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Actors, methods and production of fish fishing in the Aby lagoon (Côte d'Ivoire)

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ABSTRACT

Fishing provides the main source of dietary protein and is a resilient economic activity that influences fish stocks in the Aby lagoon. It led to an initial collapse and is now in a critical situation, generating conflicts. Decision-making to control this situation requires real data. Thus, surveys on fishermen's activity and landings were conducted to elucidate the factors of production and production in this study. The results show that the majority of national actors (80.30% of this population) are 71.08% educated. Adults aged 30 to 45 (49.67%) dominate this group of actors, most of whom are married (80.69%) and classified as occasional fishermen (49.46%). These fishermen, 49.56% of whom combine fishing with other activities, use gillnets, traps, bamboo traps, longlines, cast nets, purse seines and acadjas as fishing gear. The total fishing effort calculated for the Aby lagoon is 20,129 trips with the highest effort recorded in Adiaké (48%) and lowest in Ettuéboué (19 %). Total annual production amounted to 2,105.394 Kg highest in Assinie-Mafia (34.85 %) and lowest in Adiaké (31.72%). The total catch per unit effort is 237.80 kg/trip, highest in Assinie-Mafia (53.39 %) and lowest in Adiaké (17.90 %).

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INTRODUCTION

Fishing is an activity that involves capturing aquatic resources (fish, shrimp, crabs, molluscs, etc.). It plays a major role in food security and provides the main sources of dietary protein, contributing to economic growth (FAO, 2010). However, fishing affects the dynamics of fish stocks and populations (Myers and Worms, 2003). Today these aquatic resources face multiple constraints, the most significant of which are related to their status with 61.3% fully exploited and 9.9% of the stock underexploited (FAO, 2014). Thus, average fish consumption is estimated at 20.7 kg per capita worldwide and 9.4 kg per capita in Africa (FAO, 2024).

Côte d'Ivoire, the implementation of the new fisheries policy led to an increase in average fish consumption to 24.9 kg per capita (Fréchet *et al.*, 2022). Despite this new policy, the fisheries sector still faces challenges that are attracting the attention of researchers, particularly in the Ivoirien lagoons, despite studies already conducted by Anoh (2010); Diaby *et al.* (2012); Koulaï (2012 and 2014). Today, on the Aby lagoon, for example, overfishing has led to conflicts in certain areas (Anoh, 2012). This study is part of a series of studies aimed at establishing a better management plan for the Aby lagoon. Its objective is to describe the factors of production and production on this lagoon.

MATERIALS AND METHODS

Study environment

This study was conducted in the Aby lagoon (Fig. 1), located between 5°30' north latitude and 3°15' west longitude (N'dri *et al.*, 2023). It covers an area of 424 km² with 30 km along the coastline and 56 km from west to east. Its north-south extension is 25 km (Chantraine, 1980). The Aby lagoon is the intersection of the departments of Adiaké in the centre, Aboisso in the north and Tiapoum in the south-east.

