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Productive inclusion of family fish farmers affiliated with an association in the State of Tocantins: challenges imposed by the Covid-19 pandemic

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Abstract
The BomPeixe Association, located in Palmas, in the state of Tocantins, is relatively recent, having been founded in 2015. Its members are primarily family fish farmers. In addition, the association has access to a non-onerous area within the Sucupira Aquaculture Park, where fish farming activities are carried out. The objective of this study is to conduct a socioeconomic analysis of the impacts of productive inclusion among the family fish farmers affiliated with the BomPeixe Association in the context of the Covid-19 pandemic. A semi-structured interview was conducted with the association's members, followed by content analysis. The data revealed some initial difficulties faced by the fish farmers with the onset of the pandemic but also highlighted the adjustments that were gradually implemented to ensure the continuity of the activity and the flow of production. However, the productive inclusion of the family fish farmers affiliated with this association in formal markets has not been fully achieved, as challenges persist regarding the development of the activity and the financial and social conditions of the families. This became evident throughout the study, which identified several obstacles that still need to be overcome for productive inclusion to effectively take place, thereby promoting greater legitimacy and progress in fish farming activities in the state.
Keywords: Productive Inclusion. Associativism. Sustainable Development Goals. Innovation. Regional Development.

Inclusão produtiva de piscicultores familiares filiados a uma associação no estado do Tocantins: os desafios impostos pela pandemia da Covid-19

Resumo
A Associação BomPeixe, em Palmas, no estado do Tocantins é relativamente recente, foi fundada no ano de 2015, tendo em sua composição primordialmente piscicultores familiares. Além disso, possui acesso à área-não onerosa do Parque Aquícola Sucupira, em que praticam a atividade piscícola. O objetivo do estudo é realizar um estudo socioeconômico sobre os impactos da inclusão produtiva dos piscicultores familiares, filiados à associação BomPeixe, no contexto da pandemia da Covid-19. Realizou-se entrevista semiestruturada com os filiados da associação e posteriormente análise de conteúdo. Os dados demonstraram algumas dificuldades iniciais enfrentadas pelos piscicultores com o advento da pandemia, mas acenaram também para as adequações que foram sendo implantadas, com vistas a garantir a sustentação da atividade e escoamento da produção. Não se alcançou efetivamente a inclusão produtiva dos piscicultores familiares filiados à esta associação em mercados formais, pois persistem as dificuldades de desenvolvimento da atividade e da situação financeira e social das famílias. Isto foi sendo delineado no decorrer do estudo, com vários obstáculos ainda a serem superados, para que a inclusão produtiva aconteça de modo a conferir maior legitimidade e progresso da atividade piscícola no estado.
Palavras–chave: Inclusão Produtiva. Associativismo. Objetivos do Desenvolvimento Sustentável. Inovação. Desenvolvimento Regional.

Inclusión productiva de piscicultores familiares afiliados a una asociación en el estado de Tocantins: los desafíos impuestos por la pandemia de la Covid-19

Resumen
La Asociación BomPeixe, ubicada en Palmas, en el estado de Tocantins, es relativamente reciente, ya que fue fundada en el año 2015, estando compuesta principalmente por piscicultores familiares. Además, cuenta con acceso a un área no onerosa dentro del Parque Acuícola Sucupira, donde desarrollan la actividad piscícola. El objetivo del estudio es realizar un análisis socioeconómico sobre los impactos de la inclusión productiva de los piscicultores familiares afiliados a la Asociación BomPeixe en el contexto de la pandemia de la Covid-19. Se llevaron a cabo entrevistas semiestructuradas con los asociados y, posteriormente, un análisis de contenido. Los datos evidenciaron algunas dificultades iniciales enfrentadas por los piscicultores con el surgimiento de la pandemia, pero también señalaron las adaptaciones que fueron implementadas con el fin de garantizar la continuidad de la actividad y el flujo de la producción. No se logró efectivamente la inclusión productiva de los piscicultores familiares afiliados a esta asociación en los mercados formales, ya que persisten las dificultades relacionadas con el desarrollo de la actividad y con la situación financiera y social de las familias. Esto se fue delineando a lo largo del estudio, que identificó varios obstáculos que aún deben superarse para que la inclusión productiva ocurra de manera que otorgue mayor legitimidad y progreso a la actividad piscícola en el estado.

