



PRODUCTION FACTORS OF AN ARTISANAL FISHERY ON A MAN-MADE LAKE IN COTE D'IVOIRE

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Abstract:

Fisheries management involves, among other things, knowledge of the actors and the catching gear used. These data are generally absent in the fisheries of Côte d'Ivoire. However, there is a strong fishing activity. To lead this study, surveys were conducted among fishermen and fishery administrators. The study of fishing activity in the area of Dioulabougou (Côte d'Ivoire, West Africa) in the district of Bouaflé done from November 2013 to February 2014 identified 88 fishermen. This population is composed of ivorians (39.77%) and foreigners (60.23%). The fishing activity is led by malians (Bambara ethnic group): 34.1%. Baoulé ethnic group (29.54% of ivorian fishermen) is the greatest ethnic group of ivorians. Two categories of fishermen stand in the fishing activity. We registered professional fishermen whose job is only fishing (84.1%) and professionals with another activity (4.5%). The fishing activity in Dioulabougou is dominated by adult aged more than 45 years (48%). Fishermen are predominantly illiterate at 42.04%. The fishing techniques used at Dioulabougou are conical fishing baskets (mesh and trunk of ronier), bamboo-traps, gillnets, bottom lines and shore seines. The illiterate situation of fishermen is a serious matter for sustainable management on fish's resources.

Keywords: *Actors; Fishing Gear; Sustainable Management; Kossou Lake; Côte d'Ivoire.*

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1. Introduction

The fishing resources are an excellent source of food and job providing in inshore areas. According to FAO (2010), fishing in tropical zones has already been considered as artisanal and of subsistence for the inhabitants. The techniques used were rudimentary therefore less destructive. However, the high demand in fishing products brought about economical stakes, with the emergence of new markets. Beside, artisanal fishery in fresh water in West Africa registered a noticeable development after the construction of several hydroelectric dams on the main water courses. In Côte d'Ivoire, many hydroelectric dams have been constructed, of which

that Kossou in 1971 which favored the creation of a lake of 900km²(PMEDP, 2007). An active and commercial fishing was established on the lake with firstly, the arrival of foreign fishers and secondly, the new interest of ivoirien in this activity due to the economic crisis, to the unemployment and the decrease of the cocoa and coffee price. The great success of this activity caused the decrease of catches (Vanga, 2001) and even brought about conflicts between ivoirien and non-ivoirien fishermen (Inza, 2008; Aboya, 2014). The work on the artisanal fishing site of Dioulabougou in the area of Bouaflé (Marahoué region), is an experimental diagnostic study of a fishing area which analysis will permit to know the artisanal fishing exploitation system on Kossou lake for a sustainable management of fishing resources. This study helped to describe fishermen communities and fishing materials in the area of Dioulabougou, on Kossou Lake.

2. Materials and Methods

2.1. Description of the Study Area

Dioulabougou is situated in the average course of Bandama River on the left shore of Kossou Lake. This site is localized at 20 km of Bouaflé city. It is between 7°05 N and 5°40 W (Fig. 1). On this site, we distinguish the camp of foreign fishers called “Mali” (at 50 m from the lake) and the native village of baoulé called “Agbanigbo” (at 100 m from the Lake). The houses are built with hard packed-surface covered by straws or black plastic bags. The fishing production on Dioulabougou site is done by 45 fishermen according to the regional direction of meat and fish resources of Marahoué of Bouaflé.

2.2. Sampling Method

For this study, a daily monitoring of fishing activities and a repeat-pass survey of fishers and their fishing technique in selected localities for this study were performed. The survey was conducted from November 2013 to February 2014 and took into account all categories of fishers. Previously, a preliminary survey was conducted in this study area from 4th to 11th October 2013. This survey allowed us to conduct an initial survey of fishers.

