise taxonomic level possible (Odhner 1910, Price 1929, Wright 1956, Clay 1962, 1981, Johri 1963, Szidat 1964, Graefe 1968, Odening 1982, Bona 1994, Czsplinski & Vaucher 1994, Hoberg 1994, Khalil 1994, Navone et al. 1998, Diaz et al. 2004, Nikolov et al. 2005, Diaz & Cremonte 2010, Diaz et al. 2011, Fernandes et al. 2015, Diaz et al. 2020, Gilardoni et al. 2020). The number of parasitized hosts and the intensity of infection (number of parasites divided by number of parasitized hosts) were determined. Specimens were deposited at the Parasitological Collection of the Instituto de Biología de Organismos Marinos (CNP-Par), Puerto Madryn, Argentina.

RESULTS

A total of 21 parasite taxa, 2 ectoparasites (lice) and 19 endoparasites (helminthes) were found parasitizing the 4 coastal bird species studied (Table I). Only *Haematopus ater* was infested with ectoparasites, finding 2 Phthiraptera species, *Quadraceps ridqwayi* Kellogg, 1906 (Ischnocera, Philopteridae) and *Actornithophilus grandiceps* Piaget, 1880 (Amblycera, Menoponidae). Among the helminthes, 4 Cestoda, 11 Digenea, 3 Nematoda, and 1 Acanthocephala were recorded.

A taxonomic summary is exposed in Table I hereas remarks of each one are presented below.

ECTOPARASITES

Phthiraptera

Ischnocera Kellog, 1896

Philopteridae Eichler, 1959

Quadraceps Clay & Meinertzhagen, 1939

Quadraceps ridgwayi Kellogg, 1906 (Figure 1)

The morphological diagnosis agrees with the species recorded by Clay (1981). The genus *Quadraceps* is composed of more than 100 species parasitizing mainly Charadriiformes (Palma 1995); among them *Q. ridgwayi* was described from the American Oystercatcher *Haematopus palliatus galapagensis* Ridgway from Galapagos Island. In her study about lice from Oystercatcher, Clay (1981) reported *H. ater* for the first time as host of *Q. ridgwayi*, from samples deposited in the Natural History Museum. However, the author of this record was not mentioned in the study. In the NHM Collection, there are two slides from *H. ater* collected by A.J. Baker in "Punta Clara, Chubut". However, this does not correspond to a real geographic location, therefore it is not clear where these samples were really collected.

Amblycera Kellogg, 1896

Menoponidae Nitzsch, 1818

Actornithophilus Ferris, 1916

Actornithophilus grandiceps Piaget, 1880 (Figure 2)

The morphological diagnosis agrees with the species recorded by Clay (1962). The genus *Actornithophilus* was erected by Ferris (1916), and currently, it includes 36 species parasitizing Charadriiformes (Clay 1962). In her key to the species of *Actornithophilus*, Clay (1962) analyzed samples from *H. ater* from different locations along the South American coast, but there is

Table I. Ecto and endo parasites species recorded in the studied coastal birds from Puerto Deseado, Patagonian coast, Argentina. Mean intensity of infection is given followed by the range in parenthesis.

Coastal bird host	Parasite species	Infection site	Nº parasitized host	Intensity of infection	Deposited specimens
Haematopus ater (n = 2)	**Phthiraptera**				
	Ischnocera				
	Quadraceps ridgwayi	Feathers	2	3 (1-4)	CNP-Par 179
	Amblycera				
	Actornithophilus grandiceps	Feathers	1	4	CNP-Par 180
Larus dominicanus (n = 4)	**Cestoda**				
	Progynotaenia sp.	Intestine (first section)	1	7	CNP-Par 154
	Digenea				
	Gymnophalloides nacellae	Intestine, caeca, cloaca	1	339	CNP-Par 171
	Gymnophallus australis	Intestine, caeca, cloaca	1	100	CNP-Par 172
	Paramonostomum sp.	Intestine, caeca, cloaca	2	505 (11-1000)	CNP-Par 168
	Cestoda				
	Tetrabothrius sp.	Intestine (first and second section)	2	2*	CNP-Par 151
	Dilepididae gen. et sp.	Intestine (first and second section)	2	4*	CNP-Par 181
	Digenea				
	Gymnophallus australis	Intestine (third section)	2	27 (4-50)	CNP-Par 166
	Maritrema madrynense	Intestine (third section)	1	5	CNP-Par 182
	Parorchis sp.	Cloaca	1	8	CNP-Par 183
	Renicola sp. 1	Kidney	2	3 (1-6)	CNP-Par 184
	Schistosomatidae gen. et sp.	Intestine mesenteric vessels	1	17	CNP-Par 185
	Nematoda				
	Anisakidae gen. et sp. (larvae)	Proventriculus, intestine	2	1 (1-2)	CNP-Par 186
	Paracuaria adunca	Gizzard	1	12	CNP-Par 187
	Cosmocephallus obvelatus	Esophagus	2	5 (2-9)	CNP-Par 188
	Acantocephala				
	Profilicollis chasmagnathi	Intestine (third section)	1	2	CNP-Par 189

