


SOCIAL AND TECHNICAL ASPECTS OF FISHING IN THE ARAGUARI RIVER BASIN, AMAPÁ STATE/BRAZIL

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ABSTRACT

Fishing plays a fundamental role in the socioeconomy of Amapá. However, there is a lack of information to support management proposals consistent with the reality of each location, especially areas impacted by the construction of hydroelectric plants. The study characterized socioeconomic conditions of fishermen and fishing carried out in Ferreira Gomes/AP. Information was collected through forms between 2014 and 2017 from 135 fishermen. Fishing is intended for consumption, sale, carried out by women, with low education an average of four children. The average monthly income is low and supplemented with other activities. Fishing is classified as artisanal. Most captured species belong to the genera *Leporinus* spp., *Schizodon* spp., *Geophagus* sp., *Cichla* sp. Artisanal fishing is practiced throughout the Araguari river channel, indicating the relevance of this water body as an important means of subsistence for the local community. Such characteristics can help in the development of sustainable fisheries management strategies.

Keywords: Artisanal Fishing. Fishing Management. Amazon Fishing. Fishermen. Traditional Population.

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INTRODUCTION

Fishing is one of the main extractive activities in the Amazon and plays a prominent role in the socioeconomics of local communities (INOMATA, 2013). For Diegues (2004), artisanal fishing provides fishermen with vast knowledge regarding the life cycle of species and capture strategies. It also provides traditional populations with employment and income and, thus, potential for socioeconomic development, expanding the cultural diversity of these traditional populations.

Fishing, just like any activity that exploits natural resources, has economic, technological, social and political implications. Furthermore, managing fishery resources requires collaboration among all stakeholders who must be identified and evaluated, including consumers who drive demand (PINHEIRO et al., 2015; SANTOS; FILHO 2015). Among various available biological resources in the State of Amapá is a wide water network with the Araguari River Basin as its centerpiece. Fishing is one of the most relevant activities in the region, generating employment and local trade (AMAPÁ, 2007).

Studies on the Araguari River addressing fish biodiversity have already been carried out, such as GAMA (2008) on species composition and taxonomy, Brandão and Silva (2008) on fishing activity, SOARES et al. (2012) on fishermen's ethnoknowledge and population dynamics of fish stocks, OLIVEIRA et al. (2013) on the assessment of fish stocks, SANTOS et al. (2016) on ethnoknowledge of food and CUNHA (2017) on the socioenvironmental conservation of fishing. However, in the specific stretch of the Araguari River corresponding to the municipality of Ferreira Gomes, such studies are rare, even though this area is directly affected by the UHE Coaracy Nunes Hydroelectric Plant (SÁ-OLIVEIRA et al., 2015). Moreover, episodes of fish mortality have been reported as recorded by Gama (2020) and other state media, which still need further studies.

To fill the gaps and understand community characteristics through the main economic activity, fishing the inland waterways, both technical and socioeconomic data must be collected and evaluated (ZACARDI et al., 2014a). Therefore, the present study aimed to characterize the socioeconomic conditions of fishermen, as well as technical aspects of fishing, carried out in Ferreira Gomes, Amapá State, Eastern Amazon, Brazil.

METHODOLOGY

The study covered fishing activity in the municipality of Ferreira Gomes, located about 137 kilometers from the municipality of Macapá, with boundaries of the municipality of

Pracuúba to the north, Tartarugalzinho and Cutias do Araguari to the east, Macapá to the south, Porto Grande to the west, and Serra do Navio to the northwest (Figure 1). It has approximately 7,270 inhabitants in an area of 5,046.696 km², which represents 3.53% of the territory of the State of Amapá and 0.059% of all Brazil (IBGE, 2017; PLANO DIRETOR DE FERREIRA GOMES, 2013).

Figure 1 - Location of the study area in the Araguari river region, Ferreira Gomes, State of Amapá



Source: Prepared by the authors.

TYPE OF STUDY AND METHOD OF DATA COLLECTION

Methods of data collection were determined by the character of descriptive research. Gil (2002) states that the main objective is to describe the characteristics of a certain event or population, as well as to make the connection in a harmonic and balanced way between the variables.

Accordingly, our research was qualitative/quantitative in nature, i.e., qualitative by the subjective analysis of phenomena that dynamically affect subjects, but cannot be measured, and quantitative by measurement of the number of appearances of elements in a way that can be statistically supported by both positive and negative correlation (BARDIN, 2004).

Subjects were fishermen registered in the Colony of Fishermen Z-7 in the municipality of Ferreira Gomes. Field research was characterized by thorough observations which do not allow for isolating and controlling variables, but do allow for knowing and establishing relationships with the variables. Thus, the municipality of Ferreira Gomes was considered the object of the study and fishermen were considered subjects who interacted with the study's object (RODRIGUES, 2007).

INSTRUMENTS AND TECHNIQUES USED TO COLLECT SOCIOECONOMIC DATA

The research was developed in two stages. First, a bibliographic survey on the subject was carried out with the objective of mining pertinent information about the profile of fishermen and fishing activity in the municipality of Ferreira Gomes. Next, primary research was carried out by direct data collection, consisting of field interviews with the application of semi-structured forms composed of open and closed questions. According to Junior and Junior (2011), this technique allows the researcher to dialogue with the interviewee about the answers in order to build information of a social and economic character of the community that is being studied.

