

## Ornamental Fishery in Rio Negro (Amazon region), Brazil: Combining Social, Economic and Fishery Analyses

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### Abstract

The cardinal tetra is the number one export species in the ornamental fish trade industry in Brazil, accounting for 70% of the total amount of Brazilian fish exports [1]. The cardinal tetra inhabits the middle and upper Negro River, and its trade corresponds to 60% of the economy of the Barcelos municipality. However, fishery data have yet to be collected to better evaluate the effects of this artisanal fishery on fish populations. The present work presents data obtained from field collection interviews and a sample fishery. The data correspond to the quantity of fish caught per collection region, how many people were involved in the activity, the number of nets used, and the catch volume. Data from fisherman interviews and the type of fishing were compared for corroboration of the findings and to assist in calculating the number of fish extracted from the collecting areas during different times of the year. Altogether, these data were used to determine whether ornamental fisheries are sustainable. The present study shows that a fisheries observatory program is viable for the ornamental fish market and can be combined to increase sales, which emphasizes the preservation and wellbeing of the local communities that are active in this trade, as accomplished by the “fair trade coffee market”. We hope this idea can be pursued further by local authorities, and with better data, the preservation of the aquatic fauna can be prioritized because aquatic fauna preservation increases sales.

**Keywords:** Barcelos; CPUE; Fair trade; Negro River; Piabeiro; Ornamental fish trade

### Introduction

#### Current global trends in the ornamental fish industry and how the Brazilian market and producers are keeping up

Due to pressure from Southeast Asia, a region where the ornamental fish market has grown, the activity of exporting tropical fish, which originated from the Negro River basin, is now at risk and may completely disappear. Sales have drastically decreased over the past four years, with a decline in gross yield from US\$ 3,000,000.00 in 2006 to less than US\$ 1,500,000.00 in 2010 (Figure 1).

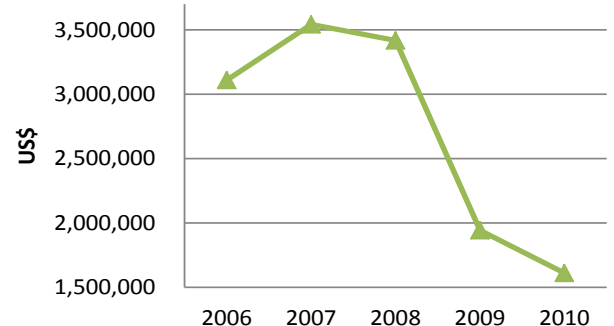
During this period, the number of fish exported decreased by more than half. The exploration of tropical fish as pets is an important aspect of the economy of the state of Amazonas. If we consider the two major producing municipalities located along the Negro River, Barcelos and Santa Isabel, this trade represents almost 80% of the local economy, contributing to more than 10,000 jobs [2]. Thus, many local families in these municipalities rely on fishing activities and artisanal exploration of such species. Furthermore, these activities have produced a low impact on the environment for many years.

The “Piaba Project”, created by Dr. Ning Labbish Chao, investigated various aspects of the pet fish trade in the middle Rio Negro region over many years and promoted the slogan “Buy a Fish and Save a Tree”, implying that if you buy ornamental fish from the Negro River you guarantee that the forest will remain untouched. The “Piaba Project” reasoned that if fishermen are working on such activity, it keeps them away from activities that cause greater harm to the environment such as wood exploration. Although this project collected some information on ornamental fisheries, the information is very fractured and inconclusive. As previously mentioned, the sales of tropical fish decreased drastically since mid-2008 due to a series of economic and political factors. This decrease in demand was worsened due to the poor conditions of the global economy in 2008. These changes are still

being felt today, and tropical fish sales have not yet recovered. The present work aims to review and explain how these factors contributed to this decline; we also aim to propose the use of fishery data as a tool to stimulate a sustainable ornamental fish trade.

#### 2008 Economic crisis

In mid-2008, the world’s economy collapsed, stock markets crashed, real estate prices in the US dropped, banks and insurance



**Figure 1:** Gross amount exported (in US\$) from 2006 to 2010 based on export data from Turkys Aquarium Company.

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companies went bankrupt, and 25% of the world's money disappeared in the blink of an eye. The fish market was significantly affected. Tropical aquarium fish is not a commodity and is used only as adornments or pets. Therefore, when families started to tighten their budgets, superfluous things such as ornamental fish were among the first items to be removed from shopping lists. Historically, the most significant markets for Brazilian ornamental fish exports, particularly Amazonian ornamental fish, were the European and US markets. Given that the old continent's economy is yet to recover to pre-2008 levels, the Amazonian ornamental fish market continues to suffer.

