Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales. 2026
doi: https://doi.org/10.18257/raccefyn.3317

**Natural Sciences**

Original article

# Natural diet and efficiency of baits for the capture of *Macrobrachium amazonicum* (Decapoda, Palaemonidae) in the lower Amazonas River, Brazil

## Dieta natural y eficacia de los cebos para la captura de *Macrobrachium amazonicum* (Decapoda, Palaemonidae) en el curso inferior del río Amazonas, Brasil

**Sting Silva Duarte**[1,*], **Jô de Farias Lima**[2], **Luziany Camilly Rodrigues**[3], **Sheyla Regina Marques Couceiro**[4]

[1] Postgraduarte Program in BioNorte, Universidade Federal do Amapá – UNIFAP, Macapá, Amapá, Brazil
[2] Empresa Brasileira de Pesquisa Agropecuária, Macapá, Amapá, Brazil
[3] Tropical Biodiversity Program - PPGbio, Universidade Federal do Amapá – UNIFAP, Macapá, Amapá, Brazil
[4] Laboratory of Ecology and Taxonomy of Aquatic Invertebrates - LETIA, Instituto de Ciências e Tecnologia das Águas - ICTA, Universidade Federal do Oeste do Pará – UFOPA, Santarém, Pará, Brasil

## Abstract

*Macrobrachium amazonicum* is a native freshwater shrimp from the northern region of Brazil, widely distributed throughout the Amazon basin, which supports an extensive regional fishery. Here, we assessed its dietary habits in the wild in a prime fishery area for this species in the lower Amazonas River (Pará state, Brazil) and evaluated the relative efficiency of three bait types (cooked rice, canned sardines, and babassu fruit meal) for both its quantitative and qualitative capture yield. Stomach contents were analyzed using occurrence frequency, the point method, and the food index. We identified four food categories: fine particulate organic matter (FPOM), coarse particulate organic matter (CPOM), particulate plant matter (PPM), and identified plant matter (INV) (leaves, root remains, and invertebrates). According to the frequency of occurrence and the point method, fine particulate organic matter (FPOM) was the most important food category (88%). In the bait attractiveness test, the average number of shrimps and total biomass captured varied significantly among treatments, with babassu flour being the most attractive. Our results indicate that *M. amazonicum* is omnivorous and an opportunistic generalist shrimp, and that among the three baits tested, babassu meal likely renders higher yields.

**Keywords:** Amazon prawn; Freshwater prawn; Food habits; Attractivity.

## Resumen

*Macrobrachium amazonicum* es un camarón de agua dulce nativo, con amplia distribución en toda la cuenca amazónica, que constituye el sostén de una importante pesquería regional. Evaluamos los hábitos alimentarios de *M. amazonicum* en estado silvestre en una de las principales zonas de pesca de esta especie en el bajo río Amazonas (estado de Pará, Brasil), y analizamos la eficiencia relativa de tres tipos de cebos (arroz cocido, sardinas enlatadas y harina de fruto de babasú) en el rendimiento cuantitativo y cualitativo de la captura. El contenido estomacal se examinó detrminando la frecuencia de ocurrencia y utilizando el método de puntos y el índice alimentario. Se detectaron cuatro categorías de alimento: materia orgánica particulada fina (MOPF), materia orgánica particulada gruesa (MOPG), materia vegetal particulada (MVP) y materia vegetal identificada (INV) (hojas, restos de raíces e invertebrados). Según la frecuencia de ocurrencia y el método de puntos, la materia orgánica particulada fina (MOPF) fue la categoría alimentaria más importante (88 %). En el ensayo de atracción de cebos, el número promedio de camarones y la biomasa total capturada variaron significativamente entre los tratamientos, siendo la harina de babasú la de mayor atractivo. Nuestros resultados indican que *M. amazonicum* es omnívoro y un generalista oportunista, y que, de los tres cebos evaluados, la harina de babasú probablemente proporcione mayores rendimientos de captura.

**Palabras clave:** Camarón amazónico; Camarón de agua dulce; Hábitos alimentarios; Atractivo.

**Citation:** Silva Duarte S, *et al*. Natural diet and efficiency of baits for the capture of *Macrobrachium amazonicum* (Decapoda, Palaemonidae) in the lower Amazonas River, Brazil. Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales. 2026 Mar 20. doi: https://doi.org/10.18257/raccefyn.3317

**Editor:** Martha Helena Rocha de Campos

***Corresponding autor:**
Sting Silva Duarte;
stingduarte@gmail.com

**Received:** October 9, 2025
**Accepted:** January 16, 2026
**Published on line:** March 20, 2026

Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales. 2026
doi: https://doi.org/10.18257/raccefyn.3317

## Introduction

Freshwater shrimps of the genus *Macrobrachium* hold remarkable economic and cultural importance across tropical regions, where they are widely valued as a culinary delicacy and as a source of income for artisanal fisheries (**Cavalcante & Castro**, 2014). In Brazil, *Macrobrachium amazonicum* (**Heller**, 1862) is the most commercially exploited freshwater shrimp species, supporting extensive fisheries, particularly in the northern and northeastern regions of the country **(Bentes *et al.***, 2011; **Alcântara & Kato**, 2016; **Lima *et al.***, 2016**; Ramos *et al.***, 2016).

