

Socio-Economic profile of fish farming in Presidente Médici (Rondônia - Brazil)

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ABSTRACT

This current study performed a simplified diagnosis on fish farming in the Presidente Médici's municipality (Rondônia State), aiming to characterize and spatialize this activity in the region. In order to do that, a documental review was performed in a governmental agency (EMATER-RO, ERGA of SEDAM/RO). Simultaneously, there were applied semi-structured interviews directed to 52 local fish farmers (among a total of 89 registered ones). The subjects was about socio-economic factors, production system, commercialization and obstacles in the fish production chain. The results showed that the properties and the fish entrepreneurs studied are mostly small sized ones (82.7%), which have a superficies water average of 2.3 ha (65.4%). In fish farming, family workforce is the mostly used (88.46%), where tambaqui is the main farmed species (96.2%). The fish production is commercialized, as fresh "in natura" or as the whole fish (91.3%), usually in the municipality itself (56.5%), but it is also commercialized in other states (34.8%; Amazonas and Goiás) and in the neighboring cities (30.4%, Ji-Paraná). The fish farmers reported that the high fish feed cost (59.6%) as the main obstacle for the fish production chain. The pisciculture in the municipality is recent, being performed for less than 5 years (73.1%), it shows a small scale commercial production profile, performing especially in the semi-intensive and a monoculture system.

Keywords: Aquaculture; fish farming; fish characterization; rural properties.

Perfil Socioeconômico da piscicultura em Presidente Médici (Rondônia - Brasil)

RESUMO

O presente estudo realizou um diagnóstico simplificado da piscicultura no município de Presidente Médici (Estado de Rondônia), visando caracterizar e espacializar essa atividade na região. Para tal, foram realizadas consultas documentais em órgãos governamentais (EMATER-RO, ERGA da SEDAM/RO). Concomitante, entrevistas semi-estruturadas foram empregadas junto a 52 piscicultores locais (dentre um total de 89 registrados). Foram abordados temas relacionados aos fatores socioeconômicos, sistema de produção, comercialização e entraves na cadeia produtiva. Os resultados mostraram que as propriedades e os empreendimentos piscícolas estudados são majoritariamente de pequeno porte (82,7%), e possuem uma área média de lâmina d'água de 2,3 ha (65,4%). Na atividade piscícola é utilizada especialmente a mão-de-obra familiar (88,46%), onde o tambaqui é a espécie mais cultivada (96,2%). A produção é comercializada, na forma "in natura" com o peixe inteiro (91,3%), geralmente no próprio município (56,5%), mas atua também em outros estados (34,8%; Amazonas e Goiás) e municípios vizinhos (30,4%, Ji-Paraná). Os piscicultores apontam o alto custo com a ração (59,6%) o principal entrave para a cadeia produtiva. A piscicultura no município é recente, sendo exercida a menos de 5 anos (73,1%), apresenta um perfil de produção comercial de pequena escala, atuando principalmente no sistema semi-intensivo de produção, na forma de monocultivo.

Palavras-chave: Aquicultura, criação de peixes, caracterização piscícola, propriedades rurais.

Introduction

At a global level, in the period from 2005 to 2014, the continental fish production increased around 65%, with an annual production estimated in 73.8 million tonnes of fish, especially the species with scales, which has reached 49.8 million tonnes (FAO, 2016). In this sense, fish is still one of the most commercialized products in the world, which resulted in a consumption estimated in 17% of all animal protein ingested by the planet's population, as reported for the year of 2013 (FAO, 2016).

In the fish farming activity, Brazil was considered a country with the greatest potential for the expansion of this sector, especially because it has a very propitious hydrography (QUEIROZ et al., 2002), and these were the reasons which kept the country among the greatest fish producers in the world, holding the 14th position in the year of 2014 (FAO, 2016). At this juncture, the fish farming was responsible for over 70% of the national aquaculture production, with a total production of (captive fish) around 507.12 tonnes in 2016, which were originated mostly from the north (27.6%), south (24.7%), and southeast (17.4%) regions of the country (IBGE, 2017). However, fish farming is also performed in other states of the federation, but they are different when comparing the farmed species, production systems and quantities produced (BARROS et al., 2011).

