



ECOSYSTEMS

Trophic plasticity of tetra-fish, *Psalidodon aff. fasciatus* (Cuvier, 1819) (Characidae), in an Atlantic Forest stream of Northeast Brazil

INGRID CAROLINE C. PIRES, FABIANE B. SOUZA & ANDRÉ T. DA SILVA

Abstract: Trophic plasticity is a distinctive feature of freshwater fishes, representing an essential strategy for fish living in resource-variable environments. We analyzed the stomach contents of individuals sampled in two Atlantic Forest streams to identify the primary food sources consumed by *Psalidodon aff. fasciatus* and verify the existence of spatial, seasonal, and ontogenetic variations. The diet was determined by analyzing the stomach contents using the Volume Method to quantify the importance of food items. In general, *Psalidodon aff. fasciatus* was classified as an omnivorous species, consuming mainly insects, plant material, and filamentous algae. The results also showed significant effects for all factors considered (spatial, seasonal, and ontogenetic). Finally, *Psalidodon aff. fasciatus* demonstrated considerable trophic plasticity, which can result in better use of available resources in the environment and improved resource partitioning, reducing intraspecific and interspecific competition.

Key words: Contas river, feeding flexibility, freshwater, Neotropical streams.

INTRODUCTION

Fish plays a fundamental role in rivers and streams' trophic structure by exerting an interference in the biotic community, which causes impacts on their prey (Motta & Uieda 2004) and directly interferes with the population dynamics of an aquatic ecosystem (Vitule & Aranha 2002). Furthermore, fish also have an essential role in nutrient cycling and the connection of aquatic and terrestrial ecosystems since they consume terrestrial plants and invertebrates that fall into streams (Milardi et al. 2016). In this context, studying fish's natural feeding is essential to comprehending the species' trophic organization. This information enhances the understanding of fish autecology in tropical streams, which are essential subsidies for a deeper perception of the functioning and

preservation of these ecosystems (Zavala-Camin 1996, Esteves et al. 2021).

One of the main goals of studying feeding species is to understand the relationship between organisms in an ecosystem, representing the basis of fish trophic ecology (Braga et al. 2012, Esteves et al. 2021). Therefore, it embraces fundamental information for several analyses such as the trophic niche breadth (Souza et al. 2015, Vidotto-Magnoni et al. 2021), species' trophic position (Uieda & Motta 2007, Reis et al. 2020), the role of trophic aspects in the ecosystem processes functioning (Finlay et al. 2010, Leduc et al. 2015), ontogenetic changes (Dala-Corte et al. 2016, Barreto et al. 2018), intrapopulation variations (Mendes et al. 2019), and resource sharing (Silva et al. 2017, Souza et al. 2020).

The feeding of a particular fish species may change according to spatial-temporal origin.

Species with extensive geographical distribution can exhibit different diets according to locality (Barreto et al. 2018, Vidotto-Magnoni et al. 2021). Furthermore, the fish may present variations in dietary composition throughout the year (Lowe-McConnell 1999, Abelha et al. 2001). In tropical streams, variations in the river's physical structure and its surroundings, such as vegetation cover, can modify the supply and availability of food resources. It may decrease or increase the input of allochthonous items (Vannote et al. 1980, Boulton et al. 2008), potentially impacting the fish's dietary habits. For instance, Lobón-Cerviá et al. (2016) demonstrated that in deforested streams, invertebrates were replaced by detritus, organic matter, and algae compared to pristine streams.

In considering the temporal dimension, it is essential to emphasize that precipitation varies throughout the year, impacting food availability and resulting in seasonal variations in fish's diets (Junk et al. 1989, Abelha et al. 2001). During periods of higher precipitation, the seasonal variation in diet, especially in streams, is associated with greater availability of terrestrial-origin food carried into the aquatic environment by rainfall (Lowe-McConnell 1999). This input of allochthonous material, besides serving as a direct food source for fish (Gonçalves et al. 2018), indirectly influences their diet by, for example, enabling algae production (Tank et al. 2010) or serving as a food base for aquatic invertebrates (Boulton & Lake 1992), which commonly form part of the repertoire of resources consumed by the fish (Rosemond et al. 2001, Gonçalves et al. 2018).

