



Mauritanian Pelagic Fisheries Improvement Project (FIP-PP)

Final monitoring report on landings and flour factories for the period May to December 2021

December 2021

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Introduction

The primary pelagic species exploited in the Mauritanian zone belong to the Clupeidae, Carangidae, Scombridae, and Engraulidae families. These migratory stocks are shared among several countries in the sub-region and play a crucial ecological, social, and economic role. Positioned in the middle of the food chain, they are a key component of the diet of most piscivorous fish (demersal fish, meagre, bluefish, tuna, etc.), as well as marine mammals and seabirds. Recent stock assessments of small pelagics show fluctuating biomass due to hydro-climatic changes and fishing pressure.

In Mauritania, annual small pelagic catches exceed one million tons on average, depending on environmental variations and fishing effort, sometimes accounting for more than 80% of total landings. Previously exploited mainly by foreign industrial fleets operating under free-license regimes, these species are now increasingly targeted by artisanal and coastal fleets.

Since 2012, the rapid expansion of the fishmeal and fish oil industry has required particular attention to ensure sustainable resource management. Unchecked growth in processing capacity and fishing effort risks depleting vulnerable stocks, such as round sardinella and ethmalosa. Over the past three decades, fishing pressure on these species has intensified, and despite increasing catches, stock health remains concerning. COPACE and IMROP working groups indicate that, apart from sardines and mackerel, most small pelagic species are either fully exploited or overexploited. Round sardinella and ethmalosa are of particular concern, as indicators suggest a worrying decline, with smaller fish being caught and an increasing proportion of juvenile specimens in landings. Additionally, scientific sampling rates for catch data (size frequencies, species composition, discards, etc.) remain disproportionately low relative to total catch volumes.

In the past two decades, the exploitation of small pelagic resources in Mauritania has shifted significantly. Initially limited to a few units in Nouakchott focused on human consumption, the artisanal fleet targeting small pelagics expanded exponentially from 2012 to 2016, mainly supplying the growing fishmeal factories in Nouadhibou and southern Nouakchott. The 2015-2019 fisheries strategy, particularly the Mauritanization of fishing crews, led to the withdrawal of a significant portion of this fleet, making way for more efficient purse seiners, which, despite being classified as industrial vessels, have intensified fishing pressure on these resources.

To promote sustainable coastal pelagic fishing and improve the positioning of fishmeal and fish oil products in international markets, a public-private partnership was established in 2017. This partnership initiated a Fisheries Improvement Project (FIP-PP) focused on small pelagics for the fishmeal industry. The pre-assessment of these fisheries revealed critical data gaps regarding both the resources and their exploitation. To address this, an action plan was developed and

submitted for funding. While awaiting full financial mobilization, a mini-project was funded by local fishmeal industry operators to support IMROP's monitoring system.

This document presents the main results of that mini-project, particularly regarding landings and fishmeal factory monitoring from May to December 2021. Utilizing and analyzing these data enables scientists to provide real-time technical advice to policymakers, facilitating better management of these sensitive and environmentally influenced resources.

The FIP for small pelagics in Mauritania has significantly improved data collection efforts. Despite the late start and initial focus on the northern Nouadhibou zone, the project achieved a high sampling rate. Data collected this year by IMROP, with support from various projects including the FIP, contributed to the COPACE group's stock assessments, which held an online meeting in June 2021. Key target species (sardines, both sardinella species, and ethmalosa) were evaluated using diverse datasets, including size frequencies, fishing effort, catches, and processing volumes.

Given that not all FIP objectives have been met due to time constraints, it has been deemed necessary to extend project activities to achieve as many goals as possible, utilizing remaining funds. Data collection efforts at landings and fishmeal factories were temporarily halted, pending long-term funding to ensure broader coverage of all landing points along the coast.

