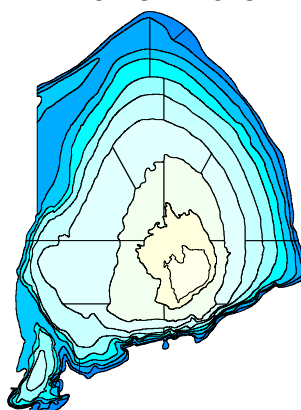


THE EU FLEMISH CAP SURVEY IN DIV. 3M OF NAFO REGULATORY AREA

FLEMISH CAP 2023



ABSTRACT

The proposed survey is the thirty-six of the fisheries research surveys series on the Flemish Cap bank started in 1988, and cofinanced by the EU through the European Maritime, Fisheries and Aquaculture Fund (EMFA), within the National Program data collection, management and use of the fisheries sector and support for scientific advice in relation to the common fisheries policy. The participating institutes are the *Spanish Institut of Oceanography (IEO-CSIC)*, the *Institut of Marine Research (IIM-CSIC)* and the Portuguese Institute for Sea and Atmosphere (IPMA).

The survey, as in previous years, is designed as a stratified random design of bottom trawl hauls, and its objective is to estimate the abundance of demersal fish stocks and to analyze the demographic structure and several biological parameters of the most important species. The area to be surveyed will be the Flemish Cap bank (NAFO 3M Division), up to 1460 meters deep, with a maximum of 181 hauls carried out throughout the area.

The survey will be carried out on board the RV Vizconde de Eza on the following dates:

- 3rd July: Arrival RV Vizconde de Eza to St. John's.
- 4th July: Scientific team replacement and departure from St. John's
- 6th July: Arrival at fishing ground and start of fishing operations in Div. 3M.
- 4th August: Completion of fishing operations and sailing to St. John's.
- 6th August: Arrival to St. John's (End reserch survey).

The scientific team will consist of 15 people.

AIMS OF THE SURVEY

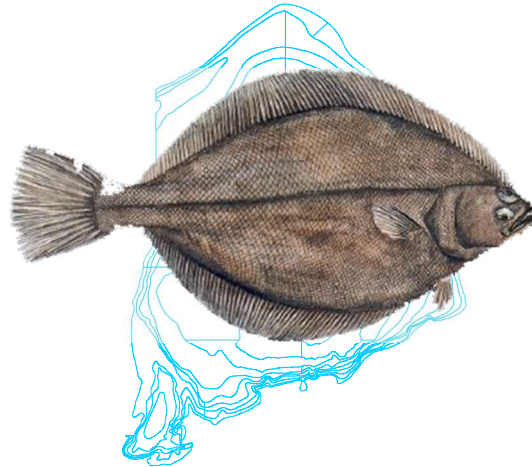
The objective of the survey is the knowledge of the condition for the main species stocks: their abundance, biomass and demographic structure, as well as the oceanographic conditions on the bank. This objective implies the following actions:

- A random stratified survey of the Flemish Cap area until 1460 m (800 fathoms) depth, making 181 bottom trawls with a Lofoten fishing gear, at daytime: between 6:00 and 22:00 hours, and 30 minutes effective fishing time.
- Detailed biological sampling in each haul, including length, sex, weight, otolith and gonad's sampling for each one of the target species. Also, length and length-weight sampling will be done for all the other species.
- Feeding analysis of most abundant species, to be done every two years.
- Sampling of invertebrates, with special attention to corals, sponges and sea pens, to allow identification of potentially vulnerable marine ecosystems.
- An oceanographic survey, by covering the bank with a reticule of CTD stations separated 15 nautical miles both in latitude and longitude.

Target species:

- cod (*Gadus morhua*)
- redfish (*Sebastes norvegicus*, *S. mentella* and *S. fasciatus*)
- American plaice (*Hippoglossoides platessoides*)
- Greenland halibut (*Reinhardtius hippoglossoides*)
- roughhead grenadier (*Macrourus berglax*)
- shrimp (*Pandalus borealis*)

Methods and procedures used in the EU bottom trawl survey of Flemish Cap (NAFO Division 3M) are described in Vázquez, A., J. Miguel Casas, R. Alpoim. 2014. Protocols of the EU bottom trawl survey of Flemish Cap. *Scientific Council Studies*, 46: 1–42. doi:10.2960/S.v46.m1



SURVEY DESIGN

Stratified random design

The survey has a stratified random design, covering the area with 181 bottom trawl fishing stations, following the methodological specifications of NAFO (Doubleday 1981).

The adopted stratification of Flemish Cap is that described by Doubleday (1981), which considers 19 strata up to 730 m (400 fathoms) depth. Stratification was later extended by the Department of Fisheries and Oceans (DFO) of Canada (Bishop 1994) to cover up to 1460 m (800 fathoms) depth, considering 39 strata (Figure 1). Two strata of this bank (numbers 26 and 27) have fishing grounds unsuitable for trawling due to the huge abundance of sponges, and the same goes for the five strata belonging to the Beothuk Noll (numbers 35-39) due, presumably, to the massive presence of corals. All these strata have been removed from the survey, resulting in 32 strata and 478 units (Table 1 and Table 2). Each unit is divided into 10 squares, which correspond to fishing units, which leads to 4780 possible bottom trawl fishing stations or hauls. The number of units and squares in each stratum is proportional to its surface.

Table 1.- Specification and characteristics of the survey area, and number of selected hauls.

	Área	Strata	Units	Possible hauls	Selected hauls
3M (profundidad < 730 m.)	10555	19	309	3090	120
3M (profundidad 730-1460 m.)	5515	13	169	1690	61
Total	16070	32	478	4780	181

TRAWL STATION METHODOLOGY

The selection of the hauls is set with the following conditions:

- The number of hauls in each stratum (Table 2) is fixed, distributed proportionately to the number of units, and ensuring at least two hauls by stratum.
- So many units as selected hauls are randomly chosen within each stratum, repeating none. In addition, two hauls cannot coincide in adjacent squares.
- Within each selected unit, the choice of the haul is done at random among ten possible ones.
- Information from previous surveys and commercial fishing is used to eliminate hauls in unsuitable fishing grounds.
- The allocation of the hauls into each square could be made more accurate using the bathymetry of the area obtained by the NEREIDA project, reducing the risks of snagging in the bottom.

In accordance with Table 2, 181 hauls will be selected at random, 120 of them in less than 730 m depth.

The criterion used to change the position of a previously selected random haul has always been the information from the commercial fishing and from previous surveys about the suitability of the bottom trawling. This information is contrasted with the more detailed bathymetric charts of the bottom that have been developed in the project NEREIDA.

Criteria for rejecting a haul:

- Snag of the trawling gear in the bottom.
- Damages in the cod-end or severe damages in large sections of the wings or belly.
- Less than 20 minutes of trawling time.
- Gear malfunction.

Rejected fishing hauls means that, because standard conditions were not achieved, such station cannot be used to quantify the biomass and abundance neither to determine the structure of the population. However, the specimens caught in any non-valid hauls can be used to make all kind of biological sampling.

Table 2 – Stratification of Flemish Cap and hauls plan.

Stratum	Depth interval (fathoms)	Area (sq. miles)	Possible hauls	Selected hauls
1	70- 80	342	100	4
2	81-100	838	250	10
3	101-140	628	180	7
4	"	348	100	4
5	"	703	200	8
6	"	496	150	6
7	141-200	822	240	9
8	"	646	190	7
9	"	314	90	3
10	"	951	280	11
11	"	806	240	9
12	201-300	670	200	8
13	"	249	70	3
14	"	602	170	7
15	"	666	200	8
16	301-400	634	190	7
17	"	216	60	2
18	"	210	60	2
19	"	414	120	5
20	401-500	525	160	6
24	"	253	80	3
28	"	530	160	6
33	"	98	30	2
21	501-600	517	160	6
25	"	226	70	3
29	"	488	150	6
32	"	238	70	2
34	"	486	150	5
22	601-700	533	160	6
30	"	1134	350	11
23	701-800	284	90	3
31	"	203	60	2
Total (strata 1-34)		16 070	4 780	181