### Freight prices

Approximately 60% of all ornamental tropical fish exported from Brazil originate from Rio Negro and are transported to Manaus by boat. The export activities start in Manaus [1] which is one of the most remote capitals in Brazil. Practically all Manaus cargo leaves and arrives via airfreight. Due to this dependency on airfreight, Manaus has one of the highest costs of living in the world. For instance, the price to transport 1 Kg of goods from Manaus to Germany is approximately US\$ 6 (six American dollars), which is double the price of freight in Singapore, which is another country that exports ornamental fish; there, the price to export one kilogram of goods to Germany is only US\$ 3 (Benzaken et al.). Considering the high freight prices charged by the Brazilian air companies, the fish market has become more expensive and less competitive. Thus, most North American and European customers prefer to buy ornamental fish from Asia given the decrease in their buying power.

### IBAMA's list

The Amazon River waterway traverses political borders with the same species being administered by more than one nation in South America. These fish species are found in Brazil, Colombia and Peru. Thus, because these fish species are found in different countries, different laws are applied to the same fish population. Brazilian laws, as opposed to other countries' laws, include a list of species that can be exported. In contrast, other countries have laws stating which fish species cannot be exported. Furthermore, recently, the number of fish species that are eligible for export was decreased in Brazil, which has

decreased the competitive power of the Brazilian market compared to that of the neighboring countries, which commercialize a larger number of fish species. Although created to protect biodiversity, the Brazilian list encourages fishermen to trade larger numbers of a smaller group of species. In neighboring countries, fishing efforts are distributed across more species.

### Strengthening of the Brazilian currency

Brazil has one of the highest interest rates in the world, and because of the current global economic situation, has experienced a large influx of investments making the Brazilian currency relatively strong. Due to this change in the currency's value, when a company sells tropical fish in dollars it receives fewer Brazilian Reais, making the company less profitable and making it more difficult to cover local expenses. The solution to compensate for this change in the currency exchange rate is an increase in prices, which is not viable during a period of economic crisis.

