INTERNATIONAL BOTTOM TRAWL SURVEY WORKING GROUP (IBTSWG)

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Contents

i Executive summary

The International Bottom Trawl Survey Working Group (IBTSWG) coordinates fishery-independent multispecies bottom-trawl surveys within the ICES area. These long term monitoring surveys of demersal fish provide data on commercial species for stock assessments and facilitate examination of changes in fish distribution and abundance. The group also promotes the standardization of fishing gears and methods and survey coordination.

This report summarizes the national contributions in 2019–2020 and plans for the 2020–2021 surveys coordinated by 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 continental shelf that ranges from North of Scotland to the Gulf of Cádiz.

The 2019-2020 sampling plan was generally completed for all areas. Some deviations concern the Portuguese survey (PT-PGFS-Q4), which was cancelled for reasons that currently remain unresolved for the 2020 survey. The Channel Groundfish Survey (CGFS) was again extended into the western channel. The French Evaluation Halieutique Ouest De L'Europe (FR-EVHOE-Q4) survey was affected by weather, but the Irish vessel was able to survey most of the missed stations in the Celtic Sea strata. The North Sea International Bottom Trawl Survey (NS-IBTS Q3) found high densities of cod, Norway pout and mackerel outside the index areas. The NS-IBTS Q1 in 2020 was affected by Germany not receiving a permit to fish in UK-waters. This was addressed by redistribution of many stations to other countries. The result is a different distribution of stations by country, and a reduced amount of overlap between countries to estimate the country/vessel-effect. Furthermore, the survey was hampered by two storms resulting in a lower number of GOV and MIK-hauls. This survey observed a very large number of 1-ringer haddock, even as far south as the southern Dutch coast.

Evaluation of methods resulted in corrections for some parameters used to calculate swept-area in the Database of Trawl Surveys (DATRAS) and algorithms were provided to fill in missing values for the NE-Atlantic surveys.

The Scottish organized trials to test new gears proposed for use by the Scottish and Irish. Trials were conducted on board R/V Scotia with participation by both countries and the Dutch. The trials showed more stable gear performance than for the Grande Ouverture Verticale (GOV) trawl and catch data indicated that all species were caught. However, there were differences in catch composition, with the Scottish gear capturing more pelagics (higher net opening), while the Irish gear included more flatfish and other fish species near the bottom (difference in groundrope). These differences may be resolved by adjusting the net opening and groundrope to make the nets more similar. Dutch observers confirmed that both nets operated properly and could be used on their vessels without adjustments. However, they preferred that the Irish gear be made with heavier/stronger netting material and the Scottish gear to include another groundrope. IBTSWG will continue evaluation of these new gears.

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	2
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)
	30 March- 3 April 2020, By Webex and Correspondence (22 participants)
	12-16 April 2021, Lysekil, Sweden.

iii Summary of Work plan (copy from resolution)

Year 1	**Organize 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 time-series
Year 3.	Carry out at sea trials and evaluate results
Recurrent annual activity	Updates for ToRs a, b, and c.

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

- The COVID-19 measures forced the IBTSWG to hold a reduced meeting by WebEx and correspondence.
- Description of survey products: Survey summaries of IBTS coordinated surveys for Q1 2019 (NEA), Q3/Q4 2019 (NS/NEA) and Q1 2020 (NS);
- Update of survey manual for the International Bottom Trawl Surveys in the North Sea has been completed and will be published in 2020;
- Validated NS IBTS Q3 2019 and Q1 2020 datasets (available via DATRAS);
- Validated 13 North eastern Atlantic survey 2019 datasets (available via DATRAS);
- A number of outstanding data errors in the relevant data for calculating the swept-area index have been corrected in DATRAS.
- The ICES data-center shiny-app has been looked at and commented on by a number of participants.
- The developments of a new survey trawl are discussed. Two routes are currently followed. On led by Scotland and the other led by Ireland. Both joined in Nov/Dec 2019 on gear trials on board of the Scottish vessel Scotia. Successful fishing was done with both gears on shallow as well deeper waters within the normal range of the NS-IBTS. The preliminary results indicate that the lighter Scottish gear with a slightly higher net opening caught better the species in the water column like sprat, but the heavier Irish gear caught better the bottom dwelling species. Clearly, this was a rigging aspect and both gears could easily be adopted to have more similar catches. The trials indicated that both gears have good ground contact, do not dig in shallower water, and seem more stable than the GOV.
- Plans for a workshop discussing the technical details of the new gears are developed. The intention is (depending on the Covid 19-measures) to be held this workshop in September/October 2020. In that case it might be possible to use the workshop information in new Scottish gear trials end of 2020. ToR are produced, we are still looking for a chair.
- The outcomes of WKREO (ICES 2020) were presented and discussed. The possible impacts of the WK recommendations on the IBTSWG were considered and most agreed with a necessary evolution of the IBTSWG. On the other hand, there is still no consensus on the modalities, especially the suggestion of separating the work done by the IBTS group into a technical part and a scientific part by regions.

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

2.1 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 northeastern Atlantic (NEA) areas are provided below in figures 2.1.1-2.1.3. 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 2.1. 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.

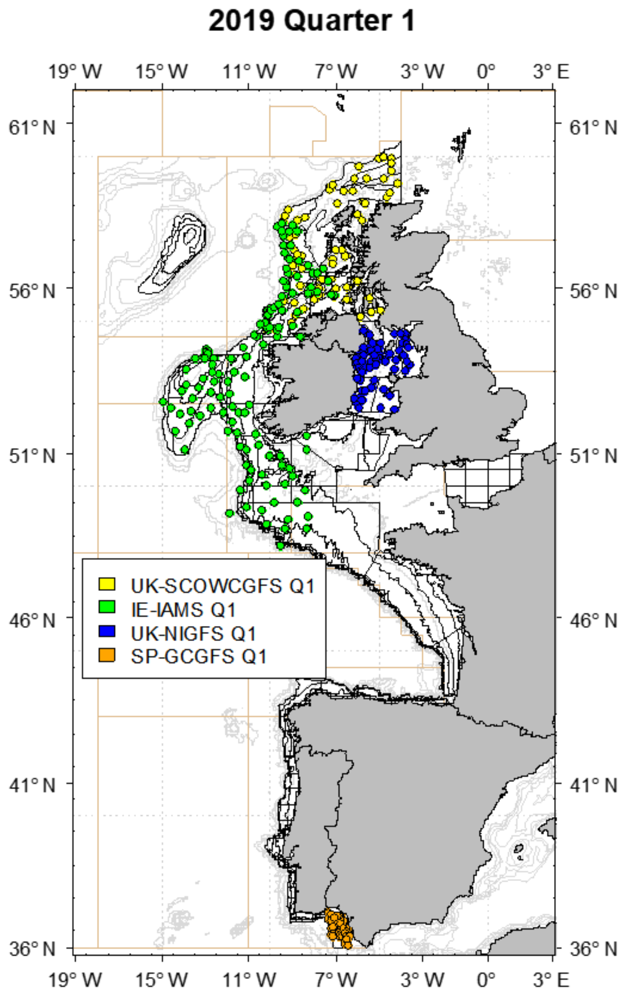


Figure 2.1.1- Station positions for the IBTS carried out during Q1 2019 in the northeastern Atlantic.

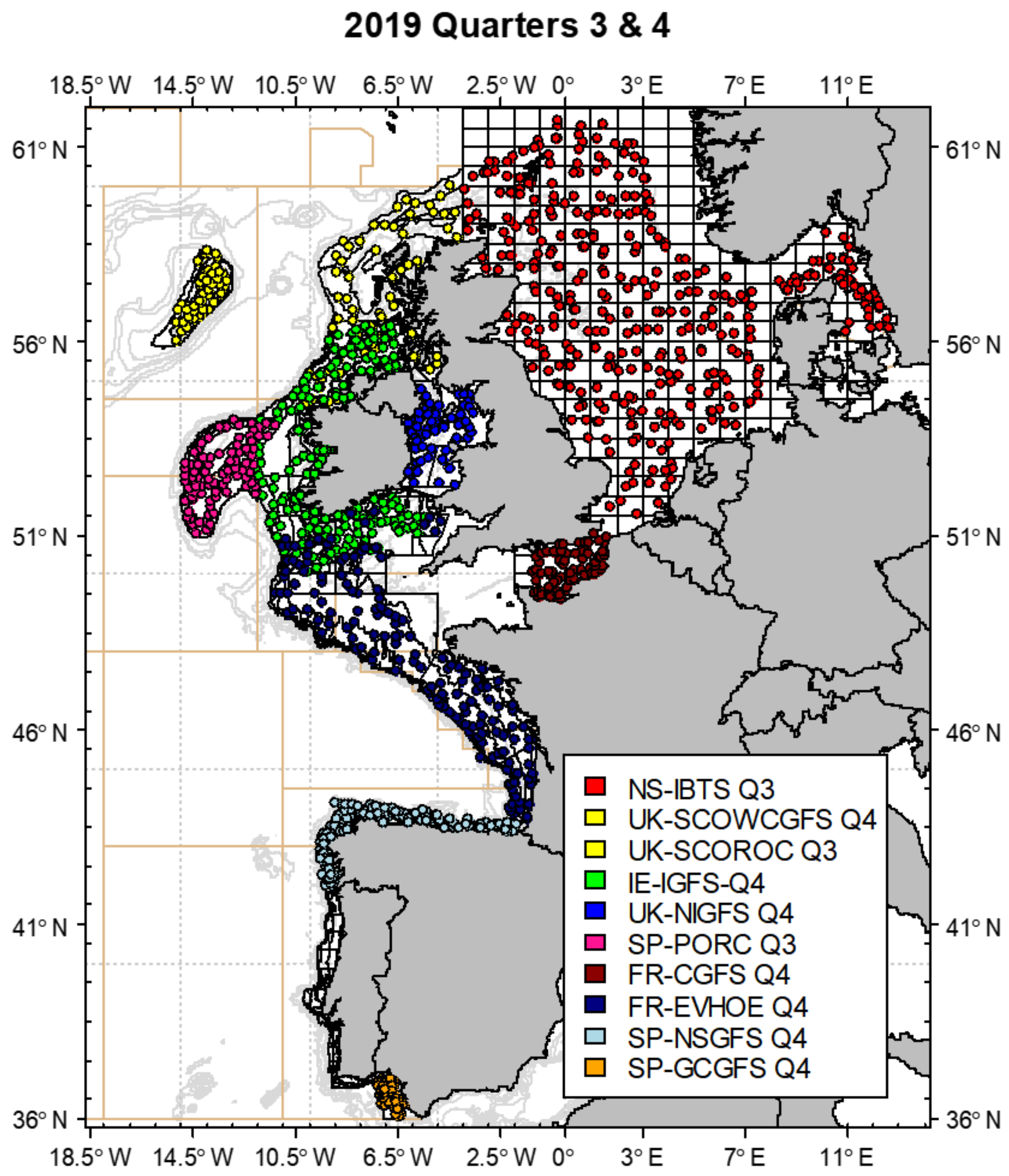


Figure 2.1.2- Station positions for the IBTS carried out in the northeastern Atlantic and North Sea area in Q3/Q4 of 2019.

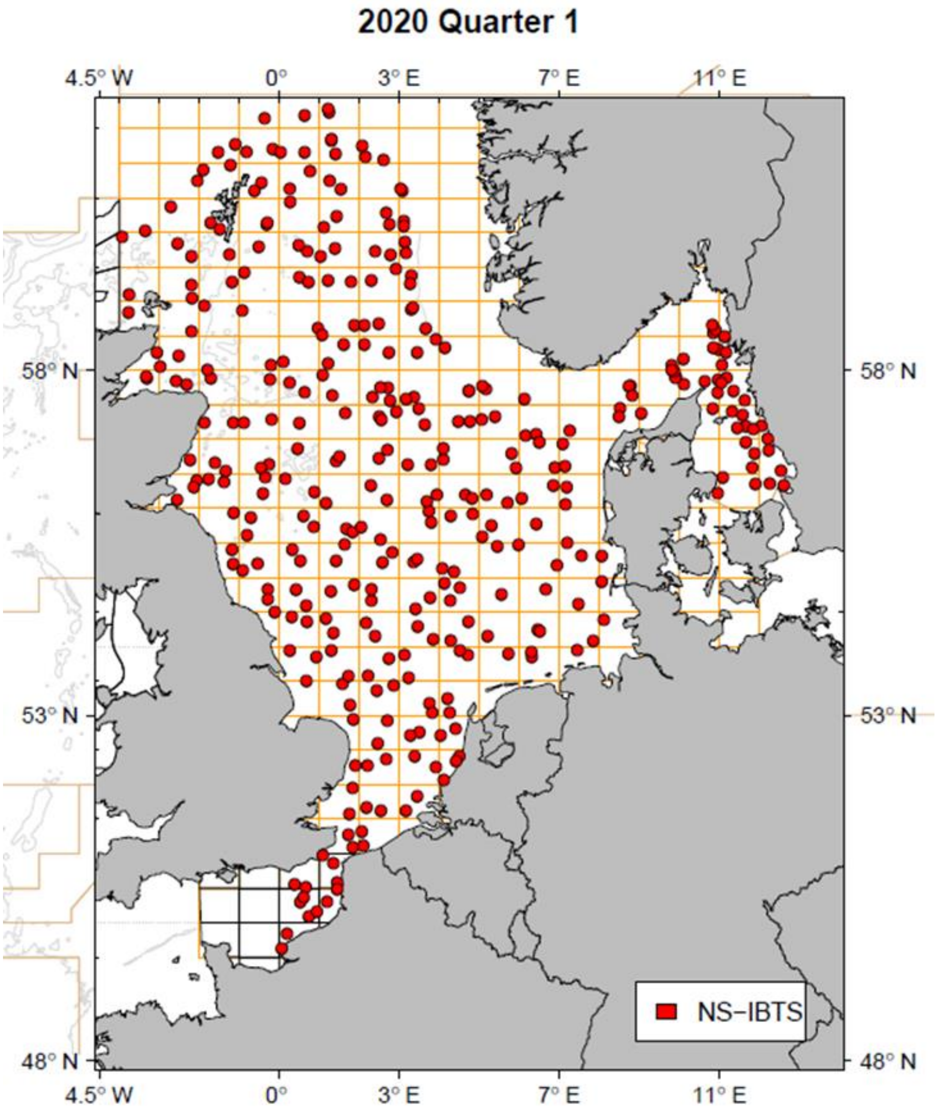


Figure 2.1.3 Station positions for the IBTS carried out during Q1 2020 in the North Sea area.

Table 2.1.1 Species for which distribution maps have been produced, with length split for prerecruit (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 Northeastern Atlantic Areas).

Scientific	Common	Code	Fig No	Length Split (<cm)
Capros aper	Boarfish	BOC	44	
Clupea harengus	Herring	HER	6-7	17.5
Conger conger	Conger	COE	45	
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

Scientific	Common	Code	Fig No	Length Split (<cm)
Leucoraja naevus	Cuckoo Ray	CUR	35	
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 spp.	Smooth Hound	SMH	34	
Nephrops norvegicus	Norway Lobster	NEP	28	
Pleuronectes platessa	European Plaice	PLE	22-23	12
Raja brachyura	Broadnose skate	RJH	40	
Raja clavata	Thornback ray (Roker)	THR	36	
Raja microocellata	Painted/Small Eyed Ray	PTR	37	
Raja montagui	Spotted Ray	SDR	38	
Raja undulata	Undulate Ray	UNR	39	
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	41	
Squalus acanthias	Spurdog	DGS	32	
Trachurus picturatus	Blue Jack Mackerel	JAA	43	
Trachurus trachurus	Horse Mackerel (Scad)	HOM	10-11	15
Trisopterus smarkii	Norway pout	NPO	42	
Zeus faber	John Dory	JOD	46	

2.2 North Sea Q1

(Coordinator: Ralf van Hal)

2.2.1 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 (Methot Isaac Kitt). 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 2020 fleet consisted of six vessels: "Dana" (Germany and Denmark), "GO Sars" (Norway), "Scotia" (Scotland), "Thalassa" (France), "Tridens II" (Netherlands) and "Svea" (Sweden). The survey covered the period 10 January to 3 March 2020. A total of 349 GOV hauls (9 of which were invalid) and 577 valid MIK hauls were deployed. All ICES-rectangles were covered by at least one GOV haul and at least two MIK hauls. The extensive summary report can be found in Annex 3.

2.2.2 Highlights

- Two official storms (Ciara and Dennis) hit the North Sea during the survey period. A Further part of the time the conditions were stormy.
    - Reduction of days-at-sea
    - Direct impact on the distribution of fish
    - Catchability issues while fishing in stormy conditions
    - No deep water hauls by Norway.
- Germany was denied a UK permit.
    - Redistribution of rectangles among countries
    - Reduction in overlap between countries, impacting the estimation of vessel/country effects.
- The new Swedish vessel Svea in use.
    - Some teething problems, reduction in hauls a day.
    - Slight differences in net geometry compared to earlier years on the Dana.
- Norway found the issue for their low net opening, and have been fishing again with a net opening in the range of the limit values.
- Large numbers of 1-ringer haddock, even as far south as the southern Dutch coast.
- Denmark reported low conditions (Fulton's k) in haddock between 35-40 cm of length. Overall this was not observed, it looks more a (persistent) low condition in the southern part of haddock's distribution as there is a clear pattern of improving conditions further north.
- MIK larvae index slightly better than in 2019.
- Large amounts of Sardine larvae in the MIK, even in the Skagerrak and West of Scotland.

2.2.3 Planning and Coordination

Following the IBTSWG 2019 planning some discussions took place and the planning for the 2020 planning was adapted further as Sweden got three additional days-at-sea. Therefore, Sweden got even more stations in the North Sea to increase the overlap between vessels/countries. Owing to the described issues this planning could not be fully fulfilled. For 2021 Sweden again get the three additional days-at-sea, therefore the planning is continue the 2020 planning for 2021 hoping for better weather, a well-functioning vessel and no permit issues. In this 2021 planning Sweden will do seven stations in the North Sea, while Denmark and Norway will do three stations in the Skagerrak (figure 2.2.3.1).

It was requested if Sweden could cover an additional rectangle “43F9” to increase overlap with Denmark in an area where small plaice is caught. This is an additional station not done in any of the previous years. Sweden will try to do this station only when time allows, and will not include it yet in their program.

Currently the planning is that all countries will be using their own research vessel. Sweden will be using the Svea, and Germany will be using the Walther Herwig III as that is expected to be available again. This means all the countries can do the survey in their preferred period, with the majority of hauls to be done in February.

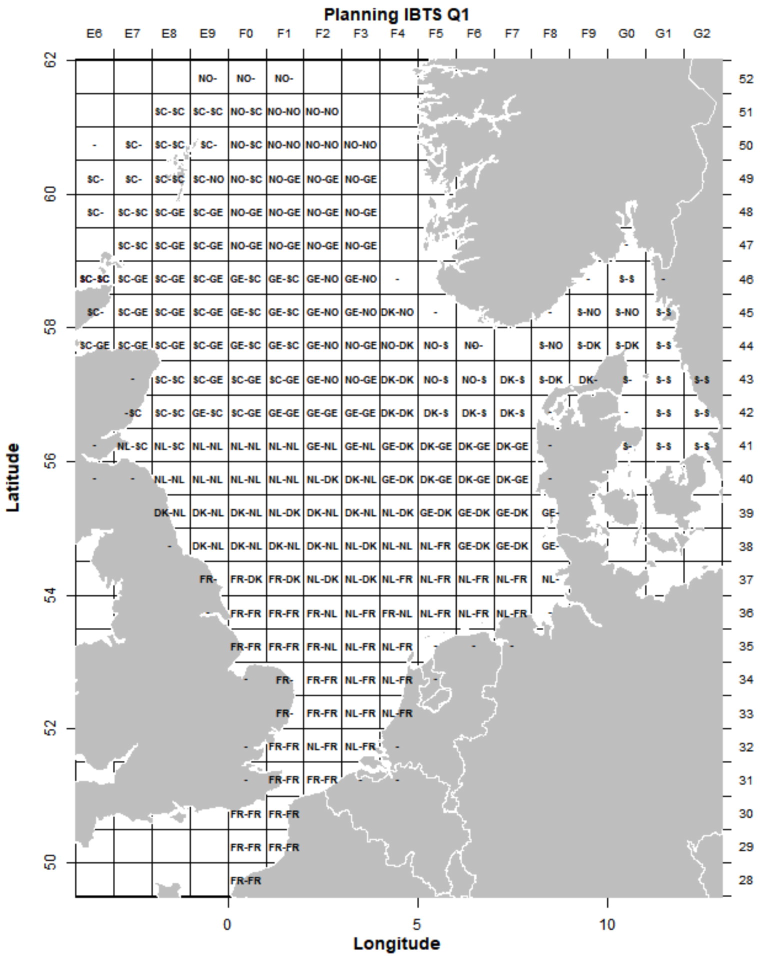


Figure 2.2.3.1 Allocation map for Q1 2021.

2.3 North Sea Q3

(Coordinator: Kai Wieland)

2.3.1 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 groundgear A for normal bottom conditions or groundgear B for rough ground (Scotland in area 4a only) 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 participated in the quarter 3 survey in 2019 using five different vessels: Dana (Denmark and Sweden), Walther Herwig III (Germany), Kristine Bonnevie (Norway), Cefas Endeavour (England) and Scotia (Scotland). The overall survey period extended from 9 July to 2 September 2019. In this period 345 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.

2.3.2 Highlights

- The number of rectangles covered by only one haul was almost the same than in the past three years;
- 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;
- 34 tows reported as valid to DATRAS were shorter than 27 minutes (ENG, GFR, NOR, SCO, SWE) and for 11 tows durations was just 15 minutes (NOR, SCO) due to various reasons;
- For some target species, high densities were found outside the actual index areas, e.g. cod, Norway pout and mackerel. Saithe and plaice index areas were revised during recent benchmarks. For the other species, actual distribution patterns may warrant a revision of the species-specific areas on which the standard indices are calculated in DATRAS;
- Recruitment indices for NS-IBTS standard species (age 0 and age 1, plaice and saithe: age 1 and age 2) were above long term (1991 to present) average for age 0 herring, age 0 and age 1 sprat, age 0 haddock, age 0 and age 1 Norway pout and age 0 mackerel.

2.3.3 Planning and Coordination

All regularly contributing countries intend to participate in the quarter 3 2020 NS-IBTS survey program. Below is a table showing the expected program dates for each country for this year.

Denmark	Dana	28 July to 14 August
England	Cefas Endeavour	30 July to 26 August
Germany	Walther Herwig III	16 July to 14 August
Norway	Kristine Bonnevie	16 July to 9 August
Scotland	Scotia	30 July to 19 August
Sweden	Svea	23 August to 6 September

Some minor changes in the rectangle allocation scheme are planned to increase the overlap between Dana and Svea. The actual rectangle allocation to the countries is show in Figure 2.3.3.1. However, if similar problems for getting permits to UK waters for foreign research vessels as in the 1st quarter 2020 survey occur rectangles have to be swapped between UK and Non-UK vessels. Country specific maps will be provided in the international cruise program in mid-June.

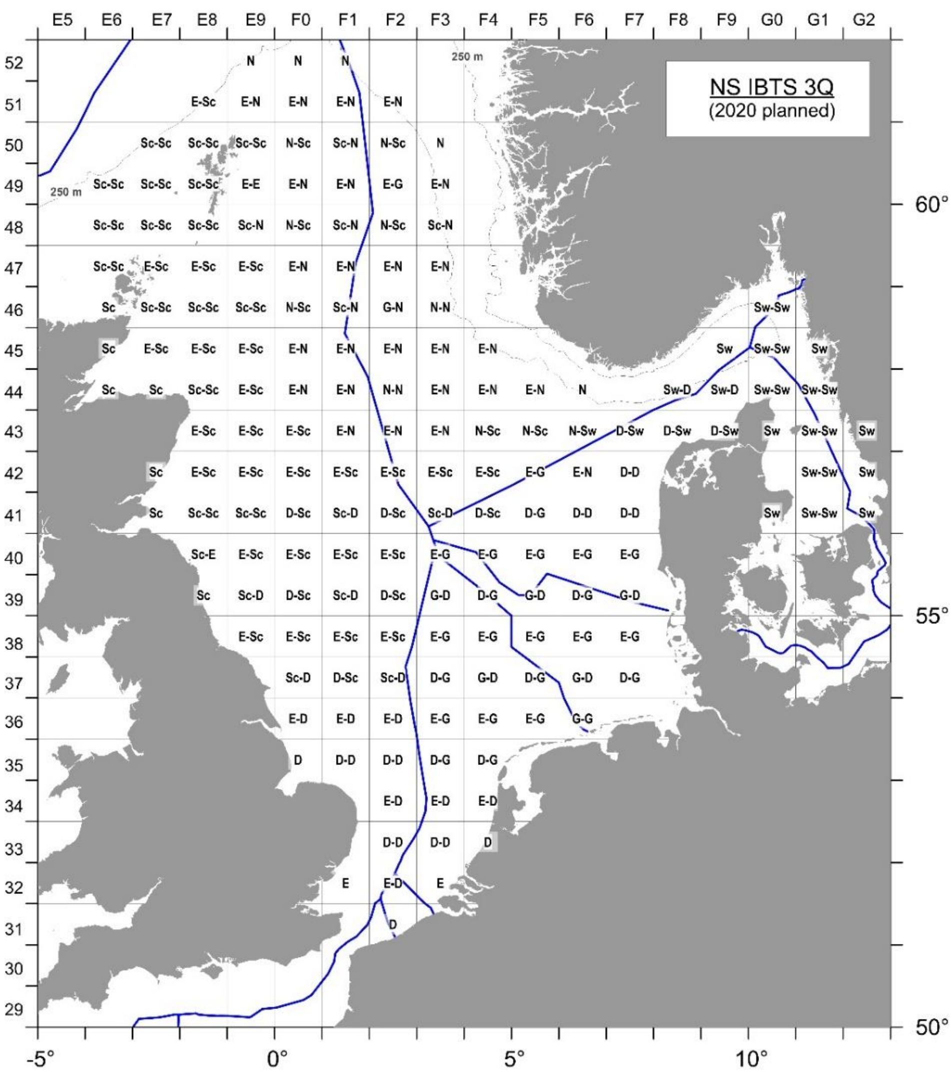


Figure 2.3.3.1. Rectangle allocation by country for the 3Q survey in 2020 (D: Denmark, E: England, G: Germany, N: Norway, Sc: Scotland, Sw: Sweden; EEZ limits indicated by blue lines).