Forms prepared and previously tested were used to remedy any problem in the construction of questions, submission of inappropriate questions or questions without clear objectives, constraints, or lack of clarity in the writing, which could make it difficult for the interviewee to understand, thus avoiding obtaining erroneous or inaccurate information (GIL, 1999). The form contained questions that generated information about socioeconomics and other aspects related to fishing activity in the municipality.

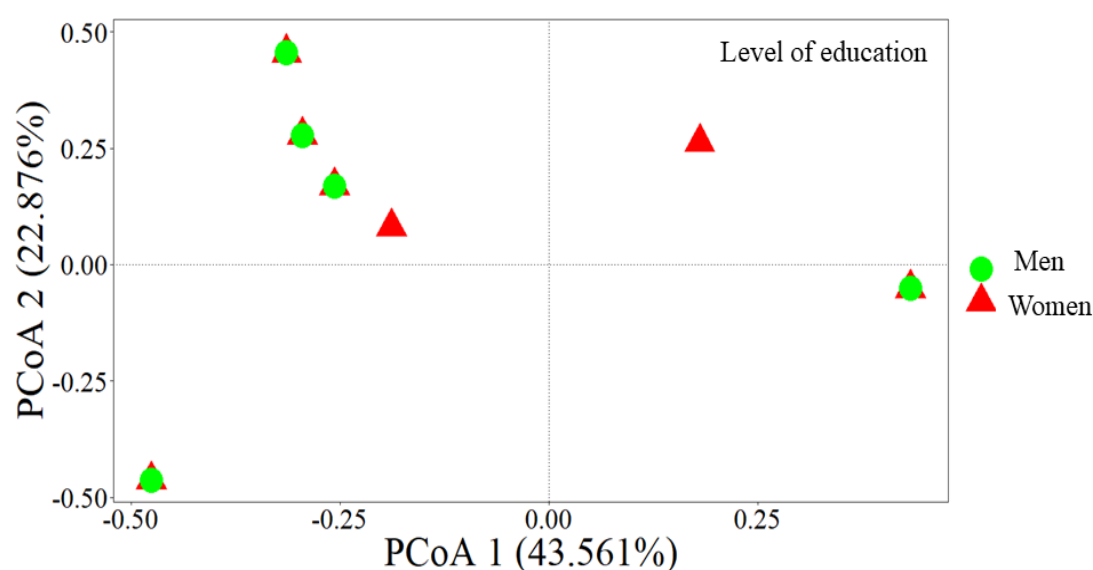
Data collection was authorized by the Ethics Committee of the Federal University of Amapá. Consent of fishermen to participate in the research was obtained through the Free and Informed Consent Term (TCLE) (Opinion number: 2,430,865), which authorizes the use of information to be discussed in this study. The first data collection was performed in August 2014 and was focused on establishing a socioeconomic profile of fishermen in the Paredão community under the auspices of PRODETEC (monitoring fishing activity in the middle Araguari River) as part of the Research Support Foundation of the State of Amapá (FAPEAP) (Process 250203/03/2014). The balance of data was collected from June to September 2017. Subjects (fishermen) were registered in Colony Z-7. In total, 207 fishermen associated with Colony Z-7 were identified with a minimum sample size of 134.7. For sampling, a confidence interval (CI) of 95% and a sampling error of 5% were

considered. The sample size calculation was performed according to Cochran (1977). After collecting the socioeconomic data, information was organized and digitized using Microsoft Office Excel 2017 in order to carry out the necessary analyses using tables and graphs for a posteriori assessment.

RESULTS

A total of 135 interviews were carried, out of which 98 came from the urban area, 31 from the Paredão community, 3 from the Terra Preta community and 3 from the Tracajatuba community. The level of education between men and women does not differ (Figure 2). Although most interviewees were women, no statistical difference in the level of education was noted between the groups.

Figure 2 – Level of education between the groups of men and women in the municipality of Ferreira Gomes, Amapá



Source: Prepared by the authors.

Among the subjects, 76.56% receive more than one social benefit, distributed among retirement government benefit for low-income families and fishermen (Table 1).

Table 1 - Type of social benefit received by fishermen interviewed in the municipality of Ferreira Gomes, State of Amapá

Social Benefit	Absolute frequency	Relative frequency (%)
Retirement	12	8.89
Retirement and Government Benefit for low-income families	1	0.74
Government Benefit for low-income families	18	13.33
Government benefit for fishermen	55	40.74
Benefit for low-income families and fishermen	16	11.85
Does not receive benefit for fishermen	33	24.44
Total	135	100.00

Source: Prepared by the authors.

Fishing season is between November 15th and March 15th, as established by the reproductive cycle of rheophilic species, which is a period when fishing is prohibited by Brazilian law no. 13,134 - 10kg/fish/day. All fishermen interviewed claimed to respect this period. However, despite their declaration of registration in the Z-7 colony, 24.44% of the fishermen stated that they did not receive closed-season insurance.

