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BIOMETRY OF CARANGID FISH AS BY-CATCH IN ARTISANAL PINK SHRIMP FISHING IN THE AMAZON ESTUARY

Biometria de Carangídeos da captura acessória na pesca artesanal do camarão rosa no estuário amazônico

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ABSTRACT

The analysis of morphometry and length-weight relationships (LWR) contribute to the expansion of the set of information available for the conservation of fishery resources, being fundamental to mitigate the anthropogenic effects caused in the natural environment by artisanal shrimp fishing. The aim of this study was to analyze the morphometry and estimate the LWR for two species of fish of the family Carangidae (*Oligoplites* spp.) in an estuarine Amazon region, Northern Brazil. In the Guajará-Mirim estuary, the seasonality of the seasons (rainy and dry periods) mainly affects water salinity, with greater frequency of the *O. saurus* species in the rainy season and *O. palometa* in the less rainy one, the differences between the morphometric measures of the species of the genus *Oligoplites* captured by the shrimp trawl, indicate the occurrence of small individuals, with the species *O. palometa* showing negative allometric growth and *O. saurus* positive allometric, , being the first records of LWR estimates, contributing to the bioecological knowledge of the species.

Keywords: Small fish, amazon seasonality, LWR

RESUMO

As análises de morfometria e relações peso-comprimento (RPC) contribuem para a ampliação do conjunto de informações disponíveis para a conservação dos recursos pesqueiros, sendo fundamentais para mitigar os efeitos antropogênicos causados no ambiente natural pela pesca artesanal de camarão. O objetivo deste estudo foi analisar a morfometria e estimar a RPC para duas espécies de peixes da família Carangidae (*Oligoplites* spp.) em uma região estuarina amazônica, Norte do Brasil. No estuário de Guajará-Mirim as sazonalidades das estações (período chuvoso e seco) afetam principalmente a salinidade da água, com maior frequência da espécie *O. saurus* na estação chuvosa e a *O. palometa* na menos chuvosa, as diferenças entre as medidas morfométricas das espécies do gênero *Oligoplites* capturadas pela rede de arrasto de camarão, indicam a ocorrência de indivíduos pequenos, sendo a espécie *O. palometa* apresenta um crescimento alométrico negativo e *O. saurus* alométrico positivo, , sendo os primeiros registros de estimativas RPC, contribuindo para o conhecimento bioecológico das espécies.

Palavras-chave: Peixes pequenos, sazonalidade amazônica, RPC

INTRODUCTION

Estuarine environments have high species richness, biomass and diversity of ecological and biological processes, ichthyofaunistic communities are highly important for influencing the composition and distribution of other biotic communities in estuaries (Barletta et al., 2008; Borges et al., 2010).

Among the fish communities, the Carangidae family contributes approximately 5% of commercial fishing catches worldwide, occurring in a tropical and warm climate environment (Able, 2005; Laroche et al., 2005).

In Brazil, approximately 35 species belong to Carangidae family, three species of the genus *Oligoplites* occurring on the Brazilian coast: *Oligoplites saliens* (Bloch, 1793), *Oligoplites saurus* (Bloch & Schneider, 1801) and *Oligoplites Palometa* (Cuvier, 1832), these species have distribution from the Western Atlantic to the Eastern Pacific, in areas of coastal waters and low salinity, found mainly in bays and feed on small fish and crustaceans (Menezes & Figueiredo, 1980; Queiroz et al. 2018).

Even with commercial importance, information about the biology of carangids is limited, especially in juvenile stages, with no previous information on the morphometric and length-weight relationships (LWR's) for species of the genus *Oligoplites* spp.

The analysis of the ichthyofauna of Amazon estuaries, through the morphometric and length-weight relationships (LWR's) is necessary due to the great importance of these areas, as well as the scarcity of information about the genus *Oligoplites*.

MATERIALS AND METHODS

SAMPLING SITES

Sampling was carried out every two months between January 2012 and November 2017, using a manual trawl net (called "Puçá"), 3 meters (m) long, 0.65 m high, 2.20 m wide and 20 mm mesh.

The "puçá" trawling technique is used by fishermen and is mainly intended for the capture of shrimp due to the benthic habit. The "puçá" consists of a nylon net in the shape of a cone or bag, attached to a fixed circular wooden frame, having a cable through which the equipment is handled (Figure 1).