2.4 Northeast Atlantic

(Coordinator: Finlay Burns)

2.4.1 General Overview

In 2019, six vessels from 5 nations performed 13 surveys along the Northeastern Atlantic (NEA) IBTS area. A total of 1071 valid hauls, out of the 1081 hauls planned, were accomplished over 341 days distributed between all quarters of 2019. See table A.5.1.1. In 2019 all surveys with the exception of the Portuguese quarter 4 survey (PT-PGFS-Q4) were undertaken with most of these being completed without significant issue. Four 1st quarter surveys (Scotland, Northern Ireland, Ireland and the Spanish survey in the Gulf of Cadiz) were operating in February and March with the Irish anglerfish survey once again extending into April. Scotland and Spain were also active during the 3rd quarter within the regions of Rockall and Porcupine bank and the Northern Spanish Coast with France, Northern Ireland, Ireland, Scotland and Spain all active during quarter 4. Survey programme highlights as well as the realized and provisional survey dates are contained within the following sections however a more comprehensive summary of survey activities together with the individual survey reports are located within Annex 5.

2.4.2 Highlights

- The 2019 Portuguese survey (PT-GFS-Q4) was cancelled amid significant domestic legal and bureaucratic constraints that have resulted in the paralysis of the research vessels and the continued postponement of the survey programme. The IBTSWG recognizes the efforts made by IPMA in attempting to circumvent this intractable issue and is hopeful that it can be resolved soon allowing the vessels to return to operational service and the PT-GFS-Q4 can be completed in autumn 2020.
- From 2018 onwards the CGFS sampling area has been extended towards the Western English Channel where 45 stations where sampled in 2019 with a bottom trawl adapted to the hard substrate of this area (GOV 36/49). We expect data from the western English Channel could be uploaded to DATRAS and used by ICES expert groups in the upcoming years.
- Severe weather encountered during the FR-EVHOE-Q4 survey forced the N / O Thalassa to cease survey operations for almost 3 days. In an effort to mitigate the impact of the lost time contact was made with the Celtic Explorer in an effort to coordinate and combine survey effort. The Irish vessel was surveying up in the Celtic Sea at the time and was successful in picking up most of the stations within the two affected northern Celtic Sea strata (Cn2 and Cn3). Thanks to the efforts of the Celtic Explorer the realized impact on the survey was minimal.
- Ireland used the first day of the 2019 IGFS to carry out initial set up of the new survey trawl, scaled up for the Celtic Explorer from initial trials on the Celtic Voyager the previous year. The trawl was then shipped to Aberdeen for comparative trials with the Jackson BT237 Trawl. In 2019 some IGFS survey effort was reallocated to the Celtic Sea (7.g & 7.j) due to difficulties encountered by the EHVOE survey in covering this area.
- Ireland's IAMS DATRAS data upload in progress.
- Scotland deployed the Gulf 7 icthyoplankton sampler on thirty occasions during the SCOWCGFS-Q1 in 2019. This was in support of the 2019 mackerel and horse mackerel eggs survey (MEGS), with the results providing valuable survey coverage in the higher latitudes early in the mackerel spawning season. Deployments were completed during the trawl downtime.

- Additional survey days were provided during both SCOWCGFS (Q1+Q4) in order to facilitate the opportunistic deployment and retrieval of passive acoustic moorings for the MSS COMPASS project. These submarine moorings are deployed at specific sites within the Minches and contain hydrophones that monitor and record cetacean activity within the region. Eight moorings were successfully serviced during the two surveys and without impacting on the core survey objectives.

2.4.3 Planning and Coordination

Table 2.4.3.1 below, presents the expected dates for the Northeastern Atlantic IBTS surveys taking place in 2020.

Table 0. Provisional/realized dates for 2020 NeAtl Surveys

Survey	Code	Starting	Ending	Expected hauls	Planned Intercal.
UK-Scotland West (spring)	UK-SCOWCGFS -Q1	16/02/2020	09/03/2020	60	-
UK-Scotland Rockall	UK-SCOROC-Q3	10/09/2020	22/09/2020	40	-
UK-Scotland West (aut.)	UK –SCOWCGFS-Q4	16/11/2020	08/12/2020	60	-
UK-North Ireland (spring)	UK-NIGFS Q1	02/03/2020	20/03/2020	60	-
UK-North Ireland (aut.)	UK-NIGFS Q4	03/10/2020	25/10/2020	60	-
Ireland – Anglerfish Survey 7bcjk	IAMS-Q1	23/02/2020	18/03/2020	65	-
Ireland - Anglerfish Survey 6a	IAMS-Q2	11/04/202	20/04/2020	40	-
Ireland - Groundfish Survey	IE-IGFS-Q4	25/10/2020	10/12/2020	170	-
France – EVHOE	FR-EVHOE-Q4	23/10/2020	07/12/2020	155	-
France - Eastern Channel	FR-CGFS-Q4	17/09/2020	19/10/2020	71	-
Spain – Porcupine	SP-PORC-Q3	05/09/2020	11/10/2020	80	-
Spain - North Coast	SP-NSGFS-Q4	16/09/2020	21/10/2020	116	-
Spain - Gulf of Cádiz (spring)	SP-GCGFS-Q1	18/02/2020	03/03/2020	45	-
Spain - Gulf of Cádiz (aut.)	SP-GCGFS-Q4	29/10/2020	11/11/2020	45	-
Portugal (aut.)	PT-PGFS-Q4	01/10/2020	31/10/2020	96	R/V "Mar Portugal"

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

(Vaishav Soni, Adriana Villamor)

3.1 Recommendations 2019 from IBTSWG to DATRAS

1) IBTSWG recommends to the data centre and ACOM that the documentation on the calculation of data products for IBTS be improved. At present the index calculations as performed by the DATRAS package cannot be replicated from the combination of data and instructions currently available. Particularly the ALK construction is subjective, but there are also significant differences in the CPUE results. This work is essential to implement a complete transparency, and as such an essential part of the transparent assessment framework.	-Automatic ALK procedure is implemented and from 2020 1 Q new indices deliverd to WGNSSK, code fro automatic selection of the ALK avelable on ICES DATRAS github -SweptArea base and CPUE calcaulation is in the plan.
2) Implement data products that will help for yearly reporting, data check and quality assurance. Some of those products initially included into the IBTSWG report could be directly produced by DATRAS (e.g. distribution of abundance for a list of species, gear parameter plots to check/monitor gear performance, ...). Those products should be developed in a transparent way and ideally could utilise existing scripts to produce them.	- Going to extend submisison staus page and some of the data part of the Shiny app development
3) IBTSWG recommends that WGDG and the data center ensure that DATRAS IBTSWG recommends that WGDG and the data centre ensure that DATRAS maintains information on biological sampling design changes such as number of otoliths taken per length class, stratified by sex or roundfish area etc. along with the data collections. This meta data is very important in evaluating survey efficiency and autocorrelation estimation. Such data are also highly relevant for a data quality assurance framework and should be implemented with urgency.	- Implemented the new field and part of the new exchange format in CA redord - Historical submission ?

The first recommendation has been well developed during this year by the DATRAS team in close communication with IBTSWG and WGNSSK chairs and the stock assessors using DATRAS indices in their stock assessments. This point will be developed later on.

Regarding the second recommendation, DATRAS team is setting up now an extended submission status front end, where uploaders can better check what is being uploaded. Furthermore, a shiny app for data mining of DATRAS is being circulated for feedback around the survey groups. If requested DATRAS team will try to fit in some of the recurrent products and figures used by the groups every year. All new products and calculations are being developed in R scripts and published in one of ICES github repositories, so transparency and replicability are assured.

The third recommendation will be finalized when the unified format submission is implemented, as in the unified format these new fields are already included.

2. Unified format status and timeline

The implementation of the unified format in DATRAS includes two consecutive phases to finalize the conversion of the database architecture:

In the first phase all surveys will submit all fields in all records. The new fields are:

HH	HL	CA
CodendMesh	DevStage	FishID
SecchiDepth	LenMeasType	GenSamp
Turbidity		StomSamp
TidePhase		AgeSource
TideSpeed		AgePrepMet
PelSampType		OtGrading
MinTrawlDepth		ParSamp
MaxTrawlDepth		MarurityScale

In this phase DATRAS team will set up the new format survey by survey. According to the initial timeline NS-IBTS should have been able to submit in the new format already in 2020 Q1 however unforeseen circumstances delayed this implementation a few weeks. However routines are ready and in testing phase, and DATRAS will open this submission in the next few months. When this happens, DATRAS team will ask NS-IBTS help to test the new upload and format (Corina Chaves and Barbara Bland offer to be part of the test panel for the Unified format).

In the second phase, the submission format will have to include headers for all record types. This new development will allow to submit only desired fields by excluding unused fields and their headers. This second phase will be ready for submission in 2020 Q3.

3. Upload overview development and timeline

This overview will be shown after the screening of data, before the upload. It will also be available in the submission status page, where for the time being only number of hauls and date is visible.

The overview will cover these details:

- Total HH, HL and CA
- Invalid hauls, Haul durations
- StatRec and DepthStrata covered
- Species in HL and CA
- Hauls per target species
- Data Types C, S and R
- HLNoAtLngt and CANoAtLngt per species
- Summary of maturity and agerings per species
- Age readings missing for target species

The front end development is expected to take place during Q3, so it will be implemented by the end of 2020.

4. New indices manualvs.automatic ALK

Currently there are 2 different time-series in DATRAS, which provided to assessment group

1) Manual substitution processed indices till 2019 3 Q
2) Automatic substitution processed indices for whole time-series.

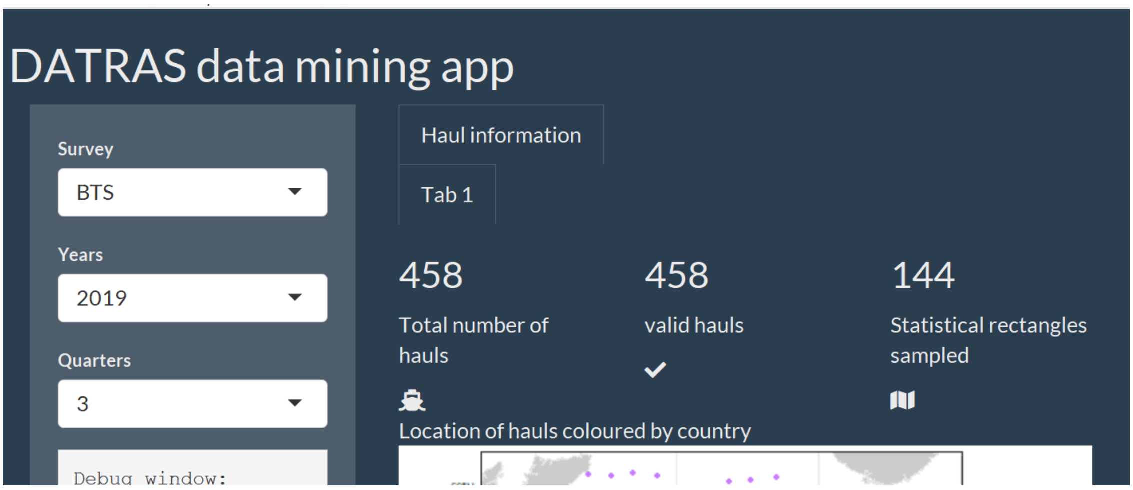
Manual approach available on the web, and automatic approach data are available on SharePoint folder, this is not an optimum way to facilitate both product, so DATRAS team suggesting providing both Indices on the download page with different naming.

3.1.1 DATRAS data mining shiny app.

This shiny app is intended to help users, to have a quick view of data availability, and hopefully to save some time in preparatory work for WGs. The published version is a draft and it has been circulated to the survey groups for specific feedback.

Link : https://ices-taf.shinyapps.io/DATRAS-data-mining/

The published version is quite slow and some existing headers do not display properly.



The timeline for the implementation of this shiny app is not strict. The published version will be improved with the feedback from working groups, but we expect it to evolve with time with the requests from different users. We define the end of 2020 as a tentative date to implement successfully the requests from the survey groups.

The IBTSWG did look at the draft version of the shiny app and recognizes that the current version is an early stage of its development. Some minor comments were made to adjust some of the current figures or put some additional information in the headers or the labels of axis. More specific were the comments on the current types of figures, which are not the ones currently used by the IBTSWG, see the figures in this report. The IBTSWG would like to see figures as those in paragraph 2.1 and those on species level by age or length in the appendix. When these could be made with the shiny app and then made available on the ICES website that would reduce a lot of work for producing this report. Those graphs would have the first priority according to the IBTSWG.

Following the presentation of the shiny app, the shiny-app of the Marine Institute Ireland was shown with a number of interesting features that could be of interest for the ICES shiny-app. The Marine Institute offers to share what they have used with the ICES data centre.

Recommendations:

- Set priorities on the development aspects of the Shiny-app, and distribute this list to the Survey WGs to comment on.
- The IBTSWG recommends to set the first priority on producing the maps as in this reports paragraph 2.1 and the species maps in appendix (annex 6).
- Second priority would be a download function for the specific data shown in the app figures.

Marine Institute has a shiny-app for their survey data running (https://shiny.marine.ie/igfs/). Use this app as a reference for building own futures. The codes for this are available.

3.1.2 Development of data manager tools to check upload vs. download data

The differences between uploaded data and data available in the download are among the most recurrent issues in DATRAS workflow. The existence of a large variety of calculations and transformations done to the original data, in connection with other ICES databases, with stored and changing procedures, to provide the data products is behind these issues.

In the DATRAS team we are trying to develop some practices to detect inconsistencies as soon as the data are uploaded and the data warehouse updated. The procedure is ready and aims to simple parameters as number of records, number of hauls per species, sum of CANoAtLngt, empty variables and number of species and hauls in every data product between the uploaded and the downloadable data.

We still need to fully define the timing of these checks in order to optimize time use of the data manager but it will be run mainly after submission deadlines and before WGs.

3.1.3 ALK automated substitution procedure

This process has taken several years, but 2020 Q1 is the first time the data products are calculated following this automated procedure, not the manual substitution as performed until now.

Further details on the process will be soon available as a document in DATRAS web.

It is still pending to get feedback from assessment groups on what time-series should be available in DATRAS, either the old time-series (which is still the official one, available online), or the new time-series calculated following the automated ALK automated substitution.

The calculation procedure is available in the DATRAS tools github repository:

https://github.com/ices-tools-prod/DATRAS

3.1.4 Online Github training for survey groups members

Following a request from several members of WGBEAM, ICES secretariat will offer a short online training on the use of github repositories for collaborative working, either projects or scripts, for those survey groups members willing to learn more about it in order to apply it for their tasks, calculations, etc.

We kindly ask the chair of IBTSWG to inform DATRAS team on the members of the group that have shown interest in this training.

3.1.5 Flexfile

IBTSWG agreed in 2013 to move from n/hr based indices towards swept-area based indices (ICES 2013) following a recommendation from WGISDAA and WKDATR (ICES 2014). Effort for providing quality checked information required for the estimation of swept-area started in 2014 and updated information was provided to IBTSWG in 2015 (ICES 2015). However, several gaps in the dataset were identified during WKSABI in early 2019 (ICES 2019b). Here, a new format for the so-called flexfile was agreed and a new version of the flexfile has become available in 2020 from DATRAS.

Despite the effort of cleaning the data required for calculating the swept-area or filling in the missing values with country specific algorithms a number errors still exist as is shown in the working document on door spread (Annex 7). These consist mainly of Norwegian data records that need to be corrected, along with minor issues in the data of other countries. Next to the working document, minor issues on other relevant variables as wingspread and warp length were identified and the majority of these were corrected during the IBTSWG.

Flexfiles are not yet available for the NE Atlantic surveys. A working document reviewing the available data for the NE Atlantic surveys can be found in annex 8. It provides information on door spread from each survey based upon what is already present on DATRAS together with regression plots and corresponding algorithms presenting the survey specific relationships between depth and horizontal net opening. The datacenter intends to work intersessionally with the relevant national laboratories to ensure that these algorithms are validated. This will be undertaken by checking the replicability of derived estimates for missing values and once verified will be incorporated in the new R-codes. Subsequent to completion of the approval process, the flexfiles should then be available.

4 New survey trawl gear (ToR c)

(Rob Kynoch, Dave Stokes, Ralf van Hal)

4.1 Introduction

The IBTSWG has a wish for a new survey trawl gear. The wish originated from CEFAS wanting to change their netting material to polyethylene as the nylon netting material was hard to get and getting too expensive. The plead that the same is true for other parts of the current GOV, which is an outdated net. From those discussions it appeared that other member had already changed some parts of the GOV and questions arose is these changes could have influence on the consistency of the time-series. As a result and review was made of the current GOVs in use by the various members and the conclusion of this was “No GOV construction currently in use matches the net plan given in the standard manual. Other trawl components vary to a lesser or greater extent from the standard” (ICES 2015).

Based upon this conclusion, the problems with sourcing the materials, and the wish for extending the survey into rockier grounds, it was decided best to develop a new survey trawl gear.

In the last years, Scotland and Ireland took the lead in this and both have developed a new gear and have done trials with it (ICES, 2019a). Since the IBTSWG 2019, the workshop NSIMP has occurred (ICES, 2019c) outlining a road map for the introduction of a new survey gear. And additional gear trials have been done on board of the Scottish vessel Scotia. During the trials the Scottish and Irish gears were compared with the current GOV. This was done under the auspices of the Scottish, Irish, and Dutch gear technicians.

During the IBTSWG meeting the preliminary results of the Scottish gear trials were presented and the work done by WKNSIMP was briefly discussed.

4.2 WKNSIMP

WKNSIMP concluded from past experiences that in order to be effective, inter-ship calibration experiments would need to be very extensive covering multiple habitats and a large number of samples. The resources for an effective calibration exercise are unlikely to be available. In addition, the IBTS survey design lends itself to estimating ship effects due to the overlap inherent in the survey design. Implementing the new gear on the IBTS surveys should follow a similar approach as suggested for the introduction of new vessels for the same reasons as the ships approach. A phased introduction of the new gear in both quarters prioritizing ships that spatially overlap that have precise estimates of ship effects (actually combined ships and gear effects).

- Nov/Dec 2019: Scotia gear trials

  IBTSWG: these are done as planned see next heading.

- Apr 2020: IBTS WG decides on gear

  IBTSWG: Unfortunately, not possible as due to the Covid-measures analyses were not done yet. Furthermore, it was considered best to postpone this to after the workshop meant in the following bullet and take advantage of the next gear trials end of this year.

• May 2020: Workshop with scientists in charge and fishing masters

> IBTSWG: Owing to the Covid-measures a new Workshop in May is impossible, it is extended till later this year. The Terms of Reference for this workshop are developed.

• June 2020 – Feb 2021: Gear tests by every country/vessel

> IBTSWG: Potentially possible to do some tests during Q1 2021, but more likely this will become 2021-2022.

• Apr 2021: IBTSWG discuss results, define minimum and maximum limits for vertical opening and door spread for valid tows and prepare final manual on the new gear

> IBTSWG: This will become deciding upon a new gear, considering the outcomes of the workshop and the latest trials results.

• Feb 2022: structure phased implementation of new survey gear by all countries in the Q1 survey.

4.3 Scottish gear trials

Further catch comparison and gear geometry trials were carried out using the new survey trawl (designated BT237) being developed by Marine Scotland (MS) Science as a possible replacement to the GOV trawl. The trials were undertaken over 12 days, between the 28th November and the 9th December, and looked to build on data obtained during the 2018 trials (IBTS Report 2018). The main objectives for these second trials were:

- To undertake further catch comparison tows in shallow water depth (<60m) comparing the performance of the new BT237 against the Scottish GOV with groundgear A.
- To test the new trawl design developed by Marine Institute (MI), Ireland (designated MI Trawl) and compare the fishing performance between the MI and BT237 trawl designs.
- To assess gear geometry for i) the MI trawl to ensure it was operating correctly; ii) BT237 at shallower water depths (<80m), iii) compare gear performance with data obtained during the 2018 trials.

Participation

The crew during the survey mainly consisted of the Scottish survey persons. Also some Irish survey persons and gear technicians and the Dutch gear technician and a boat swain of the Dutch research vessel joined the trials.

Fishing gear

<u>BT237 - new Scottish gear</u>

The design and rigging of the BT237 trawl was unchanged since the 2018 cruise and utilizes current commercial net design features in its construction. It was rigged with a light rockhopper groundgear incorporating 300mm discs in the centre and 250mm out to the wings, all rigged onto 16mm mid-link chain. The trawlnetting incorporates cutaway lower wings, guard meshes/tearing strips and is considered to be a robust and simple design compared to the GOV trawl. The Scottish GOV (Control) was rigged as per standard for Scottish IBTS North Sea surveys[1] with the Scottish version of groundgear A and 47m sweeps.

MI Trawl – new Irish gear

As reported in IBTSWG 2019 (ICES 2019a), the Marine Institute design process was to start with a blank sheet of paper. Firstly, designs for the GOV, Baca and Campelen trawls used in the IBTS area (including US) were contrasted using the guidelines outlined in the 2009 SGSTS[2] report.

The seven workshops (SGSTG 03-04 and SGSTS 05-09) leading to the SGSTS recommendations brought into sharp focus the scope of information to be considered when tackling this TOR. Addressing target species, seabed type, depth, vessel power, fishing practices and available materials across such a large heterogeneous area will always require pragmatism and some compromise. After much workshop discussion, focusing on actual data from field trials and the literature, the SGSTS group agreed on the shortlist of key principles. In terms of starting out on a new trawl design, the recommendations that the MI team felt would be extremely difficult to modify at a later point and they should focus on were:

1. Simple net panel design
2. No complicated joins
3. Simple tapers

Net panels and joins

Firstly, to remove or reduce complicated joins between panels a trawl could use one or two mesh sizes throughout the trawl. This approach means a compromise between loosing fish through large meshes throughout the trawl or else losing time mending small meshes at the front of a trawl where damage normally occurs.

The alternative is to have several panels, close in mesh size, so that they can be joined by a simple one to one join across the panel (Fig 4.3.1).

The MI adopted the latter option as it offers maximum flexibility in mesh size selectivity throughout the trawl and any additional work in construction is done on land before the survey. It was felt this would offer the simplest panel design possible for repair at sea without compromising the range of mesh sizes that might be desired for sampling purposes.

Straight joins between panels in turn affords the use of a few simple tapers to produce its overall shape. In this particular net, there are just three tapers in the main body of the trawl.

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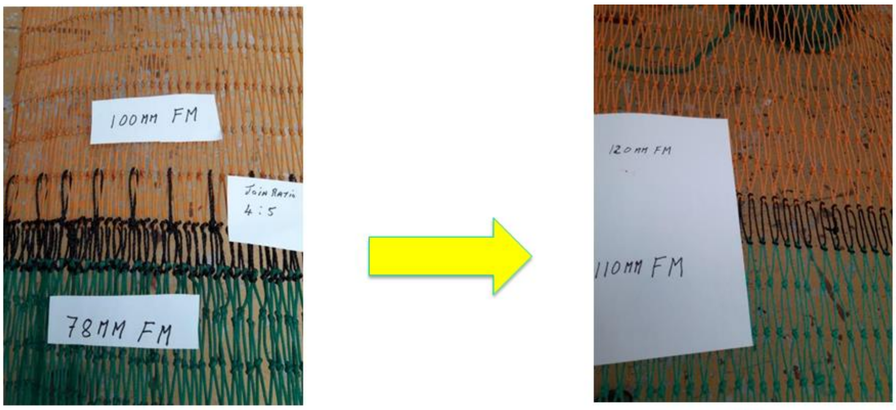
[1] ICES. 2015. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 10A, Version 10. 86 pp. http://doi.org/10.17895/ices.pub.5713

[2] ICES. 2009. Report of the Study Group on Survey Trawl Standardisation (SGSTS), by correspondence. ICES CM 2009/FTC:09. 127 pp.



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

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

Figure 4.3.1. Demonstrates difference between mesh for mesh joins or using strollers/baitings.

Trawl taper (cutting rate)

On the Top Panel for example (Fig 4.3.3) from the main wing piece to the start of the cod-end there is only one taper of 1 Point (Knot) 3 bar (1P3B). Therefore the Top/lower section have only three tapers, whereas both the GOV and many commercial trawls including the Scottish BT237 have five or more changes in cutting rate over the same area (excluding additional national differences in tearing strips). These design features make an uncomplicated trawl, easy to repair and deploy.