Palabras clave: Productive Inclusion. Associativism. Sustainable Development Goals. Innovation. Regional Development.

1 Introduction

Fish farming activities began to emerge in the state of Tocantins in 1972; however, it was only from the 2000s onward that the production chain began to consolidate, especially with the establishment of production and processing units. Another important achievement for the sector occurred in 2009 with the creation of the Brazilian Agricultural Research Corporation (Embrapa) unit dedicated to Fisheries and Aquaculture in the state capital, Palmas, mainly due to the institution's investment in research and development (R&D) (RURALTINS, 2020).

In this context, both governmental and non-governmental institutional support, combined with the state's inherent characteristics, have contributed to the rapid growth of fish farming. Between 2000 and 2024, production increased from 1.102 tons to 18.100 tons, an expressive growth of 1.642% (SEAGRO, 2025). Consequently, the state implemented more flexible regulations aimed at the sustainable development of the aquaculture sector, encouraging higher productivity, better product quality, market expansion, and the adoption of more sustainable practices. In 2017, the Fish Farming Development Program (PDP) was created to expand and improve fish production in Tocantins. Later, in 2023, the State Secretariat for Fisheries and Aquaculture (Sepea) was established, consolidating actions focused on promoting fish farming activities (COSTA; SILVA; SOUSA, 2023).

This potential has created opportunities for individuals and companies to invest in fish farming. The state has 57.032 km² of water surface, of which 27.196,622 m² are designated for aquaculture (CENSO, 2020). This vast water availability positions Tocantins as one of Brazil's leading producers of farmed fish. Other favorable characteristics include consistently high temperatures throughout the year, which provide greater sunlight exposure over the waters; predominantly flat terrain; self-sufficient fry production; increased investment in grain production for fish feed manufacturing; a privileged geographic location that supports efficient logistics and access to several Brazilian markets; the establishment of fish processing plants; and tax incentives granted by government entities (RURALTINS, 2020; PEIXE BR, 2021; OLIVEIRA; PEDROZA FILHO, 2020; PEIXE BR, 2025).

Despite the existing infrastructure for fish farming development in Tocantins, the activity still ranks 17th nationally compared to other Brazilian states in terms of farmed fish production (PEIXE BR, 2025). This position falls short of what is expected for the sector given the favorable conditions described above. The gap between potential and achievement is mainly due to insufficient environmental regulation, particularly among small producers. This limitation hinders access to bank credit, including through the National Program for Strengthening Family Agriculture (Pronaf), thereby reducing or even preventing family fish farmers from participating competitively in the productive sector. Furthermore, fish farmers face difficulties accessing formal markets due to low levels of social organization and value aggregation, high production costs, and challenges in obtaining sanitary licenses (Sousa, 2021). There is also a need to expand public policies directed toward the fish production chain (PEIXE BR, 2025). These structural bottlenecks restrict the sector's potential for broader development in the state.

In this scenario, when considering the productive inclusion of family farmers among whom family fish farmers are included. It is necessary to address several interrelated dimensions that must be considered collectively and in an integrated manner: the fulfillment of basic needs; recognition of sociocultural diversity; improvement of the social protection network; training, capacity building, and qualification of farmers; access to technical assistance, credit institutions, and markets; implementation of public policies; and the relationships established among governmental, non-governmental, and market entities (FAVARETO, 2021). These aspects are essential to ensure the successful integration of fish farmers into the market and improvements in their family and community living conditions.

Given the current situation of fish farming in the state, this study aims to conduct a socioeconomic analysis of the impacts of productive inclusion on family fish farmers affiliated with the BomPeixe Association in the context of the Covid-19 pandemic.

