INTERNATIONAL BOTTOM TRAWL SURVEY WORKING GROUP (IBTSWG)

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Contents

i Executive summary

This report summarises the national contributions in 2018–2019 and the planning for the 2019–2020 surveys coordinated by the International Bottom Trawl Survey Working Group (IBTSWG). In the North Sea, the surveys are performed in quarters (Q) Q1 and Q3 while in the Northeast Atlantic the surveys are conducted in Q1, Q3, and Q4 with a suite of 14 national surveys covering a large area of the continental shelf that ranges from North of Scotland to the Gulf of Cádiz.

The sampling plan was generally completed for all areas. Some deviations concern the Portuguese survey (PT-PGFS-Q4); 12 days were lost due to weather conditions (around 60% of the stations completed). Twelve additional hauls were undertaken aboard the commercial vessel Calypso. The Channel Groundfish Survey (CGFS) extended the area into the western channel. EVHOE survey started to collect juvenile mackerel. Among specific results, the abundance of large herring larvae was very low in the eastern North Sea (Q1, 2019) and virtually no larvae occurred in the German Bight. From the MIK samples above-average catches of pilchard larvae were found specifically in the German Bight. Pilchard in the GOV catches was also above average. High densities of some target species were found outside the actual index areas during the North Sea Q3 (2018, *e.g.* Norway pout). Actual distribution patterns may warrant a revision of the species-specific areas on which the standard indices are calculated in DATRAS.

About DATRAS related topics IBTSWG adopted the conclusion that swept-area based survey indices require tow by tow information to be included into the database and the upload of new algorithms for the calculation of the swept area data products will be allowed.

Tests for the new trawl gear undertaken by the Irish and the Scottish participants are in progress. The first results of sea trials of the two design approaches carried out in 2018 are detailed in this report.

Analysis of the impact of changes in the design of the survey on the advisory processes is still in its early development and focused on three aspects: implementing different ways of sub-sampling, implementing different methods of index calculation (model and design based indices) and automating the assessment process in an effective way to enable the evaluation of large numbers of simulations. Moreover, an evaluation of sampling strategies of otoliths focused on three objectives: development of spatial age-length key (ALK) for estimating indices of abundance at age, development of uncertainty estimators for abundance at age indices and ALK estimators and investigation of the effect of the number of otoliths sampled or hauls on abundance at age indices.

About survey design and standardization process, the efforts and methods of standardization of the combined US and Canadian surveys (Northeast Fisheries Science Center) have been presented. Finally, more general topics and scientific results were presented: example of the evolution towards an "ecosystemic survey" from EVHOE survey; results on the reorganization ('tropicalization') of the ichthyological community structure in the North Sea.

ii Expert group information

Expert group name	International Bottom Trawl Survey Working Group (IBTSWG)
Expert group cycle	Multiannual fixed term
Year cycle started	2019
Reporting year in cycle	1/1
Chair(s)	Ralf van Hal, The Netherlands
	Pascal Laffargue, France
Meeting venue(s) and dates	1-5 April 2019, Den Helder, The Netherlands (23 participants)

1 Summary of Work plan (copy from resolution)

Year 1	Organise a workshop bringing together gear technologist and survey scientists to discuss gear options in relation to data needs and implementation issues
Year 2	Evaluate proposed gear options and their effect on timeseries
Year 3.	Carry out at sea trials and evaluate results
Recurrent annual activity	Updates for ToRs a, b, and c.

2 List of Outcomes and Achievements of the WG in this delivery period

- Description of survey products: Survey summaries of IBTS coordinated surveys for Q1 2018(NEA), Q3/Q4 2018(NS/NEA) and Q1 2019(NS);
- Update of survey manual for the International Bottom Trawl Surveys in the North Sea has been completed and will soon be sent to the ICES secretariat for publication;
- Validated NS IBTS Q3 2018 and Q1 2019 datasets (available via DATRAS);
- Validated 13North eastern Atlantic survey 2018 datasets (available via DATRAS);
- The concept of the CCR has been discussed and contributors have been identified;
- The developments of a new survey trawl are discussed. Two routes are currently followed. On led by Scotland which presented results of gear comparison trials undertaken during Q4 2018 and proposed follow-up trials for Q4 2019. The other, led by Ireland completed trials in the flume tank followed up with a small number of paired comparative hauls in the field during Q4 2018, and plan for summer 2019 workshop to further discuss the route forward;
- A number of analyses and tools are presented and discussed to evaluate the effect of changes in the survey design. Amongst others on the haul duration, sampling effort and otolith collection. The tools are explained to others to use them to assess their specific questions related to these topics to make it a group effort to evaluate the survey design.

3 Coordination of North Sea and Northeast Atlantic surveys (ToR a)

3.1 Combined North Sea and Northeast Atlantic survey effort

(Finlay/Paco)

Plots of demersal trawling effort for all the associated surveys covered within this current reporting period in the North Sea (NS) and the north-eastern Atlantic (NEA) areas are provided below in figures 3.1.1 and 3.1.2. Distribution plots for selected species encountered during the IBTSurveys (NS and NEA) in summer and autumn (Q3/4) are presented in Annex 6. The species are listed below in table 3.1.1. For certain target species these have been separated into pre and post recruits and details of the length split for these species are also provided in the table.

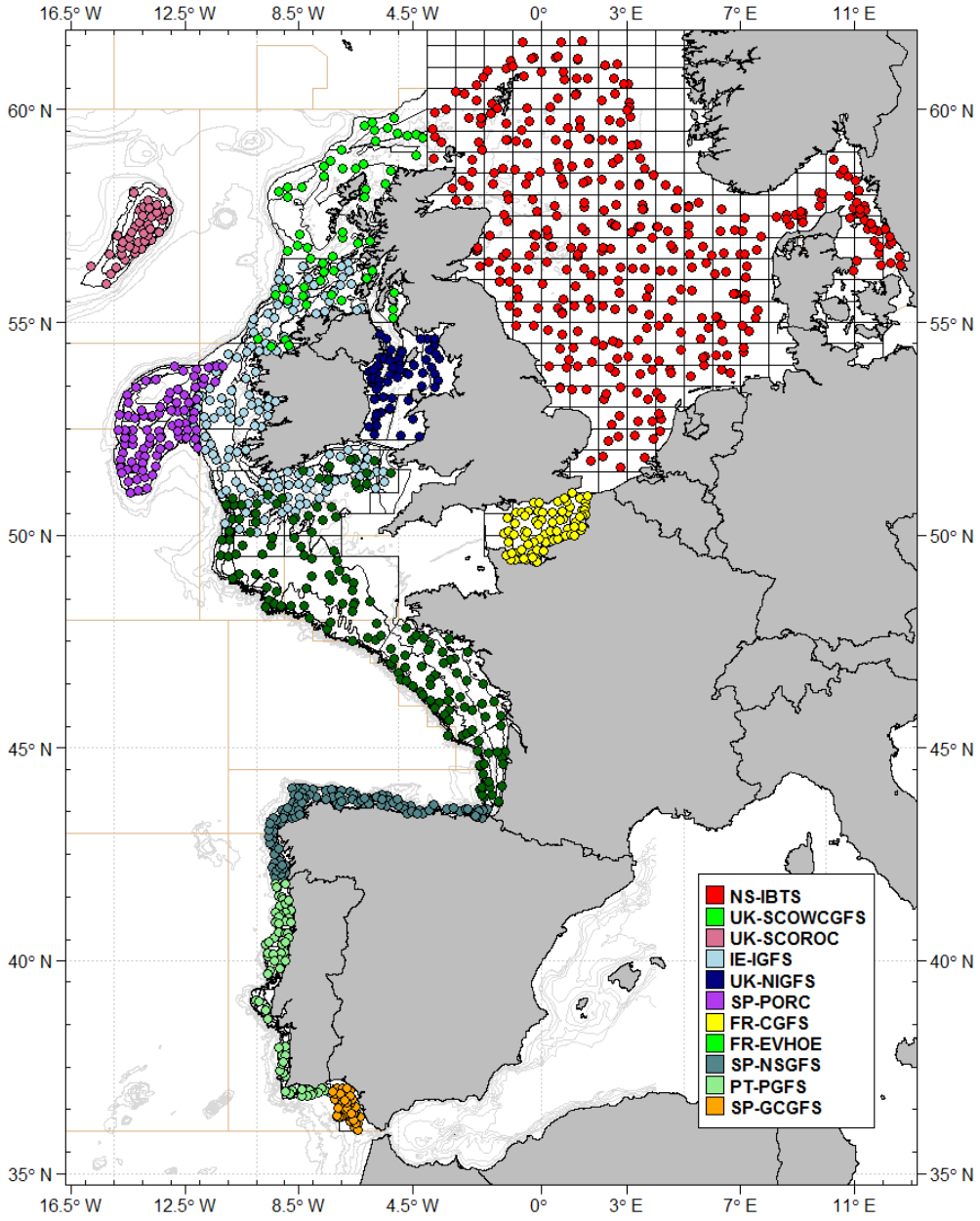


Figure 3.1.1 - Station positions for the IBTS carried out in the north-eastern Atlantic and North Sea area in Q3/Q4 of 2018.

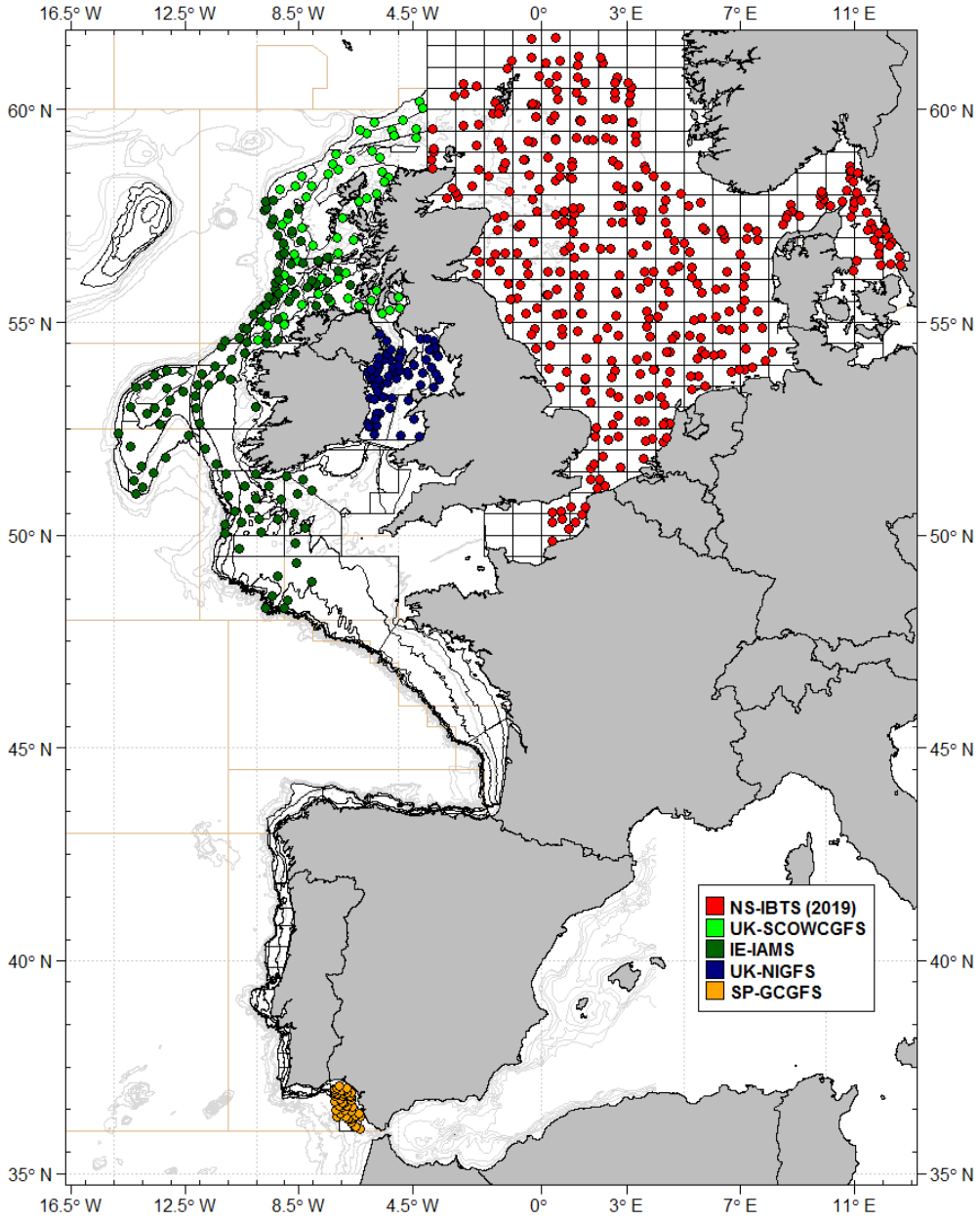


Figure 3.1.2 - Station positions for the IBTS carried out during Q1 2018 in the north-eastern Atlantic and Q1 2019 in the North Sea area.

Table 3.1.1 Species for which distribution maps have been produced, with length split for pre-recruit (0-group) and post-recruit (1+ group) where appropriate. The maps cover all the areas encompassed by surveys coordinated within the IBTSWG (North Sea and North-eastern Atlantic Areas).

Scientific name	Common name	Code	Figs No.	Length Split (<cm)
Capros aper	Boarfish	BOC	45	
Clupea harengus	Herring	HER	6-7	17.5
Conger conger	Conger	COE	46	

Gadus morhua	Atlantic Cod	COD	2-3	23
Galeorhinus galeus	Tope Shark	GAG	33	
Galeus melastomus	Blackmouthed dogfish	DBM	31	
Lepidorhombus boscii	Four-Spotted Megrim	LBI	16-17	19
Lepidorhombus whiffiagonis	Megrim	MEG	14-15	21
Leucoraja naevus	Cuckoo Ray	CUR	36	
Lophius budegassa	Black-bellied Anglerfish	WAF	20-21	20
Lophius piscatorius	Anglerfish (Monk)	MON	18-19	20
Merlangus merlangius	Whiting	WHG	24-25	20
Melanogrammus aeglefinus	Haddock	HAD	4-5	20
Merluccius merluccius	European hake	HKE	8-9	20
Micromesistius poutassou	Blue whiting	WHB	26-27	19
Mustelusmustelus	Smooth Hounds	SMH	34	
Mustelus asterias	Starry Smooth Hounds	SDS	35	
Nephrops norvegicus	Norway Lobster	NEP	28	
Pleuronectes platessa	European Plaice	PLE	22-23	12
Raja brachyura	Blonde ray	RJH	41	
Raja clavata	Thornback ray (Roker)	THR	37	
Raja microocellata	Painted/Small Eyed Ray	PTR	38	
Raja montagui	Spotted Ray	SDR	39	
Raja undulata	Undulate Ray	UNR	40	
Scomber scombrus	European Mackerel	MAC	12-13	24
Scyliorhinus canicula	Lesser Spotted Dogfish	LSD	29	
Scyliorhnus stellaris	Nurse Hound	DGN	30	
Sprattus sprattus	European sprat	SPR	42	
Squalus acanthias	Spurdog	DGS	32	
Trachurus picturatus	Blue Jack Mackerel	JAA	44	
Trachurus trachurus	Horse Mackerel (Scad)	HOM	10-11	15
Trisopterus smarkii	Norway pout	NPO	43	
Zeus faber	John Dory	JOD	47	

3.2 North Sea Q1

(Coordinator: Ralf van Hal)

3.2.1 General overview

The North Sea IBTS Q1 survey aims to collect data on the distribution, relative abundance and biological information on a range of fish species in ICES area 3a, 4 and 7d. During daytime a bottom trawl, the GOV (Grand Ouverture Verticale), with groundgear A or B, was used. A CTD was deployed at most trawl stations to collect temperature and salinity profiles. During night-time herring larvae were sampled with a MIK-net (Midwater ring net). Age data were collected for the target species cod, haddock, whiting, saithe, Norway pout, herring, mackerel, and sprat, and a number of additional species.

The 2019 fleet consisted of five vessels: "Dana" (Germany, Sweden and Denmark), "GO Sars" (Norway), "Scotia" (Scotland), "Thalassa" (France), and "Tridens II" (Netherlands). The survey covered the period 4 January to 28 February 2019. In this period 351 valid GOV hauls and 667 MIK hauls were deployed. Nearly all rectangles allocated were covered by at least 1 GOV haul and at least 2 MIK hauls. The coastal rectangle 38F8 and 39F8 were not covered. The extensive summary report can be found in Annex 3.

3.2.2 Highlights

- The German vessel Walther Herwig was unavailable this year due to necessary repairs. As a replacement they have chartered the Danish vessel Dana, which was, however, only available for 20 days instead of the normally planned 33 days. Due to shorter available ship time and the shorter daylight duration in early January, the Germans and Danes have switched their sampling area, and a priori reduced a number of hauls. Most of these hauls are covered by other countries.
- Due to the change in ship the Germans had to start their survey already in the first week of January, which is nearly a month earlier than the area would normally be covered. Especially for the larval development this might be an issue.
- The French had issues getting a permit for UK waters, only receiving it mid-way through their survey. In the meantime an exchange in haul positions with the Dutch had already been agreed, ensuring no loss of spatial coverage.
- Norway has carried out four experimental hauls between 250 and 285 m depth on the southwestern edge of the Norwegian trench.
- The spatial plots of 1-ringer herring indicates high abundances in the Skagerrak/Kattegat. Including or excluding this area from the index calculations has a much higher effect than in recent years.
- Participants reported for the second year on a row, that their impression was the total biomass of the catches was low. Quick analyses of the yearly biomass by haul do not really support these observations, which might be a result of the changes in spatial coverage in latest year than a real change in the biomass of the catch.
- In the eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was very low, and virtually no larvae occurred in the German Bight.
- From the MIK samples above-average catches of pilchard larvae were found specifically in the German Bight area (where herring larvae were lacking). Pilchard in the GOV catches was also above average

- As in last year small juvenile *Illex coindetti* were caught, which is in line with the findings that Illex is spawning in the North Sea in latest years (Oesterwind et al. submitted).
- The survey manual has been updated and will be submitted as a new version after the meeting.

3.2.3 Planning and Coordination

The issues with the German vessel will continue in 2020, with a replacement vessel being sought for the scheduled survey duration of 33 days this time. A likely candidate is again the Danish vessel Dana, in which case the Germans will need to start early January (with the same potential timing issue, especially with regards to larval development and distribution). In that case, the spatial distribution of the German and Danish survey are likely to change again.

As in other years the Germans are unlikely to complete their full program. Therefore, Denmark has offered to cover the rectangles 44F3-45F3 (figure 3.2.3.1). Next to that Denmark will cover 43F9 additionally.

Norway will be covering 44F6 also in Q1 from 2020 onward. Additionally, Norway will request additional time at sea to create an overlap with Sweden. In that case they will try to cover a number of hauls in the Skagerrak area and potentially some experimental hauls in the Norwegian trench beyond the depth limits of the IBTS as recommended by WGINOSE and WGWIDE.

Sweden will be using their new vessel and has requested additional time at sea for doing additional hauls to increase the overlap. With Denmark and Norway initially and then potentially with other countries as well. The Norwegian and Swedish proposals depend upon the additional funding, and will be discussed later this year when the funding situation becomes clearer.

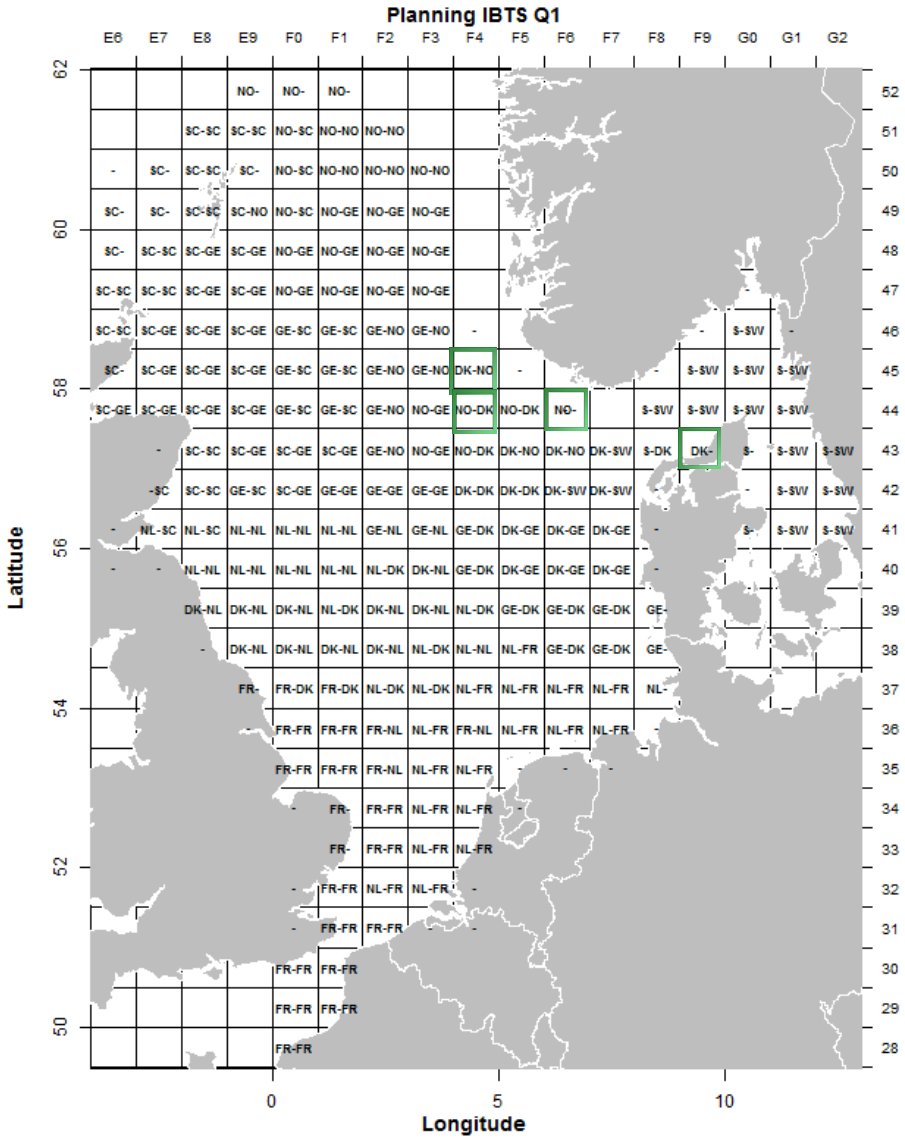


Figure 3.2.3.1 Allocation map for Q1 2020. In green the additional rectangles taken by Denmark and Norway.

3.3 North Sea Q3

(Coordinator: Kai Wieland)

3.3.1 General overview

The North Sea IBTS Q3 survey aims to collect data on the distribution, relative abundance and biological information on a range of fish species in ICES Division 3a and Subarea 4. The bottom trawl, GOV (Grand Ouverture Verticale) with standard ground gear A for normal bottom conditions or ground gear B for rough ground is used during daytime. A CTD was deployed at most trawl stations to collect temperature and salinity profiles. Age and individual fish data were collected for the standard species herring, sprat, cod, haddock, whiting, saithe, Norway pout, mackerel and plaice, and for a number of additional species.

Six nations (using five vessels) participated in the quarter 3 survey in 2018: Dana (Denmark and Sweden), Walther Herwig III (Germany), Kristine Bonnevie (Norway), Cefas Endeavour (England) and Scotia (Scotland). The overall survey period extended from 21 July to 9 September 2018. In this period 349 valid GOV hauls were deployed. Nearly all rectangles allocated were covered by at least 1 GOV haul. The extensive summary report can be found in Annex 4.

3.3.2 Highlights

- The number of rectangles covered by only one haul was less than in any year since 2010;
- Of the rectangles with only one haul, most are rectangles that are largely covered by land or other obstructions, or are not fishable with the GOV;
- 16 tows reported as valid to DATRAS were shorter than 27 minutes (ENG, NOR, SCO, SWE) and for 7 tows durations was just 15 minutes (SCO) due to various reasons;
- England and Norway did not collect biological samples for sprat;
- Sweden did not collect mackerel otoliths;
- The lack of Swedish mackerel otoliths means that the mackerel distribution by age in the Skagerrak and Kattegat depends on age samples collected by Denmark from two stations in the south-western Skagerrak and the North Sea age samples;
- For some target species, high densities were found outside the actual index areas, e.g. Norway pout and mackerel. Saithe and plaice index areas were revised during recent benchmarks, but for other species, actual distribution patterns may warrant a revision of the species-specific areas on which the standard indices are calculated in DATRAS;
- The DATRAS download of CPUE by age and haul does not include data for rectangle 44F6. Despite valid tows have been made there and it has been requested repeatedly by IBTSWG since 2015 to include all fished rectangles in the DATRAS CPUE products.

3.3.3 Planning and Coordination

All regularly contributing countries intend to participate in the quarter 3 2019 NS-IBTS survey program. Below is a table showing the expected program dates for each country for this year.

England	Cefas Endeavour	6 August to 4 September
Denmark	Dana	30 July to 16 August
Germany	Walther Herwig III	8 July to 7 August
Norway	Kristine Bonnevie	22 July to 17 August
Scotland	Scotia	3 August to 23 August
Sweden	Dana	19 August to 30 August

No major changes in the rectangle allocation scheme are planned and the actual rectangle allocation to the countries is show in Figure 5.3.3.1. Country specific maps will be provided in the international cruise program prior to the surveys.

The recording of additional information on towing times and winch speed shall continue as in previous years (ICES 2018) using the provided template sheet.

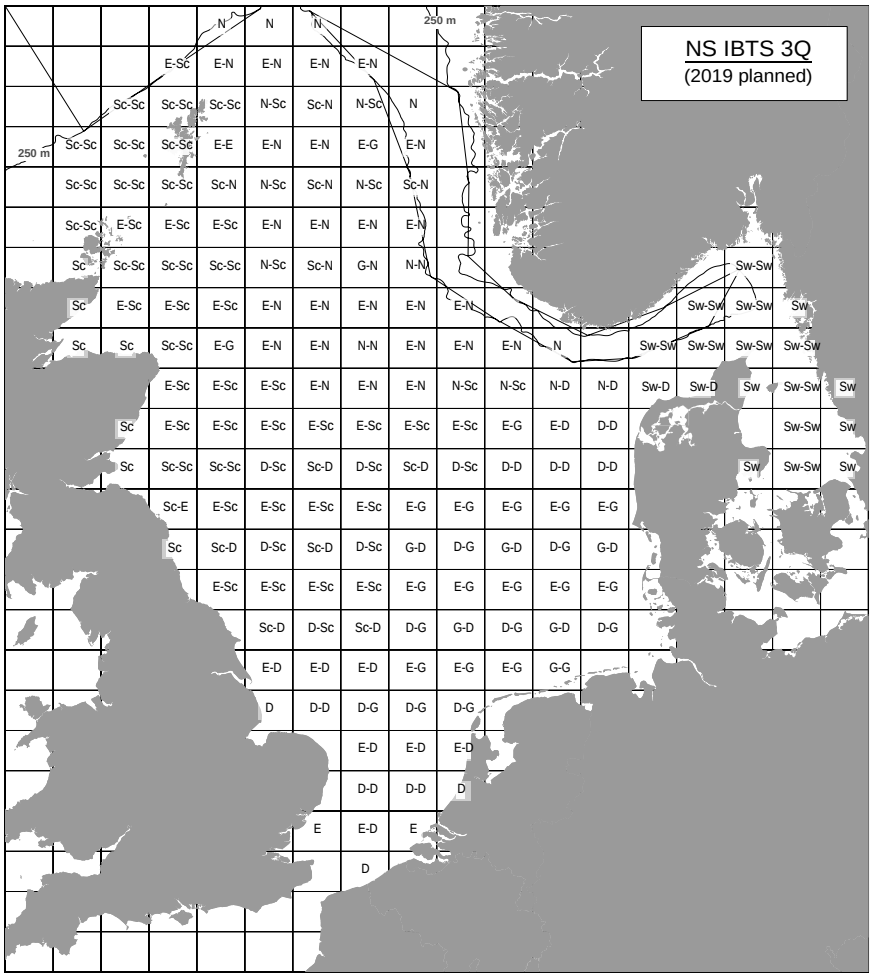


Figure 5.3.3.1. Rectangle allocation by country for the 3Q survey in 2019 (D: Denmark, E: England, G: Germany, N: Norway, Sc: Scotland, Sw: Sweden).

3.4 Northeast Atlantic

(Coordinator: Finlay Burns)

3.4.1 General Overview

In 2018, seven vessels from 6 nations performed 14 surveys along the Northeastern Atlantic (NEA) IBTS area. A total of 1155 valid hauls, out of the 1181 hauls planned, were accomplished over 324 days distributed between the first, third and fourth quarters. In 2018 all surveys were completed and most were undertaken without serious issues. Four 1st quarter surveys (Scotland, Northern Ireland, Ireland and the Spanish survey in the Gulf of Cadiz), and also the usual 3rd quarter surveys (UK-SCOROC-Q3 and SP-PORC, SP-NSGFS). France, Northern Ireland, Ireland, Scotland, Spain and Portugal were all active during the 4th quarter. Included within the reported surveys is the Irish Anglerfish and Megrim Survey (IE-IAMS-Q1) and although the data are not yet uploaded to DATRAS, the survey is now used as a tuning index for mon.27.78abd (WGBIE) since the benchmark for this stock in 2018 (WKANGLER). Information on the IAMS-Q1 was also included as an annex on the new version of the Manual of the IBTS North Eastern Atlantic Surveys, SISP 15 (ICES, 2017). The extensive summary reports can be found in Annex 5.

3.4.2 Highlights

- During the Portuguese groundfish survey (PT-PGFS-Q4), 8 days of survey time were lost to weather and an additional 4 days were lost due to other non-specific vessel related reasons with the result that only around 60% of the stations were completed during the survey on board Noruega. Due to bureaucratic constraints, and to fulfil the monitoring programme, 12 additional hauls were undertaken aboard the commercial vessel Calypso that was utilised at short notice. There are currently no plans to upload these hauls undertaken on the commercial vessel nor utilise these data in the index estimation for the target species until more specific analysis have been completed.
- The French Channel Groundfish Survey (CGFS) in 2018 extended the surveyed area into the western channel which had been not been surveyed regularly since the cessation of the Q1 English Groundfish survey in 2011. This welcome extension to the survey will be continued annually by the CGFS.
- During 2018, France commenced collection of juvenile mackerel during the EVHOE survey in quarter 4. This was in response to a recommendation received from WGWIDE;
- Ireland undertook a limited gear trial undertaking 4 comparative hauls during the IGFS comparing an experimental demersal trawl with the current Irish GOV trawl;
- Scotland undertook a set of 3 zero minute tows accompanying and directly adjacent to a nominal 30 minute trawl during the SCOWCGFS-Q1 in 2018. This will contribute to analysis that will aim to provide useful results on trawl settling time by country and will be incorporated (along with many other such sets from several countries) into the collaborative research report due at the end of this reporting cycle and discussed in section 8.3.

3.4.3 Planning and Coordination

Table 3.4.5.1 below, presents the expected dates for the Northeastern Atlantic IBTSurveys taking place in 2019.

Table 3.4.5.1. Provisional/realised dates for 2019 NeAtl Surveys

Survey	Code	Starting	Ending	Expected hauls
UK-Scotland West (spring)	UK-SCOWCGFS -Q1	17-02-19	11/03/19	60
UK-Scotland Rockall	UK-SCOROC-Q3	14-09-19	26/09/19	40
UK-Scotland West (aut.)	UK –SCOWCGFS-Q4	04/11/19	25/11/19	60
UK-North Ireland (aut.)	UK-NIGFS Q4	07-10-19	25-10-19	60
UK-North Ireland (spring)	UK-NIGFS Q1	03-03-19	22-03-19	60
Ireland –Anglerfish Survey 7bcjk	IAMS-Q1	01-03-19	26-03-19	65
Ireland - Anglerfish Survey 6a	IAMS-Q1	16-04-19	25-04-19	45
Ireland - Groundfish Survey 6a	IE-IGFS	21-10-19	12-11-19	45
Ireland - Groundfish Survey 7bgj	IE-IGFS	13-11-19	14-12-19	125
France – EVHOE	FR-EVHOE	21-10-19	12-05-19	155
France - Eastern Channel	FR-CGFS	30-09-19	17-10-19	74
Spain – Porcupine	SP-PORC	07-09-19	11-10-19	80
Spain - North Coast	SP-NSGFS	15-09-19	21-10-19	116
Spain - Gulf of Cádiz (Spring)	SP-GCGFS Q1	18-02-19	05-03-19	41
Spain - Gulf of Cádiz (Aut.)	SP-GCGFS Q4	29-10-19	11-12-19	41
Portugal (Aut.)	PT-PGFS	01-10-19	31-10-19	96

4 DATRAS and related topics on data quality (ToR b)

4.1.1 WKSABI

IBTSWG adopted the conclusion from WKSABI that swept-area based survey indices require tow by tow information of towed distance and door or wing spread from all survey participants. For several reasons this information is not always available and missing values have to be estimated. Despite the use of standardized survey trawl, gear geometry between countries or within countries between years can vary substantially and it was therefore concluded that algorithms for estimating missing values should be as specific as possible for a given survey, vessel, country and year combination. This is important in order to minimize bias and variability when including the imputed values for the calculation of swept area. Since door spread has been much more often observed than wing spread and is usually measured with a lower variability than wing spread, swept are based on door spread is preferred if indices rather than absolute estimates are required. Several countries participating in the IBTS have started to change from nylon to polyethylene net material and replacements of vessels will occur in the near future. Hence, in case of missing observations, new algorithms preferably for the actual survey should be established, and this approach has been applied for missing values of door spread for Norway and Germany from the 3Q NS-IBTS in 2018.

DATRAS will enable the option to upload new algorithms that will automatically be used in the calculation of the swept area data products. This option will allow the national submitter to add the algorithm and specify the range of years for which this algorithm should be used. In the way, also an overview of the used algorithms is created.

4.1.2 DATRAS governance group (WGDG)

The Working Group on DATRAS governance (WGDG) was initiated in 2018 and consists of representatives of the ICES Data Centre and the demersal survey working groups: WGBEAM, IBTSWG and WGBIFS. The group has four terms of reference:

a. Further evolve the framework on the governance of DATRAS;
b. Oversee and advise on the interpretation and prioritisation of recommendations from expert groups addressed to DATRAS;
c. Facilitate common functionality in terms of data providers and data user across different surveys to improve upload efficiency and allow broader perspectives (covered by more than one survey) can be effectively addressed;
d. Provide a platform for end user feedback to the DATRAS system, as well as feedback on the outcomes of those suggestions.

Related to ToR b, the WGDG representative presented the following questions for IBTSWG.

1. Which species validity codes are present within the various IBTSWG data-series and which corresponding DATRAS data products currently utilise data containing these specval codes. This information is provided below in table 4.1.2.1.

Table 4.1.2.1 Specval codes in use within IBTSWG data

specval	meaning	Take into account in IBTSWG product(s)	Comment
1	Valid information for use in DATRAS data products	Yes	Present
2	Partly valid information	No	Not used by IBTSWG
3	Length composition incomplete	No	Not used by IBTSWG
4	No length measurements only total number	No	Present Length=NULL
5	Observed only, not measured, not counted, but only presence/absence is registered	No	Present in IBTSWG data
6	No length measurements, only category catch weight	No	Present in IBTSWG data
7	No length measurements, only total number and category catch weight	No	Present in IBTSWG data
8	Only volume (litre) registered	No	Not used by IBTSWG
9	Valid information available but not recorded in the file	No	Not used by IBTSWG
10	No category catch weight, only total numbers and length composition	No	Not used by IBTSWG

2. Estimated/seeded ages

On occasion, countries provide estimated ages for smaller fish instead of read ages. It would be desirable to be able to flag these records. ICES Data Centre proposes to add it to the field 'AgeSource', and mark it as 'assumed age based on length'.

IBTSWG supports the idea to clearly mark the seeded/estimated ages. After a discussion on the subject amongst the IBTSWG community it was found that only Sweden uploaded seeded ages to DATRAS. Uploading seeded ages for a whole year is not recommended and it would be useful if there was a mechanism for flagging those records such as mentioned above.

4.1.3 Adding non-standard/experimental hauls

There has been a continued debate on including non-standard or experimental hauls in DATRAS. In DATRAS valid hauls means according to the manual and therefore suitable for stock assessment. All other hauls should be marked as invalid.

In many cases additional (invalid/not suitable for stock assessments) hauls are or cannot be uploaded to DATRAS, while these additional hauls have value and there is often interest for these very useful and costly data sets by the wider academic community given the rarity and cost of collecting this data under relatively controlled conditions on research vessels. Therefore, IBTSWG and the datacentre see the need to create the option to include these data in DATRAS. This could be done using the code "A" Additional haul in the HaulVal record of the HH-file. However, these would not identify hauls part of a planned experiment, e.g. zero minutes or 15-min comparison, for which it would be helpful to enable direct extraction of the hauls part of the experiment. The datacentre has proposed to add an additional code to the HaulVal record in the HH-file. This additional code "E" could then be used to mark experimental hauls, without the necessity to mark them as invalid.

There is no overall agreement about this solution, as in this case hauls valid for the index calculation cannot be identified as part of the experiment. Nor could all hauls being part of the experiment be extracted based on only this code. Therefore, solutions were discussed adding one or more additional columns to the HH-file with a Unique Identifier, which explains the experiment or reason for the additional haul.

In this case it could look like the table below, where the footnote column is the Unique Identifier

Description not part of the HH-file	HaulVal	Footnote
Normal haul valid	V	
Normal haul, invalid	I	
Normal haul, part of experiment	V	10001
Experimental haul	E	10001
Experimental haul invalid	I	10001
Additional haul	A	10002
Additional haul	A	10003

1001: zero minute experiment

1002: night time

1003: elongated duration

However, a number of participants do not agree with adding codes to the HaulVal column in their opinion this column should only have Valid/Invalid to indicate the use for the stock assessment. In that case a third column could be added to discriminate within the Invalid hauls. That would look like the table below.

Description not part of the HH-file	HaulVal	RealValid	Footnote
Normal haul valid	V	V	
Normal haul, invalid	I	I	
Normal haul, part of experiment	V	V	10001
Experimental haul	I	V	10001
Experimental haul invalid	I	I	10001

Additional haul	I	V	10002
Additional haul	I	V	10003

There has for now been no conclusion from this debate. Therefore, IBTSWG recommends the datacentre and WGDG to work out the discussed options and to develop their option to be used in the near future.

5 New survey trawl gear (ToR c)

5.1 Goals and objectives

The 2018 IBTSWG recommendation was to "Establish a joint workshop (WGFTFB and IBTSWG) for developing a new standard survey trawl and rigging for the NS-IBTS and the NeAtl-IBTS ". The actions for 2018 were to present the technical context to the 2018 FTFB meeting for discussion and feedback. Following this, TOR participants would meet at the IFREMER flume tank facility in Lorient, France. This Lorient workshop was to detail and agree:

1. how the general design principles outlined in WGSTS and WGSTG would be incorporated into the current design proposals
2. what additional design/configuration aspects might need to be evaluated to deliver an up to date, complete demersal sampling trawl solution

Finally, the Irish and Scottish participants had scheduled sea-time late 2018 to carry out first sea trials of the two design approaches under consideration at this point. All the above actions were achieved and reported in 2 presentations during the IBTSWG meeting 2019.

As outlined at IBTS2018, Marine Scotland had an existing Jackson designed trawl in place as part of another project that satisfied many of the criteria emanating from the earlier study groups and was therefore deemed a suitable candidate for further evaluation. The Marine Institute (Ireland) took a blank sheet approach and designed a trawl in-house from the ground up based on the SGSTS2005[1] design recommendations. As a completely new design it was the latter development that benefited most from technical input from the tank trials and Dynamit (https://wwz.ifremer.fr/dynamit_eng/) simulations during and post workshop at Lorient.

Below is a summary of the outcomes so far from the Scottish and Irish Sea Trials.

5.2 Modified gear and development

A new survey trawl has been developed by Marine Scotland (MS) Science as a possible replacement to the GOV trawl. The initial design process was guided by the road map laid out by SGSTS for the introduction of new survey gears. During November 2018 catch comparison trials were undertaken on MS Science vessel FRV Scotia to compare the capture efficiency of this new trawl against the GOV trawl rigged with ground gear A. The experimental trials were conducted on fishing grounds located west of the Shetland Islands called Scalloway Deeps in water depths between 121 to 133 m. The haul procedure was the same throughout and consisted of paired alternate hauls of between 15 and 20 minute duration with all fishing undertaken during daylight hours. A total of 18 valid paired hauls were completed with a similar species mix encountered by both gears. There were sufficient quantities of haddock, whiting, Norway pout, common dab, long rough dab, grey gurnard and cod for subsequent analysis.

The main gear geometry parameters (headline height, door and wing-end spreads) were similar for both the new and GOV trawl. Mean wing-end spreads were slightly lower (19 m-21 m) for the GOV compared to the new trawl (21 m-24 m). Door spread for the new gear was ~5m less

[1]ICES. "Report of the Study Group on Survey Trawl Standardisation (SGSTS)." ICES Council Meeting Documents [ICES Council Meeting Documents. Copenhagen], 2005. 7526884.

than the GOV but headline heights were similar (4.8 m-5.1 m). It was further noted the new gear was more stable over the speed ranges encountered during the trials. Preliminary analysis was undertaken comparing the catchabilities of the two gears using catch per unit (m^2) net swept area. Results suggested for all species catches were similar except Norway pout with the new gear retaining far more compared to the GOV. A fuller statistical analysis is planned for summer 2019.

Further catch comparison trials are planned for November/December 2019 with one option to undertake additional hauls in water depths of between 60m-70m.

5.3 New gear development

The motivation to start afresh with a blank sheet of paper to design a survey trawl replacement can be traced back to the SGSTS05 report. Based on the 'ideal survey trawl' criteria discussed and extend therein it was agreed that none of the available survey gears, which are invariably based on commercial designs, could meet all the criteria.

In considering this gear development ToR it was felt many of the gear rigging and geometry issues can be approached by adjustments or modifications to most demersal trawl designs to a greater or lesser degree. What cannot be adjusted, and needs to be 'hard-wired' in at design stage, is design simplicity.

A lot of discussion at the IFREMER workshop regarding simple net construction therefore centred on the mesh sizes for the various panels. The GOV has five different joining ratios between panels as well as multiple cutting ratios to taper the net along its length. To simplify this, the proposed design solution from the Marine Institute has a simple 1/1 joining ratio between panels throughout the trawl with a constant cutting ratio for the taper also. Joining panels of one mesh size to a smaller mesh panel on a 1/1 ratio is a very simple join obviously (Fig 5.3.1) compared to more complicated ratios with the required strollers (Fig 5.3.2).

Fig 5.3.1. Joining a 120mm to 110mm Full Mesh (FM) panel simply sewing 1 mesh to 1 mesh between panels.

Fig 5.3.2. Joining a 120mm to 78mm Full Mesh (FM) panel requires a joining ratio of 4/5 meshes between panels with accompanying strollers.

This simpler approach is only possible with small reductions (probably <12mm) in mesh size between adjoining panels however, which can increase the number of panels (steps) required between the max and min mesh sizes for a given trawl.

The number of panels required was discussed. Beyond being very simple to repair, the trade-off for selecting the mesh size for various panels is between selectivity and time to repair. Most trawl damage happens at the front of the trawl so the further forward you come with smaller meshes the multiples of hours you may have to spend making a trawl usable again after any significant damage. Conversely, the further back you go with larger meshes the more small fish you are likely to be losing through the meshes. Water flow through the trawl is also a mesh size consideration, but less significant than selection/repair.

Trials were undertaken in Galway Bay of the 2/3 scale version in mid-Dec 2018 on the 34m Celtic Voyager. Initial 2 days were setting up the trawl, followed by parallel fishing with the Celtic Explorer during the IBTS Q4 groundfish survey. Weather hampered operations so only one full day's parallel fishing was achieved in December, resulting in 4 paired hauls.

Data is limited given the restricted number of days and depths due to weather, but indications are the trawl works as expected. Buoyancy ended up essentially as per Dynamit simulations, but significantly more headline height is thought achievable with a full size version and adjustment of the chains at the wing ends.

Catch in Kg/Km2(Fig 5.3.3) indicated the new trawl was more efficient for the roundfish most commonly encountered (haddock, whiting, poor cod, gurnard)as well as flatfish (dab, sole).

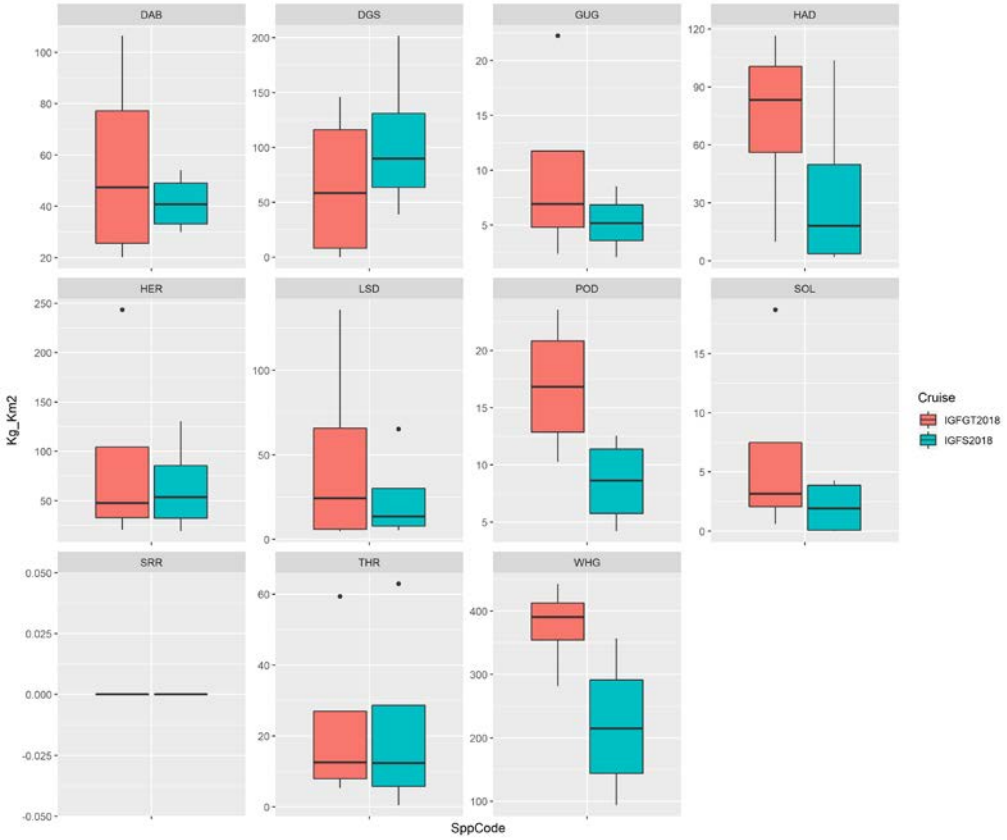


Fig 5.3.3. Box plots for catch in kg per km² from paired hauls between the GOV 36/47 on IGFS2018 survey (blue boxes) and the new survey trawl on IGFGT2018 (red boxes).

In terms of length frequencies a number of species such as whiting (Fig 5.3.4), haddock, dab and poor cod showed higher numbers of small individuals in the new trawl.

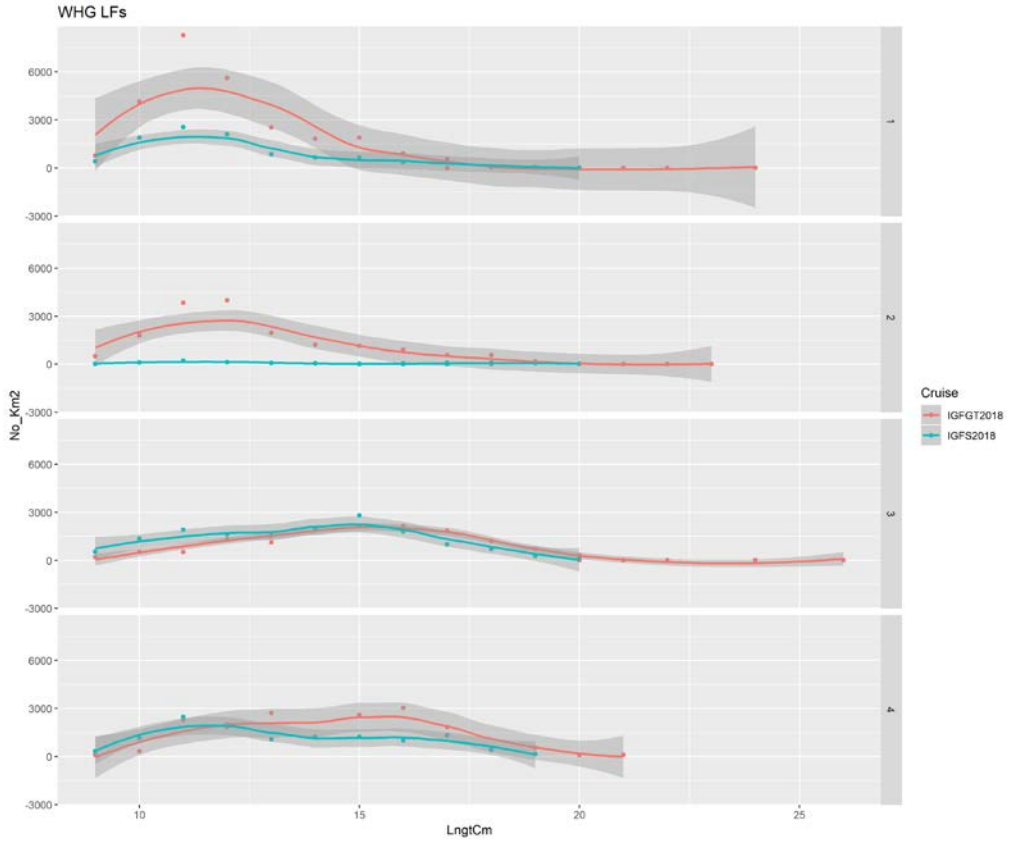


Fig 5.3.4. Length frequency plots for catch in No at length per km² from paired hauls between the GOV 36/47 on IGFS2018 survey (blue lines) and the new survey trawl on IGFGT2018 (red lines). Hauls 1 and 2 show quite a lot more small fish evident in the new trawl's catches.

The limited data doesn't support any conclusions obviously, but indications are good that geometry was predictable and stable. Catches in terms of biomass were at least equivalent if not higher for gadoids and flatfish and selectivity seemed improved for roundfish and flatfish. More work needs to be done on the rigging and in terms of collecting catch data over the coming year to stand over these initial indications however.

5.4 Vonin flyer results (ROB)

During IBTSWG (2018) meeting in Galway Marine Scotland Science (MSS) gave a commitment to obtain underwater footage of the new Vonin 'Flyer' kite. The 'Flyer' is designed to create buoyancy using water flow through three foils to give hydrodynamic lift. The group were keen to assess its potential as a replacement to the standard Exocet kite, which is expensive and difficult to operate. The 'Flyer' was tested and filmed during November 2018 on MS Science vessel Scotia with Scanmar acoustic instrumentation used to check gear geometry. Along with the Flyer a number of different configurations of kite/headline flotation were also tested for comparison:

- 60 x 200mm floats with no kite (baseline) - Headline height = 3.5m
- 60 x 200mm floats + GOV kite (standard Scottish rig) - Headline height = 5.3m
- 60 x 200mm floats + 2 x Flyers - Headline height = 4.7m
- 88 x 200mm floats no kite or Flyer - Headline height = 4.1m
- 88 x 200mm floats + 2 x Flyers (Denmark IBTS Q1, 2018) - Headline height = 5.3m

Underwater footage suggested the 'Flyer' orientates well and appears to be very stable. It was found when 2 'Flyers' are used at the headline centre floats are required in between to enable them to operate effectively. Furthermore, they proved very easy to operate compared to the standard kite with no issues encountered during deployment and retrieval. Gear geometry results suggest:

- Standard GOV kite provides ~1.8m of lift
- Two Flyers provide ~1.2m of lift and require flotation between them to operate correctly.
- Increasing flotation from 60 to 88 floats (+47%) + two flyers gives similar headline height as standard Scottish rig

Overall the Flyer design appears to function well but to replace the standard Scottish kite setup two flyers with additional floatation would be required. However, caution is needed when increasing headline lift as this may compromise ground gear contact and a trawls overall catchability.

