**Projet : Improved fisheries data and ecosystem information for small pelagics**

# First elements of the impact of pelagic fishing (inshore and offshore) on the ecosystem



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# I.  Contexte

In Mauritania, small pelagic species are among the most abundant fishery resources. They are exploited by deep-sea pelagic trawlers, coastal purse seiners (RSW) and pirogue purse seiners. They account for around 90% of annual landings.

The monitoring of commercial fishing activity provides reliable information in the light of which resource management decisions can be adopted to ensure the sustainable management of exploited resources. This information concerns data on catches, fishing effort and size structures of the main species fished. To achieve this objective, IMROP set up an information system in the 1990s, in which the scientific observation program on board fishing vessels is an essential component. The general function of scientific observers on board fishing vessels is to observe the progress of fishing vessel activities and to collect information on vessel characteristics, fishing gear, fishing zones and the quantity and nature of species caught. Since its creation, this body of observers has benefited from several training workshops on fishing techniques, sampling methods and species identification. The data collected by this observer program is one of the databases used to monitor stock status.

Artisanal and coastal pelagic fishing has grown significantly over the past two decades, following the emergence of the fishmeal industry. Mauritania's objective in developing this industry was to domesticate the exploitation of small pelagic fish, which had been exclusively exploited by foreign fishing vessels.

The anarchic development of the fishmeal industry and the conditions under which it was set up by the 2015-2019 strategy and its regulations led to a significant increase in the number of purse seiners (pirogues and coastal boats) exploiting this resource.  The number of inshore purse seine boats has risen from less than 10 units in 2013 to over 78 in 2018. This increase has created growing pressure on small pelagic resources, calling into question their sustainability as well as the industry that exploits them.

Given the importance of these resources and Mauritania's interest in positioning its products on the international market, steps have been taken in partnership with technical and financial partners to set up a certification program for small pelagic fisheries. Within this framework, a program to improve fisheries data and ecosystem information for Mauritania's small pelagics has been set up for 2023. A key activity of this program is at-sea observation. This report presents the first elements of the impact of pelagic fishing (inshore and offshore) on the ecosystem.

## II. Observation missions in 2023

During 2023, nine observation missions were carried out at sea, including two on board deep-sea vessels. Missions aboard deep-sea vessels were carried out during the cold-warm shoulder season, while those aboard inshore fishing vessels covered the cold season, the warm season and the warm-cold shoulder season.

Table 1 : summary of at-sea observation missions in 2023

| FISHING BOAT | FIHSERY | GEAR | PERIOD | SEASON |
|---|---|---|---|---|
| ILHAN YILMAZ 1 | Deep-sea fishing | Purse seine | 06 au 16/04/2023 | Cold |
| TURK YILMAZ 1 | Coastal fishing Segment 2 | Purse seine | 06 au 15/04/2023 | Cold |
| FICHING SUCCESS | Deep-sea fishing | Pelagic trawl | 27/04 au 04/06/2023 | Cold-Hot |
| KAPITAN MORGUN | Deep-sea fishing | Pelagic trawl | 17/05 au 08/06/2023 | Cold-Hot |
| NECATI REIS 2 | Coastal fishing Segment 2 | Purse seine | 12 au 26/10/2023 | Hot |
| MUSTAFA KORKMAZ A | Coastal fishing Segment 2 | Purse seine | 12 au 26/10/2023 | Hot |
| CALISKANAR | Coastal fishing Segment 2 | Purse seine | 21/10 au 11/11/2023 | Hot |
| EKI UCUNCUOGLO | Coastal fishing Segment 2 | Purse seine | 11 au 25/11/2023 | Hot-Cold |
| ILHAN YILMAZ 1 | Deep-sea fishing | Purse seine | 05 au 20/12/2023 | Hot-Cold |

## III. Materials and methods

### a. Materials

#### i. Purse seine

The purse seine is a rectangular net used on the surface to encircle schools of fish. The floats are attached to the upper part, while the lower part is weighted. The seine types used are purse seines with the option of performing the "boursage" operation (closing the lower part of the seine with a rope called a "coulisse").  The entire encircled quantity is recovered on board.



Figure 1 : Purse seine used by purse seiners sampled

Purse seines are selective gears with mesh sizes ranging from 28 to 33 mm. This gear is effective for pelagic species, which often form homogeneous shoals. This fishing technique enables us to bring excellent quality fish back on board before processing. Operating on the surface, purse seines have no impact on marine habitats. However, this technique cannot be used in bad weather, as turning the net on board is too complicated due to the very large number of nets used in purse seines. It can only be used on pelagic species.

#### ii. Pelagic trawl

Two types of pelagic trawl are used in Mauritania, depending on the fishing strategy adopted by the vessels. The Russian-type pelagic trawl (figure 4) is the most common and has been in use in Mauritanian waters for several decades. It is mainly used to catch horse mackerel and mackerel.
The second type of pelagic trawl used is the Dutch type, larger in size than the first. It is mainly used to catch clupeids (sardines, sardinella). Given the size of the catch, this type of net is sucked up using hydraulic pumps.