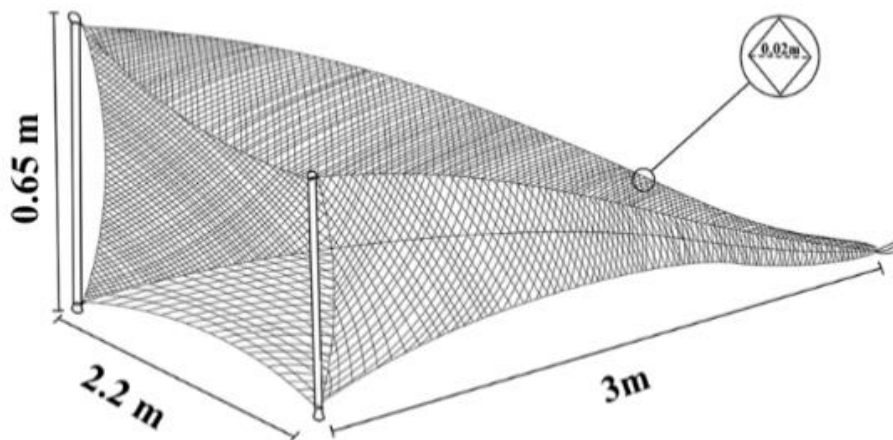


Figure 1. Characterization of "puçá", trawling equipment for shrimp capture in the Guajará-Mirim estuary, Pará State, Brazil.

The shrimp fishing net was dragged at night during low tide, at a depth of 1.0 m for 45 min, in a total course of 1,418 km between station 1 (S 00° 52 '55 "W 048° 09' 34 "), 2 (S 00° 52 '50" W 048° 09' 38) and 3 (S 00° 52 '41 "W 048° 09' 47") (Figure 2).

The captured individuals were stored and identified according to the date and place of collection, packed in a thermal box and preserved on ice, taken to the laboratory for further biometric and taxonomic analyzes.

The monitoring of the main hydrological characteristics (hydrogen potential (pH), water temperature and salinity) was measured in situ using a HANNA model HI9828 multiparameter probe.

The species were identified according to the keys of Cervigón et al. (1992) and Menezes & Figueiredo (1980).

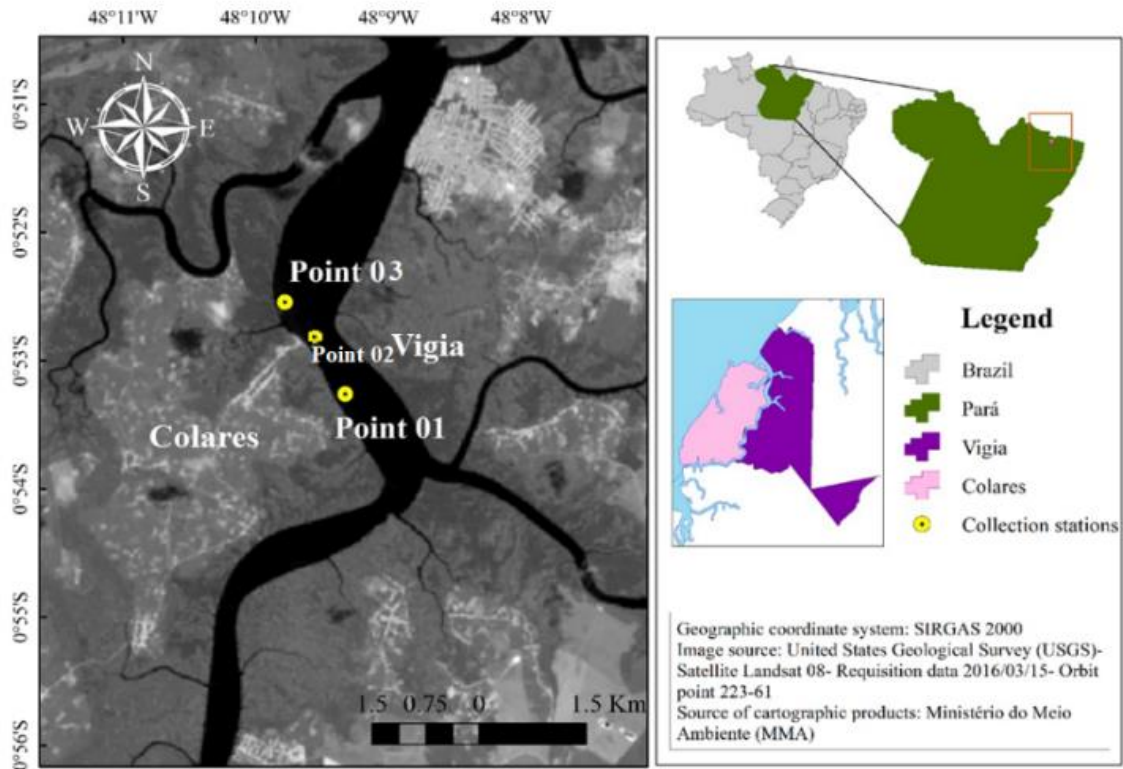


Figure 2. Map of the location of collection stations, Guajar-Mirim estuary, Par State, Brazil.

