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Individual gears fishing in Aby lagoon (Adiaké, Côte d'Ivoire): Stakeholders, fishing gear, catches and constraints

Kouamé Marcel N'DRI[1], Moustapha DIABY[1], Koudou Lobel Henri Michel ADJI[2], and Dramane DIOMANDE[3]

[1]Institute of Agropastoral Management, Peleforo GON COULIBALY University, Korhogo, Côte d'Ivoire

[2]Departmental Directorate of the Ministry of Animal and Fishery Resources, Adiaké, Côte d'Ivoire

[3]UFR Sciences and Environmental Management, NANGUI Abrogoua University, Abidjan, Côte d'Ivoire

ABSTRACT: The lagoon waters of Côte d'Ivoire contribute to the country's self-sufficiency in fish products, in the face of ever-increasing needs. This study examines the current state of exploitation of the Aby lagoon by individual fishermen. It is the result of three months of surveys, from April to June 2022, with fishermen and the fisheries administration of Adiaké. The results show that fishing is in the hands of nationals. Mostly uneducated (50%), those traditional fishermen use as dominant gears: small-mesh nets (75.20%) and nailed plank pirogues (61.91%). The most important species in catches are *Ethmalosa fimbriata* and *Sarotherodon melanotheron* with proportions of 34.78% and 30.43% respectively. The annual biomass is estimated at around 275.73 tons. There is a poor cooperation between fishermen and the administration, which impacts negatively the statistical data. The use of non-selective gears remains one the major constraints against the preservation of aquatic biodiversity. Therefore, management programs and research projects have to be implemented for avoiding an eventual collapse of stocks. A study on the spatio-temporal distribution of species with high aquaculture potential could be considered.

KEYWORDS: Aby Lagoon, Catches, Côte d'Ivoire, Fishing gears, Individuals fishermen.

1 INTRODUCTION

Fish resources represent the main animal proteins accessible to many people. Worldwide, in 2017, average per capita fish consumption was estimated at around 20.5 kg. Today, fish provides a livelihood for several millions of people in Africa, including fishermen, fish farmers, processors, transporters and traders **[1].** Fishing thus contributes to the livelihood of many people around the world. It is a source of income and it contributes to the satisfaction of their essential nutritional needs **[2].**

Côte d'Ivoire has an extensive hydrographic system, with over 550 km of seafront, four rivers, lakes and three lagoon complexes (Ebrié, Aby and Grand Lahou) in the south **[3].** Despite this fishing potential, national fish production of the order 116.028 tons, remains largely below domestic needs, estimated at over 618.182 tons. The deficit is therefore made up by imports of frozen fish **[4].** Nevertheless, lagoon fishing is playing its part in order to reduce these imports, which represent a considerable outflow of currency. Fishing in the Aby lagoon is no less important.

The Aby lagoon offers an exploitable surface area of 425 km^2. Previous studies on fishing, carried out by **[5], [6], [7], [8], [9] and [10],** testify the interest shown in this activity. According to **[9],** this has led administrative authorities, fishing industry players and researchers to become aware of the vitality of the sector in recent years. However, problems of exploitation linked to the influx of local and foreign communities, on the one hand, and to the strong pressure of fishing activity on the other hand, contribute to making it vulnerable.

This study was initiated to assess the state of individual gear fishing in this fishery. It describes fishing techniques, the level of biomass exploited and the constraints involved. The results obtained could be used for any policy to improve local fishing.

Corresponding Author: Kouamé Marcel N'DRI

2 MATERIAL AND METHODS

2.1 STUDY AREA

This study was carried out in the Aby-Tendo-Ehy lagoon complex, covering an area of 425 km^{2,} precisely in the Aby part (Figure 1). The site concerned is covered by the department of Adiaké. It lies between latitude 5°30' N and longitude 3°15' W **[11].**