Challenges Impacting Pelagic Fisheries in 2021

The 2021 pelagic fishing season faced several challenges that affected data quality, including:

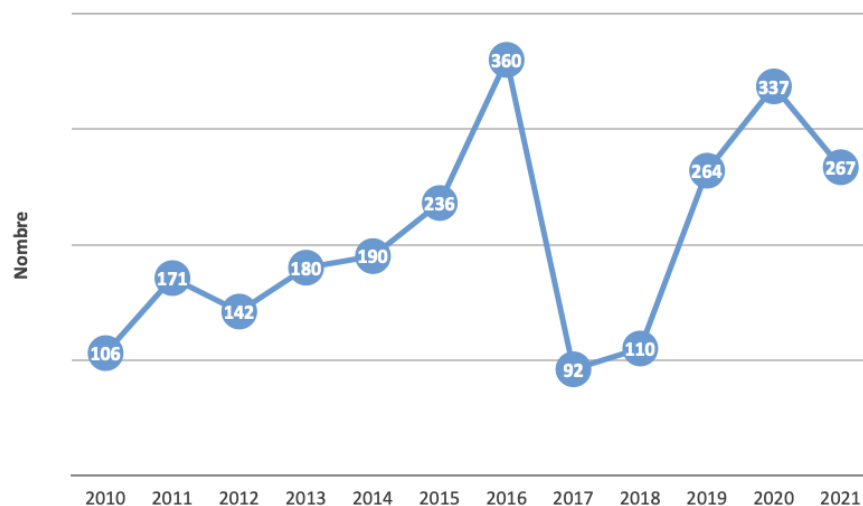
- Fishing activity shifting beyond 80 meters depth during certain periods, prompting most of the fleet to cease operations.
- A temporary fishing halt coinciding with the peak sardinella season, particularly for round sardinella, which impacted sampling rates for these key species.
- A zoning adjustment upon resumption in July that was not universally adopted by the coastal fleet, preventing a full return to normal fishing activities.
- The absence of regional pelagic stock assessment campaigns in 2021, as no country in the sub-region conducted direct resource evaluations.

Evolution of the Fleet Supplying Fishmeal Factories in 2021

Small pelagic species processed by fishmeal factories are primarily exploited by artisanal and coastal fishing segments operating under a single concession called "pelagics." This includes vessels fishing under national regulations or foreign agreements related to fisheries accords and international conventions.

Artisanal and coastal fisheries mainly target Clupeidae (sardines, sardinellas, and ethmalosa), which are preferred by processing factories. Purse seine canoes are vessels over 14.5 meters long, motorized or not, with an engine power of up to 150 HP. This type of fishing could be considered medium-scale artisanal pelagic fishing, as suggested in the Small Pelagics Management Plan.

Figure 1: Annual Evolution of the Number of Purse Seine Canoes



The fishing activity of purse seine canoes increased from 2010 to 2016, with the number rising from 171 canoes in 2010 to over 350 active canoes in 2016, not including auxiliary boats used to encircle the fish shoals with the seine net. The period from 2011 to 2016 also saw the arrival of Senegalese fishermen working on canoes mostly chartered by fishing operators who owned fishmeal factories. Under the employment contract, the factory owners financed the fishing activity (purchasing supplies and fishing equipment) in exchange for securing the entire catch of small pelagic fish at an affordable price to supply their factories. This organizational system ensured a steady supply of fishmeal factories until the end of 2016. However, the enforcement of regulations regarding the nationality of seafarers at the beginning of 2017 ended this type of charter fishing license.

According to a survey conducted in July 2015, approximately 6,000 Senegalese fishermen were operating in the area. By December 2016, their numbers had dropped to fewer than 139 due to their departure.

Following the departure of the Senegalese fishermen, a national fishing industry emerged, led by Mauritanian fishermen of Ndiago origin. Previously concentrated in the Nouakchott area, these fishermen expanded to the northern region and, for the first time, began using plastic canoes for purse seine fishing. According to a November 2019 survey, the number of purse seine canoes reached approximately 264 along the entire coastline before declining in 2020 to around 178.

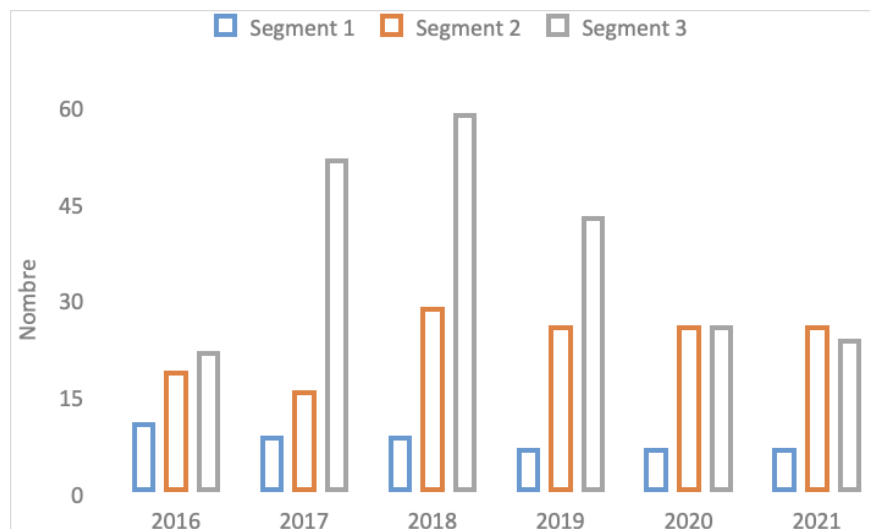
Another sector supplying the fishmeal industry consists of boats classified into three segments:

1. **Segment 1:** Boats smaller than 26 meters.
2. **Segment 2:** Boats between 26 and 40 meters.
3. **Segment 3:** Boats between 40 and 60 meters without onboard freezing systems. This category includes both purse seiners and trawlers using pair trawling.

The number of **Segment 1 boats** remained low throughout the period, fluctuating around 10, while **Segment 2 boats increased** from 9 in 2015 to about 26 in 2020.

Segment 3 boats were the most numerous, reaching about 59 in 2018, with around 20 using simple pelagic trawls. However, a sharp decline occurred in 2020, particularly among coastal trawlers that left the area following zoning changes in 2019.

Figure 2: Evolution of the Number of Coastal Boats (2016-2021)



Size Sampling at Factories (May–December 2021)

Between May and October 2021, 221 samples were collected, covering a total catch of 27,251 tons, of which 4,637 tons (17%) were analyzed. More than 22,635 individual fish were measured, primarily sardines and flat sardinella.

Nine fish species were identified in the sampled landings:

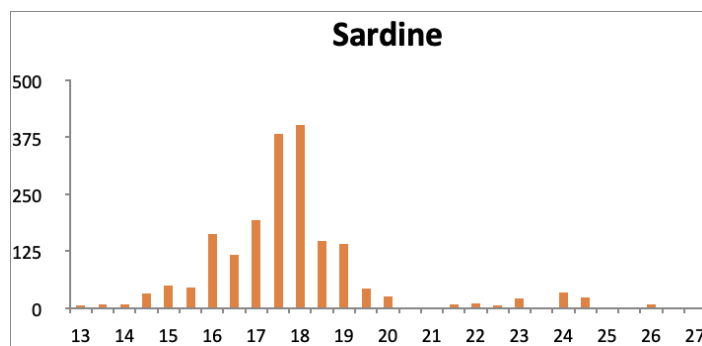
- Three species of horse mackerel
- Two species of sardinella
- Sardine
- Mackerel
- Ethmalosa
- Mullet

The sampling covered landings from both canoes and coastal boats, as well as fishmeal factories. During this period, our team monitored 38 coastal boats, 52 canoes, and 17 fishmeal factories.

Sardine

Sardine landings were recorded from September onward. Since May, sardines had migrated out of Mauritanian waters, but recent traces were observed, with peak catches expected in December, January, and February. All sardine landings, totaling over 4,100 tons, came from coastal boats and were entirely processed into fishmeal.

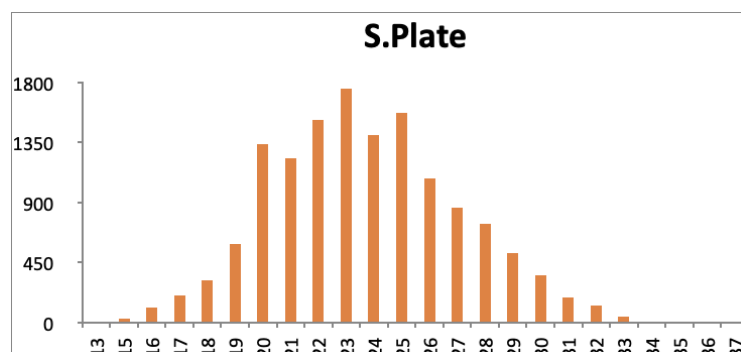
The sardines caught during this period had an average weight of 75g and sizes ranging from 13 to 27 cm, with a mode around 18 cm, as shown in **Figure 3: Sardine Size Distribution**.



Flat Sardinella

This species was present in all catches and was the most frequently recorded during the period, with peak landings in July and August. A total of 14,100 individuals were measured from over 11,000 tons of sampled fish, primarily from boats (over 82%). The average weight of the caught individuals varied by month but was around 155g.