A unique characteristic of rural areas is the high average number of residents per household, as well as poor conditions of hygiene and basic sanitation. In Ferreira Gomes, for instance, fishermen have an average of 4 children, and 5 people live in the same household. However, 87.5% of fishermen have up to 10 people per household, 44.32% have 01 to 05, 43.18% have from 06 to 10 residents and 12.5% have from 11 to 16 people (Table 2). Although 87.5% of the interviewed fishermen have up to 10 people per household, the number of people who contribute to the monthly income is low with 41.30% of households having two people contributing to expenses, and for 26.32%, only one person contributes (Table 2).

Furthermore, the income of those in the fishing sector of the municipality is relatively low, ranging from R\$150.00 to R\$3,000.00 with an average of R\$932.8. In other words, 20.74% live on less than minimum wage, 44.44% live on minimum wage, and 34.81% live on more than minimum wage (Table 2).

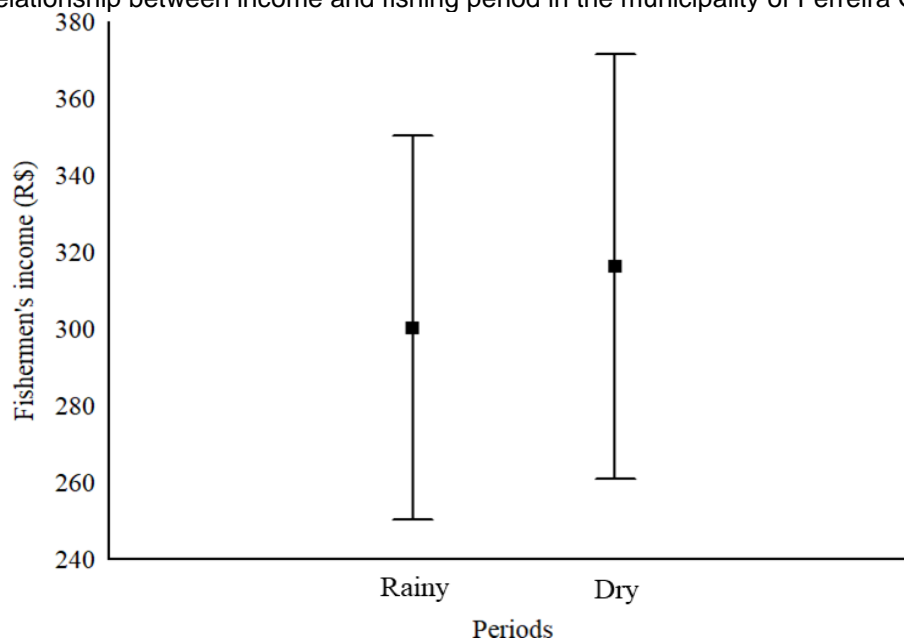
Table 2 - Monthly income and household structure of fishermen in Ferreira Gomes, State of Amapá

Household Structure	Minimum	Average	Maximum
Income	150.00	932.89	3000.00
Live at home	1	5.21	16
Sons	0	4.03	15
Depend on income	0	4	10

Source: Prepared by the authors.

Figure 3 shows the relationship between fishermen's income and fishing periods in the municipality of Ferreira Gomes. Statistical difference ($p=0.004$) is observed in the dry period where higher income was obtained compared to the rainy period.

Figure 3 - Relationship between income and fishing period in the municipality of Ferreira Gomes, Amapá



Source: Prepared by the authors.

TECHNICAL ASPECTS OF FISHING

In Ferreira Gomes, 62.22% of fishermen fish for commercialization and consumption, 32.29% for commercialization and 5.19% for consumption (Table 3). Fisheries take into account demand and fish species with the highest commercial value, which, in turn, guides the activities of fishermen.

Generally, the sale of fish is carried out directly to the consumer (92.59%), resulting in quick, immediate sales. Product is usually stored in coolers in the home (Figure 4) or locations on the corners of the main avenue of the city. Other forms of sale are carried out through middlemen (5.93%) or by order (1.48%) from some entrepreneurs who own restaurants in the municipality and the state capital.

Figure 4 - Sale of fish in the municipality of Ferreira Gomes, State of Amapá, 2017



Source: Prepared by the authors.

Subjects whose main economic and subsistence activity is fishing generally devote considerable time to this exercise. This characteristic was also confirmed in Ferreira Gomes since the working lifetime of fishermen ranged from 01 to 60 years, and 38.52% of fishermen work between 0 and 10 years (Table 3). However, it is common to find fishermen with more than 30 years of activity (12.59%), taking into account that a fisherman's retirement age is about 60 years (Table 3).

Table 3 - Aspects of fishing activity in the municipality of Ferreira Gomes, State of Amapá, 2017

Fish conservation information (n= 135)		Relative frequency (%)
Fishing Modalities	Commercialization and consumption	62.22
	Commercialization	32.59
	Consumption	5.19
	Direct to consumer	92.59
Commercialization of fish	Order	5.93
	Middleman	1.48
Fishing main source of income	Yes	88.15
	Not	11.85
Time of activity in fishing (years)	0-10	38.52
	11-20	32.59
	21-30	16.30
	> 30	12.59

Source: Prepared by the authors.