Sweepline rig

The sweepline rig for BT237 and GOV are detailed in Figure 4.3.4 and MI Trawlnet in Figure 4.3.5. All three gears were fished with the same set of Morgere Polyvalent trawl doors, which are the standard trawl doors for all Scottish IBTS surveys.

Figure 4.3.2 – MI Trawl on top drum BT237 on lower drum

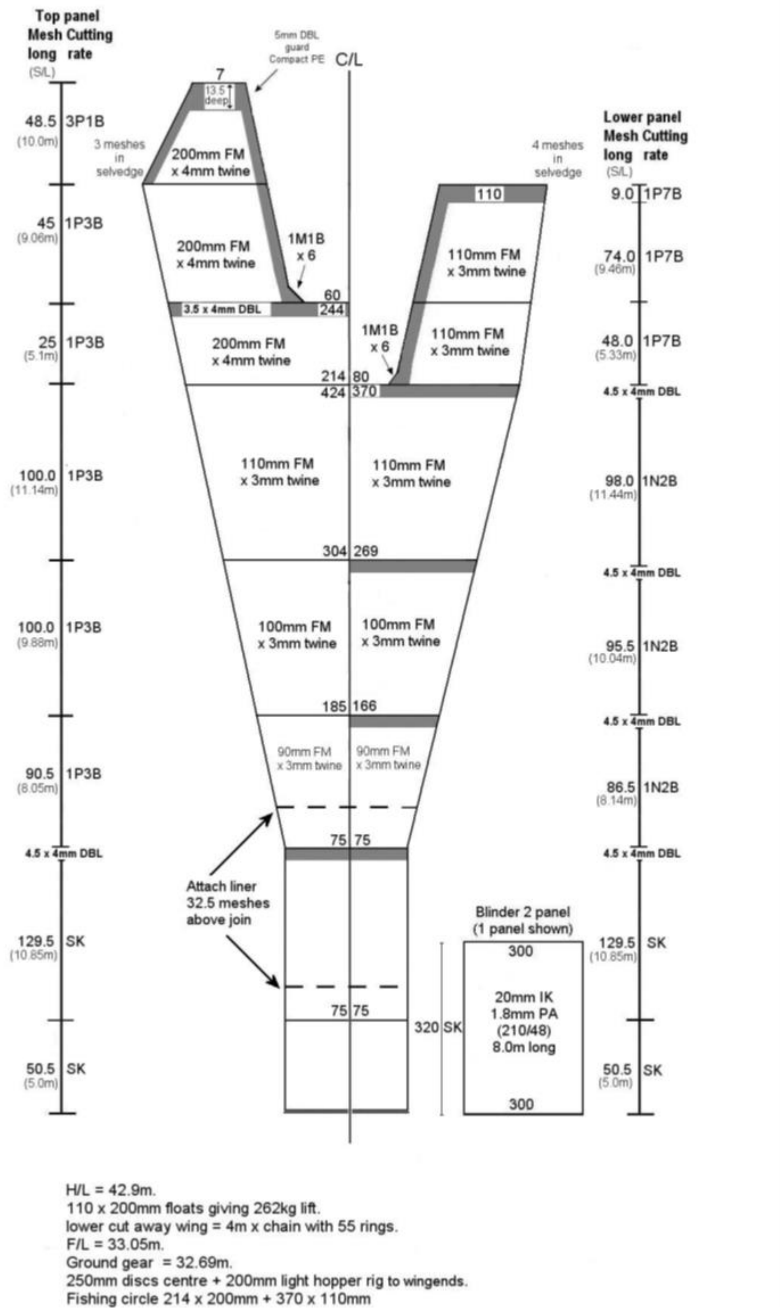


Figure 4.3.3 - MI Trawlnet plan indicating the three cutting rates employed for the top sheet panel.

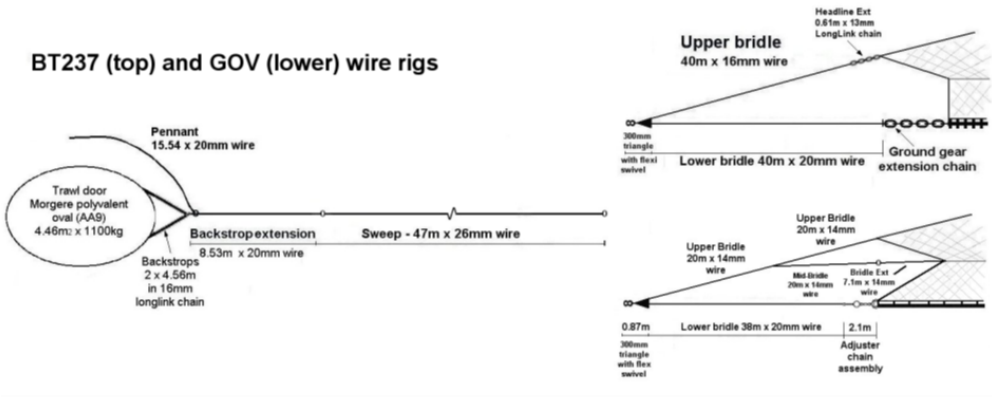


Figure 4.3.4 – Wire rigs used for BT237 and GOV.

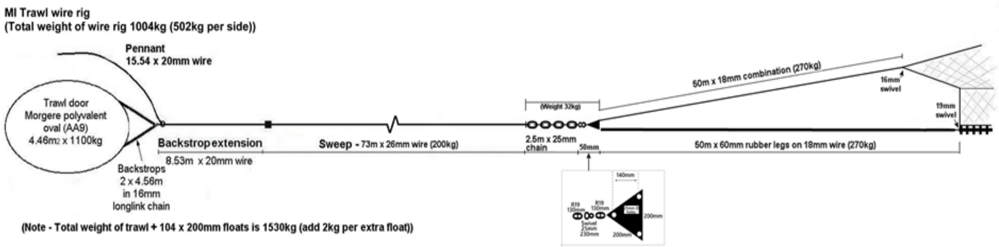


Figure 4.3.5 – Wire rig used for MI Trawl.

Sea trials

The experimental trials were conducted on the MS Science survey vessel FRV Scotia (LOA 68.6m). The cruise ran from 28 November to 9 December 2019 and all hauls were carried out in ICES Area IVa within the Moray Firth area off NE Scotland (Figure 4.3.6). Water depths encountered during the trials ranged from approximately 30 m to 125 m in soft (mud) to firm (sand) seabed substrates. Scanmar acoustic instrumentation was used during every haul to check gear geometry and a self-recording tilt meter (Somerton and Weinberg, 2001) attached to the centre of the groundrope monitored seabed contact. Values of speed over the ground and vessel position were output via the Scanmar (Scanbas) control unit to a computer every 20 seconds. Vessel towing speed (3.6 knots -3.8 knots) and warp ratios (3:1) were kept constant for all three gears during comparative hauls to minimize between haul variability. Weather conditions were similar to the 2018 cruise with sea swell height <1m being observed throughout the cruise.

Experimental design & catch handling

The procedure for all catch comparison hauls was the same throughout the trials and consisted of paired hauls of between 15 and 20 minutes duration. After completion of the first paired haul, the vessel steamed back to the start position (approximately 60-80 minutes from knockout to block-up) and made the second haul in the same direction but ~100m parallel with the first haul. At the start of each day, and to minimize bias, the order of deployment was switched so both test (BT237) and control gears (GOV/MI Trawl) were fished either first or second. Furthermore, to ensure the catches of either haul within a paired set were not influenced by towing over dawn or dusk all hauls were made in daylight.

The catches for all trawls were handled the same way and after each haul, the total catch was sorted into individual species and then weighed. All species were measured to the nearest 1.0 cm below (0.5cm for sprat). Where larger catches of a particular species was caught, a subsample was then measured and raised to the total number caught by weight.

Gear performance hauls

After fishing, additional tows were carried out to look at gear geometry specifically. The same haul procedure was used for all gear performance runs using the reciprocal tow method to account for tide or current. The gear was towed for 10-15 minutes and then hauled as the vessel turned, and gear subsequently redeployed again to start the second run. Scanmar acoustic instrumentation measured headline height, door spread and wing-end spread. Bridle angle was derived from sweep-line length, door and wing-end spreads.

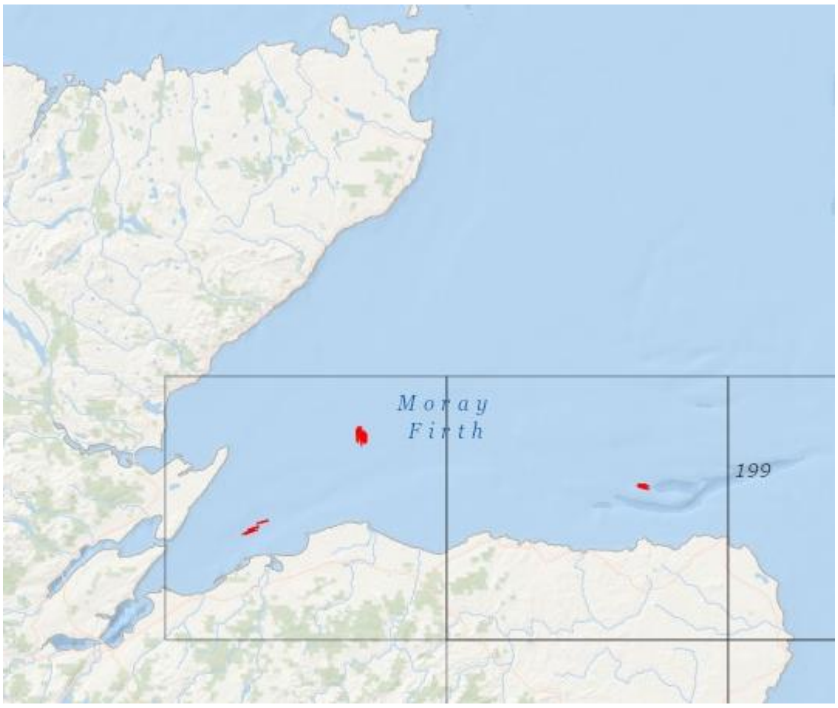


Figure 4.3.6 – Map of haul tracks completed.

Results

A total of 23 catch comparison hauls were completed; 11 sets comparing BT237 against MI Trawl and 12 sets comparing BT237 against the Scottish GOV.

Catch summary

There were sufficient quantities of haddock, whiting, common dab, plaice and sprat encountered by all gears for the analysis. However, although cod were encountered, preliminary analysis suggested there was insufficient data to detect significant differences between any of the gears. Once final analysis has been completed by MS Marine Laboratory (Due end May 2020) the data will be reported in a Working Document being drafted to inform the proposed gear design workshop at the end of 2020.

Gear performance

Gear performance data for the comparative fishing hauls is presented in Tables 4.3.1 and 4.3.2. Gear performance runs using Acoustic instrumentation were completed with both BT237 and MI Trawl to a lesser extent. The BT237 gear performed well with no adjustments required to fish correctly in shallower depths (30m – 80 m). No issues were encountered such as digging in, compromised gear geometry or loss of bottom contact. Gear parameter data for all BT237 hauls completed in 2018-2019 are given Figure 4.3.7. They demonstrate as depth changes and using 3:1 warp/depth ratio as expected door spread increases but wing-end and headline height alter very slightly. The green line shows the trend of the MI Trawl and although there were limited hauls its performance was similar to the BT237 in terms of wing-end spread and headline height.

Table 4.3.1 – Gear performance data BT237 v MI Trawl

Paired Hauls (1st – 2nd)		BT237				MI Trawl			
		Mean Door Spread (m)	Mean Wing Spread (m)	Mean Headline Height (m)	Mean Speed Over Ground (kts)	Mean Door Spread (m)	Mean Wing Spread (m)	Mean Headline Height (m)	Mean Speed Over Ground (kts)
MI	BT237	52.1	19.1	6.57	3.67	61.1	16.3	5.27	3.57
BT237	MI	52.9	17.9	6.03	3.63	60.4	15.9	5.24	3.66
MI	BT237	57.5	18.6	4.97	3.69	59.7	16.4	5.36	3.66
BT237	MI	54.6	19.5	6.39	3.57	64.1	17.9	5.10	3.60
MI	BT237	53.3	18.2	6.47	3.66	61.3	15.1	5.21	3.64
MI	BT237	55.0	19.2	6.12	3.67	64.3	15.9	4.86	3.57
BT237	MI	54.6	23.0	6.36	3.66	64.7	15.8	4.96	3.66
MI	BT237	54.5	19.2	6.39	3.64	61.6	15.9	5.18	3.66
BT237	MI	72.3	22.2	5.65	3.64	86.7	21.6	4.61	3.68
MI	BT237	71.3	22.1	5.11	3.64	86.8	21.0	4.54	3.65
BT237	MI	71.6	23.0	5.04	3.67	85.1	19.9	4.52	3.59
MI	BT237	70.9	21.3	5.72	3.62	83.8	21.3	4.55	3.67

Table 4.3.2 – Gear performance data BT237 v Scottish GOV.

Paired Hauls (1st – 2nd)		BT237				GOV			
		Mean Door Spread (m)	Mean Wing Spread (m)	Mean Headline Height (m)	Mean Speed Over Ground (kts)	Mean Door Spread (m)	Mean Wing Spread (m)	Mean Headline Height (m)	Mean Speed Over Ground (kts)
GOV	BT237	56.2	19.6	6.20	3.74	63.1	20.6	6.64	3.69
BT237	GOV	55.9	18.8	6.01	3.75	62.1	16.1	6.46	3.68
GOV	BT237	56.1	21.3	6.14	3.74	62.5	16.4	6.39	3.65
BT237	GOV	56.2	19.2	6.20	3.68	62.5	16.2	6.25	3.74
GOV	BT237	56.2	19.2	5.88	3.71	61.5	16.1	6.24	3.62
BT237	GOV	56.1	19.8	5.92	3.73	61.2	17.8	6.25	3.71
GOV	BT237	55.9	21.1	6.09	3.73	63.0	16.9	6.16	3.66
BT237	GOV	55.8	19.8	6.12	3.69	62.0	18.3	6.16	3.73
GOV	BT237	56.6	22.8	5.96	3.75	62.6	17.6	6.19	3.64
BT237	GOV	56.3	18.9	6.16	3.71	63.7	19.1	6.02	3.74
GOV	BT237	56.4	20.1	6.01	3.71	63.2	17.4	6.15	3.75

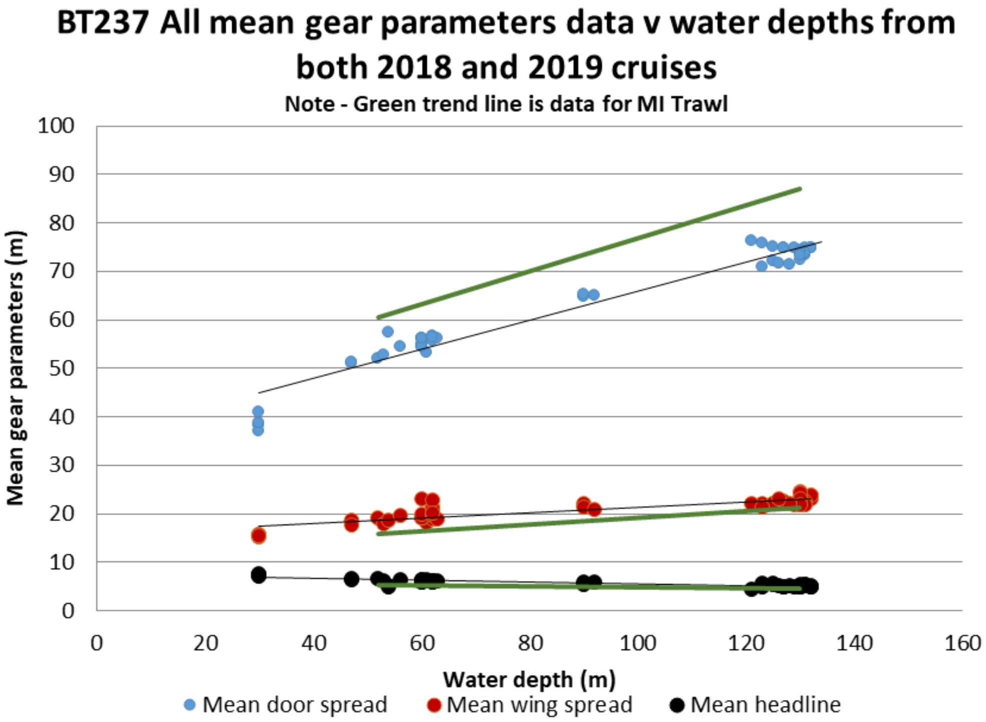


Figure 4.3.7 – All Gear performance data for BT237 (2018-2019) with trend data lines for MI Trawl shown in green.

The MI Trawl required limited fine-tuning to confirm the gear was operating as intended. However, it was suggested by the trawl designer that the MI gear (weight, buoyancy etc) was setup to tow at ~3.2 knots compared to the recommended c.4 knots (3.5-4.5 knots) for IBTS surveys. The MI considers the slower speed optimal for the primary target species on their IBTS survey. Maximizing catchability within a sustained or smaller seabed footprint is a key consideration within this TOR to update the survey-sampling trawl, especially for data limited stocks such as cod.

Another difference between the two designs was the mesh sizes in the rear portion of both trawls. The BT237 reduced down to 50mm (FM) compared to 80mm (IM) used in the MI Trawl. The 'clean' groundgear employed with the MI Trawl could be considered a modern interpretation of the A-rig, whereas the light hopper rig used with BT237 being a B-rig replacement. The difference in door spread suggests the heavier clean groundgear is providing slightly increased drag (Figure 4.3.7) compared to the light hopper rig. Bridle angles were similar for both gears and ranged between 9-10 degrees in depths <80m increasing to 13.5-14.5 degrees for the 4 paired hauls made in deeper water (~122 m).

Swept-area was somewhat higher for the MI trawl by virtue of the rigging, but this can be modified for most trawls to a reasonable degree (Fig 4.3.8).

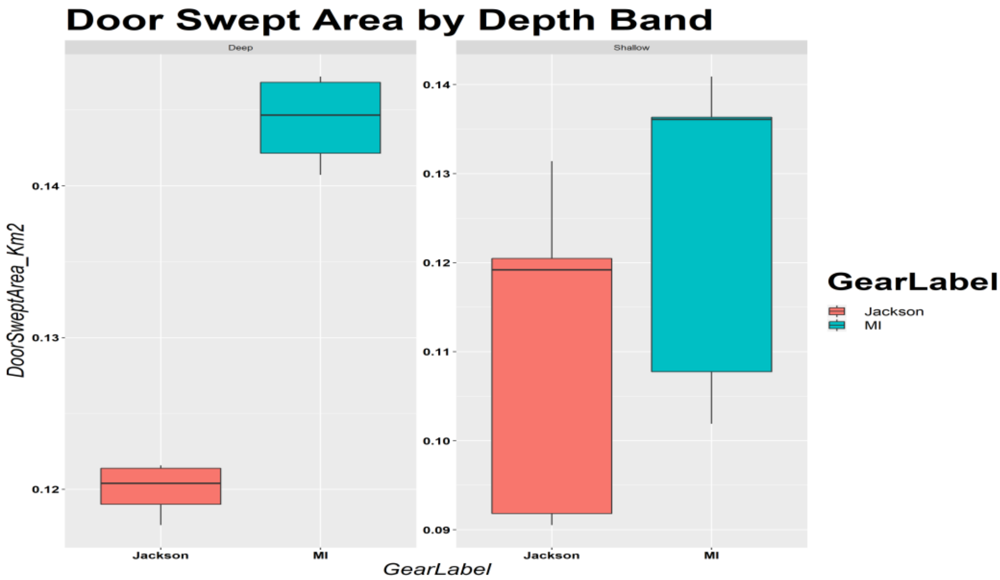


Figure 4.3.8 – Swept-area data for BT237 (red) and MI Trawl (green). Data are grouped into two depth bands, Deep >80m and Shallow ≤ 80m.

When assessing the fishing performance of the GOV in shallow water compared to deeper water, encountered during 2018 (120-130 m), it was found to have slightly better stability. Both wing and door spreads were less variable and required only limited adjustment of engine revs each haul compared to the 2018 cruise. This is assumed to be due to employing the correct length of sweep (47 m) for depths <70 m and demonstrates why the GOV was designed to be fished with different sweep lengths. However, it should be noted, the manual specifies the shorter sweep should be used for all Q1 surveys to maintain consistency between users. The GOV had far higher bridle angles compared to the two new designs and ranged between 12-13 degrees in the shallower depths (<80 m) increasing to 17-18 degrees with increasing depth. These high bridle angles suggest this gear, in depths >150m, could be overspreading and therefore compromise catchability due to the groundgear having poor seabed contact.

A further cruise is due to be undertaken by MS Science in October 2020 where increasing bridle and/or sweep length will be undertaken and comparing the catchability of cod/whiting between BT237 and Scottish GOV.

Catch comparison

Essentially this TOR has been tackled from two angles. Firstly, to take the best from proven modern trawl design we know works out of the box. Secondly, to apply the same expertise and review the characteristics of the multiple trawl designs currently employed within IBTS, put a purely research survey hat on, and start with a blank sheet of paper. On that basis, the summary below presents a short summary of the catch and trawl performance data between these two trawls currently in design, the GOV is not considered here.

Overall, the catches were good for both trawls with no species missing or noticeably sparse in one trawl when abundant in the other. Detailed analysis is in progress, but the exploratory boxplots below (Fig 3.4.9) some catch differences. While data are obviously limited at this point, in general the trials suggested species we might associate with footrope contact/selectivity (e.g. flatfish, nephrops, possibly cod) seemed more prevalent in the MI trawl. Conversely, the higher headline of the Jackson trawl may have influenced the higher catches of species like sprat and Norway pout.

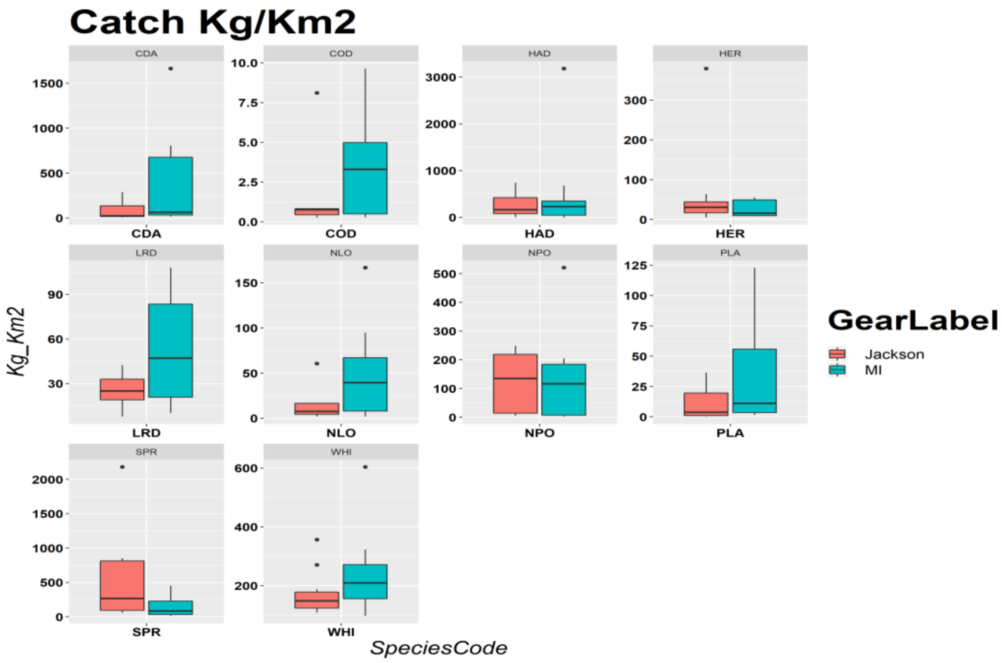
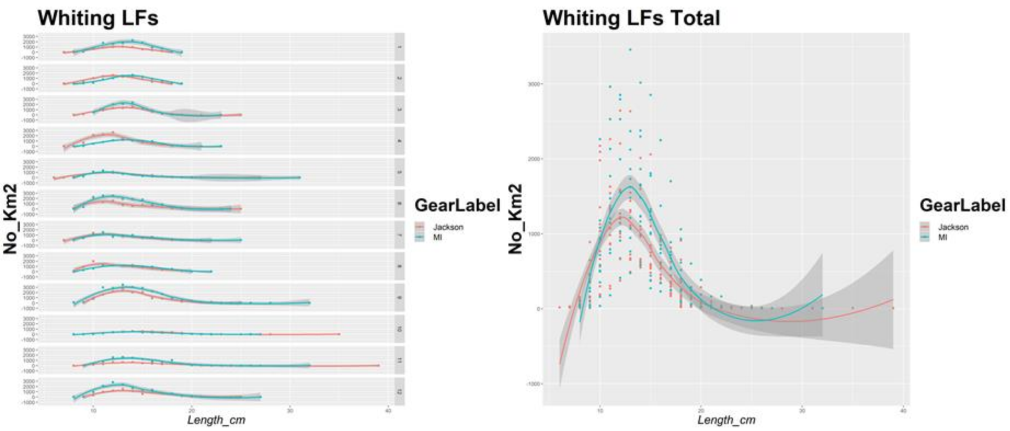


Figure 4.3.9 – Summary of paired catch data for the modified Jackson (BT237) and MI trawl. Species presented are Common Dab (CDA), Cod (COD), Haddock (HAD), Herring (HER), Long Rough Dab (LRD), Norway Lobster (NLO), Norway Pout (NPO), Plaice (PLA), Sprat (SPR) and Whiting (WHI).

