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# Fisheries at the heart of a development issue in Mauritania: Small coastal pelagics between market logic and nutritional rationality

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**Abstract**
This article characterizes the strategies, logics and games of actors around the exploitation of small pelagics in Mauritania. The dynamics of exploitation and development of small pelagics is supported by a policy of domiciliation of catches. This policy tries to find a balance between market logic and nutritional logic. This work is based on data from the Mauritanian Institute for Oceanographic Research and Fisheries (IMROP) (2010-2020) and the results of surveys carried out in early 2016 and late 2020. It appears that flour and fish oil factories-whose growth is driven in Mauritania by an attractive tax policy (establishment of a free zone in Nouadhibou) and a relatively low cost of labor remuneration-have monopolized artisanal and coastal fishing catches (Senegalese, Chinese and Turkish) through chartering contracts and fishing agreements. Added to this environment is a process of relocation of flour factories from certain countries, notably neighboring Morocco, to Mauritania, in a global context marked by a significant decline in the flour industry. There is, however, a nutritional emergency with a population growing at 2.3% per year. The public authorities are putting in place mechanisms to contain these flour factories-by introducing new taxes on turnover in addition to the 9% levied by the Mauritanian company for the marketing of fish (SMCP)-which represent at their eyes a threat both to the sustainability of resources and their environment and to food security. In a logic of meeting nutritional needs, the National Fish Distribution Company (SNDP) has been set up, which benefits from a compulsory contribution of 2% on the catches of industrial trawlers. The reconciliation of market and nutritional logic is a priority for those who want to ensure the food security of populations.

**Keywords:** Fishmeal and fish oil, food security, small pelagics, Mauritania

## 1. Introduction
Over the past two decades, the small pelagic fishery has grown by nearly 70% in Mauritania (IMROP, 2020). This growth is attributable to the increase in Senegalese canoes and Turkish coastal boats and, indirectly, to the explosion in the volume of catches (Failler *et al*., 2014; Corten *et al*., 2017; Dia *et al*., 2021) [16, 5, 13] estimated on average at more than 875,000 tonnes over the period considered (IMROP, 2021). The high endogenous demand for fishmeal and fish oil from the markets of Asia, the Middle East and Europe contributes strongly to the increase in these catches (FarFish, 2021) [20] in response to the policy of integrating small pelagics. These catches generate an average added value of more than 115 million euros, half of which comes from fishmeal and fish oil factories. Added to this is the contribution of fishing for small coastal pelagics to public finances estimated at nearly 200 million euros (Thiao *et al*., 2022) [29]. The emergence and growth of this industrial fabric, of fishmeal and fish oil factories, is supported by foreign capital, in particular Turkish, Chinese and European investments (Tarbya *et al*., 2012; Greenpeace, 2021) [28, 21]. The profit logic of economic operators producing flour exerts excessive pressure on small pelagics. Indeed, 4 to 5 kg of fresh fish are needed to produce 1 kg of fishmeal (Péron *et al*.; 2010) [27]. This is not without raising concerns related to the significant increase in demand for proteins of animal origin from the national market, whose population is growing by 2.3% per year (Failler, 2021) [18] and the regional market in Africa (Déme *et al*., 2021a). For the sustainable management of small

pelagics, the public authorities are thus trying to arbitrate between the creation of value and support for food security.