Table I. Continuation.

Leucophaeus scoresbii (n = 2)	**Cestoda** Dilepididae gen. et sp.	Intestine (first and second section)	2	4 (1-7)	CNP-Par 152
	Digenea *Gymnophallus australis*	Intestine (third section)	1	30	CNP-Par 190
	Parorchis sp.	Cloaca	1	1 (1-1)	CNP-Par 191
Lophonetta specularoides (n = 2)	**Cestoda** Hymenolepididae gen. et sp.	Intestine (first section)	1	3	CNP-Par 153
	Digenea *Levinseniella* sp.	Intestinal caeca	2	118 (86-150)	CNP-Par 170
	Odhneria odhneri	Intestinal caeca	1	20	CNP-Par 169
	Notocotylus primulus	Intestinal caeca	2	10 (1-20)	CNP-Par 173
	Renicola sp. 2	Kidney	1	16	CNP-Par 192

*** Total number of cestodes from one kelp gull cannot be determined because the scolices were not found.**

not information from continental Argentina. *Actornithophilus grandiceps* was described by Piaget (1880) from the Eurasian oystercatcher, *Haematopus ostralegus* Linnaeus. Later, this species was reported in 7 out of the 12 oystercatcher species (Price et al. 2003). According to Price et al. (2003), *H. ater* is infested by *A. grandiceps*, but there are no bibliographic references for this record. As far as we know, only 2 slides of this species from Chile are deposited at the Price Institute of Parasite Research (PIPeR, Salt Lake City).