5.5 The road forward

All participants have agreed on a road forward and accept the need for change. Scotland and Ireland have both agreed upon taking the lead on various sub-tasks and will progress their plans for further development.

1. Ireland will take the lead on the organisation of a summer workshop as a follow up meeting on the Lorient flume tank work. The focus will be to agree whether a single design and/or rigging is emerging at this point or whether further data is required from the 2 approaches. A working document will be circulated to the group prior to this to get general feedback from the group.
2. Scotland will complete additional gear trials from 28 Nov-9 Dec 2019, and invite other Countries to participate during these trials.
3. Ireland will undertake trials in the summer and construct a full size version of whatever agreed design(s) emerge from the workshop discussions. The intention will be to carry out parallel fishing with one of the other IBTSQ4 surveys in the area in Q4 2019.

5.6 Combined US and Canadian ground fish survey

US Northeast Fisheries Science Center survey standardization, calibration and gear efficiency estimation efforts

Over the past several years the Northeast Fisheries Science Center has put a lot of effort towards improving the standardization of our multispecies bottom trawl surveys and better understanding the relative catch efficiency of our survey trawl gear. This included a full transition of survey vessels and survey gear in 2009 along with extensive calibration experiments in 2008 between historical and new survey vessels and gear configurations. More recently, the NEFSC has conducted directed experiments to estimate survey trawl efficiency, focused primarily on ground gear efficiency for flatfish. In addition, the NEFSC has collaborated with the Canadian Department of Fisheries and Oceans Maritimes Region to investigate options to coordinate regional bottom trawl survey efforts in the Northwest Atlantic Ocean.

Relevant US NEFSC survey documentation:

Miller, T.J. 2013. A comparison of hierarchal models for relative catch efficiency based on paired-gear data for US Northwest Atlantic fish stocks. Canadian Journal of Fisheries and Aquatic Sciences, 2013, 70(9): 1306-1316, https://doi.org/10.1139/cjfas-2013-0136

Miller T.J., C. Das, P.J. Politis, A.S. Miller, S.M. Lucey, C.M. Legault, R.W. Brown, and P.J. Rago. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05, 233p. https://www.nefsc.noaa.gov/publications/crd/crd1005/

Politis P.J., J.K. Galbraith, P. Kostovick, R.W. Brown. 2014. Northeast Fisheries Science Center bottom trawl survey protocols for the NOAA Ship Henry B. Bigelow. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-06; 138 p. https://www.nefsc.noaa.gov/publications/crd/crd1406/

Gear efficiency experiments are currently in preparation with a manuscript publication expected.

6 Survey design (ToR d)

6.1 A Framework for evaluating survey performance at the assessment level

Cefas has been working towards a frame work for evaluating the impact of survey design changes on the advisory processes. Historically, the focus of survey data collection has been on consistency through time. However, with pressure on monitoring budgets and in the case of IBTS a need to change the current survey gear ships time is needed to evaluate gears or spatial changes in the survey design for which effort reductions in the consistent survey effort are needed. On longer time scales more emphasis needs to be directed towards addressing ecosystem questions so a means to evaluate effort deployment is necessary. The aim of the project is to address impacts at the level of the management metrics, i.e. F, SSB and recruitment coming out of the assessment process. It replicates the actual management advice process from data collection, including biological sampling through assessment.

The project is still in its early development and so far efforts have focused on three aspects, first implementing different ways of subsampling, second implementing different methods of index calculation, both model and design based indices and third automating the assessment process in an effective way to enable the evaluation of large numbers of simulations. As an example of what could be, IBTS was presented a draft analysis comparing two methods of survey reduction in relation to previous effort by the group to evaluate the impact of reducing tow duration from 30 minutes to 15 minutes.

Two methods of halving the sampling effort were compared, the first halving the tow duration, the other halving the number of stations fished in both the Q1 and Q3 NS-IBTS surveys for cod, haddock and whiting. Two different methods of index calculation (the current ICES indices used for haddock and whiting in so far as could be replicated and the delta-gam method used for cod) were applied to each of the species. For simulations using only 50% of the stations, stations were randomly subsampled from a post stratification scheme based on ecological strata.

Preliminary results suggest:

1) neither method of effort reduction had a major effect on the variability of assessment outputs, but unexpectedly some biases developed compared to the current assessment based in both cases.
2) ICES indices could not be replicated due to a subjective choice of data to include in specific years (mainly in the historic part of the series) so that effects of sampling at the station level required implementation of consistent ALK aggregation so that the overall index differed from that officially provided by ICES to the assessment process.
3) the consistency of the results when analysed with the surba method in parallel imply that the divergence is due to a shift in the survey weighting within the assessment due to a reduction in the abundance of older individuals in the survey indices.
4) the impact of using different methods for survey index calculation had a bigger effect on the assessment outcomes than did the reduction in sampling effort.
5) Given the simulations for the current assessment methods (Figure 6.1.1), one would conclude that from an efficiency perspective a 50% reduction in the number of stations is preferable to a 50% reduction in tow duration (Figure 6.1.2), particularly since from a

practical perspective reducing the number of stations saves significantly more ships time than the reduction of tow duration.

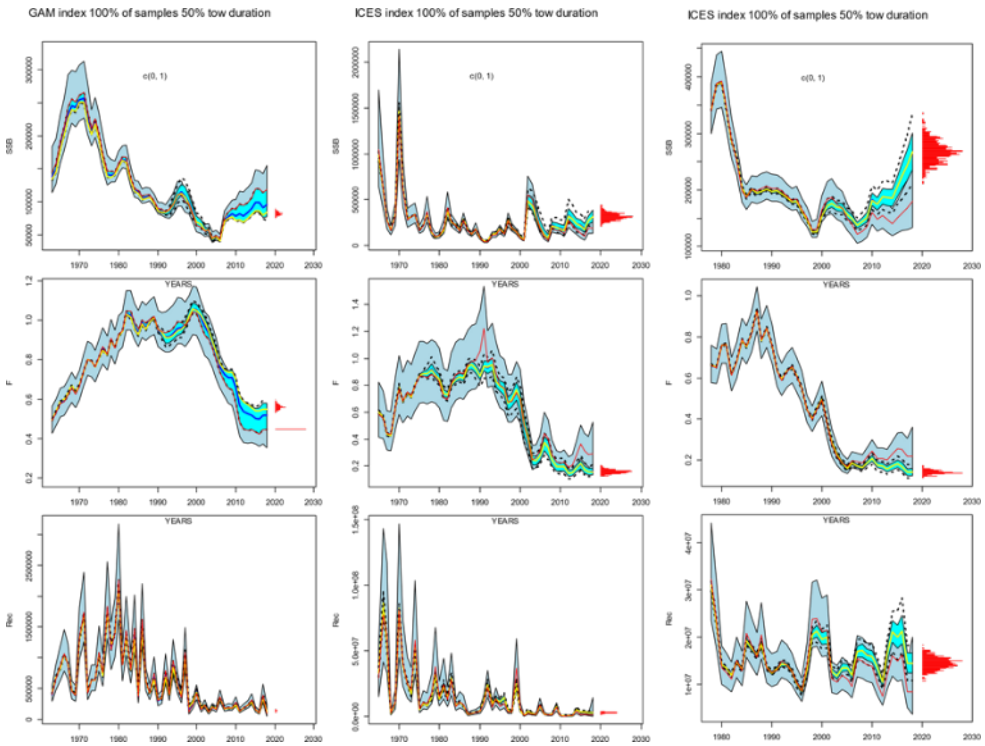


Figure 6.1.1: Stock assessment output for three species (NS cod, haddock, whiting left to right, SSB, F, recruitment top to bottom) compared to the current stock assessment as performed by WGNSSK 2018 using the approved index method for each assessment for 50% of stations at full tow duration.

Red line and grey-blue polygons indicate the estimate and the uncertainty according to the current stock assessment. Yellow and blue lines show the median and mean of the 500 simulations, with cyan polygons and dashed lines indicating 95% ci and min and max. Red histograms indicate the distribution of the 500 results.

N.B. Indices for haddock and whiting differ from those used by ICES (due to a lack of detailed rules from ICES as to how the indices are calculated) and it is not entirely clear if the reduction in sample size leads to the biases compared to the current assessment, or if the difference already exist for the full dataset (future work). Also the cod assessment failed to converge for a large number of iterations and the large separate peak in the F-plot represents the starting values in the assessment minimisation.

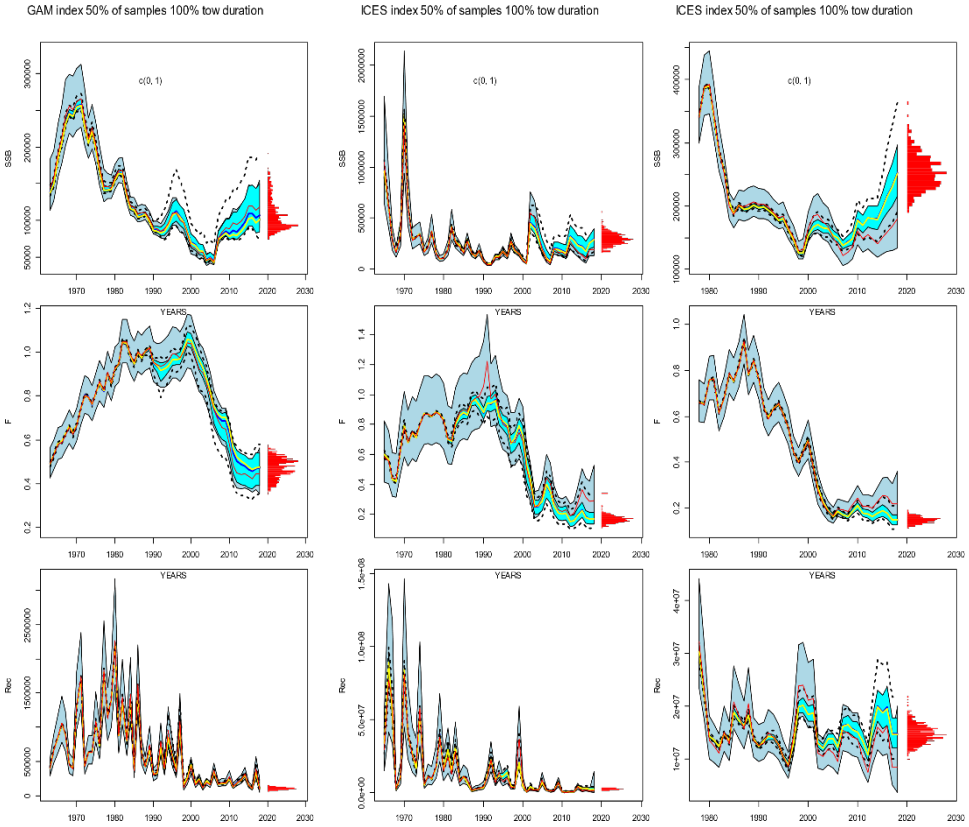


Figure 6.1.2: Stock assessment output for three species (NS cod, haddock, whiting left to right, SSB, F, recruitment top to bottom) compared to the current stock assessment as performed by WGNSSK 2018 using the approved index method for each assessment for all of stations at 50% tow duration.

6.2 Evaluation of sampling strategies of otoliths of the North Sea International Bottom Trawl Survey (IBTS)

(Natoya Jourdain, Olav Breivik, Edvin Fuglebakk - Institute of Marine Research, Norway and Norwegian Computing Centre Collaboration)

This research focused on three objectives:

1. The development of spatial age-length key (ALK) estimators for estimating indices of abundance at age
2. The development of uncertainty estimators for abundance at age indices and ALK estimators
3. Investigating the effect on abundance at age and its uncertainty if
    a. fewer otoliths are sampled
    b. the number of hauls is reduced or increased

The survey design of the North Sea IBTS is based on stratification at two levels: roundfish areas (RFAs) and statistical rectangles (Figure 6.1.1 (a)). However, ICES DATRAS uses a post-stratification of index areas for indices calculation for each target species. For example, the index area for *Gadus Morhua (*Cod*)* is given in Figure 6.1.1 (b).

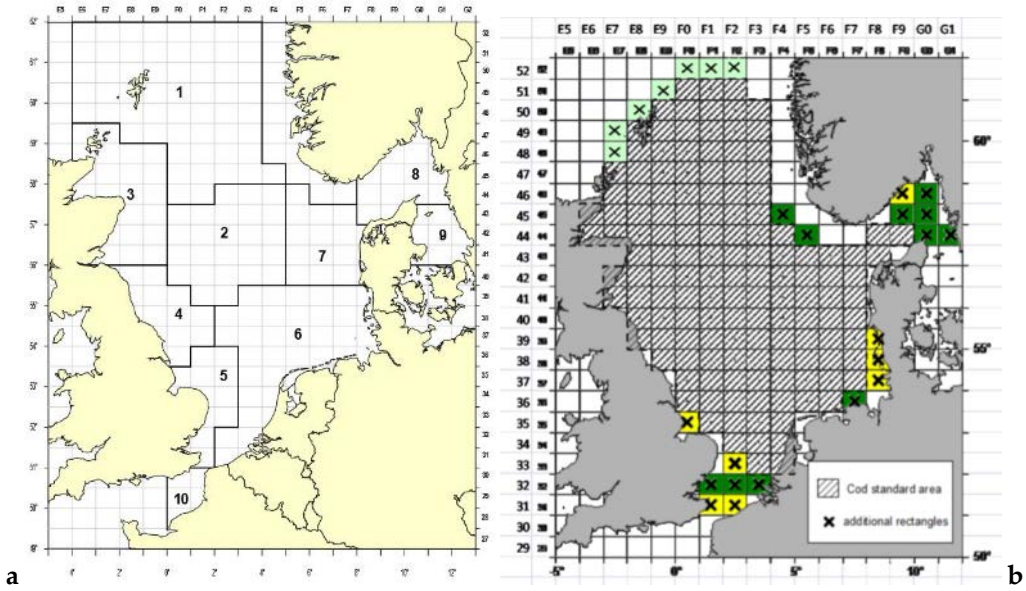
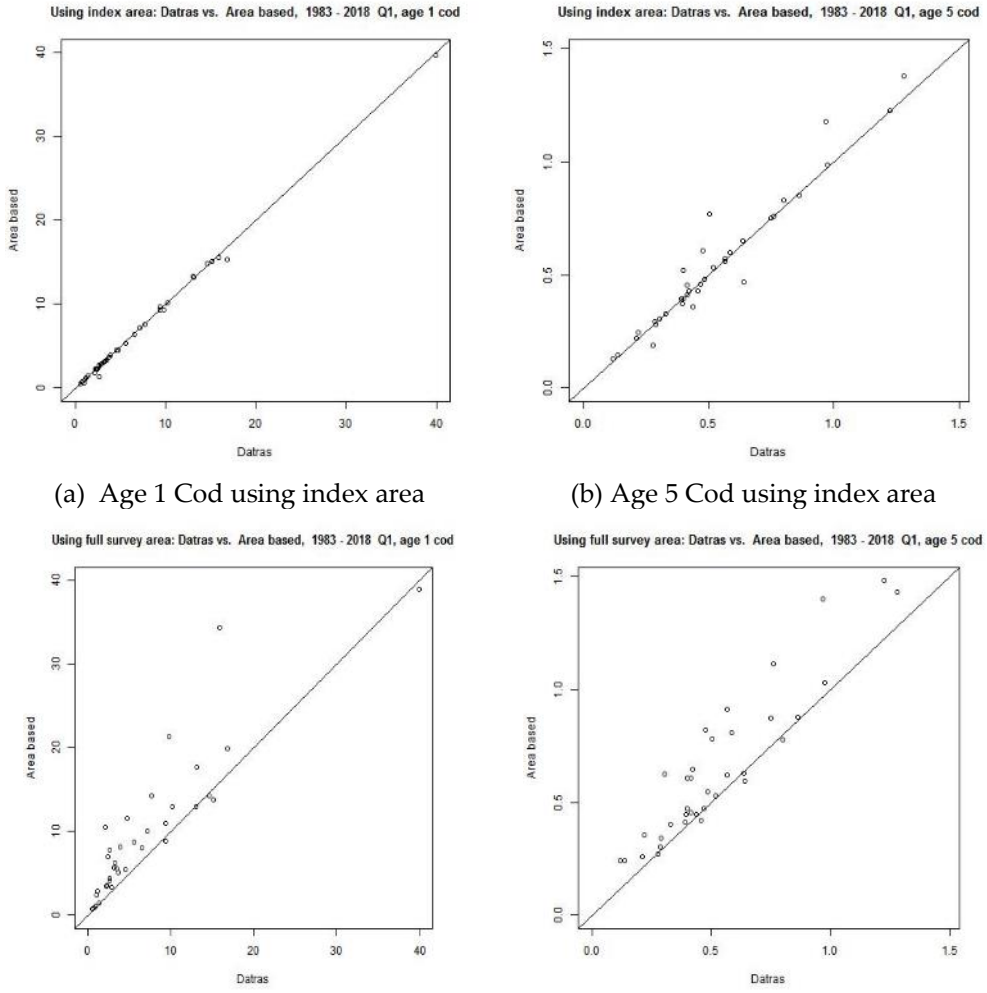


Figure 6.1.1: Standard roundfish areas (RFAs) used for roundfish since 1980 and for all standard species since 1991 (a - left panel). RFA 10 was added in 2009. The number 1, for example, indicates ICES RFA 1. The small grey rectangles indicate the statistical rectangles of approximately 30 x 30 nautical miles (these vary from approximately 28 nm wide in the north, to approximately 40 nm wide in the south of North Sea) (1^0 Longitude x 0.5^0 Latitude). Cod index area (b - right panel) Extension of cod standard area used for the NS–IBTS extended index. Crosses indicate the suggested extensions to the survey; green squares (light and dark) indicate where the IBTSWG indicate data is available; yellow squares indicate where intermittent coverage does not allow inclusion and the IBTSWG considered should be omitted; light green squares indicate the recommended extension around Shetland (ICES, 2018).

6.2.1 ALK estimators and abundance at age index

ICES DATRAS assumes a constant ALK over relatively large areas, for example an ALK is calculated for each RFA, and the index is calculated by taking the mean catch per rectangle, and then the mean over all rectangles in the index area (ICES, 2006). We refer this ALK estimator as the **Area based ALK**. We've proposed a spatial ALK estimator, where an ALK is produced for each trawl haul and the spatial variation in the data is accounted for. This is referred to as the **Haul based ALK**. We've also proposed an estimator of the index of abundance for the whole survey area (not an index area), where the survey index in calculated by taking the mean catch per rectangle, and then the mean catch over all rectangles in a RFA is calculated, and then the mean catch in the whole survey area is computed by taking a weighted mean in RFAs. In our estimation procedures we have

1. reproduced the DATRAS estimates of abundance at age of Cod using their ALK and abundance index estimator. We refer to these estimates as the Area based estimates. We compared these point estimates of abundance at age with those from DATRAS products, which are expected to be the same. However, in some cases the estimates vary (Figure 6.2.2 (a)), particularly for the older age classes. Manual and computer calculations suggest that an error in the estimated indices from DATRAS products is likely (Figure 6.2.2 (b)), as errors were found in the calculation of abundance at age for 3-year old Saithe in statistical rectangle 51E9 in year 2018 Q3. We also compared estimates using the area based ALK and survey area index of abundance with estimates from DATRAS products, which are computed using the post-stratification index area (Figures 6.2.2 (c) and (d)).



(a) Age 1 Cod using index area (b) Age 5 Cod using index area

(c) Age 1 Cod using survey area (d) Age 5 Cod using survey area

Figure 6.2.2: Estimated abundance indices of age 1 and age 5 Cod in the North Sea in years 1983-2018 Q1. Estimates from ICES DATRAS website are compared with estimates reproduced using ICES DATRAS ALK estimator and index of abundance estimator (Area based method).

2. Estimated uncertainty using three bootstrap approaches:
    a. the proposed bootstrap procedure by ICES DATRAS (ICES, 2006), where hauls are pooled in an RFA and sampled randomly with replacement, and ages in a given length class in an RFA are sampled randomly with replacement.
    b. a modification of the procedure in (a), where hauls are sampled randomly with replacement in a statistical rectangle, and ages in a given length class in an RFA are sampled randomly with replacement.
    c. a stratified bootstrap procedure, where hauls in a rectangle are sampled randomly with replacement and ages in the resampled hauls are taken.
3. Compared ALK estimators (Area based, and Haul based) for Cod in years 2015-2018 and the point estimates are the same as well the uncertainty in ALK since the variability in the ALK in the Area based approach is accounted for (Aanes and Vølstad, 2015).

Evaluation of sampling strategies of otoliths and hauls

We proposed **two** sampling strategies:

1. **Otoliths sampled**
2. **Otoliths and hauls are sampled**

Expected relative standard errors (RSE) are computed for Cod in years 2015-2018 the results suggest that:

- One otolith per 5cm could be sampled without loss of significant information about the expected abundance at age for Cod. However, since fewer older fish are typically sampled an alternative approach could be to sample fewer otoliths for the younger fish, for example 1 otolith per 5cm for fish of length up to 40cm, and 1 otolith per 1cm for fish longer than 40cm. Note that older fish tend be longer than 40cm. The number of otoliths required for estimating abundance age could be at most one-half (50%) of the current number being sampled.
- There is a marginal difference in expected RSE for if one otolith of five otoliths are used with fewer or more trawl hauls. However, the results highlight that reducing the number of hauls would increase the uncertainty.

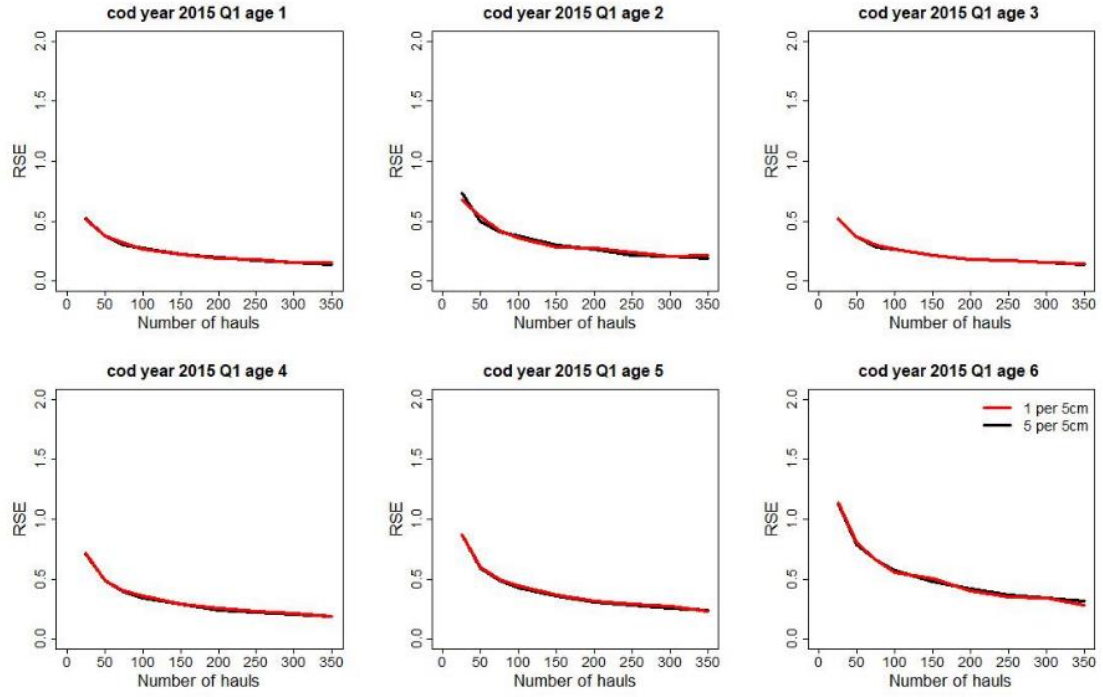


Figure 6.2.3: Expected relative standard error (RSE) of abundance at age of Cod in the North Sea in years 2015-2018 Q1. The age of Cod is 1, 2, 3, 4, 5 and 6 where 6 is a plus group. The red line gives the expected RSE for sampling one otolith per 5cm, while the black line gives the RSE for sampling 5 otoliths per 5cm for 25, 50, 100, 200, 250, 300, and 350 trawl hauls.

References

Aanes, S. and Vølstad J.H. (2015). Efficient statistical estimators and sampling strategies for estimating the age composition of fish. *Canadian Journal of Fisheries and Aquatic Sciences, 72 (6):938-953*

ICES (2006): Report of the Workshop on Implementation in DATRAS of Confidence Limits Estimation of Abundance Indices from Bottom Trawl Survey Survey Data. *International Council for the exploration of the Sea*, ICES DATRAS REPORT.

ICES (2018): Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), ICES WGNSSK REPORT 2018. 24 April - 3 May 2018 Oostende, Belgium. *International Council for the exploration of the Sea*, ICES DATRAS REPORT.

6.3 Progress CRR

The concept and extension of the CCR has been discussed and contributors to the various sections have been identified. Due to its extension and late incoming data the deadline for completion has likely to be postponed.

7 Ecosystem work

7.1 **Implementation of others ecosystem observations in EVHOE survey** (Pascal Laffargue)

The development of the ecosystem approach, the need to understand the factors underlying the dynamics of exploited populations, but also the implementation of new marine environmental management strategies (eg MFSD) have led to the fishing surveys to evolve towards an increase in the compartments of the ecosystem observed aboard research vessels. The EVHOE (IBTS Q4, bay of Biscay and Celtic Sea) survey demonstrates this evolution with a sharp increase in the components and observational tools deployed on board over the last 10 years (Figure 9.1.1). Beyond the opportunistic nature of the implementation of these observations, some of them offer a significant gain in the knowledge of certain drivers of the ecosystem (*e.g.* habitat, benthos, ...) or about the interactions between the different components (*e.g.* birds and discards ...). This development raises the question of the relevance and use of this new knowledge, particularly in the context of the exploited resources evaluation and the harmonization of these additional observations at European level.

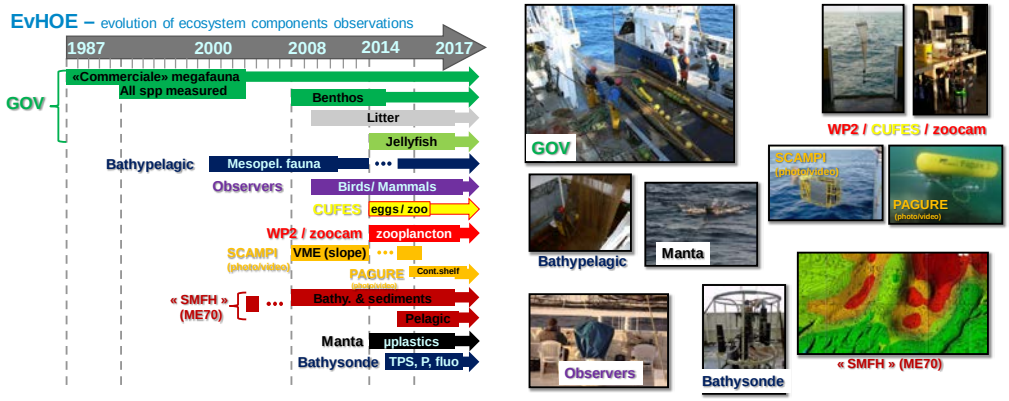


Figure 9.1.1 Time line of the implementation of additional activities during EVHOE.

7.2 **Tropicalisation of the North Sea Fish communities** (Arnaud Auber)

The ichthyological community structure of the North Sea is subjected to a progressive reorganization since several decades. That reorganization, so-called 'tropicalization', is defined as an increase in the dominance of warm-water species, which leads to an increase of the mean thermal preference of the communities. At global scale, that phenomenon is now well recognized but many uncertainties remain about potential underlying processes. An increase in the dominance of warm-water species can be the consequence of cold-water species declining. In the North Sea, data coming from the IBTS quarter 1 were used in order to better understand the underlying processes of tropicalization in the North Sea. That tropicalization has been clearly demonstrated in that ecosystem where 99% of the ICES rectangles were characterized by an increase in the mean thermal preference of the communities. Among those communities, some of them were mainly characterized by a decrease in the abundance of cold-water species ('deborealization'; see blue rectangles in Figure 7.2.2) rather than others were mainly characterized by an increase in warm-water species ('tropicalization'; see red rectangles in Figure 7.2.2). As indicated in Figure

1, red areas in the northern latittudes are also characterized by an 'arrival' of warm-adapted species which is relevant given that this area periodically receives warmer waters coming from the Shelf Edge current in the NorthEast Atlantic. Conversely, the blue area is more and more impoverished of cold-water species through time, which is another typical signature of global warming.

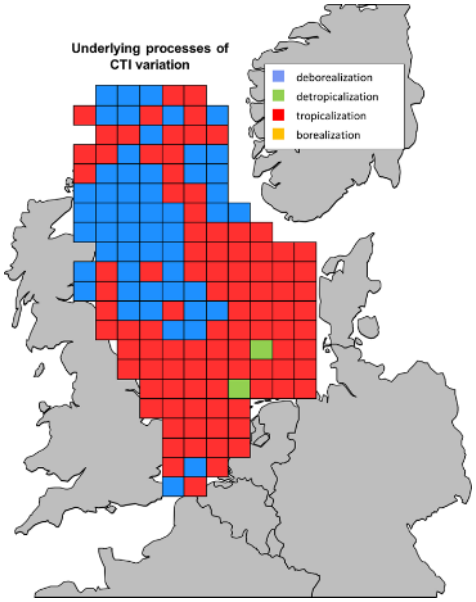


Fig 7.2.2. Underlying processes of tropicalization in the North Sea fish communities since last years.

8 Recommendations of other groups

WGINOSE and WGWIDE recommended to extend the NS-IBTS surveys into the Norwegian trench. Also the IBTSWG 2018 recommended this, by doing experimental trawls in this area being deeper than the standard IBTS depths.

During Q3 2018 Norway carried out four experimental hauls between 200 – 250 meters on the edge of the Norwegian trench, while during Q1 2019 Norway carried out four hauls between 250 and 285 m depth on the southwestern edge of the Norwegian trench (see figure 8.1 below).

Sweden had planned to take a couple of deep hauls during the 2018 Q3 survey but failed due to shortage of time. However, Sweden carried out 20 hauls at depths between 250 and 455 m around the eastern edge of the Norwegian trench (see figure 8.1 below) in October 2018 as part of a national ground fish survey albeit using a different trawl.

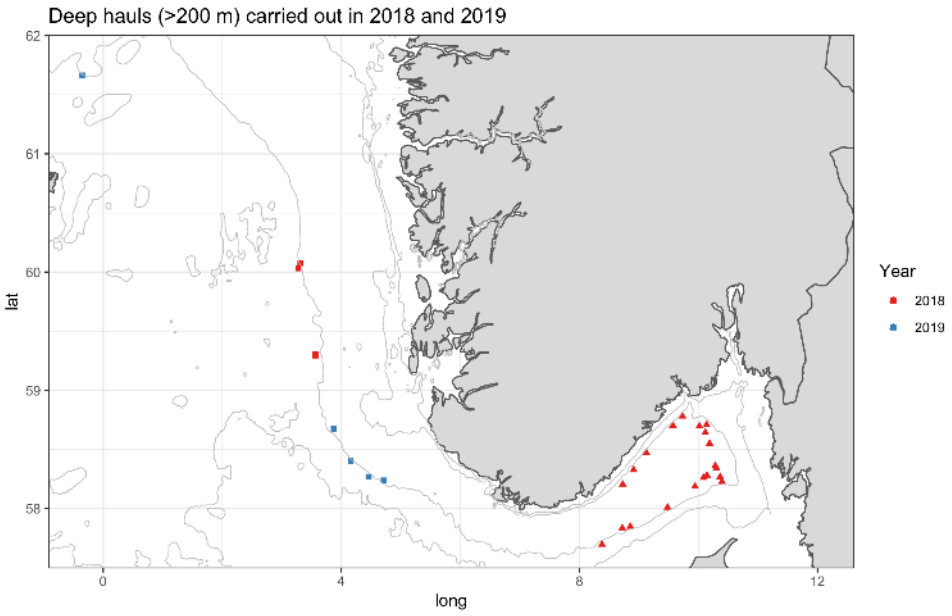


Figure 8.1- Position of experimental deep hauls carried out by Sweden ▲(national survey Q4 2018) and Norway ■(Q3 2018 and Q1 2019). Norwegian hauls in Q3 2018 were between 200 and 250 m, in Q1 2019 between 250 and 285 m (in the Norwegian trench) with one experimental haul at 210m depth at the northern edge of the continental shelf. Swedish deep hauls were between 250 and 455 m depth in the eastern part of the Norwegian trench.

It is unclear if these tows can be done consistently over the years. This will probably only be possible when Norway and Sweden get additional time at sea. Sweden will in 2020 Q1 use the new Swedish research vessel and presently it is unclear how much survey time Sweden will receive and therefore no conclusive answer can be given.

9 Revisions to the work plan and justification

ToR d: CRR on effect of tow duration on catch rates and species richness by end of 2019

As a result of additional topics added to the original plan of the CRR, the deadline of the CRR has to be extended to June 2020.

All other plans stay as they were.

10 Next meeting

30 March-3 April 2020 Lysekil, Sweden

Annex 1: List of participants

Name	Institute	Country (of institute)	Email
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Annex 2: Resolutions

ToR	Description	Background	Science plan codes	Duration	Expected deliverables
a	Coordination and reporting of North Sea and Northeastern Atlantic surveys, including appropriate field sampling in accordance to the EU Data Collection Framework. Review IBTS SISP manuals in order to achieve additional updates and improvements in survey design and standardization. (ACOM)	Intersessional planning of Q1; Q3 and Q4 surveys; communication of coordinator with cruise leaders; combing the results of individual nations into an overall survey summary. Intersessional activity, ongoing in order to improve survey and manuals quality.	3.1, 3.2	Recurrent annual update	1) Survey summary including collected data and description of alterations to the plan, to relevant assessment WGs and other EGs (WGCSE, WGNSSK, HAWG, WGHMM;,WGDEEP, WGWIDE, WGEEL, WGCEPH, WGML) and SCICOM. 2) Indices for the relevant species to assessment WGs (see above) 3) Planning of the upcoming surveys for the survey coordinators and cruise leaders 4) Updated version of survey manual, whenever substantial changes are made.
b	Address DATRAS-related topics in cooperation with WGDG: data quality checks and the progress in re-uploading corrected datasets, quality checks of indices calculated, and prioritizing further developments in DATRAS. (ACOM)	Issues with data handling, data requests or challenges with re-uploading of historical or corrected data to DATRAS have been identified and solutions are being developed	2.1, 3.1	Multi-annual activity.	Prioritized list of issues and suggestion for solutions and for quality checking routines, as well as definition of possible new DATRAS products, submitted to DATRAS group at ICES. Annual check of recent survey data.
c	Develop a new survey trawl gear package to replace the existing standard survey trawl GOV. (SCICOM)	The divergence in the GOV specification from the one given in the survey manual due to historical drift and technical creep has been acknowledged by the group (WGIBTS 2015). Furthermore, the deviation from the specification contained in the manual and between users has widened to the point where it will never be reversed. Therefore, the perefered option is to maintain the status quo of national GOV	3.1, 3.2	2 years	Design specification (Working document) in 2020

		specifications and develop a new survey trawl package to replace the GOV. A number of IBTS members are due to replace vessels in the next few years and this provides an opportunity to review time-series and undertake inter-calibration trials between the GOV and a new trawl. A further driver for a new gear has been highlighted by the Celtic Sea area where the necessity to optimize sampling opportunities are not being provided by the GOV. In parellel with trawl development the process of replacing the GOV will need to be defined with reference to continuing the assessments and existing time-series. (For this ToR, the IBTS WG seeks support from gear technology experts and welcomes their advice and input into the development of the new survey gear package)			
d	Evaluate the current survey design and explore modifications or alternative survey designs, identifying any potential benefits and drawbacks with respect to spatial distribution and frequency of sampling, survey effort in terms of number of otoliths by species and number of trawl hauls. (SCIOCM)	Specific issues to be addressed include: Stratification and optimal spatial distribution of effort.	3.2	1 - 3 years	CRR on effect of tow duration on catch rates and species richness by end of 2019 Paper on variance estimation of abundance indices in 2020 Paper on Stratification and distribution of survey effort in 2021.

Annex 3: Summary report NS-IBTS Q1

(Coordinator: Ralf van Hal)

A.3.1 General overview

The North Sea IBTS Q1 survey aims to collect data on the distribution, relative abundance and biological information on a range of fish species in ICES area 3a, 4 and 7d. During daytime a bottom trawl, the GOV (Grand Ouverture Verticale), with groundgear A or B, was used to collected information on fish and commercial shellfish species and on seafloor litter. A CTD was deployed at most trawl stations to collect temperature and salinity profiles. During night-time herring larvae were sampled with a MIK-net. Age data were collected for the target species cod, haddock, whiting, saithe, Norway pout, herring, mackerel, and sprat, and a number of additional species.

The quarter 1 2019 fleet consisted of five vessels: "Dana" (Germany, Sweden and Denmark), "GO Sars" (Norway), "Scotia" (Scotland), "Thalassa" (France), and "Tridens II" (Netherlands). The survey covered the period 4 January to 28 February 2019 (Tab. A.3.1.1).
A total of 361 GOV hauls (10 of which were invalid) (Tab. A.3.1.2) and 667 MIK hauls (Tab. A.3.1.3) were deployed. Most ICES-rectangles were covered by at least 1 GOV haul (Fig. A.3.1.1) and at least 2 MIK hauls. The coastal rectangle 38 and 39 F8 were not covered.
Biological data (weight, gender and maturity and age material) is collected from a number of species (Tab. A.3.1.4). An impression of the catches is given in FigureA.3.1.2a, by presenting the total fish catch in kilograms. Gear geometry plots are given in Figures A.3.1.3a to A.3.1.3d (lines represent theoretical values for the GOV from flume tank experiments, ICES 2015)

A specific comment is to be made on the German participation in 2019: Their vessel Walther Herwig was due to necessary repairs not available this year, they have chartered the Danish vessel Dana, which was, however, only available for 20 days instead of the normally planned 33 days in early January. Due to shorter available ship time and the shorter daylight duration in early January, the Germans and Danes have switched their sampling area, and a priori reduced a number of hauls. Most of these hauls are covered by other countries.

Another comment is made on the French participation in 2019: At the start of their time-at-sea they did not yet receive a permit for UK waters. They received this halfway through their survey, while in the meantime they had already swopped some rectangles in UK-waters with the Dutch.

For the second year on a row the impression of the participants was that the catches in total amount of fish biomass were small. There seems to be a reduction in the number of hauls with very large biomass, however the median upper and lower quartiles do not differ much of time (Fig.A.3.1.2b). Furthermore, the presence of Lusitanian species, like red mullet, anchovy, sardine, and bluemouth was higher than in average years.

Table A.3.1.1. Overview of the surveys performed during the North Sea IBTS Q1 survey in 2019.

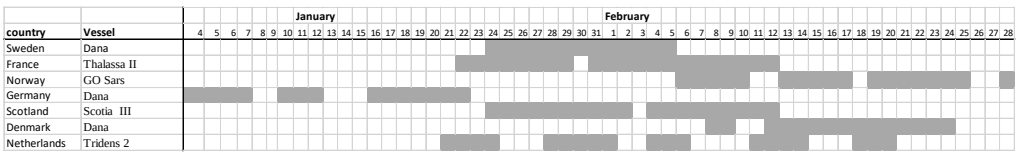


Table A.3.1.2. Overview of the GOV stations fish in the North Sea IBTS Q1 survey in 2019.

ICES Divisions	Country	Gear	Tows planned	Valid	Invalid	% stations fished
3a	SWE	GOV-A	43	42		98%
3a	DEN	GOV-A	1	2		200%
4	GFR	GOV-A	69	43		62%
	SWE	GOV-A	3	3		100%
	NO	GOV-A	42	44	3	105%
	FRA	GOV-A	43	43	1	100%
	DEN	GOV-A	42	45		107%
	NED	GOV-A	57	62	1	109%
	SCO	GOV-A	12	12		100%
	SCO	GOV-B	46	46	4	100%
7d	FRA	GOV-A	10	9	1	90%

Table A.3.1.3. Overview of the MIK stations fish in the North Sea IBTS Q1 survey in 2019.

ICES Divisions	Country	Gear	Tows planned	Valid	% stations fished
3a	SWE	MIK	54	49	91%
	DEN	MIK	4	2	50%
4	GFR	MIK	138	88	64%
	SWE	MIK	6	6	100%
	NO	MIK	84	88	105%
	FRA	MIK	86	73	120%
	DEN	MIK	84	85	101%
	NED	MIK	114	122	107%
	SCO	MIK	116	99	85%
7d	FRA	MIK	20	20	100%

Table A.3.1.4. Overview of individual length, weight and/or maturity and/or age samples collected during the North Sea IBTS Q1 survey in 2019.

Species	DEN	FRA	GER	NED	NOR	SCO	SWE	Total
Clupea harengus	523	446	719	682	1091	492	1103	5056
Merlangius merlangus	844	988	246	560	873	744	723	4978
Melanogrammus aeglefinus	718	2	75	235	887	1027	65	3009
Sprattus sprattus	30	588	418	354	3	218	1020	2631
Trisopterus esmarkii	333		25	95	1200	443	169	2265
Pleuronectes platessa	215	672	302	282	66	148	402	2087
Gadus morhua	196	28	31	56	87	363	204	965
Scomber scombrus	146		24	67	633	78		948
Eutrigla gurnardus	60		406					466
Microstomus kitt	103		150			99		352
Merluccius merluccius	66					111	153	330
Solea solea		224					33	257
Squalus acanthias			2		1	244		247
Limanda limanda	245							245
Pollachius virens	65				98	32	17	212
Mullus surmuletus		176						176
Sardina pilchardus			172					172
Glyptocephalus cynoglossus	54						55	109
Trisopterus luscus		94						94
Raja montagui			1	3		76		80
Trachurus trachurus					66			66
Engraulis encrasicolus			53					53
Leucoraja naevus				1	4	45		50
Mustelus asterias			1	5		34		40
Raja clavata		30	1	1		5		37
Scyliorhinus canicula			17	2	15			34
Lophius piscatorius					32			32
Chelidonichthys cuculus		26						26
Amblyraja radiata			12	1		10		23
Dipturus batis					1	18		19
Scophthalmus maximus		6	4			2		12
Scophthalmus rhombus		10	1					11
Dicentrarchus labrax		10						10
Hippoglossus hippoglossus				1		1		2

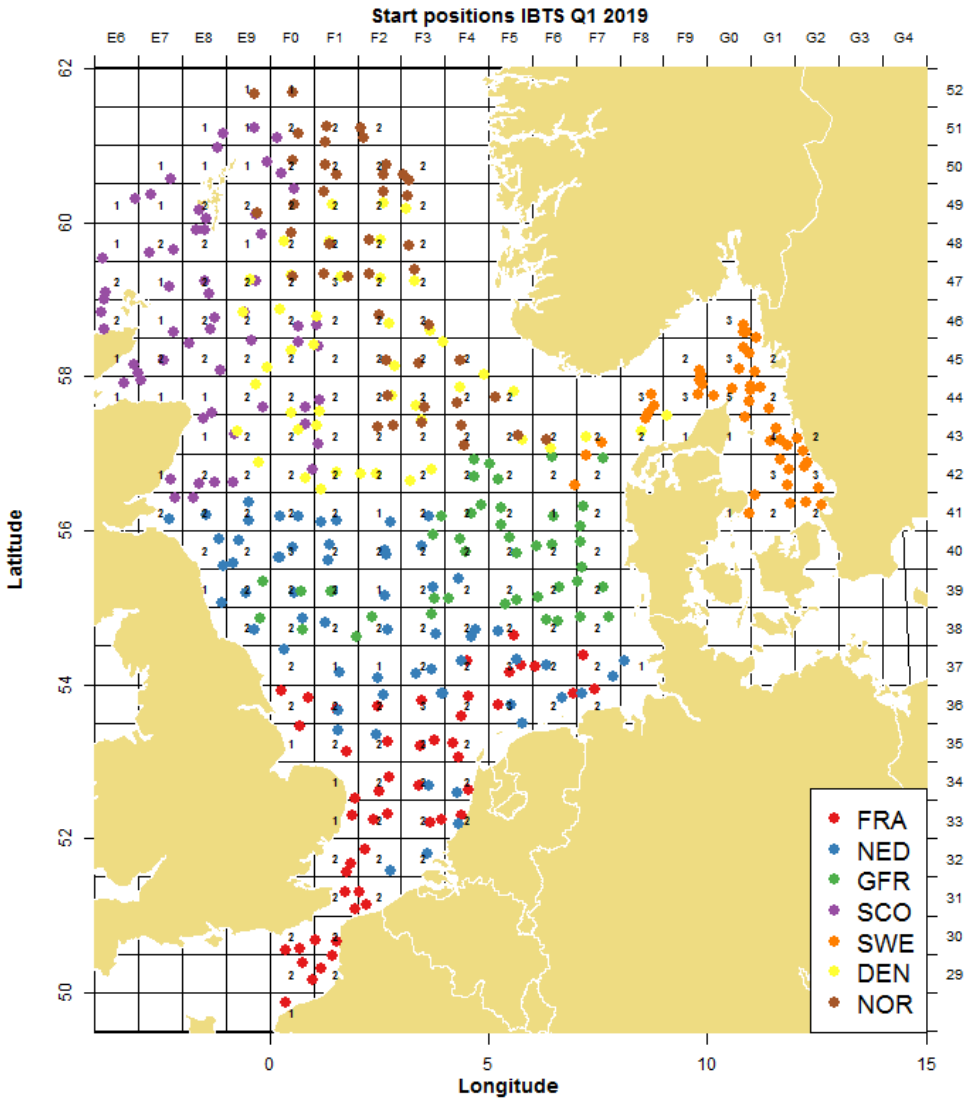


Figure A.3.1.1 Number of hauls per ICES rectangle with GOV during the North Sea IBTS Q1 2019 and the start positions of the trawls by country.

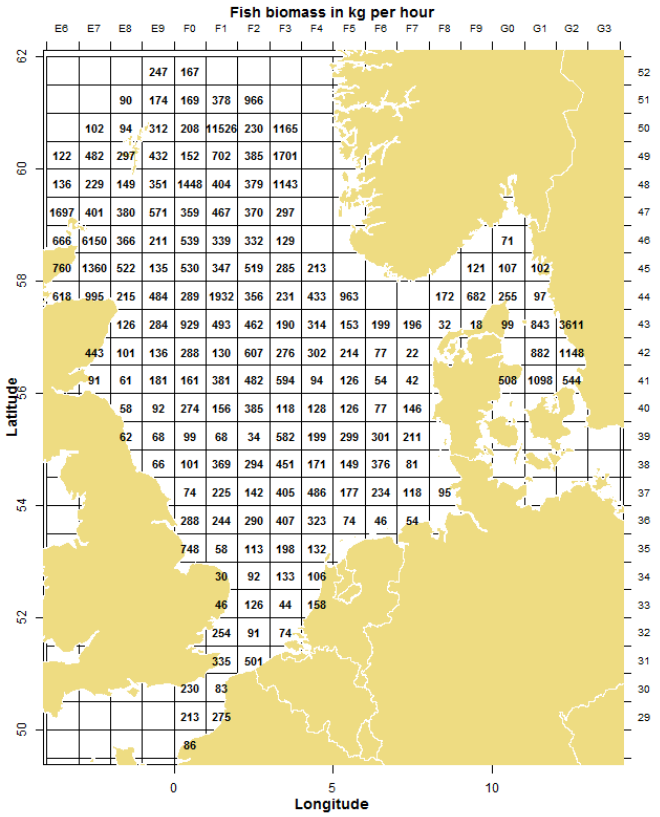


Figure A.3.1.2a Distribution of fish biomass in IBTS hauls by rectangle in the North Sea, Q1 2019 (values standardized to kg per hour haul duration; mean per rectangle).

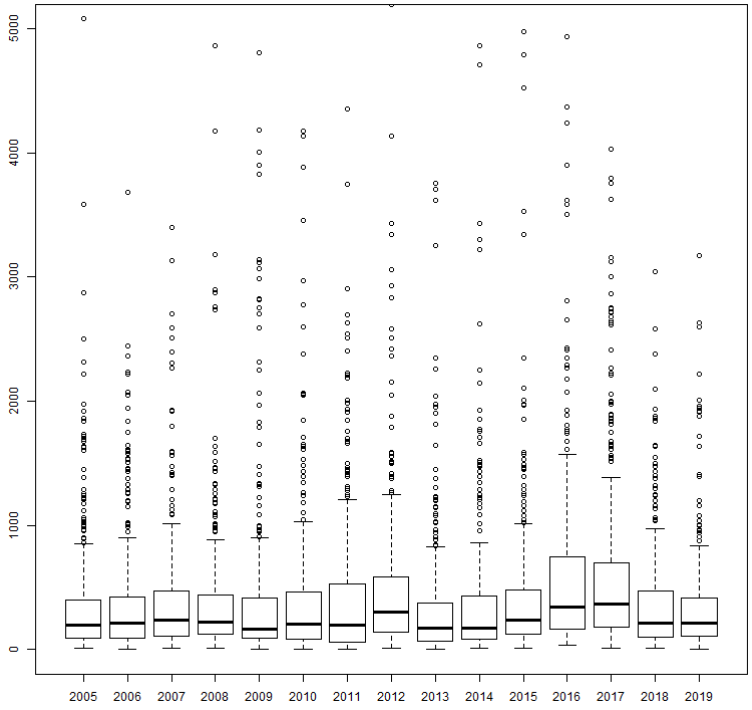


Figure A.3.1.2b Distribution of total fish biomass in IBTS hauls (kg/h) over time. The boxplots: horizontal lines are the median, the boxes first and third quartile, and the whiskers represent 1.5* IQR.