In the Amazon basin, fisheries targeting *M. amazonicum* are traditionally artisanal and take place year-round, with peak harvests recorded between July and December (**Vieira**, 2003). Harvesting is done with a wide range of gear, but one of the most representative devices is the matapi, a traditional box- or cylinder-shaped trap made from vines and palm splints, in which baits are placed to attract prawns (**Bentes *et al.***, 2014; **Lima**, 2014). This practice not only reflects the socio-cultural heritage of Amazonian riverine communities but also underscores the strong dependency of fishing success on bait type and performance.

Among the baits commonly employed, babassu (*Orbignya speciosa*) fruit meal is particularly popular, and is extensively used across different regions of the Amazon basin (**Vieira & Araújo-Neto**, 2006; **Silva *et al.***, 2012; **Bentes *et al.***, 2014). Other resources, including residues from cassava (*Manihot esculenta*) processing, fish and crab remains, as well as fruits from palms such as murumuru (*Astrocaryum murumuru*), inajá (*Attalea maripa*), and buriti (*Mauritia flexuosa*), are also used as attractants (**Silva *et al.***, 2012; **Bentes *et al.***, 2014). In some localities, for example, Santarém (Pará state), cooked rice dumplings and canned sardines are also widely used. Despite this diversity of practices and the evident economic relevance of the species, systematic assessments of bait efficiency in *M. amazonicum* fisheries remain scarce, with just a few exploratory studies (**Bentes *et al.***, 2014; **Pereira *et al.***, 2017; **Lima**, 2014).

Comparisons between bait types are essential to improve capture efficiency, as there is a strong, well-established relationship between catch rates, haul size, and bait type in crustaceans (**Kutka *et al.***, 1992; **Bentes *et al.***, 2011). Besides the acquisition costs, the choice of bait ingredients should consider the trophic characteristics of the target species (**Sanches & Sebastiani**, 2009). Despite being widely exploited by artisanal fisheries and showing great potential for aquaculture, few data on the natural diet and feeding habits of *M. amazonicum* are available. The information on the diet and the feeding habits of a species in nature is important to establish its nutritional needs and interactions with other organisms (**Chaves & Umbria**, 2003; **Albertoni *et al.***, 2003), and is indispensable to develop biological and taxonomic studies, as organisms' growth, development, and reproduction depend on the energy contributed by food (**Wootton**, 1992).

The majority of studies on prawns' feeding habits have focused on penaeid (**Marte**, 1980; **Chong & Sasekumar**, 1981; **Cortés & Criales**, 1990). The analysis of stomach contents provides important information about the feeding habits of the species, and offers evidence of their trophic position in a community, revealing their preferred food items or the most used (**Fonteles-Filho**, 1989; **Chaves & Umbria**, 2003). Studies on the feeding biology of *Macrobrachium* shrimp remain scarce, being limited to some reports by **Collins and Paggi** (1998) on *M. borelli*; **Albertoni *et al.*** (2003) on *M. acanthurus*, and **Abayomi *et al.*** (2011) on *M. vollenhovenii*, *M. tenellum*, and *M. carcinus* (**Chaves & Umbria**, 2003).

Given that *M. amazonicum* is a key species in Amazonian fisheries and has also been highlighted as a promising candidate for aquaculture, filling this knowledge gap is particularly relevant. Integrating dietary studies with evaluations of bait efficiency not only strengthens our understanding of its ecological adaptability but also provides practical guidelines for enhancing catch efficiency in artisanal fisheries and developing cost-effective feeding strategies in aquaculture systems. The present study aimed to investigate the natural feeding habits of *M. amazonicum* in a major fishery area of the lower Amazon River and to assess the relative efficiency of three traditionally used baits: cooked rice, canned sardines, and babassu meal, in capturing this species. By combining ecological and fishery-based approaches, we sought to contribute both to the biological knowledge of *M. amazonicum* and improve artisanal fishery practices in the Amazon region.

## Materials and methods

### *Study area*

The study was conducted in the lower Amazonas River, in front of Marrecas Island (02°12'19.3''S, 54°46'17.9''W) (**Figure 1**), some 30 km north of the city of Santarém, Pará state, Brazil. The area has suitable habitats for shrimp, with shallow water and slower current than the main channel of the Amazon River, and macrophyte banks (*Eichhornia* spp) allowing the development of *M. amazonicum* (**Lima *et al.***, 2014).

The climate in the region is tropical hot, with a dry period from July to December, and a rainy season from January to June (**Bentes *et al.***, 2014). In this region, the dry season coincides with ebbing and low waters, and the rainy season with flooding and high waters in the Amazon River, with an annual average oscillation of 7 m in water levels (**Almeida**, 2010).

### *Shrimp sampling and biometry*

The *M. amazonicum* specimens were collected in a single study area, and two distinct biological data sets were recorded from the same sampling site: one to characterize the natural diet of *M. amazonicum* (obtained in June and November 2017), and a second to assay the efficiency of different baits in capturing *M. amazonicum* (obtained between November 2017 and May 2018). Both data sets were collected using artisanal traps called "matapi" (cylindrical creel made by hand with vines and palm trees from the Amazon floodplain, 50 cm long, 25 cm in diameter, and a distance of 5 mm between the splints) baited with babassu (*O. speciosa* flour), and submerged (spindle) (**De araújo *et al.***, 2014) in the Amazon River at dusk (05:30 pm) for 12 h (**Lima *et al.***, 2016).