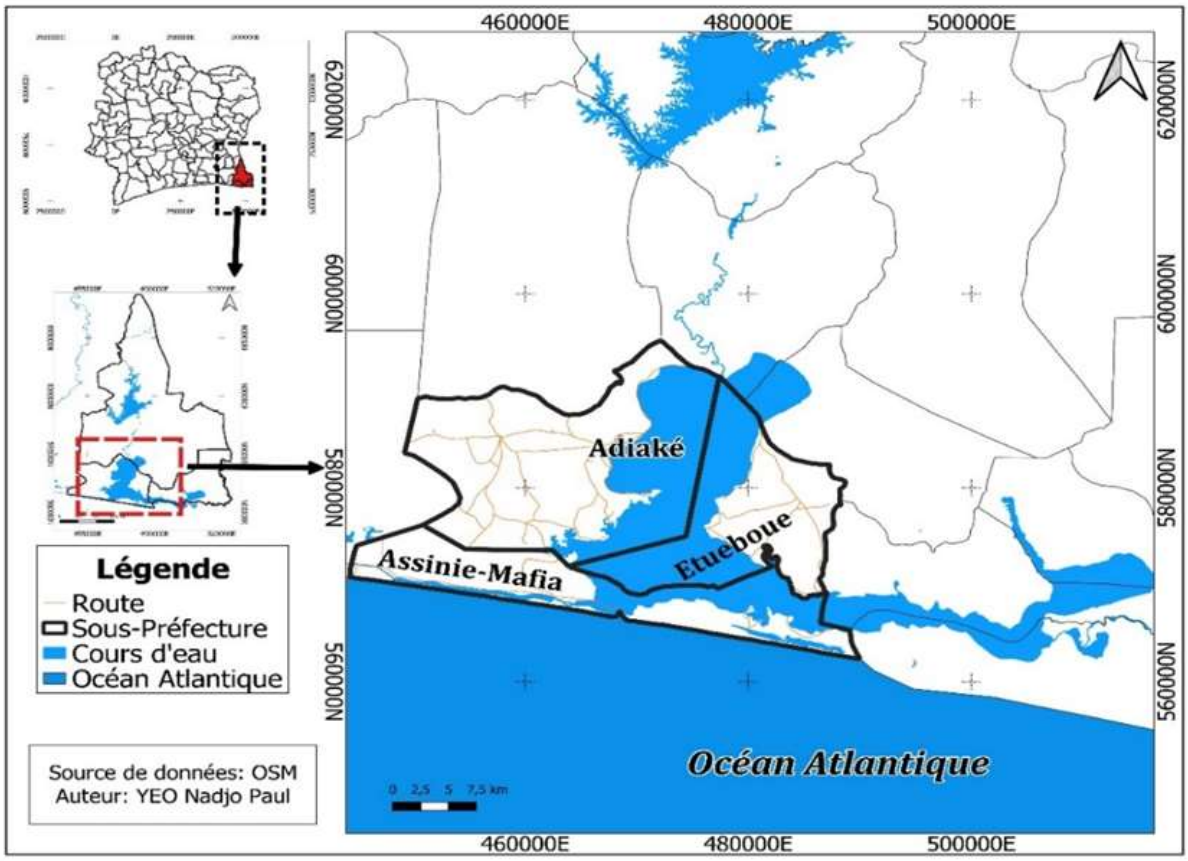

Fig. 1. Geographical location of the Aby Lagoon

Data collection

Survey on fishermen's activity

Data collection was carried out from March 2023 to February 2024 and comprised the distinct components. These included daily monitoring of fishing activities, as well as repeated surveys of fishermen to document their fishing techniques. The first part consisted of giving a questionnaire to each fisherman covering the following information: full name, nationality, gender, date of birth, level of education, marital status, fishing gear main activity and alternative activities. Direct observations on the ground were carried out to verify the information collected from the actors. The criteria defined by Vanga (2001) were used to classify fishermen according to their professional category and age. In addition, the distribution system proposed by Kien (2016) was used to group fishermen according to their educational level, nationality and marital status.

Survey of fishermen's landings

Fish landing surveys conducted four days per month over a period of 12 months. During these various missions, we examined the fishermen's daily catches. The fishermen were chosen at random and for each landing, the following information was recorded:

1. Date of departure and return from fishing
2. Type of vessel used
3. Total catch weight

These surveys enabled us to determine fishing effort, production and catch per unit effort.

