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FISH FARMING IN WESTERN PARANÁ AND THE MARKETS: A LOOK FROM SOCIAL NETWORKS

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ABSTRACT

Brazilian aquaculture is an emerging agricultural chain that has stood out in several regions, especially the state of Paraná, which is the largest producer of fish in the country. Fish farming in the western region of Paraná has been growing in recent decades at rates higher than other animal protein production chains. In view of this, the problem arises to reflect on how these fish farmers, focusing on tilapia production, interact with the markets. Therefore, the study aimed to understand the nature of the sociability of fish farmers in the West of Paraná in interactions with markets. In its theoretical framework, it values the contributions of the New Economic Sociology (NSE) and the Theory of Conventions (French), with emphasis on the analytical concepts of social networks and the social construction of markets. In addition to the theoretical framework, there is an approach to the types of markets with which family farming interacts. The research is characterized as descriptive, exploratory and typological, therefore, with a qualitative emphasis. Four fish farming networks were characterized in the western region of Paraná, they are: (1) proximity fish farming network; (2) Gastronomy and Leisure Fish Farming Network; (3) fish farming network of small and medium-sized processing units; (4) Commodity fish farming network. These coexist and allow the identification of distinct patterns of economic behavior of fish farmers in interactions with markets, resulting from a historical process in the West that began in the 1980s. The originality of the research lies in the analysis of fish farming in the West of Paraná from the notion of social networks developed by the New Economic Sociology.

Keywords: Aquaculture, Family farming, Economic coordination, Markets.

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Revista ARACÊ
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INTRODUCTION

In different regions of the world, fish farming contributes to food security, with the supply of food with high nutritional value, and to the development of countries' economies (OECD, 2016). In the Western region of Paraná, in turn, fish farming has been growing at rates higher than other local animal protein production chains already consolidated (poultry and pork), emerging as a productive reference in the sector at the national level. Thus, this research proposes to analyze how fish farming in Western Paraná is presented in terms of the conducts adopted by fish farming families in the management of economic enterprises and in their interactions with the markets. The look of social mediations and the forms of articulation of fish farmers in the markets gains importance in the study, which give dynamics and allow its existence.

In view of this, the objective of the research was to understand the nature of the sociability of about two thousand fish farmers in the West of Paraná in interactions with the markets. In this study, the subjects are the fish farmers and the relationship between family farming and markets is a given and observable fact, as markets are part of the social processes of production and reproduction of economic activities and family units. The theoretical framework of the study values the contributions of the New Economic Sociology (NSE) and the Theory of Conventions (French), with emphasis on the analytical concepts of social networks and the social construction of markets. In addition to the reference, there is an approach to the types of markets with which family farming interacts. The research is characterized as descriptive, exploratory and typological, therefore, with a qualitative emphasis. The typological construction of social networks considered eight variables that allow us to understand the nature of social networks in their interactions with markets.

The results indicate the identification of four possible fish farming networks for characterization in the western region of Paraná, namely: (1) proximity fish farming network; (2) Gastronomy and Leisure Fish Farming Network; (3) fish farming network, small and medium-sized processing unit; (4) Commodity fish farming network. These coexist and allow the identification of distinct patterns of economic behavior of fish farmers in interactions with markets, resulting from a historical process in the West that began in the 1980s. The originality of the research lies in the understanding of fish farming in the western region of Paraná from the notion of social networks, developed by the New Economic Sociology, which allowed us to observe different patterns of economic conduct adopted by fish farming families.

Revista ARACÊ
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The article is structured, without considering the introduction with five sections. The first aims to highlight the context of tilapia farming in the western region of Paraná. The following section refers to the theoretical contribution of the research. The third section concerns the methodology used to carry out the study. The fourth section presents the results and discussions of the research, based on four social networks, which are: (1) proximity fish farming network; (2) Gastronomy and Leisure Fish Farming Network; (3) fish farming network, small and medium-sized processing unit; (4) Commodity fish farming network. The last section refers to the conclusions of the research.

CONTEXT OF BRAZILIAN TILAPIA FARMING

In Brazil, tilapia farming has been developing faster than other primary sectors in rural areas, in a perception that the aquatic production system is a field with great socioeconomic and cultural potential. The strong impulse of fish farming has been stimulated by the growing demand for foods of high nutritional value, as well as by changes in the eating habits of consumers with the growing increase in fish (Rissato 2001; Barroso *et al.*, 2018; Feiden *et al.*, 2022; Peixe BR, 2024). In the period from 2005 to 2015, tilapia production grew 223% (Embrapa, 2017). Fish production in 2023, according to data from Peixe BR (2024) reached 887,029 t. In addition, Brazil is the fourth largest producer of tilapia in the world, a species that represents 65% of the country's fish production. In 10 years, according to Peixe BR, the per capita consumption of tilapia went from 1.47 kg/year in 2014 to 2.84 kg/year in 2023.

Aquaculture production in Brazil has its first records at FAO in 1969, with less than 10 t produced per year (Barroso *et al.*, 2018). According to the study, it was from the mid-1990s that the growth of aquaculture production began to be more vigorous in the country, with advances in shrimp farming and tilapia farming. At the time, fishing emerged as an important factor in which tilapia stood out, in addition to paving the way for professionalized production. The aforementioned study also highlighted that from 2006 onwards there was a growth in Brazilian aquaculture in which continental fish farming gained space throughout the country, reaching in 2015 a volume of 483,241 t of farmed fish. The history of Brazilian fish farming was strongly influenced by African and North American tilapia, carp and catfish, with tilapia being the most important crop among aquaculture crops in Brazil and the growth of tilapia farming follows the world trend (Barroso *et al.*, 2018). According to Barroso's study, tilapia has unique characteristics that allow its cultivation, such as good adaptation to

Revista ARACÊ
ISSN: 2358-2472

different production systems and geographic regions, presenting resistance to environmental changes and different cultivation systems. Thus, the study continues, given the favorable conditions and richness of water resources in Brazil, tilapia farming has the potential to become a thriving production chain in the country, contributing to food security and regional economic growth. In this sense, public policies that allow for orderly growth are important, such as the prioritization of governments (municipal, state and federal) in the processes of concession of water use (grant) and the issuance of environmental licenses and incentives for the development of the various links in the production chain (Barroso *et al.*, 2018).

It is important to mention that until the 2000s, fish farming went through a period in which it grew timidly, with low professionalization, few technologies and difficulties in the commercialization of tilapia (Rissato, 2001; Hermes, 2009; Barroso *et al.*, 2018). However, from the 1990s onwards, fish farming has been consolidated as a fish farming complex in the western region of Paraná (Rissato, 2001; Hermes, 2009; Feiden *et al.*, 2018; Chidichima, *et al.*, 2018; Welter *et al.*, 2021; Feiden *et al.*, 2022). In this period, a set of activities, direct and indirect, related to the sector emerged, such as: production of fingerlings on a larger scale, feed industries, processing industries; machinery and equipment industries; and, new production technologies. In 1993, in a field day in the West region, three technologies were presented that marked the break for a leap in the development of tilapia farming, they are: the sexual reversal of fingerlings, fish feed and automatic aerators. These technological advances have allowed for the intensive breeding of tilapia, using sexually reversed fingerlings. According to Rissato (2001, p.42) "[...], this field day can be considered a milestone in the process of technification of the activity and essential for the process of professionalization".

In view of this, tilapia farming is consolidating itself as an important structured production chain, with variations between the regions of the country in the supply of animal protein, of high nutritional quality, supplying the domestic market and seeking shares of the foreign market. The South region concentrates the largest production of tilapia in Brazil, and Paraná has stood out from the other states since the 1990s, accounting for 36% of the tilapia produced in Brazil (Barroso *et al.*, 2018; Peixe BR, 2024).