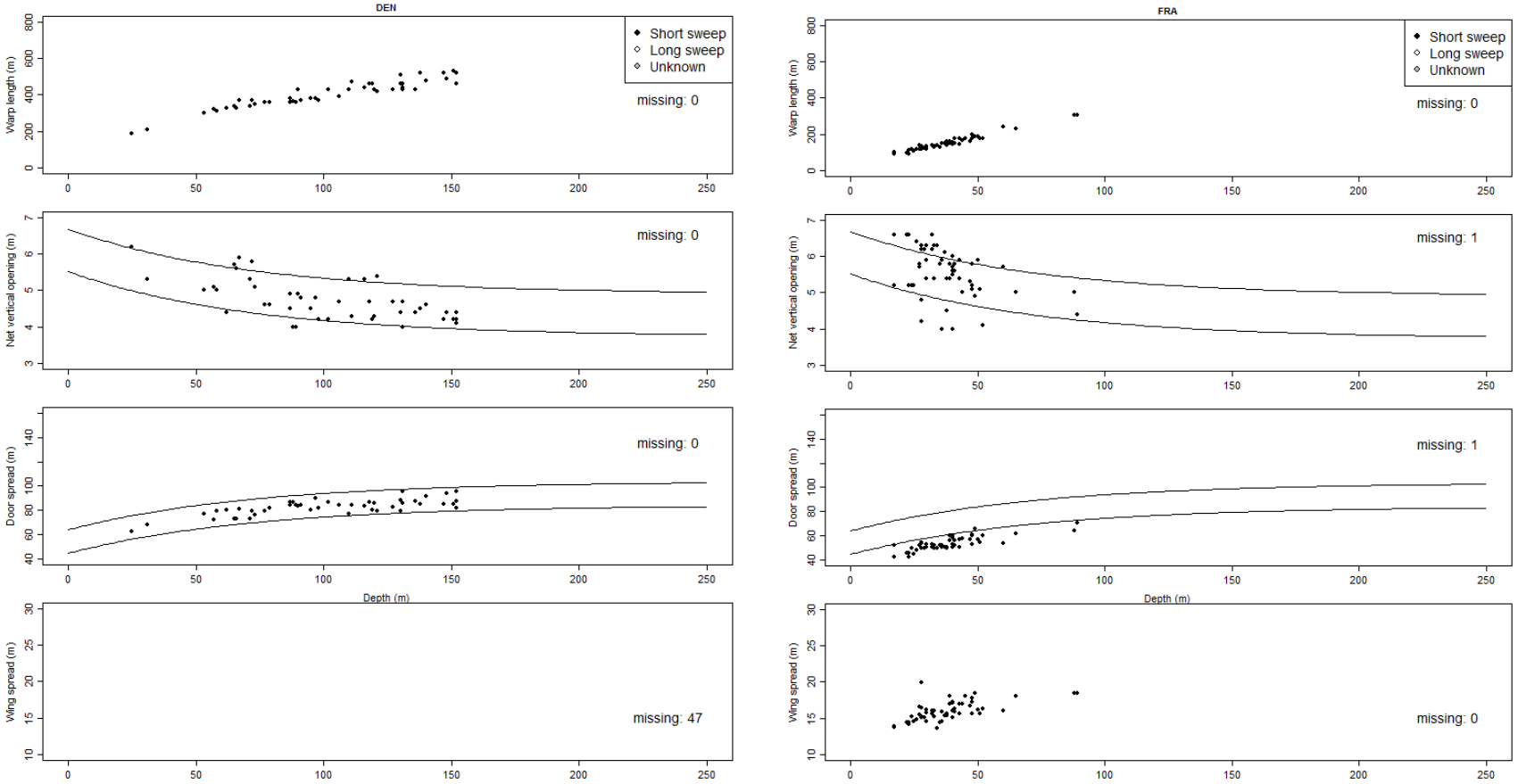


Figure A.3.1.3a Danish and French warp length and gear geometry

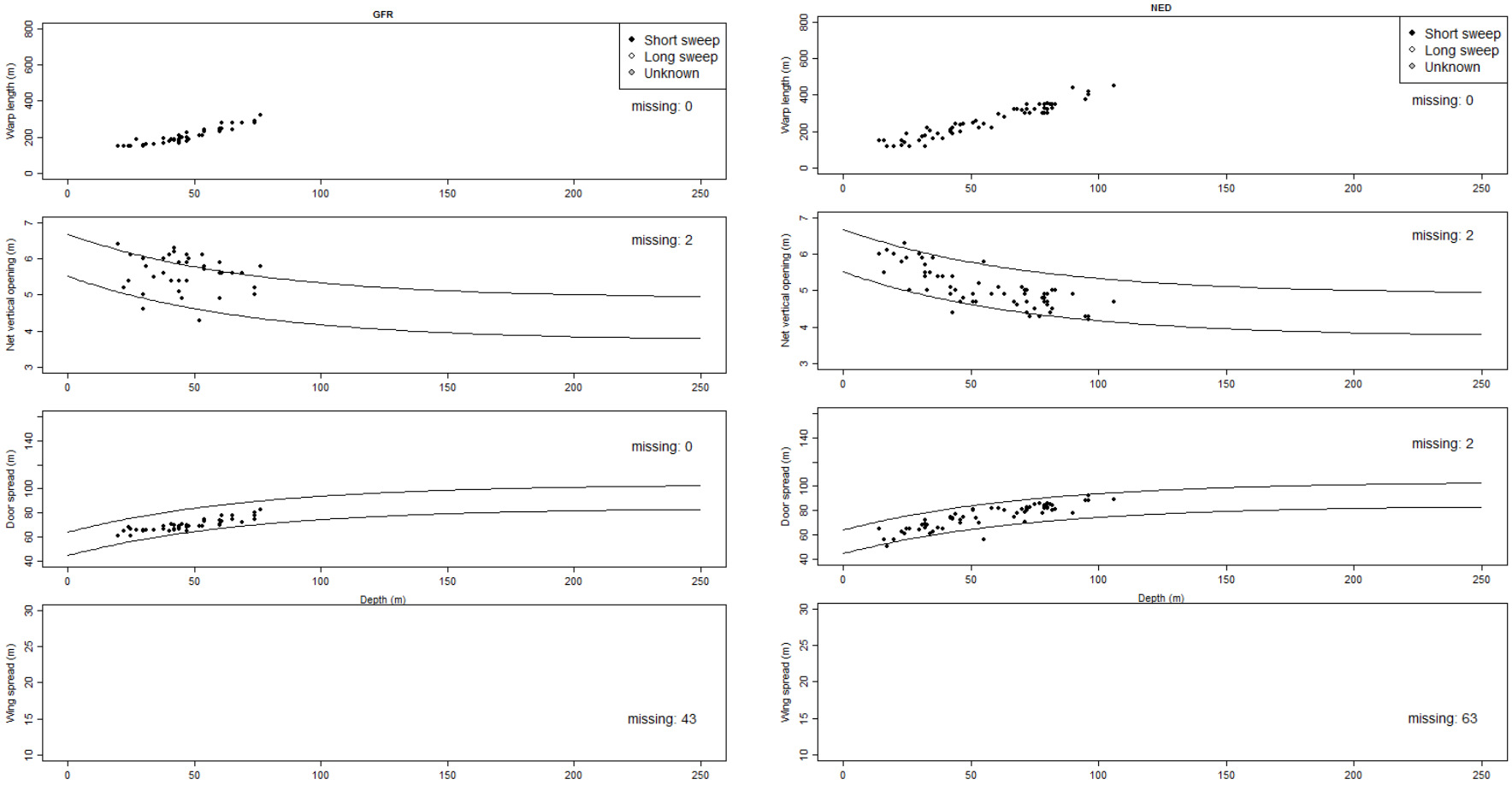


Figure A.3.1.3b German and Dutch warp length and gear geometry.

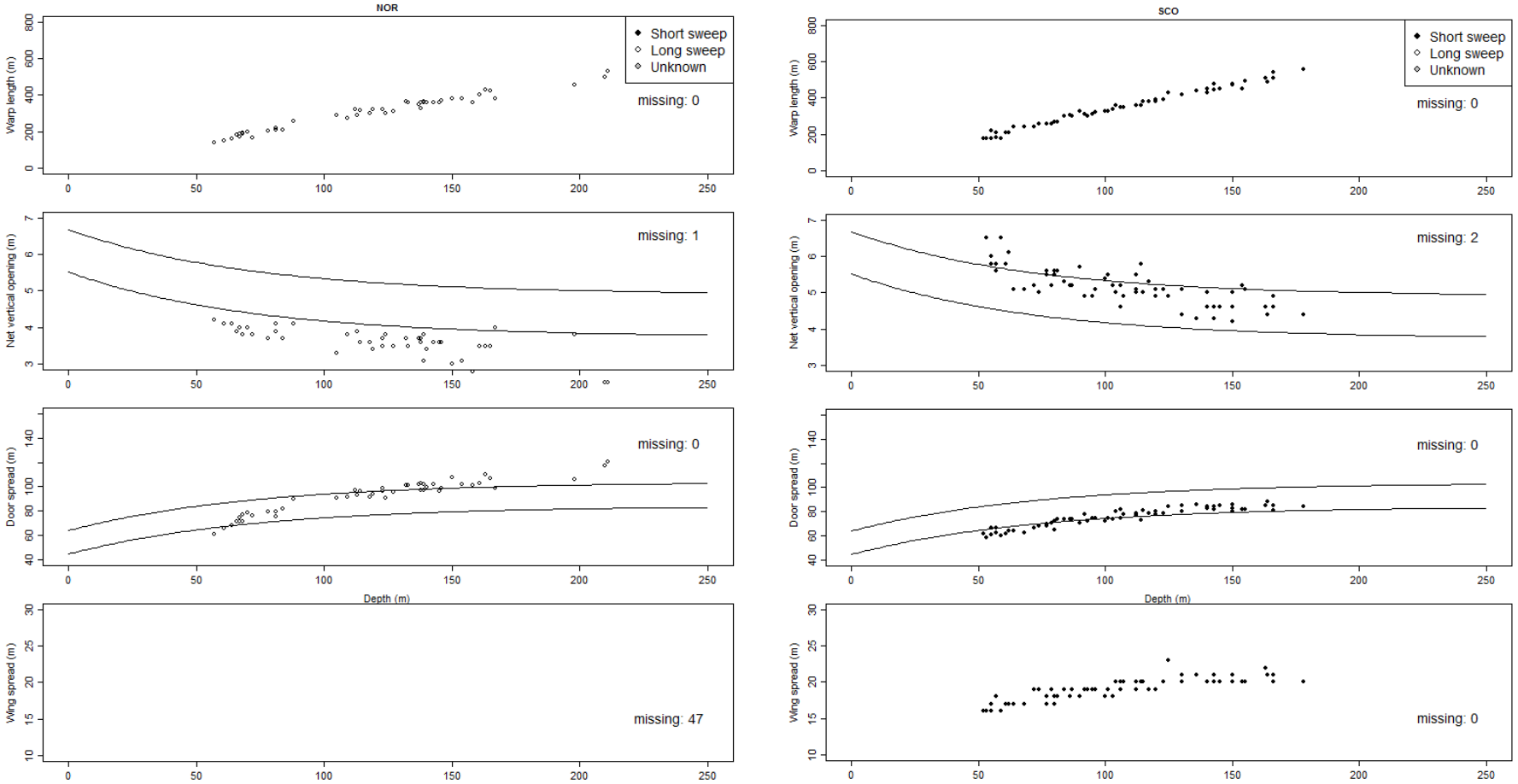


Figure A.3.1.3c Norwegian and Scottish warp length and gear geometry.

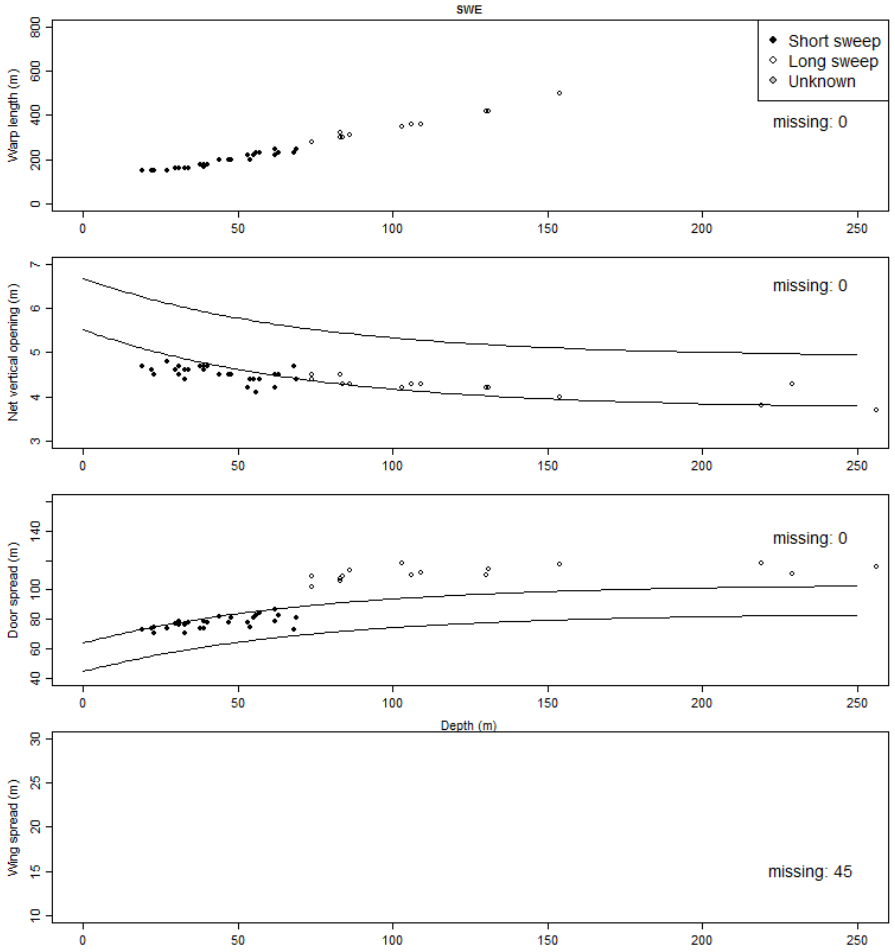


Figure A.3.1.3d Swedish warp length and gear geometry.

A.3.2 Additional activities

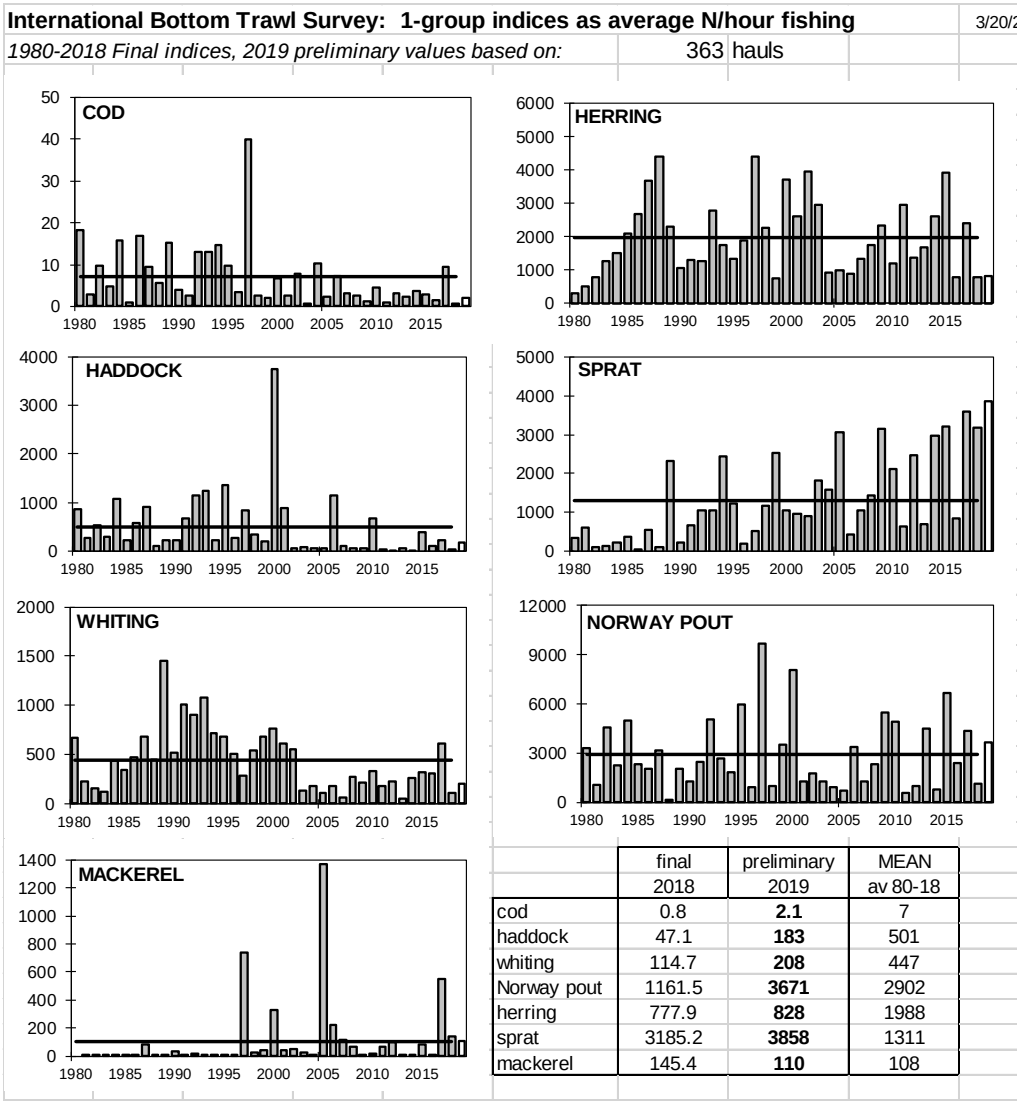
Next to the GOV and MIK tows all countries have collected additional data. All countries collected sea floor litter from the GOV tows and collected CTD (temperature and salinity) at all GOV stations when possible. A complete list of additional activities is given in Table A.3.2.1.

Table A.3.2.1 Overview of additional activities in the North Sea IBTS Q1 survey in 2019.

Activity	GFR	NOR	SCO	DEN	NED	SWE	FRA
CTD(temperature-salinity)	x	x	x	x	x	x	x
Seafloor litter	x	x	x	x	x	x	x
Water sampler (Nutrients, Microzooplankton)	x				x		x
Egg samples (Small fine-meshed ringnet; CUFES)	x	x	x	x	x		x
Water column litter (MIK)	x			x	x		
By-caught benthic animals		x			x		x
Observer for mammals and/or birds							x
Additional biological data on fish		x	x	x	x	x	x
Benthic samples (boxcore, video, dredge)							
Zoo and phytoplankton							x
Jellyfish		x					x
Hydrological transects		x					
Beam trawl (juvenile fish - age 0)							

A.3.3 GOV

The preliminary indices for the recruits of seven commercial species based on the 2019 quarter 1 survey are shown in Figure A.3.3.1. Sprat and Norway pout were above average, with sprat being the highest of the time series. All other species were below average, with herring being very low for the second time in a row.



	final 2018	preliminary 2019	MEAN av 80-18
cod	0.8	**2.1**	7
haddock	47.1	**183**	501
whiting	114.7	**208**	447
Norway pout	1161.5	**3671**	2902
herring	777.9	**828**	1988
sprat	3185.2	**3858**	1311
mackerel	145.4	**110**	108

Figure A.3.3.1. Time-series of indices for 1-group (1-ring) herring, sprat, haddock, cod, whiting, Norway pout, and mackerel caught during the quarter 1 IBTS survey in the North Sea, Skagerrak and Kattegat. Indices for the last year are preliminary, and based on a length split of the catches. Horizontal line is the mean 1980-2018.

Distribution maps of the 1-group of NS-IBTS target species with the limits of the species specific stock assessment or index areas are given in Figures A.3.3.2a to A.3.3.2e.

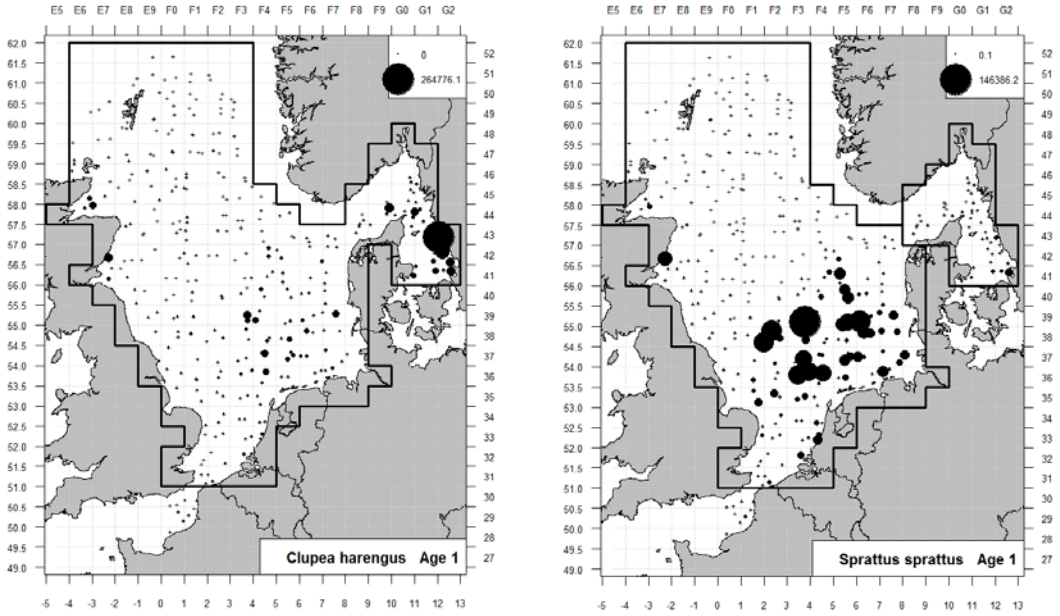


Figure A.3.3.2a Distribution of herring and sprat age 1 in the quarter 1 IBTS 2019 (thick lines: index areas for sprat in Q1 but for herring in Q3). There is still an issue in the herring map, where the data of a number of rectangles is missing, due to unclear reasons the Data Center wasn't able to include this data in the CPUE data product.

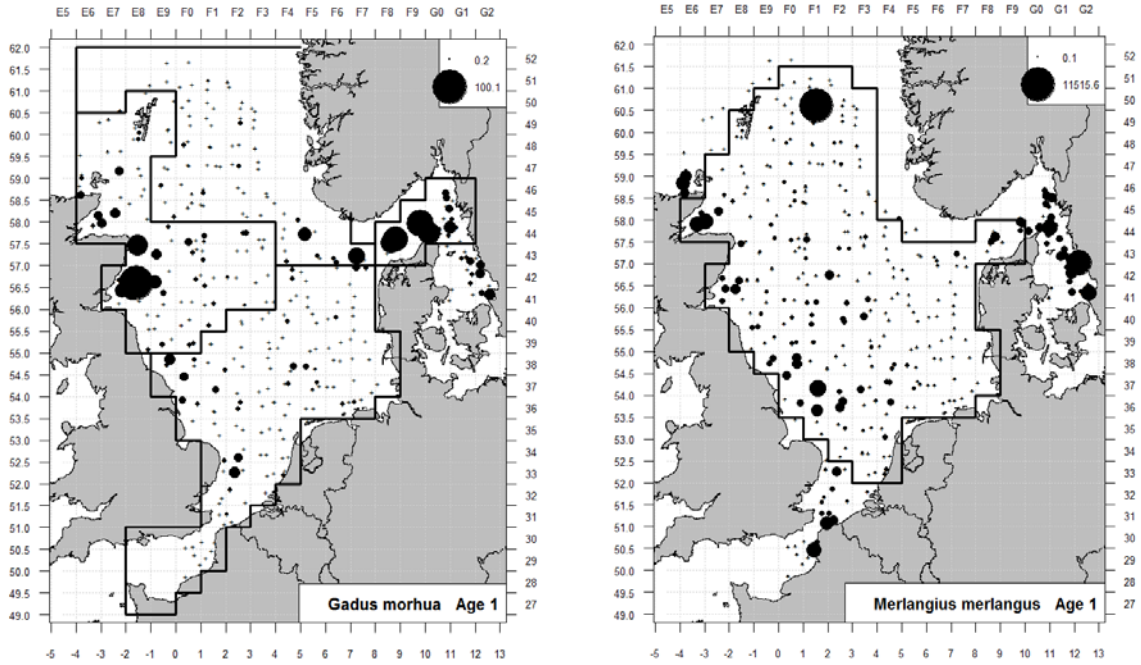


Figure A.3.3.2b Distribution of cod and whiting age 1 in the quarter 1 IBTS 2019 (thick lines: Subpopulation separation for cod, index areas for whiting).

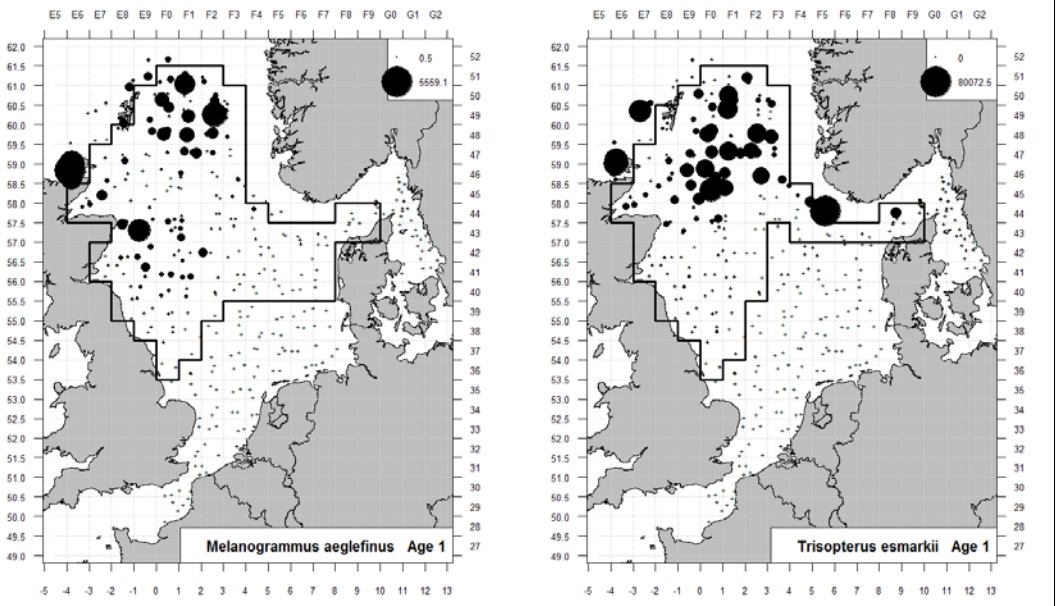


Figure A.3.3.2c Distribution of haddock and Norway pout age 1 in the quarter 1 IBTS 2018 (thick lines: index areas).

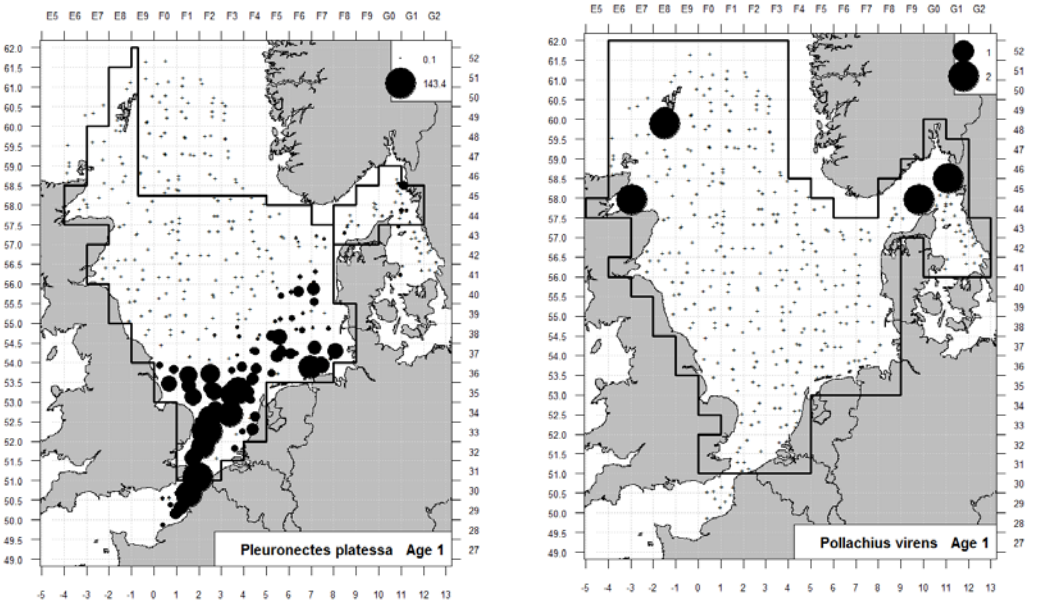


Figure A.3.3.2d Distribution of plaice and saithe age 1 in the quarter 1 IBTS 2018 (thick line: old index areas).

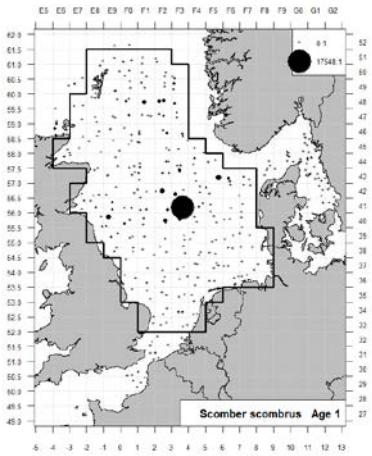


Figure A.3.3.2e Distribution of mackerel age 1 in the quarter 1 IBTS 2018 (thick line: index area).

A.3.4 MIK

The total abundance of 0-ringers in the survey area is used as a recruitment index for the stock. This year, 667 depth-integrated hauls were completed with the MIK-net. The coverage of the survey area was good with at least 2 hauls in most of ICES rectangles in the North Sea as well as in the Kattegat and Skagerrak.

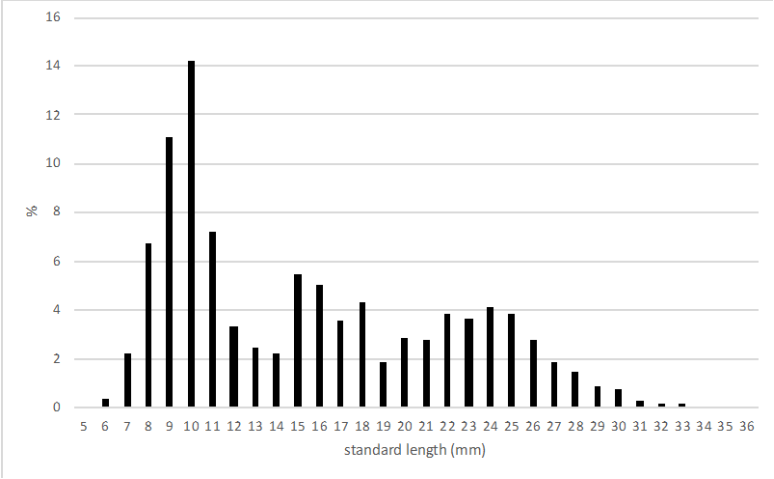


Figure A.3.4.1. North Sea herring. Length distribution of all herring larvae caught during the 2019 Q1 IBTS.

Larvae measured range between 5 and 36 mm standard length (SL). Again, and as in most years, the smallest larvae <10 mm were the most numerous, but larger larvae >18 mm SL were rarer and were caught in lower densities than last year (Figure A.3.4.1). The smallest larvae were chiefly caught in 7.d and in the Southern Bight. The large larvae appeared in moderate to high quantities only in the western part of the North Sea, in 3 rectangles of the Southern Bight and in the Skagerrak. In the eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was very low, and virtually no larvae occurred in the German Bight. The 2019 MIK 0-ringer index is 51.6.

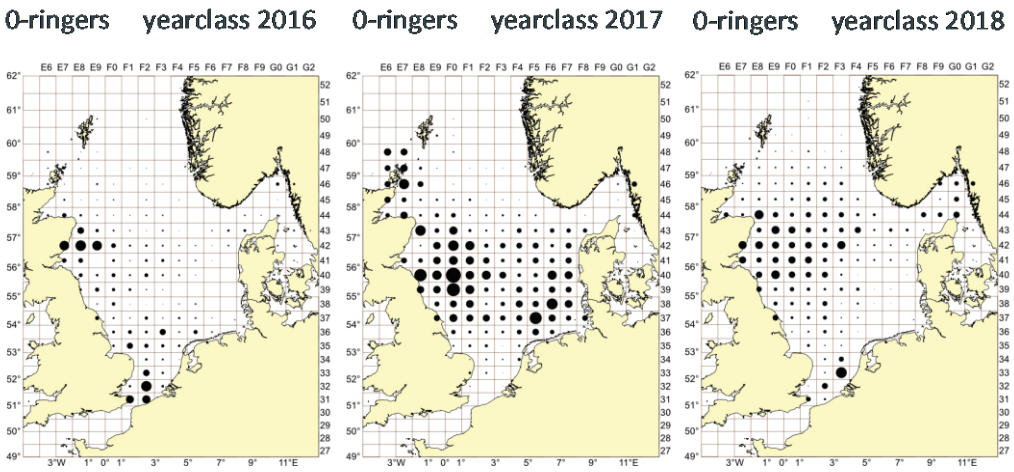


Figure A.3.4.2. North Sea herring. Distribution of 0-ringer herring, year classes 2015–2017. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2016–2018. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest circle represents a density of 1.83 m^{-2}. All circles are scaled to the same order of magnitude of the square root transformed densities.

A.3.5 Staff exchange

During the IBTS 2019 Q1, a technician from the Thuenen Institute in Germany who had participated in the German IBTS joined the Danish survey with RV Dana. This experience was particularly useful since the direct interaction between the technicians during 19 survey days permitted to identify technical differences in catch processing, subsampling and data recording, and especially the differences in otolith sampling and storage. According to this personal experience, however, it does not seem that the small methodological divergences between the two nations may lead to significant differences in the final datasets.

Annex 4: Summary report NS-IBTS Q3

(Coordinator: Kai Wieland)

A.4.1 General overview

The North Sea IBTS Q3 survey aims to collect data on the distribution, relative abundance and biological information on a range of fish species in ICES Division 3a and Subarea 4. The bottom trawl, GOV (Grand Ouverture Verticale) with standard ground gear A for normal bottom conditions or ground gear B for rough ground is used during daytime. A CTD was deployed at most trawl stations to collect temperature and salinity profiles. Age and individual fish data were collected for the standard species herring, sprat, cod, haddock, whiting, saithe, Norway pout, mackerel and plaice, and for a number of additional species.

Six nations (using five vessels) participated in the quarter 3 survey in 2018: Dana (Denmark and Sweden), Walther Herwig III (Germany), Kristine Bonnevie (Norway), Cefas Endeavour (England) and Scotia (Scotland). The overall survey period extended from 21 July to 9 September 2018 (Table A.4.1.1).

Table A.4.1.1. Overview of the surveys performed during the North Sea IBTS Q3 survey in 2018 (total survey: light grey, sampling period: dark grey).

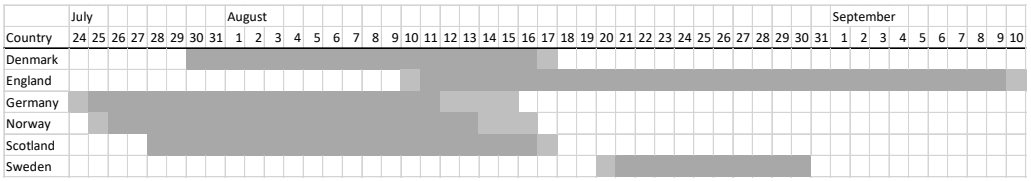


Table A.4.1.2. Overview of the GOV stations fished in the North Sea IBTS Q3 survey in 2018 (*: relative to the number of tows planned by the coordinator (IBTSWG 2018), **: minimum number to achieve coverage with 2 tows per rectangle in the Skagerrak/Kattegat, ( ): not reported to DATRAS, available at https://github.com/ices-eg or IBTSWG 2019 sharepoint).

ICES area	Country	Gear used	Number of tows proposed	Number of valid tows (as proposed)	Number of additional valid tows	Proportion of achieved valid tows (%) *	Number of additional experimental tows (15, 0 min)
3a	SWE	GOV-A	33**	33	12	136	(2, 2)
3a	DEN	GOV-A	-	-	2	102	-
4a,b,c	DEN	GOV-A	52	51	0	102	(1, 1)
4a,b,c	ENG	GOV-A	78	77	1	100	(4, 8)
4a,b,c	GER	GOV-A	31	31	0	100	-
4a,b	NOR	GOV-A	48	48	0	100	-
4a	SCO	GOV-B	46	46	4	112	-
4b	SCO	GOV-A	42	42	2	112	(2, 6)

In total, 349 valid standard GOV hauls were made in the planned rectangles (Table A.4.1.2). While a few rectangles did not achieve coverage of two hauls, the number of rectangles with only one haul was less than in any year since 2010 (Figs A.4.1.1, A.4.1.2). Of those with only one haul, most are rectangles that are largely covered by land or other obstructions, or are not fishable with the GOV (Fig. A.4.1.1).

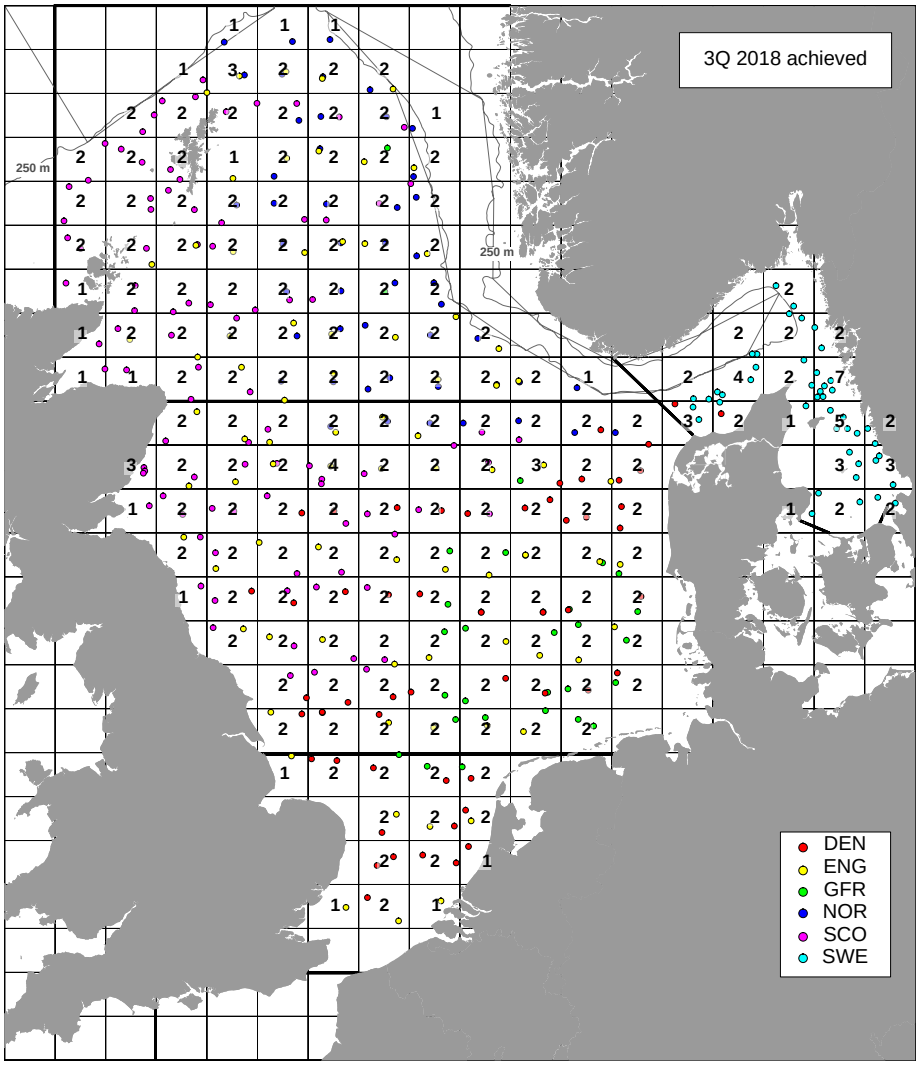


Figure A.4.1.1. Number and start position of hauls per ICES statistical rectangle as taken with the GOV during the North Sea IBTS Q3 2018. Tows are separated into ICES Divisions in the North Sea (4a, 4b,and 4c), the Skagerrak/Kattegat (3a).

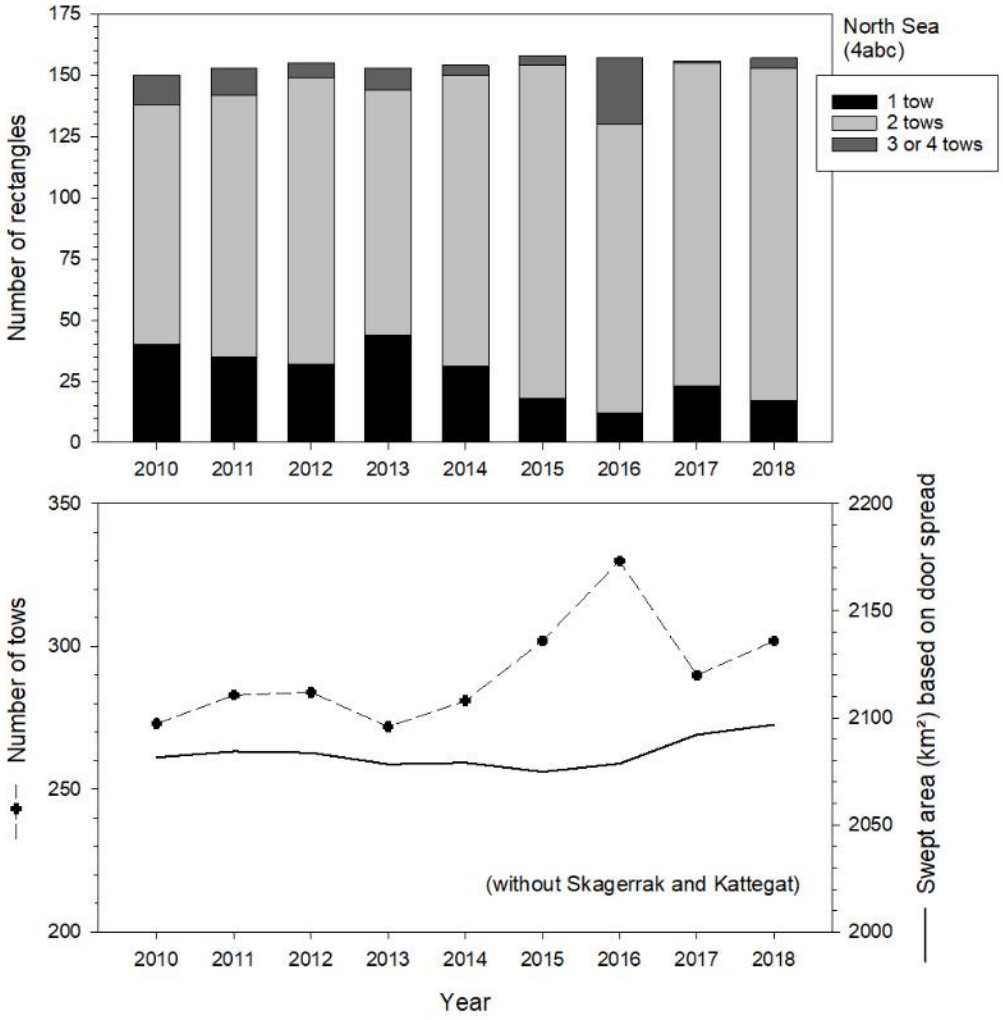


Figure A.4.1.2. Changes in survey performance, 2010-2018, reported as number of tows achieved and total amount of swept area in the North Sea (based on door spread and towed distance by haul).

All standard hauls were planned of 30-min duration. However, 16 tows reported as valid to DATRAS were shorter than 27 minutes (ENG, NOR, SCO, SWE) and for 7 tows durations was just 15 minutes (SCO) due to various reasons (Fig. 12.1.3).

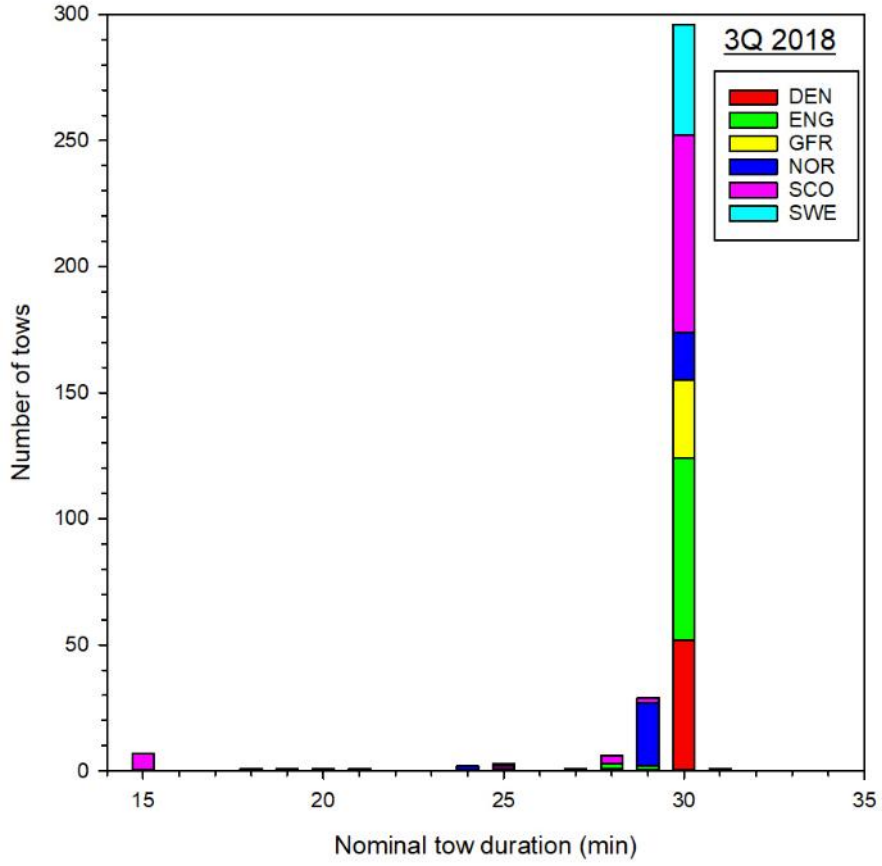


Figure A.4.1.3. Achieved tow durations by country, valid tows NS-IBTS 3Q 2018.

After 3 years with relative high values (2015 – 2018), total fish biomass seemed to decline in 2018 (Fig. A.4.1.4).

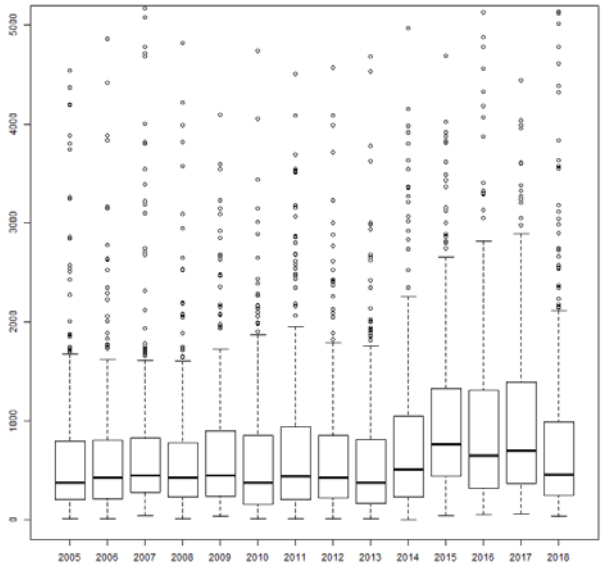


Figure A.4.1.4. Distribution of total fish biomass in IBTS hauls (kg/h) over time. The boxplots: horizontal lines are the median, the boxes first and third quartile, and the whiskers represent 1.5* IQR.

Biological data (weight, sex, maturation stage, and age material) were collected for many species (Tables A.4.1.3 and A.4.1.4); maturation stage can be difficult to determine outside of the spawning period and was therefore not recorded as routinely as in quarter 1. For some species, otoliths have yet not been read and thus age information shall be submitted to DATRAS at a later time. England and Norway do not collect biological data samples for sprat and Sweden does not collect mackerel otoliths. The latter means that the mackerel distribution by age in the Skagerrak and Kattegat depends on age samples collected by Denmark from two stations in the southwestern Skagerrak and the North Sea age samples. These data gaps are due to deviations from the survey manual and should be adjusted if possible.

Table A.4.1.3. Overview of age samples collected of NS-IBTS target species during the North Sea IBTS Q3 survey in 2018).

Species	DEN	ENG	GER	NOR	SCO	SWE	Total
Clupea harengus	459	1227	236	483	879	1048	4332
Sprattus sprattus	255	0	157	0	243	886	1541
Gadus morhua	51	414	20	313	543	156	1497
Merlangius merlangus	142	1417	286	423	1204	638	4110
Melanogrammus aeglefinus	517	1110	48	552	1353	111	3691
Trisopterus esmarki	3	318	8	298	442	134	1203
Pollachius virens	23	306	3	372	333	103	1140
Scomber scombrus	225	414	131	393	364	0	1527
Pleuronectes platessa	681	1473	244	0	243	382	3023

Table A.4.1.4. Overview of additional individual biological data collected in addition to the regular measurements specified in the manual during the North Sea IBTS Q3 survey in 2018 (*: *Dipturus batis* and *D. intermedia* are currently under nomenclature review).

Species	DEN	ENG	GER	NOR	SCO	SWE	Total
Amblyraja radiata		148	1	47	65		261
Cancer pargurus			15	1			16
Chelidonichthys cuculus		10		6			16
*Dipturus batis**		1			1		2
*Dipturus intermedia**		3			3		6
Galeorhinus galeus		13	4				17
Galeus melastomus		3		123			126
Glyptocephalus cynoglossus				48		32	80
Homarus vulgaris			2				2
Leucoraja fullonica				1	1		2
Leucoraja naevus		57		4	36		97
Lithodes maja			1	29			30
Lophius piscatorius		73	1	43			117
Merluccius merluccius	7	319	9	661	333	216	1545
Microstomus kitt		261	73	621			955
Mullus surmulletus					5		5
Mustelus asterias		261	7				268
Nephrops norvegicus			2	56		1104	1162
Psetta maxima			3				3
Raja clavata		105	5				110
Raja montagui		110	8		35		153
Scopthalmus maximus		9					9
Scopthalmus rhombus		6					6
Scyliorhinus canicula			47	2			49
Squalus acanthias		15		6	51		72
Solea solea						6	6

A.4.2 Issues and problems

There were no major issues and problems. The German vessel Walther Herwig III faced various technical problems and consequently had severely reduced ship time available, but could largely compensate the potential loss in IBTS hauls by sacrificing ship time from the national GSBTS survey.

A.4.3 Additional activities

All countries are required to collect sea floor litter from the GOV tows and CTD data (temperature and salinity, oxygen for some countries) at all GOV stations when possible. A list of other additional activities is given in table A.43.1.

Table A.4.3.1. Overview of additional activities in the North Sea IBTS Q3 survey in 2018 (Water samples for CTD calibration not explicitly listed, x: routinely, (x): ad hoc studies,*: available at https://github.com/ices-eg or IBTSWG 2019 sharepoint).

Activity	DEN	ENG	GER	NOR	SCO	SWE
CTD	x	x	x	x	x	x
Seafloor Litter	x	x	x	x	x	x
Recording of GOV deployment and retrieval time *	x	x	x	x	x	x
Water sampler (Nutrients)		x				
Collection of fish stomachs			x		x	
Collection of fish tissue (genetics)		x		x	x	x
Jellyfish from GOV catches		x		x		
Plankton biodiversity						
Epibenthos (beamtrawl)			x			
Sediment (VanVeen grab)			x			
Seabirds						
Marine mammals						
Zooplankton (e.g. MIK)	x	x				
Hydrological transect				x		
Acoustics (Ichthyofauna)		x		x		

A.4.4 Gear geometry

The current manual (SISP 10, ICES 2015) does not specify a specific warp length to depth ratio as this may not fit to the different vessels. It has, however, been emphasised that each country carefully measure net geometry, i.e. door spread and headline height over bottom (vertical opening) and, if possible, also wing spread and adhere to their "historical" standards as far as possible. Missing observations of these parameters are listed in table A.4.4.1.

Table A.4.4.1. Number of valid tows with missing gear parameters, NS-IBTS 3Q 2018 (Missing door spread values can be estimated for ENG by DS = 5.855 + 36.906 * log(depth), r^2: 0.89 and for NOR by DS = -13.340 + 44.163 * log(depth), r^2: 0.84; the regressions were estimated based on the observed values in the 3Q 2018 surveys as shown in Fig. 5.2.4.1a (ENG) and Fig. 5.2.4.2b (NOR)).

Parameter	DEN	ENG	GER	NOR	SCO	SWE
Net opening	0	0	0	17	0	0
Door spread	0	2	0	18	0	0
Wing spread	30	3	1	17	0	10

No country had serious problems in achieving the theoretical values for door spread (Figures A.4.4.1 a-c). Most countries were within or near the theoretical values for net opening for almost all tows they made.

