# Survey report
# CGFS 2021
# on R/V Thalassa


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# Information sheet

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# Summary

# Introduction

The English Channel is an area with a strong fisheries influence, mainly for the coastal countries but also more widely for the countries of Northern Europe. The ecological and economic impact of the exploitation of fisheries resources must be measured so that fishing remains a sustainable activity, taking into account the limits of the resource and its effect on the environment. To meet this need, EU Member States need to carry out scientific surveys at sea to assess the abundance and distribution of stocks, independently of data from commercial fisheries. To this end, the CGFS (Channel Ground Fish Survey) campaign is part of the European Fisheries Monitoring Programme, which provides a set of data on exploited stocks (maturity, size/age structure, recruitment indices). The time series initiated in 1988 (on N/O Gwen-Drez) is used each year by European stock assessment groups to infer the health of the main commercial species. Initially focused on the Eastern Channel, since 2018 the CGFS covers the whole Channel on a recurrent basis to be able to provide fishery-independent data in the Western area as well. Now carried out on the N/O Thalassa, the CGFS campaign allows for wider sampling and better knowledge of the entire ecosystem, meeting both the demands of marine ecosystem monitoring (MSFD) and the implementation of an ecosystem approach to fisheries at the Community level. Thus, the physico-chemical characteristics of the water, the phytoplankton and zooplankton communities, the abundance of fish eggs and the specific composition of the nekton communities are measured and analysed throughout the campaign. Specific studies, which are used in dedicated projects, allow for a more detailed analysis of the structure of the food chain and its spatial variability.

## Organisation of the campaign

The CGFS 2021 took place on the N/O Thalassa from 16 September to 30 September for the western part of the Channel and from 2 to 18 October for the eastern part.

This year, we received permission to work in UK waters, which allowed us to carry out the usual sampling plan.

A stratified random draw of 48 sets is carried out in the Western Channel, and we carried out 50 sets in order to complete some days. During this first part of the campaign, we validated all the stations. 8 trawling trials with a scraper positioned in front of the trawl were carried out in the western part of the Channel in order to compare the differences in catchability between the two gears.

During the second part of the campaign, in the eastern Channel, the protocol provided for 74 trawls. We were able to validate 66 trawl stations, as the trawl suffered 4 major breakdowns and, in the Bay of Seine, we had to clog up twice in areas with brittle stars. We also had to cancel 2 stations due to the presence of professional equipment in the area. (Fig.1, Ann.1)

Over the whole campaign, we only had 3 days of bad weather which cancelled some plankton and microplastic net sampling. Otherwise, the exceptionally good weather conditions allowed us to carry out all the work in good conditions.

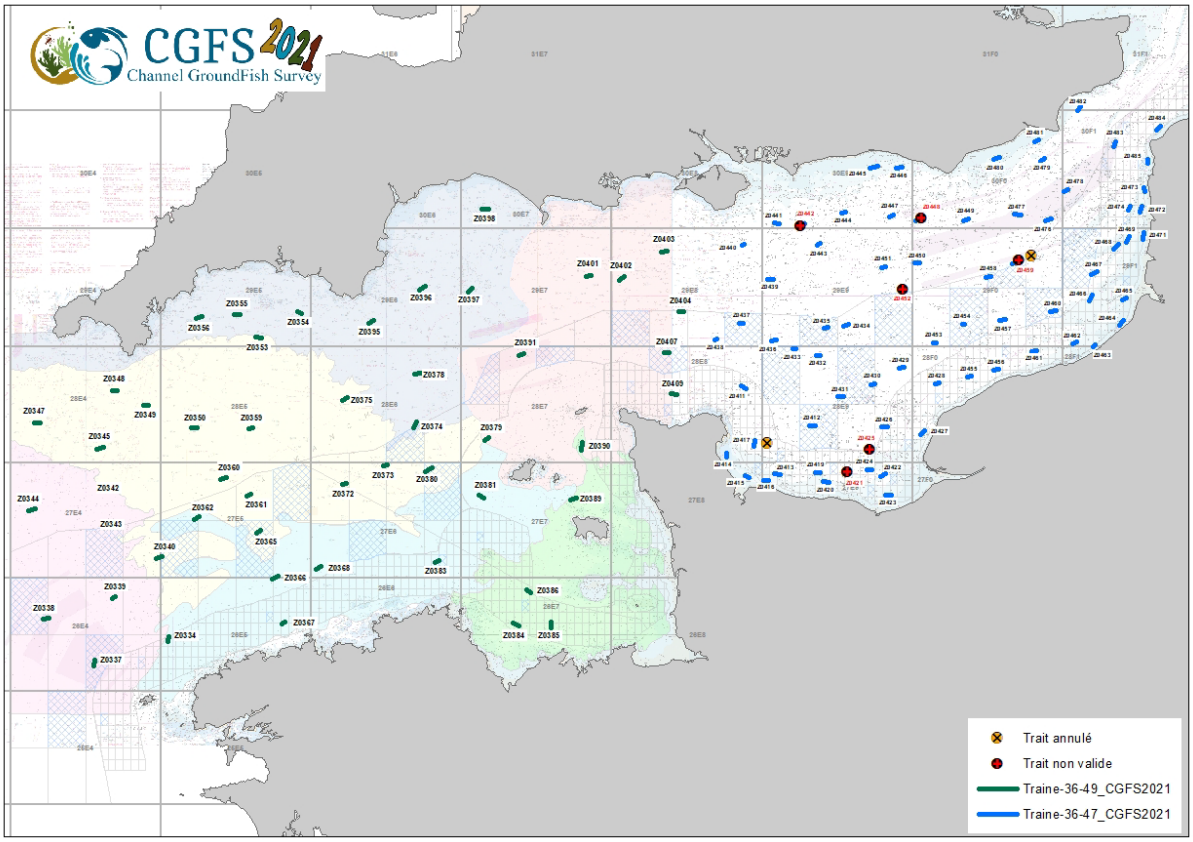



Figure 1 : Distribution of trawl stations

## Additional work :

Each year, collaborations with other IFREMER laboratories, universities or research institutes allow additional sampling and studies to be carried out during the campaign.

### RECCRU (Crustacean Recruitment) Project - IFREMER - Roscoff Marine Station:

The RECCRU project aims to provide information on the recruitment of different crustacean species of high commercial interest: lobster (*Homarus gammarus*), edible crab (*Cancer pagurus*), spider crab (*Maja brachydactylus*) and red lobster (*Palinarus elephas*). The aim of this project is to give visibility to the fleets targeting these species by developing indices on the level of recruitment of these resources in order to be able to manage the fishery for these crustaceans upstream. Thus, the project focuses mainly on the study of the larval phases of these crustaceans and their juvenile stages. In the long term, it should enable a good assessment of recruitment in order to have an overview of future fisheries on these species.

In this context, a feasibility study on sampling lobster larvae (*Palinarus elephas*) has been carried out since 2018 using the MIK (Method Isaac Kid) larval net. A total of 40 stations were carried out at night in 2021 (Fig. 3).

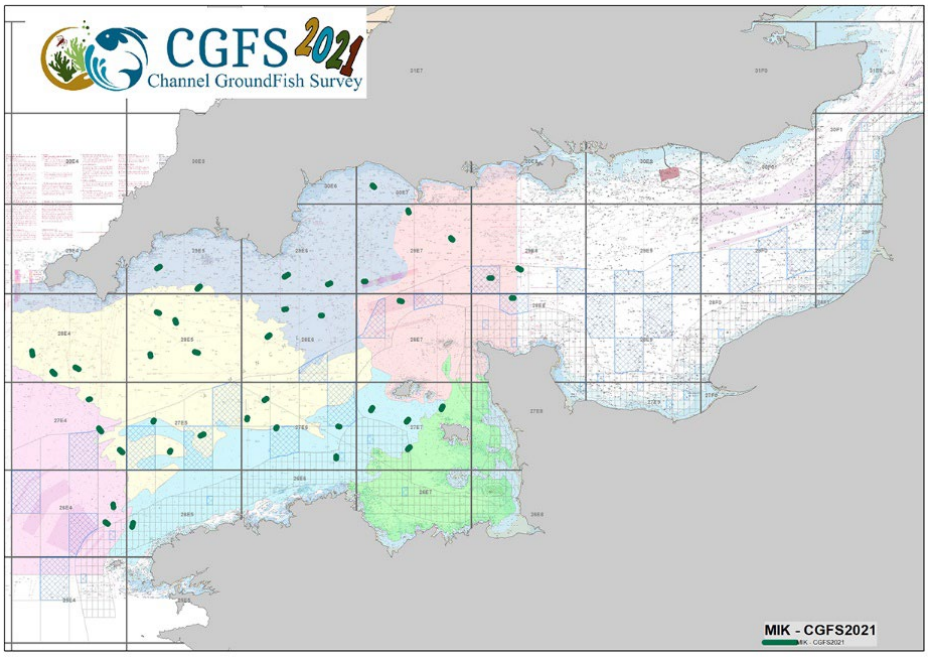



Figure 3 : Distribution of MIK nets in western Channel

### APECS (Association for the study and conservation of selachians) :

Tagging to improve knowledge of the movements of 3 species: starry smooth-hound (*Mustelus asterias*), hâ shark (*Galeorhinus galeus*) and thornback ray (*Raja clavata*). The APECS team tagged 251 and 13 skates in the Eastern Channel.

### Project FORSEA – IFREMER

Within the framework of the FORESEA 2050 project, supported by the Scientific Directorate of Ifremer, samples were taken for :

- Analysis of the genetic diversity of fish species of fisheries interest. For this, a new high-throughput sequencing technique will be used on a few specimens per species. During the campaign, samples were taken from 18 species.

- The comparison of the energy potential of fish on the coasts concerned by our campaigns (Bay of Biscay, Channel, Mediterranean, North Sea), using the sardine (Sardina pilchardus) as an example. 255 sardines muscles were collected during the CGFS2021 campaign.

- Mapping the energy potential (in terms of lipids and essential fatty acids) of zooplankton and the trophic transfer to small pelagics. A total of 118 WP2 net samples were taken to collect the data required for this part of the project.

### Project EMERTROPH – ANSES / IFREMER

Evaluation of the levels and profiles of contaminants of emerging interest (notably synthetic musks, alternative flame retardants) in the food chain of sea bass (*Dicentrarchus labrax*) and sole (*Solea solea*) (EMERTROPH programme). For this project, we sampled the species concerned and their prey species in the Baie de Seine, following a specific conservation protocol.

## Project DEFIPEL - IFREMER

DEFIPEL aims to consolidate the viability of the French small pelagic fish fishery by proposing a series of indicators on the state of the ecosystem, the resource and the industry, and adaptation scenarios co-constructed with all stakeholders. This is an integrated project, from the observation of the functioning of ecosystems and the sector to the evaluation of medium-term management plans. It aims to respond to the challenges of the socio-ecosystemic approach to fisheries, by taking into account (i) variations in the pelagic habitat (hydrology, food) under climatic control, (ii) the multi-specific strategies of fishermen under economic and regulatory constraints, and (iii) the evolution of markets in the development of fishery evolution scenarios.

Within this framework we were to sample sardines in English and French waters.

## MEGASCOPE monitoring and project DREAM (fate of air discards at the bottom of the sea) : Seabirds component

MEGASCOPE monitoring is carried out annually on certain vessels of the French oceanographic fleet in partnership with IFREMER. It consists of setting up a common protocol called Megascope applicable to different campaigns and making it possible to obtain data on the distribution and relative abundance of marine megafauna. (Report on observations in Appendix 5)

The DREAM project aims to understand the fate of commercial and non-commercial species in the marine ecosystem. The fate of the discharges will follow a compartmentalized process: the treatment of the discharges on board, avian predation, fate in the water column, as well as predation by scavengers on the bottom. The seabird component (i.e. avian predation) aims to understand and quantify the quantity of fish consumed during discharges at sea in order to deduce the quantity not taken that returns to the water column. (Summary of observations in Appendix 6)

## Acoustic acquisition in fisheries mode

The CGFS has set up this year the acquisition of acoustic data (fisheries mode) from the ME70 multibeam echosounder. These data will provide information on pelagic species over the whole campaign. These acquisitions will be compared with the catches of small pelagics by trawl.

## Bathymetric acquisitions

Acoustic data in the Channel are of great interest for methodological developments in seabed characterisation for two reasons:

1. The ground truths (CGFS video) and grab samplers of the Marine Geosciences Unit are numerous in the area and allow the physical models of the seabed to be recalibrated from the angular reflectivity curve of the seabed

2. At these shallow depths it is possible to use the two Thalassa multibeam echosounders ME70 and EM2040 at two different frequencies as was done in 2018 and better describe the sediment structure.

We therefore continued the acoustic coverage of the trawling zones, in order to study the direct correlation between the species trawled and the acoustic response (the results seem encouraging in the Bay of Biscay and in the Celtic Sea) and to make the link between the acoustic response and the description of the sediment by video and/or sampling.

## Samples for the European University Institute of the Sea (IUEM)

Freezing of whole fish for diet analysis. Provision of practical dissection work for 80 UBO undergraduate students (Biological Functions and Vital Cycles in Marine Organisms).

## Ovary sampling and illustration of maturity stages

The objective is to collect gonads from red mullet and whiting to mount histological sections once on land. These histological sections will make it possible to quantify the cell types found in the ovaries in order to determine the maturity phase of the individuals. This work will allow, in addition to the images taken on other species, to improve the discrimination of the stages of maturity during the sampling campaigns.

# Global analysis

## The Eastern Channel

### The fish component

This part contains fish in the analytical sense, including cephalopods, commercial benthos such as crabs and some bivalves. The average abundance of fish per haul is 14579 individuals and the average biomass is 432 kg per haul. Pelagic species such as horse mackerel (*Trachurus trachurus*) and mackerel (*Scomber scombrus*) are highly dominant in abundance representing 46% and 13% of the total number of individuals caught respectively (Fig. 4a). Among the other species, the sardine (*Sardina pilchardus*) is also very present in abundance with a dominance of 4%. The most abundant demersal species are whiting (*Merlangius merlangus*) and black seabream (*Spondyliosoma cantharus*) with only 1.7% and 1.03% of the overall abundance respectively (Ann.2). In terms of weight dominance, mackerel and horse mackerel represent 62% of the total weight of fish caught this year during the CGFS 2021. The demersal species with the highest dominance by weight are small-spotted catshark (*Scyliorhinus canicula*) and thornback ray (*Raja clavata*).

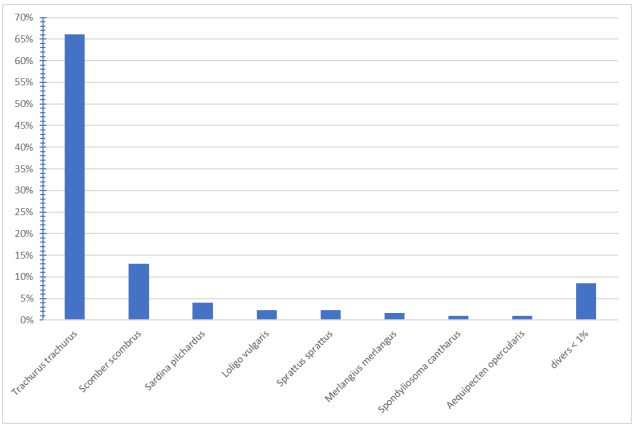



Figure 4a : Relative abundances of the main species (>1%) in the Eastern Channel

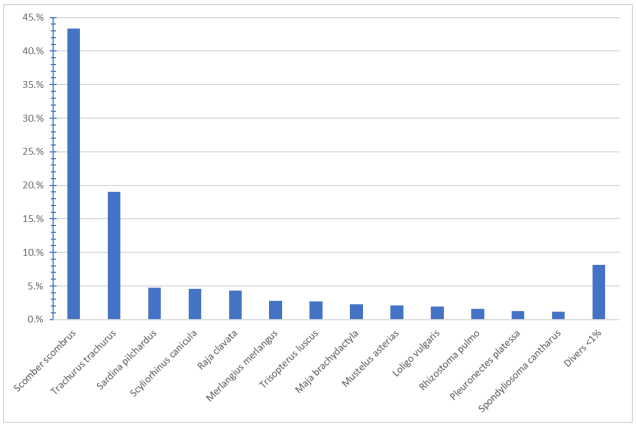



Figure 4b : Distribution of biomass dominance

In general, the geographical distribution of abundance is well correlated with that of biomass (Fig. 5). The most important areas are mainly along the coast from Boulogne sur Mer to Dieppe, in the Seine Bay and in Rye Bay on the English side. There were also two points off the Bay of Seine, on the English side, where there was a high abundance of horse mackerel, sardines, thornback ray and small dogfish. In the Bay of Veys, the Bay of Seine and off Dieppe, there was a discrepancy between abundance and biomass due to the capture of small individuals.

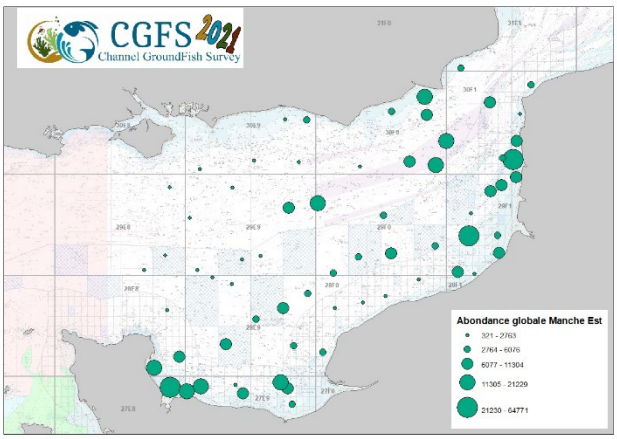



Figure 5a : Global abundance of fish (in number of fish)

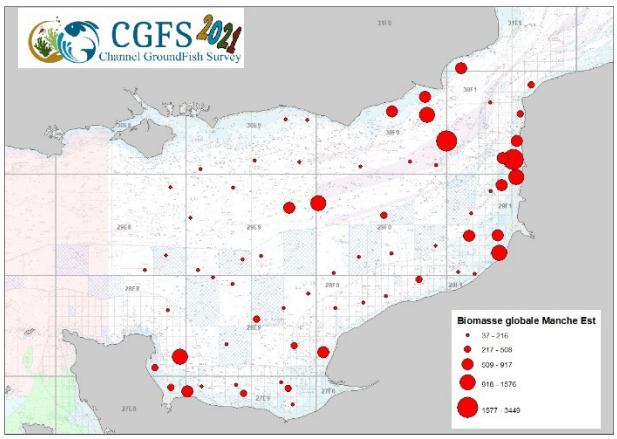



Figure 5b : Global fish biomass (in kilos)

Eighty-five fish species were identified during the 2021 CGFS in the eastern Channel. The highest species richness was found mainly along the coastline (Fig. 6).

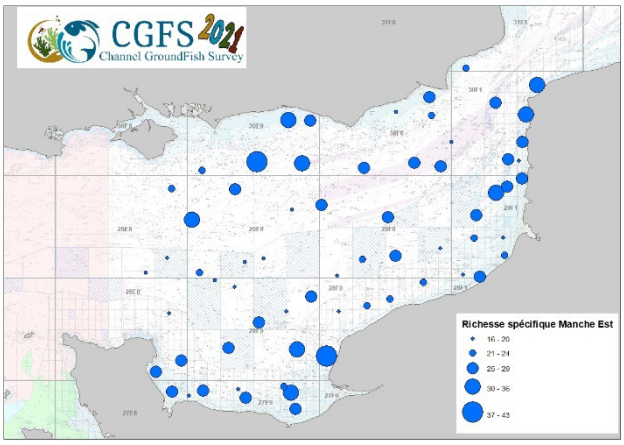



Figure 6 : Species richness distribution

In terms of occurrence, among the most widely distributed fish, we find most of the species with a strong dominance such as horse mackerel and mackerel, but also for demersal fish the Thornback ray (*Raja clavata*), the small-spotted catshark (*Scyliorhinus canicula*), the red mullet (*Mullus surmuletus*) and the black seabream (*Spondyliosoma cantharus*). For cephalopods, common squid (*Loligo vulgaris*) and cuttlefish (*Sepia officinalis*) are present in nearly 95% and 81% of the trawling stations. As in 2019, there was also a significant occurrence of the spider crab (*Maja brachydactyla*) and the John Dory (*Zeus faber*) present in 75% and 68% of the hauls (Ann.3).

## The benthos component

Ninety-seven species were identified during the CGFS 2021 in the eastern Channel. The highest biomasses of benthos were observed in the Seine Bay, in front of Boulogne sur Mer and opposite Dieppe (Fig. 7). Brittle stars (*Ophiothrix fragilis*), starfish (*Asterias rubens*) and crepidula (*Crepidula fornicata*) alone account for 85% of the total biomass of benthic invertebrates caught in the eastern Channel, with 64%, 14% and 7% respectively. In 2021, the most widely distributed species in the sampled area are sea stars (*Asterias rubens*), green sea urchins (*Psammechinus miliaris*) and hydraires (*Hydrallmania falcata*), with 86%, 77% and 67% occurrence respectively.

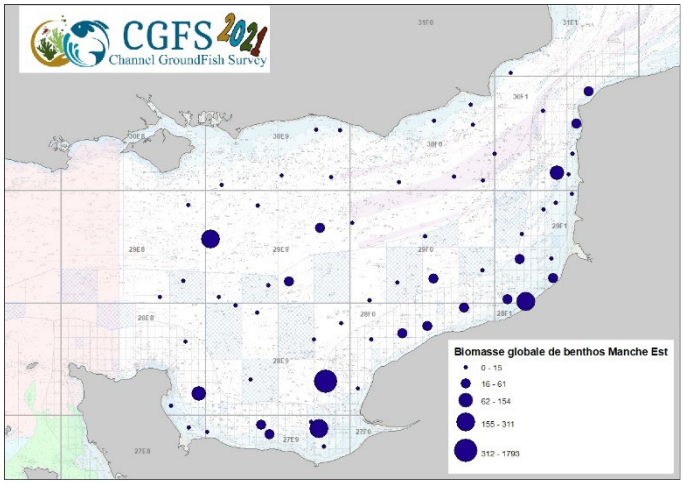



Figure 7 : Global benthos biomass (in kg)

## The Western Channel

### The fish component

In 2021, the average abundance per tow in the western Channel is 17,713 individuals and the average biomass is 387 kg. This year, we observed a much higher abundance of anchovy (*Engraulis encrasicolus*) representing 25% of the total number of individuals caught. This was followed by boarfish (*Capros aper*) and poor cod (*Trisopterus minutus*) representing 18% and 16% of the dominance in numbers respectively. Horse mackerel (*Trachurus trachurus*) has a lower dominance in numbers this year and represents 15% of the total number of individuals. We caught relatively few mackerel, which explains the 2% value. The demersal species with the highest dominance, apart from the small pout, are the veined squid (*Loligo forbesii*) and whiting (*Merlangius merlangus*), each representing 2% of the total number caught (Fig. 8a, Ann.2).