Figure 2 : Russian pelagic trawl

## b. Methodology

The sampling methods most commonly used by IMROP observers are simple random, systematic and stratified. But overall for these missions, the majority of observers used the systematic sampling recommended for inshore purse seiners and pelagic trawlers to get representative samples of the catches.

Once samples have been taken from the catches, they are sorted by species, and the main species are then measured and biologically analyzed to determine the specific composition of the catches, size structures, reproduction periods and areas, by-catches and discards.

In addition, an exhaustive record of all sampled and unsampled fishing operations is recorded in station characteristic sheets to obtain information on overall catch, fishing effort, yield and fishing area.

Estimates of purse seine catches are generally made after the fish have been sucked in by the hydraulic pump. Knowing the average capacity of the holds, we deduce the quantities caught according to the rate at which the holds are filled. We also sometimes ask the captain for help in estimating catches.

Figure 3 : Filling the hold of a purse seiner.

## IV. Resultats

### a. Industrial pelagic fishing

#### i. Fishing area

Two scientific observation missions were carried out aboard Russian trawlers during the period April-June 2023. Fishing activity was concentrated mainly in the northern zone and south of Cape Timiris. The map below summarizes the activities of the two vessels
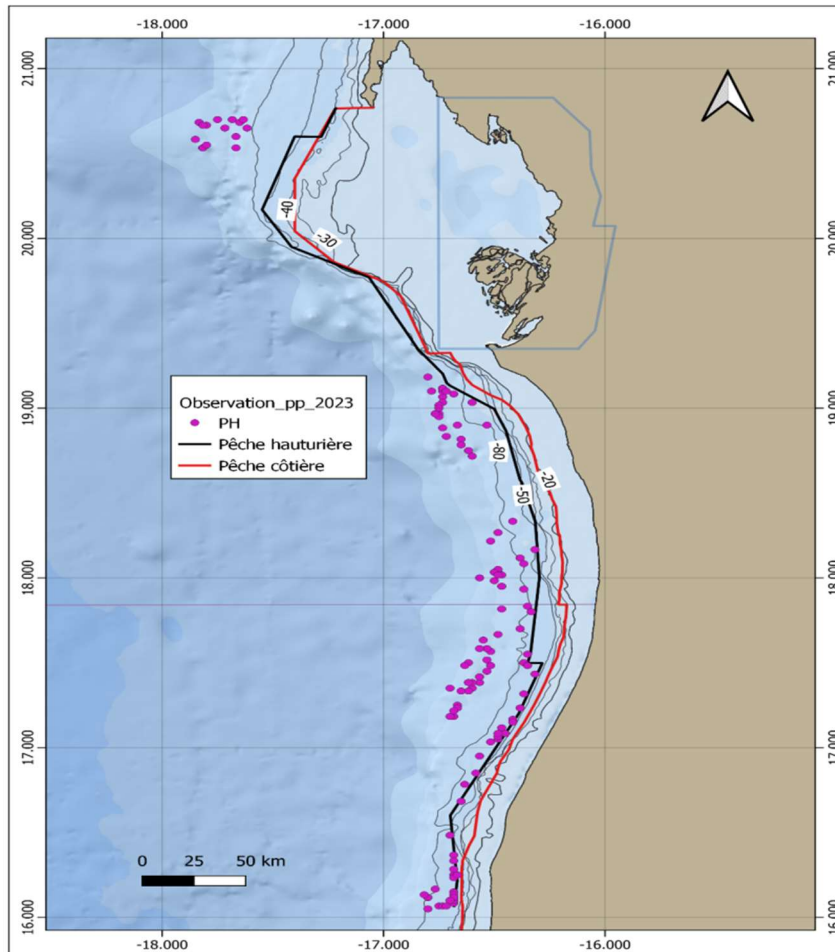
Figure 4 : distribution of activity points for russian pelagic vessels

### ii. Specific composition

A total of sixty-seven (67) species were recorded during the two missions aboard Russian-type pelagic trawlers. The main target species were horse mackerel and mackerel. Overall, catches were made up of three groups of species: target species, by-catches and discards. Discards accounted for 31%, of which 16% were juveniles of target species, 9% by-catch species and 6% discarded species.