Revista ARACÊ
ISSN: 2358-2472

Commercial fish farming[4] in the Western region began to be implemented in the second half of the 1980s, fostered by several factors, among which the following stand out: the soil management and conservation program, coordinated by the State Department of Agriculture, which made it possible to guarantee the quality of the existing waters; the subsidized credit provided to fish farmers through the Fisheries and Aquaculture[5] Program, created in 1987 by the State Government; and the diversification of production and income within the scope of family farmers (Rissato, 2001). Still, other factors favorable to the development of tilapia farming in Western Paraná can be mentioned: the available water resources; the strong presence of family farmers; the availability of technical training, teaching and research; production and availability of fingerlings; extensive processing infrastructure; good transport infrastructure; and the culture of associativism and cooperativism (Barroso *et al.*, 2018).

The hydrography of the Western region includes two large rivers, the Paraná River[6] and its tributary, the Iguaçu River[7] (Barroso *et al.*, 2018). In addition to being a favorable region for aquaculture suitability, it has soils with a high percentage of clay, therefore, ideal for the construction of excavated ponds. The number of farms with fish farming for commercial purposes in the Western region is approximately 2000, with a productive diversity in terms of uses of technologies and production volume, as well as interacting with different markets (Basso and Feiden, 2023). The fish production offered is carried out mainly by family producers, a minority of fish farmers have a business profile (non-family type). The classification of fish farmers, based on the area of water depth for breeding, is as follows: small (up to 0.5 ha), medium (0.5 to 2.0 ha) and large (above 2 ha), always taking into account the flooded area of nurseries (Barroso *et al.*, 2918). It is important to mention, according to the aforementioned study, that among the most relevant limiting factors for the implementation of fish farming, the availability of water, financial resources and environmental impediments can be highlighted.

[4] For Rissato (2001), the initial milestone of commercial fish farming in the State of Paraná is linked to the creation of the Environmental Aquaculture Research Center (CPAA) in Toledo in 1981 and the nursery stations of Jaguariaíva, Francisco Beltrão, Paranavaí and Loanda, created in the 1980s and gestated by the agencies of Paraná.
[5] The Fisheries and Aquaculture Program aimed to increase the production of cultivated fish, organize producers and production, as well as promote the genetic improvement of cultivated species (Rissato, 2001).
[6] The Paraná River is the second largest South American river with 4,880 kilometers, which rises at the confluence of two important Brazilian rivers: the Rio Grande and the Paranaíba River (Barroso et al, 2018).
[7]The Iguaçu River is the largest river in the state of Paraná with 910 kilometers, it rises in the Serra do Mar, on the Curitiba Plateau (Barroso et al, 2018).

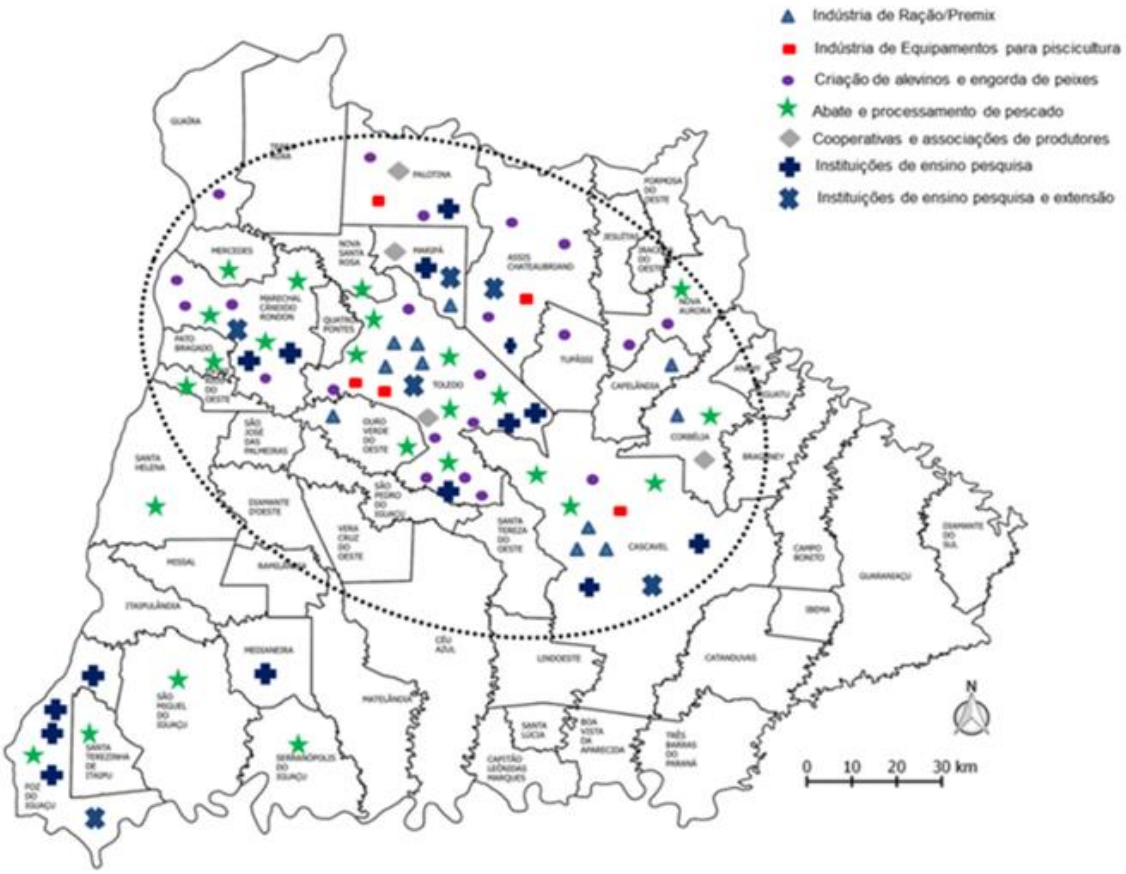
Revista ARACÊ
ISSN: 2358-2472

The western region of Paraná, consisting of 54 municipalities, is the largest producer of tilapia in the state, accounting for 69% of the state's production (Barroso *et al.*, 2018) Consolidating itself as the largest center of fish production in excavated ponds and fillet processing, concentrating 24 processing units, 20 of which are small and medium-sized units (up to 10 tons/day) and 4 large units (20 to 90 tons/day) (Feiden *et al.*, 2022). While small and medium-sized processing units are managed by fish farmers (private companies), large processing units are owned by agro-industrial agricultural cooperatives, with production coming from cooperative members. In turn, small and medium-sized private processing plants, in addition to the production of their own tilapia, have a large share of fish farmed by third parties that are located in their surroundings (Basso and Feiden, 2023). Studies mention that the tilapia processing industry was fundamental to the dynamics of the fish farming production chain, as the fish began to be sold in several markets, with an increase in scales and throughout the year (Rissato, 2001; Barroso *et al.*, 2018; Feiden *et al.*, 2022; Basso and Feiden, 2023). In recent years, some large processing units have been investing in the export of tilapia fillet.

Feiden *et al.* (2018) when analyzing the productive structure of tilapia farming and the actors linked, directly or indirectly, from the perspective of observing the emergence of a Local Productive Arrangement (LPA), found the existence of an important network of relationships and cooperation between the actors of the main links in the production chain (Figure 01).

Revista ARACÊ
ISSN: 2358-2472

Figure 1 - Map of Location and Concentration of Productive Agents of the Fish Chain in Western Paraná



Source: Feiden *et al.* (2018)

According to the authors, the contribution and involvement of organizational and institutional support institutions in the construction of the territorial pole of tilapia farming and its socioeconomic development in the region is evident. Furthermore, the authors Feiden *et al* (2018) highlight that the union between these actors favors the construction of a network of knowledge and technologies that allows increasing the competitiveness of private companies or cooperatives in the production chain. Also highlighted by Barroso *et al.* (2018), with the exception of the segment of medicines and production management software, all other inputs necessary for the dynamics of fish farming activity are present in the region.