In the laboratory, all captured shrimp were identified to species level, sexed, and measured. Taxonomic identification followed **Melo** (2003). Standard length (SL; mm), defined as the distance between the base of the ocular peduncle and the distal end of the

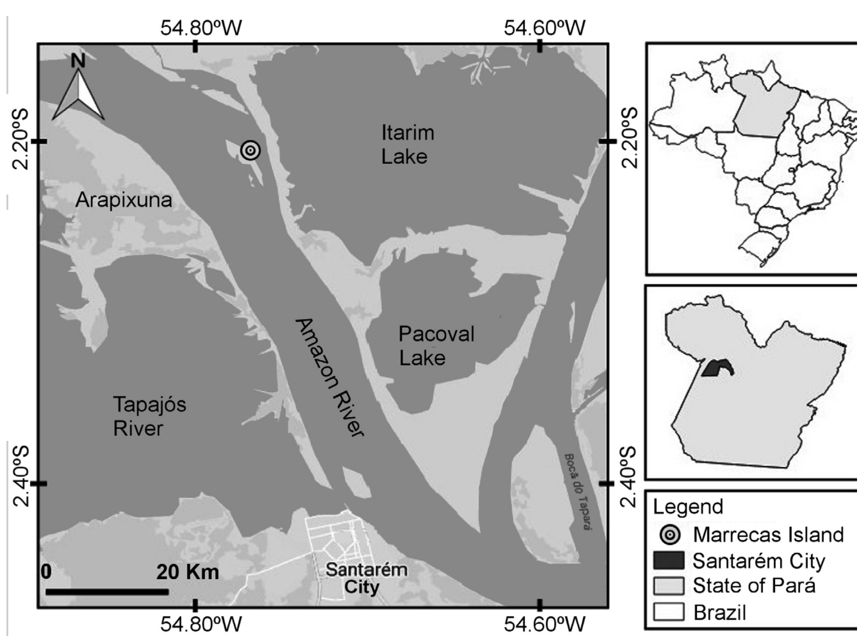


**Figure 1.** Location of the study area in front of Marrecas Island on the lower Amazon River, Santarém, Pará state, Brazil

doi: https://doi.org/10.18257/raccefyn.3317

telson, was measured following **Lima *et al.*** (2014) using analog calipers (model 125MEB-6/200, Starfer, Itu, SP, Brazil; precision 0.05 mm). Total body mass (g) was determined using a semi-analytical digital scale (model AD 330, Mars, Santa Rita do Sapucaí, MG, Brazil; precision 0.001 g).

Sex was determined based on the presence or absence of the male appendix on the endopodite of the second pair of pleopods. Individuals were classified into life-stage categories based on body size: shrimp with standard length smaller than the smallest ovigerous (egg-bearing) female recorded in the sample were classified as juveniles, whereas individuals with standard length equal to or greater than this threshold were classified as adults, following **Lima *et al.*** (2014). For diet composition analyses by size, individuals were grouped into 5-mm interval standard-length classes.

***Processing and analysis of stomach contents***

In the laboratory, the samples were processed using a stereomicroscope, Petri dishes, and entomological forceps. The stomachs were accessed through dorsal dissection of the cephalothorax using fine scissors under a stereomicroscope (ZEISS Stemi, Göttingen, Germany), following the methodology described by **Lima *et al.*** (2014). Stomach contents were carefully removed from each specimen using entomological forceps and dissecting pins, and subsequently analyzed under a light microscope using the transparency method, as proposed by **Tomanova *et al.*** (2006).

The relative contribution of each food item in the stomach contents was estimated using a point-count method based on the proportional area occupied by particles. For each slide, ten points were randomly selected and examined under a stereomicroscope (Zeiss Stemi 2000) at 100× or 400× magnifications. The proportion of each food category was calculated as the percentage of points in which the item was recorded, with values subsequently expressed on a 0–100% scale. Five food categories, adapted from **Tomanova *et al.*** (2006), were considered: fine debris < 1 mm (fine particulate organic matter – FPOM), plant tissue < 1 mm (vegetal particulate matter – VPM), coarse debris > 1 mm (coarse particulate organic matter – CPOM), algae (ALG), invertebrates (INV), and sand (SAND).

***Bait efficiency for M. amazonicum captures***

To evaluate the efficiency of different baits in capturing *M. amazonicum*, we used 30 matapi traps. The traps were equally distributed among three bait treatments: ten matapis baited with babassu fruit meal (30 g), ten baited with cooked rice (30 g), and ten baited with canned sardine (30 g).

***Data analysis***

*Natural diet*. Differences in diet composition between sexes and among size classes were evaluated using a multivariate approach. Given that occurrence frequency data represent proportional and compositional information, they do not meet the assumptions of normality and homoscedasticity required for parametric tests. Therefore, no normality tests were applied.

The variation in the composition of food categories was tested using permutational multivariate analysis of variance (PERMANOVA), based on a Bray–Curtis dissimilarity matrix, with sex and size class included as fixed factors. The statistical significance was assessed using permutation procedures. When necessary, the occurrence of individual food categories was further evaluated using generalized linear models (GLMs) with a binomial error distribution to test the effects of sex and size class on the probability of occurrence of each food item.

*Baits*. Differences in *M. amazonicum* mean body length, individual mass, catch abundance (number of individuals per trap), and total capture biomass (wet mass per trap) with different bait types were evaluated using one-way analysis of variance (ANOVA), with bait type treated as a fixed factor. Before the analysis, the data were tested for normality and homoscedasticity following **Zar** (1999). When significant effects were detected, Tukey's HSD post hoc tests were applied to identify pairwise differences among bait treatments. The proportion of juveniles and adults captured by each bait type was compared using a chi-square test. The significance level of all statistical analyses was $p < 0.05$.