In this context, Rondônia State has been standing out in farming native fish, since it has an area of 237,576.167 km² which represents 6.16% of Brazil's North region; it is irrigated by several hydrographic basins like rivers Madeira, Mamoré and Guaporé

(IBGE, 2011). The fish farming in Rondônia started early in the 80's, with a fast and disorderly growth, which started to become a complementary alternative in the income of the rural producers in the region (COSTA et al., 2016). Thus, it has remained like this, up to the present days.

The main basis for the fish farming (pisciculture) activity in the region, is with the tambaqui farming (*Colossoma macropomum*, Cuvier, 1818), because it is a fish with special particularities (rusticity, adaptability to weather, a vast technology in fish-feed production and good acceptance by consumer market) proper for the factory farming of the species (XAVIER, 2013). In this way, Rondônia has been leading the national ranking in fish farming with a production of 90.64 thousands of tonnes, which represents 17.9% of the total fish produced in the year of 2016, when there was an increase of 7.3% compared with year of 2015 (IBGE, 2017). Actually, Rondônia is the greatest producer of tambaqui, which is the second most produced species in Brazil (IBGE, 2017). In 2016, around 69.590 thousand tonnes of this species were produced in the state, which corresponds to 63.7% of the regional production and 50.8% of the national production (IBGE, 2017).

Establishing in the fish farming scenery mentioned, is positioned the Presidente Médici, (11°9'56.08"S and 61° 53'52.06"W) one of the 52 municipalities which make up Rondônia state, located 402 km away from the state capital, Porto Velho. The municipality has an area of 1,758.465 km², with a demographic density of 12.83 inhabitants per km² and a population estimated in 22,337 people (IBGE, 2016).

However, there are no research records about the situation of fish farming in this region, and this is the reason which made this study perform a simplified diagnosis on fish farming in Presidente Médici's municipality, for a later characterization and spatialization of this activity in the region, and by doing so, subsidize information which can make up a prognosis in order to help in future decision-making on sustainable handling of this production sector, respecting the social, environmental, and economic criteria which are inherent to the current fish production system.

Material and Methods

Study area

The study was carried out in the sub-regions Leitão, Riachuelo, and Muqui at the Presidente Médici's municipality, where 89 fish farms were analyzed in the region (Figure 1).

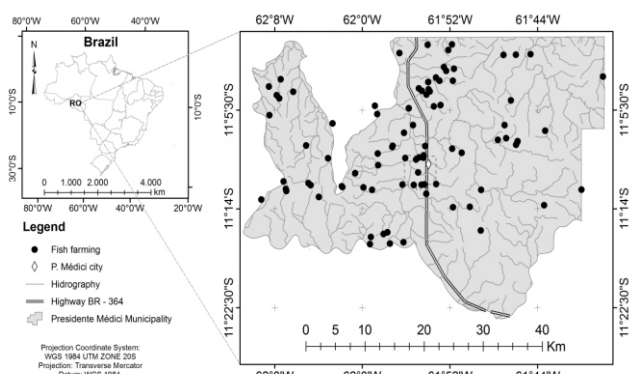


Figure 1. Geographic location of the study field and its corresponding fish farming settings (dark spots) in Presidente Médici's municipality, Rondônia State (Brazil).

Data collection

The data collection occurred in the period from October to December of 2017. In order to do so, documental reviews in the database available in the Presidente Médici's local Governmental offices agency as: Rondônia Technical Assistance and Rural Extension Company (EMATER-RO), in the Regional office for Environmental Management (ERGA) at the Ji-Paraná municipality, and also, in the State's Environmental Development Secretary (SEDAM/RO). Simultaneously was analyzed the records of environmental license requests by the fish farmers, divulged in the Presidente Médici's municipality Official Dairy.

