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RESEARCH ARTICLE ARAŞTIRMA MAKALESİ

PARASITOLOGICAL EVALUATION AND BODY INDICES OF *Osteoglossum bicirrhosum* (Vandelli, 1829) TRADED IN A FAIR OF MANAUS, AMAZONAS, BRAZIL

Jefferson Raphael Gonzaga Lemos[1*], Marcio Quara Carvalho Santos [1], Cleusa Suzana Oliveira Araújo [2], Sanny Maria Sampaio Andrade [2], Gabriela Moraes Viana [3]

[1] Laboratory of Physiology, Federal University of Amazonas, Av. Rodrigo Otávio, 3000, CEP 69077-000, Amazonas, Brazil

[2] Laboratory of Applied Zoology, Nilton Lins University, Av. Prof. Nilton Lins, 3259, CEP 69058-040, Amazonas, Brazil

[3] Graduate Program in Aquaculture. Nilton Lins University, Av. Prof. Nilton Lins, 3259, CEP 69058-040, Amazonas, Brazil

Abstract: This study evaluated the parasitic fauna and body index of *Osteoglossum bicirrhosum* specimens intended for fish trade. Fish were parasitized by ectoparasites, Monogenoidea *Telethecium nasalis* (10%), *Gonocleithrum aruanae* (100%) and Branchiura *Argulus* sp. (10%). The parasitic intensity of *G. aruanae* was positively correlated to the weight-length relationship ($p<0.05$). The weight-length relationship indicated positive allometric growth ($b > 3.00$) and the relative condition factor indicated good body condition in the examined fish ($Kn = 1$). The splen and hepato-somatic index were on average 0.13 ± 0.08% and 0.83 ± 0.22%, respectively. This was the first study on evaluation of *O. bicirrhosum* health planned for the consumer in a market of fresh fish of the Amazonas State.

Keywords: Arowana, Condition Factor, Somatic Index, Parasites of Fish, Health

* **Correspondence to:** **Jefferson LEMOS,** Laboratory of Physiology, Federal University of Amazonas, 6977-000, Amazonas, 69077-000 BRAZIL

Tel: (+ 55 92) 81912418

E-mail: jefraphae@yahoo.com.br

Özet:

Manaus'da bir markette satılan Osteoglossum bicirrhosum (Vandelli, 1829)'un parazitolojik durumunun değerlendirilmesi, Amazon, Brezilya

Bu çalışma, ticari amaçla kullanılan *Osteoglossum bicirrhosum* (Vandelli, 1829)'un parazitik faunasını ve vücut indeksini değerlendirmektedir. Balıklar ektoparazitler; Monogenoidea *Telethecium nasalis* (10%), *Gonocleithrum aruanae* (100%) and Branchiura Argulus sp. (10%) tarafından enfekte olmuşlardır. G.aruanae'nin yoğunluğu boy ağırlık ilişkisi ile pozitif korrelasyon göstermiştir ($p < 0.05$). Boy-ağırlık ilişkisi pozitif allometrik büyüme (b>3.00) ve görece kondiyon faktörü vücut kondisyonunun incelenen balıklarda iyi olduğunu (kn=1) göstermiştir. Dalak ve hepatosomatik indeks ortalaması sırasıyla 0.13 ± 0.08% ve 0.83 ± 0.22% hesaplanmıştır. Bu Amazonas eyaletinde satılan O. bicirrhosum sağlık durumu hakkında yapılmış ilk çalışmadır.

Anahtar Kelimeler: Arowana, Kondisyon faktörü, Somatik indeks, Balık parazitleri, Sağlık

Introduction

The silver arowana, *Osteoglossum bicirrhosum*, family Osteoglossidae, is a fish with a compressed body that can reach a total length of 1 m and more than 2.5 Kg. It has bony and rough tongue, barbels at the tip of the chin and large scales with silver coloration. This fish lives in lakes of flooded forests of the Amazonas river basin, being found near aquatic vegetation where it feeds primarily on insects and spiders that fall into the water or that are in stems, branches and lianas, due to the ability to jump out of the water (Lowry et al., 2005). In the Amazonas State, this fish is important for the ornamental fish industry and fish market for food consumption, available in several fish trade fairs.

