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## Fishery typology in sectors IV and V of the Ebrie lagoon in the department of Dabou (Ivory Coast)

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### ABSTRACT

Fishing is an essential activity for man because it provides him with food and income. Thus, it is important to ensure that it is practiced in a responsible and sustainable manner. The objective of this study is to collect information about fishing activities in the sectors IV and V of the Ebrie Lagoon in order to contribute to its sustainable management. Campaigns were carried out from August 2020 to July 2021 in nine villages with 152 fishermen. Data was collected using questionnaire submitted to fishing actors. Physical and online documents were also consulted. Results revealed that fishermen population was composed of 57.24% of Ivorians and 42.76% of non-Ivorians. The fishing activity was dominated by Ivorians (57.24%) of whom 46.05% were Adjoukouou. Professional and occasional fishermen were identified among both Ivorians and non-Ivorians. 40.23% of Ivorian professional fishermen practice only fishing and 44.83% of Ivorian professional fishermen were also engaged in agriculture. The non-national professional fishermen practice only fishing (84.62% of no national professional group). Generally, fishermen were aged between 30 and 45 years for the Ivorians and more of 45 years for no national. Most of the fishermen had been to school, married and practiced the activity on their own funds. The fishing techniques used were individual (gillnets with smaller mesh than the standard mesh (45 mm), longlines, hawks, traps (net and mesh), bamboo traps, shrimp nets, lines, harpoons and brushwood pens). The low level of education of non-Ivorian fishermen and the sub-standard mesh sizes constituted a real obstacle to the sustainable management of fish resources. It is therefore important to monitor fishing activity in these sectors of the Ebrie lagoon in order to avoid any damage related to overexploitation.

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**Keywords:** Artisanal fishing, Sustainable management, Ebrie Lagoon, Ivory Coast.

### INTRODUCTION

Fishing is one of the oldest activities that provide human livelihoods (Ma et al., 2022). In addition, fish provides more than 70% of protein to the African population (Idowu, 2010 and FAO, 2019).

According to the National Policy for the Development of Livestock, Fisheries and Aquaculture (MIRAH, 2022), in Ivory Coast, the fisheries sector plays a key role in the economic, social and nutritional sectors. According to these authors, fish is the primary

source of animal protein (Ayodeji et al., 2013; Awodiran et al., 2014) and its consumption is over 25.49 kg/inhabitant/year since 2016.

The availability of fish in Ivory Coast was around 654,864 tons in 2019, while local production has increased from 74,800 tons in 2014 to 105,219 tons in 2019 (MIRAH, 2022). According to Kouyate et al. (2021), the high demand for fish protein has oriented Ivorians towards fishing and attracted many foreigners to this sector. Thus, a more efficient use of available resources, accompanied by the adoption of appropriate technologies and improved management, offer considerable possibilities to increase national production and improve producers' incomes, while avoiding overexploitation of the resource. For Bédia et al. (2009) it is therefore necessary to put in place a rational and efficient management policy for fisheries resources. According to these authors, it is first necessary to acquire a body of knowledge on the stocks exploited, the actors in the fishing industry, the importance and distribution of gear, and on catches. The typology of fishing in the Ivorian lagoons has been the subject of several studies (Bédia et al., 2009 and Tano et al., 2019). Furthermore, according to Bédia et al. (2009), existing data on other lagoon plans need to be updated. However, no study has been devoted to the typology of fishing in sectors IV and V of the western strip of the Ebrie lagoon, specifically in the department of Dabou. Moreover, in the absence of information and supervision on the fishing practiced there and with a view to sustainable and rational management of fisheries resources, it appeared useful to carry out this study on the typology of artisanal fishing.

It aims to deepen the knowledge on the fishing practiced in the said area while highlighting the organization of the actors on the one hand and the fishing gears and techniques used on the other.

## **MATERIALS AND METHODS**

### **Study area**

The study was carried out in nine villages located on the banks of sectors IV and V of the western strip of the Ebrie Lagoon, precisely in the department of Dabou (Ivory Coast) (Figure 1). These were the villages of Layo (05°19'34 "N and 04°19'05 "W), Agneby (05°19'32 "N and 04°20'34 "W), N'gatty (05°17'42 "N and 04°20'26 "W), Allaba (05°17'00 "N and 04°21'57 "W), Gboungo (05°17'50 "N and 04°22'48 "W), Pass (05°17'41 "N and 04°24'46 "W), Mopoyem (05°18'58 "N and 04°27'49 "W), Bodou (05°18'16 "N and 04°27'53 "W), and Tiaha (05°17'32 "N and 04°28'26 "W). The existence of fishing activity and trade in fishery products in these villages are the reasons why they were chosen for the study.

### **Data collection**

Three techniques were used for data collection, which included literature review, interviews with resource persons and fact finding (Vanga, 2004; Tah et al., 2009; Bédia et al., 2009; N'Dri, 2019; Goli bi et al., 2019; Adou et al., 2021).

