Effects of the cachoeira caldeirão hydroelectric dam on fishing in the Araguari River, Brazilian Amazon

This study analyzes the effects of three aspects of artisanal fishing that occurred due to the construction of the Cachoeira Caldeirão dam in a community in the middle stretch of the Araguari River. Interviews were carried out with fishermen, questionnaires were applied, and field observations were made. According to fishermen, subsistence artisanal fishing for family consumption and commercial sale in Porto Grande suffered negatively after the dam, especially with the reduction of its fishing territory, limited between physical barriers and legal barriers. This scenario is aggravated by the reduction of active fishermen in fishing activities and an alteration in the fishing dynamics which poses an imminent risk to artisanal fishing, and this may cause fishing activities to disappear in a few years in the municipality of Porto Grande.

Keywords: Artisanal fishing; Impacts; Damming the river; Hydroelectric; Amapá.

Efeitos da barragem da UHE cachoeira caldeirão sobre a pesca no médio Rio Araguari, Amazônia Brasileira

Este estudo analisa os efeitos de três aspectos da pesca artesanal ocorridos em razão da barragem UHE Cachoeira Caldeirão-AP em comunidade do médio rio Araguari. Foram realizadas entrevistas com pescadores, aplicados questionários e realizadas observações em campo. Segundo os pescadores, a pesca artesanal de subsistência para fins de consumo familiar e de comercialização desenvolvida em Porto Grande sofreu negativamente depois da UHE, especialmente com a redução do seu território de pesca, limitado entre barreiras físicas e legais. Este cenário agravado com a redução de pescadores ativos na atividade pesqueira e alteração na dinâmica de pesca coloca em risco eminente a pesca artesanal, que poderá desaparecer em poucos anos no município de Porto Grande.

Palavras-chave: Pesca artesanal; Impactos; Represamento do rio; Hidrelétrica; Amapá.

Topic: **Desenvolvimento, Sustentabilidade e Meio Ambiente**

Received: **01/04/2021**

Approved: **28/04/2021**

Reviewed anonymously in the process of blind peer.

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DOI: 10.6008/CBPC2179-6858.2021.004.0044

Referencing this:

SILVA, S. L. F.; ROSÁRIO, J. M. L.; SILVA, L. M. A.; LIMA, D. P.; OLIVEIRA, N. I. S.. Effects of the cachoeira caldeirão hydroelectric dam on fishing in the Araguari River, Brazilian Amazon. *Revista Ibero Americana de Ciências Ambientais*, v.12, n.4, p.576-589, 2021. DOI: <http://doi.org/10.6008/CBPC2179-6858.2021.004.0044>

INTRODUCTION

During the last few decades there have been many studies done examining the effects of the construction of dams on rivers in Brazil and in the Amazon as part of the expansion of the hydroelectric grid. Many of these studies have demonstrated the impacts of these dams on local fisheries and have attributed these effects to changes in river morphology, substitution of the fish community, reduction in fish stocks, restructuring of territories, and intensification of conflicts, among others (AGOSTINHO, 1992; AGOSTINHO et al., 1992; OKADA et al., 1997; AGOSTINHO et al., 1999; LIMA, 2016; CINTRA et al., 2007a; 2007b; BEUX et al., 2008; SILVANO et al., 2009; SCHORK et al., 2012; ALHO et al., 2015; FEARNSIDE, 2015).

In the state of Amapá, research conducted in the Araguari River basin has increased knowledge of the socio-environmental consequences of fishing activity in local communities brought by the construction of hydroelectric dams (HD), and this is especially true for studies done using methods involving traditional ecological knowledge (TEK) of artisanal fishermen (OLIVEIRA et al., 2013; SILVA, 2015; ZACARDI, 2015; OLIVEIRA et al., 2016; SANTOS et al., 2017; MORALES, 2018; SILVA et al., 2018; MARINHO et al., 2020).

Artisanal fishing in the Araguari valley currently can be considered to be at the threshold of enormous potential changes due to the fact that there are three HD (Cachoeira Caldeirão, Coaracy Nunes, and Ferreira Gomes) in the middle stretch of the Araguari River that have been installed and are in operation within a short distance from each other. These impacts are aggravated in the middle and upper stretches of this river where there are conservation units (CU) and areas used for artisanal fishing that have been affected by these dams and caused direct negative consequences on fishing activities as traditionally practiced by fishermen in communities of the middle stretch of the Araguari River.

