



Research Article

HOW FAR CAN TUNAS AND SARDINELLAS DERIVED FROM ARTISANAL FISHING BE EXPORTED FOR RETAIL TRADE FROM CÔTE D'IVOIRE, WEST AFRICA?

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ABSTRACT

In West Africa, marine artisanal fisheries' usefulness lies in their capability to support people's increasing demand for fish, as fish-consumption is generally viewed as the first and foremost way to provide a large amount of animal proteins to consumers. Here, information about the marine artisanal fishery located at Sassandra, southwestern Côte d'Ivoire, are provided, talking about the processing, marketing and distribution of two small pelagic species that are targeted by that fishery. The study was carried out as field work activities in February-March and August-September 2021, using a questionnaire to which people working for the benefit of the fishery willingly submitted themselves. The results shed light on marketing and the route to be followed by the fishery products when these are to leave Sassandra for retail trade. Women participation in post-harvesting tasks is also singled out as a way to acknowledge the significant role they play in artisanal fisheries. The study calls on decision Makers to equip attention to equip women with modern ovens as a way to tackle problems facing women in their efforts to process the fish.

Keywords: Artisanal fishers, Commercial species, Fishery resources, Small pelagic species.

INTRODUCTION

In West Africa, many artisanal fisheries exist in the countries boarding the Atlantic Ocean where these fisheries, which are generally multispecies, target various species for commercial purposes. According to Camara (2008), fishery resources use can be viewed as one of the ancient practices that enable people to benefit by overall resources Nature graciously places at their disposal. In this regard, some marine artisanal fisheries such as the ones in Senegal became prominent, as they even export fishery products, generally in fresh form or frozen to European fish markets. Yet, no matter how efficacious an artisanal fishery may be, it cannot afford to thoroughly meet local populations' constant demand for fish. For instance, in Côte d'Ivoire, where fish-consumption is viewed as the first and foremost way that provides up to 50% of animal proteins to consumers, annual fish-consumption accounts for about 15-16 Kg of fish per capita (Document COMHAFAT, 2015).

There is an increasing trend in fish import as a result, which cannot compensate for the scarceness of national fish production. Instead, there is permanent export for fishery products on sub-regional scale, especially for smoked sardinellas, by fishers to their home (i.e. Ghana), either as a way to meet peoples' needs for food there or to increase their own income on commercial purposes. As Gueye (2012) put it at the FAO/COFI "Side Event" Workshop in Rome, smoked fishery products exported by artisanal fishers throughout West Africa act as a fuel for region-wide fish trade. For fishing for small pelagic species in West Africa stands for a vital contribution to food security on regional scale, both in terms of living condition supported by substantial revenue and ability to meet the permanent needs for peoples' daily fish-consumption.

As fish-consumption increased significantly within these last decades, with the demand for fish remaining the main source for the Ivoirian people to meet their daily

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needs for animal proteins supply, local stocks of small pelagic fish, of which sardinellas and small tunas, are being made use of in a prominent way. Citing the Gulf of Guinea in examples among other regions, Fréon *et al.* (2005) acknowledged that coastal pelagic fish contribute substantially to food security in the world, as they indicated the extent to which the contribution occurs, either directly (human consumption of fresh, smoked, or frozen fish) or indirectly (income for a component of society). In this connection, taking advantage of the free-trade policy established between West African countries, fishers residing at Sassandra, southwestern Côte d'Ivoire, make use of the coastal pelagic fish stocks, trading for sardinellas and small tunas locally and exporting a large quantity as smoked fish to neighboring countries.

As long as fishery resources use associated with ongoing scarceness to our day will make part of and raise global awareness or concerns, topics relating to production, processing, marketing and distribution of fish will deserve research interest. In addition, women at Sassandra are engaged in income-generating activities related to preservation, processing and marketing fish. The diverse array of women's roles in the artisanal fishing sector, performing many post-harvesting tasks, makes them important contributors to food security, as are the fishermen who actively participate in the production process. The main objective of the current study was to give details on small pelagic fish exploitation at Sassandra and show how the artisanal fishery there proved to be of vital importance to local populations and to other populations beyond Côte d'Ivoire. A specific goal was to shed light on marketing and the route to be followed by the fishery products when these are to leave Sassandra for retail trade.