In terms of biomass dominance (Fig. 8b), there are two pelagic species, namely horse mackerel (19.8%) and anchovy (7%), but also boarfish (12%) and sardines (*Sardina pilchardus*) (7%). For demersal species, the biomass is dominated by small pout (8%), followed by larger species such as whiting (*Merlangius melangus*) (6%), small-spotted catshark (*Scyliorhinus canicula*) (3%), and john dory (*Zeus faber*) (1.85%) (Ann.2).

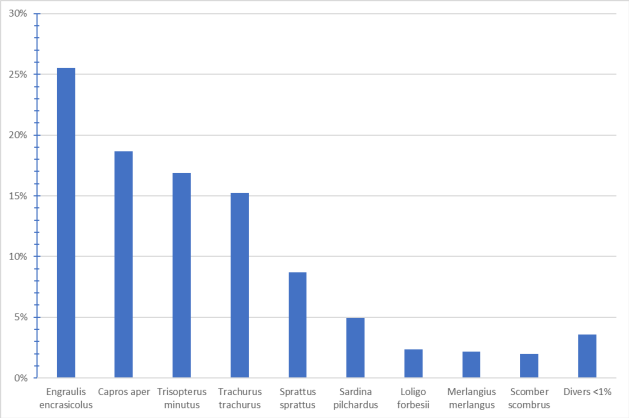



Figure 8a : Relative abundances of the main species (>1%) in the Western Channel

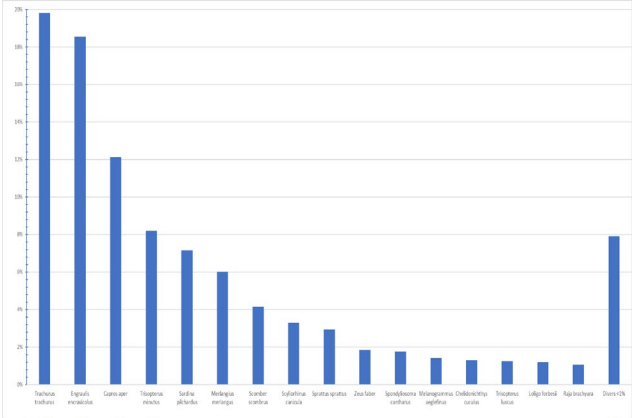


Figure 8b : Distribution of biomass dominance

The geographical distribution of abundance in the western Channel remains broadly similar to that of the biomasses. There is a more marked relative biomass in the central part north of Cherbourg and in west Jersey, corresponding to the capture of larger individuals such as mackerel (Scomber scombrus) and common pout (Trisopterus luscus).

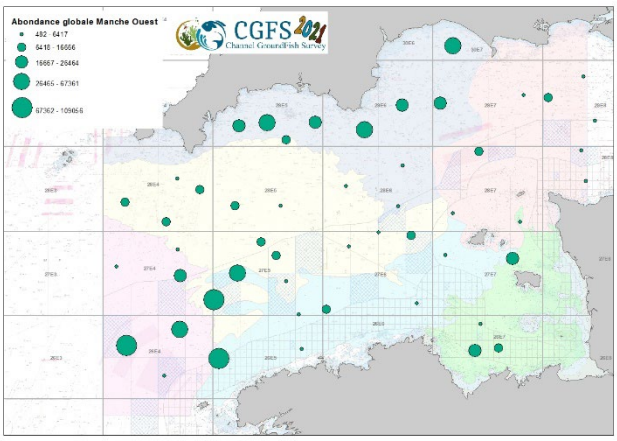



Figure 9a : Global abundance of fish (in number of fish)

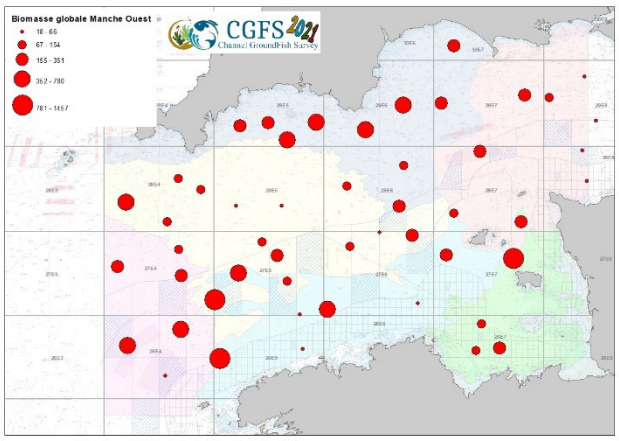



Figure 9b : Global fish biomass (in kilos)

Seventy-three species of fish, cephalopods, crustaceans and selachians were identified during the 2021 GFCS in the western Channel. The western part of the area appears to be richer overall, as well as the northern part at the level of Plymouth Bay (Fig. 10).

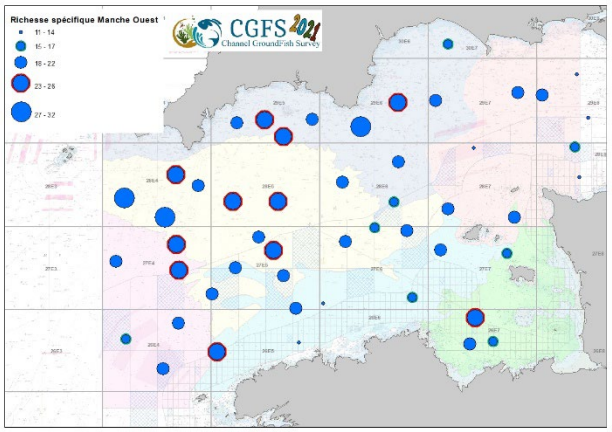



Figure 10 : Species richness distribution

As in previous years, horse mackerel is present at all trawl stations. Other widely distributed species include red gurnard (*Chelidonichthys cuculus*), poor cod, alloteuthis, and small-spotted catshark(Ann.3).

## The benthos component

Fifty-five species were identified during the CGFS 2021 campaign in the western part of the Channel. The highest biomasses of benthos are observed in the north of Finistère up to the limit of English waters. The sea urchin (*Echinus esculentus*) is largely dominant, representing 51% of the total biomass, and its spatial distribution is also the strongest, with a presence observed in 40% of the stations. The other species most represented in biomass are the ascidians and the spiny star (*Marthasterias glacialis*) with a dominance by weight of 29 and 3% respectively.

This information should be considered with caution and does not fully reflect the macro-benthos of the area. The gear used in the western arm strongly selects the larger species and lets the smaller ones through.

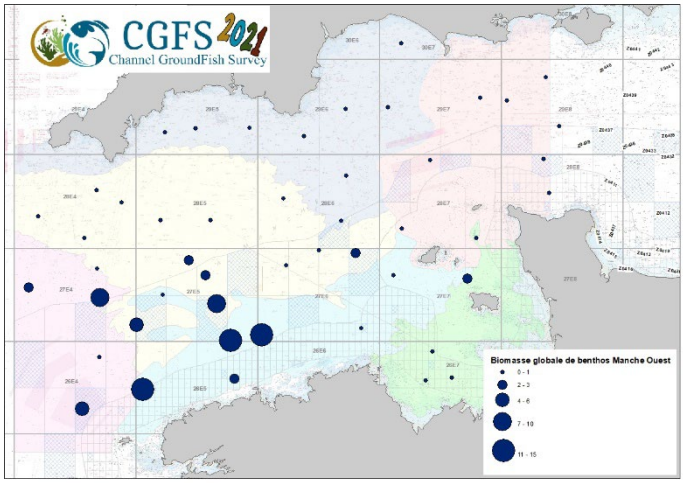



Figure 11 : Global benthos biomass (in kg)

# Analysis by species

For the eastern part, the species studied are those monitored internationally, such as sea bass (Dicentrarchus labrax), whiting, plaice (*Pleuronectes platessa*), red mullet (*Mullus surmuletus*) and cuttlefish (*Sepia officinalis*).

Although the western part has only been studied since 2018, the focus is on three species of commercial interest, namely haddock, whiting and John Dory. One of the main objectives of this campaign in this sector will be to provide medium-term indices of abundance for monitoring the stocks of the main species of commercial interest, which requires the acquisition of a series long enough to trace the evolution of the populations.

## The Eastern Channel

### Sea bass (*Dicentrachus labrax*)

During the CGFS 2021, this species is mainly caught in the bay of Wissant and in front of Boulogne sur Mer and to a lesser extent along the coast south of Boulogne to Dieppe and in the English coastal edge (Fig.12). The size spectrum ranges from 27 to 76 cm with three modes at 34, 39 and 43 centimetres. Apart from a drop in the number of individuals from 28 to 31 cm, there is a good match between the sizes compared to 2019. As the maturity of sea bass in the Channel is 42 cm, most of the fish are juveniles. As mature individuals are essentially distributed in rocky areas that are more difficult to access with the gear used for the CGFS, their catchability is low, which may explain the limited size distribution of juveniles.

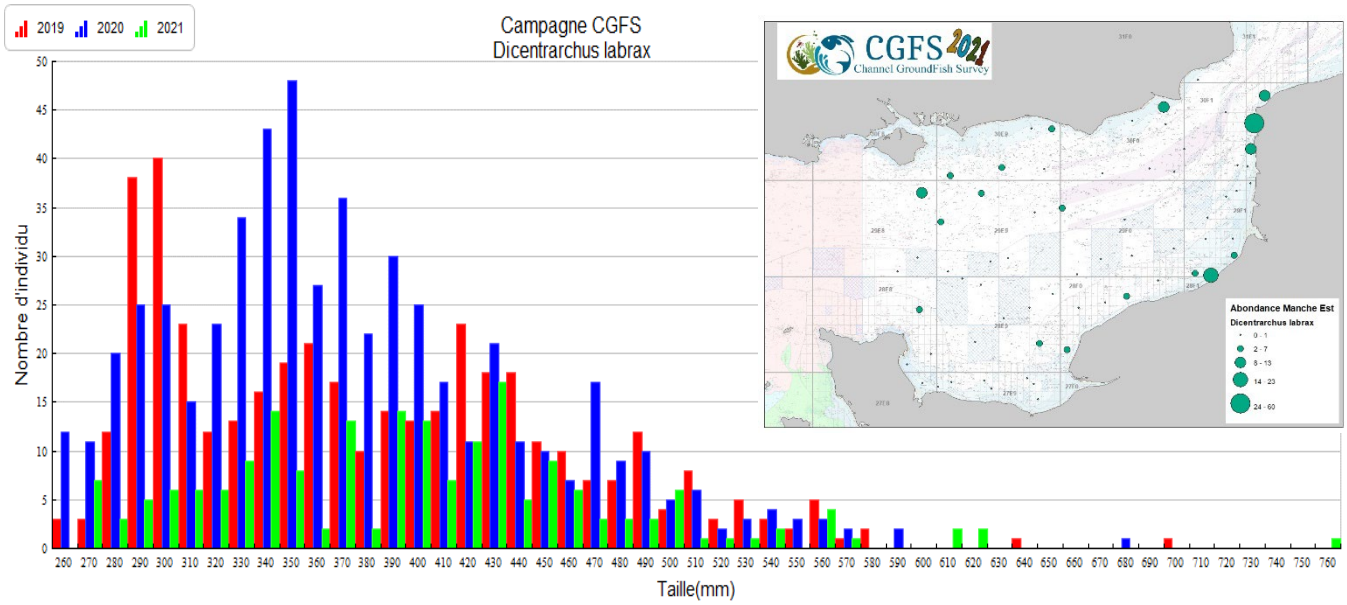



Figure 12 : Size distribution and geographical distribution of sea bass

### Whiting (*Merlangius merlangus*)

The geographical distribution of whiting is very coastal. As for the whole series, during the CGFS 2021, this species is mainly caught from Cape Gris-nez to the Bay of the Authie as well as opposite Antifer and in the area of the St Marcouf islands (Fig. 13). The size distribution is almost the same as last year, with two distinct patterns. The first concerns individuals from 13 to 22 cm with a relatively higher abundance than in previous years and the second for individuals from 23 to 31 cm (Fig.13).

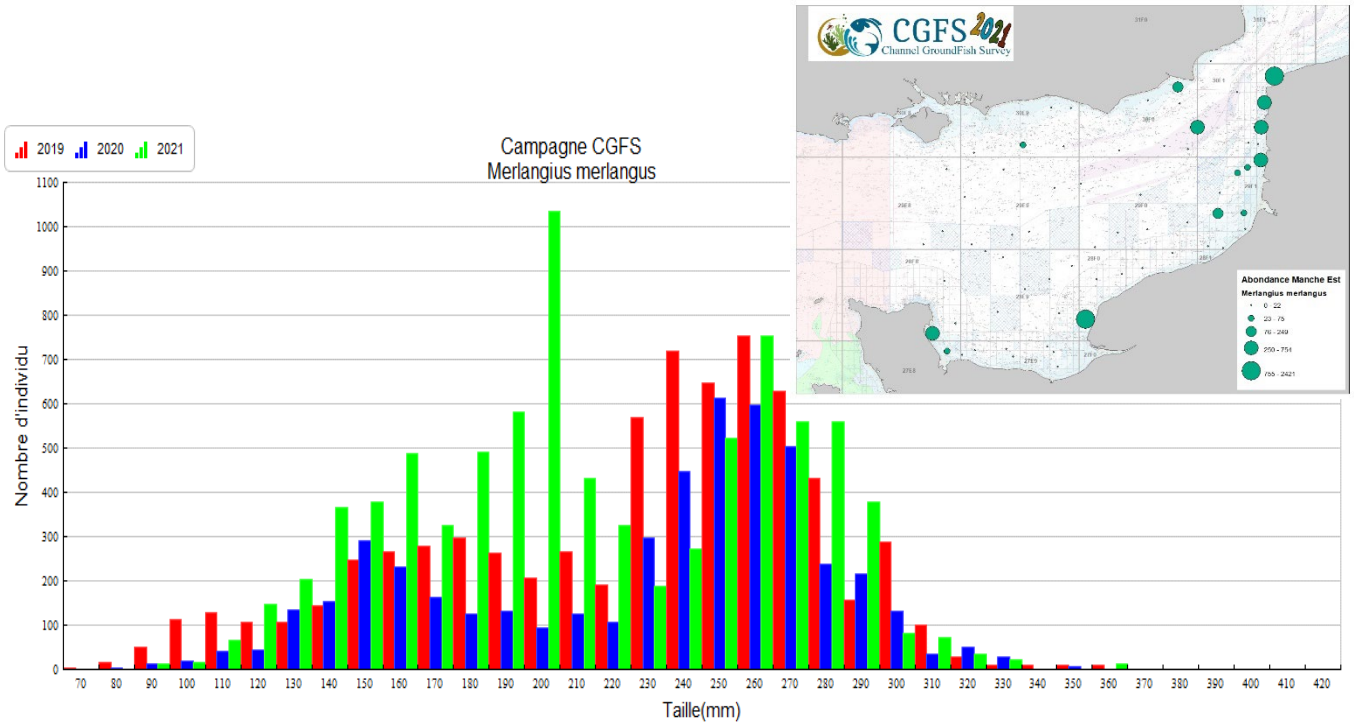



Figure 13 : Size distribution and geographical distribution of whiting

## Plaice (*Pleuronectes platessa*)

The geographical distribution of plaice is very coastal. As in 2019 and throughout the series, this species is mainly caught in 2021 from Gris Nez point to the Bay of the Authie, in front of Dieppe, in the Seine Bay and in the English coastal strip from Brighton to Folkestone (Fig.14). The size spectrum is almost the same as in previous years, with a mode around sizes 20 to 27 cm and a much higher abundance than in other years within this mode (Fig.14).

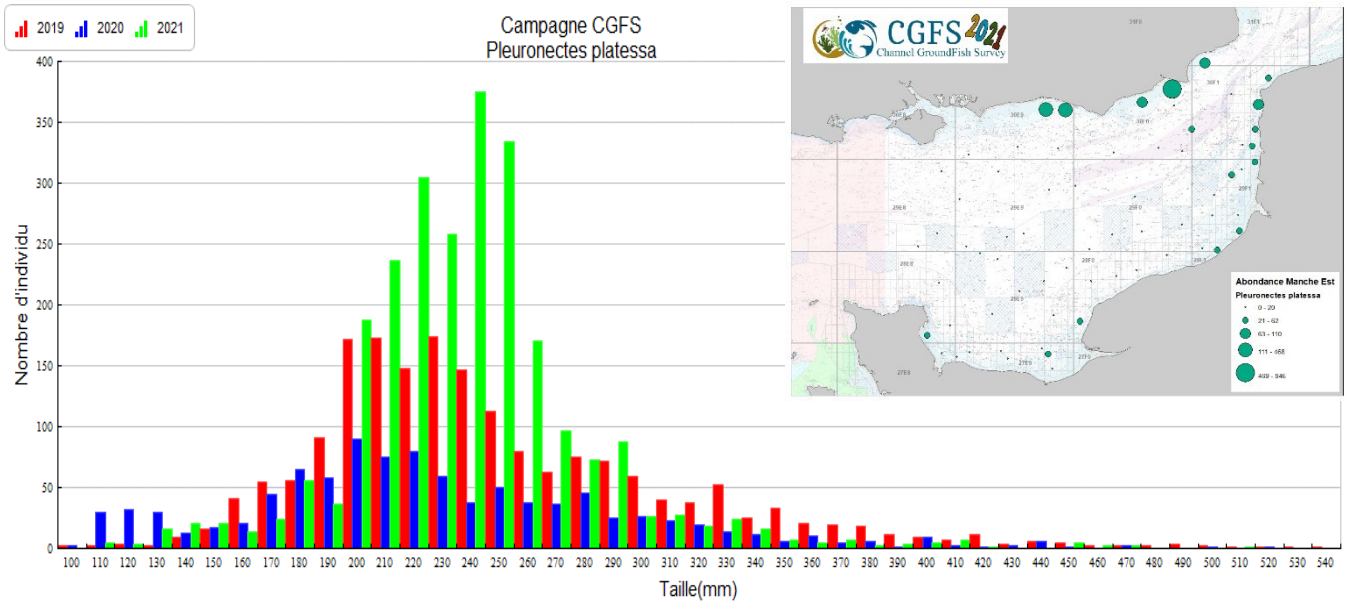



Figure 14 : Size distribution and geographical distribution of plaice

## Red mullet (*Mullus surmuletus*)

Red mullet is widely distributed in the eastern Channel in October with an occurrence of 70%. As in previous years, this species is mainly caught in 2021 in the north-east of the study area, in the Bay of Seine and the Bay of Veys (Fig. 15). Compared to 2019, the good recruitment observed in 2020 and previous years is again present, with a more important mode on sizes between 10 and 14 cm and a second mode less marked and shifted on sizes between 18 and 23 cm (Fig.15).

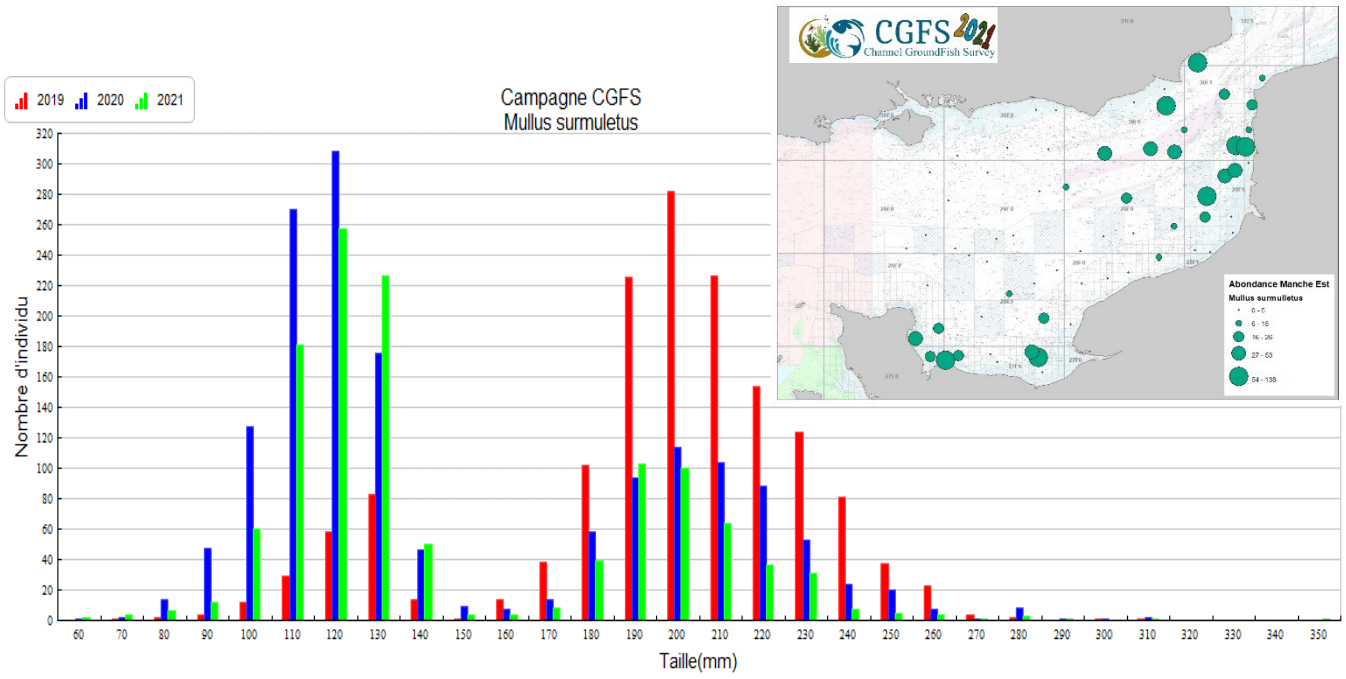



Figure 15 : Size distribution and geographical distribution of the Red mullet.

## Cuttlefish (*Sepia officinalis*)

Cuttlefish are very present in the eastern Channel in October with an occurrence of 82% this year. This species is mainly caught in the Bay of Seine and also, offset from the coast, between Dieppe and the north of the Bay of Authie (Fig.16). The size spectrum is identical to that of 2019 and 2020, characterised by a strong dominance of small cuttlefish with a cephalothoracic length of between 3 and 7 centimetres (Fig.16). A second size range appears on the graph, representing the largest individuals between 13 and 18 cm. However, there was a decrease in the abundance of small individuals compared to previous years.