## Results

### *Natural diet*

Only 2.2% of the 90 shrimps examined had full stomachs, whereas 82.2% presented partially filled stomachs, 12.2% were poorly filled, and 3.3% were empty. Sand grains were recorded in 76.7% of the stomachs analyzed. Among the food categories identified, fine particulate organic matter (FPOM) showed the highest frequency of occurrence (88%), while invertebrates (INV) presented the lowest frequency (2.6%) (**Table 1**).

The multivariate analysis of the diet composition detected no significant differences in the overall frequency distribution of food categories between males and females (PERMANOVA, $p > 0.05$) (**Table 2**). Similarly, the diet composition did not show a significant variation among shrimp size classes when considering the relative occurrence of FPOM, CPOM, PPM, and invertebrates (PERMANOVA, $p > 0.05$). Although graphical representations revealed a substantial variability within size classes, particularly reflected by large dispersion values, it did not translate into statistically significant differences in food category composition (**Figure 2A–D**).

### *Bait efficiency assessment*

*The analysis of 404 M. amazonicum specimens demonstrated that bait type significantly influenced capture performance in terms of abundance and total biomass. The mean number of shrimp captured per trap and the total wet biomass per trap differed among bait treatments, with babassu meal yielding the highest values for both metrics (one-way ANOVA; abundance: $F = 2.5$, $df = 6$, $p < 0.001$; biomass: $F = 7.5$, $df = 6$, $p <$*

**Table 1.** Percentage of total point methods (MP), frequency of occurrence (FO), and food index (lAi) of food items found in the stomachs of 90 individuals of *Macrobrachium amazonicum* in the lower Amazon River

| Food items | FO (%) | MP (%) | lAI |
|---|---|---|---|
| INV | 29.07 | 7 | 2.61 |
| MOPF | 97.67 | 70 | 87.95 |
| MOPG | 29.07 | 12 | 4.48 |
| MVP | 34.88 | 11 | 4.93 |
| Sand | 76.74 | ---- | --- |

**Table 2.** Percentage frequency test of the point method for the food categories in the natural diet of *M. amazonicum* males and females in the low Amazon River

| Itens | MP | MP | $\chi^2_{calculated}$ | $\chi^2_{tabulated\ (\chi = 0,05;\ gl=1)}$ |
|---|---|---|---|---|
| | Male | Female | | |
| INV | 8.00 | 6.20 | 0.23 | 3.84 |
| MOPF | 72.10 | 69.50 | 0.05 | 3.84 |
| MOPG | 11.10 | 11.80 | 0.02 | 3.84 |
| MVP | 8.70 | 12.50 | 0.68 | 3.84 |
| Total | 100 | 100 | --- | |

Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales. 2026
doi: https://doi.org/10.18257/raccefyn.3317

*0.002)* (**Figure 3A–B**). *In contrast, bait type did not significantly affect the demographic or morphometric characteristics of the catch. Mean body length (one-way ANOVA: F = 1.42, df = 2,401, p = 0.24) and individual mass (F = 1.67, df = 2,401, p = 0.19) did not differ among bait treatments, and Tukey's post hoc tests confirmed the absence of pairwise differences (***Table 3***). Likewise, the proportion of juveniles and adults was similar across bait types (chi-square test: $\chi^2$ = 1.02, df = 2, p = 0.60) (***Table 4***). Although variability in size and mass was observed among individuals, this did not translate into statistically detectable differences among treatments. The overall sex ratio was biased toward females (2.12 females:1 male); however, no evidence of bait-related sex selectivity was detected, as the relative proportions of males and females were comparable among treatments.*

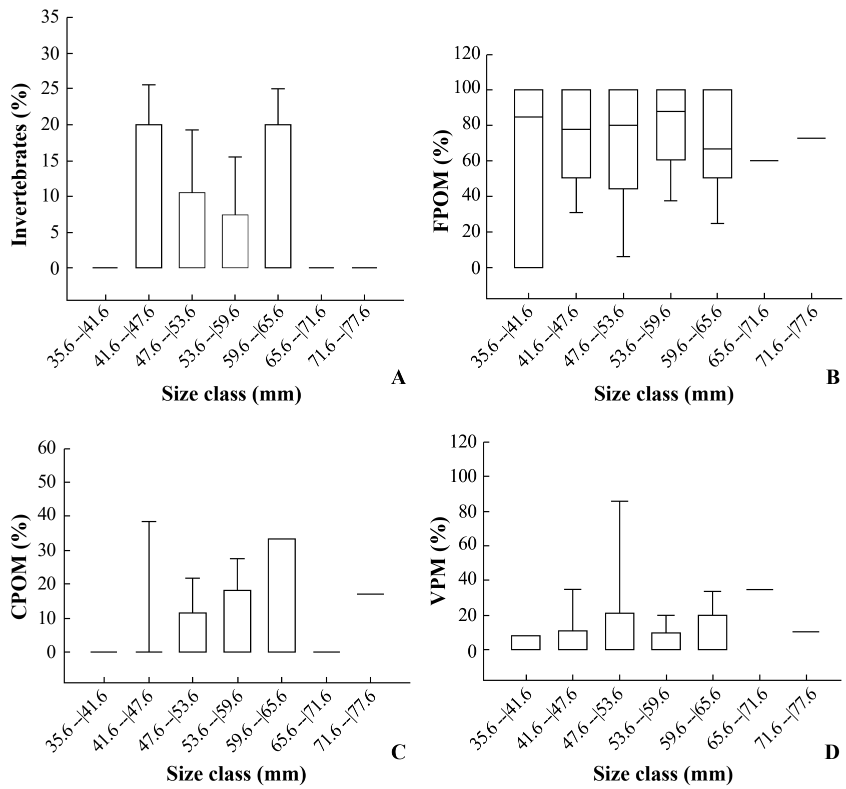


**Figure 2.** Consumption percentage of food ingested by *Macrobrachium amazonicum* from Marrecas Island, lower Amazon River, Santarém, Pará state, according to length class interval. **A.** Invertebrates (INV). **B.** Fine particulate organic matter (FPOM). **C.** Coarse particulate organic matter (CPOM). **D.** Vegetal particulate matter (VPM)