| | Species | Retained | Rejects | % retained | % reject | % Reje | Total |
|---|---|---|---|---|---|---|---|
| **Targed** | *Trachurus trecae* | 376645 | 124741 | 75 | 25 | **16%** | 501386 |
| | *Scomber colias* | 327727 | 99017 | 77 | 23 | | 426744 |
| | *Trachurus trachurus* | 68676 | 2758 | 96 | 4 | | 71434 |
| | *Caranx rhonchus* | 37531 | 241 | 99 | 1 | | 37772 |
| | *Sardinella mederensis* | 6012 | 361 | 94 | 6 | | 6373 |
| | *Engraulis encrasicolus* | 0 | 4120 | 0 | 100 | | 4120 |
| | *Sardinella aurita* | 2520 | 0 | 100 | 0 | | 2520 |
| **By catch** | *Sarda sarda* | 23097 | 28270 | 45 | 55 | **9%** | 51367 |
| | *Brama brama* | 44592 | 6226 | 88 | 12 | | 50818 |
| | *Merluccius senegalensis* | 13996 | 28790 | 33 | 67 | | 42786 |
| | *Trichiurus lepturus* | 22095 | 15327 | 59 | 41 | | 37422 |
| | *Merluccius polli* | 2262 | 31947 | 7 | 93 | | 34209 |
| | *Dentex macrophtalmus* | 17220 | 5960 | 74 | 26 | | 23180 |
| | *Scomberomorus tritor* | 20935 | 0 | 100 | 0 | | 20935 |
| | *Lichia amia* | 10076 | 829 | 92 | 8 | | 10905 |
| | *Pagellus bellotti* | 256 | 1681 | 13 | 87 | | 1936 |
| | *Schedophilus pemarco* | 140 | 315 | 31 | 69 | | 456 |
| **rejects** | *Loligo vulgaris* | 0 | 8551 | 0 | 100 | **6%** | 8551 |
| | *Pomatomis saltatrix* | 0 | 6926 | 0 | 100 | | 6926 |
| | *Zeus faber* | 0 | 6558 | 0 | 100 | | 6558 |
| | *Brachydeteurus auritus* | 0 | 6141 | 0 | 100 | | 6141 |
| | *Zenopsis conchifer* | 0 | 4837 | 0 | 100 | | 4837 |
| | *Lagocephalus lagocephalus* | 0 | 4672 | 0 | 100 | | 4672 |
| | *Arius parkii* | 0 | 4589 | 0 | 100 | | 4589 |
| | *Auxis thazard* | 0 | 3548 | 0 | 100 | | 3548 |
| | *Migil cephalus* | 0 | 3402 | 0 | 100 | | 3402 |
| | *Sphyraena sphyraena* | 0 | 2909 | 0 | 100 | | 2909 |
| | *Trachinotus ovatus* | 0 | 2902 | 0 | 100 | | 2902 |
| | *Autres poissons* | | 23602 | 0 | 100 | | 23602 |
| | **Total kg** | **973780** | **429219** | **69** | **31** | **31%** | **1403000** |

Tableau 1 : Specific composition of Russian pelagic trawler catches

### iii. Size structure

➢ **Chub mackerel « *Scomber colias* »**

A total of 2874 individuals were measured, and analysis of these data has identified three cohorts. The first cohort is essentially made up of 18 cm juveniles, the second of 23 cm juveniles and the third of 30 cm adults kept on board.
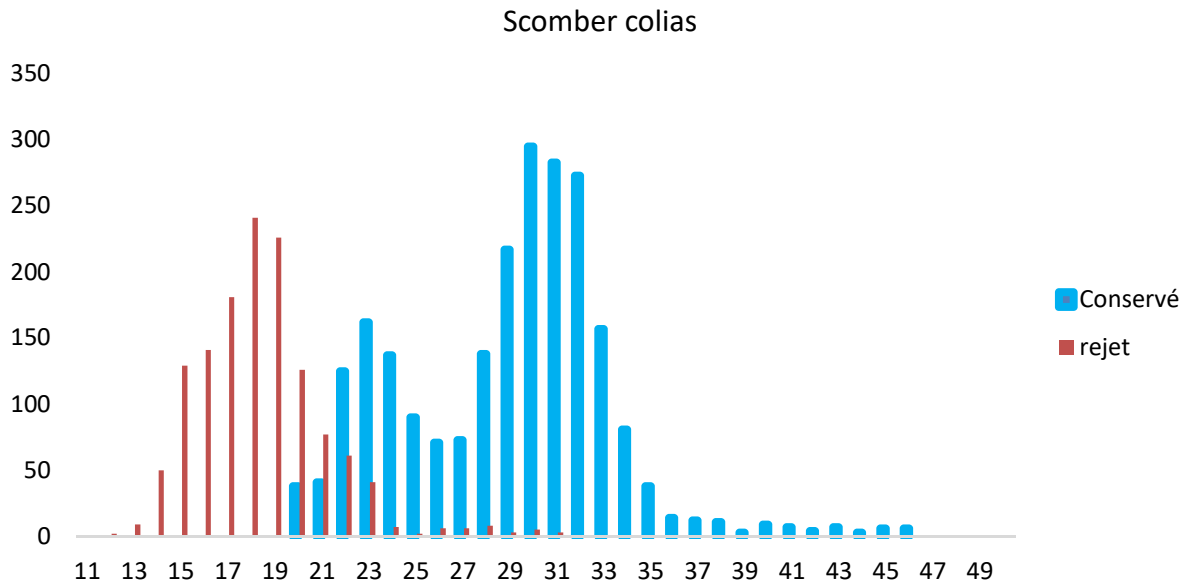
Scomber colias