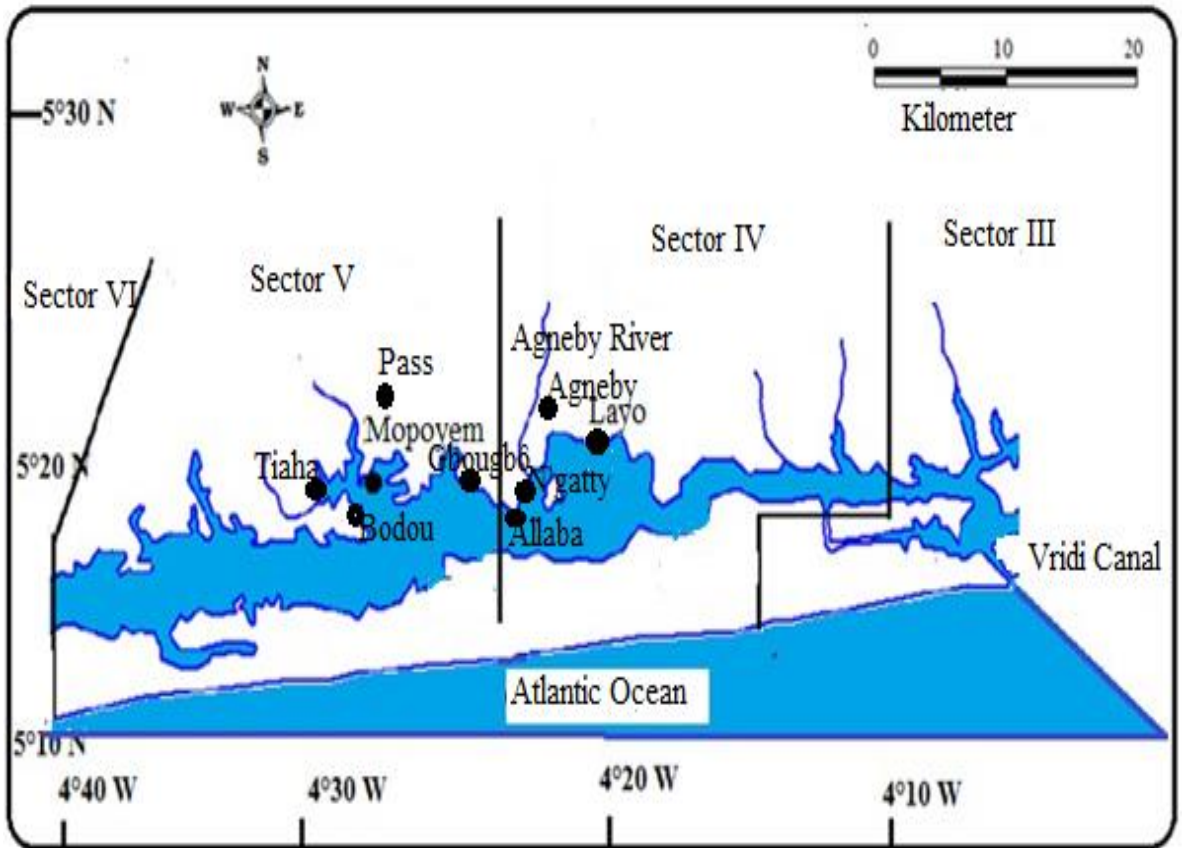
The literature review consisted of consulting the physical and online literature (scientific publications and institutional documents) available on the study area and the topic. The survey was conducted from August 2020 to July 2021 using a questionnaire that included informations such as the date, the name of the interviewer, the site, the fisherman's marital status, family responsibilities, religion, level of education, age, fishing techniques used, type of boat, activities related to fishing and mobility, the mean of financing the fishing activity and income.

Observations made directly on the sites made it possible to monitor and note the attitudes of the fishermen, their usual practices, the fishing equipment, and to verify informations that were collected from the

questionnaire and the interviews. Observation also helped to identify (Poll and Gosse, 1995) the fishing gears used and especially to clarify certain realities of fishing which were not well understood during the interviews. A digital camera and a GPS were used respectively to take pictures and to record the geographical coordinates.

The criteria for classifying fishermen, based on the time devoted to fishing, the income derived from it, the method of

financing the fishing activity and the distribution of fishermen by age group are inspired by those of Vanga (2001), Tah et al. (2009), Kien et al. (2015) and Goli Bi et al. (2019). The distribution of fishermen according to level of education and marital status is based on Boguhé et al. (2011), Kien et al. (2015), Goli Bi et al. (2019) and Adou et al. (2021). The data analysis was done by Excel Spreadsheet 2019.



**Figure 1:** Geographical location of survey villages on the shores of sectors IV and V of the Ebrie Lagoon (Dabou, Ivory Coast) between August 2020 and July 2021.

## **RESULTS**

### **Distribution of fishers by nationality and ethnicity**

Table 1 summarizes the distribution of fishers by ethnicity and nationality. In total, 152 fishermen were registered with 87 are Ivorians (57.24%), 45 Beninese (29.60%), nine Togolese (5.92%), five Ghanaians (3.29%), five Malians (3.29%) and one Nigerian (0.65%). Ivorians are divided into five ethnic groups including the Adjoukrou (majority ethnic group), the Aïzi, the Agni, the Apolo and the Baoulé. As for the Beninese community, it was represented by six ethnic groups, largely dominated by the Popo, then came the Pedah, the Fongbé, followed by the Epla, Mina and Ocloi. All the Togolese registered were Pedah. Each of the other communities was represented by a single ethnic group, namely the Malian (Bozo) and the Ghanaian (Awouan). Finally, Anango represents the Nigerian community. Two ethnic groups dominate the total number of fishermen. These are the Adjoukrou (46.05%) and the Popo (16.45%).

### **Distribution of fishermen by study area**

The largest number of fishermen was found in Allaba ( $n = 40$  or 26.32%) (Figure 2). This number was followed by those of Pass village ( $n = 21$  or 13.82%), Gbougbo and N'gatty which represent 21, 20 and 19 respectively. The other villages had only one fisherman each.

The largest foreign community was observed in Allaba with a proportion of 43.08%. This community mainly included Beninese ( $n=25$ ). In Layo, three nationalities share the fishing community. They are Ivorians ( $n=7$ ), Malians ( $n=4$ ), and Ghanaians ( $n=1$ ). The Ivorian community was dominated by the Adjoukrou ( $n = 5$ ), followed by the Agni ( $n = 2$ ) and then came the Aïzi ( $n = 1$ ). The Malian community was essentially the Bozo with a total of 4 fishermen. No foreign communities were recorded in Agneby and Tiaha. For these two villages, there was only the Adjoukrou, 11 and 13 respectively.