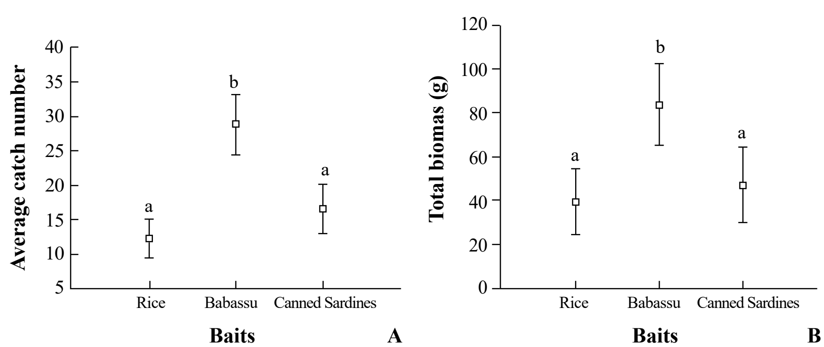


**Figure 3.** Average catch number **(A)** and biomass **(B)** of *Macrobrachium amazonicum* captured by baits tested in Marrecas Island, lower Amazon River, between November 2017 and May 2018

**Table 3.** Mean (± SD) body size and individual mass of *Macrobrachium amazonicum* captured with different bait types on Marrecas Island, lower Amazon River, between November 2017 and May 2018, and results of one-way ANOVA and Tukey post hoc tests

| Bait type | n | Body length (mm) | Tukey | Body mass (g) | Tukey |
|---|---|---|---|---|---|
| Rice | 86 | 58.88 ± 6.38 | a | 3.27 ± 1.35 | a |
| Babassu | 202 | 56.96 ± 3.20 | a | 2.98 ± 0.52 | a |
| Sardine | 116 | 56.50 ± 3.28 | a | 2.78 ± 0.46 | a |
| ANOVA | | F = 1.42 | p = 0.24 | F = 1.67 | p = 0.19 |

Letters indicate significant differences among bait types according to Tukey's HSD test ($p < 0.05$). Since there was no difference, they were all marked with "a".

**Table 4.** Proportion of *Macrobrachium amazonicum* juveniles and adults captured with different bait types, and results of the chi-square test

| Bait type | Juveniles (%) | Adults (%) |
|---|---|---|
| Rice | 8.14 | 91.86 |
| Babassu | 7.43 | 92.57 |
| Sardine | 5.17 | 94.83 |
| **$\chi^2$ test** | $\chi^2 = 1.02$ | p = 0.60 |

## Discussion

### *Natural diet*

The high percentage of *M. amazonicum* individuals with food in their stomachs (84.4%) indicated an efficient exploitation of available trophic resources around Marrecas Island during the study period, but not necessarily overall resource abundance. This pattern is consistent with the generalist and opportunistic feeding strategy described for freshwater shrimps, which allows them to utilize a wide range of food items, including detritus, plant material, and animal prey, according to local availability (**Jimoh *et al*.**, 2011; **Melo & Nakagaki**, 2013; **Lima *et al*.**, 2014). Studies from different Brazilian regions highlight the remarkable dietary plasticity of *M. amazonicum*, enabling populations to persist in highly variable freshwater environments and to maintain feeding activity even under fluctuating or limited resource conditions (**Odinetz-Collart**, 1993; **Aguiar**, 2016). This trophic flexibility is a key ecological trait underlying the species' broad distribution and resilience in seasonally dynamic ecosystems.

Within this broad spectrum of trophic resources, fine particulate organic matter (FPOM) appears as a recurrent component in the stomach contents of *Macrobrachium* species. FPOM has been frequently reported in *M. amazonicum* (**Aguiar**, 2016) and *M. brasiliense* dietary studies (**Melo & Nakagaki**, 2013), although its presence does not necessarily imply active dietary selection. Given the feeding behavior of freshwater shrimps characterized by substrate scraping, detritus handling, and suspension feeding, FPOM may be ingested both intentionally and incidentally during the exploitation of other resources such as biofilm, periphyton, and planktonic organisms.

FPOM originates from the microbial and physical breakdown of coarse particulate organic matter (**Bentes**, 2011) and can be nutritionally heterogeneous, with microbial conditioning potentially increasing its protein and lipid content. Thus, while FPOM may contribute to the overall energy intake of *M. amazonicum*, current evidence does not allow the assumption that it represents an essential or irreplaceable dietary component. Instead, its frequent occurrence likely reflects high environmental availability and the species' flexible feeding strategy.