The commercialization of fish intended for consumption may be affected by several problems related to sanitation, among which stands out parasitic diseases which can represent risk of zoonosis to human, affect the appearance of fish (Ubeira et al., 2000) or interfere with growth rate (Lizama et al., 2007). Thus, the periodic parasite assessment of fish is very important because some diseases are associated to food intake and often the fish responsible for the disease is not available to analysis, making difficult to identify the true etiologic agent (Imam and Dewu 2010).

The health status of fish can also be evaluated through the determination of the condition factor, as this specifies the ideal body condition in a certain size range, and can be affected by parasitism, nutritional status, mobilization of energy reserves and other biotic and abiotic factors which can influence fish health (Tavares-Dias et al., 2000a; Lemos et al., 2006; Lizama et al., 2007; Gomiero et al., 2008; Tavares-Dias et al., 2010), are also used to evaluate fish healthiness, the somatic index of spleen (spleen-somatic índex) and liver (hepato-somatic index), because these are linfomielopoietic organs which may be changed due to agents that stimulate the production and differentiation of erythrocytes and leukocytes, or the use of energy reserves (Laidley et al., 1988; Tavares-Dias et al., 2000a,b; Wilkie 2002).

Despite the great importance of fish consumption by Amazonian populations and sanitary quality of the commercialized fish, little is known about the fish sold in the markets of the region. The present study is the first objectifying to evaluate the parasitic fauna and body index of *O. bicirrhosum*. The results obtained in this study has practical application and provide subsides for the fish traded in the Amazonas State.

Materials and Methods

Fish were collected at the region of Castanho Lake, Amazonas Basin, Amazonas State, by professional fishermen using a gillnet. Approximately three hours after being removed from the nets, fish were placed on ice and transported to a market of fresh fish at Porto da Ceasa, Manaus, Amazonas. Immediately upon arrival at the market, before commercialization, 10 specimens of *O. bicirrhosum* (9 females and 1 male) were sampled and transported to the Laboratory of applied Zoology, Nilton Lins University, to perform biometrics analysis, dissection, determination of somatic index and parasitological examinations.

Total mass, total length and standard length were determined. The data on mass and length were used for the determination of the weight-length relationship (W-L) trough the logarithmic formula LnWt = Ln *a* + LnLt. The relative condition factor (Kn) was evaluated separately for each experimental group using the formula Kn = Wt/*a*Lt^b (Le Cren 1951). The type of growth was evaluated by the value of the angular coefficient of the weight-length relationship (*b*) (Oscoz et al., 2005). Subsequently, nostrils, eyes, gills, stomach, intestine, kidney, spleen and liver were removed for parasite examination and determination of somatic index. Spleen and liver were weighed on an analytical balance to the determination of spleen-somatic index (SSI) and hepato-somatic index (HSI) using the formula (organ mass x fish $weight^{-1}$) x 100 (Tavares-Dias et al., 2000b).

An external macroscopic examination of skin and mouth was carried out to identify macroparasites or lesions caused by them. Next, eyes, nostrils and stomach were examined visually and also under a stereomicroscope. Gills and intestine were fixed in 5% buffered formalin for later examination. Spleen, liver and kidneys were macerated to allow the examination between slide and cover slip in a microscope. Collection, fixation and quantification of parasites followed the recommendations of Eiras et al. (2006) and Thatcher (2006). Identification was based on the works of Kritsky et al. (1996) and Thatcher (2006). Recommendations of Bush et al. (1997) were followed for parasitic index and ecological terminology.

In order to compare the Kn to 1.00 we apply the Student's t-test, and to correlate parasite intensity with biometric variables and Kn the Spearman "rs" correlation was applied. Only the parasites with prevalence greater than 10% were considered (Zar 1999). The level of statistical significance was $p \leq 0.05$.

