Effects of the construction of the Souapiti hydroelectric dam on the ichthyofauna of the Konkouré River - case of the sub-prefecture of Tondon - Republic of Guinea

ABSTRACT

The present study carried out during the period from October 3, 2020 to December 28, 2020 on the Konkouré River in the sub-prefecture of Tondon aimed at evaluating the consequences of the construction of the Souapiti hydroelectric dam on the ichthyofauna of the Konkouré River in order to make concrete proposals for a sustainable management of the ichthyological fauna.

During this study, the consultation with the managers revealed the presence of 4 hydroelectric dams on the Konkouré (Garafiri, Kaléta, Souapiti and Amaria in progress). The number of professional fishermen before the construction of the dam was 201 and 198 after the dam. The number of semi-professional fishermen before the construction of the dam was 157 and 276 after the construction of the dam. The numbers of boats and fishing gear before the dam are 39 and 34 respectively, after the dam they are 113 and 103. There are 2 fishing seasons, a good season where the fishing intensity increases from June to July with 32 and 30kg of fish respectively, and a bad season from December to January with 1 and 5kg of fish respectively. After the construction of the dam, there was a decrease in catches during the good season (30 and 26kg) and the bad season (1 and 3kg). The ichthyological inventory carried out before the construction of the dam identified 34 species divided into 12 families, of which the Cichlidae were the most represented (7 species). After the dam, a total of 16 species divided into 7 families, of which the Cyprinidae were the most dominant (5 species). The sampling carried out during the experimental fisheries allowed the identification of 312 individuals in 6 stations and the spatio-temporal situation of the Konkouré River to be regressed from an environmental and ichthyofaunal point of view in the study area.

Key words: Effects, hydroelectric dam and ichthyofauna**.**

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Comment [3]: Concise, highlighting significant change in the no. of fishermen, boat , catch etc. , if any , before and after construction of the dam

Comment [4]: A change in the fish diversity and composition pattern was observed before and after the construction of the dam.

INTRODUCTION

Ichthyofauna are already under threat from development policies, which are generally translated into a significant increase in hydroelectric dams.

The way in which dams are operated relegates environmental considerations to the back burner, although the extent of the impacts of dams on ecosystems and biodiversity has been demonstrated [1].

West Africa is highly interdependent on water, with transboundary basins shared by several states. Their continental aquatic ecosystems also harbour a significant proportion of the world's biodiversity [2].

Humans tend to settle near watercourses in order to exploit the maximum resources in a variety of ways (irrigation, drinking water supply, fishing, hydroelectricity, etc.). However, a report by the World Commission on Dams showed that a significant number of dams had disastrous results. Generally, water infrastructure projects do not achieve their socio-economic objectives and cause severe damage to water quality and biodiversity [3].

In Guinea, particularly in the sub-prefecture of Tondon, the construction of the Souapiti hydroelectric dam has had~~has~~ considerable effects on the habitat of aquatic resources. The modification of the hydrological regime, the disruption of the ecological conditions upstream and downstream of the dam, the presence of erosion and solid transport lead to threats to the ichthyological communities. However, fish fauna provide a wide range of goods and services to the local population, such as food supply, job creation and increased income. The construction of dams as a policy strategy for the development of a country is a major problem that jeopardises the development of ichthyofauna.

In order to find alternative solutions to these multiple problems, it is important to have information on the consequences of dam construction on the different components of the freshwater ecosystem of the Konkouré River.