This interpretation reinforces the view of *M. amazonicum* as a trophic generalist, capable of maintaining its feeding activity across a range of resource conditions. However, since FPOM availability is closely linked to riparian vegetation and upstream organic inputs, alterations in these habitats may modify the composition and accessibility of basal food resources, with potential indirect effects on shrimp population dynamics (**Janas & Barańska**, 2008). Consequently, the conservation of riparian ecosystems remains ecologically relevant, not as a guarantee of a single food source, but as a means of sustaining the diversity and stability of trophic pathways that support shrimp populations and small-scale inland fisheries (**Melo & Nakagaki**, 2013).

Contrary to the expectations and to previous studies on other crustaceans (**Janas & Barańska**, 2008; **Jimoh *et al.***, 2011), no clear statistical relationship was detected between shrimp size classes and diet composition in this study. Although ontogenetic dietary shifts are common among aquatic invertebrates, the size categorization and analytical approach used here limit our ability to robustly detect such patterns. Therefore, the absence of significant differences should not be interpreted as evidence of dietary constancy throughout growth, but rather as an indication of high trophic overlap among size classes within the resolution of the data. Similar patterns reported for *M. brasiliense* (**Melo & Nakagaki**, 2013) support the view that *M. amazonicum* exhibits a generalist feeding strategy under the conditions examined. However, the present design does not allow conclusions about the influence of resource availability or true ontogenetic specialization, which would require finer size stratification and complementary methods to be adequately assessed.

Another noteworthy finding was the high frequency of sand in stomach contents (76%), a phenomenon also reported in both freshwater and marine shrimps (**Heales**, 2000; **Branco & Moritz-Junior**, 2001; **Jimoh *et al.***, 2011; **Lima *et al.***, 2014). While some authors have suggested sand as a potential carbonate source (**Haefner**, 1990), the more plausible explanation in *Macrobrachium* is its functional role in food maceration, since the genus lacks a gastric mill (**Mantelatto & Cristofoletti**, 2001; **Lima *et al.***, 2014). The intentional or incidental ingestion of sand may therefore be better interpreted as a consequence of benthic foraging behavior rather than as a deliberate adaptive strategy. This behavior also indicates a close interaction between shrimp feeding and sediment characteristics, suggesting that substrate composition may influence not only habitat selection but also digestive efficiency.

Taken together, these findings reinforce the view of *M. amazonicum* as an ecological generalist capable of exploiting a broad range of resources, with FPOM and sand playing particularly important roles in its feeding ecology. The species' reliance on detrital pathways emphasizes its contribution to nutrient cycling and ecosystem functioning, while its stable dietary habits across life stages highlight a strategy of ecological resilience. From a management perspective, maintaining organic matter inputs and protecting riparian zones are critical for supporting shrimp populations and the fisheries that rely on them. In addition, the frequent occurrence of sand in stomach contents, as reported for other decapods, suggests a benthic feeding-related process that merits further investigation regarding its potential functional role.

***Bait efficiency assessment***

Our study demonstrates that bait type significantly influenced *M. amazonicum* capture efficiency and biomass. Among the three baits tested, babassu meal consistently outperformed cooked rice and canned sardines, yielding approximately twice the total wet biomass. While rice and sardines have slightly higher protein content (20.0% and 20.3%, respectively) compared to babassu meal (18.9%) (**Walter *et al.***, 2008; **De Freitas *et al.***, 2015), this marginal difference is unlikely to account for the observed preference. Dietary protein requirements for post-larval and adult shrimp are substantially higher (27–35%) (**Bentes**, 2011), indicating that factors other than proximate composition determine bait attractiveness. Babassu meal effectiveness is most plausibly linked to its chemical properties: its distinctive aroma likely stimulates shrimp chemoreceptors, enhancing detectability and

doi: https://doi.org/10.18257/raccefyn.3317

capture success (**Ache**, 1982). In contrast, sardines, despite their nutritional value, emit a very strong odor that may act as a deterrent rather than an attractant, highlighting the role of volatile compounds and olfactory cues in *M. amazonicum* foraging behavior. These findings reinforce the importance of considering sensory ecology alongside nutritional content when evaluating bait performance.

Regarding morphometric composition, all bait types resulted in captured shrimp predominantly within intermediate adult size classes (54–63 mm) (**Bentes**, 2011). However, it is not possible to determine whether this reflects true gear selectivity or merely mirrors the size distribution of the local population at the time of sampling. Therefore, these data should be regarded as preliminary observations of size composition in matapi catches, providing a descriptive baseline rather than evidence of selective harvest. Future research employing broader spatial and temporal sampling, ideally including fishery-dependent monitoring and repeated seasonal assessments, will be necessary to elucidate whether matapi traps influence population demographics or the reproductive potential of *M. amazonicum*.

The sex ratio observed in this study (2.12 females: 1 male) aligns with previous reports of female-biased populations in multiple ecosystems (**Lima *et al.***, 2014). Although prior studies have suggested that such patterns may result from differences in habitat utilization or resource allocation between sexes (**Queiroz**, 2013; **Lima *et al.***, 2014), our dataset does not provide sufficient evidence to test these hypotheses or establish a causal relation. Accordingly, any discussion of sex ratio mechanisms remains speculative. From an applied perspective, the superior capture efficiency of babassu meal, combined with its favorable cost–benefit ratio compared to rice and sardines, underscores its utility as a practical, low-cost bait for small-scale *M. amazonicum* fisheries, without apparent bias toward a particular sex or size class.

Collectively, these results highlight that bait selection can substantially influence total catch and biomass, while having minimal effects on the demographic composition of captured shrimp under the conditions tested. The study also emphasizes the need to integrate sensory ecology, behavioral responses, and population biology when evaluating fishery practices. Future investigations should expand sampling effort, extend temporal monitoring, and explore potential interactions between bait type, environmental variables, and shrimp population dynamics to provide more comprehensive guidelines for sustainable small-scale fisheries management.

