



Full Length Research Article

**ACTORS - FISHING GEAR AND PRODUCTION OF FISHERIES RESOURCES OF THE MARINE
ARTISANAL FISHERIES LANDED IN ABIDJAN - CÔTE D'IVOIRE**

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ABSTRACT

The artisanal productions of the maritime fishing resources were studied in three landing-stage of Abidjan (Cote d'Ivoire) from May to October 2014. Artisanal maritime fishing in Cote d'Ivoire is exclusively practiced by the Ghanaians Fanti, Ewé and Ningo ethnics groups. The most dominant age class is 25 - 40 years old, which accounts for 62% of total fishermen, followed by those of 17- 25 years old (33%). The fishermen over 40 years old represent 5% of the total number of fishers. The unloaded resources are distributed between 16 families and 26 fish species and one species of Mollusc. In terms of fish families, Scombridae with 8 species and Clupeidae (3 species) are the most represented. The pelagic species constituted by blue marlin (*Makairanigracans*), swordfish (*Xiphiasgladius*), sharks (*Isurusoxyrinchus* and *Sphyrnalewini*) and sailfish *Istiophorusalbicans* represent an important part in total production of artisanal maritime resources landed in Abidjan. Total production of artisanal maritime resources unloaded in all three landing-stage of Abidjan were 103 171 kg. Abobo-Doumé landing-stage represent more than 78 percent of total weight with 80,688 kg.

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INTRODUCTION

According to the World Resources Institute, about 1 billion people - largely in developing countries - rely on fish as their primary animal protein source (Chassot, 2005). Fish constitutes 16.7 % of the animal protein intake of the world population and 6.5 % of all protein consumed (FAO, 2014). Located in West Africa, Côte d'Ivoire has an importance lagoon and continental area in contributing to a favorable climate for aquaculture and fisheries. Côte d'Ivoire has 200 000 Km² of Exclusive Economic Zone (EEZ); 1 200 Km² of lagoon; 1 760 Km² of Lakes and 3 000 Km of Rivers (DAP, 2013). Fisheries sector represents 0.2 % of gross domestic product (GDP) and ensures direct and indirect employment for 70 000 peoples (FAO, 2012), (Golé Bi *et al.* 2005). Total national production, estimated to 43 532 t, was dominated by artisanal fishing (63.37 %) followed by industrial (35.07 %) and aquaculture production (1.57 %). In the municipality of Abidjan, artisanal fishery resources was landed on three landing-stages Abobo-Doumé, Vridi-Ako and VridiZimbabwé. However, little research was focused on different actors involved in the sector, an inventory of all species landed and landing-places production.

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This current study, essentially based on quantitative and qualitative analysis approach, aimed to improve a sustainable management of these aquatic resources landed.

MATERIAL AND METHODS

Study area and sampling sites

The survey of artisanal maritime fishing was held in three main stations. They constitute the main landing places in Abidjan city. Choice of these stations were based on easy accessible at any season, presence of Fisheries Cooperative Association and facility to have access of cooperatives documents. Investigations were carried out during four weeks (1st to 30 July 2014) at landing places of Abobo-doumé (05°19'0" N - 004°1'60" W) in Yopougonmunicipality, Vridi-Ako (05°15.215'N-004°00.280' W) and Vridi Zimbabwe (05°16.627'- 003°59.856'W) in Port-Bouët municipality (Figure 1).

Data collection

Data were collected from May to October 2014. Fishing survey were developed to obtain information on gear characteristics, composition of catches and production of landing places. Requested information was type of loadings, serial number of the fishing vessel, people involved in

fisheries, fishing gears, nationalities, number of day fished, age of the fishermen, fishing areas and species fished. In such landing places, species were identify using FAO (1998) species identification guide for fishery purposes, then measured to the nearest mm and Ifremer (2012), and weighed to the nearest 0.1 g with a top loading balance and counted.

all individuals landed. These two parameter were good indices to examined aquatic resources stocks. Nominal and weight of catches were estimated as follows: $C_p = P_m \times C_n$ with P_m : Average weight of species

