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Socio-economic characteristics of the fishing fleets operating in Benin, West Africa

Simon Ahouansou Montcho[1], Setondé Constant Gnansounou[2,7*], Josiane Flora Chadare[3], Kolawolé Valère Salako[2], Zacharie Sohou[4], Pierre Failler[5], Romain Glèlè Kakaï[2] and Achille Ephrem Assogbadjo[2,6]

[1]School of Aquaculture, National University of Agriculture (UNA), Porto-Novo, Benin.
[2]Laboratoire de Biomathématiques et d'Estimations Forestières, Faculty of Agronomic Science, University of Abomey-Calavi, Benin.
[3] Laboratoire de Sciences et Technologie des Aliments et Bioressources et de Nutrition Humaine, Ecole des Sciences et Techniques de Conservation et de Transformation des Produits Agricoles (ESTCTPA), Université Nationale d'Agriculture (UNA), Benin.
[4]Institut de Recherches Halieutiques et Océanologiques du Bénin (IRHOB), Cotonou, Bénin.
[5]Centre for Blue Governance, University of Portsmouth, UK.
[6]Laboratoire d'Ecologie Appliquée, Faculty of Agronomic Science, University of Abomey-Calavi, Benin.
[7]Centre for Coastal Management (Africa Centre of Excellence in Coastal Resilience, ACECoR), University of Cape Coast, Cape Coast, Ghana.

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The fishery industry plays a paramount role in poverty alleviation, food security and job creation in Sub-Saharan Africa. Scientific attempts to characterize the sector are however limited. This study used primary and secondary data from 2014 to 2018 to characterize fishing fleets and the diversity of fish species landed in Benin. Primary data were collected via face-to-face interviews and focus group discussions with informants identified using snowball and purposive sampling techniques. Secondary data on the landing statistics for five years (2014-2018) were additionally obtained from the Direction of Halieutic Production (DHP). Findings showed that five fishing fleets are currently operating in Benin, including the Artisanal National Continental Fleet (ANCF), Artisanal National Maritime Fleet (ANMF), Artisanal Foreign Maritime Fleet (AFMF), National Industrial Fleet (NIF) and Foreign Industrial Fleet (FIF). The mean annual volume from all the fishing fleets for the study period was 52,997 ± 12,269 tons, with an average commercial value of 82,194,096 ± 17,618,162 euros per year. Also, 48 species were recorded for the ANMF, 36 families of freshwater species for the ANCF, 43 species for AFMF, and 40 species for FIF. The catch volumes and their associated commercial values showed significant difference across the fishing fleets (ANOVA, $p<0.05$). This study highlights the paramount importance of the Artisanal National Continental Fleet in Benin and provides useful information for regional and global assessment of the fishery industry in the country.

Key words: Fisheries, fleets, short-term assessment, West Africa.

INTRODUCTION

Hunger is rising excessively in the world and has affected about 821 million people globally so far (Hasselberg et al., 2020). The United Nations Sustainable Development Goals (SDGs), particularly Goal 2, aims to combat

hunger, achieve food security, and improve nutrition by 2030 (UN, 2015). One of the vital sectors that need to be promoted to reach the above target is the fishery and aquaculture industry (Galati et al., 2015). The significance of the fisheries sector in job creation, livelihoods support and food malnourishment eradication, is widely recognized (Aheto et al., 2019; Escamilla-Pérez et al., 2021). In West Africa, local communities rely heavily on fishing products, not only as sources of protein, but also as principal means of employment. Indeed, the sector provides direct employments for about 7 million people in the sub region (Doumbouya et al., 2017). However, the fish stock of the region has drastically declined, driven by illegal fishing, overexploitation, overcapacity and climate-related effects among others (Porobic et al., 2019). In Benin, fishing activities occur predominantly in the south. However, the existence of some water bodies in Central and Northern Benin gives opportunity to inland fishermen to also operate. Here the fisheries sector provides opportunities to about 56,876 fishermen; 20,000 fishmongers, and sustains more than 300,000 indirect jobs (Achoh et al., 2018). As noticed elsewhere in the subregion (Doumbouya et al., 2017; Porobic et al., 2019; Asiedu et al., 2021; Thiaw et al., 2021), fishing resources are under threat in Benin, predominantly as a result of manmade action (Latifou et al., 2020). Lalèyè et al. (2019) observed that over 50% of Benin populations live in the coastal zone, resulting in a large pressure on the marine and coastal resources. Despite its importance and the threats associated with the sector, limited research has been done on the fishery industry in Benin, especially with regards to the fishing fleets, their economic value, and their diversity in terms of species composition. Previous studies related to fishery in Benin have attempted to understand the fish diversity and the dynamics of fish stock within the marine and inland waters of the country (Arame et al., 2019; Djihouessi, et al. 2019; Jawad et al., 2020). Other researchers also focused on the physico-chemical and the physical characterization of inland and coastal fisheries and their implications in the maintenance of fishing activities in Benin (Houssou et al., 2017; Achoh et al., 2018; Lalèyè et al., 2019). The scarcity of data on fishing fleets and their socio-economic value hampers proper development of sustainable and integrated management approaches, which consider the complex interactions and interplays between the socio-economic and environmental dimensions. This study, therefore, sought to characterize the fishing fleets operating in Benin's fisheries, evaluate the catch volume of each fishing fleet, and assess the diversity and commercial value of the landed species.

MATERIALS AND METHODS

Study area

The study was conducted from July to November 2021 in Benin, West Africa (Figure 1). As a coastal state, the country is endowed with 125 km long seaboard and several coastal ecosystems which foster the harvesting and provision of a wide range of seafood (Lalèyè et al., 2019). Away from the maritime environment, the continental shelf of Benin is constituted by many water bodies and effluents which promote inland fishing. The most prominent water bodies which facilitate inland fisheries in Benin include the rivers Pendjari in the Northwest (420 km), Couffo in the Southeast (170 Km), Ouémé in central and Southern Benin (608 km), Niger in the Northeast and Mono in Western Benin (500 Km). Some of these rivers have many tributaries where extensive fishing activities also take place. It is the case of the River Niger with the tributaries; Mékrou (480 km), Alibori (427 Km) and Sota (254 km), and the River Ouémé with the tributaries; Zou (150 km) and Okpara (200 km) (Latifou et al., 2020). Also, the hydrographic system of the country comprises some permanent lakes and lagoons such as Nokoue, Aheme, Azili and Toho among others. These permanent lakes and lagoons play a prominent role in the sustainability of inland fisheries in the country (Houssou et al., 2017).

Data collection

The methodological approach used for this study is summarized in Figure 2. Data were collected from two different sources: primary and secondary. Primary data were collected through direct interactions with local communities via focus group discussions and in-depth interviews. Villages and landing sites visited included Krake-plage landing beach in the municipality of Seme-Kpodji, Xwlacodji and the Artisanal fishing harbour of Cotonou (POPAC) in Cotonou, Togbin landing beach in Abomey-Calavi, Djegbadji, Houakpe-Daho and Aido villages in Ouidah and Gbeffa, Ayiguinnou and Seko communities in Grand-Popo. Secondary data on the volumes of catch and their associated commercial values were acquired from the Direction of Halieutic Production (DHP), a public agency in charge of fishery and aquaculture development in Benin.

