

Analysis of the Fishing Effort and Production at the Dioulabougou Fishing Site (Lake Kossou, Cote D'ivoire)

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Abstract: The present study conducted from November 2013 to February 2014 was necessary for a diagnosis of fishing on the artisanal fishing site of Dioulabougou on Lake Kossou. The data collected revealed a fishing effort of 1.58 fishermen per km² and an average monthly production of 36.01 tons of fish at the Dioulabougou site. The highest production coincides with the low of the water level and the lowest production with the rise of the water level. These catches are dominated by the Cichlidae family (33.33%).

Keywords: Artisanal fishing, Catches, Fishing effort, Côte d'Ivoire, Man-made lake

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I. Introduction

Fishery resources are an excellent source of food and employment in coastal areas. According to the FAO [1], fishing in the tropics was considered artisanal and practiced for the subsistence of the populations.

Artisanal fisheries in freshwaters in West Africa have developed rapidly after the construction of several hydroelectric dams on the main rivers. In Côte d'Ivoire, many hydroelectric dams were built, including the Kossou dam in 1971, which favored the creation of a 900 km² lake [2]. Commercial fishing has started on the lake with the arrival of foreign fishermen and the new interest of Ivorians for this activity due to the economic crisis, unemployment and the decrease of cocoa and coffee prices. But this intense fishing activity contrasts with the lack of reliable data on fishing effort and fish catches in the fishery statistics for this lake.

This study presents a series of databases on the exploitation of these fish in order to increase knowledge about fishing in Lake Kossou. It aims to estimate fishing effort and total catch and analyze their monthly changes in the area of Dioulabougou, on the Lake Kossou.

II. Material And Methods

2.1 Study area

Dioulabougou is located in the middle course of the Bandama River on the left bank of Lake Kossou. This site is located 20 km from the city of Bouaflé, between 7°05 N and 5°40 W (Fig. 1). On this site, we can see the camp of foreign fishermen called "Mali" (50 m from the lake) and the village of the Baoulé natives called "Agbanigbo" (100 m from the lake). The houses are built in terracotta covered with straws or black plastic bags. Fishing production on Dioulabougou site is carried out by 45 fishermen according to the Regional Direction of the Animal and Halieutic Resources of the Marahoué-Bouaflé. This site was chosen because of the large number of professional fishermen identified by the Regional Direction of Animal and Halieutic Resources of Marahoué-Bouaflé.

2.2. Data collection

For this study, a daily monitoring of fishing activities and a repeated survey of fishermen and their fishing technique in the locality of Dioulabougou was carried out. The survey was conducted from November 2013 to February 2014 and concerned all categories of fishermen.

Previously, a preliminary study was conducted in this study area from 4 to 11 October 2013.

This last survey allowed us a first contact with the fishermen.

2.2.1. Survey of landing

Data were collected by observing fishing catches during landing. The number of active fishing units (FU) was noted at each port exit. For each active FU and voluntary, each fishing operation and several information were systematically mentioned. The catches were recorded for a sample of several fishing

operations so as to be representative. For each sample, the species name was identified [3] [4] and the number of individuals per species noted.

