



Actors and effort of the artisanal harvesting of mangrove oyster *Crassostrea gasar* along the littoral lagoons Ebrié and Aby (Côte d'Ivoire)

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Abstract

This work characterizes the sector of oyster *Crassostrea gasar* on the Ebrié and Aby lagoons. It aims at collecting data on the sector of oyster. Which results would be used to find strategies for an optimization of the economical income of actors and a durable management of the sector. Thus, an enquiry was carried out near the oyster harvesters during 12 months (from May 2015 to April 2016). This investigation touched 80 oyster harvesters of which 39 in Assinie, 27 in Grand-Bassam and 14 in Azito. According to the results, the oyster harvesting is dominated by the nationals (87.5%). The foreigners Bennis, Ghanaians and Togolese are also present (12.5%). All age group and the two sexes are present in the gathering activity. The study records 61.43% of schooling within the nationals group. While the rate of schooling within the foreigners group is 60%. The sector records as many unmarried as married in foreign people. The unmarried proportion is 1.12 times higher than the married in national people. All actors practise other activities. The greatest number of pirogue exits was recorded in Assinie. Pollution, mangrove regression and oyster benches disappearance constitute the major problems encountered in the sector. In the three localities, the gathering can be described as artisanal. The activity of oyster gathering is important on the socio-economic level. However, the high effort of gathering, the mangrove regression and the pollution of the habitat of oyster constitute an obstacle for a durable management exploitation of the species.

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Introduction

Côte d'Ivoire has a dense hydrographic network (Girard and Sircoulon, 1968). In this network, the lagoons contain in addition to fish, much other species of which bivalves molluscs. Located in the mangroves (Diadhiou and Le Penne, 2000), *Crassostrea gasar* Dantzenberg (1891), is a bivalve mollusc commonly called mangrove oyster. This oyster is widely distributed on the African West coast, of Senegal in Angola (Niekles, 1995; Von Cosel, 1995) and also, in South America (Lapègue *et al.*, 2002).

This mollusc has an important economic potential. It's consumed by the coastal populations and the African cities residents (Ansar and Bashir, 2007). In the Countries like Senegal, Gambia and Benin, scientific are already leaning on becoming of oyster die. In Senegal for example, works on this species were pushed until culture tests. However, although taking a significant role in food security in Côte d'Ivoire, the oyster is still in margin of scientific community research subjects.

Indeed, the oyster sector is badly known and it's not meant by fishing direction. However, it constitutes an animal protein source and a considerable economic potential for the coastal populations.

In addition, it remains for these populations, an employment and subsistence source. The mangrove oyster *C. gasar* artisanal gathering is localized along the coastal lagoons Aby and Ebrié, in the localities of Assinie, Grand-Bassam and Azito. However, at the current state of knowledge, no scientific data treats actors' portrait of this halieutic sector. However, without measurement of control, a rise of the production effort could not only reduce the specimens size and captures (Vanga, 2001), but also, entrained an often irreversible degradation of the ecosystems concerned. Moreover, the fall of the artisanal halieutic production often caused competitions between native and non-native fishermen, carrying out very often to conflicts and even to an expulsion of foreigner fishermen of these water (Gourène *et al.*, 1999; Vanga *et al.*, 2002; Da Costa and Konan, 2005; Da Costa and Dietoa, 2007).

The present study on the oyster sector aimed to define the typology of the mangrove oyster exploitation in two lagoons of Côte d'Ivoire.

Material and methods

Study area

This study was carried out in Ebrié and Aby lagoons mangroves, from May 2015 to April 2016. These zones are characterized by mangroves and a narrow sand cord, separating them from the sea. Three localities were retained for the investigations. Assinie locality for Aby lagoon and Grand-Bassam and Azito localities for Ebrié lagoon.

The choice of these localities was made according to whether they record the greatest numbers of actors who are accessible all the year. The zones retained for the investigation are presented on the Fig. 1.

Collection and data processing

A prospection campaign was made on 3 months, from February to April 2015, it made it possible to make the cards of investigations.

