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Frontiers of the unknown: the value chain of meat and fish maw of acoupa weakfish from Amazon continental shelf

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Acoupa weakfish is one of the most commonly caught species in large-scale artisanal fishing on the Amazon Continental Shelf. In addition to its meat, the swim bladder (fish maw) has high commercial value in the Asian market. This study aimed to analyze the value chain of the acoupa weakfish and its relationship with the national and international markets, as well as the socioeconomic impacts on the stakeholders involved in fishing. Interviews using semi-structured questionnaires were conducted between 2023 and 2024 in the municipalities of Belém, Vigia, and Bragança, in the state of Pará. A value chain was described, including producers, distributors, processors, retailers, and consumers of both the meat and the swim bladder. A total of 45 representatives from all categories were interviewed. The fishing of acoupa weakfish is carried out by artisanal vessels that use urn with ice or refrigerated chambers for fish storage. The average production per trip is 2.3 tons on boats with ice urns and 29 tons on boats with cold storage. The value chain for the meat is long and complex, with exports to both national and international markets, while the value chain for the swim bladder is shorter, and this byproduct is exported to the Asian market. The value chain shows that swim bladder processors achieve the highest revenues (USD 33 million), while producers generate the most jobs (N = 850). Acoupa weakfish fishing faces challenges due to the lack of regulation and effective tracking. The absence of the General Fishing Registry mainly hinders the monitoring and legality of the fish maw trade. Measures such as tracking and more effective penalties are essential to strengthen the value chain.

KEYWORDS

large scale artisanal fishing, fishermen, trade, swim bladder, China fish market

1 Introduction

Globally, over one billion people depend directly and indirectly on fishery resources, not only for subsistence and food security but also as a source of income, engaging in both artisanal and industrial fishing (McClanahan et al., 2013; Béné et al., 2015; Bennett et al., 2018). In 2022, out of the 185 million tons of aquatic animals produced, 91 million tons (49%) came from capture fisheries (FAO. Food and Agriculture Organization of the United Nations, 2024). Fish and their by-products stand out as some of the most traded food products globally, accounting for 85% of the total marine capture production (FAO. Food and Agriculture Organization of the United Nations, 2024). However, the growing demand for fish and the economic importance of fisheries have placed significant pressure on the populations of various species (Pauly et al., 2002; Sumaila et al., 2016). The predominant fishing activity is artisanal fishing, which, although practiced worldwide, is especially common in developing countries (Allison and Ellis, 2001; Tidd et al., 2022).

In the Brazilian Amazon region, a variety of fishing types can be found, encompassing different scales, from industrial to artisanal, which is the predominant form in the area (Freire et al., 2021). In coastal regions, artisanal fishing is highly important to local inhabitants, serving as both a source of food and income for a significant portion of society (Castello, 2010). In 2011, the Amazon coast contributed approximately 33.6% (94,265.3 tons) of the national marine production. Notably, the state of Pará (Northern Brazil) ranks as the second-largest producer in the country, accounting for 15.8% (87,509.3 tons) of the total production (MPA, Ministério da Pesca e Aquicultura, 2013). The largest fish landings are concentrated in the ports of the cities of Vigia, Bragança, and the capital, Belém (Braga et al., 2006).

In Northern Brazil, artisanal vessels are traditionally classified according to these authors (CEPNOR/IBAMA Centro de Pesquisa e Gestão dos Recursos pesqueiros do Litoral Norte and Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, 1998; Espírito-Santo and Isaac, 2012) and (Lutz et al., 2016). Large-scale artisanal systems use vessels ranging from 12 to 18 meters in length and have greater autonomy. Fishing activities occur from the Amazon basin to the edge of the northern continental shelf, with production destined for both the local market and export (Brito and Furtado-Júnior, 2002; Espírito-Santo, 2002; Isaac et al., 2008).

Among the fish caught on the northern coast of Brazil is the acoupa weakish, *Cynoscion acoupa*, standing out as one of the main resources of large-scale artisanal fishing (Brito and Furtado-Júnior, 2002; Furtado-Júnior et al., 2006);. In the North and Southeast regions of Brazil, the average catch was 35.67 kg/trip (for the year 2006) and 60 kg/trip (for the year 2013), respectively (Almeida and Isaac-Nahum, 2015; Martins et al., 2019);. This species is caught along the northern coast of Brazil, from Amapá to Maranhão (Sanyo Techno Marine, 1998; Matos and Lucena, 2006) with the aid of 70 mm gillnets between knots (Matos and Lucena, 2006; Mourão et al., 2009; Almeida et al., 2011). The growth of this species is slow and moderate (Froese et al., 2000). Slow in the early stages and faster in the later stages, found in sizes up to 180 cm (Souza et al., 2003; Oliveira, 2018; Oliveira et al., 2020). It is a species with high longevity, reaching a maximum age of 15 years.

The diet is based on crustaceans, fish, polychaetes, bivalve molluscs, algae and plant fragments (Ferreira et al., 2016). The acoupa weakfish reproduces throughout the year, with two main peaks: between November and December and another between March and April, with an average of 10,171,348 oocytes per ovary (Almeida et al., 2016). During spawning, it emits a croaking or percussion-like sound produced by the tissue or muscle attached to the abdominal wall (Espinosa, 1972; Mok et al., 2009). Fishermen on Lake Maracaibo, in Venezuela, take advantage of the noise to set gillnets to catch hake (Espinosa, 1972).

In general, the commercial dynamics and the exploitation of fishery resources along the Amazon coast have been substantially influenced by the global demand for fishery by-products (Jimenez et al., 2020). This is the scenario for the acoupa weakfish, whose commercial value is significant, but not limited to the quality of its meat, as its byproduct, the swim bladder, locally known as fish maw, fetches a high price in Asian markets (Sadovy de Mitcheson et al., 2019).

While the meat of the acoupa weakfish is sold in local markets at an average price of USD 5.06 per kilogram, the swim bladder can reach values of up to USD 701.95 per kilogram, depending on its texture and size (Froese et al., 2000; Azzaro, 2019; Medeiros, 2019). The high market value of swim bladders compared to acoupa weakfish meat resulted in an increase in the number of vessels and fishermen who directed their efforts towards capturing this species, although almost always aiming to obtain the swim bladder for the export market, particularly Hong Kong (Hui and Reed, 2022).

The market for fish maw exists because they are traditionally used as raw materials in the production of emulsifiers and clarifying agents (Cervigón, 1993; Wolff et al., 2000). It is highly appreciated in cooking, due to its soft texture (Yellowdawn, 2011; Guilford, 2015), in the production of specialized adhesives, wines and beers, as well as, in the pharmaceutical and cosmetics industry, as it is rich in collagen (Hickman et al., 2000; Jakhar et al., 2012). In Chinese culture, it is commonly served at festive banquets and celebratory meals (Sadovy de Mitcheson et al., 2019; BNC, 2024) and is comparable to the "shark fin" in relation to the symbolism of wealth and prosperity (Ho and Shea, 2015; Ho and Shea, 2021). The increased demand for this raw material, combined with poor monitoring and the lack of effective regulations for acoupa weakfish fishing, could cause ecological and social consequences, as happened with the Chinese bahaba (*Bahaba taipingensis*) and the totoaba (*Totoaba macdonaldi*) (Liu, 2020; Cisneros-Mata et al., 2021).

Thus, this by-product is also what guides the species' value chain, since the profit obtained from the meat is generally used to cover the costs of fishing trips (Hui and Reed, 2022). However, despite the acoupa weakfish has great social and economic importance for the Brazilian Amazon coast, little is known about its production chain, especially about the fish maw market.