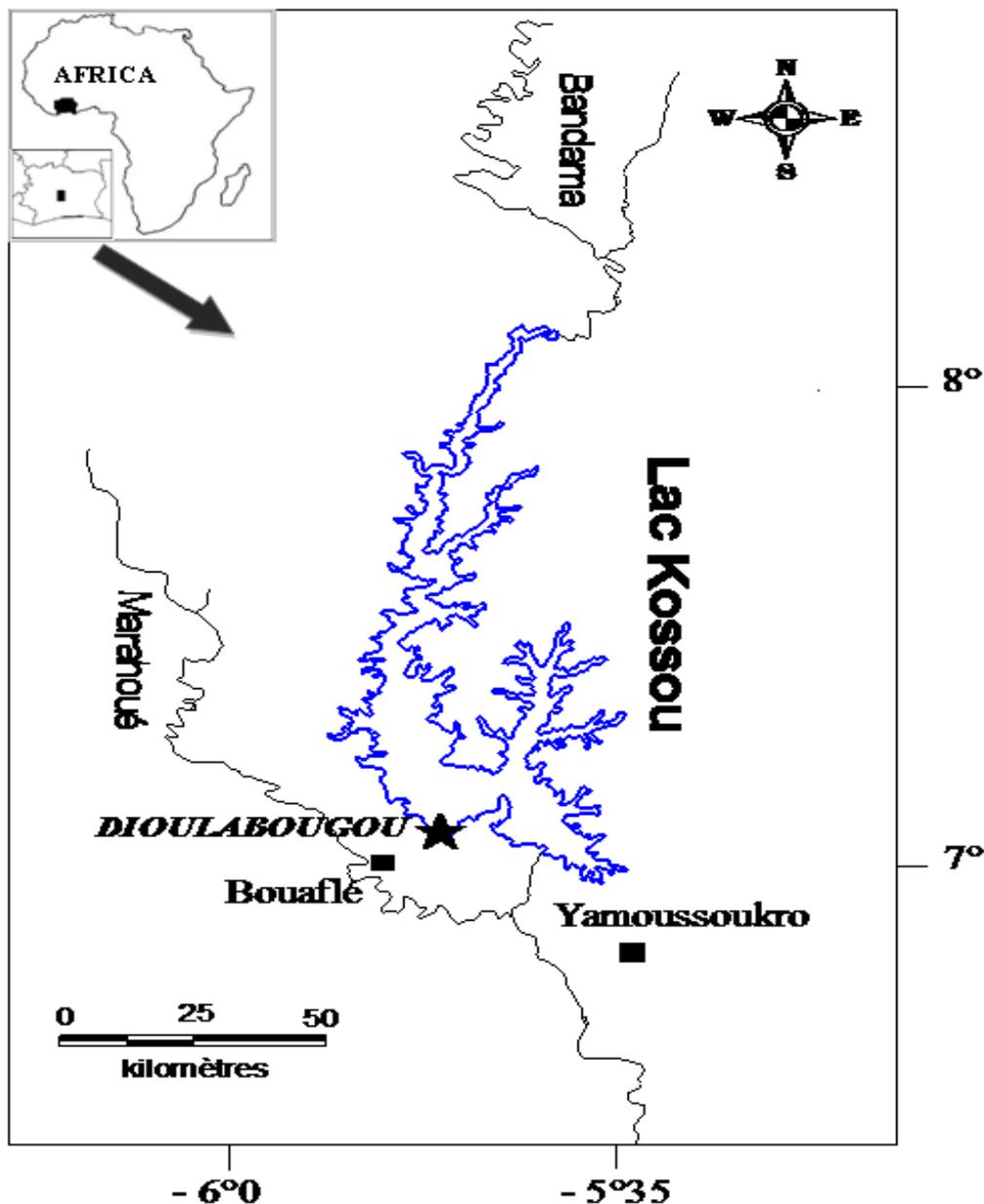


Figure 1. Geographical location of Dioulabougou artisanal fishing site at Kossou Lake.

2.2.2. Estimate of fishing effort

Failing to estimate specific fishing effort, knowledge of the number of fishing units or fishermen per unit area was used to estimate fishing effort. According to Laë [5], this variable remains the only index applicable to the heterogeneity of behavior characterizing tropical artisanal fisheries.

2.2.3. Production survey

This investigation consisted of the recording of monthly production statistics by the fishing services installed at the Bouafilé fish market. This production was determined by the weighing of the fishmongers who are sourcing from the Dioulabougou site. The total monthly weight of smoked fish is converted to fresh fish according to the following formula: $P_{fr} = 3 \times P_{fu}$ with P_{fr} = total monthly weight of smoked fish converted to fresh weight and P_{fu} = weight of smoked fish.

This conversion rate in force on the site, is the one used by the Tropical Forestry Technical Center (CTFT) which corresponds to 1 kg of fresh fish, 3 kg of smoked fish [6].

2.2.4. Statistical analyzes

The databases were developed on "EXCEL 2007" to allow the entry and processing of data collected during the different investigations.

III. Results

3.1. Fishing effort

Only active fishermen were taken into account for the unit of fishing effort. There are 84 fishermen. The surface area of the lake being 133 km², the fishing effort is estimated at 1.58 fishermen per km².

3.2. Total fisheries production

Total estimated annual production is 490.62 tons of fish caught in Dioulabougou. Production varies during the year depending on the seasons and the months. Regarding fresh fish, the highest production is noted in January (60.1t) and the lowest in August (2.8 t). The total production of smoked fish is greater in August (31.20 t) and has its lowest value in February (0.21 t). Cumulative production (fresh fish + smoked fish) records its highest value in January, with a total production of 60.73 tons. Then, it decreases to reach its lowest value at 04.71 tonnes in October (Table 1).