THEORETICAL FRAMEWORK

This section aims to highlight, in a concise way, first some elements of theoretical approaches that allow us to understand the markets and then address the different markets with which family farming interacts.

Revista ARACÊ
ISSN: 2358-2472

In recent decades, in the field of social and economic sciences, studies involving the relations between producers and markets have undergone a theoretical revitalization in the understanding of the processes and phenomena that concern the conduct of producers in relation to markets. Thus, a question has been posed to the social sciences in the current phase of reconfiguration of the agri-food system that "[...] it is to understand the processes that evidence the productive, social, institutional and governance (re)arrangements involving the construction of emerging markets" (Matte *et al.*, 2020, p.42).

It is assumed that markets are not the result of the relationship of actors with the same interest, but the result of conventions, of socially shared representations about the context in which they are inserted and experiencing, that is, the world (Nierderle, 2013). Thus, the description of any market needs to observe the social mediations and the forms of articulation that give dynamics and existence to this structure, in order to analyze the way in which the actors solve coordination problems. Based on French studies on markets, carried out by researchers Thévenot (1989, 2001) and Boltanski and Thévenot (1991), "markets are a set of conventions constituted by social actors through speculations, judgments and justifications, which guide the displacement and movement of actors through different spaces" (Matte *et al.*, 2020, p.45). Therefore, according to the researcher, it is necessary to look beyond the exchanges carried out, also observing the ways in which the actors regulate and politicize these exchanges.

The theory of conventions is constituted, in its backbone, by collective values and common goods built from an interpretative rationality (Matte *et al.*, 2020, citing Eymard-Duvernay *et al.*, 2003). In this sense, the conventions focus on "[...] not only in the asymmetry of information, but also in the distinct values that are attributed to the same information, which points to the plurality of equally legitimate forms of economic coordination" (Wilkinson, 2008, p. 129). Thus, "conventions consist of a set of guidelines that are behind the choices, the result of interactions between individual and collective actors, organizing and governing individual and collective actions as gradually constructed agreements" (Matte *et al.*, 2020, p.47). Thus, the research approach also values the reflective capacity of the actors, because according to Long (2007), they should not be configured as simple incorporeal categories or passive recipients of intervention actions. But, rather, as active participants who receive and interpret information and design strategies in their relations with the various local actors and also with external institutions.

Revista ARACÊ
ISSN: 2358-2472

In turn, the New Economic Sociology (NSE) in its project aims to explain the functioning of markets from an approach to social networks. Understanding the nature of these social networks, as well as the position of the actor in these networks, should therefore be the starting points for the analysis of economic life (Wilkinson, 2008). According to Granovetter (1985), actors do not behave or make decisions like atoms outside a social context, nor do they slavishly adopt a script written for them by the specific intersection of social categories that they may occupy. Instead, actors in their attempts to carry out actions with purpose are immersed in concrete and continuous systems of social relations. For Granovetter, conventional economic analyses have neglected the identity and prior relationships of individual traders. Still, according to him, rational individuals make decisions based on knowledge accumulated throughout these relationships. When analyzing how social actors influence the organization of markets and economic behavior, based on Granovetter's contributions, Wilkinson (2008) points out that the embededdnes (rooting) of the economy in social networks is closely related to issues of trust. Also, the reinterpretation of embededdnes in terms of social networks allows us to demonstrate the way in which economic action is permanently filtered by social relations. It also highlights that cultural distinctions are determinant in the conformation of social networks, and the notion of networks is unfolded in a typology that allows for the correlation of different patterns of economic behavior. Regarding the notion of the social construction of markets, Wilkinson mentions that for Granovetter, the type of social network is correlated with the way markets function. The market can be defined as a social construction, "[...] which results from the process of interaction between agents who exchange and exchange for different reasons, whether economic, social or cultural" (Schneider, 2016, p. 97).

The theory of conventions and the new economic sociology provide theoretical-methodological contributions to the study of markets, as it allows us to observe the interaction of actors in markets as a social construction. According to these approaches, the ways in which the actors - the fish farmers in the western region of Paraná - interact with the markets will be identified from the social practices developed in their production units and in the interaction with the markets. The different patterns of economic behavior of fish farmers will be observed from the notion of social networks that unfolds in a typology.

Schneider (2016), in an effort to contribute to the discussion on markets, proposes that we reflect on the different types of markets with which family farmers relate. Schneider points out that the relationship of farmers in markets is a given and observable fact, markets

Revista ARACÊ
ISSN: 2358-2472

are part of the social processes of production and reproduction of economic activities and family units, and also influence people's lives, their values and their culture, shape and modify institutions and are a reason for conflicts, protests and disputes. Thus, with such characteristics, it reaffirms the notion that markets are immersed in a social reality, "[...] after all, we live in a society in which markets are omnipresent, mark the day to day of our lives and organize the social fabric" (Schneider, 2016, p. 96).

According to Schneider, even though markets are so familiar and everyday, little is investigated where it is located, in space and time, as well as the form and content of these markets. Or more forcefully: where the markets come from, who are the actors who participate in them, and how the asymmetries in the relations of those who participate in these markets are composed. This study aims to value the pragmatic contribution made by Schneider (2016), which opens the possibility of a typology to consider the diversity and heterogeneity of the ways in which family farming interacts with markets.

Based on authors and revised theoretical perspectives, Schneider (2016) highlights two key variables as fundamental to carry out the classification and obtain a typology of farmers' relationships with markets. One concerns the greater or lesser degree with which interaction with markets occurs, measured by means of a gradient that varies from situations of quasi-autonomy to a situation of dependence. The other, in turn, is linked to the destination of the production of products, that is, whether they are for one's own use or for sale.

Based on the scheme built from the two key variables, Schneider (2016) obtained a classification that resulted in a typology formed by four types of markets. The types, which can be observed in Chart 01, differ from each other: by the type of farmer who accesses them; spatial reach; the nature or characteristics of the markets; the existing forms of regulation or control; and the marketing channels used.

Revista ARACÊ
ISSN: 2358-2472

Table 1 - Typology of family farming markets

	Type of family farmer	Spatial locus and/or range	Nature of exchanges/business model	Forms of regulation	Marketing channels
Proximity markets	Peasant; Surplus producer	Spot; Direct Selling; Local Only	Interpersonal + Supportive	Confidence + Friendship	- On the property (harvest and pay); - At home/home - Roadside; -Direct delivery; - Local fair; - Consumer groups
Local and territorial markets	Family farmer; Simple commodity producer	Spot; Local, regional and territorial	Diverse + Complementarity	Reputation/ Confidence + Origin + Prices	- Regional fair; - National fair; - Sales networks; -Events; - Specialized store; -Restaurants; - Sales associations; - Sacolão
Conventional markets	Producer of goods	No defined place; Placeless/Unbond	Competitive	Contracts + Prices	-Middlemen; -Cooperatives; -Agroindustry; - Private enterprise; - Internet; -Supermarkets
Public and institutional markets	All types of suppliers	Multiespacial	Bidding, Public Selection	Public contracts + Laws	- School meals; - Fair trade; - International bodies (FAO; PMA); - NGOs; - Hospitals, Universities, Armed Forces; - Assistance Entity; - Government stock

Source: Schneider (2016, p. 127)