Primary data

Focus group discussions were organized on each landing site or community investigated (9 focus group discussions in total). The focus group discussions brought together fisherfolks, fish mongers and community members whose activities are directly linked to fishing activities. A total of 45 participants were engaged for the 9 focus groups (5 participants per group). Additionally, 20 key informants including 6 fishmongers, 10 chief fishermen, 2 government officials and 2 leaders of fishery associations were engaged in in-depth interviews to collect relevant information on the topic which might not be uncovered by the focus group discussions. The fishery associations that took part in the interviews included board members of the National Union of Marine Fisherfolks and Allied of Benin (NUMFAB) which controls the marine and coastal fishing activities as well as the National Union of the Continental Fisherfolks and Allied of Benin (NUCFAB) which regulates the inland fishery. Participants were selected via snowball and

*Corresponding author. E-mail: gnansounouconstant009@gmail.com.

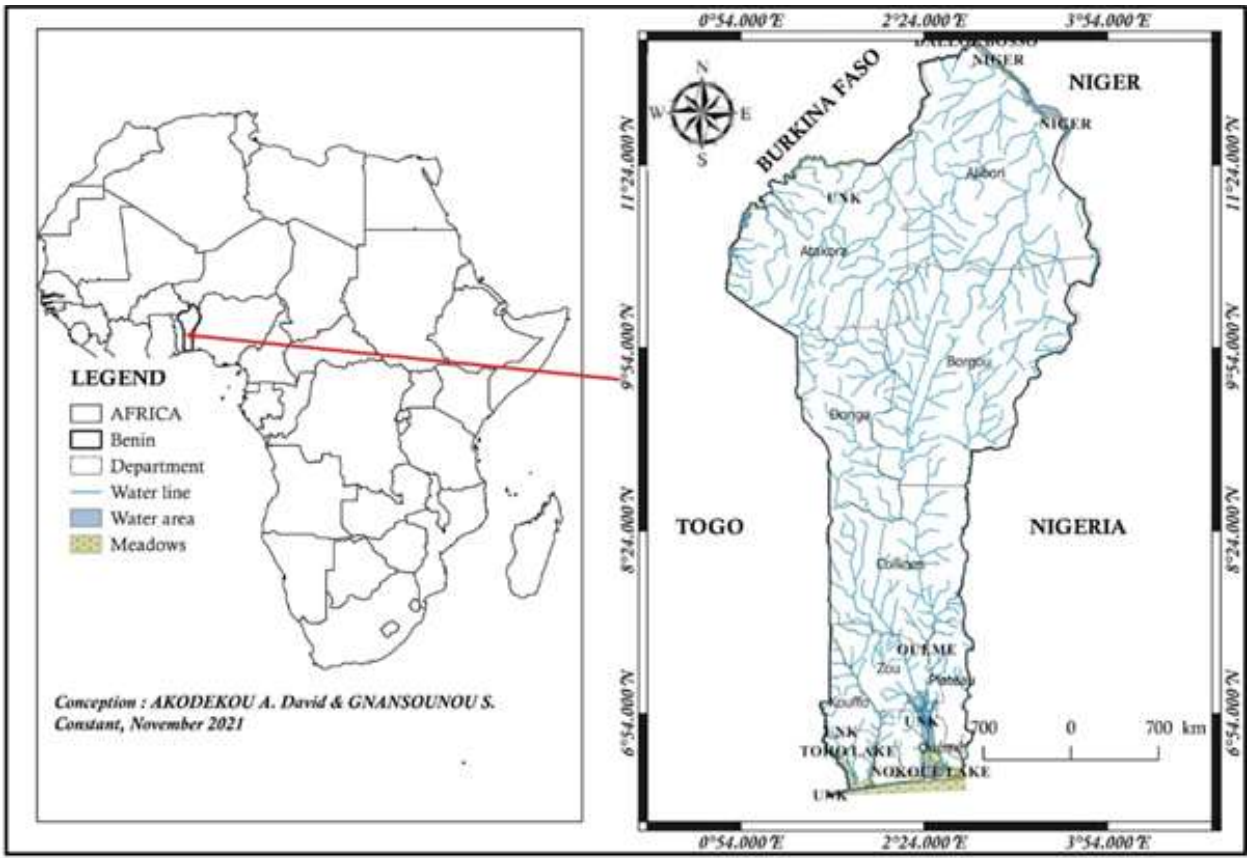

Figure 1. Location of the study area.

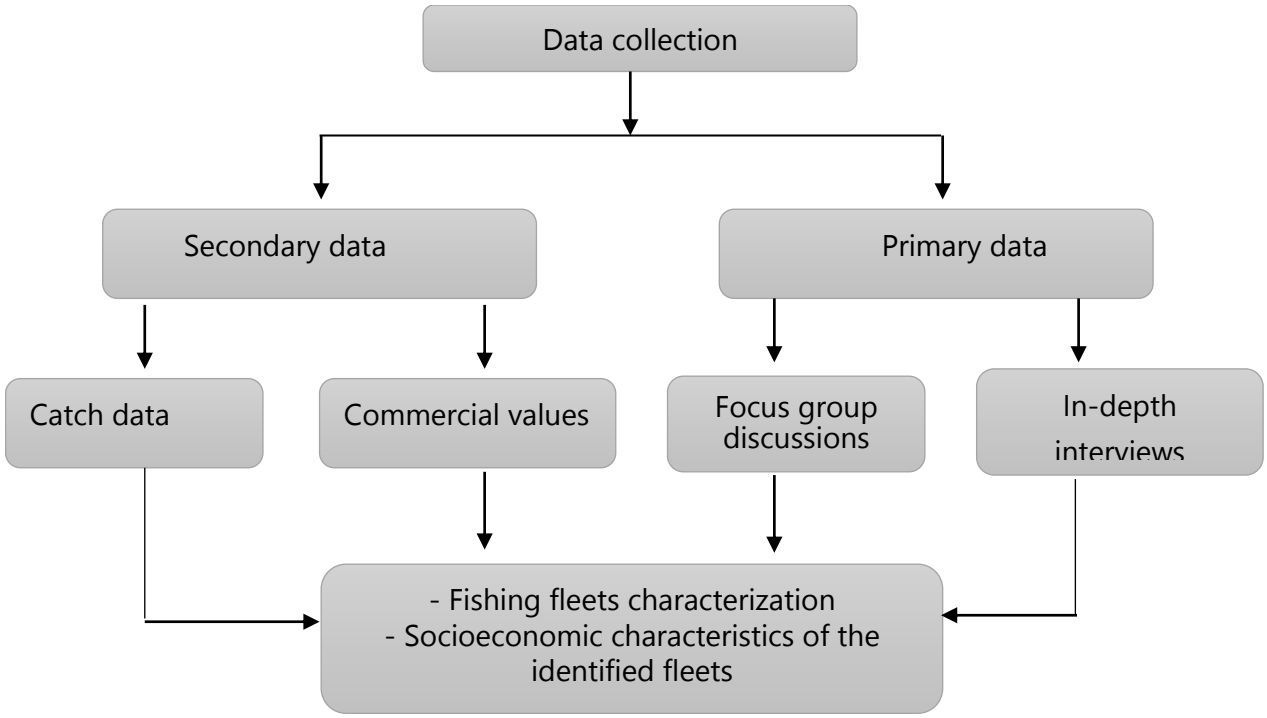

Figure 2. A hierarchical representation of the methodological approach used to collect data.

purposive sampling techniques. Data were collected with semi-structured interview guide. The questionnaire was made up of open-ended questions. Themes of the questionnaire included information on the socio-demographic characteristics of the informants as well as the types of fishing gears used, fishing period, the targeted species and the volume of fish landed during the study period. These field interactions helped the research team to crosscheck and validate the secondary data collected.