ENDOPARASITES

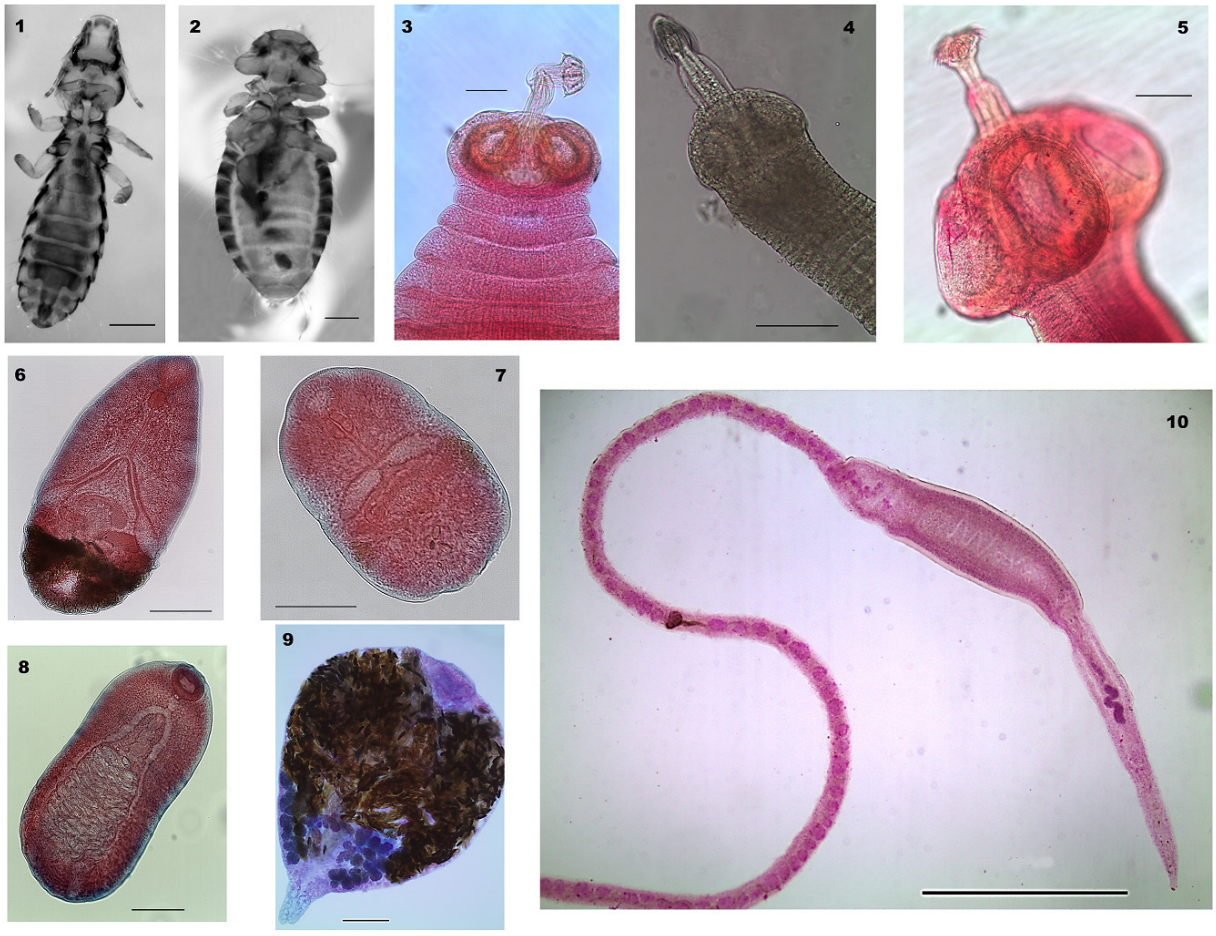
Cestoda

Tetrabothriidea Baer 1954; Tetrabothriidae Linton, 1891

Tetrabothrius Rudolphi, 1819

Tetrabothrius sp.

The morphological diagnosis agrees with species of the genus *Tethrabothrius* (Hoberg 1994). This genus is widely distributed among marine mammals and birds, including more than 40 species parasitizing seabirds (Hoberg 1994, Schmidt 1986). There are two previous records for the genus from birds on the Patagonian coast. One of these is *Tetrabothrius cylindraceus* (Rudolphi) reported in *L. dominicanus*, the other one is *Tetrabothrius lutzi* Parona, parasitizing the Magellanic Penguin, *Spheniscus magellanicus* Foster (Spheniscidae) (Diaz et al. 2010, 2011). In this study, specimens of *Tetrabothrius* were found in *L. dominicanus,* and because of the lack of mature proglottids, we could not determine them at species level.



Figures 1-10. Ecto and endoparasites of coastal birds from Puerto Deseado, Patagonian coast, Argentina. 1) *Quadraceps ridgwayi* (Ischnocera) from *Haematopus ater*, 2) *Actornithophilus grandiceps* (Ambycera) from *H. ater,* 3) *Progynotaenia* sp. (Cestoda) from *H. ater*, in toto 4) Dilepididae gen. et sp. (Cestoda) from *Larus dominicanus* and *Leucophaeus scoresbii*, in toto 5) Hymenolepididae gen. et sp. (Cestoda) from *Lophonetta specularoides,* in toto, 6) *Levinseniella* sp. (Digenea) from *L. specularoides,* in toto, 7) *Odhneria odhneri* (Digenea) from *L. specularoides,* in toto, 8) *Paramonostomum* sp. (Digenea) from *H. ater,* in toto, 9) *Renicola* sp. (Digenea) from *L. dominucanus*, in toto, 10) Schistosomatidae gen. et sp. (Digenea) from *L. dominucanus,* in toto. Scales: 1-2 (500 µm) 3-8 (100 µm) 9 (200 µm) 10 (1000 µm).

Cyclophyllidea van Benedenin Braun, 1900

Progynotaeniidae Fuhmann, 1936; Progynotaeniinae Furhmann, 1936

Progynotaenia Fuhrman, 1909

Progynotaenia sp. (Figure 3)

The morphological diagnosis agrees with species of the genus *Progynotaenia* (Johri 1963, Khalil 1994, Nikolov et al. 2005). The family Progynotaeniidae mostly parasites charadriiform birds and has been reported in different regions of the world (Johri 1963). In America, a single undescribed species of the genus *Proterogynotaenia* was reported in the American Oystercatcher *Haematopus palliatus* Temminck in Chile (Mariaux et al. 2017). There are disagreements about the location of many species into this genus or into *Paraprogynotaenia* (Nikolov et al. 2005). Following Khalil (1994), specimens collected in the present study in