Measured individuals ranged in size from 13 to 37 cm, with a mode of 23 cm, as shown in **Figure 4: Flat Sardinella Size Distribution**.

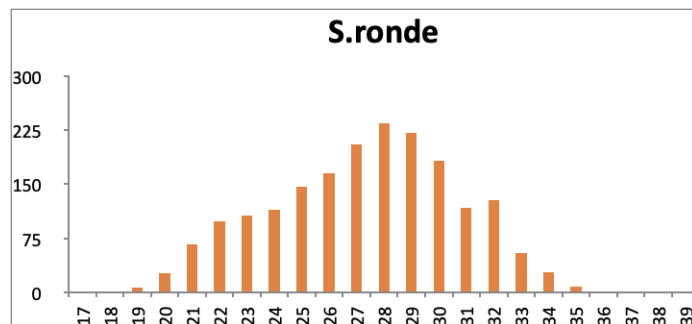


Round Sardinella

Landings of this species saw a temporary gap in April and May, only reappearing in June. The months of July and August have historically been its peak season in Mauritania. The absence of round sardinella during April and May was attributed to reduced pelagic fishing activity and a general decline in abundance.

The FIP team sampled over 3,200 tons of round sardinella, mainly caught by boats. More than 1,900 individuals were measured. Notably, the Mauritanian government prohibits the transformation of this species into fishmeal, reserving it for human consumption or export. However, some quantities were observed in fishmeal factories, likely sourced from processing waste.

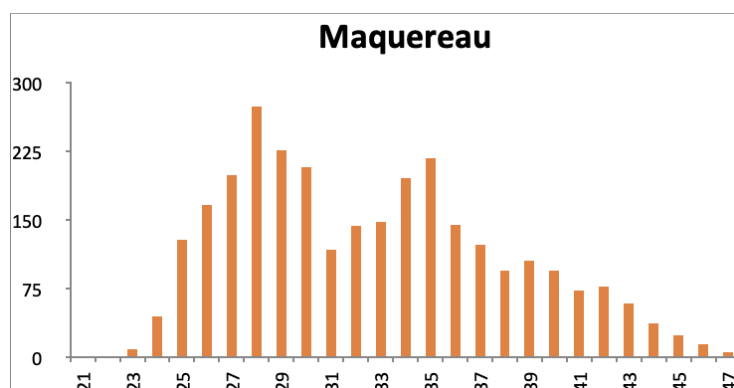
The average weight of round sardinella varied between 196g and 408g, with an overall average of 261g. Captured sizes ranged from 17 to 39 cm, with a mode of 28 cm, as shown in **Figure 5: Round Sardinella Size Distribution**.



Mackerel

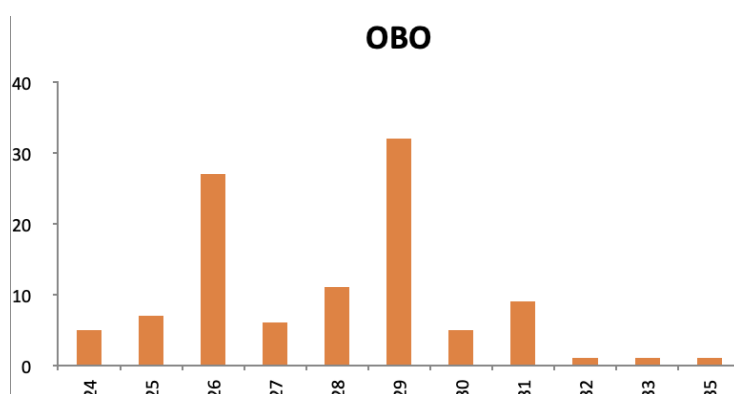
Mackerel catches came exclusively from coastal boats, as this species is not targeted by canoes. Processing mackerel into fishmeal is prohibited in Mauritania. Landings remained consistent throughout the period, with peak volumes in October exceeding 5,300 tons.

A total of 2,927 individuals were measured from a 1,255-ton sample, representing 20% of the total catch. The average weight of captured individuals was 428g, with sizes ranging from 21 to 47 cm, showing a bimodal structure with peaks at 28 cm and 35 cm, as shown in **Figure 6: Mackerel Size Distribution**.



Ethmalosa

This species was almost absent during the period, with only one recorded landing of 15 tons from a canoe in early October. The sample analysis revealed a bimodal size distribution, with individuals ranging from 24 to 35 cm and modes at 24 cm and 29 cm, as shown in **Figure 7: Ethmalosa Size Distribution**.