Secondary data

Landing statistics for five years (from 2014 to 2018) were acquired from DHP. This period was considered because of the scarcity of fishery-related secondary data in Benin for the previous five-year period. Data were obtained about the volume of fish catches during the period, species landed and their associated economic values. Other fishery-relevant publications such as technical reports, peer-reviewed scholarly articles and policy briefs from the Government of Benin, research institutions and civil society organizations covering the study period, were reviewed in order to check the accuracy and the validity of the acquired data.

Data analysis

Primary data were transcribed for content validity. Information which matches with the purpose of the study were retrieved from the audio records for understanding. The process included the listening, encoding, transcribing and the identification of the relevant themes that better explain the objectives of the study. Information recorded on the field was complemented with handwritten notes. The secondary data were tabulated. For the secondary data, they were analyzed using descriptive statistics (mean, standards errors, and proportion). A one-way ANOVA test was run to test the significance of the difference of the catch volumes and their associated values among the identified fishing fleets.

Ethical considerations

Ethical issues concerning human subjects were duly addressed before and during the conduct of this study. Prior to data collection, ethical approval reference UCCIRB/CANS/2021/20 was obtained from the University of Cape Coast Institutional Review Board (UCCIRB). On the field, the purpose of the work was explicitly explained to each interviewee as well as the possible risks associated with their participation before engaging them. Oral consent was also sought from participants before engaging them in the study.

RESULTS

Characteristics of the fishing fleets

Five fishing fleets were identified in the fisheries sector of Benin. They include the artisanal fleets comprising the Artisanal National Continental Fleet (ANCF), the Artisanal National Maritime Fleet (ANMF) and the Artisanal Foreign Maritime Fleet (AFMF), along with the industrial fleets which encompass the National Industrial Fleet (NIF) and the Foreign Industrial Fleet (FIF). Table 1 presents a thorough description of the identified fleets. In the ANMF, fisher folks use mostly lines and hooks to catch demersal fish, and purse seine and drift gillnets to harvest pelagic fish. Informants reported that these fisher folks are predominantly indigenous from Benin and reportedly operate throughout the year, and land their catch in the fishing harbours of Benin and Nigeria. An estimated number of 551 canoes were legally registered in this fleet, of which 399 go for demersal fish and 162 targeting pelagic fish. Fishing gears used by the fisher folks of this fleet and recorded on the field included lines and hooks, cast nets, purse nets, and drift gillnets. The AFMF also targets pelagic and demersal fish using almost the same fishing gears as ANMF. Information collected from the field indicated that the fleet is entirely controlled by foreign fisher folks from Togo and Nigeria, but dominated by Ghanaians. The AFMF has 114 registered units used for demersal fish catching, while only five registered boats exist for those targeting pelagic fish. No boats of this fleet lands outside Benin, making their catch available either in the artisanal fishing harbour of Cotonou or within the fishing camps located along the coastal zone of the country. Records on the ANCF indicated an estimated number of 45,000 canoes operating in the continental waters of the country. These fisher folks are predominantly from Benin, and targeted solely freshwater fish species. They carry out their activity throughout the year using a myriad of fishing gears (Table 1). The National Industrial Fleet (NIF) and the Foreign Industrial Fleet (FIF) targeted demersal and pelagic fish, with 7 and 15 registered units. The NIF is mostly handled by Benin nationals, whereas the FIF is controlled by industrial vessels from the European Union and China. The FIF does not land its catch in Benin, but rather in Ghana. As a result, their catch volumes and their associated commercial values were not considered in the study.

Catch volume

The mean annual volume from all the fishing fleets for the study period was 52,997 ± 12,269 tons (Table 2). The lowest mean catch volume was obtained in 2014 (43,121 tons), whereas the highest was recorded in 2018 (74,345 tons). The landings during the period were predominantly influenced by the ANCF. The total catch of the ANCF during this period averaged 42,147 ± 2,759 tons, that is 3 times, 22 times and 496 times higher than the ANMF (15,892 ± 11,822 tons), the AFMF (1,896 ± 109 tons) and the NIF (85 ± 28 tons), respectively. Mean annual volume catch of the ANMF during the study period was 15,892 ± 11,823 tons, ranging from 11,688 tons (2014) to 25,768 tons (2018). Small pelagic species contributed mostly to the recorded total catch volume of this fleet, with an annual mean record of 11,723 ± 8,724 tons. Landings of the ANCF varied from 29,709 tons (2014) to 45,686 tons (2018) whereas the ones of the AFMF fluctuated

Table 1. General characteristics of the identified fleets.

Fleet	Group of species targeted	Fishing gears used	No. of units	Period of activity	Main landing sites
ANMF	Demersal	Lines and hooks	28	From January to December	Fishing harbors of Benin and Nigeria
		Cast nets (Bottom Gillnets)	371	From January to December	Harbour and fishing camps of Benin
	Pelagic	Purse Seine	90	From July to January	Harbour of Benin
		Drift Gillnets	62	From March to September	Harbour and fishing camps of Benin
AFMF	Demersal	Lines and hooks	4	From January to December	Harbour of Benin
		Cast nets (Bottom Gillnets)	110	January to December	Harbour and fishing camps of Benin
	Pelagic	Purse Seine	3	From July to January	Harbour and fishing camps of Benin
		Drift Gillnets	2	March to September	Harbour and fishing camps of Benin
ANCF	Fresh water species	Cast nets, Gill nets, Conical net, Seine net, Landing net, Hooks and lines, Traps, fishing with bare hands, *Acadja, Whédo* and *Ahlo* fishing system, *etc*.	45000	January to December	Landing sites of villages
NIF	Pelagic, Demersal	Trawls	7	January to December	Fishing harbours of Benin and Nigeria
FIF	Pelagic, Demersal	Seines	15	January to December	Fishing harbours of Tema and Accra

Sources: Secondary data from DHP and Primary data from the field.

Table 2. Catch volume recorded per fishing fleet.

Fleet	Species groups	2014	2015	2016	2017	2018	Mean ± SE
ANMF	Crustacean	4	5	6	7	11	6.6 ± 4.9
	Demersal	3,116	3,734	3,947	3,160	6,591	4,109 ± 3,055
	Big pelagic	32	42	37	62	91	52.8 ± 39.75
	Small pelagic	8,536	10,432	10,608	9,966	19,075	11,723 ± 8,724
	Subtotal	11,688	14,212	14,598	13,194	25,768	15,892 ± 11,822
ANCF	Fresh water fish species	29,709	32,267	34,537	33,415	45,686	42,147 ± 2,759
AFMF	Crustacean	-	-	-	1	1	0.4 ± 0.38
	Demersal	454	457	475	355	699	488 ± 56.9
	Big pelagic	5	5	4	7	10	6.2 ± 2.38
	Small pelagic	1,265	1,293	1,287	1,124	2,040	1,401 ± 162
	Subtotal	1,724	1,755	1,766	1,487	2,750	1,896 ± 109
NIF	Crustacean	-	0.5	1.4	0.5	2.4	0.96 ± 0.54
	Demersal	-	132	74.4	41.9	130.1	75 ± 56.9
	Molluscs	-	0.2	0.2	0.8	1.2	0.3 ± 0.34
	Small pelagic	-	19.1	6.6	6.3	7.4	7.88 ± 2.31
	Subtotal	-	152	82.6	49.5	141.1	85.18 ± 28.47
	General total	43,121	48,387	50,983	48,146	74,345	52,997 ± 12,268

SE = Standard error of the mean.
Source: Secondary data from DHP.

between1,487 tons (2017) and 2,750 tons (2018) with an annual mean value of 1,896 ± 109 tons. The small pelagic fish remained the main contributors of the recorded catches throughout the study period with annual mean landing of 1,401 ± 162 tons. Concerning the NIF, the catch volume varied from 49 tons (2017) to 152 tons

Table 3. Commercial value (euros) of the landings per fleet.