In addition to spatial and temporal variations, fish diets can change due to ontogenetic variations since different diets can be found for the same species in different stages of individual development. This aspect is commonly observed for Characidae fishes, as

for *Astyanax lacustris*, *Psalidodon* aff. *fasciatus* and *P. schubarti* (Esteves 1996), *Deuterodon janeiroensis* (Mazzoni & Da Costa 2007), *D. langei* (Vitule et al. 2008), and *D. stigmaturus* (Dala-Corte et al. 2016). These variations during the individual's growth are related to different energy demands and morphological limitations (Abelha et al. 2001). Fish can alter their diet by consuming more energetically favorable prey as they grow, and this variation usually occurs along with changes in habitat use (Gerking 1994). Knowing when and at what size variances happen in fish diets can help interpret ontogenetic changes in habitat use and interactions with other fish and assess management scenarios for fish and their prey (Dauwalter & Fisher 2008).

This research focused on *Psalidodon* aff. *fasciatus* (Cuvier 1819) (= *Astyanax* aff. *fasciatus*, Terán et al. 2020) diet, popularly known in Brazil as piaba or lambari. The *P. aff. fasciatus* is widely distributed across South America (Graça & Pavanelli 2007), and several aspects of their biology were studied, especially for Paran  River and S o Francisco River basin populations. This species usually inhabits rivers and streams (Gomiero & Braga 2007, Silveira et al. 2020), although it is also found in reservoirs (Carvalho et al. 2009). It is a short-distance migrant (Gurgel 2004), and its reproductive period is commonly related to the rainy season (Gurgel 2004, Gomiero & Braga 2007, Carvalho et al. 2009). However, Silveira et al. (2020) recorded individuals in reproductive condition after this period, specifically in May.

The species' diet typically includes insect larvae and plant items (Hahn et al. 2004, Druzian et al. 2021). Nevertheless, information regarding *P. aff. fasciatus*' biology is still scarce for coastal basin populations. It is essential to highlight that the taxon *Psalidodon* aff. *fasciatus* constitutes a species complex (Pazza et al. 2008, Gavazzoni et al. 2020). Thus, this knowledge gap goes beyond

spatial dimensions, as it restricts the possibility of extrapolating information obtained from populations of other hydrographic units. *Psalidodon* aff. *fasciatus* is mainly found in the Contas River basin, where this study was conducted. The research goal was to analyze the *P. aff. fasciatus* diet to identify its primary food sources and verify potential spatial, seasonal, and ontogenetic variations in its feeding habits.

MATERIALS AND METHODS

Study area

The Gongogi River is a sub-basin of the Contas River basin and is part of the Atlantic Forest biome, where remnants of seasonal Atlantic

Forest are found. However, what predominates in the landscape are pastures and cocoa plantations (IBGE 2004). The climate in the Contas River basin region is predominantly warm, and the pluviometry shows a rainy period concentrated in the summer, with peaks in December and January and a dry period in winter between May and September.

The individuals were captured in an Atlantic Forest region, specifically in two streams of the Gongogi River sub-basin: Novo Stream (14° 72' 33.45 "S / 39° 95'35.73" W) and Gongogi Stream (14° 51' 96.88 "S / 39° 85' 69.49" W) (Figure 1). These streams are 32 km apart, following the watercourse. Both are characterized as wadeable and perennial streams. Table I summarizes the