The lack of information on productivity and market parameters may compromise analyses on the economic viability of acoupa weakfish fishing and, consequently, projections of ecological pressure in the short term. Therefore, this study aimed to analyze

the acoupa weakfish value chain and the relationship of this activity with the national and international market, as well as the socioeconomic impacts on fishing stakeholders. The information generated by this study will be useful in implementing management measures aimed at creating appropriate strategies to improve the sustainability of the ecosystem and the fishing activity itself, which already shows clear signs of overfishing (Moura et al., 2023; Mescouto et al., 2024).

2 Materials and methods

2.1 Study area

The Amazon coast, located on the Continental Shelf, extends across three states in northern Brazil: Pará, Amapá, and Maranhão. This region is dominated by the discharge of freshwater and sediment from the Amazon and Tocantins rivers (Latrubesse, 2008), which flow into the extensive local mangroves, one of the world's richest and most productive ecosystems (Kjerfve et al., 2002). This ecosystem provides an important environment for the development and survival of several species, including acoupa weakfish, and is also favorable for fishing activities (Sanyo Techno Marine, 1998; Wolff et al., 2000). In this region, more specifically in the state of Pará, the main landing ports for acoupa weakfish are located (Braga et al., 2006) (Figure 1).

2.2 Methods

2.2.1 Sampling

To describe the value chain associated with the meat and fish maw of acoupa weakfish, caught by medium-sized boats, data were collected through interviews using semi-structured questionnaires between 2023 and 2024 in the municipalities of Bragança, Vigia, and Belém. To select the interviewees, a combination of qualitative (non-probabilistic, where one interviewee indicates the next, and so on) and quantitative (random selection) approaches was used. The choice to combine these approaches was intentional in order to balance depth and breadth in data collection. The "snowball" method, used in the qualitative approach, was important to access key informants within the chain, especially in groups with less availability or where initial identification would be difficult. The selective selection was applied to avoid excessive bias and ensure a broader and more representative view of the chain. In addition, conducting the interviews in different strategic locations, such as landing ports, fairs, residences, fishing colonies, companies, allowed us to capture multiple perspectives and reduce the influence of a single environment on the perception of the interviewees.

The interviews were all conducted in person with fishermen, boat owners, fishing entrepreneurs, restaurant owners, and market vendors. The interviews with each representative of the value chain took place at landing sites, the interviewees' residences, markets, fishing colonies, and processing companies, both for fish and fish maw.

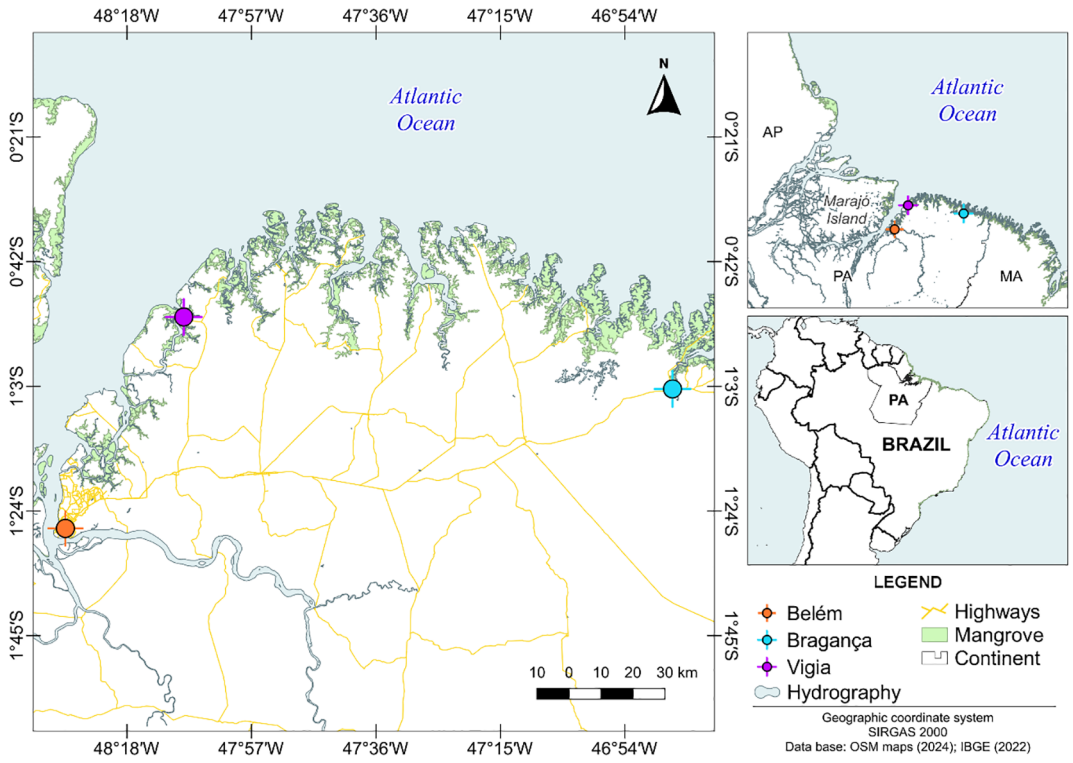

FIGURE 1
Main fishing ports on the Brazilian Amazon coast, where the artisanal Acoupa weakfish fleet that operates on the Amazon continental shelf.

2.2.2 Components and parameters of the value chain

The value chain analysis was used to describe the flow of acoupa weakfish meat and fish glue from fishing to the final consumer. For each stage, revenues, costs, jobs created, and salary were included to obtain overall estimates of the entire fishing sector's contribution to the economy and employment in the region. The analysis was based on the flow of values between the different links of the chain. In the modeling, we distinguished producers, processors, distributors, sellers, and final consumers, and described the flow between them (Figure 2).

a) Producers

They are represented by vessel owners, captains, and shipowners who work on medium-sized vessels. In this segment, data from the 'Unified Panel of the General Register of Fishing Activity' available on the website of the Ministry of Fisheries and Aquaculture (MPA, Ministério da Pesca e Aquicultura, 2024) were used to determine the approximate number of vessels involved in the capture of acoupa weakfish. This category provided information on production, price, and the technology used for both the capture of acoupa weakfish and the removal of the fish maw. Additionally, information was obtained on the size of the vessel, number of crew members, tons captured per year, and variable costs, such as food, ice, and fuel. This segment of the chain supplies products to distributors or directly to processors (Figure 2).

In this study, the agents operating on vessels equipped with urn with ice and refrigeration chambers were taken into account. Although it is known that during fishing trips, refrigerated vessels are typically accompanied by support boats called 'lice,' we focused exclusively on information related to the refrigerated vessels.

b) Distributors

Distributors are represented by middlemen, also known as intermediaries, who are responsible for the storage and distribution of the fish meat and fish maw. This segment provided information on the quantity of fish caught and the purchase price, resale price (price per kilogram), and the destination along the chain. In relation to fish maw, the middlemen send the product to a processing and trading company (Figure 2). As it was not possible to obtain the exact number of middlemen in any of the target municipalities, we chose to follow the logic reported by the fishermen themselves, that there is at least one middleman per neighborhood in each city. We consider the middleman as the marketing agent and, due to the very plasticity of the function, it is governed by the opportunity, both of the harvests that define larger or smaller volumes of fish, and of the structural policy of the market, which takes into account the