The card related to verifiable and quantifiable information. In particular, ethnos group, educational level, nationality, the sex, matrimonial situation, gathering technique, conservation mode, oyster quantity gathered, average income by dugout or exit, number of undertaken activities and encountered difficulties. Then, a survey was carried out over 12 months, from May 2015 to April 2016.

The card was submitted to 80 oyster gatherers (39 at Assinie, 27 at Grand-Bassam and 14 at Azito) by direct question. The gatherers classification and the age bracket distribution were made respectively according to Vanga (2004) and Tah *et al.* (2009).

The data were processed with the Excel software. The proportions of the various studied parameters were subjected to a Chi² test to evaluate their significant level. The results obtained were consigned in the following figures and tables.

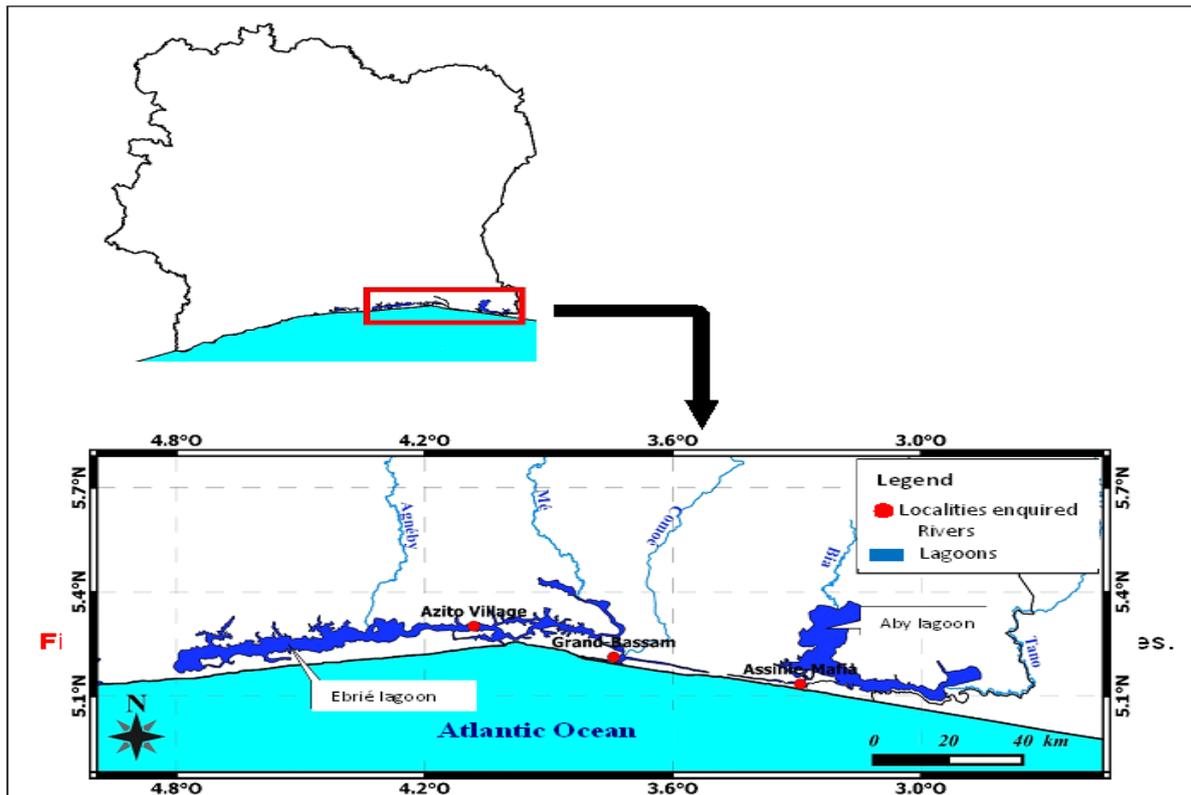


Fig. 1. Geographical situation of Ebrié and Aby lagoons with the enquired localities.

Results

Ethnic groups Involved

The investigation concerned 80 oyster harvesters including 39 at Assinie, 27 at Grand-Bassam and 14 at Azito (Fig. 2). In each locality (Assinie, Grand-Bassam and Azito), the harvesting is dominated by the native Ivorian.