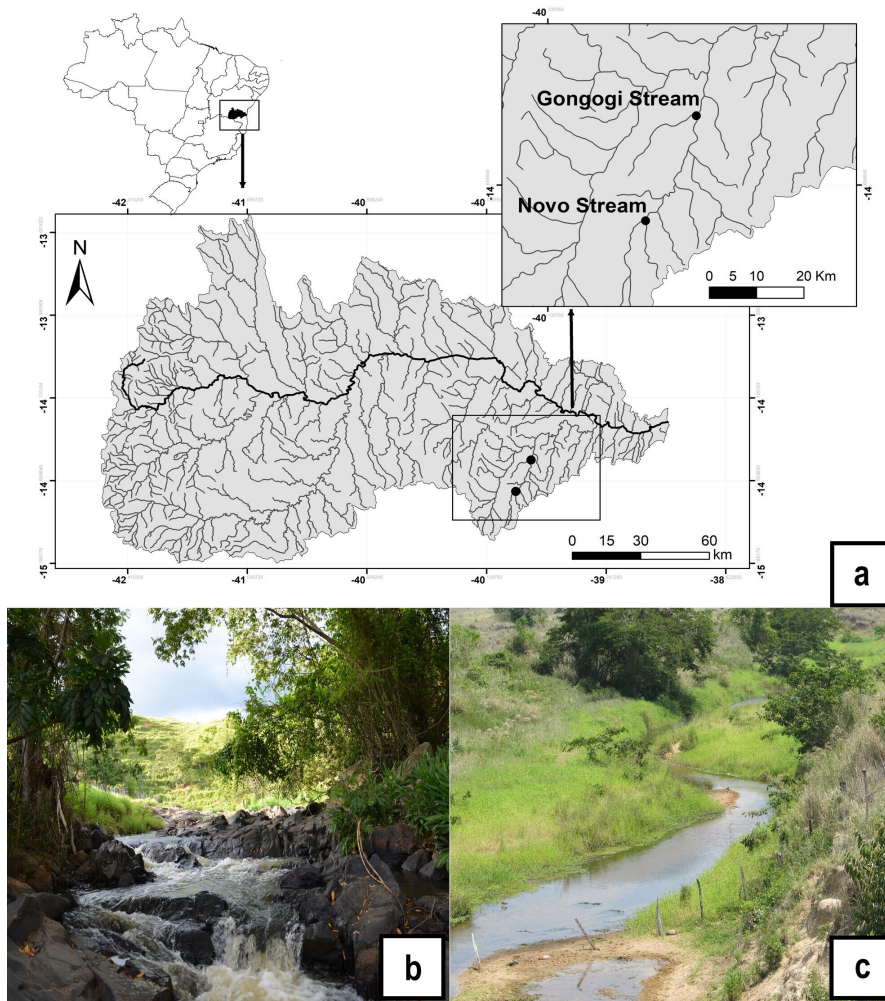


Figure 1. a: Map of the Contas River basin, highlighting the sample sites carried out on two streams: Novo Stream (b) and Gongogi Stream (c).

environmental descriptors for the two streams considered. The Novo Stream is a second-order watercourse located in a more upstream section of the sub-basin. This region is partially preserved and presents riparian coverage; the stream is not very sinuous, with a steep slope predominantly composed of riffles and a substrate composed mainly of boulders. The reach sampled in the Gongogi Stream is a third-order watercourse. It is located in a more degraded section of the sub-basin, with a predominance of pastures and scarce riparian coverage. It is sinuous and has a low slope, predominantly composed of sections with a slow current and a substrate composed mainly of sand.

Fish sampling and analysis

Psalidodon aff. fasciatus' samples were performed in four quarterly campaigns between November/2012 and August/2013. They were sampled in a 50-meter stream reach, without blocknets, through electric fishing, using a portable device (Smith-Root Backpack Electrofisher; model LR- 24; 800 V DC). For the Gongogi Stream, we also used complementary sampling methods due to greater depth in some points of the sampled stream, so the collection was also performed using cast net (5mm mesh), dragnet (5mm mesh), and seine (2mm mesh).

The total effort for these complementary methods was one hour for each campaign. The captured individuals were promptly euthanized by anesthetic overdose through immersion in benzocaine solution (1 g/L) for 10 minutes. Subsequently, the individuals were fixed in 10% formaldehyde and preserved in 70% alcohol.

In the laboratory, the fish standard length was measured with a caliper (1 mm) and weighed on an analytical scale (0.001g). For diet analysis, fish stomachs were removed and then preserved in Eppendorf with a 70% alcohol solution for later analysis of stomach contents.

The stomach contents were analyzed using a stereomicroscope, and the items found were identified at the lowest possible taxonomic level. Afterward, the food items were divided into ten categories: terrestrial insects (formicidae, diptera, coleoptera, and hymenoptera); aquatic insects (coleoptera larvae, trichoptera cocoon and larvae, simuliidae larvae, diptera pupae, and larvae, ephemeroptera nymph, chironomidae larvae, and odonata nymph); microcrustaceans (ostracod and cladocera); decapod; aranae; filamentous algae; amoeba; sediment (sand); plant fragment (roots, leaves, flower buds, stem fragment, and seeds); and insect fragments (wings and appendages of terrestrial, and aquatic insects).