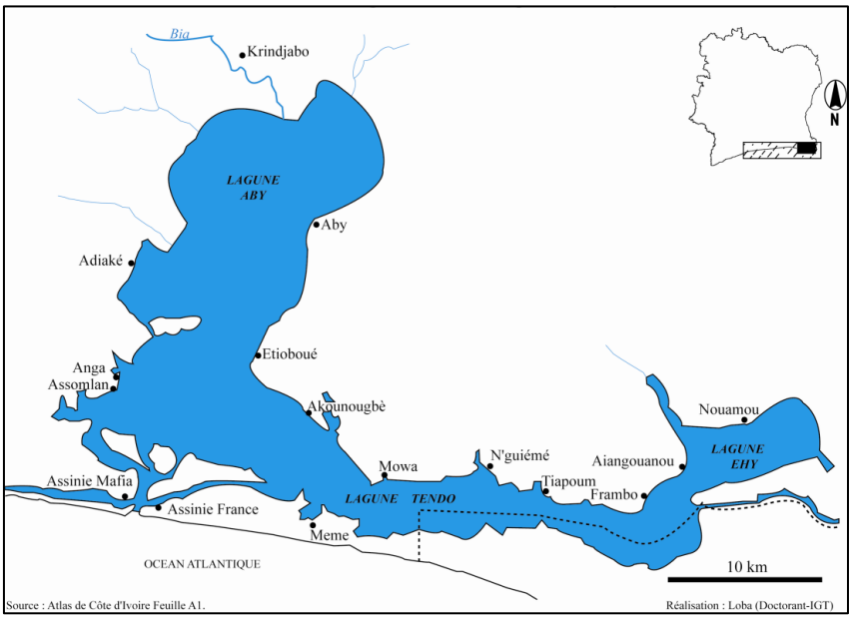

Fig. 1. Study area

2.2 DATA COLLECTION

Three methodological approaches were used from April to June 2022 to collect data. The first involved administrating a questionnaire to 70 fishermen operating at the sites of Eplemlan, Erokouan, Mauricekro and Akpagne. Secondly, an interview was conducted with agents of the Ministry of Animal Resources and Fisheries responsible for the monitoring and the statistic on fisheries production. Finally, visits were made to landing stages to examine the fishing equipment utilized, using tape measure and decameter. Information were sought on the type of fishermen, the fishing gears used, the species of fishes caught, the level of fishing exploitation and the difficulties encountered.

The age distribution of fishermen is inspired by that of **[12].** The guide in **[13]** was used to identify fishing gears. Gillnets were characterized by measuring the total stretched length and the meshes side in millimeters. The keys of **[14]** and **[15]** were used to identify fish species and families. For estimated production, daily weightings of catches were carried out using balance after the identification of the various fish species.

3 RESULTS

3.1 TYPES OF FISHERMEN

The fishermen surveyed were all Ivorian, indigenous and of Agni ethnicity. In addition, they were mostly without alternative activities (90% of stakeholders).

In socio-professional plan, 60% of those stakeholders were professional fishermen. Semi-professional (30%) and occasional fishermen (10%) were less numerous. However, 80% of all fishermen considered themselves to be traditional. In terms of years of experience, 60% had more than 10 years' experience. Those with between 5 and 10 years' experience accounted for 40%.

The fishermen surveyed did not belong to any cooperative society or formal organization. They refused to be identified and to submit their catches to veterinary controls. As a result, they carried out this activity without a fishing license or identification card. They were therefore considered as illegal fishermen.

In terms of level of education, half of the fishermen were illiterate (50%). In the category of school-educated fishermen, 30% had the level of primary school education, while those with secondary and higher education level each accounted for 10%.

Finally, in the terms of age, 80% of the surveyed fishermen were each above 45 years old (old age class). The others were in the 30-40 age group (20%). Young people (under 30) were therefore absent from this activity.

3.2 FISHING GEARS

3.2.1 BOATS

The survey identified 147 pirogues, the majority of those pirogues were pirogues with ribs (91 pirogues or 61.91%), one model of which is shown in figure 2A. The others were monoxyl pirogues (56 or 38.09%). Each fisherman owned between one and four pirogues, with 60% owning at least two. The maximum number of men was 4 (80%) of pirogues).