All harvesters (100%) met in Assinie are Ivorian people and all are Essouma ethnoses. In Grand-Bassam, the activity is dominated by the native auto-ctones Abouré (48%) and Apollonius (33%). Then, come the non-native Ghanaian (11%) and Togolese (8%).

Table 1. Alternative activities associated to harvesting.

Activities	Assinie		Grand-Bassam		Azito	
	Number of Ivorian	Number of foreigners	Number of Ivorian	Number of foreigners	Number of Ivorian	Number of foreigners
Harvesting	0	0	0	0	0	0
Harvesting + scholl	11 (28.21%)	0	0	0	1 (11.11%)	0
Harvesting + fishing	2 (5.13%)	0	16 (72.73%)	3 (60.00%)	0	0
Harvesting + trade	17 (43.59%)	0	0	0	0	3 (60.00%)
Harvesting + fishing + trade	3 (7.69)	0	5 (22.73%)	0	0	2 (40.00%)
Harvesting + tourist guide	6 (15.38%)	0	0	0	0	0
Harvesting + phone box manager	-	0	0	0	3 (33.33%)	0
Harvesting +fishing + painting	0	0	0	2 (40.00%)	0	0
Harvesting + other trades	0	0	1(4.55%)	0	5 (55.56%)	0
Total actors who live only of Harvesting ¶	0	0	0	0	0	0
Total actors having other activities	39 (100%)	0	22 (100%)	5 (100%)	9 (100%)	5 (100%)

As for Azito, the harvesting activity gathers the native Ebrié (36%), Abouré (22%) and Abbey (14%) on the one hand and the non-native Bennis (14%), Ghanaians (7%) and Togolese (7%) on the other hand.

Distribution by sex

According to the Fig. 3, the non-native group records only the male sex in the oyster harvesting activity. That is not the case in native group which records the two sexes. However, the male sex is 1.5 times ($p < 0.05$) higher than the female sex (fig. 3).

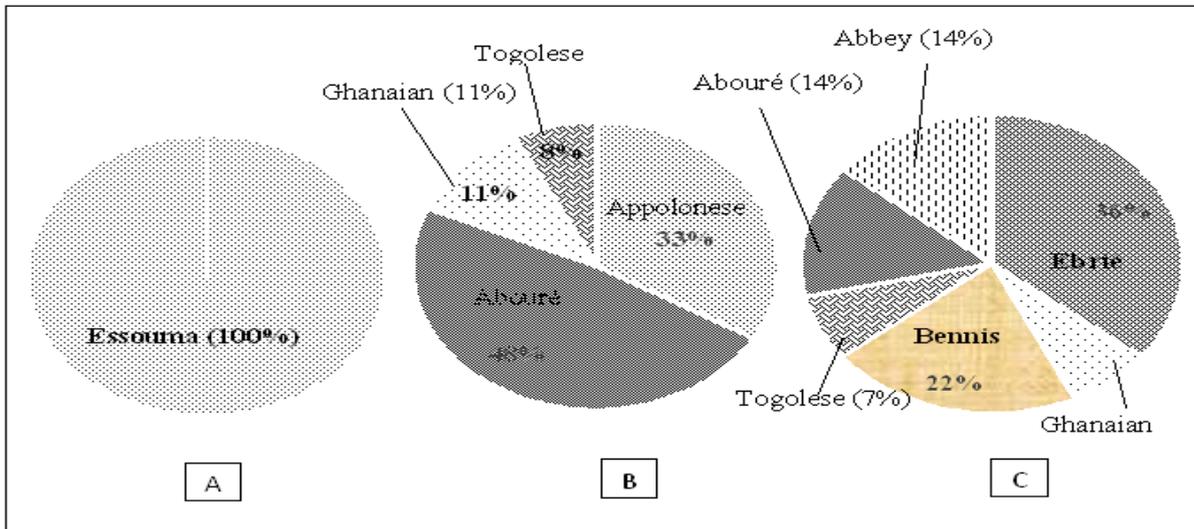


Fig. 2. Distribution of oyster harvesters by ethnics group in Assinie (A), Grand-Bassam (B) and Azito localities (C) (May 2015 to April 2016).