Table I. Geographic coordinates, order, depth (mean), width (min. max.), substrate composition, riparian cover (present or absent) of sample site considered in the study.

	Novo Stream	Gongogi Stream
Geographic coordinates (lat./long.)	14º 72' 33.45"S / 39º 95'35.73"W	14º 51' 96.88"S / 39º 85' 69.49"W
Order	2 nd	3 rd
Depth (min. – max.)	0,17m – 0,26m	0,30m – 0,57m
Width (min. – max.)	3,6m - 8,2m	7,6m – 12,5m
Substrate composition	Large rocks, followed by a rocky bed	Predominantly sand
Riparian cover	Present (partially preserved)	Absent

For diet analysis, 111 individuals from the Novo Stream and 78 from the Gongogi Stream were evaluated, totaling 189 individuals. The food items were quantified by the Volumetric (V%) method (Hynes 1950). The stomach contents were placed on a glass slide over graph paper, and the number of squares occupied by each item was counted to determine their volume (Vitule et al. 2008). The count was then converted into percentages by calculating the proportion of squares occupied by each item by the total number of frames occupied by all items in each stomach.

The individuals whose stomach contents were analyzed were distributed into four length classes, each representing 10 mm intervals: Class I: 25-35 mm, Class II: 35-45 mm, Class III: 45-55 mm, and Class IV: 55-65 mm.

The data were evaluated considering two sampling sites (Novo and Gongogi streams), two campaigns (dry and rainy seasons), and four length classes (Class I, II, III, and IV) to verify the spatial, temporal, and ontogenetic variations. We used PERMANOVA to analyze the variance between sites, seasons, and length classes (Anderson et al. 2008). The volume percentage data of each specimen's diet items were used for this analysis. The data were ordered by Non-Metric Multidimensional Scaling (NMDS) analysis based on the Bray-Curtis Index as a distance measure to verify which food categories varied in the diet between sites, seasons, and classes (Magurran 2004). We also applied a SIMPER analysis, verifying each food item's proportional contribution to distinguish the groups (sites, seasons, and classes). This analysis was conducted in the R program using the Vegan package (Oksanen et al. 2022). As an additional analysis related to the ontogenetic variation of diet, we conducted a Threshold Indicator Taxa Analysis (TITAN) to identify threshold changes in the frequency of occurrence and relative volume

of food items along the length, which was also conducted in the R program using the TITAN2 package (Baker et al. 2023).

RESULTS

The predominant food categories at both streams were plant material, insect fragments, and filamentous algae (Tables II and III). Other food items (microcrustaceans, decapod, and sediment) occurred occasionally and in small quantities.

There was strong evidence that the diet differed between the sample sites (PERMANOVA, $p = 0.001$, Pseudo-F = 41.309) and the seasons ($p = 0.005$, Pseudo-F = 5.76). The difference was also significant considering the interaction between sites and season ($p = 0.001$, Pseudo-F = 21.800) and among length classes ($p = 0.001$, Pseudo-F = 6.129). However, no significant difference was observed considering the interaction between classes and sites ($p = 0.052$, Pseudo-F = 1.982).

We observed a prevalence of plant fragments in both streams, with a more pronounced presence in the Gongogi Stream when comparing the diet of *P. aff. fasciatus* between the sampled sites (Figure 2, Table II). It highlighted the high prevalence of aquatic insects followed by terrestrial insects in the Novo Stream (Table II). In contrast, there was a significant occurrence of filamentous algae in the individuals' diet at the Gongogi Stream (Table II). The SIMPER analysis reinforced this perception, indicating that insect categories (aquatic, terrestrial, and insect fragments) contributed 31.9% to the distinction between the two analyzed streams. Furthermore, the analysis demonstrated that plant fragments and filamentous algae contributed 16.84% and 10.90%, respectively, to the stream variation.

