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OSTREICULTURE IN THE EXTREME NORTHERN ISLANDS OF PARANÁ COAST

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ABSTRACT

The extreme northern islands of Paraná Coast are populated by impoverished communities that see in the ostreiculture as the main alternative for income generation, but little is known about the conditions of cultivation and commercialization practiced by these families. In this context, in order to know the factors that interfere in the development of this activity, a descriptive exploratory research was conducted between July 2017 and January 2018, with interviews by accessibility and receptivity with 30 oyster producers. The study revealed that oyster farmers are an average 35 years old and they were characterized by low use of production technology, with the removal of the seeds for cultivation in an extractive way and the cultivations were performed only with the family work force. The difficulty of developing activities in a collectively way, and the low demand for oyster in the winter season are the main limiters in the development of the activity. It seems that the limiting factors could be softened as the communities strengthened their social force, especially the capacity of collective organization, which could result in a greater bargaining power with other social factors involved in the oyster production chain in the extreme northern of Paraná Coast.

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INTRODUCTION

Brazil has a huge coastline bathed by the Atlantic Ocean with 8,400 kilometers, which has not yet been efficiently exploited by aquaculture, and the fish consumption has been growing steadily in the country. The growth of aquaculture in the last decade in Brazil was 23.8% per year, while world aquaculture increased 10.2% per year, revealing a great potential for commercial exploitation (Simona and Silva, 2006; FAO, 2007; Ibge, 2013). According to Ibge (2013), aquaculture in Brazil generates approximately R\$ 3 billion annually, from this number R\$ 765 million was generated by shrimp farming and R\$ 58 million by mollusks culture. Nowadays, the mollusks

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cultivation represents 4.8% of national aquaculture production, mostly concentrated in the southern region of Brazil with 12.5 thousand tons, which represents 95% of the total production (Marenzi *et al.*, 2011), and in these regions this culture is an important alternative of income and survival for artisanal fishermen. The Paraná Coast is located on the southern coast of Brazil and has an extension of 105km, presenting two bays: the estuary complex of Paranaguá and Guaratuba Bay. The estuary complex of Paranaguá, is located in the north of Paraná Coast, and has two distinct micro regions, the first near to Paranaguá and Pontal do Paraná, where there is a good flow of tourists and therefore, fish production is more easily commercialized. The second micro region, is located at the extreme northern of Paranaguá Bay, covers the cities of Paranaguá and Guaraqueçaba, and due to the distance from the urban areas, fishing communities have greater difficulty in developing income sources especially related to commercial issues (Bigarella *et al.*, 1978; Anacleto *et al.*, 2017).

The extreme northern region of Paraná Coast has an estimated population of approximately 8,000 inhabitants, shared in about 20 localities along the Paranaguá Bay and Guaraqueçaba (Anacleto *et al.*, 2017; Ipardes, 2017). It is important to mention that this region has abundant oyster-growing waters in terms of salinity, average water temperature, free from harmful and polluting substances, and also it is highlighted that native oysters have high fecundity and accelerated growth in the region, being the most cultivated ones belonging to the genus *Crassostrea*, which has greater economic interest due to the meat nutritional value, and the use of the shell as raw material for handicrafts, animal calcium source and the use as soil fertilizer (Simon and Silva, 2006). The extreme northern regions, as well as all the Paraná Coast, the oysters of the native species *C. rhizophorae* and *C. brasiliiana* that are fixed in rocky parts, as well as those are fixed in mangrove roots are the preferred ones for cultivation. The species *C. rhizophorae* is commonly known as "stone oyster" or "mangrove oyster", and can reach up to 10cm in height. And the species *C. brasiliiana* is called "bottom oyster", being able to reach 20cm of height, being considered a great size species. Because of their ease of production, the oyster exploitation became attractive in Paraná Coast, then the inhabitants began the cultivation. (Nascimento, 1983; Absher and Silva, 1997; Simon and Silva, 2006). The oysters are mollusks attached to a shell, referring to the Ostreidae family and have reached interest in estuarine communities where they are easily located in banks in the infralittoral region and between tides (Absher and Silva, 1997; Simon and Silva, 2006). According to Absher and Silva (1997) in coastal areas, as in the case of Paraná State, there is an easiness in catching these mollusks in regions below the tide level. The formations of the natural banks end up making the oysters easily accessible, resulting in an abundant extraction by the region population, which also facilitates the cultivation. Absher (1997), Simon and Silva (2006) and Anacleto *et al.* (2016) say that despite the fact that oyster cultivation is relevant to these family survival, there is a scarcity of information, especially related to the cultivation of the most distant communities in relation to the quantities of seeds captured from the natural environment, so that is justified the urgency of studies that could diagnose the economic, social and environmental issues related to the cultivation of oysters in these communities farther away from the consumer centers.