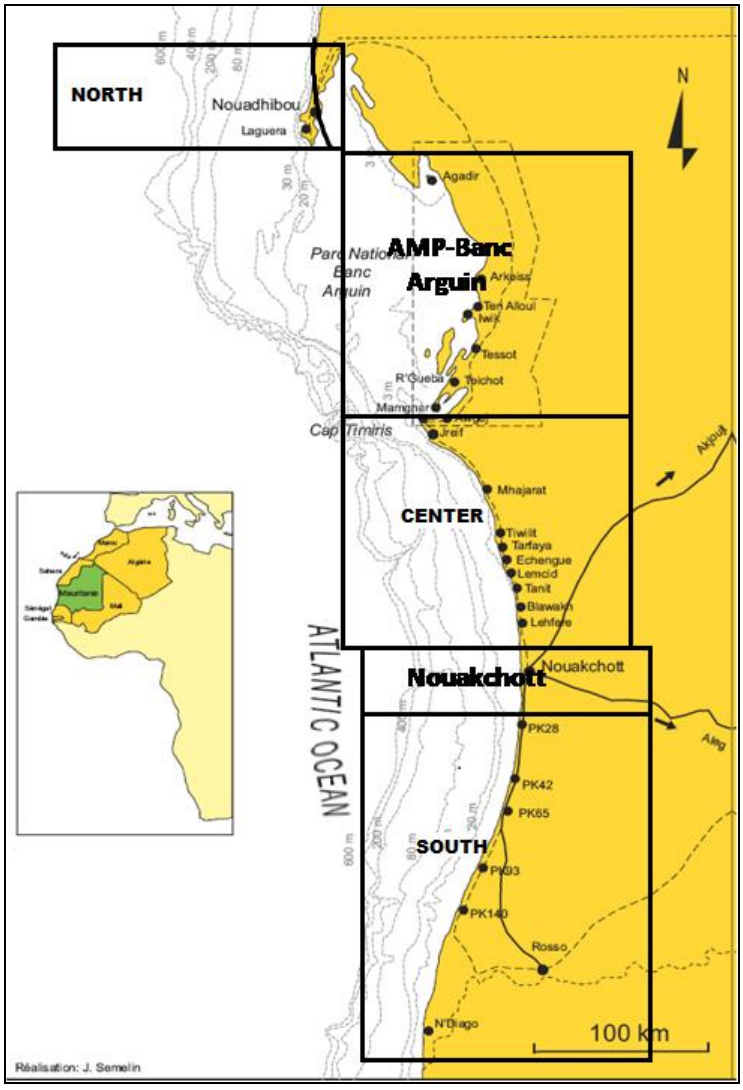
This article aims to characterize the different logics in the exploitation of small pelagics. The regulatory framework-national and foreign regime-governing fishing activity in the Mauritanian EEZ reveals a diversity of actors' strategies. The documentary research made it possible to situate the importance of the demand for fishmeal and fish oil (market price in particular) at the world level, but also the mechanisms favoring the installation of these factories in Mauritania. The IMROP data (2010-2020) made it possible to follow the evolution of the production of small pelagics ultimately that intended for the milling industries. The field surveys also completed recorded data on the production of fishmeal, which were probably incomplete because the factories are subject to minimal external monitoring (CAPE-CFFA, 2019) [3]. Also, these surveys have facilitated the identification of the interplay of actors observed in the various strategies pursued as well as the regulatory mechanisms put in place for food security. The added value of this article lies in the identification of public policies that attempt to arbitrate between market logic and nutritional logic. A work that has not, until now, received particular attention. A number of works on this theme in Mauritania are oriented towards the impact of the flour industry (Ould Med Lemine *et al*., 2011; Dia, 2012; Failler *et al*., 2014; Corten *et al*., 2017; Dème *et al*., 2021a) [30, 12, 16, 5, 8] or in the creation and distribution of the wealth of these industries (Dème *et al*; 2019; Kane *et al*., 2021) [7, 23]. This work allows public policies to better direct the catches of coastal pelagics.

The article is divided into three parts. The first part focuses on the method. The second part gives a brief historical overview of the trajectory of small coastal pelagic valorization industries by focusing on the determinants of the growth of flour factories in Mauritania. The second part sheds light on the strategies of the actors involved in the exploitation of small pelagics and its requirements for meeting food needs. The third and final part discusses the orientations of the policies for the exploitation of small pelagics, reconciling the objectives of creating added value and food security, in Mauritania.