Data processing

Fishing effort: Fishing effort is the sum of daily trips for all gear actually used to catch fish. The number of fishing trips per month (Ei) and per year for each fishing unit was calculated.

$$E_i = \sum_k E_{i,k}$$

Where k= the type of fishing gear

Production: The total production quantity is the sum of daily catches during month i. Each fishing gear monthly catches (Ci) per area (in kg) were calculated. The sum of monthly quantities was used to calculate the total annual quantity (Ca) of fish caught by fishermen using the following formula (Kien, 2016) :

$$C_a = \sum Ci$$

Catch Unit Effort (CPUE): The catch per unit effort (CPUE) is the total weight of fish caught by a fisherman during a fishing trip. It is expressed in kg/trip for all gear types. For each month and for each gear type, an average catch per unit effort (CPUEm) was determined from all daily catches recorded during the month in question, using the formula proposed by Kien (2016).

$$CPUEm = \frac{Mt}{Nt}$$

Mt = total mass in kg of daily catches landed by all fishermen surveyed during the month;

Nt = total number of fishing trips in the month

Statistical analysis

The collected data were processed and the survey data were analysed using SphinxPlus.V5. TuiTe software. The ANOVA test was applied in order to understand the origin of the sample distribution. This test evaluates the differences between means.

RESULTS

Factors of production

Fishermen

The surveys conducted during this study identified 461 fishermen spread across the sub-prefectures of Adiaké (251 fishermen or 54.45%) Assinie-Mafia (124 fishermen or 26.90%) and Ettuéboué (86 fishermen or 18.65%) (Table 1).

Nationality and ethnicity

The results of our surveys reveal that the fishermen interviewed comprise 371 Ivorians (80.30%) 78 Ghanaians (16.92%) 10 Beninese (2.16%) and 3 Malians (0.66%). The majority ethnic groups in the Aby Lagoon area are the Agni (32.54%) among nationals and the Ashanti (16.92%) among non-nationals (Table 1).

Table 1. Distribution of fishermen according to ethnicity and nationality in the various sub-prefectures of the Aby lagoon from March 2023 to February 2024

Sub-prefecture	Assinie-Mafia		Adiaké		Ettuéboué		Total	
Nationalities/Ethnicities	Nomber	%	Nomber	%	Nomber	%	Nomber	%
Ivorians								
Agni	65	14.10	150	32.54	49	10.63	150	32.53
N'zima	36	7.81	15	3.25	4	0.87	55	11.93
Bétibé /Ehotilé	3	0.65	10	2.17	15	3.25	28	6.07
Senoufo		0.00		0.00	4	0.87	4	0.87
Apollo		0.00	20	4.34		0.00	20	4.34
Total Ivorians	104	22.56	194	42.08	73	15.84	371	80.30
Ghanaians								
Ashanti	18	3.90	48	10.41	10	217	78	16.88
Total Ghanaians	18	3.90	48	10.41	10	2.17	78	16.88
Beninese								
Fon	2	0.43	8	1.74		0.00	10	2.16
Total Beninese	2	0.43	8	1.74		0.00	10	2.16
Malian								
Bambara	0	0.00	0	0.00	3	0.65	3	0.66
Total Malian	0	0.00	0	0.00	3	0.65	3	0.66
Total by site	124	26.90	251	54.45	86	18.66	461	100

Table 2. Distribution of fishermen by educational attainment on the Aby lagoon from March 2023 to February 2024

Fishermen	Ivorians		Foreigners		Total	
Schooling	Nomber	%	Nomber	%	Nomber	%
Schooled	263	70.89	30	32.97	293	63.56
Not in education	108	29.11	61	67.03	169	36.66
Total per community	371	100	91	100	461	100

Table 3. Distribution of fishermen by age group on the Aby lagoon from March 2023 to February 2024

Fishermen	Ivorians		Foreigners		Total	
Age groups	Nomber	%	Nomber	%	Nomber	%
30>	42	11.32	31	34.07	73	15.80
[30-45[	186	50.13	44	48.35	230	49.80
[45<	143	38.55	16	17.58	159	34.40
Total d'âge	371	80.48	91	19.74	461	100

Table 4. Distribution of fishermen by marital status on the Aby lagoon from March 2023 to February 2024

Communities	Ivorians		Foreigners		Total	
Matrimonial	Nomber	%	Nomber	%	Nomber	%
Married	314	84.64	59	64.84	372	80.69
Single	43	11.59	32	35.16	75	16.27
Divorced	14	3.77	0	0.00	14	3.04
Total community	371	80.48	91	19.74	461	100

