Original Research Article

HABITS AND TECHNICAL SYSTEMS AT WORK IN ARTISANAL FISH PROCESSING IN THREE LOCALITIES OF SASSANDRA-MARAHOUE'S DISTRICT OF CÔTE D'IVOIRE

ABSTRACT

Aims: Fishing and fish processing are ancient, traditional activities, which explain why this sector is of great cultural, social and economic importance and plays a key role in feeding populations.

Study design: This study consisted of conducting a survey of processors and certain services involved in the fisheries sector of the Ministry of Animal and Fishery Resources (MIRAH).

Place and Duration of Study: This prospective study…took place in the fishing areas of Bouaflé Guessabo and Soubré from October 2022 to December 2022.

Methodology:A survey was conducted using a questionnaire. The latter made it possible to collect information relating to the socio-demographic characteristics of the processors, the processing methods and equipment, the various storage strategies and the limitation of post-storage losses of processed fish and the difficulties of the activity.

Results:A total of 41 women processors, including 8 from Guessabo (19.5%), 15 from Bouaflé (36.6%) and 18 from Soubré (43.9%) were interviewed. Mostly young (average age 36 to 40 years) but with 6 to 15 years (68.3%) on average of experience, only 24.4% of them are Ivorian against 75.6% of foreign nationalities. *Tilapias zillii* and *Chrysichthys johenlsi* are the species most processed by smoking and marketed in smoked form. No fish processor in the Sassandra-Marahoué district practices a processing technique other than fish smoking.

Conclusion: Fish processing activities in the fishing areas of the Sassandra-Marahoué district are mainly carried out by women from neighboring countries. Traditional methods characterized by the use of artisanal hearths are adopted by the majority of them. There is also a variability of fish storage tools ranging from wooden baskets to bags of rice.

Keywords:*Artisanal processing, Fish, Sassandra-marahoue district, Côte d'Ivoire.*

1. INTRODUCTION

Humans eat food of animal or vegetable origin, raw, cooked or dried, natural or processed [1]. Fish is in Côte d'Ivoire, as everywhere in West Africa, a precious resource for feeding the population and its marketing gives rise to significant trafficking [2]. In many developing countries, 80% of fish catches are smoked or dried to limit damage [3]. The production, processing and marketing of fish follow very diverse practices linked to the aquatic species concerned, the processing techniques and the processing habits of those involved in this activity [4]. Moreover, the emergence of a new official discourse on hygiene and quality relating to traditional sites which are considered unhealthy, to processed fish which are considered unhygienic for national consumption even less for export[5]. All these observations lead us to seek to know the habits and technical systems implemented in processing, in order to understand the local approach to questions concerning the necessary evolution of the fish sector and quality. The objective of this study is to approach the actors of the transformation and identify with them what makes the quality of a product, in particular processed (smoked) fish, to identify their expectations and reactions to new discourses, new procedures and supervisory bodies, or in the face of innovations.

2. MATERIAL AND METHODS

2.1. Study area and sampling

The survey and the collection of information took place among processors in three towns in the district of Sassandra-Marahoué. These are Bouaflé, Guessabo and Soubré recognized as being areas of high production of fresh and processed (smoked) fish. The towns of Guessabo and Soubré are respectively traversed by the upstream and downstream of the Sassandra River and the town of Bouaflé by the Bandama River.

This prospective study of the quality assessment of fresh and processed fish (smoked, dried) in Guessabo, Soubré and Bouaflé took place from October 2022 to December 2022. It was carried out using a questionnaire.

We interviewed members of each group of fish processors.Forty-one processors were randomly interviewed in the three localities to complete the questionnaire. The information collected was related to:

- socio-demographic characteristics;
- the origins of fishermen and processors;
- fishing, fish trading and processing methods and equipment;
- storage modules;
- different strategies for limiting post-storage losses of processed fish;
- and the difficulties of their activities.