The field data was acquired through semi-structured interviews in fixed questionnaires, which were directed to the fish farmers, for collection information related to the production sector (pisciculture). Topics associated to socio-economic factors were discussed (i.e. family formation, gender, age, educational degree, family monthly income, main activity) production (i.e. farming mode, species produced, farming systems), commercialization (i.e. distribution, sales locations, production destination) and obstacles in the production chain (i.e. main difficulties). The Rondônia Federal University ethical committee approved this research (license number: 78537917.8.0000.5300).

Statistical Analyses

The dataset was tabulated in electronic spreadsheets and submitted to descriptive statistics analysis, where they used frequency histograms, arithmetic mean (μ), standard deviation (σ) and total amplitude, for a better visualization of the information collected. Later on, the data was submitted to Shapiro-Wilk test to check whether the samples came from a population with normal distribution (H_0). Also, when necessary, Pearson test was used in order to evaluate the linear relation among the variables: fish farm area versus property area (where they pound were installed), educational degree versus fish farmer's age. The significance level used in the tests was $\alpha = 0.05$.

Results

During the documental analyses at the governmental agencies, 89 records were identified, as referring to orders for environmental licenses for the performance of fish farming activities in Presidente Médici's municipality. But, when the fish farmers were

contacted, only a total of 52 active owners (58.43%) in the fish production sector were recognized, and those which accepted to participate in the survey, of these, two (2.25%) abstained and the others (39.32%) had desisted or hadn't yet started the activity.

Socio-economic factors from the fish farmers in Presidente Médici's municipality

The results showed that the fish farming in the region is designed by families formed by 3 to 4 people, and it is performed mostly by men (96.2%). On the other hand, the women (3.8%) perform other activities which help complement the family income, such as raising domestic animals (chickens and pigs) and growing vegetables.

The average age of the fish farmers was estimated at 52.9 (± 13.4) years, with a normal distribution of age data in the population (Shapiro-Wilk, $W = 0.978$; p value = 0.450), distributed in groups of different ages among the interviewed ones: 40 to 49 years old (25%), 50 to 59 years old (25%) and 60 to 69 years old (23.08%), and the other groups showed ages ≥ 70 years old (9.6%) and from 20 to 29 years old (1.92%) Figure 2.

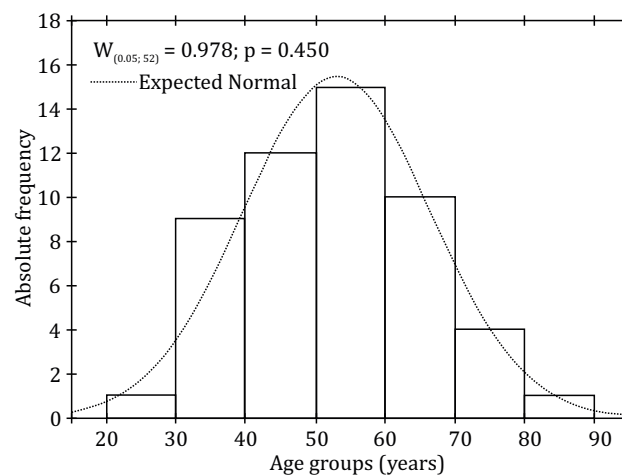


Figure 2. Absolute frequency of the fish farmer's age ranges distribution, located in the Presidente Médici's municipality, Rondônia.

As for educational degree (y), the absolute values showed a weak linear relation (Pearson's test with $r^2 = 0.022$ and $p = 0.472$) when confronted with the age (x) of those interviewed ($y = 1.8384 - 0.0068 \cdot x$). However, the fish farmers with incomplete elementary schooling ($n = 37$) were the most assiduous in the interviews with 71.15% of the total assessed, followed by those with incomplete high school (13.46%), and incomplete college education (9.61%) and the literate ones (5.76%).