Table 1: Annual fish production statistics from Dioulabougou artisanal fishing site : (source: Bouaflé Fisheries Department)

Month	Production (tons)		
	Fresh fish (t)	Smoked fish (t)	Cumulative production (fresh + smoked)
January	60.1	0.63	60.73
February	54.9	0.21	55.11
March	55.7	0.36	56.06
April	49.9	0.54	50.44
May	38.5	03	41.50
June	34	09.90	43.90
July	31.5	06.30	37.80
August	2.8	31.20	34
September	3.01	29.40	32.41
October	2.97	0.58	04.71
November	19.8	1.74	23.40
December	50.2	0.36	50.56
Total	403.38	87.24	490.62
Percentage	82.22%	17.78%	100%

3.3. Main species on the landing stage

Twelve species belonging to eight families (Table 2) were found in the fishermen's landings during this study. The most abundant families in the catches are Cichlidae with four species (33.33%) followed by Claroteidae (2 species, 16.67%) and Clariidae, Cyprinidae, Osteoglossidae, Malapteruridae, Distichodontidae, Mormyridae (1 species, 8.33% each).

IV. Discussion

The fishing effort estimated in terms of the number of fishermen per unit area (1.58 fishermen per km²) remains below the standards set by FAO (two to three fishermen per km²) for this type of water body [7]. This low density is explained by the behavior of many fishermen who, at certain times of the year, engage in agricultural activities to offset the decline in catches. This lake could be considered as under-exploited by reference to FAO standards.

Fluctuations in catches could be due to hydrological variations of the lake. Thus, during the dry season (August, September, October, November and December), the flood of the manmade lake, due to the opening gates, we have low catches correlated with a lower catching effort. This situation is explained by the fact that at this time, most of the Aboriginal fishermen, who do not have a long fishing tradition, stop the activity for fear of drowning because of the high water level of the lake [8]. However, the gradual decline of water from January to July

Table 2. List of species identified at the Dioulabougou landing stage

Families	Genus	Species
Cichlidae	<i>Hemichromis</i>	<i>Hemichromis fasciatus</i>
		<i>Hemichromis bimaculatus</i>
	<i>Coptodon</i>	<i>Coptodon zillii</i>
	<i>Oreochromis</i>	<i>Oreochromis niloticus</i>
Cyprinidae	<i>Labeo</i>	<i>Labeo coubie</i>

Mormyridae	<i>Mormyrops</i>	<i>Mormyrops anguilloides</i>
Distichodontidae	<i>Distichodus</i>	<i>Distichodus rostratus</i>
Osteoglossidae	<i>Heterotis</i>	<i>Heterotis niloticus</i>
Malapteruridae	<i>Malapterurus</i>	<i>Malapterurus electricus</i>
Claroteidae	<i>Chrysichthys</i>	<i>Chrysichthys nigrodigitatus</i>
	<i>Auchenoglanis</i>	<i>Auchenoglanis occidentalis</i>
Clariidae	<i>Clarias</i>	<i>Clarias anguillaris</i>
Total : 8	11	12

coincides with the season of large catches as reported by Vanga [9]. According to this author, fishing activity is maximum during this period. This high intensity of fishing is linked to the influx of many seasonal fishermen and the massive use of gear such as bamboo-traps, fishing basket and shore seines which are active and low selective gear.

However, the total annual production estimated at 490.62 tons is lower than the actual landed. Indeed, a certain amount of fish borrows parallel circuits. It is essentially the leakage of fish by parallel markets and the fact that self-consumption is not taken into account in production statistics. This situation raises concerns about the reliability of fisheries statistics in African continental waters as reported by another authors [10].

The production recorded on this fishing site is dominated by fish of the genus Cichlidae. This same result was noted on the lake of Buyo [9] and in the lower part of the Bandama River [11]. The predominance of this group of fish is explained by their successful adaptation to environmental disturbances.

V. Conclusion

This study on the fishing activity in Dioulabougou allowed to give certain characteristics of the exploitation of the fish on this site. The fishing effort was estimated at 1.58 fishermen per km² for a total annual production of 432.16 tons of fish caught in Dioulabougou for the 2012-2013 period. This production presents its greatest value in the month of January and the lowest in August. Fishermen's catches are dominated by species of the family Cichlidae. The artisanal fishing activity at the Dioulabougou site has presented enormous potentialities that must be developed and improved. This will improve the living conditions of fishermen and improve their production.

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