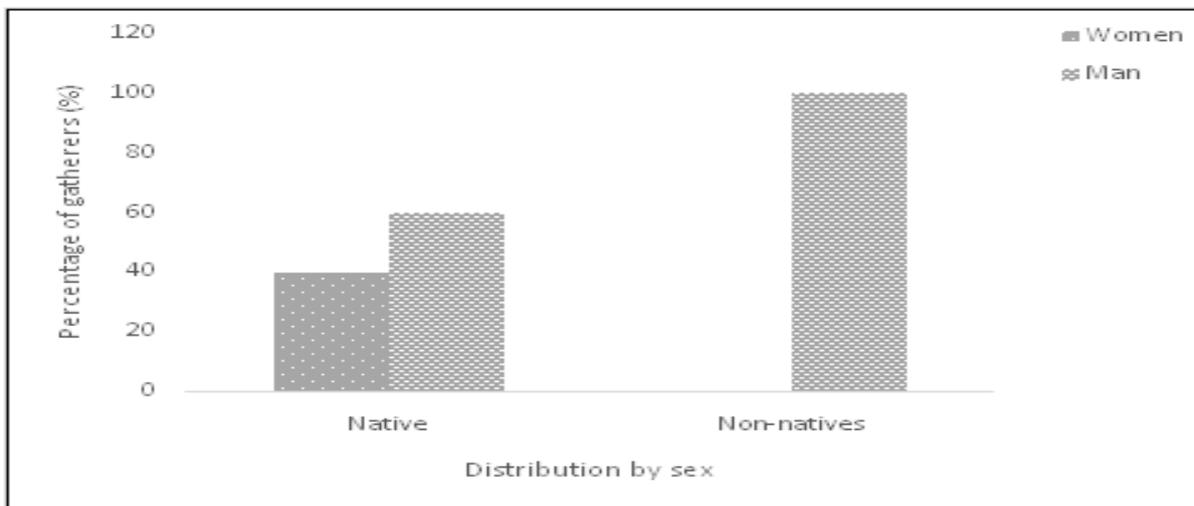


Fig. 3. Distribution by sex of the oyster harvesters listed in Assinie, Grand-Bassam and Azito localities of (native N = 70 and Non-native N = 10).

Distribution by age

The Fig. 4 presents the distribution of harvesters by age. It arises from the analysis of this figure that Ivorian are present at all ages in harvesting activity, contrary to foreigners which are announced only in the first 2 ages intervals (harvesters whose age is lower than 30 years and those whose age lies

between 30 and 45 years). Among the native, the harvesters whose age is included in the interval [30;45 years [are most numerous (54.29%). The proportion of this section is 1.41 times higher than that of the nationals whose age is lower to 30 years and 7.6 times higher than those whose age is superior at 45 years.