Results and Discussion

Biometric data of the specimens of *O. bicirrhosum* studied are presented in Table 1. The intercept of the W-L relationship indicates positive allometry (b > 3.00) for this type of growth (Figure 1), in other words, the longer the heavier. This relationship can be used to estimate the weight or the length of the fish when only one of these values is known, providing important data on the fish biomass and allowing the determination of the type of growth, if isometric or allometric (Lemos et al., 2006). This information is unpublished for O._bicirrhosum but it is well known to another widely consumed osteoglosside, *Arapaima gigas*, for which are related with the types of growth, isometric (Tavares-Dias et al., 2010), positive allometric (Scorvo-Filho et al., 2004) and negative allometric (Ruffino and Isaac, 1995). The W-L relationship can also be used to assess fish healthiness when Kn is determined from it, because it reflects the nutritional status of the fish (Ruffino and Isaac, 1995; Scorvo-Filho et al., 2004, Tavares-Dias et al., 2010) or disease caused by parasite, as observed for Brycon_amazonicus where Kn was lower in infected fish (Lemos et al., 2007). In aruanã the Kn was not different from 1.00 (p = 0.968), indicating good body condition (Figure 2).

Table 1. Biometric data of silver arowana specimens, *Osteoglossum bicirrhosum,* traded in a fair fresh fish in Manaus, Amazonas, Brazil. SD, Standard Deviation.

Biometric data	*Mean ± SD (min-max)*
Mass (g)	828.15 ± 175.35 (589.19 – 1148.00)
Total length (cm)	53.15 ± 3.17 (49.00 – 58.00)
Standard length (cm)	49.75 ± 3.06 (44.50 – 55.00)

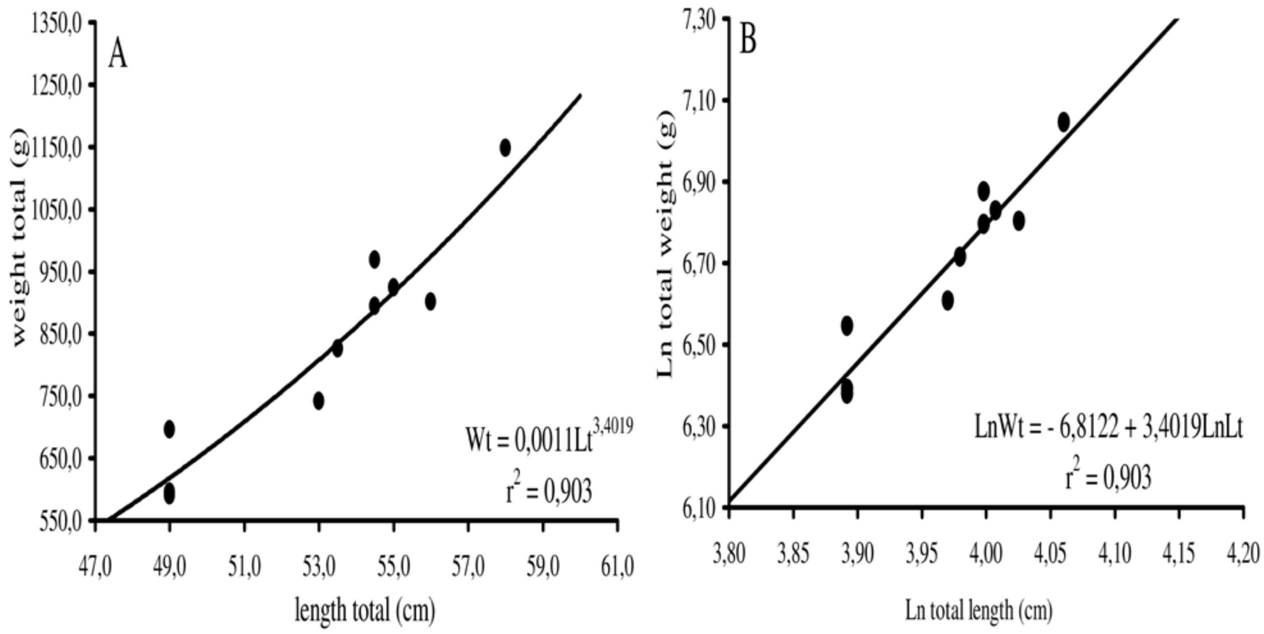

Figure 1. Weight-length relationship (A) and logarithmic transformation of weight-length relationship (B) of silver arowana specimens, *Osteoglossum bicirrhosum*, traded in a fair fresh fish in Manaus, Amazonas, Brazil.