A primary objective of the IBTS, in line with most demersal fisheries surveys, is to provide indices of recruitment. Proportion at age, or length, is a key consideration and both trawls employ a mesh size in the lower wings almost half that of the 200mm of the GOV so catches were expected to provide a reasonable sign of juvenile fish.

Variability of standardized length frequencies over the 12 pairs of tows can be clearly seen (Fig 4.3.10). Whiting and Dab in the MI trawl showed slightly higher numbers at length overall for the smaller length classes with a quite contrasting picture for Sprat can be seen.



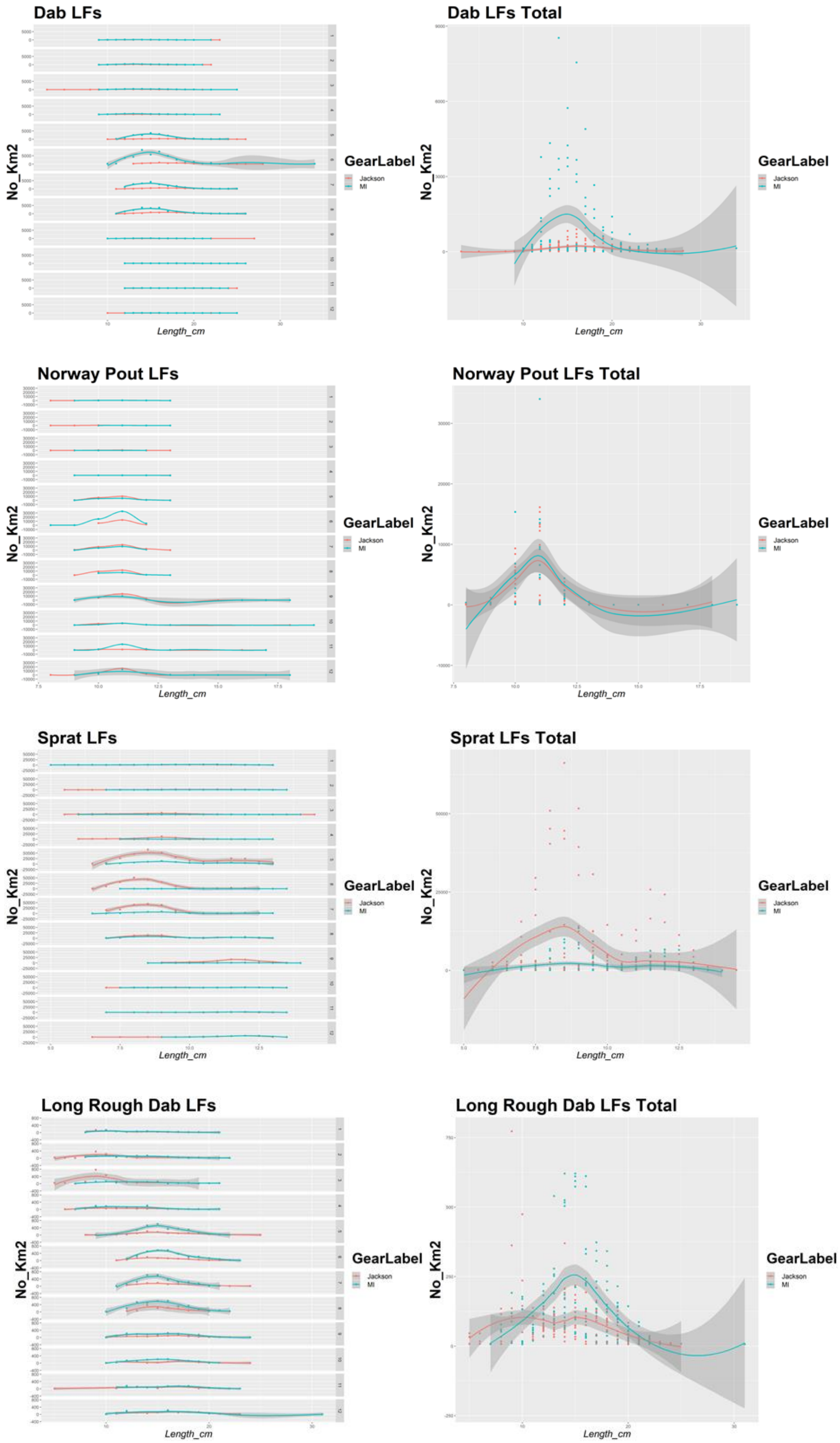


Figure 4.3.10 – Summary of whiting length frequencies for paired hauls (left panels) and simply combined over the 2019 trials (right panels). No's are standardized to swept-area for more direct comparison. The plots show a simple Loess smoothed line through the data with 95% confidence intervals.

It seems plausible that the catch differences seen in these preliminary plots could be in part caused by ground contact of the MI gear vs. headline height of the Jackson trawl. Footrope and headline height are not totally fixed of course for either net design and it is a working principle that both net designs are likely to have two groundgear versions, similar to the current GOV operation. In these trials, the Jackson was rigged with a hopper footrope that would be similar to the GOV B-gear. The MI trawl would equate more closely to the GOV A-gear with smaller disks and generally higher selectivity, but less robust. Either net could use the alternate groundgear depending on the terrain they have to operate in and target species. Likewise rigging and buoyancy could address some headline height and sweep angle differences if they are deemed to negatively impact on target species and levels required.

The important and positive outcome from the trials was that either a modified commercial design or new concept were both stable, easy to handle and broadly fished on par. Differences are likely to be largely rigging changes, separate to the net plan, that will be optimized during trials of the final design.

Other remarks

The two Dutch participants looked at the gears with the perspective of handling these on board of their own vessel. Their conclusion is that without many adjustments this should be easily feasible. The other part they commented upon was the employability of the gears in the shallow sandy waters in the southern North Sea. Their impression was that the Scottish gear as used during the trials is too heavy for these areas and that the Irish netting material is to light and should be made ticker/stronger. These are the type of discussion that have to take place with all the gear people around the table to come up with the "best" solution.

Conclusions

Based upon the current results, both gears seem feasible options to be used. They form a good basis for further refinement.

4.4 Workshop proposal

As mentioned above further refinement of the two gears and finally a proposal for The gear to be used has to be discussed. It is proposed to do this in a workshop for which all the national gear technologists and other members involved in the IBTS will be invited. The proposed Terms of Reference for this workshop are:

A: Review the data on the GOV and both new gears: the technical details, the field data on net geometry and stability, and the catch comparison data.

B: Rank the two new gears according to the criteria recommended by SGSTG/SGSTS (a.o. Robustness and durability, herding effects, stability, costs etc.). Is there merit in one design over another, or is an average of both gears the better.

C: Select design issues including detailed material choices.

D: Comment on the recommendations by WKNSIMP on implementation of the gears.

On the IBTSWG sharepoint is a document to be filled by the IBTSWG-members with their staff that has to be invited for this workshop and preferably already the dates that these persons are not available to have the workshop.

As location the IBTSWG proposes Lorient, as in that case it might be possible to use the flume tank to clarify aspects of the gear.

Currently, there is no proposal for a chair yet. Hopefully someone stands up for taking up this task.

5 Survey design (ToR d)

This ToR was only discussed marginally. It is still the intention to write a CRR about the topics on survey design as discussed on the last couple of years. This includes among other:

- The zero-minute haul experiments
- The 15-minute haul experiments
- The swept-area based indices
- Stratification of the survey

Progress in this is low and as there were no new results there was made a lot of time during the meeting to write the specific chapters.

To keep things going, intersessional webex-meetings are planned to keep track of the progress.

Annex 1: List of participants

Name	Institute	Country (of institute)	E-mail
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* By correspondance

Annex 2: Resolutions

2018/MA2/EOSG03 The **International Bottom Trawl Survey Working Group** (IBTSWG), co-chaired by Ralf van Hal*, Netherlands, and Pascal Laffargue*, France, will meet to work on ToRs and generate deliverables as listed in the Table below:

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	1–5 April	Den Helder, NL	Interim report by 20 May 2019 to EOSG	
Year 2020	30 March 2April	Webex	Interim report by 1 May 2020 to EOSG	
Year 2021	12-16 April	Lysekil, Sweden	Final report by 14 May 2021 to EOSG	

ToR descriptors

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 DGG: 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 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 oppertunity 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 oppertunities are not been 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	3.1, 3.2	2 years	Design specification (Working document) in 2020

		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.

Summary of the Work plan

Year 1	Organize 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 time-series
Year 3.	Carry out at sea trials and evaluate results
Recurrent annual activity	Updates for ToRs a, b, and c.

Supporting information

Priority	Essential, The general need for monitoring fish abundance using surveys is evident in relation to fish stock assessments, and it has increasing importance in relation to MSFD GES descriptors biodiversity, foodwebs, and bottom integrity. Besides the relation of fish abundance with descriptor 3 Exploited stocks.
Scientific justification	**ToR a)** This is a core function of the IBTSWG, an important forum for coordination and evaluation of standardized bottom trawl surveys in the Eastern Atlantic Area, to ensure good survey coverage in relation to stocks and areas. inter-calibration work. and high quality of data. The group also provides a brief overview the result of the individual surveys undertaken during the previous year and in the first quarter of the ongoing year. IBTSWG will continue to review feedback and implement modifications, including coordination and implementing new requirements of the EU DCF. To ensure quality and traceability of sampling protocols, changes in the design and procedures used in the surveys coordinated by the IBTSWG have tobe implemented and documented in detail in the IBTS manuals, which are available via the ICES webpage under Series of ICES Surveys Protocols. **ToR b)** DATRAS has become the core database containing the data obtained in the national IBTSurveys, the The development of DATRAS needs to be evaluated annually, and the group is also one of the forum to discuss with ICES Data Centre and agree on the priority of desired further developments. **ToR c)** A number of IBTS members is 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. **ToR d**) Efficiency and effectiveness are important drivers in the implementation of

	high cost surveys. Evaluations of different implementation options and their consequences need to be reviewed at regular intervals, particularly as changes to the gear are being discussed at present.
Resource requirements	A 5-day IBTS meeting. Prepared documents from members following ToR Leaders identified above. 8-day Chair's time to edit. It is estimated that each ToR will require at least 8 hours of preparation.
Participants	The Group is normally attended by some 20–25 members and guests. All members will participate on the discussion of all ToRs, but ToRs leaders have been identified and appointed to intersessionally prepare the work and lead it in the meeting.
Secretariat facilities	SharePoint plus normal secretariat support.
Financial	No financial implications.
Linkages to advisory committees	ACOM. IBTS indices are used in the assessment of multiple stocks.
Linkages to other committees or groups	There are relations with other bottom-trawl surveys (WGBEAM, WGBIFS) that also use DATRAS as the international repository for its data (WGDIM, DGG). There are also linkages with Assessment WGs using IBTS indices. Also relevant to the Working Group on Ecosystem Effects of Fishing Activities (WGECO) , the Working Group on Improving use of Survey Data for Assessment and Advice (WGISDAA) and Working Group on Integrating Surveys for the Ecosystem Approach (WGISUR).
Linkages to other organizations	IOC, GOOS, OSPAR, Regional Coordination groups (DCF).

Annex 3: North Sea Q1 2020

(Coordinator: Ralf van Hal)

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 (Methot Isaac Kitt). 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 2020 fleet consisted of six vessels: "Dana" (Germany and Denmark), "GO Sars" (Norway), "Scotia" (Scotland), "Thalassa" (France), "Tridens II" (Netherlands) and "Svea" (Sweden) . The survey covered the period 10 January to 3 March 2020 (Table A3.1).
A total of 349 GOV hauls (9 of which were invalid) (Table A3.2) and 577 valid MIK hauls (Table A3..3) were deployed. All ICES-rectangles were covered by at least 1 GOV haul (Figure A3.1) and at least 2 MIK hauls.
Biological data (weight, gender and maturity and age material) is collected from a number of species (Table A3.4). An impression of the catches is given in**Error! Reference source not found.**figure A3.2, by presenting the total fish catch in kilograms. Gear geometry plots are given in Figures 5.1.1.3a to 5.1.1.3d (lines represent theoretical values for the GOV from flume tank experiments, ICES 2015).

The 2020, Q1 IBTS was heavily effected by westerly storms in February. Two official storms (Ciara & Dennis) went over the North Sea when a number of participants was at sea. The storms have a longer impact on the sea state then the official period of storm. To be able to complete their program a number of participants has been fishing at the edge of fishable conditions. The storms themselves impact the fish distribution but also affect the catchability during rough conditions. There is no good way, yet, to correct for the impact of storms.

Another impact of the storm was that rectangles could not be fished by some participants and were covered by others. Together with the permit issue discussed below, this has caused a large number of changes in the planned program. This clearly impacted the overlap between countries, which was as result further reduced, complicating the estimation of the vessel/country effects.

A comment is to be made on the German participation in 2020: Their vessel Walther Herwig was not available this year, they had chartered the Danish vessel Dana again. Therefore, they had to start earlier with their survey. Additionally, they were denied a permit for UK waters. As a result of which the other countries having a permit for UK waters covered as much as possible the German stations in UK waters and Germany covered a much larger number of stations in the German, Danish, Swedish and Norwegian waters. They even covered a number of stations in the Skagerrak which were originally planned to taken by Denmark.

As done already during a part of the German 2019 survey on board of Dana, Vonin flyers were used instead of the normal Exocet kite. Last year, the Germans used the Dana to cover the southern part of the Danish/German area, while this year they covered their normal deeper area. The deeper water caused issues as the towing cables on Dana are thinner (20 mm) an lighter compared to those on the Walther Herwig (28 mm). With the lighter cables time to reach the bottom was much long and maintaining good bottom contact was difficult. The fishing master of the Dana advised to attach a chain tightly to the fishing line in the bosom section to add some weight (done by the Danish as well). This appeared to improve bottom contact, but at greater depths this seemed not enough. At these depth the warp to depth ratio was adjusted, by using the Danish ratio.

Another comment is made on the Swedish participation in 2020: They were able to use their new vessel Svea for the first time in the survey. There were some teething problems. Practising setting and hauling gear (GOV and MIK) was limited before the cruise due to a too tight sailing plan and a later delivery of the vessel than planned. Svea ran into problems with cooling vents in the machine room on the survey prior to ours and had to go back to port to have that fixed. This took the extra days we had planned for training the crew and get familiarized with the fishing. The crew had to figure out how to handle gear (particularly the GOVs heavy groundgear was unpopular) as we went along and modifications were made underways as the big trawl boards got stuck between the aft guiding bars (which weren't guiding at all). The procedure of fishing turned out to be a time consuming and agonizing job for the deck and bridge. Most of the problems were down to lack of practice, different control systems (Scantrol, Simrad TV80 sensor system etc) relating to the fishing were new to the bridge as well as the cruise leader. So we took it easy and day by day new challenges were overcome. As a result, a slightly smaller number of stations could be covered.

Comparisons between Svea 2020q1 and Dana 2011-2019q1 show roughly the same net geometry (figure A3.7) although the 2020q1 data show slightly lower door spread than previous years. This can possibly be explained by the fact that we kept the warp on the short side due to coarser warp dimensions on Svea.

A third comment is made on the Norwegian participation 2020: They have discovered the issue that caused their GOV net opening to be limited in the latest years. The way the floats were attached to the headline caused this issue. Now, that they discovered this they have changed it back to the original settings and were able to reach the expected net opening (see A3.3c), which is on average about one meter higher than the net opening in latest years.

Denmark reported that for haddock in particular in the size range of 26 – 40 cm a very poor condition was observed (Figure A3.5**)**. This is not observed when all the data of the whole survey is considered (Figure A3..4**).** Plotting the mean condition by rectangle shows a clear pattern of better conditions of haddock further north (Figure A3.6**)**. As Denmark executed their survey further north last years, this might be the reason behind their impression of poor condition. The spatial influence on haddock conditions requires further investigation.

Table A3.1. Overview of the surveys performed during the North Sea IBTS Q1 survey in 2020. In grey fishing activity, in purple no fishing due to storm, in red no fishing due to mechanical issues.

		January																					
country	Vessel	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Sweden	Svea															3	3	3	3	2	3	4	3
France	Thalassa II	2	3	2	2	2	3	3	3	3	2		3	4	4	3	3	4	3	3	2	3	1
Norway	GO Sars																						
Germany	Dana	3	2	2	2	0	0	3	3	1	3	2	3	3	3	0	2	3	4	3	3	3	0
Scotland	Scotia III															3	4	4	3	3	4	4	4
Denmark	Dana																						
Netherlands	Tridens 2											2	4	3	4				2	4	3	3	3

		February																													March		
country	Vessel	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1	2	3
Sweden	Svea	4	4	3	1	3																											
France	Thalassa II																																
Norway	GO Sars							1			2	4	3	3	2	0	0	0	1	0	4	0	0	4	4	0	0	3	4	3	2	3	2
Germany	Dana	0	3	4	4	3	3	2																									
Scotland	Scotia III	3	3	2		3	2	3	3	3	3	2																					
Denmark	Dana													4	2	2					2	2	3	3	4	3	4	4	2				
Netherlands	Tridens 2			2									3	5	1			1	2	5	1												

Table A3.2. Overview of the GOV stations fish in the North Sea IBTS Q1 survey in 2020.

ICES Divisions	Country	Gear	Tows planned	Valid	Invalid	% stations fished
3a	SWE	GOV-A	40	39	1	98%
	DEN	GOV-A	4	1	1	25%
	NOR	GOV-A	3	0		0%
	GFR	GOV-A	0	5		
4	GFR	GOV-A	67	62		93%
	SWE	GOV-A	8	0		0%
	NO	GOV-A	38	40	5	105%
	FRA	GOV-A	43	45		105%
	DEN	GOV-A	42	33		79%
	NED	GOV-A	57	47	1	82%
	SCO	GOV-A	12	12		100%
	SCO	GOV-B	46	43	1	93%
7d	FRA	GOV-A	10	13		130%

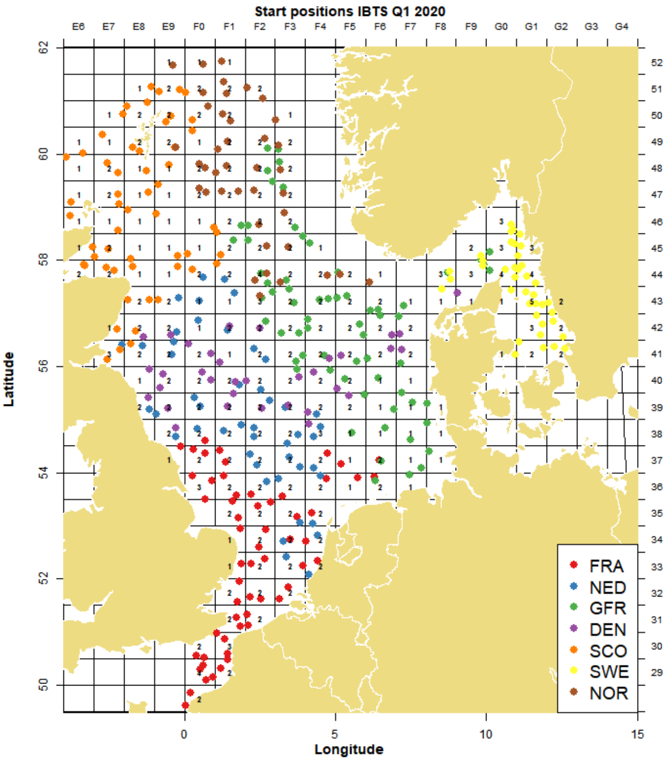
Table A3.3. Overview of the MIK stations fish in the North Sea IBTS Q1 survey in 2020

ICES Divisions	Country	Gear	Tows planned	Valid	% stations fished
3a	SWE	MIK	44	41	93%
	DEN	MIK	8	3	38%
	GFR	MIK	0	10	
4	GFR	MIK	134	119	89%
	SWE	MIK	16	0	0%
	NO	MIK	84	61	73%
	FRA	MIK	86	76	88%
	DEN	MIK	84	62	74%
	NED	MIK	114	90	79%
	SCO	MIK	116	90	78%
7d	FRA	MIK	20	25	125%

Table A3.4. Overview of individual length, weight and/or maturity and/or age samples collected during the North Sea IBTS Q1 survey in 2020.

Species	DEN	FRA	GFR	NED	NOR	SCO	SWE	Total
Clupea harengus	494	389	1342	424	1892	220	1275	6036
Merlangius merlangus	633	929	585	423	597	676	574	4417
Sprattus sprattus	277	381	798	364	1	281	1184	3286
Melanogrammus aeglefinus	413	65	410	270	659	956	139	2912
Scomber scombrus	45		297	21	2051	248	61	2723
Pleuronectes platessa	327	573	216	304	14	117	355	1906
Trisopterus esmarkii	84	12	161	83	327	341	162	1170
Gadus morhua	61	70	160	116	97	305	346	1155
Eutrigla gurnardus	206		568					774
Limanda limanda	408							408
Microstomus kitt	106		166			90		362
Pollachius virens	1		83	2	126	65	24	301
Merluccius merluccius	1		18	11		84	142	256
Mullus surmuletus		173						173
Solea solea		148					25	173
Dicentrarchus labrax		88						88
Sardina pilchardus			47		15	16		78
Engraulis encrasicolus			62		12			74
Trisopterus luscus		71						71
Helicolenus dactylopterus					66			66

Species	DEN	FRA	GFR	NED	NOR	SCO	SWE	Total
Chelidonichthys cuculus		64						64
Glyptocephalus cynoglossus	4						60	64
Scyliorhinus canicula			20	29	11			60
Mustelus asterias			18		22	14		54
Micromesistius poutassou			3		50			53
Trachurus trachurus					50			50
Lophius piscatorius			9			36		45
Squalus acanthias			38		1	5		44
Raja brachyura				3		40		43
Raja montagui			10	7		20		37
Leucoraja naevus				8	3	15		26
Amblyraja radiata			22	1		2		25
Scophthalmus maximus		14	3	3		2		22
Raja clavata			6	3	1	11		21
Scophthalmus rhombus		8	1	5				14
Mustelus				11				11
Etmopterus spinax			9					9
Dipturus batis					1	5		6
Molva molva						1		1



A3.1 Number of hauls per ICES rectangle with GOV during the North Sea IBTS Q1 2020 and the start positions of the trawls by country.

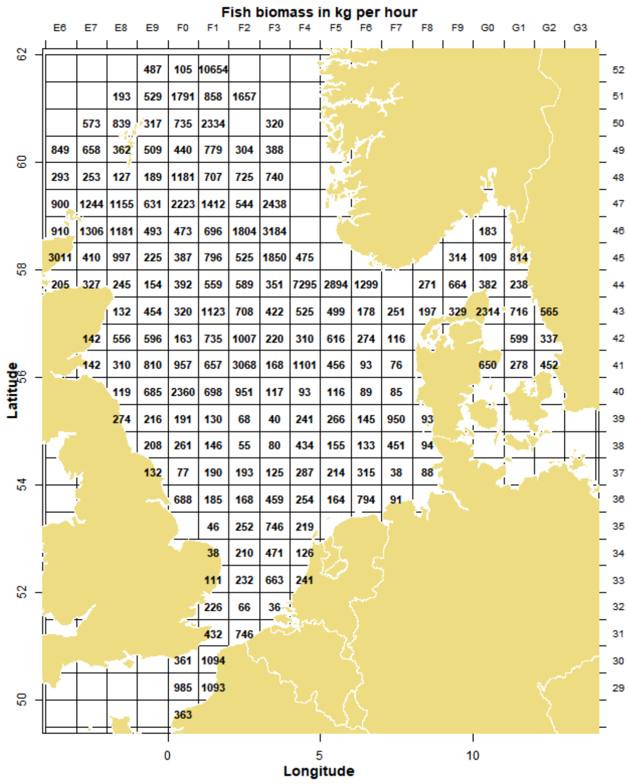


Figure A3.2 Distribution of fish biomass in IBTS hauls by rectangle in the North Sea, Q1 220 (values standardized to kg per hour haul duration; mean per rectangle).