2.2. Data processing and statistical analyzes

The information collected by the questionnaires was recorded in the SphinxME 4.5 software database. These data were analyzed and processed directly by this software according to the categories of questions.

3. RESULTS AND DISCUSSION

3.1. Results

The localities concerned by this investigation are the fishing areas of Guessabo, Soubré and Bouaflé. A survey of the different parameters highlighting the habits of fish processors was carried out. It made it possible to interview 41 processors, including 8 from Guessabo (19.5%), 15 from Bouaflé (36.6%) and 18 from Soubré (43.9%).

3.1.1. Socio-demographic characteristics of female producers

All the processors in these localities are female (100%). No man exercising the processing profession was seen.

In total, only 10 or 24.4% of the processors questioned are Ivorians and 31 or 75.6% are of foreign nationality with a predominance for Malian Bozo (Table 1).

Table 1: Origin and ethnic group of women processors in Guessabo, Soubré and Bouaflé

Origin	Ethnic group	Number	Percentage (%)
Malian	Bozo	26	63,4
Guinean	Zonmonan	5	12,2
Ivorian	Yacouba	3	7,3
Ivorian	Bété	2	4,9
Ivorian	Koyaga	2	4,9
Ivorian	Malinké	2	4,9
Ivorian	Wobé	1	2,4
TOTAL		41	100,0

The processors are mostly young ladies with an average age of 36 to 40 years old. The age parameters were established on a notation of 1 (From 18 to 25) to 10 (Over 65) with a mean of 4.02 and a standard deviation of 2.27 (Figure 1).

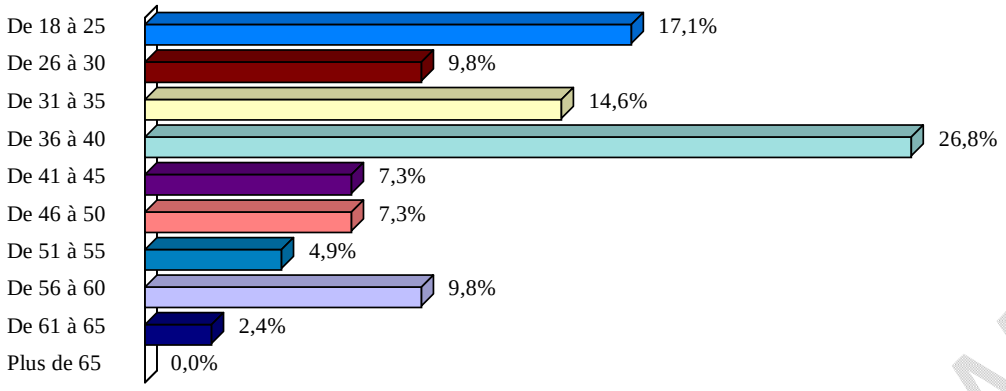

Figure 1: Age groups of female fish processors in the Sassandra-Marahoué district

All the processors in the Sassandra-Marahoué district carry out the activity on their own account. They have been processing fish for several years. 1 to 5 years (9.8%) for beginners. 6 to 15 years (68.3%) for most of them and more than 30 years (4.9%) for the oldest.

3.2. Local fish processing practices in Sassandra-marahoué district

3.2.1. Type of transformation

No fish processor in the Sassandra-Marahoué district practices a processing technique other than fish smoking. The processing of fish by drying is only done for personal consumption and for most of the time when the fish already has an advanced state of "Adjovant" spoilage.

3.2.2. Smoked species

Tilapias zillii and *Chrysichthys johenlsi* respectively known as freshwater carp and catfish are the species most processed by smoking and marketed in this form (Figure 2).