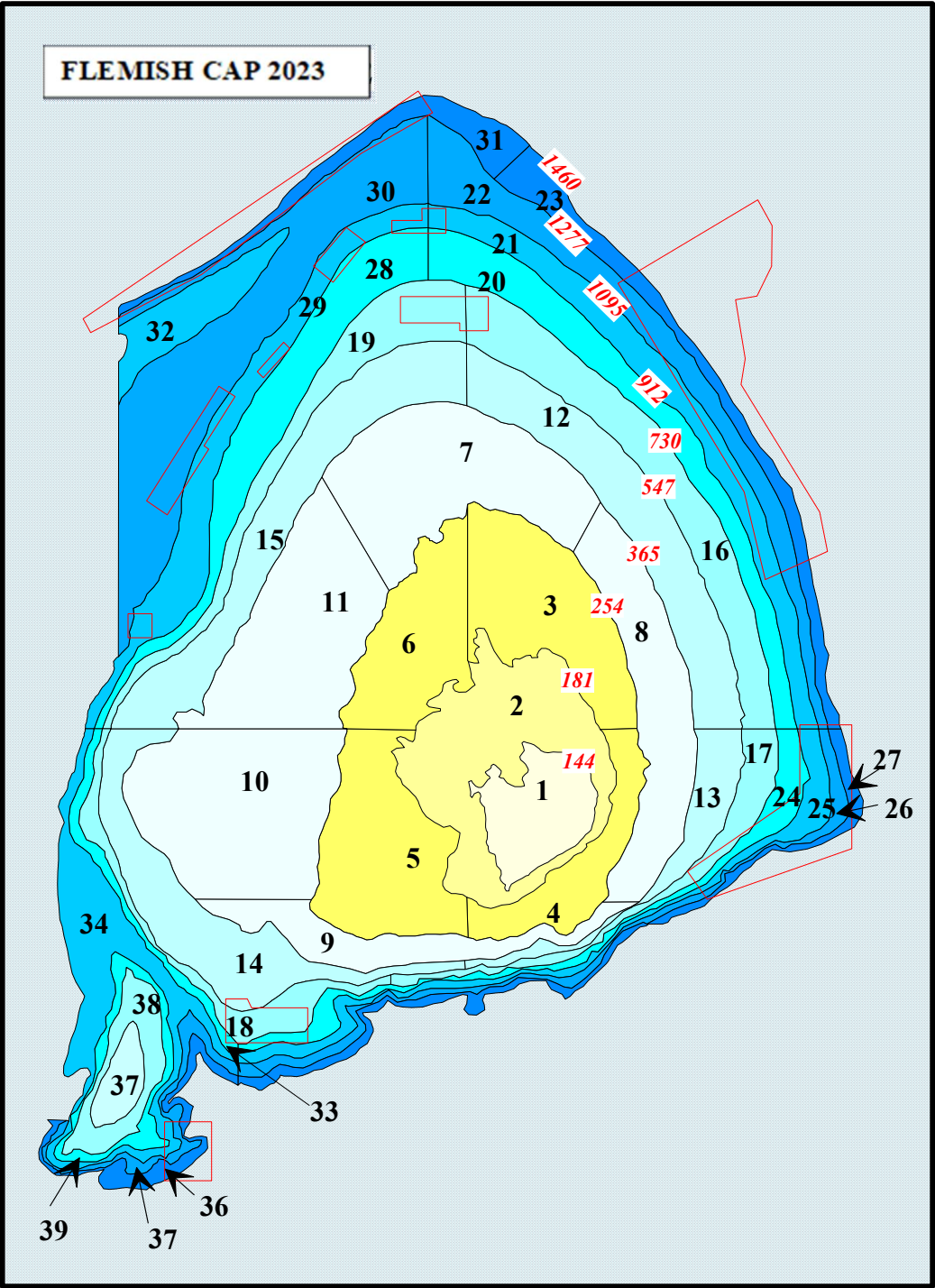


Figure 1 - Scheme of stratification of the area to prospect in 2023.



VESSEL, FISHING GEARS AND STANDARDIZATION

From 1988 to 2002, the survey was carried out on board RV Cornide de Saavedra, covering the 19 strata defined up to 730 m depth; its primary objective was to assess the populations of cod and American plaice. In 2003, taking advantage of new fishing capacities of R/V Vizconde de Eza, the surveyed area was increased to prospect 31 strata up to 1100 m depth, to cover the wider area of the Greenland halibut distribution, which was the commercial species of greatest interest to the Spanish fleet at that time. In 2004, the range of depths was extended up to 1460 m with 34 strata and it was reduced to 32 from 2008 onwards.

Calibration of R/V Cornide de Saavedra versus R/V Vizconde de Eza catch rates was made from 111 parallel hauls of the two vessels in the 2003 and 2004 surveys (González-Troncoso and Casas 2005), transforming the catch data from the Cornide de Saavedra in their equivalence in Vizconde de Eza scale, to produce homogeneous abundance indices series.

The trawling gear used is the Lofoten (NAFO 1990) (Figure 2), built and rigged as specified in Figure 3. This gear is similar to that used by the commercial fleet engaged in American plaice fishing on Flemish Cap in the years when the survey started. It is characterized by being well adapted to the frequent hard bottoms of the bank and showing a good performance throughout the years.

The cod-end mesh size is 35 mm, which is adequate for fishing juveniles of most important commercial species, particularly for cod at age one.

The order of execution of selected stations is determined during the survey, setting each day the hauls to be held the next day, trying to minimize the routes between stations. A detailed plan of the order of the stations is impractical because it is necessary to make changes due to unforeseen malfunction of the gear (e.g. obstruction, breakages...).

Daily fishing period: 6.00 to 22.00h

The target trawling speed is 3.5 knots. It is not always possible to maintain the speed when trawling at deeper grounds due to insufficient weight of the trawl doors used. While this problem is not solved, deeper sets are made at the highest speed possible, which is always around 3.0 knots.

The hauls have 30 minutes trawling time, counted between the first contact the gear with the bottom, when the gear acquires its characteristic shape, and the start of the haul in. Its control is done, whenever possible, by using net sounders (MARPORT), which enables accurate measures of those times. The start of the haul in is kept as the haul's end to be consistent with previous criterion (with the exception of 2005) used.

In the surveys previous to 2003 the 30 minutes were counted according to the expression:

$$t \text{ (min)} = 32 + \text{depth (m)} / 100$$

where t was the time from the time when the specified amount of wire is out and the winches are stopped to the time where the winches hauling the net back in.

This criterion was established in Flemish Cap 1992 survey, in which it was made a systematic control of the gear behaviour with the SCANMAR eco sounder. The interpretation that was then made for counting the trawling time per haul was "as long as the art is in contact with the bottom before the start of the haul in" (Report 1992).

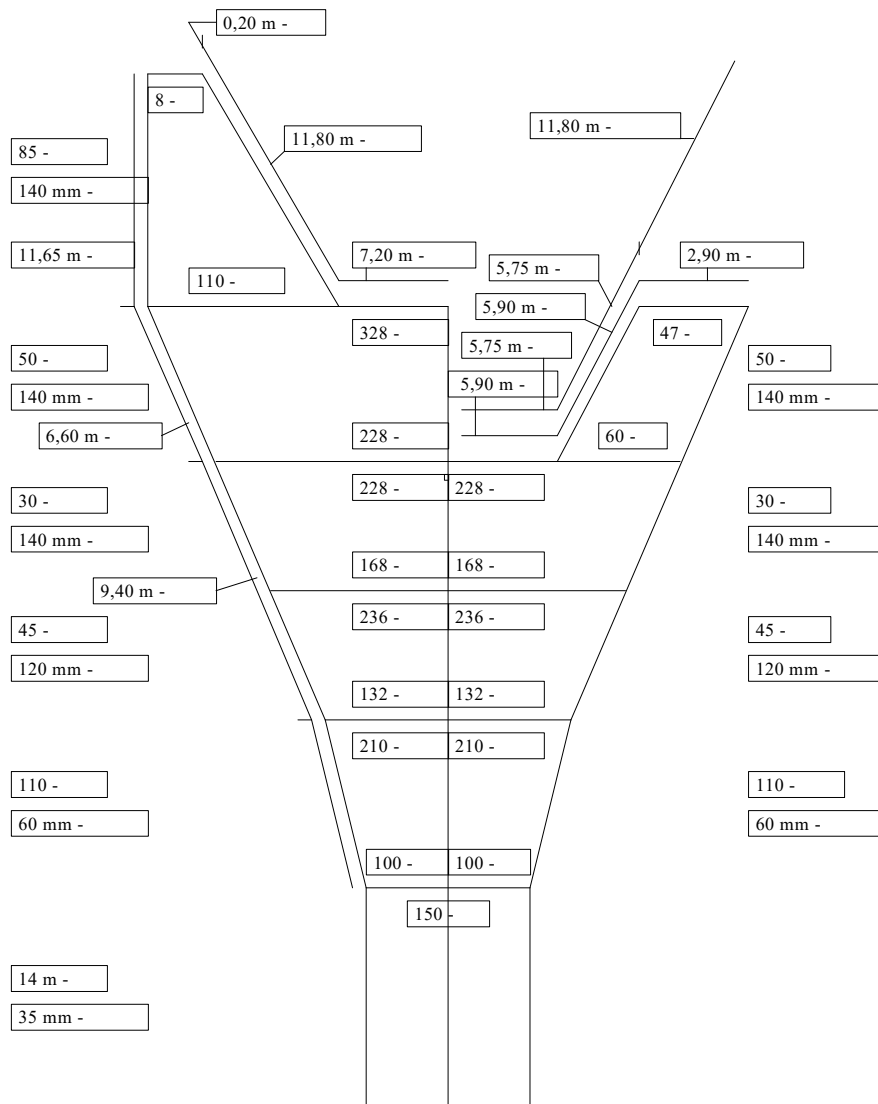
The length of the wire released is determined by the following relationship (meters):

$$\text{Cable length} = 2 * \text{depth} + 400$$

Obtaining the following table of values for the different depths:

Depth (m)	Cable (m)	Depth (m)	Cable (m)	Depth (m)	Cable (m)	Depth (m)	Cable (m)
100	600	450	1300	800	2000	1150	2700
150	700	500	1400	850	2100	1200	2800
200	800	550	1500	900	2200	1250	2900
250	900	600	1600	950	2300	1300	3000
300	1000	650	1700	1000	2400	1350	3100
350	1100	700	1800	1050	2500	1400	3200
400	1200	750	1900	1100	2600	1450	3300

The dimensions of the trawling gear Lofoten are shown in Figure 2. Groundrope and bobbins dimensions are detailed in Figure 3.



Dimensions of the trawling gear Lofoten (31.20 m × 17.70 m)

The cod-end mesh size (35 mm) is inefficient to retain juvenile shrimps (ages 1 and 2), and delays in one or two years the estimation of each new year-class entering the fishery. After several attempts in different surveys, an auxiliary net bag of 10 mm mesh size is used since 2000 to prevent the escape of the youngest individuals of shrimp. The base of the bag is a diamond of 36 cm in each side, and it is attached to the cod-end in a central-dorsal position, 26 cm from the seam end, just in a position where it is believed that the escape is maximum (Aschan and Sunnana 1997).

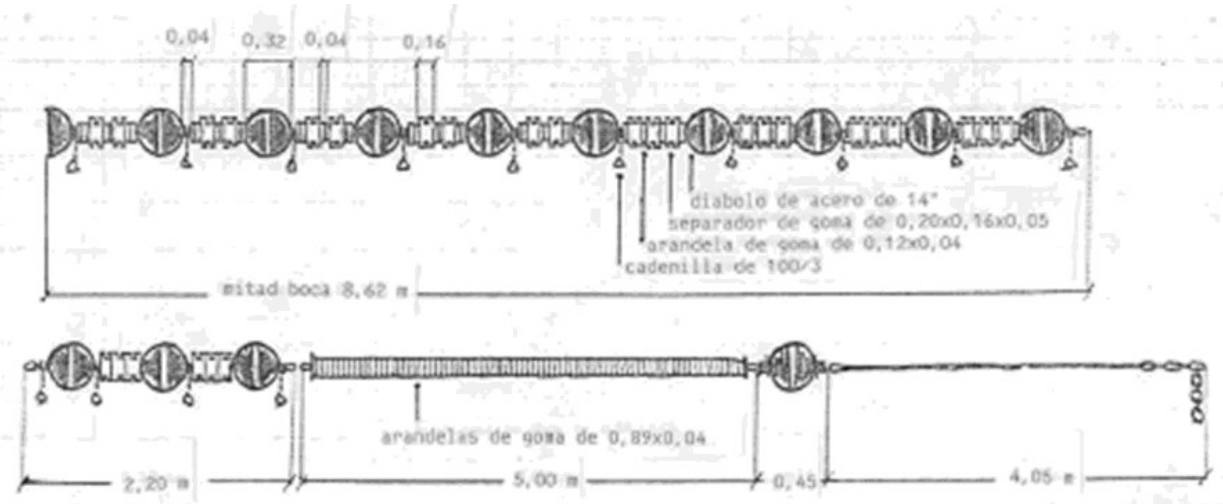


Figure 3 – Groundrope rigging.

Table 3.– Technical data of the survey. Characteristics and deployment of the fishing tackle.

<i>procedure</i>	specification
Survey type Haul selection method Criterion to change position of a selected haul Criterion to reject a haul Daily fishing period Species to be sampled Species for aging	Stratified sampling Random Bottom unsuitable for trawling according to commercial fishing or former surveys. - snag in the bottom - severe damages in the net or in the cod-end - trawling time inferior to 20 minutes - gear malfunction 6:00 to 22:00 local time All fishes, cephalopods, shrimp and non-commercial invertebrates. cod, American plaice, redbfish, Greenland halibut and roughhead grenadier.
Vessel TRB Power Maximum trawling depth Area to be surveyed Time to survey	RV Vizconde de Eza 1400 GT 1800 kW 1460 m Div. 3M (depth < 1460 m) 30 days
Fishing gear Groundrope / headrope Groundrope Floats Bridles Vertical opening Horizontal opening Rigging warps Trawl doors Wire Wire length Cod-end mesh size Towing speed Trawling time	Lofoten 17.70 m /31.20 m 27 steel bobbins Ø 35 cm Ø 20 cm (2 × 16) + Ø 24 cm × 20 8 m Ø 16 mm 3.5 m 14 m = 0.0075 miles 100 m, 45 mm, 200 kg/100m Oval polyvalent, 850 kg Ø 20 mm 2 × Depth + 200 m 35 mm 3.5 knots 30 minutes of effective fishing time determined by net sounder or “32 + Depth (m)/100” minutes from the time the winches are locked.

SCIENTIFIC EQUIPMENT ON BOARD

See attached file: "Instrumentación Científica y Apoyo Técnico Humano_Campañas NAFO 2023_2nov22.doc".

SAFETY ON BOARD

Everything related to the safety of risks of the surveys is included in the document.

"Procedure for the prevention of labor risks for fieldwork management: NAFO 2023 SURVEYS".

SCIENTIFIC TEAM

The scientific team consists of 15 scientists distributed:

- 1 cruise leader from Institute of Marine Research (IIM-CSIC)
- The rest of the scientific staff will consist of 14 people from the Spanish Institute of Oceanography (IEO-CSIC), the Portugues Institut for Sea and Atmosphaera (IPMA), the Institute of Marine Research (IIM-CSIC) and subcontracted.

Scientific personnel:

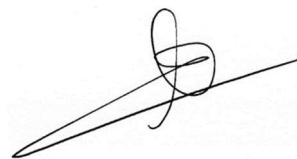
Sampling catch (2 teams of 6 persons each)	12
Data processing	1
CTD	1
Survey leader	1
TOTAL	15 scientists

TENTATIVE DATES

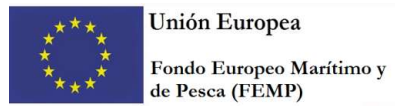
This survey will be carried from 4th July to 6th August (St. John's, Canada)

- 3rd July: Arrival RV Vizconde de Eza to St. John's.
4th July: Scientific team replacement and departure from St. John's
6th July: Arrival at fishing ground and start of fishing operations in Div. 3M.
4th August: Completion of fishing operations and sailing to St. John's.
6th August: Arrival to St. John's (End reserch survey).

Vigo, November 2, 2023

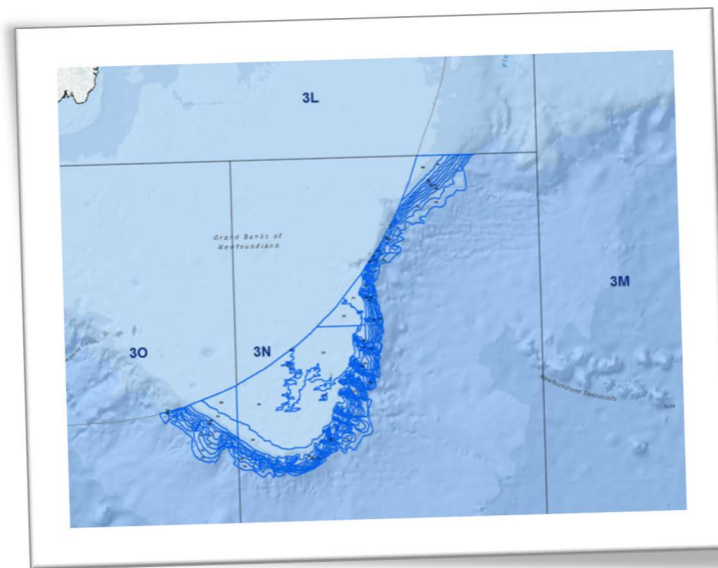


Jose Miguel Casas Sanchez
Flemish Cap Project Coordinator



THE EU PLATUXA SURVEY IN DIV. 3NO (NRA)

PLATUXA 2023



R/V VIZCONDE DE EZA

Cruise leader: JOSE LUIS DEL RIO IGLESIAS

**INSTITUTO ESPAÑOL DE OCEANOGRAFÍA (CSIC)
C.O. de Vigo**

November 2022





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Abstract

The proposed survey is the twenty-eight edition of the Platuxa research demersal surveys series, which began in 1995. This survey is included in the National Program Data Collection, and is organized, prepared and managed by the Far Fisheries Program of the Instituto Español de Oceanografía - CSIC (CO Vigo). The survey has the support of the Secretaría General de Pesca, which contributes to the R/V Vizconde de Eza. It is also co-financed by the European Union through the European Maritime, Fisheries and Aquaculture Fund (EMFAF) within the National Program for the collection, management and use of data from the fisheries sector and the support for scientific advice in relation to the common fisheries policy.