MATERIALS AND METHODS

MATERIALS

Brief presentation of the study area

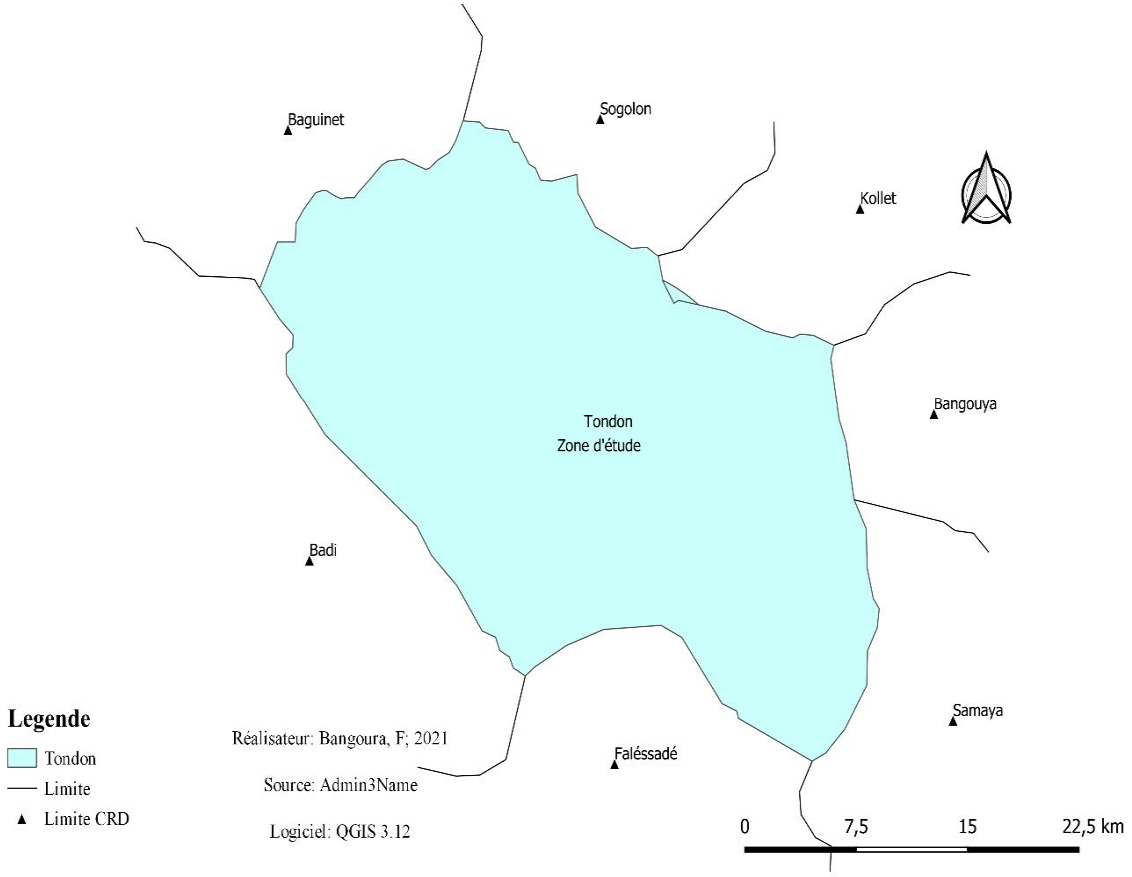
The sub-prefecture of Tondon is a district of the prefecture of Dubréka, located 180 km from the capital Conakry. It lies between 10°22' north latitude and 13°21' west longitude. It is bounded.

- to the east by the sub-prefectures of Bangouya and Samaya ;
- to the west by the sub-prefecture of Badi ;

- to the north by the sub-prefectures of Baguinet, Sogolon and Kollet ;

-to the south by the sub-prefecture of Falessadé.

Map of the sub-prefecture of Tondon



Map 1: Map of the sub-prefecture of Tondon

METHODS

1. Consultation of managers and exploitation of archives

The survey of the managers of the National Directorate of the Souapiti Hydroelectric Development Project was carried out using a pre-established survey form in order to find out the number of hydroelectric dams installed on the Konkouré River and their main characteristics (year of installation, capacity of the water reservoir, river ecosystem, presence of the fish pass as well as the sustainable management measures of the aquatic resources

envisaged by the project). Secondly, some of the available documents concerning the facilities were studied in order to examine the current situation of the ichthyofauna.

2. Survey of fishermen

In order to determine the volume of fishing activity in the study area, individual and group interviews with fishermen were conducted. The interview guides used addressed questions relating to the composition of fish species, types of fishing gear and boats, fishing sites, fishing seasons, fishing techniques, quantities caught per season, trends in the quantities caught in recent years, fish reproduction periods and fish that were caught before but are no longer caught. They were asked to reveal whether there are any new species being caught that were not caught before. These interviews were conducted with all groups of fishermen along the river over a distance of 6 km upstream and downstream of the Souapiti dam. Following the individual interviews, focus groups were organised to validate certain information at Loukhourébouigni, Bengué and Tambama on the left bank, and Souapiti, Bambougou and Garama on the right bank.