Figure 6 : Size structures of Scomber colias

➢ **Horse Mackerel « *Trachurus trecae* »**

A total of 6098 individuals were measured during these missions. Three cohorts are also shown in Figure 7. The first was a 15 cm juvenile, the second a 21 cm juvenile and the third a 25 cm adult, all of which were kept on board.
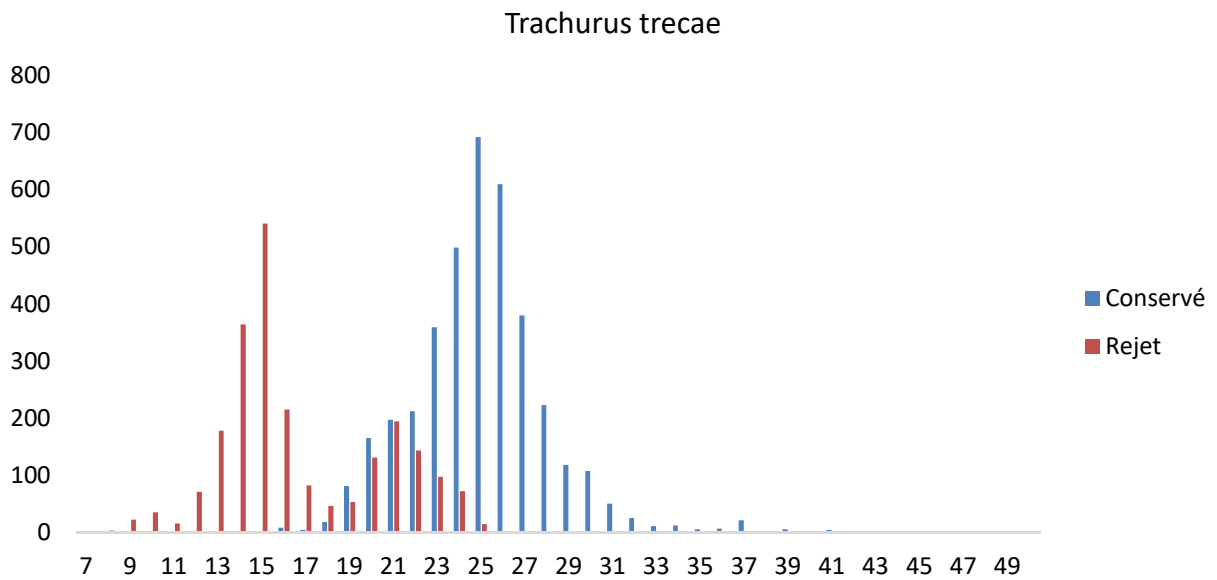
Trachurus trecae



Figure 7 : Size structure of Trachurus trecae

> ## Horse Mackerel « *Trachurus trachurus* »

Measurements were taken on 714 individuals.  Two cohorts were identified: the main cohort was made up of youngsters measuring 24 cm and the second of adults measuring 32 cm.
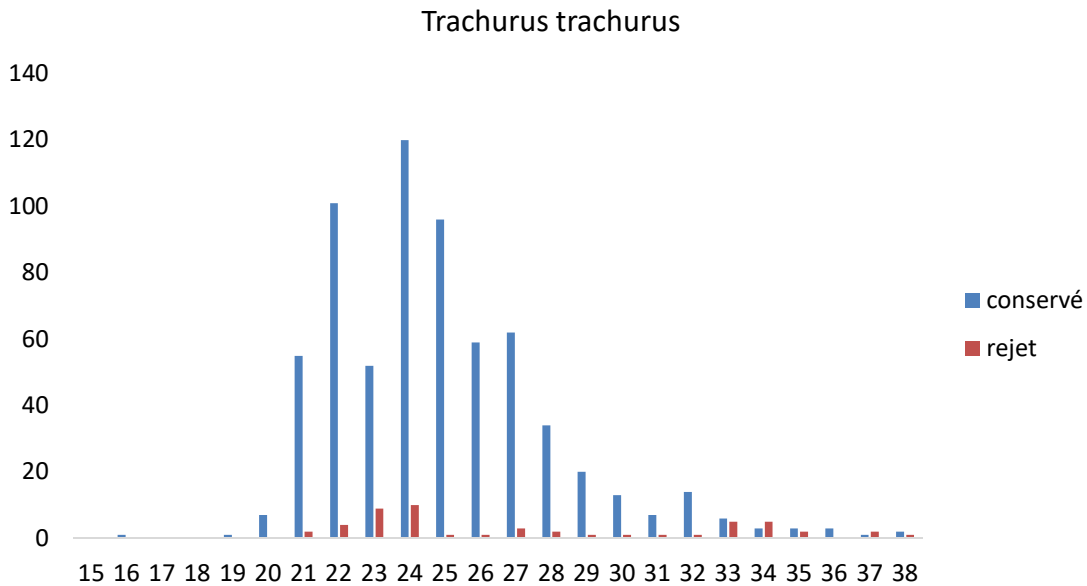