The BomPeixe Association, located in Palmas, Tocantins, was founded in 2015 and is primarily composed of family fish farmers. It has access to a non-onerous area within the Sucupira Aquaculture Park, granted by the government to family fish farmers for cage fish farming in the Lajeado reservoir, located in the rural area of Palmas – TO, covering a water surface area of 200 hectares (TRAJANO, 2025). The Aquaculture Park was established in 2013 by the Ministry of Fisheries and Aquaculture (MPA), which made it possible to create 209 aquaculture areas, each covering 0.3 hectares, with the goal of enhancing aquatic organism production and facilitating environmental licensing. This structure enables the production of up to 48 tons per social area per year (GONZÁLES, 2018).

Although the Aquaculture Park was established in 2013, effective production began only in 2015, after the demarcation of individual areas. As an incentive, the government initially proposed to finance production and infrastructure, but this plan was never implemented. To remain in the activity and utilize their designated areas, many producers were forced to sell personal assets to purchase fish cages. In the absence of financing, only 40 families began production, and of these, only 17 continued (GONZÁLES, 2018).

Despite these challenges, through the sharing of materials among members, the activity was able to develop, and with the support of technical assistance and R&D institutions, fish farmers achieved a production of 52 tons in 2018. However, the high cost of fish feed has significantly reduced the expected financial return, preventing the activity from becoming profitable despite its potential (GONZÁLES, 2018).

The Covid-19 pandemic had various impacts on the global economy, and the challenges of adapting to this new context forced professionals across different sectors and economic activities to seek alternatives to cope with the uncertainty experienced worldwide. Since productive inclusion requires new possibilities for improving the livelihoods and production of family fish farmers, the pandemic demanded new strategies as a matter of survival for the families involved.

Given this scenario, this study seeks to answer the following questions regarding the BomPeixe Association's performance during the pandemic: How were marketing channels established during this period? Was there access to public policies? Was public technical assistance provided? These and other variables were

analyzed to provide an overview of the reality experienced by the association's affiliated fish farmers, aiming to contribute valuable insights into their experiences during the Covid-19 pandemic.

2 Family Farming in the Context of the Covid-19 Pandemic

In Brazil, family farming (FF) plays an important and crucial role in supplying food to the population, particularly through the delivery of fresh products such as vegetables, legumes, animal-based products, and fruits. However, a single health crisis was enough to disrupt both production and distribution, as this sector was severely impacted by government actions taken to contain the spread of Covid-19. For instance, while supermarkets were authorized to continue operating, open-air markets were shut down, and public procurement programs were reduced.

As a result, the main local establishments where family farmers used to deliver their products faced operational restrictions, including fruit and vegetable markets, supermarkets, hotels, snack bars, and especially direct-to-consumer venues such as open-air markets, neighborhood sales, or home deliveries where producers sold directly to a fixed clientele. They were also affected by the loss of institutional contracts, such as those under the National School Feeding Program (PNAE), due to school closures, which led to reduced income and difficulties in distributing their produce. Similarly, the Food Acquisition Program (PAA) was suspended in some municipalities (PEREIRA, 2021). These actions were detrimental to the sector, making evident that in times of crisis, financially stronger sectors are often favored by government decisions.

In this context, words such as reinvention, restructuring, readaptation, rearrangement, and adaptation began circulating in the media and on social networks as society faced the challenges brought by the Covid-19 pandemic. These challenges demanded new behaviors and changes in attitude from various social groups amid the global social, symbolic, economic, environmental, and health crisis. "The pandemic accelerated and deepened a trend of increasing vulnerability among the Brazilian population, turning what was once an economic, political, and institutional crisis into a humanitarian tragedy of enormous proportions" (FAVARETO, 2021, p. 8). This reality also affected family farmers, who, faced with social distancing measures and restrictions on in-person gatherings, had to rethink their work dynamics and strategies for marketing their production.

In this sense, the pandemic context represented a major challenge for family fish farmers in establishing and implementing productive inclusion strategies, due to the disruptions caused by measures adopted worldwide to contain the spread of the virus. These strategies, as pointed out by Barroso and Pedroza Filho (2014, p. 14), include

> [...] ranging from the implementation of cooperatives and producers' organizations (aimed at achieving economies of scale) to initiatives for product differentiation through labels and certifications, with the goal of accessing the market and fostering a more inclusive value chain (...) the development of fair trade, short distribution circuits, geographical indication, social and/or environmental certifications and labels, and product processing.