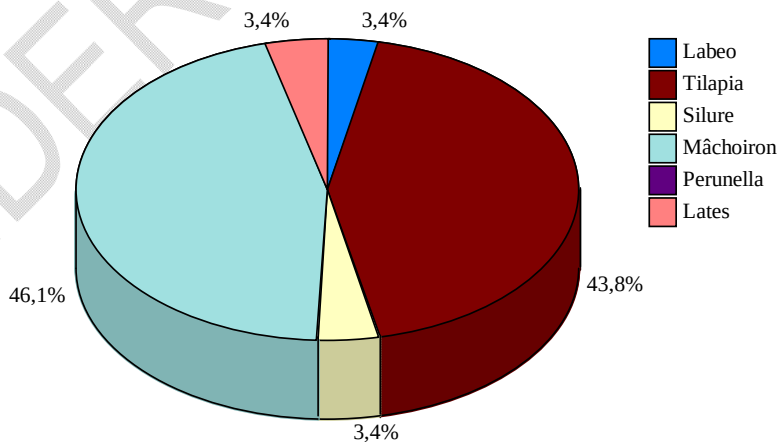

Figure 2: Smoked fish species in the Sassandra-marahoué district

3.2.3. Types of ovens used

79.2% of the ovens used for processing in the localities studied are traditional compared to 20.8% of improved ones, all obtained in Soubré. The improved ovens offered to women processors in Guessabo by the World Bank were all out of service at the time of this study.

3.3. Local fish conservation practices in Sassandra-marahoué district

3.3.1. Storage tools

Regarding fish storage tools, almost all of the processors in the Sassandra-Marahoué district prefer wooden baskets for their ventilation, but also because, she says, they reduce the risk of the fish crumbling. On the other hand, 13.0% and 11.1% of them respectively use plastic basins and bags of rice or cocoa, commonly Bôrô in the local commercial language “dioula” (figure 3).

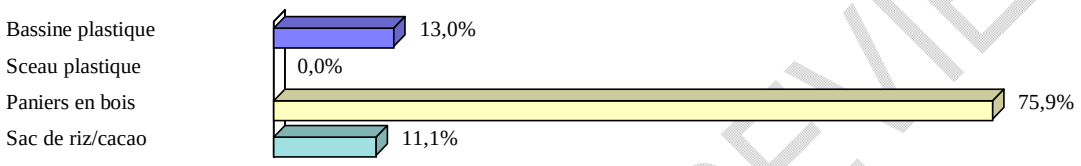

Figure 3: Processed fish storage tool preference.

3.3.2. Fish storage time

Fish storage times are not the same (Mean = 3.22; Standard Deviation = 0.96) depending on market realities. Only 26.8% of processors manage to sell their products within 1 to 3 days compared to those who manage to do so in 3 to 6 days (3.1%) or 6 to 9 days (29.3%). It even takes more than 9 days on average for some to dispose of their processed fish stocks (Figure 4).

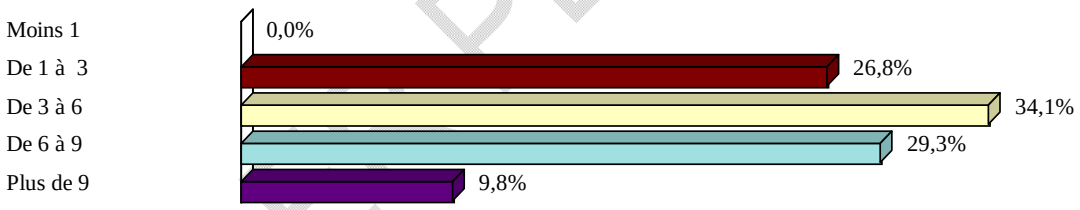

Figure 4: Storage time (day) of processed fish.

3.3.3. Presence and frequency of the intruders intofish

With regard to the frequency of appearance of foreign elements in fish (fresh or smoked), 70.7% of processors admitted to occasionally dealing with insects (59.7%), larvae (37.3%) and fungi (3.0%) (Figure 5 and 6).