Figure 8 : Size structure of Trachurus trachurus

> ## Anchovy « *Engraulis encrasicolis* »

474 individuals were measured. Despite the size of the stock, this species is still not exploited and catches are thrown back into the sea. A single cohort of the 13 cm mode has been noted.
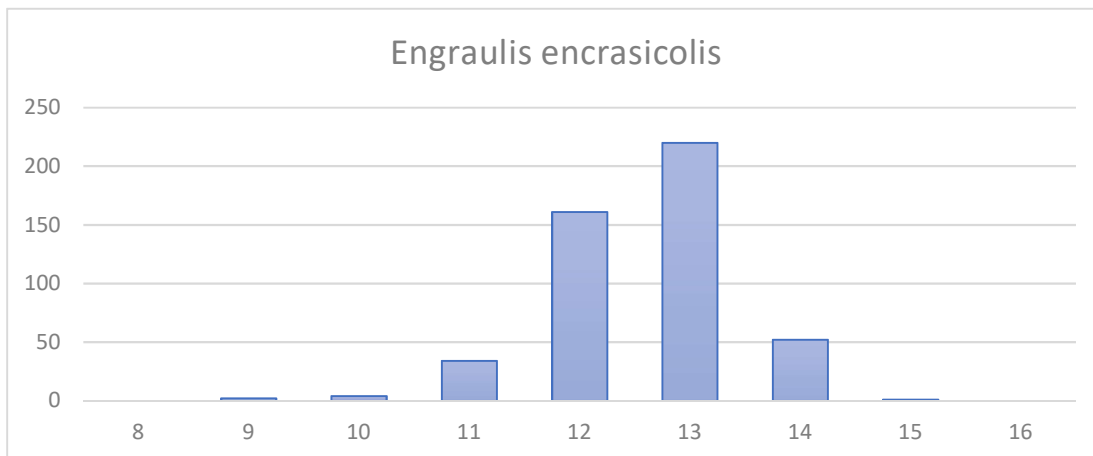


Figure 9 : Size length of Engraulis encrasicolis

Figure 10 : sampling of engraulis encrasicolis

## b. Coastal fishing

### i. Area fishing

Inshore seiner fishing activity was concentrated mainly in the northern zone and slightly in the center. The map below gives a summary of inshore seiner fishing areas.
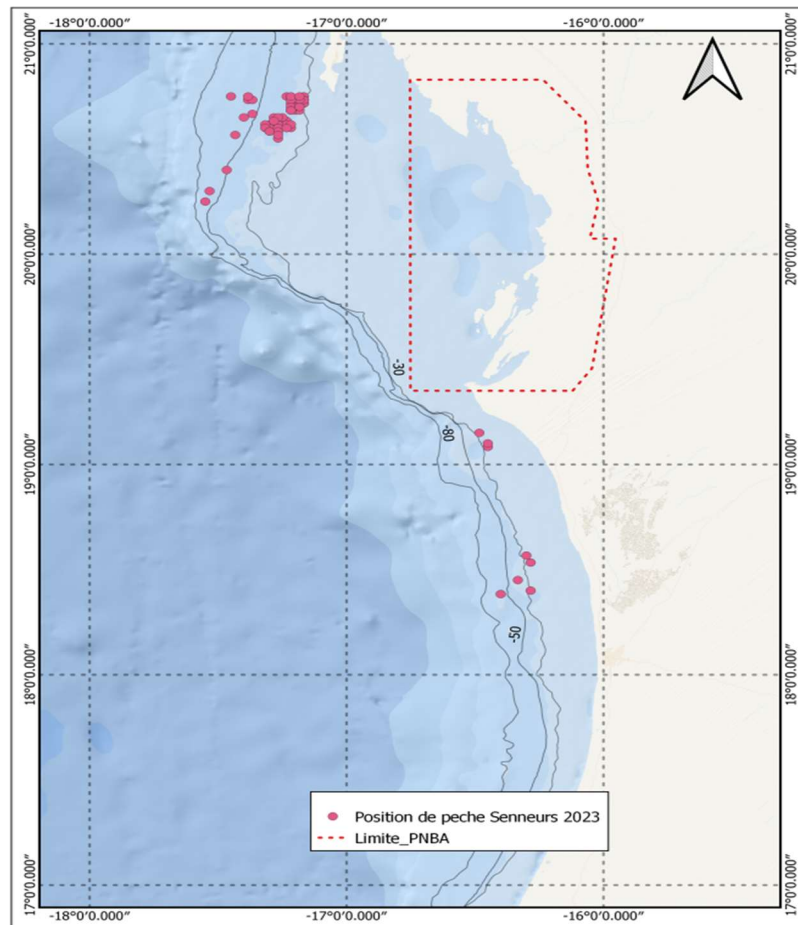


Figure 11 : inshore seiner activity zones

## ii. Specific composition

### 1. April mission (cold season)

Two missions were carried out in April at the end of the cold season, and 18 species were encountered in the catches. Target species accounted for around 90% of catches, with Sardinella maderensis dominating, followed by Sardina pilchardus with 61.59% and 17.36% respectively. This fishery is characterized by 0% discards. Catches are either preserved (frozen) or processed into fishmeal.