The cultivation in the extreme northern islands, despite being facilitated by the geographic condition, has limitations in terms of commercial capacity, since the access only occurs by sea and often by small boats, which greatly limits the action of the harvest transportation due to the fact that the producers are all small producers, and most of the time do not have structure and technological resources to transport production (Anacleto *et al.*, 2016). Although the region is known for its fishing activity since the beginning of the Paraná colonization, nowadays according to Simon and Silva (2006) and Anacleto *et al.* (2016) it still shows the human development index (HDI) in only 0.587, considered one of the lowest ones in Paraná State, being urgent the need for proposals that focus the sustainable development of these impoverished communities. Thus, aiming at a better understanding of the factors that affect this familiar activity in the production and trade of oysters in the extreme northern islands of Paraná Coast, the research sought to: a) organize a socioeconomic survey of the oyster farmers that live in the extreme northern of Paraná Coast; b) describe a characterization of the activity of cultivation and

trade of oysters in the region; c) promote an analysis of the implications and potentialities related to this economic activity described in the interviewees' perception.

MATERIALS AND METHODS

An exploratory and descriptive research was carried out between July and November of 2017, using face-to-face interviews with 30 oyster families that live in the communities of Almeida, Ponta do Lanço, Tromomô, Medeiros, and Ilha Rasa, all located in the extreme northern of Paraná Coast. In order to verify the factors that affect these families in the production and trade of oysters, semi-structured questionnaires were applied to a member of the family. The oyster farmers' perception related to the main problems faced by them was obtained through the qualitative approach, and the data were initially obtained individually. In order to investigate the main problems in the perception of oyster farmers, the interviewees described the 5 most important factors, categorizing them hierarchically (1 to 5), and then it was performing the interpretive and descriptive analysis of the contents. After this phase, an impact matrix was organized according to Anacleto *et al.* (2017), this matrix according to the authors, assigns percentage values from 0 to 100 to each opinion expressed by the interviewees, first individually and then the subsequently information was crossed and checked in a collective manner, comparing the influence practiced and received on the activity income generation, so the higher the index, the greater the relevance and the attention to be devoted in solving the problem.

The impact matrix generates an index of relevance (importance to the development) that can be obtained by the equation:

$$IR = \frac{InRn * InPn * 100}{\sum SIsp}$$

IR= Relevance Index of the evaluated situation;

InRn = Index of received influence;

Inpn = Index of practiced influence;

SIsp= Indexes Sum (InRn* InPn) of all questions analyzed by the participants.

RESULTS AND DISCUSSION

The artisanal fishermen located in the extreme northern of Paraná Coast are characterized, mainly, by the simplicity of the technology adopted in the cultivation and by the low cost of the production that generally is accomplished with the family work force. The time of work dedication was on average six hours per day, varying from 3 to 6 days a week, and in most cases (83%) the cultivation activity was carried out by only one person of the family. The average age of the interviewees was 35 years, most of them women (53.33%). Regarding to technical training in order to develop their cultivation, only one producer had taken courses for the performance of the functions, and the rest of the interviewees developed the daily actions based on knowledge transmitted to the fisher by the elders in the community or some had the knowledge by the interaction with the neighbors and work partners. According to the interviewed producers, the most favorable and productive time of year to implant the crops is the winter, specifically from June to August, whereas the best time for sales occurred between December and February due

Table 1. External scenario diagnosis to the activity of oyster production and trade in the islands of the extreme northern of Paraná Coast in the perception of the interviewees (n = 30)