The *P. aff. fasciatus* diet presented considerable differences at each site, differing in the dry and rainy seasons. In the Novo

Table II. Number of analyzed individuals (n), mean volume (%) of food items on the diet of *Psalidodon aff. fasciatus* by season (dry and rainy) in the Novo and Gongogi streams, Contas river basin, Bahia, Brazil.

	Novo Stream		Gongogi Stream	
	Dry	Rainy	Dry	Rainy
	n=45	n=66	n=51	n=27
Autochthonous food items				
Aquatic insects	6.74	14.11	8.49	0.12
Microcrustacean	0.06	0.14	0	0
Decapod	0	0.02	0	0
Filamentous algae	0.06	1.32	15.70	29.60
Amoeba	0	0.09	0	0
Sediment	0.18	0.36	0.18	0.76
Allochthonous food items				
Terrestrial insects	1.95	5.08	0.36	0
Plant fragments	52.61	37.82	57.58	67.58
Aranae	0	0.04	0	0.08
Unkown origin				
Insect fragments	38.40	41.00	17.69	1.86

Stream, *P. aff. fasciatus* ingested a significant proportion of plant and insect fragments during the dry period and aquatic insects in the rainy season (SIMPER: Insects fragments: 14.50%, Plant fragments: 12.89%, Aquatic insects: 7.96%) (Table II). In the Gongogi Stream, the consumption of plant fragments by tetra-fish was evident at both times of the year (Table II). Additionally, during the rainy season, there was a significant ingestion of filamentous algae, which decreased during the dry season when insect fragments became more pronounced (SIMPER: plant fragments: 18.23%, filamentous algae: 16.90%) (Figure 2).

We noticed significant differences between length classes (Figure 2), in which the individuals of minor length classes (Class I and, secondarily, Class II) consume predominantly filamentous

algae (Table III). Insects (aquatic, terrestrial, and insect fragments) were primarily consumed by intermediate-length classes (Class II and III). The ingestion of plant fragments increased in representativeness due to the increase in individual length, predominant in Classes III and IV (Table III). The Titan analysis supported these findings, revealing a significant reduction in the proportion of filamentous algae in the diets of individuals with a standard length greater than 42.15 mm (IC 95%: 31.10-46.30). Conversely, individuals with a standard length exceeding 46.45 mm (IC 95%: 42.15-66.30) exhibit a more frequent and substantial consumption of plant fragments. Additionally, the analysis demonstrated that individuals with a standard length greater than 33.35 mm (IC 95%: 29.9-36.0) consumed insects more frequently.

Table III. Number of analyzed individuals (n), mean volume (%) of food items on the diet of *Psalidodon aff. fasciatus* by length class (Class I: 25|-35mm; Class II: 35|-45mm; Class III: 45|-55mm; Class IV: 55|-65mm) in the Novo and Gongogi streams, Contas river basin, Bahia, Brazil.

	Novo Stream			Gongogi Stream		
	Class II	Class III	Class IV	Class I	Class II	Class III
	n=19	n=62	n=30	n=17	n=28	n=33
Autochthonous food items						
Aquatic insects	29.40	10.50	7.99	1.46	4.55	0.11
Microcrustacean	0.39	0.11	0.06	0	0	0
Decapod	0	0.02	0	0	0	0
Filamentous algae	1.02	0.98	0.69	56.04	26.46	23.29
Amoeba	0.02	0.10	0	0	0	0
Sediment	0.86	0.38	0.04	0	0.21	1.04
Allochthonous food items						
Terrestrial insects	6.59	4.23	3.04	0	0.21	0
Plant fragments	17.96	34.79	61.72	38.83	55.92	74.70
Aranae	0	0.05	0	0.73	0	0
Unknown origin						
Insect fragments	43.76	48.83	26.46	2.93	12.66	0.85

DISCUSSION

The research results indicate that *Psalidodon aff. fasciatus* consumes items of both animal and plant origin, thereby being classified as an omnivorous species. These findings align with other studies on the diet of *P. aff. fasciatus*, suggesting that the species feeds on similar items in rivers and streams (Vilella et al. 2002, Ferreira 2007, Wolff et al. 2009, Silva et al. 2014, Fonseca et al. 2022). Pusey et al. (2010) comment that omnivory represents an efficient ecological strategy for fish that live in highly variable and unpredictable environments, such as rivers and streams.