The expectation is that these productive inclusion initiatives will be capable of improving the development of fish production along the entire value chain, leading to greater value added to the products and expanding access to more financially attractive markets. The association of fish farmers in cooperatives or producer organizations represents an important opportunity in this direction. Pereira, Freitas, and Freitas (2013) add that such collective organizations help mediate connections with the market, allowing producers to meet conventional market demands such as large-scale production, cost reduction, and increased bargaining power over prices. Furthermore, they broaden the possibility of accessing government programs such as the PAA and PNAE when fish farmers are affiliated.

Another advantage of cooperative organizations in the development of fish farming lies in their ability to achieve a more sustainable position within the production chain, as they can supply larger quantities at competitive costs and in the volumes required by new retail channels. When small fish farmers work individually, as noted by Almeida and Mendes (2015, p. 31), they may become "more susceptible to the bottlenecks that exist within the chain."

Moreover, the points raised by Barroso and Pedroza Filho (2014) regarding productive inclusion highlight the importance of advancing the development of fish farming activities, particularly in the context of the pandemic, which required new adaptations. The experiences faced by family fish farmers mirrored those of other family farming sectors, as they shared common challenges and sought alternative means to market their production, which will be discussed below.

As Oliveira and Lavarda (2022) point out in their study of fish farmers in southwestern Pará, findings similar to those from other studies conducted during the pandemic revealed the main difficulties faced by producers: lack of technical assistance, the high cost of fish feed (the main production input), insufficient public support, and unfair competition, as well as the absence of an adequate and organized cost-control system.

In the state of Tocantins, a case study of a cooperative composed mainly of family farmers highlighted the challenges faced during the pandemic, including a drastic reduction in sales compared to the pre-covid-19 period, primarily due to dependence on open-air markets and institutional contracts. This led to a decline in the cooperative's revenue and, consequently, in the farmers' income, requiring the search for new alternatives to diversify marketing channels and institutional markets. Among the possibilities identified in the study was the proposal for public policies to promote technological innovations in the production processes of family farming (SOUSA, JESUS & BERALDO, 2021).

Preliminary results presented by Embrapa Fisheries and Aquaculture indicated that, in Brazil, the marketing and consumption channels for fish were affected and changed due to the pandemic. Among these changes was a preference for frozen fish and a decline in the consumption of raw fish or Japanese cuisine. These shifts were likely linked to concerns over food contamination, as well as to the closure of open-air markets by local governments and the growing use of delivery services (KATO et al., 2021).

In this scenario, Breitenbach (2021) emphasizes that the most vulnerable links in the production chain family farmers and low-income consumers were directly impacted. This led to increased food insecurity and rural impoverishment, as

producers' incomes declined. Additionally, the social ties of trust, loyalty, and reciprocity traditionally established between producers and consumers through face-to-face interactions were weakened by social distancing measures.

In Rio Grande do Sul, a study conducted by Preiss et al. (2022) across five regions of the state showed that, despite regional particularities, family farmers managed to create new opportunities to access consumers, reconfiguring agri-food systems and marketing channels. Among the alternatives identified were associative organizations, which helped promote and sell family farm products through social media, thus maintaining food supply dynamics and ensuring food security. Another approach was direct home delivery, which required the use of digital technologies and adaptation to new logistics typical of digital markets.

Cenci and Schneider (2023), in a study conducted in the Serra Gaúcha region, observed that the commercialization of family agribusiness production remained primarily local and regional. Access to marketing channels such as open-air markets and the PNAE was significantly hindered, leading to a reduction in income and revealing a risky dependency on these channels in crisis situations like the pandemic.