H. ater belong to *Progynotaenia*, being the first record of the family Progynotaeniidae in Argentina.

Hymenolepididae Ariola, 1899

Hymenolepididae gen. et sp. indet. (Figure 4)

The morphological diagnosis agrees with species of the family Hymenolepididae (Czsplinski & Vaucher 1994). Among cestodes, Hymenolepididae is the family that includes the highest number of species. Few species from this family were reported in gulls from Argentina. Szidat (1964) reported *Hymenolepis semiductilis* Szidat, 1964 parasitizing *L. dominicanus* and *Larus maculipennis* (Lichtenstein) (Laridae) from the Paraná River, Santa Fé province, and Labriola & Suriano (2001) registered *Wardium paucispinosum* (Sandground 1928) and *Microsomacantus shetlandicus* Szidat, 1964 in some gulls from the Mar del Plata coast, Buenos Aires province. The specimens found in *L. specularioides* are small and delicate, so they are easily fragmented, showing great variability in many of the morphological characteristics. The present finding represents the first record of this family in *L. specularioides* from Argentina.

Dilepididae Raillet and Henry, 1909

Dilepididae gen. et sp. indet. (Figure 5)

The morphological diagnosis agrees with species of the family Dilepididae (Bona 1994). Dilepidid cestodes are very common birds parasites including more than 100 genera that exhibit host specificity at the order level of the host (Schmidt 1986, Bona 1994). The specimens here found in *L. scoresbii* and *L. dominicanus* resembles *Anomotaenia dominicana* (Railliet & Henry 1912), which were recorded in *L. dominicanus* from Península Valdés (Diaz et al. 2011). The specimens found in the present study constitute the first record of this family in *L. scoresbii*.

Digenea

Gymnophallidae Odhner, 1905; Gymnophallinae Odhner, 1905

***Gymnophallus australis* Szidat, 1962**

The morphological diagnosis agrees with the species recorded in *L. dominicanus* from northern Patagonia, Argentina (Diaz et al. 2011). The species was originally described as *Gymnophallus australis* (metacercariae parasitizing the mussel *Mytilus edulis* Linnaeus (Mytilidae) and then reassigned by the same author to the genus *Parvatrema* (Szidat 1965). Cremonte et al. (2008) re-described the species from cultured metacercariae and adults obtained in the laboratory from intertidal mussels and reassigned again to the genus *Gymnophallus*.

***Gymnophalloides nacellae* Cremonte, Pina, Gilardoni, Rodrigues, Chai & Ituarte, 2013**

The study of the specimens collected in this study allowed the description of the adult form of *Gymnophalloides nacellae* (Gilardoni et al. 2020). The metacercaria was described by Cremonte et al. (2013) from specimens parasitizing the limpet *Nacella magellanica* (Gmelin) (Nacellidae) which acts as a second intermediate host. The sporocysts with cercariae were described by Gilardoni et al. (2020) from specimens parasitizing the bivalve *Gaimardia trapesina* (Lamarck) (Gaimardiidae). Due to the restricted geographic distribution of their first intermediate host, *G. trapesina* (Gilardoni et al. 2020), the geographic distribution is limited to the Magellanic region on the Patagonian coast due to the restricted geographic distribution of their first intermediate host, *G. trapesina* (Gilardoni et al. 2020).

Microphallidae Travassos, 1920

***Levinseniella* sp. Stiles & Hassall, 1901 (Figure 6)**

The morphological diagnosis agrees with species of the genus *Levinseniella* (Szidat 1964). Several bird species were recorded as host of this trematode in different areas of Argentina (Szidat 1964, Lunaschi & Drago 2007). In Patagonia, *L. cruzi* was reported in L. *dominicanus* and *L. maculipennis* from lakes of the Río Negro and Neuquén provinces (Szidat 1964). In marine areas, this species was recorded in *C. bairdii* from the Chubut province (Capasso et al. 2019). The present finding represents the southernmost record of this genus. It is necessary to study the specimens to know whether they belong to an already described species or an undescribed one.