Subsequently, a questionnaire was administered to each fisherman for the following information: name, nationality, sex, date of birth, educational level, main activity, alternative activities, origin, religion, family charges, fishing financing mode and fishing materials. They also have interviews with authorities in charge of fishing management and direct field.

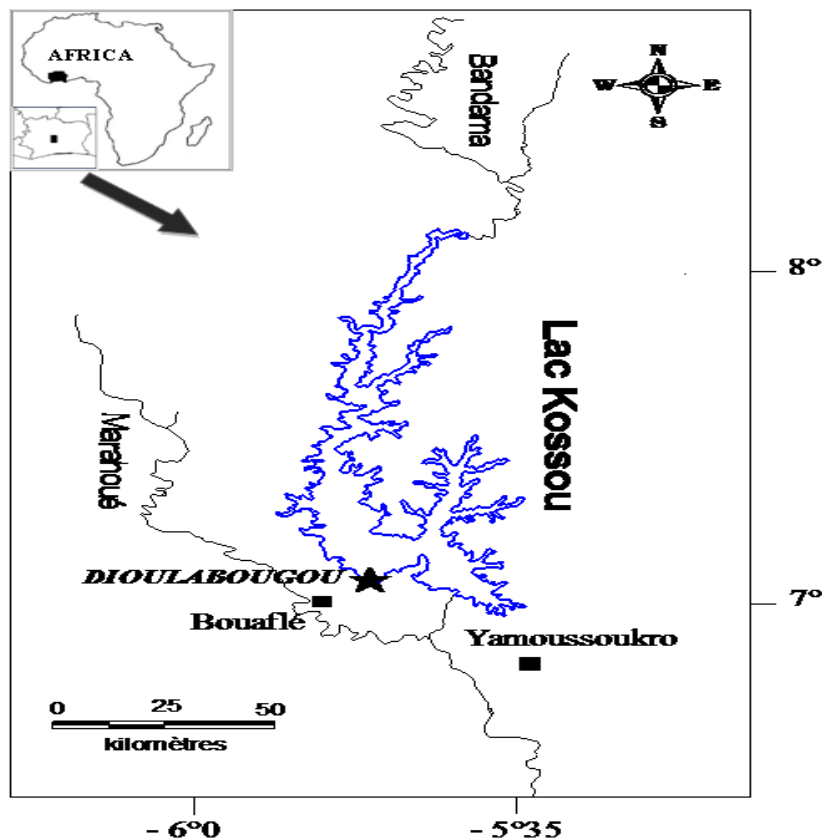


Figure 1: Localization of artisanal fishing area of Dioulabougou on Kossou Lake

Observations to verify the information gathered from the actors. The criteria for classification of fishermen, based on the time devoted to the fishing, the fishing activity financing mode, distribution of fisherman by age were based on those of Vanga (2004) and Tah, Da Costa, Kouassi & Moreau (2009). The distribution of fishermen by level of study and matrimonial situation was done (Boguhé, Gooré Bi, N'Zi, Yao, Kouamélan & Kouassi, 2011).

Excel 2003 software was used for the various data processing operations.

3. Results and Discussions

3.1. Results

3.1.1. Nationalities of Fishers

Fishing at Dioulabougou is done by people from five countries (Table 1). Out of 88 fishers registered, malians are the most numerous (51.15%). Ivorians are the second group with 39.77% of registered fishers. They are followed by burkinabes with 5.68%. Togolese and ghanaian represent less important rates with respectively 2.27% and 1.13%. Among the ethnic groups of fishers in Dioulabougou's area (Table 1), bambara is the most numerous. They represent 34.1% of registered populations. They are followed by baoulé (ivorian fishers) who represent a rate of 29.54%. mossi and bozo represent 5.68% each.