Nogueira and Marcelino (2021) specifically examined the impact of covid-19 on family farming food sales in the Federal District (DF). Although losses were recorded, especially in the early months of the pandemic, the study highlighted that cooperatives and associations were effective means of ensuring the flow of production. Organized farmers had better opportunities to coordinate and respond to food demand during the crisis. Institutional programs such as PAA and PNAE helped sustain production, as farmers continued supplying food to students and their families providing income on one hand and reducing food shortages among vulnerable populations on the other. Institutional actors such as Embrapa, the National Rural Learning Service (SENAR), the National Supply Company (CONAB), the Technical Assistance and Rural Extension Company of Minas Gerais (EMATER), and the National Confederation of Agricultural Workers (CONTAG), as well as universities, also provided technical support to farmers facing the challenges imposed by the pandemic.

In this sense, the covid-19 outbreak exposed vulnerabilities and flaws in the existing agri-food system both on the supply side, where many workers in the processing sector were infected and producers were unable to distribute their products, and on the demand side, where access to food became largely restricted to those with sufficient financial means, while a significant portion of the population faced shortages and limited access to quality food (SCHNEIDER et al., 2020).

Despite the instability caused by covid-19 and the obstacles to production flow and compliance with safety regulations, it is noteworthy how resilient and mobilized this social category was in maintaining food availability, even with insufficient state support (PREISS et al., 2022). As Nepomoceno (2021) demonstrates, the pandemic context legitimized family farming as a concrete model of sustainable production and practices, responding to the growing demand for healthier foods that promote human health and environmental conservation. It also reaffirmed the importance of short food supply chains, providing fresh or value-added products that meet the dietary needs of Brazilians. Consequently, the need arose to identify new short supply

chains and make appropriate use of information technologies to strengthen ties with consumers and ensure product commercialization.

Thus, the covid-19 outbreak clearly demonstrated the importance of local and short food supply chains managed by family farmers, in contrast to large, industrialized corporate chains, as they are capable of fostering socioecological sustainability and greater food security (ALTIERI & NICHOLLS, 2020). As emphasized by Schubert, Tonin, and Schneider (2023), the current global food system relies heavily on indiscriminate use of inputs and pesticides, contaminating both the environment and food, and depends on long supply chains requiring long-distance transport. This generates a negative energy balance, directly impacting natural resources and leading to their gradual depletion undermining the foundation of food production itself.

Accordingly, depending on the context, the fish production chain or other family farming products may take on different forms. Oliveira and Filho (2020) highlight that the chain may encompass all stages from inputs, production, and processing to distribution and that distribution can be strengthened through institutional support, including technical assistance, access to credit, the adoption of new technologies, and other measures that enhance efficiency and effectiveness. The authors also emphasize that certain links in the chain may be stronger or weaker depending on the characteristics of the activity and production site.

Cavalli et al. (2020) reflect on the critical role of family farming in times of crisis, such as the Covid-19 pandemic, emphasizing its capacity to produce sufficient quality food to ensure household and local supply. This underscores the importance of valuing local food systems and value chains, particularly through public policies that strengthen food resilience, especially in the face of future crises (TITTONEL et al., 2021).

Gazolla and Aquino (2021) identified four key findings regarding family farming and social organizations during the Covid-19 outbreak. First, as also observed by Preiss et al. (2022), was the sector's ability to readapt its commercialization channels to appropriately meet consumer demand. Second, the recognition that family farmers relying on their own labor, land, and knowledge have the potential to produce and market quality food capable of meeting urban demand. Third, the importance of farmers organizing into associations or cooperatives to effectively access online markets. Fourth, the lack or insufficiency of state support for family farmers, particularly in developing public policies that promote access to digital technologies.

Regarding the new ways family farming products were promoted through social media platforms such as Instagram, Facebook, and WhatsApp as a means to maintain sales and avoid losses. Nogueira and Marcelino (2021) highlight this strategy in their study conducted in the Federal District. Similarly, Preiss et al. (2022), in their research in Rio Grande do Sul, note that mastering digital technologies allowed closer interaction with consumers, though further training is still needed for farmers to understand and make full use of available digital tools.

Favareto (2021) pointed out that terms such as "digital platforms" or "digital markets" encompass a variety of Information and Communication Technology (ICT) tools ranging from corporate-managed marketplaces offering agri-food products to e-commerce apps, individual or collective producer websites for product promotion

and sales, institutional platforms, and social media networks. Integrating these technologies into daily routines entails transformations in family farmers' work practices and enterprise management, as they must now deal with "entry barriers and competition; aspects related to scale, scope, and stability of both supply and demand; logistics; organizational arrangements and governance; and information management" (FAVARETO, 2021, p. 11).