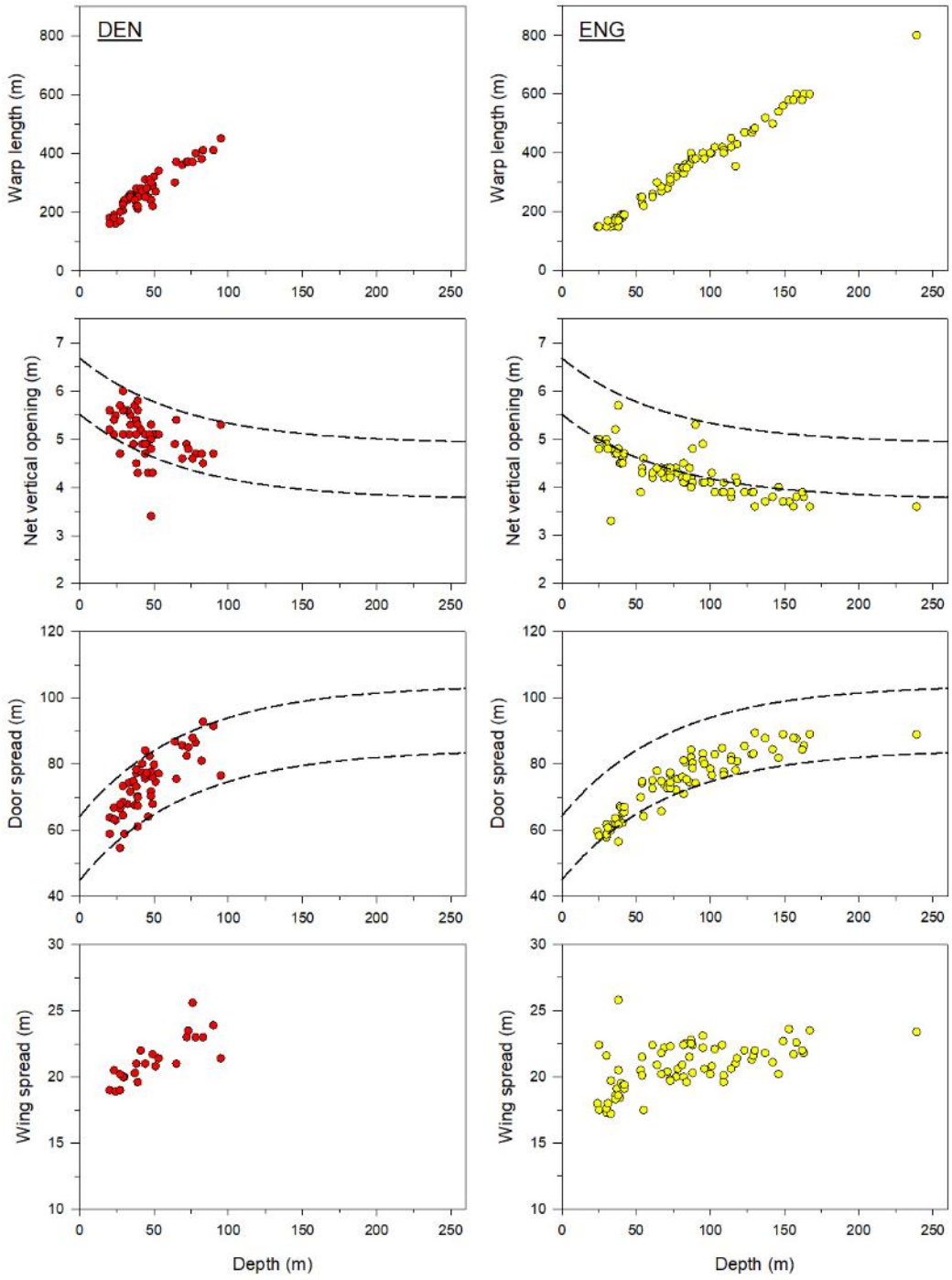


Figure A.4.4.1a. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2018, Denmark (all tows with 2 Vonin flyers instead of the standard Exocet kite) and England. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

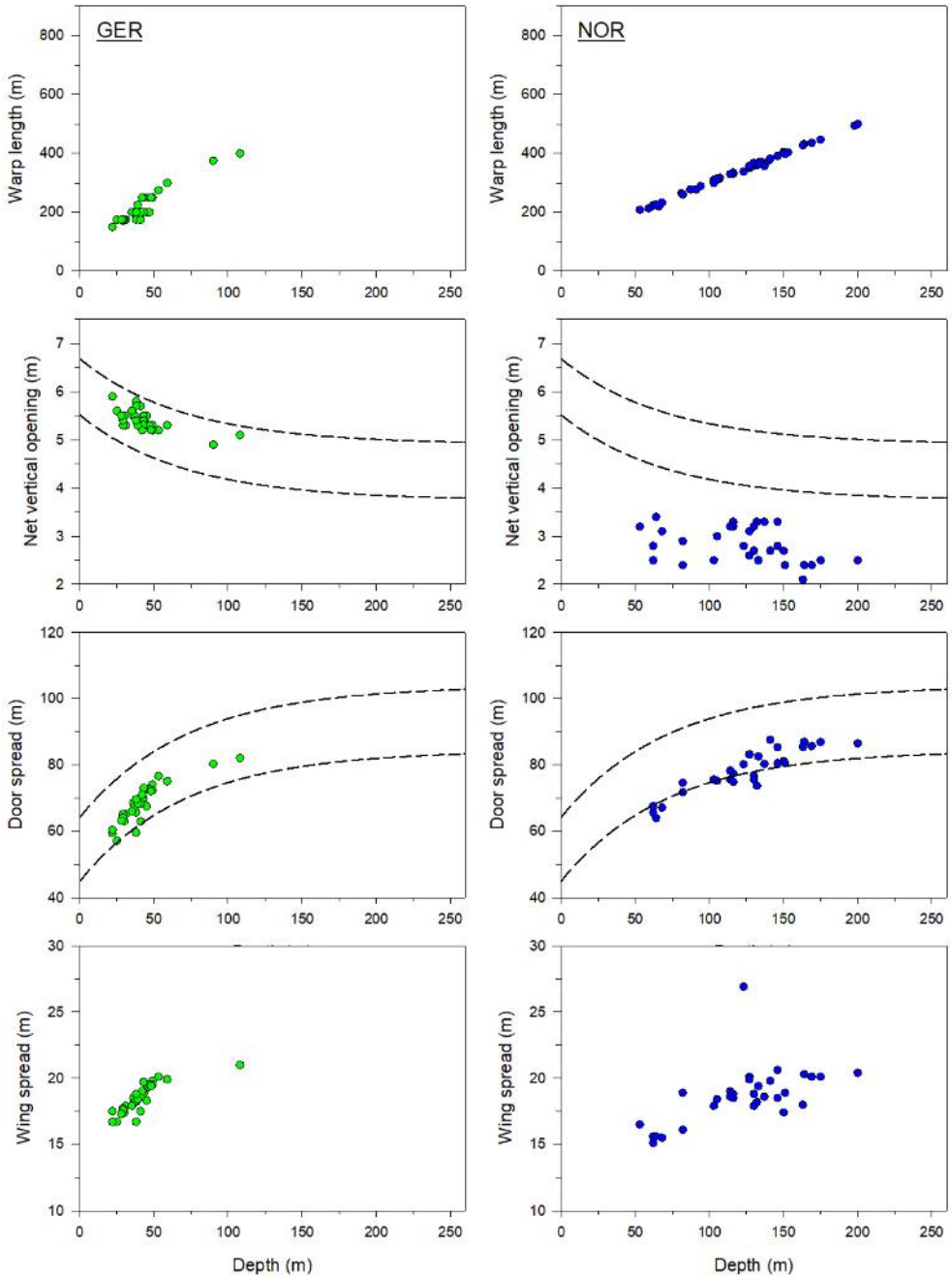


Figure A.4.4.1b. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2018, Germany and Norway. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

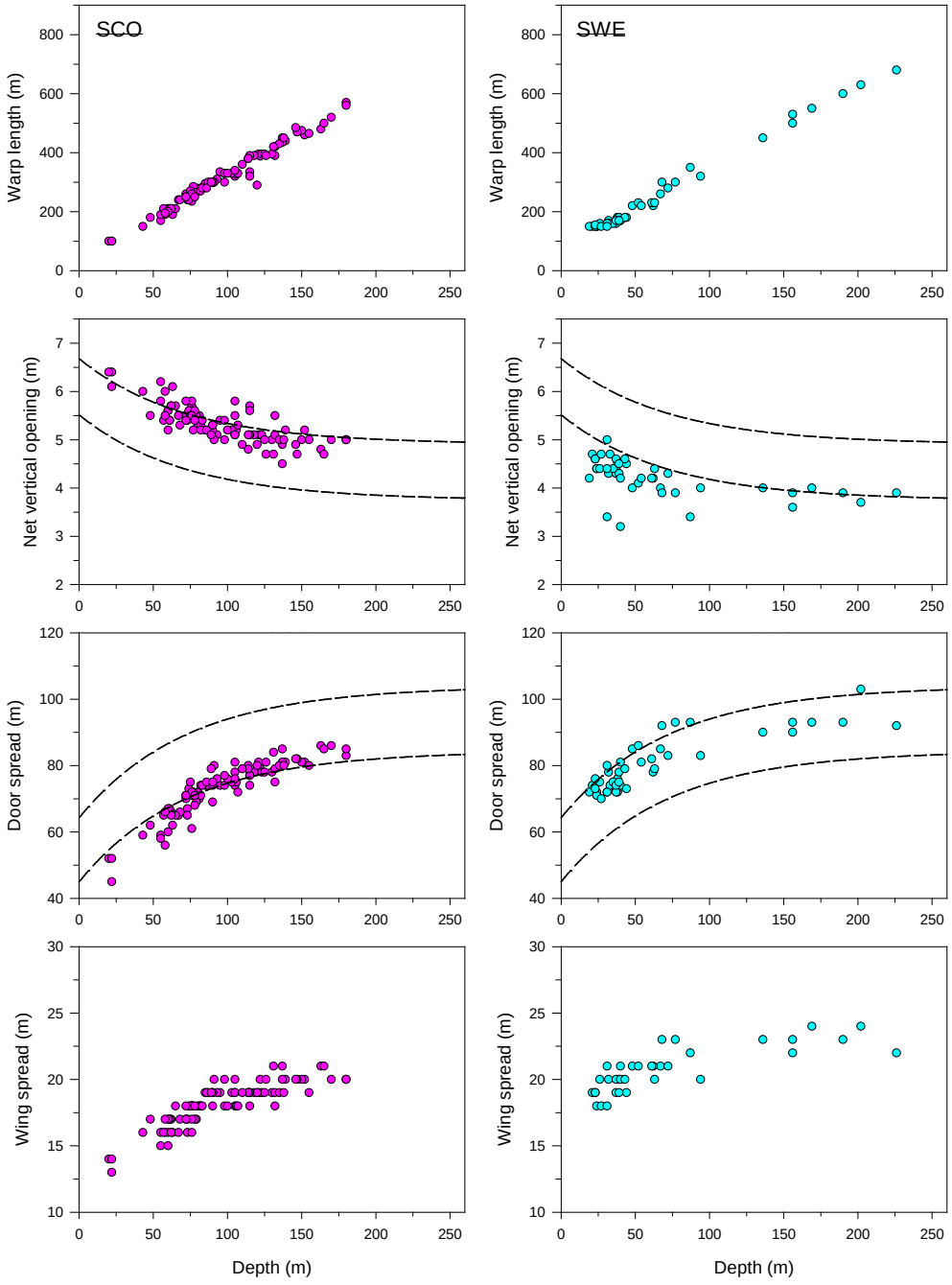


Figure A.4.4.1c. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2018, Scotland and Sweden. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

There were, however, pronounced differences between the countries for door spread and in particular vertical net opening at a given depth (Fig. A.4.4.2). Sweden and especially Norway had net openings that were consistently low, but the gear operated within the normal range for these countries. Furthermore, differences in swept area at depth between the countries were encountered where in particular the values for Scotland (low door spread and low groundspeed) deviated from the others (Fig. A.4.4.3).

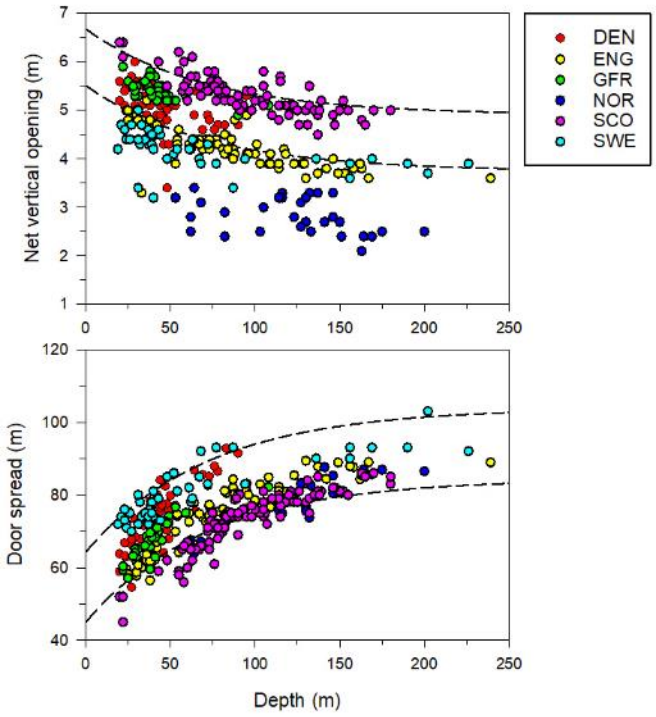


Figure A.4.4.2 Comparison of vertical net geometry and door spread related to depth between countries for the North Sea IBTS Q3 2018. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

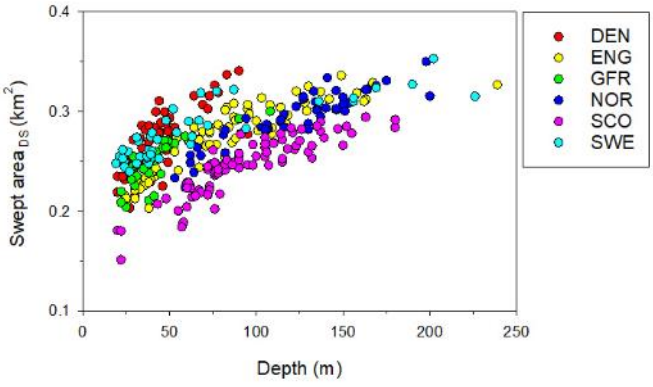


Figure A.4.4.3 Comparison of swept area (based on door spread related to depth between countries for the North Sea IBTS Q3 2018 (only hauls with a duration of > 26 min considered; Note: Average groundspeed for SCO and SWE only 3.7 kn (for historical reasons), as opposed to the target speed of whereas 4.0 kn (largely matched by the other countries).

A.4.5 GOV standard indices and distribution of target species

Time series of abundance indices (in number per hour) and distribution maps (in number per km^2, swept area based on door spread) for the recruits of the NS-IBTS standard species based on the 2018 quarter 3 survey are shown in Figures A.4.5.1. For some target species, high densities were found outside the actual index areas, e.g. Norway pout and mackerel. Saithe and plaice index areas were revised during recent benchmarks, but for other species, actual distribution

patterns may warrant a revision of the species-specific areas on which the standard indices calculated in DATRAS.

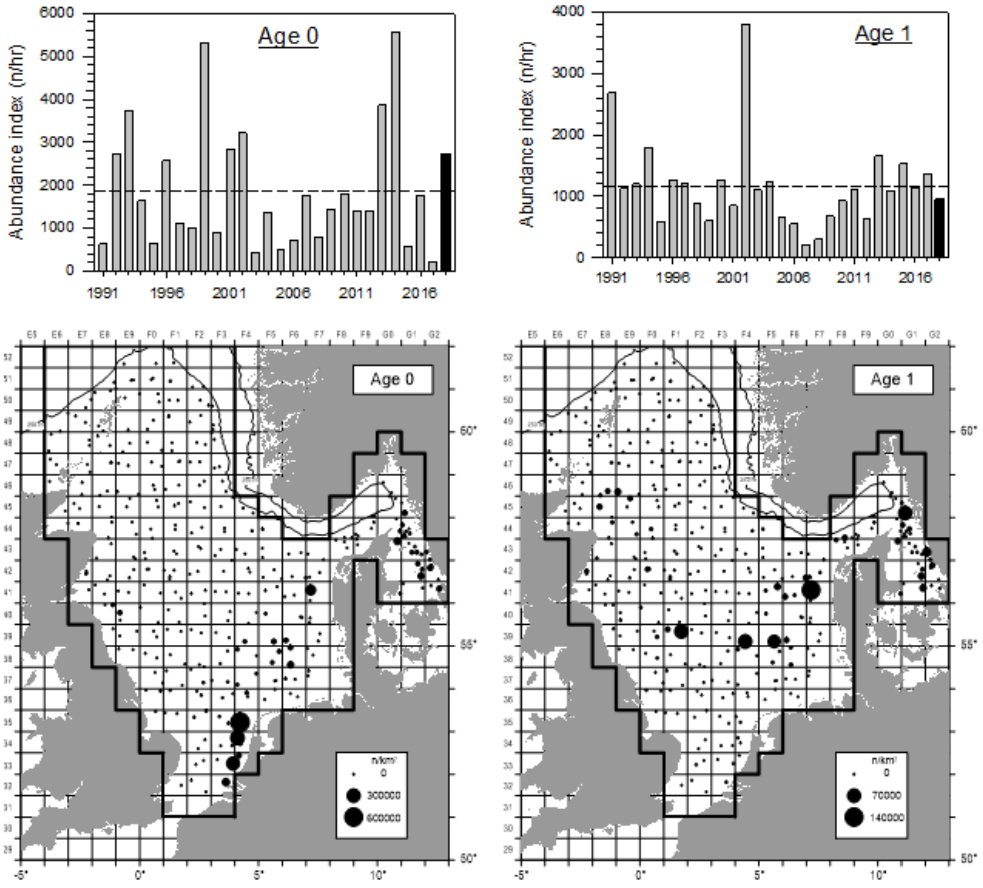


Figure A.4.5.1a. Abundance indices for herring 3Q NS-IBTS 1991-2018 (top panels; dashed lines represent long-term mean) and distribution in 3Q 2018 (bottom panels; thick solid line represent limit of the current index area).

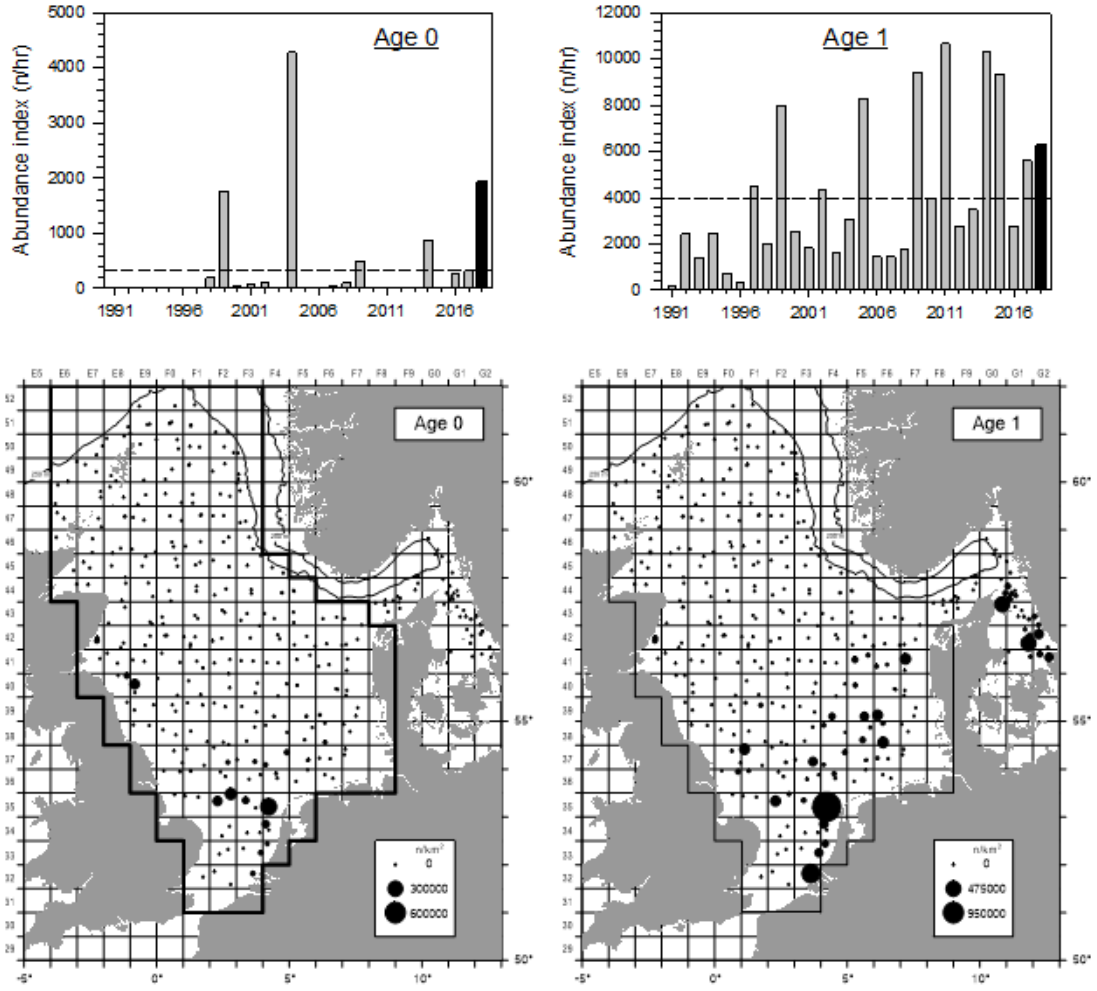


Figure A.4.5.1b. Abundance indices for sprat 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

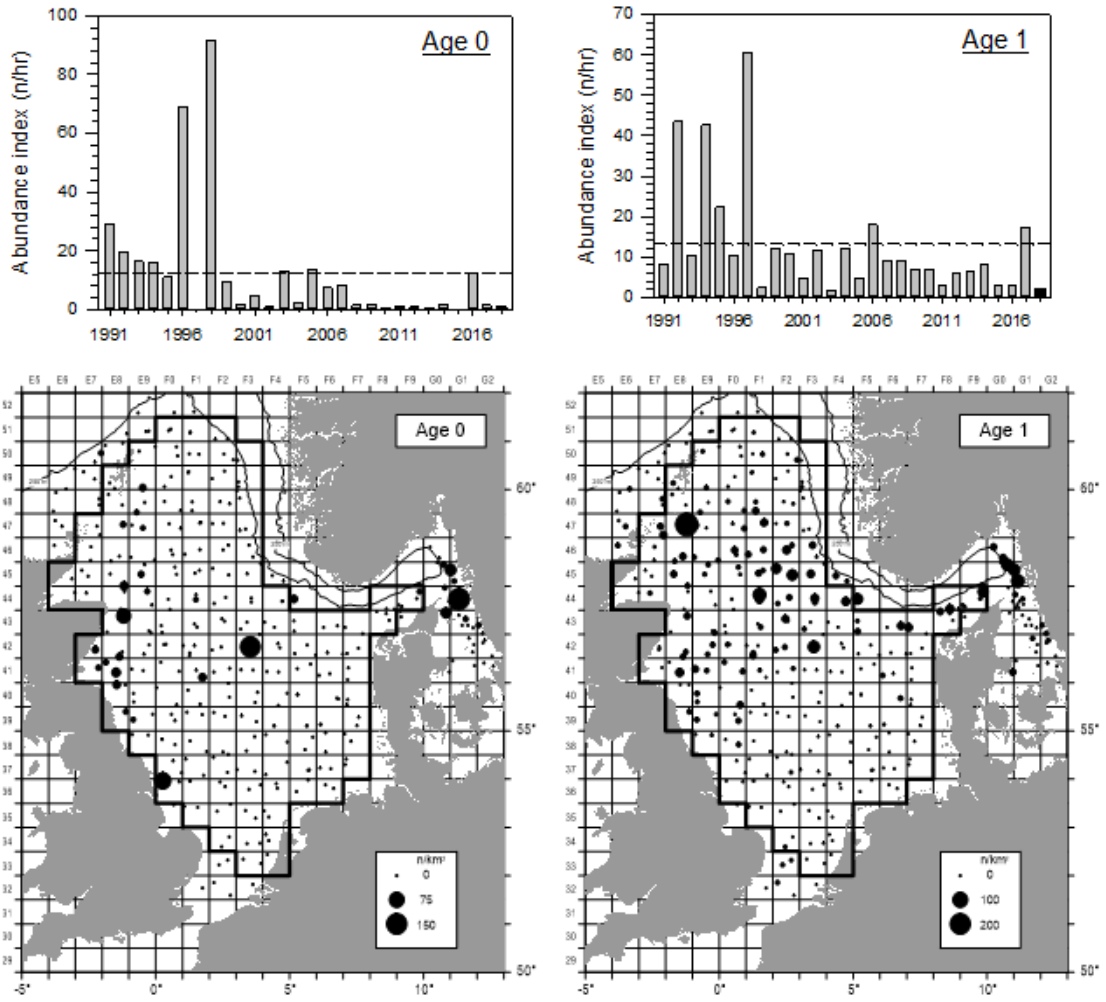


Figure A.4.5.1c. Abundance indices for cod 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

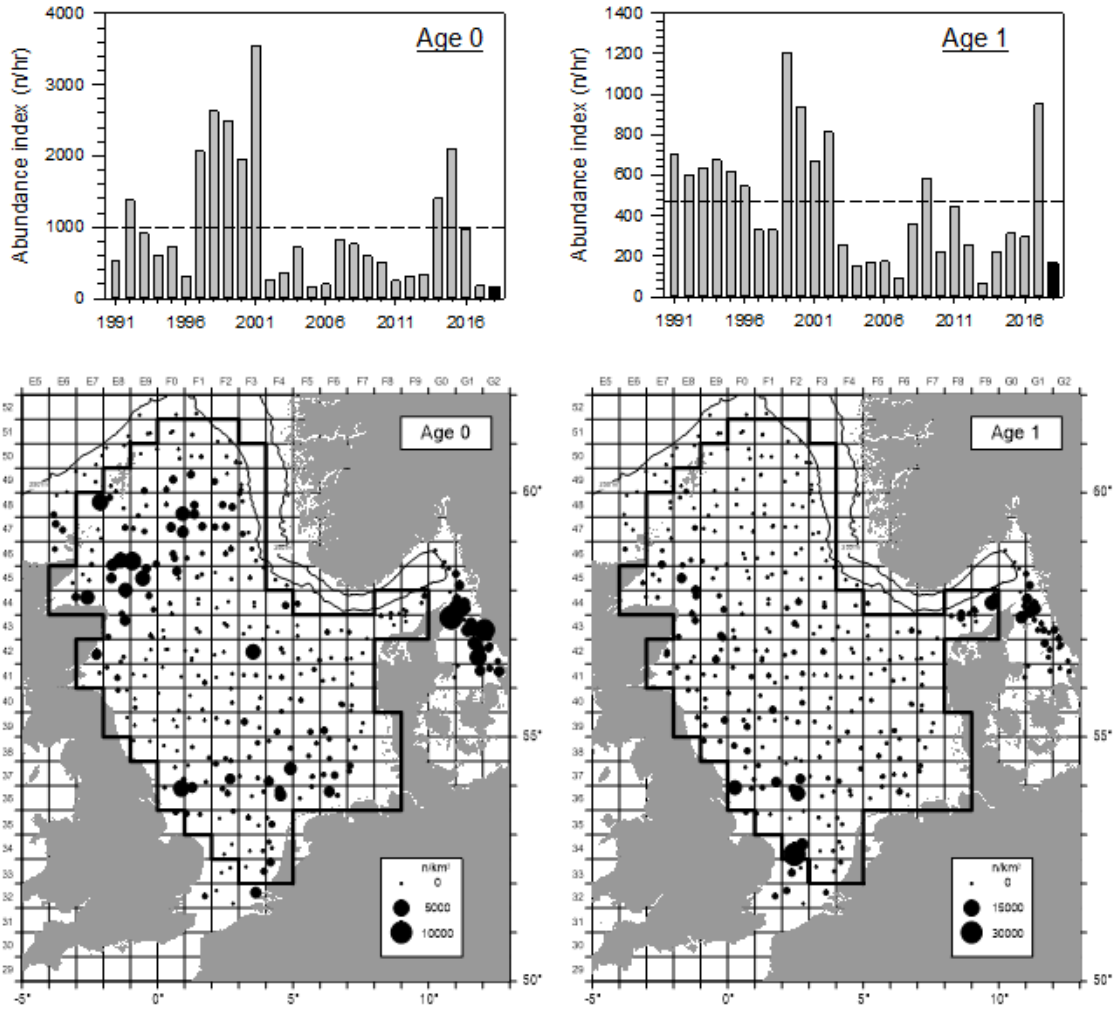


Figure A.4.5.1d. Abundance indices for whiting 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

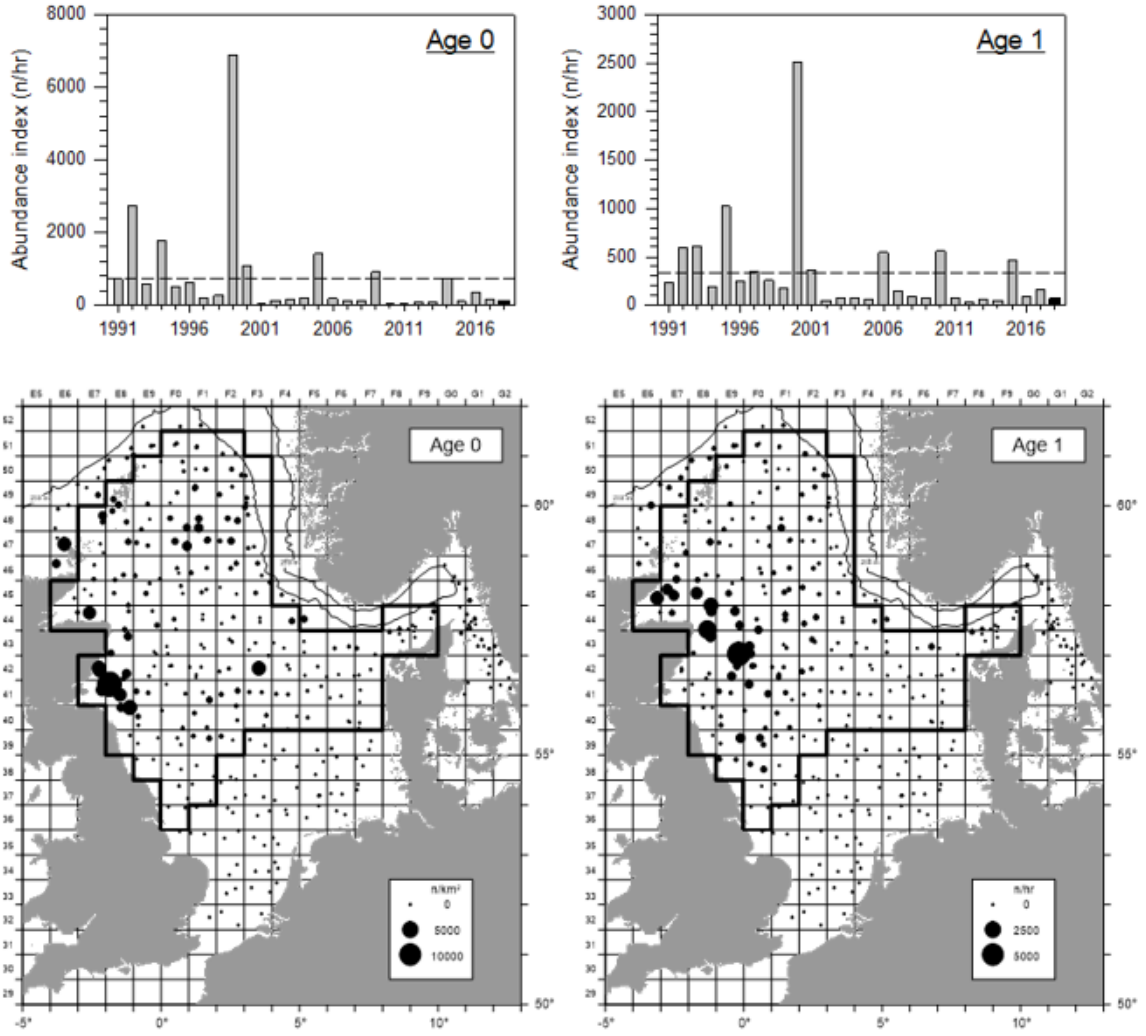


Figure A.4.5.1e. Abundance indices for haddock 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

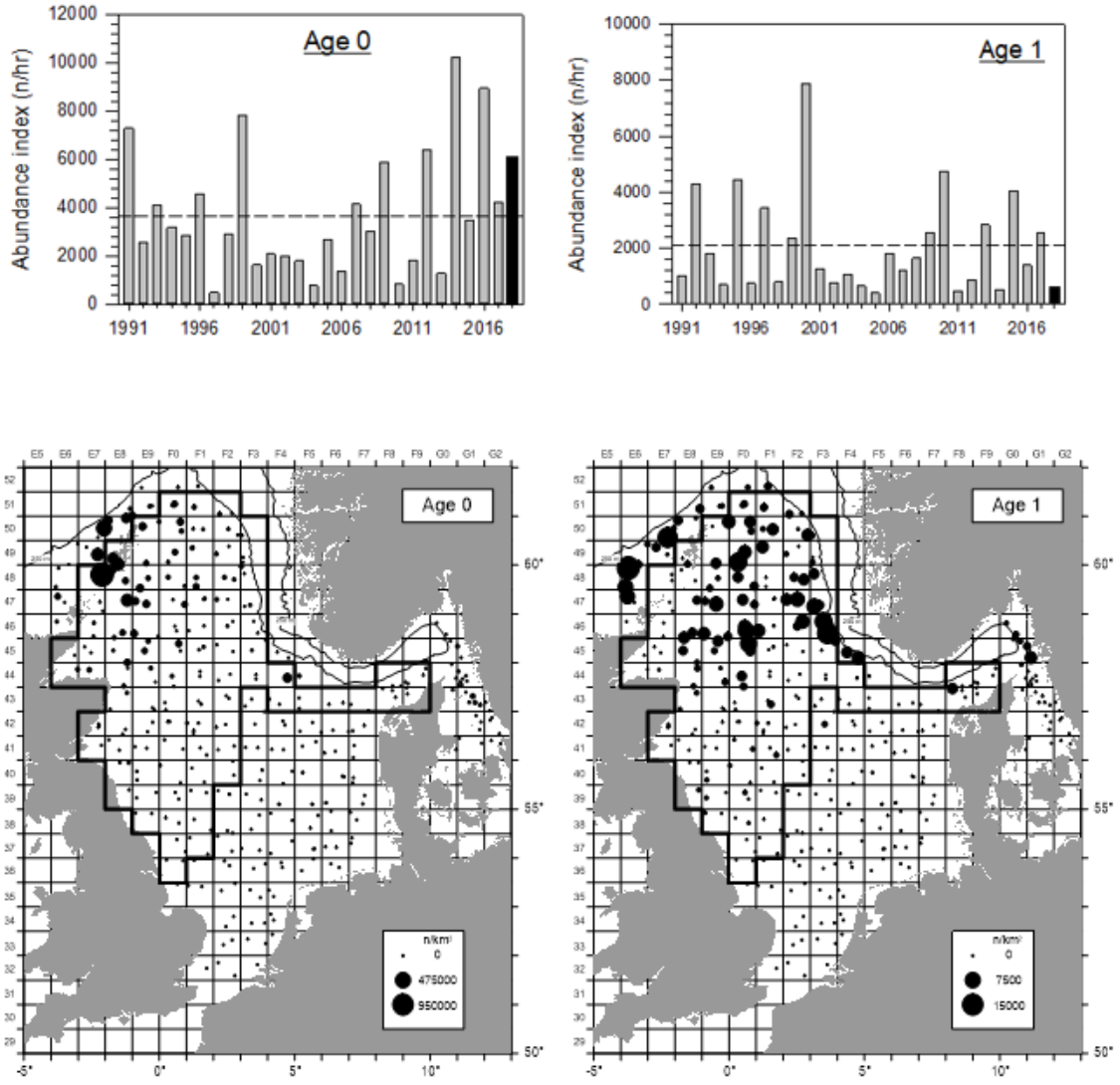


Figure A.4.5.1f. Abundance indices for Norway pout 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

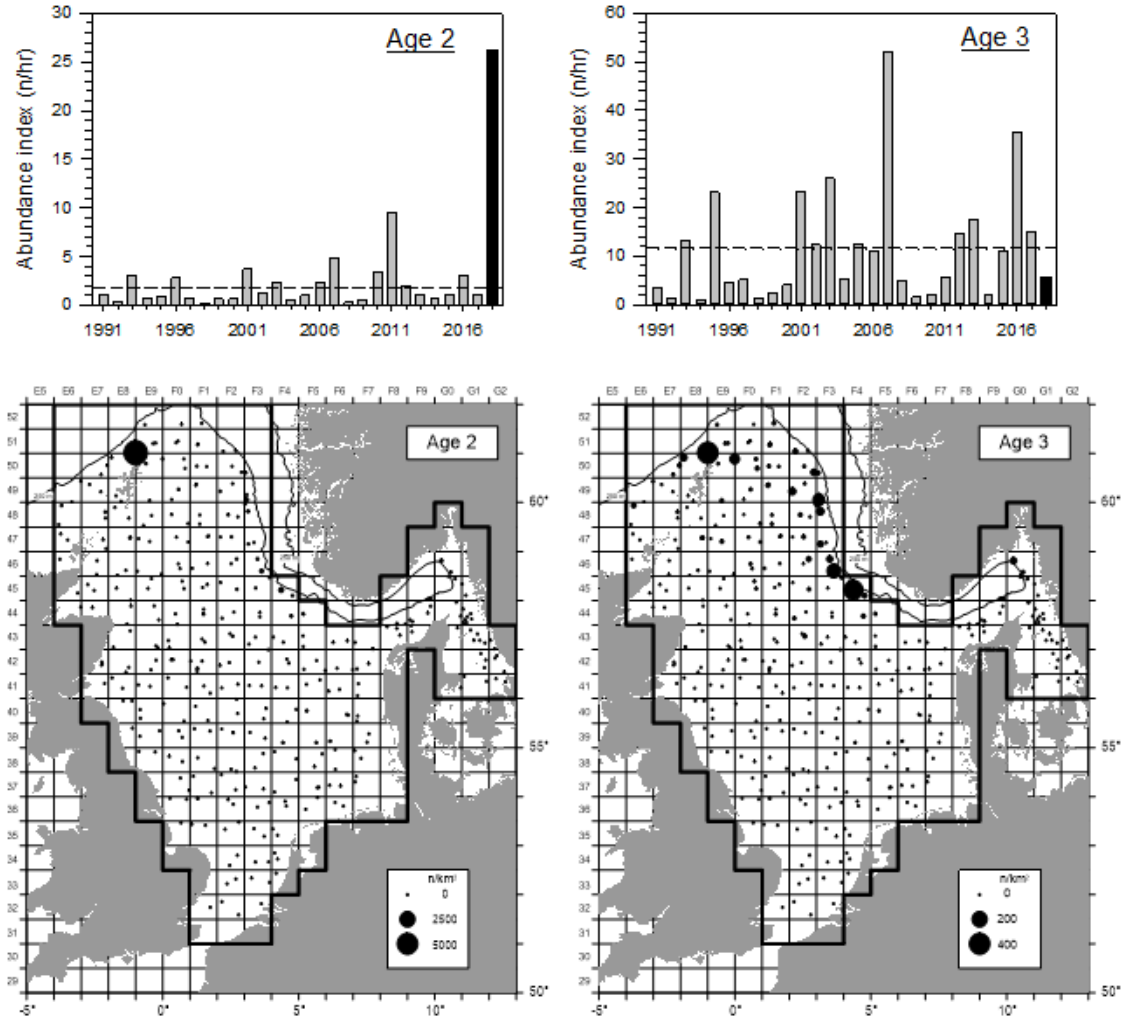


Figure A.4.5.1g. Abundance indices for saithe 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area; Note: Indices may differ from DATRAS standard indices due to a change in the index area for this species).

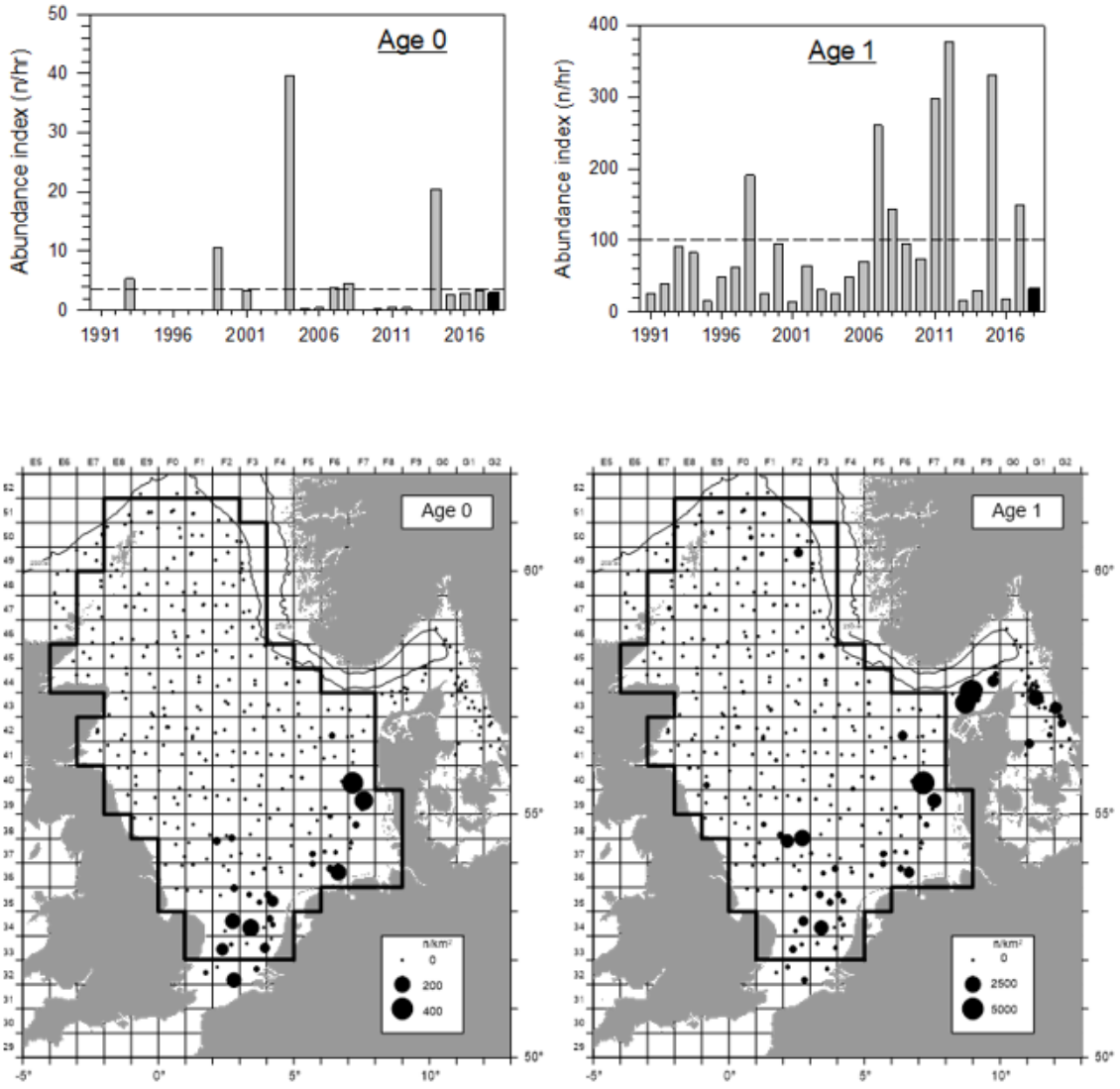


Figure A.4.5.1h. Abundance indices for mackerel 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area).

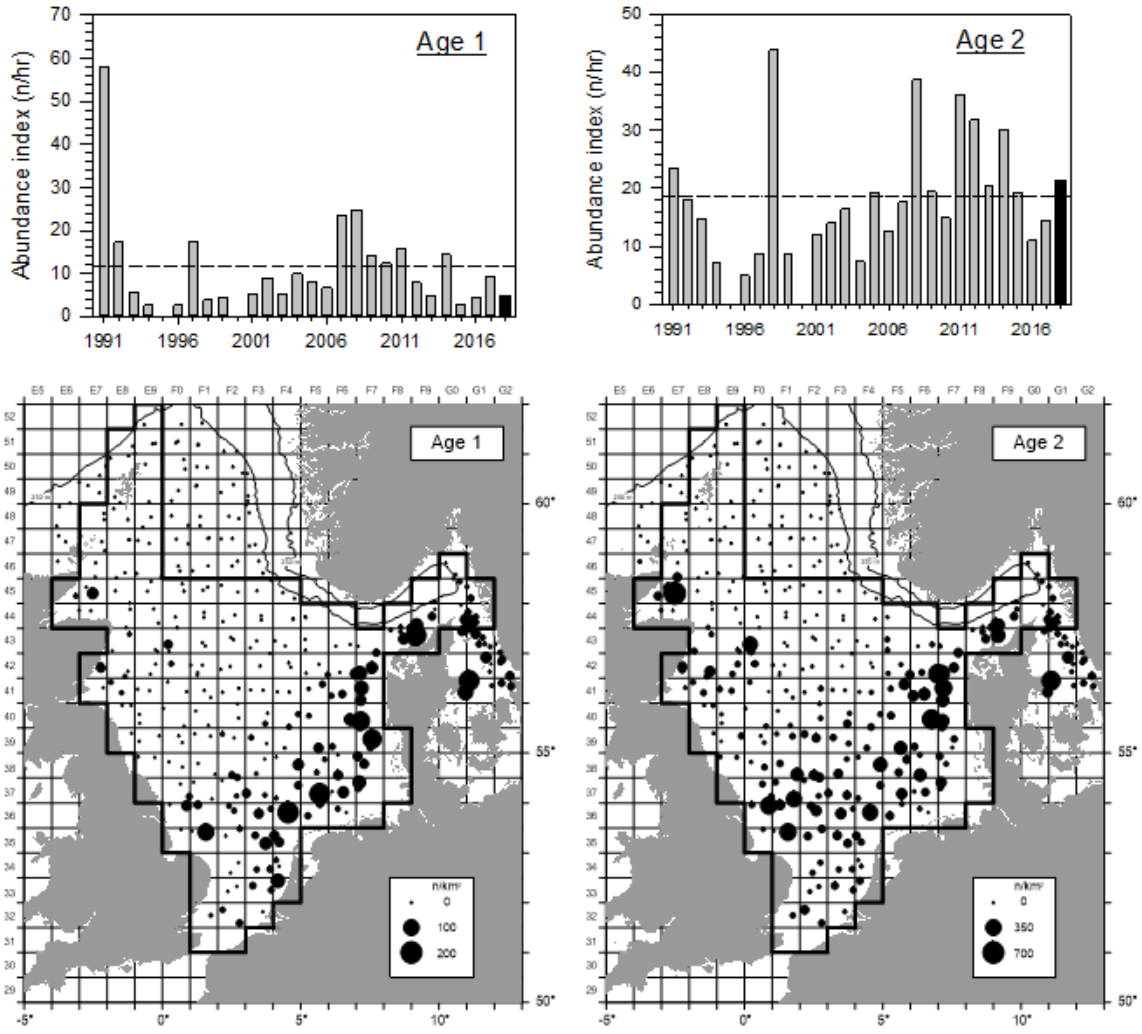


Figure A.4.5.1i. Abundance indices for plaice 3Q NS-IBTS 1991-2018 (dashed lines represent mean) and distribution in 3Q 2018 (thick solid line represent the limit of the current index area; Note: Indices may differ from DATRAS standard indices due to a change in the index area for this species).

The DATRAS download of CPUE by age and haul does not include data for rectangle 44F6 and although valid tows have been made there and it had been requested repeatedly by IBTSWG since 2015 to include the all fished rectangles in the DATRAS CPUE products. Hence, the request has been renewed during the 2019 WG meeting.

In the future, the indices should presented as number per swept area considering the recommendations from ICES WGISDAA (ICES 2013) and WKSABI (ICES 2019).

A.4.6 Other issues

A.4.6.1 Staff exchange

No staff exchange has occurred during the 2018 Q3 surveys, and no concrete plans are there yet to have an exchange in 2019. However, IBTSWG continues to encourage staff exchange.

A.4.6.2 Data exchange

During the cruises, information about successfully completed hauls are regularly exchanged between survey vessels. It has been agreed that preliminary indices based on length splitting for the standard species will no longer be exchanged during the Q3 survey since the final data for

the NS-IBTS main target species (if not all species), including age information, are usually submitted to DATRAS within 2 to 3 weeks after completion of the survey.

A.4.7 References

ICES. 2013. Report of the Working Group on Improving Use of Survey Data for Assessment and Advice (WGISDAA), 19-21 March 2013, Marine Institute, Dublin, Ireland. ICES CM 2013/SSGESST:07.22 pp.

ICES. 2018. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 19 - 23 March 2018, Oranmore, Ireland. ICES CM 2018/EOSG:01. 233 pp.

ICES. 2019. Workshop on Methods to develop a swept-area based effort index (WKSABI). ICES Scientific Reports. 1:3. 24 pp. http://doi.org/10.17895/ices.pub.4902.

Annex 5: Summary report NEA surveys

A.5.1 General Overview

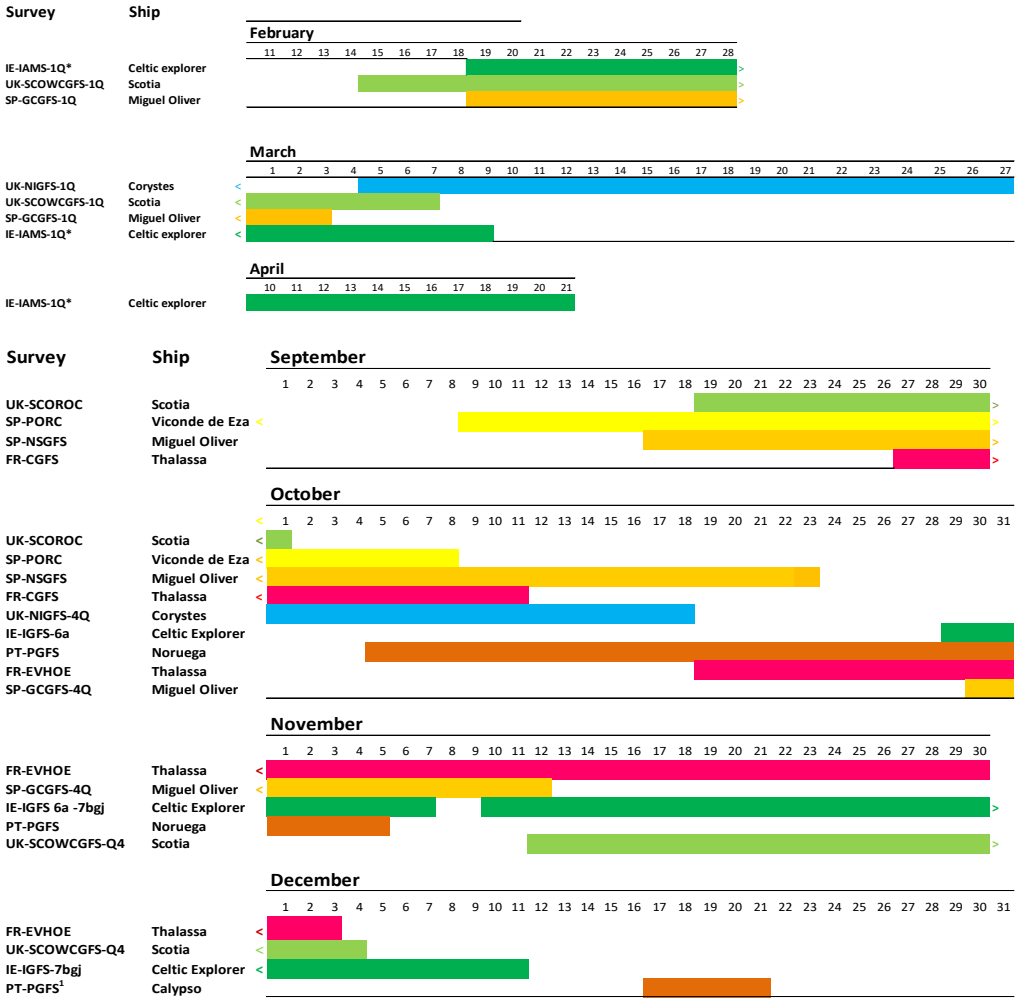
In 2018, seven vessels from 6 nations performed 14 surveys along the Northeastern Atlantic (NEA) IBTS area. A total of 1155 valid hauls, out of the 1181 hauls planned, were accomplished over 324 days distributed between the first, third and fourth quarters. See tables 5.4.1.1 and 5.4.1.2.In 2018 all surveys were completed and most were undertaken without serious issues. Four 1st quarter surveys (Scotland, Northern Ireland, Ireland and the Spanish survey in the Gulf of Cadiz), and also the usual 3rd quarter surveys (UK-SCOROC-Q3 and SP-PORC, SP-NSGFS). France, Northern Ireland, Ireland, Scotland, Spain and Portugal were all active during the 4th quarter. Included within the reported surveys is the Irish Anglerfish and Megrim Survey (IE-IAMS-Q1) and although the data are not yet uploaded to DATRAS, the survey is now used as a tuning index for mon.27.78abd (WGBIE) since the benchmark for this stock in 2018 (WKANGLER). Information on the IAMS-Q1 was also included as an annex on the new version of the Manual of the IBTS North Eastern Atlantic Surveys, SISP 15 (ICES, 2017). Selected data tables summarising biological as well as additional activities for all reported surveys are provided in the following sections of this report however comprehensive and detailed information for all reported surveys including survey coverage plots and catch per unit effort (CPUE) estimates for target species are presented within the individual cruise summary reports and these are located in annex 5.