METHODOLOGICAL PROCEDURES

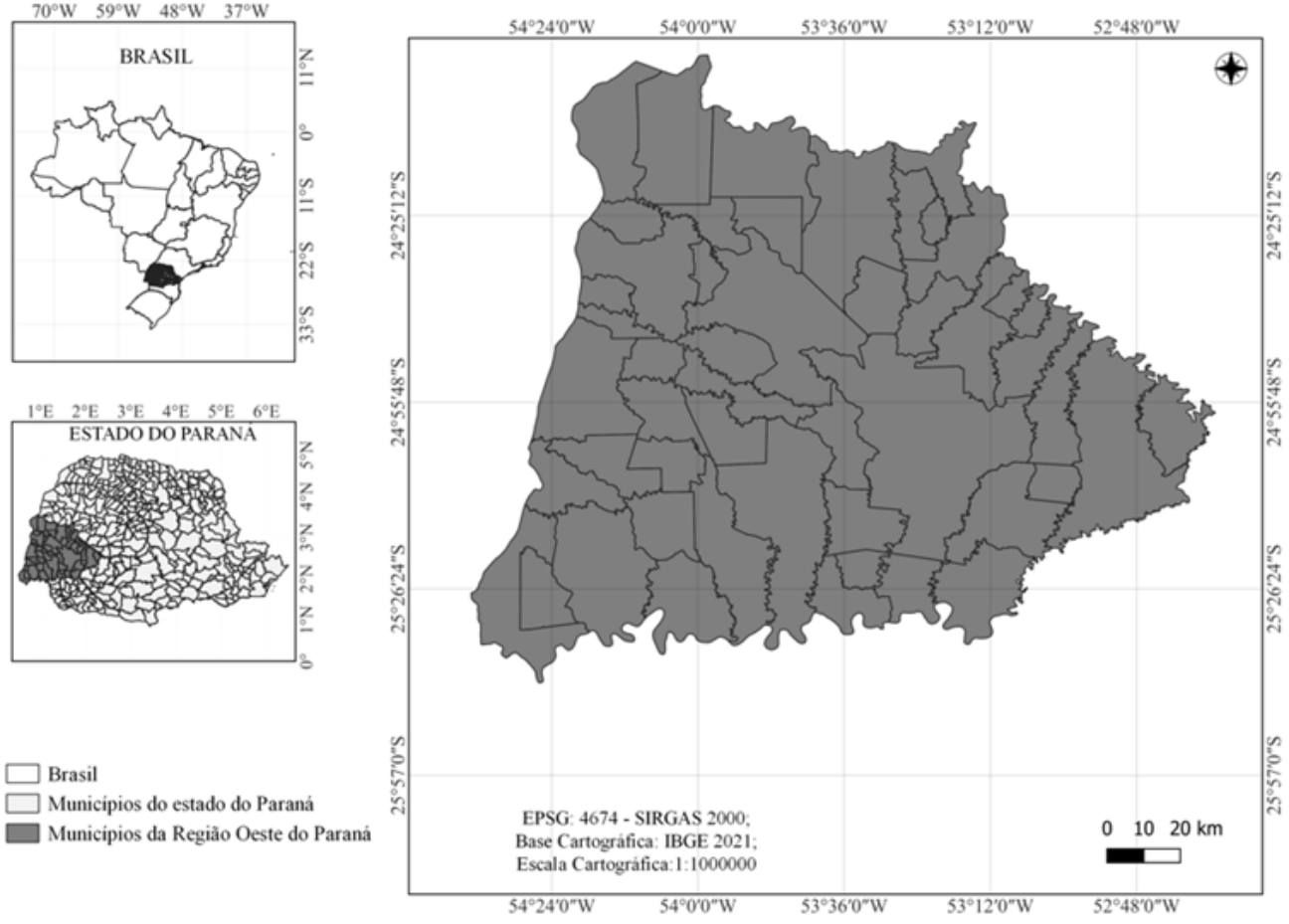
The research values the qualitative and typological method, by understanding subjective aspects of the social practices of the study subjects, it is characterized as descriptive and exploratory. Bibliographic literature and documentary literature are used, as well as the collection of data from primary sources and opinions from in-depth interviews and visits to fish units and fish processing units. The interview script included open questions that related to the variables selected in the study. Visits and interviews were carried out with 12 fish farmers in their production units, 08 interviews between technicians, leaders and researchers who work in fish farming in the western region of Paraná. Also, part of the research procedures was the participation in six (06) events in the fish

Revista ARACÊ
ISSN: 2358-2472

production chain, of which three (03) were of an international nature, in which there was a presentation of academic and scientific papers, during the years 2022, 2023 and 2024.

The subjects of the study fall mostly into the social category of family farmers[8], represented in this study by the socio-professional identity of fish farmers, as well as, and in a minority way, by fish farmers who manage their fish farming enterprise under the capitalist logic of production (not family). The research included fish farmers in the western region of Paraná, which can be seen in Figure 02, which includes approximately 2000 active fish farmers.

Figure 2 - Location of the Western Paraná Region



Source: Prepared by the authors, 2024.

In view of the diversity and heterogeneity of family farmers (Basso, 2013; Basso and Gehlen, 2015; Schneider, 2016; Hooffmann, 2024) and the objective of understanding the nature of the sociability of fish farmers in the interaction with the markets of the Western

[8] Family farmers are work and production units, which generally work in a small area, almost always privately owned, from which they take the essentials to feed their own families, but also to sell, buy, exchange and accumulate (Schneider, 2016).

Revista ARACÊ
ISSN: 2358-2472

region of Paraná, the study values the methodological perspective of the ideal types. The ideal types is always a mental construction elaborated by the researcher. They do not aim to express the content of reality as it is in its essence. They are a means that the researcher chose to organize social reality in a logical way, at the level of thought, without the intention of translating exactly the structure of society, but of approaching reality and understanding it from the values that guide conduct (Weber, 2002). An instrument by which its use is justified both by the objective of the study and by the diversity by which family farmers interact with the markets. The typological method aims to obtain the intelligibility of social relations in the context of intellectual and rational knowledge (Schnapper, 2000) established by fish farmers, through the interactions established by them in the socioeconomic, political, cultural and environmental context in which they are inserted. Through the ideal types it is possible to understand the researched reality, observing to what extent, in each concrete case, the behavior of the fish farmers (social actor) approaches or distances itself from the ideal type. In this way, the ideal type, hereinafter also called social networks, operates as a precise reference for locating phenomena, allowing the identification of their presence or absence through the confrontation between the characteristics of the constructed type and the observed data (Cohn, 2003). It is a simplified and schematized framework of the research theme with which the understanding of social behaviors is sought only as a means of knowledge (Schnapper, 2000). The typological construction[9] of tilapia farming networks considered eight qualitative variables that allow describing and understanding the practices of fish farmers, which allow us to observe the different forms of economic coordination in the management of fish farming enterprises and integration into markets, which are as follows: 1) who buys the fish/tilapia?; 2) production strategy and purposes of fish farming; 3) technological level in fish production; 4) use of financing in production; 5) sanitary inspection system; 6) consumer markets; 7) temporality of the social network; 8) contribution of associativism and cooperativism in the dynamics of productive activity. The typology constructed made it possible to describe four (4) social networks, which are the following: (i) proximity fish farming network; (ii) Gastronomy and Leisure Fish Farming

[9] The process of constructing the typology of fish farmers in the western region of Paraná first included methodological procedures such as a review of bibliographic literature, visits to fish farmers and tilapia processing units, and interviews with researchers and technicians who work in fish farming, carried out during the years 2022 and 2023. The second moment concerns the selection of the eight variables that were used to build the types of fish farmers' network. In the definition of the variables, the following aspects were observed: the degree (greater or lesser) of interaction with the markets; destination of tilapia production (purpose of production); sanitary certification, temporality of the networks, the types of family farming markets (Schneider, 2016) and the presence (or not) of associativism and cooperativism.

Revista ARACÊ
ISSN: 2358-2472

Network; (iii) fish farming network, small and medium-sized processing unit; (iv) Commodity fish farming network. Which will be described individually in the results and discussion section.