Preservation of captured fish is done with ice (94.07%), using Styrofoam vats, or delivering directly to fisheries. Most respondents (84.44%) produce their own ice, both for fishing and for preserving fish during marketing (Table 4).

Table 4 - Conservation and place of purchase of fish in the municipality of Ferreira Gomes, State of Amapá, 2017

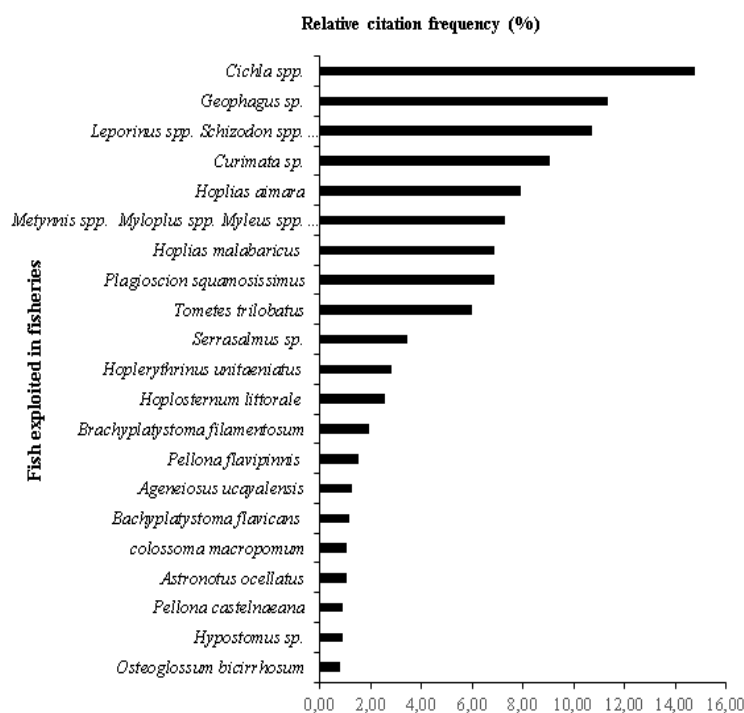
Information (Total respondents = 135)		Relative frequency (%)
conservation of fish	Freezer	2.22
	Ice	94.07
	Ice and freezer	2.22
	Ice and salt	0.74
	Does not conserve	0.74
Ice shop location	Ferreira Gomes	7.41
	Paredão community	1.48
	Produces own ice	84.44
	Buy and produce	6.67

Source: Prepared by the authors

CAPTURED SPECIES

The distribution of fish is variable (Figure 5); that is, Tucunaré (*Cichla* spp.), Acará and Aracú (*Leporinus* spp. and *Schizodon* spp.) were the most captured, making up 36.82%, but little mention was made of yellow Sarda (*Pellona castelnaeana*), Acari (*Hypostomus* sp.) and Aruanã (*Osteoglossum bicirrhosum*) at 0.89%, 0.89 and 9.76%, respectively.

Figure 5 - List of fish most cited by fishermen in Ferreira Gomes, State of Amapá, 2017



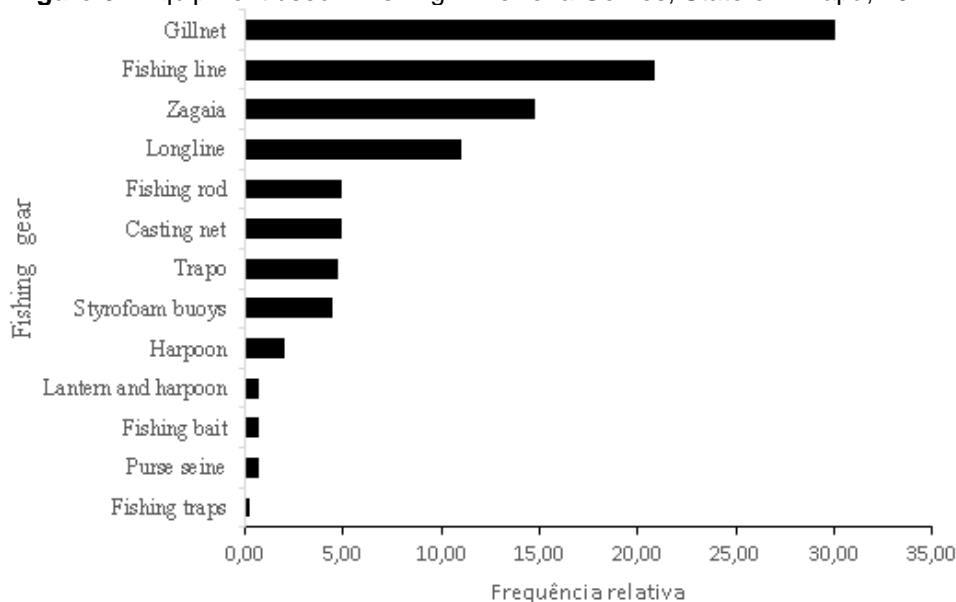
Source: Prepared by the authors.