## 2. Materials and Methods

### 2.1 Study zone

With more than 700 kilometers of coastline divided into 5 zones: North (Nouadhibou), PNBA (National Park of Banc Arguin), Center, Nouakchott and South Nouakchott (see map 1), Mauritania has particular characteristics in its area maritime. This is an ichthyological richness explained by the presence of very favorable hydroclimatic conditions. According to scientists, this physical mechanism, called upwelling, is caused by the trade winds which induce upwellings of deep, cold water rich in mineral salts, enriching the entire food chain.




**Map 1:** Geographical areas of small pelagics fishing and landings

The alternation of these seasonal phenomena is one of the foundations of the richness and diversity of marine production that have made the reputation of Mauritanian waters. This permanent phenomenon of Cap-Blanc, combined with the current of the Canaries in the cold season and that of Guinea in the hot season (Ngando *et al*., 2020) [26], leads to the displacement of temperate species from the North and tropical ones from the South. According to the statistics made available to us, small pelagics largely dominate and represent more than 80% of the catches made in these different areas.

### 2.2 Data collection and processing

The IMROP data (20010-2020) was collected as part of the Artisanal and Coastal Fisheries Monitoring System (SSPAC). This system makes it possible to give an estimate of catches and fishing effort based on the main landing points on the coast. It is taken into account, on the one hand, the volumes of small pelagics landed in Mauritania and, on the other hand, the quantities of these fish which are intended for the fishmeal and fish oil factories. This work carried out using a few economic indicators (multiplier coefficient, growth rate, average annual growth rate) made it possible to assess the dynamics of the evolution of the supply of these factories over the period from 2010 to 2020. These indicators retained in the exploitation of the data were supplemented by field surveys of around a hundred Mauritanian, Senegalese and Turkish fishermen operating in Mauritania. This work took place in Nouakchott and Nouadhibou, the main areas where these fishermen and fishmeal factories are located, in late 2016 and late 2020. It thus made it possible to determine the systems put in place by the processors, price negotiation strategies between fishermen and processors to monopolize the resource and the institutional changes that accompany them.

## 3. Results

### 3.1 The establishment of fishmeal and fish oil factories in Mauritania: a development strategy

The emergence and large-scale expansion of fishmeal and fish oil factories to feed animals in aquaculture farms and factory farms are driven by strong endogenous demand from Asian and Middle Eastern markets. As the economic situation is also favourable, the price of flour is estimated at 1,100 EUR/t and 1,400 EUR/t for oil.

Since the mid-2010s (EUMOFA, 2020) [15]. The growing demand for these products, particularly from the Asian aquaculture industry, was coupled with a reduction in production from the main producing country, Peru. The drastic drop in the production of fishmeal and fish oil in South America and an attractive tax policy linked to the establishment of a free zone in Nouadhibou in 2011 favor the establishment of meal factories in Mauritania. Indeed, Mauritania guarantees to approved companies the stability of the tax conditions applicable to their investment from the date of notification of their registration or approval. The country thus offers advantageous conditions for foreign direct investment, positioning itself as an El-Dorado that offers significant opportunities in terms of the availability of fish resources and affordable labor costs. To this situation is added the process of relocation of flour industries from certain countries, in particular neighboring Morocco, to Mauritania in favor of a global context marked by a significant decline in the flour industry in a number of countries. In doing so, fishmeal and fish oil factories experienced particularly rapid growth between 2010 and 2020, where the number of factories increased from 5 to 40 (Dème *et al*., 2019) [7], i.e. a multiplier of 8.

**Table 1:** Nombre d'usines de farine de poisson

| Fishmeal factories | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| Nouadhibou | 5 | 5 | 5 | 10 | 13 | 19 | 20 | 29 | 29 |
| Nouakchott | 0 | 0 | 1 | 2 | 3 | 4 | 4 | 11 | 11 |
| Total | 5 | 5 | 6 | 12 | 16 | 23 | 24 | 40 | 40 |

***Source*:** Completed Dème *et al*. 2019, IMROP (2021)

These factories benefited from the wait-and-see attitude of the state (Williams and Jaladudin, 2019) [30]. Initially, the government wanted to develop the domestic fishing industry in order to increase the country's local profits in addition to the monies received from license fees and export taxes.