Table 5. Occupational categories of fishermen in the Aby Lagoon from March 2023 to February 2024

Sub-prefecture	Assinie-Mafia				Adiaké				Ettuéboué				Total	
Communities	Ivorians		Foreigners		Ivorians		Foreigners		Ivorians		Foreigners			
Activities	Nomber	%	Nomber	%	Nomber	%	Nomber	%	Nomber	%	Nomber	%	Nomber	%
Professional fishermen	21	4.56	5	1.08	59	12.80	13	2.82	22	4.77	4	0.87	124	26.96
Fishermen's assistants	19	4.12	9	1.95	40	8.68	37	8.03	10	2.17	4	0.87	119	23.48
Occasional fishers	64	13.88	6	1.30	96	20.82	6	1.30	40	8.68	5	1.08	217	49.56
Total fishermen	104	22.56	20	4.34	195	42.30	56	12.15	72	15.62	13	2.82	461	100

Level of education

The school enrolment rate for all fishermen in the Aby Lagoon is 63.56%. It is 70.89% for nationals, compared with 32.97% for non-nationals (Table 2).

Age groups

Adults aged between 30 and 45 (49.80%) dominate fishing activity on the Aby lagoon. They are followed by older people (>45 years old) (34.40%) and young people (<30 years old) (15.80%). Among nationals adults are also the most represented, accounting for 50.13% of fishermen. They are followed by the elderly who account for 38.55% and young people who account for 11.32% of the workforce. Among non-nationals adults also dominate, accounting for 48.35%. Young people (34.07%) and older people (17.58%) are less numerous (Table 3).

Marital status and dependants

Of all the fishermen surveyed 80.69% live with their wives followed by 16.27% who are single and 3.04% who are divorced (Table 4). Among nationals these rates are distributed as follows: 84.64% (married) 11.59% (single) and 3.77% (divorced). Among non-nationals, the rates are 64.84% (married) and 35.16% (single). Each fisherman is responsible for between 2 and 18 people, with a higher average among nationals (8) than among non-nationals (2).

Professional category of fishermen

Three categories of fishermen have been identified on the Aby lagoon. First there are professional fishermen who make up only 26.96% of this community and consist of 22.12% national fishermen and 4.77% non-national fishermen. Next are occasional fishermen who make up the majority of this population with a percentage of 49.56%. This group is composed of 41.21% nationals and 3.69% non-nationals. Finally, there are fishing assistants who make up 23.48% of the population with 12.58% nationals and 10.85% non-nationals (Table 5).

Fishing and related activities

On the Aby lagoon, only 124 fishermen (26.96%) fish as their sole activity. The others (217 or 49.56%) combine fishing with another activity (Table 6). In this second group farmer-fishermen (16.59%) and fish farmer-fishermen (15.67%) are the most numerous. Ivorians are the most represented in these two groups with 16.59% and 15.67% respectively. Fishermen-traders are also significant in this group, accounting for 12.90% of whom 12.44% are Ivorians and 0.46% are non-nationals. The other activities associated with fishing are presented in Table 6.

Fishing equipment

Boats

A total of 390 canoes were counted on the Aby lagoon during the present surveys (Fig. 2).

Fig. 2. Types of boats on the Aby lagoon from March 2023 to February 2024 (a = dugout canoe, b = nailed plank canoe, c = sailing canoe, and d = square-rigged canoe)

Nailed and square-bottomed canoes dominate the canoe fleet accounting for 53% and 36% respectively. These are followed by dugout canoes and monoxyl canoes accounting for 7% and 4% respectively (Fig. 4). The canoe fleet is denser in Adiaké (41%) than in Assinie-Mafia (35%) and Ettuéboué (24%). The majority of these boats (89%) are motorised.