Another important point concerns the use of information technology in rural areas. While digital tools have the potential to promote inclusion, they can also exacerbate exclusion, as access to such technologies is not homogeneous or equal among family farmers. Although the digitalization process had already begun before the pandemic, it accelerated with the spread of the SARS-CoV-2 virus. However, questions remain about whether this process has progressed equally across social groups differentiated by age, gender, and class (NIEDERLE, SCHNEIDER & CASSOL, 2021). Limited digital inclusion is still observed, due to factors such as low educational levels, older age groups resistant to adopting digital tools, and poor internet infrastructure in rural areas (BREITENBACH, 2021).

Two main situations emerged from the studies reviewed: one referring to the initial instability faced by the family farming sector at the beginning of the pandemic marked by uncertainty, declining sales, and social vulnerability and another, developing over the following months, characterized by adaptation and change, enabling the continuity of production and commercialization, ensuring food security, and sustaining family livelihoods.

3 Methodology

The research was conducted at the Association of Fish Producers of the Sucupira Aquaculture Park (BomPeixe), located in Palmas, Tocantins, which was founded in 2015. It is an association of family fish farmers, composed of ten members, primarily engaged in the commercialization of fresh fish. Semi-structured interviews were used for data collection. The main analytical variables (Table 1) addressed to the research participants were:

Table 1: Variables and Their Corresponding Question Relationships

Variables	**Question Mapping**
Digital Media	Do you have access to the internet?
	Did you conduct or start conducting any online promotion or sales of your products during the pandemic? Through which platforms or channels?
Access to Public Policies	Do you have access to any public policies? If so, which ones?
Public Technical Assistance	Did you receive technical assistance or support from any institution regarding guidance on the best ways to market your products during the pandemic?
Production Process and Product Commercialization	What was the quantity of production sold? Did it change during the pandemic?

	What were the main strategies used to market or distribute your products during the pandemic?
	Did the number of customers change during the pandemic?
	What are the channels through which you sell your products? Which one is the main channel?
	Are there challenges in accessing these markets? If so, what are they?
	Were the prices of your products affected during the pandemic?
	What were the main strategies used to distribute or sell your products during the pandemic?
	Did the number of customers change during the pandemic?

Source: Research Data, 2022.

The interview script was constructed based on the list of questions presented in Table 1, aiming to provide an overview, through a case study of a collective organization, of the production process and product commercialization; access to public policies; access to public technical assistance; and the use of digital media during the covid-19 pandemic.

Field research was conducted in August 2022, with semi-structured interviews carried out with 60% of this population. The interviews took place at the Sucupira Aquaculture Park and lasted an average of thirty minutes, being recorded with the participants' consent. The remaining members of BomPeixe did not participate in the interviews as they were not engaged in fish farming at that time. According to Severino (2017), the interview technique allows for the collection of information relevant to a specific topic through a relationship established between researcher and respondent, using targeted questions following a pre-established script, which may be adapted as needed.

For data analysis, content analysis was employed to understand the context of the family fish farmers' activities within the BomPeixe association during the covid-19 outbreak. This process involved three distinct phases: a) pre-analysis, which is the phase of organization, including management of decisions taken; b) material exploration, carried out through coding and enumeration based on pre-established rules; and c) treatment of results, involving inference and interpretation of the data (Bardin, 1994).

4 Discussion and Results

To understand the context of productive inclusion of family fish farmers associated with the BomPeixe Association after the decline of the covid-19 outbreak, information was collected regarding changes in marketing channels, cost structures, investments and revenues, social organization, access to public policies, among other analytical variables, as will be presented below.

The data indicate that internet use was well accepted among the respondents, primarily through mobile phones. However, some participants reported lacking the skills to use this technology and, consequently, expressed a dislike for it.