***Maritrema madrynense* Diaz & Cremonte, 2010**

The morphological diagnosis agrees with the species described in *L. dominicanus* from northern Patagonia, Argentina (Diaz & Cremonte 2010). Other four species of this genus had been previously reported in Argentinean waters: *Maritrema formicae* Diaz, Gilardoni & Cremonte, 2012 from *L. dominicanus* and *C. bairdii*; *Maritrema bonaerensis* Etchegoin & Martorelli 1997 from *L. dominicanus, L. atlanticus,* and *L. maculipennis* (Etchegoin & Martorelli 1997, La Sala et al. 2009, Diaz et al. 2012); *Maritrema orensensis* Cremonte & Martorelli 1998 from *L. dominicanus* and *L. atlanticus* (Cremonte & Martorelli 1998, La Sala et al. 2009); and *Maritrema pichi* Capasso, Diaz and D'Amico, 2019 parasitizing *C. bairdii* from Chubut Province (Capasso et al. 2019). The pulmonate limpet *Siphonaria lessonii* Blainville (Siphonariidae) acts as the first and second intermediate host of *M. madrynense,* harboring sporocysts with cercariae and/or metacercariae (Alda & Martorelli 2009, Gilardoni et al. 2011); besides, the crab *Cyrtograpsus altimanus* Rathbun (Varunidae) and the isopod *Idotea baltica* (Pallas) (Idoteidae) were recorded as the second intermediate hosts (Diaz & Cremonte 2010, Bagnato et al. 2015).

***Odhneria* Travassos, 1921**

***Odhneria odhneri* Travassos, 1921 (Figure 7)**

The morphological diagnosis agrees with *Odhneria odhneri* Travassos, 1921, which is the only species of the genus and it was widely recorded in the western hemisphere parasitizing birds belonging to several families: Anatidae, Ardeidae, Charadriidae, Laridae, Scolopacidae, and Phalacrocoracidae (Fernandes et al. 2015). In Argentina, it was reported from *Calidris fuscicollis, C. bairdii* (Scolopacidae), *Charadrius falklandicus* (Charadriidae), *Phalacrocorax brasilianus* (Phalacrocoracidae) and *L. dominicanus* on the Patagonian coast (Cremonte & Etchegoin 2002, Diaz et al. 2011, Capasso et al. 2017), and from *L. atlanticus* on the Buenos Aires coast (La Sala et al. 2009). The present finding represents the first record from *L. specularioides*.

Notocotylidae Lühe, 1909

***Notocotylus* Diesing, 1839**

***Notocotylus primulus* Diaz, Gilardoni, Lorenti & Cremonte, 2020**

The study of the specimens collected in this study allowed the description of a new species of the genus *Notocotylus* (Diaz et al. 2020). Six species of this genus were registered parasitizing birds from Argentina: *Notocotylus attenuatus* (Rudolphi, 1809) infecting the Silver Teal *Lophonetta versicolor* Vieillot and the Black-necked Swan *Cygnus melanocorypha* (Molina) (Anatidae); *Notocotylus gibbus* (Mehlis in Vreplin, 1846) infecting the White-winged

Coot *Fulica leucoptera* Vieillot (Rallidae) from the Buenos Aires province; *Notocotylus biomphalariae* Flores & Brugni, 2005 infecting *Lophonetta* sp. (Anatidae) and *Gallus gallus domesticus* (Linnaeus) (Phasianidae); and *Notoctylus imbricatus* (Noble, 1933) infecting the Chiloe Wigeon *Lophonetta sibilatrix* (Poepping) (Anatidae) from the Rio Negro province; *Notocotylus chionis* Baylis 1928 infecting the Snowy Sheathbill *Chionis albus* (Gmelin) (Chionidae); and *Notocotylus tachyeretis* Duthoit, 1931 in the Flying Steamerduck *Tachyeres patachonicus* (King) (Anatidae) from Patagonia (Lunaschi & Drago 2007 and reference there).

Paramonostomum Lühe, 1909

Paramonostomum sp. (Figure 8)