The total length (TL) between the front end of the head and the end of the caudal fin, standard length (SL) (between the front end of the head and the end of the spine), head length (HL) were recorded (between the anterior end of the snout and the edge of the operculum), diameter of the eye and the base of the dorsal fin using a pachymeter with a precision of 0.01 mm and the total weight recorded with a precision digital scale of 0.01 g.

Taxon nomenclature followed the international standard, using FishBase's online database (Froese & Pauly, 2023).

STATISTICAL ANALYSES

The relationships between length and weight (LWR's) were determined for the species, separately, according to the equation $TW = a.TL^b$, where TW = total weight; TL = total length; and 'a' and 'b' = growth parameters (Weatherley & Gill, 1987).

The growth rate was assessed by the degree of allometry as isometric ($b = 3$), positive allometric ($b > 3$) or negative allometric ($b < 3$) (Zar, 2009).

The Student's t-test ($\alpha = 0.05$) was used to verify statistical differences between the means of the chemical physical parameters and for the abundance of occurrences of the species during the rainy and dry periods through in software PAST version 3.25.

RESULT

In the Guajar-Mirim Amazon estuary, the seasons are known as the rainy season (from January to June) and the dry season (from July to December). In the rainy season, the average salinity (1.60 ± 0.72) is lower when compared to the dry season (6.64 ± 0.88), with a difference between seasonal averages ($p = 7.6947E-07$). The mean temperature and pH parameters were 28.25 ± 0.45 ° C and 6.76 ± 0.40 (rainy season) and 28.50 ± 0.45 ° C and 6.74 ± 0.34 (dry season), the difference between seasons was not significant in temperature ($p = 0.3665$) and hydrogen potential ($p = 0.93947$).

A total of 137 individuals were captured, which belong to the species *O. saurus* (89.78%) and *O. palometa* (10.22%).

The species *O. saurus* had a higher occurrence in the rainy season and *O. palometa* in the less rainy season, being possible to observe that there are no statistically significant differences between seasonal

catches for *O. saurus* ($p = 0.708$) and *O. palometa* ($p = 0.363$) (Figure 3).

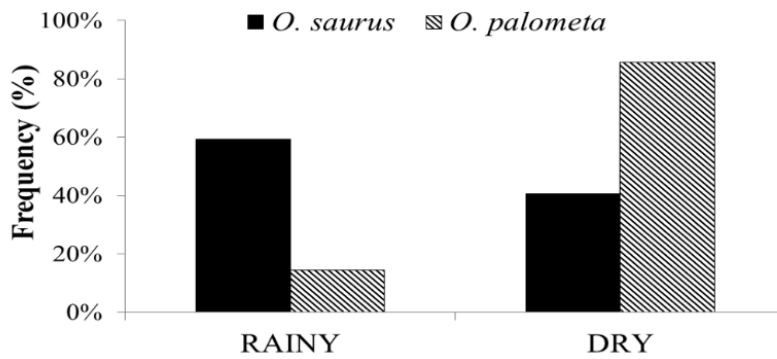


Figure 3. Seasonal frequency of species of the genus *Oligoplites* in Guajar-Mirm estuary, Par State, Brazil.

The morphometric measurements of the species of the genus *Oligoplites* captured by the shrimp trawl, indicate the occurrence of small individuals, in the juvenile phase (Table 1). The species *O. palometa* showed negative allometric growth and *O. saurus* positive allometric, that is, when b is less than 3, fish become thinner with increasing length, suggesting that these species have a relatively slow weight gain and tend to be longer in length, when b is greater than 3 (positive allometric growth) fish tend to gain more weight (Table 2).

Table 1. Morphometric measurements of species of the genus *Oligoplites* in the Guajar-Mirm estuary, Par, Brazil.