The survey, as in previous years, is designed as a stratified random design of bottom trawl hauls, and its objective is to estimate the abundance of demersal fish stocks and to analyze the structure and various biological parameters of the most important species. The area to be surveyed will be the Divisions 3NO (NAFO Regulatory Area), up to 1500 meters deep, with a maximum of 115 hauls carried out throughout the area.

The survey will be carried out on board the R/V Vizconde de Eza on the following dates:

5 th June:	Departure Vigo. Start of survey.
11 th June:	Arrival at fishing ground and start of fishing operations in Div. 3NO.
12 th -2 nd July:	Completion of fishing operations and sail to St. John's.
3 rd July:	Arrival to St. John's and change scientific team.
4 th July:	Arrival to Vigo (End survey).

Survey objectives

The Platuxa survey has been carried out annually in the Divisions 3NO of the NAFO Regulatory Area since 1995. The survey has been carried out in the R/V Vizconde de Eza, belonging to the Secretaría General de Pesca, since 2001.

The survey has the following objectives:

- 1) Collection of the necessary data to estimate the abundance and biomass indices to to know the condition of target species stocks.



Target species:

- cod (*Gadus morhua*)
- redfish (*Sebastes* spp)
- American plaice (*Hippoglossoides platessoides*)
- Greenland halibut (*Reinhardtius hippoglossoides*)
- yellowtail flounder (*Limanda ferruginea*)
- roughhead grenadier (*Macrourus berglax*)
- thorny skate (*Amblyraja radiata*)
- witch flounder (*Glyptocephalus cynoglossus*)
- black dogfish (*Centroscyllium fabricii*)
- white hake (*Urophycis tenuis*)
- shrimp (*Pandalus borealis*)

- 2) Detailed biological sampling in each haul, including length, sex, weight, otoliths and gonad's sampling for each one of the target species. Only length and length-weight sampling will be done for all the other species.
- 3) Feeding analysis of most abundant species, to be done every two years.
- 4) Sampling of invertebrates, with special attention to corals and sponges, to allow identification of potentially vulnerable marine ecosystems.
- 5) Collection of hydrographic data with a CTD station at the end of each fishing.



Methods and survey design

The survey has a stratified random design, covering the area with 115 valid bottom trawl fishing stations, following the methodological specifications of NAFO (Doubleday, 1981). Figure 1 shows the survey area in the Divisions NAFO 3NO. The sample consists of 115 standardized diurnal fishing, with 30 minutes of effective trawling and a depth range of 40 - 1500 m. The number of hauls is distributed randomly within each stratum, and their number varies between two and seventeen, depending on the area of the stratum and ensuring at least two hauls by stratum (Table 1).

Information from previous surveys and commercial fishing is used to eliminate hauls in unsuitable fishing grounds. The allocation of the hauls into each square could be made more accurate using the bathymetry of the area obtained by the NEREIDA project, reducing the risks of snagging in the bottom.

The order of execution of selected stations is determined during the survey, setting each day the hauls to be held the next day, trying to minimize the routes between stations. A detailed plan of the order of the stations is impractical because it is necessary to make changes due to unforeseen malfunction of the gear (e.g. obstruction, breakages...).

The target trawling speed is 3.5 knots. The daily fishing hours are from 06:00 to 22:00 if there are reinforcement sailors. In his absence, the working hours and the number of fishing must be reduced.

The development of the survey depends on the weather conditions and other factors (breakdowns, breakage of the gear, etc.), so that the order of the hauls is decided each day in order to optimize the use of the day of fishing job.



Table 1. Stratification of Platuxa survey and hauls plan. Area is in square nautical miles and depth range (DR) in meters.

Division	Stratum	Area (nm ²)	DR (m)	Possible hauls	Selected hauls
3N	357	164	275-366	40	2
3N	358	225	185-274	50	3
3N	359	421	93-183	110	5
3N	360	2783	57-91	860	17
3N	374	214	57-91	240	2
3N	375	271	<56	420	3
3N	376	1334	<56	400	8
3N	377	100	93-183	30	2
3N	378	139	185-274	40	2
3N	379	106	275-366	30	2
3N	380	96	275-366	30	2
3N	381	144	185-274	50	2
3N	382	343	93-183	180	4
3N	723	155	367-549	50	2
3N	724	124	550-731	40	2
3N	725	105	367-549	30	2
3N	726	72	550-731	20	2
3N	727	96	367-549	60	2
3N	728	78	550-731	40	2
3N	752	131	732-914	40	2
3N	753	138	915-1097	40	2
3N	754	180	1098-1280	50	2
3N	755	385	1281-1463	110	4
3N	756	101	732-914	30	2
3N	757	102	917-1097	30	2
3N	758	99	1098-1280	30	2
3N	759	127	1281-1463	40	2
3N	760	154	732-914	40	2
3N	761	171	915-1097	50	2
3N	762	212	1098-1280	60	2
3N	763	261	1281-1463	70	3
3O	353	269	57-91	340	3
3O	354	246	93-183	130	3
3O	355	74	185-274	30	2
3O	356	47	276-366	20	2
3O	721	65	367-549	20	2
3O	722	84	550-731	30	2
3O	764	100	732-914	30	2
3O	765	124	915-1097	30	2
3O	766	144	1098-1280	40	2
3O	767	158	1281-1463	40	2

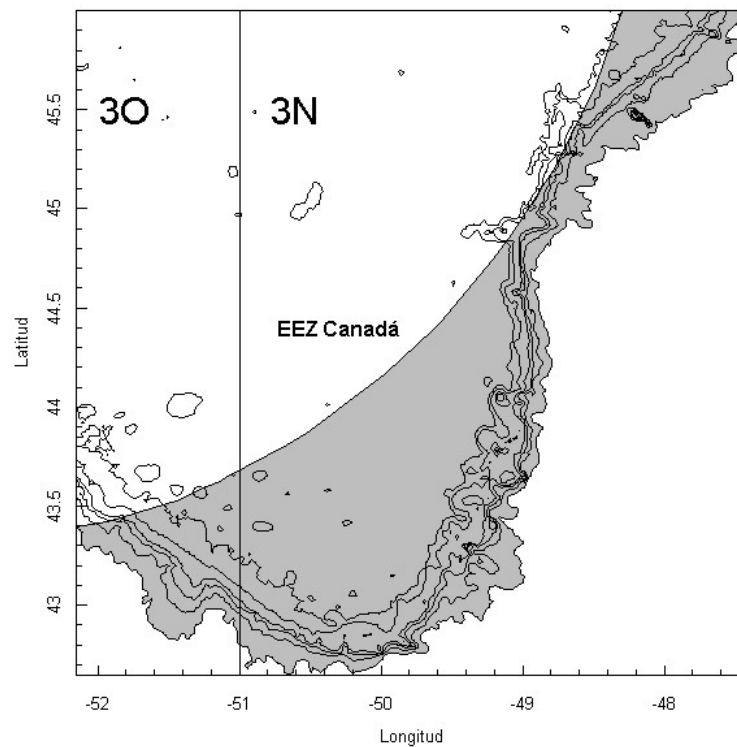


Figure 1. Prospecting area (shaded gray) of the Platuxa survey, delimited by the Canadian EEZ and the 1500 m isobath. The 100, 200, 500, 700 and 1000 m isobaths are also shown.

The trawling gear used is the Campelen 1800 and the cod-end mesh size is 44 mm, which is adequate for fishing juveniles of most important commercial species.

