



Coastal Small Pelagic in Senegal: What Strategies to Sustainably Improve the Added Value Generated

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Abstract

This study assesses the share of the added value generated by coastal small pelagic fisheries in Senegal. The methodology is based on the reconstitution of the operating accounts of the different segments of artisanal fishing. The intermediate consumption of the value chain was the subject of field surveys. The results reveal that fuel is the most significant operating cost for small-scale maritime fishing units; on the other hand, for fish traders and processors, it is raw materials (fish). Overall, the average annual added value generated by sedentary senegalese coastal pelagic fisheries is estimated at \$44.628 million US over the period 2014 - 2018. More than 44% of this added value (\$20.661 million US) is generated by the production segment. The fishmonger and artisanal processing segment generated 10.744 and \$11.570 million US, respectively. The added value of the freezing segment is the lowest, less than \$1.653 million US per year. Improving this added value will not be possible through a continuous increase in landings due to the over-capacity of the means of production deployed in the fishery and the resulting state of overexploitation of resources. It is no longer a question of producing more but of making the best use of current levels of exploitation. That involves identifying bottlenecks in the value chain and finally proposing points for improvement likely to overcome them in the long term.

Keywords: Senegal; Coastal Pelagic; Value Chain; Added Value; Improvement Points

Abbreviations: MSY: Maximum Sustainable Yield; DPM: Directorate of Maritime Fisheries; DITP: Directorate of Fisheries Processing Industries; CRODT: Centre for Oceanographic Research of Dakar Thiaroye; FAO: Food Organization of the United Nations; NA: Not Applicable.

Reminder of the Context of the Fisheries and Objectives of the Study

Coastal small pelagic represent a strategic commodity, economic and social food, and nutritional safety net [1,2]. These resources play an important role for rural and urban populations with low purchasing power by providing protein at affordable prices [3-7]. Coastal pelagic, which account for

56% of landings in 2018, represent only 37% of commercial values. On average, 278,000 tons of coastal pelagic landed annually in Senegal concerning the period 2014-2018 [8].

The multi-purpose characteristics of coastal small pelagic relate to local fish trading, which is dominant (150,120 tons) followed by artisanal processing (116,760 tons), production of fishmeal (4,654 tons), and exports in completely fresh/frozen (11,120 tons) [9]. Thus, the objective of this study is to assess the share of the added value generated by coastal small pelagic fisheries in Senegal. Then, we propose the improvement points to support a better strategy of valuations of fishery products, which can strongly contribute to food security [10].

The Fishery Committee for the Eastern Central Atlantic (hereinafter-called COPACE) working group in 2018 estimates the fisheries potential of the sub-region (Guinea Bissau, Gambia, Mauritania, and Senegal) at biomass levels of around 2,222,500 tons. The stock statuses as assessed by the various COPACE working groups [11-13] indicate that, apart from sardine, the stocks situation has rather deteriorated, in particular for key species in landings (*Ethmalosa fimbriata*, *Sardinella maderensis* and *aureta*, and *Trachurus trecae*). The state of over-exploitation of these pelagic resources was confirmed in Senegal by the assessments conducted by the Centre for Oceanographic Research of Dakar Thiaroye (hereinafter-called CRODT) in 2021. The maximum sustainable yield (MSY) is around 270,667 tons for round and flat sardinella, 26,496 tons for black horse mackerel, and 16,896 tons for bonga. That corresponds to an increase of 131%, a decrease of 37%, and NA (not applicable) respectively for these species compared to the results for the year 2016.

It is no longer a question of producing more but of making the most of the landings of coastal small pelagic. Hence, the interest of this work seeks to define strategies for an increase in added value in the value chain.

Methodological Approach

The study started with a documentary review to refine the basic knowledge on the research topic. It consisted of collecting and analysing secondary data on the internet and from the libraries of structures working in the fishing sector (Directorate of Maritime Fisheries (DPM), Directorate of Fisheries Processing Industries (DITP), Centre for Oceanographic Research of Dakar Thiaroye (CRODT), and Food Organization of the United Nations (FAO)). This documentary review made it possible to take stock of knowledge on the context of Senegalese fisheries in general and coastal small pelagic in particular and to carry out initial mapping of the stakeholders in the value chain.

For the calculation of the added values and their distribution in the different segments of the value chain, the operating account of each type of actor was reconstructed (owner of fishing units, fishmongers, retailers fresh fish, fish processors, freezer factory) based on information collected directly from stakeholders or secondary data.