Fleet	Species groups	2014	2015	2016	2017	2018	Mean ± SE
ANMF	Crustacean	25,586	36,944	26,109	59,595	79,334	45,513 ± 10,462
	Demersal	7,700,233	9,562,166	9,417,564	8,394,469	16,515,475	10,317,981 ± 1,586,560
	Big pelagic	73,307	95,959	84,721	141,207	209,245	120,887 ± 24,913
	Small pelagic	12,891,437	15,971,647	15,803,575	14,993,973	28,552,481	17,642,623 ± 2,781,981
	Sub total	20,690,563	25,666,716	25,331,969	23,589,244	45,356,535	28,127,005 ± 4,396,669
ANCF	Fresh water fish species	-	55,578,693	59,246,142	53,761,977	84,084,822	50,534,327 ± 6,319,099
AFMF	Crustacean	3,755	4,534	3,140	6,677	8,421	5,305 ± 981
	Demersal	1,130,099	1,173,429	1,132,643	940,533	1,752,968	1,225,934 ± 137,815
	Big pelagic	10,759	11,776	10,189	15,821	22,209	14,150 ± 2,242
	Small pelagic	1,891,969	1,959,974	1,900,684	1,679,954	3,030,587	2,092,634 ± 239,245
	Subtotal	3,036,582	3,149,713	3,046,656	2,642,985	4,814,185	3,338,024 ± 379,035
NIF	Crustacean	-	5,794	12,625	4,638	21,348	8,881 ± 3,437
	Demersal	-	291,217	153,812	93,824	318,317	171,434 ± 48,241
	Molluscs	-	11	319	290	1,256	124 ± 76
	Small pelagic	-	36,454	10,286	10,539	12,969	14,049 ± 5,658
	Subtotal	-	333,476	177,042	109,291	352,634	194,488 ± 53,187
	General total	23,727,145	84,728,598	87,801,809	80,103,497	134,609,432	82,194,096 ± 17,618,162

SE = Standard error of the mean.
Source: Secondary data from DHP.

(2015), with an annual mean of 85 ± 28 tons. Demersal species were mostly captured by this fleet during the study period, with a mean volume of 75 ± 56 tons per year, while molluscs and crustacean were scarce in the landings with the annual catch volumes of 0.3 ± 0.3 tons and 0.9 ± 0.5 tons, respectively. There is a significant difference of the catch volume across the fishing fleets (ANOVA test, $p<0.05$).

Commercial value of the landings per fleet

Landings for all the fleets put together generated an average of 82,194,096 ± 17,618,162 euros per year from 2014 to 2018 (Table 3). The fishing fleet which generated more financial resources was ANCF with a mean commercial value of 50,534,327 ± 6,319,099 euros, that is 2 times, 15 times and 260 times higher than ANMF (28,127,005 ± 4,396,669 euros), the AFMF (3,338,024 ± 239,245 euros) and NIF (194,489 ± 53,187 euros), respectively. The total commercial value of the ANMF's fishery resources increased progressively from 20,690,563 euros (recorded in 2014) to 45,356,535 euros (2018) with small pelagic species contributing mostly to the recorded financial resources (17,642,623 ± 2,781,981 euros) (Table 3). Likewise, the commercial value of the freshwater species landed by fisher folks operating in the continental waters increased from 55,578,693 euros (2015) to 84,084,822 euros (2018). Like in the ANMF, small pelagic fish species contributed mostly to the financial resource generated by the AFMF, with a record of 2,092,634 ± 239,245 euros. The financial resources generated by this fleet ranged from 2,642,985 euros (2017) to 4,814,185 euros (2018). Lastly, the NIF recorded a total commercial value ranging from 109,291 euros (2017) to 352,634 euros (2018). Here, the demersal fish species contributed mostly to the recorded financial value with an annual mean of 171,434 ± 48,241 euros, whereas the molluscs contributed less with an annual mean of 124 ± 76 euros. The commercial values showed significant difference across the fishing fleets (ANOVA test, $p<0.05$).

Diversity of species landed and their commercial values

Fishing products harvested in Benin during the study period differed according to the fishing fleets. Two species of crustacean, 27 species of demersal fishes, one species of big pelagic fish and 18 species of small pelagic fish were landed by the ANMF. The harvested crustacean species included *Panulirus* sp*.* and *Portunus validus,* with a mean catch volume of 4 ± 1.14 tons and 2.2 ± 0.8 tons, and a mean commercial value of 38,527 ± 10,573 euros and 6,986 ± 2,427 euros, respectively. Big pelagic fish captured belonged to the family Istiophoridae/Xiphiidae and averaged 52 ± 10 tons per year, with an associated commercial value of 120,887 ± 24,913 euros. The dominant demersal species brought

offshore by artisanal national maritime fisher folks included *Galeoides decadactylus* (mean catch volume =921 ± 65 tons, mean commercial value = 1,832,016 ± 1,24,765 euros), *Pseudotolithus* spp. (mean catch volume= 950 ± 297 tons, mean commercial value = 4,352,283 ± 2,68,304 euros), *Carcharhinus* sp. (mean catch volume = 466 ± 146 tons, mean commercial value= 2,31,250 ± 16,968 euros) and *Carcharhinus brevipinna* (mean catch volume 416 ± 135 tons, mean commercial value= 2,06,708 ± 23,735 euros). The small pelagic species were dominated by *Euthynnus alletteratus (*mean catch volume = 2,507 ± 282 tons, mean commercial value = 2,871,557 ± 233,685 euros), *Cypselurus* spp. *(*mean catch volume = 2,350 ± 196 tons, mean commercial value = 95,677 ± 7,472 euros), *Scomberomorus tritor* (mean catch volume = 2,205 ± 192 tons, mean commercial value= 6,733,355 ± 5,73,298 euros) *and Caranx* spp. (mean catch volume = 1,573 ± 120 tons, mean commercial value = 1,482 ± 286 euros) (Table 4). Concerning the ANCF, existing records showed a total of 36 family of freshwater species from 2014 to 2018 (Table 5). The landings were dominated by the Cichlidae (mean catch volume = 14,562 ± 979 tons, mean commercial value = 25,455,720 ± 1,915,139 euros) and Clariidae (mean catch volume = 5,144 ± 928 tons, mean commercial value= 8,796,917 ± 1,774,659 euros).