Over time, the number of jobs created has increased considerably from 900 in 2015 to 1972 in 2019. There is a strong predominance of direct jobs, which have increased from 67% to 74% over the last five years (Thiao *et al*., 2022) [29]. Added to this are indirect jobs such as collectors, shippers and transporters involved in the development of small coastal pelagics. The fishermen met in the field underline the attractiveness of the prices offered by the flour factories. They improve “their income thanks to opportunities to sell fishery products, particularly in the event of excess and/or damaged catches”.

Due to the attractive prices of fishmeal and fish oil, artisanal purse seine canoes from Senegal as well as Turkish coastal boats are mostly chartered by the processors of the National Fisheries Federation (FNP). Indeed, these fishermen confirm that they work: “exclusively on behalf of fishmeal and fish oil factories belonging to Mauritanians who have set up these factories with their own funds or with the complicity of foreign partners”.

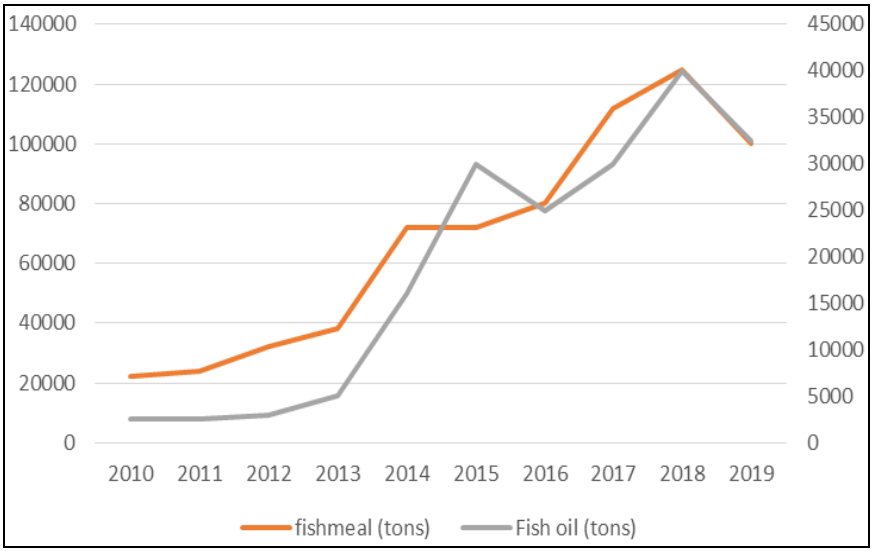
### 3.2 The strategies of actors in the exploitation of small pelagics with harmful consequences

The supply of fishmeal and fish oil factories is ensured until 2015 by Senegalese canoes either under a charter contract or under a fishing agreement between Senegal and Mauritania. The charter contract between the two parties consists in the factory operator providing the financing of the fishing activity (food for the fishermen, fishing equipment) in return, he benefits from a preferential regime which allows him to benefit from the entire volume of landed products ensuring the supply of fish factories at an affordable price for processors. These prices are thus negotiated in advance. According to field surveys carried out as part of the GREPPAO project, the negotiated price, depending on the season, is on average 84 euros/ton for a ton of sardinella instead of 134 euros on the local market. For bonga, the negotiated price can reach 67 euros instead of 94 euros on the market (IMROP, 2021). The certainly cyclical rise in the price of these commodities on the international market and this chartering regime being the only determinants of the rise in prices.