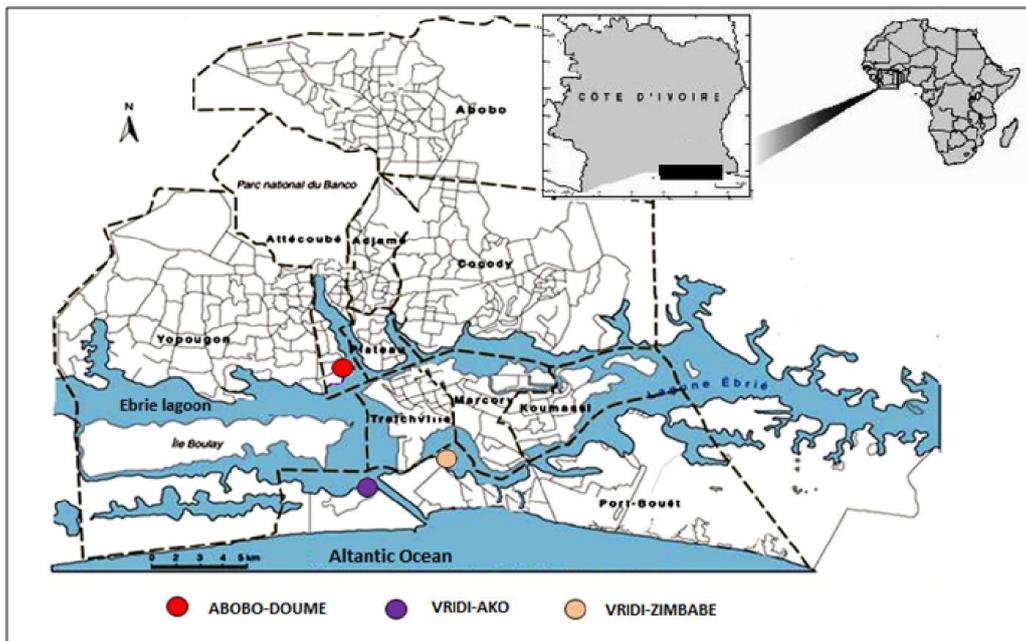


Figure 1. Landing places and samples sites of maritime artisanal resources in Abidjan

Analytical procedure

Fishing effort

The most appropriate measures to be applied in fisheries investigation, is the time devoted to an active research of fish (Soro *et al.*, 2009). In this study, the fishing effort (E_p) was considered as the number of fishing boats monthly used for fishing.

$$E_p = N_{jp} \times N_{msj}$$

N_{jp} : Number of fishing days per month and N_{msj} : average of daily fishing activity

Mean weight of species landed

In every landing places, an average weight of species was obtained starting from the basins of 20 dm³ filled beforehand with individuals of the same species and weighed. Average weight of species (P_m) was estimated per species landed, as follows:

$$P_i = \frac{\sum n_i P_i}{N}$$

P_i : Total weight of all individuals landed for a species i ; P_i : weight of one individual of specie i ; n_i : Number of individuals i of P_i ; N : Total number of all individuals of species i .

Nominal and weight of catches

The weight of catch (C_p) is the quantity in kilogram of aquatic resources fished. Whereas the nominal catch (C_n) is number of

Catch Per Unit of effort

The catch Per Unit of effort (CPUE) is widely used as a relative abundance index in several fisheries all over the world (Tah *et al.* 2009; Mendonça *et al.*, 2010). Therefore, the CPUE was chosen as an indicator of the status of fisheries resources of the three landing places. The CPUE in kilogram was estimated per landing station, as follows: $P_m C_n E_p^{-1}$. With P_m : weight of catches; C_n : Nominal catches and E_p = Fishing effort

RESULTS

Actors and fishing gears

The number of fisherman in activity during sampling period in all the landing places is 1952 persons. Those fishermen are broken down into 573 in Abobo-doumé, 1210 in Vridi-Ako and 169 in Zimbabwe. In the communities of investigated fishermen, only one person is Malian, the others are Ghanaian. Among Ghanaian fishers, Fanti ethnic group with 70 percent of the total fishermen, is the most important followed by Awran or Ewe (25 %) and Ningo (5 %) ethnic group. Twenty-eight per cent (28 %) of Ghanaian fishermen live in Cote d'Ivoire and 72 % return to their own country after fishing season. These ethnic groups are characterized by gears and boats used for fishing, the target species, the duration of the fishing trip and the fishing area (Table 1). Investigations showed that 60% of the crafts (mainly the open wooden fishing vessels known as 'pirogues') are the property of the Ghanaian operators who make their business. Thirty-nine percent (39 %) of fishermen have their own boats but they are