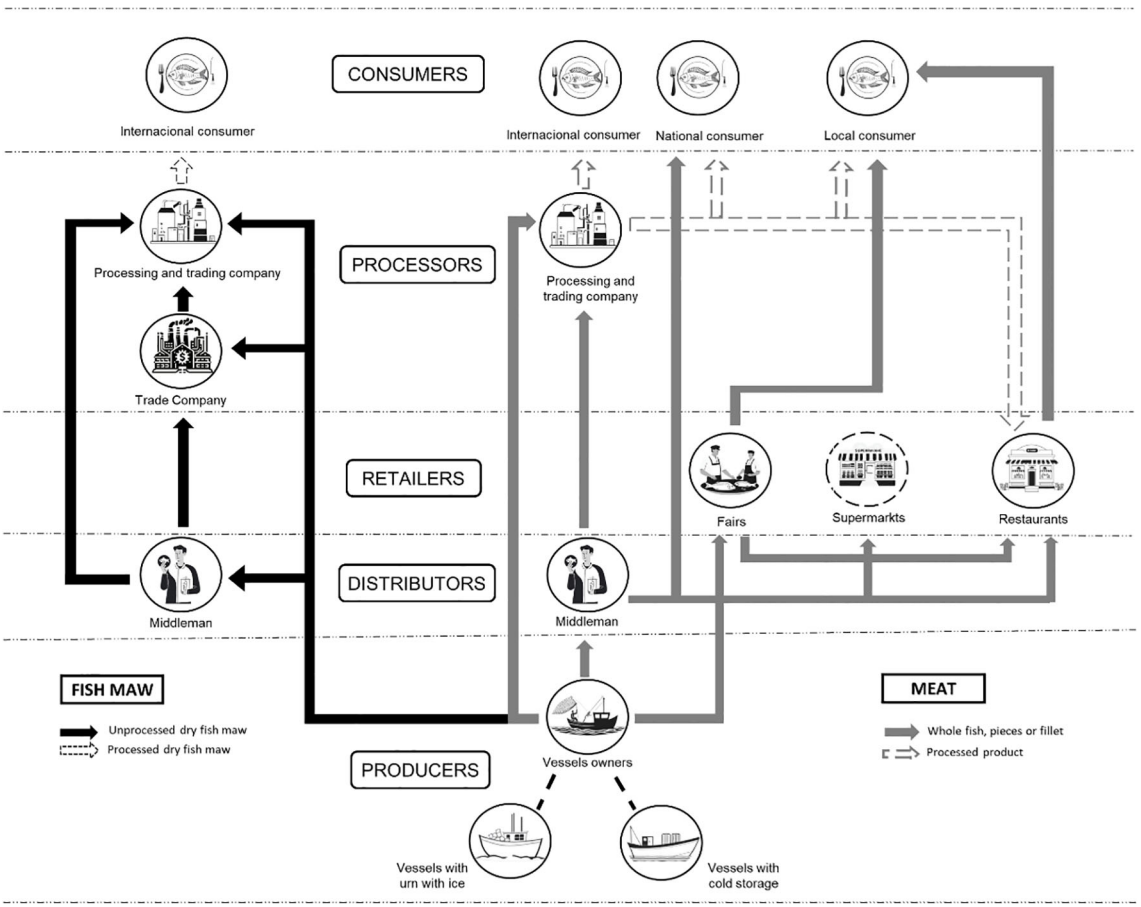

FIGURE 2
Value chain of meat and fish maw of acoupa weakfish caught on the Amazon Continental Shelf, Brazil.

articulation with other local middlemen and even from other municipalities, in a casual and random way.

c) Processors

The processors are represented by companies that process and trade the meat or fish maw of the acoupa weakfish, or that are solely dedicated to the commercialization of the by-product. The processing and trading company receives the meat and fish maw directly from producers and/or intermediaries and prepares them for the final consumer. The information requested included the monthly quantity of fish and fish maw processed, the total production purchased monthly, the purchase price from producers, the resale price, the processing cost, the destination of the products and the number of employees (Figure 2).

d) Retailers

Retailers are represented by the people who work at the markets, as well as the number of restaurants and supermarkets. Information was obtained from them regarding the purchase and sale price per kilogram of acoupa weakfish, the volume sold per month, who they buy from, and to whom they sell (Figure 2).

e) Consumers

Consumers were identified as local consumers, inhabitants of the municipalities where the research took place; national consumers and international consumers. In this segment of the chain, restaurants are included, representing the final consumers, and the information of interest was only the knowledge of the final destinations of the meat and fish maw (Figure 2).

2.2.3 Data analysis

The information was tabulated by calculating the percentage of mentions in each response category for each interview question.

For the calculation of production, revenue, costs, production value, profit, average salary, and GDP contribution, averages were made for each segment of the value chain of the fish maw and meat of the acoupa weakfish.

Gross Revenue is the total income generated throughout each segment before the deduction of expenses, that is, it is the cash inflow generated by the commercial activity of each actor interviewed. This variable is an initial indicator of the economic activity of a segment and reflects the performance of sales operations. First, revenue was calculated for each interviewed actor, and then an average of all the involved actors was calculated.

$$Revenue = Selling\ Price\ (US) \times Production\ (t)$$

Costs are the sum of all expenses incurred during normal business operations. Operating costs were calculated for each segment, and then the average for all the involved actors was calculated. For this calculation, expenses such as salary, boat outfitting costs, maintenance, transportation, etc., were taken into account.

Profit measures the amount of earnings that exceed the total expenses of a business. It is an essential metric for stakeholders to assess the profitability and efficiency of the business. Profit was calculated for each segment and then the average for all actors involved was calculated.

$$Profit = Revenue - Costs$$

Production value refers to total production multiplied by its price per kilo in each segment.

The GDP contribution is an essential metric for understanding the value added by a company to the country, in this sense, the Gross Added Value (GVA) was calculated first,

$$GVA = Revenue - Cost\ (without\ including\ salary)$$

Salaries are excluded from the GVA calculation because they are considered remuneration for production factors, already included in the added value.

Next, the GDP contribution was calculated, which represents the sum of all values generated by economic activity in the country. The GDP contribution calculation includes the following components:

$$GDP\ Contribution = GVA + Wages + Profit$$

Here, the salary is added because they represent income generated by economic activity, which contributes directly to the total output of the economy.

The economic multipliers were based on the study by (Jacobsen et al., 2014), which uses numbers to calculate the total impact of a segment on a region's economy. As such, a multiplier of 1 indicates no multiplier effect (i.e., no indirect or induced impact), and higher multipliers indicate greater total economic impact. For example, a fishery with a revenue multiplier of 1.5 would generate $500 in indirect and induced economic activity for every $1,000 of landed catch.

3 Results

In total, 45 representatives were interviewed across all categories. Among them were 15 producers (representing 30% of the 50 total producers interviewed), 4 processors (29% interviewed, out of a total of 14), 16 retailers (33% of the 48 total retailers), 10 of which were market retailers (out of a total of 33) and 6 restaurant-owning retailers (out of a total of 15), in addition to 10 distributors (26% of a total of 38 distributors) (Table 1).

TABLE 1 Number of representatives in each segment of the value chain of acoupa weakfish caught on the Amazon Continental Shelf.

Category	Total collected (n)	Total collected (%)	Overall Total (n)
PRODUCERS	15	30%	50
DISTRIBUTORS	10	26%	38
PROCESSORS	4	29%	14
RETAILERS	10	30%	33
RESTAURANTS	6	40%	15

3.1 Description of acoupa weakfish fishing

Acoupa weakfish is caught along the Amazon continental shelf, mainly in fishing grounds located near Amapá, known as "Norte". The main vessels that capture fish in this area are medium-sized artisanal vessels (EMP) that have two types of fish storage: the ice urn and the cold storage chamber, denoting the configuration of two capture systems (Table 1).