The species is usually classified as a generalist species, presenting omnivorous and nektonic habits, high food plasticity, and the ability to capture prey both in the water column

and on the substrate (Ferreira 2007, Ceneviva-Bastos et al. 2010). Commonly, species from the Characidae family have a high capacity to adapt to environmental changes and the availability of resources, which gives them a higher probability of surviving extreme variations in their habitat (Lobón-Cerviá & Bennemann 2000, Menezes et al. 2007). The generalist feeding habit of the species probably also confers a better use of available resources, promoting the sharing of resources among individuals in the population. The food segregation pattern among characids (e.g., *Astyanax* e *Bryconamericus*) has been reported in other studies and can be explained by differences in microhabitat use, trophic morphology, and feeding tactics (Silva et al. 2012, Silva et al. 2017, Bonato et al. 2018).

Many studies indicated that *P. aff. fasciatus* presents a highly flexible diet, and some

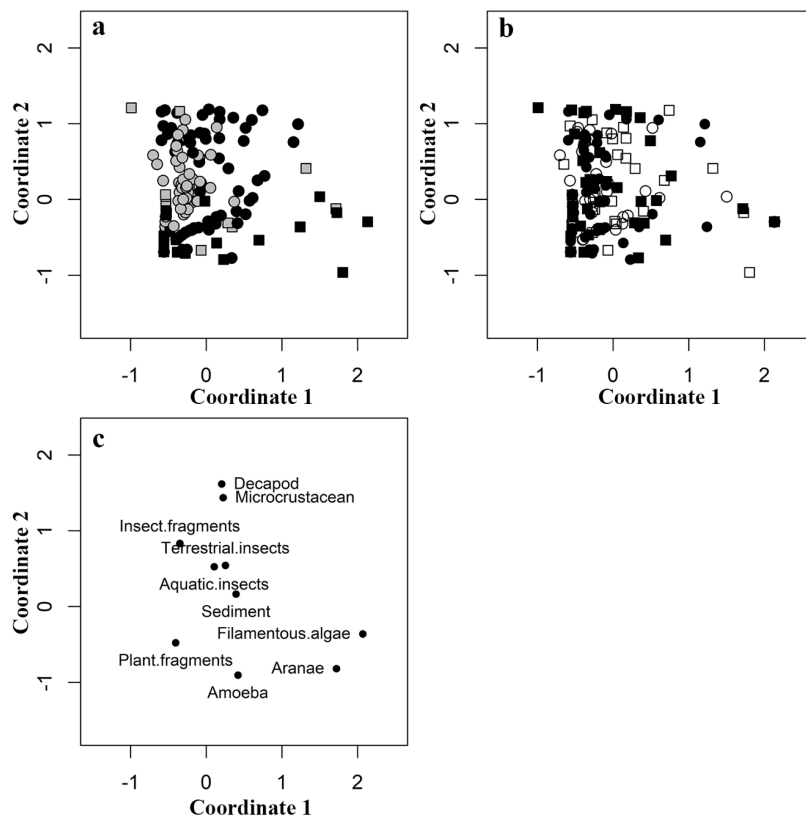


Figure 2. Plots of the first two axes resulting from the Non-Metric Multidimensional Scaling (NMDS) ordination of individuals of *Psalidodon aff. fasciatus* from drainages of the Atlantic Forest streams of Contas river basin Bahia Brazil, based on the percentage volume (V%) of consumed food items. a: Ordination of analyzed individuals, distinguishing sites (Circle: Novo Stream; Square: Gongogi Stream) and seasons (Gray: dry season; Black: wet season). b: Ordination of analyzed individuals, distinguishing length classes (White circle: Class I; White square: Class II; Black square: Class III; Black circle: Class IV). c: Distribution of food items in multidimensional space.

of these studies attribute such plasticity to environmental variations (Maia & Matsumura Tundisi 1984, Vilella et al. 2002, Wolff et al. 2009, Hirt et al. 2011, Souza et al. 2020). Agreeing with these findings, we identified a significant spatial and seasonal variation in the species' diet. Habitat variations lead to significant changes in fish diet due to differences in abiotic conditions and food supply across various locations and periods (Abelha et al. 2001). Small characids tend to present generalist feeding habits in streams and usually constitute opportunistic species that exhibit variance in their diet due to spatial variations in resource availability and interactions with other organisms (Bennemann et al. 2005, Abilhoa et al. 2008, Uieda & Pinto 2011, Barreto et al. 2018).