## Conclusion

The analysis of the natural diet of *Macrobrachium amazonicum* near Santarém, lower Amazon River, indicated that the species is omnivorous and an opportunistic generalist. The diet was composed mostly of fine particulate organic matter (FPOM), coarse particulate organic matter (CPOM), and invertebrates. No variation in the frequency of occurrence and relative abundance of food categories among size classes, nor between males and females, was observed. Among the three bait types compared, babassu meal was found to be more attractive than cooked rice or canned sardines to capture *M. amazonicum*. Captured shrimp did not differ among baits in the proportion between young and adult, nor between males and females.

## References

**Aguiar, F.P.** (2016). *Dinâmica populacional e hábitos alimentares em Macrobrachium sob influência de barragem.* Master's dissertation, Universidade Federal de Lavras.

**Alcântara, G.d.L.C. & Kato, H.C.A.** (2016). Good handling practices of fresh shrimp sold in street fairs of Belém, PA, Brazil. *Journal of Bioenergy and Food Science*, *3*, 139-148.

**Almeida, M.C.** (2010). *Composição, abundância e pesca da ictiofauna como indicadores do estado de conservação de dois lagos de várzea no baixo rio Amazonas (Brasil).* Master's dissertation. Universidade Federal do Pará.

**Almeida-Neto, M.E. & Freire, A.G.** (2017). Avaliação de consumo alimentar e textura do exoesqueleto do camarão marinho *Litopenaeus vannamei* (Crustacea: Penaeidae) em cultivo comercial, durante o ciclo de muda. *Instituto de Pesca de São Paulo, 33*, 147-156.

**Haefner, Jr. P.A.** (1990). Natural diet of *Callinecles ornalus* (Brachyura: Portunidae) in Bermuda. *Journal of Crustacean Biology*, *10*, 236-246.

**Ache, B.** (1982). Chemoreception and thermoreception. ln: Atwood, H.L.; Sanderman, D.E. (Ed.). *The Biology of Crustacea*. Academic Press.

**Bentes, B.S., Martinelli, J.M., Souza, L.S., Cavalcante, D.V., Almeida, M.C., Isaac, V.J.** (2011). Spatial distribution of the Amazon River prawn *Macrobrachium amazonicum* (Heller, 1862) (Decapoda, Caridea, Palaemonidae) in two perennial creeks of an estuary on the northern coast of Brazil (Guajará Bay, Belém, Pará). *Brazilian Journal of Biology*, *71*, 925-935.

**Bentes, B., Martinelli, J.M., Paes, E.T.P., Fernandes, S.C.P., Paula J.D., Isaac, V.** (2014). Experimental study on the efficiency of different types of traps and baits for harvesting *Macrobrachium amazonicum* (Heller, 1862). *Acta Scientiarum. Biological Sciences*, *36*, 383-391.

**Branco, J.O. & Moritz-Jr, H.C.** (2001). Alimentação natural do camarão sete-barbas, *Xiphopenaeus kroyeri* (Heller) (Crustacea, Decapoda), na Armação do Itapocoroy, Penha, Santa Catarina. *Revista Brasileira de Zoologia*, *18*, 53-61.

**Cavalcante, R.M. & Castro, P.M.** (2014). Verificação das potencialidades do camarão de água doce *Macrobrachium jelskii* Miers, 1877 com o cultivo em viveiros de tambaqui *Colossoma macropomum* no município de Alto Alegre no Estado de Roraima. *Revista Eletrônica Ambiente, Gestão e Desenvolvimento*, *6*, 45-53.

**Carnevali, R.P., Collins, P.A., Neiff, A.S.G.P.** (2012). Trophic ecology of the freshwater prawn, *Pseudopalaemon bouvieri* (Decapoda: Palaemonidae) in Northeastern Argentina, with remarks on population structure. *Revista de Biología Tropical*, *60*, 305-316.

**De Freitas, M.A.G., Siqueira, G.B., Siqueira, F.L.T.** (2015). Avaliação do uso do resíduo farelo de babaçu (*Orbignya* sp) na alimentação de ruminantes. *Interações Campo Grande*, *15*, 59-70.

**Heales, D.S.** (2000). The feeding of juvenile grooved tiger prawns *Penaeus semisulcatus* in a tropical Australian estuary: A comparison of diets in intertidal seagrass and subtidal algal beds. *Asian Fisheries Science*, *13*, 97-104.

**Jimoh, A.A., Clarke, E.O., Whenu, O.O., Adeoye, H.B.** (2011). Food and feeding habits of the African river prawn (*Macrobrachium vollenhovenii* Herklots, 1857) in Epe Lagoon, southwest Nigeria. *International Journal of Fisheries and Aquaculture*, *3*, 10-15.

**Janas, U. & Barańska, A.** (2008). What is the diet of *Palaemon elegans* Rathke, 1837 (Crustacea, Decapoda), a non-indigenous species in the Gulf of Gdańsk (southern Baltic Sea). *Oceanologia*, *50*, 221-237.

**Kawakami, E. & Vazzoler, G.** (1980). Método gráfico e estimativa de índice alimentar aplicado no estudo de alimentação de peixes. *Boletim do Instituto de Oceanografia*, *29*, 205-207.

**Kutka, F.J., Richards, C., Merick, G.W., Devore, P.W.** (1992). Bait preference and trap ability of two common crayfishes in northern Minnesota. *The Progressive Fish-Culturist*, *54*, 250-254.