FISHING TACKLE

In general, artisanal fishermen use simple and traditional fishing gear, usually homemade with natural products and, recently, manufactured materials, with very specific characteristics according to purposes and species of interest.

However, it is common to use more than one type of equipment selected according to area, depth, time of day or target species. The gillnet stands out as the most used device, generally having variable height and length and usually made with nylon threads arranged vertically in the water column by a series of floats (Styrofoam buoys) on the upper part and lead or leaded cable at the bottom (Figure 6).

Figure 6 - Equipment used in fishing in Ferreira Gomes, State of Amapá, 2017



Source: Prepared by the authors.

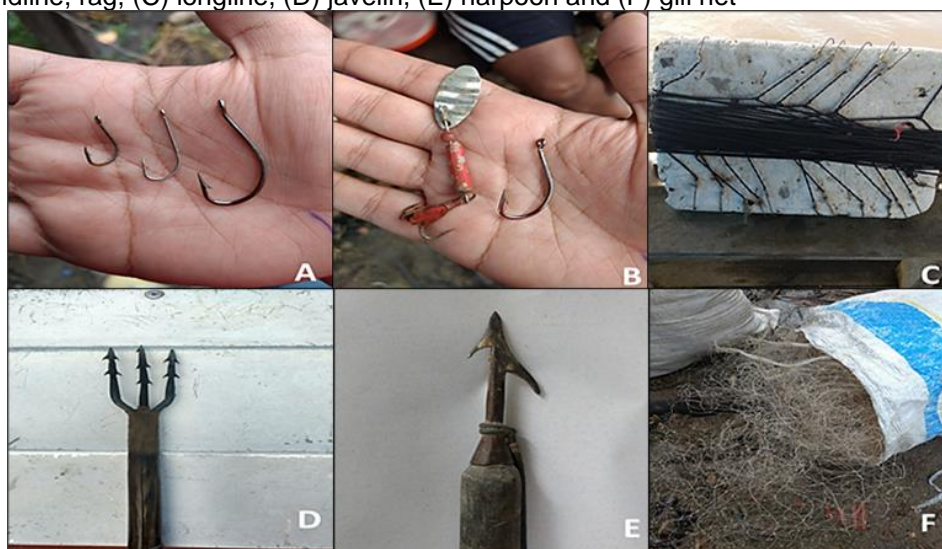
Some characteristics of nylon thickness and mesh size may vary according to the species captured. The nets used in fishing in Ferreira Gomes range from 50m to 100m in length and 2.0m to 8.0m in width. Mesh size ranged from 25mm to 90mm between opposite nodes. Nets are submerged for up to 24 hours and monitored every 4 hours. Using nets, different groups of fish are captured, specifically *Aracus* species (*Leporinus* spp. and *Schizodon* spp.), Whitefish (*Curimata* sp.), Bluefish (*Geophagus* sp.), Jejú (*Hoplerythrinus nitaeniatus*), traíras (*Hoplias malabaricus*) and other large fish at the mouth of the Araguari.

Other fishing gear used are the hand line and the javelin. The first is used to capture bottom and mid-water fish. It consists of a main line to which one or more hooks are attached and at the end (Figure 7). The javelin, an instrument similar to a harpoon, consists

of three or more points with barbs and is used to capture medium-sized and small fish. It is attached to the end of a rod (2 to 3 m) and can also be used for night fishing with a flashlight or near some other source of light, such as a lighthouse.

The longline consists of a main line with hooks attached to secondary lines (Figure 7). The numbers and sizes of hooks used depend on the target species, and the length varies with the size and capacity of the vessel. The inputs for making the items mentioned in the study, such as netting, hooks, ropes and buoys, are usually purchased in the state capital, as these supplies are said to be more cost-effective, but other lower-value inputs are obtained from local businesses.

Figure 7 - Equipment used during fishing in Ferreira Gomes in 2017: A) and (B), hooks used for making the equipment handline, rag, (C) longline, (D) javelin, (E) harpoon and (F) gill net



Source: Prepared by the authors.

FISHING EFFORT

When interviewees were asked about fishing effort, the number of fishing trips ranged from 1 to 30 days per month with fishing time from 1 to 4 days carried out by 1 to 8 fishermen on each fishing trip. Mean values showed a difference between number of fishing trips and fishing time in relation to dry and rainy periods (Table 5).

Table 5 - Fishing effort data carried out in the municipality of Ferreira Gomes, State of Amapá, 2017

Period	Features	Minimum	Average	Maximum
RAINY	Number of fisheries (month)	1	9	30
	Fishing time (days)	1	2	4
	Number of fishermen	1	3	8
DRY	Number of fisheries (month)	1	8	30
	Fishing time (days)	1	1.8	4
	Number of fishermen	1	2.5	8

Source: Prepared by the authors.

The ebb period is considered favorable for fishing. With a decrease in the volume of water, a greater concentration of fish is found in the main channel of the rivers, facilitating fishing and increasing the availability of fish, while the number of fisheries and fishing time are reduced.