### **Distribution of fishermen by age group**

Fishing activity in the department of Dabou was practised by men aged between 30 and 45 years, among the natives (47.13%) (Figure 3). In foreign communities, fishing was practised by men aged 45 years or more (53.85%). Among Ivorians, the oldest fishermen (at least 45 years old) were more numerous than the younger (less than 30 years old) with respectively 39.08% and 13.79% of the sample analyzed. Among the non-natives, on the other hand, fishermen whose age ranged from 30 to 45 were more numerous than those under 30 with 13,85% and 32,31% respectively.

### **Educational level**

The results showed that 44.83% of the Ivorian fishers had primary education, 31.03% had secondary education and 6.90% had university education (Figure 4). The rate of unschooled fishers was 17.24%. In the foreign community, we recorded the highest rate of non-schooling, 38.46%. Of the non-Ivorians, 36.92% had primary education, 21.54% had secondary education and 3.08% had higher education. The schooling rate of this community was therefore 61.54%.

### **Association and religion**

Ivorian fishermen were not organized into cooperatives. They engage in subsistence fishing. On the other hand, fishermen of other nationalities (Malian, Togolese, Beninese and Ghanaians) are organized in cooperatives headed by respective chiefs who represented them before the village and administrative authorities. In general, fishing was artisanal and individual. However, some catching techniques (seines) require the participation of several people. 93.1% of Ivorians who practiced fishing were Christians (Figure 5a). The remaining Ivorians (6.9%) were animists. The foreign community on its part (Figure 5b) is made up of 49.23% Christians, 38.46% Muslims and 6.15% Animists.

### **Marital status and family responsibilities**

Among Ivorians, 80.46% of fishermen were married, while 96.92 of non-natives are

married (Figure 6a). The proportion of single people was 19.54% among Ivorians and 3.08% among non-Ivorians (Figure 6b). their households are generally made up of 2 to 17 people with a dominance of households having between 4 and 7 people among Ivorians (44.83%) and non-Ivorians (38.46%) (Figure 7). In general, the daily expenses of these fishermen varied between 1000 and 2500 FCFA.

### **Distribution of fishermen by socio-professional category**

In the localities surveyed, two types of fishermen were identified, namely professional fishermen and occasional fishermen. Fishermen assistants are other actors who accompany the professional fishermen. Of all Ivorians, there was 78.16% of professional fishermen (Figure 8), 20.69% of occasional fishermen and 1.15% of fishermen assistant. Most foreign fishermen (96.92%) were professional fishermen and the rest (3.08%) were occasional fishermen. Among Ivorians, 40.23% of the actors live exclusively from fishing (Figure 9) and 44.83% practice agriculture in addition to fishing. The latter grow rubber, oil palm and cassava for household food needs. A proportion of 14.94% exercised small trades such as mechanics, sewing, shop management, electricity, carpentry and painting. However, nearly 84.62% of foreigners lived exclusively from fishing and the others (15.38%) were engaged in the parallel activities mentioned earlier.

### **Method of financing the fishing activity**

Self-financing was favoured by both ivorian (91.95%) and foreign (90.77%) fishermen (Figure 10). Only 6.90% of indigenous fishermen and 7.69% of non-indigenous fishermen said that they had benefited from a credit to start their activities. A proportion of 1.15% of Ivorians and 1.54% of foreigners received a gift of fishing equipment. The cost of making fishing gear varies according to the type of gear. Thus, the purchase price of a canoe of about four metres in length costs an average of 120,000 CFA francs, and that of about six metres in length

costs about 160,000 CFA francs. Paddles are sold at 2,000 CFA francs each. For fishing gear, the purchase price depends on its nature and size. A gillnet with a mesh size of 8 to 30 mm and a length of 100 metres (*tchoukou-tchoukou*) costs around 25,000 CFA francs. The large mesh gillnet, the stretched mesh netting of 160 to 200 mm was generally made from wire of 0.60 to 0.75 mm in diameter and 100 metres long. Longlines with small hooks (n°15) were sold at 1,250 F CFA per package while longlines with large hooks (n°4) cost 7,000 F CFA. The cost of the net was 5,000 CFA francs compared to 6,000 CFA francs for the liane net. The crab scale, known locally as Eglé, costs an average of 500 CFA francs per unit. As for the sparrowhawk was made for 25,000 to 35,000 CFA francs and finally. The conical shrimp net (locally called *gbagba-loulou*) costs on average 40,000 CFA francs. For individual fishing, the minimum investment costing is 150,000 CFA francs, excluding license fees.

### **Fishing gear and techniques**

Individual fishing techniques were varied. They included hawks, gillnets, beach seines, multiple hook lines (unbaited and baited), hand lines, pots, bamboo traps, crab scales, shrimp seines, branch pens and harpoons.

The sparrowhawk (Figure 11a) (locally called *assawa*) was one of the main active gears used by fishermen with mesh sizes between 20 and 65 mm. The average height was five metres and the diameter varies between four and seven metres.

Gillnets (Figure 11b) (soft): these are standing nets whose length could vary according to the number of sheets used, but the average was around 100 metres. The drop varied between 1.50 and two metres. The net was laid at dusk and lifted the next morning. Depending on the mesh size used, three types of net were identified in this study. These are:

1. Mesh gillnets with three sizes. There are small-mesh gillnets (28 to 42 mm) which are used to catch ethmaloses and tilapias. According to the fishermen, the life span of the net was two to six months. The

medium-mesh net, known locally as *tchoukou tchoukou*, is made of stretched meshes of 70 to 100 mm. It was generally fixed to piles at the ends on mud or sandy-mud bottoms. The gear was used to catch tilapia, sarotherodon and chrysosicht. And finally the large-mesh gillnet with 160 to 200 mm stretched-mesh netting. The Trachinotus net, locally called *Ahremou*, was held at the surface by small polyester floats spaced about one metre apart.