The values of SSI and HSI of *O. bicirrhosum* ranged from 0.08 to 0.34% and 0.38 to 1.16%, respectively (Figure 3). The somatic index of the linfomielopoietic organs are very important to understand several disorders that can occur at the environmental conditions that affect the proportion of the organ mass in relation to fish mass (Tavares-Dias et al., 2000b; Tavares-Dias et al., 2008). Due to the absence of bone marrow fish use, in addition to kidneys, the spleen as an important erythropoietic organ that provide blood-filtering, and the liver as the organ that produces leukocytary response to infections and stock of energy reserves (Ardell and Woo 2006). The SSI and HSI can be used to demonstrate differences among species, as shown to *B. amazonicus* and *Colossomoma macropomum* (Tavares-Dias et al., 2008) and in the comparison of *Oreochromis niloticus* and *Piaractus* mesopotamicus, *Leporinus macrocephalus* and the hybrid tambacu, or to correlate to the levels of parasitic infestation, as demonstrated for *O. niloticus* (Lizama et al., 2007) and *P.* mesopotamicus (Tavares-Dias et al., 2000a). Data of SSI and HSI for *O. bicirrhosum* generate information for management plans and evaluation of health conditions for the species.

Parasites were diagnosed only in nostrils and gills. In nostrils two specimens of Telethecium nasalis were found Kritsky, Van Every and Boeger, 1996 (Monogenoidea, Dactylogyrid), with prevalence in 10% of the fish examined. In gills *Gonocleithrum aruanae* were found Kritsky and Thatcher, 1983 (Monogenoidea, Dactylogyrid) with 100% prevalence and mean intensity 92.00 ± 24.93 (32-124), and a specimen of Argulus sp. (Branchiura, Argulidae) was observed a positive and significant correlation between *G. aruanae* and the W-L relationship (Fig. 4). The Specimens of *O. bicirrhosum* studied were free of endoparasites with zoonotic relevance.

The two species of Monogenoidea identified are specific to *O. bicirrhosum* (Kritsky et al., 1996; Thatcher 2006), but this is the first report of the occurrence of Argulus sp. in this fish. These ectoparasites can cause lesions and affect the growth of the hosts when present at high intensity of infection, but the Kn values showed that the specimens of *O. bicirrhosum* presented good body condition. The positive and significant correlation observed between *G. aruanae* and the W-L relationship, indicate that greater the fish more higher is the infestation by that parasite, which occurs due to the greater available gill area as the fish grows.