The vessels equipped with refrigerated chambers for fish storage are referred to here as "mother vessels". The vessel size, total catch, autonomy, and other information can be found in Table 1. This type of vessel goes out fishing accompanied by 3 to 6 "lices", which are small artisanal fishing vessels that rely on the support of the "mother vessel" during fishing. When the "lice" urns are full, the fishermen transfer the fish to the refrigerated vessel for preservation. Medium-sized vessels equipped with only an urn with ice have an average size and smaller urn capacity than the "mother vessel" (Table 1). The average number of crew members on vessels with ice and with a refrigeration system is the same; however, the "lice" go fishing with a maximum of 6 crew members, who have the roles of captain, driver, ice handler, cook, and fishermen.

The main fishing gear used by both vessels are gillnets, made of multifilament thread, with varying sizes, from 1500 to 8000 fathoms (a fathom is a unit of measurement that is equal to 1.8 meters, essentially representing the distance between the fingertips of a person's outstretched arms), which are cast twice a day and remain submerged for up to 6 hours until they are hoisted. Some interviewees reported also using longlines, consisting of a 10-meter line and size n° 8 hooks. This gear remains submerged for up to 5 hours before being retrieved.

Vessels equipped with only urn with ice remain at sea for approximately 50 days, while those equipped with refrigeration systems can stay at sea for an average of 4 months due to their greater fish storage capacity. These fisheries occur throughout the year; however, those interviewed in Bragança reported that the peak fishing season for acoupa weakfish takes place between May and December, while those from Vigia indicated it occurs between January and July. The average production of acoupa weakfish caught is 2.3 tons for boats with urn with ice and 29 tons for boats with refrigeration systems. It is worth mentioning that, in addition to acoupa weakfish, these vessels also catch other species, including green weakfish (*Cynoscion virescens*), snook (*Centropomus* spp.), catfish (*Sciades* spp.), Spanish mackerel (*Scomberomorus brasiliensis*), and the Gillbacker sea catfish (*Sciades parkeri*).

Most vessel departures are financed by the owners. However, some companies that are dedicated to the processing and marketing of meat and fish maw finance the trips and, in exchange, appropriate the fishing products. Companies that only work with processing and selling the fish maw only keep this byproduct, while the fish remains with the owner of the vessel. On the other hand, companies that process the fish meat retain all the products: they sell the fish maw to specialized companies and market the meat.

3.2 Value chain

3.2.1 Meat

Still inside the vessel, the acoupa weakfish is gutted, washed with sea water and stored in the cold chamber or in the urn with ice. The fish maw is carefully removed by the fish maw maker, who is the person trained to take care of this byproduct.

Upon arriving at the port, the acoupa weakfish follows two flows: one for the meat and the other for the fish maw (Figure 2). The owners of vessels with cold storage chambers and those with urns allocate the meat directly to different sectors, whose values are also different (Table 2). When destined for processing and marketing companies, both the meat (which are whole fish or fish fillets cut transversely perpendicular to the spine) and the fillet (meat cut longitudinally, having an elongated and flat shape) are destined for local and national markets, mainly for the Northeast and Southeast regions of Brazil, with the fillet being sold for USD 11.05/kg. Only whole fish are sent to the international market, such as the United States (USA), by fish processing companies. The values of export fish are unknown to those interviewed.

When the owner of the vessel sells the fish to the middleman, the meat is distributed to processing and marketing companies, supplying both local markets (fairs, supermarkets and restaurants) and national markets, in the form of fillets and meat. Although we find acoupa weakfish fillets in supermarkets, they do not come from the collection sites but from other cities. In addition to these sectors, the flow of meat and fillet also occurs within local markets, supplying restaurants and consumers with acoupa weakfish. In the case of supermarkets, meat and fillet are only sold in the capital, since local establishments cannot compete with market vendors, who sell fish by the kilo for a lower price.

3.2.2 Fish maw

After being removed from the fish, the fish maw is exposed to the sun for 4 to 7 days to dry and prevent deterioration. Upon arrival at the landing port, the swim bladder is allocated to three different sectors:

i) to processing and marketing companies (EBC) that are registered with the Federal Inspection Service (SIF). The state of Pará is the main exporter of fish maw, with a total of 11 processing and marketing companies registered with the Federal Inspection Service (SIF) as of 2024. After going through the processing process, the fish maw is mostly exported to Hong Kong, but also to Vietnam, Suriname and the United States.

ii) to marketing companies (EC) that purchase the fish maw from intermediaries and boat owners. Although they are legal entities, they do not have SIF, but they still export to Hong Kong. The acquired by-products are sent to processing and marketing companies (EBC) that are contracted and have SIF (and consequently, a label). These companies carry out the processing and exporting the by-product (to Hong Kong), and the SIF and label belong to the contracted company, but the name of the exporter belongs to the company that bought the fish maw from the middlemen and boat owners, in this case EC. This dynamic

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TABLE 2 Differences in variables per trip between vessels with ice urns, "mother vessel" and "lice" that operate in the capture of acoupa weakfish along the Amazon Continental Shelf, Brazil.

VARIABLES	UNIT	TYPES OF VESSELS											
		URN OF ICE				REFRIGERATED VESSELS							
						"MOTHERSHIP"				"LICE"			
		Min	Max	AVG	SD	Min	Max	AVG	SD	Min	Max	AVG	SD
Vessel size	Meters	12	18	16	2,3	17	27	19	4,4	9	16	12	3,5
Crew number		6	15	9	3,5	8	10	9	6	6	6	6	0
Capacity of the hold	Tonne	6	23	13	8,6	50	55	53	2,9	4	12	8	
Fishing areas		Norte				Norte				Norte			
Vessel autonomy	Days	25	90	45	23,4	60	150	120	42,4	60	150	120	42,4
Main fishing gear per trip		Gillnet and longline				Gillnet				Gillnet			
Total catch per trip	Kg	1.000	3.500	2.300	900	20.000	35.000	29.000	6.600				
Fish first sale price	USD/ Kg	4,78	5,51	5,15	5,2	2,21	4,96	3,79	6,7				
Fuel per trip	USD	1.102,94	5.330,88	3.694,85	1.300,40	32.169,12	55.147,06	44.424,02	11.565,31				
Supplies per trip	USD	459,56	1.838,24	1.011,03	470,7	4.044,12	4.596,59	4.411,76	318,89				
Ice per trip	USD	477,94	5.514,71	1.504,60	1.489,50	1.102,94	3.308,82	2.389,71	1.147,98				
Boat and equipment maintenance	USD	275,74	9.191,18	3.507,97	3.082,80	18.382,00	27.574,00	4.505,00	5.307,00				
Gear cost	USD	919,12	2.941,18	2.058,82	856,3	6.434	7.353	6.893	530,65				
Crew salary	USD	2.941,18	6.617,65	3.880,72	1.057,80	73.529,41	79044,12	76.286,76	3.899,49				
Maintaining vessel cost	USD	6.801,47	19.852,94	12.837,32	4.718,00	139.338,2	171.507,40	159.068,60	18.279,70				
Crew payment		"A few days before departure, crew members are paid an advance, called a 'voucher'. The remaining amount is paid on landing, with the advance deducted."				A few days before departure, an advance is paid to the crew members. After 35 to 40 days of the trip, another installment is paid, with the advance already deducted."				The payment is made by the boat owner, in the same way as on the mothership.			

clearly constitutes a process of 'outsourcing' processing. These companies can also supply, although in small quantities, the national market, more specifically the state of São Paulo, which has a large concentration of Chinese people who buy for their own consumption or as ingredients for preparing typical foods that are sold in their restaurants. One of the traditional dishes found in these restaurants is "fish belly" soup, sold for USD 10.11 (price recorded in August 2024).

iii) to the middleman, who buys the fish maw from the boat owners. From there, the fish maw can be sent directly to a company with SIF or to a marketing point, whose owner is an individual. Due to their tradition, they are now recognized as "companies" by local fishermen. These "companies" also purchase fish maw from various middleman or boat owners, who then sell them to processing companies.