2. The soft *Akpa* or captain's net, whose depth did not exceed 2.50 m, was held at the bottom by stones attached to the ends of the net.
3. Beach seines are used in shallow waters near the shore or on the shallows and were operated by a and are operated by five to 10 people. Their length varied from 200 to 500 metres.

Multi-hooked lines were of two types:

Unbaited lines or longlines, locally called *gbanzan-gbanzan* (Figure 11c) with variable size could be up to 300 metres long. They are placed in the water column so as to form a barrier against *Chtysichthys*. They are set in the evening and could remain in the water for three to four days.

Baited lines were always baited with molluscs, insects or even soap. These were longlining with more widely spaced and fewer hooks (100 to 200).

The fishing line is a rope designed for fishing with the end of which is attached to a hook. There are two types of fishing lines : traditional lines whose manipulation is done manually and sophisticated lines which include an automatic device for their manipulation.

Catch baskets were fishing instruments that were placed at the bottom of the water, in the shape of a cylindrical basket, made of rosewood. The basket was cylindrical, made of rosewood, net or wire, with a gully through which fish could enter but not exit. In this study, three types of creels were identified. These are woven bamboo pots without mesh (Figure 11d), wire mesh pots and fishing net pots on a liana frame. Bamboos (Figure 11e) were hollow cylinders about 30 cm long, laid

at the bottom or embedded in the mud and marked by a floating rope.

The crab scale (Figure 11f), known locally as the *Eglé*, had a circular support made of an iron circle. The support handle was made of two intertwined iron slats. A rope connects the device to the surface where it was terminated by a small float of some kind to mark the trap. The bait consisted of various fish and sometimes rotting animal offal to attract crabs. Shrimp seines (Figure 11g), conical in shape, this net was made up of sheets of different mesh sizes: 25 mm at the opening, 15 mm in the middle and 10 mm at the bottom of the pocket. The seine used at night was pulled by two people using wooden handles over depths of one metre to 1.50 m.

Shrimp nets (Figure 11h) (*bgagba-loulou*) were set in the evening and removed when the current subsides. This net was generally much longer, three to seven metres, with the mesh getting finer and finer by about 4 mm from the base to the top of the cone.

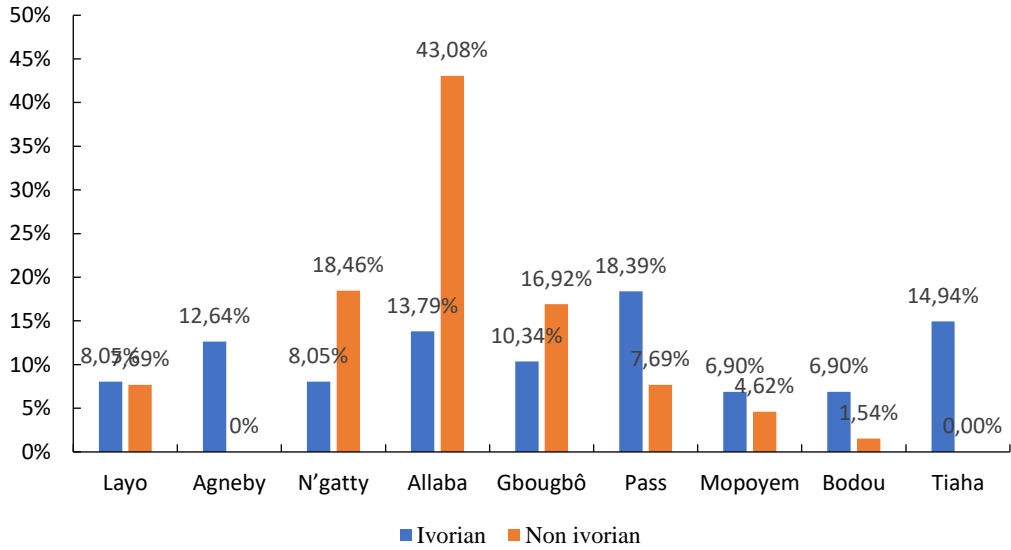
Branch pens (Figure 11i). These 'Acadja' pens encountered varied in size. The catches from the "Acadja" pens were mainly Cichlidae. The use of used tyres was also noted in the "Acadja" parks. The harpoons used by the fishermen were generally of the traditional type with an average length of 87 cm. When diving, the fish was bombarded with the hooks of the spear which penetrate the flesh. The hooks remain embedded in the flesh and the fish was retrieved by pulling on the rope.

