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RESEARCH ARTICLE

FISHING EFFORT, CATCH PER UNIT EFFORT AND FISH PRODUCTION OF PURSE SEINES OPERATING AT THE EAST OF BOULAY ISLAND (OSSIBISSA, CÔTE D'IVOIRE, WEST AFRICA)

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ABSTRACT

Catch composition, fishing effort, catch per unit effort and the purse seine production were estimated through this study. Samplings were carried out from May 2022 to April 2023 by the mean of artisanal purse seine fisheries. Few species namely *Sardinella aurita*, *S. maderensis*, *Caranx crysos* and *Engraulis encrasicolus* were recorded in the catches. Length frequency distribution shows for both species *Sardinella aurita* and *S. maderensis* the presence of mature individuals regarding mean size and length range. The highest fishing effort and monthly CPUE were recorded during the long cold season (July). Regarding CPUE of the main species, the highest values were obtained with *Sardinella aurita* during the cold season. The purse seine production oscillated between 20.995 tons in May and 36.365 tons in July with a mean production of 28.680 tons. The total fish production was estimated at 34.25 tons.

INTRODUCTION

Fish is an important source of protein, especially in the developing world and represents between 15-16 kg/year of consumption per inhabitant. In West Africa, the fishing sector plays an important role by providing food security (Chavance and Morand, 2020). Small-scale fisheries are an important sub-production for food and nutrition security. According to current data, the small-scale sector accounts for about half of global catch and 90 percent of the world's fishers (World Bank, 2012). Despite general agreement about the significance of small-scale fisheries for food security and livelihoods, lack of reliable data precludes a more rigorous quantification of that significance. Often, small-scale vessels are not registered or their catches are not reported in statistics. Moreover, it is difficult to discretely classify small-scale production as subsistence, that is, for direct consumption by the family or community, or commercial, because many of the fisheries are multi-species and harvest concurrently for household consumption and trade (Allen, 2013).

As a result, official statistics (that is, those reported to FAO) likely underreport small-scale fisheries catches. Catch reconstruction data estimate much higher landings for marine small-scale fisheries (Chuenpagdee et al., 2006; Belhabib and Pauly 2015; Zyllich and Pauly., 2015). Small-scale fisheries are less monitored and controlled because of the multiplicity of landings points. This situation makes a great deal of information escapes scientist and fisheries managers. The study area (Ossibissa) a place of intense fishing activity (Kacou, 2019) is concerned by the almost total lack of fishery monitoring. The purpose of the current study was to Characterized the production parameters of the study area in terms of fishing effort, catch per unit effort. Information acquired from this study will bring contributions to the already existing management interventions geared towards sustainable fishery in Côte d'Ivoire coastal waters

MATERIALS AND METHODS

Study area: This study focused on the south coastline of Côte d'Ivoire at the east of Boulay island (Ossibissa) located at 4° 5' 9'' W and 5°16' 45'' N (Duffour et al., 1985). The vegetation of the study

area consists mainly of mangroves dominated by *Rhizophora racemose*.

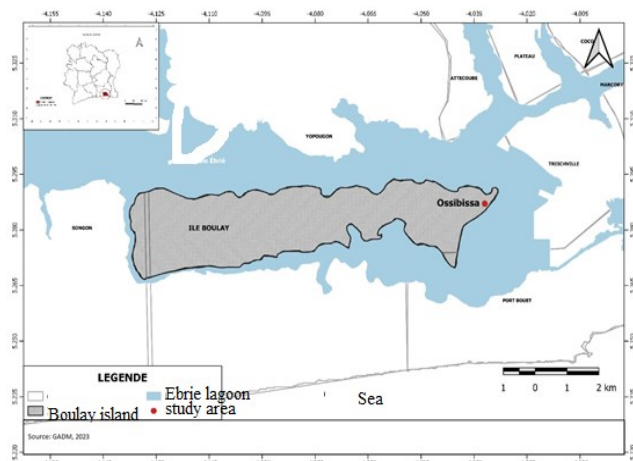


Figure 1. Mapshowing the study area

Data collection

Data were collected from commercial catches between May 2022 and April 2023 and involved two major research activities. i) survey designed to obtain information on the fishermen activities and survey designed to obtain information on landings. Concerning the first step, from Mai 2022 to April 2023, each month during 15 days, information such as number of fishing trip and the probable cause (s) of non-fishing were recorded. The second step concerned survey of daily catches during four days per month. Total catch of each fisherman was weighted. Fish species composition, weight and / or number of individuals per specie were noted. Species were identified according to fisheries. Fishing effort considered in the present study was the fishing trip per day. The fishing effort by gear type was then evaluated per month. The total monthly catches per unit effort (CPUE) were estimated using a model equation derived from the one developed by each landing, all the catch or 30 individuals when the catch exceeded 10 kg chosen randomly were weighted to the nearest gram and. Independently daily statistics production were recorded during 15 days per month.