The informed monthly income varied from R\$ 400.00 to R\$ 30,000.00, with the average of R\$ 4,072.00 per interviewee. This income was distributed among those involved in the sector as follows: a group of people with income < 1 minimum salary ($n = 6$) 11.5%, income $> 1 < 5$ salaries ($n = 35$) 67.3%, income $> 5 < 10$ minimum salaries ($n = 6$) 11.5%, and groups with income greater than 10 minimum salaries ($n = 5$) 9.6%.

The values related to the performance of fish farming in the rural sector was not as the only activity, but it was performed as one of the most important activities for income generation, and cattle raising stood out as the main study field, with 71.2% of the citations from the interviewees. However, the fish farmers report that they also perform other non-exclusive activities (28.8%) such as those related to public management and private enterprises.

The data showed that 98% of the interviewees are owners of the properties, and only 2% declared to be tenants of the properties. Also, 92.3% of the fish farmers manage their activity in an individual way, and just 7.7% affirmed to have an associate or a partner in this activity.

As for the size of the properties evaluated in the study, they were classified according to Federal Law 8,629, February 25th, 1993, as follows: small properties (92.3%, with an area less than of 4 fiscal modules; 1 fiscal module = 60 hectares) and medium properties (7.7% with areas between 4 and 15 fiscal modules).

Furthermore, the size of the fish farming also were classified as shown in Annex I in Table 1 from the Rule No. 413/2009 from the "Environmental National Council - CONAMA", which addresses the pisciculture licensing and defines the entrepreneurship framework according to the following sizes: I - Small size: An area smaller than 5 hectares (ha) of water surface per entrepreneurship; II - Medium size: An area with 5 to 50 hectares (ha); III - Large size: An area with more than 50 hectares (ha). Considering this classification, 82.7% (n = 43) of the entrepreneurship visited in the municipality were classified as Small sized ones, and 17.3% as Medium-sized. The average area intended for pisciculture (water surface) was 2.3 ± 2.7 ha (65.4%). The values of the pisciculture and property areas, when submitted to the Pearson's test, showed a positive substantial relation ($r^2 = 0.436$, $r = 0.660$ and $p < 0.001$), which means that the fish farming areas increase in proportion with the areas of the properties where they are installed (Figure 3).

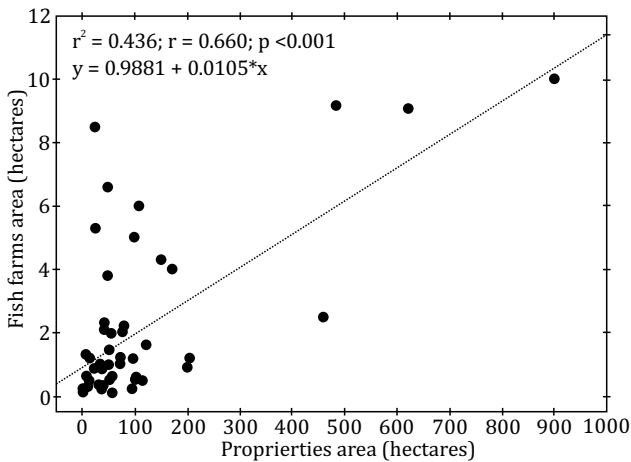


Figure 3. Linear relation between the pisciculture areas and the properties where they are installed.

The data related to the period of the fish farmer's activity in the sector show that the activity is recent in Presidente Médici's municipality, where 73.1% of the producers have performed the activity for less than 5 years, with an average experience of 4.3 ± 4.2 years, in pisciculture business. This activity is used especially for commercial purposes (76.9%), but it is also used for subsistence and leisure. Among the fish farmer's, (55.8%) reported they obtain public technical assistance. On the other hand, 32.7% of the interviewees do not obtain any type of assistance, and other 11.5% hire technical assistance by themselves.