MATERIALS AND METHODS

Carrying out surveys

Interviews were conducted in the manner described by Bahou *et al.* (2022). Briefly, questions were asked to respondents, as in an informal discussion, enabling them to talk about their fishery-related activities and daily life conditions. With people's disability to write in mind - for some respondents had no schooling - we took answers in note form on duly designed sheets of paper, which we used as enquiry sheets. Interviewees were to answer various questions, especially the ones having connection with preservation of the fish, places or areas where customers generally come from, the kind of species that were fished for, which form the fish was sold, and the final destination for the fishery products when these are to be conveyed for retail trade. The series of questions that were asked read this way: 1. Hello sister, what type of activity are you carrying out? 2. Are you resident of Sassandra? Where do you live? 3. What is the final destination for your fishery products? 4. Is there any period in the year when fish is plenty? 5. How do you handle transportation of the fish after buying? 6. Do you generally sell the fish frozen or smoked? 7. What is the type of species whose occurrence is

profitable to the furtherer of your activities? 8. How are the fish preserved? Can you tell us about the preservation process?

A total of 174 respondents, essentially women, were surveyed in this fashion, as they willingly submitted themselves to the questionnaire, telling us in the beginning of conversation the corporation to which they belong.

Data analysis

All respondents ranged considerably in age and experience, which enabled us to have a large array of opinions. All the data we collected were processed as Bahou *et al.* (2022) did, being registered in an Excel file to facilitate expressing the data as percentages. While simple counts were used to illustrate some data, in contrast, for other data, salient points were to be brought out using figures to enhance readers' comprehension.

RESULTS AND DISCUSSION

Various species are landed by the artisanal fishers residing at Sassandra, southwestern Côte d'Ivoire. Table 1 shows the kinds of fish landed, with indication of English name, French name and Local name for each of them. Besides overall pelagic fish indicated by stars, including sardinellas and small tuna species, fishers' wives sell many other fishes to buyers. In general, all kinds of fish are meant to be sold in fresh form, immediately after landing. As a large portion would remain unsold, a category of women known as smoke-curing agents, made up of fishers' wives, retailers and some wholesalers, would process the fish by treating them with wood smoke. All small pelagic fish are handled this way, while fishes other than small pelagics would be sold preferably in fresh form as "noble fish" to wholesalers. All the respondents admitted that there is plenty of fish each year, from July to September, though the abundance of fish is not as consistent as it formerly used to be. Overall, there are two kinds of fish. Table 1 shows that in terms of diversity, fishes known as small pelagics are quite numerous in their kind.

Two kinds of ovens are used in women's efforts to preserve the fish in conditions that conform to customers' conveniences. Figure 1 shows those ovens. The smoke-curing-type oven (Figure 1A) is used to smoke-cure the fish that are still in fresh form and not yet sold after landing. The preservation-type oven (Figure 1B) is used to warm up the fish in order to prevent them from going or smelling rotten or still from getting into decay. Both ovens differ in size and capacity to rapidly process the fish while these are displayed on wire nettings; the former being shorter and the later taller. Instead, they equally possess an aperture where sliced wood displayed in pile are inserted and set alight while being used as fuel for heating the fish. For that reason, the fish are displayed on wire nettings (Figures 1A and 1B). The fish are regularly treated with wood smoke until they reach the consistency of solidness barely subject to decay. The preservation-type oven permits smoke-curing agents to have in store for a long period of time (from

several days up to several months) a quantity of smoked fish that is not yet sold out. This type of oven is regularly supplied with the heat maintained by a soft wood-fire. Small pelagic species such as sardinellas (e.g. round sardinella *Sardinella aurita* and flat sardinella *S. maderensis*) and small tuna (e.g. frigate tuna *Auxis*

thazard, bullet tuna *A. rochei*, little tunny *Euthynnus alletteratus*, and Atlantic bonito *Sarda sarda*) are generally sold as smoked fish, being displayed in containers, ready for sale (Figure 1C). Additionally, Figure 1D shows how the fish are wrapped up in cardboard packaging to facilitate transportation after buying.

Table 1. Some commercially important fish, of which small pelagics*, landed in February-March and August-September 2021 by artisanal fishers at Sassandra, southwestern Côte d'Ivoire.