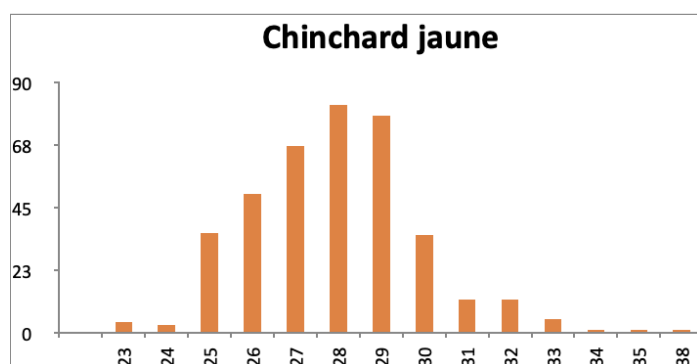


Chinchards

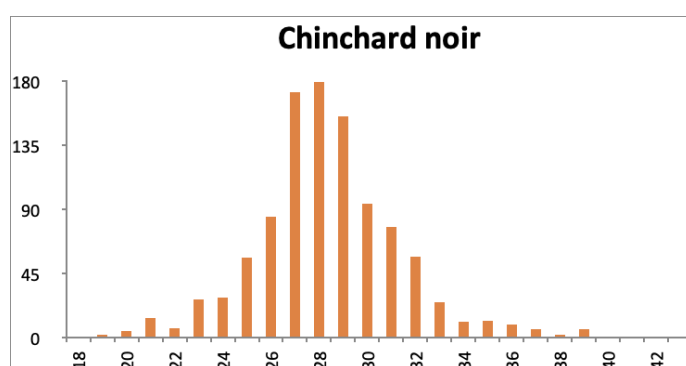
The three species of chinchards are found in landings, with the black chinchard being the most dominant, accounting for a catch of 1,650 tons. The other species, white and yellow chinchards, are less abundant, especially the white chinchard. All catches of these species are made by coastal boats. The size frequencies measured for the yellow and black chinchards are shown in the figures below for each species. The white chinchard was less present, and the collected samples were not significant.

Measured black chinchards ranged in size from 18 to 43 cm, with a mode of 28 cm. The yellow chinchard also had a mode of 28 cm.

- **Figure 8:** Size frequency of yellow chinchards



● **Figure 9:** Size frequency of black chinchards



Monitoring of Fishmeal and Fish Oil Factories

Currently, Nouadhibou has 32 active fishmeal and fish oil factories with a daily processing capacity exceeding 17,000 tons. Given this installed capacity, any quantity of small pelagics caught will be absorbed. The proliferation of these factories, most of which are owned by foreigners under local proxies, raises concerns about increased fishing effort and overexploitation. Since 2018, more than 350,000 tons of sardines have been exclusively converted into fishmeal each year. Sardines also serve as an excellent food source—should they be reserved solely for this basic use?

In this context, the FIP considers monitoring fishmeal factories a priority to quantify the species mainly processed into fishmeal and oil. Data collected by the mini-project team indicate that this component remains below expectations, aiming to achieve measurable results to ensure the FIP's viability. Efforts must be intensified, and engagement with factory owners must be strengthened. Some operators are reluctant to report their catches for professional reasons, while others cooperate well and recognize the importance of this monitoring.

In 2021, twelve factories provided monthly production data inconsistently (see Annex 3). In total, 108,800 tons of fish were processed, mainly consisting of sardines, fish waste, and two

sardinella species. Notably, no chinchard or mackerel was reported among the declared processed quantities, unlike round sardinella.

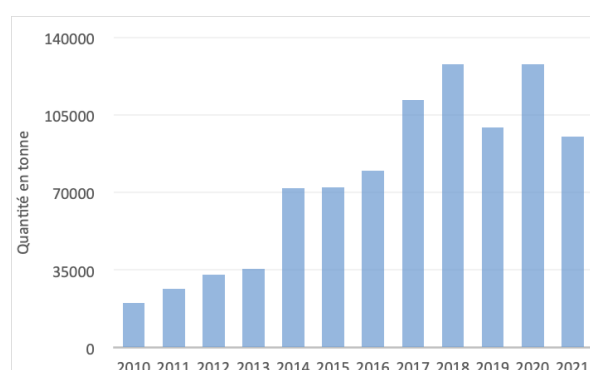
- **Table 1:** Variation in round sardinella weight

Species	Round Sardinella	Flat Sardinella	Bonga	Sardine	Others	Waste	Total
Quantity transformed into (ton)	23882	35618	7635	17690	386	23633	108843
%	22	33	7	16	0	22	

The fishmeal production amounted to approximately 21,300 tons, with an average conversion ratio of 5.11 (i.e., five tons of fresh fish yield one ton of fishmeal).