3. Evaluation of the impact of the dam on the ichthyofauna of the Konkoure River before and after the construction of the Souapiti dam

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At this level, we based ourselves on certain parameters such as: the inventory and determination of the abundance of ichthyofauna in the study area, the mapping of stations and the carrying out of experimental fishing as well as the spatio-temporal situation of the Konkoure River before and after the construction of the Souapiti hydroelectric dam.

- Inventory and determination of the abundance of the ichthyofauna situation before and after the construction of the Souapiti dam

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In this section, we ~~photographed~~documented the fish species encountered at the landing sites. All the names given by the fishermen were submitted for validation during the focus groups by all the fishermen, based on the photos taken of each fish. In addition, an identification key from [4], in its document Fauna of West African freshwater fishes was used for identification. Then the fish specimens

inventoried were determined according to the list in [3]. Finally, we determined the abundance of the fish families by counting the fish specimens landed during our field investigations to find out which fish families were most represented in the study area.

- Mapping of stations and execution of experimental fisheries

To map the stations and carry out experimental fishing in the study area, we used a GPS (Android) for this purpose. The operation consisted of tracing the fishing stations by non-motorised dugout canoe (ribs) with the fisherman, at each fishing station the fisherman

stopped the canoe to enable us to collect all the information on the time of parking, the number of the station, that of the sample and the type of sample taken. For the present study, 2 sampling stations were selected in the area influenced by the Souapiti project. The selection of the stations for this study was based on the stations close to the project located upstream and downstream of the dam. Fish were then caught using 1500 m long, 25 m drop gill nets~~gillnets~~ with a mesh size of 20 mm, and several stations were sampled, including two close to the new dam; the stations at : Souapiti upstream and Loukhourébouigni downstream. Each gill net~~gillnet~~ was left in the water at 4pm to be removed the next morning at 7am. This fishing made it possible to update some of the fish species in the Konkouré River at that time. Finally, the data was used in QGIS software for processing to produce maps.

- Spatial and temporal situation of the Konkoure River before and after the construction of the Souapiti dam

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At this level, we used Google Earth software to obtain satellite images of the Konkouré River in the Souapiti dam area. Then we geo-referenced the images using the WGS84 system with the UTM 28 North projection. Finally, we asked fishermen questions to obtain clear information about : the loss of fish species, decrease or increase in fish production in time and space, loss of plant species on the river banks, as well as the general morphology of the river before and after the dam construction. The data obtained was used to produce maps.