### Travelling gear

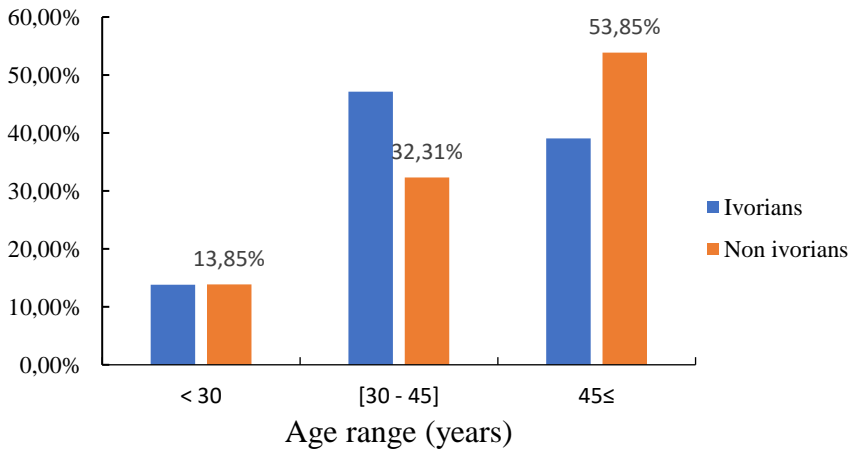
The majority of fishermen operating in this area used nailed plank canoes (Figure 12) for fishing activities. With dimensions of about 3.67 m long, 0.65 m wide and 0.30 m deep, the ivorians (62.07%) have boats with an average capacity of two people. Unlike foreigners (86.15%), who have relatively large boats, about five m long. These boats can hold up to five people. In addition to these canoes, there were also single-engined canoes, which were in low numbers among both Ivorians (13.79%) and non-Ivorians (6.15%). Some fishermen, that is 21.84% of Ivorians and 6.15% of non-Ivorians, did not own a canoe. They rented

canoes either on a monthly basis or on a quarterly basis. A very small number of motorized boats were observed. These were two canoes made of nailed planks on the Ivorian side (2.30%) and one monoxyle canoes

on the foreign side (1.54%). According to the interviewees, the durability of these boats was between two and 10 years. It depended on the quality of the wood used to make them.



**Figure 2:** Distribution of fishermen by study site between August 2020 and July 2021 at the edge of sectors IV and V of the Ebrie Lagoon (Dabou, Ivory Coast)

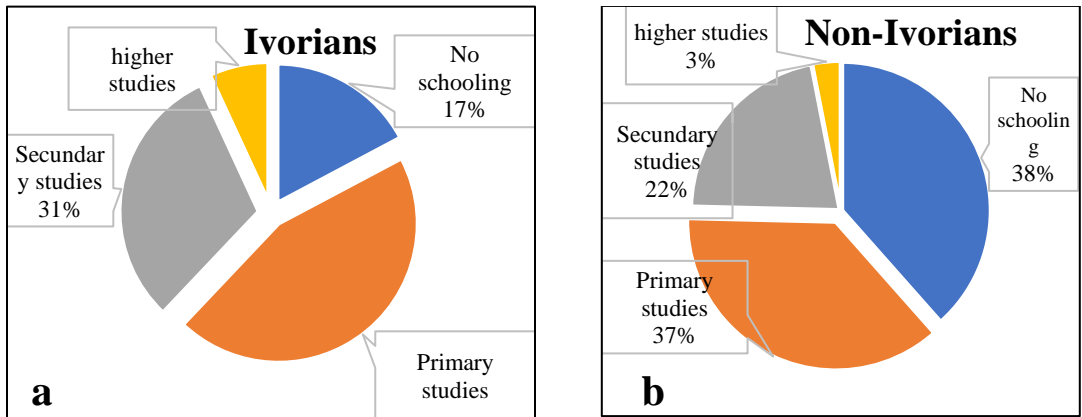


**Figure 3:** Distribution of fishermen surveyed between August 2020 and July 2021 in sectors IV and V of the Ebrie Lagoon (Dabou, Ivory Coast) according to age group.

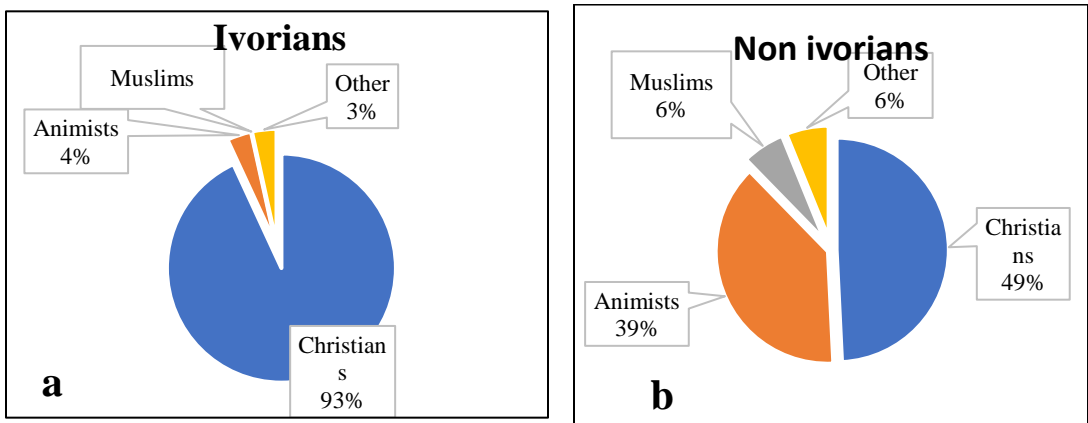
**Table 1:** Distribution of fishermen according to ethnicity and nationality in the villages at the edge of sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast) between August 2020 and July 2021.