The main workforce used in the piscicultures at the Presidente Médici region is the family labor with 88.46%, followed by the permanently hired staffs (especially labors working with cattle raising) with 11.54% of the total of interviewees. However, during the production process, daily workers are also hired in order to help the farmers with the fishing and the cleaning of the farming structures.

Production systems, farmed species and handling

Monoculture is the most used farming system informed by the interviewees and it can be found in 50% of the properties, followed by polyculture (36.54%) and mixed system (13.46%), where the fish farmer uses monoculture and polyculture in different structures. The semi-intensive culture system was dominant in most of the properties (98%), except for an pisciculture, which works with the extensive production system.

Fish fattening was the dominant production purpose among the fish farmers (98%), followed by fish-seed (young fish) production (e.g. for the fish as: tambaqui, pirarucu, pintado, piaçu, carpa capim and ornamental fish) which holds 2%. However, there are seven piscicultures which have the natural reproduction of pirarucu as the secondary purpose. The fish-seeds purchased from the aquacultures are mostly originated from three fish farming which are fish-seeds producers (post-larvae and young fish) in Rondônia State, located in the municipalities of Presidente Médici (76.9%), Pimenta Bueno (13.46%) and Ji-Paraná (11.5%).

Among the fish species produced, tambaqui (*C. macropomum*)

was the most farmed species (96.2%). However, were also mentioned in the interviews as complementary fish species for farming in the region, the pirarucu (*Arapaima gigas*, Cuvier, 1829) which represented 42.3%, followed by pintado (*Pseudoplatystoma corruscans*, Spix and Agassiz, 1829) with 34.6% of the total created. Also, other fish species with lower commercial demand were develop in the fish farming activity as piaçu (*Leporinus friderici*, Bloch, 1794), curimba (*Prochilodus nigricans*, Agassiz, 1829) and jatuarana (*Brycon amazonicus*, Spix and Agassiz, 1829).

Fish feeding

As for feeding the fish, industrialized feed is used in most of the entrepreneurship (98.08%), except for a fish farming which works with the extensive production system. In addition to the feed, other sub-products were also used in the food complementation in the fish farming, where the corn was the most used feed (53.84%), followed by manioc (38.46%) and local fruit (23.07%).

In relation to fish feed, 62.74% (n = 32) of the interviewees reported that they feed their fish production, according to their fish biomass (live weight) existing in each farming structure. On the other hand, 19.61% stated they provide uncertain feed quantities on alternate days, and other 17.65% provide feed until the fishes were satisfied.

Distribution, commercialization and fish production cost

The distribution of fish production in Presidente Médici's municipality is carried out only by roads. The fish produced is commercialized within the municipality (56.5%), in other states (34.8%; Amazonas and Goiás) and in the neighboring cities (30.4%, Ji-paraná), with its highest peak in sales in March and April, coinciding with the Holy Week period. The fish produced is marketed in a whole body (*in natura*), which corresponds to 91.3% of the total, the remaining produced fish is sold cooled (guttled, whole, or in pieces).

The expenses in fish production (installation, production, and maintenance) in Presidente Médici's municipality are predominantly funded (86.5%) with resources from the farmers themselves. These costs are managed accurately by 57.7% (n = 30) of the interviewees, however, the activity is considered as a hard-working sector, due to numberless difficulties found in this production sector. The other interviewees (42.3%) reported that they do not have a detailed control over these expenses.

Obstacles found in fish production

The data showed that 59.6% of the fish farmers affirmed that the fish feed is the biggest obstacle for fish farming in the region, due to the high prices of the product in the markets (varying from R\$ 1.80 or U\$ 0.57 to R\$ 2.08 or U\$ 0.66 per kilo of feed), followed by the commercialization process (42.6%) among others less commonly mentioned (environment license, technical assistance, purchase of good quality fish-seeds, fish thefts, and credit line).