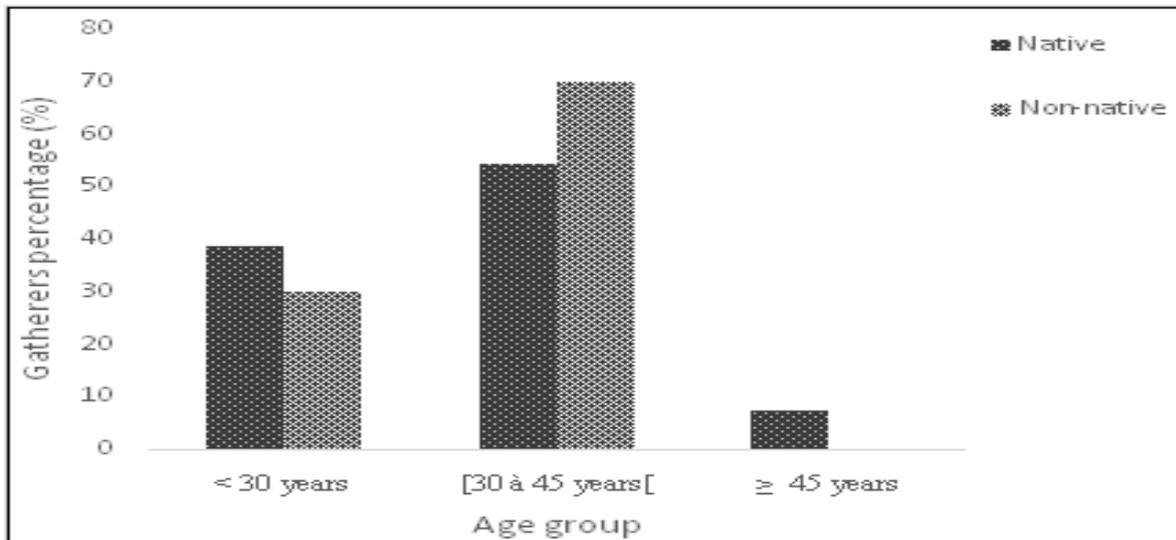


Fig. 4. Distribution by age group of the oyster harvesters listed in Assinie, Grand-Bassam and Azito localities (N = 80).

The proportion of non-native whose age lies between 30 and 45 years is 2.34 times superior to that of those whose age is lower than 30 years.

Matrimonial situation of the actors

The investigation records as many unmarried (50%) that married (50%) in the community of non-native harvesters. So in native group, the unmarried are 1.21 times higher than married group (Fig. 5).

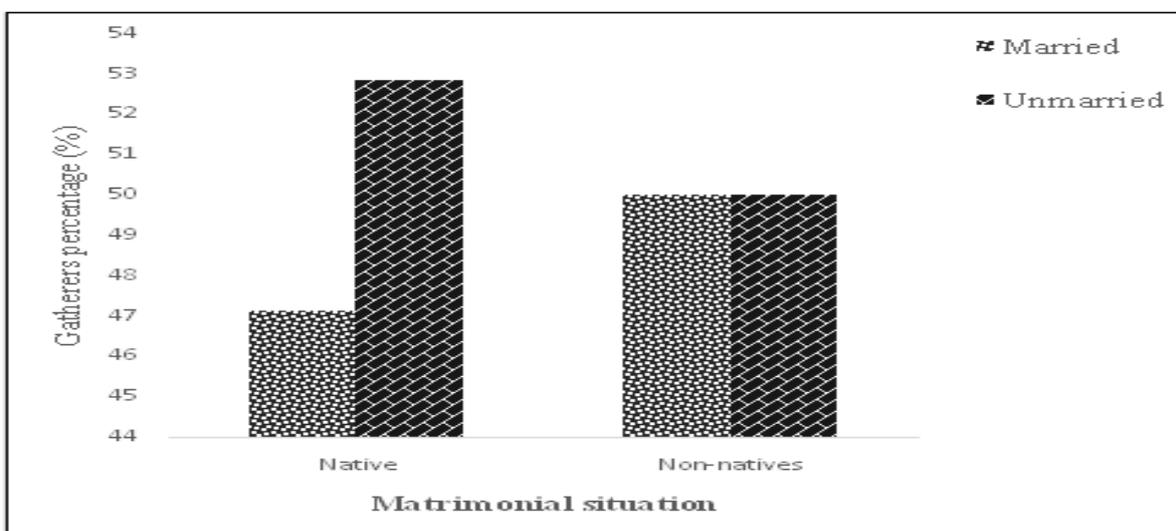


Fig. 5. Distribution by matrimonial situation of oyster harvesters (native: N = 70 and non-native: N = 10).

Actors educational level

The native harvesters record 61.43% of schooling in which, 47.14% have a primary education level, 12.86% a secondary level and 1.43% a university level. Among the non-natives, the rate of schooling is 60% and all have primary education level (Fig. 6).

Alternative activities associated to harvesting

In the three enquired localities (table 1), all actors practice in addition to harvesting, and other activity. The majority of foreigner practices in addition to harvesting, the fishing, the trade or the painting. Among the national actors, 17.14% are pupils, 25.71% fishers, 24.28% trader and 11.43% are fisher and trader at the same time.

Always among the Ivorian harvesters, 8.57% are tourist guide. The remainder of 12.86 % are between phone box manager and other small jobs. However, in season of harvesting, the actors of Assinie and Grand-Bassam localities make of the gathering, their principal activity.

