



## Reflections on teaching aquaculture in the Marajó archipelago, Eastern Amazon

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**ABSTRACT.** Aquaculture is a growing agricultural activity in the Marajó Archipelago, State of Pará, Brazil. Thus, it is important to discuss the creation of aquatic organisms in technical courses in the field of agrarian sciences. Given this, the present study aimed to understand the students' reflections in agriculture regarding the area of aquaculture, through the application of diagnostic analysis. The methodology consisted of a qualitative and explanatory field research. The study was developed with 50 students of the first year of high school of the technical course in Agriculture of the Federal Institute of Education, Science and Technology of Pará (IFPA), *Campus Breves*. In conclusion, the students declared that they found the subject of aquaculture important as a discipline within the technical course, although they interested in fish farming. The lack of knowledge about aquaculture ventures in Marajó may be one of also demonstrate little affinity with the area; those who have shown affinity are the factors responsible for the students' lack of interest in the area, because in the region the culture of fishing activity has been even stronger for fish generation in the Marajó archipelago.

**Keywords:** Rural Education, Aquatic Organisms, Island, Amazon.



## Reflexiones sobre la enseñanza de la acuicultura en el archipiélago de Marajó, Amazonía oriental

**RESUMEN.** La acuicultura es una actividad agrícola en crecimiento en el archipiélago de Marajó, Estado de Pará, Brasil. Por lo tanto, es importante discutir la creación de organismos acuáticos en cursos técnicos en el campo de las ciencias agrícolas. En vista de esto, el presente estudio tuvo como objetivo comprender a los estudiantes de agricultura en el área de la acuicultura, mediante la aplicación de análisis de diagnóstico. La metodología consistió en una investigación de campo cualitativa y explicativa. El estudio fue desarrollado con 50 estudiantes del primer año de secundaria del curso técnico en Agricultura del Instituto Federal de Educación, Ciencia y Tecnología de Pará (IFPA), *Campus Breves*. En conclusión, los estudiantes declaran que consideran el tema de la acuicultura como una disciplina dentro del curso técnico, aunque también demuestran poca afinidad con el área; aquellos que han demostrado afinidad están interesados en la piscicultura. La falta de conocimiento sobre las empresas de acuicultura en Marajó puede ser uno de los factores responsables de la falta de interés de los estudiantes en el área, porque, en la región, la cultura de la actividad pesquera ha sido aún más fuerte para generar peces en el archipiélago de Marajó.

**Palabras clave:** Educación del Campo, Organismos Acuáticos, Isla, Amazonas.

## Reflexões sobre ensino da aquicultura no arquipélago do Marajó, Amazônia Oriental

**RESUMO.** A aquicultura é uma atividade agropecuária em crescimento no arquipélago do Marajó, Estado do Pará, Brasil. Assim, é importante discutir a criação de organismos aquáticos em cursos técnicos da área de ciências agrárias. Diante disso, o presente estudo teve como objetivo entender os estudantes em agropecuária quanto à área da aquicultura, por meio da aplicação da análise diagnóstica. A metodologia consistiu em uma pesquisa de campo, qualitativa e explicativa. O estudo foi desenvolvido com 50 alunos do primeiro ano do ensino médio do curso técnico em Agropecuária do Instituto Federal de Educação, Ciência e Tecnologia do Pará (IFPA), *Campus Breves*. Em conclusão, os estudantes declaram achar importante o assunto da aquicultura como disciplina dentro do curso técnico, apesar de, também demonstrarem pouca afinidade com a área; os que demonstraram afinidade apresentam o interesse pela criação de peixes. A falta de conhecimento sobre empreendimentos de aquicultura no Marajó pode ser um dos fatores responsáveis pelo desinteresse dos estudantes pela área, isso porque, na região, a cultura da atividade de pesca tem sido ainda bem mais forte para geração de pescado no arquipélago do Marajó.