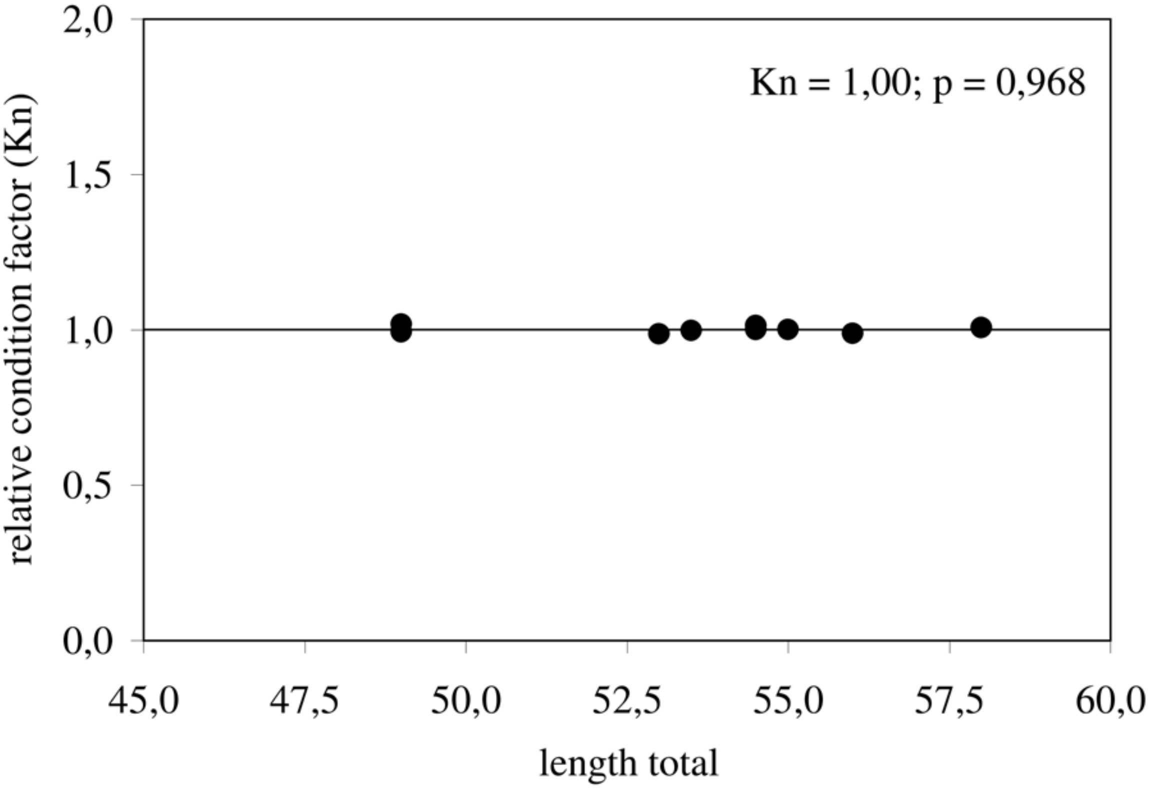

Figure 2. Relative condition factor (Kn) of silver arowana specimens, *Osteoglossum bicirrhosum*, intended for trade of fresh fish in open-air fairs in Manaus, Amazonas, Brazil.

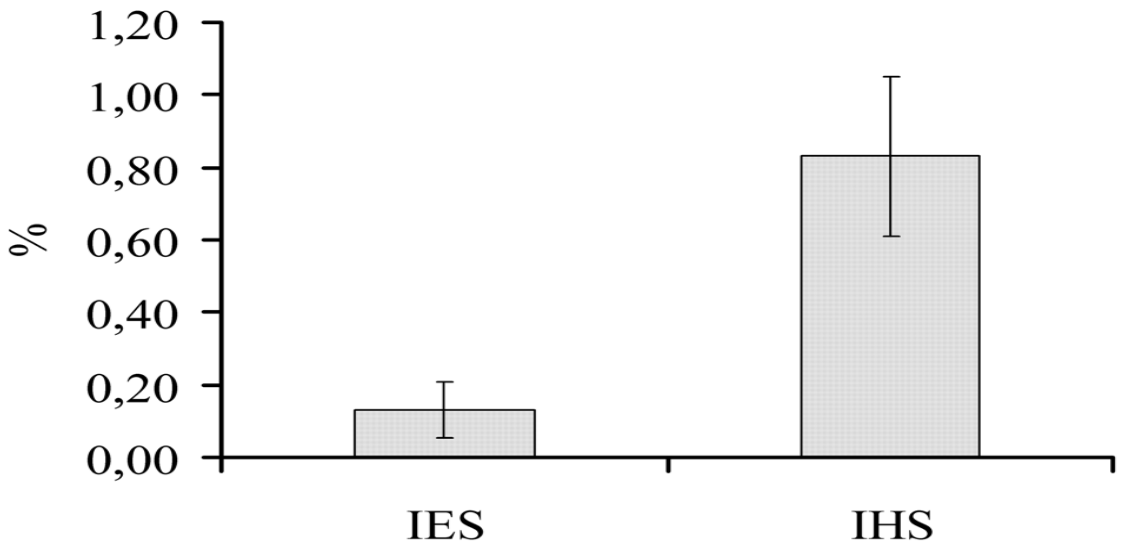

Figure 3. Spleen and hepato-somatic index (SSI and HIS) of silver arowana specimens, *Osteoglossum bicirrhosum*, traded in a fair fresh fish in Manaus, Amazonas, Brazil.