The gear is built and rigged as specified McCallum & Walsh (1994) (Figure 2). The trawl doors are Injector, Shark Model, with a weight of 1400 kg and 4.2 m² of surface.

The trawling gears to be used will be reviewed by the project and survey leaders at least 30 days before the campaign, according to the protocol described in McCallum & Walsh (1994).



frequency. In general, the rule of measuring a number of individuals equivalent to the size range multiplied by four can be applied, as recommended by Doubleday (1981). Likewise, the number of individuals destined for biological sampling necessary in each set can be estimated as a guideline, in order to distribute the sampling uniformly within the study area.

- 4) Collection of otoliths and gonads of American plaice (*Hippoglossoides platessoides*), cod (*Gadus morhua*) and Greenland halibut (*Reinhardtius hippoglossoides*).
- 5) In the case of shrimp, if there is no time to process the samples during sets, a sample of 2 kg will be stored in the freezer to be analyzed before the end of the season or in the laboratory. In addition, a sample will be kept to carry out the size / weight sampling on land. If the catch is as low as in recent years (<5 kg), the entire sample should be frozen.
- 6) Invertebrates will be identified as accurately as possible, and otherwise specimens will be kept for later identification in the laboratory.
- 7) Photographs of invertebrate species, with special attention to corals and sponges, to allow identification of potentially vulnerable marine ecosystems.
- 8) In order to improve the quality control of the data and minimize the necessary corrections in the laboratory, successive quality controls will be carried out on the recorded data.
- 9) The correction of the recorded data will be carried out during the survey, within the scheduled working hours of each work shift when there is free time between hauls.

Scientific team

The scientific team consists of 15 scientists distributed:

- 1 cruise leader from Instituto Español de Oceanografía (CSIC) – IEO Vigo: José Luis del Río Iglesias.



- The rest of the scientific staff will consist of 14 people from the Instituto Español de Oceanografía (CSIC), subcontracted companies and university student.

Scientific personnel:

Sampling catch (2 teams)	11
Data processing	1
CTD	1
University	1
Survey leader	1
TOTAL	15

The survey leader is assigned the following tasks throughout the survey:

- 1) Organization of the team for sampling catch and inform the participating personnel of the tasks to be carried out, with special attention to people with less experience.
- 2) Daily fishing planning with the Captain.
- 3) Monitoring, recording of data and incidents corresponding to each haul.
- 4) Verification of the data collected in the sampling before recording and contrast information with the corresponding sampling manager when necessary.
- 5) Review data recording.
- 6) Preparation of preliminary and technical reports.

The twelve people assigned to the sampling catch are divided into two teams responsible for the following tasks:

Two teams of six people for sampling the catches, described in the methods section:

- a) Each team has a manager who organizes the work to be done in each haul, records the total catches of each species, and reviews the sampling before handing them over to the survey leader. He also participates in tasks 1-4 listed in the methods section.



- b) The person assigned to the invertebrate sampling in each team is in charge of tasks 6 and 7 listed in the methods section, in addition to collaborating on tasks 1-4 listed in the methods section. Tasks 1-4 are given priority.
- c) The remaining four people from each team participate in tasks 1-4 listed in the methods section.

The two people responsible for the CTD and the recording of the data collected during the survey are assigned the following tasks:




- 1) Download and check the data after obtaining each CTD profile.
- 2) Communicate incidents to the survey leader in case a CTD profile needs to be repeated.
- 3) Recording and sending the data to the survey leader within the established deadlines.
- 4) Organization of the tasks necessary to correct the recorded data.
- 5) Updating the data when errors are detected and sending the corrected database to the survey leader, with information about the changes made.

Calendar and working hours

According to the schedule, this survey will be carried from 5th June (Vigo, Spain) to 3rd July (St. John’s, Canada).

- 5th June: Departure Vigo. Start of survey.
- 11th June: Arrival at fishing ground and start of fishing operations in Div. 3NO.
- 12th -2nd July: Completion of fishing operations and sail to St. John’s.
- 3rd July: Arrival to St. John’s and change scientific team.
- 4th July: Arrival to Vigo (End survey).

JUNE		JULY
5-31		1-4
5-11	12-2	3-4

-  Sailing
-  Fishing
-  Scientific team return



The work schedule for the scientific teams is eight hour day divided into two shifts. The first team has shifts 07:00 - 11:45 and 16:45 - 19:45 and the second team has shifts 11:45 - 16:45 and 19:45 - 22:45. The beginning of the first shift of the day is subject to changes depending on the arrival of the first haul, which can be delayed in the deeper layers due to the amount of cable to be cast. Likewise, the end of the last shift of the day may vary depending on the catch obtained in the last hauls of the day.

The working hours of the two persons in charge of the CTD profiles and the recording of the data cannot be determined exactly as it depends on the collection of hydrographic data and the rate of sampling. In general, in shallow strata, obtaining profiles is very fast and does not affect the fishing schedule. However, in the deep strata it is necessary to obtain the profile corresponding to the first haul of the next day at the end of the day's fishing, or before starting the first haul at 06:00. It is also not possible to set in advance the schedule of the survey leader, which will depend on the fishing and completion of the assigned daily tasks.

Scientific equipment on board

See attached file:

- *Instrumentación científica y Apoyo Técnico Humano_Campañas NAFO_2023.*

Safety on board

Everything related to the safety of risks of the surveys is included in the document. "Procedure for the prevention of labor risks for fieldwork management: NAFO 2023 SURVEYS".



References

- Doubleday, W.G. 1981. Manual on groundfish surveys in the Northwest Atlantic. *NAFO Sci. Council Studies*, No 2, 56 pp.
- ICES, 2006. ICES guidelines for CTD Data, 9 pgs.
- McCallum, BR & Walsh, SJ. 1994. Survey trawl reference manual. Department of Fisheries and Oceans, Newfoundland, Canada.
- McCallum, BR & Walsh, SJ. 1997. Groundfish Survey Trawls Used at the Northwest Atlantic Fisheries Centre, 1971 to Present. *NAFO Sci. Council Studies*, No. 29: 93-104.

Vigo, November 03, 2022

Fdo.: José Luis del Río Iglesias



Fletán Negro 3L

R/V VIZCONDE DE EZA

From 5th August to 2nd September, 2023



The EU “Fletán Negro 3L” survey in Div. 3L of NAFO Regulatory Area
Spanish Institute of Oceanography (IEO, CSIC)
Oceanographic Center of Vigo
Team Distant Fisheries

Head of survey: Esther Román

Acronym

- **FN 3L-23** (*Fletán Negro 3L – 2023*)

Background

Annually, every summer, the Spanish Institute of Oceanography carries out various Oceanographic and Fisheries Research Surveys (Platuxa, Flemish Cap and Fletan Negro 3L), in International NAFO waters (Areas 3NO, 3M and 3L), involving the Spanish vessel “*Vizconde de Eza*” from May to August (**ANNEX I: Figure 1**). They are took place on the Nose and Tail of the Grand Bank as well as on the Flemish Cap (outside the Canadian EZZ).

The Spanish surveys in Div. 3L of NAFO Regulatory Area (Flemish Pass) were initiated in 2003. The Research vessel “*Vizconde de Eza*” has carried out these surveys following the same procedures and using the same bottom trawl gear. In 2003-2004 the initial plan could not be completed due to lack of the availability of the vessel and scientific staff. In 2005 the survey could not be carried out because of breakdowns and delays accumulated in the previous survey (Flemish Cap); and in 2006, for the first time, an adequate prospecting survey in Division 3L, with over 100 valid hauls, was conducted.

In 2020-2022, due to COVID-19 situation, the Fletán Negro 3L survey was not conducted.

The following Table shows the complete series of the Fletan Negro 3L Survey: Trawl No., Fishing period, Vessel, Gear, Surveyed Strata.