Fishing gear and techniques

Seven types of fishing gear and techniques used in the Aby Lagoon, namely gillnets, traps, bamboo traps, longlines, cast nets, acadjas and purse seines (Fig. 3).

Fig. 3. Types of fishing gear used in the Aby lagoon from March 2023 to February 2024 (a: gillnet, b: cast net, c: longline, d: trap net, e: seine nets, f: bamboo trap and h: acadja net)

The gillnets are rectangular in shape with an upper selvedge equipped with floats and a lower selvedge carrying weights (Fig. 3a). These nets vary in length from 500 to 1000 cm and have a drop of 1.5 to 3 m with mesh sizes between 0.5 and 5.5 cm. They are used as fixed nets.

They are made of either multifilament or fine monofilament nylon. These nets can be handled by one person or a team of two. To set the nets the edges are placed in the water. The lower edge attached to stones sinks into the water, while the edge with the floats remains on the surface and is connected to a float canister. They are set in the evening (4-6 p.m.) and lifted the next morning (6-8 a.m.). The cast net consists of a circular multifilament net with weights around the edge (Fig. 3b). It is conical when deployed shape and is generally used in shallow water. The nets used to make it have meshes between 10 and 30 mm. The cast net can be thrown from the shore or from a boat.

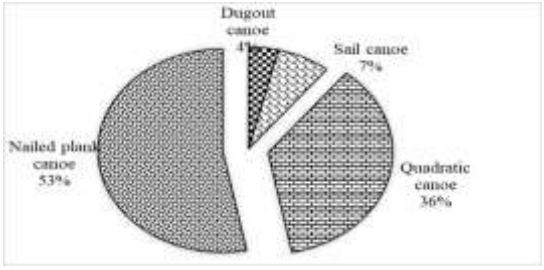

Fig. 4. Percentage of different types of canoes on the Aby lagoon from March 2023 to February 2024

The longline consists of a main line, called the mother line or leader, to which hooks are attached. The number of hooks ranges from 200 to 500.

The distance between the hooks depends on the species being targeted. The line is set in the evening and retrieved after 3 to 4 days.

Pots are cylindrical traps with cage or basket shapes equipped with nets on a vine frame used to catch fish. Three types of traps are used in the waters of the Aby lagoon. These are metal mesh traps, net traps mounted on vines, and bamboo traps (Fig. 3d). These traps are usually baited with corn bran, cassava, and coconut meal.

The seines used in the Aby lagoon are purse seines. These nets are made from multifilament nets with a mesh size ranging from 1 to 1.5 cm between each knot. The seines do not have a true pocket. In general, their length varies from 25,000 to 40,000 cm and their drop height from 700 cm. The seines are used in shallow areas, which have been cleared of the numerous tree stumps that litter the bottom of the lagoon. They are collective gear, requiring the presence of 6 to 20 people to operate (Fig. 3e).

Bamboo traps are sections of Chinese bamboo that are completely open at one end and pierced with a small hole at the other, to allow water circulation (Fig. 3f). These traps come in two forms. Some consist of a single tube one metre long hung vertically with the large opening facing upwards. The other type of

bamboo trap consists of a set of three tubes each about 40 cm long tied together with string. They are placed horizontally on the bottom and held in place by stones.

Acadja nets are made of monofilament threads with a mesh size ranging from 10 to 20 mm. These nets surround the acadja trap made of branches to prevent fish from escaping. They are 500 to 1,000 cm long and 1 to 1.5 m high. Four people are requied to operate these nets. They are used in shallow areas (Fig. 3h).

Production

Fishing effort

The results of this study indicate that fishermen carried out a total of 20,129 fishing trips between March 2023 and February 2024 in the Aby lagoon. This fishing effort was distributed as follows: 9,596 trips (48%) in Adiaké, 6,748 trips (33%) in Assinie-Mafia and 3,785 trips (19%) in Ettuéboué (Fig. 5). The highest fishing effort was observed in Adiaké (8,161 trips) while the lowest in Ettuéboué (2,750 trips). The monthly average is 5,069.33±2,786.28 trips. ANOVA test applied to these values indicates a significant difference ($p< 0.05$) between the fishing efforts recorded in these three locations.