Table 5.4.1.1. Summary of surveys, hauls and days at sea per country performed in the IBTS NorthEastern Atlantic area in 2018

Country	Survey	Hauls				Days
		Planned	Valid	Invalid	Total	
UK-Scotland	UK-SCOWCGFS-Q1	60	60	4 + 3*	67	21
	UK-SCOROC-Q3	40	40 + 1	1	42	14
	UK-SCOWCGFS-Q4	60	56	3	59	23
UK-North Ireland	UK-NIGFS-Q1	62	62	0	62	19
	UK-NIGFS-Q4	62	61	3	64	16
Ireland	IE-IAMS-Q1	115	116	9	121	21
	IE-IGFS-Q4	171	153 + 4**	5	162	42
France	FR-CGFS-Q4	74	73	1	73	15
	FR-EVHOE-Q4	155	153	8	161	45
Spain	SP-PORC-Q3	80	80 + 2	5	87	32
	SP-NSGFS Q4	116	112 + 23	2	137	35
	SP-GCGFS-Q1	45	41	1	42	11
	SP-GCGFS-Q4	45	45	0	45	12
Portugal	PT-PGFS-Q4	96	53	4 + 12***	69	38
Total		1181	1155	40	1194	324

***: Zero-minutes tows ; **: trials ; ***: Calypso Stations**

Table 5.4.1.2. Overview of the surveys performed during quarters 1, 3 and 4 on the Northeastern Atlantic IBTS area in 2018.



Biological Sampling

Table 5.4.3.1 provides an overview of the number of biological samples as reported per country/survey within the North-eastern Atlantic area.

Table 5.4.3.1. Number of individuals sampled for maturity and/or age in 2018 surveys on NEatlIBTS.

	UK-SCO			UK-NI		IE		FR		SP				PT
Target species	**Q1**	**Q3**	**Q4**	**Q1**	**Q4**	**IAMS**	**IGFS**	**CGFS**	**EVHOE**	**PORC**	**NSGFS**	**GC-Q1**	**GC-Q4**	**PGFS**
Clupea harengus	715		347				250							
Gadus morhua	191	5	239**	171	79	34	73	8	36					
Lepidorhombus boscii						255**				307	512			5
L. whiffiagonis						980	1443		855	724	440			7
Lophius budegassa						606	373		296	46	34			
Lophius piscatorius			43*			1398	527	6	200	162	19			
M. aeglefinus	1623	1703	1217**	955	760	678	1808		880					
Merlangius merlangus	1202	10	768**	1275	1315	350	1213	610	713					
Merluccius merluccius	375		289**	34	16	1941**	613		1092	636	872	237/654*	335/1697*	1383/826*
*Nephrops norvegicus**										912*		23*	180*	95*
Pollachius virens	414	7	33**			132	75							
Scomber scombrus		61	156				433		625		561			154/332*
Sprattus sprattus	382		219**											
Trachurus trachurus							1221				431			620/1086*
Additional species														
Chelidonichthys cuculus					42		191**	82	280					23
Chelidonichthys lucerna														
Conger conger				11			116**			19	137**			

Dicentrarchus labrax							9	252	56					
*Dipturus. batis cf. flossada**	9*	85*	7*			52	27							
*D. batis cf.intermedia**	42*		39*			182	63							
*Dipturus oxyrinchus**		3*												
Engraulis encrasicolus									182		141			
*Galeorhinus galeus**	1*		5*											
G. cynoglossus			22**			325	416		199					
Helicolenus dactylopterus										175	165			198
*Illex coindeti**												158	44	27
*Leucoraja fullonica**		8												
*Leucoraja naevus**	29*		239*			457	176							
*Loligo forbesi**												52	196	
*Loligo vulgaris**													830	276
Micromesistius poutassou							589				1161			293/692*
Microstomus kitt					10	348**	663		350					
Molva dypterygia														
Molva molva	68		44**			352	87		24	10				
Mullus surmuletus								224	170		139			11
*Mustelus spp.**	13*		7*											

*Octopus vulgaris**												17	428	
*Parapeeus longirostris**												1933	1996	495
Phycis blennoides									395	226	184			
Pleuronectes platessa	180		166**	525	205		1336	582	250					
Pollachius pollachius	10*			5	2		24		4					
*Raja brachyura**	6*		10*	24	2		46							
*Raja clavata**	76*	16*	96*	114	75		326							
*Raja montagui**	96*		226*	138	75		1034							
*Raja naevus**				23										
Sardina pilchardus									180					185
Scomber colias											95			151
Scophthalmus maximus	3*		1*			9	51		1					
Scophthalmus rhombus	2*		10*	20	8	6*	70**		3					
Solea solea						9	247	163	127					
*Sepia officinalis**												87	305	
*Squalus acanthias**				2	25	285	755							
Trisopterus luscus								88	237		158			
Zeus faber				11	16	223*	177**				58**			

Additional Activities

Table 5.4.4.1 gives an overview of the Additional activities performed in 2018 as reported per country/survey within the North-eastern Atlantic area.

Table 5.4.4.1.Additional activities undertaken in 2018 surveys on NEatlIBTS

	UK-SCO			UK-NIGFS		IRL	FR		SP				PT
	Q1	Q3	Q4	Q1	Q4	IGFS	CGFS	EVHOE	PORC	NS	GC Q1	GC Q4	PGFS
CTD (Temp+salinity)	1	1	1	1	1	1	1	1	1	1	1	1	1
Seafloor Litter	1	1	1	1	1	1	1	1	1	1	1	1	1
Water sampler (Nutrients)							1	1					
Plankton sampling							1	1					
Benthos sampling		1		1	1	1	1	1	1	1	1	1	1
Observers: mammals, birds							1	1	X	1			
Additional biological data on fish	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish stomach contents				X	X	X	X	X		1	X	X	X
Benthic samples (boxcore, video, dredge)		1				1	X	X	X	X	X	X	
Jellyfish				1	1	1	1	1					1
Hydrological transect						1	1	1		1	X	X	
Acoustic for fish species	1		1			1		X	1				X
Multibeam: seabed mapping						X	X	1					X

1: Annually, X: Occasional

A.5.1 - Scotland –SCOWCGFS-Q1

Nation:	Scotland	Vessel:	Scotia
Survey:	0318S (SCOWCGFS-Q1)	Dates:	15th February – 07th March 2018

Cruise:	Q1 West Coast Scotland survey aims to: • Collect data on the distribution, relative abundance and biological information (EU Data Directive 1639/2001) on commercial gadoid species and a range of other fish species in ICES subarea 6a. • Obtain temperature and salinity data from the surface and near seabed at each trawling station • Collect additional biological data in connection with the EU data collection framework (DCF). • Opportunistic completion of zero hours hauls to assess unquantified time spent by the trawl on the seabed • Opportunistic retrieval of Compass moorings deployed in November 2017. Retrieval of Hydrographic Glider from west of Barra Head.
Gear details:	GOV incorporating groundgear D was used at all stations. Sweeps were 97m in all cases where the mean depth was >80m (n=57), otherwise 47m sweeps were used (n=10). The following parameters were recorded during each haul using SCANMAR: headline height, wing spread, door spread and distance covered. A bottom contact sensor was attached to the groundgear and downloaded following each haul.
Notes from survey (e.g. problems, additional work etc.):	**Demersal Survey** The 2018 survey utilises a random-stratified survey design with normally 60 primary trawl locations distributed within 11 sampling strata (see figure A.5.1.1). Trawls were undertaken on suitable ground as near to the specified sampling position as was practicable and within a radius of 5 nautical miles of the sample position. When the trawl could not be undertaken at the primary site then a suitable replacement was chosen from a list of secondary random positions. The Scanmar system was used to monitor headline height, wing spread, door spread and distance covered during each tow. A bottom contact sensor was attached to the groundgear for each tow to monitor ground contact as well as to validate time of touch-down and lift-off of the groundgear and was downloaded every haul. During the first half of the survey MSS had been provided with new SCANMAR SS4 distance sensors to trial on the wings of the GOV. These performed very well during the 3 days when they were in use and also required no modifications to be made to the SCANBAS receiver cabinet/RADOS monitoring system which was also encouraging. Hauls were typically of 30 min duration however various factors (large pelagic fish marks, poor ground) resulted in lesser durations for 9 hauls. It should also be noted that no valid hauls were of a duration shorter than 15 minutes thus complying with recommendations pertaining to minimum haul duration stated in the 2009 IBTSWG report. Of the 60 valid hauls that were achieved all but 2 of these were completed during daylight hours. There were 4 foul hauls, 2 of which (124, 134) were aborted due to strong tides, with another (133) being as a result of bad ground where the belly was torn out from the net. Haul 112 was invalid due to the net being full of

	mackerel and despite valiant efforts to retrieve the net intact and release the catch both the catch and the nylon bag were lost. Conservative estimates put the weight of mackerel contained in the bag at 50 tonnes. The locations used for the valid trawl positions during this survey were a combination of established MSS and commercial trawled areas. On 15 occasions grounds were successfully used that previously were unfished by MSS. See figure 1 for a plot of all survey tows. Additional tow time information for all trawl deployments was recorded during this survey and subsequently sent to the IBTSWG NEA survey coordinator prior to the IBTSWG meeting in march 2018. 3 zero minute tows were also completed(hauls 80 – 82). These information will provide valuable information regarding the inter-vessel variability and hitherto unquantified trawl time on the seabed. The CTD recorder (Seabird19+) was deployed at 55 out of the 60 valid trawling stations in order to obtain a temperature and salinity profile to within approximately 5m of the seabed. Hauls 86, 95, 110, 115, and 132 had no associated hydrography data. 5 acoustic moorings were successfully located and retrieved by Scotia from 5 different locations from within the Minches area. In addition 6 new moorings were also successfully deployments within the same areas. After some initial issues concerning communication with the hydrostatic release mechanism, the process became much easier with every subsequent retrieval. During the 21st February Scotia was asked to rescue a damaged Hydrographic glider (WH01 – OUC) that had been drifting across the Atlantic since it deployment off the Eastern United States in November 2017. Scotia successfully located and retrieved the damaged glider without incurring any significant loss of time and the glider was sent back at *Wood's Hole Oceanographic Institute, Massachusetts*. Figure 1 provides the both the mooring and glider locations. All of the otoliths from the main commercial demersal species were aged at sea, the pelagic otoliths were aged at the lab. All litter picked up in the trawl was classified, quantified and recorded then retained for appropriate disposal ashore. **Misc Sampling:** • • Pelagic fish sample collection Approximately 6kg each of mackerel and herring from the Minch area were frozen for environmental monitoring (CRCE Scotland, Glasgow) • Bobtail squid identification All bobtail squid (Sepiolida) caught (n=25) were preserved in 70% ethanol for identification at Naturalis Biodiversity Centre, Leiden. • Regional provenance testing – *Southampton University* Collection of muscle samples from commercial gadoid species. Aim is to develop a way of tracing the geographic origin of fish using stable isotopes. • eDNA Collection from CTD seawater sampling – *MSS/Aberdeen University* Additional water samples retained from CTD stations for analysis from throughout the entire survey area
	A total of 90 species were recorded for an overall catch weight of ~28 tonnes *(80, 43,7).* Major components in approximate tonnes included: haddock *Melanogrammus aeglefinus* – 5.87 *(9.5)*, mackerel *Scomber scombrus* – 3.6 *(8.5)*, cod *Gadus morhua* – 0.58

No. fish species recorded and notes on any rare species or unusual catches:	*(5.6)* Norway pout *Trisopterus esmarkii* - 1.26 *(3.7)*, whiting *Merlangius merlangus* – 2.86 *(3.2)*, herring *Clupea harengus* – 3.27 *(2.9)*, and scad *Trachurus trachurus* – 2.45 *(2.1)*. Notable hauls included haul number 104, approx. on the shelf edge West of Barra Hd, which contained over 2.5 tonnes of mackerel and also haul 138 NE of Stoer Point in the North Minch which contained over 200kgs of small juvenile saithe. In addition haul 112, on the shelf edge NW of Donegal hauled up an estimated 50 tonnes of mackerel that unfortunately was unable to be brought aboard. Similar trend was observed in the Clyde as 2017 with gadoid species once again dominating the catches in hauls 125 – 127. Table A.5.1.2 provides overall catch rates per unit effort (CPUE) of the above species and several other major overall components. The CPUE index (numbers caught per hour fishing) for 1-group gadoids (cod, haddock, whiting and saithe) weights the indices for each of the 11 sampling strata by the surface area of said stratum. These are then pooled to produce the index for ICES Subarea VIa. Results for all age classes of the major commercial gadoid species are shown in table A.5.1.3 while those of 1-groups only for period 2011-2017 are shown in table A.5.1.3. The overall CPUE by weight over the same period is displayed in table A.5.1.5. Overall catch weight was down substantially when compared to 2017 and for what was a comparable number of valid survey hauls. Of the main commercial demersal species only saithe provided an increase compared to the CPUE indices estimates provided in 2017.

Table A.5.1.1: Number of stations surveyed/gear during 0318S

ICES Divisions	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
VIa	All	GOV-D	60	60	0	1+3*	100	*1 foul haul 3 zero min tows completed

Table A.5.1.2. Overall CPUE of major components of combined catch Q1 2018

Species	Common name	kg/hr	no/hr
Melanogrammus aeglefinus	Haddock	206	671
Scomber scombrus	Mackerel	127	738
Gadus morhua	Cod	20.4	7
Trisopterus esmarkii	Norway Pout	44.1	1998
Merlangius merlangus	Whiting	100	567
Clupea harengus	Herring	115	993
Trachurus trachurus	Horse Mackerel	86	542

Scyliorhinus canicula	Lesser Spotted Dogfish	67	112
Pleuronectes platessa	Plaice	6.4	34
Eutrigla gurnardus	Grey Gurnard	19	215
Capros aper	Boar Fish	12.3	230
Squalus acanthias	Spurdog	6.3	4.4
Pollachius virens	Saithe	42.5	70
Merluccius merluccius	Hake	18.4	54
Dipturus intermedia	Flapper Skate	9.1	1.6
Loligo ssp	Long Finned Squid	16.5	257
Raja montagui	Spotted Ray	12.3	14.9
Lophius piscatorius	Angler	4.7	1.9
Sprattus sprattus	Sprat	2.5	240
Raja clavata	Thornback Ray	8	4.7
Chelidonichthys cuculus	Red Gurnard	10.8	43.2
Micromesistius poutassou	Blue Whiting	6.9	165
Limanda limanda	Common Dab	2.3	31
Microstomus kitt	Lemon Sole	3	21
Lepidorhombus whiffiagonis	Megrim	3.7	11.3

Table A.5.1.3. CPUE indices (nos/hr) by year class of major demersal species Q1 2018

Age	Cod	Had-dock	Whiting	Saithe	N. Pout
0	0	0	0	0	0
1	0.17	39.8	196	1.28	538
2	2.04	133	183	29.61	1275
3	0.72	118	107	10.2	102
4	1.98	400	114	12.11	3.54
5	1	6.54	13.23	4.54	0
6	0.23	0.69	1.36	0.29	0
7	0.1	0.26	0.16	0.07	0
8	0	0.22	0.19	0.16	0
9	0.04	9.8	0.14	0.1	0
10	0	0	0	0.05	0
11	0	0	0	0.03	0
12	0.03	0	0	0.06	0
13	0	0	0	0	0

14	0	0	0	0.06	0
15	0	0	0	0	0
16	0	0	0	0.0	0

Table A.5.1.4. CPUE indices (nos/hr fishing) of 1-groups of major demersal species since 2011

Species	2011	2012	2013	2014	2015	2016	2017	2018
Cod	0.05	1.4	2	1.1	0.82	0.47	0.29	0.17
Haddock	2.4	14.7	5.2	53	680	56	217	39.8
Whiting	22.2	344	5.5	580	254	323	497	196
Saithe	0.0	0.0	0.04	0.0	0.0	0.0	0.0	1.28
N. Pout	173	1012	4238	2136	4649	3245	4370	538

Table A.5.1.5. CPUE indices (kg/hrs fishing) of major demersal species since 2011

Species	2011	2012	2013	2014	2015	2016	2017	2018
Cod	9.6	21.2	29.3	11.6	72.5	44.1	190.5	20.4
Haddock	148.8	153.4	180.0	113.7	169.2	191	324.6	206
Whiting	49.3	46.9	63.8	35.0	58.7	96.9	109.7	100
Saithe	10.8	6.1	15.2	25.0	24.0	17.1	16.2	42.5
N. Pout	280.9	131.1	130.7	125.8	65.4	73.9	126.8	44.1

Table A.5.1.6: Numbers of biological observations per species collected during 0318S. These consist of length, weight, sex and age, unless:

* length, weight, sex, maturity and otoliths retained (to be aged at a later date)

**length, weight, sex, maturity

† length, weight, sex and externally determined maturity only

Species	No.	Species	No.
Melanogrammus aeglefinus	1623	***Scophthalmus maximus*	3
Merlangius merlangus	1202	***Scophthalmus rhombus*	2
Gadus morhua	191	*†Dipturus flossada*	9
Pollachius virens	414	*†Dipturus intermedia*	42
Trisopterus esmarkii	293	*†Leucoraja naevus*	29
Clupea harengus	715	*†Mustelus asterias*	13
Sprattus sprattus	382	*†Raja brachyura*	6
Scomber scombrus	320	*†Raja clavata*	76
**Merluccius merluccius*	375	*†Raja montagui*	96
**Pleuronectes platessa*	180	*†Squalus acanthias*	37
***Pollachius pollachius*	10	*†Galeorhinus galeus*	1

***Molva molva* 68

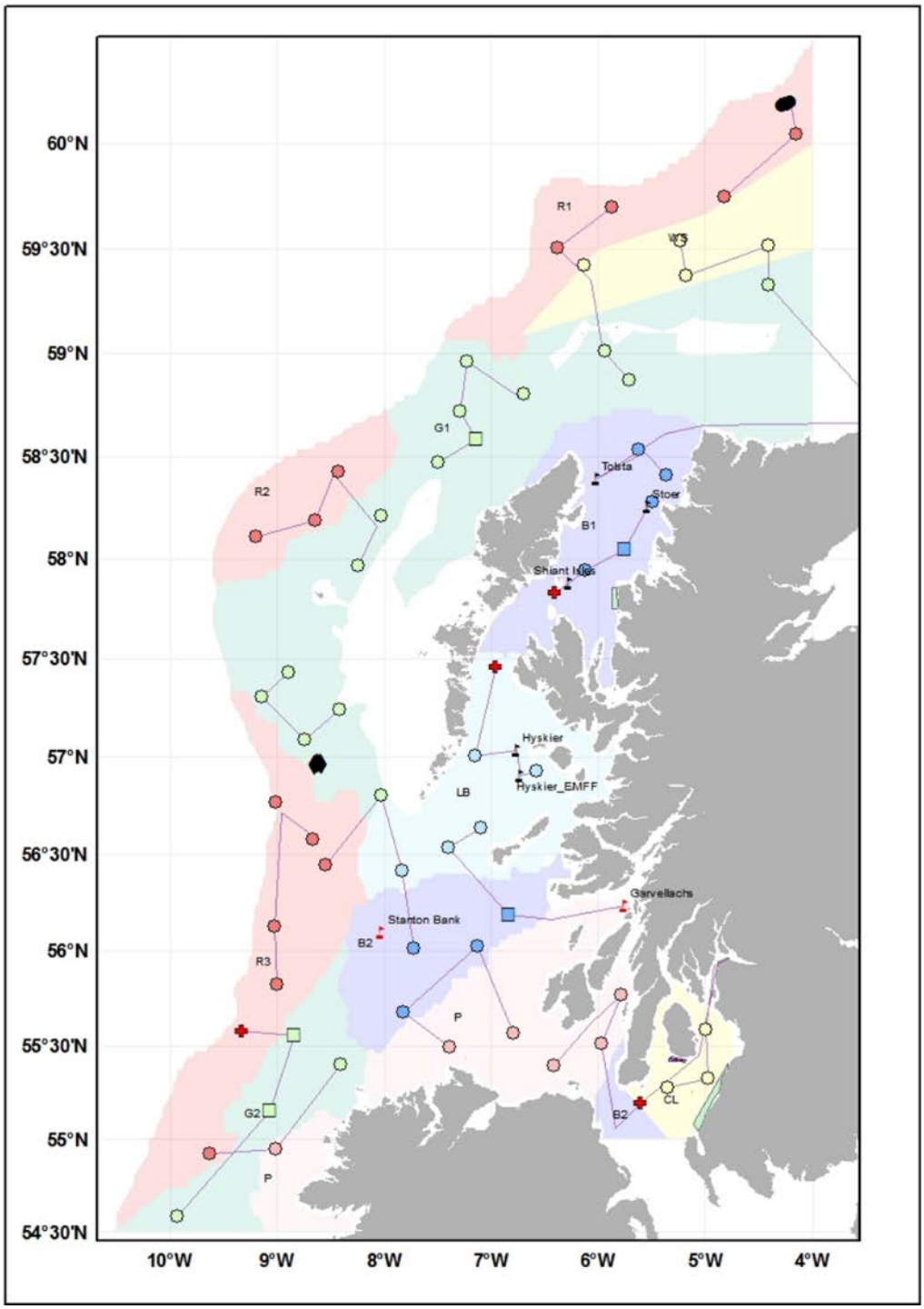


Figure A.5.1.1: 0318S survey map showing survey strata (coloured polygons), valid trawl positions are denoted as either filled circles (primary stations used) or filled squares (secondary positions used). Invalid hauls are denoted by a red cross. The tracked position of the retrieved hydrographic glider is represented by filled black diamonds and the positions of the

zero minute tows are denoted using black filled circles. Black flags denote sites where mooring was successfully recovered whereas red flags denote sites where the mooring could not be retrieved.

A.5.2 – Northern Ireland – NI IBTS Q1

Nation:	Northern Ireland	Vessel:	Corystes
Survey:	CO1018 (NI IBTS Q1)	Dates:	5th March – 27th March 2018

Cruise:	Q1NI survey aims: • To obtain information on spatial patterns of abundance of different size-and-age classes of demersal fish in the Irish Sea. • To obtain abundance indices of cod, whiting, haddock and herring for use at ICES Working Groups. • To quantify external parasite loads in whiting and cod by area. • To collect additional biological information on species as required under DCF. • To collect tissue samples for genetics studies on mature cod and hake. • To collect information on the extent of marine littering in the Irish Sea. • Collect 15 fish samples for reverse ring test organized by Thomson Unicomarine Ld, recording species, length and station. • To collect stomachs and fish samples from target species list for analysis of food webs. • To collect reference collection of Irish Sea benthic species (prey fish and invertebrates) for genetic and visual stomach contents analysis.
Gear details:	A commercial Rockhopper trawl fitted with a 20mm liner in the cod-end was towed over three nautical miles or one nautical mile in the Irish Sea and St George's Channel The following parameters were recorded during each haul using SCANMAR: headline height, door spread and distance covered. At some stations wind-spread was also recorded. A bottom contact sensor was attached to the groundgear and downloaded following each haul.
Notes from survey (e.g. problems, additional	**Demersal Survey** 62 valid hauls were completed, 22 stations were towed for one hour and 39 stations were 20 minute tows. Station 258 was trawled for 40 minutes. The width of seabed swept by the trawl doors increased from around 35m in shallow water (30m sounding) to around 45m in deeper water (80m sounding), with variations due to tidal flow. The average headline height

<table>
<tr><td>work etc.):</td><td>was 2.5 – 3.1 m. Trawl parameters were consistent with previous surveys. Cod and whiting taken for biological analysis were screened for external parasites. Trawl data and length frequencies were archived using the newly developed groundfish survey database. A total of 67 species of fish and 68 non-fish species were recorded in the catches.

Misc Sampling:

• Genetic samples

Cod – 112

Hake - 33

• Stomach samples collected

<table>
<tr><th>SPECIES</th><th>NUMBER</th></tr>
<tr><td>Cod (Gadus morhua)</td><td>171</td></tr>
<tr><td>Haddock(Melanogrammus aeglefinus)</td><td>743</td></tr>
<tr><td>Whiting (Merlangius merlangus)</td><td>484</td></tr>
<tr><td>Hake (Merluccius merluccius)</td><td>31</td></tr>
<tr><td>Spotted (Raja montagui)</td><td>63</td></tr>
<tr><td>Thornback (Raja clavata)</td><td>49</td></tr>
<tr><td>Grey Gurnard (Eutrigla gurnardus)</td><td>278</td></tr>
<tr><td>Red Gurnard (Chelidonichthys cuculus)</td><td>263</td></tr>
<tr><td>Tub Gurnard (Chelidonichthys lucerna)</td><td>64</td></tr>
<tr><td>Spurdog (Squalus acanthias)</td><td>2</td></tr>
<tr><td>Lesser Spotted Dogfish (Scyliorhinus canicula)</td><td>232</td></tr>
</table>
Additional water samples retained from CTD stations for analysis from throughout the entire survey area.</td></tr>
<tr><td>No. fish species recorded and notes on any rare species or unusual catches:</td><td>A total of 67 species of fish and 68 non-fish species were recorded in the catches.</td></tr>
</table>

Table A.5.2.1: Number of stations surveyed/gear during CO1018

ICES Divisions	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
VIIa	All	GOV-D	62	62	0	0	100	Additionally 7 cod tagging tows

Table A.5.2.2. Overall catches in kg of major components of combined catch Q1 2018

SPECIES	COMMON NAME	TOTAL WEIGHT (KG)
Gadus morhua	Cod	172.169
Melanogrammus aeglefinus	Haddock	2227.556
Merluccius merluccius	Hake	12.794
Merlangius merlangus	Whiting	2463.949
	Other Gadoids	364.401
Clupea harengus	Herring	3367.604
	Other Pelagic	1057.073
Limanda limanda	Common Dab	298.998
Pleuronectes platessa	Plaice	1265.68
	Other Flatfish	205.7
	Other Teleosts	330.653
	Elasmobranches	3159.517
Nephrop Norvegicus	Nephrop	55.595
	Cephalopods	254.967
	Crustaceans	14.125
	Molluscs	7.798
	Other Invertebrates	14.142

Table A.5.2.3: Numbers of biological observations per species collected during CO1018. These consist of length, weight, sex and age, unless:
† length, weight, sex and externally determined maturity only

SPECIES	AGE AND MATURITY	SPECIES	MATURITY
Cod *(Gadus morhua)*	171	†Blonde (*Raja brachyura*)	24
Haddock*(Melanogrammus aeglefinus)*	955	†Cuckoo (*Raja naevus*)	23
Plaice*(Pleuronectes platessa)*	525	†Spotted *(Raja montagui)*	138
Whiting*(Merlangius merlangus)*	1275	†Thornback *(Raja clavata)*	114
Hake*(Merluccius merluccius)*	34		
Brill*(Scophthalmus rhombus)*	20		
Turbot*(Psetta maxima)*	0		
Conger*(Conger conger)*	11		
Sea Bass*(Dicentrarchus labrax)*	0		
Pollack*(Pollachius pollachius)*	5		
Ling*(Molva molva)*	0		
John Dory*(Zeus faber)*	11		
Spurdog *(Squalus acanthias)*	2		
Red Gurnards*(Chelidonichthys cuculus)*	121		
Lemon Sole (*Microstomus kitt*)	76		
Megrim (*Lepidorhombus whiffiagonis*)	0		

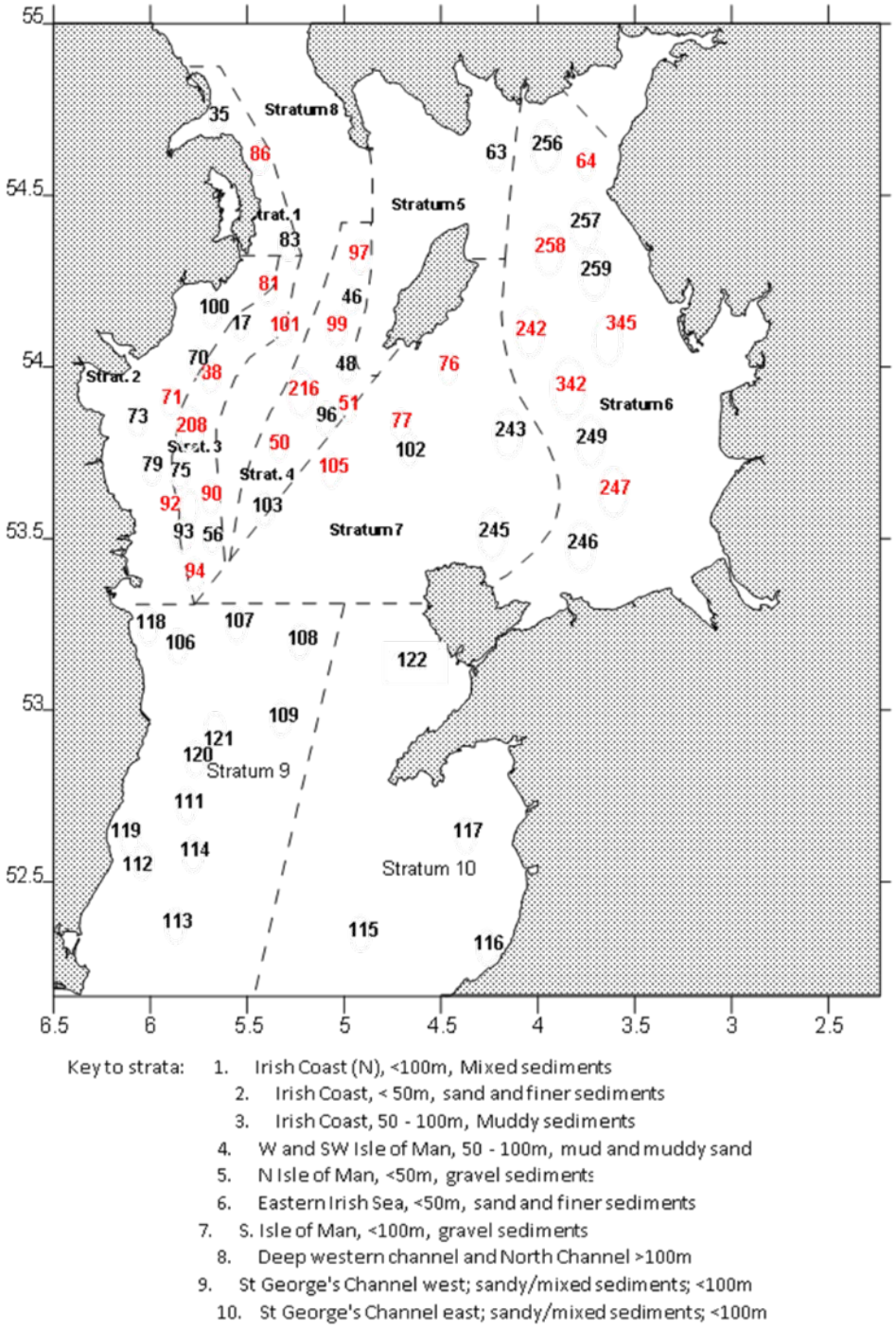


Figure A.5.2.1: CO1019 survey map showing survey strata and approximate midpoints of haul positions of 20 minute tows (red) and 60 minute tows (black) with haul numbers.

A.5.3 - Ireland – IAMS2018

NATION:	IRELAND	VESSEL:	CELTIC EXPLORER
Survey:	IAMS	Dates:	19th Feb– 9th Mar 2018 (VIIb,c,j,k) 10th – 21st April 2018 (VIa)

Cruise	The main objective of the Q1 Irish Anglerfish and Megrim Survey survey is to obtain abundance and biomass indices for anglerfish (*Lophis piscatorius* and *L. budegassa*) megrim (*Lepidorhombus whiffiaginis* and *L. boscii*) in VIa (south of 58°N) and VII (west of 8°W). Secondary objectives are to collect data on the distribution and relative abundance of anglerfish, megrim and other commercially exploited species. The survey also collects maturity and other biological information for commercial fish species. The stock assessment working group WGBIE expectes to use this survey in future assessments of anglerfish and megrim, once the time-series is long enough (the survey series started in 2016)
Gear details:	The trawl is based on a standard commercial otter trawl used in the anglerfish fishery and is described in detail in Reid et al. (IJMS 2007, 64:8 p1503-1511).
Notes from survey (e.g. problems, additional work etc.):	• No technical downtime; 36hrs weather downtime; one haul with extensive damage resulting 24hrs downtime • A 1.2m length of chain was added to the headline bridles. This chain was part of the design of the gear but was omitted from the gear plans and not used before. Four additional tows were completed to examine the effect of adding this chain on the gear geometry. While this was insufficient to clearly identify the effect of the chains, the average door spread was 5m larger than in 2017, a difference that cannot be explained by the chains alone. There were no indications that fitting the chains changed the bottom contact or the amount of digging-in of the ground gear. The index estimation takes the swept area of the ground gear and sweeps into account.
Number of fish species recorded and notes on any rare species or unusual catches:	In 2018, 78 species of fish, 25 elasmobranch, 7 cephalopod and 50 other species/groups were recorded. No unusual species were recorded

Table A.5.3.1 - Stations fished (aim to complete 110 valid tows per year)

ICES Divisions	Strata	Valid Tows	Stratum area (km²)	Swept area (km²)
6a	VIa_Shelf_L	18	37,003	7.93
6a	VIa_Shelf_M	9	4,746	4.79
6a	VIa_Slope_H	11	3,114	6.50
6a	VIa_Slope_M	11	3,044	6.88
7bcjk	VII_Porc_L	3	11,798	1.42
7bcjk	VII_Shelf_H	16	50,764	8.22
7bcjk	VII_Shelf_L	7	22,322	3.22
7bcjk	VII_Shelf_M	6	14,621	2.80
7bcjk	VII_Slope_H	24	35,768	13.52

7bcjk	VII_Slope_L	1	7,914	0.47
7bcjk	VII_Slope_M	10	29,406	6.22
	TOTAL	116	220,500	61.97

Table A.5.3.2 - Biological samples (length, weight, sex, maturity and age material); maturty* (lengh, weight, sex and maturity); length weight only (length and weight).**

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):			
Species	No.	Species	No.
*Dipturus flossada**	52	*Molva molva*	352
*Dipturus intermedia***	182	*Pleuronectes platessa*	431
Gadus morhua	34	*Pollachius pollachius*	36
*Glyptocephalus cynoglossus***	325	*Pollachius virens*	132
*Lepidorhombus boscii***	255	*Raja brachyura**	1
Lepidorhombus whiffiagonis	980	*Raja clavata**	301
*Leucoraja naevus**	457	*Raja montagui**	194
Lophius budegassa	606	*Scophthalmus maximus (psetta maxima)***	9
Lophius piscatorius	1398	*Scophthalmus rhombus**	6
Melanogrammus aeglefinus	678	*Solea solea*	9
Merlangius merlangus	350	*Squalus acanthias**	285
*Merluccius merluccius***	1941	*Zeus faber**	223
*Microstomus kitt***	348		

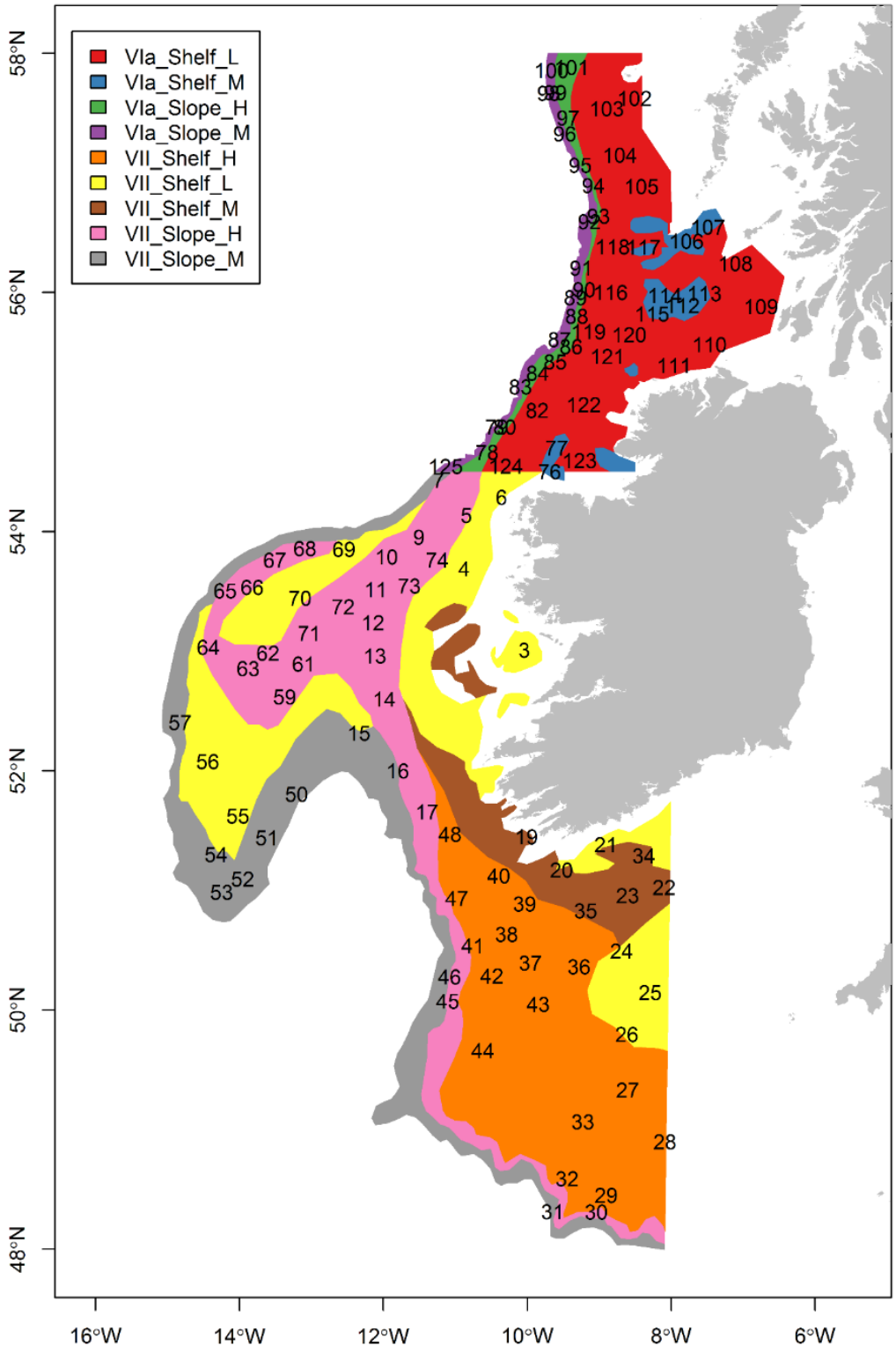


Figure A.5.3.1 - Map of valid survey stations completed by the Irish Anglerfish and Megrim Survey in 2018. The numbers refer to the haul number.

Table A.5.3.3 - Summary statistics by stratum. Stratum area is given in Km², Num hauls is the is the number of valid hauls in each stratum and Swept area is the total area swept between the doors in each stratum (in Km2), catch numbers are given for L piscatorius (MON), L budegassa (WAF) and L whiffiagonis (MEG).

Stratum	Stratum area	Num hauls	Swept area	Catch num MON	Catch num WAF	Catch num MEG
VIa_Shelf_L	37,003	18	7.93	103	29	99
VIa_Shelf_M	4,746	9	4.79	117	62	62
VIa_Slope_H	3,114	11	6.50	356	130	329
VIa_Slope_M	3,044	11	6.88	419	2	307
VII_Shelf_H	11,798	3	1.42	15	1	45
VII_Shelf_L	50,764	16	8.22	59	184	299
VII_Shelf_M	22,322	7	3.22	27	36	50
VII_Slope_H	14,621	6	2.80	30	47	39
VII_Slope_M	35,768	24	13.52	346	196	353
Total	7,914	1	0.47	1	0	0

Table A.5.3.4 -Estimated numbers (millions) and biomass (kT) in the survey area, with CV and confidence intervals (CIlo and CIhi). Only fish >500g live weight (approximately 32 cm) were included in the estimate.

	L piscatorius		*L budegassa*	
	VIa	**VII**	**VIa**	**VII**
NumMln	4.569	9.289	1.137	16.846
NumCV	15.3%	9.2%	24.8%	19.7%
BiomKT	4.887	25.519	0.868	8.198
BiomCV	12.3%	9.2%	23.3%	19.0%

A.5.4 – Spain – SP GCGFS Q1

NATION:	SP (SPAIN)	VESSEL:	MIGUEL OLIVER
Survey:	SP-GCGFS-Q1 (ARSA 0318)	Dates:	19 February - 03 March 2018
Cruise	Spanish Gulf of Cadiz bottom trawl survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in the Gulf of Cadiz area (ICES Division IXa). The primary species are hake, horse mackerel, wedge sole, sea breams, mackerel and Spanish mackerel. Data and abundance indices are also collected and estimated for other demersal fish species and invertebrates as rose and red shrimps, Nephrops and cephalopod molluscs.		
Survey Design	The survey is random stratified with 5 depth strata (15-30 m, 31-100 m, 101-200 m, 201-500 m, 501-800 m). Stations are allocated at random according to the strata surface.		
Gear details:	Baca 44/60 with Thyborøn doors.		
Notes from survey (e.g. problems, additional work etc.):	Additional work undertaken included CTD casts at all trawl stations and special grid with 92 CTD stations.		

Number of fish species recorded and notes on any rare species or unusual catches:	Overall a total of 143 fish species, 53 crustaceans and 53 mollusks were recorded.

Table A.5.4.1 - Stations fished (aim: to complete 45 valid tows per year)

ICES Divisions	Strata	Gear	Tows planned	Valid	Additional	Invalid	% stations fished	comments
9a	All	Baca 44/60	45	41	-	1	91%	
	TOTAL		45	41	-	1	91%	

Table A.5.4.2 - Biological samples (length, weight, sex, maturity and age material.

Species	Age	Species	Age
Merluccius merluccius	237	*Loligo forbesii**	52
*Merluccius merluccius**	654	*Sepia officinalis**	87
*Parapenaeus longirostris**	1933	*Octopus vulgaris**	17
*Nephrops norvegicus**	23		

(*) Maturity only.

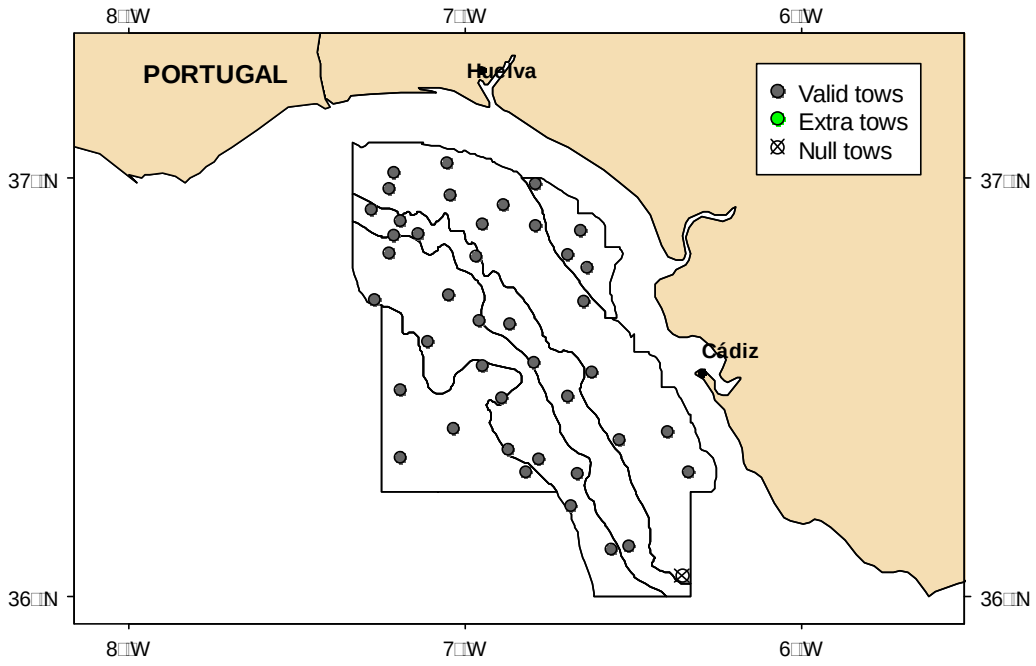


Figure A.5.4.1 -Trawl stations in Q1 Gulf of Cadiz 2018 survey .

Table A.5.4.3 -

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$
			kg/0.5h	%	%	n/0.5h	%	%
Merluccius merluccius	All	41	5.78	70.5	-25.6	151.7	195.9	-15.0
Micromesistius poutassou	All	41	1.39	-83.1	-88.7	16.3	-80.2	-96.6
Nephrops norvegicus	All	41	0.16	-76.5	-47.7	4.5	-79.5	-55.7
Parapenaeus longirostris	All	41	1.22	79.4	38.3	278.9	113.8	43.9
Octopus vulgaris	All	41	0.34	-87.2	-5.2	0.4	-90.4	12.7
Loligo vulgaris	All	41	0.42	-37.3	-18.3	10.6	157.2	39.1
Sepia officinalis	All	41	1.00	51.5	-34.6	2.4	35.6	-41.5

y_i, year estimate (2018); y_{i-1}, previous year estimate (2017); $y_{(i,i-1)}$, Average of last two year estimates (2018 and 2017); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2016, 2015 and 2014).

A.5.5 – Scotland – Rockall Haddock

Nation:	Scotland	Vessel:	Scotia
Survey:	1318S (SCOROC-Q3)	Dates:	19th September – 1st October 2018

Cruise:	Q3 Rockall 2018 survey aims to:

	• Collect data on the distribution, relative abundance and biological information (EU Data Directive 1639/2001) on haddock *Melanogrammus aeglefinus* and a range of other fish species in ICES areas VIb. • Obtain temperature and salinity data from the surface and near seabed at selected trawling stations • Collect additional biological data in connection with the EU data collection framework (DCF). • To undertake sediment sampling on an opportunistic basis when the vessel was not fishing • To record marine litter at each trawl station to comply with our MSFD obligations
Gear details:	GOV incorporating groundgear D was used at all stations. Sweeps were 97m in all cases. The following parameters were recorded during each tow using SCANMAR: headline height, wing spread, door spread and distance covered. A bottom contact sensor was attached to the groundgear and downloaded each tow.
Notes from survey (e.g. problems, additional work etc.):	The 2018 survey design was random-stratified with primary trawl locations randomly distributed within 4 sampling strata defined by depth contour: 0-150m, 150-200m, 200-250m, 250-350m. Trawls were undertaken within a radius of 5 nautical miles to the specified sampling position and as near to the actual point as was practicable. If for any reason the trawl could not be undertaken at the primary site then a replacement was taken from a list of secondary random positions. There were 41 valid trawls completed (Table A.5.1) with all fishing taking place during daylight hours. Figure 2 displays sampling strata, trawl locations and haul numbers. A total of 42 trawl stations were undertaken with the GOV, 41 of which valid (see table 1). Of the valid hauls 39 were the standard duration of 30 minutes and 2 were shorter (24 and 25 minutes) due to the net coming fast on the seabed. In both those instances the net was retrieved successfully and without sustaining any damage. (see figure A.5.2 for trawl positions). There was one invalid deployment at haul 366. This was an extra R4 station which was hauled back after 5 minutes due to a parted port bridle. All 40 programmed primary stations were successfully completed and although there were some minor adjustments required to the positioning of several trawls due to the presence of a Spanish longline vessel this was possible without the need to select a secondary (substitute) station. The numbers of trawls completed by depth stratum are as follows. (R1 – 5, R2 – 21, R3 – 10, R4 – 4). In addition an extra trawl station was successfully completed in the area outside of the standard survey depth boundary and deeper than 350 m (R5). These are periodically undertaken in order to monitor and test the existing maximum depth boundaries of the survey. Station 339 was deployed at a depth of 392 metres and yielded almost 7kgs of haddock for a 30 minute haul. Whilst this does not constitute a large amount, the presence of haddock at this depth is significant and is in all likelihood linked to the overall resurgence of adult haddock that is being observed over the whole of Rockall Bank. Haddock recruits and juveniles were observed in reasonable numbers over the entire upper bank, however the CPUE index is significantly down on both the 2017 and 2016 estimates and less than the series average for the new survey. A similar situation exists with age 1 haddock. Numbers of age 2+ haddock are by contrast the highest yet reported during this survey series and this was reflected in almost all of the survey hauls which recorded significant numbers of adult haddock. (Figure A.5.1 and table A.5.3).

	Ages were recorded for haddock, whiting, cod and saithe along with sex, and weight data. Data on other species sampled for biological information are summarised in Table A.5.5 CTD casts (n=19) were made at selected stations to give a representative coverage of the bank over the depth range surveyed. Sediment grabs were attempted from a total of 81 deployments during periods when the vessel was not fishing. Of these 47 produced viable sediment samples over a depth range of 145-389m (Figure A.5.2). All otoliths were aged back at the institute. All litter picked up in the trawl was classified, quantified and recorded and up-loaded to the national MSS litter database from where it will eventually be up-loaded to DATRAS. The litter was retained onboard for appropriate disposal ashore.
No. fish species recorded and notes on any rare species or unusual catches:	Overall a total of 47 species were caught during the survey for a total catch weight of ~27.9 tonnes. There were large catches overall of haddock (~11.4 tonnes), grey gurnard (~3.7 tonnes) and blue whiting (*Micromesistius poutassou*, ~3.6 tonnes). Fin Whales were sighted over several days feeding on top of the bank. During 1318S very few cod (*Gadus morhua*, ~32kg, 5 fish) and saithe (*Pollachius virens*, ~92kg, 7 fish) were caught. 5.1kg of whiting (*Merlangius merlangius* were observed during the survey which equated to 10 fish, and only 2 of which were 0 – groups and this reflects a significant reduction on recent years. CPUE of other major commercial species are summarised in Table 4.