THE SOCIAL NETWORKS OF FISH FARMERS IN THE WESTERN REGION OF PARANÁ

The purpose of this research aims to understand the nature of the sociability of fish farmers in the West of Paraná in interactions with markets. In view of this, the data and analysis of the four social networks of fish farming are presented below, which are: (1) proximity fish farming network; (2) Gastronomy and Leisure Fish Farming Network; (3) small and medium-sized fish farming network; (4) Commodity fish farming network. These networks allow, based on their descriptions, to identify different patterns of economic behavior of the research subjects (fish farmers) in the management of their fish farms and in the interactions with the markets.

PROXIMITY FISH FARMING NETWORK

In this network there are approximately 850 families of fish farmers, representing about 45% of the total number of fish farmers in the Western region. They have fish farming in their production units as an activity that aims to diversify production, contribute to food security and also guarantee a complementary income (Rissato, 2001; FAO, 2013; Feiden *et al.*, 2022). Fish farming has been part of the production systems of these fish farmers, since the 1980s, in a strategy of reconstruction of production systems and in a conduct of valuing the proximity market.

Some fish farmers in this network make use of polyculture of fish, with several species simultaneously to take advantage of the productive potential. The sale of fish occurs mostly within the scope of kinship, neighborhood and proximity relations. However, in the event that there is a greater production of fish by some fish farmers, sales may occur to middlemen or to nearby small and medium-sized processing units.

Thus, in this network, fish production is carried out under the management of the family itself, with no formal contracts between the actors involved in the exchanges, but rather based on relationships based on trust. As a whole, these families, which operate with water depths of up to 01 hectare for the most part, have maintained production systems with technological levels ranging from low to medium technology. The low technology can

Revista ARACÊ
ISSN: 2358-2472

be observed by the following characteristics: low density of tilapia stocked per m² (up to three per square meter); use of artificial feed (feed) as supplementation; sporadic or absent technical guidance; do not use power generators for support in case of power outage for aeration maintenance; Usually manual feeding or with adapted equipment on the property. In turn, medium technology contemplates, among its characteristics, the following practices: a storage of fish up to a density of 5 fish per square meter of water depth; use of balanced rations in all production cycles; occasional technical guidance; use of automatic feeders and manually controlled aerators; use of power generators and eventually implementation of cogeneration of energy on the rural property. Therefore, these fish farmers, by promoting production management that, on the one hand, operates with a low production scale and considers the risks of the activity and, on the other hand, interacts with the proximity market, make limited use of the modern technologies available in the markets. In general, they do not make use of credit for funding and investment, they normally operate with their own resources. But, when they make use of credit, the funding line has priority and they do so partially. Among the financial agents, the presence of credit cooperatives[10], from the mid-2000s, in the lines of costing and investments, can be highlighted.

Due to the sale in the proximity market, the sanitary quality of the fish of these fish farmers in the proximity network is guaranteed by the relationship of trust with consumers. These fish farmers do not aspire to make investments in small processing rooms, as tilapia consumption occurs in the nearby market and in the form of whole live fish or chilled on ice. Only in cases where tilapia is sold to middlemen, in the form of fish on ice, the consumer market for the fish is located in other regions of the country.

The temporality of the network can be observed from the 1980s to the present day. In its initial phase, at the end of the 1980s, fish farming in the West of Paraná experienced a strong presence of associations with various purposes, such as: access to government programs that enabled subsidies for machine hours; obtain discounts on the purchase of inputs for production; collective use of fishing equipment; organize fish marketing channels; access to technological innovations (Rissato, 2001; Feiden *et al.*, 2018; Brezan, 2023). In the following years, 04 aquaculture cooperatives were formed, fostered from initiatives of the Municipal Governments, the Rural Development Institute of Paraná (IDR-Paraná) and the State University of Western Paraná (Unioeste). Currently, two of these aquaculture cooperatives are active, with a membership of less than 100 members in total. Therefore,

[10] Cresol System, Sicredi System and Sicoob System.

Revista ARACÊ
ISSN: 2358-2472

most of the fish farmers in this network work individually. That is, they do not use associativism and cooperativism as a strategy neither for the production process nor for access to the proximity market. Table 02 aims to briefly highlight the characteristics of this network of fish farmers.

Chart 2 - Characterization of the Proximity Tilapia Farming Network in Western Paraná, 2023.

Variables	Approximately 850 families experience this social network. Important: For these families, fish farming aims to obtain a supplementary income for the family.
1. Who buys the fish/tilapia?	Extended family (kinship) and neighbors, as well as proximity consumers.
2. Production strategy and purposes of fish farming	The fish farmer carries out the entire management of the fish unit, not counting on other partnerships in the production process. The fish farming enterprise aims, in addition to meeting family demand, a complementary financial income to the establishment.
3. Technological level in the production of fish/tilapia	Predominance of low and medium technology in the crops.
4. Production financing	In general, they do not make use of credit for funding and investment, they operate with their own resources. But when they make use of credit, funding has priority and they do it partially.
5. Sanitary Inspection System of the actors	They do not use a sanitary inspection system, but the quality of production is given by the relationship of trust between the producer and consumers.
6. Consumer markets	Proximity market preferably. In the case of tilapia sales to middlemen, the consumer market for the fish is located nearby and eventually in other regions.
7. Temporality of the social network	Early 1980s to the present day.
8. Associativism and cooperativism	Most fish farmers act individually, not making use of associativism and cooperativism as a tool of their fish enterprise.

Source: Prepared by the authors, 2024.

The fish farming activity of the fish farmers in the proximity network is inserted in an economy of proximity, with mutual influence between space and economic activity. These fish farmers are immersed in concrete and continuous systems of social relations. That is, they are rooted in economic relations constantly filtered by social, political and cultural relations, as well as sustained by trust and friendship as a form of regulation of the proximity market. They are family farmers who have diversified production systems in which fish farming is located. Most of them, in addition to contributing to the food security of the family and its surroundings, provide a complementary income to the family group.

The commercialization of fish is carried out nearby and directly by the fish farmer. Among the most relevant marketing channels is sales on the property and direct deliveries

Revista ARACÊ
ISSN: 2358-2472

to the homes of families and restaurants. It is important to mention that part of these fish farmers practice the polyculture of species in order to meet, in addition to their own demand, also those of consumers. By privileging nearby markets, they value impersonal exchange relations, sustained by affinities of kinship, inter-knowledge and reciprocity.

Finally, the study seems to show that fish farmers in the proximity network have a more autonomous conduct in interacting with the markets, considering that they undertake production to meet their own family consumption and for proximity sales for the purpose of complementary income.

FISH FARMING, LEISURE AND GASTRONOMY NETWORK

One of the marketing channels for fish farming in the West of Paraná, provided for in the strategy for the implementation of the activity since its inception, relied on the fishing/fishing grounds, in the West region and outside it. Fishing was the largest fish sales channel in the 1980s and 1990s. Thus, a large part of the fish production of the period was directed to the provision of leisure and gastronomy services, with fish farmers who were specializing to offer these services. It is important to highlight that the industrialization phase of fish in the Western region will occur from 1992 onwards. Therefore, until this moment the marketing channels were the sale of live fish meeting the demand of the fish-pay of the West and several other regions of the country and of fish on ice to supply the emerging industries in the West and in the nearby states. According to Rissato (2001), in the early 1980s the structure of commercialization of fish production was one of the main obstacles to the development of fish farming in Paraná. There are several studies (Rissato, 2001; Hermes, 2009; Feiden *et al.*, 2018; Chidichima, Feiden and Signor, 2018) and reports from fish farmers, technicians and researchers who mention the fact that the live fish sales channel went through difficulties, that is, there was a lack of commitment from buyers, generating a crisis in fish farming in Western Paraná. This crisis was mitigated, on the one hand, by the emergence of small and medium-sized processing units, as will be analyzed below, and, on the other hand, by the professionalization of families in the provision of leisure and gastronomy services.