Table 1: Classification of Dioulabougou fishermen by nationality and ethnic

Nationality	Ethnic	Number	Percentage
Ivorian	Guéré	4	04.55%
	Senoufo	3	03.41%
	Gouro	2	02.27%
	Baoulé	26	29.54%
	Total	35	39.77%
Malian	Bambara	30	34.1%
	Bozo	5	05.68%
	Peul	4	04.55%
	Maraka	3	03.41%
	Kador	3	03.41%
	Total	45	51.15%
Burkinabe	Mossi	5	05.68%
	Total	5	05.68%
Ghanaian	Ashanti	1	01.13%
	Total	1	01.13%
Togolese	Aminan	2	02.27%
	Total	2	02.27%
Global total		88	100%

3.1.2. Age of Fishers

Fishing activity on Dioulabougou's area is dominated by fishers whose age is superior to 45 years (48% of fishers). Followed by fishers less than 30 years with 32% and those whose age is between 30 and 45 years with a proportion of 20% (Table 2).

Table 2: Classification of Dioulabougou fishermen by age, family status, number of persons in charge and study level

Parameters	Number	Percentage
Age		
<30 years	28	32%
30 – 45 years	18	20%
>45 years	42	48%
Family status		
Cohabitation	62	70.45%
Single	26	29.55%
Persons in charge		
any	3	4%
1 to 3	25	28%
4 to 7	14	16%
8 to 11	35	40%
12 to 16	11	12%
Study level		
Any	37	42.04%

Koranic	20	22.73%
Primary	14	15.91%
Secondary	17	19.32%

3.1.3. Family Status

The study of family status showed that all fishers of Dioulabougou are not married. However 70.45% live with their girlfriend (cohabitation) and 29.55% are singles (Table 2).

3.1.4. Number of Persons in Charge

Fishers of Dioulabougou registered take care of a least 8 persons. This number varies from zero to sixteen. 40% of registered fishers have in charge 8 to 11 persons. 16% of fishers have in charge 4 to 7 persons, while 12% said that they have between 12 and 16 persons in charge. The proportion of fishers having in charge one to three persons is 28%. Those who have no person in charge represent 4% (Table 2).

3.1.5. Study Level

Table 2 shows the classification of fishers according to studies level. According to this table, 22.73% went to Koranic School. Those who reached primary school are 15.91%. Secondary school fishers are 19.32%.

3.1.6. Professional Categories

Four categories of fishers work on Dioulabougou's area (Table 3). They are:

- 1) Professional fishers main activity is fishing. They practice this activity all year. Our investigations results showed that 25% of Dioulabougou's fishers are professional fishers. Among them, malians with a proportion of 17.04% are predominant. Followed by ivorians with 5.68% of this population. And the burkinabe and togolese with 1.14% each.
- 2) Assistant of fishers are persons who help professional fishers in their activity. They are inexperienced persons who learn fishing activity (children, brothers, friends and nephews). They are most often occasional workers of professional fishers or the master fisher. These assistant fishers (59.1% of fishers) are predominantly composed by malians with a proportion of 34.1%. Ivorians (22.73%) and burkinabe (2.27%) are the other representatives of this category.
- 3) Occasional fishers who constitute a category of fishers having another activity apart from fishing. They are farmers and gold diggers. They represent 11.37% of Dioulabougou's fishers and are divided into ivorians (9.1%) and burkinabe (2.27%).
- 4) Master fishers who are former professional fishers who moved into other activities namely gold exploitation. They represent 4.5% of Dioulabougou's fishers and employ occasional fishers who work for them. Ivorian fishers represent in this category 2.27%. Togolese and ghanaian represent 1.14% each.

3.1.7. Materials and Fishing Techniques

The fishing gears used by fishers of Dioulabougou are gillnets, conical fishing baskets, shore seine, bottom lines and bamboo-traps (Table 4).