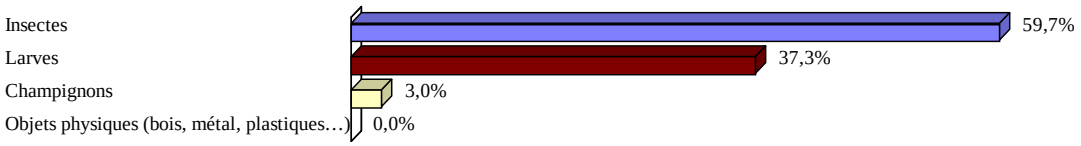

Figure 5: Foreign elements observed in fish

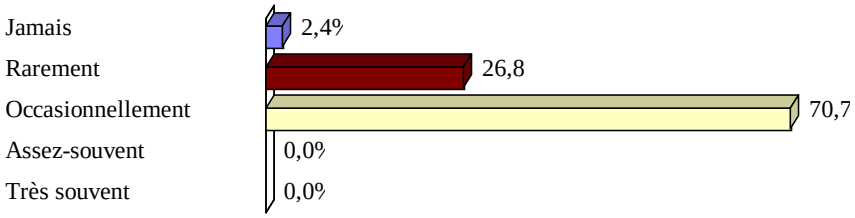

Figure 6: Frequency of appearance of foreign elements in fish

3.3.4. Fish pest control

Only 4.9% of the respondents admitted to often using pesticides against pests in the storage of processed fish. Conversely, the 95.1% say they have never used insecticides on fish. To fight against these, the processors in 70.7% of cases reheat the fish over a wood fire against 2.4% who opt for exposure to the sun. Some (17.1%) prefer the combination by reheating the fish on a fire before exposing it to the sun. For others (9.8%), exposure to the sun comes before reheating over a wood fire (Figure 7).

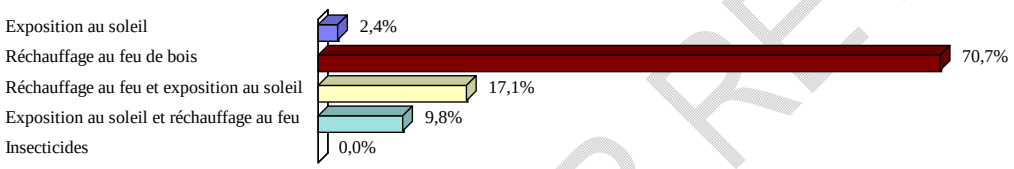

Figure 7: Control techniques used against fish intruders

3.4. Assessment of the fish processing activity according to the actors

3.4.1. Satisfaction with the profession of processors

Despite all the difficulties and physical efforts related to the activity, all the actresses approached (100%) claim to be satisfied with the profession of fish processors. The difficulties encountered in the processing activity are 78.4% due to excessively intense and exhausting work and 21.6% due to health problems related to the inhalation of smoke from the wood fire.

3.4.2. Evolution of the activity

However, only 19.5% of actresses find a development favorable to the activity. 75.6% of them find no real change (constant activity) and 4.9% find that the activity is becoming increasingly unfavourable.

Nevertheless, they note remarkable efforts in the field. 49.0% observed changes in the organization of women processors in their locality and 51.0% noted the improvement in fish processing techniques.

When asked what aspects of the activity to improve, 24.5% of women processors say they want an objective organization of the processing activity. 1.9% want to see a federation of fish processors. For a large number of them, making improved ovens accessible (in quantity and quality) to all processors would partly solve the problem of cooking to perfection and therefore of product quality. Note that, Soubré is the only fishing area at the time of this survey to have an improved oven (only one) for a multitude of

processors. This therefore forces many of them to process their fish at home in artisanal makeshift ovens. For others (1.9%), storage places should not remain on the sidelines and should allow optimal storage free of all forms of cross-contamination.

They are unanimous at 76.0% that raising awareness of responsible processing (respect for cooking times, hygiene of premises, equipment and product) is the most important action to take to guarantee sustainable development of the activity of transformation. On the other hand, 24.0% opt for complete regulation of the processing activity.