Serie Campaña FLETAN NEGRO 3L (2003-2021)

Year	Vessel	Tows (Valid + Null)	Dates	Gear	Surveyed Strata (No.)
2003	R/V <i>Vizconde de Eza</i>	40 (39+1)	02/06/03 -05/06/03;	Campelen	17
2004	R/V <i>Vizconde de Eza</i>	58 (50+8)	09/06/03 07/08/04 - 15/08/04	Campelen	23
2005	No Survey				
2006	R/V <i>Vizconde de Eza</i>	101 (100+1)	31/07/06 - 18/08/06	Campelen	24
2007	R/V <i>Vizconde de Eza</i>	99 (94+5)	23/07/07 - 11/08/07	Campelen	24
Trawl doors change (INJECTOR MODELO SHARK)					
2008	R/V <i>Vizconde de Eza</i>	103 (100+3)	24/07/08 - 11/08/08	Campelen	24
2009	R/V <i>Vizconde de Eza</i>	103 (98+5)	25/07/09 - 12/08/09	Campelen	24
2010	R/V <i>Vizconde de Eza</i>	103 (97+6)	25/07/10 - 14/08/10	Campelen	24
2011	R/V <i>Vizconde de Eza</i>	89 (89+1)	10/08/11 - 24/08/11	Campelen	24
2012	R/V <i>Vizconde de Eza</i>	105 (98+7)	30/07/12 - 18/08/12	Campelen	24

2013	R/V <i>Vizconde de Eza</i>	107 (100+7)	30/07/13 - 19/08/13	Campelen	24
2014	R/V <i>Vizconde de Eza</i>	102 (99+3)	30/07/14 - 19/08/14	Campelen	24
2015	R/V <i>Vizconde de Eza</i>	104 (97+7)	28/07/15 - 17/08/15	Campelen	24
2016	R/V <i>Vizconde de Eza</i>	105 (98+7)	28/07/16 - 17/08/16	Campelen	24
Monitoring System Change (MARPORT)					
2017	R/V <i>Vizconde de Eza</i>	103 (99+4)	21/07/17 - 08/08/17	Campelen	24
Vessel Management Company change					
2018	R/V <i>Vizconde de Eza</i>	101 (100+1)	31/07/18 - 19/08/18	Campelen	24
2019	R/V <i>Vizconde de Eza</i>	97 (96+1)	03/08/19 - 23/08/19	Campelen	24
2020-22	No Survey (COVID19)				

FN 3L-23 is a Spanish research survey in NAFO Division 3L, outside the Canadian EEZ (on the Nose of the Grand Bank), targeting Greenland halibut and other commercial fish species. It will be the seventeenth survey in the same area of a series that started in 2003.

The aim of this survey is to get a deeper knowledge of demographic structure (length distribution) and the state of the stocks in this area in particular the Greenland halibut. This objective implies the following actions:

- The main objective of this research is to estimate biomass and abundance indices of Greenland halibut (*Reinhardtius hippoglossoides*) and other commercial species.
- Obtain the demographic structure (length distribution) of Greenland halibut and other species in this area
- Biological sampling of the target species.
- Feeding studies on some demersal species (biennial, in even years).
- Hydrographic studies: temperature and salinity will be measured in each haul

Target species:

- **Greenland halibut (*Reinhardtius hippoglossoides*)**
- Atlantic cod (*Gadus morhua*)
- Witch flounder (*Glyptocephalus cynoglossus*)
- American plaice (*Hippoglossoides platessoides*)
- Black dogfish (*Centroscyllium fabricii*)
- Thorny skate (*Amblyraja radiata*)
- Redfish (*Sebastes* spp.)
- Grenadier (*Macrourus berglax*)
- Northern shrimp (*Pandalus borealis*)

Fishing Area

- NAFO Regulatory Area, Division 3L, on the Nose of the Grand Bank, outside the Canadian EEZ (ANNEX I: Figures 1, 2).

Range of Depth Strata

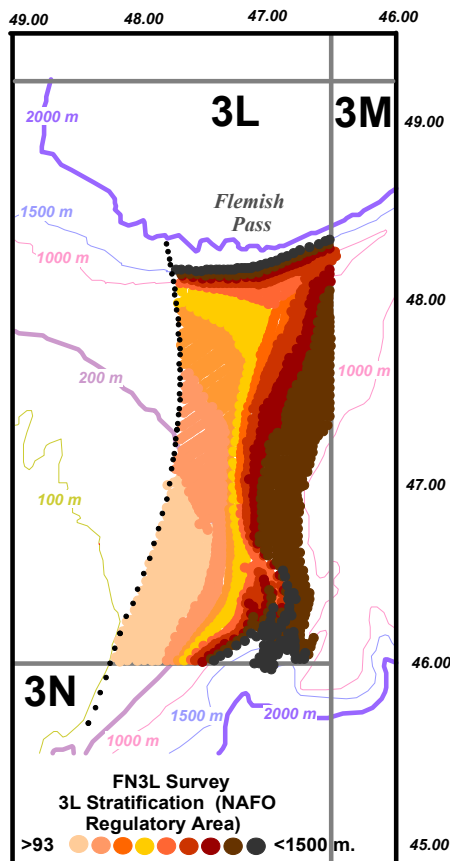
- 93 m. – 1463 m.

Vessel

- Spanish Research Vessel “*Vizconde de Eza*” (MAPA-General Secretariat of Fishery)
<https://www.mapa.gob.es/es/pesca/temas/proteccion-recursos-pesqueros/buques-secretaria-general/investigacion-pesquera-oceanografica/vizconde-de-eza/presentacion/>

Fishing Gear

- Bottom trawl net type “*Campelen 1800*” (McCallum & Walsh, 1994, 1997)¹. Trawl doors – 1400 kg. and mesh size of cod-end - 44 mm. (ANNEX I: Figure 3)



Fishing Operations Plan

The survey project corresponds to a random stratified prospecting that covers the area (24 strata between 93 and 1463 m) with 100 half-hour fishing hauls. The survey has a stratified random design following NAFO specifications (Doubleday, 1981)².

Hauls are allocated to strata proportionally to stratum size, with a minimum of two planned hauls per stratum (Bishop, 1994)³ and the trawl positions were chosen at random.

The order of the fishing operations selected will be determined during the survey, deciding each day which are to be done the following day, and attempting to minimise sailing time between settings.

During de survey and in connection with the Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas (OSPAR, <https://www.ospar.org/>) will try to avoid bottom trawl fisheries in those positions that have already been prospected in previous years and which have been identified highly vulnerable marine habitats in order to avoid destroying them.

In the same way and following the recommendations of the NAFO Scientific Council, hauls in the areas closed to fishing existing in the prospecting area will be avoided, as far as possible (NAFO, 2019; NAFO Conservation and Enforcement Measures, 2019; Duran, *et al.*, 2020)⁴.

Table 1 presents the stratification of Division 3L (on the Nose of the Grand Bank, outside the Canadian EEZ) and the fishing planned in the **FN3L23 Survey**.

Table 1.-

NAFO Div.	Strata	Depth range (m.)	Depth range (f.)	Total Area (sq miles)	Area Outside Canadian ZEE	Fishing operations
3L	385	93-183	51-100	2356	118	2
	387	275-366	151-200	718	256	4
	388	275-366	151-200	361	357	5
	389	185-274	101-150	821	509	7
	390	93-183	51-100	1481	815	12
	391	185-274	101-150	282	282	4
	392	275-366	151-200	145	145	2
	729	367-549	201-300	186	186	3
	730	550-731	301-400	170	1709	3
	731	367-549	201-300	216	216	3
	732	550-731	301-400	231	231	4
	733	367-549	201-300	468	234	4
	734	550-731	301-400	228	153	2
	741	732-914	401-500	223	100	2
	742	915-1097	501-600	206	64	2
	743	1098-1280	601-700	211	51	2
	744	1281-1463	701-800	280	66	2
	745	732-914	401-500	348	348	5
	746	915-1097	501-600	392	392	6
	747	1098-1280	601-700	724	724	10
	748	732-914	401-500	159	159	2
749	915-1097	501-600	126	126	2	
750	1098-1280	601-700	556	556	8	
751	1281-1463	701-800	229	229	4	
TOTAL	24	93-1463	51-800	11117	6487	100

This survey is funded by the EU through the European Maritime, Fisheries and Aquaculture Fund (EMFAF) within the National Program of collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.

Scientific team

The scientific team consists of 15 scientists distributed:

- 1 cruise leader from Spanish Institute of Oceanography (IEO, Vigo): Esther Román.
- The rest of the scientific staff will consist of 14 people from the Spanish Institute of Oceanography (IEO), subcontracted and students from the University.