The morphological diagnosis agrees with species of the genus *Paramonostomum* (Graefe 1968, Odening 1982). Four species of this genus were registered parasitizing birds from South America; *Paramonostomum fuscicollis* Diaz & Guevara, 1970 parasitizing *C. fuscicollis* from Venezuela, *P. ionorme* Travassos, 1921 parasitizing the Common Gallinule *Gallinula galeata galeata* (Lichtenstein), the Plumbeous Rail *Pardirallus sanguinolentus* (Swainson), the Purple Gallinule *Porphyrio martinicus* (Linnaeus) (Rallidae), the Wattled *Jacana jacana* (Linnaeus) (Jacanidae), from Brazil and parasitizing *P. martinicus* from Venezuela and *P. pseudalveatum* Price, 1931 parasitizing the Yellow-billed Pintail *Lophonetta georgica* Gmelin (Anatidae) from Chile (Fernandes et al. 2015 and reference there). Other two species were recorded on the Antarctic Peninsula, *P. antarticum* Graefe, 1968 parasitizing *C. alba* and *L. dominicanus* (Graefe 1968, Odening 1982) and *P. signiensis* parasitizing *C. alba* (Jones & Williams 1969). At present, two larval stages (rediae with cercariae and metacercariae) of the family Notocotylidae were recorded from marine environments; one in the snail *Laevilitorina caliginosa* (Gould) (Littorinidae) from the Antarctic Peninsula (Graefe 1968), and other from the limpet *N. magellanica* from Patagonia, Argentina (Bagnato et al. 2015, Gilardoni et al. 2019). Specimens found at the present study were recorded for the first time in Argentina and this represents a new species awaiting study (E. Bagnato, G. Gilardoni & C. Cremonte unpublished data). Molecular sequences of larval stages from *N. magellanica* match with adults from *H. ater* (E. Bagnato, C. Gilardoni & F. Cremonte unpublished data).

Philophthalmidae Travassos, 1918

Parorchis Nicoll, 1907

Parorchis sp.

The morphological diagnosis agrees with the species recorded parasitizing *L. dominicanus* from the northern Patagonian coast, Argentina (Diaz et al. 2011). By the study of the new specimens recovered from the same host species and from *C. fuscicollis*, based on some morphological differences but clearly distinguished by molecular features, J.I. Diaz et al. (unpublished data) suggest that it may belong to a new species resembling *P. acanthus*. The snail *Trophon geversianus* (Pallas) (Muricidae) acts as the first intermediate host in the life cycle of this species harboring rediae with cercariae; the metacercariae are found encysted in the substrate (Bagnato et al. 2015, Gilardoni et al. 2019). The present record from *L. scoresbii* constitutes evidence of a new host for this species.

Renicolidae Dollfus, 1939; Renicola Cohn, 1904

Renicola spp. (Figure 9)

The morphological diagnosis agrees with species of the genus *Renicola* (Wrigth 1956). Some morphological features allow us to determine that different species are present in *L. dominicanus* and *L. specularioides*. *Renicola* sp. was recorded parasitizing *L. dominicanus* from Brazil (Wrigth 1956). Other three species were recorded in South America: *Renicola cruzi* Wright, 1956 parasitizing the South American Tern *Sterna hirundinacea* Lesson, *Sterna* sp., and the Royal Tern *Sterna maxima* Boddaert (Sternidae) from Brazil; *Renicola* cf. *cruzi* parasitizing *S. maxima* from Colombia; and *Renicola mirandaribeiroi* parasitizing the Brown Booby *Sula leucogaster* (Boddaert) (Sulidae) from Brazil (Fernandes et al. 2015 and references there). Two larval stages (sporocyst with cercariae) were recorded from the northern Patagonian coast, Argentina; one of them parasitizing the snail *T. geversianus* and the other parasitizing the limpet *N. magellanica* (Bagnato et al. 2015, Gilardoni et al. 2019). It means that two renicolid species cohabit on the Patagonian coast; the adult found in *L. dominicanus* could be a different species than that parasitizing *L. specularioides*. A renicolid metacercaria belonging to the same species to the redia found in *T. geversianus* was recorded in the mussel *M. edulis* (Bagnato et al. 2015). Other renicolid metacercariae were found parasitizing the limpet *N. magellanica* and the bivalves *Lasaea adansoni* and *G. trapesina* on the Patagonian coast (F. Cremonte & C. Gilardoni unpublished data). Species (as an adult stage) of this genus are recorded for the first time in Argentina.

Schistosomatidae Stiles & Hassall, 1898

Schistosomatidae gen. et sp. indet. (Figure 10)

The morphological diagnosis agrees with species of the family Schistosomatidae (Odhner 1910, Price 1929). Two species were recorded in birds from Argentina; *Dendrithobilharzia rionegrensis* Martorelli, 1981 parasitizing the Red-fronted Coot *Fulica rufifrons* Philippi & Landbeck (Rallidae) and *Ornithobilharzia canaliculata* (Rudolphi, 1849) Odhner, 1912 parasitizing *L. maculipennis* and *L. dominicanus* (Fernandes et al. 2015 and reference there). Larval stages (sporocyst with cercariae) of one species belonging to this family were recorded parasitizing the pulmonate marine snail *S. lessonii* (Alda & Martorelli 2009, Gilardoni et al. 2011), and it belongs to the same species of the schistosomatid adults found in *L. dominicanus* but not morphologically described at present (Brant et al. 2017).