Beyond declared data from some factories, total fishmeal production in 2021, according to various sources (SMCP and Customs), was approximately 95,440 tons, marking a 25% decrease compared to 2020. The highest recorded transformation was over 128,000 tons, largely due to the return of Senegalese-type pirogues operating under charter agreements. The decrease in 2021 was attributed to the forced halt of coastal fishing during the spring fishing period.

- **Figure 10:** Evolution of fishmeal production from 2010 to 2021



Conclusions and Perspectives

The monitoring of fish processing factories in 2021 provided scientific data on species-specific processing volumes, size frequencies of caught species, and the impact of the fishmeal industry on exploited resources. Since 2012, the fishmeal and fish oil industry has experienced significant growth due to rising global demand and high market prices following production declines in Peru and Chile.

This industry has driven a rapid increase in small pelagic catches by artisanal and coastal fisheries. It is viewed as a way to add value to small pelagic species, aligning with the sector's integration into the national economy. Until recently, foreign industrial and artisanal fleets almost entirely exploited these species without local added value. Fishmeal production is also seen as a way to utilize waste from various processing and freezing factories.

Close monitoring of fishmeal factory activities revealed:

- Fish waste yields less fishmeal and oil, with conversion ratios ranging from 5.25 to 6 (i.e., 5-6 tons of whole fish yield one ton of fishmeal).
- Round sardinella and sardines produce more fishmeal and oil, with conversion ratios of 4.2 and 4.8, respectively.
- Round sardinella accounted for over 22% of processed quantities.
- Factories generally operated at less than 50% of their production capacity.
- Most factories operated consistently, except for a few scattered days.

A precautionary management approach remains necessary due to the limited and transboundary nature of small pelagic resources, as well as their high natural variability, which is expected to fluctuate significantly with climate change. The national challenge in managing pelagic fisheries lies in balancing allowable catches among different uses while optimizing socio-economic benefits.

Key recommendations include:

- Encouraging artisanal pirogue fishing to supply the domestic market and increase per capita fish consumption.
- Allocating a quota of the annual small pelagic stock to fishmeal factories, considering waste levels. The allocation should be fair, accounting for different uses and the factories' environmental and social measures.
- Defining the raw material composition for fishmeal factories in terms of waste and whole fish percentages by species.
- Strengthening monitoring of small pelagic fisheries at landing sites and fishmeal factories, with support from the mini-project for at least two years to develop size-based assessment models.
- Expanding monitoring beyond northern Nouadhibou to other key zones, such as Tanit and Ndiago, once the project's vehicle is available.
- Covering all active fishmeal factories and landed boats in Nouadhibou and Nouakchott.
- Supporting the development of the Ndiago port and small pelagic landings in that area.
- Funding direct assessment campaigns for small pelagic species through hydroacoustic surveys.
- Adopting appropriate models for small pelagic stock assessments.

- Continuing the development of ecosystem models to better understand the role of key species in Mauritania's and Northwest Africa's marine ecosystem.
- Expanding biological data collection for all small pelagic species.

Acknowledgments

The project team would like to thank the fishmeal factory operators for their support and cooperation during data collection.

Annexes

Annex 1: Development of the Data Collection Protocol at Fishmeal Plants

The data collection protocol focused on the development of collection sheets for technical characteristics of the plants (processing capacity, fill, etc.) and daily production per fishmeal plant, biological data collection, and measurement of landed species.

Fishmeal and Fish Oil Production Tracking Sheet:

It is important to recall that fishmeal and fish oil production was traditionally concentrated on species with low demand for direct human consumption (such as Peruvian anchovies) and also on surplus catches, fishing discards, and processing residues. Currently, it targets species directly intended for human consumption. In the particular case of Mauritania, fishmeal is almost entirely made up of small pelagics in general and round sardinella and obo in particular, which is why it is necessary to know the species processed as well as the quantities at the plants. To this end, a list of priority small pelagic species has been defined, which includes: the two sardinella species, three chinchard species, sardine, mackerel, anchovy, and ethmalosa.