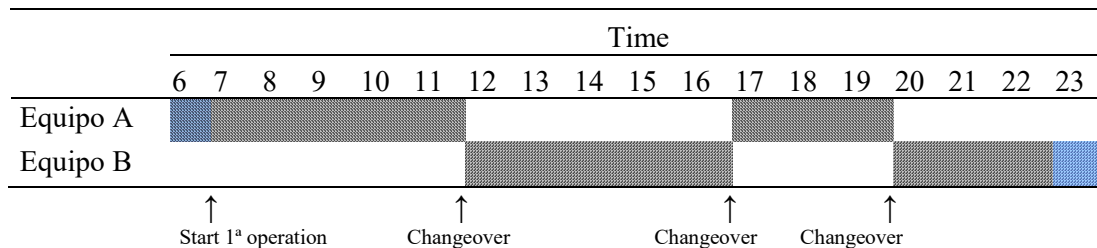
Tentative dates

This survey will be carried from 7th August (St. Johns, Canada) to 2nd September (Vigo, Spain):

- 6th August: Arrival in St. John's
- 7th August: To leave St John's towards fishing area. Start of survey
- 9th August: Arrival at fishing ground and start of fishing operations in Div. 3L
- 27th August: Completion of fishing operations and sail to Vigo port
- 2nd September: Arrival to Vigo (End survey)

Sampling on board

With regards to sampling, two teams of five people each with the following timetable will be established:



Trawl station methodology ([ANNEX II](#)):

- Realization of **100 half-hour fishing hauls**, randomly distributed from the shallowest waters to 1500 m. **Data from each trawl station will be collected:** Starting and ending positions (latitude and longitude), starting time and duration, direction and distance towed, trawl depth, gear condition, trawl performance, weather conditions and oceanographic data (temperature and salinity).

- **The catch from each haul is sorted into species, placed in baskets or other containers and weighted.** The species of redfishes (*Sebastes mentella*, *S. fasciatus* y *S. marinus*) will not be separated, number and weight of the three species being estimated all together.
- **Length measurements will be taken by sex.** Total length of the fish rounded down to the nearest centimeter, except for the grenadiers (Macrouridae), whose preanal length (length between the tip of the beak and the beginning of the anal fin) will be measured and rounded down to the nearest half centimeter. For chimaeras, dorsal fin cleavage length (L.EAD) will be measured. For shrimps (Pandalidae), measurements will be taken of the cephalothorax (from the edge of the eye socket to the edge of the posterior dorsal of the cephalothorax, OCL) rounded down to the nearest millimeter.
- **Biological sampling of the target species** will include: length (to the cm, ½ cm or ½ mm depending on the species), total weight (gr), sex, macroscopic maturity stage, (according to protocols, stomach repletion and extraction of otolith and gonad, if required).
- **Feeding studies** on some demersal species (biennial).
- **Study of benthic invertebrates** will be performed as a routine work during the survey (catch in weight and number, photographs and collection for study in the laboratory)
- **Hydrographic studies:** Temperature and salinity will be measured in each haul by means of CTD (SBE Se 25 SEALOGGER CTD)

Vigo, November 2nd, 2022



Esther Román Marcote

ANNEX I

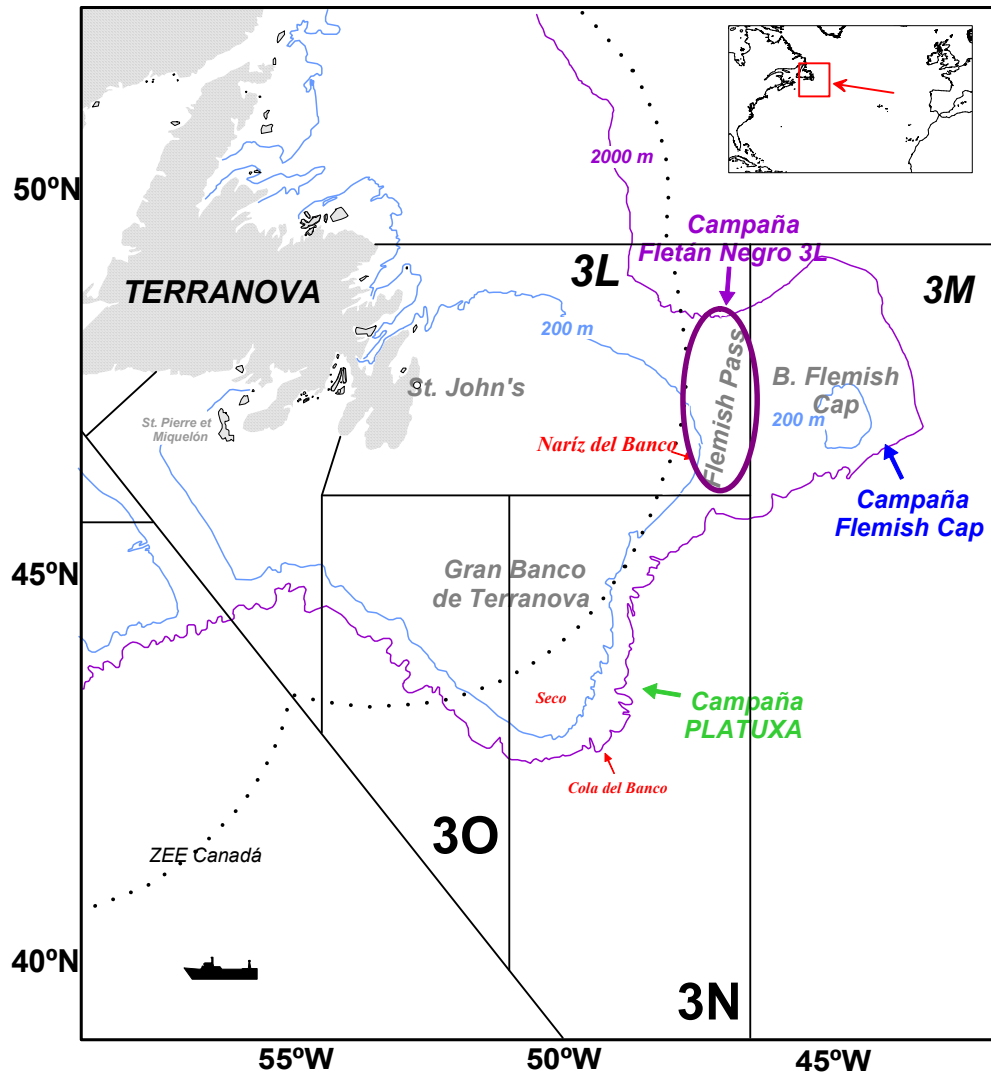


Figure 1.- Oceanographic and Fisheries Research Surveys (Platuxa, Flemish Cap and Fletán Negro 3L), in International NAFO waters (Areas 3N0, 3M and 3L).

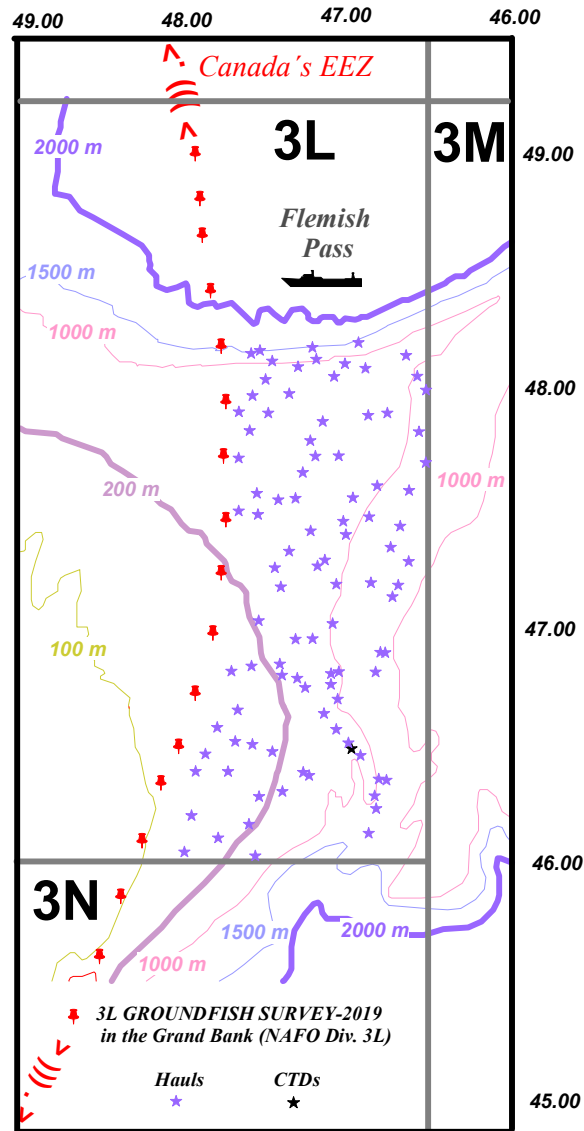


Figure 2.- Map of the location of area prospected by the FN 3L-19 Survey.