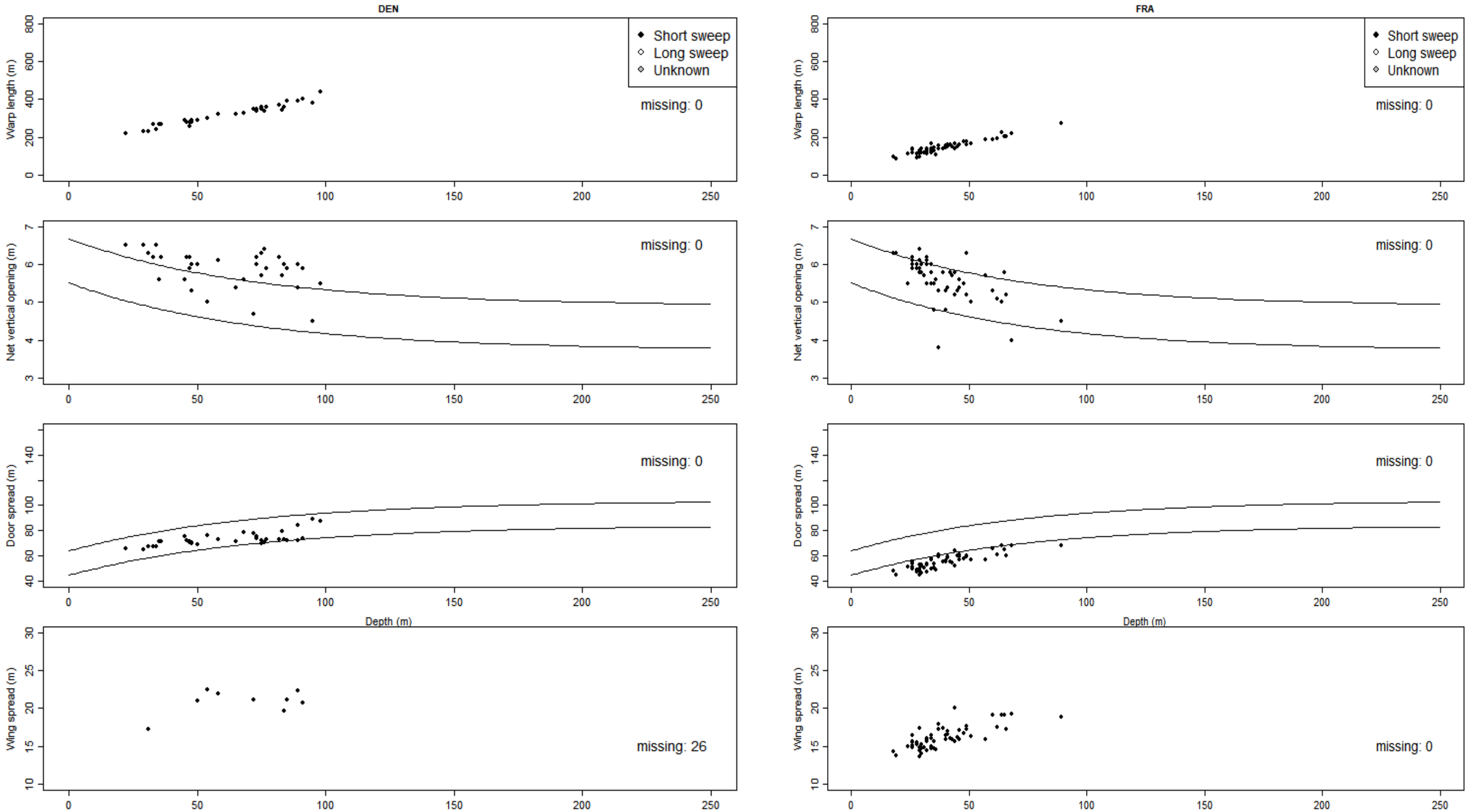


Figure A3.3a Danish and French warp length and gear geometry

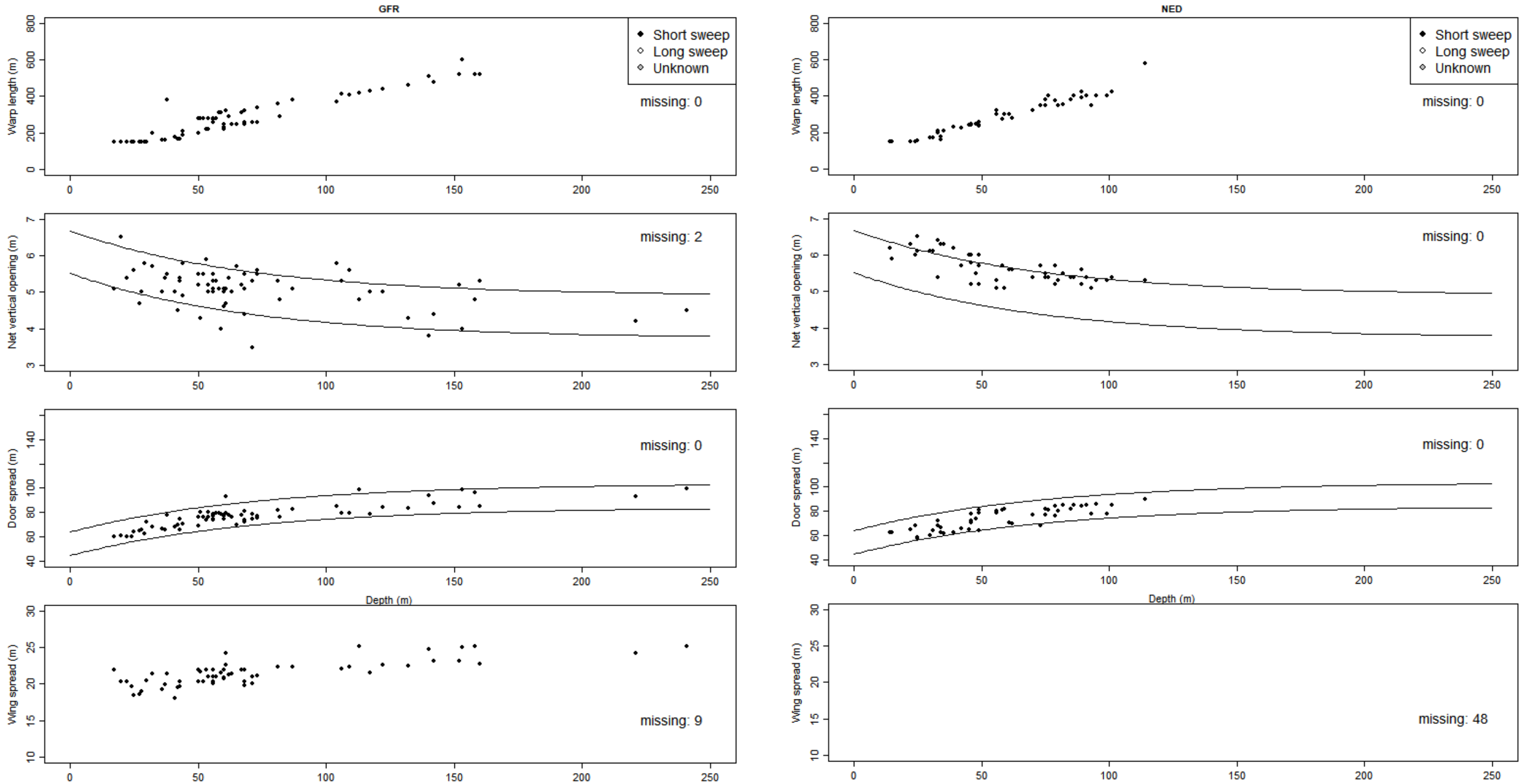


Figure A3.3b German and Dutch warp length and gear geometry.

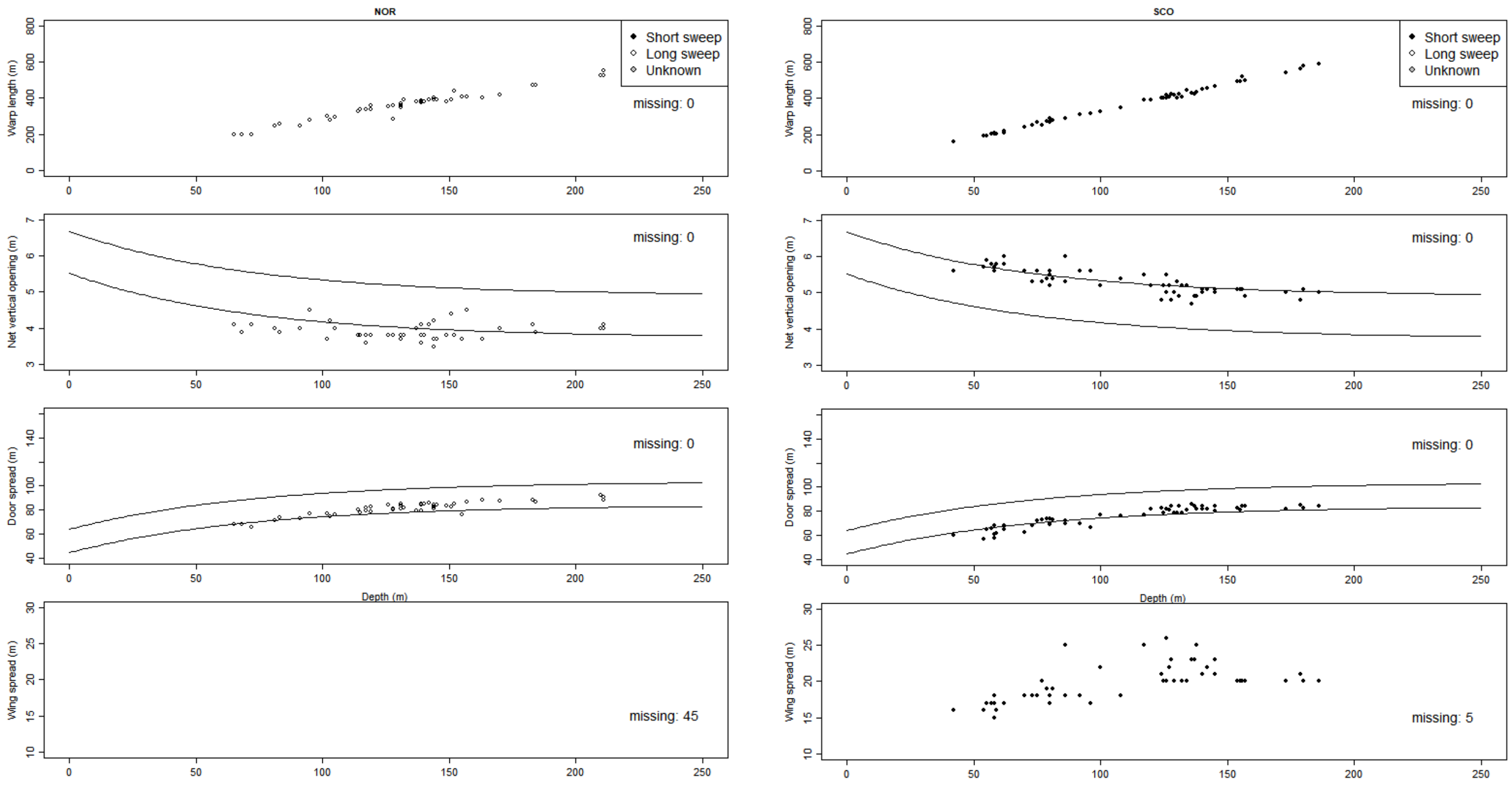


Figure A3.3c Norwegian and Scottish warp length and gear geometry.

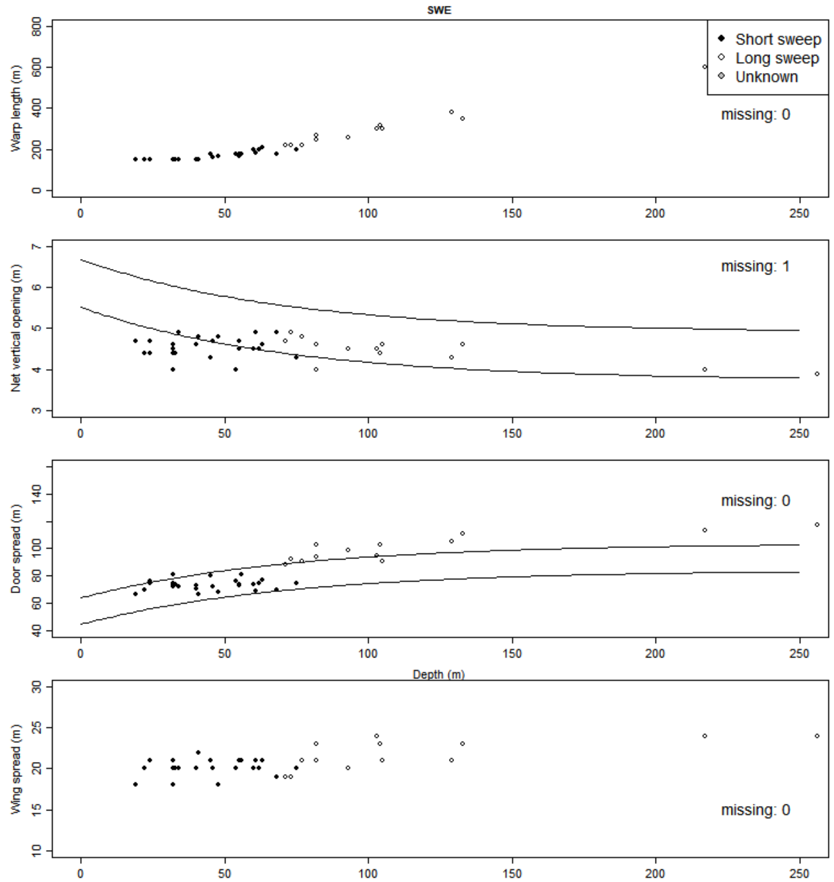


Figure A3.3d Swedish warp length and gear geometry.

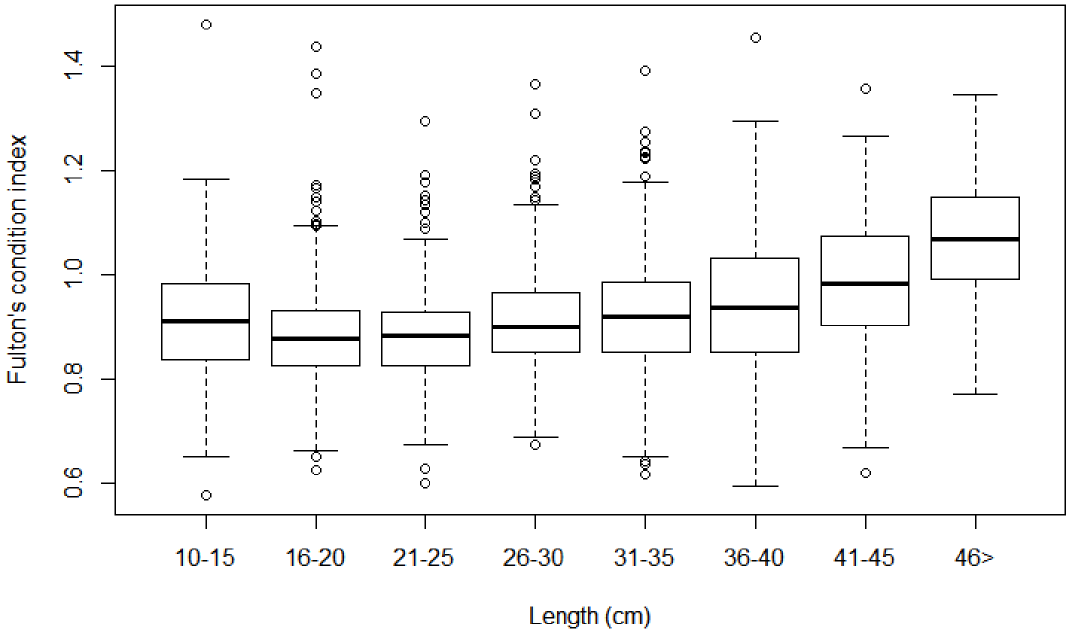


Figure A3.4 Fulton's condition index of all the haddock of the whole NS-IBTS 2020 based on all CA-records in datras.

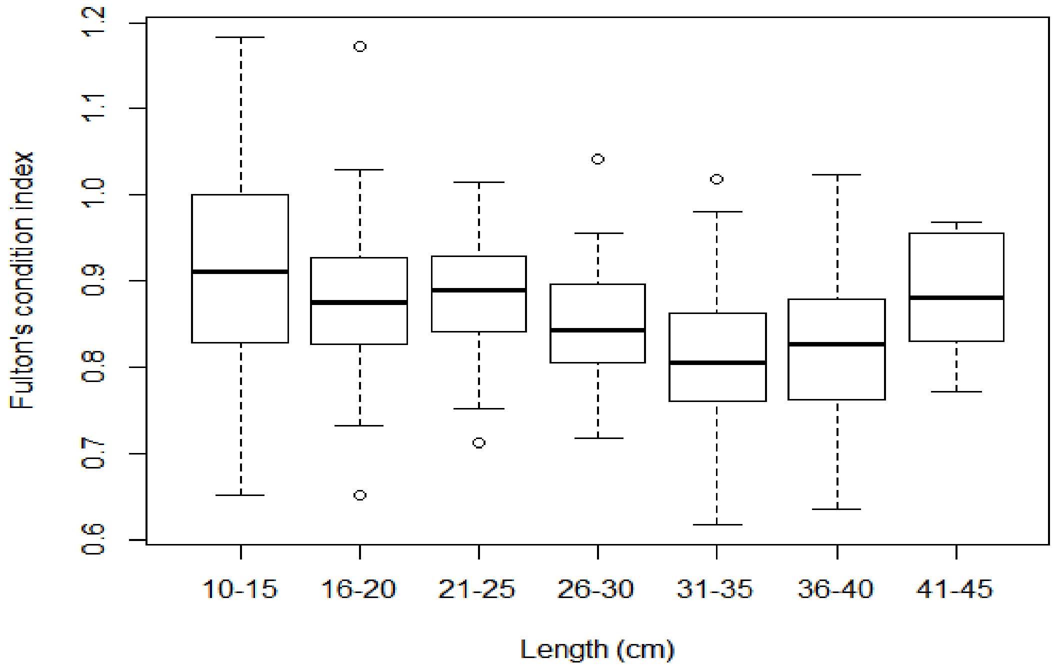


Figure A3.5 Fulton's condition index of all the haddock of the Danish NS-IBTS 2020 based on the Danish CA-records in datras.

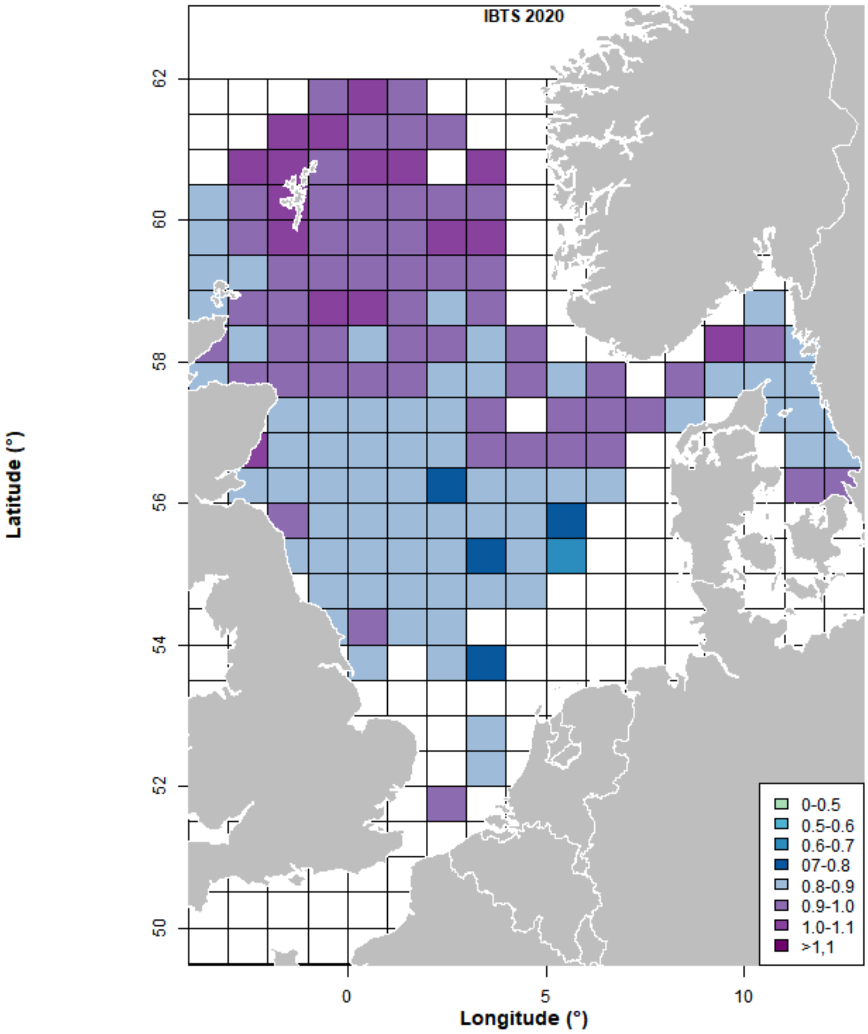


Figure A3.6 Mean Fulton's condition index by rectangle of all the haddock in the CA-files of 2020.

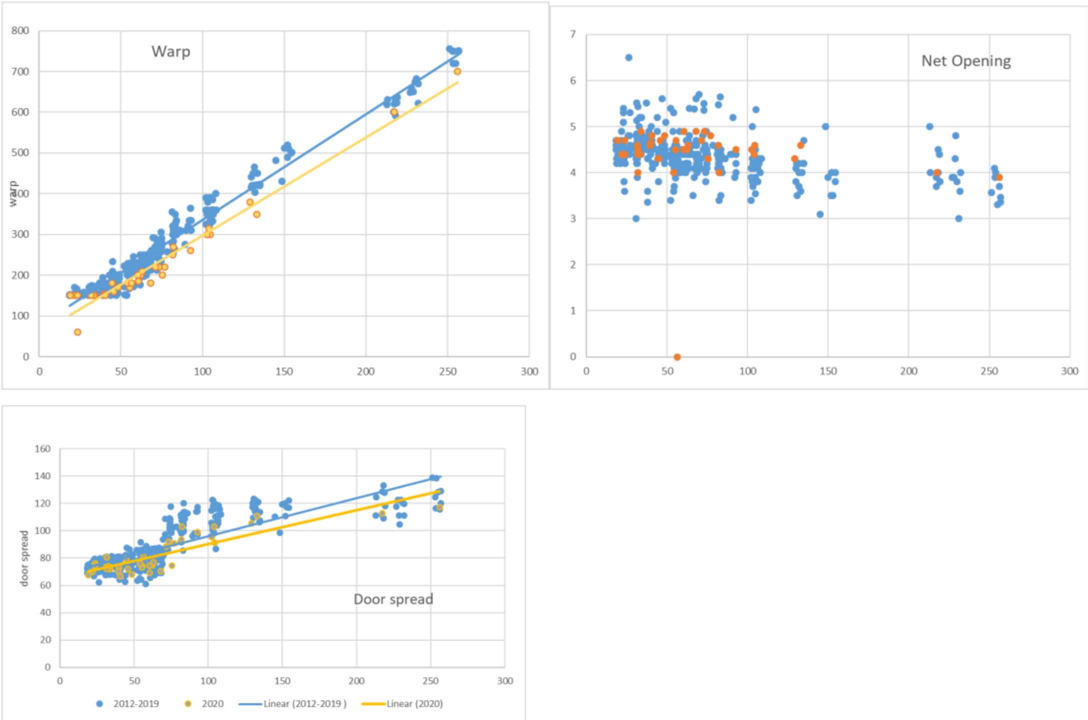


Figure A3.7 Comparisons of Swedish data relevant to net geometry (warp length, Net opening, door spread) between the older data collected on board of the Dana (2012-2019, blue) and the recent 2020 data with the Svea.

Issues and problems encountered

Be sides the large impact of the storms that went over the North Sea in the period of our survey, there were some mechanical issues as well. The Dutch vessel Tridens had issues with it gaskets a had to go back to the home harbour (Scheveningen) costing nearly a full week of survey time. Also the new Swedish vessel Svea had mechanical issues delaying the start of the survey and hampering the time available for the introduction. Also Denmark experienced some mechanical issues, losing a day survey time.

Permit issues for the UK made clear that the bureaucracy can have a major impact on the survey. The point of time to submit your request for a permit became earlier and is currently maximum half a year for most of the countries. A later submission results in delays in receiving or even denial of a permit. This reduces flexibility, as a changes of vessel is required after this point in time it costs a lot of work to change the permits to the new vessel. If changes in area to be covered occur this is difficult or impossible to get this done in the permit. There also seems to be some arbitrary choices in the permit process, some countries have to (by their own Embassy or the receiving country) include a prior locations for fishing in their permit request and are judged and in case of Germany denied a permit based on overlap of specific locations with features (cables, MPAs, etc.), while other countries can still get the same permit by supplying the rectangles to be fished stating that predefined locations are impossible and in the field it will be decided where to fish considering all rules for fishing among that in the vicinity of structures. Permits based on the first description with fixed locations are considered by some of the skippers as being allowed to fish only on these locations, taking over locations, doing additional hauls etc. because impossible with that. While others see the permit as free pass to fish everywhere within the national borders obeying rules for fishing of course. This allowed the Dutch to take over the German stations further north than the area they actually defined in their permit request.

The restrictions on fishing are still increasing, by the construction of additional gas/oil-platforms and pipes, windfarms and their cables, and also by the installation of Nature areas. These reduce the possible areas for fishing, and with that it reduces the possibility to have a good sample of the distribution of the stocks. The installation of the Nature areas also results in an increase in bureaucracy as for many of these areas impact assessments have to be done, judged and approved.