Table A.5.5.1: Number of stations surveyed/gear 1318S

ICES Division	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
VIb	GOV-D	40	41	2	1	102	Invalid station was additional

Table A.5.5.2. CPUE data (all strata combined) for major species caught during 1318S.

Species	mean kg/hr	mean no/hr
Melanogrammus aeglefinus	562	2696
Micromesistius poutassou	177	3469
Eutrigla gurnardus	181	684
Sebastes viviparus	137	2585
Argentina sphyraena	24	383
Trisopterus minutus	36	475
Gadiculus argenteus thori	35	1400
Helicolenus dactylopterus	18	301
Molva molva	11	3
Lophius piscatorius	22	6
Dipturus flossada	22	4

Lepidorhombus whiffiagonis	0.9	5
Microstomus kitt	5	45

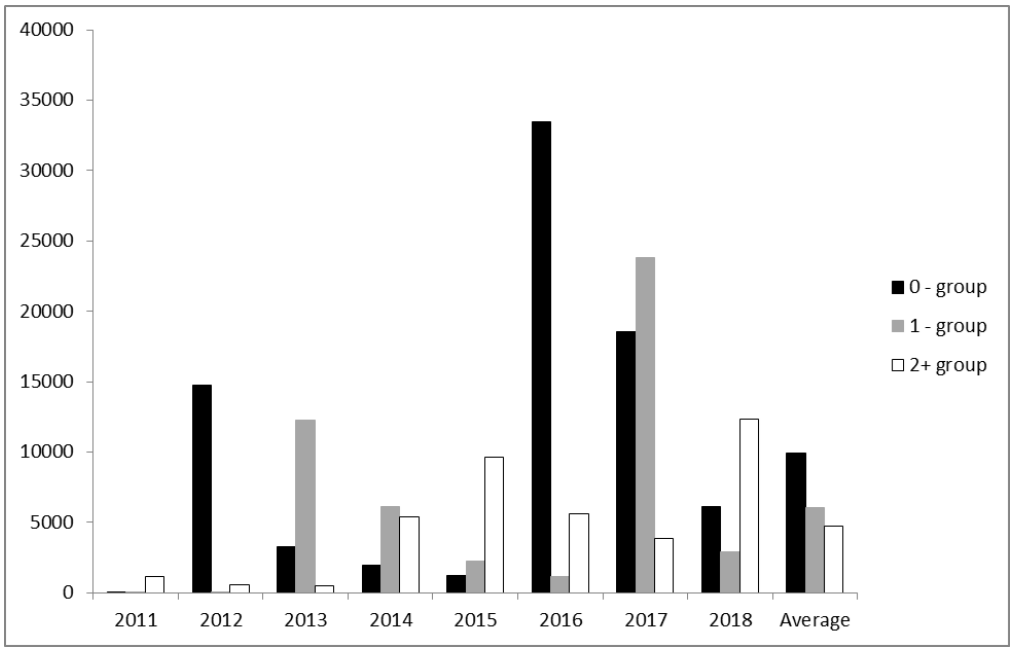


Figure A.5.5.1: Indices of 0 and 1-group haddock at Rockall in 2018 shown relative to the previous years and the average since 2011 (beginning of new survey design).

Table A.5.5.3: Rounded CPUE indices (no. per 10 hrs fishing) by age for Rockall haddock 2011-2018 (actual values).

Age	2011	2012	2013	2014	2015	2016	2017	2018
0	5.3	14779	3248	1926	1212	33441	18583	6119
1	16.3	2.2	12259	6146	2238	1154	23853	2879
2	138	8.5	7.9	5275	5390	1403	615	10396
3	17.9	55.8	22.1	3.8	4195	2444	967	249
4	68.0	9.6	36.6	0	0	1703	1596	532
5	101	59.3	22.6	8.8	0	13.6	692	857
6	816	32.0	28.0	0	8.6	0.8	0.7	325
7	2.6	413	71.7	6.6	0.5	3.5	0.2	0
8	2.7	5.3	273	6.4	6.4	0.8	0.9	0
9	2.7	0.4	0.5	94.3	1.6	1.9	0.0	1
10	0	0	0	0.5	42.2	2.8	1.3	0
11	0	5.8	1.1	0.6	0.5	16.1	2.1	0
12	0	0	1.0	0	0	0.5	4.8	0.3
13	0	0	0	1.0	0	0.0	1.4	1.2
14	0	0	0	0	0	0	0	1.7

Table A.5.5.4: Rounded CPUE indices (no. per 10 hrs fishing) by age for other species of major commercial interest - 1318S.

Age	Whiting No/10 hr	Cod No/10 hr	Saithe No/10 hr
0	0.5	0	0
1	0.8	0	0
2	0.9	0.3	0
3	0	0.6	0
4	0	0.3	0
5	0.3	0.3	0.6
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0.3
13	0	0	1.5
14	0	0	0.3
15	0	0	0

Table A.5.5.5: Numbers of biological observations per species collected during 1318S. Data is weight/length/sex/maturity/age except * where age data was not collected.

Species	Biodata	Species	Biodata
Gadus morhua	5	*Dipturus flossada*	85*
Melanogrammus aeglefinus	1703	*Dipturus oxyrinchus*	3*
Merlangius merlangius	10	*Leucoraja fullonica*	8*
Pollachius virens	7	*Raja clavata*	16*
Scomber scombrus	61	*Squalus acanthias*	1*

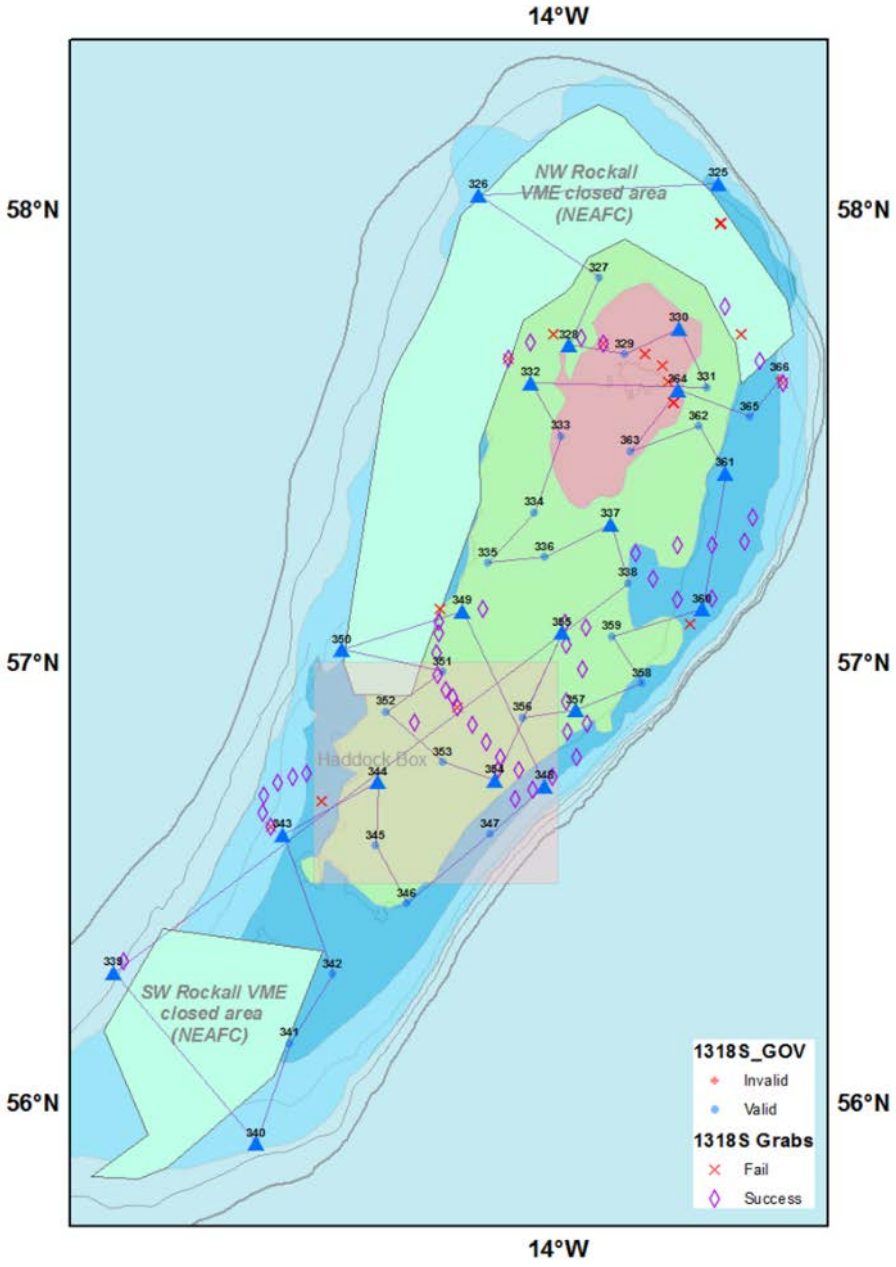


Figure A.5.5.2. Survey strata, cruise track, NEAFC closed areas, trawl positions with haul numbers of stations and grab positions undertaken at Rockall during 1318S. Blue triangles denote trawl samples where an associated CTD deployment was completed. Survey strata: Red area = 0-150 m, green = 150-200 m, blue = 200-250 m, light blue = 250-350 m and lighter blue = >350 m (outside survey area)

A.5.6 – Spain – SP-PORC-Q3

NATION:	SP (SPAIN)	VESSEL:	VIZCONDE DE EZA
Survey:	SP-PORC-Q3 (Porcupine 18)	Dates:	09 September - 08 October 2018
Cruise	Spanish Porcupine bottom trawl survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in Porcupine bank area (ICES Division VIIb-k). The primary target species are hake, monkfish, white anglerfish and megrim, which abundance indices are estimated by age, with abundance indices also estimated for Nephrops, four-spot megrim and blue whiting. Data collection is also carried out for several other demersal fish species and invertebrates.		
Survey Design	The survey is random stratified with two geographical strata (northern and southern) and 3 depth strata (170-300 m, 301-450 m, 451-800 m). Stations are allocated at random according to the strata surface.		
Gear details:	Porcupine Baca 39/52 with Polyvalent doors.		
Notes from survey (e.g. problems, additional work etc.):	Weather conditions were poor and bad during most of 2018 survey, especially the first leg. This year it has been maintained the reduction in tow duration implemented two years ago from 30 minutes after gear ground contact to 20 minutes. Additional work undertaken included 83 CTD casts at most trawl stations and 7 in four radials perpendicular to the bank limits to obtain a general image of the hydrography.		
Number of fish species recorded and notes on any rare species or unusual catches:	Overall a total of 100 fish species, 40 crustaceans, 27 mollusks, 30 echinoderms and 28 species of other invertebrates were identified.		

Table A.5.6.1 - Stations fished (aim: to complete 80 valid tows per year)

ICES DIVISIONS	STRATA	GEAR	TOWS PLANNED	VALID	ADDITIONAL	INVALID	% STATIONS FISHED	COMMENTS
7b-k	All	Porcupine baca	80	80	3	5	104%	
	TOTAL		80	80	3	5	104%	

Table A.5.6.1: Biological samples collected during Spanish Porcupine Bank 2018 survey. Data collected: length, weight, sex and maturity.

SPECIES	AGE	SPECIES	AGE
Merluccius merluccius	936	*Molva molva*	10
Lepidorhombus whiffiagonis	724	*Conger conger*	19
Lepidorhombus boscii	307	*Helicolenus dactylopterus*	175
Lophius budegassa	46	*Phycis blennoides*	226
Lophius piscatorius	162	*Nephrops norvegicus**	912

(*) Maturity only.

Nation:	**UK (Scotland)**	Vessel:	Scotia
Survey:	1718SSCOWCGFS-Q4	Dates:	12 November – 4 December 2018

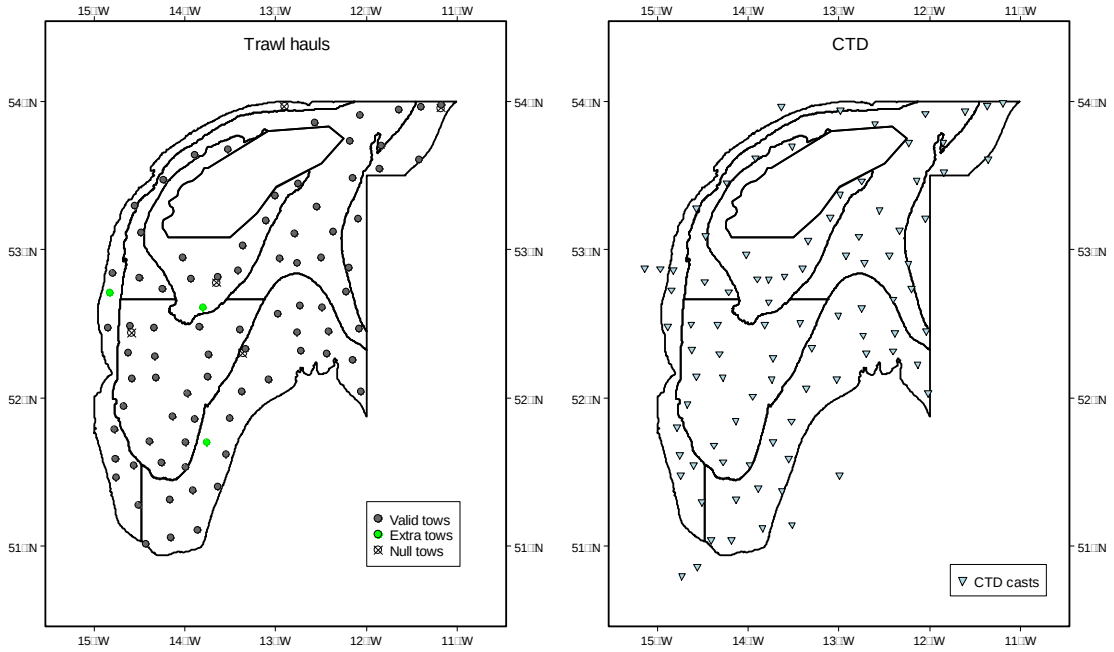


Figure A.5.6.1 - a) Trawl stations in Spanish Porcupine 2018 survey and b) CTD .

Table A.5.6.2: Abundances in biomass and number of main species during 2018 Spanish Porcupine Bank 2018 survey, compared with the four previous years.

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$
			kg/0.5h	%	%	n/0.5h	%	%
Merluccius merluccius	All	80	29.19	-39.8	-45.2	59.2	-35.9	-1.0
Lepidorhombus whiffiagonis	All	80	11.15	-21.0	-13.1	197.0	3.3	7.9
Lepidorhombus boscii	All	80	11.09	-2.5	-16.5	117.0	6.0	-22.1
Lophius budegassa	All	80	0.80	-21.6	-42.9	0.8	29.0	-31.3
Lophius piscatorius	All	80	14.36	-29.6	-13.6	4.2	-30.3	-7.7
Micromesistius poutassou	All	80	463.51	-30.0	25.3	4686.1	-28.4	6.0
Nephrops norvegicus	All	80	2.99	106.2	192.1	107.8	80.4	171.9

y_i, year estimate (2018); y_{i-1}, previous year estimate (2017); $y_{(i,i-1)}$, Average of last two year estimates (2018 and 2017); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2016, 2015 and 2014).

A.5.7 – Scotland .SCOWCGFS – Q4

Cruise	Q4 Scottish Western Coast VIa random stratified survey aims to collect data on the distribution, relative abundance and biological information (in connection with EU Data Directive 1639/2001) on a range of fish species in ICES areas VIa and VIIb. Age data were collected for cod, haddock, whit-

	ing, saithe, Norway pout, herring, mackerel and sprat. A CTD was deployed at each trawl station (except 4) to collect temperature and salinity profiles.
Gear details:	The GOV incorporating the standard "Exorcet" kite was used throughout the cruise with groundgear "D" (Rockhoppers). Sweeps were 110m except where the water depth was <=80m where 60m sweeps were deployed, standardising with the Irish VIa survey. Headline height, wingend and door spread were monitored by Scanmar acoustic instrumentation and distance covered/speed using the vessels GPS navigation system. The density of fish entering the mouth of the trawl was monitored by a Scanmar acoustic trawl eye system and a self-recording bottom contact sensor was attached to ground gear centre and monitored contact with the seabed.
Notes from survey (e.g. problems, additional work etc.):	The 2018 survey design was the same as the methodology used since 2011 using a random-stratified design with primary trawl stations randomly distributed within 12 sampling strata. Hauls were undertaken on suitable ground as near to the specified sampling position as was practicable and within a radius of 5 nautical miles of the sample position. If for any reason the haul could not be undertaken at the primary site due to poor ground, static gear or prevailing weather conditions restricting towing direction then the nearest replacement was chosen from a list of secondary random positions. For all hauls except 460 fishing was carried out during daylight commencing each day at first light. During the cruise three hauls were classified as foul in ICES area VIa 444 due to a broken port bridle and torn wing, 451 due to a torn wing and belly and 453 due to the headline height being bellow the recommended value. During the second half of the cruise weather conditions were poor with gales throughout. Furthermore, significant shoals of pelagic fish (horse mackerel and mackerel) were encountered which limited a number of hauls to less than 30 minutes. A total of 56 valid hauls were completed during the cruise, 4 less than the number allocated for this survey, with the daily cruise track given in Figure A.5.7.1. The 110m sweep rig was used for 48 hauls and the 60m rig for 11 hauls. All demersal and pelagic otoliths were processed at sea and were subsequently aged back at the institute. All haul summary data and length frequencies were entered at sea via the Electronic Data Collection system. A CTD was deployed at 52 stations to obtain a vertical temperature and salinity profile. However, 4 deployments were abandoned due to the time or weather conditions.

Table A.5.7.1: Number of stations fished

			Stations	Valid Stations	Additiona	Invalid	% Stations
ICES Divisions	Strata	Gear	Planned	Achieved	Stations	Stations	Achieved
VIa	11	GOV-D	56	54	0	3	96
VIIb	1	GOV-D	4	2	0	0	50

Table A.5.7.2: CPUE indices (no./1hrs) by year class for major species Q4 WC survey in 2018.

Age	No/1 hour				
	Cod	Haddock	Whiting	Saithe	N. Pout
0	0	379.8651	644.1788	0	8516.502
1	0.4569	98.9114	50.2522	0.0363	96.7608
2	1.5945	160.9863	55.1576	0.8212	57.527
3	0.4809	65.9698	28.4411	0.2648	0.348
4	3.9902	241.248	22.0063	0.1966	0
5	2.9022	5.1353	3.2889	0.0696	0
6	1.0887	2.0035	0.0972	0.0921	0
7	0.0829	0.207	0.4875	0	0
8	0	0.0383	0	0	0
9	0	2.543	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0

Table A.5.7.3: CPUE indices (numbers/1hrs fishing) of 1-groups for Q4 since 2012

Species	2012	2013*	2014	2015	2016	2017	2018
Cod	1.98	1.4	2.37	2.82	0.62	1	0.4569
Haddock	11.48	6.96	67.87	995.59	93.55	168.82	98.9114
Whiting	96.4	12.5	151.78	279.36	241.54	294.29	50.2522
Saithe	0.1	0	0.04	0.5	0.06	0	0.0363
Norway Pout	721.39	134.39	266.97	1481.43	1227.48	48.7	96.7608

*** Note – Q4 survey 2013 was not completed only, half of the sampling area covered**

Table A.5.7.4: Q4 SCOWCGFS biological sampling 2018. Data is weight/length/sex/maturity/age except * where age data was not collected, ** where no maturity data collected or ***length/whole weight data.

Species	Nos	Species	Nos
Gadus morhua	239**	*Scophthalmus rhombus*	10*
Merlangius merlangus	768**	*Galeorhinus galeus*	2*
Melanogrammus aeglefinus	1217**	*Psetta maximus*	1*
Merluccius merluccius	289**	*Glyptocephalus cynoglossus*	22*
Trisopterus esmarkii	236**	*Raja brachyura*	10*
Pollachius virens	33**	*Leucoraja naevus*	239*
Molva molva	41**	*Dipturus intermedia*	39*

Zeus faber	48**	*Dipturus flossada*	7*
Scomber scombrus	156	*Raja clavata*	96*
Clupea harengus	347	*Raja montagui*	226*
Pleuronectes platessa	166	*Mustelus asterias*	7*
Sprattus sprattus	219**	*Lophius Piscatorius*	43*
Liparis liparis	1***		

Table A.5.7.5:Q4 CPUE data for major species: 2018

Species	Strata	Mean nos/hr	Mean kgs/hr
Norway Pout (*Trisopterus esmarkii*)	ALL	6918.9	68.8
Mackerel (*Scomber scombrus*)	ALL	4661.7	204.3
Horse Mackerel (Scad) (*Trachurus trachurus*)	ALL	1388.9	210.9
Whiting (*Merlangius merlangus*)	ALL	1032.3	69
Haddock (*Melanogrammus aeglefinus*)	ALL	983.6	240.9
Lesser Argentine (*Argentina sphyraena*)	ALL	756.4	45.3
Herring (*Clupea harengus*)	ALL	728.1	20.4
Blue Whiting (*Micromesistius poutassou*)	ALL	474.5	23.4
Poor Cod (*Trisopterus minutus*)	ALL	441.5	5.4
Grey Gurnard (*Eutrigla gurnardus*)	ALL	399.6	48.2
Boar Fish (*Capros aper*)	ALL	263.6	9.5
Long Finned Squid (*Loligo forbesii*)	ALL	242.2	40.7
Silvery Pout (*Gadiculus argenteus*)	ALL	211.7	0.9
Sprat (*Sprattus sprattus*)	ALL	135.4	1
Lesser Spotted Dogfish (*Scyliorhinus canicula*)	ALL	135.1	78.6
Blue-mouth (*Helicolenus dactylopterus*)	ALL	64.6	4.8
Hake (*Merluccius merluccius*)	ALL	62	7.7
Norway Lobster (*Nephrops norvegicus*)	ALL	51	1.9
Plaice (*Pleuronectes platessa*)	ALL	34.2	6.9
Long Rough Dab (*Hippoglossoides platessoides*)	ALL	30.8	1
Common Dab *Limanda limanda*)	ALL	27.6	2.2
European flying squid (*Todarodes sagittatus*)	ALL	27.3	4.4
Alloteuthis (*Alloteuthis subulata*)	ALL	25.1	0.1
Red Gurnard (*Chelidonichthys cuculus*)	ALL	23	7.4
Spurdog (*Squalus acanthias*)	ALL	20.9	30.9
Bobtail Squids Unidentified (*Sepiolidae* sp)	ALL	19.4	0
Lesser flying squid (*Todaropsis eblanae*)	ALL	17	0.9
Megrim (*Lepidorhombus whiffiagonis*)	ALL	14.3	3.4
Spotted Dragonet (*Callionymus maculatus*)	ALL	12.5	0.1
Lemon Sole (*Microstomus kitt*)	ALL	11.6	1.8
Cod (*Gadus m*orhua)	ALL	11.5	51.3
Pandalus (unidentified) (*Pandalus* sp)	ALL	10.2	0
Spotted Ray (*Raja montagui*)	ALL	9.4	8.8
Glass Shrimps (*Pasiphaeidae*)	ALL	5.5	0
Dragonet (*Callionymus lyra*)	ALL	4.7	0.2
Thornback Ray (*Raja clavata*)	ALL	4	6.5

Thickback Sole (*Microchirus (Microchirus) variegatus*)	ALL	2.8	0.1
Gobies (unidentified) (Gobiidei (Gobies))	ALL	2.3	0
Angler (Monk fish) (*Lophius piscatorius*)	ALL	2.2	4.3
Brown shrimps (Crangonidaie)	ALL	2.2	0
John Dory (*Zeus faber*)	ALL	2.2	1.8
Flapper Skate (*Dipturus intermedia*)	ALL	1.9	6.1
Ling (*Molva molva*)	ALL	1.8	3.2
Pearlsides (*Maurolicus muelleri*)	ALL	1.6	0
Stout Bobtail Squid (*Rossia macrosoma*)	ALL	1.3	0
Saithe (*Pollachius virens*)	ALL	1.3	1.6
Cuckoo Ray (*Leucoraja naevus*)	ALL	1.1	1.1
Scaldfish (*Arnoglossuslaterna*)	ALL	1.1	0
Witch (*Glyptocephalus cynoglossus*)	ALL	1	0.1

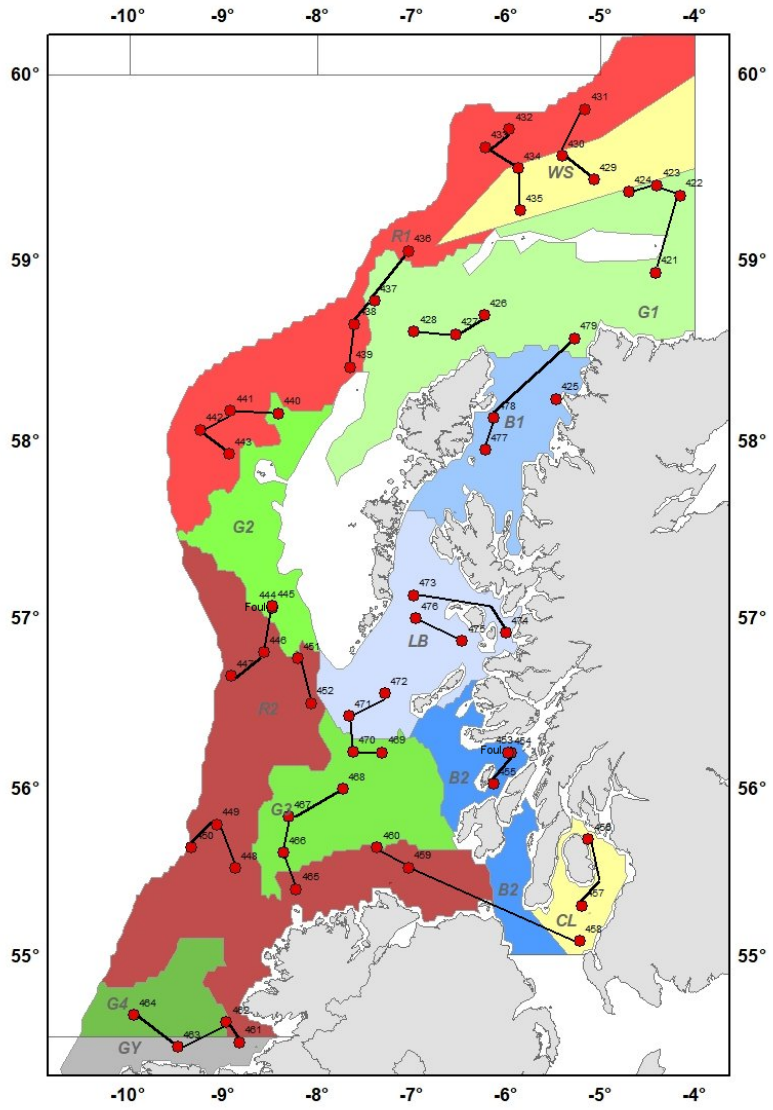


Figure A.5.7.1 – Trawl stations completed during the Q4 WC with daily cruise track – IBTS 2018 (1718S) the 3 invalid hauls are marked Fouled. (Note - The colour shading indicates the 12 different sampling strata covered by this survey)

A.5.8 – Northern Ireland – NI IBTS Q4

Nation:	Northern Ireland	Vessel:	Corystes
Survey:	CO4218 (NI IBTS Q4)	Dates:	1st October –17th October 2018

Cruise:	Q4 NI survey aims: • To obtain information on spatial patterns of abundance of different size-and-age classes of demersal fish in the Irish Sea. • To obtain abundance indices of cod, whiting, haddock and herring for use at ICES Working Groups. • To quantify external parasite loads in whiting and cod by area.

<table>
<tr><td></td><td>

To collect additional biological information on species as required under DCF.
To collect information on the extent of marine littering in the Irish Sea.
To collect fish stomachs and fish samples from target species list for analysis of food webs.

</td></tr>
<tr><td>Gear details:</td><td>A commercial Rockhopper trawl fitted with a 20mm liner in the cod-end was towed over one nautical mile in the Irish Sea and St George’s Channel

The following parameters were recorded during each haul using SCANMAR: headline height, door spread and distance covered. At some stations wind-spread was also recorded. A bottom contact sensor was attached to the groundgear and downloaded following each haul.</td></tr>
<tr><td>Notes from survey (e.g. problems, additional work etc.):</td><td>Demersal Survey
66 tows were completed of which 3 were invalid, 2 stations were repeated and one exploratory tow. Two stations were not trawled due to static gear on the tow line and two tows were trawled for a valid 15 minutes instead of 20 minutes. The width of seabed swept by the trawl doors increased from around 35m in shallow water (30m sounding) to around 45m in deeper water (80m sounding), with variations due to tidal flow. The average headline height was 2.8 – 3.2 m. The trawl parameters were consistent with previous surveys. Cod and whiting taken for biological analysis were screened for external parasites. Trawl data and length frequencies were archived using the ground-fish survey database.

Misc Sampling:
Stomach samples collected
<table>
<tr><th>SPECIES</th><th>NUMBER</th></tr>
<tr><td>Cod (Gadus morhua)</td><td>79</td></tr>
<tr><td>Haddock (Melanogrammus aeglefinus)</td><td>396</td></tr>
<tr><td>Whiting (Merlangius merlangus)</td><td>664</td></tr>
<tr><td>Hake (Merluccius merluccius)</td><td>16</td></tr>
<tr><td>Spotted (Raja montagui)</td><td>116</td></tr>
<tr><td>Thornback (Raja clavata)</td><td>122</td></tr>
<tr><td>Grey Gurnard (Eutrigla gurnardus)</td><td>246</td></tr>
<tr><td>Lesser Spotted Dogfish (Scyliorhinus canicula)</td><td>420</td></tr>
<tr><td>Spurdog (Squalus acanthias)</td><td>127</td></tr>
<tr><td>Tub Gurnard (Chelidonichthys lucerna)</td><td>77</td></tr>
</table>
</td></tr>
</table>

	Poor Cod *(Trisopterus minutes)* — 94 Red Gurnard *(Chelidonichthys cuculus)* — 42 Lesser Spotted Dogfish *(Scyliorhinus canicula)* — 232 Additional water samples retained from CTD stations for analysis from through-out the entire survey area.
No. fish species recorded and notes on any rare species or unusual catches:	A total of 67 species of fish and 68 non-fish species were recorded in the catches. Some stations had very high aggregations of herring and trawling had to be stopped. A number of large tope were caught on the survey, and one considerably large conger eel. Three mackerel (at 2 stations) of an as yet unidentified species, possibly Spanish mackerel.

Table A.5.8.1: Number of stations surveyed/gear during CO1018

ICES Divisions	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
								2 stations were repeated later on
VIIa	All	GOV-D	62	60	1	3	99	2 stations omitted due to static gear

Table A.5.8.2. Overall catches in kg of major components of combined catch Q4 2018

SPECIES	COMMON NAME	TOTAL WEIGHT (KG)	KG/HR
Gadus morhua	Cod	28.31	1.29
Melanogrammus aeglefinus	Haddock	1597.93	72.63
Merluccius merluccius	Hake	10.31	0.5
Merlangius merlangus	Whiting	3929.69	180.90
	Other Gadoids	556.65	25.30
Clupea harengus	Herring	2846.70	129.39
	Other Pelagic	802.05	36.46
Limanda limanda	Common Dab	168.63	7.66
Pleuronectes platessa	Plaice	676.11	30.73
	Other Flatfish	80.50	3.66

	Other Teleosts	425.58	19.34
	Elasmobranches	3181.13	144.60
Nephrop Norvegicus	Nephrop	123.36	5.61
	Cephalopods	466.4	21.2
	Crustaceans	29.88	1.36
	Molluscs	89.10	4.05
	Other Invertebrates	282.68	12.85

Table A.5.8.3: Numbers of biological observations per species collected during CO4218. These consist of length, weight, sex and age, unless:
*** length, weight, sex and externally determined maturity only**

SPECIES	AGE AND MATURITY	SPECIES	AGE AND MATURITY
Chelidonichthys cuculus	42	Pollachius pollachius	2
Conger conger	0	Psetta maxima	2
Dicentrarchus labrax	0	Raja brachyura*	0
Gadus morhua	79	Raja clavata*	75
Melanogrammus aeglefinus	760	Raja montagui*	75
Merlangius merlangus	1315	Raja naevus*	0
Merluccius merluccius	16	Scophthalmus rhombus	8
Microstomus kitt	10	Squalus acanthias	25
Molva molva	0	Zeus faber	16
Pleuronectes platessa	205	Lepidorhombus whiffiagonis	0

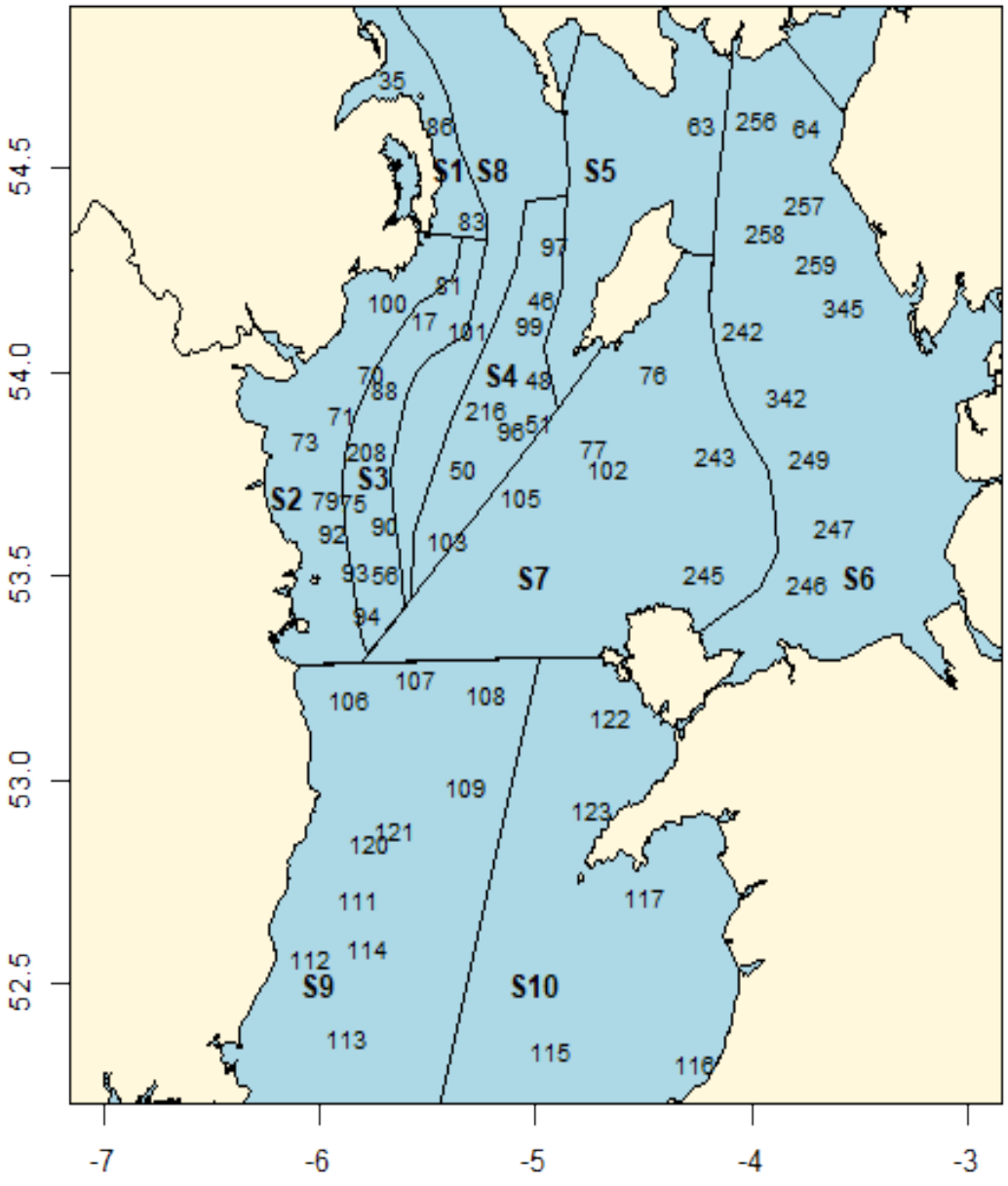


Figure A.5.8.1: CO4118 survey map showing survey strata and approximate midpoints of haul positions.

A.5.9 - Ireland – IGFS2018

NATION:	IRELAND	VESSEL:	CELTIC EXPLORER
Survey:	IE-IGFS	Dates:	30th Oct – 7th Nov (VIa) 9th Nov – 13th Dec (VIIb,g,j)

Cruise	The Q4 Irish Groundfish Survey (IGFS) collects data on the distribution, relative abundance and biological parameters of commercial commercially exploited demersal species in VIa south, VIIb & VIIg,j north. The indicess currently utilised by assessment WG's are for haddock, whiting, plaice, cod, hake and sole. Survey data is also provided for white & black anglerfish, megrim, pollack, ling, blue whiting and a number of elasmobranchs as well as several pelagics (herring, horse mackerel and mackerel).
Gear details:	Two gear survey since 2004, using GOV ground gear "A" for areas VIIb,g & j; and a hopper gear "D"for area VIa.
Notes from survey (e.g. problems, additional work etc.):	Three full days lost to bad weather during 2018 with a few hours and slow operations at other times. Overall the weather overall was poor for operations, particularly towards the end and did limit complete coverage of the commercial fishing area in the Celtic Sea (The Smalls). With stratification and the overall survey coverage it is not expected to be a major concern.
Number of fish species recorded and notes on any rare species or unusual catches:	In 2018, 91 species of fish, 18 elasmobranch, 11 cephalopod and 53 crustacean and 120 other species/groups were caught. Overall virtually all species saw a decrease in catch rate over the previous year (see table below). The most significant increase in VIa was another strong increase in horse mackerel (*Trachurus trachurus*) in terms of both biomass (96%) and numbers (57%). Other than a small increase in megrim biomass only, the other main commercial species appear o be down. For the Celtic Sea and West of Ireland (VIIb,g,j) horse mackerel showed a slight increase with more significant increases for megrim, hake and herring. The value for herring however is from a very low value in 2017 and only for numbers, not biomass, indicating a likely increase in juveniles rather than adults in the fishery. These indices are quite coarse, but overall perception during the survey in 2018 was for very poor fishing with the notable exception of horse mackerel showing a second year of increase. There was some good catches of juvenile whiting, but not much strength in the haddock catches. The patches don't seem to convert to an overall increase so likely to be a function of distribution rather than abundance. Hake also showed some reasonable hauls, but does not appear to result in an overall increase in trend.

Table A.5.9.1: Stations fished (aim to complete 170 valid tows per year)

ICES Divisions	Strata	Gear	Tows planned	Valid	Additional	Invalid	% stations fished
VIa	All	D	45	37	0	2	86
VIIb,c	All	A	38	46	4*	1	134
VIIg	All	A	48	37	0	1	79
VIIj	All	A	40	33	0	1	85
	TOTAL		171	153	4	5	96

**Additional tows in VIIb,c were standard IBTS tows done as part of gear trials for new survey trawl.*

Table A.5.9.2: Biological samples (length, weight, sex, maturity and age material); maturty* (lengh, weight, sex and maturity); length weight only (length and weight).**

	Number of biological samples (maturity and age material, *maturity		
Species	No.	Species	No.
Chelidonichthys(aspitrigla)	191	*Microstomus kitt*	663
Clupea harengus	250	*Molva molva*	87
*Conger conger***	116	*Pleuronectes platessa*	978
Dicentrarchus labrax	9	*Pollachius pollachius***	14
*Dipturus flossada**	27	*Pollachius virens*	75
*Dipturus intermedia***	63	*Raja brachyura**	29
Gadus morhua	73	*Raja clavata**	467
*Glyptocephalus cynoglossus***	416	*Raja montagui**	1104
Lepidorhombus whiffiagonis	1443	*Scomber scombrus*	433
*Leucoraja naevus**	176	*Scophthalmus maximus (psetta maxima)***	51
Lophius budegassa	373	*Scophthalmus rhombus***	70
Lophius piscatorius	527	*Solea solea*	247
Melanogrammus aeglefinus	1808	*Squalus acanthias**	755
Merlangius merlangus	1213	*Trachurus trachurus*	1221
Merluccius merluccius	613	*Zeus faber***	177
Micromesistius poutassou	589		

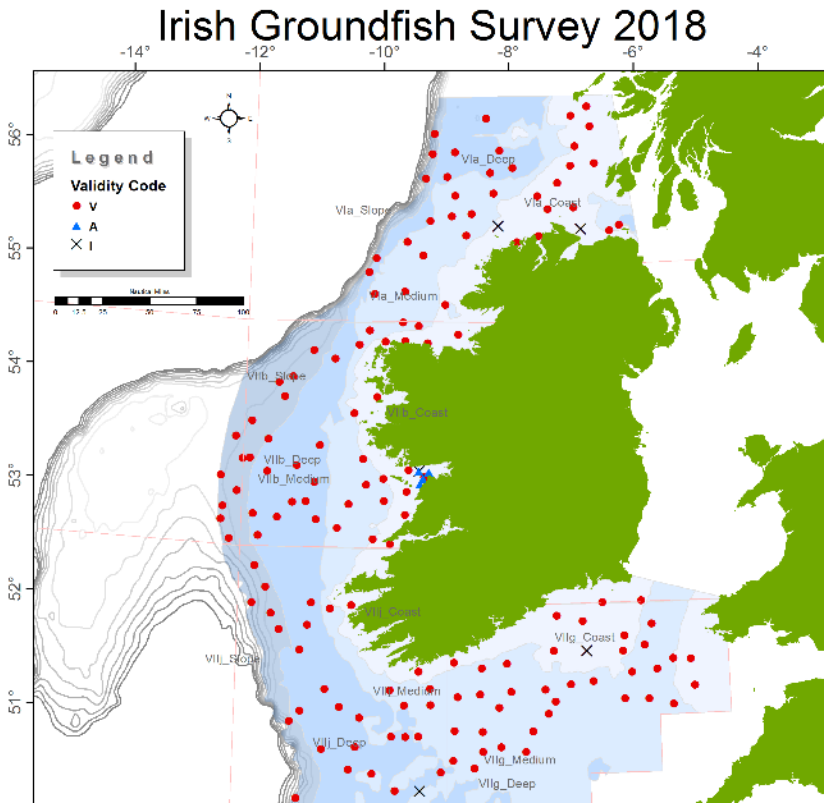


Figure A.5.9.1: Map of Survey Stations completed by the Irish Groundfish Survey in 2018. Valid = red circles; Invalid = black crosses; Additional = blue triangles.

Table A.5.9.3: Abundances in biomass and number of main species during 2018 Irish Groundfish Survey compared with the four previous years.

Biomass and number estimates								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$
			kg/Hr	%	%	No/Hr	%	%
Gadus morhua	VIa	37	2.2	-35.0	-45.9	1.8	9.6	-61.2
Melanogrammus aeglefinus	VIa	37	194.0	-37.3	-38.5	834.9	-24.3	-58.0
Clupea harengus	VIa	37	13.3	-70.4	-85.4	266.7	-47.4	-70.8
Merluccius merluccius	VIa	37	6.5	-20.7	-45.5	22.0	-44.6	-13.2
Trachurus trachurus	VIa	37	584.3	71.1	95.8	3840.1	7.7	57.7
Scomber scombrus	VIa	37	121.7	-18.7	-23.8	2832.7	82.9	-1.6
Lepidorhombus whiffiagonis	VIa	37	1.7	23.0	-19.2	10.9	73.2	28.8
Lophius piscatorius	VIa	37	1.5	-61.9	-24.0	1.3	-43.8	-47.9
Pleuronectes platessa	VIa	37	11.6	-16.1	-5.4	67.9	-25.1	-2.3
Solea solea	VIa	37	0.4	68.7	-39.8	1.6	66.3	-19.4
Micromesistius poutassou	VIa	37	19.2	-71.6	-86.8	347.7	-58.0	-92.8
Merlangius merlangus	VIa	37	177.5	71.4	-48.8	1425.8	164.0	-55.5
Gadus morhua	VIIbgj	116	2.0	-56.0	-48.6	0.6	-48.4	-67.4
Melanogrammus aeglefinus	VIIbgj	116	99.4	40.2	-40.2	1703.8	376.9	20.9
Clupea harengus	VIIbgj	116	14.1	1425.1	-33.8	1005.9	2698.5	244.4
Merluccius merluccius	VIIbgj	116	30.7	-0.8	44.6	131.9	-59.8	26.8
Trachurus trachurus	VIIbgj	116	137.7	-30.4	18.8	2406.7	-48.0	-6.1
Scomber scombrus	VIIbgj	116	115.2	670.2	18.1	2055.2	573.1	12.5
Lepidorhombus whiffiagonis	VIIbgj	116	4.6	40.9	-0.3	49.9	89.4	53.6
Lophius piscatorius	VIIbgj	116	7.3	-7.9	1.2	10.4	48.4	7.4
Pleuronectes platessa	VIIbgj	116	9.0	30.3	-36.4	58.9	48.7	-26.3
Solea solea	VIIbgj	116	0.7	5.3	3.8	3.8	37.0	36.9
Micromesistius poutassou	VIIbgj	116	20.5	3.5	-71.1	381.1	51.5	-83.4
Merlangius merlangus	VIIbgj	116	26.8	-46.0	-67.0	532.4	-19.7	-32.3

Year estimate 2018 (y_i); previous year estimate 2017 (y_{i-1}); average of last two years estimate ($y_{(i,i-1)}$); average of the previous three year estimates 2014-16 ($y_{(i-2,i-3,i-4)}$). As results for survey trends are ratios they are quite sensitive to stocks with high variance, therefore comparing the 2 yr vs. 5 yr trend is advisable.

A.5.10 – France – CGFS 2018

Nation:	France	Vessel:	Thalassa 2
Survey:	CGFS 2018	Dates:	11 September - 12 October 2018

Cruise	Carried out now on the R/V Thalassa, the CGFS (Channel Ground-Fish Survey) is part of the European program monitoring fish resources, which gather data relative to the exploited stocks (abundance, spatial distribution, maturity, age/size structure, recruitment index). Each year in autumn, about 74 stations are sampled with a standard high vertical opening bottom trawl (GOV 36/47) in the eastern English Channel, and the haul is processed to produce the required data. The time series initiated in 1988 is used every year by European stock assessment working groups to derive the exploitation state of the main commercial fish species. From this year onwards the CGFS study area has been extended to include the western English Channel where 48 stations were realized with a GOV 36/49.
Gear details:	In the eastern English Channel (74 stations): a GOV (36/47), 4.7 meters for the vertical opening and 16m for the horizontal opening (gear geometry recorded with Marport system) In the western English Channel (48 stations): a GOV (36/49),5.5 meters for the vertical opening and 19.4 m for the horizontal opening (gear geometry recorded with Marport system)
Notes from survey (e.g. problems, additional work etc.):	A total of 74 hauls in the eastern English Channel have been realized, among which 72 were valid. From this year onwards the CGFS study area is extended to include the western English Channel where 48 stations were realized in 2018 with a GOV 36/49. During the survey, following additional data collection have been performed : - total number of 3205 biological samples (otoliths, scales and/or illicia for Lophius species) have been realized, with 1956 samples in the eastern English Channel and 1249 in the western English Channel. - hydrology stations (deploying hydrological probe, niskin bottle and plankton WP2 net) - - stations sampled in the eastern English Channel with the MANTA net, in order to collect microplastics - samples of sub-surface water, in order to get fish eggs, along the vessel trajectory in the eastern English Channel - During daylight, two observers were also continuously recording seabirds and marine mammals. - Wastes were counted and weighted at each trawl station.

	- Invertebrates ("benthos") were sorted, identified counted and weighted at the lowest taxonomic level (mostly species) for each trawled station.
Number of fish species recorded and notes on any rare species or unusual catches:	Similarly to previous years, 2018 is characterized by a high dominance of pelagic species as horse mackerel (*Trachurus trachurus*), sprat (*Sprattus sprattus*) and mackerel (*Scomber scombrus*) in both areas. Concerning the eastern English Channel a difference between dominance in biomass and dominance in abundance (Fig.4) was observed, especially for the sprat which was very abundant but with a very low mean weight. At the opposite the mean weight of mackerel was high which explains a more important dominance in biomass. We can observe the same difference in the western English Channel, particularly for the sprat.