Several "companies" of this type were recorded, consisting of independent middlemen or employees of processing and marketing companies who dictate market prices. Depending on the category (Table 3), the fish maw can reach up to USD 661.76/kg. The acquisition of fish maw can occur through direct purchases from previously contacted vessel owners or from those who randomly offer the product at purchase points. It was observed in most establishments that when the middleman sells the product to the processing company or marketing "company," there is an average increase of USD 18.37 over the purchase price.

Among the variety of fish maw available for sale, acoupa weakfish stands out for its high market value. The price of fish maw can vary according to size (or category) and shape, since a small quantity can be sold in natura, also called fresh or green, and the majority is sold dried. The fresh (or "green") fish maw is those that have not undergone the drying process. They have a whitish coloration and are almost twice the size of dried fish maw. Generally, the fish maw that are sold while still green are those obtained at the end of the fishing trip, and therefore, have not had time to dry on the boat, and are sold at a 50% reduction in value compared to when dry. The specifications of the categories (size) may vary depending on the establishment. For example, fish maw over 350g may be called "Super" or "Top" (Table 3).

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TABLE 3 Purchase and sale price of acoupa weakfish (*Cynoscion acoupa*) caught along the Amazon Continental Shelf, Brazil.

CATEGORY	UNIT ($)	AVERAGE (Purchase price)	AVERAGE (Sale price)	WEIGHT OF EACH PIECE OF FISH MAW
SUPER	USD/ Kg	661,76	680,15	Above de 350g
EXTRA	USD/ Kg	591,91	610,29	349 - 300g
TOP/G	USD/ Kg	503,68	522,06	299 - 270g
1ª/A	USD/ Kg	447,24	465,63	269 - 100g
M	USD/ Kg	300,18	318,57	99 - 80g
3ª/ B	USD/ Kg	238,97	257,35	79 - 70g
PP	USD/ Kg	153,13	171,51	69 - 50g

In most cases, the middlemen or processing companies already have an agreement with the owners of the vessels that catch the fish maw to pass on the fish maw. As previously mentioned, in some cases, this link in the chain equips the owner's vessel to obtain all of the byproduct. Interviewees reported that some fishermen who work on "lice" vessels appropriate the fish maw to sell them directly to the middlemen. The whole fish, from which the fish maw have been removed and "diverted", are discarded overboard to avoid raising suspicion.

When the fish maw, both dry and green, arrive at the processing and marketing company, they undergo a cleaning and washing process with chlorinated water, following the standards established by their PACs (Self-Control Program) to eliminate any type of contamination of the product. The quality of the fish maw is essential to ensure good sales. The fish maw with traces of blood or colors that do not meet quality standards have their sales value reduced on the international market or are rejected. Some processing companies buy acoupa weakfish fish maw from other states to be processed in Belém. This processed by-product is destined for Hong Kong via air transport. At one of the processing and trading companies, it was reported that only the by-products of this species are sent by plane, as it is not economically viable to transport them by sea container due to the low quantity of the product.

The fish maw of other species shipped by sea due to the larger quantity. It was also mentioned that, just over four years ago, between the months of July and December, around 5 tons of acoupa weakfish fish maw were processed and exported and that currently they process between 2.5 and 3.5 tons per month.

In one of the processing companies, a kilogram of fish maw is sold for USD 735.29 to 4 Asian importers, obtaining a monthly profit of 20 to 25% of the total sales. These companies no longer focus on processing fish maw due to the low quantity that is caught.

In relation to the value chain of the fish maw, at sea, vessels equipped with cold storage generated the highest revenues (Table 4). In general terms, processors were the ones who made the most profit and obtained the highest revenues/employment. In relation to social benefits, producers generated the highest number of jobs, with the vessels with cold storage having the highest number of employees.

In the value chain of meat, processors had lower revenues than producers. However, in terms of revenue/employment, processors had superior performance. Distributors and market vendors (retailers) contributed less employment along the chain (Table 4). Combining the two products (fish maw and meat), processors generated the highest revenue, followed by vessels with cold storage. The contribution to GDP is higher for these vessels in all forms of acoupa weakfish sales (Table 4).

The value chain of the fish maw shows that processors have the best economic indicators, but the best social indicators can be observed in the producer segment, which is responsible for the greatest generation of jobs (Table 5). There is no retail segment in this chain. In relation to meat, producers presented the best economic and social indicators, with the highest profits and salaries paid, followed by processors, who have the lowest salary costs. The lowest profits are observed with retailers (Table 5). Combining the segments of the meat and fish maw value chain shows that processors have the best economic results, except in relation to average salary (Table 5). Employees at processing companies and restaurants receive a fixed salary, ensuring remuneration independent of market fluctuations. While intermediaries and market vendors, have their income directly linked to the profit from fish sales, which can result in significant variations in remuneration, depending on demand and the marketing price.

Fishermen's salaries are calculated based on a percentage. Typically, 50% of the production profit is used to cover fishing expenses, while the other 50% is divided between the crew and the owner of the vessel. The distribution among the crew may vary according to the roles performed during the fishing trip. A few days before departure, the crew receives a "voucher" as an advance payment, the value of which may vary between vessels. The salary of the boat captain is determined by the value of the fish caught; however, payment is not based solely on the catch of acoupa weakfish, as this fishery includes other species.

In the value chain of fish maw, producers send most of their production directly to processing and marketing companies. These companies receive 98.8% of the total by-production production (in kilograms) to be processed (Figure 3). As a result, these companies generate the highest revenue, followed by cold storage vessels, which account for 32.78% of revenue. Producers generated the largest number of jobs, while distributors, represented by middlemen, had a lower percentage in all three indices (Figure 3).

In the meat value chain, the cold storage vessel recorded the highest percentage in the three indexes shown in the graphs,

TABLE 4 Revenue (USD per year), contribution to GDP (USD per year) and jobs (in number) generated by each segment at sea and on land, and their respective percentages in the value chain of the acoupa weakfish (*Cynoscion acoupa*) meat caught in the Amazon Continental Shelf.