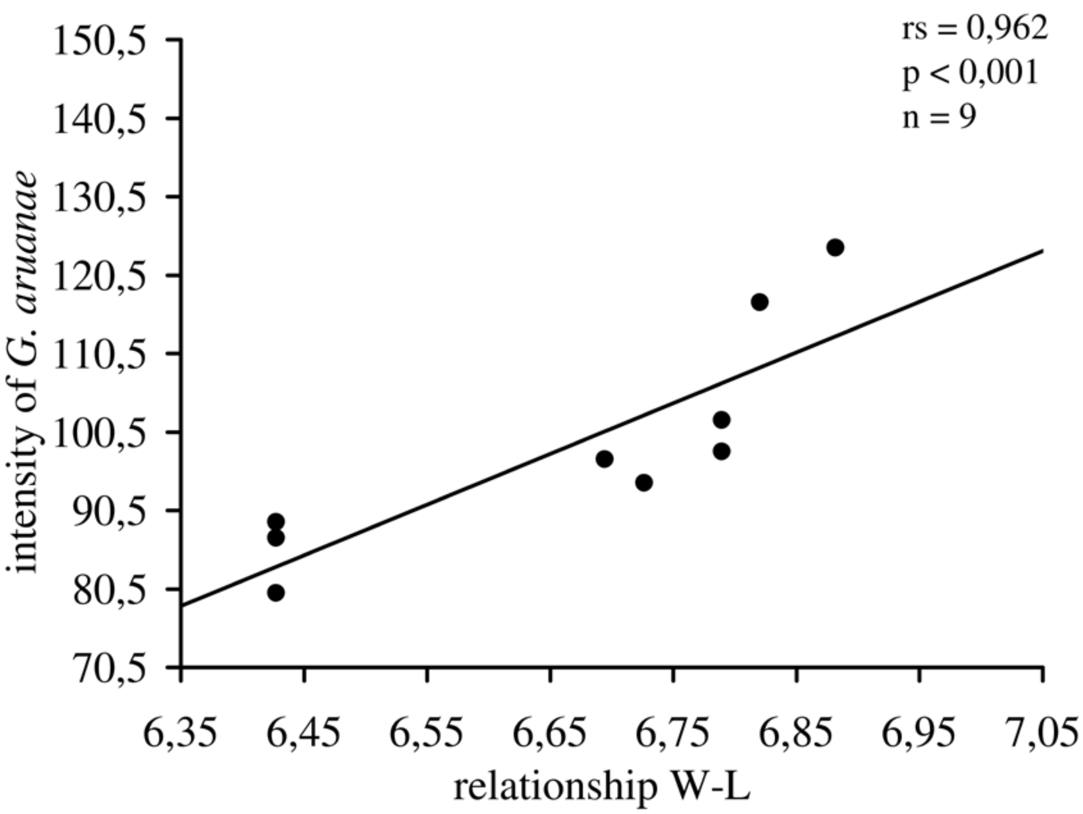

Figure 4. Spearman correlation "rs" between the parasitic intensity of *Gonocleithrum aruanae* and the weight-length relationship (W-L) of silver arowana specimens, *Osteoglossum bicirrhosum*, traded in a fair fresh fish in Manaus, Amazonas, Brazil.

The Monogenoidea and Brachiura is among the parasites which causes most concern for fish hatcheries but are not among the zoonosis that causes concern to human health (Ubeira et al., 2000), unlike endohelminths cestodes, trematodes and specially nematodes (Oliveira and Viegas 2004). In the case of nematodes, transmission to humans occurs when raw or undercooked fish is eaten, and larvae can migrate to intestines causing diseases (Luque 2004). Recent studies have focused on the larval forms of anisakid nematode due to the increase of the practice caused by eating raw fish, originated from oriental culture (Audicana et al., 2002). In the present study, the absence of endohelminths is a positive note from the health point of view.

Conclusions

In spite of the good body condition and absence of endoparasites with zoonotic relevance, the need for maintenance of good hygiene practices during fish processing such as freezing at refrigerated chambers when storage is necessary, good baking of fish before eating and the regular examinations of the other fish species used for human consumption should be emphasized.

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