- 1) The gillnets (Fig. 2) used by these fishers have mesh sizes between 20 and 55mm. They are 100m long a throwing height of 2 to 3m. These gillnets, rectangular, are vertically wetted in water, set between two floats of the superior headline and the sinkers of the lower headline. The double actions of the two headlines permit to keep the net vertically, creating a filtering fence which blocks fishes. They are set at 14 o'clock and removed the following day at 6 o'clock. The gillnets are used all the seasons.
- 2) -The bottom lines (Fig.3) are fishing materials containing a main line on which are fixed several fish hooks by the intermediary of trawls with 10cm of interval. Bottom lines are used the whole year. They are set in the afternoon and may stay in water 3 to 4 days. Frogs and some fishers are used as baits.
- 3) The conical fishing baskets identified on the site of Dioulabougou are three types.

Table 3: Classification of Dioulabougou fishermen by category and nationality

Category of fishermen	Nationality	Number	Percentage
Professionals fishermen	Ivoirian	5	05.68%
	Malian	15	17.04%
	Ghanaian	-	-
	Burkinabe	1	01.14%
	Togolese	1	01.14%
	Total	22	25%
Assistant-fishers	Ivoirian	20	22.73%
	Malian	30	34.10%
	Ghanaian	-	-
	Burkinabe	2	02.27%
	Togolese	-	-
Total	52	59.10%	
Occasional fisher	Ivoirian	8	09.10%
	Malian	-	-
	Ghanaian	-	-
	Burkinabe	2	02.27%
	Togolese	-	-
Total	10	11.37%	
Master-fishers	Ivoirian	2	02.27
	Malian	-	
	Ghanaian	1	01.14%
	Burkinabe	-	
	Togolese	1	01.14%
Total	4	04.5%	
Global total		88	100%

Table 4: Percentage and period of the use of different fishing gears

Name of gear	Popular name of gear	Percentage of used gears	Period of fishing
Gillnets (65 mm)	Djô	4.08%	drop + flood
Shore seine	Djôba	0.51%	flood
Conical fishing basket (mesh) (20 mm)	Papolo	15.3%	drop + flood
Conical fishing basket (grilling) (35 mm)	Papolo	1.53%	drop
Conical fishing basket (coconut wood)	Papolo	2.55%	drop
Bottom line	Hameçon	1.02%	drop + flood
Bamboo-traps	Bambou	75%	drop + flood



Figure 2: gillnet



figure 3: bottom lines

They are:

- 1) Conical fishing baskets in grilling with 35mm as mesh size. They are rectangular gears of 1.5m long and 1m width. It is used on the lake during falls of water level;
- 2) Conical fishing baskets in coconut wood, cylindrical about 1m long and 30 to 40cm of diameter (Fig.4);
- 3) Conical fishing baskets in mesh called "papolo", with meshes of 20 to 30mm of side. They is about 70cm long and 50 to 80cm of opening diameter (Fig. 5).These conical fishing baskets are baited with maize bran or cassava pieces and boiled rice. They are used during drop period and spate period and kept at the bottom of water by stones.
- 4) Bamboo-traps are pieces of bamboo entirely opened to an end and closed to the other with a tiny opening permitting water to flow (Fig.6). They are 0.5 m long in average with a diameter of 10 cm in average. The entirely opened side of the bamboo trap is slightly high and tied to a tree trunk. It is from this side that the fish enter and is caught by the trap. This gear is removed almost each two days. The bamboo-traps are used the whole year.
- 5) The shore seines are among collective gears. They are set and removed by a team of fishers. They are gear of almost 500 m long and 7 m height of throwing (Fig.7) and have a pocket in their middles. The superior headline contains floats while the lower headline contains small pieces of sinkers. The shore seines are used during spate period.
- 6) The canoes registered at Dioulabougou (153) do not have engines. They are made of flat pieces of nailed down wood. The canoe is 7 m long and is led by a paddle.