Number of pirogues exited per month

Among the three localities (Fig. 6), Assinie records the greatest number of pirogues exited per month for investigation period, with a maximum of 121 in September. Then comes Grand-Bassam, 81 pirogues in September and finally Azito, 24 pirogues in February.

In Assinie and Grand-Bassam localities, harvesting is seasonal and is mainly between June and December. In Assinie, harvesting activity stops after the season of Harvesting. This is not the case of Grand-Bassam which records sporadic exits of pirogues out of the aforementioned season. The number of pirogues which exits per month in Azito evolves inversely to that of the first two localities. During the investigation period, it remained by far weakest (<30 pirogues) with the low frequencies between June and October (<20 pirogues).

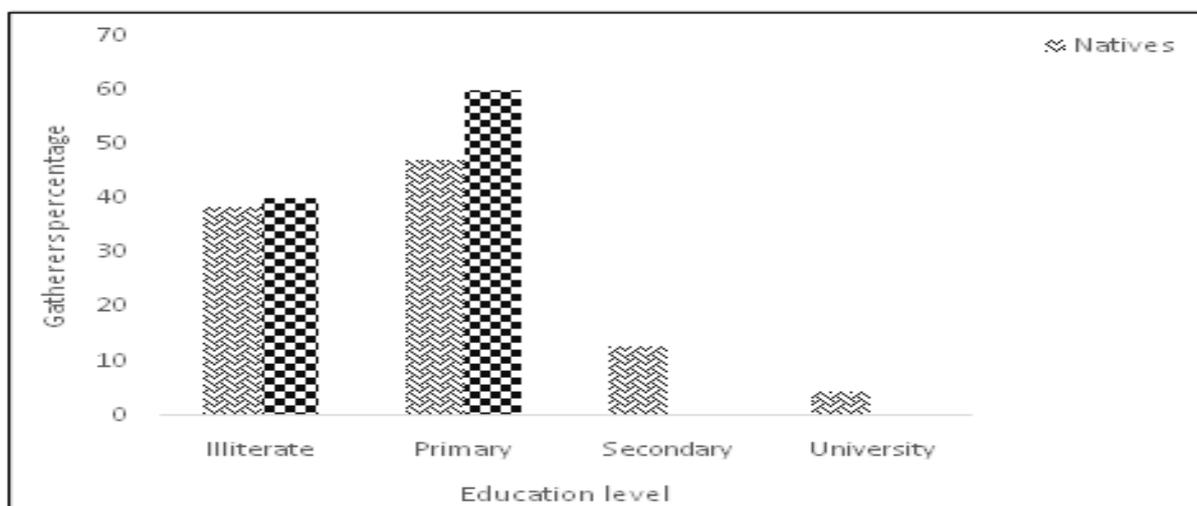


Fig. 6. Educational level of the oyster harvesters in Assinie, Grand-Bassam and Azito localities (N = 80).

Organization of harvesting

In the three localities, the harvesting is done either with naked hand or with the hand covered with sock or glove to avoid the possible notches caused by the blade of the oyster valves. No form of associative organization is recorded in practice of the activity of harvesting. Except Assinie, where a regrouping is observed among women right before leaving on water for the gathering. Indeed, the women divide themselves into group of three per pirogue. Generally, the choice of the groups takes account of neighborhood and blood bond. Thus, each group rents a pirogue and is accompanied by a boatman. The pirogue is divided consequently into three compartments including one for each woman. Once returned at village, the booty is managed individually.

Women return to remove oysters from their shell by heating into vapor. Then, they sell them fresh or smoked. In the three localities, one or two men to more go per pirogue for the harvesting. However, in Grand-Bassam and Azito localities where the activity is entirely male, the oysters are sold fresh, with or without shell just after harvesting. In these two localities, the sale is done in the empty limps of tomato (2 dm³ of dimension) at 2000 F CFA the box without shell and 100 F CFA the limps when it's sold with the shell.

In Assinie, the oyster fresh is sold without shell in the empty boxes (bonnet rouge) (capacity 158 cm³) at 100 F CFA the box. However, when it is dried, it is inserted in rods because of 20 oysters per rod at the same price (100 F CFA).