Nationality / Ethnicities	Layo	Agneby	N'gatty	Allaba	Gbougbo	Pass	Mopoyem	Bodou	Tiaha	Total	Percentage
<b>Ivoirians</b>											
Adjoukrou	4	11	6	0	9	15	6	6	13	70	46,05%
Aïzi	1	0	0	12	0	0	0	0	0	13	8,55%
Agni	2	0	0	0	0	0	0	0	0	2	1,32%
Apollo	0	0	0	0	0	1	0	0	0	1	0,65%
Baoulé	0	0	1	0	0	0	0	0	0	1	0,65%
<b>Total ivoirien</b>	<b>7</b>	<b>11</b>	<b>7</b>	<b>12</b>	<b>9</b>	<b>16</b>	<b>6</b>	<b>6</b>	<b>13</b>	<b>87</b>	<b>57,24%</b>
<b>Malian (Bozo)</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>3,29%</b>
<b>Nigérien (Anango)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0,65%</b>
<b>Ghanaian (Awouan)</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>3,29%</b>
<b>Beninese</b>											
Popo	0	0	10	15	0	0	0	0	0	25	16,45%
Pedah	0	0	1	6	5	2	0	1	0	15	9,87%
Epla	0	0	1	0	0	0	0	0	0	1	0,65%
Fongbé	0	0	0	2	0	0	0	0	0	2	1,32%
Mina	0	0	0	1	0	0	0	0	0	1	0,65%
Ocloi	0	0	0	1	0	0	0	0	0	1	0,65%
<b>Beninese Total</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>25</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>45</b>	<b>29,60%</b>
<b>Togolese (Pedah)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>5,92%</b>
<b>Total by location</b>	<b>12</b>	<b>11</b>	<b>19</b>	<b>40</b>	<b>20</b>	<b>21</b>	<b>9</b>	<b>7</b>	<b>13</b>	<b>152</b>	<b>100%</b>

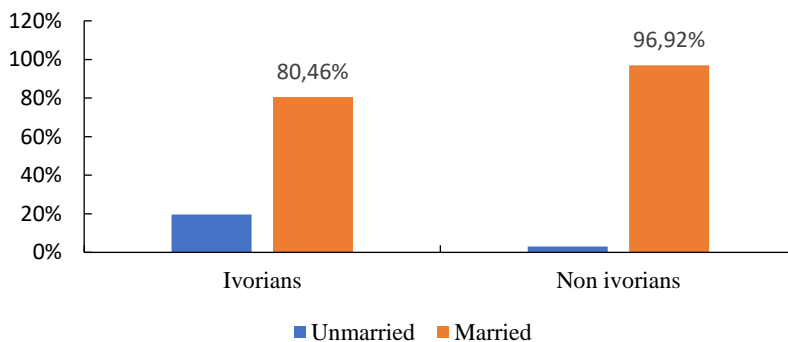




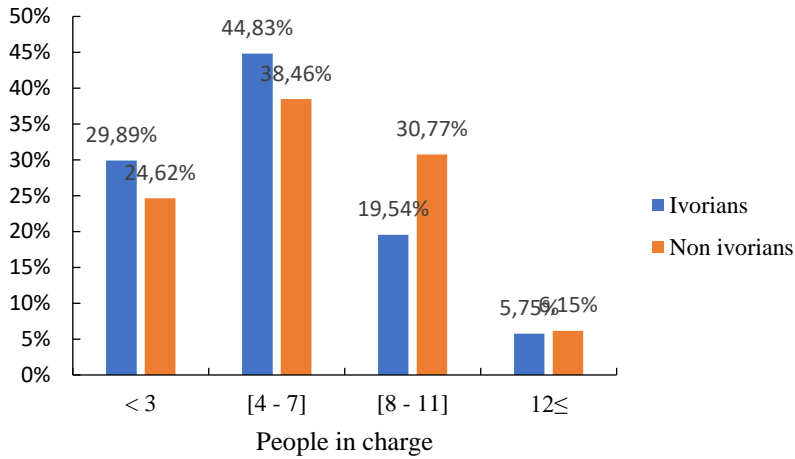
**Figure 4:** Distribution according to the level of education of the fishermen identified in the villages located on the shores of sectors I and II of the Ebrie lagoon between August 2020 and July 2021 (a: Ivorians et b: non-Ivorians).



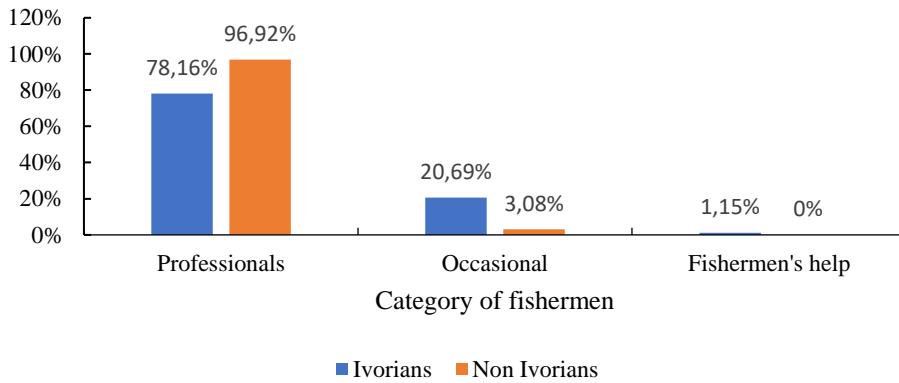
**Figure 5:** Distribution of fishermen surveyed according to association and religion between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrie Lagoon (Dabou, Ivory Coast) (a: Ivorians et b: non-Ivorians).



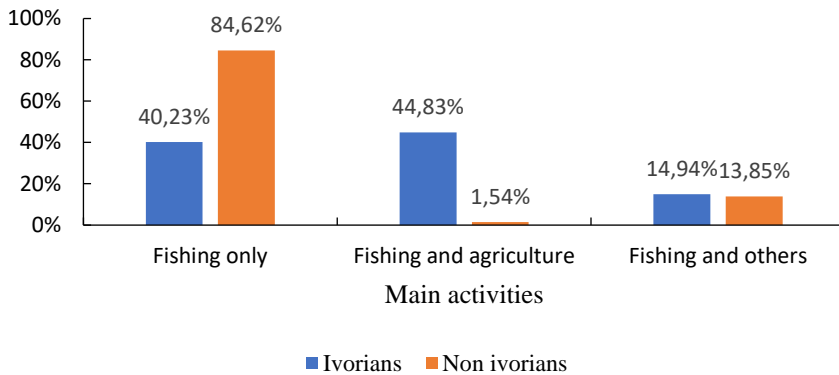
**Figure 6:** Distribution of fishermen surveyed according to marital status and origin between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié lagoon (Dabou, Ivory Coast).