Artisanal fishing is one of the principal economic activities practiced in the Araguari valley along the middle stretch of the Araguari River (OLIVEIRA et al., 2013; SILVA, 2015). Although fishing in the municipality of Porto Grande is an important activity that complements income and is a quality source of animal protein that is accessible to the lower income population (SILVA et al., 2018), there are few studies on artisanal fishing that have been conducted after the installation of the HD on the Araguari River, which represents a large gap in information on the impacts generated by these HD. In this context, the objective of this study was to identify the effects caused by the damming of the river after the installation of the Cachoeira Caldeirão HD with respect to three aspects, namely, territory, fishing effort, and dynamics, related to artisanal fishing in a community located in the middle stretch of the Araguari River.

METHODOLOGY

This study was conducted in the municipality of Porto Grande, located 108 km from the city of Macapá, in the middle stretch of the Araguari River, state of Amapá (Figure 1). The municipality has an area of 4,428,013 km² which represents 3.8% of the territory of Amapá. The municipal seat is located on the banks of the middle stretch of the Araguari River, which together with its tributaries is especially important for fishing activities in the municipality.

This research, of an exploratory-descriptive nature, was focused on the inhabitants of Porto Grande who are engaged in fishing activities, whether for commercial or subsistence purposes. The research included a bibliographic search and fieldwork of a qualitative/quantitative character that included individual and informal interviews with key actors involved in fishing activities in the municipality (BRITTO JUNIOR et al., 2011). Additionally, semi-structured questionnaires were applied to the fishermen (GIL, 1999), using the snowball technique (BAYLE, 2008). The research is authorized by the Ethics Committee of Plataforma Brasil (opinion no. 2,939,811 in October 18, 2018), which regulates the participation of the population in research using the Informed Consent Form.

The statistical sampling universe was composed of 61 interviews with fishermen and fisherwomen between February and May 2019, which corresponds to more than half of the total of artisanal fishermen affiliated with the Z16 fishing colony. This sample size provided a strong degree of representativity and is adequate for the objectives of this research.

Figure 1: Study area, municipality of Porto Grande, middle stretch of the Araguari River/AP.

The methodology adopted to identify the fishing territory is in accordance with that described by Santos (2017), which says that the elaboration of cartographies is possible to be carried out through participatory mapping. The semantic mapping technique was used in groups of up to five fishermen from

Porto Grande to record their perceptions with respect to identification and characterization of their fishing territory. Additionally, a census of boats used in fishing activities was done in loco, including photographs, characterization, and descriptions of them.

RESULTS

Fishing territory used by fishermen from Porto Grande

The participatory method was applied to fishermen in the municipality of Porto Grande using a cartographic base of the Araguari valley, fishermen spatially expressed the place where the fishing activity operates. The information generated the cartographic map of the fishing territory of fishermen in the municipality of Porto Grande (Figure 2). Thus, it was identified that the fishing territory is concentrated in two areas, these being the preferred places for exploitation of fishing resources: a) fishing area of the upper Araguari River, with 27 active fishing spots, and b) fishing area of the lower Amapari River, with 4 fishing spots. The fishing territory map also located prohibited spots (4) and inactive fishing spots (7) (Figure 2).

Figure 2: Locations used for fishing by fishermen from Porto Grande/AP.

In terms of the frequency of fishing activities at preferred sites, the majority of artisanal fishermen of Porto Grande (94% of interviewed fishermen) fish in the Araguari River, and nearly half of the interviewees (48%) fish exclusively in the Araguari River, and a small group of fishermen (6%) prefer to fish in the Amapari River. These results demonstrate the importance of the Araguari River to fishing activities in the municipality.

With respect to the specific type of environment preferred by the fishermen, Figure 3 shows their preferences for low areas, still backwaters, and streams. Table 1 shows a descriptive analysis of 22 active fisheries in the middle and upper Araguari with greater relevance in terms of productivity according to fishermen. These results show that flooded forests, backwaters, and stream share equal relevance as preferred fishing spots for the fishermen of Porto Grande. The fishing spot called “Santa Rosa waterfall” is currently considered by these fishermen as the most important locale on the Araguari River, since it is a backwater environment with good fish production (Table 1).

Figure 3: Frequency of fishing in different environments by the fishermen of Porto Grande.