Furthermore, the social distancing measures imposed by the pandemic required the enhancement of mobile phone use and other strategies, which were gradually adapted throughout the pandemic to maintain product sales. This demanded changes in the behavior of family fish farmers, as highlighted in interview reports. To market their products, farmers began selling on the streets due to the closure of fairs, directly on their properties, or via delivery as a viable option given the need for social distancing, since some producers had gone more than three months without selling their products. Without municipal authorization to operate the fairs, some vendors were unable to display their products, making direct sales at the Sucupira Aquaculture Park the alternative.

Schneider et al. (2020) emphasize that farmers responsible for supplying local and territorial markets faced delivery restrictions due to mandatory social distancing. In this context, they had to accelerate their adoption of e-commerce, an initiative that had been planned before the pandemic but became crucial for product distribution.

Another challenge related to the production process was the sharp increase in feed and input prices, which nearly doubled. However, according to interview reports, the selling price of fish remained largely unchanged because consumers' purchasing power was compromised; thus, raising prices was not a viable option in the crisis scenario.

In response to this situation, several government actions were implemented in the state of Tocantins during the pandemic to support aquaculture activities, such as the authorization of

> [...] simplified environmental licensing for small and medium aquaculture producers with up to five hectares of water surface, including water use permits; exemption from ICMS (state value-added tax) for agricultural products; fiscal incentives for the establishment of fish feed industries; and the cultivation of tilapia in net pens in the reservoirs of the Tocantins River basin (PEIXE BR, 2021, p. 59).

These actions represent a positive factor for aquaculture in the state, helping to mitigate the adverse impact that the pandemic caused across all productive sectors of society. Thus, even while facing the challenges imposed by covid-19, fish production in Tocantins increased, reaching 14,804 tons in 2020, an increase of 11.3% compared to the previous year (PEIXE BR, 2021).

On one hand, as reported by interviewees, despite the many challenges family fish farmers faced in marketing their production during the pandemic, they were able to maintain adequate sales, with increased demand at certain periods, even leading to shortages of fish for sale. On the other hand, some respondents highlighted difficulties, citing the loss of consumers' purchasing power and the lack of infrastructure for storing production, such as the absence of cold storage facilities, as well as regulatory challenges, since some farmers reported being unable to issue invoices. Nevertheless, according to the interviews, normal marketing flows have begun to resume.

Even with state actions benefiting the development of aquaculture, respondents indicated that these measures remain incipient in light of the many existing demands, which were intensified by the pandemic.

According to Valadares et al. (2020), at the national level, family agriculture faced difficulties in marketing its production, as industrial sectors that normally purchased part of the output from family farmers sharply reduced demand. Other points of sale, such as open-air markets, were prevented from operating in several municipalities due to decrees halting commercial activities. Consequently, the category faced the risk of indebtedness, needing to pay off Pronaf loans and other financing, without alternatives to store perishable products.

Regarding access to public support policies for aquaculture, three programs were cited by respondents: PAA, Seguro Defeso, and Bolsa Família. Concerning the PAA, access to the program was inconsistent. Reasons included low prices paid relative to market value and the limited periodicity of the program. One respondent reported receiving both Seguro Defeso and Bolsa Família simultaneously. These institutional marketing channels were thus underutilized by BomPeixe fish farmers, highlighting the continuing difficulty of benefiting from governmental programs and policies intended for family agriculture.

Among the species produced by BomPeixe members are tambaqui, tilapia, piau, caranha, pirosca, pintado, pirarucu, and tabatinga. Of these, tambaqui, tilapia, piau, and pintado are primarily marketed, usually selling the entire production. Production occurs year-round, respecting the reproductive cycle of each species. The introduction of tilapia in Tocantins has been successful, expanding fish production and marketing, which positively contributes to the development of the sector (PEIXE BR, 2021).

Fish is mainly sold in urban markets, supermarkets, and restaurants. Respondents identified challenges in marketing their products, including: production regularization to access the PNAE; payment methods and pricing since in markets farmers can set prices and receive immediate payment; lack of resources for net pen structure and feed; absence of cold storage facilities to maintain proper conservation; local cold storage buying at prices below market rates; formal markets requiring sanitary inspection certificates, which family fish farmers lack; and the sale of the municipal cold storage by Palmas City Hall. Respondents perceived another obstacle as the disinterest of public authorities in addressing these issues.