In the municipality of Ferreira Gomes, fishing is carried out in different environments, including reservoirs and natural lakes, but the Araguari River and streams are the main local fishing environments and present considerable activities where fishermen move with motorized boats (Table 6).

Table 6 - Fishing environments cited by fishermen from Ferreira Gomes, State of Amapá 2017

Fishing environments	
Lakes	Region of lakes in the municipality of Pracuúba and Tartarugalzinho, lakes in the region of Aporema, Munguba, Bom Jesus community
River	Araguari River, Tracajatuba River, Aporema River
Creek	Palha, Triunfo, Jaguar, Traíra, Cavalcante, Pedro, Brilliant, Aningal, Clay, Andiroba
Reservoirs	HPP of Cachoeira Caldeirão, Coaracy Nunes, Ferreira Gomes Energia

Source: Prepared by the authors.

Owing to its potential, the Araguari River Basin has become a target for the construction of large hydroelectric projects and has been undergoing transformation and environmental change along its course, which has modified the dynamics of fishing in the region by a decrease in fishing sites, as well as the availability of fishery resources.

The interviewed fishermen (Table 7) also mention the greater distance for fishing (2.22%) and consequently the delay in time to remove the gillnet as one of the reasons for losing fish in fisheries (2.22%).

Table 7 - Main reasons for the deterioration of fish quality during fisheries in Ferreira Gomes, State of Amapá, 2017

Is there fish damage during fishing?	Reason	Absolute frequency	Relative Frequency (%)
Yes	Little ice	7	5.19
	Longer distance to fish	3	2.22
	It takes time to get the gillnet	3	2.22
	Out of the water		
	Smaller fish were already dead	two	1.48
Not	Direct-to-consumer sales	100	74.07
	Fish that are not sold are consumed	20	14.82
Total		135	100

Source: Prepared by the authors.

Ice for the preservation of fish is one of the obstacles to local fishing activity. Since the municipality does not have an ice factory, its acquisition is difficult. Thus, many fishermen produce their own ice, but not always in sufficient quantities, affecting the autonomy of fisherman during fisheries, or even in fish sales, as in some cases, fish are lost owing to the lack of ice for preservation.

VESSELS

Among the main boats used by the local community, 64.42% use motorized wooden boats called “rabetas” or “barges” (Wooden vessel made of large tree trunks, hollowed out, featuring a single piece using a propulsion engine), with an average 6.16 meters in length, followed by rowing canoes, also called “montaria” (25.77%) with an average 4.94 meters in length, and aluminum boats (4.5%) with 8.5 meters (Table 8).

Table 8 - Sizes of vessels used in fisheries in Ferreira Gomes, State of Amapá, 2017

Sizes (m) of vessels				
	Relative frequency of citation	Minimum	Average	Maximum
Barge	64.42	two	6.16	10
Canoe	25.77	two	4.94	7
Speedboat	9.82	4.5	8.5	10

Source: Prepared by the authors.

Barge-style vessels use “sterndrive” type propulsion engines (1.8 to 18 HP of power) and are powered by gasoline (Figure 8). These engines have a long tail, allowing the

propeller to be close to the surface of the water, favoring navigation in shallow places with rocks, such as rivers in the region.

Figure 8 - Vessels used in fisheries in Ferreira Gomes in 2017: (A) canoe (mount), (B) barge-type vessel, (C) speedboat



Source: Prepared by the authors.

This type of transport, as well as motorboats, is used when fishing is practiced far from dwellings. Canoes, generally propelled by oars, are used for fishing close a fisherman's dwelling and mainly used by those who live around the reservoirs, as well as for support in long distance fisheries. In this case, these are left hidden in the vicinity of fishing sites.

All fishermen interviewed have their own boat. Physical structures are generally rustic without a separate outbuilding to preserve and store product. However, most fishermen use coolers with ice to keep their catches cool. Some fishermen even pack their catches in ice on the boat until landing for sale.

DISCUSSION

In the Amazon, artisanal fishing is vitally important in the lives of traditional populations, especially those along river banks, providing food, a source of work and income through the commercialization of fish (SOUSA et al., 2017). In the State of Amapá, fishing extractivism is a traditional activity with socioeconomic importance since fishing is carried out by more than 9,000 registered fishermen who ply different aquatic environments for their catches in what is a predominantly small- and medium-scale artisanal practice (ZACARDI et al., 2014a).

Our socioeconomic profile is based on interviews with registered fishermen from Ferreira Gomes. Our data on gender corroborate findings of Ferreira Gomes Energia (2013)

in studies performed in the same municipality, where it was found that 52.58% of the interviewed fishermen were female and 47.42% male. In general, men and women play a fundamental role in fishing and therefore do not have time for the highest levels of education. However, these results contradict those that have already been published in other fishing communities in the Amazon, such as Lima et al. (2012), Zacardi (2015), and Rabelo et al. (2017), who show that most fishermen were male.

Women participate in fishing, either directly with their husbands by assisting in piloting vessels or removing grilled fish, or indirectly by repairing or making equipment, as demonstrated in several studies in the Amazon region, such as Sá-Oliveira et al. (2013), Zacardi et al. (2014a) and Rabelo et al. (2017). The lack of education is worrying since it may represent an obstacle against training for or employment in another trade, resulting in migration for low-paying work.