Table 1: Descriptive analysis of active fishing spots in the upper and middle Araguari River/Ap.

Name of fishing spot	Environment(s)	Target species	Degree of importance (1 to 4)
Mestre Stream	Backwater	Trairão, curupeté	1
Sapo seco	Backwater, rapids	Trairão	1
Gavião	Backwater, rapids	Trairão curupeté, pacu branco	1
Capivara	Backwater, rapids	Mandubé, traíra, curupeté	3
Osvaldo Stream	Stream mouth, rapids	Mandubé, traíra, curupeté	1
Melancia	Rapids	Sarda, trairão	3
São Paulo Stream	Central stream, flooded forest	Trairão	3
Bacaba	Stream with flooded forest, bay, backwater	Trairão, curupeté	1
Genipapo	Stream that dries up in the dry season, river	Trairão	1
Josefa	Stream, flooded forest	Trairão,	3
Tibitiça	Stream, stream mouth	Trairão, sarda	1
Santa Rosa	Waterfall, backwater	Cumaru, trairão, curupeté, pacu branco	4
Poço da Ilda	Well	curupeté	3
Abelheira	Rapids, stream, backwater	Trairão, curupeté, pirapucu	3
Travessão	Waterfall, backwater	Curupeté	3
Santo Antonio	Central stream	Trairão	1
Ilha da purgada	Backwater, island	Trairão, curupeté	1
Porto da Serra	River	Trairão	1
Lamparina	Waterfall	Curupeté, trairão, cumaru	2
Ilha dos patos (Duck Island)	Stream	Trairão, curupeté, pacu branco	3
Poraquê	Waterfall, backwater	Cumaru, curupeté	3
Batata	Stream	Trairão	1

According to the fishermen, stream referred to as “central” have great importance for fishing because they are deeper and longer and do not dry up during the dry season. Fishing activity in streams often occurs near its mouth (confluence with another river), in flooded forest environments and in canals.

A total of 95% of the fishermen affirmed that they did not fish within the limits of the Tumucumaque Mountains National Park (TMNP), but when asked if they would like to fish in prohibited areas (Conservation Units, (CU)), including the TMNP, 100% of the fishermen responded affirmatively. The reasons for these fishermen affirming that they would like to fish within the CUs of the upper Araguari are shown in Figure 4. The majority (41%) of the fishermen responded that within these CUs the work necessary to catch fish would be much less due to the abundance of fish there, whereas 31% of these fishermen stated that their parents and ancestors fished these waters before the creation of the CUs, and this fact should guarantee the right of their descendants to continue to use the resources of these areas.

Figure 4: Responses (%) of fishermen from Porto Grande when asked about their motives for claiming the right to fish in Conservation Units along the Araguari River/AP.

When the fishermen from Porto Grande were questioned about changes observed in fishing activities during recent years, about 70% stated that there was a reduction in production due to the difficulty in capturing fish.

Fishing effort

The Z16 fishing colony currently has 127 affiliated artisanal fishermen, according to colony record. The fishing fleet of Porto Grande in this study is estimated at 229 boats. The method used to arrive at this number consisted of counting (census) and classifying the boats found at 17 places where the fish catch is unloaded for market in Porto Grande.

These fishermen related that the type of propulsion used in these fishing boats is, in the majority, long-tail motors of the type called 'rabeta' (39 responses) and that only a few (9) outboard motors are used. Among the 'rabeta' motors, there were a greater number of responses referencing use of these motors in the lower horsepower (HP) range of 6.5 HP (51.3%) and 7 HP (15.4%), which is probably a function of the low purchasing power of these fishermen, whose income is primarily derived from fishing (Table 2). Despite their importance in traditional communities, oars and paddles were not cited in the interviews as being used by boats on fishing trips, thus demonstrating that these fishermen almost exclusively use motorized transport for fishing activities.

Table 2: Percent by type and horsepower for boats used in fishing activities by interviewed fishermen in the municipality of Porto Grande /AP

Type of motor	Horsepower	Percent by horsepower (%)
Outboard (9)	15	33.3,
	25	66.7
Rabeta (39)	6.5	51.3
	7	15,4
	9	2.6
	13	10.3
	14	5.1
	15	15.4

Dynamics of fishing activities (Characteristics of fishing activities)

The results from the questionnaires applied to the fishermen of Porto Grande during scheduled visits to their homes allowed for division of fishing expeditions into long and short trips with respect to the time

spent (Table 3).