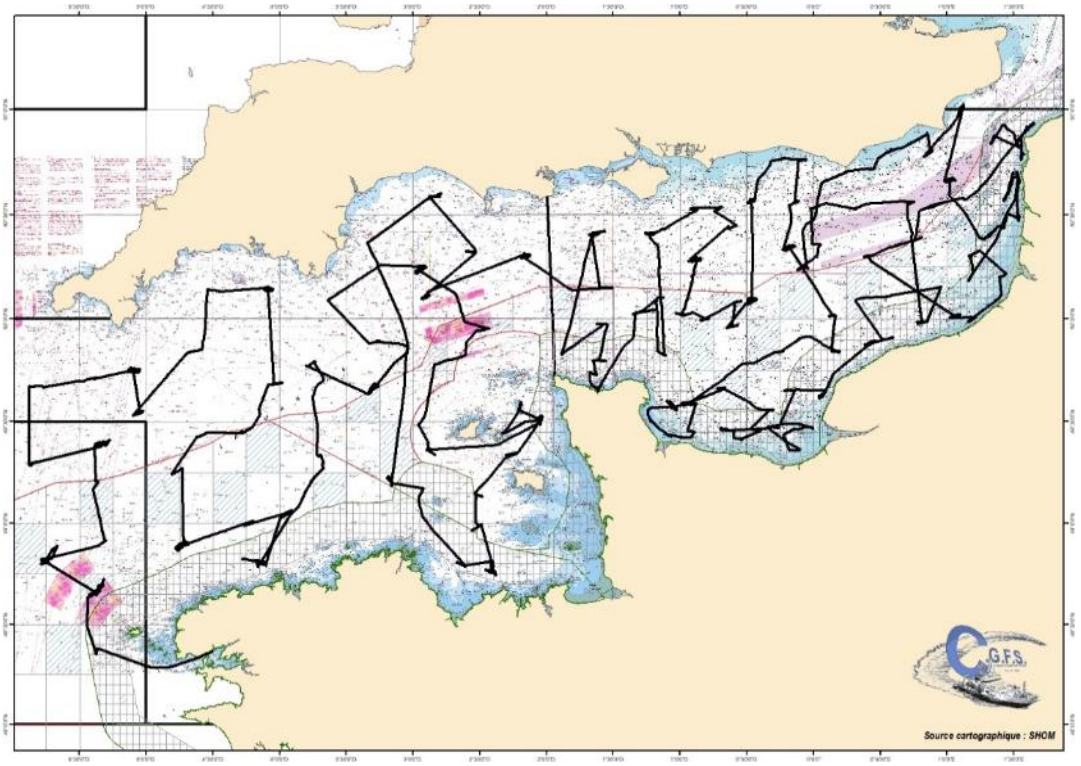
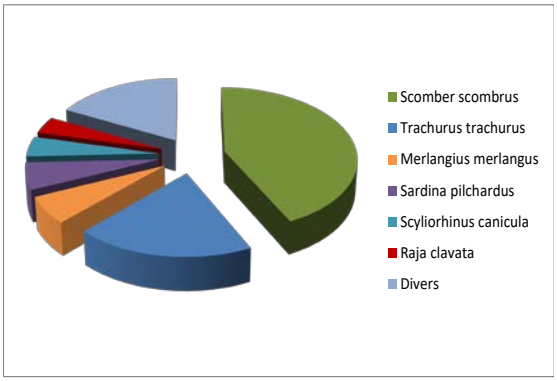


Figure A.5.10.1:Bottom trawl sampling stations of the CGFS 2018 survey



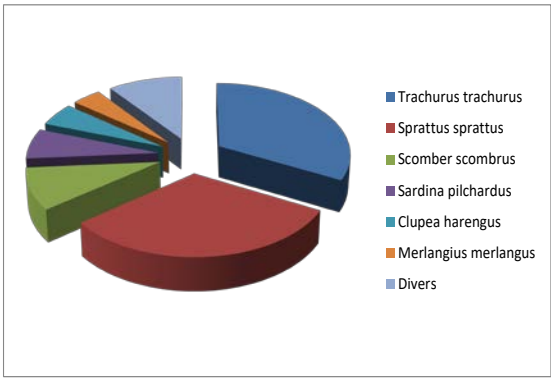


Figure A.5.10.2: Fish dominance in biomass (left) and abundance (right) in the Eastern English Channel

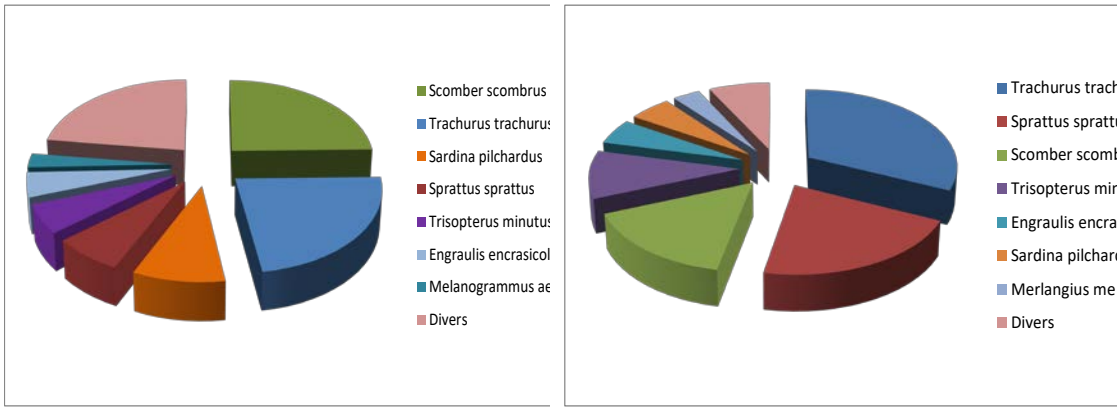


Figure A.5.10.3: Fish dominance in biomass (left) and abundance (right) in the Western English Channel

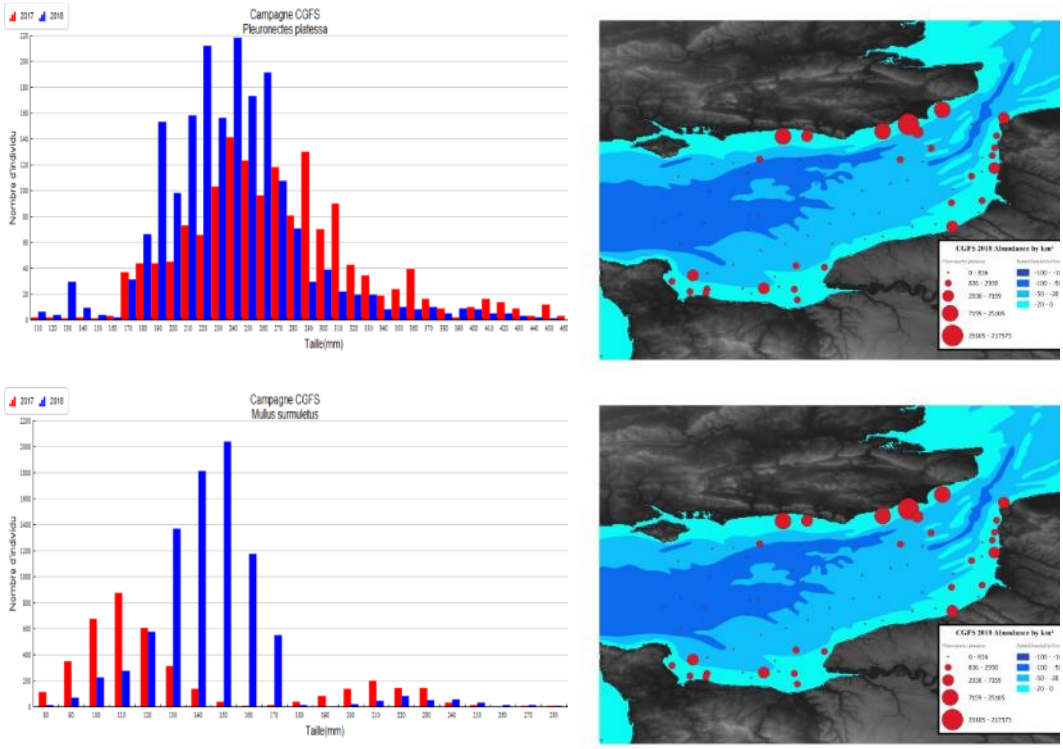


Figure A.5.10.4: Size distribution and spatial distribution (abundance by km²) of the 2 species assessed by WGNSSK[2] in the VIId ICES area: plaice (top) and red mullet (bottom). Comparison between 2017(in red) and 2018 (in Blue)

[2] *ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak*

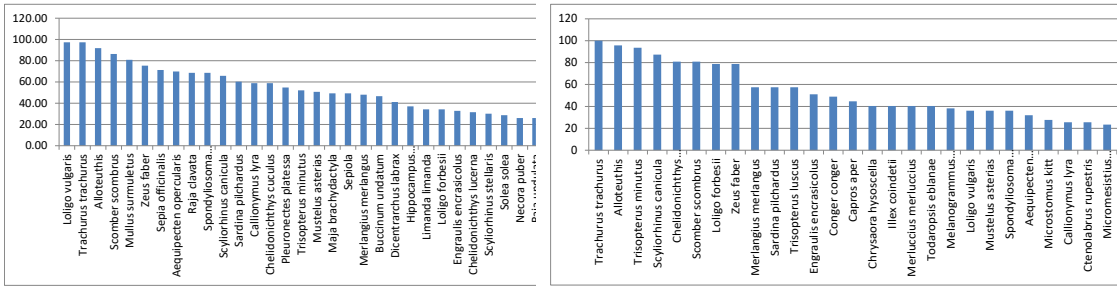


Figure A.5.10.5: Fish occurrence In the Eastern (left) and Western (right) English Channel (>20%)

A.5.11 – France – EVHOE 2018

Nation:	France	Vessel:	Thalassa 2
Survey:	EVHOE 2018	Dates:	19 October – 3 st December 2018

Cruise	EVHOE Groundfish survey aims at collecting data on the distribution, relative abundance and biological parameters of all fish and selected commercial invertebrates in subareas 7f-j and 8a,b,d. The primary species are hake, monkfishes, megrim, cod, haddock and whiting. Data are also collected for all other demersal, pelagic fish and cephalopods as well as for the whole invertebrate megafauna. From 2016 onward, sampling design is fixed, based on a previously randomly selected set of points based on bathymetric and sedimentary strata.
Gear details:	A GOV (36/47) with standard Ground gear (A) but no kite replaced by 6 extra floats. The boards have been replaced by new equivalent ones and the ground gear attachment has been adjusted to be more in line with the original plan of the trawl and to limit the risk of damage.Marport sensors for doors, wings, and vertical net opening.
Notes from survey (e.g. problems, additional work etc.):	Due to a technical problem, the campaign was delayed by 2.5 days on the initial plan, caught up by a lengthening of the campaign of the same duration.A total of 158 hauls have been realized and 96,8% of them were validated (table 5.3.2.8.1). 98,7 % of the initial program have been realized and validated (153 valid hauls of 155 planed). Among the 158 hauls realised, 5 hauls were not validated because of trawl damage or shorted hauls due to strong pelagic fish acoustic detection. During the survey following additional data collection have been performed : - A total number of 4585 biological samples (otoliths, scales and/or illicia for *Lophius*species) have been realised. The addition ofsamples for mackerel mainly explains the increase in the number of samples compared to previous years -Trawl geometry data (Marport sensors) have been collected during all the hauls. -157 CTD temperature and salinity profile - 32 “profiles boxes” with multibeam echosounder to collect bathymetry and reflectivity data - during transects and trawling hauls continuous records with multibeam echosounder to collect data for pelagic ecosystem - mammals and birds observations during the legs 1 and 2. -Additional works, partly for MSFD, were realized at night mostly in the evening or early morning: • 28 Manta net hauls for collecting surface microplastics was put up during first and second leg

	• 34 samples with WP2 net for zoo and phytoplancton were collected during parts one and two. • transects with CUFES device (Continuous Underwater Fish Egg Sampler) • 47 vertical profiles with "SBE 19 Bathysonde" to collect temperature, phytoplancton, particle densities ... • 52 Photo/Video transects with PAGURE sledge • 6 mesopelagic hauls at the shelf break • acoustic transects (ME70 echo-sounder) for water column - Wastes were counted and weighted at each trawl station. - Invertebrates ("benthos", 445 taxa including some mesopelagic invertebrates) were sorted, identified counted and weighted at the lowest taxonomic level (mostly species) for each trawled station.
Number of fish species recorded and notes on any rare species or unusual catches:	About 262 fish taxa (including mesopelagic) and 36 cephalopods taxa were recorded. Additional work on selected species : muscle samples, stomach contents, fishes morphometry, sharks and rays tagging

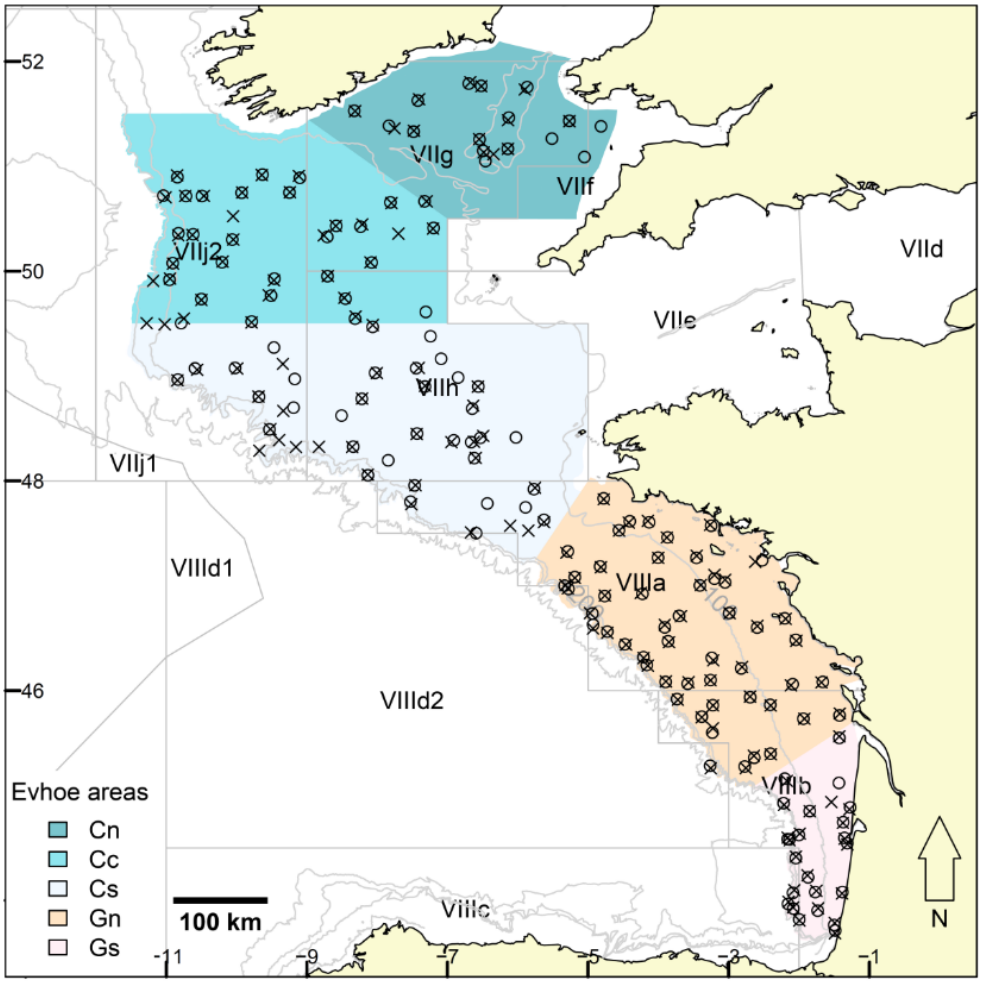


Figure A.5.1.1: Planned stations in the fixed sampling plan (o) and validated tows (x) for EVHOE 2018. ICES areas as well as EVHOE strata (Gs, Gn, Cs, Cc, Cn) are indicated.

Table A.5.1.1: Trawling stations planned, realised and validated for the whole EVHOE 2018 survey.

STRATA	ICES DIVISIONS	GEAR Sweep length	OWS PLANNE	TOWS REALISED	VALID	ADDITIONALions samplec	
Cc3	7g,h,j	GOV (50m)	8	10	10	2	125
Cc4	7g,h,j	GOV (100m)	15	15	15	0	100
Cc5	7g,h,j	GOV (100m)	4	5	5	1	125
Cc6	7g,h,j	GOV (100m)	3	4	4	1	133
Cc7	7g,h,j	GOV (100m)	0	1	1	1	
Cn2	7g,h,j	GOV (50m)	7	3	3	0	43
Cn3	7g,h,j	GOV (50m)	9	9	9	0	100
Cs4	7g,h,j	GOV (100m)	24	25	20	1	104
Cs5	7g,h,j	GOV (100m)	7	7	7	0	100
Cs6	7g,h,j	GOV (100m)	4	4	4	0	100
Cs7	7g,h,j	GOV (100m)	0	1	1	1	
Gn1	8a,b	GOV (50m)	5	4	4	0	80
Gn2	8a,b	GOV (50m)	5	6	6	1	120
Gn3	8a,b	GOV (50m)	14	14	14	0	100
Gn4	8a,b	GOV (100m)	20	20	20	0	100
Gn5	8a,b	GOV (100m)	3	3	3	0	100
Gn6	8a,b	GOV (100m)	2	2	2	0	100
Gn7	8a,b	GOV (100m)	2	2	2	0	100
Gs1	8a,b	GOV (50m)	3	3	3	0	100
Gs2	8a,b	GOV (50m)	6	6	6	0	100
Gs3	8a,b	GOV (50m)	4	4	4	0	100
Gs4	8a,b	GOV (100m)	4	4	4	0	100
Gs5	8a,b	GOV (100m)	2	2	2	0	100
Gs6	8a,b	GOV (100m)	2	2	2	0	100
Gs7	8a,b	GOV (100m)	2	2	2	0	100
All		GOV	155	158	153 (96,8%)	0	98.7

Table A.5.1.2: Biological samples (length, weight, sex, maturity and age material)in the ICES Division 8ab and 7fghj

Species scientific name	Species code (Aphia ID)	Total number	%M	%F	%I	Type of material
Sardina pilchardus	126421	180	54.4	44.4	0	otolith
Engraulis encrasicolus	126426	182	29.1	62.1	8.8	otolith
Gadus morhua	126436	36	30.6	69.4	0	otolith
Melanogrammus aeglefinus	126437	880	37.3	54.9	7.8	otolith
Merlangius merlangus	126438	713	40.8	42.6	16.5	otolith
Pollachius pollachius	126440	4	75	25	0	otolith
Trisopterus luscus	126445	237	37.1	59.1	3.8	otolith
Molva molva	126461	24	58.3	41.7	0	otolith
Merluccius merluccius	126484	1092	42	42.7	15.1	otolith
Phycis blennoides	126501	395	20.5	54.9	24.1	otolith
Lophius budegassa	126554	296	39.5	37.2	19.3	illicia
Lophius piscatorius	126555	200	35.5	34.5	22.5	illicia
Dicentrarchus labrax	126975	56	46.4	53.6	0	scale
Mullus surmuletus	126986	170	28.8	41.8	27.6	otolith
Scomber scombrus	127023	625	25.1	17.4	55.2	otolith
Glyptocephalus cynoglossus	127136	199	24.6	67.8	7	otolith
Microstomus kitt	127140	350	52.3	47.7	0	otolith
Pleuronectes platessa	127143	250	30.4	68.8	0.8	otolith
Lepidorhombus whiffiagonis	127146	855	29.7	60	9.9	otolith
Scophthalmus maximus	127149	1	100	0	0	otolith
Scophthalmus rhombus	127150	3	0	100	0	otolith
Pegusa lascaris	127156	1	0	0	0	otolith
Solea solea	127160	127	27.6	70.9	1.6	otolith
Chelidonichthys cuculus	127259	280	24.3	63.9	11.1	otolith

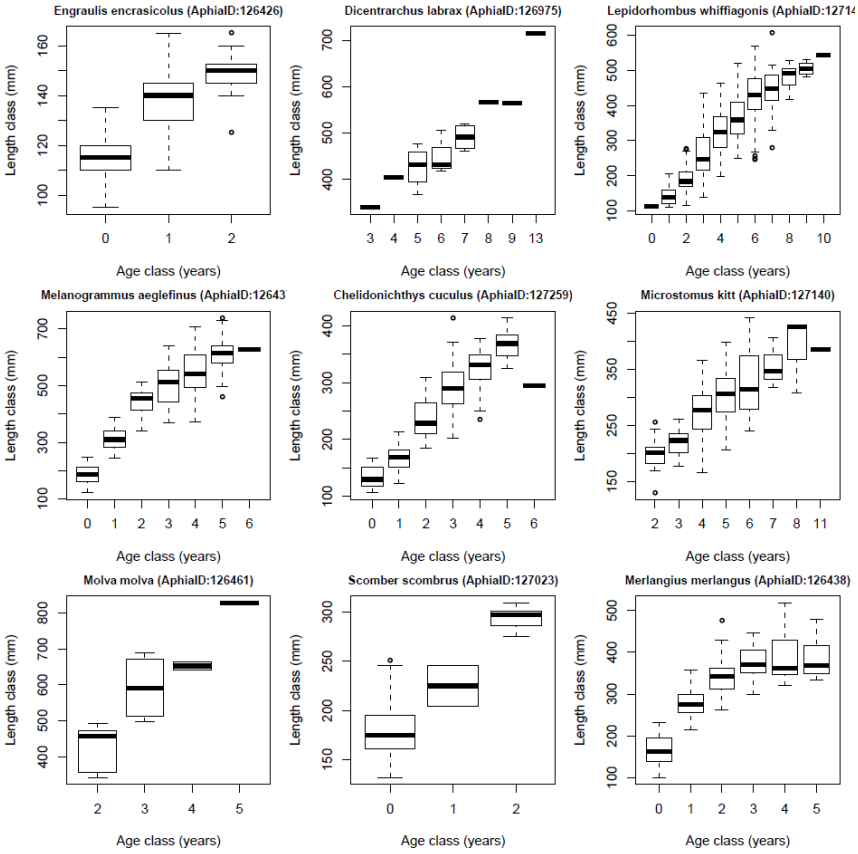


Figure A.5.1.2: Length at age relationships for species with biological sampling during EVHOE 2018

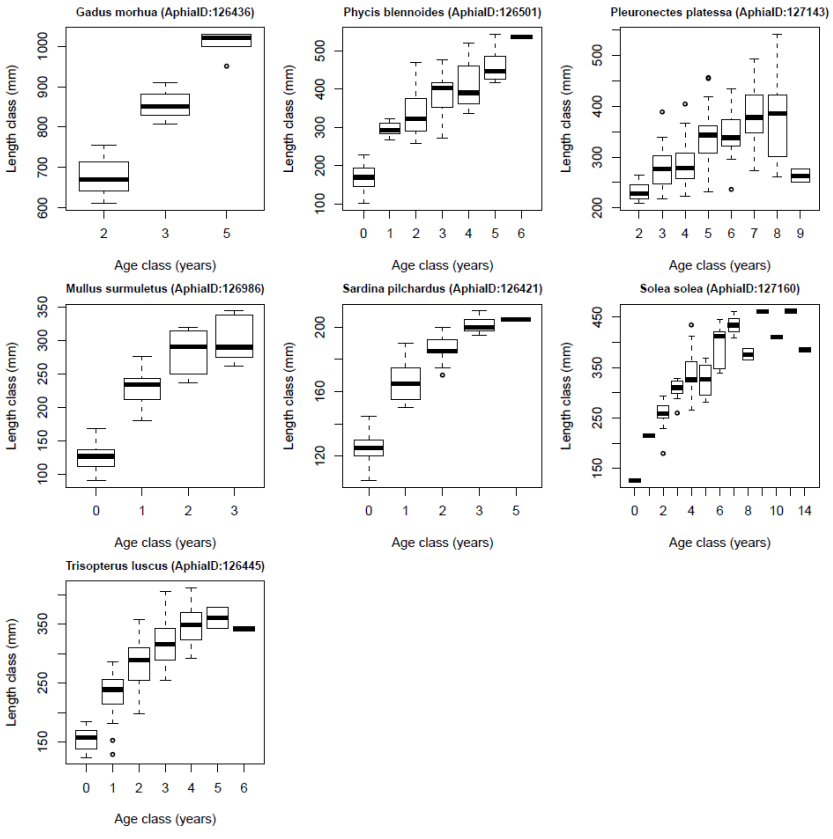


Figure A.5.1.2 (continued): Length at age relationships for species with biological sampling during IBTS Q1 (EVHOE) 2018

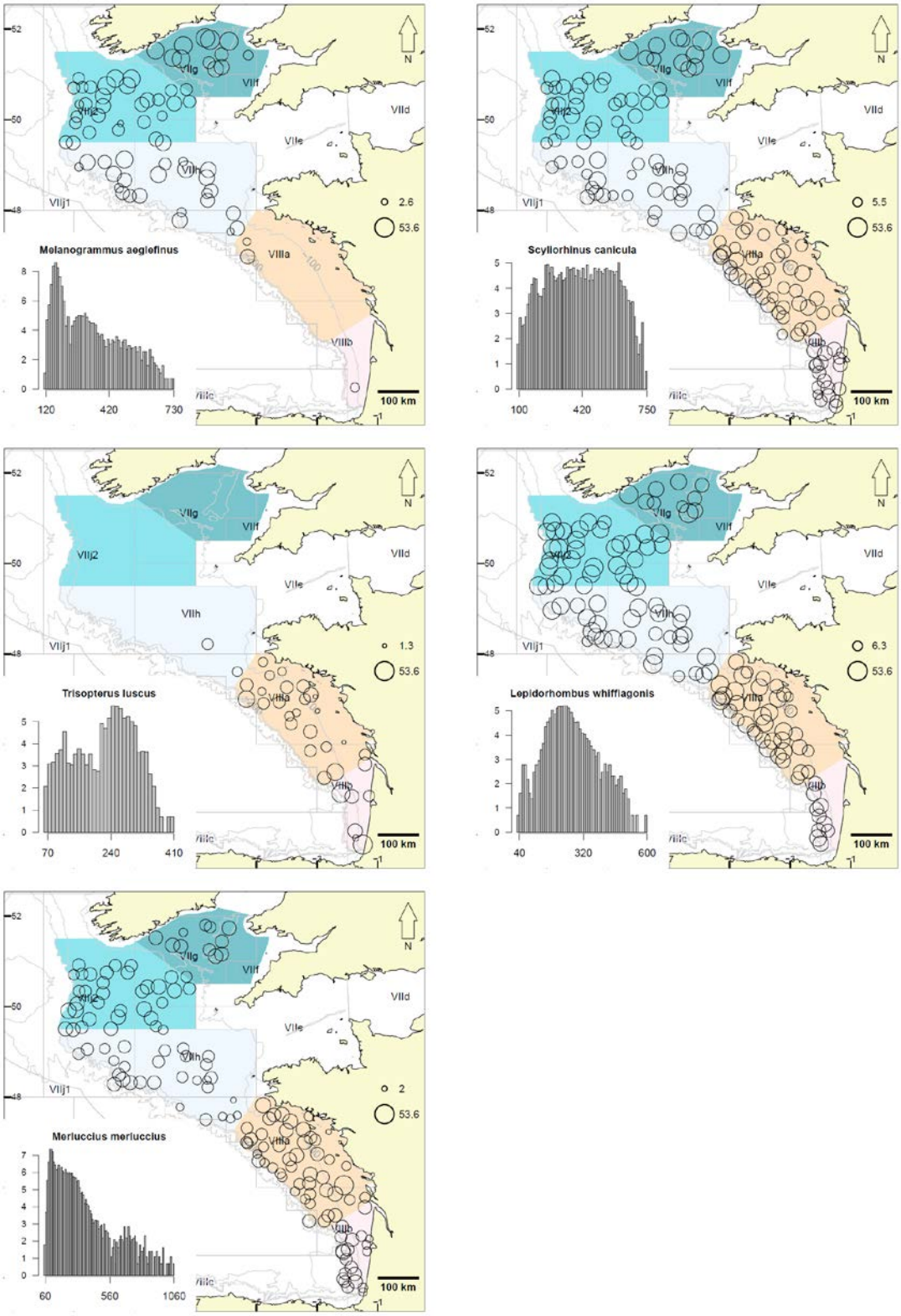


Figure A.5.1.3: Spatial distribution of biomass and barplot giving size distribution (logarithm of abundance by size class) for the main species caught during IBTS Q1 (EVOE) survey in 2018.

A.5.12 – Spain – SP NSGFS Q4

NATION:	SP (SPAIN)	VESSEL:	MIGUEL OLIVER
Survey:	SP-NSGFS-Q4 (N18)	Dates:	17 September - 23 October 2018
Cruise	Spanish North Coast bottom trawl survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in ICES Divisions 8c and Northern 9a. The primary species are hake, monkfish and white anglerfish, megrim, four-spot megrim, blue whiting and horse mackerel abundance indices are estimated by age, with abundance indices also estimated for Nephrops, and data collection for other demersal fish and invertebrates.		
Survey Design	This survey is random stratified with five geographical strata along the coast and 3 depth strata (70-120 m, 121-200 m, 201-500 m). Stations are allocated at random within the trawlable stations available according to the strata surface.		
Gear details:	Baca 44/60 with Thyborøn doors.		
Notes from survey (e.g. problems, additional work etc.):	2018 survey was performed on the R/V *Miguel Oliver* instead of the R/V Cornide de Saavedra, after the intercalibration performed in 2012, results from the survey are in line with those from the time series, showing the usual proportion of bentho-demersal species as megrims, skates, and catfish… As in previous years, two additional hauls were undertaken to cover shallow stations between 30 and 70 m, and 13 deeper stations, between 500 and 700 m. Additional work undertaken included CTD casts at all trawl stations and dredges carried out with a box-corer and a meso-box-corer to create a grid of sediments and in some areas infauna samples. Seabirds census was also carried out during fishing manoeuvres. Analyses of stomach contents of main demersal species was performed in all hauls during the survey.		
Number of fish species recorded and notes on any rare species or unusual catches:	A total of 240 species were captured, 114 fish species, 55 crustaceans, 46 molluscs, 36 echinoderms and 33 other invertebrates.		

Table A.5.12.1: Stations fished (aim: to complete 116 valid tows per year)

ICES DIVISIONS	STRATA	GEAR	TOWS PLANNED	VALID	ADDITIONAL	INVALID	% STATIONS FISHED	COMMENTS
8c	All	Standard baca	96	93	15	1	98%	
9a North	All	Standard baca	20	19	2	1	99%	
8b	All	Standard baca	0	1	0	0	Na	
TOTAL			116	112	23	2	106%	

(1) Additional 15 hauls on shallow and deep grounds.

Table A.5.12.2:Biological samples collected during the 2018 groundfish survey on the northern Spanish shelf. Data and samples: length, weight, otolith, sex and maturity

SPECIES	AGE	SPECIES	AGE
Merluccius merluccius	872	*Scomber scombrus*	561
Lepidorhombus whiffiagonis	440	*Mullus surmuletus*	139
Lepidorhombus boscii	512	*Scomber colias*	95
Lophius budegassa	34	*Zeus faber***	58
Lophius piscatorius	19	*Trisopterus luscus*	158

SPECIES	AGE	SPECIES	AGE
Trachurus trachurus	431	*Helicolenus dactylopterus*	165
Micromesistius poutassou	1161	*Phycis blennoides*	184
Engraulis encrasicolus	141	*Conger conger***	137

(*) Otoliths read for the ALK.

(**) Otoliths and vertebrae, only the former read for John Dory.

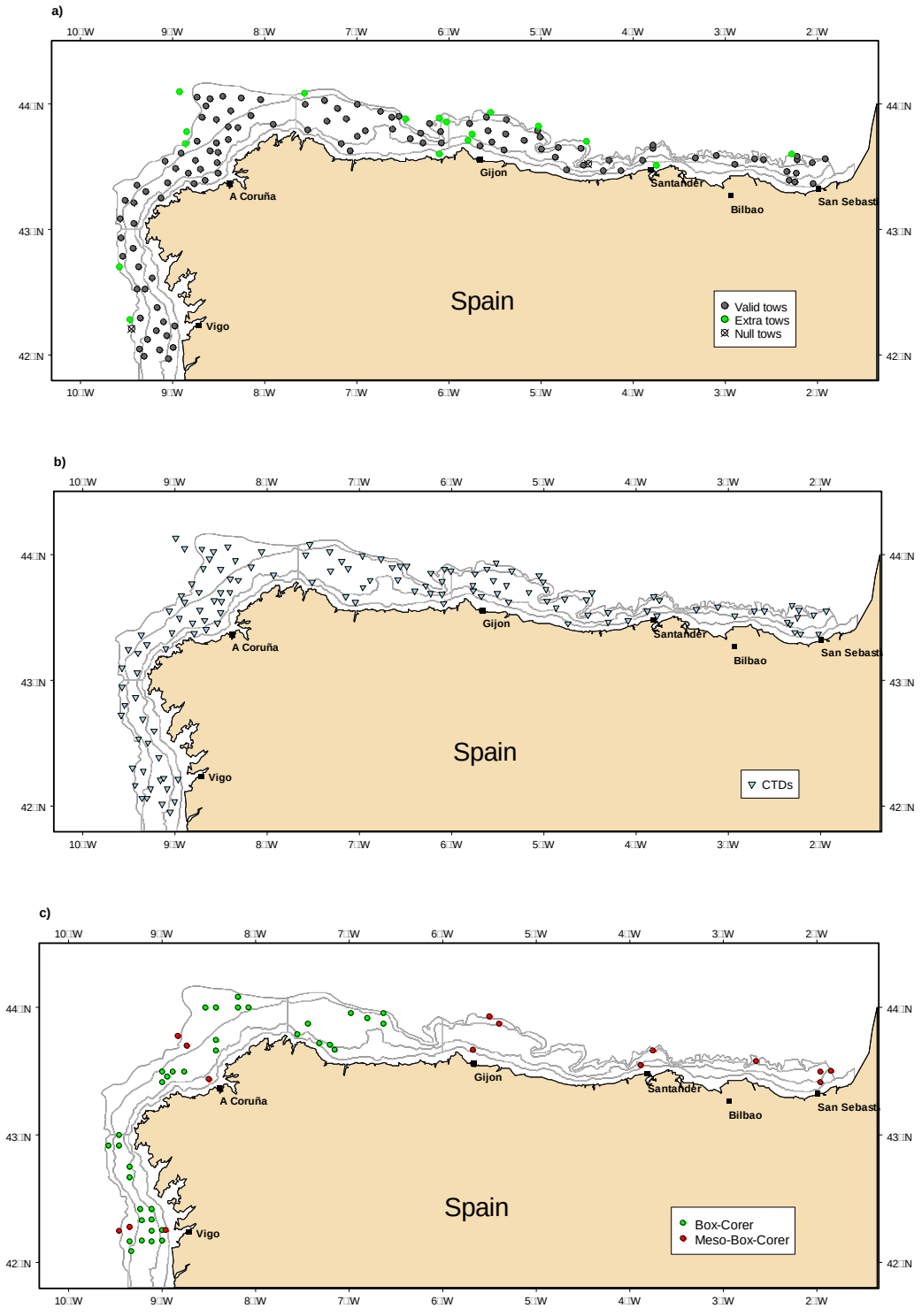


Figure A.5.12.1: a) Trawl stations in northern Spanish Shelf 2018 survey, b) CTD and c) dredge stations.

Table A.5.12.3: Abundance indices in biomass and number during 2018 survey compared with previous years in the time-series.

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$	y_i	y_i/y_{i-1}	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$
			kg/0.5h	%	%	n/0.5h	%	%
Merluccius merluccius	9aN	19	3.50	-33.8	-59.8	236.9	92.6	-49.7
Lepidorhombus boscii	9aN	19	4.13	-37.2	5.6	68.1	-46.2	0.3
Lepidorhombus whiffiagonis	9aN	19	0.11	-38.9	171.9	0.8	-55.1	159.7
Lophius budegassa	9aN	19	0.30	57.9	122.7	0.2	-15.0	26.1
Lophius piscatorius	9aN	19	0.24	118.2	208.8	0.0	-60.0	-47.5
Micromesistius poutassou	9aN	19	81.11	322.4	-38.2	2747.2	509.3	-31.4
Trachurus trachurus	9aN	19	0.05	-100.0	366.8	0.4	-100.0	440.3
Scomber scombrus	9aN	19	0.94	-77.8	-64.3	11.3	-65.5	-79.3
Nephrops norvegicus	9aN	19	0.00	-100.0	-62.5	0.1	-28.6	-65.4
Merluccius merluccius	8c	93	7.10	3.5	11.0	314.1	88.7	41.7
Lepidorhombus boscii	8c	93	5.6	-8.8	25.8	92.0	-15.1	36.7
Lepidorhombus whiffiagonis	8c	93	4.10	-8.7	81.2	49.4	-17.9	64.7
Lophius budegassa	8c	93	0.87	38.1	-12.5	0.3	-15.8	-44.1
Lophius piscatorius	8c	93	0.73	17.7	-51.2	0.1	-30.0	-79.5
Micromesistius poutassou	8c	93	228.67	354.3	-6.3	6917.5	594.0	-22.1
Trachurus trachurus	8c	93	50.53	210.4	-36.2	1109.9	181.5	-38.1
Scomber scombrus	8c	93	0.89	-70.1	-38.6	10.1	-90.8	37.4
Nephrops norvegicus	8c	93	0.03	0.0	-40.0	0.7	1.5	-20.3
Merluccius merluccius	Total	112	6.59	-14.2	11.6	159.0	-24.8	4.6
Lepidorhombus boscii	Total	112	6.21	28.3	-5.7	111.5	28.5	11.8
Lepidorhombus whiffiagonis	Total	112	3.75	37.9	69.7	50.2	16.2	151.6
Lophius budegassa	Total	112	0.55	5.8	-45.2	0.4	-14.6	-56.5
Lophius piscatorius	Total	112	0.53	-31.2	-59.2	0.2	-40.0	-82.5
Micromesistius poutassou	Total	112	44.98	-60.8	-28.5	902.9	-65.2	-55.3
Trachurus trachurus	Total	112	34.63	30.1	-19.3	563.7	3.9	-36.5
Scomber scombrus	Total	112	3.19	81.3	-42.8	97.3	297.2	-0.4
Nephrops norvegicus	Total	112	0.03	-25.0	-34.4	0.6	-23.0	-22.9

$\mathbf{y_i}$, year estimate (2018); $\mathbf{y_{i-1}}$, previous year estimate (2017); $\mathbf{y_{(i,i-1)}}$, Average of last two year estimates (2018 and 2017); $\mathbf{y_{(i-2,i-3,i-4)}}$, Average of the previous three year estimates (2016, 2015 and 2014).

A.5.13 – Spain – SP-GCGFS-Q4

NATION:	SP (SPAIN)	VESSEL:	MIGUEL OLIVER
Survey:	SP-GCGFS-Q4 (ARSA 1118)	Dates:	30 October – 12 November 2018
Cruise	Spanish Gulf of Cadiz bottom trawl survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in the Gulf of Cadiz area (ICES Division IXa). The primary species are hake, horse mackerel, wedge sole, sea breams, mackerel and Spanish mackerel. Data and abundance indices are also collected and estimated for other demersal fish species and invertebrates as rose and red shrimps, Nephrops and cephalopod molluscs.		
Survey Design	The survey is random stratified with 5 depth strata (15-30 m, 31-100 m, 101-200 m, 201-500 m, 501-800 m). Stations are allocated at random according to the strata surface.		
Gear details:	Baca 44/60with Thyborøn doors.		
Notes from survey (e.g. problems, additional work etc.):	Additional work undertaken included 43 dredges carried out with a box-corer.		
Number of fish species recorded and notes on any rare species or unusual catches:	Overall a total of 162 fish species, 58 crustaceans and 57 mollusks were recorded.		

Table A.5.13.1: Stations fished (aim: to complete 45 valid tows per year)

ICES DIVISIONS	STRATA	GEAR	TOWS PLANNED	VALID	ADDITIONAL	INVALID	% STATIONS FISHED	COMMENTS
9a	All	Baca 44/60	45	45	-	-	100%	
	TOTAL		45	45	-	-	100%	

Table A.5.13.2:Number of biological samples, data and samples on maturity and age material.

SPECIES	AGE	SPECIES	AGE
Merluccius merluccius	335	*Loligo vulgaris**	830
*Merluccius merluccius**	1697	*Loligo forbesii**	196
*Parapenaeus longirostris**	1996	*Sepia officinalis**	305
*Nephrops norvegicus**	180	*Octopus vulgaris**	428

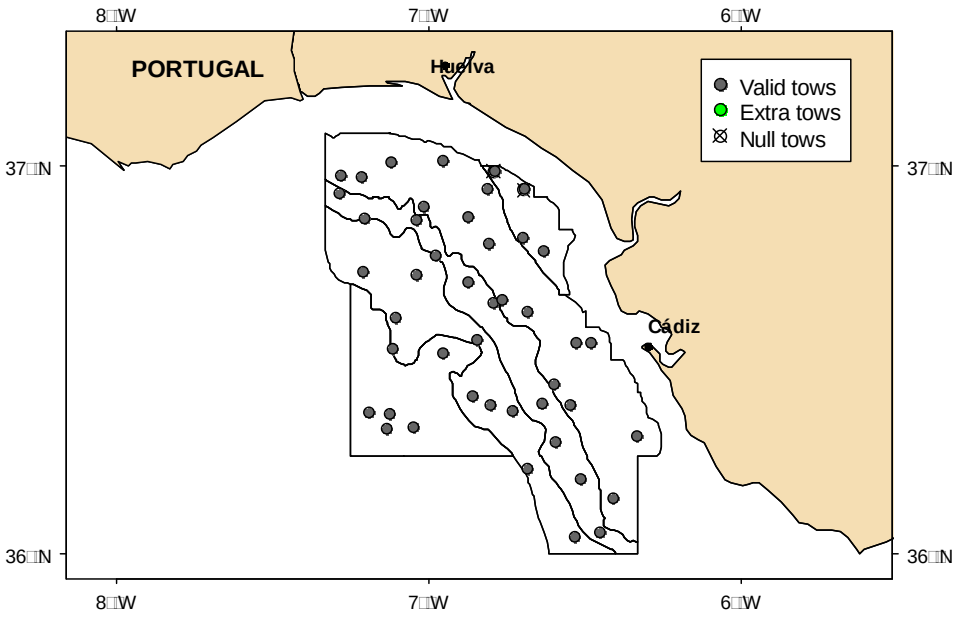


Figure A.5.13.1:Trawl stations in Q4 Gulf of Cadiz 2018 survey .

Table A.5.12.3: Abundance indices in biomass and number during 2018 survey compared with previous years in the time-series.

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i kg/0.5h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %	y_i n/0.5h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Merluccius merluccius	All	41	8.00	68.8	-33.7	72.0	-58.9	-18.9
Micromesistius poutassou	All	41	8.98	-51.9	-38.1	221.4	-31.0	-53.6
Nephrops norvegicus	All	41	0.65	-30.9	18.1	26.2	-33.5	31.5
Parapenaeus longirostris	All	41	2.96	77.2	464.6	637.3	48.1	724.1
Octopus vulgaris	All	41	2.16	170.0	-39.3	6.7	378.0	2.6
Loligo vulgaris	All	41	2.91	259.3	-24.5	20.8	288.6	-31.1
Sepia officinalis	All	41	1.91	1.1	28.4	6.4	36.7	20.7

$\mathbf{y}_i$, year estimate (2018); $\mathbf{y}_{i-1}$, previous year estimate (2017); $\mathbf{y}_{(i,i-1)}$, Average of last two year estimates (2018 and 2017); $\mathbf{y}_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2016, 2015 and 2014).

A.5.14 – Portugal - PT-GFS-Q4 2018

NATION:	PORTUGAL	VESSEL:	R/V NORUEGA& CALYPSO
Survey:	Autumn 2018	Dates:	5th October 4th November 2018 (Noruega) & 17th-21st December 2018 (Calypso)

Cruise	Autumn Groundfish survey aims to estimate the abundance and distribution of hake and horse mackerel recruits, indices of abundance and biomass of the most important commercial species, biological parameters, e.g. maturity, ages, sex-ratio, weight, food habits and biodiversity indicators. The primary species are hake, horse mackerel, blue whiting, mackerel and Spanish mackerel. Other data is also collected for several other demersal fish species and invertebrates.
Area	Portuguese continental waters (Div. IXa), from 20 to 500 m depth.
Survey design	96 fishing stations, 66 at fixed (grid) positions and 30 at random. Tow duration is 30 min, with a trawl speed of 3.5 knots, during day light. Temperature is recorded with a CTD (Conductivity, Temperature, Depth) equipment at the end of each haul. Scanmar used to monitor gear parameters.
Gear details	NCT (Norwegian Campbell Trawl) gear with rollers in the groundrope. The mean horizontal opening between the wings is 14.7 m and the mean vertical opening is 4.4 m. Codend mesh size is 20 mm. In the case of damage of NCT, CAR (FGAV019) net is used. This net does not have rollers in the groundrope but a tickler chain. The mean horizontal opening between the wings is 25 m and the mean vertical opening is 2.5 m. Codend mesh size is 20 mm. Onboard Noruega, the trawl doors used are the same for both gears.
Notes from survey (e.g. problems, additional work etc.)	During the Autumn2018 survey, 8 days were lost to bad weather and 4 extra days were lost to other reasons. Due to the time restriction that ensued, the number of hauls to be performed was reduced, with the elimination of 10 hauls, based on keeping at least 2 stations by strata, in compliance with the sampling scheme. But due to a combination of unfixable damage within a week time until the end of the survey and bad weather, the Southwestern part of the Portuguese Continental Coast, where main recruitment areas are present, was not sampled. Additionally, bureaucratic constrains stopped us from extending contracts for fishing crew to finalize the survey as soon as reparation were done. To collect information on the unsampled area, it was decided to rent a commercial trawler, equipped with CAR net and monitoring system with doors similar to Noruega's ones. The number of hauls to be performed was decided to be 1 haul by strata, 12 in total, to collect length frequency and biological data for main species (hake, horse mackerel, mackerel, chub mackerel, megrim, four-spotted megrim and monk-fishes). As a result, 29 hauls were excluded for the whole survey (~30%). Conversion factors are applied for data collected on Noruega with CAR gear to be comparable with data collected with NCT gear and data collected on board Calypso is to be analysed for suitability for index purposes.
Number of fish species recorded and notes on any rare species or unusual catches:	Overall, 135 species of fish, 20 of cephalopods and 30 of crustaceans were recorded during the survey. 30 species of other groups were recorded, e.g., Echinodermata, Cnidarians, Bivalves, Gastropods, Polychaeta, Ascidians and Nudibranchia.

Table A.5.14.1: Stations fished

ICES Divisions	Strata	Gear	Tows planned	Valid	Invalid	% stations fished	comments
IXa	ALL	NCT	96	48	3	60	Also available by depth and geographical strata
IXa	ALL	CAR		5	1		
IXa	ALL	CAR	12	12	0	100%	Recruitment area coverage onboard commercial trawler "Calypso"

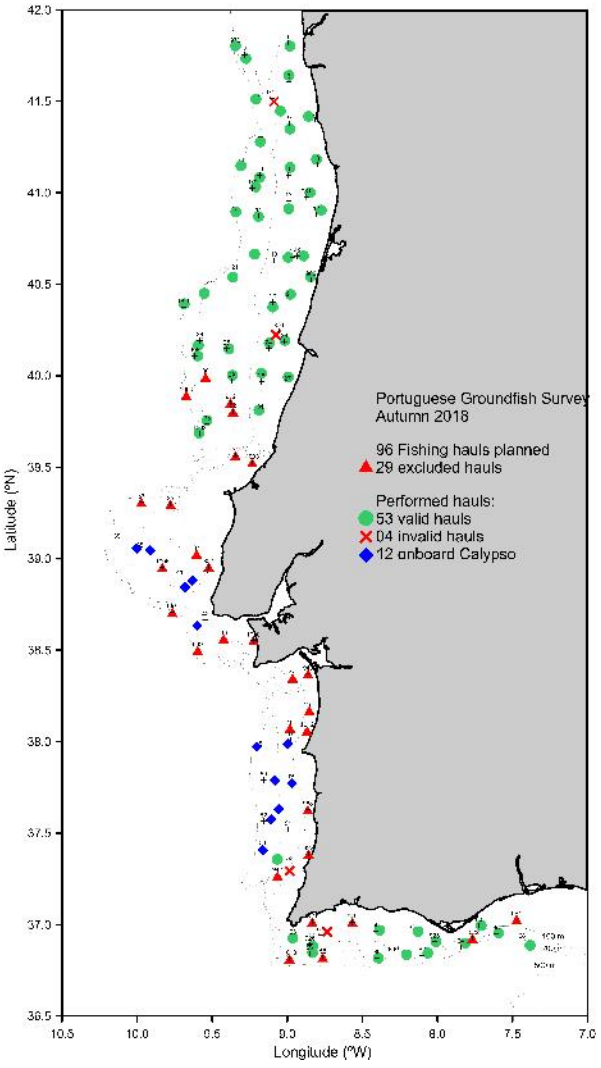


Figure A.5.14.1: Map of fishing stations performed, excluded and fished with commercial bottom trawler Calypso

Table A.5.14.2: Number of biological samples (maturity and age material)

Species	Samples*	Maturity	Otoliths	Species*	Samples*	Maturity	Otoliths
Chelidonichthys cuculus	4	23	23	*Mullus surmuletus*	5	11	11
Illex coindetii	7	158		*Nephrops norvegicus*	1	95	
Lepidorhombus boscii	1	5	5	*Parapenaeus longirostris*	14	495	
Loligo vulgaris	15	276		*Sardina pilchardus*	3	185	
Merluccius merluccius	53	826	1383	*Scomber colias*	13	255	151
Micromesistius poutassou	16	692	293	*Scomber scombrus*	13	332	154
				Trachurus trachurus	25	1086	620

***- Number of stations sampled**

Table A.5.14.3: Portuguese Groundfish survey – Autumn 2018 (4th quarter) – Only R/V Noruega estimates

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i kg/h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %	y_i n/h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Merluccius merluccius	IXa	53	24.0	22.1	-9.3	275.4	7.5	-18.1
Trachurus trachurus	IXa	53	64.4	-50.0	252.6	1090.7	-41.4	122.6
Trachurus picturatus	IXa	53	0.0	-99.8	-93.9	0.1	-99.6	-97.3
Micromesistius poutassou	IXa	53	140.5	54.8	83.7	3006.4	80.4	50.7
Scomber scombrus	IXa	53	44.5	102.5	276.8	636.0	254.0	152.9
Scomber colias	IXa	53	10.7	-83.7	3308.8	229.1	-79.5	4695.4
Lepidorhombus boscii	IXa	53	0.1	-40.8	14.9	1.8	-33.7	18.8
Lepidorhombus whiffiagonis	IXa	53	0.0	-47.9	-16.6	0.2	7.6	14.7
Lophius budegassa	IXa	53	0.1	191.5	-38.1	0.1	39.3	672.9
Lophius piscatorius	IXa	53	0.0	0	0	0.0	0	0
Nephrops norvegicus	IXa	53	0.1	-46.0	166.6	2.3	-40.3	156.9

$\mathbf{y}_i$, year estimate (2018); $\mathbf{y}_{i-1}$, previous year estimate (2017); $\mathbf{y}_{(i,i-1)}$, Average of last two year estimates (2018 and 2017); $\mathbf{y}_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2016, 2015 and 2014).

Table A.5.14.4: Portuguese Groundfish survey – Autumn 2018 (4th quarter) –R/V Noruega & Calypso converted estimates

BIOMASS AND NUMBER ESTIMATES								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i kg/h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %	y_i n/h	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Merluccius merluccius	IXa	65	18.1	-8.1	-21.7	252.0	-1.6	-21.7
Trachurus trachurus	IXa	65	50.4	-60.9	226.9	789.9	-57.6	99.9

Trachurus picturatus	IXa	65	0.6	-82.6	-92.8	3.9	-90.0	-97.1
Micromesistius poutassou	IXa	65	112.5	24.0	61.5	2482.6	49.0	33.8
Scomber scombrus	IXa	65	30.5	38.5	197.1	434.6	141.9	90.5
Scomber colias	IXa	65	10.7	-83.8	3305.4	210.8	-81.1	4630.1
Lepidorhombus boscii	IXa	65	0.6	282.3	247.9	9.6	260.8	229.2
Lepidorhombus whiffiagonis	IXa	65	0.0	-59.5	-23.0	0.2	23.3	23.4
Lophius budegassa	IXa	65	0.1	204.3	-36.1	0.3	586.1	2438.9
Lophius piscatorius	IXa	65	0.0	0	0	0.0	0	0
Nephrops norvegicus	IXa	65	0.1	-60.7	141.2	1.6	-57.0	130.1

Annex 6: Maps of species distribution in 2018

Table A.6.1. Species for which distribution maps have been produced, with length split for pre-recruit (0-group) and post-recruit (1+ group) where appropriate. The maps cover all the area encompassed by surveys coordinated within the IBTSWG (North Sea and North-eastern Atlantic Areas).

Scientific	Common	Code	Fig No	Length Split (<cm)
Capros aper	Boarfish	BOC	45	
Clupea harengus	Herring	HER	6-7	17.5
Conger conger	Conger	COE	46	
Gadus morhua	Atlantic Cod	COD	2-3	23
Galeorhinus galeus	Tope Shark	GAG	33	
Galeus melastomus	Blackmouthed dogfish	DBM	31	
Lepidorhombus boscii	Four-Spotted Megrim	LBI	16-17	19
Lepidorhombus whiffiagonis	Megrim	MEG	14-15	21
Leucoraja naevus	Cuckoo Ray	CUR	36	
Lophius budegassa	Black-bellied Anglerfish	WAF	20-21	20
Lophius piscatorius	Anglerfish (Monk)	MON	18-19	20
Merlangus merlangius	Whiting	WHG	24-25	20
Melanogrammus aeglefinus	Haddock	HAD	4-5	20
Merluccius merluccius	European hake	HKE	8-9	20
Micromesistius poutassou	Blue whiting	WHB	26-27	19
Mustelus mustelus	Smooth Hound	SMH	34	
Mustelus asterias	Starry smooth hound	SDS	35	
Nephrops norvegicus	Norway Lobster	NEP	28	
Pleuronectes platessa	European Plaice	PLE	22-23	12
Raja brachyura	Broadnose skate	RJH	41	
Raja clavata	Thornback ray (Roker)	THR	37	
Raja microocellata	Painted/Small Eyed Ray	PTR	38	
Raja montagui	Spotted Ray	SDR	39	
Raja undulata	Undulate Ray	UNR	40	
Scomber scombrus	European Mackerel	MAC	12-13	24
Scyliorhinus canicula	Lesser Spotted Dogfish	LSD	29	
Scyliorhnus stellaris	Nurse Hound	DGN	30	
Sprattus sprattus	European sprat	SPR	42	
Squalus acanthias	Spurdog	DGS	32	
Trachurus picturatus	Blue Jack Mackerel	JAA	44	
Trachurus trachurus	Horse Mackerel (Scad)	HOM	10-11	15
Trisopterus smarkii	Norway pout	NPO	43	
Zeus faber	John Dory	JOD	47	

The catchability of the different gears used in the NeAtl surveys is not constant; therefore the following maps do not reflect proportional abundance in all the areas but within each survey.