The AFMF recorded during the study period only one species of crustacean, 24 species of demersal fishes, one species of big pelagic and 17 species of small pelagic (Table 6). The recorded crustacean and big pelagic species included *Panulirus* sp. (mean catch volume = 0.4 ± 0.24 tons, mean commercial value = 4,466 ± 5,002 euros) and Istiophoridae/Xiphiidae (mean catch volume = 6.2 ± 1.06 tons, mean commercial value = 14,150 ± 2,242 euros), respectively. As for the demersal fishes, they were dominated by the same major species recorded in the ANMF, including *G, decadactylus* (mean catch volume = 129 ± 14 tons, mean commercial value= 2,17,230 ± 17,075 euros), *Pseudotolithus* spp. (mean catch volume = 1,130 ± 12 tons, mean commercial value= 5,18,999 ± 891 euros), *Carcharhinus* sp. (mean catch volume = 56 ± 9 tons, mean commercial value= 28,137 ± 611 euros) and *C. brevipinna* (mean catch volume = 48.8 ± 11.12 tons, mean commercial value= 24,217 ± 4,783 euros). Regarding the small pelagic species, they were mostly represented by *E. alletteratus* (mean catch volume = 292 ± 50 tons, mean commercial value= 11,362 ± 1,299 euros), *Cypselurus* spp. (mean catch volume = 279 ± 33 tons, mean commercial value= 14,150 ± 2,242 euros), *S. tritor (*mean catch volume = 260 ± 32 tons, mean commercial value = 868 ± 214 euros) and *Caranx* spp (mean catch volume = 187 ± 21 tons, mean commercial value= 4,29,517 ± 4,898 euros).

Data collected credited the FIF with three crustacean species, 32 demersal species, one mollusc and seven small pelagic species (Table 7). Crustacean species recorded were *Panulirus* sp., *Penaeus* sp. and *P. validus,* with a mean volume catch of 0.37 ± 0.06 tons, 0.65 ± 0.29 tons and 0.17 ± 0.11 tons, respectively. Demersal fishes were dominated by *Albula vulpes* (mean catch volume = 4.97 ± 1.70 tons, mean commercial value = 2.8 ± 3.18 euros), *Cynoglossus* sp. (mean catch volume = 7.75 ± 1.64 tons, mean commercial value = 5,052 ± 940 euros) and *Zanobatus schoenleinii* (mean catch volume = 7.05 ± 2.46 tons, mean commercial value = 2,279 ± 712 euros), whereas the small pelagic species were scarce and mostly represented by *Cypselurus* spp (mean catch volume = 1,325 ± 0.43 tons, mean commercial value = 1,621 ± 533 euros) and *Alectis alexandrines* (mean catch volume = 1.67 ± 0.95 tons, mean commercial value = 2,839 ± 1 603 euros).

DISCUSSION

Diversity and general characteristics of fishing fleets in Benin

The thorough assessment of the fishing fleets described herein sheds new light on the internal organization of the fishery sector in Benin. Attempts to document both industrial and artisanal fleets as done in this study fills the gap of the global understudied state of the artisanal fishery sector observed by many studies (Tickler et al., 2018; Rousseau et al., 2019). Five fishing fleets including three artisanal and two industrial using various fishing gears were recorded in the country. These five fleets identified in Benin are similar in size and composition to those observed by Brinson et al. (2009) in Ghana and Senegal. The observed similarity in fishing fleets among these geographically closely-related countries is as a result of the actors operating in the industry in West Africa. Indeed, fishing activities in West Africa, particularly the artisanal sector is dominated by migrant fishermen from Ghana (Failler and Ferraro, 2021). Their massive presence in these countries coupled with their same fishing techniques justifies the observed trend. Among the characterized fishing fleets, four are marine-related, thus constituting 80% of the total fleet. This large predominance of marine fleets in the industry can be explained by the interest gained by this sector in West Africa over the past decades (Pazou et al., 2020). Indeed, due to the increasing seafood demand from Europe and Asia and the depletion of their local fish stock, over 70% of the European Union Seafood is being imported from the developing coastal countries, particularly from West Africa (Belhabib et al., 2015). As a result, many well equipped Chinese and European fishing companies have emerged in the industry in Benin, making the sector more mechanized than the continental one. On the other hand, due to the abundance of small pelagic fishes in West Africa and their associated high commercial value (Lozano-Bilbao et al., 2020), many migrant fishermen from Ghana, Nigeria and Togo are

Table 4. Species landed and their commercial values from 2014 to 2018 by the Artisanal National Maritime Fleet.

Groups of species	% of catch	Catch volume (tons) (Mean ± SE)	Commercial value (Euros) (Mean ± SE)
Crustacean (0.02%)			
Panulirus sp.	64.51	4 ± 1.80	38,527 ± 16,717.74
Portunus validus	35.48	2.2 ± 1.26	6986.2 ± 3838.85
Total	**100**	**6.2 ± 1.96**	**45,513.2 ± 16541.97**
Demersal (15.61%)			
Brachydeuterus auritus	24.11	253.4 ± 79.64	348,024.8 ± 23,638.54
Carcharhinus brevipinna	23.39	416.6 ± 135.25	206,708.6 ± 23,735.03
Carcharhinus sp.	11.82	466 ± 146.90	231,250.2 ± 16,968.91
Cephalopholis taeniops	10.57	3.4 ± 1.13	15,504.8 ± 2,370.71
Chaetodipterus goreensis	7.00	9.4 ± 3.26	21,288 ± 3,905.67
Cynoglossus spp.	6.43	4.8 ± 1.52	21,356.4 ± 1,582.34
Dasyatis spp.	5.17	22.2 ± 6.95	11,018.8 ± 674.62
Dentex spp.	2.37	53.8 ± 17.10	246,394.4 ± 21,397.96
Drepane africana	1.73	2.6 ± 0.82	5,935 ± 462.81
Elops lacerta	1.50	93.4 ± 31.38	142,940.4 ± 21,654.83
Epinephelus spp.	1.36	203.8 ± 64.25	934,124.6 ± 68,823.22
Galeoides decadactylus	0.73	921.75 ± 65.6	1,832,016.8 ± 124,765.11
Lutjanus spp.	0.58	276 ± 86.42	1,264,368 ± 76,334.55
Megalops atlanticus	0.56	1.6 ± 0.66	12,387 ± 1,423.69
Pagellus bellottii	0.46	68.2 ± 21.53	104,506.6 ± 7,937.81
Pentanemus quinquarius	0.46	12.6 ± 3.98	9,582.2 ± 744.10
Plectorhinchus mediterraneus	0.34	18.2 ± 6.08	27,639.8 ± 4,005.53
Polydactylus quadrifilis	0.34	23 ± 8.60	105,984.2 ± 25,355.65
Pomadasys spp.	0.31	59.2 ± 19.41	271,114.8 ± 34,285.78
Psettodes belcheri	0.23	1.2 ± 0.37	6,174.6 ± 562.52
Pseudotolithus spp.	0.12	950.2 ± 297.71	4,352,283.8 ± 268,304.03
Rachycentron canadum	0.08	18.2 ± 5.73	41,749.2 ± 3,097.74
Rhinobatos sp.	0.06	29 ± 9.07	14,325.6 ± 843.35
Seriola spp.	0.06	13.4 ± 4.54	37,911.25 ± 4,178.11
Sphyraena barracuda	0.05	13.6 ± 4.61	77,499.25 ± 8,395.91
Sphyrna spp.	0.04	2.4 ± 0.81	1,417.25 ± 154.64
Stromateus fiatola	0.03	2.2 ± 0.71	5,040.75 ± 481.95
Total	**100**	**3,755.8 ± 1,165.03**	**10,316,741.2 ± 682,908.48**
Big pelagic (0.20%)		52.8 ± 24.20	120,887.8 ± 55,707.44
Istiophoridae/Xiphiidae	100	52.8 ± 24.20	120,887.8 ± 55,707.44
Small pelagic (84.15%)		9517 ± 771.34	17,642,622 ± 1,390,990.49
Alectis alexandrinus	21.39	25.6 ± 1.93	148,323.2 ± 10,485.62
Balistes spp.	20.05	4.8 ± 1.20	59,068.8 ± 4,369.012
Caranx spp.	18.81	1573 ± 120.47	1,482.25 ± 286.40
Cephalacanthus volitans	13.41	0.8 ± 0.10	3,602,629.8 ± 269,001.37
Chloroscombrus chrysurus	7.89	184.4 ± 26.31	276.5 ± 8.79
Coryphaena equiselis	5.56	125.4 ± 10.05	84,461.4 ± 11,751.85
Cypselurus spp.	2.92	2350.8 ± 196.28	95,677.6 ± 7,472.13
Euthynnus alletteratus	2.70	2507.6 ± 282.50	2,871,557.4 ± 233,685.14
Hemiramphus spp.	1.97	232 ± 39.87	284.8 ± 47.30
Ilisha africana	1.97	651.8 ± 51.67	1,914,296.2 ± 210,200.81
Mixed species	1.57	231 ± 21.79	141,496.4 ± 23,713.71
Miliobatis sp.	1.06	2 ± 0.28	298,615 ± 23,062.05
Muraena spp.	0.32	4.8 ± 1.15	317,775 ± 1,133.99

Table 4. Contd.