Table 3: Description of fishing trips and fishing effort expended by the fishermen of Porto Grande.

Type of fishing trip	Duration (days)	Number of boats per fisherman	Principal fishing spots	Capture strategy	Destination of production	of
Long	8 to 12	1 to 2	27 fisheries on Araguari river and 04 in the Amapari River.	There are up to nine (09) fishing methods. Depending on the environment, time of day, and whether fishing is done upriver or downriver from the city, four (04) methods may be used simultaneously.	Principally for commercial sale.	for
Short	1 to 2	1	Streams near the city of Porto Grande, along beaches in front of the city.	One method, or two simultaneously are used.	Principally for family consumption, with the excess for commercial sale.	with

According to the fishermen, long fishing trips last at least 8 days and can be up to 12 days going upriver. During these trips there are larger number of helpers than on short trips, and these can reach up to 8 people who are, in general, members of the same family, and are not just men but also include women, and even some of the youngest members of the family participate in these long trips.

The travel time to the last fishing spot where it is permitted to fish is called “época fora” and is situated upriver on the Araguari River and can take up to 2½ days if a lower horsepower motor such as a rabeta is used; when motorized aluminum boats are used this trip can take up to 8 hours leaving from Porto Grande.

On longer fishing trips, the batelões carry an auxiliary canoe, besides large quantities of equipment and supplies (Figure 5). The auxiliary canoe is needed to be able to fish in waters where access is difficult or limited. However, on shorter trips, some fishermen use a method of conservation of captured fish called “reboque”, wherein captured fish are attached by the mouth to a stringer or a length of strong line and then this is tied to the boat so the live fish (usually trairão) can swim along in tow as the boat moves. This method is used on trips that are not exceedingly long, and without the use of ice for conservation (Figure 6). This strategy is generally adopted when there is a scarcity of ice for sale to fishermen in Porto Grande, or when the fisherman does not have enough money to buy or produce the ice himself.

Figure 5: Transport of the auxiliary canoe on the “batelão” used on long fishing trips.

Figure 6: Transport strategy for live fish called “trairão in tow”.

This study revealed that the fishermen of Porto Grande use a diverse range of strategies (dynamics) in their fishing activities, which include a plurality of equipment divided into passive (gillnets, “trapão”, “trapinho”, floats, “tiradeira”) and active (fishing pole, “zagaia”, fishing line held directly in the hands,

underwater spearing, casting net (tarrafa)). These different types of equipment can be used simultaneously, depending on the type of environment and the target species that is fished (Table 4).

Table 4: Description of fishing equipment, strategy, and target species of fishing activities in Porto Grande.