These sheets are provided to the plants to collect this information at least twice a week. They must be filled out by the workers as they go. These sheets are then collected by the scientists at the end of the week to summarize the activity. The investigators were trained on how to collect the information and fill out the sheets.

Biological Data Sheet:

The biological parameters to be collected are clearly defined on the sheet, and they are used to update and calculate growth parameters and determine spawning periods and areas, if possible, for the main target species. The biology of most of these species is poorly understood due to a lack of collected data. It is rare to find a complete cycle that allows for establishing a reproduction period. The sampling protocol involves collecting a sample twice a month, each with 30 individuals (see Annex 2). The work must be done immediately to maintain the quality of the samples. A team is responsible for this activity to ensure that all target species landed are collected and that the cycle is complete.

Measurement Sheet:

A random 50 kg sample must be taken at the plants for measurement to determine the most commonly caught sizes and the average weight of an individual. The sample should be as exhaustive as possible, with at least one sample per thousand tons (see Annex 3). This information is very useful for feeding the evaluation models conducted during the COPACE group.

Similarly, samples are planned at the time of landing to complement the information on the species caught and not processed, knowing that currently, the processing of certain species is prohibited by Mauritanian regulations, such as round sardinella.

Annex 2: **List of Sampled Boats, Pirogues, and Plants:**

("Bateaux, Pirogues and Sociétés" translates to: "Boats, Pirogues, and Companies")

Bateaux	Pirogues	Sociétés
AGUN BAZAKAN	SL 1714GN	ACOMAT/SARL
AKGUN KARLESER	SL0024G N	ACOR/SARL
CALISKNAR	SL0443G N	AFCO-2
CAP BLAN	SL0458G N	AKUA GROUP-3
CINAR GULARI-1	SL1079	BOUNTIYA
CINAR IBRAHIMA	SL1303G N	C-F-H-P
CINAR OGULARI	SL1343	CONTINENTA SEA FOOD
CINARO GULLARIZ	SL1449G N	CONTINENTAL
DAVUD KIYAK	SL1677G N	FSHP
FALIH BAZERAN	SL1852	GOLDEN RIM SARL
H.A.A OGULARI-3	SL1852G N	MAURITANIA PELAGIC
HABIBIN ENVER	SL1925	MCF
HABIBIN YAVUZ	SL2021	MFH
IBRAHIM MUHAMED KIYAK	SL2142G N	MMOA PECHE
ILHAN YILMAZ	SL2350G N	OCEAN PELAGIGUE

ILHAN YILMAZ 1	SL2375	OMAUICI
ILHAN YILMAZ-3	SL2567G	RIMFISH MEAL
KAKMAZLAR BALIKULIK	SL2878G	SEN RICE
KALIS KANLAR	SL3003	SEPH
KAVARAMIS MAHMUT	SL3408G	S-F-H-P SARL
MAADGULL ARI-3	SL3611GN	ZAK FISHING SARL
MAHMUT	SL3712G	ALFA SREVICE
MAMULI ISMAIL	SL376GN	
MARGO MAHMUT	SL3857G	
MIMATI ORHAN	SL3918G	
MIREM-1	SL4006G	
NACATT REIS-2	SL4312G	
OCEAN MARIA	SL5549	
ORHAN REIS-2	ST 10044	
PAN HAA HOGULARI-3	PP0504SL	
TRODER HAV	PP1677SL	
TURK YILMAZ		

TURK YILMAZ-1

TURKMENLER

List of Fishmeal Plants Providing Data for the FIP

	J	F	M	A	M	J	J	A	S	O
AFRICA PROTEINE	v	v	v						v	v
ATLANTIC PROTEINE	v	v								
ATYFEN SARL	v	v	v	v			v	v	v	v
AUSSIE GROUP	v	v	v							
M.M.O.A	v	v	v	v	v		v	v		
MAHEL TURK	v	v	v	v	v		v	v		v
MCF	v	v	v	v	v	v	v	v	v	
OMAUCCI sa						v	v	v	v	v

RIM FISH MEAL	v	v								
SFHP SARL	v	v	v	v	v	v	v			
SICOP	v	v	v	v		v	v			
XIANGHI-SHUN	v	v	v							

This section of the annex mentions that the processing of certain species, like round sardinella, is prohibited by Mauritanian regulations, which supports the earlier point about the management of banned species.