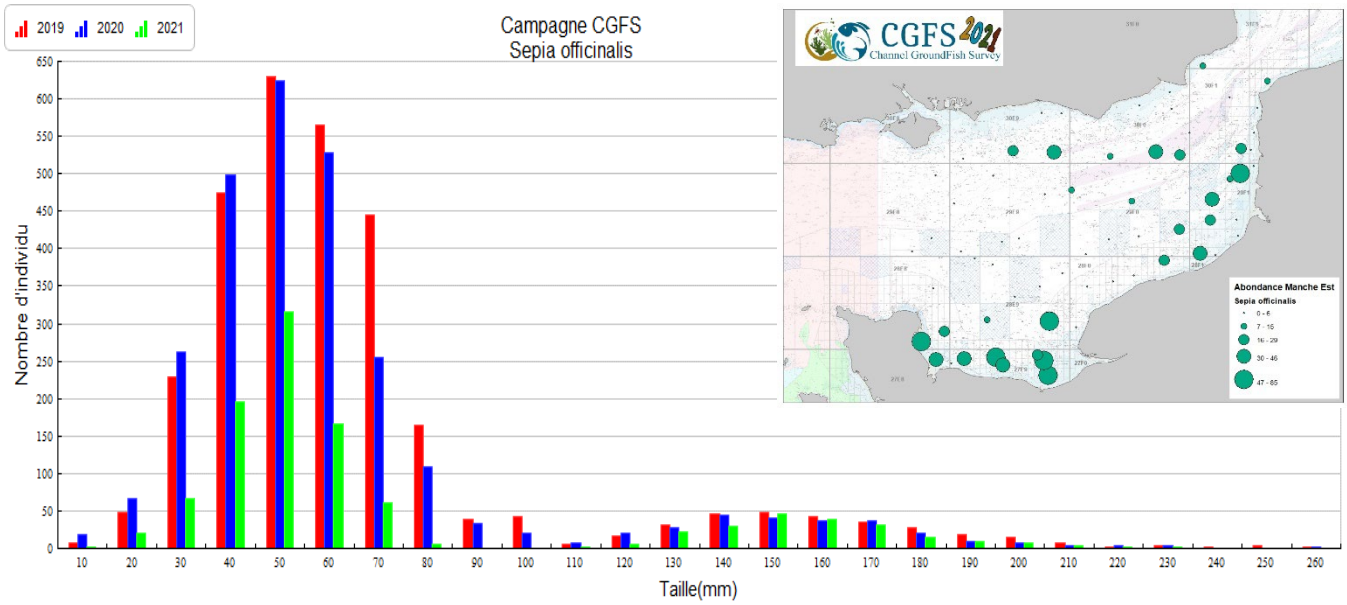
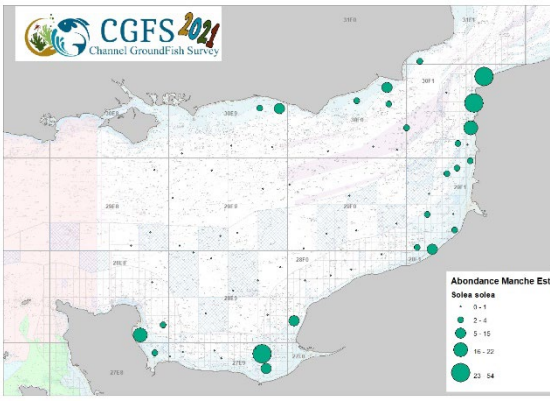
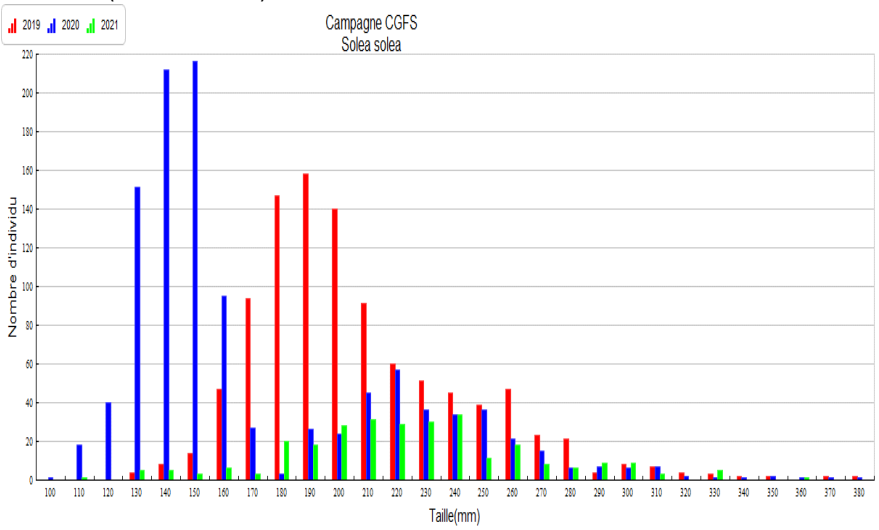



Figure 16 : Size distribution and geographical distribution of cuttlefish

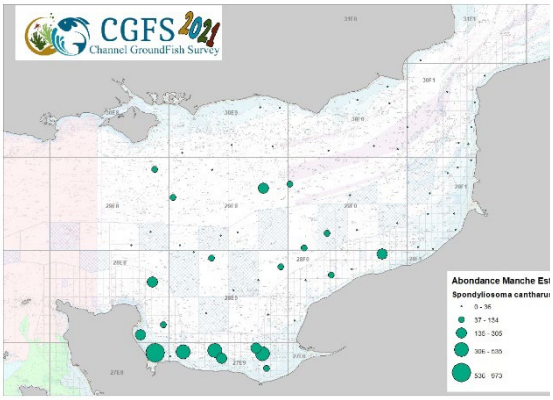
## Other important species in the area (size distribution and geographical distribution of abundance)

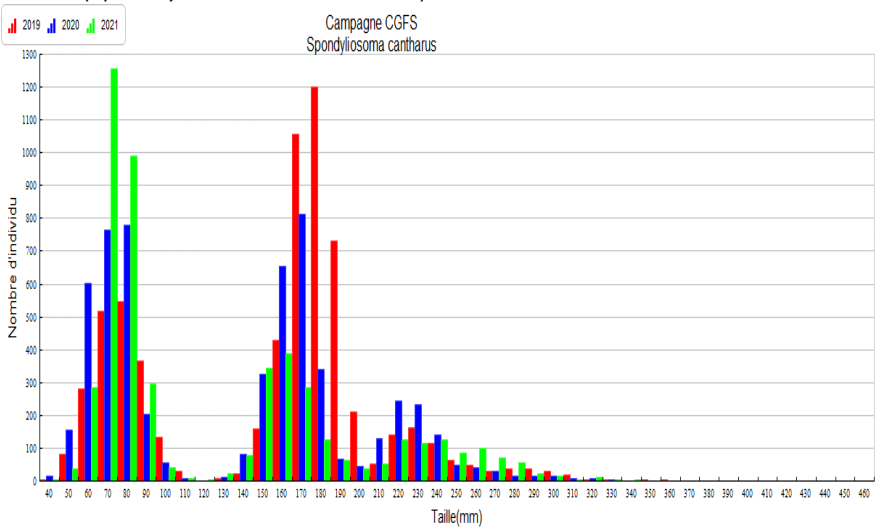
### Sole (*Solea solea*)



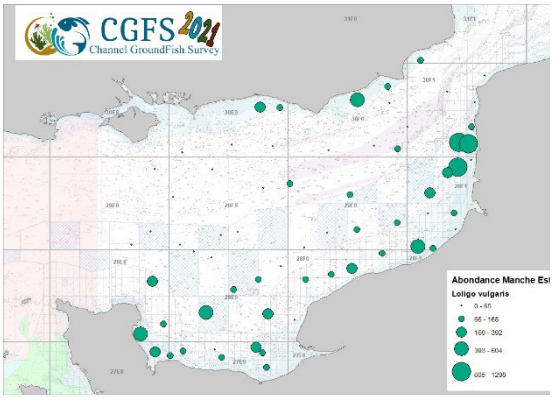



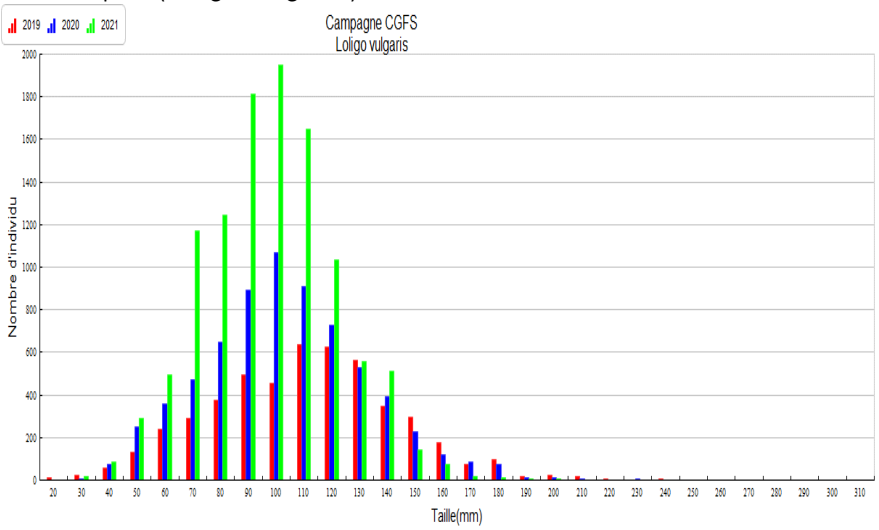

### Black seabream (*Spondyliosoma cantharus*)



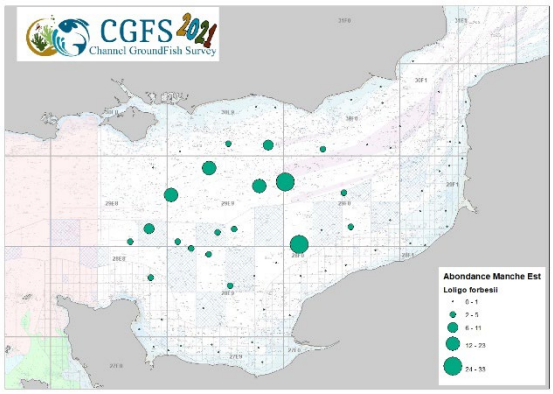



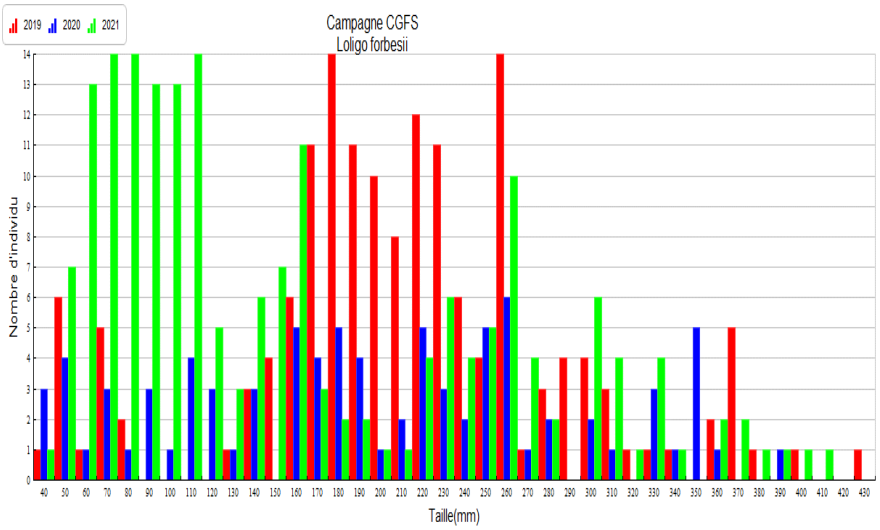

### Common squid (*Loligo vulgaris*)



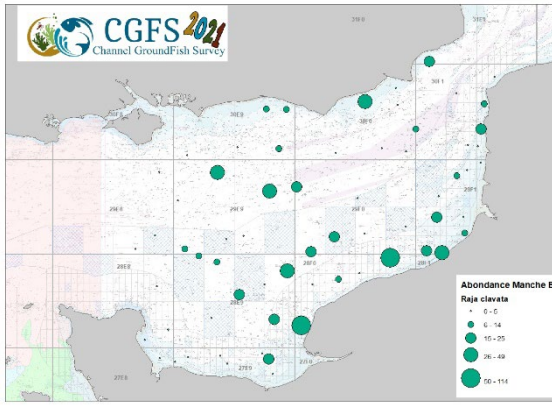



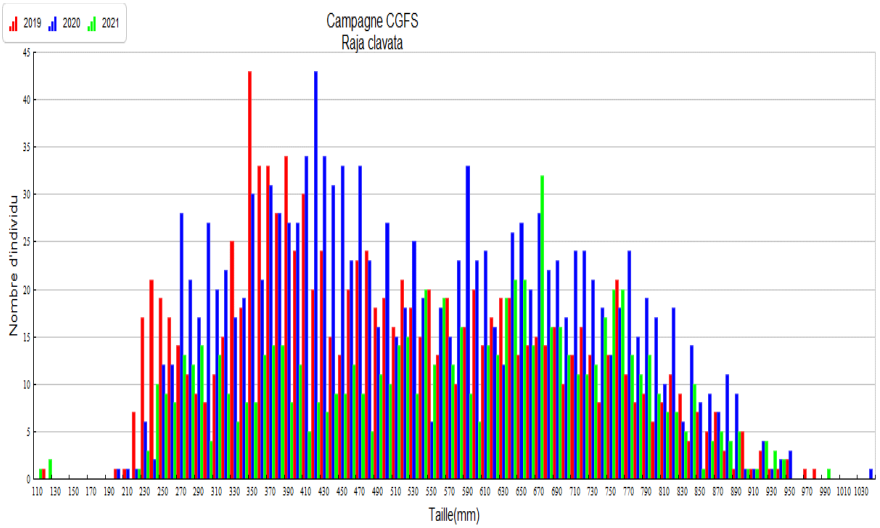
## Veined squid (*Loligo forbesii*)



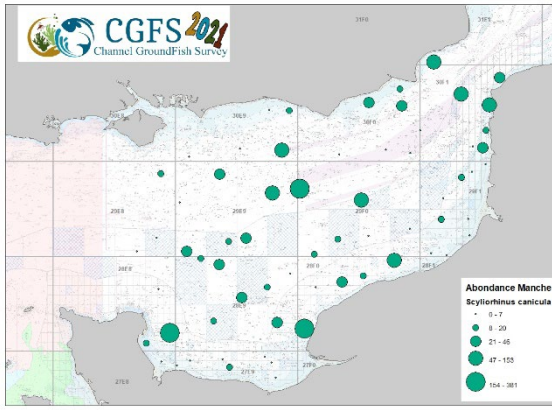



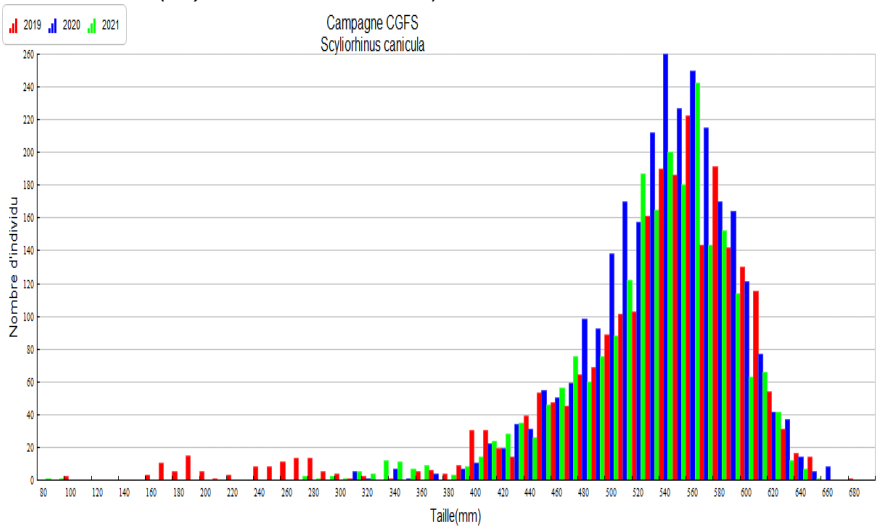

## Thornback ray (*raja clavata*)




## Small-spotted catshark (*Scyliorhinus canicula*)



## The Western Channel

### Haddock (*Melanogrammus aeglefinus*)

Haddock are more abundant in the western Channel (Fig.17) with an occurrence of 24% of the hauls made. This species is less distributed to the east than in 2019 and is mainly concentrated to the west of the 5° W meridian, from the north-west of Ushant to the south of Lizard Point (Fig.17). Compared to 2019, abundance (360 individuals in 2021, -80%/2019) and biomass (193 kg in 2021, -72%/2019) are significantly lower. This is reflected in the size distribution, which shows that we have caught fewer individuals between 25 and 33 cm, but that the distribution of the largest individuals remains the same. It seems that there is a better representation of small individuals between 15 and 20 cm compared to the 2019 campaign.

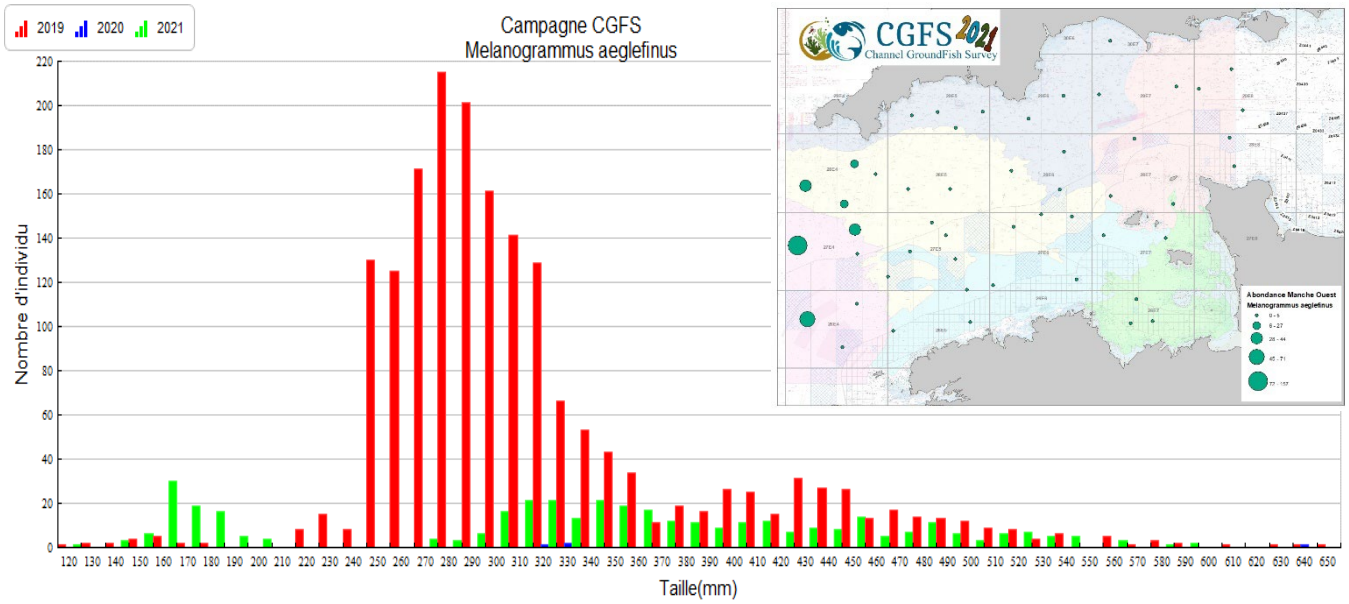



Figure 17 : Size distribution and geographical distribution of haddock

### Whiting (*Merlangius merlangus*)

In the Western Channel, whiting is mainly distributed in the northern half of the area, along the English coast. Compared to 2019, we found it less in the central West Channel. The occurrence of the species in comparison to 2019 is stable and represents 54%. (Fig.18). The size distribution also shows how important English waters are for whiting (Fig.18b). For whiting, there is an increase in abundance (19043 individuals in 2021, +200%/2019) and to a lesser extent in biomass (816 kg in 2021, +20%/2019) compared to 2019. This evolution is partly explained by the size distribution. It shows a high abundance of small individuals (between 10 and 16 cm) and a more measured increase in larger individuals between 24 and 34 cm.