Under this charter regime, Dia *et al*. (2012) [12] underline the development of pelagic fishing in the northern zone by a remarkable boom due to the massive influx of Senegalese fishing units (mainly purse seines) and their crews. These fishermen, who came mainly from Guet Ndar de Saint-Louis in Senegal, are renowned for their migratory culture and the search for accumulation along the West African coast (Dème, 2012; Failler *et al*., 2020; Bocoum, 2021) [6, 17, 1]. "Mauritania

remains one of the few abundant fishing areas for small pelagics" replies this Guet-ndarien fisherman. He continues: the opportunities in terms of sales are also there "while worrying about the suspension of the increasingly recurrent fishing agreements. This chartering strategy promoted by public policies ensured the supply of flour factories until the end of 2016. The effective application of the new fishing strategy at the beginning of 2017 has discontinued this type of charter fishing licence. Foreign fishermen are no longer authorized to carry out fishing activities in the Mauritanian EEZ with the exception of the chartering of bare-boat boats for financial consideration. Senegalese fishermen, whose number was estimated during the framework survey of July 2015 at 6,000 sailors, have begun to timidly leave the area. This is why the number of fishermen has decreased significantly, i.e. less than 139 fishermen according to the framework survey of December 2016 (Braham and Wagne, 2016) [2].

However, the rapid expansion in the number of factories and the limited supply provided by Senegalese ships meant that these factories were still operating at only around 30-50% capacity by mid-decade. The government then offered Turkish purse seiners to enter the fishery under a charter regime that recognizes Turkish vessels as part of the national fleet category of "coastal fishing". Senegalese canoes gradually gave way to Turkish industrial purse seiners (Corten *et al*., 2017) [5]. This fleet grew rapidly, so that it was responsible for the majority of the small pelagic catches landed in the country. In this, the catches of coastal boats, mainly Turkish, record more than 630,000 tons, or nearly 73%, and that of Senegalese purse seine canoes up to 240,000 tons, or nearly 27% (IMROP, 2021). Thus, the largest share of production is destined for fishmeal and fish oil factories, with an annual average of more than 425,000 tons of small pelagics.




***Source*:** Authors, IMROP (2021)

**Fig 1:** Evolution of fishmeal and fish oil production in Mauritania

Fishmeal production has tripled in four years, from almost 23,000 tons in 2010 to over 72,000 tons in 2014. Over the same period, the volume of fish oil produced has increased fivefold, to nearly from 3,000 to 15,000 tons. During the period 2015-2018, fishmeal production doubled and reached an all-time high of over 125,000 tons. With the conversion rate mentioned above, the level of production in 2018 could be estimated at more than 550,000 tons (IMROP, 2021). The large quantities of small pelagics destined for these factories threaten the sustainability of pelagic stocks.

Freezing receives about 10% of total production, or an average of 75,000 tons. Less than 11,000 tons are injected into the artisanal processing sector. Overall, the local consumption market absorbs an annual average of less than 170,000 tons and exports are far greater with more than 700,000 tons of small pelagics exported.

This tendency to train production to supply flour factories threatens the consumer market in Mauritania (Failler, 2021) [18] and West African countries (Dème *et al*., 2021a) [8].