Tableau 2 : specific composition of inshore seiners at the end of the cold season (April)

| | Species | Catch in kg | % | % |
|---|---|---|---|---|
| **Targed species** | Sardinella maderensis | 856066 | 61.59 | **90.35%** |
| | Sardina pilchardus | 241335 | 17.36 | |
| | Sardinella aurita | 81128 | 5.84 | |
| | Trachurus trecae | 50031 | 3.6 | |
| | Caranx rhonchus | 27281 | 1.96 | |
| **By catch** | Diplodus bellottii | 25589 | 1.84 | **9.65%** |
| | Alectis alexandrinus | 23737 | 1.71 | |
| | Arius sp. | 15152 | 1.09 | |
| | Pagellus acarne | 11869 | 0.85 | |
| | A.latiscutatus | 11111 | 0.8 | |
| | Pagellus bellottii | 11111 | 0.8 | |
| | Triciurus lepturus | 11111 | 0.8 | |
| | Campogramma glaycos | 7407 | 0.53 | |
| | Pomadasys incisus | 5263 | 0.38 | |
| | Brachydeuterus auritus | 4506 | 0.32 | |
| | Diplodus SP | 3700 | 0.27 | |
| | Galoides decadactylus | 1850 | 0.13 | |
| | Pagellus sp. | 1364 | 0.1 | |
| | Diplodus bellotti | 312 | 0.02 | |
| | Plinctorhinchus mediter-ranus | 75 | 0.01 | |
| | Total | 1390000 | 100 | |

## 2. October and November missions

Five scientific observation missions aboard inshore purse seiners were carried out, 4 in October and 2 in November. Analysis of their data enabled us to determine the species composition. A total of 15 species were identified in the catches. Target species accounted for around 97.63% of catches, while by-catches accounted for around 2.37%. Three species dominated the catches: Trachurus trecae, Scomber colias and Sardina pilchardus with 45%, 35.61% and 15.66% respectively.

Tableau 3 : Specific composition of inshore seiners in october and november 2023

| | Species | Catch in kg | % | % |
|---|---|---|---|---|
| **Targed species** | *Trachurus trecae* | 340871 | 45.65 | |
| | *Scomber colias* | 265940 | 35.61 | **97.63%** |
| | *Sardina pilchardus* | 116920 | 15.66 | |
| | *Caranx rhonchus* | 5372 | 0.72 | |
| **By Catch** | *Pagellus sp.* | 4819 | 0.65 | |
| | *Pomadasis incisis* | 4080 | 0.55 | |
| | *Trichiurus lepturus* | 4016 | 0.54 | |
| | *Pagellus acarne* | 2357 | 0.32 | |
| | *Sarda Sarda* | 900 | 0.12 | **2.37 %** |
| | *Plectorhinchus mediterraneus* | 884 | 0.12 | |
| | *Priacanthus arenatus* | 213 | 0.03 | |
| | *Spondyliosoma cantharus* | 210 | 0.03 | |
| | *Boops boops* | 174 | 0.02 | |
| | *Pagellus belloti* | 16 | 0.00 | |
| | *Pomadasis insusis* | 4 | 0.00 | |
| | **Total en Kg** | **746776** | **100.00** | |

## 3. size structure

Measurements were carried out mainly on target species. Table 4 below gives a summary of the measurements carried out.

Tableau 4 : summary of measurements on board inshore seiners

| Species | Number |
|---|---|
| ***Trachurus trecae*** | 3741 |
| ***Scomber colias*** | 1057 |
| ***Sardinella maderensis*** | 960 |
| ***Sardina pilchardus*** | 690 |
| **Total** | **6448** |