Kind of fish landed	English name	Local name
<i>Albula vulpes</i> (Linnaeus, 1758)	Bonefish	Copace
<i>Alectis alexandrinus</i> (Geoffroy Saint-Hilaire, 1817)	Alexandria pompano	Japon
<i>Arius parkii</i> Günther, 1864	Guinean sea catfish	Mâchoiron
<i>Auxis rochei</i> * (Risso, 1810)	Bullet tuna	Pokou
<i>Auxis thazard</i> * (Lacépède, 1800)	Frigate tuna	Pokou
<i>Brachydeuterus auritus</i> * (Valenciennes, 1831)	Bigeye grunt	Lôcô-Lôcô
<i>Brotula barbata</i> (Bloch & Schneider, 1801)	Bearded brotlutula	Loche
<i>Campogramma glaycos</i> (Lacépède, 1801)	Vadigo	Petit-Japon
<i>Caranx crysos</i> (Mitchill, 1815)	Blue runner	Japon
<i>Caranx latus</i> Agassiz, 1831	Horse-eye jack	Japon
<i>Chloroscombrus chrysurus</i> * (Linnaeus, 1776)	Atlantic bumper	Plat-plat
<i>Coryphaena hippurus</i> Linnaeus, 1758	Dolphinfish	Machette
<i>Decapterus rhonchus</i> * (Geoffroy Saint-Hilaire, 1817)	False scad	Apolo/Chacha
<i>Drepane africana</i> Osorio, 1892	African sicklefish	Saint-Pierre
<i>Elops lacerta</i> Valenciennes, 1846	West African ladyfish	Guinée
<i>Ethmalosa fimbriata</i> * (Bowdich, 1825)	Bonga shad	Ahoubé
<i>Euthynnus alletteratus</i> * (Rafinesque, 1810)	Little tunny	Pokou
<i>Galeoides decadactylus</i> (Bloch, 1795)	Lesser African threadfin	Capitaine
<i>Ilisha africana</i> * (Bloch, 1795)	West African ilisha	Lame/Rasoir
<i>Katsuwonus pelamis</i> (Linnaeus, 1758)	Skipjack tuna	Listao
<i>Lethrinus atlanticus</i> Valenciennes, 1830	Atlantic emperor	Carpe grise
<i>Mugil cephalus</i> Linnaeus, 1758	Flathead grey mullet	Mulet
<i>Pentanemus quinquarius</i> (Linnaeus, 1758)	Royal threadfin	Capitaine
<i>Pomadasy peroteti</i> (Cuvier, 1830)	Parrot grunt	Carpe blanche
<i>Priacanthus arenatus</i> Cuvier, 1829	Atlantic bigeye	Motar
<i>Pseudotolithus elongatus</i> (Bowdich, 1825)	Bobo croaker	Sosso
<i>Pseudotolithus senegalensis</i> (Valenciennes, 1833)	Cassava croaker	Sosso
<i>Sarda sarda</i> * (Bloch, 1793)	Atlantic bonito	Assaf
<i>Sardinella aurita</i> * Valenciennes, 1847	Round sardinella	Magni
<i>Sardinella maderensis</i> * (Lowé, 1839)	Flat sardinella	Magni
<i>Scomber colias</i> * Gmelin, 1789	Atlantic chub mackerel	Maquereau
<i>Scomber scombrus</i> * Linnaeus, 1758	Atlantic mackerel	Maquereau
<i>Scomberomorus tritor</i> (Cuvier, 1832)	West Afric.Span. mackerel	Thon blanc
<i>Selene dorsalis</i> * (Gill, 1862)	African lookdown	Plat-plat
<i>Seriola dumerili</i> (Risso, 1810)	Greater amberjack	Coco-taillé
<i>Thunnus albacares</i> (Bonnaterre, 1788)	Yellowfin tuna	Albacore
<i>Trachinotus teraia</i> Cuvier, 1833	Terai pompano	Arrê
<i>Trachurus trachurus</i> * (Linnaeus, 1758)	Atlantic horse mackerel	Apolo/Chacha
<i>Trachurus trecae</i> * Cadenat, 1949	Cunene horse mackerel	Apolo/Chacha
<i>Trichiurus lepturus</i> * Linnaeus, 1758	Largehead hairtail	Ceinture
<i>Umbrina canariensis</i> Valenciennes, 1843	Canary drum	Ombrine

Small pelagic fish are indicated by stars*. French name for each species (from top to bottom) is indicated as follows: Banane de mer; Cordonnier bossu; Mâchoiron de Guinée; Bonitou; Auxide; Lippu pelon; Brotule barbé; Liche lirio; Carangue coubali; Carangue mayole; Sapater; Coryphène; Comète coussut; Forgeron ailé; Guinée copace; Ethmalose d'Afrique; Thonine commune; Petit capitaine; Alose rasoir; Bonite à ventre rayé; Empereur atlantique; Mulet cabot;

Capitaine royal; Grondeur perroquet; Beauclair soleil; Otolithe bobo; Otolithe sénégalais; Bonite à dos rayé ; Allache ; Grande allache ; Maquereau espagnol ; Maquereau commun ; Thazard blanc ; Musso africain ; Sériole couronnée ; Albacore ; Pompaneau né-bé ; Chinchard d'Europe ; Chinchard cunène ; Poisson sabre commun ; Ombrine bronze.