3.2.2 CAPTURE GEARS

Two types of fishing gears were identified. These were gillnets (Figure 2B) and hawks nets, numbering 242 and 7 respectively.

Gillnets accounted for 97.19% of fishing gears. They were divided into small-mesh nets (≤ 25 mm side mesh) for a total of 182 nets (75.20%) and medium-mesh nets (between 25 and 35 mm side mesh) for the remainder (24.80%). Their length varied from 75 m to 100m. The number of hawk nets per fishermen ranged from 1 to 3, with an average of 2 nets.

The majority of fishermen owned their fishing gears (90%). The others (10%) rented the gears for 1500 FCFA / net / fishing. Concerning the period of activity, 70% of those surveyed fished both day and night, 20% at night and only 10% during the day. Moreover, fishing was a year-rounded activity in this locality.

A: Pirogue with ribs *B: Gillnet*

Fig. 2. Some of the fishing gears found on the landing stages

3.3 FISH SPECIES CAUGHT

Six fish species were identified in the catches. These were *Ethmalosa fimbriata, Sarotherodon melanotheron, Mugil curena, Elops lacerta, Lichia glauca* and *Chrysichthys sp*. Their distribution is shown in the figure 3. The species *Ethmalosa fimbriata* (Clupeidae) and *Sarotherodon melanotheron (*Cichlidae) were in the majority, with proportions of 34.78% and 30.43% respectively. The least common was *Mugil curena* (Mugilidae) with 4.44% of productions.

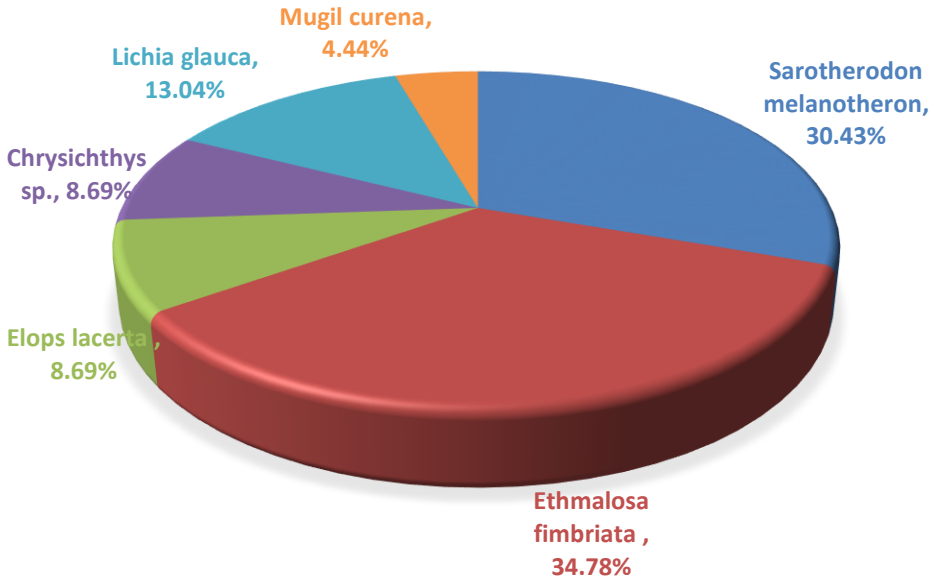

Fig. 3. Fish species caught in Aby lagoon by individual fishermen

3.4 FISH PRODUCTION EXPLOITED

Total annual biomass was estimated at around 275.73 tons, with each fisherman producing an average of 3.93 tons/year. High catches were achieved in June, July, August and September, when fishermen recorded between 30 and 150 kg of fish per fishing trip. Conversely, low production was recorded in January, February, November and December, with catches generally below 25 kg/day/fisherman.

3.5 REGISTERED CONSTRAINTS

Many difficulties exist in the collaboration between fishermen and the public administration in charge of controlling fishing on this stretch of water. According to these public officials (Veterinary Services), individual fishermen remain hostile towards them. Among other difficulties, no formal organization exist among the fishing communities. However, there is an informal association of individual fishermen, which operates as well as it can. Also, in relation to the census of catch levels, fishermen were not at all cooperative at this level, for fear of being regularly required to pay taxes. Only catches declared by fishmongers are therefore taken into account. Individual fishermen therefore reigned supreme on this stretch of water.