	LOCAL	CATEGORY		REVENUE	% OF TOTAL REVENUE	JOBS	% TOTAL OF JOBS	REVENUE/ JOB	GDP CONTRIBUTION	% OF TOTAL GDP
Fish maw	At the sea	Producers	Vessel with urn with ice	$2.472.339,15	4,58	350	33,78	$7.063,83	$3.963.375,77	6,46
			Vessel with cold storage	$17.685.922,18	32,78	500	48,26	$35.371,84	$28.655.207,57	46,72
		Total at the sea		$20.158.261,34	37,36	850	82,05	$42.435,67	$32.618.583,33	53,18
	On land	Distributors	Middleman	$198.799,63	0,37	18	1,74	$11.044,42	$7.996,32	0,01
		Processors	Processing and trading companies	$33.600.000,00	62,27	168	16,22	$200.000,00	$28.710.705,88	46,81
		Total on land		$33.798.799,63	62,64	186	17,95	$211.044,42	$28.718.702,21	46,82
	Overall total			**$53.957.060,97**	**100**	**1036**	**100**	**$253.480,09**	**$61.337.285,54**	**100**
Meat	At the sea	Producers	Vessel with urn with ice	$2.472.339,15	4,58	350	33,78	$7.063,83	$3.963.375,77	6,46
			Vessel with cold storage	$17.685.922,18	32,78	500	48,26	$35.371,84	$28.655.207,57	46,72
		Total at the sea		$20.158.261,34	68,25	850	66,30	$42.435,67	$32.618.583,33	96,77
	On land	Distributors	Middleman	$497.702,21	1,69	20	1,56	$24.885,11	$29.753,68	0,09
		Retailers	Fairs	$192.019,76	0,65	22	1,72	$8.728,17	$17.885,11	0,05
			Restaurant	$229.527,57	0,78	192	15,56	$1.195,46	$90.820,59	0,27
		Processors	Processing and trading companies	$8.400.000,00	28,44	150	11,70	$56.000,00	$926.470,59	2,75
		Total on land		$9.376.631,43	31,75	432	33,70	$65.923,63	$1.087.635,11	3,23
	Overall total			**$29.534.892,77**	**100**	**1282**	**100**	**$108.359,30**	**$33.706.218,44**	**100**
***Cynoscion acoupa* (Fish maw and meat)**	At the sea	Producers	Vessel with urn with ice	$2.472.339,15	5,90	350	28,18	$7.063,83	$3.963.375,77	8,33
			Vessel with cold storage	$17.685.922,18	42,18	500	40,26	$35.371,84	$28.655.207,57	60,24
		Total at the sea		$20.158.261,34	48,08	850	68,44	$42.435,67	$32.618.583,33	68,58
	On land	Distributors	Middleman	$348.250,92	0,83	19	1,53	$18.329,00	$18.875,00	0,04

(Continued)

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TABLE 4 Continued

	LOCAL		CATEGORY	REVENUE	% OF TOTAL REVENUE	JOBS	% TOTAL OF JOBS	REVENUE/ JOB	GDP CONTRIBUTION	% OF TOTAL GDP
		Retailers	Fairs	$192.019,76	0,46	22	1,77	$8.728,17	$17.885,11	0,04
			Restaurant	$229.527,57	0,55	192	15,46	$1.195,46	$90.820,59	0,19
		Processors	Processing and trading companies	$21.000.000,00	50,09	159	12,80	$132.075,47	$14.818.588,24	31,15
			Total on land	$21.769.798,25	51,92	392	32	160328	$14.946.168,93	31,4
		Overall total		**$41.928.059,59**	**100**	**1242**	**100**	**$202.763,77**	**$47.564.752,27**	**100**

Values are in US dollars (exchange rate was 1 USD = 5.44 BR in June 2024, Central Bank of Brazil).
Sum of the values of Revenue "At the sea" and "On land", Jobs, Revenue/Employment, GDP Contribution to Fish Maw, Meat and the junction Fish Maw and Meat of acoupa weakfish.

followed by processing companies, which recorded a production of 41.1% and a revenue of 28.5%, higher than that of the boat with urn with ice. Restaurants, market vendors and intermediaries generate revenue of less than 2%, but restaurants were the ones that generated the most jobs (Figure 3).

The economic multipliers across fish maw's value chain averaged 2.4. This suggests that for every unit of value created on the boats, the sector as a whole generates about 2.4 times that value in the subsequent segments (Figure 4). Although the economic multiplier for the value landed by the urn with ice boat is low, the value of production increased significantly when marketed by processing and marketing companies (Figure 4).

4 Discussion

The fishing sector provides millions of people around the world with diverse employment and livelihood opportunities (Andrew et al., 2007; Teh and Sumaila, 2011). On the Brazilian Amazon coast, acoupa weakfish fishing is of great economic and social importance for the population (Yellowdawn, 2011; Souza Junior et al., 2020). Therefore, studying the value chain of this species is essential since it is configured in a complex network and little known in terms of income both in the national and international markets.

In this study, it is important to highlight three dimensions addressed: i) economic, where the high added value of the fish maw was observed, mainly in Asian markets; however, the distribution of the value generated by the trade of this by-product is unequal, with the majority going to processing and marketing companies; ii) socially, it is clear that the base of the chain, formed by producers, plays a fundamental role in generating jobs, however, there is inequality in the distribution of profits and; iii) environmentally, as acoupa weakfish has suffered increasing and evident fishing pressure, and the biomass available for fishing and for maintaining stocks is unknown, because of to the lack of assessments due to the unavailability of reliable time series. It is recognized that the search for this resource may be (or has already been) intensified to the maximum due to the high market value of the fish maw. In addition, the absence of management measures may encourage even more predatory practices, compromising the sustainability and natural replenishment of this source.

There is significant investment in acoupa weakfish fisheries on the Amazon coast (Silva Filho et al., 2022), encouraged by the high demand in the national and international market and the high commercial value of the species. This financial return reflects the economic motivation of capitalist systems, which see the exploitation of fishing resources as an opportunity for profit (Campling et al., 2012). However, in studies by (Campling, 2012) and (Longo and Clark, 2012) which analyzed the production chain of a species of tuna (*Thunnus thynnus*) in the Mediterranean Sea, it was observed that this search for profit ended up harming both fishing activities, in terms of structuring trade, and tuna populations, the latter being evidently expected. In search of this high yield, in recent years in Brazil, and particularly on the North coast, there has been an increase in investments in catching acoupa weakfish, resulting in vessels with new technologies and

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TABLE 5 Production estimates and economic and social indicators in each segment of the value chain for the fish maw, meat and average of each product from the acoupa weakfish (*Cynoscion acoupa*) fishery caught in the Amazon Continental Shelf, Brazil.

		PRODUCER	DISTRIBUITION	RETAILER	PROCESSING
Fish Maw	Production per trip	793750 kg	435 kg	-	36000 kg
	Production value per trip	$3.752.297,79	193.017,92	-	$28.800.000,00
	Revenue per trip	$10.079.130,67	198.799,63	-	$33.600.000,00
	Cost per trip	$2.491.191,79	190.803,31	-	$19.244.647,06
	Profit per trip	$6.727.786,61	7.996,32	-	$14.311.747,06
	Average salaries (month)	$1.993.566,18	7.996,32	-	$43.605,88
	GDP contribution per trip	$16.309.291,67	7.996,32	-	$28.710.705,88
	Quantity in each segment	50	18	-	12
Meat	Production per trip	793750 kg	87500 kg	20737,5 kg	90000 kg
	Production value per trip	$3.752.297,79	496.610,75	$123.408,78	$992.647,06
	Revenue per trip	$10.079.130,67	497.702,21	$210.773,67	$992.647,06
	Cost per trip	$2.491.191,79	467.948,53	$179.125,97	$529.411,76
	Profit per trip	$6.727.786,61	29.753,68	$5.546,60	$424.301,47
	Average salaries (month)	$1.993.566,18	29.753,68	$35.043,66	$9.375,00
	GDP contribution per trip	$16.309.291,67	29.753,68	$54.352,85	$926.470,59
	Quantity in each segment	50	20	42	3
Fish Maw and Meat	Production per trip	793750 kg	43967,5 kg	23812,5 kg	90000 kg
	Production value per trip	$3.752.297,79	344.814,34	$143.985,52	$14.896.323,53
	Revenue per trip	$10.079.130,67	348.250,92	$252.556,87	$17.296.323,53
	Cost per trip	$2.491.191,79	329.375,92	$214.013,44	$9.887.029,41
	Profit per trip	$6.727.786,61	18.875,00	$5.917,05	$7.368.024,26
	Average salaries (month)	$1.993.566,18	18.875,00	$42.788,37	$26.490,44
	GDP contribution per trip	$16.309.291,67	18.875,00	$66.924,86	$14.818.588,24
	Quantity in each segment	50	38	42	15

Values are in US dollars (exchange rate was 1 USD = 5.44 BR in June 2024, Central Bank of Brazil).

infrastructure that increase the efficiency of fishing operations, such as cold storage chambers that have allowed greater autonomy in trips and access to fishing grounds further from the coast, culminating in a clear increase in catchability and yields.