Additional activities

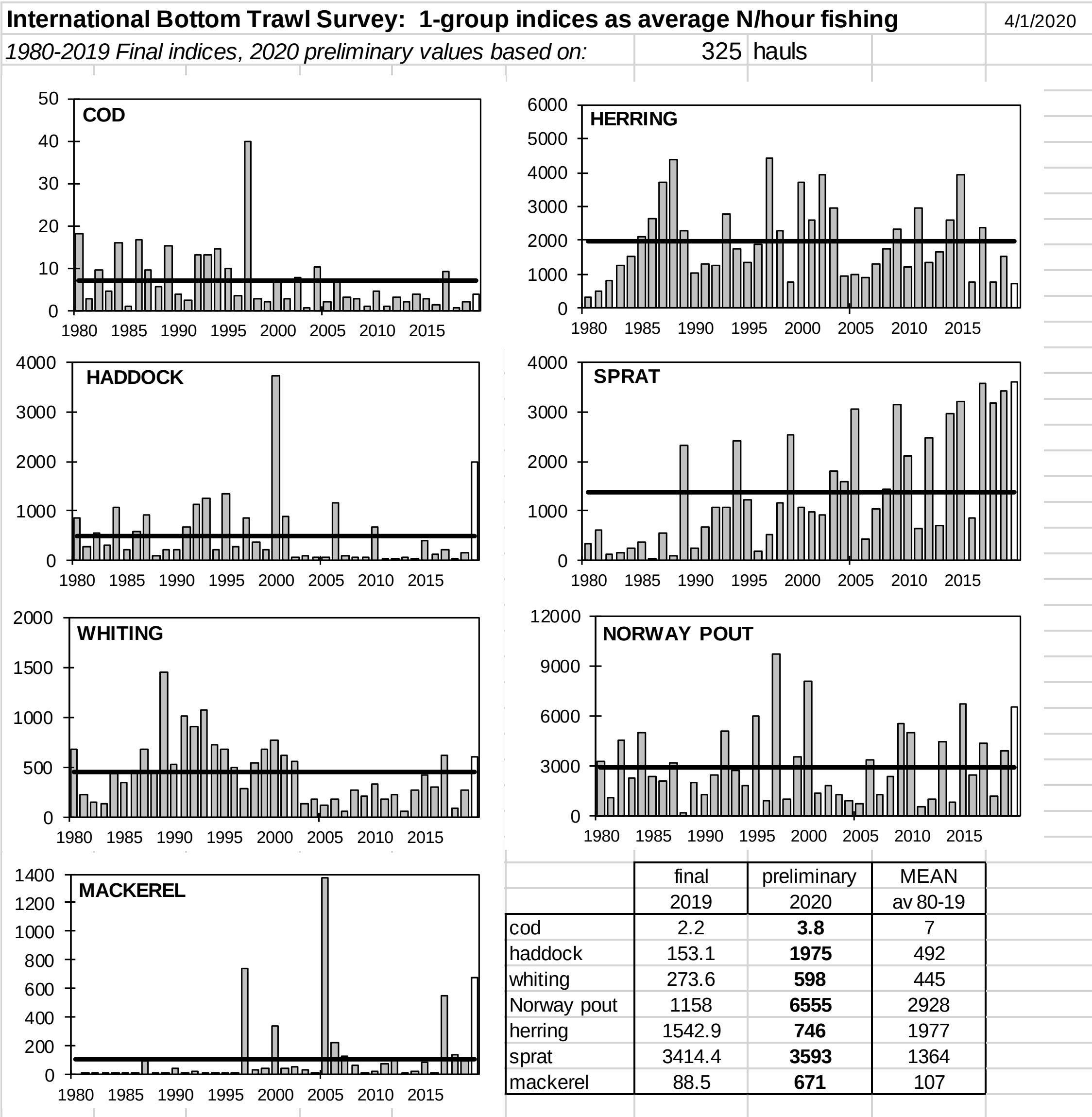
Next to the GOV and MIK tows all countries have collected additional data. All countries collected sea floor litter from the GOV tows and collected CTD (temperature and salinity) at all GOV stations when possible. A complete list of additional activities is given in Table A3.5.

Table A3.5 Overview of additional activities in the North Sea IBTS Q1 survey in 2018

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)			x	x	x		x
Egg samples (Small fine-meshed ringnet; CUFES)	x	x	x	x	x		x
By-caught bentic animals		x					x
Observer for mammals and/or birds							x
Additional biological data on fish		x	x	x	x	x	
Bentic samples (boxcore, video, dredge)							
Zoo and phytoplankton		x					
Jellyfish		x					x
Hydrological transects		x					x
Beam trawl (juvenile fish - age 0)		x					

GOV

The preliminary indices for the recruits of seven commercial species based on the 2020 quarter 1 survey are shown in Figure A3.8. Haddock indicates the second best recruitment in the time-series, sprat shows as in the last four years very high recruitment. Norway pout indicates one of the higher recruitments in the time-series, which is the same for mackerel. Only cod and herring indicate below average recruitments.



	final 2019	preliminary 2020	MEAN av 80-19
cod	2.2	**3.8**	7
haddock	153.1	**1975**	492
whiting	273.6	**598**	445
Norway pout	1158	**6555**	2928
herring	1542.9	**746**	1977
sprat	3414.4	**3593**	1364
mackerel	88.5	**671**	107

Figure A3.8 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 1980-2019.

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 A3.9a to A3.9e.

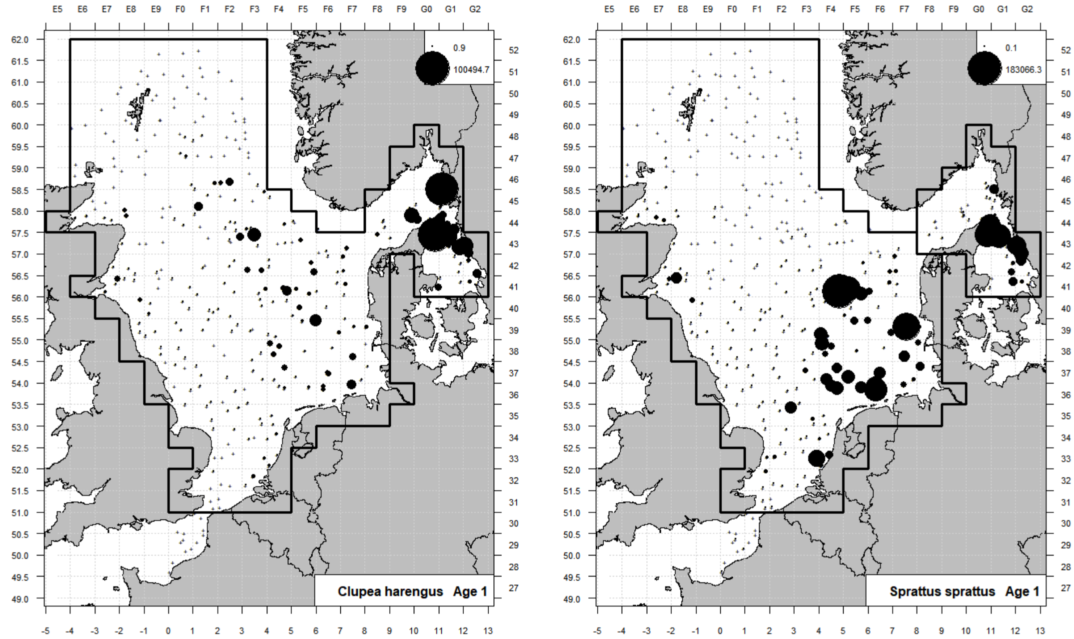


Figure A3.9a Distribution of herring and sprat age 1 in the quarter 1 IBTS 2020 (thick lines: index areas for sprat in Q1 but for herring in Q3).

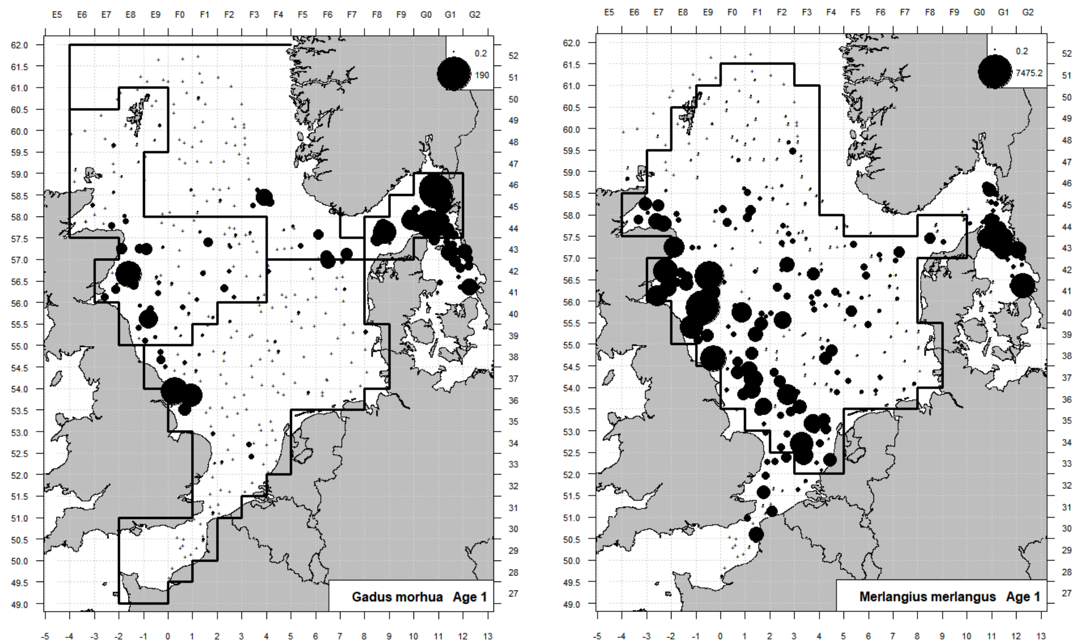


Figure A3.9b Distribution of cod and whiting age 1 in the quarter 1 IBTS 2020 (thick lines: Subpopulation separation for cod, index areas for whiting).

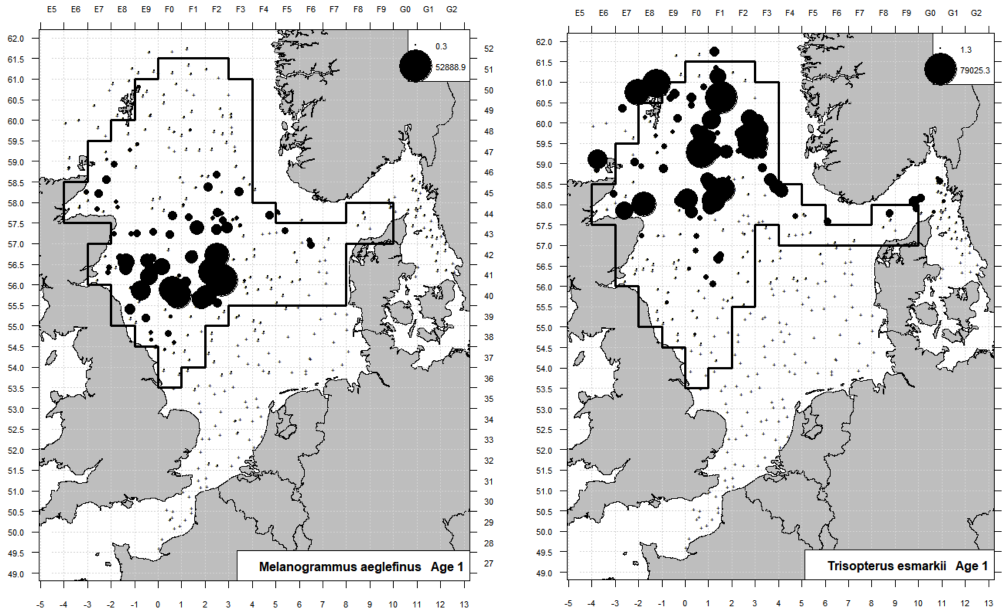


Figure A3.9c Distribution of haddock and Norway pout age 1 in the quarter 1 IBTS 2020 (thick lines: index areas).

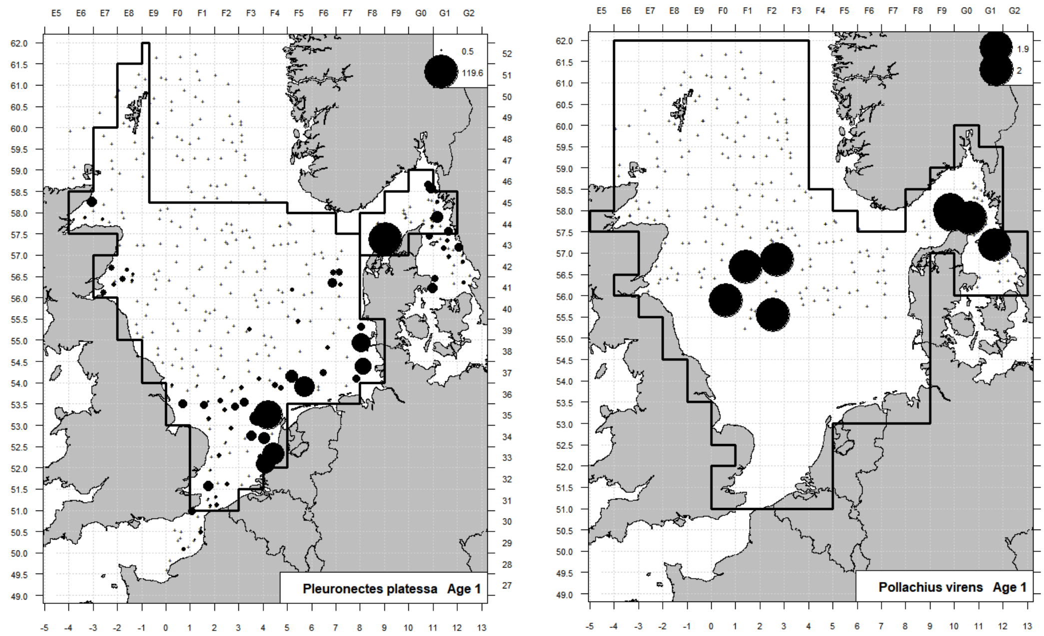


Figure A3.9d Distribution of plaice and saithe age 1 in the quarter 1 IBTS 2020 (thick line: old index areas).

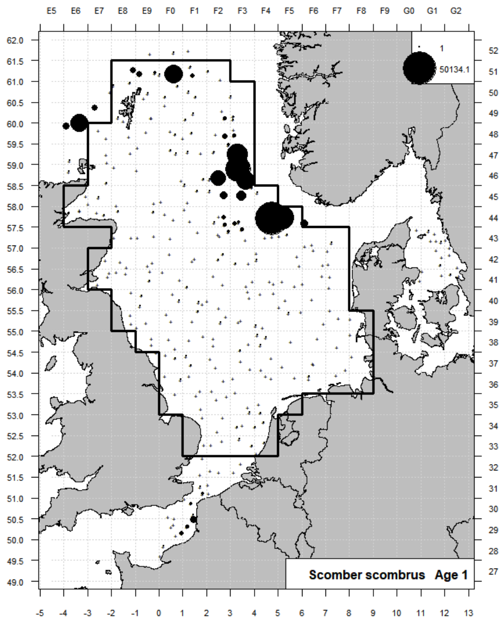


Figure A3.9e Distribution of mackerel age 1 in the quarter 1 IBTS 2020 (thick line: index area).

MIK

The International Bottom Trawl Survey (IBTS) provides the time-series for 1-ringer herring abundance index in the North Sea from GOV catches carried out during daytime. In addition, night-time catches with a fine meshed 2 m ring trawl provide abundance estimates for large herring larvae (0-ringers) of autumn spawning stock components.

The total abundance of 0-ringers in the survey area is used as a recruitment index for the stock. This year, 576 depth-integrated hauls were completed with the MIK-net, which is 61 MIK hauls less than in 2019. Several issues hampered MIK sampling during the Q1 IBTS: in particular the permit to work in UK waters was not issued for the German participation and other nations had to step in. Their sampling, however, was severely affected by prevailing bad weather with strong winds and high waves. The coverage of the survey area was, however, still good with at least 2 hauls in most of ICES rectangles in the North Sea as well as in Kattegat and Skagerrak.

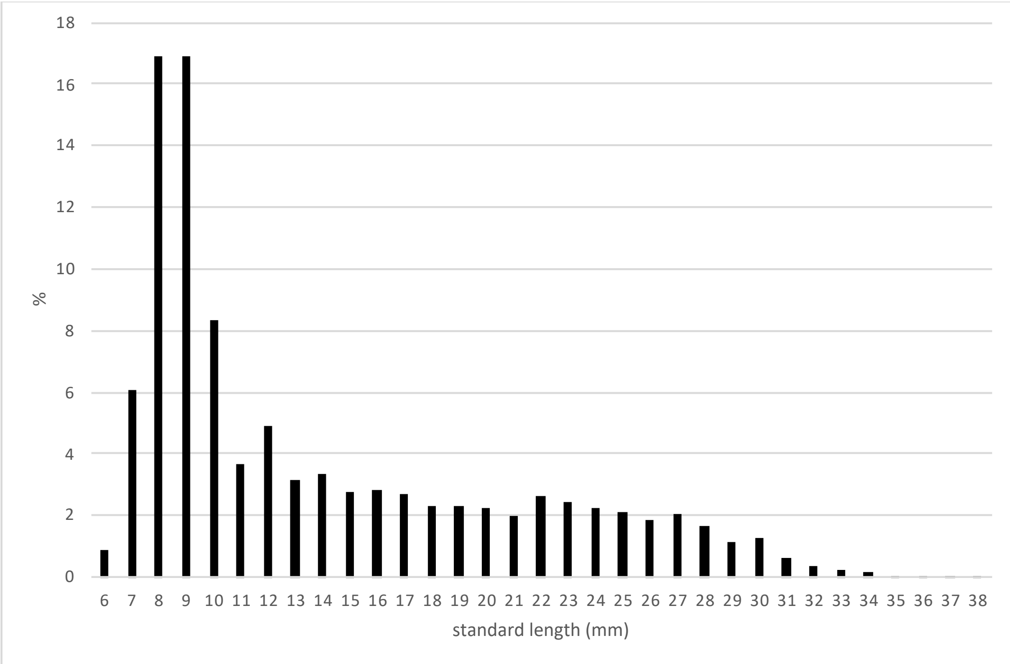


Figure A3.10. North Sea herring. Length distribution of all herring larvae caught during the 2020 Q1 IBTS.

Larvae measured between 5 and 38 mm standard length (SL). Again, and as in most years, the smallest larvae <10 mm were the most numerous but (Figure A3.10). Larger larvae >18 mm SL were rarer and were caught in slightly higher densities than last year (Figure A3.11). The smallest larvae were chiefly caught in 7.d and in the Southern Bight. The large larvae appeared in moderate to high quantities in both, the west-ern and eastern parts of the North Sea. In the southeastern and eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was much higher than last year.

The newly proposed rule was applied to the MIK herring larvae data time-series from 1992 onwards, where because of data quality issues all French data before 2008 were excluded. The 2020 index is 62.4.

It appears noteworthy that again a large number of sardine larvae were found in the samples. With an abundance of 7.4 * 10^9, sardine larvae made up 11.9 % of herring larvae abundance in the entire North Sea, Channel and Kattegat/Skagerrak. Most sardine larvae occurred in the southern and southeastern North Sea, and in the Skagerrak (Figure A3.12). However, for the first time, sardine larvae were recorded in the Kattegat and in the vicinity of the Orkney/Shetland area. The latter may indicate at another intrusion path into the North Sea, apart from the know one through the channel.

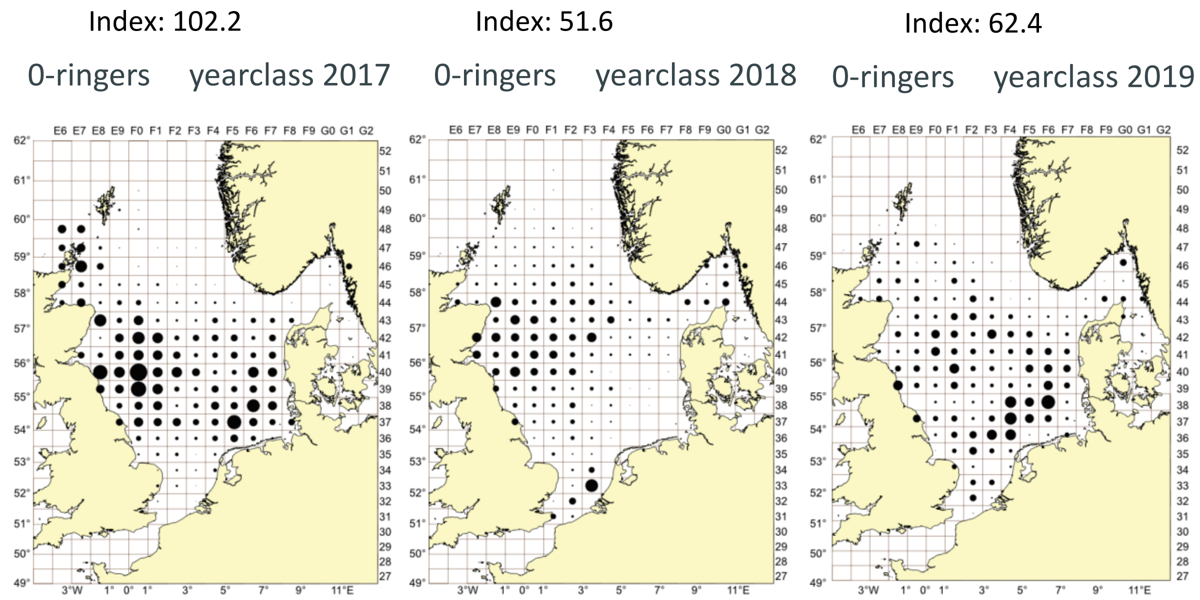


Figure A3.11. North Sea herring. Distribution of 0-ringer herring, year classes 2017–2019. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2018–2020. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest 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.

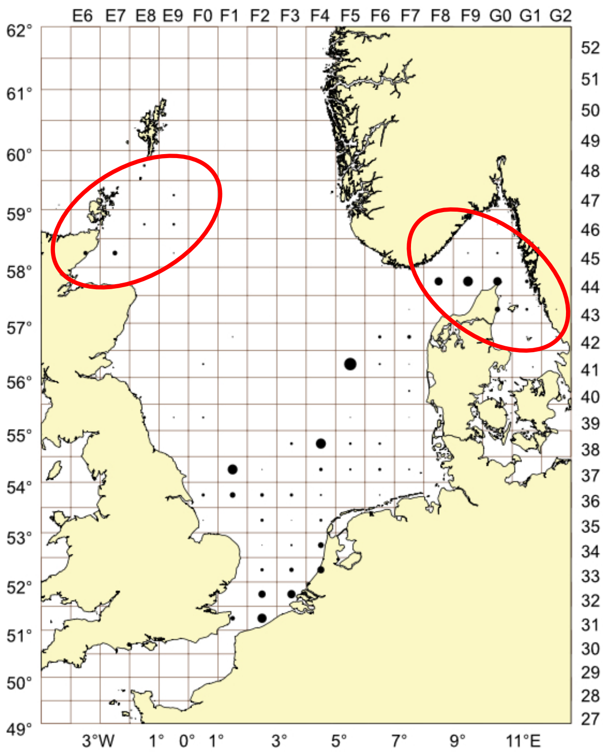


Figure A3.12: Distribution of sardine larvae in January/February 2020. Density estimates of sardine larvae within each statistical rectangle are based on MIK catches during IBTS in January/February 2018–2020. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest circle represents a density of 0.33 m^{-2}. All circles are scaled to the same order of magnitude of the square root transformed.

Staff exchange

No staff exchange occurred during the IBTS Q1 2020. However, a Dutch WMR staff member and a Dutch boatswain of the Tridens II participated in the Scottish gear trials end of 2019. The came back with an idea to solve an issue the Dutch had with gaining the net opening. They have attached additional the floats as have the Scottish on their GOV. This is indeed stabilized the headline and slightly increased the net opening.

Furthermore, they were a bit confused with the Scottish subsampling method. Despite they had some discussions about this on board about this, they were not fully convinced that it was an easier or better method then our own way of subsampling.

They were also happy to have worked with the CEFAS electronic measuring board. They clearly saw some benefits for this, however they reported also a number of negative aspects of the system and did not advice to start using this specific system on board of the Dutch vessel.

Annex 4: North Sea Q3 2019

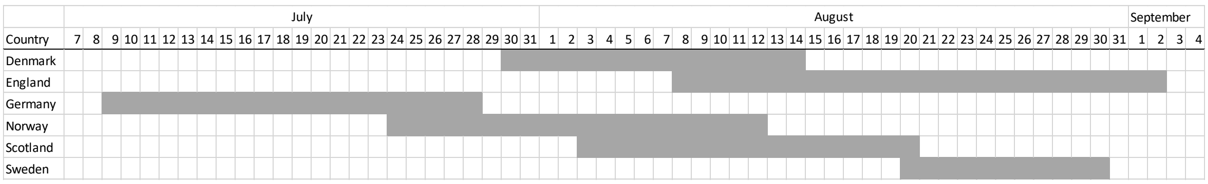
(*Coordinator: Kai Wieland*)

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 groundgear A for normal bottom conditions or groundgear 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 2019: Dana (Denmark and Sweden), Walther Herwig III (Germany), Kristine Bonnevie (Norway), Cefas Endeavour (England) and Scotia (Scotland). The overall sampling period extended from 9 July to 2 September (Table A.4.1.1).

Table A.4.1.1. Sampling periods in the North Sea IBTS Q3 survey in 2019.



In total, 345 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 (Figure A.4.1.1). They consequently have a small amount of area at depths < 200 m, which is the maximum survey depth limit in the North Sea according to the current manual; only in the Skagerrak, the depth limit is 250 m.

Table A.4.1.2. Overview of the GOV stations fished in the North Sea IBTS Q3 survey in 2019 (*: relative to the number of tows planned by IBTSWG 2019, ( ): not reported to DATRAS but available at https://github.com/ices-eg or IBTSWG 2020 sharepoint).

