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Ectoparasites on *Mugil liza* (Osteichthyes: Mugilidae) from the Tramandai-Armazém lagoon system, Southern Brazil

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Abstract. Among the fish species present in the Tramandaí-Armazem lagoon system on the north coast of Rio Grande do Sul, Brazil, members of the Mugilidae are prominent and economically important. This study evaluated the occurrence of ectoparasites on mullet *Mugil liza* caught in shallow nearshore waters in Tramandaí lagoon and the channel connecting the estuary to the sea. From January to May 2010, 63 individuals of *M. liza* were acquired from artisanal fishermen and the ectoparasites were observed and identified. Forty-seven fishes (74.6%) showed the following ectoparasites: 32 (68%) *Ergasilus* (Copepoda: Ergasilidae), 5 (11%) *Gyrodactylus* (Monogenea: Gyrodactylidae), 2 (4%) *Metamicrocotyla* (Monogenea: Metamicrocotylidae), 2 (4%) *Caligus* (Copepoda: Caligidae) on the gills; two (4%) Mollusca larvae (glochidia) and 7 (15%) metacercariae of digenetic trematodes adhered to the tegument. The preferred site of fixation was the gills. Length-weight relationship showed no significant difference between the parasitized and non-parasitized mullets.

Keywords: *Mugil liza*, marine fish parasites, Copepoda, Monogenea

Resumo: Ectoparasitos de *Mugil liza* (Osteichthyes: Mugilidae) do sistema lagunar Tramandaí-Armazém, Sul do Brasil. Dentre as espécies de peixes presentes no sistema Lagunar Tramandaí-Armazém, litoral norte do Rio Grande do Sul, Brasil, destaca-se a família Mugilidae, de ampla distribuição em águas tropicais e subtropicais, tendo grande importância econômica para a região. O objetivo deste estudo foi verificar a ocorrência de ectoparasitos em tainhas *Mugil liza* oriundas das margens rasas da laguna Tramandaí e do canal de ligação do estuário com o mar. No período entre janeiro e maio de 2010, sessenta e três *M. liza* foram compradas de pescadores artesanais e os ectoparasitos foram observados e identificados. Quarenta e sete tainhas (74,6%) foram positivas para os seguintes ectoparasitos: 32 (68%) *Ergasillus* (Copepoda: Ergasilidae), 5 (11%) *Gyrodactylus* (Monogenea: Gyrodactylidae), 2 (4%) *Metamicrocotyla* (Monogenea: Metamicrocotylidae), 2 (4%) *Caligus* (Copepoda: Caligidae) localizados nas brânquias; 2 (4%) larvas de Mollusca (gloquídias) e 7 (15%) metacercárias de trematódeos digenéticos no tegumento. A relação peso-comprimento não apresentou diferença significativa entre os mugilídeos parasitados e não parasitados.

Palavras-chave: *Mugil liza*, Parasitos de peixes marinhos, Copepoda, Monogenea

Introduction

Mugil liza (Valenciennes, 1836) is a commercially important fish distributed along the western Atlantic coast, from the Caribbean to southeastern Brazil (Albieri *et al*., 2010). Mullets are fished throughout year, however more intensively from May to August, when they migrate to southern and southeastern Brazil to breed and spawn (Herbst & Hanazaki, 2014). Mullets are an important food source that supports many small communities through both fishing and aquaculture (Katselsis *et al*., 2005). *M. liza* is commercially exploited by artisanal fishermen in the Tramandaí-Armazém estuary system on the northern coast of Rio Grande do Sul, Brazil, providing not only a source of food and work but also a local cultural identity (Peterson *et al*., 2008).

In nature, a range of parasites are well adapted and evolved with their hosts, with lasting relationships where the host may show no clinical signs of infestation (Broglia & Kapel, 2011). Parasitic diseases occur when the natural equilibrium among the environment, host and parasite is disturbed. Usually, environmental changes such as temperature and climate, or anthropogenic changes such as pollution and urbanization cause the imbalance between parasites and host (Iwanowicz, 2011). Thereby, parasites may affect fish health causing mechanical, physical and reproductive damage. Worm infestation may have significant consequences, such as reducing the efficiency of food utilization and the growth rate, as well as depressing the immune system, allowing the pathogenic action of opportunistic agents. Digenetic trematodes, for example, have been associated with economic losses in aquaculture, in terms of reduction of fish growth/weight and mortality increase (Crotti, 2013). Studies have reported the occurrence of parasites in *M. liza* in different countries along the Atlantic coast (Diniz *et al*., 2005; Santos *et al*., 2013; Sarabeev & Desdevises, 2014). In addition, new species of parasites were reported from *M. liza* in the State of Rio de Janeiro, Brazil (Oliveira *et al*., 1988; Abdallah *et al*., 2009). In this context, it is important to know the parasitological fauna of fish populations and to consider the effects of parasites on fish health. This information may help producers and researchers to understand changes in fish populations and the ecosystem.

This study evaluated the occurrence of ectoparasites on mullet *Mugil liza* from the Tramandaí-Armazém estuary.

Materials and Methods

Tramandaí-Armazém estuary is located on the northern coast of Rio Grande do Sul State (29°55'-30°00'S; 50°06'21"- 50°11'20"W) (Figure 1). The estuary is connected to the Atlantic Ocean by a 1.5 Km long channel with an average depth of 3.0 m.