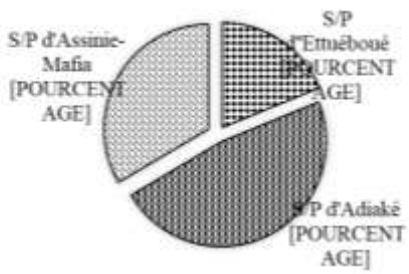

Fig. 5. Fishing effort by study location and fishing gear in the Aby lagoon from March 2023 to February 2024

The Ettuéboué sub-prefecture, the maximum fishing effort (688 trips) was recorded in December and the minimum (9 trips) in August, with a monthly mean of 229.17±211.46 trips (Table 7). The effort highest Adiaké (1,785 trips) was observed in December and the lowest (23 trips) in August, with a monthly mean of 680.08±507.26 trips.

Table 6. Additional activities of fishermen in the Aby lagoon from March 2023 to February 2024

Communities	Ivorians		Foreigners		Total	
Activities	Nomber	%	Nomber	%	Staff	%
Fishing + agriculture	36	16.59	0	0.00	36	16.59
Fishing + trade	27	12.44	1	0.46	28	12.90
Fishing + farming	18	8.29	0	0.00	18	8.29
Fishing + security guard	5	2.30	0	0.00	5	2.30
Fishing + fish farming	34	15.67	0	0.00	34	15.67
Fishing + mechanics	8	3.69	0	0.00	8	3.69
Fishing + coconut cracker	11	5.07	9	4.15	20	9.22
Fishing + building electrician	4	1.84	0	0.00	4	1.84
Fishing + refrigerator repair	2	0.92	1	0.46	3	1.38
Fishing + football	3	1.38	0	0.00	3	1.38
Fishing + sewing	6	2.76	0	0.00	6	2.76
Fishing + land transport	5	2.30	0	0.00	5	2.30
Fishing + lagoon transport	24	11.06	1	0.46	25	11.52
Fishing + koutoukou production	17	7.83	0	0.00	17	7.83
Fishing + canoe design	5	2.30	0	0.00	5	2.30
Total fishermen + related activities	205	94.47	12	5.53	217	100

Table 7. Variations in fishing effort according to the different sub-prefectures of the Aby lagoon from March 2023 to February 2024

Sub-prefectures	Total output	Minimum output	Maximum output	Average output
AssinieMafia	4297	0	1027	358.08±305.83
Ettuéboué	2750	9	688	229.17±211.46
Adiaké	8161	23	1785	680.08±507.26

Sub-prefecture Assinie-Mafia the maximum effort (1,027 trips) was also recorded in December while no fishing trips (0 trips) in August a monthly mean of 358.08±305.83 trips.

The performance of the gear types is distributed as follows: gillnets (3,562 trips), purse seines (204 trips), cast nets (197 trips), bamboo traps (88 trips), longlines (43 trips) and acadjas (22 trips) (Fig. 6).

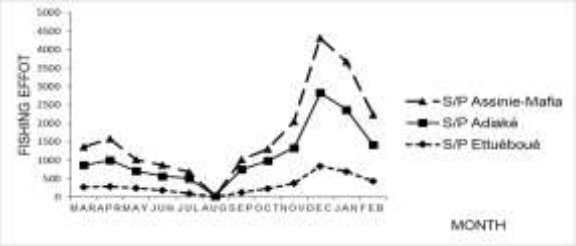

Fig. 6. Monthly variation in catches per unit effort in the Aby lagoon from March 2023 to February 2024

Total production

The total annual production of the Aby lagoon was 2,105.394 Kg with a monthly mean of 9.27±17.96 Kg (Table 8). The highest production (733.74 Kg or 34.85 %) was recorded in the Assinie-Mafia sub-prefecture. In this locality, the highest production was observed in December (291.48 Kg) and the lowest in September (5.23 Kg) with a monthly mean of 88.67±105.43 kg.