NEMATODA

Spirurida (Diesing, 1861)

Acuariidae (Seurat, 1913), Acuariinae Raillet, Henry and Sisoff, 1912

Cosmocephalus obvelatus (Creplin, 1825)

The morphological diagnosis agrees with the species recorded parasitizing *L. dominicanus* from the northern Patagonian coast, Argentina (Diaz et al. 2011). This acuariid nematode has a wide geographical and host distribution (Diaz et al. 2011). In *Larus* spp., this species has been found in Canada, Brazil, Spain, New Zealand, and Chile (Diaz et al. 2011). In Argentina, the species was reported parasitizing the Magellanic Penguin and the Kelp Gull (Diaz et al. 2001, 2010, 2011). The species showed great morphological stability and it was concluded that it has high adaptability to different hosts and localities (Diaz et al. 2011).

Paracuaria adunca (Creplin, 1846)

The morphological diagnosis agrees with the species recorded parasitizing *L. dominicanus* from the northern Patagonian coast, Argentina (Diaz et al. 2004). This is a frequent nematode parasitizing several piscivorous birds (e.g. Laridae, Gaviidae, Podicipedidae, Diomedeidae, Anatidae) and widely distributed in North and Central America, Europe, and Asia (Anderson & Wong 1982). It was reported for the first time in South America and for *L. dominicanus* and later, the species was found from the same host in Chile (see Diaz et al. 2004, 2011).

Anisakidae Railliet & Henry, 1912

Anisakidae gen. et sp. indet. (larvae)

The morphological diagnosis agrees with species of the family Anisakidae (Navone et al. 1998). Anisakid nematodes have a worldwide distribution and are associated with fishes, birds, and marine mammals. Transmission of species usually involves aquatic invertebrates and fish as intermediate or paratenic hosts (Anderson 2000). In the Southwest Atlantic, larval stages of a different genus of this family were reported (Garbin et al. 2019a). Among them, species of *Contracaecum* Raillet and Henry, 1912 were registered in different Patagonian birds (Garbin et al. 2019b).

ACANTOCEPHALA

Polymorphidae Meyer, 1931

Profilicollis Meyer, 1931

Profilicollis chasmagnathi (Holcman-Spector, Mañé-Garzón & Dei-Cas, 1977)

The morphological diagnosis agrees with the species recorded parasitizing *L. dominicanus* from the northern Patagonian coast, Argentina (Diaz et al. 2011). Amin (2013) recognized 9 species of the genus *Profilicollis*. All of them are parasites of waterfowl and fish eating adult birds and use decapods as intermediate hosts (Rodríguez et al. 2017, Lorenti et al. 2018). In Argentina, *P. chasmagnathi* was reported in *Larus atlanticus* from the Bahía Blanca estuary, Buenos Aires Province (La Sala et al. 2013) and in *L. dominicanus* from the Chubut Province coast (Diaz et al. 2011). This finding represents the southernmost geographical record for *P. chasmagnathi*.

DISCUSSION

A total of 2 ectoparasites and 19 endoparasites taxa were recovered from the 4 coastal birds species here studied: 6 from *Haematopus ater,* 11 from *Larus dominicanus*, 3 from *Leucophaeus scoresbii*, and 5 from *Lophonetta specularioides*.

The study of ectoparasites, particularly lice, in aquatic birds from Argentina is very scarce. Most of the host-parasite associations known were described by materials collected in the country and later deposited abroad in museum collections such as the Natural History Museum of London, or the Kellogg Collection, University of California, USA. In this work, we only found two lice species, *Quadraceps ridgwayi* and *Actornithophilus grandiceps* from *H. ater*. Both of them were previously recorded parasitizing *H. ater* but without precise bibliographic references. Only one previous work focused on the lice of shorebirds in Argentina. Daciuk et al. (1981) reported three species parasitizing the Kelp Gulls from Península Valdés, *Austromenopon transversum. Quadraceps punctatus,* and *Saemundssonia (Saemundssonia) lari*. In a recent study, we analyzed and compared the community structure of lice infesting Kelp Gulls from anthropogenic environments, i.e. a urban waste landfill and fisheries discards, from two different locations