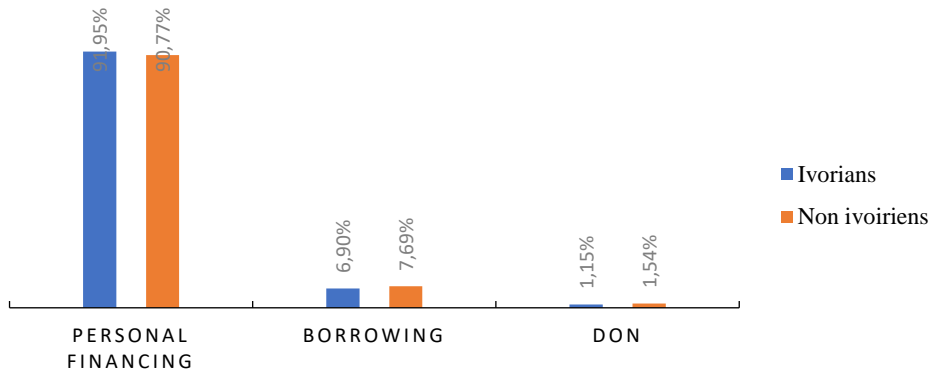
**Figure 7:** Distribution of fishermen surveyed according to those in charge between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast).



**Figure 8:** Distribution of fishermen by socio-professional category between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast).



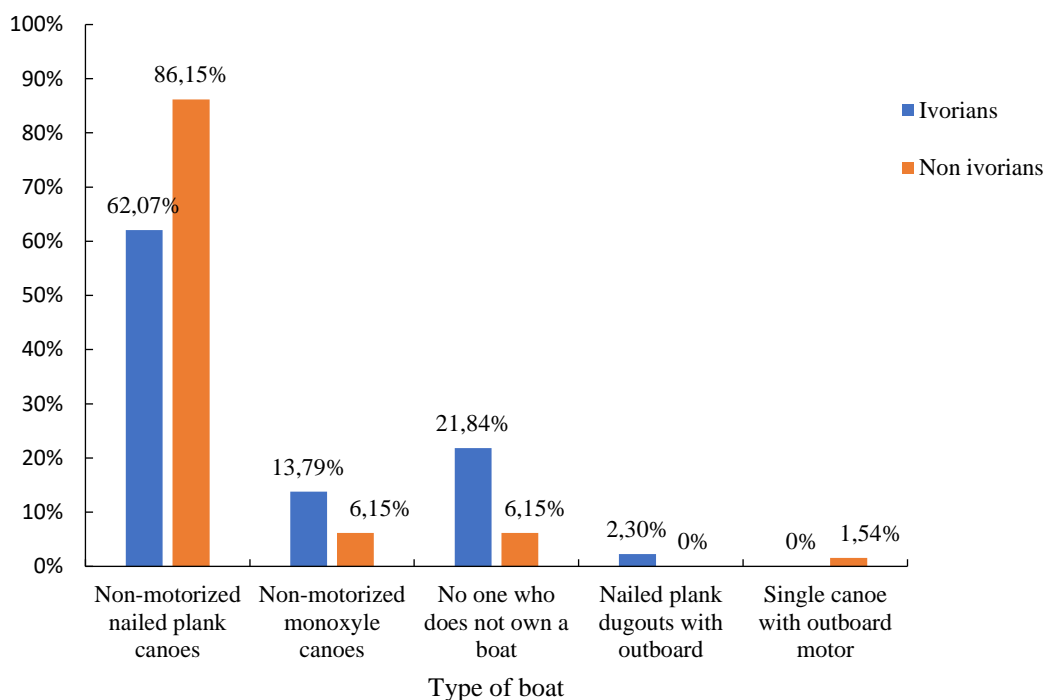
**Figure 9:** Distribution of fishermen surveyed according to main activities between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast).



**Figure 10:** Distribution of fishermen surveyed between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié lagoon (Dabou, Ivory Coast) according to the mode of financing



**Figure 11:** Fishing gear used by fishermen surveyed between August 2020 and July 2021 on the shores of Sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast) (a: Sparrowhawk, b: gillnet, c: longline, d: woven bamboo trap, e: bamboo trap, f: crab scales, g: shrimp seines, h: bgagba-loulou net and i: branching pens).



**Figure 12:** Number and type of boats surveyed between August 2020 and July 2021 on the shores of sectors IV and V of the Ebrié Lagoon (Dabou, Ivory Coast)

## DISCUSSION

The majority of the fishermen identified in this study were Ivorians represented by the Adjoukrou ethnic group, who were native of the region. These observations were corroborated by those made by Adou et al. (2021) at the Agneby River in the locality of Dabou. However, they are in contrast to those of Kien et al. (2015), Blahoua et al. (2018) and N'Dri (2019). According to these authors, the majority of fishermen in Ivory Coast were Malians (bozos). The strong dominance of Ivorian fishermen (Adioukrou) in sectors IV and V of the Ebrie Lagoon was linked to the fact that they originate from villages located on the shores of the lagoons. These situations create a favorable climate for the development of fishing. According to Anoh (2010), fishing tradition has been perpetuated by the Adjoukrou people. Perrot (1989) stated that until the second quarter of the twentieth

century, they practiced fishing as their main occupation. In addition, the high demand for fish products has created economic challenges (Kantoussan, 2007). In such a context, subsistence fishing gave rise to an economic activity (Njiru et al., 2005). For Ouattara et al. (2006) and Anoh (2010), fishing is an economic issue for many riparian communities. The earnings obtained from the sale of fish would have enabled fishermen to send their children to school and support their families. The low rate of non-native fishermen on the water body could be explained by the mode of access to the water body. In this department, it is the chiefs who give permission to fish on the water body and received commissions in return. In return, patches are paid to the chiefdom. For some villagers, accepting foreigners who did not respect the rules set by the chiefdom for responsible fishing would be to jeopardize the

stock. This explained the absence of non-natives in certain villages such as Agneby and Tiaha.