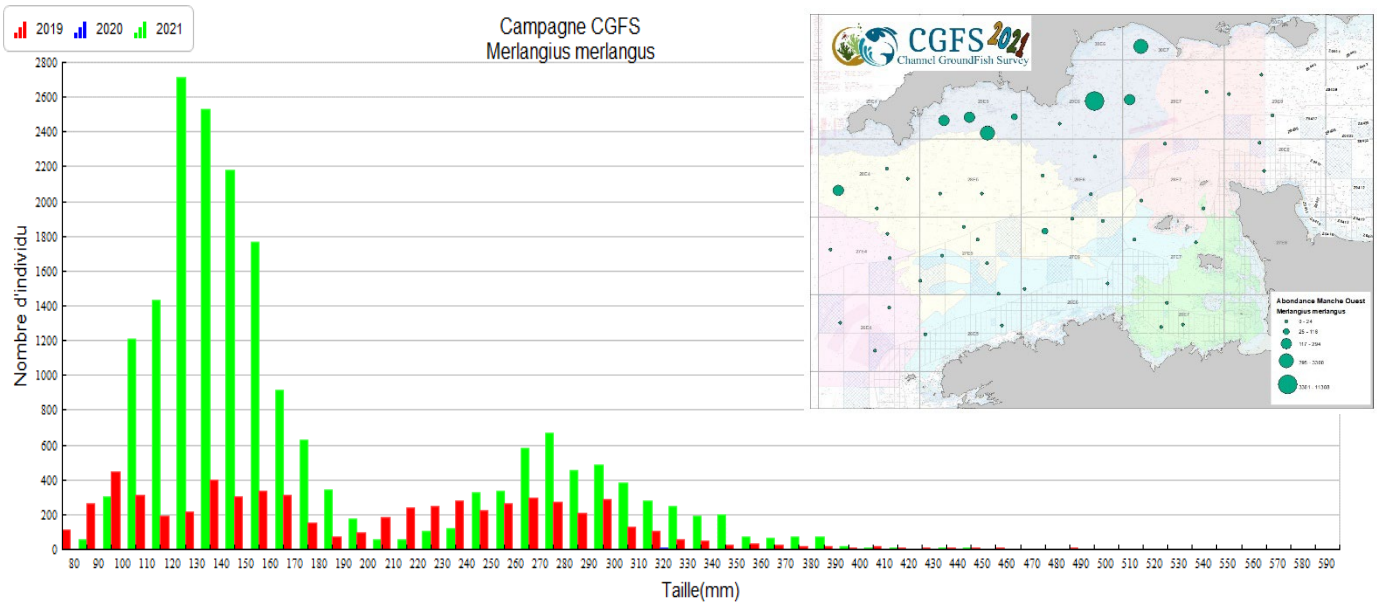
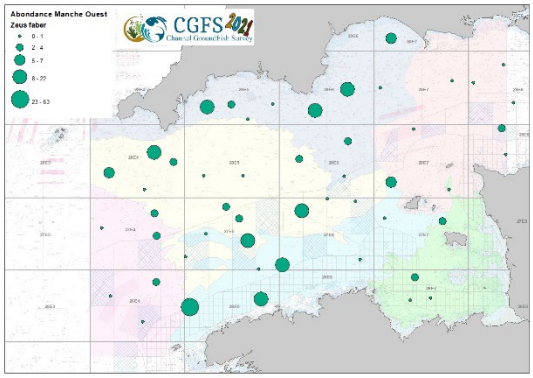



Figure 18 : Size distribution and geographical distribution of whiting

## John Dory (*Zeus faber*)

John Dory is distributed over the north of Brittany and off the English points. Its abundance is less important around the Normandy-Breton Gulf. In 2021, the St. Pierre is present in 70% of the hauls made. There was a slight increase in abundance (244 individuals in 2021, +5%/2019) and biomass (251 kg in 2021, +25%/2019). This evolution is confirmed by the size distribution of the species in 2021, with a better representation of large individuals (42 to 52 cm). The size distribution of the St. Pierre shows four modes in 2021. The first concerns individuals measuring between 22 and 30 cm, the second the largest individuals measuring between 31 and 40 cm. The third is between 40 and 45 cm and the last is between 46 and 52 cm. Apart from the greater abundance of larger individuals, the histogram is almost identical to that of 2019.



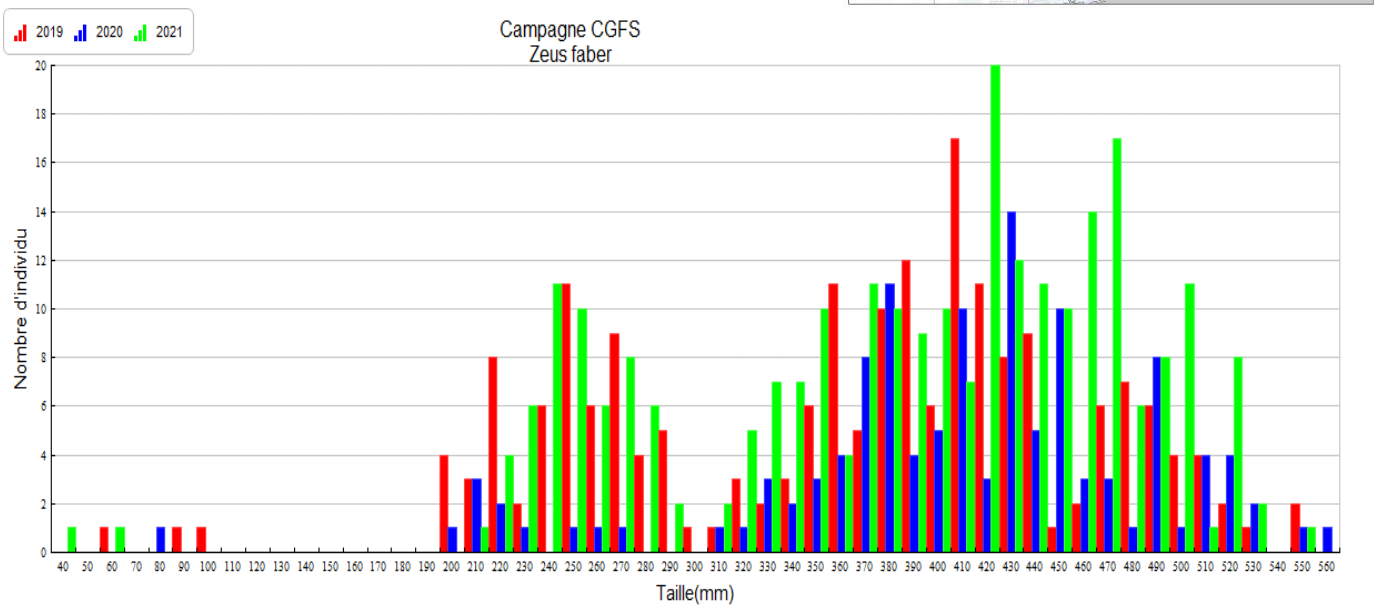
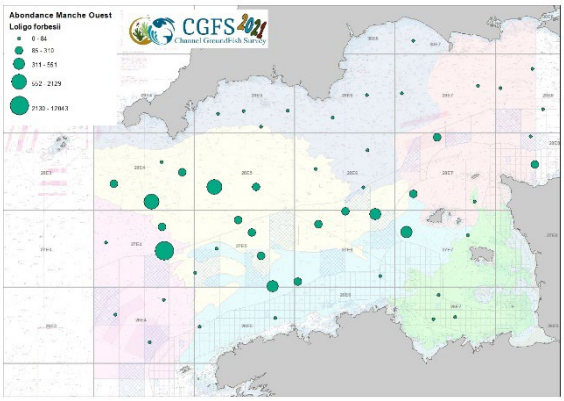
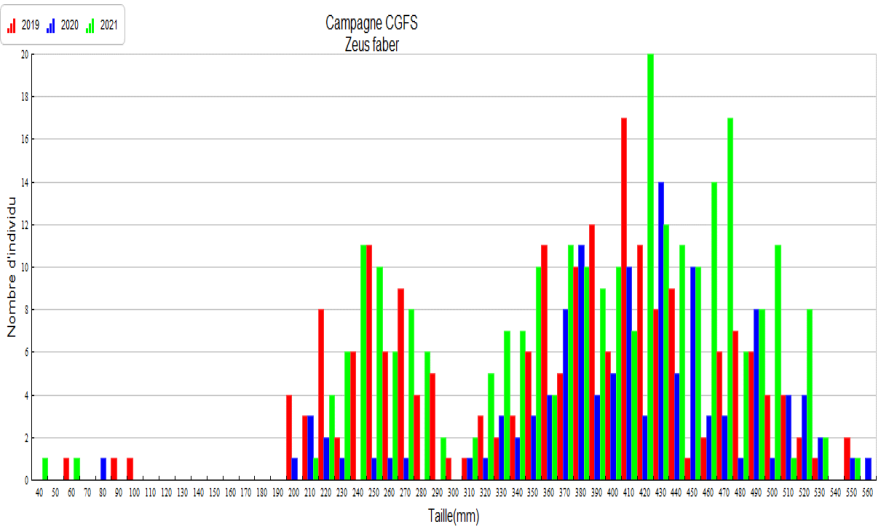



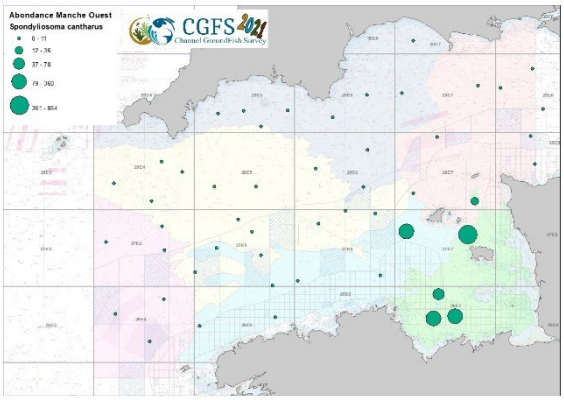

Figure 19 : Size distribution and geographical distribution of John Dory

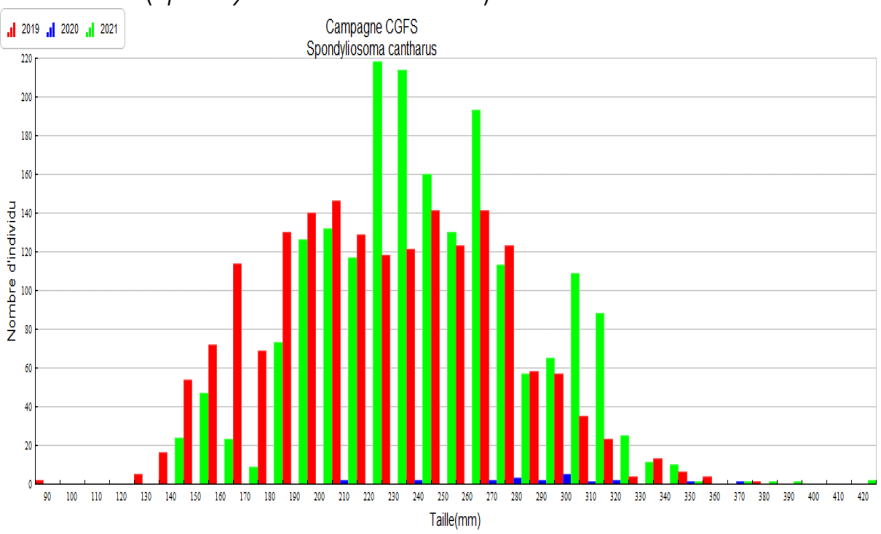
## Veined squid (*Loligo forbesii*)



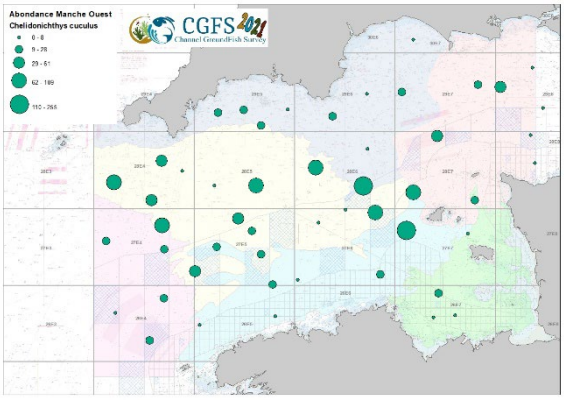



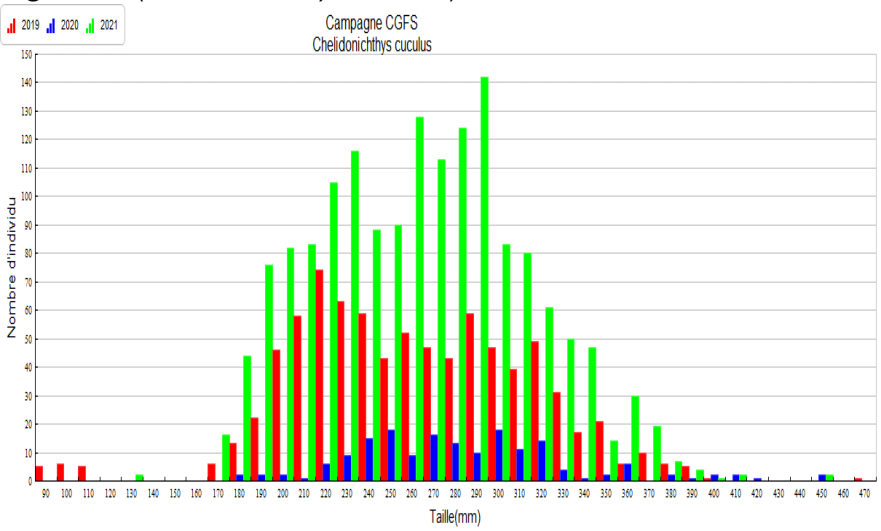

## Black seabream (*Spondyliosoma cantharus*)



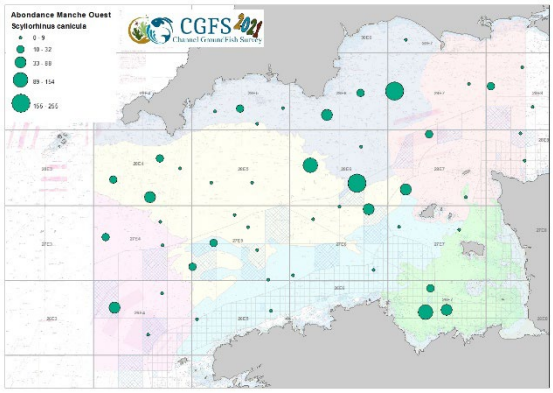



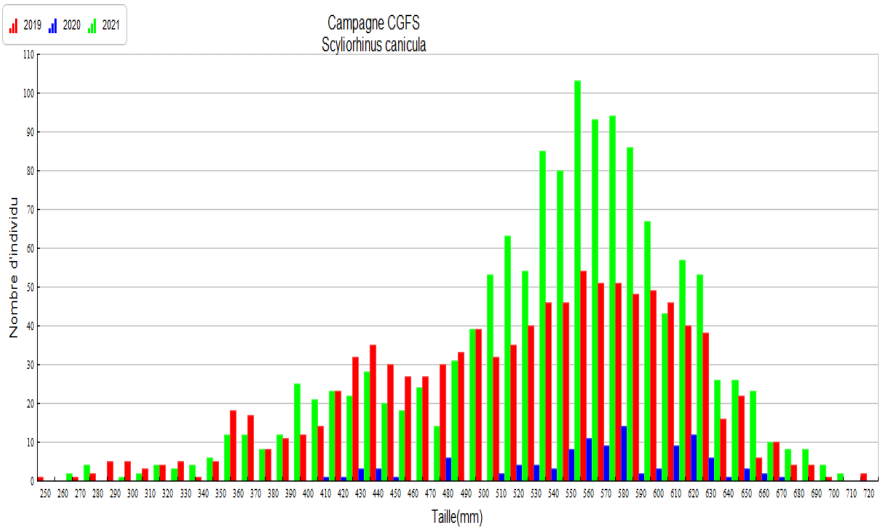

## Red gurnard (*Chelidonichthys cuculus*)



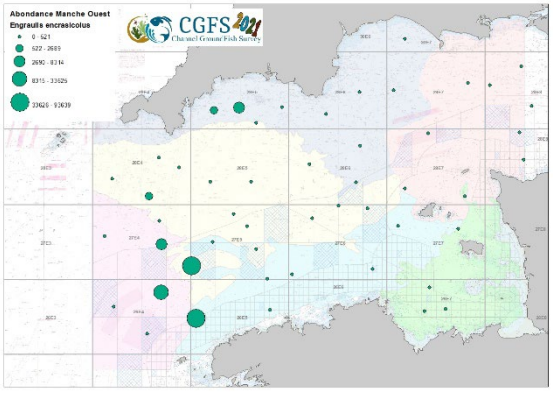



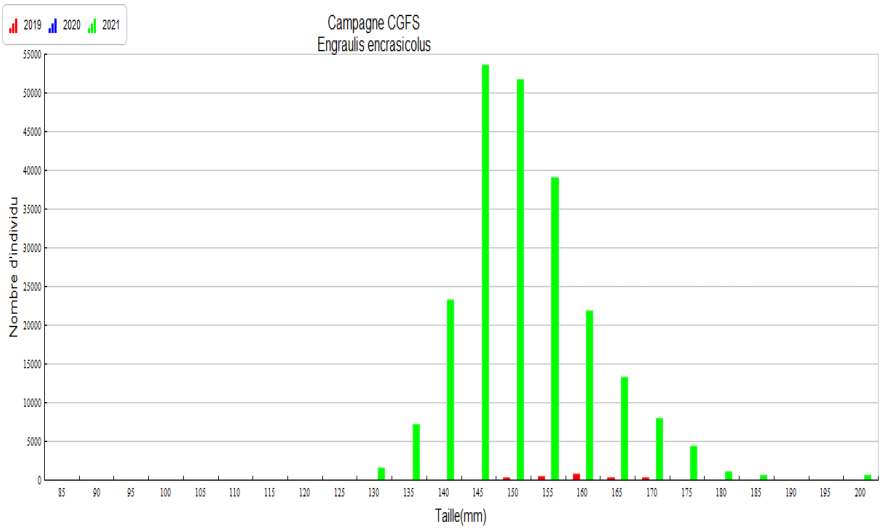
small-spotted catshark (*Scyliorhinus canicula*)



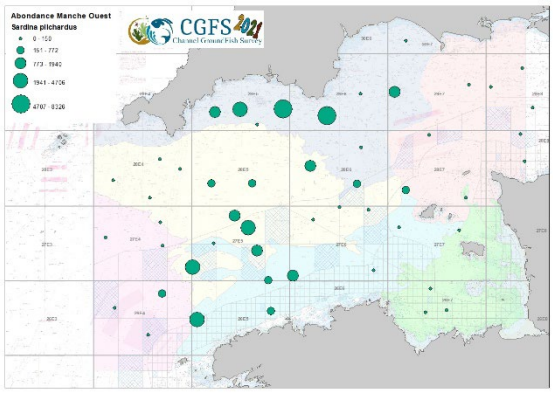



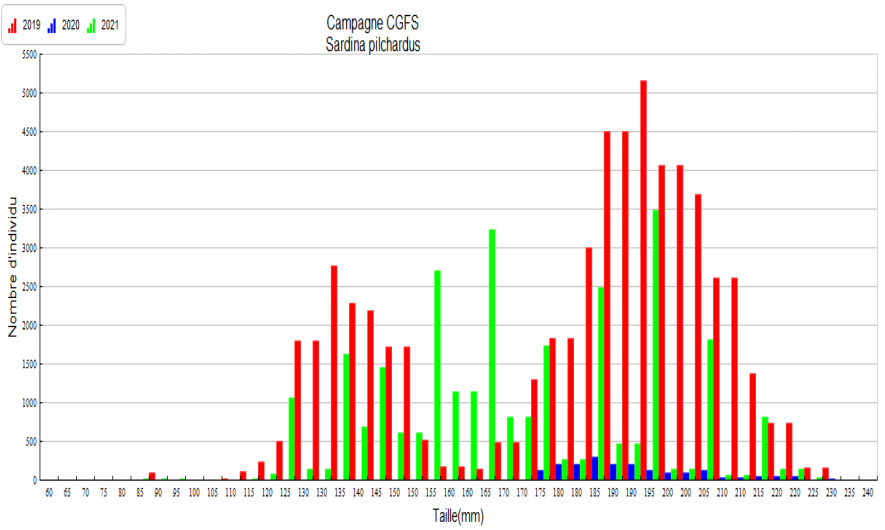

Anchovy (*Engraulis encrasicolus*)




Sardine (*Sardina pilchardus*)