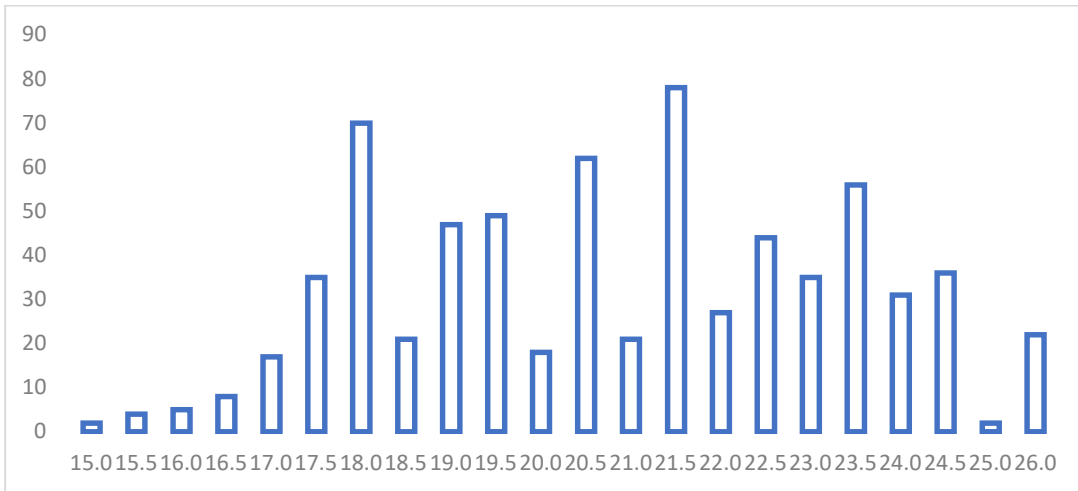➢ **Sardine**

A total of 690 individuals were measured.



Tableau 5 : Sardine size structure

Analysis of the figure above shows three cohorts, a young one with an 18 cm mode, the second with a 21.5 cm mode and the third with a 23.5 cm mode.

➢ **Sardinella maderensis**
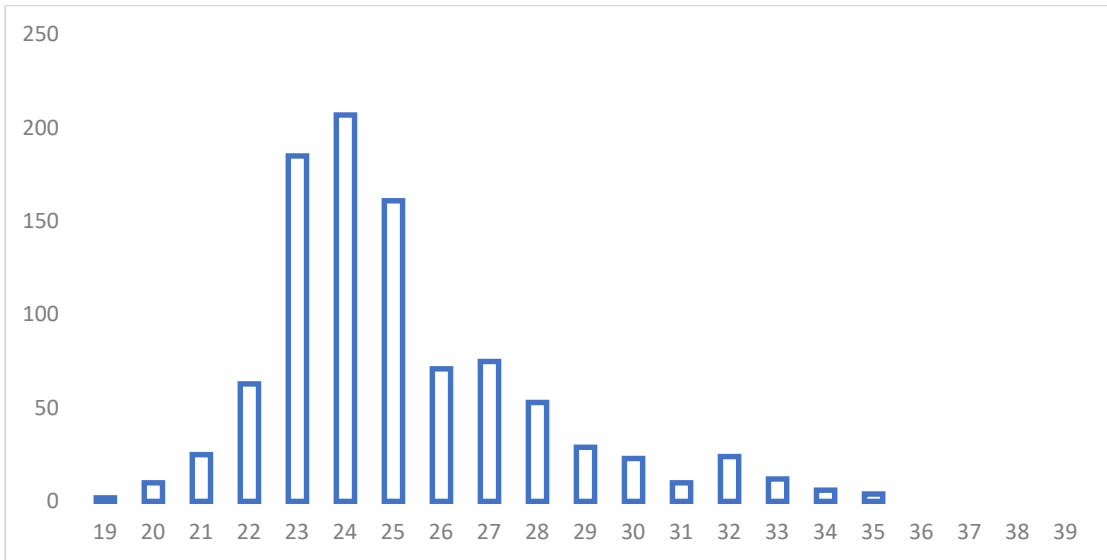
A total of 960 individuals were surveyed.



Tableau 6 : sardinelle plate size structure

Two cohorts are identified in the figure above, the main young cohort with a 24 cm mode and an adult cohort with a 32 cm mode.
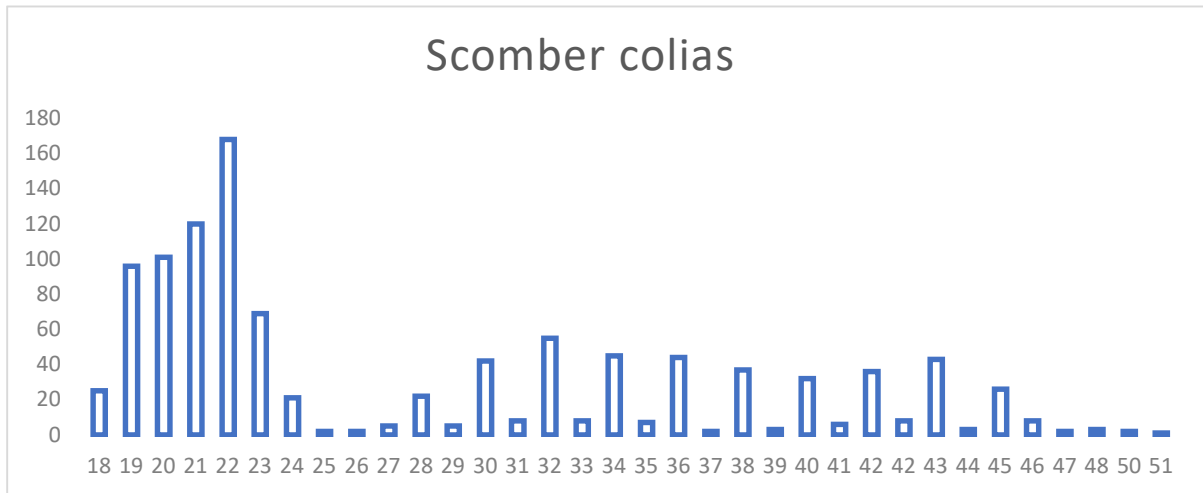