With no differences in education level, most respondents are older and have incomplete primary education.

According to Alves et al. (2015), low education is bad for the sustainability of any activity since the lack of formal education is an impediment to improving one's prospects in life or the ways one conducts his/her office in life, or job, in this case, fisheries. Authors such as Brito & Costa (2019) and Zacardi et al. (2014a) also emphasize low education as an obstacle to the development of an entire sector, which is an invitation to those who would take advantage of a weakened economy.

Amanajás (2018) also reports on the egress of young people from riverine communities in search of jobs considered to have more social status and mobility than fishing. More education for these youngsters translates into a greater desire to move away from fishing as a way of life. Adults do not discourage this, however.

As for access to social benefits, such as closed-season insurance, respondents claim that bureaucracy and lack of support/organization from the colony are the main obstacles to accessing the benefit. According to Silva and Dias (2010), the lack of effective representation, poor management, lack of preparation by most colony leaders, or even corrupt practices by some, such as nepotism, are all factors that make it difficult for fishermen to dialogue with governmental and financial entities such that fishing is known as one of the most disorganized sectors in the country. As a result, many fishermen engage in other activities to maintain their family's livelihood. According to Ferreira Gomes Energia (2013), during the closed season, 49.48% of fishermen in Ferreira Gomes are idle, 13.40%

carry out some agricultural activity, 8.35% continue fishing, 19.08% carry out temporary activities and 9.79% do domestic services.

Our study also investigated the average number of residents per household. Maruyama (2009) explains that more than one family may be sharing a household. This happens because married children do not have the means necessary to live in a separate house, a fact also observed by Anjos et al. (2010), studying the profile of fishermen in the municipalities of Aquidauana and Anastácio in Minas Gerais, Ramires et al. (2012) on fishing and fishermen in Ilhabela São Paulo and Santos (2015) on the socioeconomic impacts on fishermen in Ferreira Gomes, State of Amapá.

Although 87.5% of the interviewed fishermen have up to 10 people living per household, the number of people who contribute to the monthly income is low. In this case, 41.30% of the households have two people contributing to expenses, and 26.32% of households have only one contributor. In studies in the same region, data corroborate Santos (2015) who observed that only one to two people (79%) contribute to the family income in the municipality of Ferreira Gomes.

Differences may be observed in fishermen's income between open season fishing and harvest and off-season periods, demonstrating a significant change in local fishing. Flux in monthly income found in the present study, which in some cases reached R\$ 3000.00/month in periods of greater availability of fish and R\$ 150.00/month in the low season, is evident in the region studied.

Petrere Jr. et al. (2006) explain that this variation results from pursuing other activities in the slow period or when some species are off limits owing to biological closure. During these times, fishermen work in agriculture or mining to complement family income. Alternatively, they file for benefits derived from closed-season insurance, a fact also identified in studies by Prestes et al. (2021). Although economic analyses of artisanal fishing are difficult to carry out, as expense items are poorly recorded, these data are still extremely important to understand behaviors related to fishing activity, as well as daily income.

In this context, Ramires et al. (2012) state that the diversification of economic activities among populations of fishermen can be understood as an adaptive strategy of a socioecological system, both to fluctuations and uncertainties in relation to the fishing stock and expenses associated with fishing. Findings similar to those in the present work were recorded by Zacardi et al. (2014a), Zacardi (2015) and Prestes et al. (2021) who studied

family income in other regions of the state and Alves et al. (2015) and Silva and Braga (2017) in other municipalities in the Amazon.

Although the transfer of fish to middlemen is small, it is still a factor that reduces the profit of fishermen, given that they buy at a low value and resell at a value that is, at least, twice as high, which only serves to heighten competition between them (VAZ et al., 2017). Sá-Oliveira et al. (2013) found that 45.29% of interviewed fishermen sell fish, 58.49% sell fish from their homes, on the street, at fairs, or even near river banks or reservoirs of UHE Coaraci Nunes.

Most fishermen claim fishing as their main source of income. Lima et al. (2012) emphasize the importance of fishing as an important social function and remunerated occupation on a rural basis in riverside communities in the Amazon, which is reflected in the number of self-identified families of professional fishermen in each locality. Despite the representation of fishing, as the main source of income in the region, 11.85% declare working in other jobs to supplement their income, such as civil construction and agriculture.

The time spent fishing was evaluated in this study, and the findings were similar to those of other regions, as described in several studies by Ferreira Gomes Energia (2013) and Sá-Oliveira et al. (2013) who found that a majority of time was spent pursuing this activity by fishermen in the municipality of Ferreira Gomes. This is common in other fishing communities in the Amazon region, such as cited by Cintra et al. (2013), Silva and Braga (2017), Rabelo et al. (2017), and Brazil by Façanha & Silva (2017) and Abreu et al. (2020).