The landing volumes and prices and the fishing effort data used in this article were drawn from several sources, including CRODT and DPM statistical bulletins. The analysis of the DPM's statistical bulletins made it possible to break down the landings of coastal pelagic in the different segments of the value chain, namely fish trading (distribution of fresh fish), small-scale fish, and industrial processing. The intermediate consumption of each segment of the value

chain was the subject of field surveys.

The microeconomic approach was followed by a mesoeconomic approach with the aggregation of sectoral added values. In a macroeconomic dynamic, the added value generated by coastal pelagic fisheries has been assessed.

Results

It should be noted that gross value added (GVA) is a good indicator of wealth creation through fishing. Furthermore, the net added value (NAV) is equal to the sum of the remuneration of the factors of production and the net income of the State withdrawn from the coastal small pelagic fishery. For the production segment, the fishing units targeted are the purse seine and the encircling gillnet, which account for most of the landings of coastal small pelagic. For 800 tons landed annually by a purse seine fishing unit, the net added value generated is US\$55,821.2, the added value generated per kilogram of fish landed is US\$0.07. For the encircling gillnet fishing unit, the annual tonnage of 235 tons landed yields an added value of US\$21,775.21, which gives an added value of US\$0.09 per kilogram of fish (Table 1).

Headings/Fishing units	Purse seine	Encircling gillnet
Turnover	198,347.11	58,264.46
Exploitation charges		
Intermediate consumption and services		
• Fuel	133,636.36	33,413.22
• Food	248	74.38
• Maintenance and repairs	8,642	3,002
Crew wages	37,919	19,059.12
Fishing permits	41.32	41.32
Depreciations	5,512.40	2,048
Total of the exploitation charges	181,137.19	53,702.48
Financial and economic profitability		
Net profit	12,348.47	626.83
Added value	55,821.20	21,775.21

Source: Field survey data, 2019.

NB. Conversion day: March 7, 2022, 1 Dollar American = 605 Franc CFA.

Table 1: Operating accounts of artisanal maritime fishing units (US\$).

About 80% of the 278,000 tons on average over the period 2016-2018 is landed by purse seine units (222,400 tons) compared to 20% by encircling gillnet units (55,600 tons). The added values generated by purse seine and gillnet fishing units are \$15.504 million US and \$5.140 million US, respectively. That gives an overall added value of \$20.645 million US for the production segment of the value chain.

For 400 tons of fish distributed annually, a fish trade workshop generates an added value of US\$27,438.02 (Table 2), which corresponds to an added value of US\$0.069 per kilogram of fish distributed. For 150,120 tons of fish distributed annually, the added value of the fish trading segment is \$10.298 million US.

Fish trader actors	Fishmonger
Turnover	165,289.26
Exploitation charges	
Intermediate consumption and services	
• Raw materials (fish)	99,174
• Fuel	21,653
• Ice	16,529
• Vehicle maintenance et repairs	496
Wages	3,554
Taxes	744
Depreciation	3,306
Total of the exploitation charges	145,455
Financial and economic profitability	
Net profit	19,835
Added value	27,438.02

Source: Field survey data, 2019.

Table 2: Trading account of fishmongers (US\$).

Concerning the small-scale fish-processing segment, the added value generated by the oven is US\$17,726 (Table 3),

which corresponds to an added value of US\$0.1 per kilogram. For 116,760 tons of fish processed on an artisanal basis, the added value of the artisanal processing segment is \$11.752 million US.

Headings	US\$
Turnover	61,091
Intermediate consumption	
• Raw materials (fish)	29,091
• Fresh fish transport	582
• Combustible	9,309.09
• Salt	2,182
• Packaging	2,036.36
• Maintenance and repair of ovens	165.29
Wages	1,164
Depreciation	149
Total intermediate consumption	44,678
Financial and economic profitability	
Net operating income	16,413.22
Added value	17,726

Source: Field survey data, 2019.

Table 3: Smoking oven operating account (US\$).

Discussion and Improvement Points

Among the main marine fish landings in Senegal, coastal pelagic take first place with relative commercial values and are valued in different forms. In terms of budget revenue, coastal small pelagic fisheries generated US\$59,917.36 in 2018 as annual fishing license fees [8]. Beyond this importance, we approach the operating accounts of artisanal maritime fishing units (production segment), among which fuel (with more than 90%) and wages represent the most significant expenses [14,15]. The average investment costs of a purse seine (PS) and an encircling gillnet (EGN) are respectively US\$53,375.21 and US\$19,554 (Table 4).

Capital equipment/Fishing units	Purse seine	Encircling gillnet
Pirogues of 22 m	9,917.36	
Pirogues of 20 m	8,264.46	8,264.46
Engines	12,631.40	4,058
Fishing gear	21,488	6,818.18
Accessories	1,074.38	413.22
Total equity	53,375.21	19,554

Source: Field survey data, 2019.