**Lima J.F., Garcia J.S., Silva T.C.** (2014). Natural diet and feeding habits of a freshwater prawn (*Macrobrachium carcinus*: Crustacea, Decapoda) in the estuary of the Amazon River. *Acta Amazonica, 44*, 235-244.

**Lima, J.F.** (2014). Viabilidade de matapis adaptados com diferentes espaçamentos entre talas sobre a captura do camarão da Amazônia (*Macrobrachium Amazonicum* Heller, 1862) no estuário do Rio Amazonas. *Embrapa Amapá-Comunicado Técnico*, *3*, 1-3.

**Lima, J.F., Cintra, I.H.A., Bastos, A.M., Damasceno, L.F., Montagner, D., Varela E.S.** (2016). Caracterização do sistema pesqueiro de produção do camarão-da-Amazônia no Estuário Amazônico. *Embrapa Amapá Documentos*, *95*, 44.

**Mantelatto, F.L.M. & Christofoletti, R.A.** (2001). Natural feeding activity of the crab *Callinectes ornatus* (Portunidae) in Ubatuba Bay (São Paulo, Brazil): influence of season, sex, size and molt stage. *Marine Biology*, *138*, 585-594.

**Melo, G.A.S.** (2003). *Manual de identificação dos Crustacea Decapoda de Água Doce do Brasil.* 1st ed. Loyola.

**Melo, M.S. & Nakagaki, J.M.** (2013). Evaluation of the feeding habits of *Macrobrachium brasiliense* (Heller, 1862) in the Curral de Arame stream (Dourados/Mato Grosso Do Sul, Brazil). *Nauplius*, *21*, 25-33.

**Odinetz-Collart, O.** (1993). *Ecologia e Potencial pesqueiro do camarão-canela, Macrobrachium amazonicum, na Bacia Amazônica. Bases Científicas para Estratégias de Preservação e Desenvolvimento da Amazônia.* Editora INPA.

doi: https://doi.org/10.18257/raccefyn.3317

**Pereira, J.A, Castro, P.M., Costa, F.Z., Santo, M.A.L.** (2017). Camarões de água doce (Crustacea: Decapoda) que ocorrem no igarapé Água Boa, municípios de Alto Alegre e Boa Vista, Roraima. *Boletim do Museu Integrado de Roraima, 11,* 39-44.

**Queiroz, L.F.S.** (2013). Biologia reprodutiva de *Macrobrachium amazonicum* (HELER, 1862) (Decapoda, Palaemonidae) no reservatório da Pedra do Cavalo Rocha, S.S. 2010. Diferença entre dois métodos de coleta utilizados na captura de crustáceos decápodes em um rio da Estação Ecológica Juréia-Itatins, São Paulo. *Iheringia, Série Zoologica*, *100*, 116- 122.

**Ramos, A.S., Pereira, L.d.J.G., Cintra, I.H.A., Bentes, B.S.** (2016). Etnoconhecimento de pescadores artesanais de *Macrobrachium rosenbergii* em campos alagados de uma região Amazônica-Brasil. *Acta of Fisheries and Aquatic Resources*, *4*, 93-105.

**Sanches, E.G. & Sebastiani, E.F.** (2009). Atratores e tempo de submersão na pesca artesanal com armadilhas. *Biotemas*, *22*, 199-206.

**Silva, B.B., Cañete, V.R., Martinelle, J.M., Isaac, V.J.** (2012). Descrição socioeconômica da pesca do camarão *Macrobrachium amazonicum* (Heller, 1862) (Decapoda: Palaemonidae) em um estuário da costa Norte do Brasil: o caso da ilha do Mosqueiro (PA). *Boletim do Laboratório de Hidrobiologia*, *25*, 12-23.

**Simonian, L.T.L.** (2006). Pescadoras de camarão: gênero, mobilização e sustentabilidade na ilha Trambioca, Barcarena, Pará. *Boletim do Museu Paraense Emílio Goeldi*, *1*, 35-52.

**Teixeira, R.R & Couto, E.C.G.** (2012). Crustacea Decapoda capturados através de coleta passiva em um trecho do Rio dos Mangues (Porto Seguro – BA). *Biotemas, 25,* 149-156.

**Vieira, I.M.** (2003). *Bioecologia e pesca do camarão Macrobrachium amazonicum (Heller, 1862) no baixo Rio Amazonas-AP.* Master's dissertation, Universidade de Brasília.

**Vieira, I.M. & Aaraújo-Neto, M.D.** (2006). Aspectos da socioeconomia dos pescadores de camarão da ilha do Pará (PA) e arquipélago do Bailique (AP). *Boletim do Laboratório de Hidrobiologia*, *19*, 85-94.

**Walter, M., Marchezan, E., Avila, L.A.D.** (2008). Arroz: composição e características nutricionais. *Ciência Rural*, *38*, 4.

**Wear, R.G. & Haddon, M.** (1987). Natural diet of the crab *Ovalipes catharus* (Crustacea, Portunidae) around central and northern New Zealand. *Marine Ecology Progress Series*, *35*, 39-49.

**Williams, M.J.** (1981). Methods for analysis of natural diet in portunid crabs. (Crustacea: Decapoda: Portunidae). *Journal of Experimental Marine Biology and Ecology, 52,* 103-113.

**Zar, J.H.** 1999. *Biostatistical Analysis*. Fourth Edition. 1ª ed. Prentice-Hall, Inc.