RESULTS AND DISCUSSION

1. Consultation of the Framework and exploitation of the archives

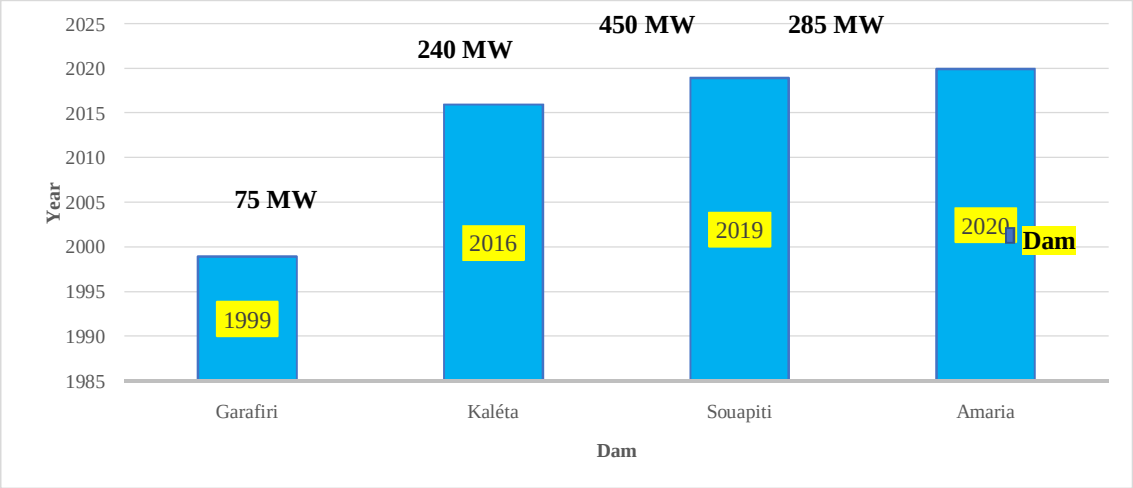


Figure 1: Status of hydroelectric dams on the Konkoure from 1999-2020

2. Survey of fishermen

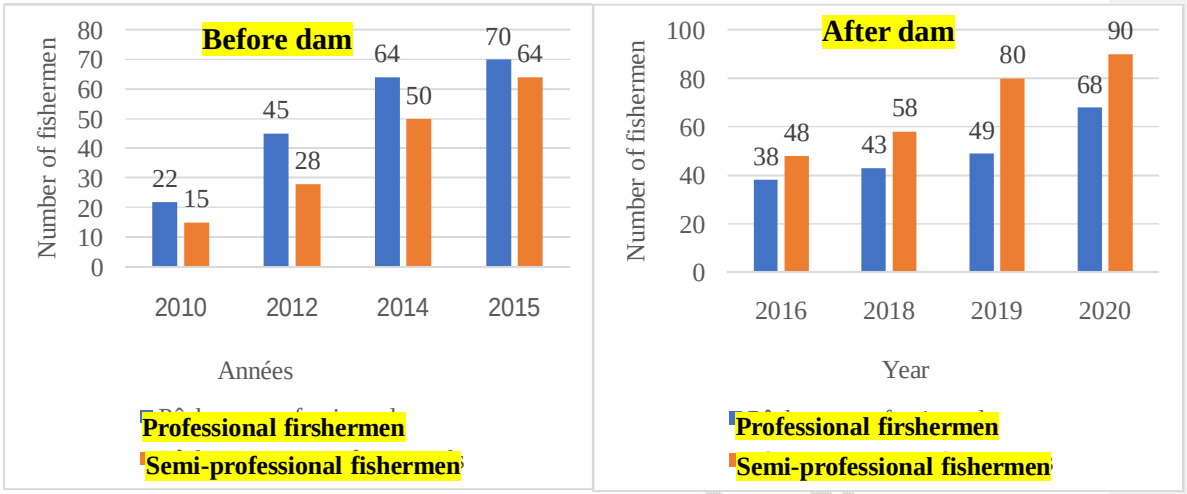
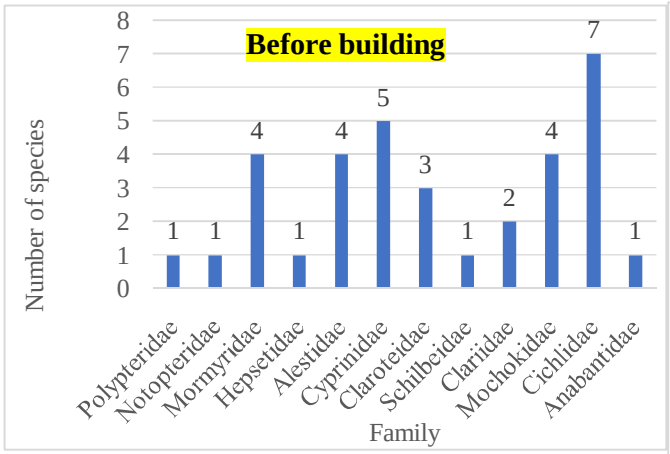
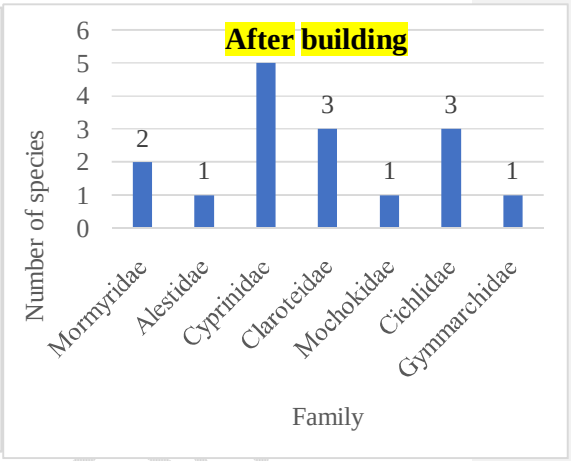