Data analysis

Catch per unit effort: Catch per unit effort (CPUE) is the average catch rate. CPUE (Kg/Harvester/day) for the site was estimated after the sum of all weighted catches divided by the number of harvesters (Mafambissa et al., 2022) the monthly total catches were also estimated (Tah et al., 2012): $C(t) m = CPUEm \times fm \times Nfm$ With C (tm): the monthly total catches in the month m; CPUEm= weight of fish caught (kg) per unit effort in the month m; fm = the month average fishing effort and Nf m the number of fishing days during the month The annual total catches were estimated by adding up each monthly catches $Ca = \sum (t) m$ with Ca: annual catches; C (tm): monthly catches

Statistical analysis: The CPUE data followed a normal distribution and thus parametric analysis of variance (ANOVA) was used to compare species CPUE among seasons.

RESULTS

Catches composition of purse seine from the study area: *Sardinella aurita*, *S. maderensis*, *Engraulis encrasicolus*, *trachurus tracae*, *Caranx crysos*, *Selene dorsalis* were the essential species in the catches. *S. aurita* was the top dominant species with 59% followed by *S. maderensis* with 28% and *Caranx crysos* (4%) (Figure 2).

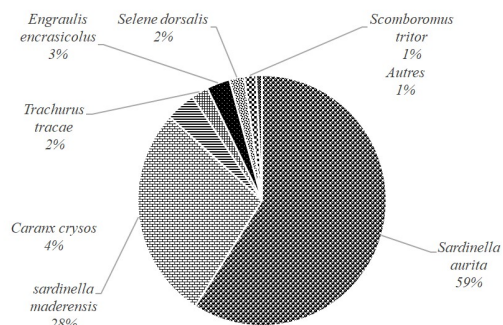


Figure 2. Ponderal proportions of dominant fish species landed by purse seines in the study area (Ossibissa) from May 2022 to April 2023

Length frequency distribution of *Sardinella aurita*, *S. maderensis* and *Engraulis encrasicolus* in the catches: The length range of *Sardinella aurita* in the catches was from 7 to 46 cm with a mean of 18,74 cm. The modal class was ranged in the interval 19-20 cm. The length range of *S. maderensis* was from 13 to 41 with a mean length at 24.51cm. The length range of *Engraulis encrasicolus* was from 4 cm to 8 cm with a mean length of 6.07 cm. The modal class was ranged at 6-7 cm for the species (Figure 4).

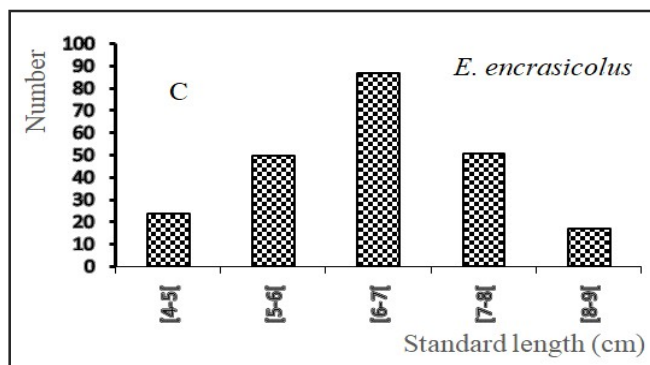
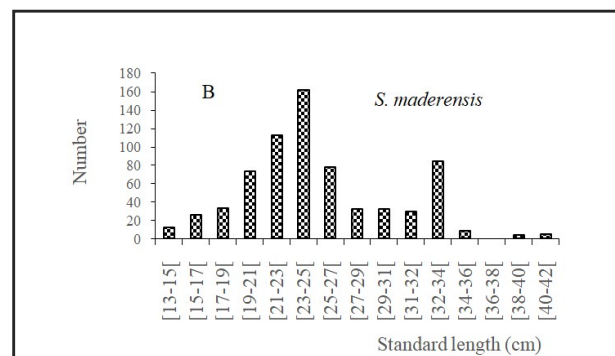
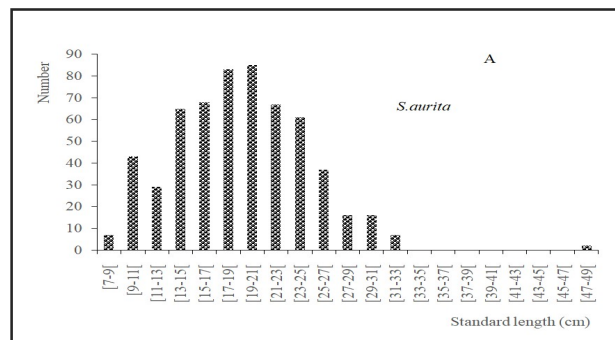


Figure 3. Length frequency distribution of *S. aurita* (A), *S. maderensis* (B) and *Engraulis encrasicolus* (C).