Threats		IR	Opportunities		IR
1	Lack of public power incentive	17,09	1	Financial return due to high customer demand	22,2
2	Bureaucracy to obtain cultivation authorization	17,09	2	An economic activity opportunity for the islands residents	16,7
3	Difficult work place	17,09	3	Processo de cultivo de fácil aprendizagem	16,7
4	Work place with difficult access	11,83	4	Production technologies adapted to local reality	11,1
5	Accidents at work	10,83	5	Process that can be carried out individually	11,1
6	Climatic instability	5,98	6	Increase in sales due to summer season	11,1
7	Prices competitiveness	5,12	7	Use of female labor	5,55
8	Oyster steals in crops	5,12	8	Possibility of expanding cultivation areas	5,55

Table 2. Internal scenario diagnosis to the activity of oyster production and trade in the islands of the extreme northern of Paraná Coast in the perception of the interviewees (n = 30)

Weaknesses		IR	Strengths		IR
1	Difficulty in working collectively	19,78	1	Income	35,3
2	Variable price in commercialization	16,48	2	Place of cultivation near the residences	17,6
3	Difficult access to outlets outside the islands	15,38	3	Culture related to oyster cultivation	11,8
4	Need to take the oysters out early for sales	13,18	4	Ease of handling equipment	11,8
5	Lack of suitable seeding equipment	9,89	5	Ease of sales due to summer season	5,88
6	Lack of suitable boats for cultivation	6,59	6	Autonomy to choose the working days	5,88
7	Shortage of oyster seeds	6,59	7	Family supply	5,88
8	Unprotected cultivation subject to thefts	4,39	8	Domain of cultivation technology	5,88

to the greater amount of tourists in the region. The most commonly used means of transport to travel to oyster culture was the motorized canoe (n = 60%), followed by the use of paddle boating (n = 30%), in these cases the average time of these oyster farmers displacement to their place of work was 32 minutes, according to the interviewees (n = 30). The value for commercialization varied according to the size of oysters and it ranged from R\$ 25.00 to R\$ 75.00 a box with fourteen dozen. Thus, the activity of oyster cultivation and commercialization, conferred to these families the average annual value of R\$ 1,700.00 to R\$ 5,000.00. All the interviewees developed multi activities in their properties, being hunting and the production of subsistence foods like cassava and rice part of the familiar activities, nevertheless all the oyster producers although they still practice sporadically, were already professional fishermen in the past. The stagnation of fishing activity along the Paraná Coast due to the over-exploitation of the vast majority of the available fish resources, through predatory fishing imposed to these fishing communities, especially those farther away from urban centers, a reality where schools were reduced and consequently the family income, which has led to the exodus of families to other regions and the massive abandonment of fishing activity.

In this context, as an income alternative in the extreme northern of Paraná Coast, oyster cultivation emerged, and the potential of the activity and its productive capacity has proved to be decisive for the future of the artisanal fishermen families who see an alternative of income based on the sustainability of the sea environments and they can remain in their places of origin. In this context, new proposals for strategic actions planned for these producers that are related to the concept of sustainable development and preservation of the environment should be studied, because this is the great challenge for these fishermen, thus it is urgent to reveal the limiting conditions in the process of development and exploitation of natural resources. The scenario of oyster production in the external context of the cultivated areas reveals a similar scenario and has already been reported in other studies (Simon and Silva, 2006; Anacleto *et al.*, 2017). Although all the opportunities reveal a promising scenario as

an alternative of income and development in this region, the contingent of threats acts in a limiting way, imposing to the families that are dedicated to oyster cultivation a hard condition, especially related to the function of the public power which should act as a stimulus to the activity in order to promote development and income (Table 1), but in the interviewees' perception, which interfere in the development of the activity is excessively bureaucratic procedures. The formalization of the cultivation towards environmental authorities is the great difficulty for the oyster producers due to too much bureaucracy, which creates difficulties for the oyster farming families and, many times, it makes the crops unviable, partly because of the constant need to travel to the urban areas which generates high financial costs due to distance, the need to pay the fees and also the long waiting time until the area of cultivation is authorized. In this context, similar to what was reported by Ferreira *et al.* (2017), for other income-generating activities on Paraná Coast, without incentives to the traditional families, they are often driven to the exodus to urban areas trying to have better alternatives for survival. The activity of ostreiculture is nowadays, an economic alternative classified as viable and sustainable closer to the professional and cultural reality of artisanal fishermen associated to remnants of traditional communities as also described by Simon and Silva (2006), and which may be the antidote against the strong exodus of the activity, but the study showed that the lack of producers organization, especially the difficulty to carry out activities collectively (Table 2) may be one of the slowing factors to the development process of the productive arrangement of oysters in the extreme northern of Paraná Coast. Although the study revealed that the interviewees considered collective activities relevant, some residents reported that there was already a fishing cooperative on Paraná Coast, but according to the residents, they found it difficult to join to the cooperative due to the divergence of the cooperative's management, the distance from the cooperative headquarter to the islands which was more than 100 km, and especially due to the fact that this cooperative did not work with the trade of oysters and shellfish, but only with the trade of fish and shrimps. The interviewees reported that the participation in a collective system could enable a fixed income with periodic delivery in a cooperative or even a