(Silva Filho et al., 2022) highlight the high cost of maintaining refrigerated vessels, emphasizing the demand for financial investments to make this type of fleet viable. In this scenario, the diesel oil subsidy for fishing vessels, whether equipped with urn with ice or refrigeration chambers, plays an important role in reducing operating costs and making the activity economically viable. Government support, regulated by Decree No. 7.077, of January 26, 2010, ensures vessel owners full exemption from the Tax on the Circulation of Goods and Services (ICMS) when purchasing diesel oil, making it possible to equalize the price of national and international diesel oil, increasing the competitiveness of Brazilian fish abroad and, consequently, increasing the profitability of fishermen.

Most boat owners do not have a professional fishing license, a document that proves the person's registration in the General Fishing Registry (RGP), similarly, most fishing vessels that catch acoupa weakfish do not have an RGP. This license is essential to regulate and control fishing activity in the country, since until now, this sector has not been prioritized by national public policies, considering that most fisheries are not regulated or managed (Mourão et al., 2009). This documentation ensures that all those involved are legally authorized (MPA Ordinance No. 127 of 08/29/23), a legality that would guarantee the actors involved access to subsidies offered by the federal government, such as diesel oil, which would help reduce operating costs. Furthermore, access to this subsidy would allow more effective monitoring of the number of vessels, crew members and effort applied to catching acoupa weakfish. In summary, the absence of this registration hinders obtaining information on fishing effort, making it impossible to

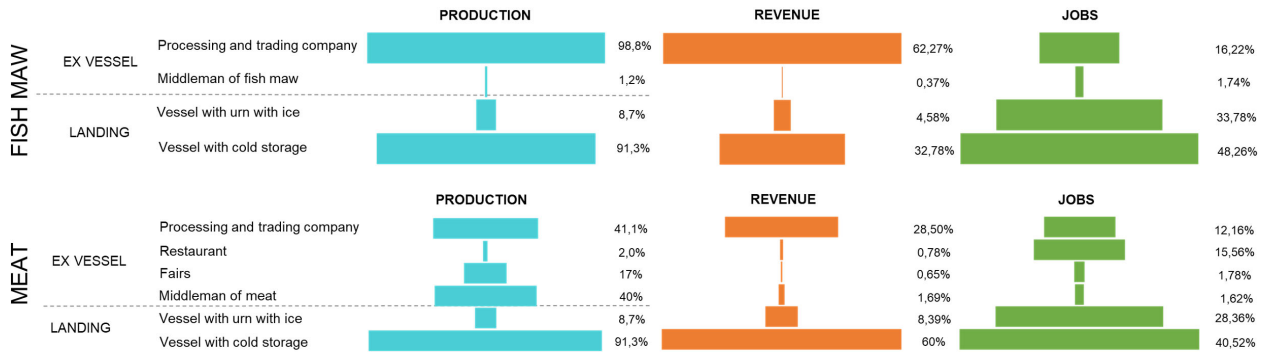

FIGURE 3
Distribution of social and economic benefits. Relative proportions of total production (kg), revenue (USD/month) and jobs (numbers) at each stage of the value chain of acoupa weakfish (*Cynoscion acoupa*) fish and meat caught on the Amazon Continental Shelf, Brazil.

record mortality resulting from catches. In a study on the status of acoupa weakfish fishing on the Amazon coast, conducted by (Moura et al., 2023), the ecological indicator of the activity obtained a low score due to the absence of certifications and/or minimal monitoring of vessel licenses and volumes landed.

The lack of subsidies for large-scale acoupa weakfish fishing (Moura et al., 2023) generates high operational costs for fuel, food, ice, salaries and maintenance. The absence of these incentives leads vessels to maximize their production on each trip, leading to intensification of impacts to fishing stocks. Although, when present, this financial aid contributes to expenses, increased profits and income for fishermen, in addition to reducing costs, it can also increase capacity and consequently encourage overexploitation of fisheries (Pomeroy, 2012; Sakai et al., 2019; Sumaila et al., 2019). In some regions of the world, notably in fisheries whose products are always more noble, such as snapper (*Pagrus auratus*) in New Zealand and salmon (*Oncorhynchus* sp.) in Alaska, this assistence has led to a reduction in fishing resources (Peacock and Hansen, 1999; Newell et al., 2005; Grafton et al., 2006; Sumaila and Pauly, 2006). In Pará, due to resources from the Fundo Constitucional de Financiamento do Norte, operated by Banco da Amazônica, there was an increase in the number of fishing vessels in the early 2000s (Frédou and Asano-Filho, 2006).

In addition to operational reasons and access to government subsidies, the commercialization of fish maw has emerged as a compensatory means for the high costs of fishing trips. The high commercial value of the fish maw has attracted many fishermen, however, in a disorderly manner (Smith et al., 2023). This attraction to the commercialization of this by-product is not limited to covering operational costs, but stands out mainly as a highly profitable source (Sadovy de Mitcheson et al., 2019). The lack of legislation that guarantees the traceability of by-products can compromise the legality of exports, especially to the international market, as happened with sea cucumber stocks from Pacific islands (Purcell et al., 2014). The absence of traceability for the origin of these byproducts highlights the weakness of the entire inspection system in Brazil and, concurrently, opens the door for more investors. Monitoring the origin of the fish maw, for example through DNA analysis, would allow for more precise identification of the species and origin (Wen et al., 2015; Kresna et al., 2017; Ong and Chin, 2022). and (Galvão et al., 2010), studying tuna and cod, respectively, concluded that traceability is essential to improve transparency and sustainability in the production chain of these fisheries, guaranteeing the origin of the product, resource management, consumer reliability, compliance with environmental standards, and combating fraud. This type of product monitoring strengthens the fishing industry, promoting responsible and sustainable practices.

Furthermore, the absence of the RGP and the lack of reliable invoices for the product sold compromises not only the legalization of exports, which are in fact already legal, but also prevents more effective and realistic tracking/control of the volumes sold, translating them as biomass removed from the environment. The lack of control from the moment of capture compromises the traceability of the product, which could be easily remedied by correctly filling out the on-board maps, linked to the vessels' RGP and the invoices issued. This is one of the necessary premises to market the product as being edible in accordance with RIISPOA (Regulation of Industrial and Sanitary Inspection of Products of Animal Origin), that is, companies holding SIF can only receive products if it is possible to prove their origin, ensuring their traceability.

Along the acoupa weakfish value chain we can observe the presence of four segments (producers, distributors, retailers and processors) that are divided into two markets: meat and fish maw (shorter chain). The meat value chain is the longest and most complex. Refrigerated vessels are part of the segment that stands out most in terms of social returns, providing more employment and higher revenue, which benefits the local economy and drives economic growth. Research on small-scale fishing in Baía Formosa, Rio Grande do Norte, carried out by (Bevilacqua et al., 2019), showed similar results, where large motor-powered vessels generated a greater number of jobs compared to smaller boats. The increase in these job opportunities provides socioeconomic growth and promotes the development of the local economy. In addition, knowledge about the number of workers involved in the sector can prevent the excessive exploitation of fishing resources (Teh and Sumaila, 2011).