Table I. Seasonal variations of CPUE in the main species at Boulay island during the surveys period from May 2022 to April 2023.

CS: cold season, WS warm season

	<i>S. aurita</i>	<i>S. maderensis</i>	<i>T. tracae</i>	<i>C. crysos</i>	<i>E. encrasicolus</i>	mean
CS	256.65	176.95	61.80	66.73	57.83	123.99
WS	214.93	136.15	51.43	51.43	59.35	104.63

Fishing effort: The temporal fishing effort variations for purse seines in the study area were mentioned in figure 5. The highest fishing effort (15 fishing trip/day) in the study area was recorded in the long cold season whereas the low values (8-9 fishing trip/day) were obtained in the short warm season.

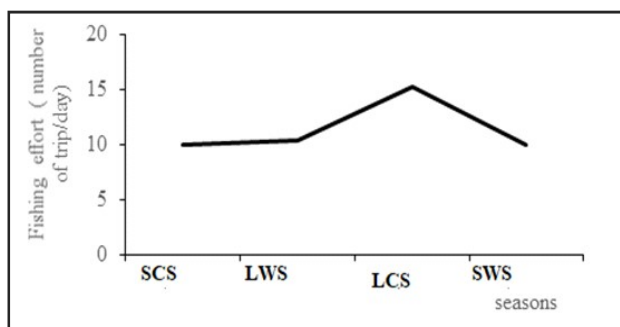


Figure 4. Seasonal variations of fishing effort of purse seines operating in the study area SCS: Short cold season; LWS: long warm season; LCS: long cold season; SW: short warm season

Catches per unit effort (CPUE) of the purse seines at Boulay island Monthly variations of CPUE of purse seines: The temporal Catches per unit effort (CPUE) of the purse seines were illustrated in figure 6. The highest value of CPUE (139.86 kg/fishing trip) was recorded in July whereas the lowest value of CPUE (80.74 kg/fishing trip) was recorded in May with a monthly mean value of 111,81±15,29 kg/fishing trip.

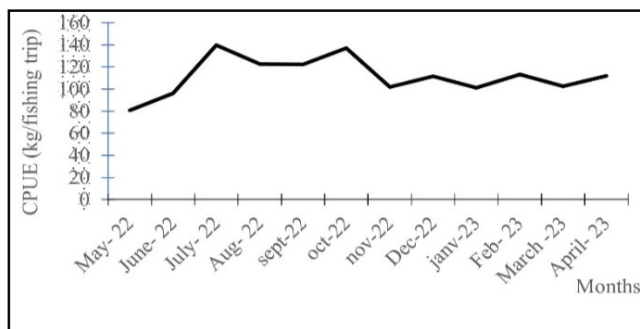


Figure 5. Monthly variations of CPUE at Boulay island during the surveys period from May 2022 to April 2023

Variations of CPUE for the main species: CPUE monthly variations for the main species were mentioned in figure 7. The highest value of CPUE (287kg/fishing trip) was recorded in *Sardinella aurita* in October (cold season) whereas the lowest value of CPUE (40 kg/fishing trip) was recorded in *Trachurus tracae* in Mai (warm season). The CPUE mean value was estimated at 232,63±62.80 ;153,17 ± 10.5; 55,75±10.60; 63,56±14.14; 58,72±7.07 for *Sardinella aurita*, *S. maderensis* *Trachurus tracae*, *Caranx crysos* and *Engraulis encrasicolus* respectively. ANOVA analysis showed a significant difference (p=0;000; F =19.56) between CPUE values of species.

Seasonal variations of the main species CPUE: CPUE seasonal variations were mentioned in table I. The highest value (256,65 kg/fishing tip) of seasonal CPUE was recorded in the cold season whereas the lowest value of seasonal CPUE (51.43 kg/fishing trip) was recorded in the warm season with a mean value of seasonal CPUE of 123.99 and 104.53 respectively.