Figure 2: Situation of the number of fishermen by category before and after the construction of the Souapiti hydroelectric dam

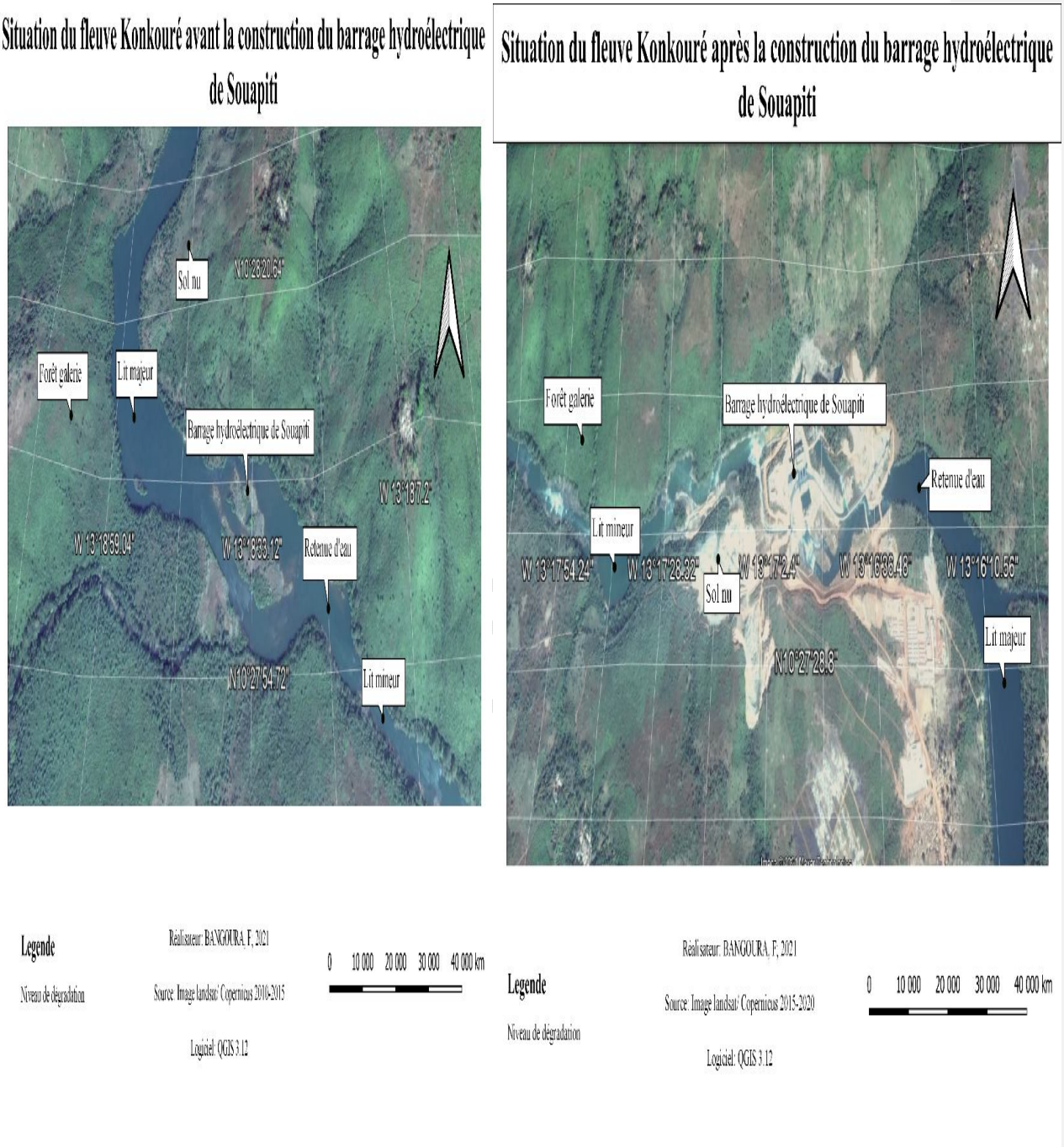
3. Assessment of the impact of the dam on the ichthyofauna of the Konkouré River