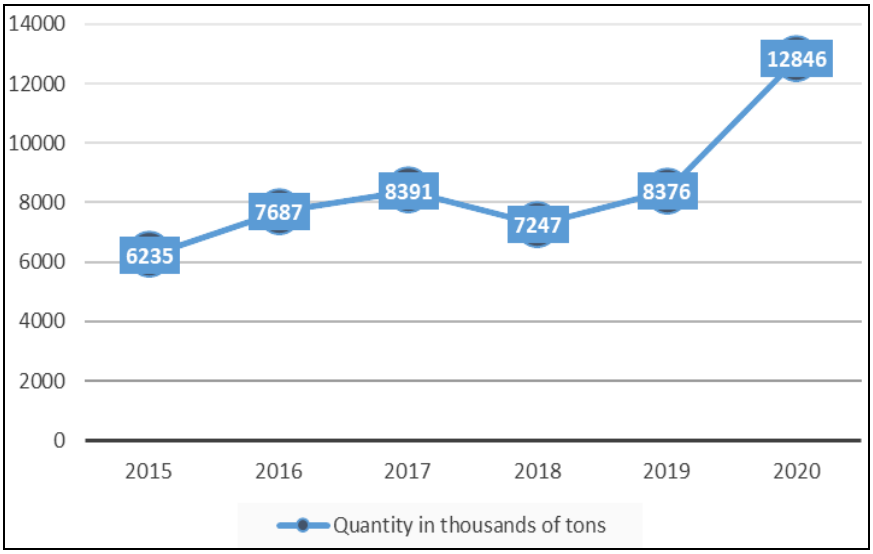
### 3.3 Means of meeting food needs

Since 2015, the Mauritanian authorities have been promoting the use of small pelagics for human consumption and trying to reduce the quantities that are reduced to flour and oil (CAPE, 2022) [4]. To this end, regulatory provisions have been implemented requiring factories to limit the volumes to be processed to 10,000 tons of whole fish with the intention of reducing this quantity by 15% in the following four years (MPEM, 2015) [25]. This quantity authorized to process corresponds to 2,000 tons of flour. Any production beyond this authorized limit must be made from waste and scrap resulting from a process of processing fish products intended for human consumption. Unfortunately, these limits are not observed due to limited monitoring. Fishermen, particularly Senegalese, whom we had met confided to us: "our catches are monitored, perhaps, the problem lies in the monitoring of regulatory mechanisms at factory level".

However, the public authorities are defending themselves with the objective of these measures, which is to "better value catches and strengthen food security". Per-capita consumption in Mauritania has improved significantly, from 4.3 kg in 2003 to 12.6 kg in 2018 (IMROP, 2019); despite this strong increase, per capita consumption remains low compared to neighboring countries such as Senegal (19.2 kg/capita) and Morocco (19.5 kg/capita) (Dinçer, 2018) [14]. It is also far from the world average of 20.5 kg in 2018 (FAO, 2020) [19]. Low awareness on the importance of the nutritional value of pelagic fish, dietary habits is among the factors that have

limited the accessibility of the product to a large part of the population. The price of sardinella, which was less than 93 euros/ton at the start of the 2010s, is currently above 370 euros/ton.

Faced with this situation, efforts were undertaken in 2013 by the public authorities through the creation of the National Fish Distribution Company (SNDP). It aims to solve the problem of accessibility and availability of fish products throughout the national territory. That being so, it has been decided that 2% be levied on the catches of foreign vessels as a contribution to needy populations. Also, within the framework of the Convention on fisheries and aquaculture linking Senegal and Mauritania, Senegalese pirogue units must land 15% of their fishing quota in Mauritania to be put on the markets and points of sale put in place. Place by the Government. These activities aim to facilitate the supply of seafood products to domestic markets. As a result, distribution, at symbolic prices, is organized on a regular basis in the most remote areas of the country. The distribution of fish by the SNDP has increased from more than 6,200 tons in 2015 to nearly 13,000 tons in 2020, an average increase of 18%. The availability of fish throughout the year means that in 2020 the daily average is around 50 tons, of which more than 20 tons are distributed in Nouakchott. However, 36 towns and several roads are covered in proportion to the size of its population (MPEM, 2020) [26].