Sardinella spp.	0.21	342.4 ± 48.41	523,148.2 ± 72,095.65
Scomberomorus tritor	0.04	2,205.2 ± 192.67	6,733,355 ± 573,298.45
Sphyraena guachancho	0.04	925.4 ± 69.69	565,113.6 ± 41,466.64
Thunnus spp.	0.017	317 ± 34.11	242,043 ± 25,329.79
Trichiurus lepturus	0.006	38.2 ± 4.90	34,987.4 ± 4,423.29
Total	100	9517 ± 77	17,642,622 ± 1,390,990

SE = Standard error of mean.
Sources: Secondary data from DHP and Primary data from the field.

currently operating in Benin (Latifou et al., 2020), making the sector more important than the continental one in terms of the number of fleets. However, the environmental impacts of these marine-related fleets as well as their contribution to socio-economic development need to be explicitly explored. Indeed, artisanal marine fisher folks in Ghana are noted for some environmentally unfriendly fishing techniques including the use of chemicals and explosives in fishing, the use of petrol or diesel, the light fishing, the transshipment commonly known as "*saiko fishing*" and the use of unauthorized mesh size among others (Afoakwah et al., 2018; Okyere et al., 2020).

Although four out of the five identified fishing fleets are marine-related, they depicted very low number of units as compared to the only one continental fleet. Table 1 show that an estimated number of 45,000 canoes operated in the inland fisheries sector in Benin from 2014 to 2018, against 679 canoes and vessels for the marine fleets. This concurs with the findings of Latifou et al. (2020) who observed that majority of the indigenous fisher folks operated in Benin fish from the inland waters. For instance, a fishery report published in 2010 reported that over 30,000 fisher folks were operating within the continental waters of the country against 3,596 fisher folks fishing within the sea (Latifou et al., 2020). This indicates that most fisher folks in Benin operate in the continental waters since marine fishing is highly demanding in terms of techniques, equipment, fishing inputs and operating costs (Kimani et al., 2020). However, the increasing number of units recorded in the continental fleet will undoubtedly exacerbate the dire situation of the already collapsing inland fishery resources in Benin (Kpanou et al., 2021). It is then important to engage inland fisher folks in some alternative livelihoods in order to curb additional pressures on the resources and ensure the replenishment of the Benin's inland fish stock. Though few units were recorded for the marine fishery as compared to the continental one, the increase in seafood demand resulting from the current global population growth may impede the sustainability of marine resources in Benin going forward. There is then the need to engage stakeholders associated with the sector on regular basis in order to attain the effective resilience of these resources. Fishing gears used differ according to the fleet, but remain similar for the marine-related fleets (Table 1). The fishing gears recorded in the framework of this study are consistent with those observed by previous research works, which documented the fishing gears used in the coastal and inland environments of Benin (Attingli et al., 2017; Codjo et al., 2020). They are also similar to those indicated by Fulanda et al. (2009) who documented the fishing gears used by migrant fishermen in Kenya, East Africa. This portrays the homogeneity in terms of the use of fishing gears in artisanal fisheries across Africa. Direct observations from the fields also showed that fishing inputs such as fish nets and canoes used by the marine fleets are larger and stronger than the ones used by continental fisher folks. This may be due to the difference in the physical characteristics of the two environments. Indeed, the wind blowing from the seashore coupled with the strong wage and the tidal range make marine fishery more challenging than continental fishing. On the other hand, the fishing periods recorded for the different identified fleets are consistent with the findings of many authors. Adeoti et al. (2018) and Latifou et al. (2020) observed that freshwater species are generally harvested in Benin throughout a yearly cycle, with the high productivity occurring from September to December, the medium productivity occurring from April to July and the low productivity happening in January, February, March, and August. Sossoukpe et al. (2016) explained that the production of fish species in Benin, particularly marine small pelagic fishes generally decrease from May to July because this period represents the transition between the wet and the dry season. This seasonal fish stock depletion results most of the time in the transition of a lot of fishermen from fishing to other unsustainable livelihood-support activities such as vegetable growing with chemical and pesticides and firewood collection and trading among others, with dire impacts on coastal and inland fragile ecosystems (Gnansounou et al., 2021).

Catch volume and commercial value

The mean annual production of the sector averaged 52,996 tons (Table 2). This is higher than the figures

Table 5. Species landed and their commercial values from 2014 to 2018 by the Artisanal Foreign Maritime Fleet.