Faced with this scenario of fish farming, dozens of fish farmers have structured their production units with a view to leisure and gastronomy services. In addition to planning the production units with polyculture to better meet the demand of visitors for fishing, processing rooms were built to carry out cleaning, evisceration of fish and production of

Revista ARACÊ
ISSN: 2358-2472

fillets, depending on the interest of the visiting consumer. Also, some of these families started to add more value to the activity with the implementation of specialized restaurants, offering a gastronomy in which fish are the basis of their menus.

Nowadays, the western region of Paraná has about 50 families who undertake their businesses in leisure and gastronomy services, valuing the history of fish farming and local culture (rural environment, rustic buildings, customs, cuisine). The need to make constant improvements and innovations, from fish production to gastronomic services, required management and financial skills. Therefore, a specialization in the service sector of these families of fish farmers. This contributed to explain the low number of families belonging to this social network.

In these production units, the consumer will be able to practice fishing, which can be whole or processed, fishing and prioritizing sports practice and being a user of restaurants. The production planning of fish is the responsibility of the producers themselves, varying according to the strategies of each economic enterprise. Some fish-pay/fishing producers, depending on the need, buy fish from other producers to meet their leisure demand. Also, those families who have restaurants complement their gastronomic menus with fish from other regions of the country. Thus, fish from different regions of Brazil are consumed in these restaurants alongside tilapia and other fish from local production.

Regarding the technological level in the production of fish in this net, an intermediate level (low-medium, mentioned in the proximity fish farming network) is observed, with a diet that considers the fishing activity, in the modalities of catch-up and catch-release and poorly mechanized management, but the quality of the water is observed, which must be regularly monitored. In turn, in the scope of financial resources, the funding credit line is occasionally used, as they are fish farmers who have a higher working capital. The investment line is used to make investments in production and infrastructure to enable leisure and gastronomy activities, with emphasis on fish farmers who work with themed restaurants aiming to expand rural tourism.

The fish farmers in this network vary in the process of formalizing the sanitary inspection system in their establishments. Those in which the production is intended for fishing and provide only cleaning and packaging services for the fish carry out the activity informally. On the other hand, those who process the fish, whether in evisceration and filleting, as well as those who have restaurants, have certification, which can be from the Municipal Inspection System (SIM) to another larger system.

Revista ARACÊ
ISSN: 2358-2472

The fish consumer market is made up of the local population, especially those who live in urban areas. Also, tourists from other regions who visit the West of Paraná are consumers of leisure and gastronomic services.

The temporality of this network has its beginning since the implementation of fish farming, in the 1980s, with fish farmers who had units for fishing in the catch-up modality. At the end of the 1990s, the catch-and-release modality (sport) also gained importance and in this period the specialization of part of these fish farmers for the restaurant sector began. From the 2000s onwards, restaurants were consolidated as a focus on rural and gastronomic tourism[11] . The fish farmers in this network keep their enterprises under family management, that is, they do not make use of associative tools. Table 03 aims to briefly highlight the characteristics of this network of fish farmers.

Chart 3 - Characterization of the tilapia farming network for leisure and gastronomy in Western Paraná

Variables	Approximately 50 families experience this network
1. Who buys the fish/tilapia?	Consumer of catch-take, catch-free, prioritizing sports practice; users of gastronomic restaurants.
2. Production strategy and purposes of fish farming	Fish production is fully managed by the fish farmer's family. The production is for sale, through leisure and gastronomic services provided.
3. Technological level in the production of fish/tilapia	Intermediate level (low-medium).
4. Production financing	They have their own working capital. However, for the costing it is occasional, but they make investments aiming at innovations, either for production or in the structure to meet leisure and sport fishing and/or even for fish processing units. They make use of specific credit lines for rural tourism.
5. Sanitary Inspection System of the actors	From informal facilities (sport fishing and those that provide cleaning and packaging services) to those families that have formalized processing units, with emphasis on serving restaurants. Therefore, the inspection service is valued depending on the purpose of production.
6. Consumer markets	Local population, especially the urban population, people and tourists who visit the region.
7. Temporality of the social network	From 1980 to the present day, the net exists to catch and take the fish; From 1990 to the present day, the novelty of catch-and-release emerges and specialization for restaurants begins; 2000s onwards – restaurants with a focus on rural tourism and gastronomy are consolidated.
8. Associativism and cooperativism	Individualized families manage the enterprises, that is, there is no presence of associative practices among the fish farmers in this network.

Source: Prepared by the authors, 2024.

[11] Examples are the restaurants Big Peixe, in Sede Alvorada, Cascavel; Pesque Floresta Park, in Santa Terezinha de Itaipu/PR; Celeiro Peixes & Cia in Vila Nova, Toledo/PR, and Pantanal restaurant in Toledo/PR and Cascavel/PR.

Revista ARACÊ
ISSN: 2358-2472

In this network, fish farmers guide fish production with a view to serving leisure and gastronomy activities offered directly to different consumer audiences. For this, they have a welcoming and well-being environment for users, with buildings that can be from rustic to contemporary. Thus, these fish farming families, when selling their services and products, experience interpersonal relationships, in direct contact with consumers who value trust and friendship. Such fish enterprises contribute, in a very significant way, to the generation of non-agricultural jobs. By operating with localized sales in their own enterprises, they have autonomy in relation to the ability to organize, with the resources they have, fish production and leisure and gastronomic services.

5.3 SMALL AND MEDIUM-SIZED FISH FARMING NETWORK PROCESSING UNIT

This fish network is made up of producing families that sell tilapia, for the most part, to small and medium-sized processing units located in the western region of Paraná. Currently, approximately 500 fish farmers, focusing on tilapia monoculture, are part of this network. For the most part, they have water depths of 01 to 05 hectares. With a storage of fingerlings of 1 gr. or juveniles with 5 to 30 gr.

The emergence of small and medium-sized processing units in the West region represents another way for the fish sector to reach the markets, which began in the mid-1990s. With the emergence of these processing units in the region, the sale of tilapia fillet began, contributing to overcome the crises experienced by the sector. According to a study carried out in 2022, the estimated annual income in six processing units in the micro-region of Toledo was R$ 71,039,430.00, showing that the sector is an important vector for the development of municipalities (Feiden *et al.*, 2022).

In most of these processing units, the family itself is responsible for the agro-industrial enterprise, and has an important part of the production of tilapia to be processed. Thus, according to the slaughter capacity and markets of each processing unit, fish from fish farmers that are in its surroundings are purchased by the entrepreneurs of these units to meet the total demand of the agro-industrial enterprise. In this way, fish farmers sell tilapia production to entrepreneurs in small and medium-sized processing units, establishing a partnership between the parties that contributes to fostering and consolidating this network of fish farmers.

In Figure 01, spatialization of the tilapia production chain in the West of Paraná, mentioned in section 2, it is possible to observe the territorial distribution of the fish slaughtering and processing units installed in the West region, with a greater concentration

Revista ARACÊ
ISSN: 2358-2472

in the micro-region of Toledo. The West region has 21 processing units in this network, which have different certifications with regard to sanitary inspection, as can be seen in Table 01.

Table 1 - Number of fish slaughterhouses classified by certification and percentage representation of each type of certification for the fish sector, Western region of Paraná.

Inspection Type*	Quantity	%
SIF/POA	2	9,5
SISBI/POA	2	9,5
SUSAF	2	9,5
YES/POA	15	71
TOTAL	21	100

*SIF/POA: Federal Inspection Service/Products of Animal Origin; SISBI/POA: Brazilian System of Inspection of Products of Animal Origin; SUSAF: Unified State System of Family, Artisanal and Small Agroindustrial Health; SIM/POA: Municipal Inspection Service for Products of Animal Origin.
Source: Prepared by the authors, 2024.