Thus, launching new products has been hindered because there is no cold storage to process fish. When processing is possible, it is limited to fillet production.

Research by Criança et al. (2020) in the Southeast Pará microregions reports similar challenges during the pandemic: minimal government incentives for property legalization, high input costs, and lack of cold storage to facilitate formal sales.

Regarding participation in associations, there was a decrease in the number of members, as many were unable to continue due to rising input costs, particularly feed. Although associations and cooperatives can facilitate productive inclusion through market access, maintaining engagement remains a challenge, especially within a competitive culture and considering obstacles that prevent adherence to pre-established agreements.

The data show that despite the undeniable potential of aquaculture in Tocantins, infrastructure utilization remains inconsistent with available capacity. Factors related to production, marketing, governmental and non-governmental incentives, infrastructure, and innovative processes are still incipient and do not meet the numerous demands identified in the study with BomPeixe members.

Achieving productive and social inclusion requires the improvement and diversification of public policies that account for the heterogeneity of family agriculture, including aquaculture. Partnerships between different social actors including society, private organizations, and governmental entities are essential, alongside environmental preservation and respect for life, prioritizing the conscious and responsible management of productive activities.

5 Conclusão

The practice of fish farming, carried out by the members of Associação BomPeixe, was directly impacted by the restrictions imposed during the pandemic, due to the limitation of face-to-face contact, especially in the initial months of the outbreak, which directly affected fish production and commercialization. However, even in a context of instability and uncertainty, the activity gradually normalized, owing to the adaptations implemented by the fish farmers to reestablish the flow of production. Consequently, income did not drop abruptly, being stabilized according to the new marketing strategies adopted by the fish farmers, although it did not increase, remaining stable, particularly because raising prices was not feasible given the loss of purchasing power on the part of the end consumer.

Regarding the social and symbolic relationships maintained through face-to-face interactions between fish farmers and consumers, these were somewhat weakened due to the need for social distancing. To prevent these ties from being broken, new strategies were implemented, such as the use of mobile phones.

Nevertheless, the resilience of family farmers, and within this category, fish farmers, demonstrated their capacity for transformation and adaptation in the pandemic and crisis context. Some of the experiences highlighted above reflect this reality, such as the adoption of delivery strategies as a way to promote and sustain product commercialization, which allowed for renewed proximity to customers, contributing to client loyalty, product distribution, and income generation.

Cooperative enterprises were crucial and essential in creating joint alternatives in response to the reality imposed by the pandemic, thus ensuring the continuity of production and consumption through effective distribution. However, as evidenced by the experience of Associação BomPeixe, the financial limitations faced by fish farmers hindered their ability to remain active. Insufficient infrastructure for product processing, combined with obstacles faced by the associations in issuing invoices, are among the barriers to staying affiliated and continuing fish farming activities.

Governmental institutional support contributed to developing strategies for agricultural enterprises to survive the crisis, including the gradual reopening of open-air markets while adhering to all safety guidelines, as well as progress in the granting of concessions for enhancing fish farming activities. Nonetheless, regarding access to institutional programs, such as the PNAE, the members of Associação BomPeixe were not adequately included, leaving significant opportunities for product distribution and financial returns for families untapped.

Effective productive inclusion in formal markets for family fish farmers affiliated with Associação BomPeixe was not achieved, neither during the pandemic nor after the easing of the outbreak, as challenges related to activity development and the financial and social conditions of families persist. Several obstacles remain to

be overcome to ensure productive inclusion, which would provide greater legitimacy and advancement for fish farming in the state and for the members of the association.

Therefore, it is important to establish stronger coordination among governmental levels municipal, state, and federal as well as non-governmental actors, organized civil society, NGOs, cooperatives, and associations, to strengthen the development of fish farming in Tocantins. Likewise, ensuring the effective productive inclusion of fish farmers would allow them to overcome adversities and thrive in challenging scenarios, such as those caused by the pandemic.

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