Discussion

In the south region of Brazilian Amazon, is situated Rondônia State, which holds the largest national fish production originating from fish farming, where this activity has been carried out in more than 10.8 thousand hectares of water surface, scattered among more than seven thousand licensed properties (PDSE, 2015), and these properties are mostly specialized in the production of tambaqui (*C. macropomum*), an endemic fish species from the Amazon basin (PARENTE et al., 2003). The Rondônia State has conditions which help the activity development, and it has made the region, one of the most important areas for fish production and development for this economy sector (DANTAS, 2010). Presidente Médici's is inserted in this scenery and it holds around 90 active fish farms in the region, which produced about 1.27 thousand tonnes of fish farmed in the year of 2016 (IBGE, 2017).

The overview on pisciculture in the Presidente Médici shows that the basis of the labor force carried out in this activity is predominantly made up by family groups formed by 3 or 4 people, which shows a similar pattern to the fish farmers in the region of Presidente Figueiredo in the Amazonas State (BARBOSA and LIMA, 2016) and Guamá's regions and Rio Capim in Pará State (ARNAUD, 2012) It is possible to connect this tendency to the small number of

people involved in fish farming, as a reflection of the decrease process in population fecundity and rural exodus which has been happening systematically in the country for the past few decades (IBGE, 2011).

In these family groups, the men stand out more times as the responsible ones for providing the family's support (IBGE, 2011) by working on the management of the rural properties. Such a pattern has repeated among the rural producers who work with pisciculture in the study region, as well as in the others municipalities like Tabatinga and Presidente Figueiredo at the Amazonas State (NAKAUTH et al., 2015; BARBOSA and LIMA, 2016) and Capitão Poço at the Pará State (BRITO et al., 2017). This phenomenon may be caused by the necessity of work force used in more burdensome activities (fence constructions, metallic structures and excavations), related to rural activities, which has contributed to a decreased number of women involved in this production sector (IBGE, 2011). However, the women perform other activities (they raise domestic animals and grow vegetables), and they help complement the family income (ARAUJO and SCALON, 2005).

As for the age of the active farmers in Presidente Médici's municipality, the applicants showed a normal age range distribution, with an average of 52.9 ± 13.4 years old, which is considered of a high level range when compared with the values estimated for the rural population in the north region, which is 30.6 years old (IBGE, 2011). The discouraging factor of the 20-39 year-old group for pisciculture, and the preference for cattle raising, happens because this activity has been culturally inserted in the state for more than 50 years, representing the third most important activity in the state's Gross Domestic Product (GDP) (CARVALHO and SOUZA, 2013). Rondônia is responsible for 10.3% of all the exports of deboned and nationally frozen beef, and for 83.2% of the exports in the north region (MEIRELLES, 2011). Therefore, the rural producers consider pisciculture a risky activity, based on the market variation.

Also, it was verified that the fish farmers in the municipality showed a low educational level, which is a recurring model among the fish farmers in the southern region of Pará State (SILVA et al., 2010) and in Acre State (REZENDE et al., 2008). On the other hand, there was no relation between the educational level and age, which showed that the education level does not depend on the fish farmer's age. However, the educational level is important in order to have access to new technologies (BRITO et al., 2017), to optimize the training in the fish farming activity (BARROS et al., 2011; ARNAUD, 2012) and to control its cost in the production (SOUZA, 2006).

The data shows that the average family income among the producers was R\$ 4,072.88 per month, however, 50% of the interviewees stated monthly income up to R\$ 2,172.00. Thus, the income increase occurred due to 21.2% of the fish farmers, whose amount acquired from the activities in the properties were higher than R\$ 5,000.00 per month. This difference in the family income is a reflection primarily from the several economic activities carried out by the producers, especially cattle raising.