Equipment	Characteristics of equipment	Capture strategies	Target species
Fishing net	Net with about 80m for each section, and 30, 50, 60, 70, 80, 100 mm between knots.	Are used by fixing them to the edge of larger rivers or by closing off a small stream from one bank to the other, preferably by placing it at the end of the afternoon and leaving it during the night and removing it in the morning. These nets can also be dragged for small distances along the beach in front of the city to catch fish for family consumption (subsistence fishing).	Mesh size 100 captures curupeté, cumaru, tucunaré; mesh size 80 is used for trairão, 70 trairão, pacu branco, Malha 60 for mafurá, mandusbé, mandi Mesh size 50 captures mafurá and sarda; Mesh size 30 captures aracu, branquinha, piranha
Tiradeira	Silk line 10 to 30 m long (principal line) with 30 cm portions of silk line fixed at intervals of 1.5 m using Nº 3 and 4 hooks.	The principal line is extended and pulled tight, in streams, from one bank to the other, or on larger rivers along the edges or even from one rock to another in the middle of the river. These are placed at night and removed in the morning. Bait used include pieces of aracu, sardas or piabinhas	Trairão, mandubé, piranha
Trapão	Silk line with Nº 2 or 3 hooks and wire to estrovar the hook.	The line is tied to a pole that is 1.5 to 2 m and fixed in the ground on the edge of a river or on a small cliff or overhang, with the hook swinging about 20 cm above the bottom. About 25 poles are used with about 10 m between each one and are generally placed about 18:00h and removed about 8:00h the following morning. Visits to check lines are made about every 3 h. Bits used include pieces of aracu, sarda, mafurá.	Trairão Mandubé
Trapinho	Made with a 70 cm length of silk line, nº 12 and 13 hooks, and wire to estrovar the hook.	These lines are tied to branches and suspended over the water (in-season fruit trees are used). There can be up to 50 trapinhos for each fishing session. This method is used during the day, generally between 7 h and 17h. The types of bait used are sarão (<i>Euphorbiaceae Alchornea fluvintilis</i>), comuti, ginja (cajarana), genipapo, taperebá, seringa, andiroba.	Pacu, pacu branco, aracu, mafurá, curupeté
Float	Silk line (0.5 to 1 m) tied to plastic bottles with a nº 12 hook. Wire to estrovar the hook.	Day fishing. Used in rivers and rapids (not in streams). Up to 15 floats are used in each fishing session. Are checked every two hours and replaced. Baits used include jenipapo, matupiri, taperebá, Ginga (cajarana)	Curupeté, pacu branco, cumaru,
Bamboo pole	A 2.5m bamboo pole (lamuci, <i>Pseudoxandra cuspidata</i> Maas, bambu) with nº50 nylon line and a nº 12 or 13 hook.	Fishing is done descending the river, usually under fruit trees, with one or two poles, Baits used include genipapo and matupiri, taperebá, Ginga (cajarana)	Curupeté, pacu, aracu, pacu branco, mafurá, piranha
Zagaia	A 2 m pole with 3 iron points on the end with bait on each point.	Fishing is done at night with the aid of a flashlight or headlamp. After spotting the fish the fisherman throws the zagaia. This method is also used simultaneously with bamboo pole fishing.	Curupeté, trairão, tucunaré, acará, traíra do igapó, apaiari, aracu.
Hand line	Nylon line, generally nº 30, 50, 60, 100 with nº 12 to 03 hooks and wire.	Generally used near rocks, rapids, heads of islands, wells, backwaters; one line per fisherman.	Trairão and curupeté
Harpoon (Arbalete)	Underwater spearfishing: mask, snorkel, and lantern are also used.	Can be done at night or during the day, up to 3m in depth. Is generally done in streams in calm waters, principally in the summer.	Tucunaré, trairão, curupeté, acará.
Artificial fishing lure	Artificial lure used with a hand line.		Trairão and tucunaré
Tarrafa	A small circular net with small weights distributed around the circumference of the base of the net.	Is generally used in front of the city e and close to riverside houses in a rural area, and along the edge of the river near beaches, in canoes or in the middle of a river or lake.	Matupiri, pratinha, branquinha, sarda, João-druo, acari, acará.

The fishing net was cited by 100% of the fishermen, followed by fishing line held directly in the hands (95%), while the “trapão” and “trapinho” (Figure 7) were cited by 44% and 59% respectively.

Figure 7: Two fishing techniques used by the fishermen of Porto Grande, trapinho (A) and trapão (B).

DISCUSSION

Fishing territory

In the region occupied by the municipality of Porto Grande there are thousands of families whose lifestyle is based on use of aquatic natural resources as a primary means of economic productivity. Fishing is engaged in by artisanal fishermen for subsistence or commercial ends, who for many decades have taken advantage of the many resources provided by the Araguari River and its tributaries.

The most frequented fishing spots, called “pesqueiros” in Portuguese, are specific places or micro-areas where the fishermen harvest most of their fish (BEGOSSI, 2004). According to the fishermen, before the damming of the river by the Cachoeira Caldeirão HD, there were good fishing spots that were frequented on the Araguari along a stretch from Caldeirão bay (today this spot is below the Cachoeira Caldeirão HD) to a spot known as “época fora”, which is at the limit of the Amapá National Forest (FLONA Amapá) with the Tumucumaque Mountains National Park.

The fishermen stated that currently their fishing territory is limited by the physical barrier of the Cachoeira Caldeirão dam and the legal barriers imposed by the borders of the regional Conservation Units of Tumucumaque Mountains National Park, FLONA Amapá, and the Private Natural Heritage Reserves (RPPN) of Retiro Boa Esperança and Seringal Triunfo.

These reports corroborate those record of Soares et al. (2012), in which it describes was a decrease in the size of the fishing area due to the creation of preservation and conservation areas that limited the fishermen to the middle region of the Araguari River.