The lowest production was recorded in the Adiaké sub-prefecture with 667.81 Kg or 31.72 %). Production fluctuated between in 667.81 Kg in October and 2 kg in April with a monthly mean of 66.78± 79.81 Kg.

The Ettuéboué sub-prefecture production was 703.84 Kg (33.43 %). The highest production was recorded in December (482.54 Kg) and the lowest in September (2.23 kg). The monthly average in this locality was 2,937,016.5 ± 989,087.44 kg. The ANOVA test to comparing production across the three localities showed no significant difference ($p > 0.05$).

Table 8. Variations in fish production according to the different sub-prefectures of the Aby Lagoon from March 2023 to February 2024

Table 8. Variations in fish production according to the different sub-prefectures of the Aby lagoon from March 2023 to February 2024

Sub-prefecture	Production (Kg)			
	Total	Minimum	Maximum	Average
Ettuéboué	703.84	2.23	482.54	95.09±175.50
Adiaké	667.81	2	260.89	66.78± 79.81
Assinie-Mafia	733.74	5.23	291.48	88.67±105.43

Catch unit effort (CPUE)

From March 2023 to February 2024, the catch per unit effort for the entire Aby lagoon was 237.80 kg/trip, with a mean value of 97.62 ± 41.50 kg/trip. The highest CPUE was recorded in the Assinie-Mafia sub-prefecture (126.97 kg/trip or 53.39%) while the lowest was observed in the Adiaké sub-prefecture (42.56 kg/trip, or 17.90%) (Fig. 7).

In the Ettuéboué sub-prefecture the CPUE reached 68.28 kg/trips (28.71%). The maximum value (248.93 kg/trip) was observed in October whereas the minimum (0.009 kg/trip) occurred in September with a monthly mean of 51.68±79.79 kg/trip.

In Assinie-Mafia, CPUE values fluctuate between 271.94 kg/trip in December and 0.003 kg/trip in June with a monthly mean of 72.30±95.23 kg/trip.

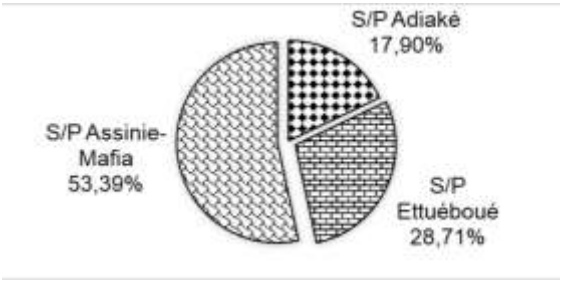

Fig. 7. Capture per unit of effort in the various sub-prefectures studied in the Aby lagoon from March 2023 to February 2024

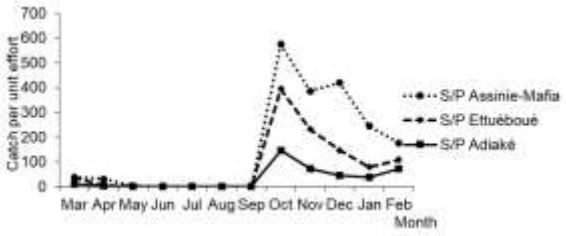

Fig. 8. Monthly variation in catch per unit effort in the various study locations in the Aby lagoon from March 2023 to February 2024

In Adiaké, the highest CPUE was recorded in October (145.43 kg/trip) and the lowest CPUE in August (0.006 kg/trip), with a monthly mean catch of 32.07±45.31 kg/trip (Fig. 8).

Statistical analysis (ANOVA; $p< 0.05$) indicates a significant difference between locations.