In the municipality, fish farming is still incipient, but it emerges as one of the most important activities for income generation, and cattle raising stands out as the main activity in the study region. This model is opposite to the existing model happened in Tabatinga municipality at the Amazonas State, and in the Capitão Poço at the Pará State, where aquaculture is the primary activity carried out by the rural producers (NAKAUTH et al., 2015; BRITO et al., 2017). On the other hand, the main economic activities performed by the Brazilian fish farmers, especially those with a small scale production, are related to the rural sector (ARNAUD, 2012).

It was verified that fish farming has been predominantly carried out in an individual way and in private properties, aiming commercialization, supporting the results of ARNAUD (2012) and MPA (2010) where they report that this behavior is also evident and predominant (> 80%) in other regions of the country, and it has contributed to investments in the production line (OLIVEIRA, 2012), centered management and decrease of costs, without the necessity of land rent.

The results also, showed that the water surface (average of 2.3 ha) used in the piscicultures at the Presidente Médici, exhibited a

high amount of water, when compared with the amounts of water surface found in the Pará State (average of 1.4 ha) (ARNAUD, 2012) and 1.3 ha for the pisciculture in the Acre State (REZENDE et al., 2008). However, this variation in the size of the water surface area, may be related to different farming means and purposes, where the small scale fish farmers usually aim at subsistence or sporadic trade, whereas larger piscicultures aim at commercialization only (ARNAUD, 2012). However, both production modalities (subsistence and commercialization) objective to improving family income through the commercialization of their products (OLIVEIRA, 2012), and these results are similar to the ones found in the regions of Cruzeiro do Sul municipality at the Acre State (SARAH et al., 2013) and Capitão Poço in the Pará State (BRITO et al., 2017).

However, the pisciculture in the region under study is still a recent activity when compared with other Brazilian agribusiness chains, like cattle raising and agriculture (PEDROZA FILHO et al., 2014), since the producers have been working in this segment for less than 5 years. This is a similar pattern to the ones that can be found in other states in the north region of Brazil, like Divinópolis municipality (Tocantins State) with a three-year average experience in the activity (SILVA et al., 2013) and in the Amapá State, where the activity has been carried out for no more than 4 years (TAVARES-DIAS, 2011).

In the field of study, it was verified that pisciculture is based on family manual labor, supporting the data found in the Tabatinga municipality at the Amazonas State (NAKAUTH et al., 2015), Divinópolis in the Tocantins State (SILVA et al., 2013), Acre (REZENDE et al., 2008), and Amapá States (TAVARES-DIAS, 2011), where the activities related to fish farming are performed by using family workforce, typical to small scale piscicultures, which are different from larger scale fish farming, which need a permanent or temporary hired labor for specific services in the entrepreneurships (ARNAUD, 2012).

Monoculture is the most common mode in the municipality fish farming, which can be found in 50% of the properties mentioned, followed by polyculture (36.54%). The latter has a lower comparative expression, but it's representative among the ways of fish farming (COSTA et al., 2015), however, the lack of information that determines which species must be used the several farming systems is an obstacle for this production model (BARROS et al., 2011).

The semi-intensive farming system has been predominant in most of the properties, and it is the most nationally widespread system, where it is explored in 95% of the farms, and it is characterized by showing peculiar handling conditions such as, natural feed from the fish pounds themselves, and periodic treatment of the water by using organic and chemical fertilizers (CANTELMO, 2002). Primarily, these piscicultures aim at fish fattening, but in a smaller scale, they also produce fish-feeds (young fish). Similar data was found among the fish farmers in the Araguatins municipality of the Tocantins State (SILVA et al., 2016) and in the regions of Guamá and Rio Capim municipalities at the Pará State (ARNAUD, 2012), where fish fattening is the main goal among the visited entrepreneurships (MPA, 2010).