**Palavras-chave:** Educação do Campo, Organismos Aquáticos, Ilha, Amazônia.

## Introduction

Fish production is an activity divided between fishing and aquaculture. Fishing is based on the extraction of fishery resources from the natural environment (Friedlander, 2018). The second terminology usually occurs in a confined and controlled space (Senff et al., 2018). In aquaculture we can consider fish farming (Baldisserotto et al., 2018), shrimp farming (Maciel & Valenti, 2014), the cheloniculture (Magnusson et al., 2003), the malacoculture (Sampaio et al., 2017), among other aquatic and semi-aquatic organisms. These activities are important from both the social and economic point of view (Santiago et al., 2018), responsible for the continued growth in fish supply to the world's population (FAO, 2018).

Fish has high protein quality, as well as being a source of lipids, omega-3 and 6 fatty acids, vitamins and minerals (Cheng et al., 2014; Gonçalves et al., 2015). In 2017, world production in aquaculture was 80 million tons of fish and 30.1 million tons of aquatic plants. Aquaculture accounted for 17 to 18% of total fish produced in Africa, the Americas and Europe, followed by 12.8% in Oceania (FAO, 2018).

In fish farming, Brazil has accumulated a production of 474,300 thousand tons, which provides the discreet

eight position among large producers, losing to Asian countries like Vietnam, Philippines and Chile in South America (FAO, 2016). According to a survey by the Brazilian Fish Association (PEIXE BR, 2018). In 2017, Brazil was the 4th largest producer of 357,639 tons of Nile tilapia (*Oreochromis niloticus*) in the world, placing it among the world's four largest producers, behind China, Indonesia and Egypt. Thus, it is evident that fish farming in South America is representative compared to other aquaculture activities in the world (Valladão et al., 2018).

The Northeast region of Brazil had the largest participation in fish farming, with 26.8%; then the northern region, with 25.7%; the southern region, with 24.2%; the Midwest region with 12.6% and the Southeast with 10.7%, according to the Brazilian Institute of Geography and Statistics (IBGE, 2016). In the Amazon, the states of Rondônia and Pará create native species, especially tambaqui (*Colossoma macropomum*). The first one is highlighted in the national scenario, with 80 thousand tons annually. Pará is growing, being an activity developed by small, medium and large farmers, besides being exercised by family farming and riverine (Aizawa et al., 2014).

Fish farming is a growing agricultural activity in the Marajó

Archipelago, Pará State, Brazil. The region has its numerous tributaries, which allow the practice of various fishing modalities, especially the capture of the Amazon Shrimp, *Macrobrachium amazonicum* and the tambaqui, *Colossoma macropomum* fish farming. The region in Marajó is notably vulnerable socially and economically, as it has one of the lowest Human Development Indexes (HDI) in Brazil. Thus, the path to the development of fish farming must first and foremost be through basic education, technical and vocational training (Tubino, 2008). For this reason, discussions about fish farming are necessary in the curriculum of technical courses in agrarian sciences. The technical course in agriculture offered by the Federal Institute of Education, Science and Technology of Pará (IFPA), *Campus Breves*, currently offers the discipline of Aquaculture, which provides the training of professionals able to work in this area.

Students of the technical course in agriculture located in the Marajó Archipelago of waters and forests, when studying the discipline of Aquaculture, for example, become potential people to work in the aquaculture production chain, either as entrepreneurs, in technical consulting, in research assistance and/or in public agencies and private companies focused on fish farming. Thus, the objective of this

study was to describe the interest of the agricultural technical students in the aquaculture activity.

## Material and methods

The study was conducted at the Federal Institute of Education, Science and Technology of Pará (IFPA), *Breves Campus*, from April to June 2019. The Institute currently has a technical course integrated with High School in Agriculture, with a contingent of students from various municipalities of the Marajó Archipelago, according to data from the campus academic secretariat. This study consists of an experience report in the classroom during Communication and Rural Extension. It was possible to discuss issues related to agricultural activities, especially aquaculture in Marajó, Pará, Brazil.