# ANNEXE 1 : trawl stations characteristics

## Eastern Channel

| Code station | Haul Number | Stratum | Gear | Date | ShootLat | ShootLong | HaulLat | HaulLong | Duration | Distance | Depth | Validity | Abond. NBRE/km² | Biom Kg/km² |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z0411 | 1 | 28E8-7d | GOV 36/47 | 02/10/2021 09:35:00 | 49.830100 | -1.137400 | 49.820400 | -1.104900 | 31 | 2571 | 59.0 | Y | 23840 | 3882 |
| Z0412 | 2 | 28E9 | GOV 36/47 | 02/10/2021 13:01:00 | 49.659300 | -0.689400 | 49.659300 | -0.649800 | 29 | 2875 | 40.0 | Y | 169071 | 3814 |
| Z0413 | 3 | 27E9 | GOV 36/47 | 02/10/2021 15:50:00 | 49.448600 | -0.879300 | 49.451800 | -0.916700 | 30 | 2730 | 25.0 | Y | 409285 | 5172 |
| Z0414 | 4 | 28E8-7d | GOV 36/47 | 03/10/2021 06:11:00 | 49.542300 | -1.240200 | 49.525200 | -1.234900 | 20 | 1968 | 17.0 | Y | 696880 | 11058 |
| Z0415 | 5 | 27E8-7d | GOV 36/47 | 03/10/2021 07:52:00 | 49.445300 | -1.115000 | 49.433900 | -1.086800 | 23 | 2397 | 20.0 | Y | 1889796 | 12389 |
| Z0416 | 6 | 27E9 | GOV 36/47 | 03/10/2021 10:04:00 | 49.424300 | -0.988400 | 49.422900 | -0.955900 | 27 | 2355 | 23.0 | Y | 555701 | 14420 |
| Z0417 | 7 | 28E8-7d | GOV 36/47 | 03/10/2021 12:01:00 | 49.596100 | -1.046800 | 49.571900 | -1.055700 | 30 | 2766 | 35.0 | Y | 4173182 | 27077 |
| Z0419 | 8 | 27E9 | GOV 36/47 | 04/10/2021 06:06:00 | 49.455800 | -0.616600 | 49.458800 | -0.650100 | 30 | 2442 | 27.0 | Y | 100806 | 3433 |
| Z0420 | 9 | 27E9 | GOV 36/47 | 04/10/2021 07:36:00 | 49.415500 | -0.559200 | 49.419500 | -0.596000 | 31 | 2700 | 26.0 | Y | 196583 | 11524 |
| Z0421 | 10 | 27E9 | GOV 36/47 | 04/10/2021 09:24:00 | 49.460300 | -0.430900 | 49.459600 | -0.423100 | 6 | 572 |  | N |  |  |
| Z0422 | 11 | 27E9 | GOV 36/47 | 04/10/2021 11:30:00 | 49.438700 | -0.215900 | 49.451300 | -0.181600 | 30 | 2853 | 33.0 | Y | 12439766 | 12815 |
| Z0423 | 12 | 27E9 | GOV 36/47 | 04/10/2021 13:49:00 | 49.358900 | -0.180500 | 49.359600 | -0.141100 | 30 | 2846 | 15.0 | Y | 467887 | 2774 |
| Z0424 | 13 | 27E9 | GOV 36/47 | 05/10/2021 06:13:00 | 49.468800 | -0.270100 | 49.470800 | -0.302400 | 30 | 2345 | 36.0 | Y | 355157 | 5352 |
| Z0425 | 14 | 28E9 | GOV 36/47 | 05/10/2021 07:32:00 | 49.556800 | -0.282200 | 49.557000 | -0.300400 | 16 | 1314 |  | N |  |  |
| Z0426 | 15 | 28E9 | GOV 36/47 | 05/10/2021 09:31:00 | 49.653200 | -0.170600 | 49.653100 | -0.203600 | 25 | 2374 | 37.0 | Y | 70859344 | 53177 |
| Z0427 | 16 | 28F0 | GOV 36/47 | 05/10/2021 12:13:00 | 49.619500 | 0.055600 | 49.640200 | 0.081600 | 31 | 2963 | 27.0 | Y | 101703 | 14038 |
| Z0428 | 17 | 28F0 | GOV 36/47 | 05/10/2021 14:26:00 | 49.838600 | 0.147900 | 49.842600 | 0.178700 | 30 | 2255 | 31.0 | Y | 53606 | 1876 |
| Z0429 | 18 | 28E9 | GOV 36/47 | 06/10/2021 06:12:00 | 49.910700 | -0.060500 | 49.906900 | -0.092900 | 31 | 2366 | 40.0 | Y | 196844 | 4856 |
| Z0430 | 19 | 28E9 | GOV 36/47 | 06/10/2021 08:08:00 | 49.839500 | -0.251400 | 49.836800 | -0.279800 | 31 | 2069 | 43.0 | Y | 225517 | 4613 |
| Z0431 | 20 | 28E9 | GOV 36/47 | 06/10/2021 10:27:00 | 49.785100 | -0.457900 | 49.784300 | -0.500000 | 30 | 3028 | 44.0 | Y | 66323 | 8618 |
| Z0432 | 21 | 28E9 | GOV 36/47 | 06/10/2021 12:58:00 | 49.959500 | -0.642000 | 49.962500 | -0.614900 | 31 | 1964 | 50.0 | Y | 69840 | 4877 |
| Z0433 | 22 | 28E9 | GOV 36/47 | 06/10/2021 15:25:00 | 49.990800 | -0.794300 | 49.990900 | -0.774800 | 22 | 1399 | 55.0 | Y | 42809 | 5138 |
| Z0434 | 23 | 29E9 | GOV 36/47 | 07/10/2021 06:10:00 | 50.096900 | -0.424000 | 50.087100 | -0.457300 | 30 | 2610 | 46.0 | Y | 71216 | 2453 |
| Z0435 | 24 | 29E9 | GOV 36/47 | 07/10/2021 07:24:00 | 50.081500 | -0.565000 | 50.079100 | -0.586100 | 31 | 1534 | 51.0 | Y | 36639 | 1997 |
| Z0436 | 25 | 29E9 | GOV 36/47 | 07/10/2021 10:30:00 | 50.028300 | -0.909300 | 50.022100 | -0.940600 | 30 | 2351 | 64.0 | Y | 30101 | 2955 |
| Z0437 | 26 | 29E8 | GOV 36/47 | 07/10/2021 12:43:00 | 50.100400 | -1.154000 | 50.100300 | -1.130100 | 30 | 1701 | 55.0 | Y | 33045 | 1464 |
| Z0438 | 27 | 29E8 | GOV 36/47 | 07/10/2021 14:41:00 | 50.029400 | -1.316700 | 50.031600 | -1.305600 | 30 | 833 | 69.0 | Y | 57413 | 2950 |
| Z0439 | 28 | 29E9 | GOV 36/47 | 08/10/2021 06:15:00 | 50.286400 | -0.967200 | 50.285500 | -0.923100 | 30 | 3140 | 69.0 | Y | 4485395 | 10000 |
| Z0440 | 29 | 29E8 | GOV 36/47 | 08/10/2021 08:25:00 | 50.434900 | -1.120500 | 50.429900 | -1.135100 | 30 | 1180 | 35.0 | Y | 35845 | 5142 |
| Z0441 | 30 | 30E9 | GOV 36/47 | 08/10/2021 10:23:00 | 50.524700 | -0.889300 | 50.526200 | -0.920100 | 30 | 2182 | 29.0 | Y | 15404 | 2520 |
| Z0442 | 31 | 30E9 | GOV 36/47 | 08/10/2021 12:13:00 | 50.512900 | -0.746600 | 50.522700 | -0.716800 | 31 | 2368 |  | N |  |  |
| Z0443 | 32 | 29E9 | GOV 36/47 | 08/10/2021 15:07:00 | 50.432200 | -0.636800 | 50.438000 | -0.614000 | 30 | 1736 | 62.0 | Y | 35333 | 5167 |
| Z0444 | 33 | 30E9 | GOV 36/47 | 08/10/2021 16:57:00 | 50.566200 | -0.471400 | 50.573900 | -0.447900 | 25 | 1868 | 63.0 | Y | 41299 | 4219 |
| Z0445 | 34 | 30E9 | GOV 36/47 | 09/10/2021 06:13:00 | 50.765900 | -0.235400 | 50.759600 | -0.282900 | 30 | 3412 | 14.0 | Y | 40550 | 3804 |
| Z0446 | 35 | 30E9 | GOV 36/47 | 09/10/2021 07:51:00 | 50.762900 | -0.070500 | 50.756200 | -0.109000 | 31 | 2808 | 15.0 | Y | 121374 | 4303 |

| Code station | Haul Number | Stratum | Gear | Date | ShootLat | ShootLong | HaulLat | HaulLong | Duration | Distance | Depth | Validity | Abond. NBRE/km² | Biom Kg/km² |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z0447 | 36 | 30E9 | GOV 36/47 | 09/10/2021 10:08:00 | 50.559400 | -0.129200 | 50.552900 | -0.155400 | 30 | 1982 | 65.0 | Y | 48282 | 3932 |
| Z0448 | 37 | 30F0 | GOV 36/47 | 09/10/2021 12:14:00 | 50.546100 | 0.057700 | 50.536100 | 0.018000 | 31 | 3011 | | N | | |
| Z0449 | 38 | 30F0 | GOV 36/47 | 09/10/2021 16:01:00 | 50.536400 | 0.339300 | 50.544600 | 0.370100 | 30 | 2356 | 47.0 | Y | 48213 | 2433 |
| Z0450 | 39 | 29F0 | GOV 36/47 | 10/10/2021 06:16:00 | 50.357100 | 0.016900 | 50.358600 | 0.049300 | 31 | 2297 | 52.0 | Y | 379489 | 39851 |
| Z0451 | 40 | 29E9 | GOV 36/47 | 10/10/2021 08:01:00 | 50.334700 | -0.207600 | 50.341600 | -0.179400 | 20 | 2145 | 47.0 | Y | 219899 | 16497 |
| Z0452 | 41 | 29E9 | GOV 36/47 | 10/10/2021 10:32:00 | 50.245300 | -0.065300 | 50.242100 | -0.082300 | 21 | 1260 | | N | | |
| Z0453 | 42 | 29F0 | GOV 36/47 | 10/10/2021 15:23:00 | 50.014300 | 0.135700 | 50.016600 | 0.157300 | 20 | 1566 | 40.0 | Y | 183796 | 6104 |
| Z0454 | 43 | 29F0 | GOV 36/47 | 10/10/2021 16:55:00 | 50.093500 | 0.328900 | 50.096100 | 0.347800 | 20 | 1374 | 37.0 | Y | 251105 | 9051 |
| Z0455 | 44 | 28F0 | GOV 36/47 | 11/10/2021 06:16:00 | 49.867800 | 0.361700 | 49.871400 | 0.390200 | 30 | 2078 | 27.0 | Y | 46209 | 4506 |
| Z0456 | 45 | 28F0 | GOV 36/47 | 11/10/2021 07:39:00 | 49.898500 | 0.537200 | 49.903300 | 0.572000 | 31 | 2544 | 25.0 | Y | 57957 | 1765 |
| Z0457 | 46 | 29F0 | GOV 36/47 | 11/10/2021 10:00:00 | 50.109700 | 0.577100 | 50.115000 | 0.613900 | 22 | 2684 | 34.0 | Y | 284795 | 3480 |
| Z0458 | 47 | 29F0 | GOV 36/47 | 11/10/2021 12:21:00 | 50.298100 | 0.519900 | 50.293200 | 0.488100 | 30 | 2317 | 58.0 | Y | 189084 | 9212 |
| Z0459 | 48 | 29F0 | GOV 36/47 | 11/10/2021 14:35:00 | 50.368200 | 0.705700 | 50.353700 | 0.663800 | 30 | 3374 | | N | | |
| Z0460 | 49 | 29F0 | GOV 36/47 | 12/10/2021 06:25:00 | 50.147500 | 0.917400 | 50.153300 | 0.953800 | 31 | 2672 | 31.0 | Y | 117883 | 2009 |
| Z0461 | 50 | 28F0 | GOV 36/47 | 12/10/2021 08:16:00 | 49.980000 | 0.790400 | 49.982700 | 0.826000 | 30 | 2562 | 26.0 | Y | 213388 | 9353 |
| Z0462 | 51 | 29F1 | GOV 36/47 | 12/10/2021 11:00:00 | 50.018300 | 1.089300 | 50.013600 | 1.066300 | 20 | 1721 | 23.0 | Y | 432177 | 7789 |
| Z0463 | 52 | 28F1 | GOV 36/47 | 12/10/2021 13:01:00 | 50.007400 | 1.216100 | 49.996900 | 1.197500 | 20 | 1767 | 19.0 | Y | 216419 | 16771 |
| Z0464 | 53 | 29F1 | GOV 36/47 | 12/10/2021 14:41:00 | 50.112300 | 1.404600 | 50.092100 | 1.376300 | 30 | 3066 | 16.0 | Y | 210325 | 29780 |
| Z0465 | 54 | 29F1 | GOV 36/47 | 13/10/2021 06:10:00 | 50.200000 | 1.394200 | 50.206900 | 1.423100 | 21 | 2191 | 19.0 | Y | 201302 | 26473 |
| Z0466 | 55 | 29F1 | GOV 36/47 | 13/10/2021 07:40:00 | 50.196100 | 1.174100 | 50.221200 | 1.195000 | 31 | 3159 | 25.0 | Y | 758620 | 15470 |
| Z0467 | 56 | 29F1 | GOV 36/47 | 13/10/2021 09:59:00 | 50.308700 | 1.190100 | 50.321200 | 1.228600 | 30 | 3057 | 30.0 | Y | 44035 | 1953 |
| Z0468 | 57 | 29F1 | GOV 36/47 | 13/10/2021 11:32:00 | 50.415700 | 1.338800 | 50.435000 | 1.368700 | 30 | 3018 | 26.0 | Y | 147437 | 2543 |
| Z0469 | 58 | 29F1 | GOV 36/47 | 13/10/2021 13:33:00 | 50.444400 | 1.423900 | 50.469200 | 1.438700 | 25 | 2951 | 29.0 | Y | 163521 | 15024 |
| Z0471 | 59 | 29F1 | GOV 36/47 | 14/10/2021 06:28:00 | 50.485200 | 1.538100 | 50.458200 | 1.534300 | 31 | 3009 | 16.0 | Y | 188043 | 22264 |
| Z0472 | 60 | 30F1 | GOV 36/47 | 14/10/2021 08:20:00 | 50.570400 | 1.512500 | 50.598200 | 1.522600 | 30 | 3175 | 25.0 | Y | 578553 | 39354 |
| Z0473 | 61 | 30F1 | GOV 36/47 | 14/10/2021 10:51:00 | 50.660600 | 1.542500 | 50.676300 | 1.536400 | 21 | 1792 | 22.0 | Y | 354038 | 17620 |
| Z0474 | 62 | 30F1 | GOV 36/47 | 14/10/2021 12:52:00 | 50.579300 | 1.433500 | 50.595900 | 1.448500 | 23 | 2126 | 27.0 | Y | 607837 | 21363 |
| Z0476 | 63 | 30F0 | GOV 36/47 | 15/10/2021 06:20:00 | 50.544700 | 0.922100 | 50.534600 | 0.879500 | 30 | 3226 | 37.0 | Y | 275693 | 3018 |
| Z0477 | 64 | 30F0 | GOV 36/47 | 15/10/2021 07:48:00 | 50.561800 | 0.721800 | 50.562900 | 0.673000 | 31 | 3441 | 44.0 | Y | 126817 | 3747 |
| Z0478 | 65 | 30F1 | GOV 36/47 | 15/10/2021 10:35:00 | 50.660400 | 1.003400 | 50.667200 | 1.033200 | 25 | 2234 | 44.0 | Y | 420068 | 81307 |
| Z0479 | 66 | 30F0 | GOV 36/47 | 15/10/2021 15:04:00 | 50.787600 | 0.852500 | 50.797500 | 0.878300 | 20 | 2120 | 37.0 | Y | 297043 | 43004 |
| Z0480 | 67 | 30F0 | GOV 36/47 | 16/10/2021 06:23:00 | 50.804600 | 0.580500 | 50.793500 | 0.538700 | 31 | 3183 | 17.0 | Y | 109293 | 19185 |
| Z0481 | 68 | 30F0 | GOV 36/47 | 16/10/2021 08:30:00 | 50.876600 | 0.834800 | 50.867400 | 0.808700 | 21 | 2094 | 17.0 | Y | 386136 | 17988 |
| Z0482 | 69 | 30F1 | GOV 36/47 | 16/10/2021 10:58:00 | 51.015900 | 1.115000 | 50.998000 | 1.095800 | 26 | 2432 | 27.0 | Y | 137463 | 15993 |
| Z0483 | 70 | 30F1 | GOV 36/47 | 16/10/2021 13:49:00 | 50.849300 | 1.337500 | 50.866900 | 1.348100 | 24 | 2105 | 28.0 | Y | 360107 | 6518 |
| Z0484 | 71 | 30F1 | GOV 36/47 | 17/10/2021 06:49:00 | 50.935200 | 1.650400 | 50.917300 | 1.618900 | 30 | 2967 | 25.0 | Y | 201608 | 11760 |
| Z0485 | 72 | 30F1 | GOV 36/47 | 17/10/2021 08:51:00 | 50.794400 | 1.566000 | 50.776300 | 1.561000 | 30 | 2042 | 23.0 | Y | 202622 | 13125 |

| Code station | Haul Number | Stratum | Gear | Date | ShootLat | ShootLong | HaulLat | HaulLong | Duration | Distance | Depth | Validity | Abond. NBRE/km² | Biom Kg/km² |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z0334 | 1 | NOB (CGFS) | GOV 36/49 | 17/09/2021 12:26:00 | 48.742000 | -4.945100 | 48.718300 | -4.949800 | 30 | 2665 | 108.0 | Y | 959103 | 24295 |
| Z0337 | 2 | OFF (CGFS) | GOV 36/49 | 18/09/2021 06:31:00 | 48.638100 | -5.441800 | 48.611300 | -5.446500 | 25 | 2990 | 111.0 | Y | 11266 | 1014 |
| Z0338 | 3 | OFF (CGFS) | GOV 36/49 | 18/09/2021 09:24:00 | 48.819300 | -5.783100 | 48.821700 | -5.745800 | 30 | 2737 | 115.0 | Y | 1017171 | 14532 |
| Z0339 | 4 | OFF (CGFS) | GOV 36/49 | 18/09/2021 12:51:00 | 48.916900 | -5.301800 | 48.907400 | -5.319900 | 20 | 1689 | 111.0 | Y | 560256 | 20593 |
| Z0340 | 5 | WEC (CGFS) | GOV 36/49 | 18/09/2021 15:38:00 | 49.092600 | -4.993400 | 49.082900 | -5.028800 | 30 | 2788 | 106.0 | Y | 805200 | 22465 |
| Z0342 | 6 | OFF (CGFS) | GOV 36/49 | 19/09/2021 06:09:00 | 49.394300 | -5.319200 | 49.385700 | -5.360800 | 30 | 3155 | 102.0 | Y | 34612 | 1748 |
| Z0343 | 7 | OFF (CGFS) | GOV 36/49 | 19/09/2021 07:51:00 | 49.237800 | -5.296900 | 49.225200 | -5.342300 | 30 | 3574 | 103.0 | Y | 171406 | 2988 |
| Z0344 | 8 | OFF (CGFS) | GOV 36/49 | 19/09/2021 11:19:00 | 49.291200 | -5.877300 | 49.298100 | -5.837300 | 32 | 2996 | 109.0 | Y | 49387 | 4121 |
| Z0345 | 9 | WEC (CGFS) | GOV 36/49 | 19/09/2021 14:30:00 | 49.557500 | -5.425100 | 49.564800 | -5.379400 | 31 | 3391 | 99.0 | Y | 97067 | 1567 |
| Z0347 | 10 | WEC (CGFS) | GOV 36/49 | 20/09/2021 06:03:00 | 49.673300 | -5.799900 | 49.671300 | -5.839100 | 31 | 2820 | 96.0 | Y | 157259.42 | 7117.0942 |
| Z0348 | 11 | WEC (CGFS) | GOV 36/49 | 20/09/2021 09:01:00 | 49.810200 | -5.322100 | 49.811500 | -5.290600 | 30 | 2267 | 83.0 | Y | 65487 | 2598 |
| Z0349 | 12 | WEC (CGFS) | GOV 36/49 | 20/09/2021 11:12:00 | 49.746100 | -5.117500 | 49.746400 | -5.085100 | 31 | 2332 | 86.0 | Y | 141238 | 2920 |
| Z0350 | 13 | WEC (CGFS) | GOV 36/49 | 20/09/2021 13:49:00 | 49.652000 | -4.800000 | 49.649700 | -4.755900 | 30 | 3178 | 86.0 | Y | 79579 | 1116 |
| Z0353 | 14 | WEC (CGFS) | GOV 36/49 | 21/09/2021 06:25:00 | 50.036800 | -4.333400 | 50.038900 | -4.368600 | 29 | 2528 | 76.0 | Y | 190256.62 | 13317.7402 |
| Z0354 | 15 | SOE (CGFS) | GOV 36/49 | 21/09/2021 08:30:00 | 50.141000 | -4.067000 | 50.149300 | -4.091500 | 20 | 2038 | 64.0 | Y | 239508 | 11145 |
| Z0355 | 16 | SOE (CGFS) | GOV 36/49 | 21/09/2021 11:14:00 | 50.137500 | -4.508900 | 50.135400 | -4.473000 | 31 | 2570 | 66.0 | Y | 430747 | 7392 |
| Z0356 | 17 | SOE (CGFS) | GOV 36/49 | 21/09/2021 13:40:00 | 50.118900 | -4.761900 | 50.129700 | -4.725000 | 30 | 2887 | 66.0 | Y | 175485 | 3934 |
| Z0359 | 18 | WEC (CGFS) | GOV 36/49 | 22/09/2021 06:08:00 | 49.650800 | -4.385700 | 49.646800 | -4.414700 | 30 | 2132 | 86.0 | Y | 29932 | 1091 |
| Z0360 | 19 | WEC (CGFS) | GOV 36/49 | 22/09/2021 08:18:00 | 49.437500 | -4.564300 | 49.426200 | -4.604300 | 30 | 3146 | 95.0 | Y | 74073 | 1571 |
| Z0361 | 20 | WEC (CGFS) | GOV 36/49 | 22/09/2021 10:31:00 | 49.356600 | -4.425900 | 49.364500 | -4.401500 | 30 | 1977 | 90.0 | Y | 132363 | 5040 |
| Z0362 | 21 | NOB (CGFS) | GOV 36/49 | 22/09/2021 13:22:00 | 49.251500 | -4.778100 | 49.264300 | -4.744200 | 31 | 2836 | 97.0 | Y | 619385 | 13661 |
| Z0365 | 22 | WEC (CGFS) | GOV 36/49 | 23/09/2021 06:19:00 | 49.205600 | -4.335200 | 49.196000 | -4.359700 | 30 | 2075 | 95.0 | Y | 33937 | 4146 |
| Z0366 | 23 | NOB (CGFS) | GOV 36/49 | 23/09/2021 08:21:00 | 49.005900 | -4.222100 | 48.994000 | -4.260500 | 30 | 3094 | 95.0 | Y | 23542 | 1140 |
| Z0367 | 24 | NOB (CGFS) | GOV 36/49 | 23/09/2021 11:04:00 | 48.799200 | -4.191300 | 48.805700 | -4.177200 | 20 | 1262 | 83.0 | Y | 109295 | 1338 |
| Z0368 | 25 | NOB (CGFS) | GOV 36/49 | 23/09/2021 13:47:00 | 49.036400 | -3.967100 | 49.047600 | -3.935700 | 30 | 2594 | 85.0 | Y | 84524 | 8531 |
| Z0372 | 26 | WEC (CGFS) | GOV 36/49 | 24/09/2021 06:07:00 | 49.411400 | -3.765200 | 49.404600 | -3.790300 | 30 | 1965 | 122.0 | Y | 0 | 0 |
| Z0373 | 27 | WEC (CGFS) | GOV 36/49 | 24/09/2021 08:08:00 | 49.492600 | -3.495500 | 49.485200 | -3.522100 | 30 | 2094 | 118.0 | Y | 21730 | 1337 |
| Z0374 | 28 | SOE (CGFS) | GOV 36/49 | 24/09/2021 10:41:00 | 49.649500 | -3.316600 | 49.674000 | -3.296300 | 30 | 3090 | 73.0 | Y | 55946 | 3359 |
| Z0375 | 29 | WEC (CGFS) | GOV 36/49 | 24/09/2021 14:05:00 | 49.768200 | -3.790600 | 49.781400 | -3.761500 | 31 | 2547 | 73.0 | Y | 59083 | 3211 |
| Z0378 | 30 | SOE (CGFS) | GOV 36/49 | 25/09/2021 06:04:00 | 49.887000 | -3.275500 | 49.881500 | -3.311900 | 31 | 2675 | 71.0 | Y | 17452 | 1628 |
| Z0379 | 31 | CEC (CGFS) | GOV 36/49 | 25/09/2021 09:07:00 | 49.607000 | -2.818600 | 49.597500 | -2.843200 | 30 | 2067 | 74.0 | Y | 31861.83 | 2496.7216 |
| Z0380 | 32 | WEC (CGFS) | GOV 36/49 | 25/09/2021 12:09:00 | 49.476100 | -3.195900 | 49.461400 | -3.239500 | 30 | 3548 | 73.0 | Y | 103644 | 2650 |
| Z0381 | 33 | NOB (CGFS) | GOV 36/49 | 25/09/2021 15:15:00 | 49.358800 | -2.886600 | 49.344900 | -2.853100 | 30 | 2873 | 65.0 | Y | 63347 | 4185 |
| Z0383 | 34 | NOB (CGFS) | GOV 36/49 | 26/09/2021 06:12:00 | 49.073100 | -3.149100 | 49.067500 | -3.173500 | 30 | 1884 | 71.0 | Y | 8009 | 744 |
| Z0384 | 35 | NBG (CGFS) | GOV 36/49 | 26/09/2021 09:09:00 | 48.789200 | -2.620100 | 48.802200 | -2.658100 | 30 | 3139 | 40.0 | Y | 230963 | 2410 |
| Z0385 | 36 | NBG (CGFS) | GOV 36/49 | 26/09/2021 12:47:00 | 48.805900 | -2.405300 | 48.781300 | -2.405300 | 31 | 2730 | 39.0 | Y | 107351 | 5035 |