4 DISCUSSION

The indigenous nationals have exclusively control over the fishery studied. Most are traditional fishermen, and most have no alternative activities. This situation may be explained by the fact that fishing is their main source of employment, income and means of fighting against food insecurity. In addition, **[10]** notes that in the Aby lagoon, the reasons for banning foreign fishermen from working there were linked to their habit of abusive fishing, including the use of illegal gears and toxic products. This ban, confirmed by **[9],** is still the rule on this stretch of water. However, it does not seem to be applied to other lagoon water stretch in Côte d'Ivoire. Indeed, the authors **[16]** recorded 34.76% of foreign fishermen as Ghanaians, Malians, Togolese and Senegalese on the Grand-lahou lagoon. Furthermore, **[17]** reveals that on the lagoon water of Côte d'Ivoire, indigenous fishermen have gradually abandoned fishing in favor of new speculations (rubber farming, for example) deemed more economically profitable.

With regard to educational level, it was noted that fishermen were more likely to be illiterate (50%) and to have primary school education level (30%). Similar observations were made by **[16],** where 63.10% of the fishermen surveyed were illiterate, 24.60% of primary level and 12.30% of secondary level. This result is justified by the fact that they are traditional fishermen. As fishermen themselves, their parents gave almost no priority to sending their children to school.

With regard to fishing gears, individual fishermen prefer gillnets (97.19%) to hawk nets. Reference **[9]** mentions, in addition to these two fishing gears, the use of creels in Aby lagoon. Observations in this work are similar to those made by **[16]** where

fishermen use the same gears (79.68% gillnets and 20.32% hawk nets). The preference for these fishing gears by individual fishermen could be explained by their ease of handling and relatively low acquisition cost.

In addition, small-mesh gillnets (≤ 25 mm side mesh) with a proportion of 75.20% were the most used by fishermen. It should be noted that Ivorian administration does not authorize the use of side meshes smaller than 35 mm for this type of gear in continental fishing, according to public administration officials. As result, abusive fishing is practised there. According to **[10],** the reason for this is the search for more catches in order to improve profitability in a competitive environment with the collective of fishermen, whom they accuse of excessive fishing. Furthermore, **[18]** notes that the use of unconventional gears in Lake Bolondo in the Bagoué region could be explained by the lack of training and insufficient supervision of those involved in the industry.

Annual production was estimated at 275.73 tons, with each fisherman producing an average of 3.93 tons/year. Furthermore, catches are dominated by the species *Ethmalosa fimbriata* (34.78%) and *Sarotherodon melanotheron* (30.43%). The dominance of these species is in line with the findings of **[10],** which showed that *Ethmalosa fimbriata* was in the first place with a proportion of 60% followed by *Sarotherodon melanotheron,* which accounted for 20% of catches provided by the individual and collective gear pair. However, the biomass obtained remains lower than the actual quantity. Not all individual fishermen were surveyed. Also, as indicated in the results, the catches of these individual fishermen are not taken into account by agents responsible for collecting the statistics. Another reason for this underestimation is that collecting statistics remains a difficult activity.

5 CONCLUSION

In the Aby lagoon, individual fishermen are Ivorian. They are more illiterate and have a primary school education level. Fishing is mostly carried out with non-regulation gillnets. Catches are dominated by the species *Ethmalosa fimbriata* and *Sarotherodon melanotheron*. Poor cooperation between fishermen and the public administration has a negative impact on data collection and the organization of fishing activities. In order to avoid a possible collapse of stocks, development programs and research projects must be implemented to restore the lagoon and its resources.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

Kouamé Marcel N'DRI and Koudou Lobel Henri Michel ADJI collected data from fishermen and the fisheries administration. Kouamé Marcel N'DRI and DIABY Moustapha took part in drafting the document. Dramane DIOMANDE supervised the work.

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