This last method of sale doesn't arrange the saleswomen in terms of income. In Azito, the exit of the gatherers is directly conditioned by customer order. Indeed in this locality, the harvesters go to gather only when they have orders to honor. Thus, the quantity of oyster gathered at an exit is closely related to the orders which result from this. However, in Assinie and Grand-Bassam localities, at each exit, the gatherers collect until the pirogue is full. In these two localities, the income by exit oscillates between 25000 and 30000 F CFA. In the three localities, every day is favorable to gathering except the Sunday which is voluntarily reserved at rest and at worship. Since the majority of the actors of this activity are Christian confessions.

Difficulties encountered in the activity of gathering

In Azito locality, the first difficulty announced by the majority of oyster harvesters is pollution, related to the industrial waste and the hospital institutions rejection in particular, the Hospital complex and University of Yopougon (CHU). This situation causes more and more distrusts of the oyster consumption. As regards the difficulties encountered in Grand-Bassam, the actors say to provide more and more effort and spend also more time before filling their pirogues. This, since the reduction of the mangroves in the favorable zones to gathering. Assinie remains the only locality which doesn't complain about any of the two problems referred to above. However, a common problem binds the three localities. They are problems of natural mortality whose causes are not known.

Discussion

In the various enquired localities, the activity of oyster harvesting is dominated by the nationals, generally native of the area. The forte presence of autochtones in this should permit to saying that they have a tradition of harvesting that is inherited from their ancestor. Work of Cormer-Salemin Senegal in 1989 on the sector of oyster had shown similar results. Indeed, according to this work, the oyster harvesting is an ancestral activity practised by the autochtones diola (Cormer-Salem, 1989).

In Côte d'Ivoire, the oysters were exploited by the coastal people for subsistence but especially for its shell which was used as binder in the cement for construction. More and more, the oyster started to be exploited on a purely commercial basis with the development of tourism and the reduction of the captures of fishing. The implication of the natives of all the age group in the gathering could be due to a perfect command of the activity which was transmitted from generation to generation. The presence of much young native in the die could be explained by the accessibility to oysters. Indeed, contrary to the fishing which is an activity requiring much effort and often dangerous, where the survival of the men depends on their courage, the quality of their equipment and their professional competence (Koffi, 1997), the oyster harvesting doesn't require a main physical effort. Since the oysters are localized in sand or the mud, at the bottom of water and a water depth seldom exceeding one meter. Moreover, the activity of harvesting is considered in the localities inquired like a juvenile activity. Adults and old men have been really interested by the harvesting of oyster because of the reduction of the stocks of fish and the financial difficulties due to the thin incomes of their activities. However, in the case of Senegal, the activity is practiced only by adult women or old women in general (Cormer-Salem, 1989). The same observation is noted in Gambia (Momodou and Ousman, 2011). However, in Côte d'Ivoire, the activity is dominated by men. All the women recorded in this study come from Assinie locality. That could be due to the fact that in this locality, the women are not associated to fishing activities. Indeed contrary to Grand-Bassam and Azito, where the sale of fished fish is partly devoted to the women, the sale of the products of fishing is ensured by the fishermen themselves in the case of Assinie. The permanent presence of visitors and tourists in this locality, permit to the large majority of fishermen to sell their fish themselves. In addition, the reduction in the captures of fishing and the fact that the men gradually gave up fishing for other activities, pushed the women to be turned to the oyster harvesting to fill the needs in protein of their family on one hand and the needs economic on the other hand.

The study records a weak presence of foreigner in the activity. That could be the result of mistrust due to the fact that their tutor have already the monopoly of activity and they wouldn't wish to have problems with them. The important rate of schooling recorded in the natives harvesters could be partly explained by the return at village of the young natives who have stopped school.

In addition, that could be due to the fact that the season of harvesting very often coincides with the school holidays. Lagoon people, they are just turned over to their origin activities which are the fishing and the gathering. Since these lagoon people don't have cultivable grounds. The activity of oyster harvesting is not practiced all the year and it records more unmarried than married in the natives group.