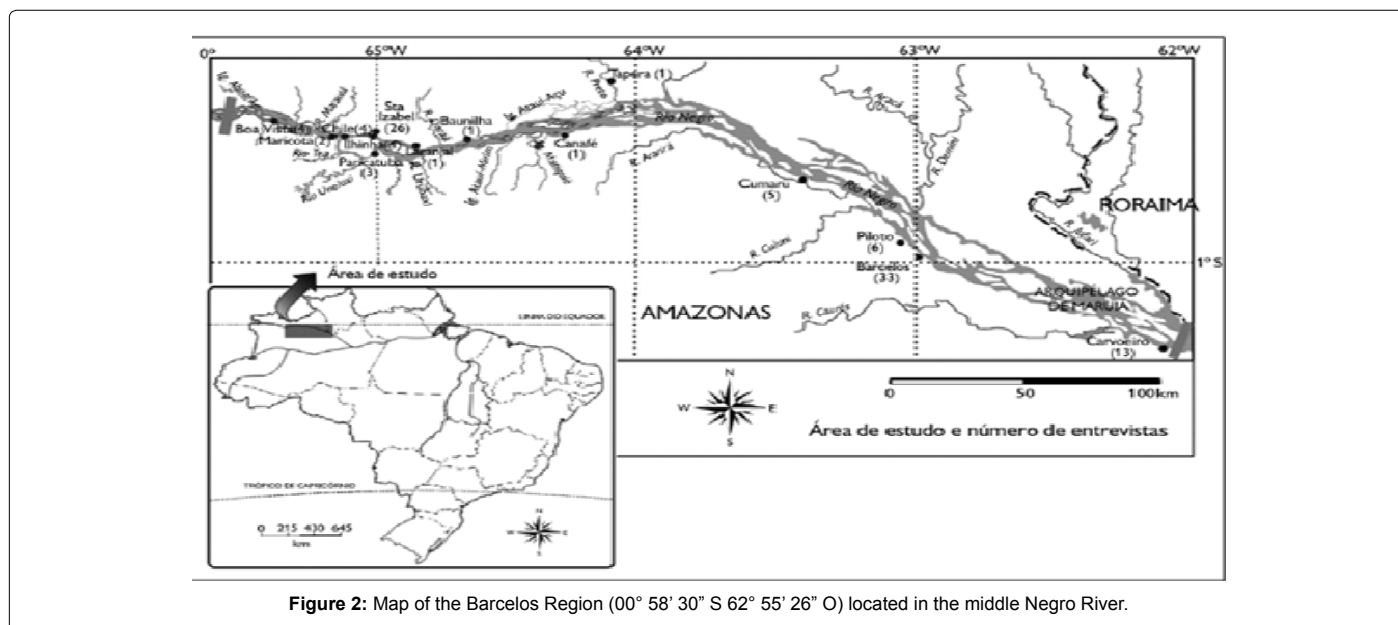
### Brazilian bureaucracy

This problem is well known in various sectors of the Brazilian economy, and the problem also affects fish export activities. A shipment requires more than 12 hr to clear customs and depart from Manaus. During this time, the fish must stay packed at the airport, awaiting clearance, which decreases the quality of the packed water. To compensate, fish trading companies must add more water to their packing bags, which causes an increase in the weight and increased freight costs, making the price of Amazonian tropical fish less competitive worldwide.

### Methodology

The Barcelos region is located approximately 300 Km from the city of Manaus in the middle Negro River [Figure 2] it is the second largest Brazilian municipally and the third largest in the world. To proceed with this project, we designed a study to acquire data on the amount of fish captured in the middle Negro River. There are three possible ways to determine the amount being fished:

- i. directly collecting data on how much fishermen are fishing in the field.



- ii. collecting data on how much ornamental fish export companies receive in the city of Manaus and
- iii. obtaining legal export documents from the Brazilian government asserting the quantity of fish exported.

To evaluate the catch directly from the fisherman activities, we collected data from the town of Barcelos because it is the main location where fishermen gather to initiate the trade of ornamental fish. Every Saturday, fishermen arrive from their fishing sites to deliver fish to the export company stations. There are four of these stations in Barcelos. Therefore, we observed the production on the same day in four locations within the city. At each station, we checked the cargo of the fishermen to record what they brought to the port and performed the following survey by answering the questioner below:

- 1) How many traps did you use?
- 2) How many people were involved in your fishing group?
- 3) What is your estimate of the number of fish per trap?
- 4) How long did you leave the trap in the water?
- 5) Where was the trap set?
- 6) What type of fish was brought, and how much by catch was caught?
- 7) Did you use cooking oil as bait?
- 8) What was the destination of the by catch?

After the questionnaire was applied, if the fishermen complied with the research, they received R\$1 (one real) per 1000 fish brought in addition to what they sold to the fishing company. The payment of R\$1/1000 fish was to reward the fishermen for their help and work provided to the researcher creating the sense that providing fishery data is a type of work. Furthermore, the interviews were validated with fishing trips where fish was actually caught using the same methods as the fisherman used to obtain the data to validate the information.

Finally, we counted the number of fish per species sold to the fish exporting companies in Manaus and compared these numbers to the official numbers exported per species provided by the government authorities.

At the end of the data gathering process, we expect to calculate the site specific CPUE (Catch per Unit Effort) for each of the sub-locations. The CPUE will prove to the end consumer that the fish came from sustainable fisheries. Furthermore, consumers will understand that the extra money paid is being used for fishery maintenance and to improve the lives of riverine people. The CPUE was calculated by dividing the total number of fish caught in a month by the number of fisherman multiplied by the number of days worked.

## Results and Discussion

We established this study based on the Costa Rican fair trade coffee model, where agencies must demonstrate to the end customers that the coffee they are buying comes from farms that paid a fair wage to the local people involved in the coffee production [3]. The present study was similar to the coffee model based on the economic importance of this fish production to the riverine people.

The agencies that control the trade could pay extra to the fishermen if they provide fishery data and if they prove where the fish came from to control the stocks in all areas. The collected data facilitated

an understanding of how much fishing was taking place, not only worldwide but also at the sub-location of the Negro River. This also allowed us to better control the stocks at the Negro river basin within this specific site.

Based on the interviews, we determined that in total, there were 64 fishing groups working in approximately 20 different locations, and some of these locations were considered subsidiary rivers of the Negro River (e.g., Téia and Ciuini) or small bodies of water that run off into the Negro (e.g., Daracoá and Zamula). Each fishing group has an average of 4-5 fishermen who work to extract the fish from the flooded forest or flooded fields, which is where the fish are most often located. One of the most productive locations was the Daracoá region. Each fishing group worked for an average of 20 days per month, and because the production was combined, it was possible to single out each fisherman as a producer on their own and calculate the total production of every individual in this group according to [4]

The monthly CPUE calculated for the Daracoá region shows that extraction of cardinal is sustainable because the production doubles depending on the water flooding patterns yearly; the latter is the only variable that limits the ability to catch the fish. During the wet season, fishermen must go deeper into the forest to search for the fish compared to the dry season where the fish are found much closer to the village (Figures 3 and 4). The Daracoá community represents 5% of the total production of the state.