Figure 4: Conical fishing basket (coconut wood)



Figure 5: Conical fishing basket (papolo)



Figure 6: Heap of bamboo-traps



Figure 7: Shore seine

3.1.8. Staff and Fishers Experience

The fishing material increased during practical years. Fishers, who have a great experience, have got an important stock of materials. The number of fishers varied between one and four persons per canoe and it generally depends on the practiced activity. Thus, shore seines require more than two fishers. Many fishers, generally bozo, have already practiced fishing activity on other sites. The majority of Dioulabougou's fishers have a high experience in this activity. More than the half of fishers registered (68%) have more than 15 years of practice experience (Table 5).

Table 5: Classification of Dioulabougou fishermen according to practice experience

Number of years	> 5 years	5 - 15 years	15 - 25 years	25 - 35 years
Percentage	20%	12%	20%	48%

3.2. Discussions

Fishing activities on Dioulabougou area are dominated by foreign fishers (malians). This result is similar to those of Kponhassia (1996), Da Costa and Dietoa (2007) registered on Buyo, Taabo and Faé lakes. The low presence of ivorian fishermen on Dioulabougou may be explained by the disinterest for this activity because of the fear of water. Also, to the fact that ivorian actors are most attracted by consumption crops (cassava, bananas, etc.), of cocoa and coffee. The two last cultivations of annuity were part of the determination of social status of the population (Fabio, Njifonjou, Assienan, Kodjo, Ndia, Salvati and Seghieri, 2002).

Our results show that the fishing activities are dominated by fishermen whose age is superior to 45 years. This domination may be explained by the fact that fishing activity is physically luring

and dangerous where the survival of human beings depends on their courage and their professional competence (Koffi, 1997) and also on their experience in the activity. Therefore, they are fishermen having a great experience in the fishing activity they do. The high rate of schooling among ivoirien fishermen of Dioulabougou may be due to the young school leavers who became fishers. As far as concerned the classification of fishers by categories, malian can be subdivided into two sub-groups. The first sub-group is made of people whose only job is fishing. The second sub-group is composed of people used as workers by the first sub-group in the fishing activity. Concerning Ivoirien fishers, ghanaians fishers and togolese fishers, taking profits from annuity cultivations and panning for gold, they practice fishing the whole year. They are helped by young ivoiriens and burkinabes, that they pay thanks to the profits from the fish sale. This situation could be justified by the volunty of these actors to diversify their incomes in order to improve their living condition. The mesh, the bottom line, the shore seines, the bamboo-traps are the gears of fishing used on the Dioulabougou site. The fishing techniques noted on the site are similar to those described by Vanga (2004) on Ayamé Lake. The structure of the fisher's population may explain this situation. In fact, at Dioulabougou, the structure of the population shows a predominance of malians fishers in the fishing activity like in Ayamé lake, so the use of the same fishing techniques. Besides, Vanga, Bard, Gourène and Ouattara (2002) noted that gears like the shore seines, bamboo-trap may provoke the destruction of spawning grounds and the catch of *Chrysichthys* female which are egg laying.

The boats used by fishers on Dioulabougou area are essentially wooden-made canoes. The preference of this type of material is justified by the fact that big trees are hardly found. That is due to the deforestation for the creation of cocoa and coffee plantations. Canoes' makers buy sawmill woods. Moreover this kind of canoe has been made by fishing development projects, initiated on buyo and kossou lakes (Vanga, 2001).

4. Conclusion

The study of fishing activity at Dioulabougou allowed to know that fishing exploitation is under the control of malian inhabitant from bambara ethnic. Fisher's population is dominated by old persons. Malians fishers are all professionals. Ivoiriens, ghanaians and togolese practice agriculture and panning for gold in addition to fishing. Contrary to foreigners, a high level of instruction is noted among the ivoirien fishers. The fishing activity is characterized by five types of material that are: the gillnets, the conical fishing basket; the shore seines, the bottom line and bamboo-traps. The artisanal fishing at Dioulabougou site showed a lot of potentialities that should be developed and improved. For that, it is urgent that fishers organize in associations of cooperation to defend their interests face to the speculations of fish whole sellers in order to assure a better valorization of their production. This will permit to improve fishers living conditions.

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