3.4.3. Expectations of transformation actors

The expectations of the actors of the transformation of the district of Sassandra-marahoué vis-à-vis the State through their supervisory ministries (Ministry of Animal and Fisheries Resources, Ministry of Trade, Ministry of Health and Public Hygiene), are material (80.0%) and technical (18.0%) support (Figure 8).

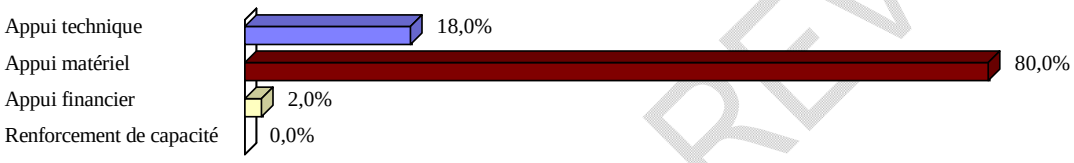

Figure 8: Expectations of female fish processors vis-à-vis the State

3.2. Discussion

Fish resources represent the main source of animal protein for nearly 2/3 of the world's population [6, 7]. Fresh fish is a very perishable commodity whose shelf life hardly exceeds one day in a tropical environment due to the lack of adequate conservation infrastructure and climatic conditions [8, 9]. To limit these losses, a good part of the fish caught is smoked or dried. More than 80% of the fish marketed in rural areas is smoked using archaic methods[10]. In West Africa, fish smoking is widespread and is also practiced on deep-sea fish products [9, 11]. But, smoking technologies differ from one country to another even if there are always similarities between those of West African countries [5]. The diversity of origin of women processors working in the Sassandra-Marahoué district therefore seems to be a considerable asset for the innovation and improvement of fish smoking techniques. But, it takes a lot more than that to get healthy quality smoked fish. Despite the experiences and acquired ancestral habits, women processors want to be open to modern methods and improved processing techniques. For this, much remains to be done in terms of infrastructure and equipment. In the areas in which this study was carried out, improved ovens remain inaccessible or non-existent for women processors.In the locality of Guessabo, the improved ovens provided by a World Bank development project are no longer operational. In Soubré, the insufficient number of improved ovens forces processors to return to traditional ovens under conditions that leave something to be desired. Bouaflé, on the other hand, has so far not benefited from any installation of improved ovens, reducing exclusively its local production of smoked fish to artisanal production with archaic methods. Fish processed under these conditions does not guarantee any health quality to consumers. In addition, smoked or dried fish must be stored for later consumption. The storage period varies from a few weeks to several months depending on the seasons, the storage structures and the climate. During storage, fish always

remain highly perishable and suffer both quantitative and qualitative impairments due to microbial proliferation and infestation by harmful insects [10,11,12, 13]. However, the services of the Ministry of Animal and Fishery Resources (MIRAH) are making every effort to raise the awareness of processors on compliance with good hygiene and manufacturing practices and on the danger associated with the consumption of products of poor hygienic and the use of non-homologous chemicals to control fish-eating insects. The hygiene of processors and sanitary practices at production sites are essential factors in quality control and evaluation [5]. Compliance with personal hygiene prescriptions is closely linked to the level of understanding of this principle and therefore to the educational level of the processors. This is why, beyond the technical and material support requested by these actors, the strengthening of their capacities is necessary despite their many years of experience in this activity.