in Argentina (E. Lorenti et al., unpublished data). In Puerto Madryn, Patagonia, we found 2 of the lice species previously reported as parasites of Kelp Gulls, *S lari*, and *A. transversum*. Eighty percent of the gulls were infested by at least one of these species. Despite there are no meaningful differences between populations, no latitudinal differences have been studied along the distribution of Kelp Gulls. In this sense, we assumed that the absence of lice might reflect a lower prevalence in this geographical area. In their recent work with shorebirds in Perú, Tavera et al. (2019) reported a prevalence of 62% Philopteridae and 49% Menoponidae. Despite the low number of birds analyzed in our work, the low infestation rates in Perú agree with our results. However, further research is needed to compare the ecology of lice in shorebirds and the possible differences between locations and host species.

This survey reports several new records of helminthes. Five species, *Renicola* sp. 1 from *Larus dominicanus*, *Levinseniella* sp., and *Renicola* sp. 2 from *Lophoneta specularioides*, and *Paramonostomum* sp. and *Progynotaenia* sp. from *H. ater*, are recorded for the first time in the mentioned coastal birds. For all birds, the helminth community was dominated by digeneans. These coastal birds feeding upon the intertidal zones and these areas are dominated by digeneans due to the high diversity of invertebrates acting as intermediate hosts.

Almost all the helminth species recovered parasitizing *L. dominicanus* in this survey were already previously recorded in Argentina (Diaz et al. 2011, Brant et al. 2017) excepting *Renicola* sp. 1. For the rest of the coastal birds analyzed, all findings represent new records, mainly because until now, parasite surveys for these bird species were practically non-existent. The three taxa (1 cestode and 2 digeneans) recorded for *L. scoresbii* and the four taxa (1 cestode and 3 digeneans) recorded for *H. ater* are the first records for these birds worldwide. Only 2 nematode species were previously recorded for *L. specularioides* (Agüero et al. 2015), then the five taxa (1 cestode and 4 digeneans) recovered in this survey constituted new records parasitizing this duck species.

This study contributes to the knowledge on marine biodiversity and elucidation of the parasites life cycles. Marine endoparasites are mainly transmitted using food webs; invertebrates usually act as intermediate hosts and vertebrates as definitive hosts (Lafferty et al. 2008). Therefore, birds parasites, the main top predators on the intertidal areas, can be indicators of diet and feeding habits.

The Kelp Gull *L. dominicanus* harbors a rich assemblage of parasites in agreement to its generalist feeding habits (Bertellotti & Yorio 1999, Diaz et al. 2011). Due to the presence of acuariid nematodes and cestodes that use fish as intermediate hosts, endoparasites reflect a diet including fish (Anderson & Wong 1982, Hoberg 1987). Crustaceans transmit the digenean *Maritrema madrynense* (Diaz & Cremonte 2010, Bagnato et al. 2015) and the acanthocephalan *Profilicollis chasmagnathi* (Lorenti et al. 2018). The digeneans *Gymnophallus australis* and *Renicola* sp. 1 are transmitted by mytilid bivalves (Szidat 1965, Cremonte et al. 2008, Bagnato et al. 2015).

Parasites of the Crested Duck *L. specularioides* allow us to infer that these birds feed upon crustaceans, which transmit two microphallid digeneans, and unknown bivalves which transmit the renicolid digenean. Notocotylid digeneans life cycles involve aquatic gastropods as intermediate hosts; cercariae usually encyst on vegetation or sometimes on the outer shell and/or operculum of the snail first intermediate host (Yamaguti 1975).

The limpet *Nacella magellanica* lives strongly adhered to the rocky substrate in the intertidal (Cortés & Narosky 1997) being a difficult prey for birds. Oystercatchers are adapted to eat limpets (Sapoznikow et al. 2008), and it is demonstrated by the presence of two digeneans, *Gymnophalloides nacellae* and *Paramonostomum* sp., which use this limpet species as intermediate hosts (Bagnato et al. 2015, Gilardoni et al. 2020, E. Bagnato, C. Gilardoni & F. Cremonte, unpublished data).

Birds, as definitive hosts, are the main promoters of the parasite diversity in aquatic environments (e.g., Fredensborg et al. 2006, Thieltges et al. 2011). The high vagility of birds compared to the other hosts in the trematode life cycle makes birds the main dispersal agents for trematodes. The close relationship between parasites and their hosts would allow understanding the ecological interactions in the coastal marine ecosystem.

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