| Code station | Haul Number | Stratum | Gear | Date | ShootLat | ShootLong | HaulLat | HaulLong | Duration | Distance | Depth | Validity | Abond. NBRE/km² | Biom Kg/km² |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z0386 | 37 | NBG (CGFS) | GOV 36/49 | 26/09/2021 14:45:00 | 48.948700 | -2.566100 | 48.933100 | -2.538800 | 30 | 2642 | 42.0 | Y | 26271.19 | 1887.2453 |
| Z0389 | 38 | NBG (CGFS) | GOV 36/49 | 27/09/2021 06:07:00 | 49.339200 | -2.276300 | 49.345400 | -2.233400 | 30 | 3180 | 51.0 | Y | 228453 | 27169 |
| Z0390 | 39 | NBG (CGFS) | GOV 36/49 | 27/09/2021 08:06:00 | 49.555700 | -2.206200 | 49.585900 | -2.197100 | 31 | 3432 | 43.0 | Y | 40880 | 3447 |
| Z0391 | 40 | CEC (CGFS) | GOV 36/49 | 27/09/2021 12:50:00 | 49.969900 | -2.583200 | 49.960800 | -2.619000 | 30 | 2753 | 68.0 | Y | 161247 | 3938 |
| Z0395 | 41 | SOE (CGFS) | GOV 36/49 | 28/09/2021 06:08:00 | 50.097800 | -3.619700 | 50.110900 | -3.584600 | 30 | 2893 | 67.0 | Y | 368941.73 | 7980.9019 |
| Z0396 | 42 | SOE (CGFS) | GOV 36/49 | 28/09/2021 08:07:00 | 50.241500 | -3.279900 | 50.257000 | -3.242100 | 30 | 3194 | 61.0 | Y | 232051 | 7795 |
| Z0397 | 43 | SOE (CGFS) | GOV 36/49 | 28/09/2021 10:25:00 | 50.250800 | -2.932500 | 50.230700 | -2.954700 | 31 | 2736 | 61.0 | Y | 273520 | 4388 |
| Z0398 | 44 | SOE (CGFS) | GOV 36/49 | 28/09/2021 13:42:00 | 50.585700 | -2.819500 | 50.585900 | -2.863500 | 33 | 3118 | 33.0 | Y | 400169 | 7046 |
| Z0401 | 45 | CEC (CGFS) | GOV 36/49 | 29/09/2021 06:10:00 | 50.299100 | -2.173900 | 50.303100 | -2.139800 | 31 | 2455 | 55.0 | Y | 71920 | 4972 |
| Z0402 | 46 | CEC (CGFS) | GOV 36/49 | 29/09/2021 07:43:00 | 50.283800 | -1.952300 | 50.297600 | -1.921100 | 31 | 2700 | 52.0 | Y | 95849 | 2024 |
| Z0403 | 47 | CEC (CGFS) | GOV 36/49 | 29/09/2021 10:13:00 | 50.407300 | -1.634100 | 50.402600 | -1.669700 | 30 | 2571 | 38.0 | Y | 6254 | 426 |
| Z0404 | 48 | CEC (CGFS) | GOV 36/49 | 29/09/2021 12:58:00 | 50.149000 | -1.525900 | 50.149500 | -1.557000 | 31 | 2215 | 77.0 | Y | 12468.63 | 839.5032 |
| Z0407 | 49 | CEC (CGFS) | GOV 36/49 | 30/09/2021 06:07:00 | 49.975300 | -1.651900 | 49.973400 | -1.619600 | 30 | 2321 | 78.0 | Y | 6316 | 492 |
| Z0409 | 50 | CEC (CGFS) | GOV 36/49 | 30/09/2021 10:07:00 | 49.797400 | -1.608200 | 49.794500 | -1.571500 | 28 | 2655 | 58.0 | Y | 6359 | 1090 |

# ANNEXE 2 : Dominance of the top 20 fish species

## Eastern Channel

| Scientific name | Code_Rubin | Dominance in numbers |
|---|---|---|
| *Trachurus trachurus* | TRACTRA | 66.09% |
| *Scomber scombrus* | SCOMSCO | 13.08% |
| *Sardina pilchardus* | SARDPIL | 4.03% |
| *Loligo vulgaris* | LOLIVUL | 2.27% |
| *Sprattus sprattus* | SPRASPR | 2.25% |
| *Merlangius merlangus* | MERNMER | 1.70% |
| *Spondyliosoma cantharus* | SPONCAN | 1.03% |
| *Aequipecten opercularis* | AEQUOPE | 1.02% |
| *Clupea harengus* | CLUPHAR | 0.99% |
| *Trisopterus minutus* | TRISMIN | 0.94% |
| *Alloteuthis* | ALLO | 0.84% |
| *Trisopterus luscus* | TRISLUS | 0.70% |
| *Limanda limanda* | LIMDLIM | 0.56% |
| *Pleuronectes platessa* | PLEUPLA | 0.50% |
| *Scyliorhinus canicula* | SCYOCAN | 0.47% |
| *Echiichthys vipera* | ECITVIP | 0.42% |
| *Callionymus lyra* | CALMLYR | 0.42% |
| *Necora puber* | NECOPUB | 0.27% |
| *Buccinum undatum* | BUCCUND | 0.25% |
| *Mullus surmuletus* | MULLSUR | 0.25% |

| Scientific name | Code_Rubin | Dominance in weight |
|---|---|---|
| *Scomber scombrus* | SCOMSCO | 43.39% |
| *Trachurus trachurus* | TRACTRA | 19.07% |
| *Sardina pilchardus* | SARDPIL | 4.73% |
| *Scyliorhinus canicula* | SCYOCAN | 4.56% |
| *Raja clavata* | RAJACLA | 4.31% |
| *Merlangius merlangus* | MERNMER | 2.77% |
| *Trisopterus luscus* | TRISLUS | 2.71% |
| *Maja brachydactyla* | MAJABRA | 2.24% |
| *Mustelus asterias* | MUSTAST | 2.13% |
| *Loligo vulgaris* | LOLIVUL | 1.93% |
| *Rhizostoma pulmo* | RHISPUL | 1.61% |
| *Pleuronectes platessa* | PLEUPLA | 1.25% |
| *Spondyliosoma cantharus* | SPONCAN | 1.15% |
| *Limanda limanda* | LIMDLIM | 0.69% |
| *Raja undulata* | RAJAUND | 0.69% |
| *Raja brachyura* | RAJABRA | 0.65% |
| *Sepia officinalis* | SEPIOFF | 0.52% |
| *Conger conger* | CONGCON | 0.52% |
| *Dicentrarchus labrax* | DICELAB | 0.48% |
| *Scyliorhinus stellaris* | SCYOSTE | 0.41% |

## Western Channel

| Scientific name | Code_Rubin | Dominance in numbers |
|---|---|---|
| *Engraulis encrasicolus* | ENGRENC | 25.38% |
| *Capros aper* | CAPOAPE | 18.59% |
| *Trisopterus minutus* | TRISMIN | 16.80% |
| *Trachurus trachurus* | TRACTRA | 15.19% |
| *Sprattus sprattus* | SPRASPR | 8.68% |
| *Sardina pilchardus* | SARDPIL | 4.90% |
| *Merlangius merlangus* | MERNMER | 2.39% |
| *Loligo forbesii* | LOLIFOR | 2.32% |
| *Scomber scombrus* | SCOMSCO | 2.00% |
| *Loligo vulgaris* | LOLIVUL | 0.71% |
| *Alloteuthis* | ALLO | 0.60% |
| *Micromesistius poutassou* | MICMPOU | 0.32% |
| *Clupea harengus* | CLUPHAR | 0.26% |
| *Spondyliosoma cantharus* | SPONCAN | 0.22% |
| *Chelidonichthys cuculus* | CHELCUC | 0.21% |
| *Scyliorhinus canicula* | SCYOCAN | 0.18% |
| *Aequorea* | AEQO | 0.17% |
| *Gymnammodytes semisquamatus* | GYMASEM | 0.17% |
| *Trisopterus luscus* | TRISLUS | 0.14% |
| *Aequipecten opercularis* | AEQUOPE | 0.12% |
| *Todaropsis eblanae* | TODIEBL | 0.11% |

| Scientific name | Code_Rubin | Dominance in weight |
|---|---|---|
| *Trachurus trachurus* | TRACTRA | 19.52% |
| *Engraulis encrasicolus* | ENGRENC | 18.29% |
| *Capros aper* | CAPOAPE | 11.96% |
| *Trisopterus minutus* | TRISMIN | 8.08% |
| *Sardina pilchardus* | SARDPIL | 7.07% |
| *Merlangius merlangus* | MERNMER | 5.93% |
| *Scomber scombrus* | SCOMSCO | 4.10% |
| *Scyliorhinus canicula* | SCYOCAN | 3.25% |
| *Sprattus sprattus* | SPRASPR | 2.90% |
| *Trisopterus luscus* | TRISLUS | 2.63% |
| *Zeus faber* | ZEUSFAB | 1.81% |
| *Spondyliosoma cantharus* | SPONCAN | 1.74% |
| *Melanogrammus aeglefinus* | MELAAEG | 1.40% |
| *Chelidonichthys cuculus* | CHELCUC | 1.29% |
| *Loligo forbesii* | LOLIFOR | 1.18% |
| *Raja brachyura* | RAJABRA | 1.06% |
| *Conger conger* | CONGCON | 0.83% |
| *Micromesistius poutassou* | MICMPOU | 0.72% |
| *Lophius piscatorius* | LOPHPIS | 0.55% |
| *Dicentrarchus labrax* | DICELAB | 0.53% |
| *Scyliorhinus stellaris* | SCYOSTE | 0.48% |

# ANNEXE 3 : Percentage occurrences (>10%)

| Eastern Channel | |
|---|---|
| Scientific name | Occurence |
| Trachurus trachurus | 98.48% |
| Loligo vulgaris | 95.45% |
| Alloteuthis | 90.91% |
| Scyliorhinus canicula | 83.33% |
| Scomber scombrus | 81.82% |
| Sepia officinalis | 81.82% |
| Raja clavata | 78.79% |
| Buccinum undatum | 77.27% |
| Maja brachydactyla | 75.76% |
| Aequipecten opercularis | 72.73% |
| Callionymus lyra | 71.21% |
| Mullus surmuletus | 69.70% |
| Mustelus asterias | 69.70% |
| Zeus faber | 68.18% |
| Spondyliosoma cantharus | 66.67% |
| Sardina pilchardus | 65.15% |
| Chelidonichthys cuculus | 60.61% |
| Pleuronectes platessa | 57.58% |
| Trisopterus minutus | 54.55% |
| Solea solea | 50.00% |
| Chelidonichthys lucerna | 48.48% |
| Merlangius merlangus | 48.48% |
| Pecten maximus | 46.97% |
| Dicentrarchus labrax | 40.91% |
| Limanda limanda | 34.85% |
| Conger conger | 34.85% |
| Raja undulata | 34.85% |
| Loligo forbesii | 31.82% |
| Trigloporus lastoviza | 30.30% |
| Blennius ocellaris | 30.30% |
| Necora puber | 28.79% |
| Sepiola | 28.79% |
| Scyliorhinus stellaris | 27.27% |
| Echiichthys vipera | 22.73% |
| Engraulis encrasicolus | 22.73% |
| Platichthys flesus | 22.73% |
| Trisopterus luscus | 22.73% |
| Raja brachyura | 21.21% |
| Rhizostoma pulmo | 19.70% |
| Scophthalmus maximus | 19.70% |
| Buglossidium luteum | 19.70% |
| Hippocampus hippocampus | 19.70% |
| Cancer pagurus | 18.18% |
| Eutrigla gurnardus | 18.18% |
| Hyperoplus lanceolatus | 16.67% |
| Ostrea edulis | 16.67% |
| Sprattus sprattus | 16.67% |
| Trachinus draco | 15.15% |
| Microstomus kitt | 13.64% |
| Agonus cataphractus | 13.64% |
| Pomatoschistus | 13.64% |
| Clupea harengus | 12.12% |
| Lophius piscatorius | 12.12% |
| Aequorea | 12.12% |
| Arnoglossus laterna | 10.61% |
| Dasyatis tortonesei | 10.61% |
| Chrysaora hysoscella | 10.61% |

| Western Channel | |
|---|---|
| Scientific name | Occurence |
| Trachurus trachurus | 100.00% |
| Chelidonichthys cuculus | 92.00% |
| Trisopterus minutus | 90.00% |
| Alloteuthis | 88.00% |
| Scyliorhinus canicula | 88.00% |
| Loligo forbesii | 86.00% |
| Aequorea | 76.00% |
| Sardina pilchardus | 74.00% |
| Zeus faber | 70.00% |
| Scomber scombrus | 70.00% |
| Merlangius merlangus | 54.00% |
| Sprattus sprattus | 52.00% |
| Todaropsis eblanae | 50.00% |
| Capros aper | 48.00% |
| Micromesistius poutassou | 46.00% |
| Microstomus kitt | 42.00% |
| Engraulis encrasicolus | 40.00% |
| Conger conger | 40.00% |
| Illex coindetii | 38.00% |
| Trisopterus luscus | 38.00% |
| Lophius piscatorius | 32.00% |
| Merluccius merluccius | 32.00% |
| Spondyliosoma cantharus | 28.00% |
| Chrysaora hysoscella | 28.00% |
| Scyliorhinus stellaris | 26.00% |
| Aequipecten opercularis | 26.00% |
| Loligo vulgaris | 26.00% |
| Hyperoplus immaculatus | 26.00% |
| Eledone cirrhosa | 26.00% |
| Lepidorhombus whiffiagonis | 24.00% |
| Eutrigla gurnardus | 24.00% |
| Callionymus lyra | 24.00% |
| Melanogrammus aeglefinus | 24.00% |
| Raja undulata | 20.00% |
| Microchirus variegatus | 18.00% |
| Arnoglossus imperialis | 18.00% |
| Galeorhinus galeus | 16.00% |
| Sepia officinalis | 16.00% |
| Dicentrarchus labrax | 16.00% |
| Maja brachydactyla | 16.00% |
| Raja brachyura | 16.00% |
| Pecten maximus | 16.00% |
| Mullus surmuletus | 14.00% |
| Chelidonichthys lucerna | 14.00% |
| Cancer pagurus | 14.00% |
| Mustelus asterias | 12.00% |
| Pleuronectes platessa | 12.00% |
| Raja clavata | 10.00% |
| Limanda limanda | 10.00% |
| Echiichthys vipera | 10.00% |
| Hyperoplus lanceolatus | 10.00% |
| Ctenolabrus rupestris | 10.00% |

# ANNEXE 4 : Summary table of works

## Hydrological samples

| Gear | Number | | Application |
|---|---|---|---|
| | Western Channel | Eastern Channel | |
| **Manta** | 20 | 19 | Microplastics DCSMM |
| **WP2** | 71 | 142 | Food chain, zooplankton abundance |
| **Niskin à la surface** | 24 (+ 37 RECCRU) | 21 | Total chlorophyll, TSS, nutrient salts, phytoplanktonic flora, food web (isotopy) |
| **SBE** | 68 | 76 | Temperature, salinity, pH, Fluorescence, Par (irradiance), Oxygen, Turbidity, depth |
| **MIK** | 40 | | Phylosome sampling (greater slipper lobster and crayfish larvae) |

## Trawling and sampling stations to support research programmes

| Gear | Number | | Application |
|---|---|---|---|
| | Western Channel | Eastern Channel | |
| **Trawl station** | 50 + 8 Scraper test | 72 dont 6 invalid et 2 cancelled | |
| **Otholiths** | 885 | 1221 | Production of age abundance indices |
| **Measurement** | 21165 | 25366 | |
| **APECS** | | 273 | 245 Tagging of M*ustellus asterias*, 6 *Mustelus sp*, 9 *Raja clavata* et 13 *Galeorhinus galeus* |
| **Samples ANSES** | | Sampling of sole, sea bass and their prey | Evaluation of contaminants in the food web of sea bass and sole |
| **IUEM** | 1000 Poor cod 100 Pout, | | Student training |
| **FORESEA - Sardines** | 140 sardines | 115 sardines | Sampling of sardine muscles |
| **Genetic FORESEA** | 18 species | | Genetic diversity analysis (high-throughput sequencing), multi-species |
| **Sample maturity** | | Samples and photos | Histological section for the determination of the stages of maturity |
| **DEFIPEL** | 2 échantillons | 2 échantillons | |
| **photos V.Badts** | Scomber scombrus 150 R/V<br>Trachurus trachurus 150 R/V<br>Trisopterus luscus 50 R/V<br>Sardina pilchardus 150 R/V | | Provide reference images to develop a taxon recognition algorithm |
| **Sample seal prey** | | Sampling in the Seine Bay and Somme Bay | |

## Bathymetric acquisitions :

| Gear | Number | | Application |
|---|---|---|---|
| | Western Channel | Eastern Channel | |
| **Sounder ME70 et 2040** | 12 | 12 | Development of physical models description of the background |

## Monitoring MEGASCOPE :

| Type of observation | Number | |
|---|---|---|
| | Western Channel | Eastern Channel |
| **Human activity** | 315 | 247 |
| **> Fishing buoy** | 41 | 57 |
| **> Boat** | 189 | 117 |
| **> Waste** | 84 | 71 |
| **> Other activity** | 1 | 2 |
| **Marine mammal** | 47 | 5 |
| **Marine bird** | 732 | 1 736 |
| **Land bird** | 17 | 120 |
| **Other megafauna species (tuna, elasmobranchs...)** | 47 | 7 |
| **Dead individual (bird or mammal)** | 1 | 1 |
| **Other** | 2 | - |

# Suivi de la distribution de la mégafaune marine en Manche

## MEGASCOPE

Campagnes CGFS

Bilan de campagne 2021

Ariane Blanchard
Thierry Sanchez
Ghislain Dorémus

Observateurs :
Vincent Bretille
Hervé Lormée

Novembre 2021

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## Effort et conditions d'observation

La campagne s'est déroulée du 17 septembre au 17 octobre et a été répartie sur 2 legs d'échantillonnage. Le transit de Boulogne à Brest réalisé du 18 au 20 octobre a complété la campagne.

Le protocole standard au cours duquel s'enchainent l'effort d'observation en prospection et les relevés pendant les manœuvres a été suivi au cours de 156 heures pour 32 jours en mer.

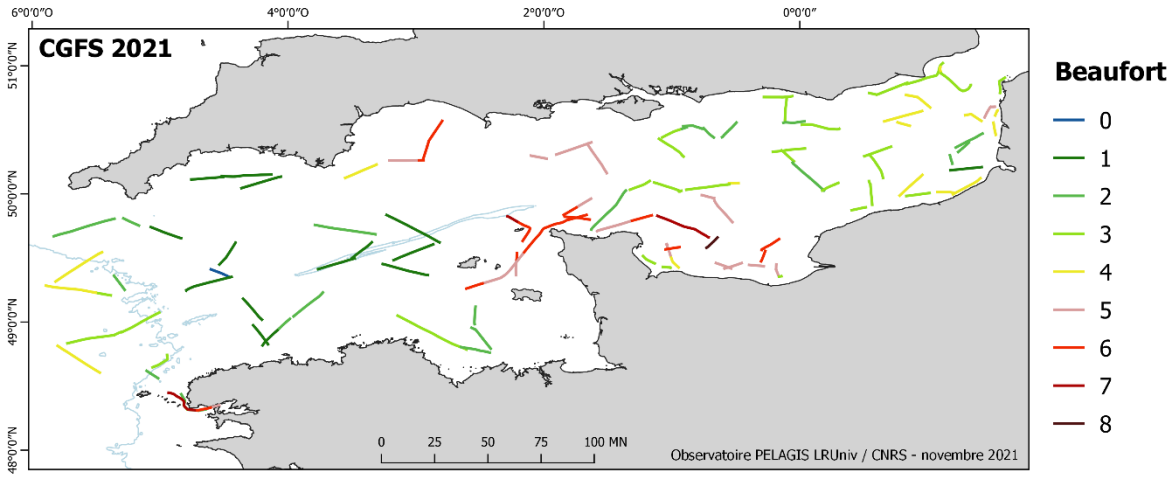



*Figure 1 : Surface parcourue en effort d'observation et conditions*

L'effort de prospection selon le protocole standardisé totalise 103 heures d'observation passées sur le pont avant, soit en moyenne 3,2 heures par jour. Les relevés « suiveurs » lors des opérations de chalutage représente quant à eux environ 53 heures d'observation.

Les conditions rencontrées sur l'ensemble de la campagne sont apparues favorables à la détection un peu plus de la moitié du temps. Elles ont ainsi permis d'exercer 60% de l'effort avec un état de la mer inférieur ou égal à 3 Beaufort.

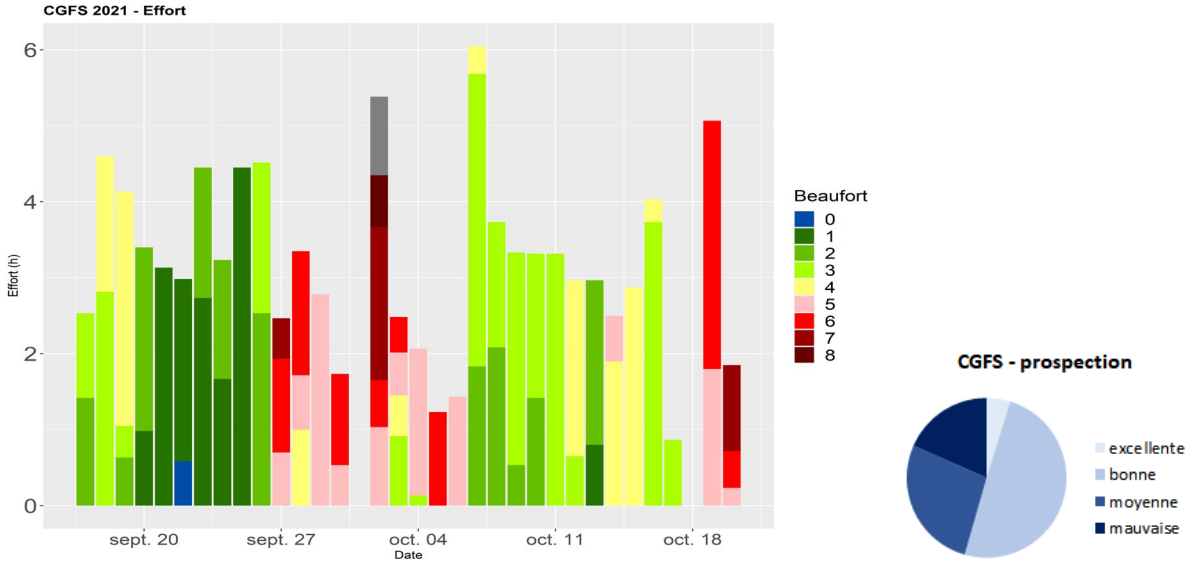



*Figure 2 : Temps d'effort d'observation avec états de la mer rencontrés (en Beaufort) et conditions estimées par les observateurs*

## Données relevées au cours de CGFS 2021

Le total des observations recueillies s'élève à 3 277 tous taxons confondus et en effort, c'est-à-dire strictement pendant les périodes de prospections en conditions standardisées, et 175 hors protocole standardisé (tableau 1).