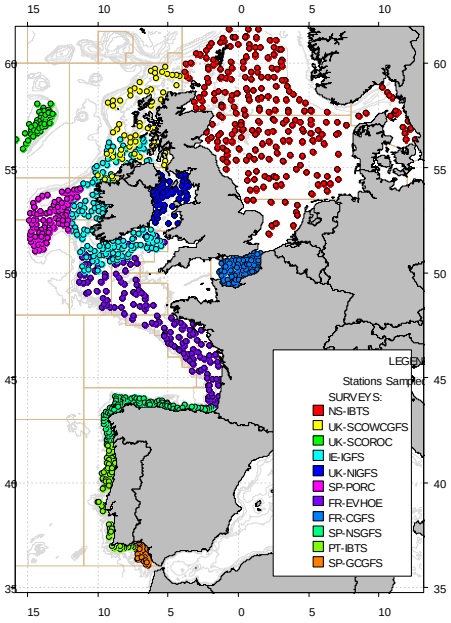


Figure A.6.1. Station positions for the IBTSurveys carried out in the North Eastern Atlantic and North Sea area in summer/autumn of 2018. Quarters 3 and 4

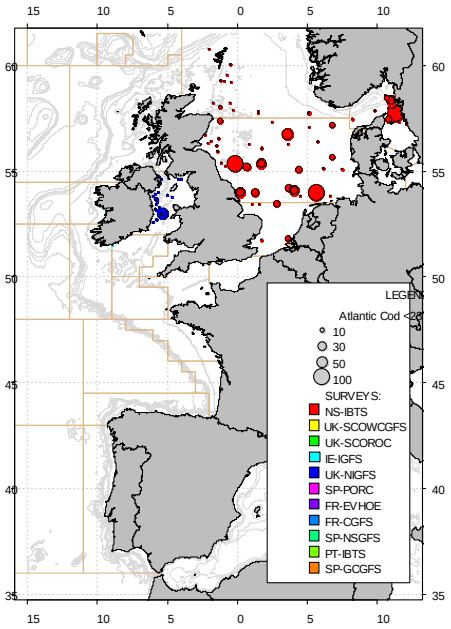


Figure A.6.2. Catches in numbers per hour of 0-group Cod, *Gadus morhua* (<23cm), in summer/autumn 2018IBTSurveys.

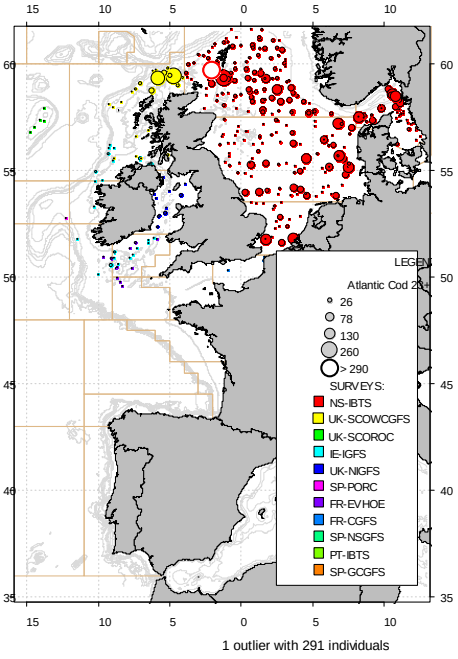


Figure A.6.3. Catches in numbers per hour of 1+ cod, Gadus morhua (≥23cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

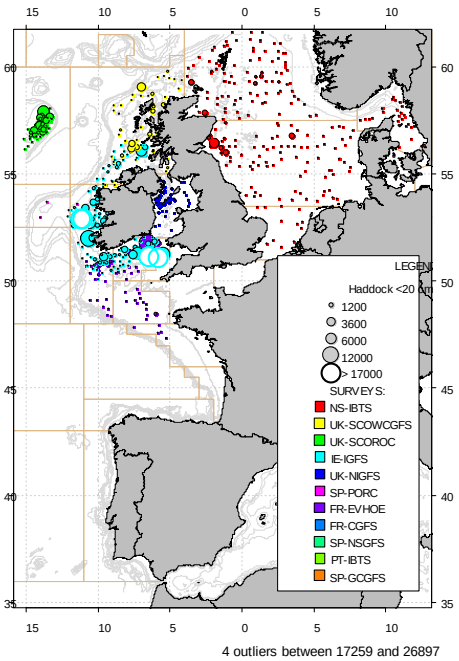


Figure A.6.4. Catches in numbers per hour of 0-group haddock, Melanogrammus aeglefinus (<20cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

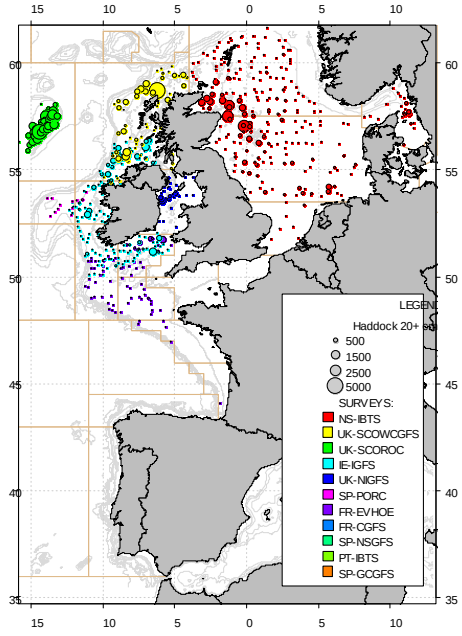


Figure A.6.5. Catches in numbers per hour of 1+ group haddock, Melanogrammus aeglefinus (≥20cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

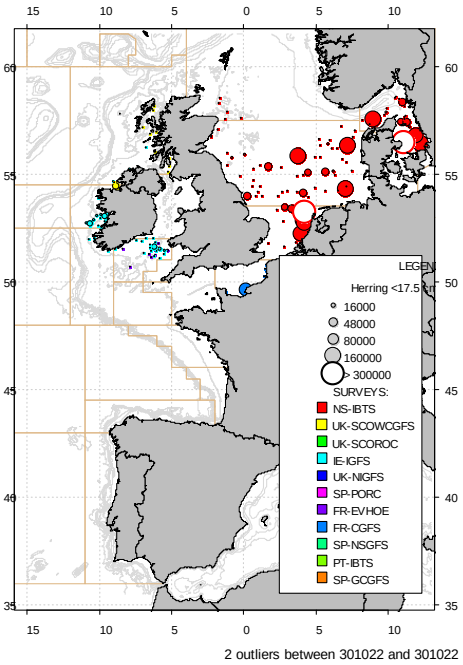


Figure A.6.6. Catches in numbers per hour of 0-group herring, Clupea harengus (<17.5 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

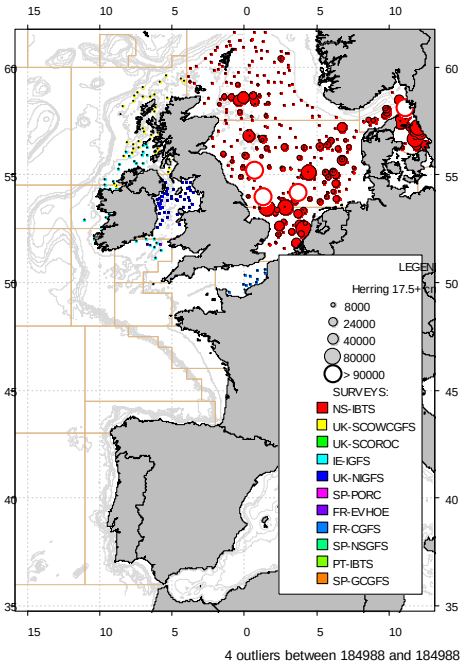


Figure A.6.7. Catches in numbers per hour of 1+ group herring, Clupea harengus (≥17.5 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

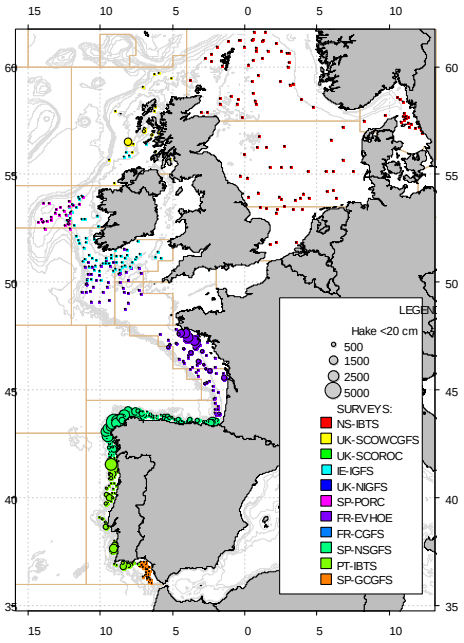


Figure A.6.8. Catches in numbers per hour of 0-group European hake, Merluccius merluccius (<20cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

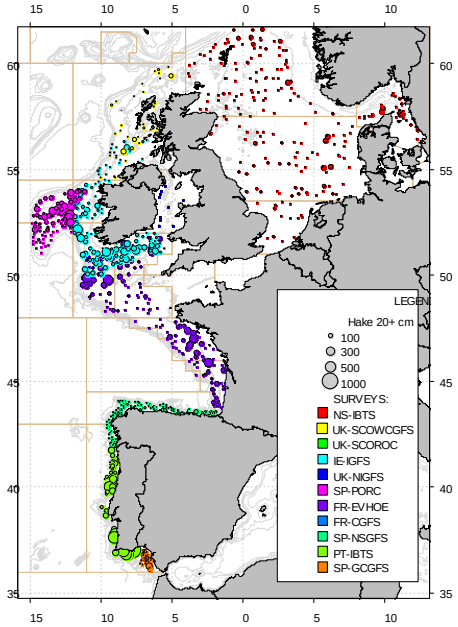


Figure A.6.9. Catches in numbers per hour of 1+ group European hake, Merluccius merluccius (≥20cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

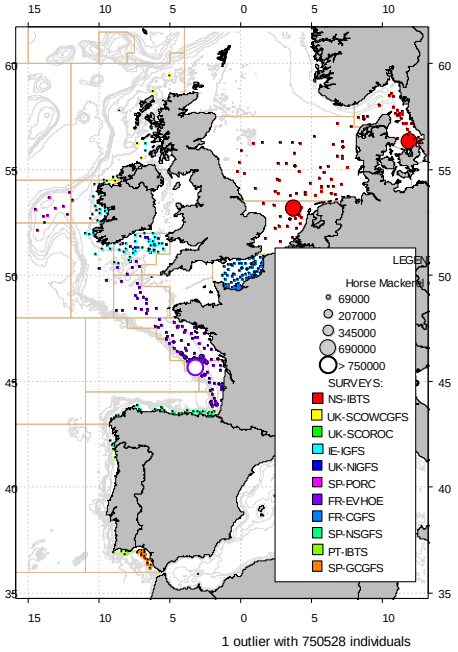


Figure A.6.10. Catches in numbers per hour of 0-group horse mackerel, Trachurus trachurus (<15 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

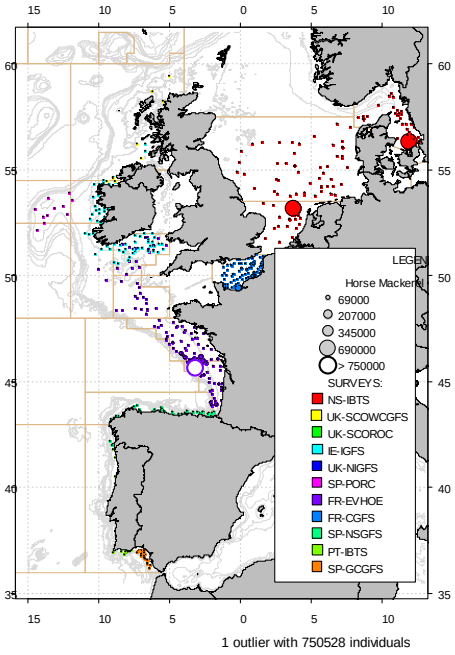


Figure A.6.11. Catches in numbers per hour of 1+ group horse mackerel, *Trachurus trachurus* (≥ 15 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

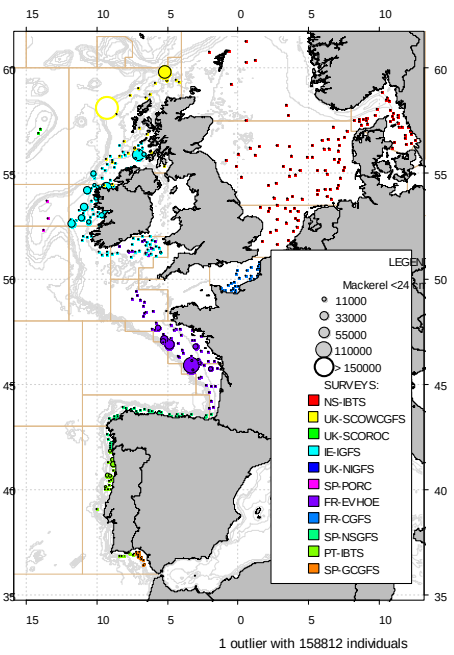


Figure A.6.12. Catches in numbers per hour of 0-group mackerel, *Scomber scombrus* (<24 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

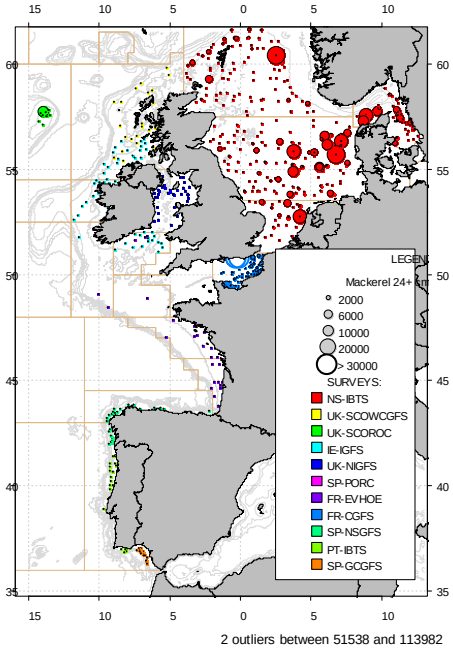


Figure A.6.13. Catches in numbers per hour of 1+ group mackerel, Scomber scombrus (≥24 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

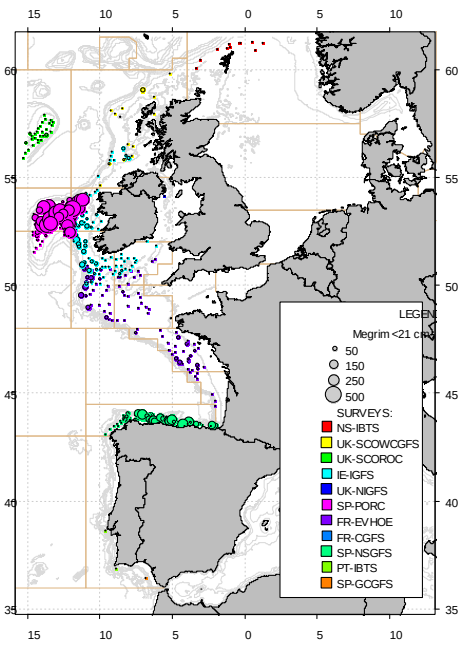


Figure A.6.14. Catches in numbers per hour of megrim recruits, Lepidorhombus whiffiagonis (<21 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

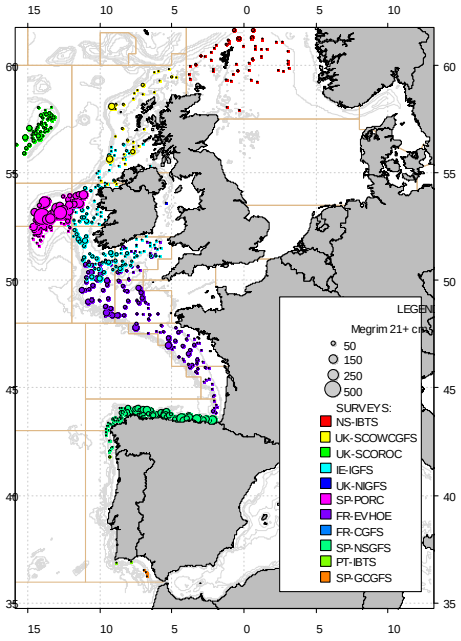


Figure A.6.15. Catches in numbers per hour of 2+ group megrim, Lepidorhombus whiffiagonis (≥21cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

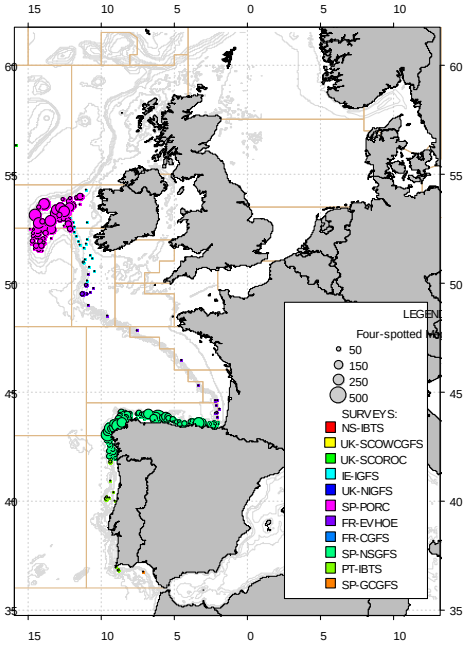


Figure A.6.16. Catches in numbers per hour of recruits of four-spotted megrim, Lepidorhombus boscii (<19 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

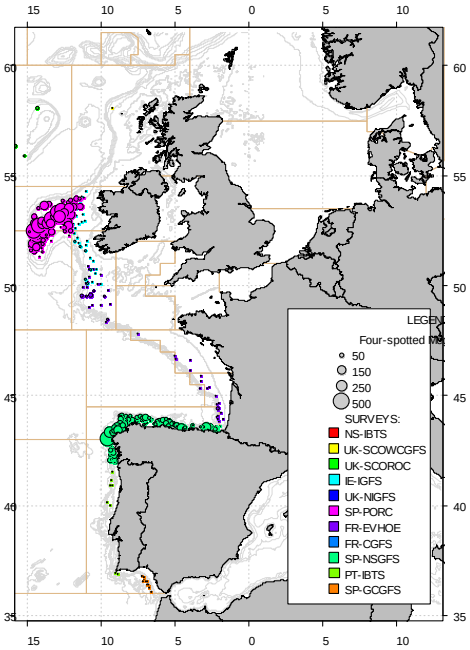


Figure A.6.17. Catches in numbers per hour of 2+ group four-spotted megrim, Lepidorhombus boscii (≥19 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

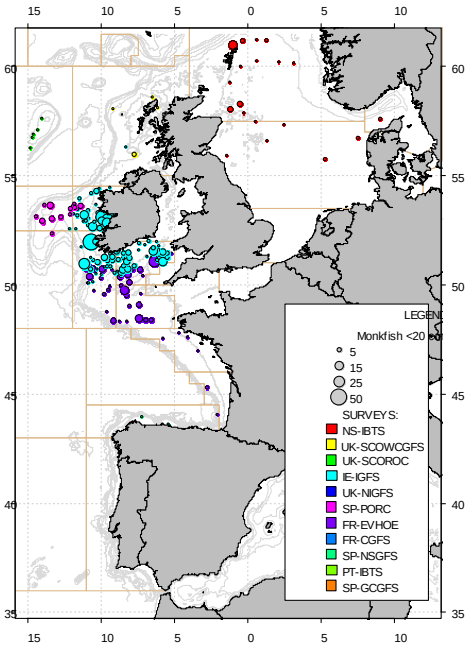


Figure A.6.18. Catches in numbers per hour of 0-group monkfish, Lophius piscatorius (<20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

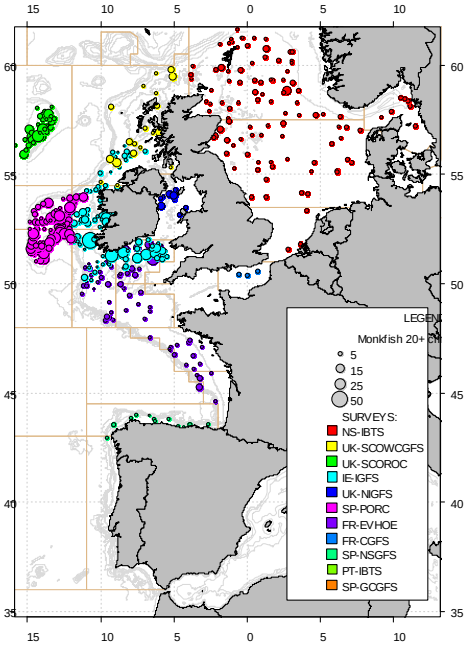


Figure A.6.19. Catches in numbers per hour of 1+ group monkfish, *Lophius piscatorius* (≥20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

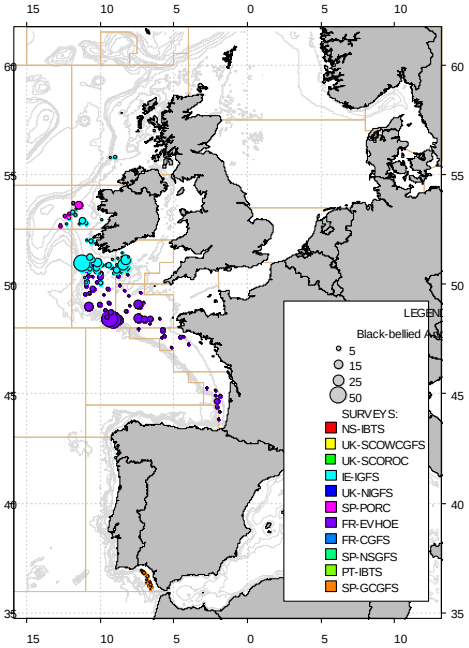


Figure A.6.20. Catches in numbers per hour of 0-group black-bellied anglerfish, *Lophius budegassa* (<20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

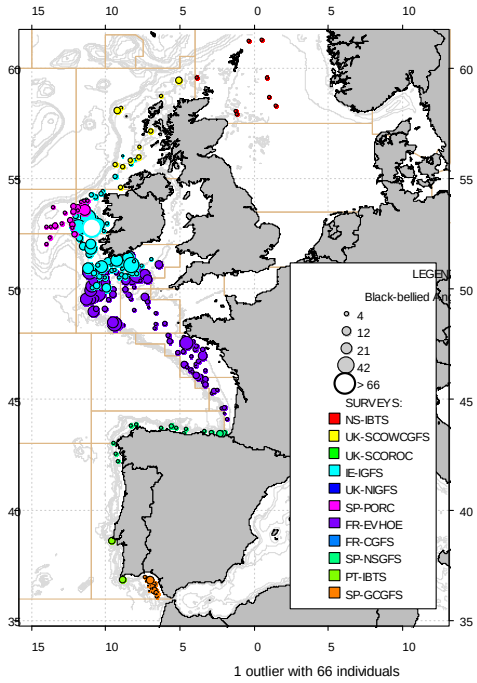


Figure A.6.21. Catches in numbers per hour of 1+ group black-bellied anglerfish, Lophius budegassa(≥20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

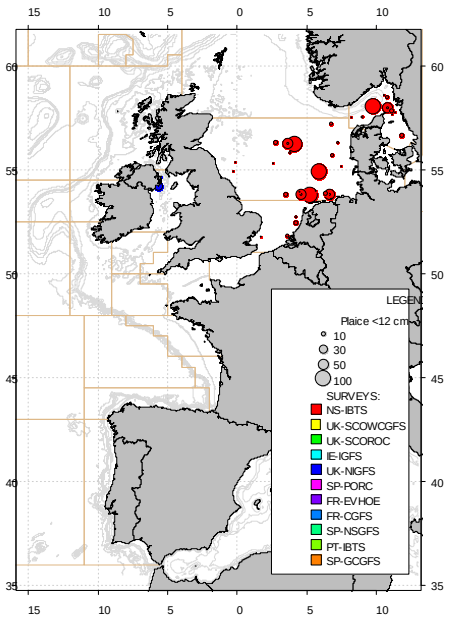


Figure A.6.22. Catches in numbers per hour of 0-group plaice, Pleuronectes platessa(<12 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

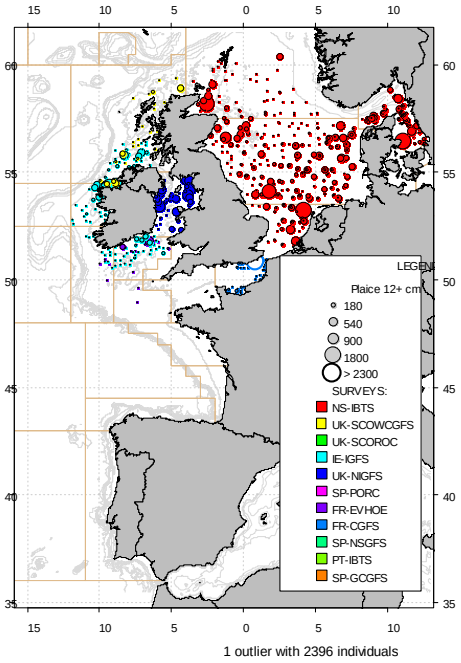


Figure A.6.23. Catches in numbers per hour of 1+ group plaice, Pleuronectes platessa (≥12 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

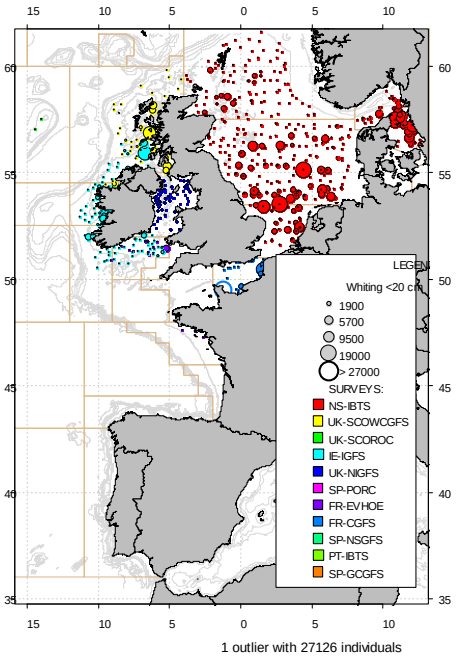


Figure A.6.24. Catches in numbers per hour of 0-group whiting, Merlangius merlangus (<20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

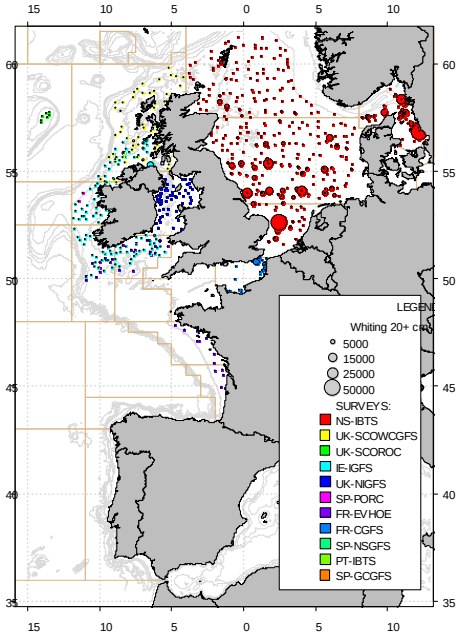


Figure A.6.25. Catches in numbers per hour of 1+ group whiting, Merlangius merlangus (≥20 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

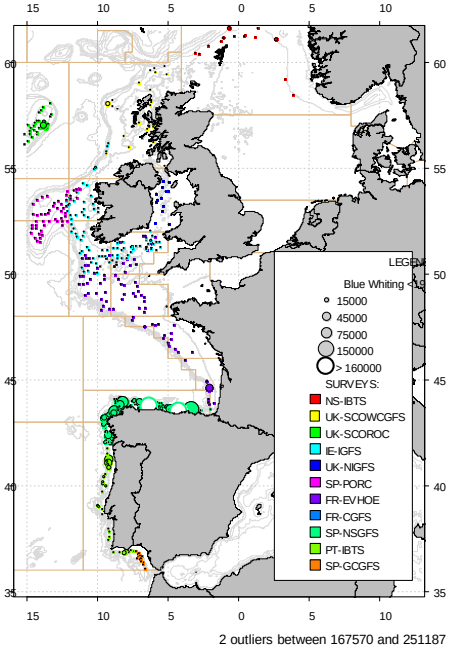


Figure A.6.26. Catches in numbers per hour of 0-group blue whiting, Micromesistius poutassou (<19 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

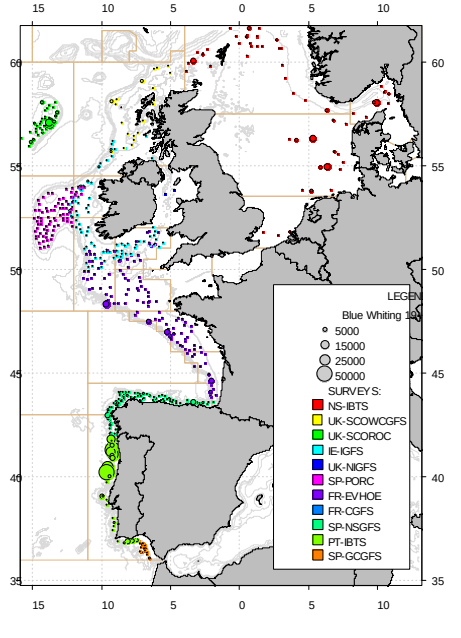


Figure A.6.27. Catches in numbers per hour of 1+ group blue whiting, Micromesistius poutassou (≥19 cm), in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

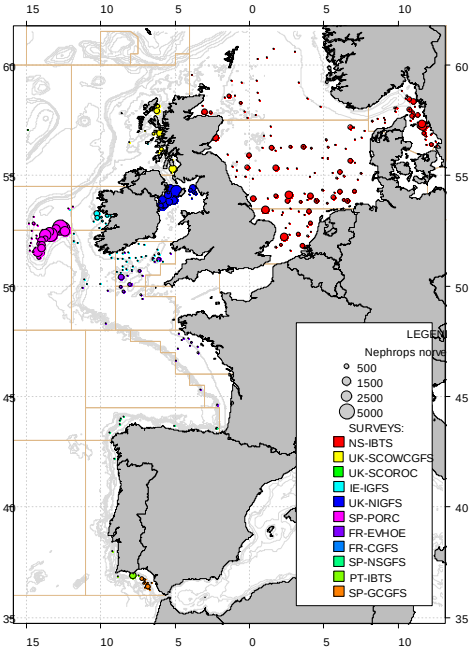


Figure A.6.28. Catches in numbers per hour of Norway lobster, Nephrops norvegicus, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

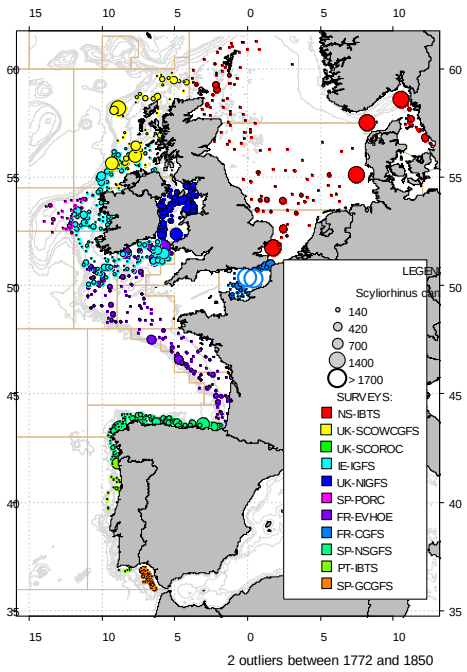


Figure A.6.29. Catches in numbers per hour of lesser spotted dogfish, Scyliorhinus canicula, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

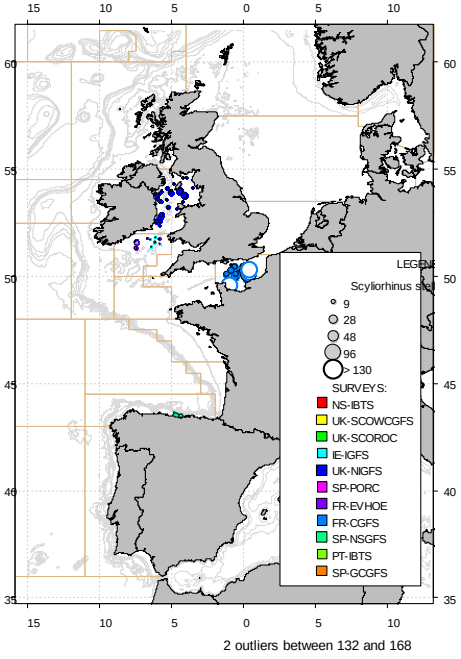


Figure A.6.30. Catches in numbers per hour of nurse hound, Scyliorhinus stellaris, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

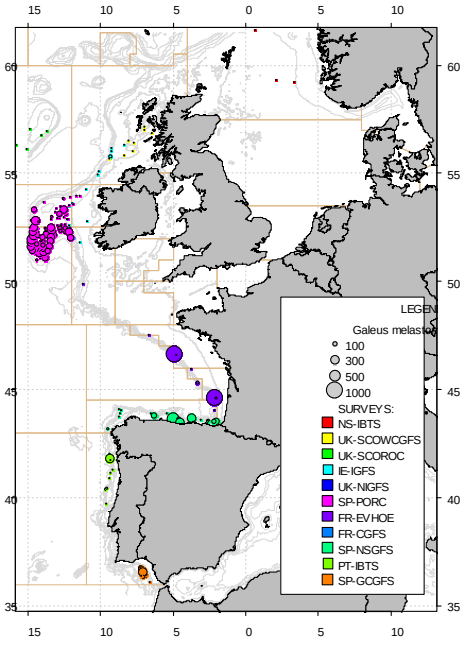


Figure A.6.31. Catches in numbers per hour of Blackmouthed dogfish, Galeus melastomus, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

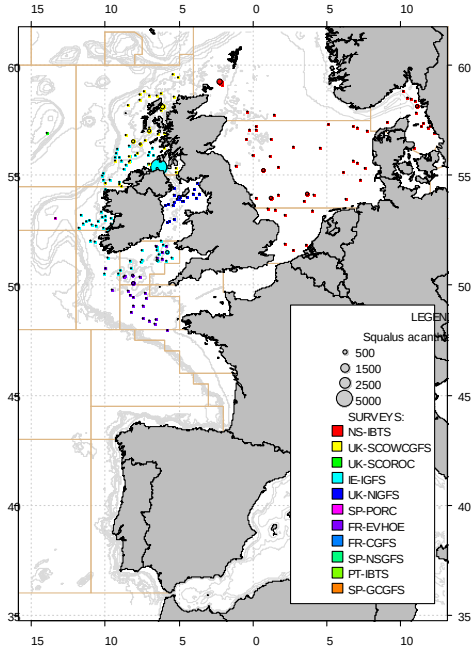


Figure A.6.32. Catches in numbers per hour of spurdog, Squalus acanthias, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

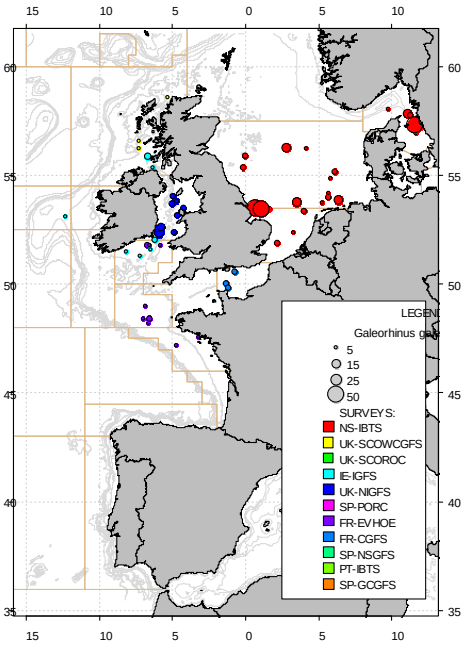


Figure A.6.33. Catches in numbers per hour of tope, Galeorhinus galeus, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

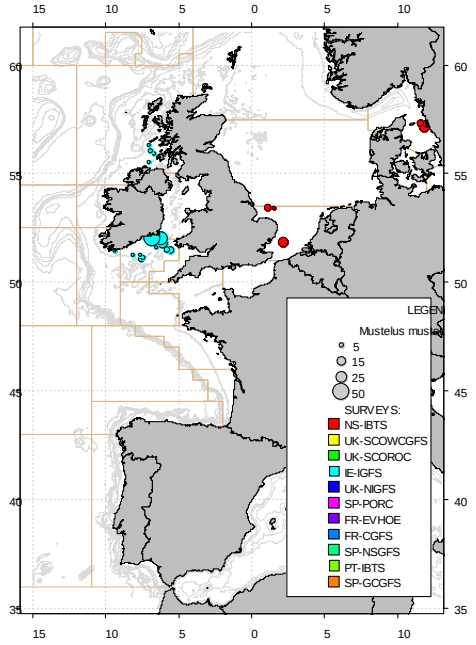


Figure A.6.34. Catches in numbers per hour of smooth-hound, Mustelus mustelus in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

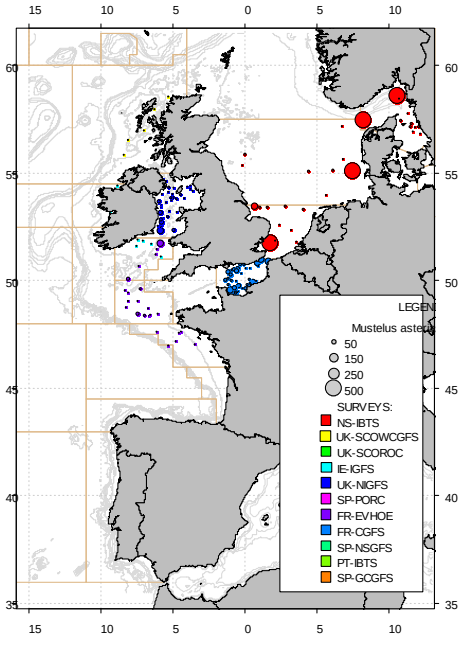


Figure A.6.35. Catches in numbers per hour of smooth-hound, Mustelus asterias, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

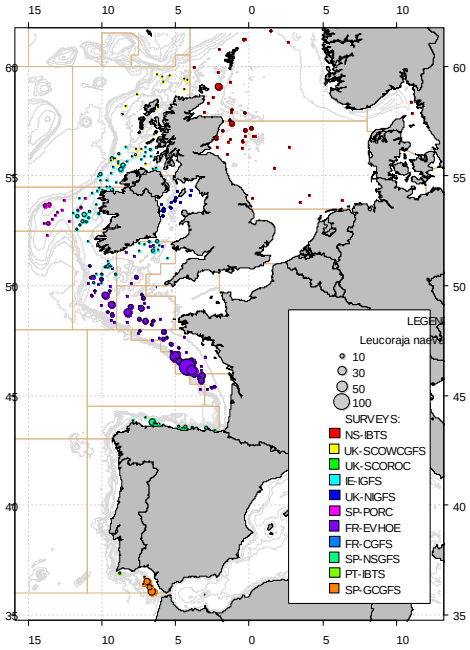


Figure A.6.36. Catches in numbers per hour of cuckoo ray, Leucoraja naevus, in summer/autumn 2018IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

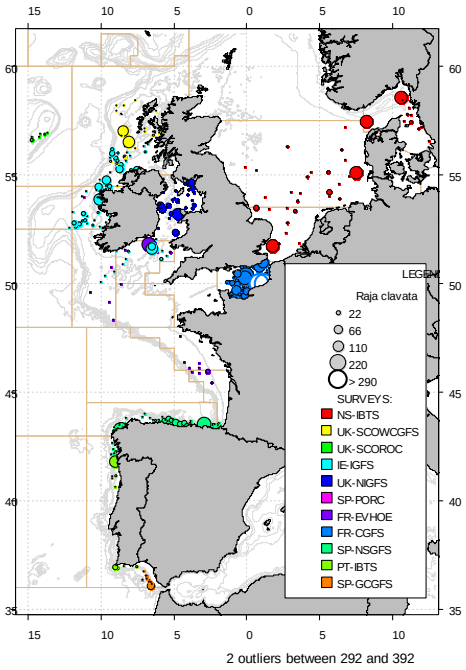


Figure A.6.37. Catches in numbers per hour per hour of thornback ray, Raja clavata, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

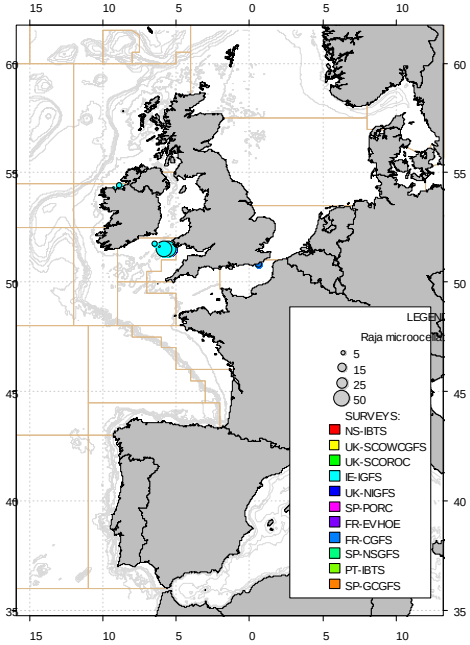


Figure A.6.38. Catches in numbers per hour per hour of small eyed ray, Raja microocellata, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

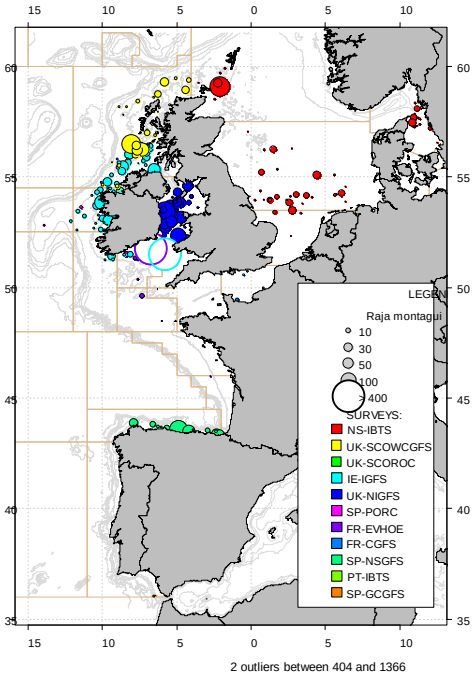


Figure A.6.39. Catches in numbers per hour per hour of spotted ray, Raja montagui, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

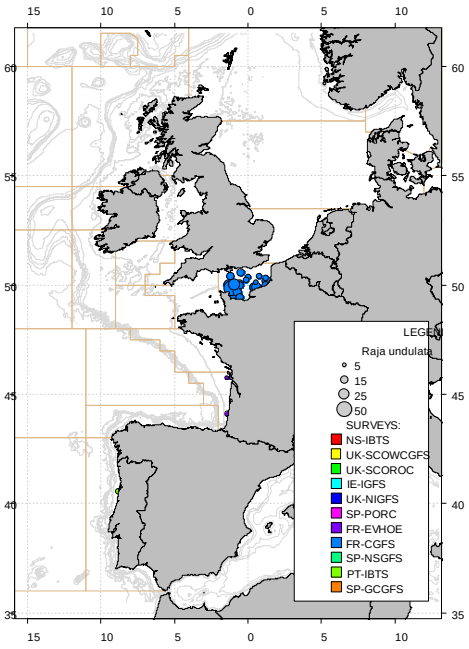


Figure A.6.40. Catches in numbers per hour per hour of undulate ray, Raja undulata, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

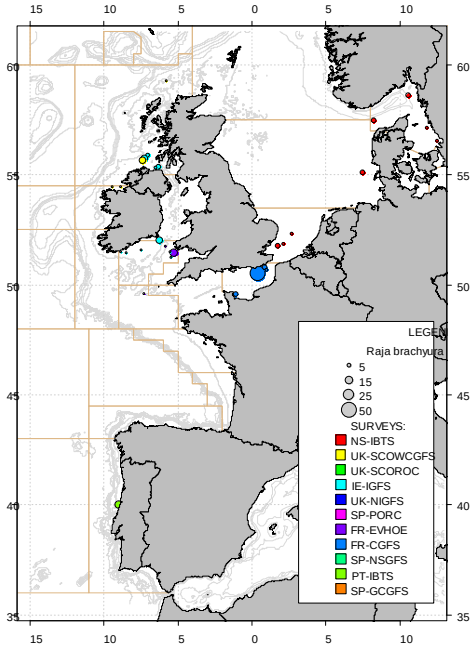


Figure A.6.41. Catches in numbers per hour per hour of Broadnose skate, Raja brachyura, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

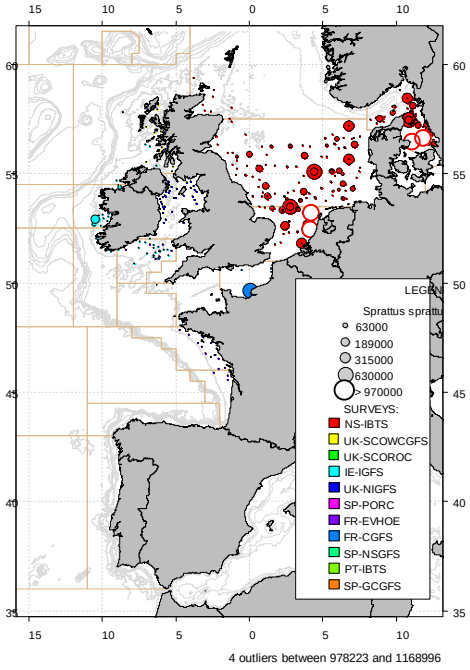


Figure A.6.42. Catches in numbers per hour per hour of European sprat, Sprattus sprattus, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

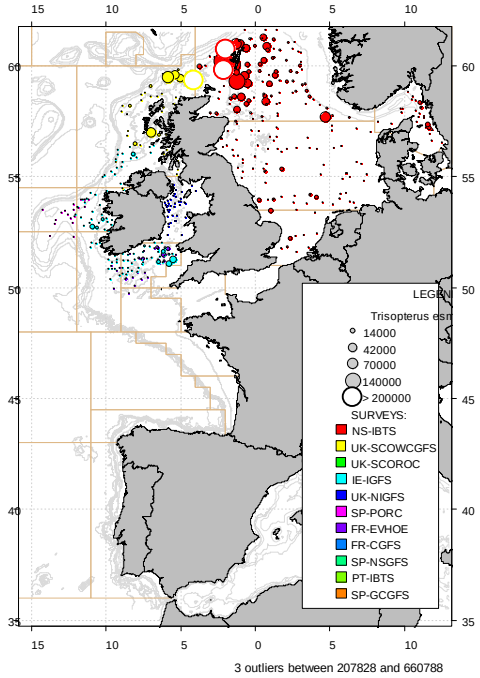


Figure A.6.43. Catches in numbers per hour per hour of Norway pout, Trisopterus esmarkii, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

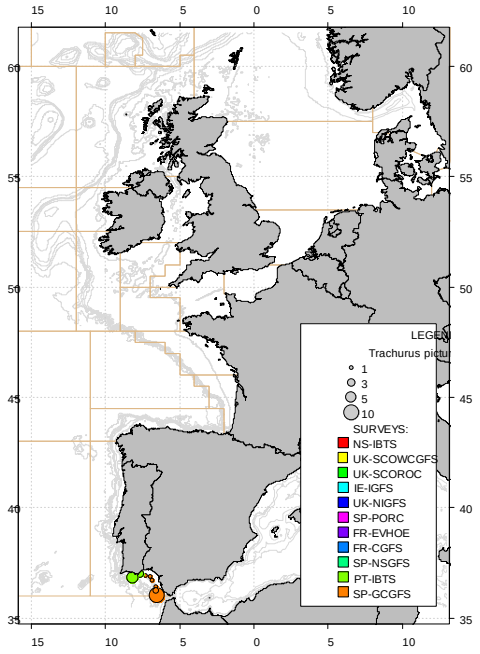


Figure A.6.44. Catches in numbers per hour per hour of blue jack mackerel, Trachurus picturatus, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

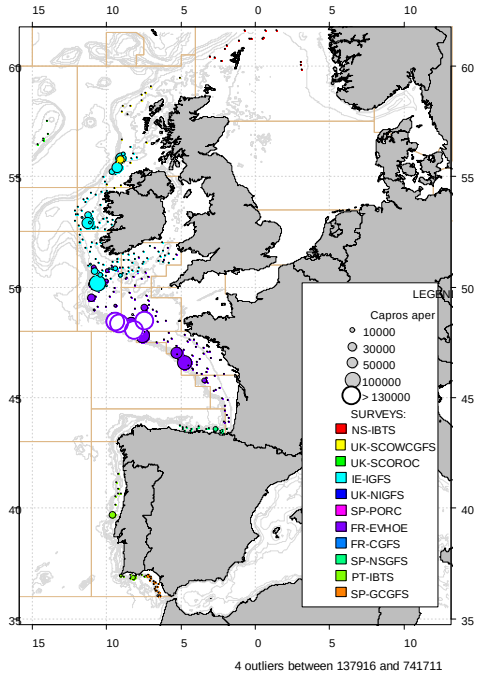


Figure A.6.45. Catches in numbers per hour per hour of Boarfish, Capros aper, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

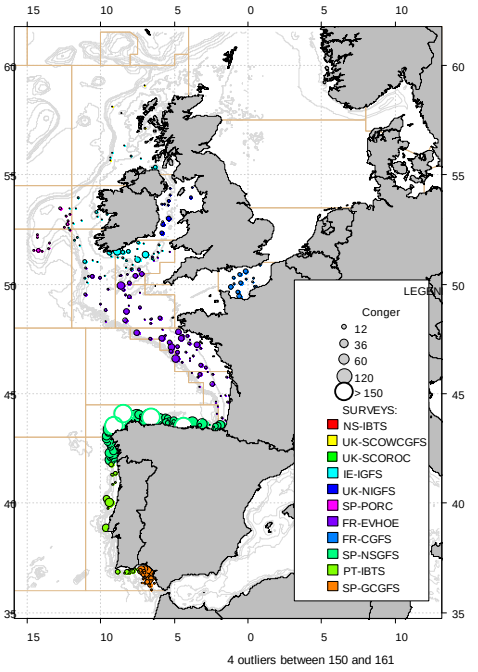


Figure A.6.46. Catches in numbers per hour per hour of Conger, Conger conger, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.

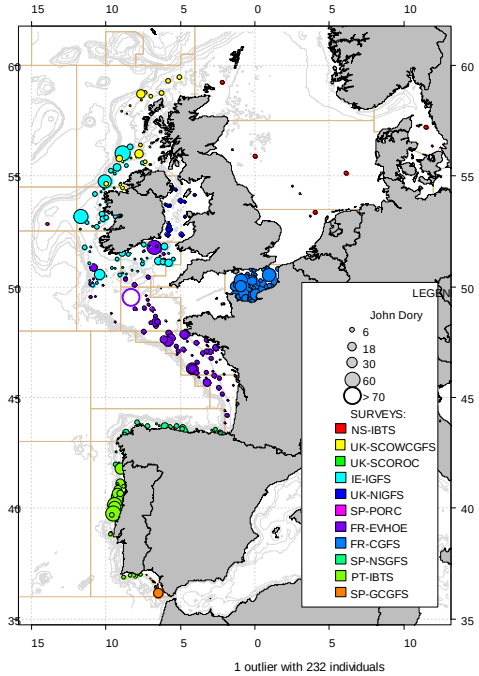


Figure A.6.47. Catches in numbers per hour per hour of John Dory, Zeus faber, in summer/autumn 2018 IBTSurveys. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.