ANOVA analysis showed that there was no significant difference (p>0.05; F =0.144) between CPUE values of cold and warm seasons.

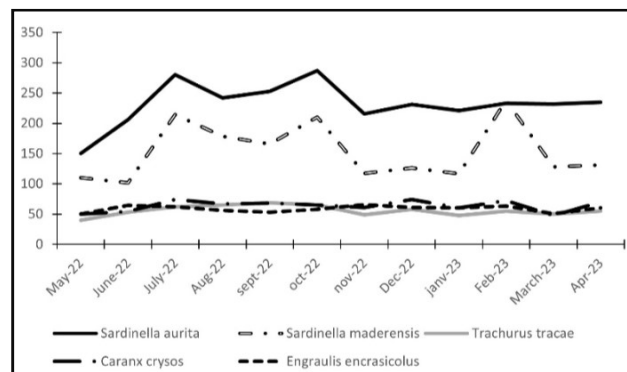


Figure 6: Monthly variations of the main species CPUE at Boulay island during the surveys period from May 2022 to April 2023

Total fish production of the purse seines at Boulay island: Figure 8 shows monthly fish production landed at Boulay island (Ossibissa) by purse seines. The highest value (3636.57 kg) of fish production was recorded in July and the lowest value (2099.40 kg) was obtained in May with a mean value of 2868.75±571.16 kg. the annual production of purse seines operating in Boulay island was estimated at 34.425 tons

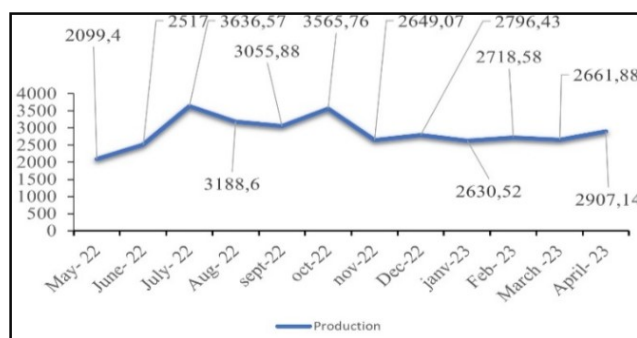


Figure 7. Monthly variation of fish production at Boulay island during the surveys period from May 2022 to April 2023

DISCUSSION

The result showing a predominance of certain pelagic fish in the catches is not specific to the present work. Indeed, according to Beare and Tanimomo (1991), the catches of purse seines in artisanal fisheries are made up of pelagic fish including *Sardinella aurita*, *S. maderensis* and *Engraulis encrasicolus*. Species number in the catches is low and indicates the selective nature of the fishing gear. *S. aurita* was the most abundant species in the catches as mentioned by Ecoutin (1992). Size composition of fish in the landings was determined from length-frequency distributions. The length distribution of *Sardinella aurita* and *Engraulis encrasicolus* showed a unimodal in landings whereas that of *S. maderensis* had a bimodal distribution. Our result was different from the unimodal length distribution of *Sardinella aurita* and *S. maderensis* mentioned in Ghana by Ofori-danson *et al.* (2018). The length values obtained in the present work are higher than the values mentioned in Ghana by Ofori-danson *et al.* (2018). Length frequency distribution of fish can be used as an indicator of overfishing particularly in data-poor fisheries contexts (Froese, 2004). If exploited stocks are dominated by fish above length at first sexual maturity, the fishery is likely to be sustainable. But, if the fish are landed below their size at first sexual maturity, it is a good indication that overfishing is occurring (Froese, 2004). Size data at first sexual maturity available for *S. aurita* and *S. maderensis* on the Ivorian coastal waters are 15.8 cm and 19.4 cm respectively indicating a sustainable fishery for these species.

The size at first sexual maturity mentioned in Ivorian coastal waters was 8.4 cm for the species (Ouattara *et al.*, 2015). According to Ecoutin (1992), clupeid family constitutes the majority of purse seine catches. This result is in agreement with our work where sardinella dominates the catches. The long cold season seems to be the most favourable for the activity, since the highest value of fishing effort was recorded during this period with purse seines. The result obtained in our study corroborated to that reported previously by Ecoutin (1989; 1992).

CONCLUSION

Results reported in the study give information on fishing effort of purse seine with higher values during the long cold season. Regarding the main species CPUE, the highest value was obtained with *Sardinella aurita* in October followed by *S. maderensis*. The total catch of the gear was estimated at 34.345 tons. The study also shows the selective nature of the purse seine with only few pelagic species in the catches.

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