The low participation of young people in fishing activities could be linked to rural exodus and the lack of experience and equipment. Bédia et al. (2009) also mentioned this on the Aghien-Potou lagoon, Boguhé et al. (2011) and Kien et al. (2015) on the lower Bandama River, N'Dri (2019) on Lake Bolondo (Bagoue region) and Adou et al. (2021) on the Agneby River. These data were contrary to those of Tah et al. (2009) and Vanga (2011). For these authors, fishing was mostly practiced by young people on the Ayamé I dam lake. The low presence of young people could also be explained by the lack of financial means for the purchase of fishing equipment. Also, they were often afraid of drowning because of their inexperience.

The high rate of Ivorians attending school could be attributed to the proximity of Abidjan, located barely 40 kilometers from the city of Abidjan. Dabou is a rapidly urbanizing area that benefits from numerous educational facilities that facilitate access to schools.

In addition, fishing was one of the many alternatives for out-of-school youth to obtain farmland (Dabié, 2009). In contrast, foreign communities were dominated by uneducated fishermen. This could be explained by the fact that these foreigners mostly lived in the camps.

There was no formal professional organization among the fishermen surveyed. This situation could be explained by the fact that they had little or no information on the advantages of being in a cooperative society. Some fishermen mentioned the issue of transparent in the management of these formal professional organizations. Studies had already mentioned the lack of cooperative associations among Ivorian fishermen operating on the lakes of Faé, Ayamé and Bolondo (Da Costa and Diétoa, 2007 ; Blahoua et al. 2018 ; N'Dri, 2019). On the other hand, these observations were contrary to those of Boguhé et al. (2011) who mentioned the existence of a cooperative among Ivorian fishermen in Taabo. The majority of fishermen are married. This was beneficial to them

because they could assist their husbands in the daily exercise of their activity. They are in charge of the processing of fish products and/or their marketing.

About half of the fishermen working in sectors IV and V of the lagoon lived not only from fishing but also from agriculture, which could be explained by the fact that cassava cultivation is important in this area. The town of Dabou is renowned for its Atiéké (known as Atiéké de Dabou), which was sold in all the markets in Abidjan. In contrast, more than 84% of foreigners worked full-time as fishermen. This could be explained by the increasingly difficult access to cultivable soil in this locality by non-Ivorians. Our results corroborate those of Blahoua et al. (2018) and Goli Bi et al. (2019). According to these authors, non-nationals who practice fishing on the Ayamé 2 and Buyo dam lakes make it a main activity and the natives of these localities marginalize the fishing vocation. On the other hand, according to the work of Adou et al. (2021), more than half of the Ivorian fishermen on the Agnéby River in the locality of Dabou live solely on fishing income, they worked full time as fishermen. However, non-Ivorians occasionally practice it part-time in favor of other activities such as trade and agriculture.

Fishermen finance their activities themselves. They rarely receive credit. This finding was also made by Kien et al. (2015) and Blahoua et al. (2018) among fishermen surveyed in sectors IV and V of the lagoon. This could explain the absence of a cooperative in the study area. Regarding the gears used, gillnets, hawksbills and creels predominate. Our results were in agreement with those of Da Costa and Diétoa (2007) and N'Dri (2019), respectively on Lake Faé and Bolondo. In contrast, at 54%, bamboo trap was the most used fishing gear at Lake Ayamé 1 (Vanga, 2011). According to Da Costa and Diétoa (2007), several factors enter into the choice of catching gear. These include the characteristics of the site to be exploited, the nature of the species sought, the regulations in force, customary requirements and the cost of the gear. The daily use of the above-mentioned gears in sectors IV and V of the Ebrié Lagoon

could be explained by their availability, their easy acquisition conditions and their control. The boats used on the water are exclusively dugout canoes, most of which were made of nailed boards. These same observations were made on the Buyo and Bolondo lakes by Vanga (2001) and N'Dri (2019). These pirogues were used mostly because they were resistant to bad weather (Vanga, 2001).

### Conclusion

The exploitation of fishery resources in sectors IV and V of the western strip of the Ebrié lagoon in the department of Dabou is of an artisanal and individual type. It is dominated by adult, married and literate professional fishermen. Among Ivorians, mainly represented by Adjoukrous residents, fishing is mostly a secondary activity. The fishing techniques used are: gillnets with smaller mesh than the standard mesh (45 mm), longlines, hawks, traps (net and mesh), bamboo traps, shrimp nets, lines, harpoons, and brushwood pens. There is practically no credit financing granted to the fishermen due to the non-existence of cooperatives. In view of the socio-economic aspect of fishing, it is necessary to establish a sustainable management of fishery resources by the competent authorities. It must take into account the low level of education of the fishermen, the mesh size of the nets used, the fishing effort and the expansion.

### COMPETING INTERESTS

There is no conflict of interest between the different authors.

### AUTHORS CONTRIBUTIONS

NJJK: field investigation, data processing and drafting of manuscript. SSY: Director scientist of the study. KPY: field investigation, directive technique and correction of the manuscript.

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