*Tableau 1 :* Nombre d'observations réalisées en effort

| Catégories | Manche Ouest | Manche Est | Total |
|---|---|---|---|
| Activité humaine | 315 (336) | 247 (272) | 562 (608) |
| > Bouée de pêche | 41 (43) | 57 (59) | 98 (102) |
| > Bateau | 189 (200) | 117 (139) | 306 (339) |
| > Déchet | 84 (92) | 71 (72) | 155 (164) |
| > Autre activité | 1 (1) | 2 (2) | 3 (3) |
| Mammifère marin | 47 (336) | 5 (5) | 52 (341) |
| Oiseau marin | 732 (4 559) | 1 736 (11 464) | 2 468 (16 023) |
| Oiseau terrestre | 17 (50) | 120 (1 020) | 137 (1 070) |
| Autres espèces de mégafaune (thoni élasmobranches…) | 47 (2 971) | 7 (10) | 54 (2 981) |
| Individu mort (oiseau ou mammifère | 1 (1) | 1 (1) | 2 (2) |
| Autre | 2 (2) | - | 2 (2) |
| **Total** | **1 161 (8 255)** | **2 116 (12 772)** | **3 277 (21 027)** |

* nombre d'observations et entre parenthèses nombre d'individus

Les relevés suiveurs représentent quant à eux 999 observations mais avec potentiellement les mêmes individus d'une opération à l'autre (tableau 2). Peu de relevés ont été effectués lors des filages. La raison étant que cette opération apparait moins pertinente lors des dernières analyses.

*Tableau 2 :* Nombre de points de relevés de suiveurs

| Catégories | Manche Ouest | Manche Est | Total |
|---|---|---|---|
| Virage | 110 | 316 | 426 |
| Rejets | 153 | 348 | 501 |
| En transit | 31 | 37 | 68 |

Globalement, les observations d'oiseaux marins restent largement supérieures en nombre et se distribuent sur toute la zone échantillonnée (figure 4). Ce sont surtout les fous de Bassan et diverses espèces goélands qui dominent ces observations. La cinquantaine d'observation de mammifères marins est majoritairement située en Manche Ouest bien que quelques petits cétacés ou pinnipèdes figurent vers le détroit du Pas-de-Calais (figure 3). Les autres espèces de mégafaune remarquées sont surtout les thonidés avec 39 observations principalement localisées en Manche Ouest. Concernant les activités humaines, les navires de transport de marchandises et de pêche sont très présents ainsi que les macrodéchets.

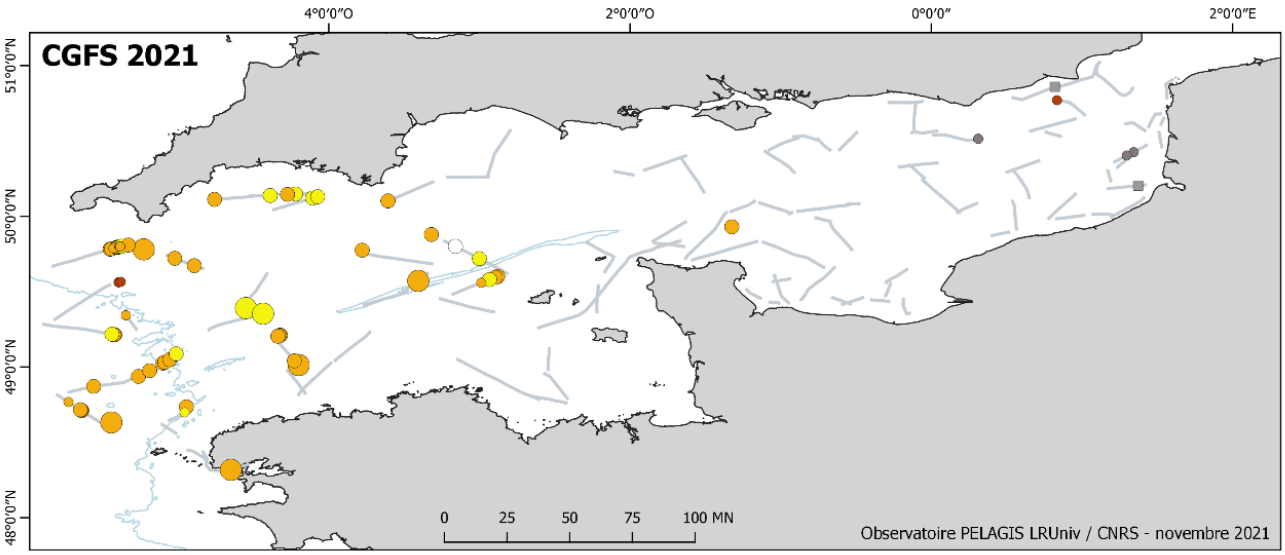



*Figure 3 : Distribution de toutes les observations de mammifères marins (en effort et hors effort)*

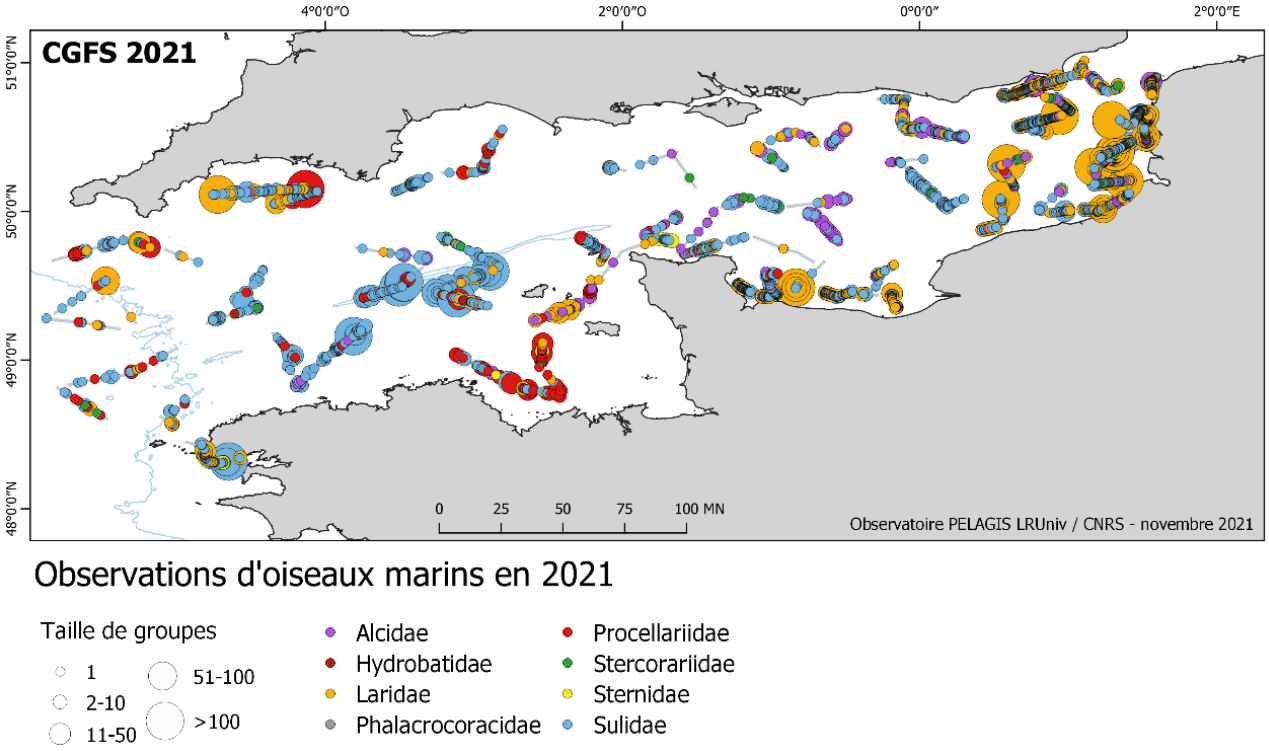
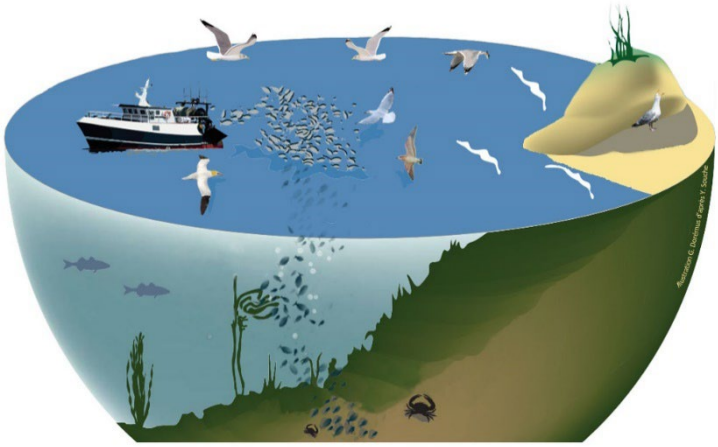



*Figure 4 : Distribution des observations d'oiseaux marins en effort d'observation*

N.B. : ce rapport est un descriptif rapide de relevés sur oiseaux suiveurs ainsi que de l'expérimentation sur leur sélectivité vis-à-vis des rejets de pêche réalisés lors de la campagne CGFS 2020. Il présente également les premiers résultats bruts. Projet DREAM – description et objectif

# Projet DREAM* : Volet prédation Aviaire

*Devenir des Rejets de l'Air au fond de la Mer



## Rapport expérimentation et relevés des oiseaux suiveurs sur rejets de pêche – CGFS 2021

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Novembre 2021

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## Rapport expérimentation et relevés des oiseaux suiveurs sur la campagne halieutique CGFS 2020

*Ce rapport est un descriptif rapide de relevés sur oiseaux suiveurs ainsi que de l'expérimentation sur leur sélectivité vis-à-vis des rejets de pêche réalisés lors de la campagne CGFS 2021. Il présente également les premiers résultats bruts.*

# 1. Projet DREAM – description et objectif

Le projet DREAM (Devenir des Rejets de l'Air au fond de la Mer) a pour objectif de comprendre le devenir des rejets d'espèces commerciales et non commerciales, dans l'écosystème marin. Le devenir des rejets va suivre un processus compartimenté : le traitement des rejets à bord, la prédation aviaire, le devenir dans la colonne d'eau, ainsi que la prédation par les nécrophages dans le fond. Le volet oiseaux marins (i.e. prédation aviaire) vise à comprendre et chiffrer la quantité de poissons consommée lors de rejets en mer afin d'en déduire la quantité non prélevée qui retourne dans la colonne d'eau.

Afin d'estimer la part de rejet consommée par les oiseaux, un modèle de consommation a été développé. Ce modèle inclut différents paramètres répartis dans deux compartiments relatifs aux rejets (i.e. biomasse rejetée et composition) et au floc d'oiseaux suiveurs (i.e. composition spécifique, nombre d'oiseaux, régime alimentaire, nombre de prises / satiété par évènement rejet). Si les données relatives à la composition des rejets sont disponibles à la fin des campagnes, les différents paramètres concernant les oiseaux suiveurs sont à évaluer. C'est pourquoi, différents types de suivis sur le comportement alimentaire des oiseaux suiveurs ainsi qu'une expérimentation sur la sélectivité des rejets ont été développés afin de pouvoir être réalisés lors de la campagne CGFS.

Cette étude vise principalement les fous de Bassan et les grands laridés (i.e. goélands brun, argenté, leucophée et marin), car l'ensemble de ces espèces compose près de 70% des groupes d'oiseaux suiveurs présents lors des rejets.

## 2. Relevés oiseaux suiveurs – rejets salle de tri

Des relevés sur les oiseaux suiveurs lors d'évènements de rejets de la salle de tri ont été réalisés afin d'obtenir des informations sur le comportement alimentaire de ces espèces.

Les données récoltées serviront à compléter les informations inexistantes dans la littérature pour le modèle bayésien de consommation.

Pour chaque évènement de rejets, trois types de relevés ont été réalisés :

- Dénombrement global du groupe d'oiseaux suiveurs et identification des espèces présentes (ce relevé a été réalisé par les observateurs Megascope relevant les mammifères marins et oiseaux de mer présents en passerelle. Il ne sera pas présenté dans ce rapport).
- Quadrat afin d'évaluer le nombre de captures par espèce. Ce type de relevé a été réalisé à l'aide d'une caméra fixée à différents endroits sur le flanc bâbord du bateau et a eu pour objectif de filmer les interactions oiseaux - rejets.
- Suivis focaux permettant de mesurer le temps entre deux prises alimentaires. Ces suivis ont été réalisés sur le spardeck bâbord afin d'avoir le plus grand champ de vision possible sur les interactions entre les oiseaux et les rejets.

### Résultats

Au total ce sont près de 51 suivis qui ont été réalisés, 11 au moment des rejets en continu (i.e. rejets de sous-échantillonnage du contenu du chalut) et 38 lors de rejets concentrés (i.e. rejets réalisés en fin de tri). Un autre suivi a également été réalisé lors de rejets de godaille réalisés par les marins. Sur ces 51 suivis, il y en a eu 22 sans oiseaux suiveurs, 6 où les oiseaux étaient trop loin pour faire des focales et 1 où les oiseaux n'étaient pas intéressés. Seulement 14 de ces suivis nous ont permis de faire des focales.

- Quadrat

Sur ces 51 suivis, ce sont 49 vidéos qui ont été réalisées. Leurs durées varient de 45sec à 15min, correspondant respectivement à des suivis sur rejets concentrés (*i.e.* rejets de fin de tri) et sur rejets éparses (*i.e.* rejets en continu de sous échantillonnage). Ces vidéos seront analysées afin de relever les informations telles que le nombre d'oiseaux venant se nourrir sur les rejets et réalisant des prises alimentaires.

- Focales

Ce sont 43 focales pour les deux groupes d'espèces qui ont été réalisées, 12 pour les fous de Bassan et 31 pour les grands laridés (18 focales sur des adultes et 13 sur des juvéniles). De par la mobilité des oiseaux et du navire, le fait de mesurer le temps entre deux prises alimentaires n'a pas été simple. De plus, des focales avec un plus large panel de comportements suite à la première prise ont été réalisées (Tableau 1).

*Tableau 1: Distribution des différents types de focales obtenues pour les fous de Bassan et les grands laridés*

| Type de focales | Fou de Bassan | Grands laridés |
|---|---|---|
| Succès - succès | 25 | 24 |
| Succès – reste sur bord du flock | 2 | 16 |
| Succès – hors champ | 5 | 5 |
| Succès – lâche sa prise | 0 | 5 |

Quatre types majeurs de focales ont ainsi été réalisés incluant 1) des focales entre deux prises alimentaires (*i.e.* succès – succès) ; 2) suite à la première prise, l'animal se pose sur l'eau ou reste en vol sur le bord du flock (*i.e.* succès – reste sur bord du flock) ; 3) suite à la première prise, l'individu sortait du champ de vision en

passant de l'autre côté du bateau ou à l'avant (*i.e.* succès – hors champ) ; 4) suite à la première prise, l'animal relâche sa prise.

Le nombre de focales réalisées pour chaque cas et chaque groupe d'oiseaux est présenté dans le tableau 1. Le temps moyen entre deux prises alimentaires (succès – succès) pour les fous de bassan était de 24 secondes, pour des tailles de poisson de 15cm en moyenne ; et de 33 et 28 secondes pour respectivement les adultes et juvéniles de grands laridés, avec des tailles de prises de 10 cm en moyenne.

Cette année, le nombre de relevés et de focales et bien inférieur à ceux de l'année précédente, lors de la campagne 2020. Ces suivis ont été réalisées sur le leg 1 de CGFS qui couvrait uniquement la Manche Ouest et non sur l'ensemble de la Manche. La diversité et le nombre d'oiseaux observés en Manche Ouest est beaucoup plus faible qu'en Manche Est (i.e. deuxième leg). Cependant, le fait que les effectifs soient moins importants dans les flocks d'oiseaux observés, nous a permis de mettre en évidence un comportement de foraging sur les rejets des juvéniles de grands laridés ce qui est non négligeable pour les modèles. Les juvéniles peuvent rester un moment à voler au-dessus des rejets avant qu'un individu ne se décide à prendre un poisson, les autres adoptant par la suite un comportement de cleptoparasitisme. Il semblerait donc que les juvéniles observés lors des rejets, n'aient pas complètement acquis leur comportement autonome de foraging. Cette nouvelle information, importante va être inclue dans le modèle. Ainsi nous traiterons les grands laridés adultes et juvéniles séparément (index de succès de prises).

## 3. Sélectivité sur les rejets

Les objectifs de cette partie sont d'évaluer les préférences alimentaires des grands laridés et fous de Bassan ainsi que d'évaluer le comportement alimentaire de ces espèces, en fonction de l'ordre du type de poisson rejeté.

Une classification de rejets a été réalisée en 3 catégories, suivant la taille et la forme, représentant ainsi pour chacune des classes un degré d'appétence différent pour les oiseaux. C'est trois catégories sont :

- Classe 1 : cette classe représente un fort degré d'appétence et inclut tout poisson rond (sans épine dorsale) et céphalopode (manteau) mesurant moins de 20 cm.

- Classe 2 : cette classe représente un degré d'appétence moyen et inclut tout poisson rond (sans épine dorsale) et céphalopode mesurant entre 20 et 30 cm ; ainsi que tout poisson plat et poisson rond avec épine dorsale (*e.g.* sarzotin) mesurant moins de 30 cm.

- Classe 3 : cette classe représente un faible degré d'appétence et inclut tout poisson et céphalopode de plus de 30 cm.

L'expérimentation vise à jeter le contenu de 3 caisses, chacune contenant des poissons et/ou céphalopodes correspondant à l'une de ces classes, et faire varier l'ordre de rejet au fur et à mesure des expérimentations.

Le contenu des caisses est réalisé avec des poissons et céphalopodes obtenus lors des différentes opérations de chalutage. La composition de chaque caisse ainsi que le poids sont relevés. Afin de pourvoir réaliser ces manipulations dans des conditions optimales, certains critères étaient requis :

Le contenu des caisses doit être le plus frais possible (la fraîcheur pouvant influencer la flottabilité)

Réalisation des manipulations de préférence le matin, car l'appétit des oiseaux est plus important en début de journée

Le bateau soit à l'arrêt ou en route à vitesse réduite (<4 nœuds), permettant la réalisation après les opérations de chalutages (i.e. virage) ou pendant les stations.

Ne pas avoir de rejets de la salle de tri en même temps afin d'éviter de biaiser le comportement alimentaire des oiseaux.

*Figure 1: Représentation photographique de l'expérimentation sur la sélectivité*

Cette expérimentation est réalisée au niveau du spardeck tribord et requière trois personnes. Deux personnes sont postées sous la plateforme, l'une devant jeter le contenu des caisses et la seconde prendre des vidéos (qui seront ensuite analysées afin de relever différents critères, notamment le nombre de prises et le nombre de tentatives) ; une troisième personne est postée sur le spardeck afin d'évaluer le comportement alimentaire des oiseaux et plus particulièrement le degré de frénésie des oiseaux.

## Résultats

Cette expérimentation a pu être réalisée qu'une seule fois. En effet les mauvaises conditions météo la deuxième semaine, associées au nombre d'oiseaux ainsi qu'à l'éblouissement trop important à l'arrière du bateau le soir, ne nous ont pas permis de réitérer la manip.

Lors de l'expérimentation, les caisses ont été rejetés dans l'ordre décroissant d'appétence (*i.e*. classe 1, classe 2, et classe 3). Une quinzaine de grands laridés a été observé au début de l'expérimentation pour atteindre 30 individus à la fin. Un degré de frénésie a été observé tout au long du rejets du contenu des caisses. Cependant, le contenu des caisses s'est rapidement retrouvé en subsurface pour une partie et a coulé pour l'autre, rendant ainsi les poissons inaccessibles pour les goélands, puisqu'ils se nourrissent majoritairement en surface.

# 4. Flottabilité des rejets

Les résultats de l'unique expérimentation de sélectivité ont mis en évidence l'importance de la flottabilité des rejets. En effet, la flottabilité reflète l'accessibilité des rejets aux oiseaux suiveurs, en particulier pour les grands laridés qui se nourrissent en surface, tandis que les fous de Bassan se nourrissent également en subsurface. Aucune information relative à la flottabilité des poissons en surface n'est renseignée dans la littérature. C'est pourquoi, lors de ce premier leg, nous nous sommes également intéressés à ce paramètre. Deux expérimentations ont été réalisés à partir du pont arrière prenant en compte différentes espèces de poissons et différentes tailles. Ces expérimentations ont été réalisées avec une vitesse de navigation inférieure à 4 nœuds. Cependant, les observations obtenues ne sont pas exploitables puisque les poissons ont coulé directement.