Variables (cm)	<i>O. palometa</i>			<i>O. saurus</i>		
	Mn	Mx	Mean±SD	Mn	Mx	Mean±SD
Total length	1.67	7.28	3.45± 1.55	1.9	4.29	2.92± 0.59
Standard length	1.34	6.15	2.85± 1.34	1.62	3.87	2.37± 0.54
Head length	0.47	1.77	0.90± 0.35	0.56	1.13	0.80± 0.13
Eye diameter	0.18	0.61	0.32± 0.12	0.19	0.43	0.27± 0.06
Dorsal fin base	0.47	3.5	1.47± 0.80	0.32	1.57	0.91± 0.45

Table 2. Total body weight and total length-weight ratio (LWR's) and allometry parameters (A), in the Guajar-Mirm estuary, Par, Brazil.

Species	Total weight (g)			(LWR) Parameters			
	Mn	Mx	mean±SD	a	b	R ²	A
<i>O. palometa</i>	0.04	2.61	0.61 ± 0.77	0.0128	2.7435	0.8281	(-)
<i>O. saurus</i>	0.05	0.75	0.21±0.17	0.0042	3.6088	0.7753	(+)

DISCUSSION

The values of the physical-chemical parameters in the Guajar-Mirm estuarine region corroborate with those found in the municipality of Vigia – PA (Brazil) by Silva et al. (2002) and Carvalho et al. (2019) who observed in the dry period (July, September and November) average values of the chemical physical parameters higher than the rainy period (January, March and May) emphasizing that salinity is higher in the dry period.

The species *O. palometa* has characteristics as the first dorsal fin spines with 4 to 5, the first branchial arch has from 14 to 19 tracks and *O. saurus* in its first dorsal fin is composed of 4 to 6 spikes, the first branchial arch with 17 to 21 trails and upper jaw with two rows of teeth, the genus is known in the Amazon region as Timbira or Pratiuira (Espirito-Santo et al. 2005).

The species *O. palometa* can reach up to 70 cm in length, but it is more common to find animals around

50 cm (Cervigón, 1993). Its weight reaches 900g, and *O. saurus* reaches a maximum described length of 35 cm, with specimens around 27 cm being more common, the maximum published weight is 287g (Menezes & Figueiredo, 1980).

Barros et al. (2011) recorded the occurrence of *O. palometa* in the rainy and dry periods, being found in estuarine and coastal/marine environments, in pelagic habitats, in the estuaries of municipalities São Caetano de Odivelas and Vigia, both in the state of Pará.

According to Espírito-Santo and Isaac (2012), among the species captured in the coastal region, the composed by the species *O. palometa* and *O. saurus* contributed with 21 tons landed in the ports of the estuary of the Caeté River, municipality of Bragança.

The species *O. palometa* is captured through industrial fishing, according to Silva et al. (2014) who recorded the occurrence of the species in fishing for various fish on the Amazon continental shelf and Maia et al. (2016) observed the occurrence of the species as an accompanying fauna in the industrial fisheries of marine shrimp in the mouth of the Amazon River.

Zacardi and Bittencourt (2017) in the Guajará Bay region, *O. saurus* larvae were considered dominant in the outermost region of the estuary, distributed at all times (day and night) regardless of the tides. Queiroz et al. (2018) observing fish in carangid estuary Curuçá, in northeastern Pará, reported an average of $1 \text{ cm} \pm 0.25$ (*O. palometa*) and $2.12 \pm 0.41 \text{ cm}$ (*O. saurus*).

The length and weight of the fish are two useful measures in the evaluation of the fish stock and, in general, in studies of population ecology, ecology of communities and ecosystems (Giarrizzo et al. 2015; Baitha et al. 2018).

The length-weight relationships make it possible to estimate the biomass used to determine the population development through the stock assessment models (Oliveira et al., 2020). For species of the genus *Oligoplites*, all individuals were considered sexually immature, which could influence the relationships reported in this study for the LWR's parameters estimated in the Guajará-Mirim estuary, that is, the estimated relationships are annual mean values, emphasizing that they are not it is representative of a specific seasonal season (Mouine et al. 2007; Pardoe et al. 2008).

In the Guajará-Mirim estuary, these species are caught in shrimp trawling and discarded as companion fauna due to their short length and weight.

Until now, there was no data available on the morphometric characteristics and length-weight relationships for the species *O. palometa* and *O. saurus* in the Amazon region, they are probably the first LWR's estimates, contributing to the bioecological knowledge of the species in an estuarine environment.

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