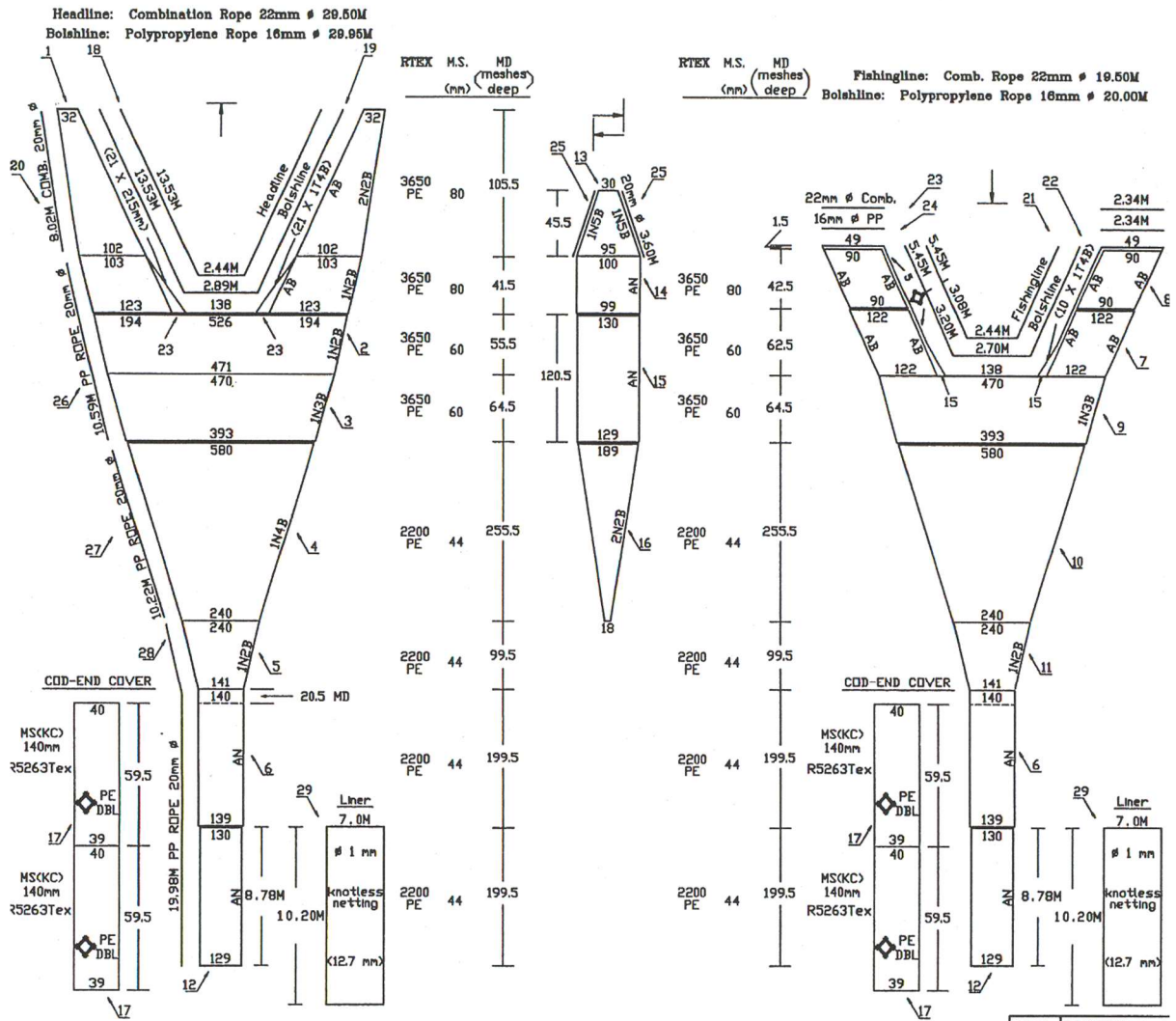
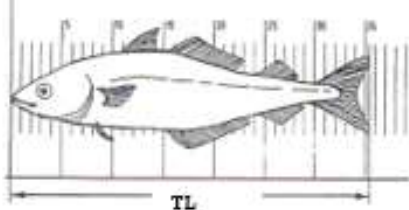
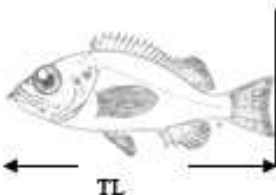
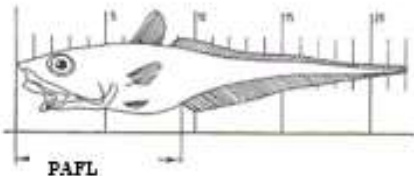
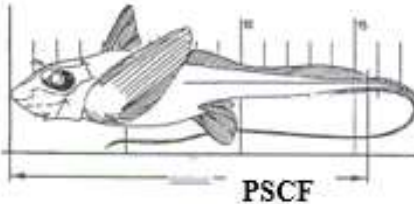


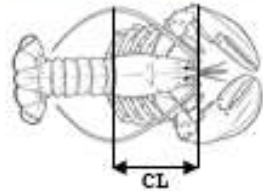
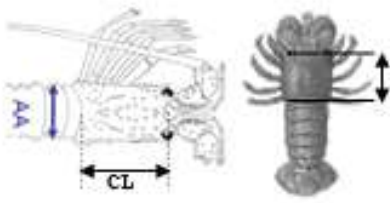
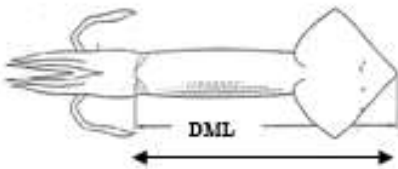
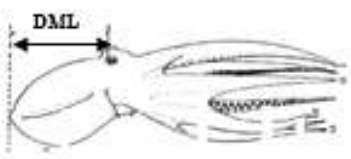
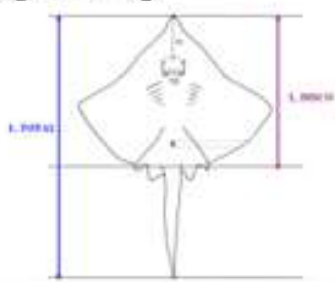


Figure 3.- Fishing gear “Campelen 1800” (McCallum & Walsh, 1994)¹ and bottom trawl doors.

ANNEX II

“FLETAN NEGRO 3L Survey” - Measuring FISHES	
Total Length (TL) to the lower centimeter	
Redfish (Sebastes): Total Length (TL) to the lower centimeter	
Grenadiers (Macrouridae): Pre-Anal fin Length to the lower half centimeter (PAFL).	
Chimareidae: Pre-Supra-Caudal Fin Length to the lower half centimeter (PSCFL)	
CRUSTACEANS	
Shrimp (Pandalidae): Caparace Length (CL) to the lower half millimetre	
Crabs: Caparace Width (CW) to the lower half millimetre	

“FLETAN NEGRO 3L Survey”	
<p>Nephrops // Homarus:</p> <p>Caparace Length (CL) to the lower half millimetre</p>	
<p>Palinurus // Scyllaridae:</p> <p>Caparace Length (CL) to the lower half millimetre</p>	
CEPHALOPS	
<p>Squids:</p> <p>Dorsal mantle length (DML) to the lower half centimeter</p>	
<p>Octopus:</p> <p>Dorsal mantle length (DML) to the lower half centimeter</p>	

“FLETAN NEGRO 3L Survey” – Biological data	
Length	cm Except: <ul style="list-style-type: none"> • grenadiers and chimaeras - ½ cm • Shrimp - ½ mm
Weight	gr
Sex	1 - Males 2 - Females 3 - Indeterminate
Macroscopic maturity	Greenland halibut – 1,2,3,4,5,6,9 (F) // 1,2,3,4,9 (M) Red fish - 1,2,3,4,5,6,9 (F y M) Roughhead grenadier - 1,2,3,4,9 (F y M) Coreano - 1,2,3,4,5,9 (F) // 1,2,3,4,9 (M) American plaice- 1,2,3,4,5,9 (F) // 1,2,3,4,9 (M) Cod - 1,2,3,4,5,9 (F y M) Tiburón negro - 1,2,3,4,5,6,7,8 (F) // 1,2,3,4,5 (M) Thorny skate – 1,2,3,4,5,6 (F) // 1,2,3,4,5 (M) Shrimp – Males, Transition, Immature female, Mature female, Ovigerous female.
Stage of stomach	0 – Empty 1 – Middle 2 – Full 3 - Evaginated
Otoliths	O – otolith collection
Gonads	G – gonads collection
Other tasks	Gutted weight (without visceras and gonads) – gr Skates: disc length (cm) Grenadiers: Total length (½ cm) Chimaeras: Total length (½ cm) 
Genetic	Collection of samples for genetics (Gen)
Oceanographic data	Temperature [ITS-90, deg C] PressureStrain Gauge [db] Salinity [PSU] Depth [salt water, m]