The Marajó is bordered to the North by the Atlantic Ocean, east and south by the Pará River and to the west by a series of canals (IBGE, 2010). The Marajó has a territorial area of 104,140 km<sup>2</sup>. Archipelago is formed by a total of 16 municipalities: Afuá, Anajás, Bagre, Breves, Cachoeira do Arari, Chaves, Curalinho, Gurupá, Melgaço, Muaná, Ponta de Pedras, Portel, Salvaterra, Santa Cruz do Arari, São Sebastião da Boa Vista and Soure. The municipality of Breves is

in the portion known as the water and forest regions of the archipelago.

A total of 50 students from the technical course in agriculture integrated with high school (morning and afternoon) participated in the research. Data collection was carried out through a diagnostic analysis (Rodrigues et al., 2012). After the extension class, it was possible to analyze each diagnosis by students. Thus, the students dealt with the subject of aquaculture in the student formation, allowing a (re) construction of knowledge in which the experience is the center. It was possible to know and understand, from the student's perspective, how the construction of knowledge takes place, based on the experiences with the class. It was possible to understand the impact of aquaculture activities on the students' trajectory, which favors the exchange between the involved and their different experiences, stimulating the emergence of collective discussions in varied experiences, bringing a diverse set of information, according to Silva (2019).

The diagnosis presented several questions constituted according to the research objectives. The questions were directed to the theme of fish farming experience in the technical course. The students' answers included information about their affinity in relation to the fish

farming area; the interest in being a producer and which organism (s) would cultivate; the presence of aquaculture enterprises and the existence or not of public policies for production in the municipality of origin; and performance in the area of aquaculture.

It was possible to carry out socialization (conversation circle) with the diagnoses, adapted from Silva et al. (2019), between the researcher professor and the students involved, where the professor assumed the role of mediator. Each diagnosis read, the participants were invited to debate and, at first, the participants were shy, but throughout the readings and discussions of the issues raised, they were more comfortable, which allowed for greater concentration. Topics related to the fish farming production chain and the students' experiences in the Marajó region were discussed. This was a qualitative study, classified as descriptive-exploratory. The results of the research obtained from the diagnostic analysis and scientific literature.

## **Results and discussion**

In the present study, 60% were male and 40% female. Participants' ages ranged from 15 to 17 years. People at that age have the potential to be in high school (IEPA, 2010). All students were born in

Pará, prevailing (100%) people born in the Marajó region, which includes the municipalities of Bagre, Breves, Curralinho, Melgaço and Portel. IFPA *Campus* Breves is a renowned educational institute in the Marajó Archipelago, Pará. Since its foundation, it has been serving students from various municipalities in its area (Afuá, Anajás, Bagre, Breves, Chaves, Curralinho, Gurupá, Melgaço and Portel). This institution practices professional and technological education through teaching, research and extension, articulating the knowledge and socio-cultural diversity, for the formation of citizens committed to the sustainable development of Marajó.

Regarding the students' opinion regarding the importance of aquaculture within the technical course mentioned in the diagnostic, 95% agree that the theme is necessary, 2% think it is unnecessary and 3% did not opine. Aquaculture is understood as an agricultural activity (Garutti, 2003). This activity is necessary in the technical courses in agriculture, because it is inserted among the competences of these professionals, which is foreseen in Resolution CEB No 4, of December 8, 1999 (CEB/CNE, 1999). The students demonstrated that aquaculture is important both for the basic knowledge of the technicians in agriculture and for the professional performance of the technician,

which corroborates the recommendation of the aforementioned Resolution.

Regarding aquaculture as a discipline on the part of the students, all participants answered. Seventy percent (consider deleting - and 70%) considered the discipline excellent, 20% good, 5% fair and 5% bad. Despite being rated good or excellent by most students, the majority of respondents (80%) say they have little affinity for the area and only 20% say they have affinity for the aquaculture. Regarding the interest in aquaculture, 70% of respondents indicated they had not have not thought about it, but are interested in it and only 30% intend to follow in the area. This low rate may reflect the lack of affinity shown by most students.