(A) : Smoke-curing-type oven, with wire netting on top of it

(B) : Preservation-type oven, with wire netting on top of it



(C) : Smoked sardinellas specimens in a heap inside a (wash)basin



(D) : Smoked sardinellas specimens wrapped up in cardboard packaging

Figure 1 .Photographs showing two types of ovens (A and B), how ready smoked fish are displayed for retailing and for wholesaling (C), and the manner of packaging fishery products (D) at Sassandra, southwestern Côte d'Ivoire.

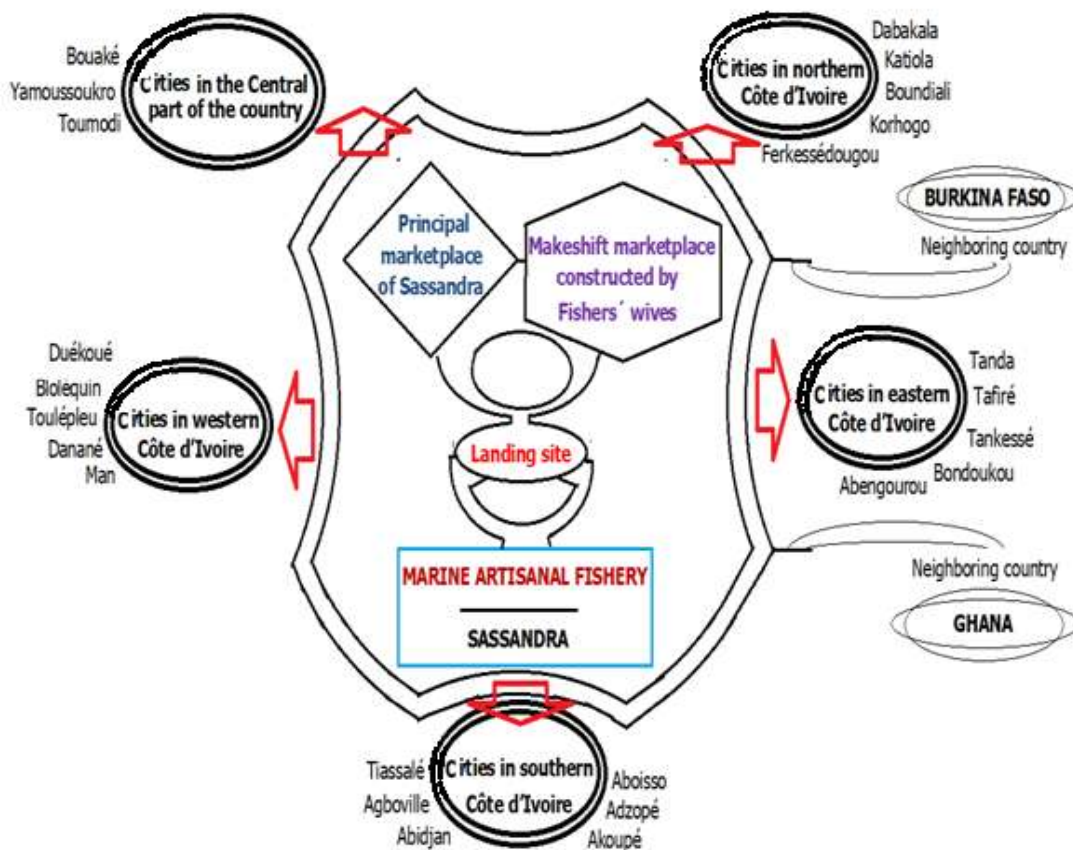


Figure 2 . Simplified representation of the route to be followed by fishery products when these are to leave Sassandra (southwestern Côte d’Ivoire) for retail trade. Note : Cities listed in this Figure are not the only ones where the fishery products landed by the marine artisanal fishers are exported to.

The route of retail trade for the fish is shown in Figure 2. A close observation of Figure 2 clearly shows that a large quantity of smoked fish is exported to neighboring countries such as Ghana, Burkina Faso, Liberia, and Mali, to name a few. Transportation of the fish is handled with the help of appropriate and long vehicles from Ghana. However, at local level, transportation of smoked small pelagic species is carried out with the aid of small Van drivers or with drivers of vehicles covered with tarpaulin, carrying heavy loads, which they transport far off from Sassandra to many cities of Côte d’Ivoire. In addition, at Sassandra, three principal places are known to buyers for showing fish-trade conveniences. These are the principal marketplace of Sassandra, the makeshift marketplace constructed by fishers’ wives and the landing site. From those places, purchased smoked fish are conveyed to many other cities of Côte d’Ivoire (Figure 2).