4. CONCLUSION

This study, carried out in three towns in the Sassandra-Marahoué district of Côte d'Ivoire, reveals that the processing activity is dominated by women from neighboring countries. They have rich experience in the practice of fish processing from 6 to 15 years for most of them and more than 30 years for the oldest. No fish processor in the Sassandra-Marahoué district practices a processing technique other than the smoking of fish for commercial purposes. The most smoked local fish marketed in this form are *Tilapias zillii* and *Chrysichthys johenlsi* respectively known as Freshwater carp and Jaws. Traditional ovens remain the most used processing tool even for localities that have improved ovens. Faster in smoking. Artisanal ovens adapt better to the needs of processors, even if they do not guarantee a better physico-chemical quality of the finished products. The traditional methods of storage characterized by the use of wooden baskets, plastic bowls and bags of rice or cocoa (bôrô) are adopted by the majority of processors given that it often takes more than 9 days on average to dispose of their stocks of processed fish. This forces the actors of the transformation to occasionally face intruders such as insects, larvae and fungi. In order to overcome difficulties in the exercise of their activity and improve the quality of processed fish, the expectations of the actors of the transformation of the district of Sassandra-marahoué vis-à-vis the State are essentially material and technical support. It would be appropriate, following the different results obtained, to diagnose the different technologies and practices in order to identify the critical points for improvement.

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REFERENCES

1. FAO. (2016).The state of world fisheries and aquaculture.Contributing to food security and nutrition for all. Rome (Italy). 229 p.

2. Fatou N., Pascale M., Cécile B. (2002). From the canoe to the dish: Smoked fish on the Senegalese Petite Côte. CIRAD. ISBN 2-87614-517-0. 90 p.

3. Tamgno B.R., Tekou N.H., Nyamsi T.N.L., Mouamfon M. and Ngamo T.L.S. (2020). Insect pests of smoked fish during storage and damage caused in the northern loop of the Dja Biosphere Reserve (East Cameroon). *International Journalof Biologicaland Chemical Sciences*. 14(2): 528-538.

4. ANSES. (2010). Consumption of fish, molluscs and crustaceans: nutritional and health aspects for humans. *Reports Scientific edition.*193 p.

5. Abdoullahi, H.O., François T., Flibert G., Cheikna Z., Lawane I.A., Abdelsalam T. & Aly S. (2018). Technologies, Quality and socioeconomic importance of dried fish in Africa. *Review Science Technology, Synthesis*. 37: 49-63.

6. FAO. (2009). Technical document on fisheries and aquaculture. Roma, 535 p.

7. FAO. (2012). State of world fisheries and aquaculture. Rome, 241 p.

8. Gram L. (2010). Microbiological spoilage of fish and seafood products. In Compendium of the Microbiological Spoilage of foods and Beverages, Sperson WH &Dolye MP (eds); 87-119.

9. Degnon R.G., Faton A.N., Adjou E.S., Tchobo F.P., Dahouenon-Ahoussi E., Soumanou M.M., Sohounhloue D.C.K. (2013). Comparative efficacy of essential oils of two aromatic plants in the post-smoking preservation of horse mackerel (*Trachurustrachurus*). *Journal of Animal and Plant Sciences*, 19 (1): 2831-2839. DOI: http://www.m.elewa.org/JAPS.

10. Folorunso A.A., Sambo B.A., Danjuma M, Usman, A. Ibeawuchi R.K., Edosa O. (2006). Effect of insect infestation on nutritional quality of smoked fish species in Jos, Nigeria. *Cam. Journal of Experimentation Biology,* 2(1): 26-30.

11. Sameza M.L., Tchameni S.N., Ekoue J.D.A., Jazet P.M.D., Tchoumbougnang F. (2016). Growth inhibition of the stored fish (Ethmalosafrimbiata) fungus Aspergillus flavus, exposed to extracted essential oils from Callistemon citrinus and Ocimumcanum. Af. J. Microbiol. Res., 10(30): 1164-1172. DOI: 10.5897/AJMR2016.8028.

12. Keita D.M.O. (2005). Contribution to the study of the quality of processed fish (smoked, dried) in Bamako, Mopti, Niono and Sélingué. Doctoral thesis, University of Bamako, Mali.

13. Ndrianaivo E.N., Cornet J., Cardi M., Razanamparany L., Berge J.P. (2016). Storage of smoked and/or dried fish: case of Oreochromisniloticus "Fihasaly" from Madagascar. *Africa Sciences*, 12(2): 254–265. DOI: http://www.afriquescience.info.