Sixty-three individuals of *M. liza* were acquired from artisanal fishermen between January and May 2010. These mullets were collected from shallow waters of the Tramandaí lagoon and the channel connecting the estuary to the sea. The dead mullets were packed in ice and transported to the laboratory, where each fish was measured for length (cm), weighed (g) and dissected. The body surface was checked for the presence of ectoparasites, and when detected they were carefully removed and observed under a stereomicroscope and processed using appropriate techniques (Eiras *et al*., 2006). The length-weight relationship (Wt / Lt) was calculated by the equation Wt = a Ltb (Wt= total weight in g; total length in cm; a and b= constant values). The b value was tested by the t-test for b = 3, at the 5% significance level, and the (r) significance level was estimated.

Figure 1. Tramandaí-Armazém estuary adapted from Google Earth.

Results

Six different parasites were found in 47 (74.6%) of the 63 mullets (Table I). The length-weight relationship was $Wt = 0.0265.Lt^{2.7267}$ ($r^2 = 0.923$) for the 47 parasitized fish, and $Wt = 0.015.Lt^{2.8853}$ ($r^2 = 0.974$) for the 16 non-parasitized fish. The b value was 2.7267 for the parasitized fish and 2.8853 for the non-parasitized fish.

Discussion

Studies on fish parasites focus mainly on taxonomy, describing species of etiologic disease

agents, and relatively few treat ecological aspects of parasites in their microhabitats. Parasite effects are dependent on several factors such as the target organ, parasite species and intensity. Furthermore, in nature there is a balance among the environment, fish host and parasite.

Table I. Parasite found in 47 *Mugil liza* caught between January and May 2010 from the Tramandai-Armazém lagoon system, Southern Brazil. N = number of parasitized hosts.P = prevalence

Parasite	N	P (%)	Location
Ergasillus	32	68	Gills
Gyrodactylus	5	11	Gills
Metamicrocotyla	2	4	Gills
Caligus	2	4	Gills
Mollusca larvae (Gloquidia)	2	4	Tegument
Metacercaria of digenetic trematode	7	15	Tegument

Environmental changes such as dissolved oxygen, decrease and increase of carbon dioxide and ammonia, may cause stress and decrease resistance, causing illnesses in fish (Val *et al*., 2004). On the other hand, parasite life cycle often depends on seasonal climate changes, so the parasite prevalence and intensity may depend on the period of the year (Lisboa *et al*., 2015). Between January and May 2010, a total of 47 mullets (74.6%) were found infested by ectoparasites on the gills and tegument. Five (11%) specimens were parasitized by *Gyrodactylus* (Monogenea: Gyrodactylidae) and two (4%) by *Metamicrocotyla* (Monogenea: Metamicrocotylidae). Monogenea are common gill parasites of marine fish (Del Río-Zaragoza *et al*., 2010), and heavy infestations may cause hyperplasia of gill lamellae, resulting in gill pathology and interference with the exchange of respiratory gases and ions (Stephens *et al*., 2003). Copepods showed the highest prevalence: 32 (68%) specimens had *Ergasilus* and two (4%) had *Caligus*. Copepods are the most common marine fish ectoparasites, and cause damage to both farmed and wild fish (Costello, 2006). Copepod attachment and feeding activity on the skin and gills are the main cause of localized damage, such as cell infiltration and hyperplasia (Dezfuli *et al*., 2011). Ergasilids have the potential to affect the growth, fecundity, and survival of their hosts (Johnson *et al*., 2004). However, in this study, the mullets showed no signs of disease, as also found by Ranzani-Paiva & Silva-Souza (2004) who reported that in *Mugil platanus* the presence of copepods on gills did not cause any change in the fish health and condition. In the present study, the members of *Ergasilus* and *Caligus* were found associated with monogenetic and digenetic trematodes (black spots). Digenetic trematodes may cause "black grub" or "black spot" disease. Cercariae infect the fish host by penetrating the skin and transforming into metacercariae (visible encysted black grub). These digenetic trematodes have apparently few pathogenic consequences for fish health, although their presence often renders the fish undesirable to consumers (Lane & Morris 2010). Fish are able to implement behavioral, physiological and biochemical adjustments that allow them to live in unfavorable environmental conditions.

Among the most important stressors are adverse chemical conditions in the aquatic environment, including hypoxia and the presence of heavy metals and pollutants. There are obviously limits to this capacity, and stress occurs when these limits are exceeded. Depending on the intensity and frequency of the stressor, animal survival may decrease (Silveira *et al*., 2009). In this study, fish were captured from one of the most critical points regarding environmental pollution in Imbé Municipality. This part of the Tramandaí River receives large volumes of domestic sewage, and which attracts the mullets. These fish consume the debris, a complex of high nutritional value, composed of decomposing organisms and protozoa. This feeding habit is uncommon in other estuarine teleostian fishes, and is an advantage for mullets, which can avoid competing with other fish for food.

Furthermore, since estuaries accumulate large amounts of debris, including urban and industrial sewage, these fish are important in recycling excess organic material, and also serve as an environmental biomarker (Tancioni *et al*., 2015).

An important consequence of parasite infection is weight reduction, frequently associated with lipid decrease and muscle water-content increase (Eiras, 1994). However, the present results for the length-weight relationship (Wt/Lt) showed no significant differences between parasitized and non-parasitized mullets. The reason might be that mullets are highly resistant to stressors and, probably for this reason, the parasitized fish showed no clinical signs of disease. To understand the role of the parasite community in the ecosystem, studies on species composition are required (Debenedetti *et al*., 2013). It is important not only for fish and ecosystem health reasons, but also because fish are

becoming more important as a ready food source in Brazil and other countries. Further studies in the Tramandai-Armazém estuary are needed in order to get a sense of the overall health of the mullet *Mugil liza* in this system, which in turn will give researchers an indication of environmental changes.

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