Groups of species/species	% of catch	Catch volume (tons) (Mean ± SE)	Commercial value (Euros) (Mean ± SE)
Crustacean			
Panulirus sp.	100	0.4 ± 0.38	4,466.6 ± 1,056.34
Total	**100**	**0.4 ± 0.38**	**4,466.6 ± 1,056.34**
Demersal (20.40%)			
Brachydeuterus auritus	26.45	30.4 ± 1.53	41,447.4 ± 5,002.05
Carcharhinus brevipinna	23.14	48.8 ± 4.78	24,217.4 ± 5,549.33
Carcharhinus sp.	11.53	56.4 ± 4.17	28,137.4 ± 4,783.94
Cephalopholis taeniops	9.97	0.4 ± 0.10	1,841.6 ± 611.39
Chaetodipterus goreensis	6.74	1 ± 0.19	2,397.8 ± 953.91
Cynoglossus spp.	6.21	0.6 ± 0.10	2,519.8 ± 322.22
Dasyatis spp.	4.90	2.8 ± 0.16	1,323.8 ± 168.74
Dentex spp.	2.28	6.2 ± 0.45	29,017.6 ± 4,569.64
Elops lacerta	1.63	11.2 ± 1.57	17,152.8 ± 5,693.45
Epinephelus spp.	1.39	24 ± 1.30	110,254.2 ± 13,682.98
Galeoides decadactylus	1.26	129.4 ± 6.40	217,230.2 ± 24882.01
Lutjanus spp.	0.69	33 ± 1.60	151,442.6 ± 17,075.52
Megalops atlanticus	0.57	0.5 ± 0.13	642.4 ± 351.64
Pagellus bellottii	0.49	8 ± 0.45	12,313.2 ± 1,593.96
Pentanemus quinquarius	0.49	1.8 ± 0.08	1,157 ± 191.66
Plectorhinchus mediterraneus	0.44	2.4 ± 0.29	3,169 ± 958.71
Polydactylus quadrifilis	0.40	2.4 ± 0.63	11,679 ± 6,391.31
Pomadasys spp.	0.40	6.8 ± 0.71	31,261.2 ± 7,851.48
Pseudotolithus spp.	0.36	113.2 ± 5.25	518,999 ± 55,689.04
Rachycentron canadum	0.20	2.2 ± 0.16	5,086 ± 891.21
Rhinobatos sp.	0.12	3.4 ± 0.17	1,720.8 ± 204.36
Seriola spp.	0.10	2 ± 0.15	3,470.6 ± 925.13
Sphyraena barracuda	0.08	2 ± 0.22	7,219.4 ± 1,943.07
Sphyrna spp.	0.05	0.25 ± 0.09	132.2 ± 35.87
Total	**100**	**488 ± 4.87**	**1,225,934 ± 4,875.05**
Big pelagic (0.25%)		6.2 ± 2.38	14,150.8 ± 2,242.36
Istiophoridae/Xiphiidae	100	6.2 ± 2.38	14,150.8 ± 2,242.36
Small pelagic (79.31%)			
Ablennes hians	20.89	11.6 ± 0.66	17,788 ± 2,068.21
Alectis alexandrinus	19.91	3 ± 0.15	7,043.4 ± 788.26
Balistes spp.	18.58	0.5 ± 0.12	132.2 ± 60.18
Caranx spp.	13.38	187.6 ± 10.64	429,517.8 ± 48,598.18
Cephalacanthus volitans	7.87	0 ± 0	27.4 ± 2.61
Chloroscombrus chrysurus	5.56	21.2 ± 2.52	9,771.4 ± 2,291.31
Coryphaena equiselis	3.02	14.8 ± 0.82	11,362.4 ± 1,299.51
Cypselurus spp.	2.79	279 ± 16.87	340,792 ± 41,186.92
Euthynnus alletteratus	1.98	292.8 ± 25.14	223,505.6 ± 38,398.17
Hemiramphus spp.	1.94	27.8 ± 4.37	16,961.6 ± 5,334.33
Ilisha africana	1.51	78 ± 4.76	35,681.8 ± 4,374.83
Mixed species	1.05	27.2 ± 1.96	37,705.6 ± 5,480.40
Muraena spp.	0.82	1 ± 0	868.8 ± 214.95
Sardinella spp.	0.31	42.4 ± 6.10	64,834.4 ± 18,601.94
Scomberomorus tritor	0.21	260.4 ± 16.09	795,219.6 ± 98,191.58
Sphyraena guachancho	0.07	110.4 ± 6.27	67,480.2 ± 7,638.35
Thunnus spp.	0.03	39.2 ± 4.27	29,708.6 ± 6,481.22
Total	**100**	**1,896.4 ± 109.7**	**2,092,633.8 ± 281,894.81**

SE = Standard error of mean.
Sources: Secondary data from DHP and Primary data from the field.

Table 6. Species landed and their commercial values from 2014 to 2018 by the National Industrial Fleet.

Groups of species	% of catch	Catch volume (tons) (Mean ± SE)	Commercial value (Euros) (Mean ± SE)
Crustacean (1.12%)			
Panulirus sp.	54.62	0.37 ± 0.072	3,943.75 ± 847.80
Penaeus sp.	31.09	0.65 ± 0.33	6,873 ± 3,081.26
Portunus validus	14.28	0.17 ± 0.13	284.75 ± 179.32
Total	**100**	**0.96 ± 0.54**	**11,101.5 ± 3,843.40**
Demersal (89.24%)			
Acanthurus monrovia	30.66	0.3 ± 0.06	298.5 ± 161.01
Aluterus monoceros	9.99	4.97 ± 0.62	4.75 ± 3.18
Bothidae	9.09	0.25 ± 0.01	16,725 ± 5,746.20
Chaetodipterus goreensis	8.57	1.15 ± 0.32	37.25 ± 17.32
Cynoglossus sp.	6.41	1.5 ± 0.10	8.75 ± 0.45
Dasyatis sp.	5.70	2.5 ± 0.44	3,117.5 ± 2,425.68
Drepane africana	5.37	7.75 ± 0.60	5,052.25 ± 940.56
Elops lacerta	5.22	0.1 ± 0.01	4.25 ± 2.47
Epinephelus spp.	3.22	0.07 ± 0.00	2,128.75 ± 1,046.03
Galeoides decadactylus	3.18	6.65 ± 0.70	16,574.5 ± 3,493.67
Lagocephalus laevigatus	2.99	2.32 ± 0.26	297.25 ± 74.70
Lutjanus spp.	1.93	4.17 ± 0.98	12,217.75 ± 3,544.20
Pagellus bellottii	1.76	0.4 ± 0.03	1,127.75 ± 359.60
Polydactylus quadrifilis	1.48	1.12 ± 0.20	4,575.5 ± 2,954.62
Pomadasys spp.	1.44	7.05 ± 1.38	1 ± 0.03
Psettodes belcheri	0.96	0.75 ± 0.09	2,599 ± 1,336.32
Pseudotolithus sp.	0.51	23.77 ± 1.51	18,247.5 ± 9,590.48
Rachycentron canadum	0.38	0.03 ± 0.01	2,043.75±723.13
Raja miraletus	0.32	0.1 ± 0.01	79,855.75 ± 13,970.72
Rhinobatos sp.	0.25	1.37 ± 0.33	11.5 ± 8.60
Scorpaena sp.	0.12	0.03 ± 0.01	31.75 ± 3.05
Scyllarides herklotsii	0.12	0.03 ± 0.01	3 ± 0.08
Sepia officinales hierredda	0.09	4.42 ± 0.33	1,171.75 ± 784.45
Stromateus fiatola	0.03	0.2 ± 0.02	33.5 ± 19.65
Torpedo torpedo	0.03	4.05 ± 1.01	12.75 ± 10.03
Zanobatus schoenleinii	0.03	2.47 ± 0.28	5,375.25 ± 1,710.13
Total		**75.86 ± 2.3**	**183,054 ± 42,099.07**
Molluscs 0.35%)			
Cymbium sp.	100	0.3 ± 0.34	469 ± 271.36
Total	**100**	**0.3 ± 0.34**	**469 ± 271.36**
Small pelagic (9.27%)			
Alectis alexandrinus	29.75	1.67 ± 0.63	2,839.5 ± 1,603.04
Caranx sp.	20.54	0.67 ± 0.38	2,221.5 ± 1,813.57
Cypselurus spp.	16.73	1.32 ± 0.28	1,621.5 ± 533.97
Mixed species	13.22	2.97 ± 0.75	5,028.5 ± 1,887.86
Muraena spp.	6.71	0.2 ± 0.06	645.5 ± 311.73
Scomberomorus tritor	6.01	0.6 ± 0.26	964 ± 853.48
Sphyraena guachancho	5.01	2.05 ± 1.01	3,803.75±2,789.53
Trichiurus lepturus	2.00	0.5 ± 0.15	438±205.24
Total	**100**	**7.88 ± 1.45**	**17,562.25 ± 6,326.59**

SE = Standard error of mean.
Sources: Secondary data from DHP and Primary data from the field.

Table 7. Species landed and their commercial values from 2014 to 2018 by the Artisanal National Continental Fleet.