When data from the current study are compared to those from Soares et al. (2012) in the same region of the Araguari, there was a drastic reduction in the number of fishing spots, where these authors registered 53 active fishing spots, all in the Araguari River, while in the current study 27 fishing spots were identified, a reduction of 50.9% in relation to the cited study.

With the installation of the Cachoeira Caldeirão dam and the formation of the reservoir, at least 7 traditional fishing spots were lost, which include Igarapé Manoel Jacinto, Igarapé Guardino, Igarapé do Eduardo, Cachoeira do Pião, Terra Preta, Cachoeira do Caldeirão and Caldeirão bay. These data corroborate those from Silva et al. (2018) who affirmed that there was a restructuring process of fishing territory after

installation of the HDs along the Araguari River.

With respect to the specific type of environment preferred by the fishermen, these results are similar to those reported by Brandão et al. (2008), Soares et al. (2012) and Oliveira et al. (2018) by fishermen who fished inside the FLONA Amapá and the surrounding area (upper Araguari).

The damming of waterways by hydroelectric dams is one of the causes of the loss of space used for fishing by fishermen of the middle Araguari River (SILVA et al., 2018), because the morphology of the river changed with the formation of the reservoir, and rapids and backwater environments, which were traditional fishing spots, were submerged

A majority of fishermen stated that they would like to fish in prohibited areas such as CUs, including the TMNP, and that their parents and ancestors fished these waters before the creation of the CUs, and therefore this should guarantee the right of their descendants to continue to use the resources of these areas.

This clearly demonstrates the perceptions and unwritten rules of these local artisanal fishermen since they are defending the idea that fishing territory should be inherited from previous generations of the same family group. According to Diegues (2000), traditional community knowledge, meaning the set of practices and cognitive and cultural skills, including strategies for use of territory or space, are passed on between generations.

It is evident that the participation of local fishing communities may have been disregarded during the process of creating conservation units in the Araguari valley. Resulting in the reduction of the fishing communities of the middle Araguari. According to Begossi (2004), fishing areas are aquatic spaces used for fishing by a diverse range of individuals or by a community.

Fishermen affiliated with the Porto Grande fishing colony, as well as those of the Serra do Navio colony, recognize the fishing spots along the upper Araguari as being territory that is open to artisanal fishing. It can take up to two days to get to some of these fishing spots along the stretch of the upper Araguari, leaving from Porto Grande. These same spots are oftentimes fished by fishermen affiliated with the Serra de Navio fishing colony, for whom the trip is quick to get to these spots, taking two hours from the city of Serra de Navio. The dispute between fishermen of the two neighboring cities for this stretch of the Araguari has generated conflicts. These conflicts arise because fishermen perceive that their territory has been invaded without consent by other fishermen in order to capture the same fish (SILVA, 2007).

Agreements between fishing colonies can reduce or even eliminate conflict through the establishment of rules that determine the extraction of fish from the area under conflict (ISAAC et al., 1993). However, mediation of this process by public authorities is of fundamental importance, and when this does not occur the tension between fishermen of neighboring colonies increases.

Fishing effort

According to the current president of the colony, the decrease of 57% well below the number of 222 reported by Soares et al. (2012), which is a decrease of 57%, is the result of a reorganization of the executive

board of directors, as recommended by the Federation and Confederation of Fishermen. During this process, the official register of enrollment of the affiliated fishermen was reanalyzed, and those fishermen who had not paid their dues or who were no longer active in the profession were removed from the official registry.

Furthermore, according to the fishermen, as a result of the compensation payments received from the Cachoeira Caldeirão HD construction project after the damming of the Araguari River, some fishermen affiliated with the colony ceased their fishing activities completely and used the money to start other businesses such as small grocery markets or purchasing a vehicle to engage in transport and delivery of freight.

With respect to the type of boat used in fishing activities, as shown by Soares et al. (2012), before the damming of the river Araguari, two types of boats were customarily used for fishing, the *batelão* (a larger boat that is a type of skiff with a flatter bottom) and the canoe. In the current study, besides the *batelão* and canoe, about 20 aluminum motorboats were also registered.