Table 1. Caractéristiques des pêcheurs artisans en fonction de la résidence, des engins de pêche, du type de pirogue, des espèces cibles, de la zone de pêche et de la durée de pêche

Ethnicgroups	Résidences	Fishinggears	Type of fishingsboats	Target species	Fishing area
Fanti	Assibissa, Iles Bouley, Vridi-zimbabwé, Vridi-Ako	Fixed gillnets, Drift nets, Purse seines, longlines, hand line and fishing lines	Fanti canoe or sadine canoe motorized (40 Cv); 8 - 15 m long and 1.5 m width ; Absence of fish hold for conservation	Clupeidae (<i>Sardinellasp</i>)	Abidjan, Grand-Bassam, Jacqueville and Assinie
Awran	Assibissa, Iles Bouley, Vridi-zimbabwé, Vridi-Ako	Fixed gillnets, Drift nets, Purse seines, longlines, hand line and fishing lines	Canoe of Tuna motorized (40 Cv); 15 - 18 m long and 2 m width; Presence of fish hold for conservation	Bullet tuna; Largeheadhairtail; Atlantic bonito; Pompano dolphinfish; Swordfish; Scalloped hammerhead; Shortfinmako; etc...	Abidjan, Grand-Bassam, Jacqueville, Assinie, Sassandra, Ghana and Grand Lahou.
Ningo	Vridi-Zimbabwé	Longlines, hand line and fishing lines	Canoe of Dusky grouper or Ningo Canoe motorized (40 Cv); 18 - 20 m long ; 3 m width; Presence of fish hold for conservation	Rubberlip grunt; Atlantic salmon; Red pandora and Dusky grouper	Jacqueville, Grand-Lahou, Sassandra, Grand-Béréby, Libéria and Sierra Léone

Table 2. Aquatic resources species collected in Abidjan landing places between May and October 2014; + = recorded

Groups	Families	Species	Communs names	Landing places		
				Abobo-Doumé	Vridi-Zimbabwé	Vridi-Ako
FISH	Scombridae	<i>Thunnusalbacares</i> (Bonnaterre, 1788)	Yellowfintuna	+	+	+
		<i>Auxisrochei</i> (Risso 1810)	Bullet tuna	+	+	+
		<i>Sardasarda</i> (Bloch, 1793)	Atlantic bonito	+	+	+
		<i>Katsuwonuspelamis</i> (Linnaeus, 1758)	Skipjacktuna	+	+	+
		<i>Thunnusobesus</i> (Lowe, 1839)	Bigeyetuna	+	+	+
		<i>Acanthocybiumsolandri</i> (Cuvier 1831)	Wahoo	+	-	-
		<i>Euthynnusalletteratus</i> (Rafinesque, 1810)	Littletonny	+	+	+
		<i>Scomberjaponicus</i> (Houttuyn, 1780)	Chubmackerel	+	-	-
	Coryphaenidae	<i>Coryphaenaequiselis</i> (Linnaeus, 1758)	Pompanodolphinfish	+	+	+
		<i>Sardinellaaurita</i> (Valenciennes, 1947)	Round sardinella	+	+	+
	Clupeidae	<i>Sardinellamaderensis</i> (Lowe, 1839) Syn. <i>S. eba</i> Valenciennes 1947)	Madeiransardinella	+	+	+
		<i>Ethmalosafimbriata</i> (Bowdich, 1825)	Bongashad	+	+	+
	Trichiuridae	<i>Trichiuruslepturus</i> (Linnaeus, 1758)	Largeheadhairtail	+	-	+
		<i>Xiphias gladius</i> (Linnaeus, 1758)	Swordfish	+	-	-
	Istiophoridae	<i>Makairanigricans</i> (Lacepède, 1802)	Blue marlin	+	-	-
		<i>Manta Birostris</i> (Donndorff, 1798)	Giantmanta	+	-	-
	Mobulidae	<i>Sphyrnalewini</i> (Linnaeus, 1758)	Scallopedhammerhead	+	+	-
		<i>Isurusoxyrinchus</i> (Rafinesque, 1810)	Shortfinmako	+	+	-
Istiophoridae	<i>Istiophorusalbicans</i> (Latreille, 1804)	Atlantic sailfish	+	-	-	
	Haemulidae	<i>Plectorhinchusmediterraneus</i> (Guichenot, 1850) Syn. <i>Diagrammediterraneus</i> (Guichenot, 1850)	Rubberlipgrunt	-	+	-
<i>Caranx carangus</i> (Bloch, 1793)		Crevalle jack	+	+	-	
<i>Epinephelusmarginatus</i> (Lowe 1834)		Duskygrouper	-	+	-	
<i>Pagellusbellottii</i> (Steindachner, 1882) syn. <i>Pagelluscoupei</i> (Dieuzeide, 1960)		Redpandora	-	+	-	
<i>Salmosalar</i> (Linnaeus, 1758)		Atlantic salmon	-	+	-	
MOLLUSCS	Ommastrephidae	<i>Todaropsiseblanae</i> (Ball, 1841)	Lesserflyingsquid	+	-	-
		2	16	25	21	17