ICES area	Country	Gear used	Number of tows planned (IBTSWG 2019)	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	28	28	17*	100	
	DEN	GOV-A	2	2	0	98	-
4a,b,c			52	51	0		-
	ENG	GOV-A	78	77	0	99	
	GER	GOV-A	31	31	0	100	
4a,b	NOR	GOV-A	48	55	0	115	
4a	SCO	GOV-B	49	44	0	94	
4b		GOV-A	40	40	0		

* In order to comply with Sweden's depth stratified design

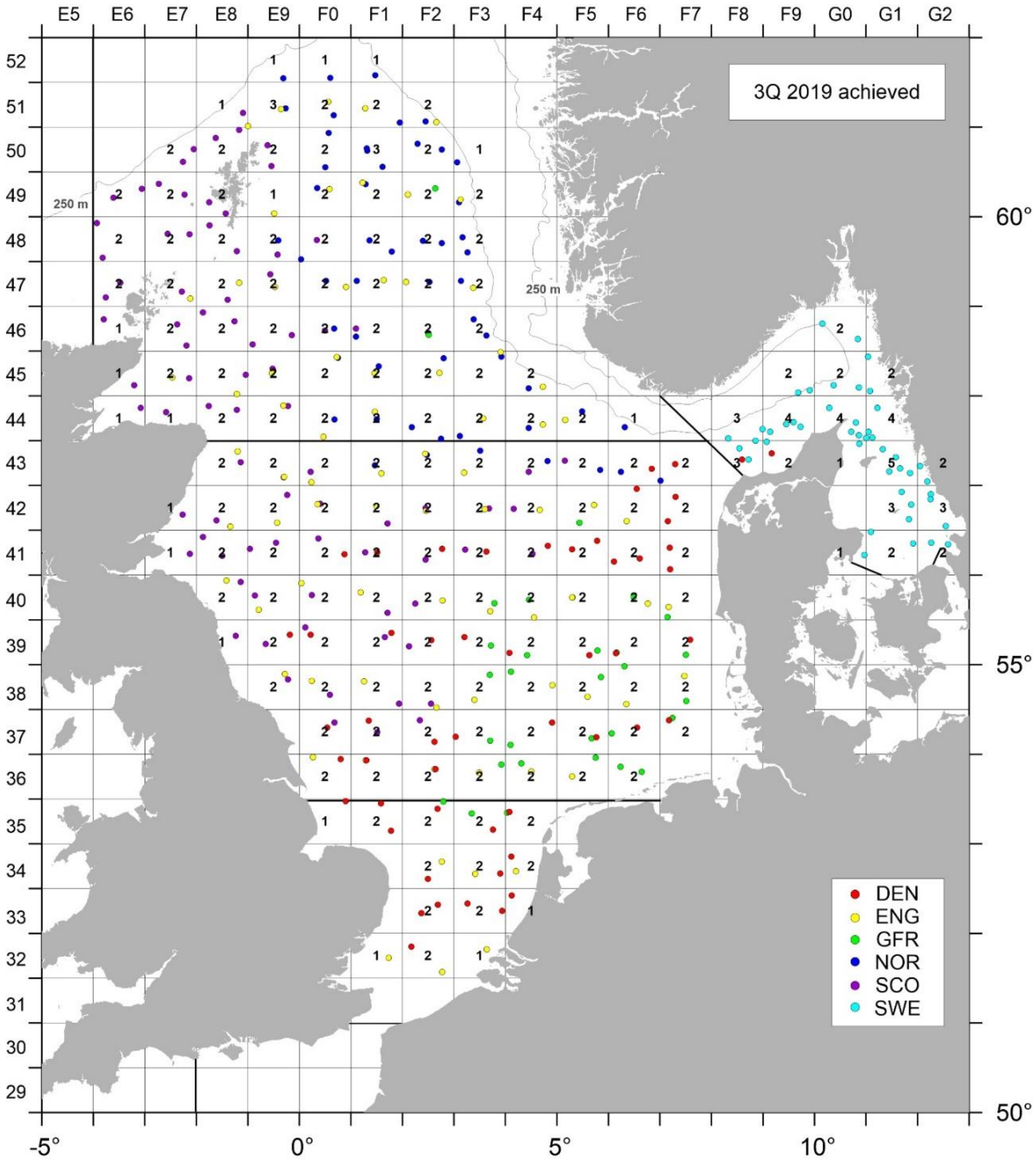


Figure A.4.1.1. Number and start position of hauls per ICES statistical rectangle as taken with the GOV during the North Sea IBTS Q3 2019. Tows are separated into ICES Divisions in the North Sea (4a, 4b,and 4c), the Skagerrak/Kattegat (3a), and the English Channel (7d).

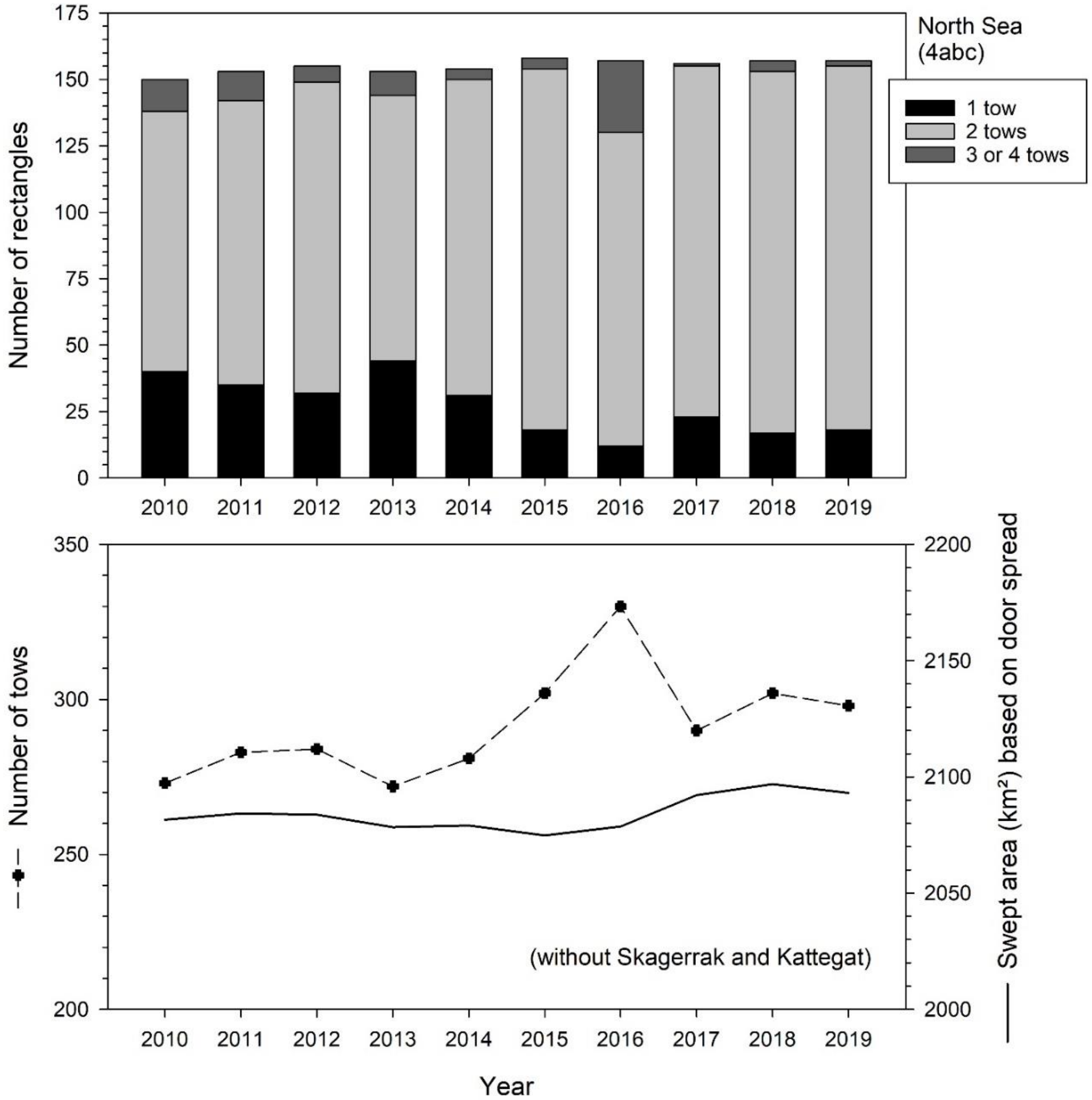


Figure A.4.1.2. Changes in survey performance, 2010-2019, reported as number of tows achieved and total amount of swept-area in the North Sea (based on door spread and towed distance by haul).

All standard hauls were planned of 30-min duration. However, 34 tows reported as valid to DATRAS were shorter than 27 minutes (ENG, GFR, NOR, SCO, SWE) and for 11 tows were just 15 minutes (NOR, SCO) (Figure A.4.1.3). Denmark was the only country for which all hauls had a duration of 30 min.

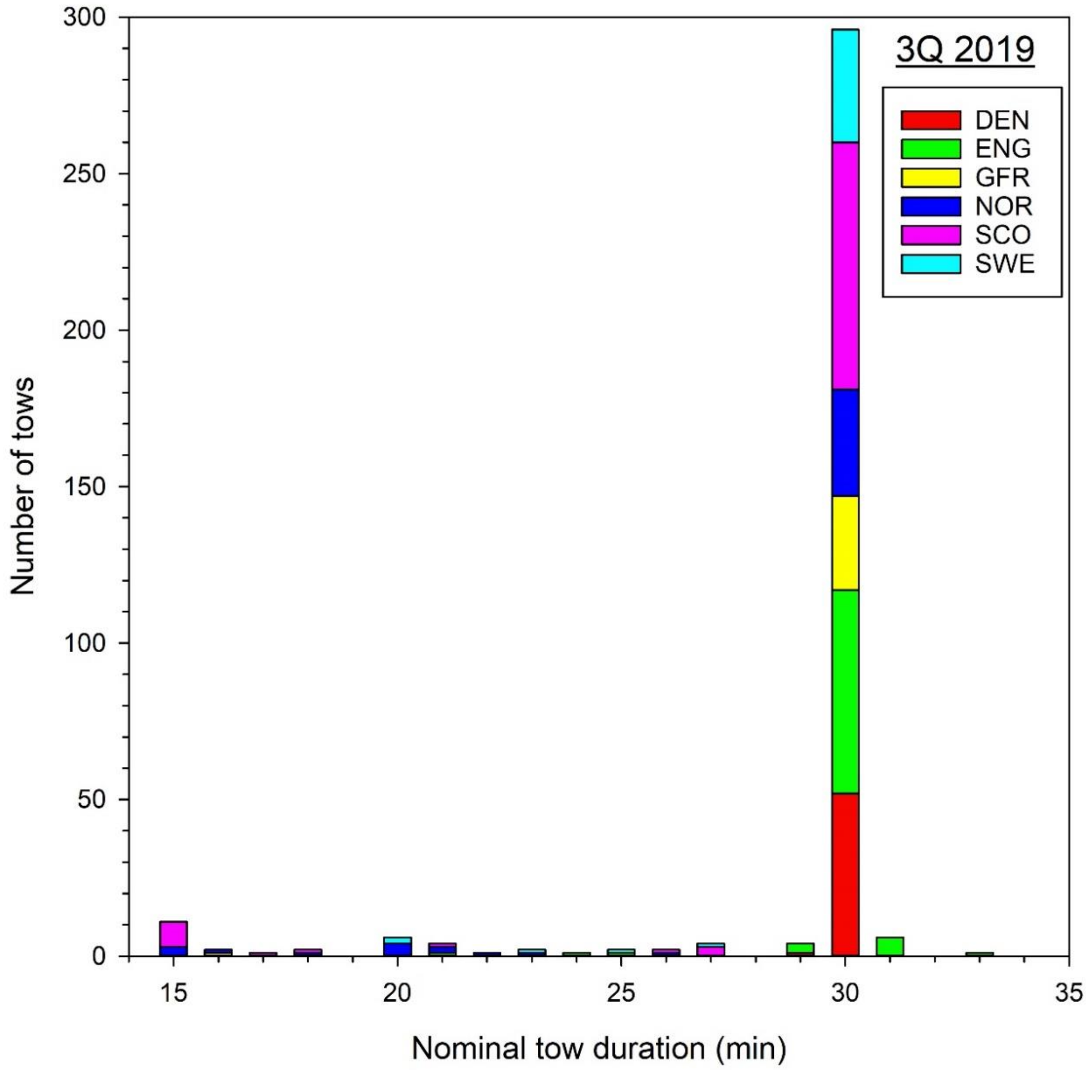


Figure A.4.1.3. Achieved tow durations by country, valid tows NS-IBTS 3Q 2019.

Biological data (weight, sex, maturation stage, and age material) were collected for many species (Tables A.4.1.3 and A.4.2.1.4); 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 does not collect biological data samples for sprat. These gaps are deviations from the survey manual and should be adjusted if possible.
Sweden has not collected mackerel otoliths in the past, mainly due to very low catches for many years but started sampling mackerel in 2019Q3. Currently, these samples have not been aged due to lack of local age reading expertise.

Sweden will continue to collect biological data for mackerel in quarter 1 but is reluctant to do so in quarter 3. The modelled bottom-trawl recruitment index used in assessment is based on quarter 1 and quarter 4 data only,and there is no obvious end-user for quarter 3 data. Given the overarching aim to optimize sampling it seems counterproductive for Sweden to initiate biological sampling of mackerel in quarter 3 at this time. However, when sharing North Sea rectangles Sweden will collect biological data on mackerel in quarter 3 in order to maintain present time-series, but with the expectations that the end-user needs for these data will been clarified in the near future.

Table A.4.1.3. Overview of age samples collected of NS-IBTS target species during the North Sea IBTS Q3 survey in 2019).

Species	DEN	ENG	GER	NOR	SCO	SWE	Total
Clupea harengus	339	1207	91	1583	590	1388	5198
Sprattus sprattus	265	0	207	10	104	847	1433
Gadus morhua	82	310	22	243	474	187	1318
Merlangius merlangus	582	1465	124	804	1002	701	4678
Melanogrammus aeglefinus	197	1323	91	890	1331	199	4031
Trisopterus esmarki	10	348	12	719	338	169	1596
Pollachius virens	10	195	1	323	160	51	740
Scomber scombrus	224	386	143	903	439	237	2332
Pleuronectes platessa	23	1221	141	114	393	291	2183

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 2019 (*: *Dipturus batis* is now considered to be two species (*D. flossada* and *D. intermedia*; [1)]: individual weight, [2)]: Individual weight and sex, [3)]: individual weight, sex and maturity, [4)]: individual weight, sex, maturity and age, [5)]: individual weight, sex and male maturity, [6)]: carapace length, sex and maturity).

Species	DEN	ENG	GER	NOR	SCO	SWE
Amblyraja radiata		123 [3)]	1 [2)]	88 [3)]	40 [5)]	
Cancer pargurus			6 [2)]			
Chelidonichthys cuculus		33 [4)]				
*Dipturus batis**						
Dipturus intermedia		6 [5)]			8 [5)]	
Dipturus flossada						
Dipturus linteus				1 [1)]		
Dipturus oxyrinchus				1 [1)]		
Etmopterus spinax				223 [3)]		
Galeorhinus galeus		2 [3)]				
Galeus melastomus		21 [3)]		116 [1)]		
Glyptocephalus cynoglossus		56 [4)]				116 [4)]
Homarus vulgaris						
Leucoraja fullonica						
Leucoraja naevus		35 [3)]	2 [2)]	7 [3)]	37 [5)]	
Lithodes maja			1 [2)]			
Lophius piscatorius		77 [4)]				
Merluccius merluccius	23 [3)]	1465 [4)]				231 [3)]
Microstomus kitt		235 [4)]				
Mullus surmulletus		47 [4)]			10 [1)]	
Mustelus asterias		20 [5)]	2 [2)]			
Nephrops norvegicus			11 [2)]			1770 [6)]
Pollachius pollachius					1 [1)]	
Psetta maxima						
Raja clavata		87 [3)]	2 [2)]		4 [5)]	
Raja montagui		124 [3)]	7 [2)]		62 [5)]	
Rajella fyllae				4 [3)]		
Scopthalmus maximus		11 [4)]				
Scopthalmus rhombus		7 [4)]				
Scyliorhinus canicula			4 [2)]	5 [3)]		
Squalus acanthias		22 [5)]	1 [2)]	3 [3)]	45 [5)]	
Solea solea						11 [4)]

A.4.2 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.4.2.1.

Table A.4.2.1. Overview of additional activities in the North Sea IBTS Q3 survey in 2019 (Water samples for CTD calibration not explicitly listed, x: routinely, (x): ad hoc studies,*: available at https://github.com/ices-eg or IBTSWG 2020 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
Water sampler (Nutrients, eDNA)		x	x	x	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				

A.4.3 Issues and problems

There were no major issues and problems.

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 emphasized 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 2019 (Missing door spread values can be estimated for ENG by DS = 10.057 + 33.688 * log(depth), r^2: 0.84; the regressions were estimated based on the observed values in the 3Q 2019 surveys as shown in Figure A.4.4.1a (ENG) and is supposed to be superior to the overall regression combining several years back to 2004 due to potential recent gear changes).

Parameter	DEN	ENG	GER	NOR	SCO	SWE
Net opening	1	0	2	0	0	0
Door spread	0	5	0	0	0	0
Wing spread	53	12	8	19	0	45

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. There were, however, pronounced differences between the countries for door spread and in particular vertical net opening at a given depth. Sweden and in particular Norway had net openings that were consistently low whereas Germany had net openings which were much higher than for the other countries especially at shallow stations (Figure A.4.4.2).

Wing spread was not measured by all countries because of missing sensors and also for those countries which had wing spread sensors the missing values and highly variable observations were common (Figures A.4.4.1 a-c and Figure A.4.4.2).

Differences in swept-area at depth based on door spread between the countries were encountered where in particular the values for Scotland (low door spread and low groundspeed) deviated from the others (Figure A.4.4.3).

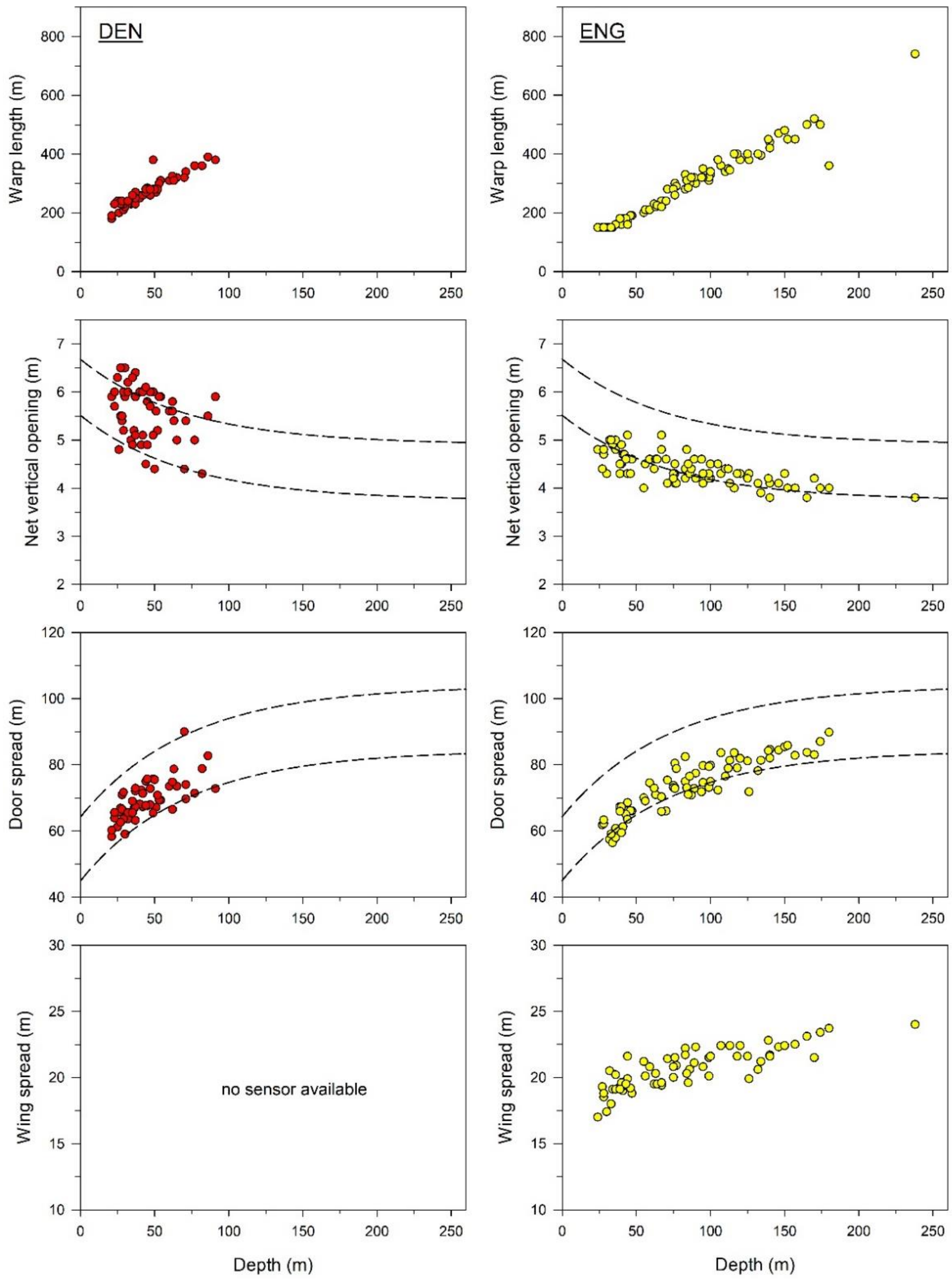


Figure A.4.4.1a. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2019, Denmark (all tows with 2 Vonin flyers instead of the standard Exocet kite) and England. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

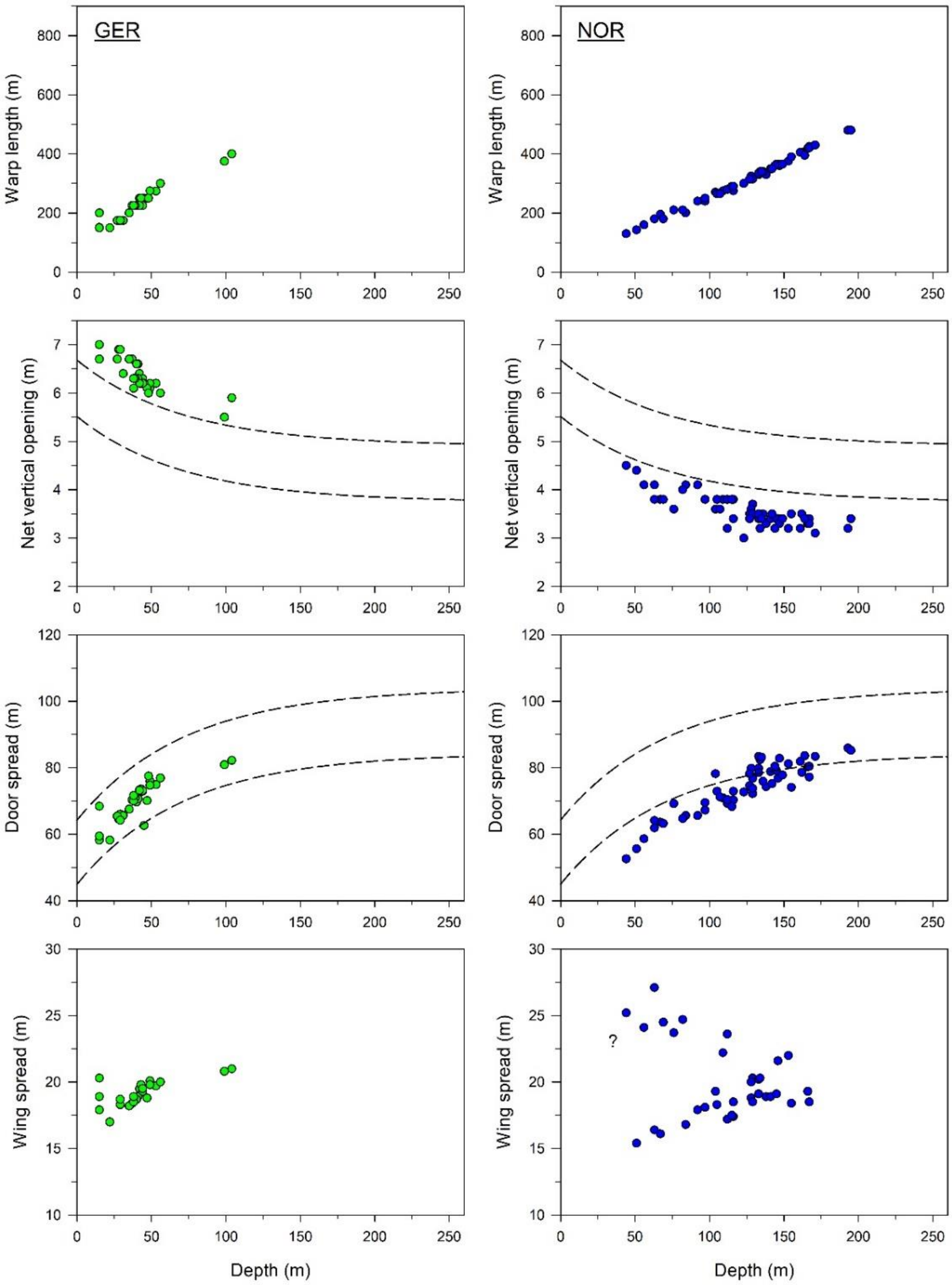


Figure A.4.4.1b. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2018, Germany and Norway. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