marketing association, but since it was not possible, it demanded that oyster sales should be made directly by fishermen. This situation resulted in direct sales to consumers being limited in part because fishermen did not offer a sales system with credit or debit cards, this situation favored the strengthening of wholesale brokers reducing producers' profit. Anacleto *et al.* (2017) described that even in the fish commercialization, even in the more distant producers, the money in their physical form is losing more and more space for credit and debit cards and payments made through electronic devices. Still according to Anacleto *et al.* (2017) in Paraná Coast, oyster traders should also consider other ways of receiving the payment, not only cash, since the convenience offered by non-physical cash payment is beneficial to both parts, both for whom sells, and for those who buy that has the agility and also security, but the distance from the continent and the difficulty of obtaining signal from telephone lines is still a big problem for these people. The impossibility of sale price standardizing given the irregular size of the oysters constitutes a serious problem according to the interviewees ($n = 100\%$), which determines a great variation in the price paid per box that varied from R\$ 25.00 up to R\$ 75.00, being the distinctive size of the oysters the reason for price differentiation. The lack of standardization at the time of commercialization, according to the interviewees, concludes that a significant proportion of oyster producers at the time of commercialization prefer to sell for slower price than the value that could be obtained, as a way to guarantee the sale in a more expeditious way. In this sense a collective organization could create standards for the pricing of oyster-size production, as well as promoting other actions such as acquisition of new production equipment, transportation of ready-to-sell product on a shared basis, reducing production costs and raising profit margins collectively. Anacleto *et al.* (2017) describe the need to establish a channel for dialogue between these communities who are residents from extreme northern of Paraná Coast, especially the oyster producers of the islands, along with government actors who are representatives of public institutions. The dialogue for rural development is essential, since the public power in Paraná can seek the solution of problems more easily if communities are better organized by raising their bargaining power, combining that government actors can act in a more decisive way in the search for solutions to problems and the fulfillment of the aspirations of these communities. The oyster cultivation in the extreme northern islands of Paraná Coast, in a general context, could be consolidated as a relevant alternative to contain the impoverishment of the communities of artisanal fishermen, who have few income alternatives, as well as positively promote the occupation of women and young people labor force who can contribute little to the formation of income in the local economy. From these processes of valorization of the female and young people labor force, the exodus to the great urban areas could be softened, however the consolidation must occur from processes of sustainable development that rethink the oyster crops as an alternative of development, but respecting the local culture as well as the regeneration dynamics of oyster species.

Final Considerations

The study revealed that in the general context the oyster producers located in the extreme northern of Paraná Coast were on average 35 years old, and they were characterized by the low use of technology of production, with the withdrawal of the cultivation seeds in an extractive way, and the crops

were performed only with the family workforce. The totality of the interviewees developed multi activities in their properties, being the production of subsistence foods like cassava and rice part of the familiar daily activities, nevertheless all the oyster producers, although still practice of sporadic form, they were already professional fishermen in the past. In the external context of the properties, in the interviewees' perception the difficulty of legalizing new crops due to bureaucracy, and the lack of public power incentive are the main implications that hamper the development of the activity in the islands from extreme northern of Paraná Coast. In the internal context, the properties, the difficulty in developing activities collectively and the low demand for the oyster in the winter time are the main limiters in the development of the activity. It seems that the limiting factors could be softened as the social structure was strengthened, especially the capacity for collective organization, which could result in greater bargaining power with other social actors involved in the oyster production chain in Paraná Coast.

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