Addressing fishing the dry and rainy periods, Cunha (2011) studied Lago Grande de Manacapuru and described how increase in the flooded area allows the expansion of habitats. This allows fish to find refuge, making them less vulnerable to fishing. This explains why fishermen in the region spend more time fishing, consequently increasing fishing effort. Characterizing fishing in the community of Miritituba, State of Pará, Zacardi et al. (2014b) corroborate the data found in our study.

Many studies have addressed representative species of catches; particularly, those studies carried out in the Amazon with landing data indicate the frequency of capture of such fish as tucunaré, aracu, acará and others (BARTHEM and FABRÉ, 2004; GONÇALVES and BATISTA, 2008; ALCÂNTARA et al., 2015). Captured species along the Araguari River also include these species (BRANDÃO; SILVA, 2008; SÁ-OLIVEIRA et al., 2013; OLIVEIRA et al., 2018; ROSA et al., 2020; LIMA et al., 2021).

Fishing carried out in the municipality can be characterized as multi-equipment since fish are taken by a variety of methods and fishing gear, depending on type of environment exploited and target species. Such variety of gear is noted in other fishing areas in the Amazon (ZACARDI et al., 2014a; VAZ et al., 2017; ROSA et al. 2020). The fishing tackle used is simple and traditional, most often homemade with natural products and, recently, with commercial materials, having different characteristics according to purpose and species of interest (ALVES et al., 2015). This stems from the need for fishing activity to be carried out throughout the year based on the seasonal nature of available captured species and the need for regularity in income (PEREIRA et al., 2007).

During fisheries, fish are preserved on ice using Styrofoam vats. The data from this study corroborate the results presented by Borcem et al. (2011) and Zacardi et al. (2014a), but the preservation of fish varies according to the distance from the fishing site and the economic conditions of the fisherman. We found that the availability of ice constitutes an obstacle. Schork et al. (2012), analyzing artisanal fishing at the UHE de Machadinho in Alto do Rio Uruguai, identified the limited availability of ice and thus the poor preservation of fish after capture, impairing quality.

Cintra et al. (2011) state that the quality of inputs for fishing production, as well as mechanisms for improving the activity, contribute to better products on the market and reduce waste during the capture, storage and transport stages of fish. A good example would be improving the quality and availability of ice for fishermen and building small fishing warehouses, adequately sized, in order to facilitate commercialization, thereby reducing fishing time and fish losses during storage and transport.

The perception of fishing environments is important to understand the relationship between fishermen and the environment in which they interact to withdraw natural resources for their survival (SOUZA et al., 2015). In this context, the Araguari River Basin has become the target of large hydroelectric projects and has undergone transformation and environmental change along its course, which has modified fishing dynamics in the region and the availability of fishing resources. According to Sá-Oliveira et al. (2013) at UHE Coaracy Nunes, fishermen do not usually fish in areas other than those most familiar. That is, those who fish in the reservoir do not fish upstream and downstream; similarly, upstream and downstream fishermen do not change sites. This loyalty to fishing environments is an important process in harmonizing the activity among fishermen, avoiding possible conflicts and improving techniques in their respective fishing grounds.

The author also states that the greater concentration of fishermen in the area downstream of the reservoir may be influenced by freedom of this activity in the downstream area since obstacles prevent entry to the reservoir by ELETRONORTE. Also, more fish are found downstream, enabling more income and, therefore, attracting more fishermen.

Alcântara et al. (2015) studied the municipality of Juruá and identified lakes and rivers as the main places for catching fish. Oliveira et al. (2018), studying the upper and middle Araguari River, also report fisheries carried out in lakes, streams and rivers. In our study, it was also found that fishermen in the municipality of Ferreira Gomes fish in different environments according to accessibility and displacement, habits of the target species and fishermen's experience. For fisheries involving small displacements, respondents generally use canoes propelled by oars, while motorboats are used for longer distances.

Zacardi et al. (2014b) studied fishing on the banks of the Tapajós River in Pará and reported that the small size of local vessels is important to guarantee good fishing in the region which consists of several sandbanks and rocks fully exposed during the dry season. This leaves only narrow strips available for navigability, corroborating data in our study. Fishing vessels in the municipality of ferreira gomes have the same physical and technical characteristics as those of other fishing communities in the amazon region (Rabelo et al., 2017; Vaz et al., 2017; Silva et al., 2018; Brito; Costa, 2019).

CONCLUSIONS

The number of fishermen, types of vessels and the variety of equipment used, artisanal fisheries in the Municipality of Ferreira Gomes can be carried out by small vessels with production destined for commercialization and consumption, emphasizing the capture of Acarás, Aracus and Tucunarés. Despite the importance of fishing for the socioeconomic development of the state of Amapá, it was found that this activity has received few government incentives over time and that the bodies responsible for this sector have been neglectful in building structures for landing and providing commercialization, storage, preservation and access infrastructure for production. Such bodies have also failed to apply effective policies for better organization of the fishing sector. From the results of the present study, it can be concluded that data collection should be ongoing in the region in order to subsidize strategies, organization and management of fisheries, in addition to contributing to monitoring for the evaluation of changes that may occur owing to factors intrinsic to the

activity itself or anthropic actions, as well as subsidizing adequate public policies for the development of fishing in the state.

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