before and after the construction of the Souapiti dam

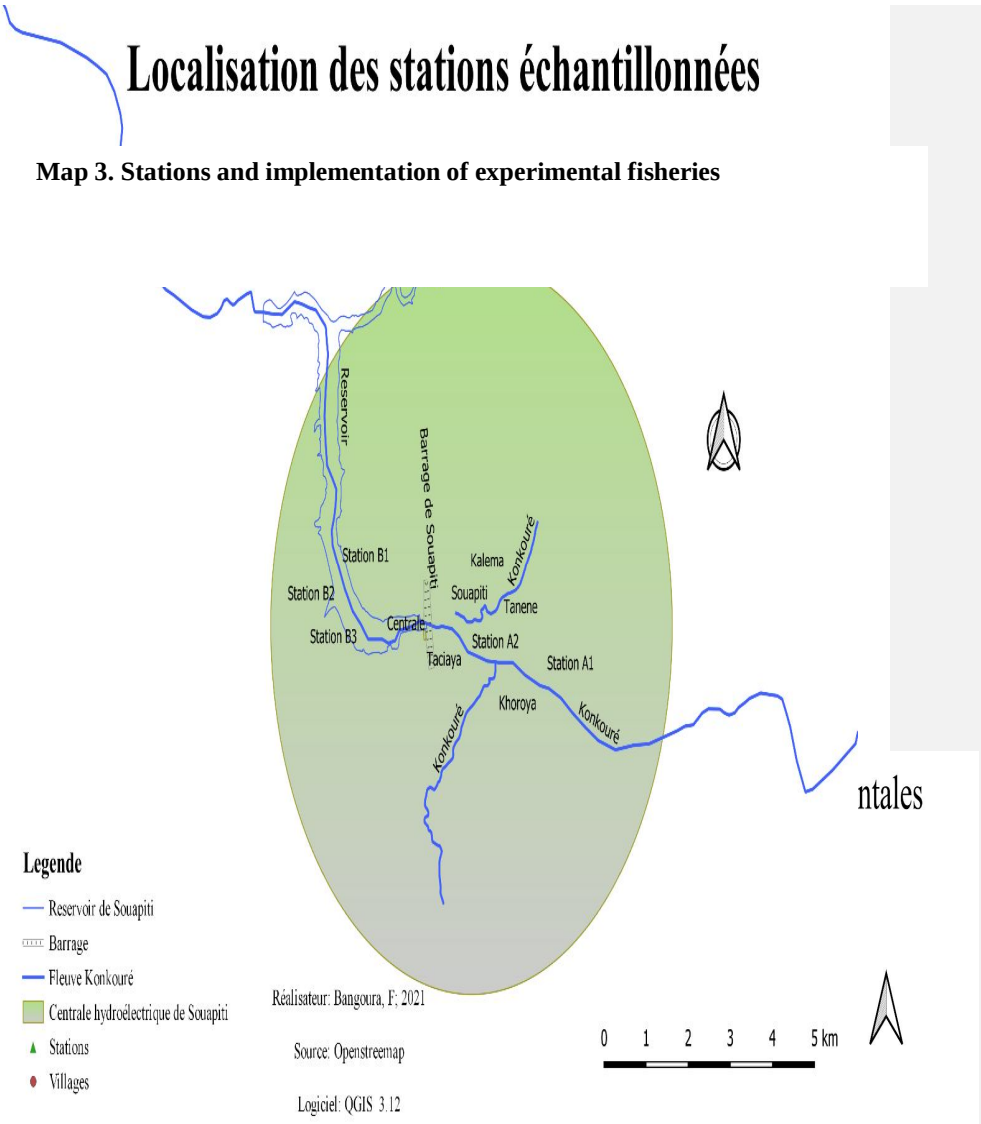
Figure 3 : Determination of the relative abundance of fish families before and after the construction of the Souapiti dam



Map 2 : Spatial and temporal situation of the Konkouré River before and after the construction of the Souapiti hydroelectric dam