According to the fishermen, the use of aluminum motorboats occurred due to three principal motives: 1) with the financial compensation provided by the Cachoeira Caldeirão HD some fishermen were able to acquire an aluminum motorboat; 2) due to the formation of the lake (reservoir) and the loss of the rapids, fishing trips by aluminum motorboat were more secure, and 3) with the formation of the lake, the best fishing spots were now further from Porto Grande, and an aluminum motorboat greatly reduced travel time.

According to Marinho et al. (2019), the changes that occurred in local communities due to the construction of the HDs had repercussions on fishing, which ranged from a reduction in fish capture to more extreme effects such as abandonment of fishing altogether. There is no doubt that the installation of the Cachoeira Caldeirão HD contributed to changes in the active labor force of fishermen in Porto Grande, and the subsequent inclusion of aluminum boats in fishing activities

Dynamics of fishing activities

The fishing expeditions of the fishermen of Porto Grande are artisanal in nature, with production destined for family consumption or commercial sale. According to Diegues (1988), artisanal fishing is that in which the fisherman goes alone or together with other fisherman with the explicit objective of catching fish using relatively simple equipment.

The questionnaire applied to the fishermen of Porto Grande, whether they were part of the Z-16 fishing colony or not, allowed for identification of fish that were captured, the equipment used in fishing, fishing strategies, duration of fishing trips and number of people involved.

It is important to emphasize that the time spent at each fishing spot is a function of the productivity of fishing there. Brandão et al. (2008), related that fishing trips done by fishermen from the Z-16 colony, in the area around the FLONA Amapá, usually lasted a maximum of 10 days, with an average of 5 days.

The fish captured on long and short trips is transported to the city in large Styrofoam coolers filled with ice. The duration of a fishing trip is also limited by the method of conserving captured fish, as stated by

a fisherman from Porto Grande: “[...] a fishing trip will last as long as the ice does”.

With respect to fishing methods, studies done in 2012 related the following hierarchy of preferred fishing methods of the fishermen from Porto Grande: trapo, trapão and net (SOARES et al., 2012; OLIVEIRA et al., 2018). Although seemingly similar, the methods trapinho and trapão have certain characteristics that cause them to be different. For example, with reference to the specific place where the line with hooks are placed, the trapinho is hung from a branch that extends over the water, while for the trapão the line is connected to a pole which is then jammed into the soil of a small cliff or overhang above the water (Figura 11). According to Soares et al. (2012) trapinhos are used more during the Amazon ‘winter’ (rainy season) when the water level is high which makes placement of a trapão on the river’s edge difficult. In the region of Alto Rio Tiquié (AM) this equipment is frequently used by indigenous people and is called a ‘waiting line’ (linha de espera in Portuguese). Cabalzar (2005) and Petrere Junior (1978) described a similar implement called a curumim.

Underwater spearfishing has increased in the last two years because of the creation of the reservoir after damming of the river. The Peacock bass (tucunaré) is the principal target and the harpoon (arbalete) is used in this technique. Production that was previously destined only for family consumption is now sold to local restaurants. The fishermen stressed that the increase in underwater spearfishing has occurred because of the lower effort and costs involved with this method, since the fishermen do not need to travel long distances and can simply fish in the reservoir near the city.

CONCLUSIONS

The results of this research demonstrate that three aspects of fishing in the municipality of Porto Grande were significantly compromised with the installation of the Cachoeira Caldeirão HD. This study showed that the fishing territory of artisanal fishermen of Porto Grande was modified by the Cachoeira Caldeirão HD through the loss of traditional fishing spots. The damming of the river and the appearance of the lake changed the dynamics of fishing and one of that we consider to be most significant is the intensification of underwater fishing, especially among younger fishermen. Before the formation of the reservoir, underwater fishing was not significant, with the main objective being leisure and family consumption of captured fish, but with the installation of the HD the fish captured through this method began to be sold to local restaurants. This scenario places artisanal fishing in the municipality of Porto Grande in imminent risk, and if the public authorities and the HD do not offer policies that provide incentive to artisanal fishing this activity could disappear in the municipality in just a few years.

ACKNOWLEDGMENTS: The authors would like to thank the Fundação de Amparo a Pesquisa do Amapá (FAPEAP) for the financial support in carrying out the research, the artisanal fishermen of Porto Grande and the Z-16 fishing colony for participating in this research, the Jordalan da Silva dos Santos and Jeferson Silva Paixão, for helping in the fieldwork, and to the graphic artist Barbara Meg Silva Macêdo for the illustrations.

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