Regarding the aquaculture industry, all (100%) of the students stated categorically that they worked in fish farming. According to a student "... fish farming, it comes with great relevant information about the characteristics of fish in our region, but we need to know the real need of fish farmers ...". (Agriculture 1 year/Morning, 16 years old); "... Because we only attended a communication and rural extension class, we had the opportunity to discuss fish farming in our training, it is very important to understand this range of options to act (Agriculture 1 year/Afternoon, 17 years student); "... I

had the opportunity to meet some fish farmers here in Breves, and their fish production in a nursery excavated ...". (Agriculture 1 year/Afternoon, 16 years student); "... here in Marajó there are many active fish farms with a well-developed production, but there are producers who stopped working due to lack of resources or had no technical support for the development of the activity ...". (1st year c Agriculture lass/Late 15 years student); "... before entering the agricultural course, I researched about the professional's performance and fish farming is one of them, I got to know about the equipment that used for oxygen production ...". (1st year Agriculture/Morning, 17 years student).

Students' opinions point to aquaculture as a promising activity for Marajó, for they possessed having knowledge about the real situation of this activity in the region. According to Brabo (2014) fish farming in Pará stands out with great growth prospects in northern Brazil. Fish production from fish farming in Pará is developed by small, medium and large-scale aquaculture farmers, as well as family farming, extractivists and riverine farmers (Aizawa et al., 2014). The production system of the enterprises in Marajó has been developed both monoculture and polyculture (Silva et al.,

2018). It is noteworthy that in the municipalities of Pará the native species tambaqui (*Colossoma macropomum*) and the exotic tilapia species (*Oreochromis niloticus*), are highlights for the creation (Brabo et al., 2014; Silva et al., 2017; Viana et al., 2018; Castro et al., 2019).

The low interest for the development of other aquaculture activities by students may be related to the lack of information about the realization of these breeding in the Marajó region and the low representation of the production of these fishery resources. In Pará, the shrimp farming activity (Tavares & Santos, 2006), oyster farming (Sampaio et al., 2017) and turtle farming (Silva et al., 2012), has been practiced. These activities do not show a significant and regular production to supply the market needs. They are more a subsistence character, being unprofitable for those who develop it (Macedo et al., 2016).

In the diagnosis, they highlighted the existence of some type of aquaculture in their municipality, 60% of respondents answered that there is, 10% that does not exist and 30% could not inform. The lack of knowledge about the presence of enterprises in their place of origin may reflect the lack of job prospects and, consequently, the student's low interest in fish farming. According to Silva (2019),



there are 80 aquaculture producers in the Marajó Archipelago.

They pointed out an extremely important issue about public policies for fish farms in the municipality of students such as the National Program for Strengthening Family Farming (PRONAF), 20% said there was no such policy, 20% said they knew the policies existed for producers, 60% could not inform, due to lack of knowledge. The students who answered to know the existence of public policies, declared that there was through technical assistance and financial incentive to the producer. The student in this area of knowledge needs to understand the productive chain in fish farming (please indicate why). To identify strengths (abundance of water, species, available land, favorable climate and family groups active in production), weaknesses (licensing to perform the activity, high prices and qualities of feed, fingerlings, training of producers and management of enterprises), opportunities (institutional partnerships to strengthen activity, job creation, income and development in the region) and threats (abandonment of creation and possible investment cuts) (Bush et al., 2010; Da et al., 2011; Osmundsen et al., 2017; Lima et al., 2018).