Most of the fish-seeds purchased were used for fattening objective within the municipality limits, and this young fish originates mostly from three piscicultures in the region, which are located in the Presidente Médici (76.9%), Pimenta Bueno (13.46%), and Ji-Paraná (11.5%) municipalities. However, young individuals (fish-seeds) can be purchased from other sites (14 registered laboratories) scattered all over Rondônia State (XAVIER, 2013; COSTA et al., 2016).

Among the species produced, tambaqui is the most commonly farmed fish species between the entrepreneurships visited, followed by pirarucu and pintado. Other species with lower commercial demand are also farmed such as, piauçu, curimba and jatuarana. However, tambaqui has stood out as the second most produced species in Brazil, just behind tilapia *Oreochromis niloticus* (Linnaeus, 1758), with a harvest of approximately 136.99 thousand tonnes recorded in 2016 (IBGE, 2017). The North region is the largest producer of the tambaqui, especially because Rondônia State, which accounts for 50.8% of the national production of

these individuals (IBGE, 2017). Contributing with this amount of fish production, also was the Presidente Médici municipality, which archived the 22nd place (0.98 thousand tonnes of tambaqui produced) among the others Rondonian municipalities (IBGE, 2017).

The regional fish production is distributed through terrestrial routes, as Presidente Médici is connected from North to South through BR 364 highway, the most important road in the state, among the ones with a smaller size, which make the access easier; and by doing so, contributing with cost-benefit and in the production logistics (GOES et al., 2015). The fish production in the region is predominantly commercialized in the municipality (with sales peaks in March, April and during the Holy Week), with whole fish (fresh), without processing, usually stored in ice (XAVIER, 2013) sold to supermarkets, restaurants, snack bars, or directly to the final consumers in open air markets. Also, part of the fish production is commercialized with “middlemen” from other states such as, Amazonas and Goiás.

One of the main factors which influences the productivity and profitability of fish production is the supply of fish feed in enough quantities which are able to provide the essential nutritional needs and thus guarantee the ideal fish growth (FAO, 2016). Industrialized fish feed was used in practically all the entrepreneurship visited, which was a peculiar characteristic of the companies in the sector, which aim at high productivity in a short period of time (SANTOS et al., 2014).

The expenses originating from the fish production in the region are predominantly funded with the farmer's own resources, who in turn, manage their properties accurately (57.7%), decreasing the costs on human resources, and thus positively focusing on sustainability increase in pisciculture business (COSTA et al., 2015). On the other hand, it was verified that 62.74% of the interviewees feed the fish according to the fish biomass (live weight) existing in each structure of the farming, and 19.61% stated that they provide uncertain quantities of feed on alternate days. The lack of control over fish feed cost and supply shows the necessity for the activity professionalization (LEE and SARPEDONTI, 2008; ARNAUD, 2012), since the commercial fish feed is considered the most expensive input in fish farming, representing up to 80% of the fish production costs (KUBITZA et al., 1998; REZENDE et al., 2008).

Based on the above considerations, more diversified studies are necessary about the most varied segments in pisciculture production, aiming at creating instruments which are capable of developing the activity in a reasonable manner, allowing for economic, social, and environmental development in a sustainable manner, through the use of strategic and efficient measures, which are able to optimize the activity growth and decrease the difficulties found, thus contributing by strengthening the fish sector and the economic development in the region.

Conclusion

Fish farming is still recent in the region of Presidente Médici (Rondonia), poorly developed as a primary activity, but it emerges as the main secondary activity. It is performed in private lands by using their own resources, which is carried out especially by men with a low educational degree, by using family workforce. They obtain specialized technical assistance from EMATER-RO and they control their production costs. However, they report the high fish feed cost has become a major bottleneck of the sector; and these issues are faced by Brazilian piscicultures, which does not make it a regional obstacle, rather, a national one. The fish farming is considered small scale, semi-intensive, primarily working with tambaqui fattening (monoculture), for commercial purposes and in lower quantity in fish-seeds production. The fish is mostly commercialized in the municipality itself as fresh fish.

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