funded by local wholesalers to whom they deliver their capture. Only 1 % of fishermen boats are owned by Ivoirians traders. For each fishing trip and according to craft types, 8-20 persons are needed. The most dominant age class is 25 - 40 years old, which accounts for 62% of total fishermen, followed by those of 17- 25 years old (33%). The fishermen over 40 years old represent 5% of the total number of fishers.

Species composition landed

The specific composition of aquatic resources inventoried in Abidjan landing places during this study is reported in Table II. A total of 24 fish species belonging to 15 families, and one species of Mollusc belonging to Ommastrephidae family were observed. Among fish, Scombridae family with 8 species

(*Thunnusalbacares*, *Auxisrochei*, *Sardasarda*, *Katsuwonuspelamis*, *Thunnusobesus*, *Acanthocybiumsolandri*, *Euthynnusalletteratus*, *Scomberjaponicus*) are the most represented. Followed by Clupeidae family with 3 species (*Sardinellaaurita*, *Sardinellamaderensis* et *Ethmalosafimbriata*) (Table 2).

Figure 2 show nominal production of aquatic resources landed during the study period. Landing place of Abobo-Doumé with 256 268 individuals (80 % of the total individuals landed), is the most important in municipality of Abidjan. It was followed by Vridi-Ako landing place with 60 991 individuals (19 % of total individuals landed) and Vridi-Zimbabwé (3 135 individuals and 1 % of total individuals landed). Clupeidae family is the most dominated fishery statistics with 275 866

individuals. This family is followed by Scombridae and Trichiuridae with 28 540 and 16 591 individuals respectively. Two species, *Trichiuruslepturus* (Linnaeus, 1758) and *Sardinella* sp. dominate total fish diversity in the landing places with respectively 16 591 and 275 866 individuals. *Plectorhynchusmediterraneus* (Guichenot, 1850), *Epinephelusmarginatus* (Lowe 1834), *Pagellusbellottii* (Steindachner, 1882) and *Salmosalar* (Linnaeus, 1758) species, commonly referred to as noble species, are less represented in catches.

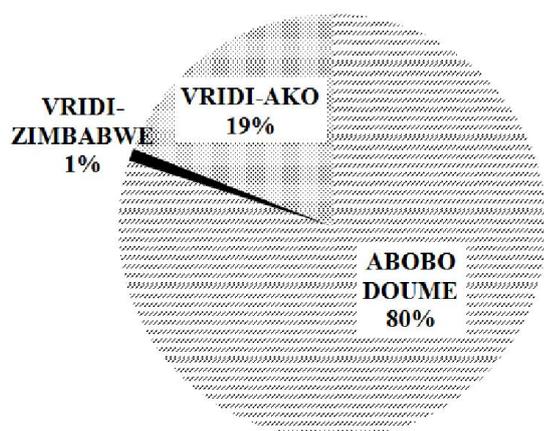


Figure 2. Nominal production of aquatic resources landed in Abidjan municipality landing places (Cote d'Ivoire) from May to October 2014