Based on the analysis of the collected data on the fishing trips along with the interviews, we suggest that tropical fish extraction from the Middle Negro River Basin is sustainable. We anticipate, based on the calculated CPUE values, that fishermen do not extract more than 1500 fish per day, which was constant throughout most of the year.

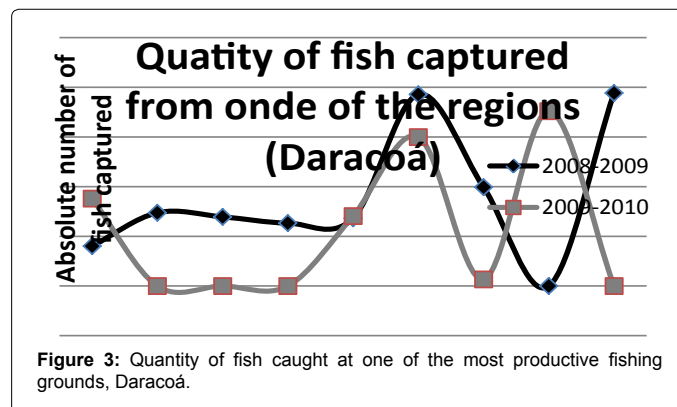


Figure 3: Quantity of fish caught at one of the most productive fishing grounds, Daracoá.

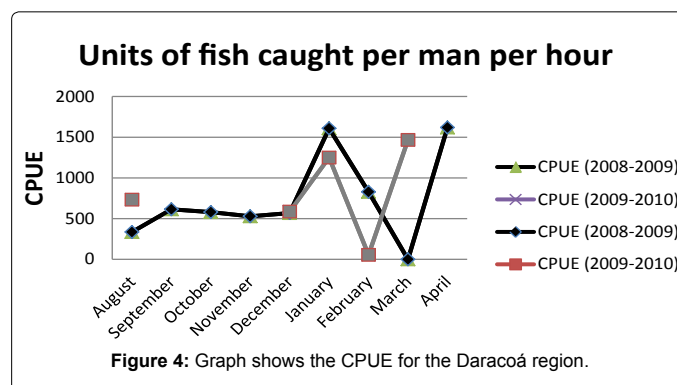


Figure 4: Graph shows the CPUE for the Daracoá region.

Similar work was performed in different regions of the Amazon basin with positive results [5] collected data from landings at the Manicore port using questionnaires and comparing the answers to the quantity of fish that exited the boats; they obtained good results including calculating the CPUE for the fisheries in question. The fishing effort of the Manicore fishery is increased when the water levels are higher because fishermen must spend more time with the nets in the water [5]. The same results were found for the Negro River Basin [6].

Furthermore [6] stated that the buying power of the fish exporters located in Manaus was the limiting factor for the amount of fish extracted from the rivers. If the exporters did not order a certain type of fish, the fishermen did not go out to catch it and the fisherman reported quantities of fish that were released back into the river because there was no demand for it.

Brazilian fishery authorities are well known for imposing various types of regulations to try to preserve the fishing stocks (e.g., banning fishing in certain areas or prohibiting the use of some types of traps). [7] concluded that most of these regulations are inefficient for controlling the stocks and only generate additional costs to implement them. In one case, the amounts of fish caught and spotted in preserved areas were similar to those from unpreserved areas over a ten-year period perhaps because the larvae were from different individual location.

Aggregating the preservation values for the product becomes the most productive way to help continue to preserve the fish stocks, so population data collection efforts are worthwhile. The fishermen believe that preserving and maintaining the fishing stocks at good levels will benefit them financially, so they are more inclined to be involved in these activities, which illustrate the increased benefits of implementing a fair trade program in various areas, not only in the Middle Negro river basin. This method of preservation can be used in addition to or in place of other methods such as fishing bans and the use of different fishing instruments.

## Conclusions

Fair trade has become widespread in the commercialization of certain goods, particularly those products that consumers pay more for if they know that the producers are receiving a better income and if production is environmentally sustainable. The data shows that, although this fishery was explored for more than 50 years, its numbers still fluctuate back to high numbers annually, and the fisherman are still able to achieve good production levels.

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