Differences in the *P. aff. fasciatus* diet was evident between sample sites. In the Novo

Stream, there was a higher incidence of plant and insect fragments on the species' diet when compared to the Gongogi Stream, where the most important items were plant fragments and filamentous algae. This spatial variation in the species' diet may be attributed to many factors, such as the degree of disturbance in the riparian vegetation and the physical characteristics of the studied streams (Wolff et al. 2009). For instance, species with invertivorous tendencies are associated with greater margin stability and substrate diversity, differing from species with omnivorous tendencies, which are usually associated with more simplified and disturbed environments due to anthropic activities (Cruz et al. 2013, Gonçalves et al. 2018, Peressin et al. 2020).

The spatial variations observed in the diet composition between the streams can be

explained by differences in the surrounding characteristics of the sampled localities, potentially influencing the food resources supply. For example, both sample sites differ regarding the type of predominant mesohabitat and the surrounding characteristics. The Gongogi Stream does not present riparian coverage, and there are more areas with slow currents. In contrast, areas with rapids predominate in the Novo Stream, and a certain amount of riparian cover can still be found.

In the Novo Stream, riparian coverage possibly led to a higher incidence of insects and vegetation fragments on the *P. aff. fasciatus* diet. Riparian vegetation is essential for maintaining the aquatic biota integrity in streams, constituting one of these ecosystems' primary food (Esteves et al. 2021). The shading produced by riparian vegetation limits autotrophic production (Knight & Bottorff 1984, Lowe-McConnell 1999), so the fish start to depend mainly on external food sources, even if indirectly. Thus, the substrate associated with allochthonous organic matter favors the establishment of invertebrate communities (Wolff et al. 2009, Cruz et al. 2013, Gonçalves et al. 2018), such as the aquatic insects, items frequently found in the individuals' diet composition sampled in the Novo Stream. Other studies also reported the insects' and plants' relevance (mainly of allochthonous origin) on the *P. aff. fasciatus* diet (Villela et al. 2002, Wolff et al. 2009, Silva et al. 2014).

The vegetation's low structural complexity in the Gongogi Stream, represented by the lack of riparian coverage, increases the sunlight incidence and favors the autotrophic production and proliferation of filamentous algae (Pusey & Arthington 2003), which were used as one of the primary food sources by the *P. aff. fasciatus*, along with the plant fragments of allochthonous origin. In this regard, it is essential to emphasize that habitat degradation and loss of riparian

vegetation results in habitat homogenization, reducing trophic guilds that rely, at least in part, on allochthonous resources (Borba et al. 2008, Ferreira et al. 2012).

It is essential to highlight the resource availability of the sampled sites is possibly related to their position along Gongogi river sub-basin longitudinal axis. In the classic study that proposed the River Continuum Concept, Vannote et al. (1980) demonstrated that in regions closer to the headwaters, there is a more significant influence of the surrounding vegetation, which contributes to allochthonous material (plant material and terrestrial insects). As the stream increases, the importance of terrestrial organic matter imports decreases. This pattern was reported by Silva et al. (2014), who found differences in the *P. aff. fasciatus* diet related to the longitudinal gradient where individuals in the headwaters depended on allochthonous material, decreasing the importance of these features along the longitudinal gradient.