Tableau 7 : Chub Mackerel size structure

Three cohorts can be seen in the figure above, the main one consisting of juveniles with a mode of 22cm, and two other adults with modes of 32cm and 43 cm respectively.
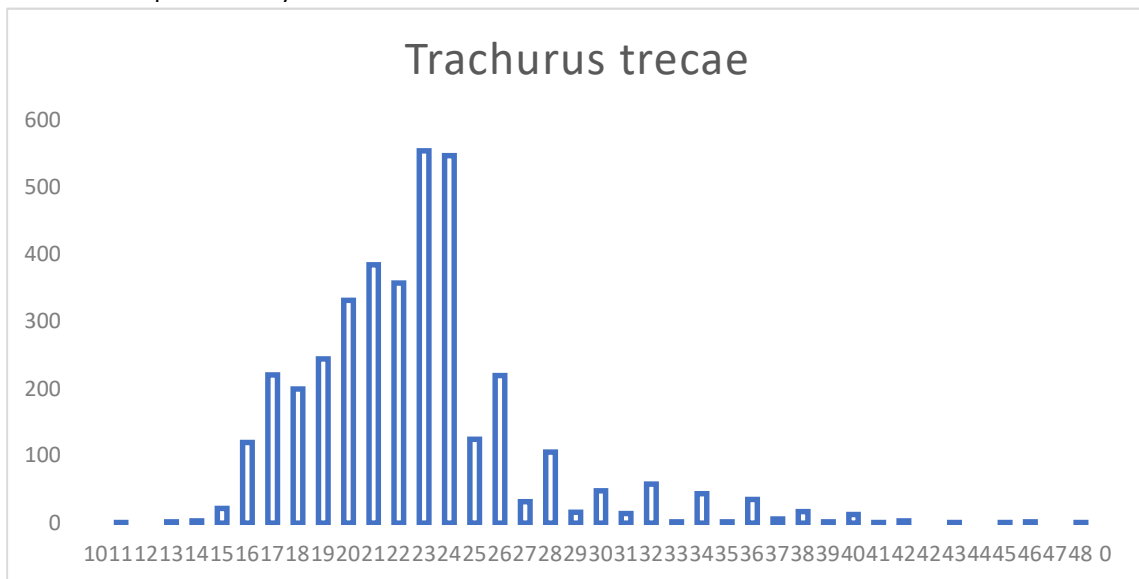


Tableau 8 : Horse Mackerel size structure (trachurus treace)

The figure shows two cohorts, the main one measuring 23 cm and the adult one measuring 32 cm.

## V.    Conclusion

Nine scientific observation missions were carried out, including two on pelagic trawlers between May and June, and eight on inshore purse seiners, two in April, four in October and two in November. Analysis of these data has produced a number of results.

The fishing effort of industrial pelagic trawlers was deployed in the northern zone, but most of the activity took place in the central zone and south of Nouakchott. For purse seiners, on the other hand, fishing effort was concentrated in the northern zone.

Catches by Russian-type pelagic trawlers were dominated by African horse mackerel (Trachurus trecae), mackerel (Scomber colias) and European horse mackerel (Trachurus trachurus).

The retained part of the catch represented 69%, of which 58% came from target species and 11% from by-catches, while discards accounted for 31%, of which 16% from juveniles of target species, 9% from by-catches and 6% from purely discarded species.

On the other hand, analysis of the specific composition of inshore purse seine catches enabled us to identify eighteen (18) species in catches at the end of the cold season (April). Target species accounted for around 90% of catches, with Sardinella maderensis dominating, followed by Sardina pilchardus with 61.59% and 17.36% respectively. By-catches accounted for around 10%.  This fishery is characterized by 0% discards.

 Whereas at the end of the warm season and the beginning of the warm-cold inter-season, we identified 15 species in purse seine catches. Target species accounted for around 97.63% of catches, while by-catches accounted for around 2.37%. Three species dominated the catches: Trachurus trecae, Scomber colias and Sardina pilchardus with 45%, 35.61% and 15.66% respectively.

Size structure analysis of pelagic species in pelagic trawlers shows the presence of three cohorts for Trachurus trecae and Scomber colias. Juvenile cohorts of 15 cm and 18 cm for Trachurus trcae and Scomber colias respectively, and other juveniles and adults.

For inshore seiners, on the other hand, analysis of size structures for pelagic species shows three cohorts for sardines, one juvenile of mode 18 cm, the second of mode 21.5 cm and the third of mode 23.5 cm. The histogram of size frequencies shows three cohorts for mackerel, the main one made up of juveniles of mode 22cm, and two other adults of modes 32 cm and 43c m

respectively. For Trachurus trecae, two cohorts have been identified, the main one of mode 23 cm and an adult of mode 32 cm.