These fish farmers, partners of small and medium-sized enterprises, are located within a radius of about 50 km from the processing units that acquire tilapia. Also, some fish farmers sell tilapia to intermediaries (middlemen) who use the fish on ice technique to transport them to slaughterhouses in other regions or distribution centers. Part of these fish are transported to marine fish processing industries (as examples, plants that process sardines and tuna and that in the off-season process tilapia) or slaughterhouses in the states of São Paulo and Mato Grosso do Sul that have a low supply of fish for slaughter in their regions, which occurs seasonally.

The production of tilapia in this network does not have formal contracts between the producer and the entrepreneur of the processing unit or a vertical integration type contract, as it is known in the poultry and pork chains. The commercialization of tilapia occurs from a relationship of trust between producer and entrepreneur. In this way, it is up to the fish farmer to assume, with his own capital, the production of tilapia, in a productive planning in dialogue with the entrepreneur who will acquire the production. Thus, when the entrepreneur communicates to the producer to acquire the fingerlings and carry out the production, the agreement between the parties to purchase the tilapia production is implicit. The purchase guarantee by the processing unit makes it easier for the producer to access credit in financial institutions, in the lines of costing or investment. On the other hand, the planning of the acquisition of fingerlings by fish farmers in partnership with the entrepreneur of the processing unit, in periods scheduled between the parties, contributes to the planning of the slaughter of tilapia.

Revista ARACÊ
ISSN: 2358-2472

The technological level of these fish farmers is quite variable, as the storage of tilapia can vary from 2 to 12 fish per m² of water depth, however a medium-high storage predominates. In view of this, those who adopt a storage of up to 5 fish per square meter of water depth make use of medium technology, with practices such as: use of balanced rations throughout the production cycle; occasional technical guidance that may be offered by the processing unit or by the seller of the feed; use of automatic feeders and manually controlled aerators; use of power generators and eventually implementation of cogeneration of energy on the rural property. High technology is used in systems with high storage, above 5 fish per m², and is characterized by the following practices: automation of feeding and aeration systems; balanced and complete rations (probiotics, additives); daily control of water quality parameters; use of power generators and energy cogeneration; implementation of water reuse systems; constant technical assistance; makes use of periodic biometrics to adjust feed supply rates and prophylactic management of diseases and parasites.

The fish farmers in this network make use of financing to foster and generate the working capital necessary for the fish enterprise, in the lines of funding and investments with the various local financial institutions, such as credit unions, public banks and private banks. Regarding the type of sanitary inspection of the tilapia processing units, the presence of several systems in this network is observed, the SIM/POA, SUSAF, SISBI/POA and the SIF/POA. As shown in Table 01, the SIM/POA inspection system is adopted by most of the processing units of this network of fish farmers. According to Chidichima, Feiden and Signor (2018), the main technological needs that could help the sector for the development and growth in the SIM/POA modality is the increase of new products and partnerships for the innovation of dishes and the automation of processes related to the clean area of industries (filleting, skin removal, V-cutting, freezing and packaging).

The chain's processing units are focused on the production of tilapia fillet and the consumer markets are local, territorial and regional, including the markets of the southern states and São Paulo. The temporality of the small and medium-sized processing network began in the 1990s (Rissato, 2001), but it was from 2005 onwards that it consolidated its agro-industrial model (Chidichima, Feiden and Signor, 2018). Given the described characteristics of this network, associativism and cooperativism are not formally present in the production area, with the exception of those fish farmers associated with credit cooperatives for access to credit resources and other financial services. However,

Revista ARACÊ
ISSN: 2358-2472

according to what is described in this network, there are practices of cooperation between fish farmers and entrepreneurs of the processing units, which are based on reputation and trust, but under informality. Chart 04 aims to briefly highlight the main characteristics of this network of fish farmers.

Chart 4 - Characterization of the Small and Medium-Sized Processing tilapia farming network in Western Paraná

Variables	Approximately 500 producers are part of this network.
1. Who buys the fish/tilapia?	Mostly the entrepreneurs of small and medium-sized processing units and, in the minority, the middlemen (intermediary agents) who make use of the fish on ice technique to take to slaughterhouses in other regions of the country and/or distribution centers.
2. Production strategy and purposes of fish farming	Fish farmers take responsibility for the tilapia production process, in a partnership sustained by reputation and trust with the entrepreneurs of the processing units (there is no formal contract between the parties involved). Fish production is entirely carried out with the purpose of selling to the markets.
3. Technological level in the production of fish/tilapia	For these producers, the technological level is variable, but a medium-high technology predominates as they stock fish per m² of medium-high.
4. Production financing	They carry out financing for funding and investments.
5. Sanitary Inspection System of the actors	The agro-industrial processing units of the tilapia buyers of these producers in the network have sanitary inspection of the SIM/POA system for the most part. There will also be some with SUSAF, SIP/POA, SIF/POA.
6. Consumer markets	In addition to the local and territorial market, this network accesses the regional markets of the southern states of Brazil (RS, SC and PR) and São Paulo.
7. Temporality of the social network	The agro-industrial units began processing tilapia in the 1990s, but were consolidated in 2005.
8. Associativism and cooperativism	In view of the characteristics of this network, the presence of associativism and cooperativism is not observed formally, nor among the producers and between them and the entrepreneurs of the processing units. However, between fish farmers and entrepreneurs there are partnership practices of high importance for the development of this network and fish sector, based on reputation and trust. To exemplify: a processing unit can aggregate the tilapia production of 10 to 20 partner producers in its surroundings, in addition to having its own production.

Source: Prepared by the authors, 2024.

The fish farmers of the small and medium-sized tilapia processing network are predominantly related to the local, territorial and regional market. Unlike the proximity tilapia farming network in which the fish farmer maintains contact with the consumer in the sale of fish, in this network the figure of the intermediary is observed, which is materialized by the entrepreneur of the processing units. Therefore, fish farmers no longer sell their product (tilapia) directly to consumers, but to entrepreneurs in the sector. They have their interests

Revista ARACÊ
ISSN: 2358-2472

and make use of control and regulation mechanisms to maintain their power within this complementary business model, such as prices according to demand, among others. Among the most used marketing channels, sales chains, specialized stores and restaurants stand out. Therefore, the fish farmers in the network are inserted in markets that expand outside the location, reaching the territory and the regional/national market.

The fish farmers of the network plan and carry out their production in order to meet the demand of small and medium-sized processing units, regulated based on reputation, trust, origin and prices. In this way, they participate in a business model in which there is complementarity between the parties. Fish farming is no longer a complementary income, as we have seen in the proximity network, to gain greater importance in the income of the family economic enterprise as a whole. In addition, the fish farmers of the network, when implementing their production based on the description made, follow a path of interaction with the market, in which they experience a certain degree of dependence, that is, they no longer have the level of autonomy enjoyed by the fish farmers of the proximity network. It is important to mention the fact that the fish farmers of this network are immersed in a system of values of reputation and trust that are fundamental to the complementary business model. Therefore, reciprocity and interknowledge begin to coexist together with other devices such as prices and competition.

COMMODITY FISH FARMING NETWORK

The commodity fish farming network includes approximately 600 fish farmers, responsible for the production of 2/3 of the total volume of tilapia in western Paraná. The emergence of this network of fish farmers consolidates the tilapia farming agroindustry complex in the Western region. This fact is due to the entry of the large[12] agro-industrial cooperatives in the West of Paraná in the tilapia farming sector from 2008 onwards, which already operate in consolidated production chains such as poultry and pork.