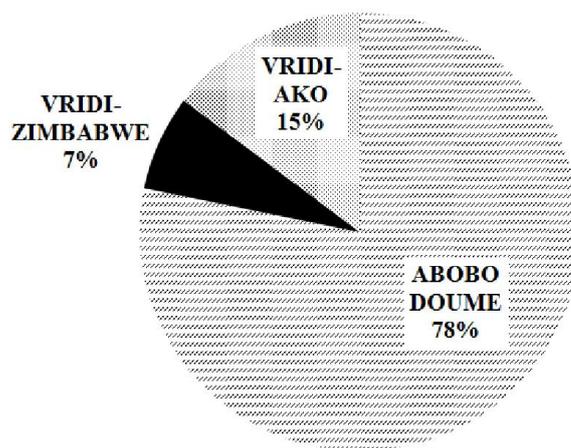


Figure 3. Weight production of landing places in Abidjan municipality (Cote d'Ivoire) from May to October 2014

Followed by Vridi-Ako with 15 211 kg (15 % of total weight) and Vridi-Zimbabwe (7 272 Kg and 7 % of total weight) (Figure 3). Clupeidae and Scombridae families dominate the total weight production with 45 242 kg and 36 051 Kg.

Fishing effort and Catch Per Unit of effort

The total fishing effort (E_p) noted in all landing places is 326 fishing trip with an average of 12.6 fishing trip / days. The high value of E_p were noted in Abobo-Doumé landing place (186 fishing effort) with an average of 7.15 fishing trip / days.

Table 3. Production and Catch Per Unit of effort in Abidjan landing places between May and October 2014

		ABOBO-DOUME		VRIDI-ZIMBABWE		VRIDI-AKO		
Families	Species	Catches (kg)	CPUE	Catches (kg)	CPUE	Catches (kg)	CPUE	
Scombridae	<i>Thunnusalbacares</i> (Bonaterre, 1788)	2380,00	12,80	688,00	38,22	103,00	0,85	
	<i>Auxisrochei</i> (Risso 1810)	1775,00	9,54	311,00	17,28	720,00	5,95	
	<i>Sardarda</i> (Bloch, 1793)	5240,00	28,17	195,00	10,83	207,00	1,71	
	<i>Katsuwonuspelamis</i> (Linnaeus, 1758)	5240,00	28,17	25,00	1,39	207,00	1,71	
	<i>Thunnusobesus</i> (Lowe, 1839)	400,00	2,15	2739,00	152,17	81,00	0,67	
	<i>Acanthocybiumsolandri</i> (Cuvier 1831)	2,00	0,01	0,00	0,00	0,00	0,00	
	<i>Euthynnusalletteratus</i> (Rafinesque, 1810)	10040,00	53,98	568,00	31,56	1516,00	12,53	
	<i>Scomberjaponicus</i> (Houttuyn, 1780)	4200,00	22,58	0,00	0,00	369,00	3,05	
	Coryphaenidae	<i>Coryphaenaeguiselis</i> (Linnaeus, 1758)	38220,00	205,48	97,00	5,39	6925,00	57,23
	Clupeidae	<i>Sardinellaaurita</i>	420,00	2,26	0,00	0,00	0,00	0,00
<i>Sardinellamadereensis</i>		360,00	1,93	0,00	0,00	0,00	0,00	
Trichiuridae	<i>Trichiuruslepturus</i> (Linnaeus, 1758)	60,00	0,32	0,00	0,00	5083,00	42,01	
Xiphiidae	<i>Xiphias gladius</i> (Linnaeus, 1758)	370,00	1,99	0,00	0,00	0,00	0,00	
Istiophoridae	<i>Makairanigricans</i> (Lacepède, 1802)	1782,00	9,58	0,00	0,00	0,00	0,00	
Mobulidae	<i>Manta birostris</i> (Donndorff, 1798)	4398,00	23,65	0,00	0,00	0,00	0,00	
Sphyrnidae	<i>Sphyrnalewini</i> (Linnaeus, 1758)	4065,00	21,85	322,00	17,89	0,00	0,00	
Lamnidae	<i>Isurusoxyrinchus</i> (Rafinesque, 1810)	957,00	5,15	76,00	4,22	0,00	0,00	
Istiophoridae	<i>Istiophorusalbicans</i> (Latreille, 1804)	459,00	2,47	0,00	0,00	0,00	0,00	
Haemulidae	<i>Plectorhynchusmediterraneus</i> (Guichenot, 1850)	0,00	0,00	184,00	10,22	0,00	0,00	
Carangidae	<i>Caranx hippos</i> (Linnaeus, 1766)	220,00	1,18	470,00	26,11	0,00	0,00	
Serranidae	<i>Epinephelusmarginatus</i> (Lowe 1834)	0,00	0,00	1390,00	77,22	0,00	0,00	
Sparidae	<i>Pagellusbellottii</i> (Steindachner, 1882)	0,00	0,00	27,00	1,50	0,00	0,00	
Salmonidae	<i>Salmosalar</i> (Linnaeus, 1758)	0,00	0,00	174,00	9,67	0,00	0,00	
Ommastrephidae	<i>Todaropsiseblanae</i> (Ball, 1841)	100,00	0,54	0,00	0,00	0,00	0,00	
Total Catches (kg)		80688,00		7266,00		15211,00		
CPUE (Kg/Canoe)		433,81		403,67		125,71		