Species of various kinds are sold by retailers, wholesalers and fishers’ wives, mainly because the artisanal fishery at Sassandra is a multispecies one. In other words, the number of the fish listed in this study testifies to

the fact that fishers do not concentrate on at least one category or type of fish. However, small pelagic fish would contribute up to 80% of the total landing of marine species by Ivorian fisheries (FAO, 2008). This is of no mere occurrence. In fact, small pelagic fish are abundant in all oceans and seas except the Antarctic (Fréon *et al.*, 2005). Those fish of prolific nature, generally represented by coastal species, are of vital importance to artisanal fisheries worldwide. According to Pézenec *et al.* (1993), coastal pelagic species account for the principal fishery resources of Côte d’Ivoire. Yet in terms of species richness, two fish species known as the sardinellas (i.e. *Sardinella aurita* and *S. maderensis*) prominently occur in the catches (Bahou *et al.*, 2021). This situation is mainly due to feeding facilities encountered by those fish in the area, as zooplankton and phytoplankton consumers (Ghéno and Fontana, 1981 ; Médina, 1985 ; Fréon, 1988 ; Binet, 1993 ; Fréon *et al.*, 2005), following suitable environmental conditions favoured by cooling, because of the occurrence of the main upwelling season from July to September (Binet *et al.*, 1991; Pézenec *et al.*, 1993; Binet, 1995).

Through various fishery-related activities, of which post-harvesting tasks, retailers, wholesalers and fishers' wives became collaborators to fishers, regularly supplying local fish market with fishery products. Therefore, the marine artisanal fishery of Sassandra can afford to continue satisfying peoples' increasing demand for animal proteins of fishery sources. As crucial value-chain agents, women engaged in post-harvesting tasks play key roles marketing the fish and well-preserving the fish through the smoke-curing process. In Senegal, for instance, 40% of the total catch derived from marine artisanal fishing would be treated by means of smoke-curing process using traditional ovens (Mbaye, 2005). In fact, the smoke-curing process is the commonest and widespread method for treating the fish with wood smoke and ensuring a quality desirable to purchasers and consumers. The type of ovens that women use at Sassandra to process the fish depicts the partially-developed stage of their business. Those ovens require cheaper and affordable material for their construction. Treating the fish with wood smoke results in the fish being increased in solidness, so that they can be conveyed to remote localities and even to sub-regional fish markets. According to Mbaye (2005), processing the fish by mean of ovens is a must, being relatively modest as a way to keep a portion of the total catch that was not sold in fresh form from the risk of decay, thereby reducing the occurrence of post-capture losses.

Women participation in fisheries activities is quite remarkable in West Africa and can serve as additional detail to what people observed elsewhere in the world. Several authors noted that worldwide, women in fishing communities have been observed to participate actively in fisheries, even expanding their role playing a part in the maintenance of their families (Nwabeze *et al.*, 2013; Cliffe and Akinrotimi, 2015). Actually, fishers would barely succeed in their efforts to supply entire communities with fish, were women not there to serve as a powerful aid. Fall *et al.* (2019) rightly acknowledge the problem of preservation and storage of landed fish as a major societal challenge in three West African countries (e.g. Benin, Côte d'Ivoire, and Senegal), due to the lack of industrial infrastructures. Finally, smoked Sardinellas trade and trade of smoked tuna in southwestern Côte d'Ivoire can be portrayed this way: they both spread out from Sassandra as a central point. Sardinellas trade would however radiate to some cities of Côte d'Ivoire and expand to neighboring countries.

CONCLUSION

The current study showed the contribution of fishers' wives and that of other women such as retailers, wholesalers and smoke-curing agents to the spread of the benefits related to fish trade and fish-consumption. This role, which is quite visible locally at Sassandra, expanded to sub-regional countries through fish retail-trade, as a way to meet peoples' demand for fish there. The study also recalls to decision Makers' attention the persistent problem facing women in their efforts to preserve the fish using traditionally made ovens. Truly, much has been done

elsewhere by Non Governmental Organizations (NGOs) to solve this problem, but much more remains undone for such brave women whose contribution to fisheries still is undeniable.

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