Fish farmers participating in the commodity network are characterized by having tilapia production systems with high specialization, productivity and production scale, as well as by operating in highly competitive markets. Thus, they operate with more extensive trading circuits – national and export – called commodity markets.

The fish farmers in this network have tanks excavated with depths of 01 to 20 ha of water depth, most of which have less than 10 ha. All fish farmers operate through the

[12] The cooperatives Copacol and C-Vale consolidate the production of tilapia in the West of Paraná.

Revista ARACÊ
ISSN: 2358-2472

production system known as "vertical integration contract" with the agricultural cooperatives that operate in this production chain. The integration contract (or production and partnership contract) establishes that the producer is responsible for investments in tilapia production infrastructure on his property, electricity, water and food for the tilapia, which, in the end, must be delivered to the cooperative. In return, the cooperative provides inputs (fingerlings, feed, others), technical services, carries out fishing, industrializes the fish, and remunerates the fish farmer.

Due to the needs of scale, productivity and the competitive environment of the markets in which they operate, the fish farmers of this network operate with a storage of more than six fish per square meter of water depth and make use of high technology, which is characterized by the following practices: automation of feeding and aeration systems; balanced and complete rations (probiotics, additives); daily control of water quality parameters; use of power generators and energy cogeneration; implementation of water reuse systems; constant technical assistance; they do biometrics periodically and prophylactic management against diseases and parasites.

To meet the demands of this fish farming network, which is demanding in financial investments, producers who work with the integration contract system make use of investment credit by accessing public policies such as the Crop Plan and Pronaf. Within the scope of sanitary inspection, the commodity network, cooperatives have industrial units certified by the Federal Inspection System (SIF) and the Brazilian System of Inspection of Products of Animal Origin (SISBI), as well as carry out sanitary monitoring of tilapia with the fish farmer.

The consumer markets for tilapia fillet and other products in this network are predominantly national and export. The temporality of the commodity network is more recent, that is, it is from 2008 that the cooperatives that work with tilapia began discussions and implementation of their industrialization units. The agricultural cooperatives Cooperativa Copacol[13] and Cooperativa C-Vale[14] consolidated the production of tilapia

[13] Copacol (Consolata Agroindustrial Cooperative), founded on October 23, 1963, was a pioneer in fish farming in vertical production systems in Western Paraná. In 2008 it invested in one of the largest fish industrial complexes in the country. (Copacol - Our history. Website: <https://www.copacol.com.br/copacol/historia>. Accessed on: Nov. 22. 2024)

[14] C-Vale is the second largest agro-industrial cooperative in Brazil, operating in Paraná and other states in Brazil, and in 2017 implemented the fish slaughterhouse, currently with a capacity of 150 thousand tilapia/day. (C-Vale – Fish slaughterhouse. Website: https://www.cvale.com.br/site/complexo-agroindustrial/abatedouro-de-peixes. Accessed on: Nov. 22. 2024).

Revista ARACÊ
ISSN: 2358-2472

through the vertical integration system. Table 05 aims to briefly highlight the characteristics of this network of fish farmers.

Table 5 - Characterization of the Commodity Tilapia Farming Network in Western Paraná, 2024

Variables	Approximately 600 producers are part of this network.
1. Who buys the fish/tilapia?	Cooperatives Large Agroindustries for the most part; in smaller volume private agribusiness companies.
2. Production strategy and purposes of fish farming	The production of tilapia is carried out through a vertical integration contract signed between the cooperative and the fish farmer. Fish production is entirely carried out with the purpose of selling to the markets.
3. Technological level in the production of fish/tilapia	High technological level.
4. Production financing	Producers make use of investment credit, as a priority.
5. Sanitary Inspection System of the actors	They have a federal inspection system (SIF and SISBI), with the monitoring of the tilapia production process with integrated fish farmers.
6. Consumer markets	Mostly the national and international market. E.g.: Cooperative exports part of the production of tilapia fillet to the USA.
7. Temporality of the social network	From the years 2008.
8. Associativism and cooperativism	Presence of large agro-industrial cooperatives.

Source: Prepared by the authors, 2024.

The fish farmers of the commodity network have their production systems inserted in the conventional market, essentially carried out by agricultural cooperatives. The conventional tilapia production market is guided by national and international supply and demand, led by powerful economic agents that operate in the production chain.

In view of this, in this network it is observed the adaptation of fish farmers to the transformations of the markets and to the new criteria of regulation. Therefore, being inserted in the conventional market demands great efforts from these fish farmers in this process of social construction of markets, which involves alliances, implementation of new rules and technical systems, as well as having intentionality and normativity. These markets result from a long process in which a set of values are negotiated and whose universalization allows the dynamics of a production chain with actors acting at a distance, dispensing with direct contact with both the producer and the product (Wilkinson, 2008). These fish farmers who interact with the conventional market, in order to remain in the globalized environment, are oriented to adopt behaviors based on values of economy of scale, productivity and competitiveness.

Revista ARACÊ
ISSN: 2358-2472

Thus, the fish farmers in this network, who produce exclusively for the purpose of selling, are fully inserted in the markets and are in a situation of dependence, in the sense addressed by Schneider (2016), with the conventional market. Because, by acting in these national and global markets, in which the nature of exchanges is competitive, and also because they are dependent in their form of regulation by contracts and prices, these fish farmers in the commodity network interact in an environment of risks and uncertainties. Since, according to Schneider (2026, p.124), these are markets in which intermediation mechanisms pass "[...] to be governed by complicated representation contracts, trademark use agreements, regulation of earnings percentages, and rules for the use and administration of property rights."

Finally, in a look at the four fish networks, we can observe four specific economic coordinations to the networks, resulting from a historical process of tilapia farming in the western region of Paraná. Which were understood, in their qualitative nature, from the eight (08) variables selected in the construction of the typology of tilapia farming social networks. Each of the networks is characterized, in summary, by the following aspects: productive strategy adopted; spatial reach of the market; form of regulation; and, marketing channels. The four (04) tilapia farming nets presented are active concomitantly. Each of the tilapia farming networks produces results that, as a whole, contribute to the consolidation of the fish complex in western Paraná, as well as to the socioeconomic and cultural development of the region. However, different directions and perspectives are presented for each of the tilapia farming networks studied, implying specific actions, governmental and non-governmental, which can connect with the various tilapia farming networks in Western Paraná with a view to strengthening the sector and the socioeconomic, environmental and cultural development of the region.

FINAL CONSIDERATIONS

The study analyzed fish farming in the western region of Paraná, consisting of approximately 2000 fish farms. It was possible to understand the distinct nature of each of the four fish farmer networks from the social network approach to meet the objectives of this study. The distinct economic coordinations that emerge from each of the four characterized networks can be observed as resulting from a historical process and social construction of tilapia farming in the western region of Paraná.

Revista ARACÊ
ISSN: 2358-2472

Thus, the study contributes to the understanding of the productive, social and institutional processes and governance of the fish complex in the western region of Paraná, as a social construction of the markets. In the description of the networks of fish farmers, with their different ways of carrying out the economic coordination of the enterprises, it is possible to verify how the social mediations and the forms of articulation of the actors involved give dynamics and existence to the markets. This also makes it possible to observe the way in which fish farmers, of each type/network of fish farming, address the problems of the different patterns of economic coordination. They are located in the fish sector as active producers, receiving and interpreting information and designing strategies in their economic ventures and interactions with markets. Thus, it is possible to verify that each of the fish farmer networks described in the study is correlated with the way the markets operate. Corroborating Schneider (2016) on the diversity and heterogeneity of the ways in which family farming (in this study fish farmers) interact with markets.

Based on the theoretical-methodological perspective of this study, it is suggested to continue investigations to expand knowledge about family fish farming and interaction with markets, as well as analyses that can contribute to a more detailed description of the various networks of fish farmers.

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Revista ARACÊ
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