In the fish maw value chain, processors show the best economic indicators compared to producers, as this high-value product is driven towards the international market (Sadovy de Mitcheson

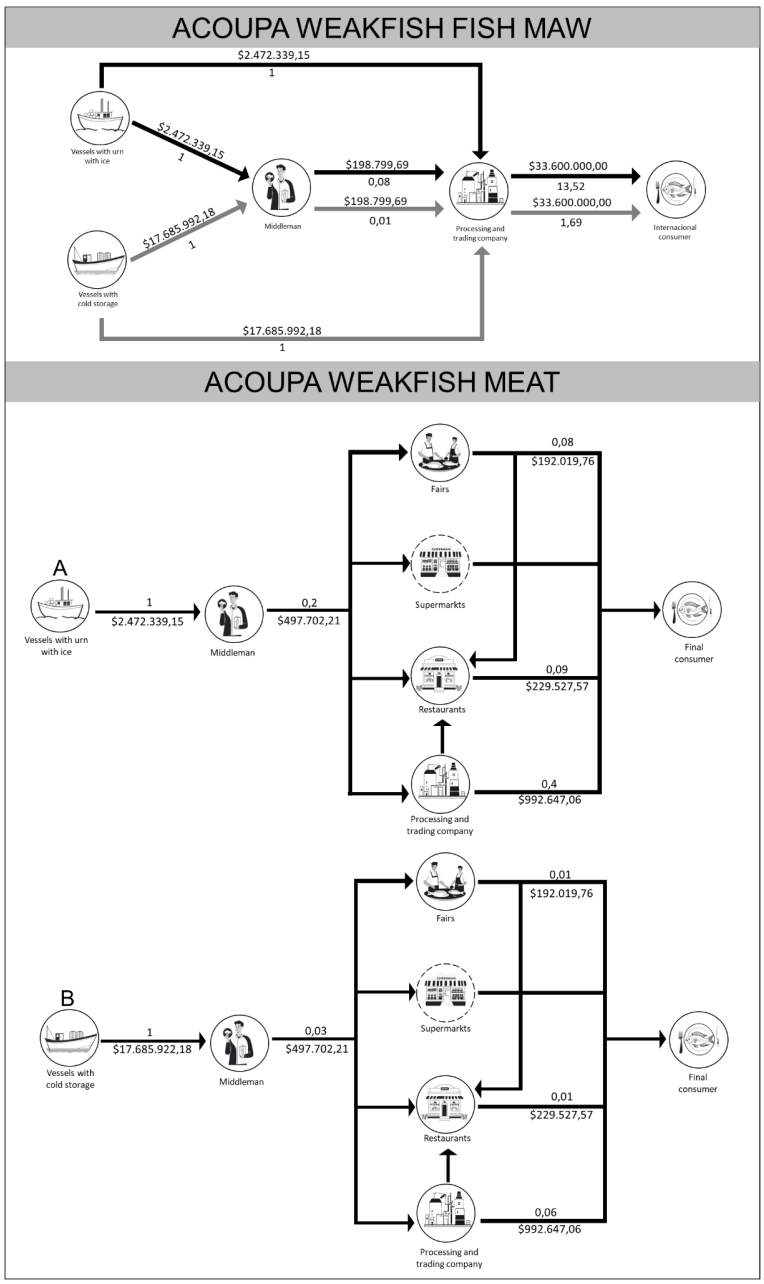

FIGURE 4
Economic multipliers of the value chains for fiah maw and meat of acoupa weakfish (*Cynoscion acoupa*) caught in the Amazon Continental Shelf, Brazil. Acoupa weakfish - based product marketed and the total gain (average per kilo in USD) in each segment of the value chain. (**A**: Boat with ice urn, **B**: Boat with cold storage) (the exchange rate was 1 USD = 5.44 BR in June 2024, Central Bank of Brazil).

et al., 2019; Ben-Hasan et al., 2021). This focus on the foreign market results in higher revenues and, consequently, high earnings for processors. In contrast, the meat value chain goes through different segments until it reaches the end consumer. These segments, such as distributors and retailers (market vendors), are important in the logistics and flow of acoupa weakfish meat along the chain, in addition to creating a link between the production sector and the consumer (Christensen et al., 2014), which is essential for the valorizations of fish in the local market. Local supermarkets, despite being part of the meat distribution chain, rarely offer acoupa weakfish; when available for sale, they come from other cities, but in small quantities. This limited supply can be explained by direct sales at markets, where fresh fish is more accessible to consumers and supplied at more competitive prices.

Studying the value chain of acoupa weakfish is essential to promoting sustainable fishing practices, benefiting economically and socially all those involved in the production chain who depend directly and indirectly on this fishing resource. The analysis of this chain highlights the challenges that this activity faces, such as the lack of traceability, legislation and adequate regulations for the

management of the species, and intensive exploitation of stocks due to high demand in the international market, especially for fish maw.

Proper regulation and traceability are essential to ensure the legality of the trade of acoupa weakfish and its by-products. The adoption of tracking measures, such as the use of trade codes like those implemented by the Hong Kong Census and Statistics Department, combined with the strengthening of documentation, such as the RGP, can contribute to a more transparent value chain aligned with international standards, allowing for the monitoring of more accurate information on the volume of by-products of this and other species that are caught and exported. This monitoring should be a recurring practice to generate information for planning and management purposes. These actions prevent illegal trade and overfishing, ensuring the sustainability of these resources.

The provision of subsidies, when poorly managed, can encourage the intensive exploitation of fishing resources, especially acoupa weakfish. However, when managed responsibly, it can adopt practices that minimize environmental impacts, such as the implementation of more selective techniques or the use of technologies that allow for more effective monitoring, reducing fishing pressure and promoting a balance between fishing activity and conservation. In addition, this resource could encourage the traceability of both the fish maw and the meat, establishing a more transparent and regulated market and, at the same time, preventing illegal and excessive fishing.

Furthermore, we suggest the collaboration of the entire fishing sector, from production to meat and fish maw processing, to enables the exchange of information for studies on catchability, biology, feeding, and export volume. This data would help implement management policies, according to the needs of the stocks. Policies that promote the establishment of closed seasons and the definition of fishing quotas for this species are necessary, as they would allow for recovery and strengthening of sustainability. Government policies, together with rigorous monitoring, may contribute to the sustainability of acoupa weakfish fishing, benefiting both the conservation of stocks and the generation of employment and income for all those who survive from it.

5 Conclusion

Acoupa weakfish fishing on the Amazon coast is of great economic and social importance, but it faces challenges due to the lack of regulation and traceability, which are essential to ensuring the sustainability of this fishery. The lack of documents, such as the General Fisheries Registry (RGP), compromises the monitoring of catches, the legality of trade and access to government subsidies that reduce operating costs. Traceability is important to meet international standards, especially in the trade of fish maw. Although advancements in technology and infrastructure have improved the efficiency of fishing operations, they have also intensified the pressure on these stocks. Stricter regulations, reliable tracking systems and management policies such as fishing quotas and closed seasons are necessary to ensure sustainable exploitation, as well as to promote economic and social returns across all segments of the value chain.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

HM: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. ZN: Conceptualization, Funding acquisition, Resources, Supervision, Writing – original draft, Writing – review & editing, Formal analysis. GS: Data curation, Formal analysis, Investigation, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. LP: Conceptualization, Investigation, Methodology, Writing – original draft. AC: Conceptualization, Data curation, Investigation, Methodology, Supervision, Writing – original draft. FS: Data curation, Investigation, Methodology, Writing – original draft. DT: Data curation, Formal analysis, Investigation, Visualization, Writing – original draft. WS: Data curation, Investigation, Writing – original draft. BB: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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