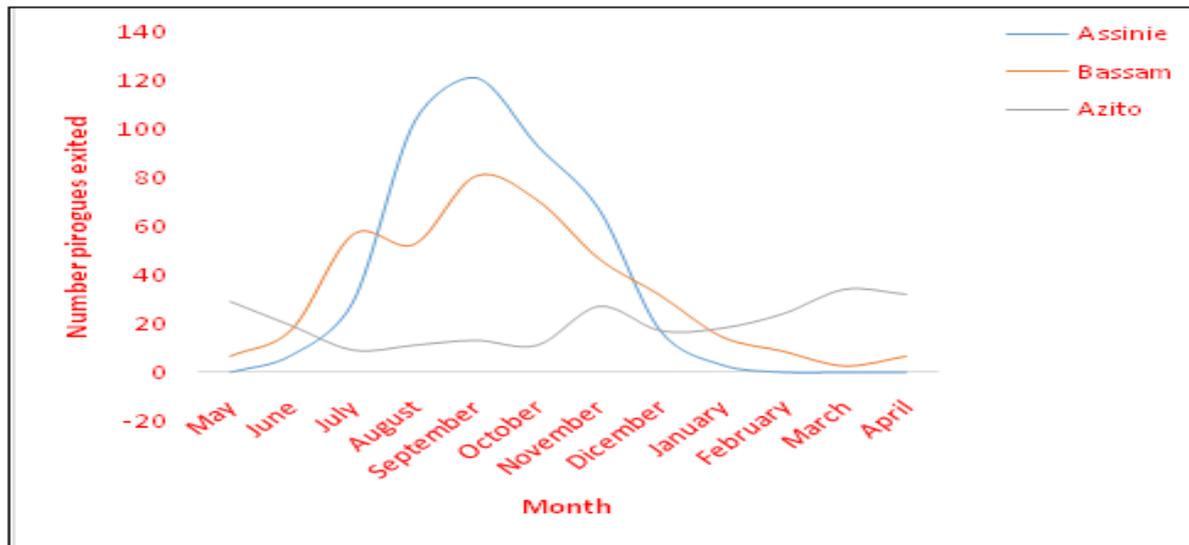


Fig. 7. Numbers of pirogues exited per month in the different localities (Assinie, Grand-Bassam and Azito).

The important presence of unmarried in the activity would be due to the fact that the products of the harvesting are easy to evacuate. Indeed, certain customers early come the morning to recover their order with these unmarried harvesters, very dynamic and excited by the profit.

Thus, this money enables them to have what to honour the daily needs this investigation shows that all the actors of the harvesting practice other activities.

This situation could be due to the fact that the oyster is not permanent all the year. Since in season of gathering, they practice only the harvesting. The small number of the pirogue exit recorded in Azito, would be due at the high level of pollution of Ebrié lagoon. Indeed, this lagoon directly receives the wastes industrial and urban and more particularly, those of hospital complex and university of Yopougon.

So, the customers of Azito prefer oysters of Large-Bassam and Assinie. That would explain in addition, the small number of harvesters recorded in Azito, at the image of its customers.

Conclusion

The characterization of the oyster sector in lagoons Aby and Ebrié permits to note that the activity of harvesting is in an artisanal condition and without associative organization. It is dominated by the national autochtones (87.5%). In particular, the Essouma in Assinie, the Abourés and Apollonius in Grand-Bassam and the Ebriés, Abbeys and Abourés in Azito. The activity records a predominance of adult in native people as well in the foreigner community. In Ivorian community, all age group are represented in particular, the harvesters whose age is lower than 30 years, those whose age lies between 30 and 45 years and those whose age is higher than 45 years contrary to foreigners which are present in the first two age groups.

These foreigners record a low educational level compared to the Ivorian community who has an education level of 61.43%. The male sex is 1.5 times higher than the female sex. Among the three localities, the effort of gathering per month for investigation period is higher in Assinie, with a maximum of 121 in September. The harvesting is done by diving and the oysters are gathered with the hand. No notable associative group is observed. This work gives a report on the typology of the oyster gathering in the lagoons Ebrié and Aby. Considering the socio-economic interest which characterizes this activity, it becomes important to take measures for a durable management of stocks. However, that could not be possible that by considering the species itself in particular, its bioecology for its breeding.

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