DISCUSSION

The study shows that fishing activity in the Aby lagoon is predominantly carried out by national fishermen (80.30%). This predominance is explained by the fact that foreign fishermen were banned from this body of water by local residents following the post-election crisis of 2011. These events led to their departure to other fishing areas. Furthermore, the majority of these fishermen (49.80%) are between 30 and 45 years old. The massive presence of this adult segment in fishing activity in this eastern area of Côte d'Ivoire, already reported by Vanga (2001) and Tah *et al.* (2009) on Lake Ayamé 1, is thought to be linked to the same 2011 military-political crisis. During this period many young people fled the cities for the villages. This influx coincided with the departure of foreigners, which led these young people to take up fishing. Fourteen years later, they now belong to the adult class. The examination of educational attainment revealed that fishermen with schooling (63.56%) constitute the majority. Cissé (2022) work also mentioned these observations. This high school enrolment rate could be explained by the fact that many students who drop out of school return to their respective villages and take up fishing. In terms of the fishermen's responsibilities, the majority (80.69%) are married under customary law. This marital situation can be explained by the important role that women play in organising their husbands' work. Indeed, they assist their husbands by marketing and/or processing fish, as highlighted by Kien (2016) and Cissé (2022) in their respective works. The majority of fishermen (16.59%) combine agriculture with fishing. These results are similar to those noted by Boguhé *et al.* (2011) and Kien (2016). These authors believe that for Ivorians, who are more numerous in this community, fishing is not an activity to be passed on to their descendants, unlike farming, hence the need for these practices, which also protect their forest heritage in a context of recurrent land conflicts in the area.

Furthermore, this behaviour on the part of fishermen may be attributed to changes in water colour and the scarcity of fish, especially in the southern area. This has forced some fishermen to turn to agriculture, livestock farming, maritime transport and other informal activities when fishing is impossible.

Monitoring of fishing activities shows higher fishing effort in Adiaké (48%) and lower effort in Ettuéboué (19%). The majority of trips made in Adiaké could be due to both the town's proximity to the lagoon and the higher number of fishermen in this locality. The low fishing effort in Ettuéboué can be explained by the absence of fishing during the flooding of the Bia River, combined with the impossibility of navigating to transport products to the various markets during this period. According to fisheries officials, this discontinuity leads to a significant lack of control over resources. On this subject, Boguhé *et al.* (2011) established a correlation between the number of fishermen and fishing effort.

The total annual production exploited from the Aby lagoon is 2,105.394 Kg. The highest production is obtained in Assinie-Mafia and the lowest inAdiaké. The results of Diaby *et al.* (2012) indicate that high production is linked to high fishing effort. The high production in Assinie-Mafia would therefore be linked to its higher fishing effort.

The total annual catch per unit effort in the Aby lagoon is 237.80 kg/trip. It is higher in Assinie-Mafia. This catch is thought to be due to the effect of the end-of-year festivities, with the massive arrival of fishermen from Ghana to pull in their seines. The end-of-year holidays are a time of high fishing pressure from seine nets. The low catch per unit effort in August could be explained by the rising waters and the reproductive cycle of certain species. The low catch per unit effort in August could be explained by the four-month closure of the seine fishery each year for biological rest. This period is established by the prefect of Adiaké for the biological rest of the lagoon so that populations can replenish their aquatic resources.

CONCLUSION

At the end of this study, the results revealed that fishing is practised by both nationals and non-nationals. On the Aby lagoon, fishing is dominated by nationals, mainly Agni. These fishermen are mostly farmers and fish farmers. They are mainly adults, married and educated. They use gillnets, purse seines, cast nets, traps, longlines, bamboo traps and acadjas.

The total fishing effort is 20,129 trips with a total annual production of 9,216,022.353 kg.

Most of the fishing effort and production comes from the sub-prefecture of Adiaké (9,596 trips and 46,103,113.802 kg). The annual catch per unit effort 237.80 kg/trip and higher in Assinie-Mafia (856,167.786 kg/trip). The collapse of the fish stocks in this lagoon could have devastating consequences for the ecology and economy of the Adiaké department, which is highly dependent on fishery resources.

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