***Source*:** Authors

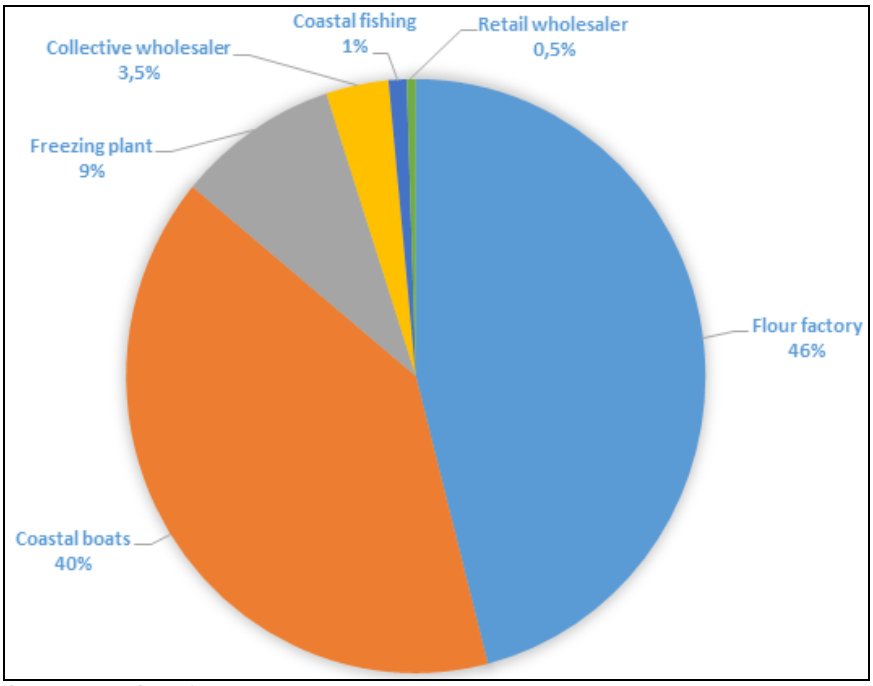
**Fig 2:** Evolution of the quantities of fish distributed by the SNDP

These initiatives have been based, on the one hand, on the obligation to land a certain quantity of fish within the framework of the access and royalty-in-kind regimes introduced for pelagic industrial fishing and, on the other hand.

This distribution carried out by the SNDP in the various regional markets benefited for a period of four years (2012-2018) from the support of the Project to Improve the Access of the Mauritanian Population to Fish Consumption. This Food Security Reinforcement project for the supply of the country's populations is financed and executed by the Spanish Agency for International Cooperation for Development (AECID).

In addition to these devices, a range of technical measures are implemented. These are zoning as a management tool aimed at reducing by catch; losses related to discharges, to ensure better protection of sensitive areas and to curb conflicts between the various trades. The zoning implemented in Mauritania since 2012 and separating production areas between artisanal, coastal and offshore fishing units aims, in particular, to protect coastal ecosystems by keeping trawling beyond depths of 20 m (IMROP, 2019). Similarly, the coastal pelagic fishery was segmented into three sub-segments based on the size of the boats. This triple fragmentation, setting itself the goal of boosting the supply of onshore factories with fresh products intended for human consumption, did not achieve the expected effects. On the contrary, this provision was thwarted by the application in 2017 of a new zoning established by the public authorities. This, by authorizing the deployment of seines, with a drop of several tens of meters in areas of shallow depths, will have notably affected the availability of small coastal pelagic resources.

**4. Discussion: is the reconciliation of a commercial and nutritional logic possible?:** The policy of domiciliation of catches contributes to valuing small pelagics, which until now were little exploited. The Mauritanian fisheries strategy (2015-2019) has given priority to the development of industrial value chains, particularly those of small pelagics. However, it faces the reality of a booming fishmeal industry which currently processes around half of the catches of these species. In addition to the added value created by these species in Mauritania, it is a source of foreign currency. The export value of fishmeal and fish oil products increased from almost €2,700,000 in 2010 to almost €142,000,000 in 2018. Over the same period, fish oil exports increased from 600,000 euros to more than 42,000,000 euros (Thiao *et al*. 2022) [29]. In addition to exports, the contribution of these factories to public finances is not negligible. Additional taxes paid to the public treasury, fishing permits paid by fishing boats chartered by factories, royalties collected by the government also constitute a constant direct contribution to the Mauritanian economy. The overall contribution of the fisheries sector to State revenue amounts, on average, to 198 million euros. According to the results of the field surveys carried out, within the framework of GREPPAO, the overall contribution of small pelagics is 11.981 million euros, or 6.06% of the revenues of the fisheries sector (IMROP, 2021).