Family of Fresh water Species	Catch volume (tons) (Mean ± SE)	Commercial value (Euros) (Mean ± SE)
Alestidae	76.75 ± 15.45	126,682.5 ± 25,558.65
Anabantidae	22 ± 9.45	29,127.25 ± 12,639.21
Ariidae	706 ± 9.67	1,336,440.75 ± 5,756.9
Bagridae	2123.5 ± 2342.10	5,284,646.5 ± 5,828,162.03
Carangidae	6.75 ± 1.87	12,728 ± 876.98
Centropomidae	116.75 ± 44.72	276,051 ± 106,285.96
Channidae	906.75 ± 90.77	1,751,029 ± 174,962.29
Cichlidae	14562.25 ± 1095.51	25,455,720.75 ± 1,915,138.73
Citharinidae	163.75 ± 55.37	240,155.5 ± 81,171.71
Clariidae	5144.5 ± 1037.92	8,796,917.75 ± 1,774,658.5
Claroteidae	1384.25 ± 800.95	2,388,178.75 ± 1,381,694.48
Clupeidae	1550.25 ± 651.08	2,262,861.5 ± 950,252.99
Cynoglossidae	56 ± 67.17	51,319.75 ± 61,306.51
Cyprinidae	460 ± 79.30	598,242 ± 103,044.63
Distichodontidae	2.75 ± 0.98	4,731.5 ± 55.86
Eleotridae	64.5 ± 75.66	71,956.5 ± 84,211.46
Elopidae	443.5 ± 321.22	839,684 ± 607,937.58
Gecarcinidae	904.75 ± 76.56	1,139,643 ± 5,454.58
Gerreidae	31.25 ± 38.53	46,653.5 ± 5,566.97
Gobiidae	101.5 ± 43.43	300,551.25 ± 128,714.52
Gymnarchidae	78.5 ± 23.59	200,484.75 ± 60,045.77
Haemulidae	5.25 ± 1.34	10,067 ± 5,676.05
Hepsetidae	85.5 ± 29.50	111,282.25 ± 38,649.07
Malapteruridae	3.25 ± 0.95	5,747.25 ± 3,645.56
Mochokidae	1204 ± 151.21	1,508,825.5 ± 189,415.06
Monodactylidae	0.5 ± 30.33	1,173.25 ± 63,581.93
Mormyridae	68.5 ± 268.92	144,263.25 ± 45,648.94
Mugilidae	851.25 ± 1.52	1,630,165.25 ± 514,878.03
Notopteridae	2.75 ± 232.88	3,580.5 ± 1,895.63
Osteoglossidae	1061 ± 209.70	2,373,172 ± 520,584.63
Penaeidae/Palaemonidae	1012 ± 5.03	2,138,391 ± 443,305.26
Polypteridae	13.25 ± 1098.71	76,475 ± 28,018.20
Portunidae	1819.25 ± 45.35	2,152,460.25 ± 1,300,079.41
Protoperidae	230.25 ± 5.033	228,398.75 ±44,886.72
Schilbeidae	989.75 ± 90.41	1,569,740.75 ± 143,319.18

SE = Standard error of mean.
Sources: Secondary data from DHP and Primary data from the field.

observed by Latifou et al. (2020) who reported that the fisheries sector produces an average 30,000 tons of fish, shrimps and crabs every year. This increase in the mean annual production may be explained by the increase of fishing efforts driven by the large fish demand countrywide already reported by many authors (Sossoukpe et al., 2016; Kpanou et al., 2021). This may put additional pressure on the fish stock already shaken by human actions and climate-related impacts. However, the observations of the authors which informed that the inland fishery contributes more to the annual production of fishery resources in Benin concur with our results. This may be explained by the fact that most marine fleets land out of the country whilst the continental fleets make all their catch available in the country. Indeed, information collected indicated that all ANCF land their catches in the country whereas the FIF does not land its catch in Benin, but rather in Ghana. In addition, many fishermen belonging to the NIF and the ANMF land their catches in Nigeria (Table 1). These catches landed out of the country are not generally taken into account in the statistics of the DHP, making the contribution of the ANCF higher than the one of the marine-related fleets. In addition, Ayoubi and Failler (2013) narrated that the

annual marine fisheries' production accounts just for the 5% of the total production of the entire sector, while the inland fishery produces the larger part. This aligns with our findings which demonstrate that the ANCF provides the important part of the annual landings of the fisheries sector (Table 2). This good performance of the continental fleet over the other marine fleets can also be because of the large number of fisher folks engaged in the continental fishing activities in Benin as compared to the marine sectors, since the marine sector is highly demanding in terms of techniques, equipment and production costs (Latifou et al., 2020). The fisheries sector, if well managed in Benin has the potential of producing spectacular results in terms of economic returns. As shown in Table 3, the sector generated an average of 82,194,096 euros per year from 2014 to 2018, with a large contribution of the continental fleet. This is consistent with the findings of Adeoti et al. (2018) who reported the economic significance of inland fisheries in Benin. The authors indicated that fishery activities in southern Benin generate a net daily benefit fluctuating from 45 euros to 65 euros, contributing to the wellbeing of the actors engaged in the sector. Belhabib et al. (2015) also emphasized on the economic performance of the sector in West Africa. However, many fisher folks are still living poor conditions, particularly in southern Benin, since fishing is a team work and the economic returns are equitably shared. Taking the case study of the European and Chinese industrial vessels, the authors established that over the 2000-2010 period, catches worth 8.3 billion euros were taken by European Union and Chinese industrial fleets operating in West Africa, including Benin.

Diversity of species landed and their commercial values

The dominant species landed per fleet in Benin and reported in this study are similar to those reported in the freshwater systems as well as the coastal and marine environment in West Africa (Starnes and Darwall, 2021). Fish species were mostly targeted and accounted for over 90% of the landings, whereas the other groups of species, including the crustacean and molluscs were scarce. This may be explained by consumers' preference. Fish represents the mostly consumed fishing product in Benin (Afé et al., 2021). This is in line with Douny et al. (2021) who observed that fisherfolks generally target fish species, particularly those with high commercial value and available market in order to make profit. Results of this study showed a difference in the species landed according to the fishing fleets. Species harvested by the continental fleet differ taxonomically from those collected in the marine-related fleets. This can be justified by the difference in physico-chemical characteristics of inland and marine waters. The continental waters are generally fresh waters while the marine environment is made up of salty and brackish waters. This difference in nature leads to a difference in fish species composition of the two aquatic environments. Table 1 shows that national and foreign industrial fleets harvest not only demersal fishes but also some species of pelagic fishes. As industrial fleets operating in the high sea, these fleets are not supposed to harvest pelagic fishes inhabiting sunlit water above the continental shelf. Pelagic fishes are meant for the artisanal fisher folks who use gears and vessels of low capacity and operate in reachable area in short time (Gyan et al., 2020). The frequent harvesting of these pelagic fishes by the industrial fleets therefore poses severe threats to the sustainability of marine artisanal fishing and compromise food security and the livelihood of thousands of people including artisanal fisher folks, fishmongers and consumers in Benin.

Conclusion

The fishery sector plays a pivotal role in the local economy and animal protein provision. The industry is characterized in Benin by five fishing fleets, comprising the ANCF, the Artisanal National Maritime Fleet (ANMF), the Artisanal Foreign Maritime Fleet (AFMF), the National Industrial Fleet (NIF) and the Foreign Industrial Fleet (FIF). However, the Artisanal National Continental Fleet performs better in terms of catch volume and economic returns, due to the large number of indigenous fisher folks interested in this fleet. The catches are relatively more diverse for ANMF (48 species) than AFMF (43 species), and FIF (40 species). Detailed studies are needed to identify catches at species level for ANCF, where most fishes were identified at family level. Furthermore, the per capita consumption of fish generated by the industry is very low and needs to be improved. New paradigms and management approaches are therefore essential to sustain the sector, under threat globally.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest.

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