Table 4: Investment costs of the main maritime artisanal fishing units (US\$)

The production segment benefits from the subsidy opportunities for outboard motors (due to US\$1,653 per motor), which leads to an increase in the added value of about twice as large as the other two segments of artisanal fishing (artisanal processing and fish trading). From a social point of view, trades related to artisanal processing show a downward trend due to the emergence of the fishmeal and fish oil industry. The issue of fish quality and the hygiene of small-scale processing sites are the factors that determine the variation in added value. Operating on a small scale, processors have very few initiatives. Therefore, they make little effort to find new markets. Thus, the difficulties related to the sale of their products combined with the insufficiency of storage warehouses mean that processors are often forced to sell off their products. In addition, wholesalers ensure the direct export of fish products in a fresh and frozen state to local and regional markets. Based on these results, this segment generates little added value.

The daily sale of fish by fishmongers with a problem of conservation of products that arise pushes them to resell the rest of their products to processors at derisory prices. That amounts to ending up at a purchase price of the raw material (fish) of US\$29,091 (Table 3) for the artisanal processing segment. Consequently, the average price of targeted coastal pelagic is US\$0.248 per kilogram (fishmonger) against US\$1.157 per kilogram for smoked fish (artisanal processing). It would also be interesting to make the comparison in terms of added value between artisanal and industrial processing if data are available.

Indeed, in the value chain of the different segments of artisanal fishing, the fishmongers pay taxes (health certificate and municipal taxes) up to US\$743.8 (Table 2). In addition to taxes, the purchase of raw material (fish) of US\$99,174 constitutes the main expenses for the fish trade. Competition between fish trading and processing (artisanal and industrial) for the purchase of small pelagic fish, difficulty access to credit, and other factors mentioned above have meant that the value added is lower for the fish trade segment than other of the value chain. On the other hand, this segment has a turnover higher by 63.04% than the artisanal processing segment and lower by 35.59% than the production segment (PS and EGN).

Nevertheless, it appears from the field that the conditions for the conservation of pelagic fish on-board pirogues are poor. The catches are piled up there and exposed to the sun for long hours. These poor storage conditions deteriorate the quality of the fish before landing and cause significant post-harvest losses [16]. The conditions of fish landing, selling, packaging, and loading into vehicles are also unsanitary.

Fish braising is still done on the ground in many processing sites along the Senegalese coast. This artisanal fish processing process causes significant losses and poor product quality. Processing sites are no different from garbage dumps with sewage, fish entrails, and other trash littering the ground. In addition, the spaces adjacent to the processing sites constitute garbage dumps. These organic materials, which decompose very quickly, cause the proliferation of flies, beetles, and larvae, which affect the quality of the processed fish. Consequently, all these bottlenecks make it difficult for the different segments of the value chain to improve their added value.

Thus, to achieve a better strategy to improve sustainably the added value generated, it could be proposed some points for improvement:

- Management of the safety of fish storage operations on-board pirogues, their landing, and packaging;
- Raising awareness and a good promotion policy by building the capacity of processors to better integrate the benefits of ovens into their processing habits and practices, with particular emphasis on the best quality of products (consumer tastes and preferences), their longer shelf life, lesser infestation, and less arduous working conditions;
- Closing off processing sites;
- Make accompanying efforts on the diversification of commercial outlets and the widening of the area of distribution of Senegalese processed products;
- Curb trends by replacing frozen products with artisanal processed products that bring added value and jobs;
- Minimize the use of fresh coastal pelagic edible by the fishmeal industry;
- Identify the coastal pelagic, which are not currently used in Senegal, and which make it possible to meet the quality needs of the fishing industry in their flour manufacturing process.

The sustainable improvement of the added value depends on the strict respect of all these bottlenecks mentioned above. For this, participatory revitalization and involvement of all stakeholders in the value chain must be encouraged. Beyond that, the actions must fall within the framework of awareness-raising, training, and support for actors in the different segments of the value chain.

Conclusion

In this study, the added value generated by the production segment is twice as high as the other two segments of small-scale fishing (small-scale processing and fish trading). This added value would help reduce the poverty of actors in the coastal small pelagic value chain through significant

additional income. Coastal small pelagic are mainly exploited in Senegal by an artisanal fleet made up of purse seines and encircling gillnets. On the other hand, the improvement points identified should result in greater empowerment of women processors, greater diversification of commercial outlets for actors, and an expansion of the distribution area of Senegalese fish products. Hygiene and healthiness measures in fish processing areas would ensure high-quality products. Greater adoption of smoking ovens would lead to higher quality processed products, less arduous working conditions, and reduced wood consumption and gas emissions.

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