The effects of the season variation on the *P. aff. fasciatus* feeding was also notable in this study. A more significant variability in the species' feeding was observed, mainly in the Novo Stream, with a higher occurrence of insects in the rainy season. This may be directly related to a greater supply of insects and plants during this season than the dry period. Other studies have shown insect community fluctuations leading to fish diet changes in tropical regions (Deus & Petrere-Junior 2003, Peterson et al. 2017, Benone et al. 2020), which is because most tropical waters show seasonal variations, in which the hydrometric oscillations present in these environments lead to regular flooding. This process results in the aquatic environment expansion during the rainy season, ultimately promoting a series of physical, chemical, and biological changes in the water (Lowe-McConnell 1999, Abelha et al. 2001, Carvalho &

Uieda 2010), and a more significant contribution of allochthonous items. This seasonal effect generates fluctuations in food availability and establishes new survival conditions for the species, leading to qualitative and quantitative changes in the fish diet (Esteves et al. 2021). Neves et al. (2021) observed a seasonal trophic niche adjustment in two syntopic omnivorous characins belonging to the genus *Psalidodon*, wherein they exploited different resources during periods of increased resource diversity. Additionally, the authors argue that these seasonal trophic adjustments may be an essential mechanism promoting the coexistence of omnivorous species in Neotropical streams.

Differences in feeding between length classes indicate ontogenetic variation in *P. aff. fasciatus*. It is expected to record different diets between its developmental stages, and this differentiation may be related to changes in energy demand and morphological limitations (Abelha et al. 2001, Esteves et al. 2021). Furthermore, variations in diet among different length classes suggest that individuals of varied sizes have distinct morphological or behavioral characteristics that allow the reduction of intraspecific competition (Lampert et al. 2022).

The ontogenetic variation in the *P. aff. fasciatus* feeding was more expressive in the Novo Stream, where the smaller individuals exhibited a predominant diet of insects, which was replaced by plant material in the largest length classes. Juvenile individuals usually have a higher protein requirement, represented by the minor length classes. In this sense, it is expected to observe the predominance of animal-origin food items during this development stage, replaced by the omnivorous habit as an adult (Sabino & Castro 1990, Vitule et al. 2008). Wolff et al. (2009) also reported this pattern of substituting consumption of animal-origin items for plants during growth for

P. aff. fasciatus individuals. To these authors, the differences are associated with changes in the digestive tract since younger individuals have lower intestinal coefficients than adults. The substitution process of animal-origin items when young for items of plant-origin when adults are also observed in other species of the genus, such as the *Psalidodon paranae* (Rautenberg et al. 2021), in addition to other characins such as *Hemigrammus marginatus* (Barreto et al. 2018), *Deuterodon langei* (Vitule & Aranha 2002, Vitule et al. 2008), and *Deuterodon intermedius* (Souza et al. 2015).

Finally, our results have shown that the *Psalidodon* aff. *fasciatus* demonstrated high food plasticity by consuming animal and vegetable-origin items, allowing better use of the available resources in the environment. Moreover, ontogenetic, spatial, and seasonal variation in this species' diet was evident. Although similar patterns have been reported in rivers, few studies have analyzed this species' diet in streams and ecosystems suffering continuous degradation by human activities. Lastly, our results contribute to filling the knowledge gap of the species' biology in a coastal basin in the Northeast region of Brazil.

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INGRID CAROLINE C. PIRES¹

<https://orcid.org/0009-0002-1715-7592>

FABIANE B. SOUZA²

<https://orcid.org/0000-0003-4110-081X>

ANDRÉ T. DA SILVA³

<https://orcid.org/0000-0002-4910-1051>

¹Programa de Pós-Graduação em Ecologia e Evolução, Universidade Estadual de Feira de Santana, Departamento de Ciências Biológicas, Av. Transnordestina, s/n, Novo Horizonte, 44036-900 Feira de Santana, BA, Brazil

²Instituto Federal de Educação, Ciência e Tecnologia Baiano, Campus Santa Inês, BR 420, Rodovia Santa Inês – Ubaíra, Zona Rural, 45320-000 Ubaíra, BA, Brazil

³Universidade Estadual de Feira de Santana, Departamento de Ciências Biológicas, Laboratório de Ictiologia, Av. Transnordestina, s/n, Novo Horizonte, 44036-900 Feira de Santana, BA, Brazil

Correspondence to: **Ingrid Caroline Costa Pires**

E-mail: ingridcosta397@gmail.com

Author contributions

Ingrid Caroline Costa Pires contributed to the laboratory analyses, data analysis, and research writing. Fabiane Barreto Souza contributed to the laboratory analyses, charts and maps preparation, and research writing. André Teixeira da Silva contributed to fish sampling, data analysis, and research writing.