Regarding the performance in fish farming, 30% of the students answered that they would act, 20% would not act and 50% could not inform. Regarding the students who would work in the area, the main reasons for choosing would be related to the existence of fish farming in the region and being considered a promising activity. Fish farming is a promising and growing activity in the country and in the world (FAO, 2016; 2018; Peixe BR, 2018). As for the students who stated that they would not work in the area, the main justifications were related to the lack of affinity with the area and fear about the profitability of the sector. This is worrying because the region has natural resources available for breeding (Silva, 2019), and the technicians in agriculture are fundamental manpower to leverage the activity in Marajó, and should be enthusiastic for the development of the aquaculture sector. The current situation of agricultural production may also be contributing to the students' lack of interest in fish farming; the lack of tradition of aquaculture activity in Marajó may be a determining factor for the decision of respondents about acting in the aquaculture sector.

Pará has a tradition in beef production, which is the largest agricultural production in the state (46%),

followed by cassava (11%), milk (6%), black pepper (4%) and corn grain (3%), disregarding aquaculture production (Tsunechiro & Coelho, 2009). Due to its high production, livestock is the most prominent activity in the state. For the fish supply, the state counts on the production from the fishing. According to the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), the state of Pará is the second largest producer of fishery fish in Brazil, behind only the state of Santa Catarina (IBAMA, 2007). The two activities together (fishing and livestock) dominate food production in the state of Pará, while aquaculture remains in a secondary position in production.

Paraense fish farming, as well as in Marajó has a subsistence character, practiced in several municipalities, with well diversified cultivation modalities, since the subsistence (De-Carvalho et al., 2013; Silva et al., 2017), not creating many jobs, so much so that the number of specialized technicians working in the sector is very low. Most people employed in the activity have low education and no specialization in aquaculture. Another major problem pointed to the development of aquaculture in the region is related to technological deficiency; the species with the highest potential for aquaculture are

migratory, causing difficulties with induced spawning technique, chronic feeding difficulties in the larval, post-larval and fingerling phase of the species (Petreire Júnior, 2001; Ostrensky & Boeger, 2008).

Given this scenario, the state's technical, technological and higher education institutions have, in recent years, offered various types of education in the aquaculture area. There are institutions such as the Federal University of Pará (UFPA), the Federal University of Western Pará (UFOPA), the Federal Rural University of Amazonia (UFRA), the Federal Institute of Education, Science and Technology of Pará (IFPA) and the Fishing School House, linked to the Bosque School Foundation (Brabo, 2014). Such institutions aim at training professionals with capacity to undertake the aquaculture business; bring the development of the sector to areas lacking qualified professionals; promote applied scientific research and train citizens who value ethics and sustainable social and environmental development.

Even with all the obstacles perceived by the students of the IFPA *Campus Breves* integrated technical course in agriculture, they were questioned as to how they intend to act in aquaculture. They highlighted the performance in technical assistance to fish farmers and acting as an

entrepreneur, with 30% and 70%, respectively. According to Silva (2019), the difficulties of aquaculture are related to the deficiencies and technical deficiencies of the sector in Marajó. The interest of future agricultural technicians in developing technical assistance and entrepreneurship activities in aquaculture may be decisive for the expansion of this activity in the region.

The lack of technical assistance mainly causes two problems: a) lack of planning and preparation of the producer and b) the use of inadequate or less productive techniques (Igarashi, 2019). The deficiency in technical assistance has been pointed as one of the great difficulties faced by fish farmers of the Marajó Archipelago (Souza et al., 2015; Silva et al., 2017; Silva, 2019), even though it is an additional opportunity for employment and performance of the technical professional in agriculture in the Marajó Archipelago, state of Pará, Brazil.

## Conclusion

The students of the technical course in Integrated Agriculture (IFPA), *Campus Breves*, highlighted that aquaculture is important for students area of expertise. Although most diagnoses have shown little affinity for the area, possibly due to the lack of knowledge about the development

of aquaculture in their municipalities of origin. The introduction of fish farming discussions in the curriculum matrix of the technical course is necessary to add to the options of action of this professional, contributing to the development and expansion of aquaculture activity in Marajó. Aquaculture is an agricultural activity that has not yet stood out in the countryside, due to the strong culture of extractive fishing in the Marajó Archipelago, Pará, Brazil.

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