In quantitative aspect, total weight production to all landing places is 103 171 kg. Abobo-Doumé landing place with 80 688 kg represented 78 % of total weight production.

Catch Per Unit of effort (CPUE) in Abobo-Doumé is 433.81 kg / Conoe. Landing place of Vridi-Ako have 121 fishing trip with an average of 4.81 fishing trip / days, and CPUE is 125.71 kg / Conoe. The low value of fishing trip was observed

in Vridi-Zimbabwe with $E_p = 18$ fishing trip and an average of 0.69 fishing trip / days. In Vridi-Zimbabwe Catch Per Unit of effort (CPUE) is 4.81 kg / Conoe (Table 3).

DISCUSSION

Almost all of the actors involved in artisanal production of marine fisheries resources landed in the Abidjan is Ghanaian nationality. The low representation of Ivorian actors in this sector could be explained by their lack of fishing tradition (Delauney, 1991). Fishing is indeed sidelined in favor of agriculture and urban jobs. Similar results were obtained in Côte d'Ivoire by (Hié, 1986), (Traoré, 1996). For these authors, 70 to 98 percent of Ivoirians are dedicated to agriculture. According to fishing technics, they differ from one ethnic group to another. This different could be explained by each ethnic group is being specialized in the capture of one or more species. However, the mesh size of fishing nets is below the required regulatory standards. This modification could change species composition of exploited stocks as well. Similar observations have been noted by Vanga *et al.* (2008) in Buyo and Ayamé Lakes (Cote d'Ivoire) and Watson *et al.* (2006) in North America and Europe. Clupeidae family are the most exploited in maritime fisheries. These results are in conformity with those of FAO (2008). This abundance of Clupeidae in catches coincides with the major upwelling during the cold season from July to October. Indeed, during this period, there is an enrichment of waters by nutrients and a significant proliferation of phytoplankton and zooplankton. Consequently, the number of species feeding on zooplankton and phytoplankton such as *Ethmalosafimbriata*, *Sardinellaaurita*, *graulisencrasicolus* and *S. maderensis*, will increase (Marchal, 1993). The quantitative abundance of minor Thonidae of the family Scombridae in catches could be explained by the fact that these species of this family have a diet preferentially consisting of small pelagic species such as the Clupeidae (Bahou, 2007; ICCAT, 2014).

In addition, These Thonidae would therefore tend to follow Clupeidae for food and are caught by fishermen in abundance. The decline in commercially important species such as Rubberlip grunt *Plectorhinchusmediterraneus* (Haemulidae), Dusky grouper *Epinephelusmarginatus* (Serranidae), Red Pandora *Pagellusbellottii* (Sparidae) and Atlantic salmon (*Salmosalar*, Salmonidae) could be explained by overexploitation of these species (Affaires maritimes et pêche, 2015) in one hand, and by the very few specialized fishermen in their capture, on other hand. The dominance weight and nominal production of the landing place Abobo-Doume in the artisanal maritime fisheries of Côte d'Ivoire is reported for the first time. This abundance is related to its geographical position and to its accessibility in any season. Indeed; Abobo-Doumé is easily accessible by road and lagoon which would justify the significant number of landings products of artisanal maritime fishery.

Conclusion

This study shows that in Abidjan municipality, artisanal exploitation of halieutic resources is performed by Ghanaian nationality belonging to three ethnics groups

Fanti, Awran or Ewe and Ningo. Twenty four fish species and one mollusc species are landed. Two families Scombridae with 8 species and Clupeidae with 3 species are the most landed. The landing place Abobo-Doumé constituted more than 78 % of all aquatic resources landed in Abidjan.

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