***Source*:** IMROP, 2021

**Fig 3:** Contribution of small coastal pelagics to public finances

We note the importance of the contributions of flour factories and coastal boats to the revenues of the sector which are respectively 46% and 40%. The contribution of freezing plants is very low, i.e. 9%; which is due to the smaller number of these factories compared to flour factories whose number has reached more than forty. However, we observe the marginal contributions of collective wholesalers, coastal fishing and retail wholesalers which are respectively 3.5%, 1% and 0.5%.

However, the development of the fishmeal industry tends to disrupt the fishing economy in Africa and particularly in Mauritania. The supply of fishmeal and fish oil factories increases the pressure exerted on small pelagics. A veritable rush towards small pelagics which has thus taken place, which constitutes the raw material of these fishmeal manufacturing factories, which does not go without arousing concern about the food security of Mauritanians and western populations. African. Fish and other aquatic foods nourish and provide sustainable diets for many communities around the world. In Africa and Asia, where many people suffer from malnutrition, this is an opportunity because food of animal origin remains the least expensive and the most consumed. In addition to the pressure exerted on small pelagics generated by these economic dynamics, the consequences are already being felt for the actors encountered and who are active in the economic niches of artisanal processing. In neighboring countries, like Senegal and Gambia, which have small-scale productive sectors of social and economic importance, many economic agents suffer from competition from fishmeal factories, such a situation particularly affect women in charge of processing and selling products (CAPE-CFFA, 2019; Farfish, 2021; Dème *et al*.; 2022b) [3, 20, 11]. "We cannot compete with the factories" they say, "because of the purchase prices offered. At this price, we will not find what we are looking for" (focus group interviews, 2016). Therefore, the Ministry of Fisheries and Maritime Economy (MPEM) has been trying to correct this situation for some years. The objective of the MPEM is therefore to go against the current dominant use of processing small pelagics. The public authorities are putting in place mechanisms to curb these flour factories by adopting a dissuasive tax system by introducing new taxes on turnover in addition to the 9% levied by the SMCP. Already producers have been fighting unsuccessfully since to reduce the 23% tax on annual turnover they pay.

The market for human consumption has good prospects, as the demand for small pelagics in West Africa increases with the increase in population. This nutritional emergency is all the more present with a population that is growing by 2.3% per year. The evolution scenarios studied suggest that the simple extrapolation of the current trend is not sustainable. In Mauritania, small pelagics, despite the relatively small volumes intended for the national market, constitute an important source of animal protein accessible to segments with low purchasing power and could therefore contribute to guaranteeing the food security of many populations. By 2030, the commissioning of factories currently under construction or planned is likely to generate a demand for small pelagics incompatible with the supply of the internal market, unless potentially costly or politically delicate reorientations of the exploitation of fishery resources in the sub-region are implemented.

## Conclusion

The quantities landed in small pelagics and consubstantially those intended for processing into fishmeal and fish oil are undoubtedly attributable to the dizzying growth of the milling industry. This model of industrial development, while well in line with the state strategy of domiciliation of catches, nevertheless shows obvious limits on many aspects of the sectoral fisheries policy. Indeed, despite the importance of the wealth generated by the development of this activity in terms of turnover and added value, the sector remains today paradoxically little integrated into the national economy. This remains highly dependent on the labor force and production tools from foreign countries. Suffice to say that a significant part of the financial windfall generated goes back abroad. Also, the modalities of the current configuration of the exploitation of small coastal pelagics in Mauritania, testifies

to a real threat to food security. In Mauritania, the national authorities are trying to respond to the many ecological, health and nutritional concerns of the populations by setting limits on the annual volume that each factory must process. This situation should contribute to reducing the pressure on pelagic species intended for processing, the targeting of which has greatly increased, especially with the arrival of chartered Turkish vessels operating in the Mauritanian EEZ. If the current trend marked by intensive and massive targeting of small pelagics were to continue, we would be in a situation that would jeopardize the long-term exploitation of small pelagic resources in a global context characterized by a sharp increase in the food needs of the local populations of the countries. The less well off. A global strategy for the exploitation of small pelagics will have to be put in place and the systems of access to the resource reassessed to be in line with the food needs of the population.

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