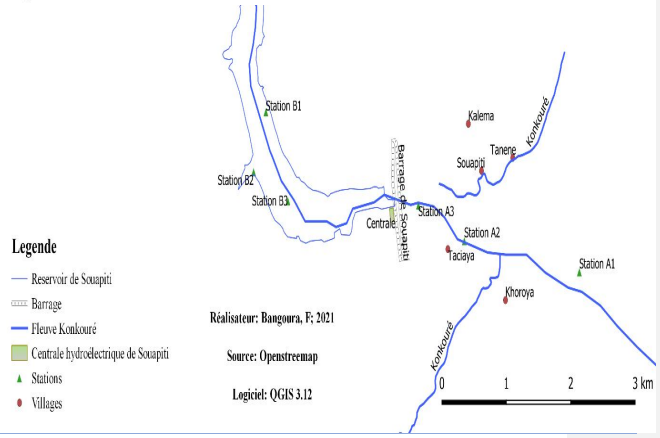
State of the Konkouré river before the construction of the dam

State of the Konkouré river after the construction of the dam



Map 3. Stations and implementation of experimental fisheries

fisheries conducted during the experimental fisheries study



Map 4 : Location of sampled stations

Table 1: Results of the weight and size determination observed during the experimental fisheries

Name of the	Total number	Total weight removed/kg	Minimum size taken/ cm	Maximum size taken/	Weight of individual	Equipment used

station	collected			cm	sampled/kg	
Station B1	43	40	19	28	0,93	Standing net
Station B2	30	35	14	23	1,17	Standing net
Station B3	50	48	12	25	0,96	Standing net
Station A1	54	47	15	23	0,78	Standing net
Station A2	60	40	10	18	0,75	Standing net
Station A3	75	72	7	22	0,96	Standing net

In general, the Konkouré river is threatened by the construction of 4 hydroelectric dams, 2 in operation (Garafiri and Kaléta), 1 under construction (Souapiti) and the fourth in the starting phase (Amaria). These dams on the Konkouré River have varying electrical capacities (75, 240, 450 and 285 MW). These results converge with those of [5], which indicate that the

construction of hydroelectric dams on the Niger (Selengué, Jebba, Kainji, Kandadji) in operation and of Fomi, Tossaye, Gambou, Dyodyonga (under study) has consequences on aquatic biodiversity, water chemistry, substrate size as well as the conversion of a lotic environment into a lentic one upstream and the reduction of river flow downstream from the dam. This convergence of results would be due to the fact that the dams built on these rivers have roughly the same size and capacity.

When the Souapiti dam was built, the number of professional fishermen was higher than the number of semi-professional fishermen. This means that during the pre-dam period, the semi-professional fishermen were less interested in fishing activities and considered this activity less profitable. After the construction of the dam, this trend was reversed, with a dominance of semi-professional fishermen. Our results are similar to those obtained in a survey carried out in Côte d'Ivoire by [6], which indicates~~indicate~~ a strong presence of the Akan ethnic group in the continental fisheries sub-sector in the Lakes region. This similarity of results could be explained on the one hand by the production of identical effects linked to the construction of dams, and on the other hand, by the massive involvement of the population following the submergence of cultivable land.

Before the construction of the Souapiti dam, 34 species belonging to 12 families were present, of which Cichlidae and Cyprinidae are the most numerous (7 and 5 respectively). After the construction, during our investigations,~~investigations~~ 16 species belonging to 7 families were recorded,~~recorded~~ among which Cyprinidae and Cichlidae are the most numerous (5 and 3 respectively). Our results corroborate those of [7], which state that during the experimental fisheries carried out on the Konkouré in 1994, 37 species of fish belonging to 8 families were present, among which the Cichlidae and Cyprinidae were the most represented. This convergence of results suggests that the construction of dams acting on the rivers~~river~~ does not make certain families disappear, although several of them have become rare, especially those that depend mainly on the floodplains for recruitment and growth. Species such as *Brycinus macrolepidotus*, *Stenopoma kingsleya*e and *Brycinus longipinnis* have become rare, due to the precarious ecological conditions that are nevertheless prevalent in the area.

CONCLUSION

This study highlights the lack of environmental consideration given to the project and the fact that there are real management problems in this regard. It should be noted that the construction of the Souapiti hydroelectric dam has had considerable effects on the modification of the hydrological regime, the disruption of ecological conditions, the low flow

of the watercourse, as well as serious threats to the survival of fish. In view of these alarming findings, new strategies should be undertaken by introducing the ichthyofauna component into environmental and social impact studies during the development of hydroelectric dams with a view to rational and sustainable management of freshwater biodiversity.

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