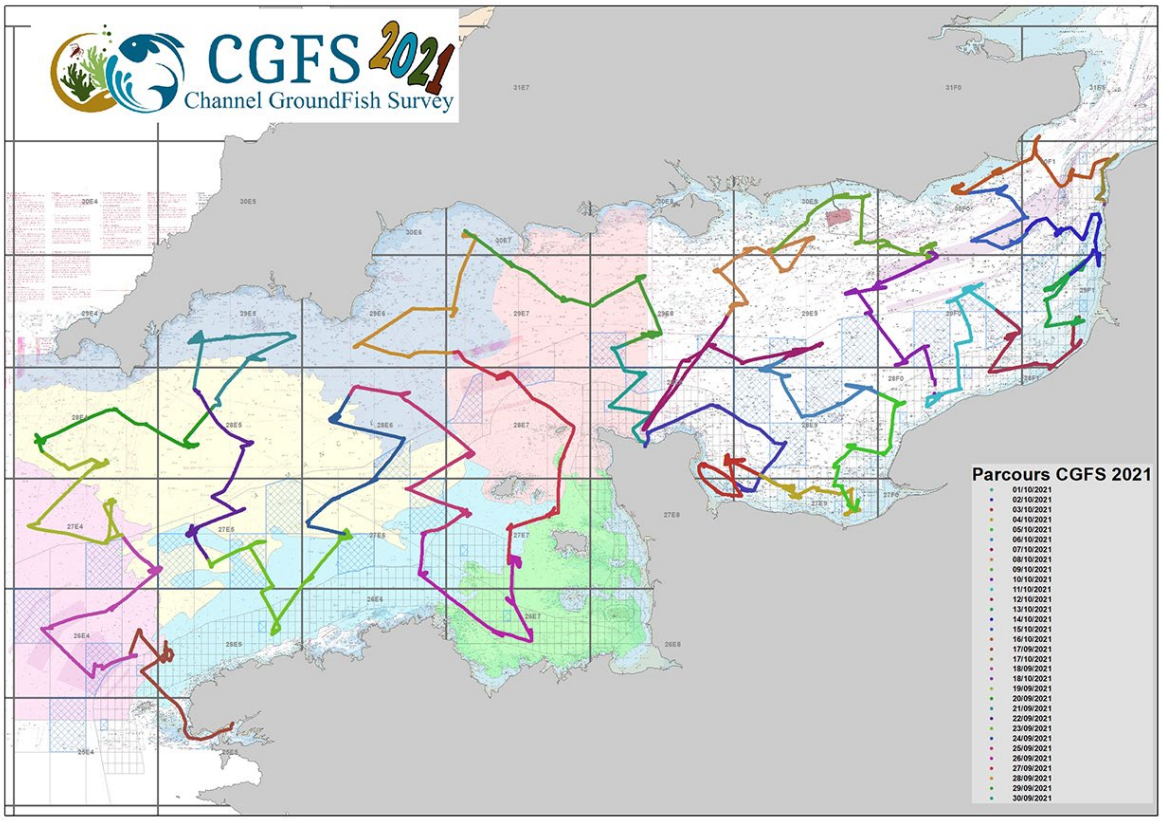
Il est à en tirer principalement que la profondeur du chalutage semble jouer un rôle dans la flottabilité des rejets. Les vidéos prises dans le cadre des relevés par quadrats serviront également à évaluer la flottabilité des poissons en associant les résultats à la profondeur du trait de chalut correspondant à l'évènement rejets.

# 5. Conclusion

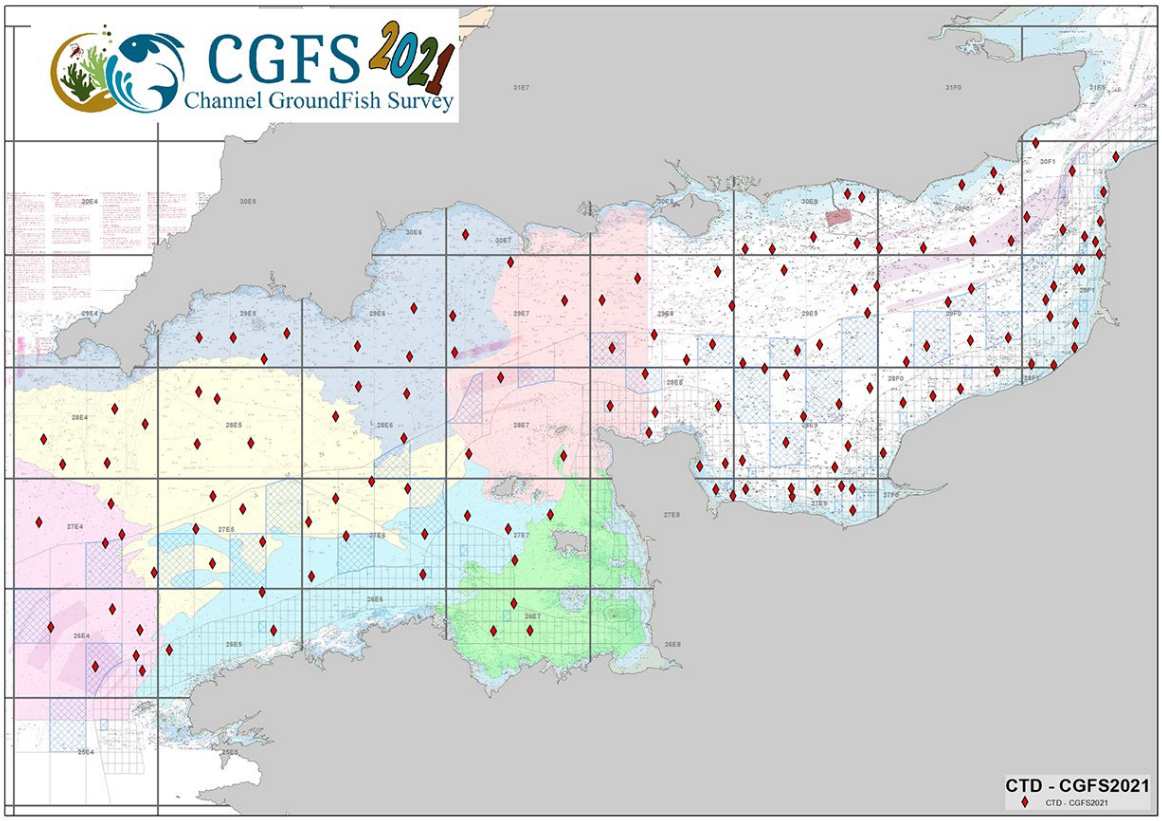
Les données récoltées lors de cette campagne seront intégrées dans le modèle de consommation dans les prochains mois. Elles complèteront également celles récoltées l'année dernière lors de la campagne CGFS en Manche, et EVHOE dans le Golfe de Gascogne. Le nombre de focales est moins nombreux que l'année dernière, et la réalisation de l'expérimentation de sélectivité a été plus difficile à cause des conditions météo. Cependant, les suivis de l'année précédente ont pu être réalisés sur les deux leg, couvrant ainsi l'ensemble de la Manche. La majorité des focales et des expérimentations sur la sélectivité avaient été réalisées en Manche Est, puisque le nombre d'oiseaux observés (et donc ceux venant interagir avec les rejets) sont beaucoup moins nombreux en Manche Ouest. Cependant, cela a permis de relever certaines zones d'ombre, comme la flottabilité et la différence de comportement de foraging sur les rejets entre les goélands adultes et les juvéniles. Ces derniers seront ainsi traités séparément dans le modèle de consommation.

# Annexe 6 : Maps of the samplings carried out

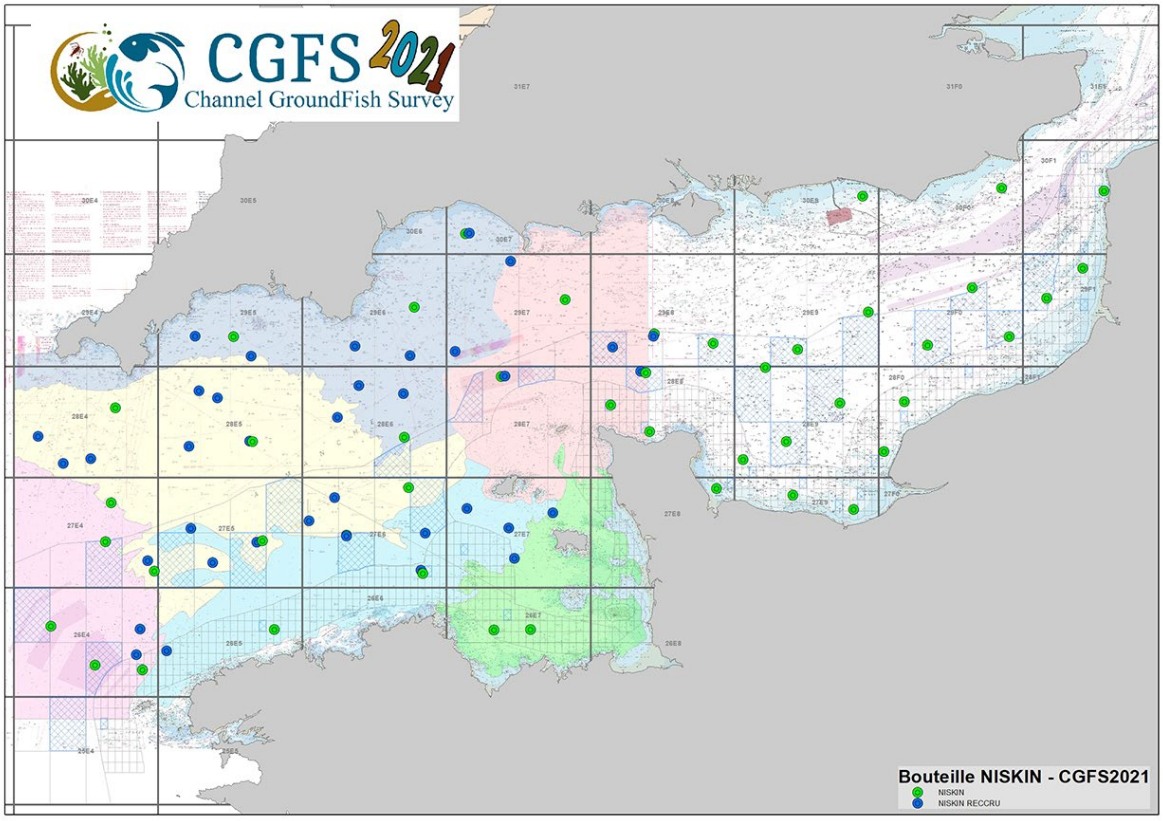
Course of the CGFS 2021 campaign



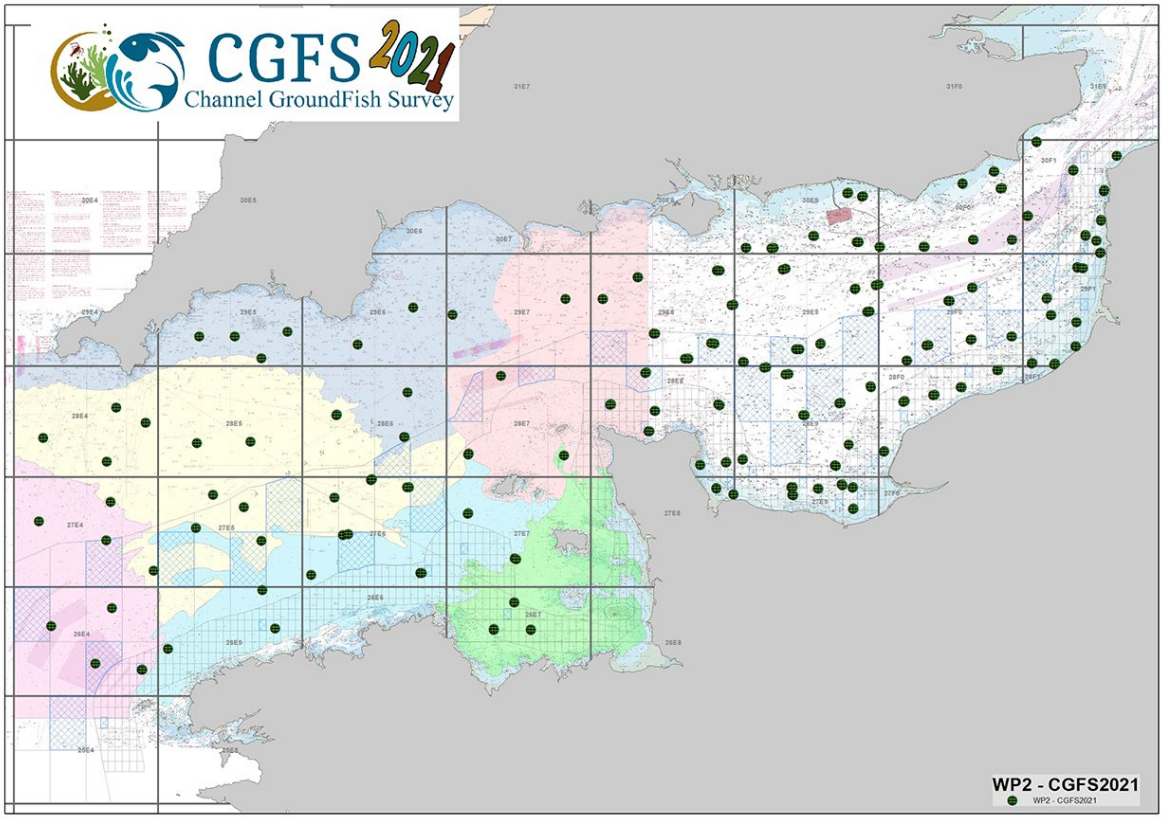

Distribution of CTD profiles



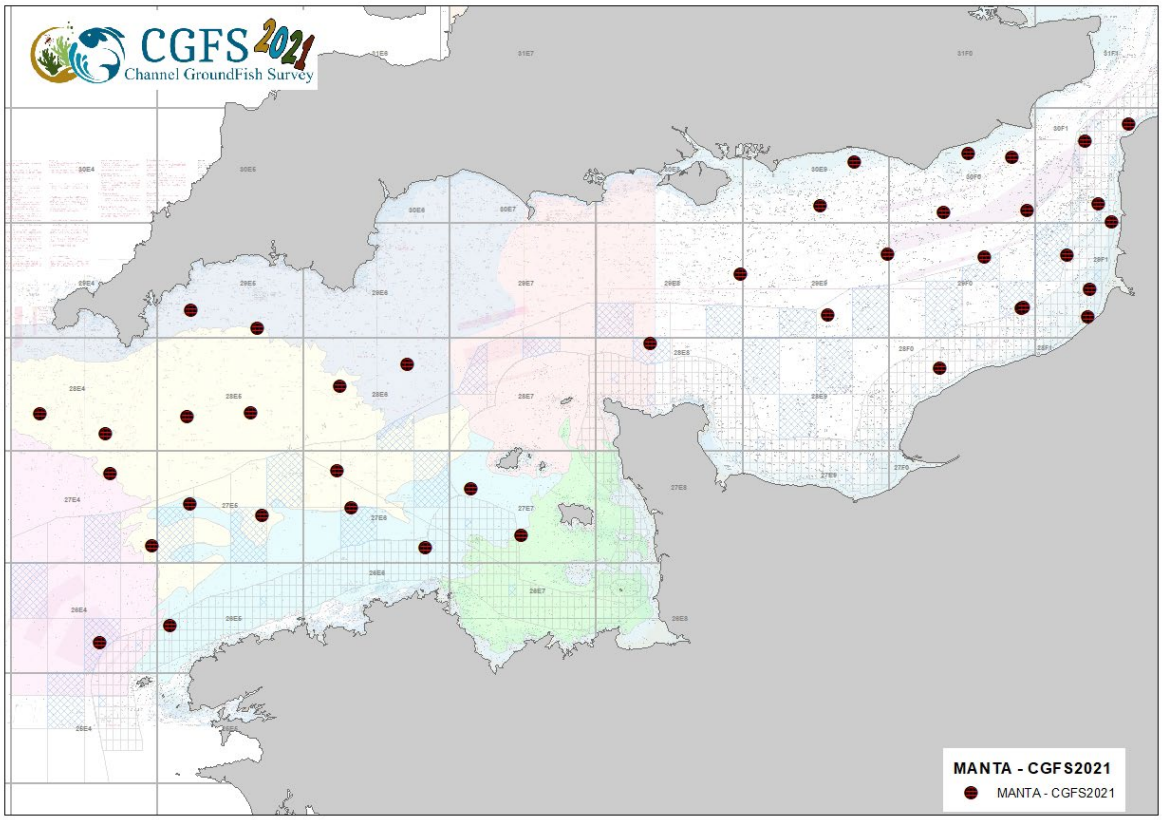
Sampling of NISKIN bottles on the surface



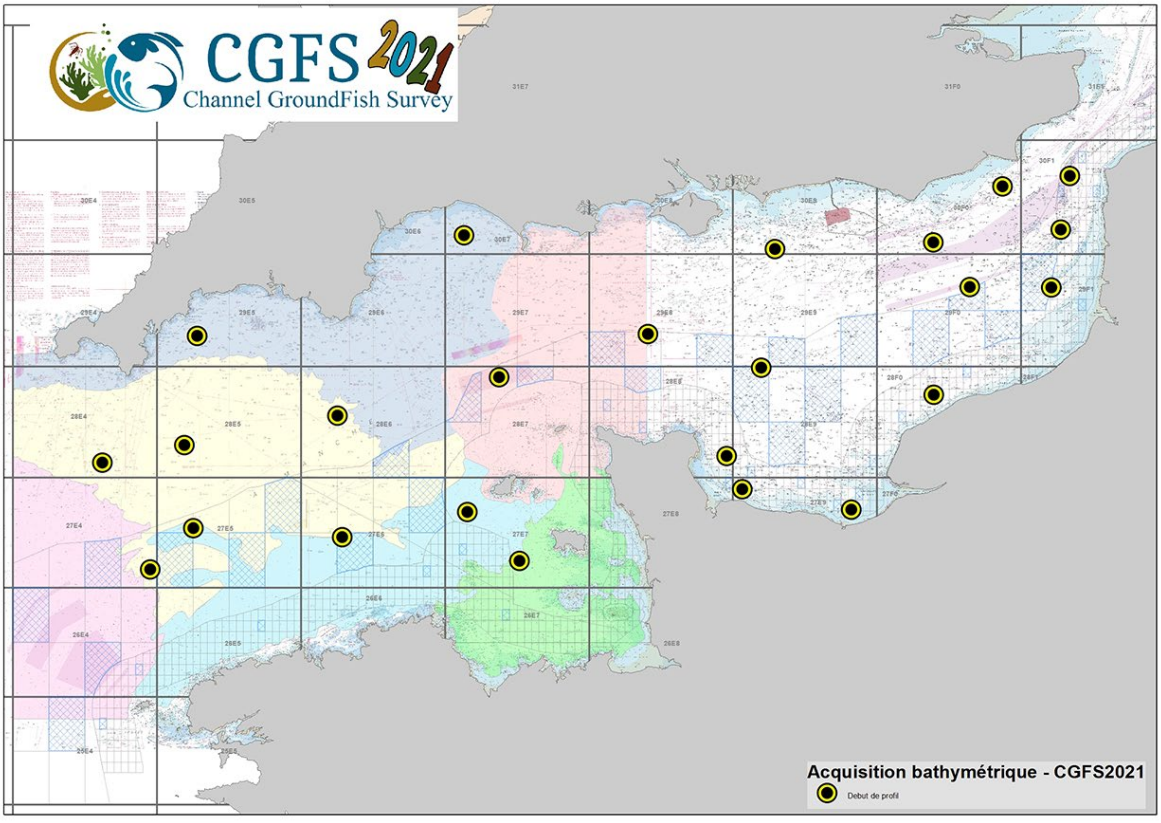

Net sampling WP2



MANTA net sampling for microplastics




Multibeam bathymetric acquisitions



# Annexe 7 : France – East English Channel Quarter 4 FRCGFS

| Nation: | **France** | Vessel: | THALASSA II |
|---|---|---|---|
| Survey: | CGFS2021 | Dates: | THALASSA II: 16/09/2021 to 18/10/2021 |

| | |
|---|---|
| Cruise | As from 2018 France sampled both the Eastern (7d) and Western (7e) English Channel. Currently only data from the Eastern French English Channel Q4 survey is submitted to DATRAS. Trawling w carried out during the day. CTD was deployed at each trawl station to collect temperature and salinity profiles. Age data were collected for 12 species. |
| Gear details: | The gear used for the Eastern English Channel is the standard GOV 36/47 with ground gear modified for CGFS (bobbins Ø 250 mm) with Marport sensors to record doors, wings and vertical openning parameters. |
| Notes from survey (e.g. problems, additional wo etc.): | This year we did not have any problems with work permits in UK waters and were therefore able to carry out all the sampling originally planned.<br>The Thalassa left Cherbourg on 2 October and the eastern Channel was covered by 72 GOV trawl stations. Of these stations, 66 were validated as we had damage to 4 trawls and 2 trawls were clogged by brittle stars (Ophiura fragilis). We had to cancel 2 stations of the initial sampling plan of 74 trawls, due to the presence of professional equipment in the area.<br><br>*Additional works* :<br>- The CUFES device (Continuous Underwater Fish Egg Sampler) was used during all the survey (day and night) and samples were scanned on board.<br>- Plancton samples were collected for analysis on the planktonic foodweb structure (110 stations with a plankton net (20µm), WP2 and Fluoroprobe)<br>- Microplastic was collected with a Manta net<br>- Observers for mammals and birds information was collected throut out the survey. |
| Number of fish species recorded and notes on rare species or unusual catches: | 60 different fish's species were recorded (sharks and rays included). Cephalopods and shellfish w also measured and benthic fauna identified within each haul. |

## Stations fished

| ICES | Divisi | Strata | Gear | Tows planned | Valid | Invalid | % stations fished | comments |
|---|---|---|---|---|---|---|---|---|
| **VIId** | | **ICES squares** | **GOV** | **74** | **66** | **6** | **89%** | |
| | | TOTAL (GOV) | | 66/74 | | | | |

## Number of biological samples (weight, maturity and age material (otoliths):

| Species | Age | Species | Age |
|---|---|---|---|
| *Merlangus merlangius* | **605**<br>244(7D) – 361 (7E) | *Gadus morhua* | **0**<br>0 (7D) – 0 (7E) |
| *Mullus surmuletus* | **143**<br>129 (7D) – 14 (7E) | *Dicentrarchus labrax* | **188**<br>130 (7D) – 58 (7E) |
| *Pleuronnectes platessa* | **312**<br>295 (7D) – 17 (7E) | *Chelidonichthys cuculus* | **226**<br>108 (7D) – 118 (7E) |
| *Trisopterus luscus* | **173**<br>95 (7D) – 78 (7E) | *Solea Solea* | **200**<br>199 (7D) – 1 (7E) |
| *Melanogrammus aeglefinus* | **235** (7E) | *Scophthalmus maximus* | **16**<br>15 (7D) – 1 (7E) |
| *Pollachius pollachius* | **2** (7E) | *Scophthalmus rhombus* | **6** (7D) |

### Thalassa: GOV hauls FRCGFS-Q4