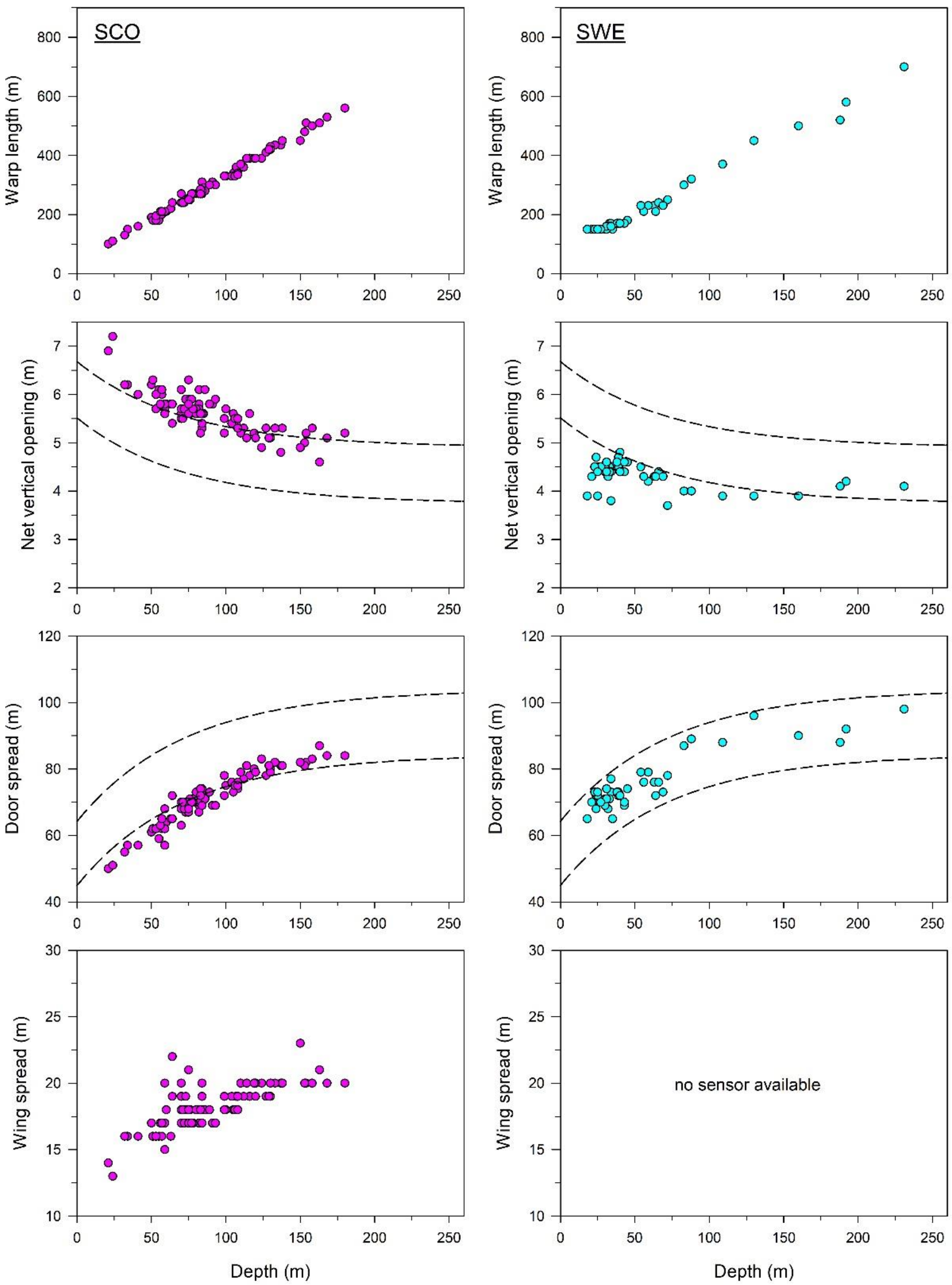


Figure A.4.4.1c. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2018, Scotland and Sweden. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

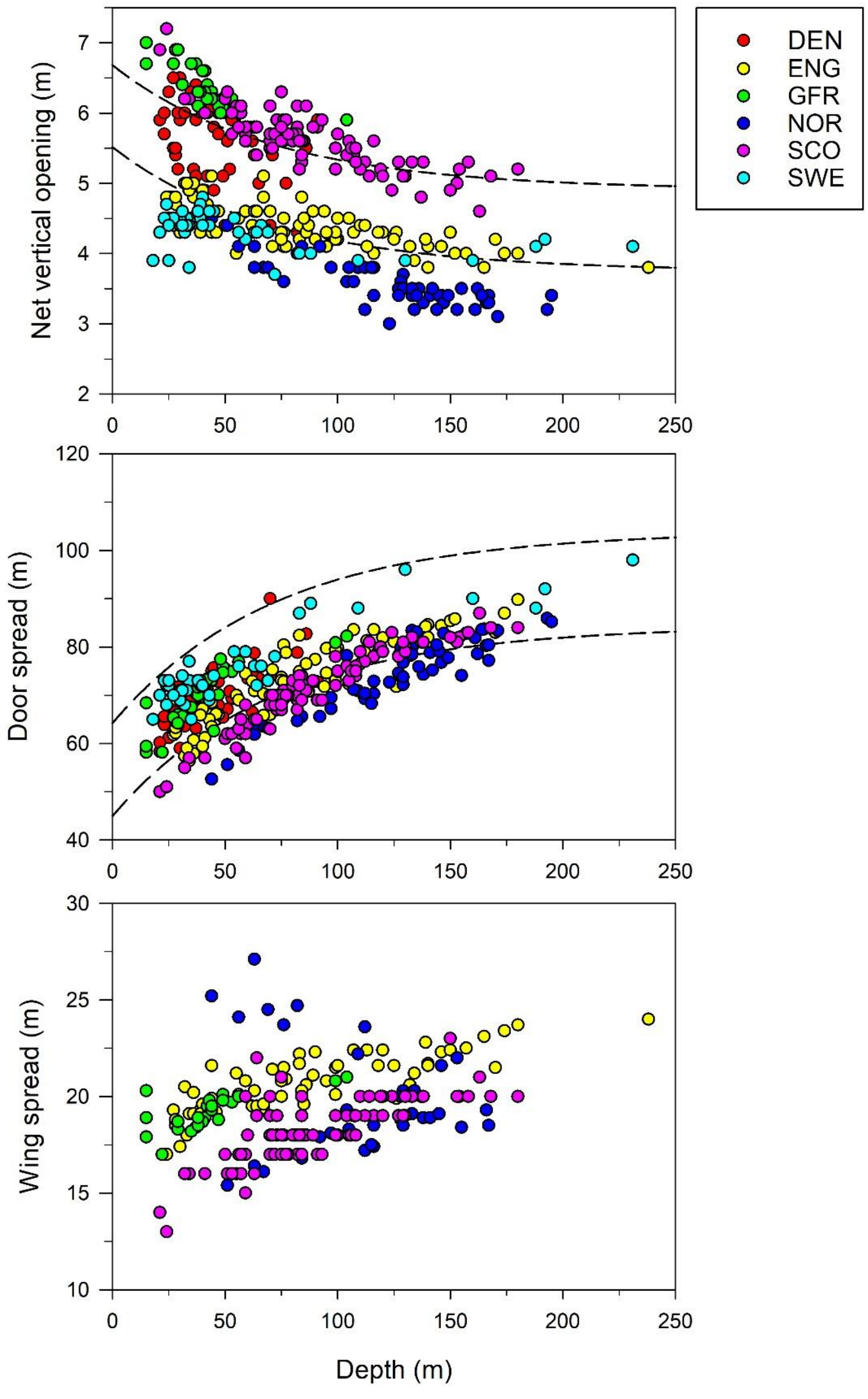


Figure A.4.4.2 Comparison of trawl geometry related to depth between countries for the North Sea IBTS Q3 2019. Dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual.

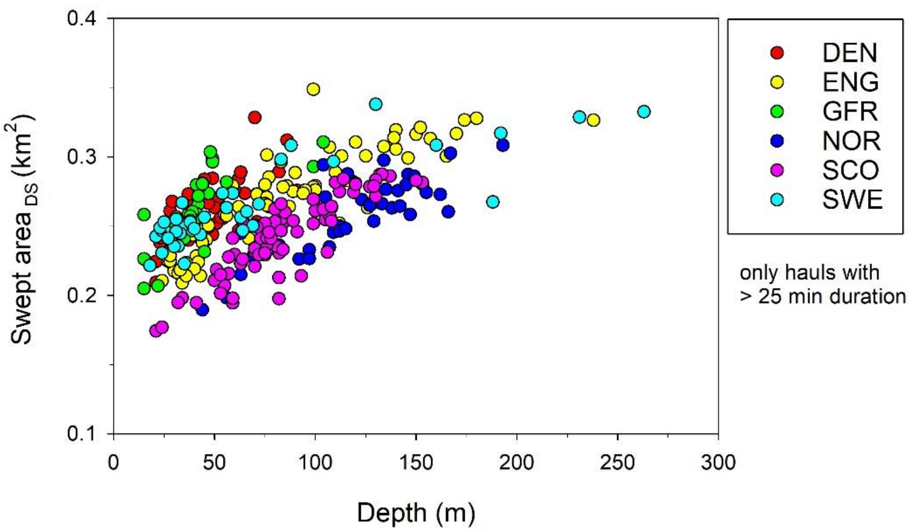


Figure A.4.4.3 Comparison of swept-area (based on door spread related to depth between countries for the North Sea IBTS Q3 2019 (only hauls with a duration of > 25 min considered; Note: Average groundspeed for SCO and SWE only 3.7 kn (for historical reasons), as opposed to the target speed of 4.0 kn (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 km², swept-area based on door spread) for the recruits of the NS-IBTS standard species based on the 2019 quarter 3 survey are shown in Figures A.4.5.1. For some target species, high densities were found just outside the actual index areas, e.g. cod, 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.

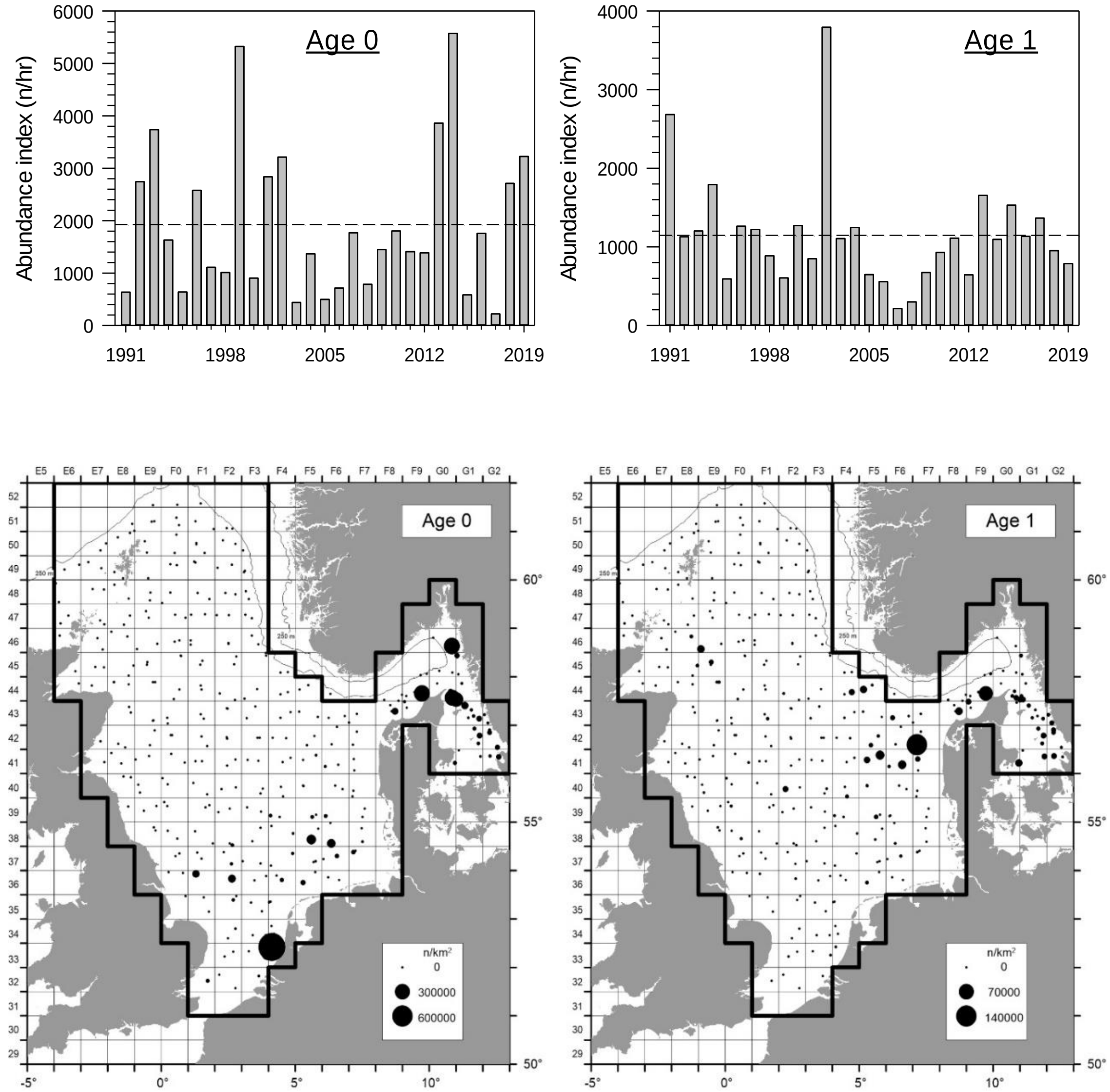


Figure A.4.5.1a. Abundance indices for herring 3Q NS-IBTS 1991-2019 (top panels; dashed lines represent long term mean) and distribution in 3Q 2019 (bottom panels; thick solid line represent limit of the current index area in Q#).

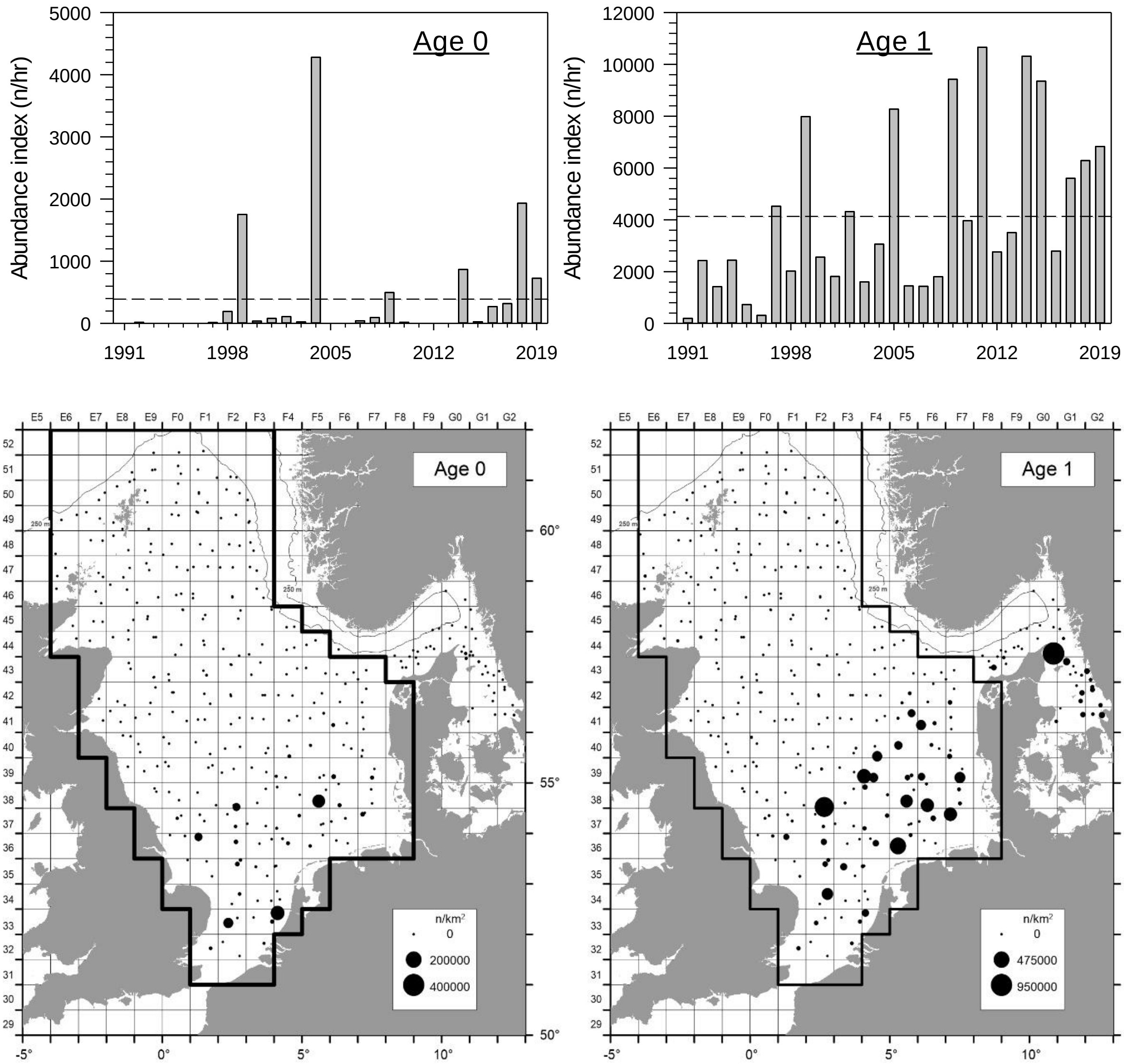


Figure A.4.5.1b. Abundance indices for sprat 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

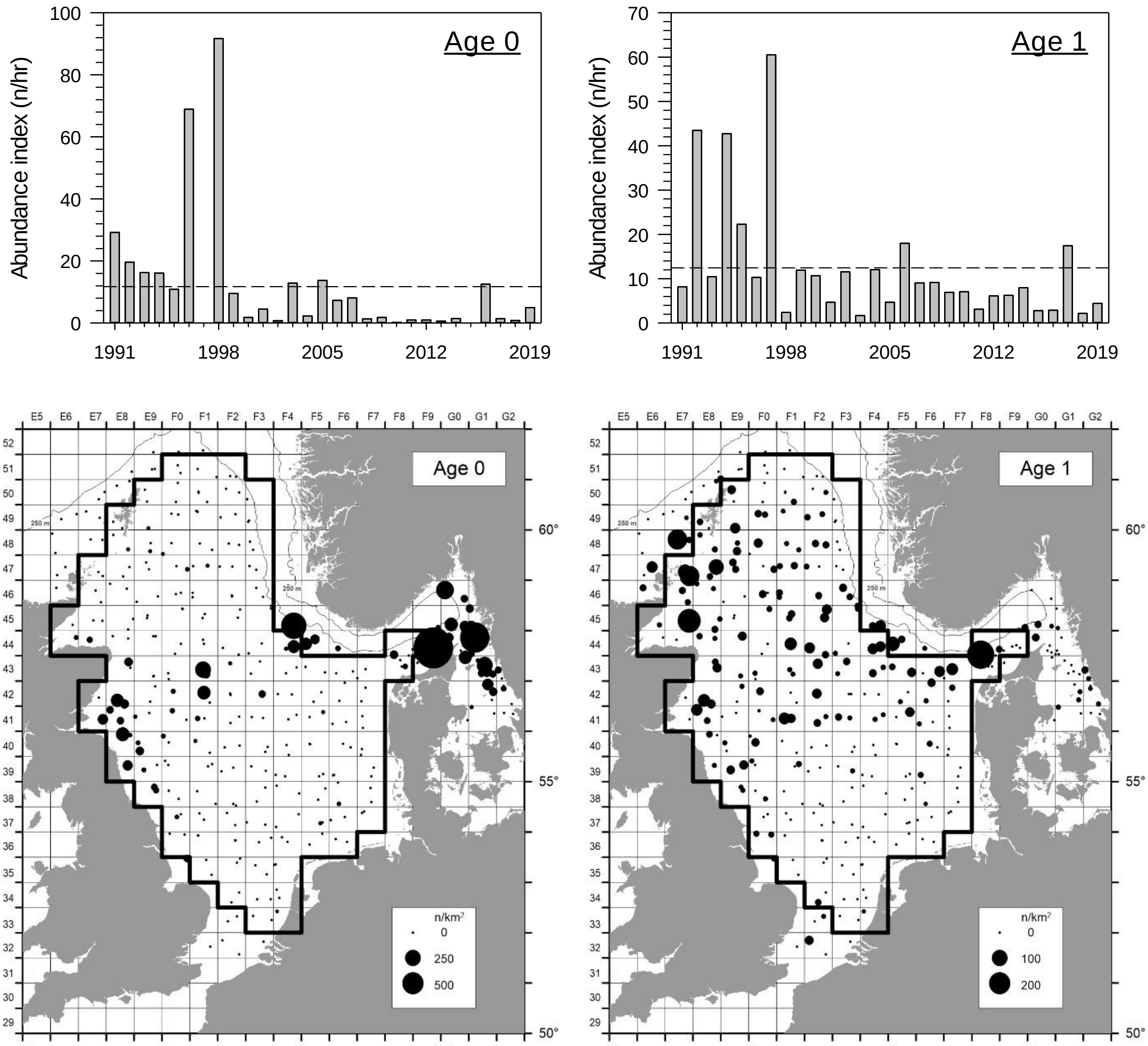


Figure A.4.5.1c. Abundance indices for cod 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

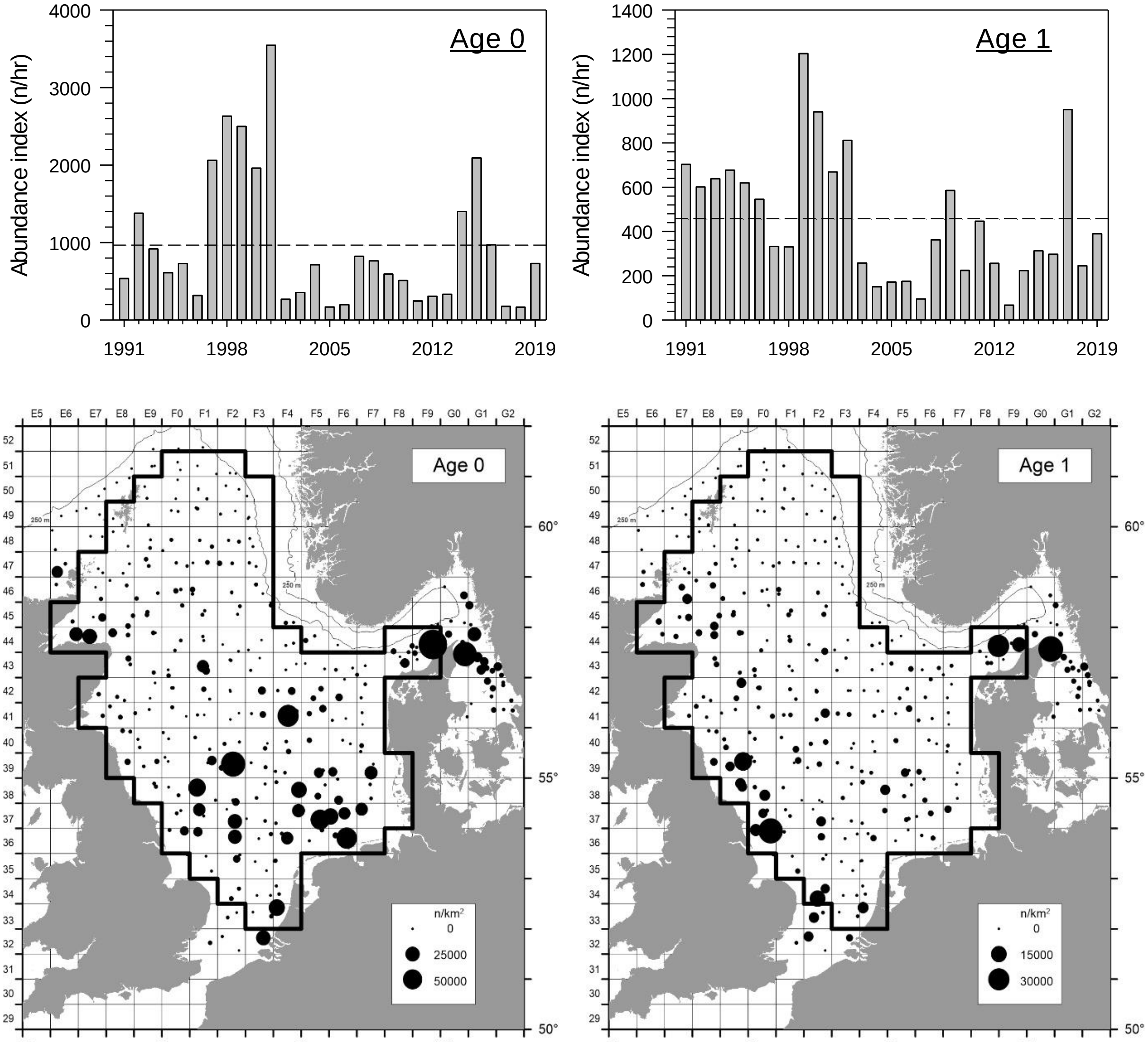


Figure A.4.5.1d. Abundance indices for whiting 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

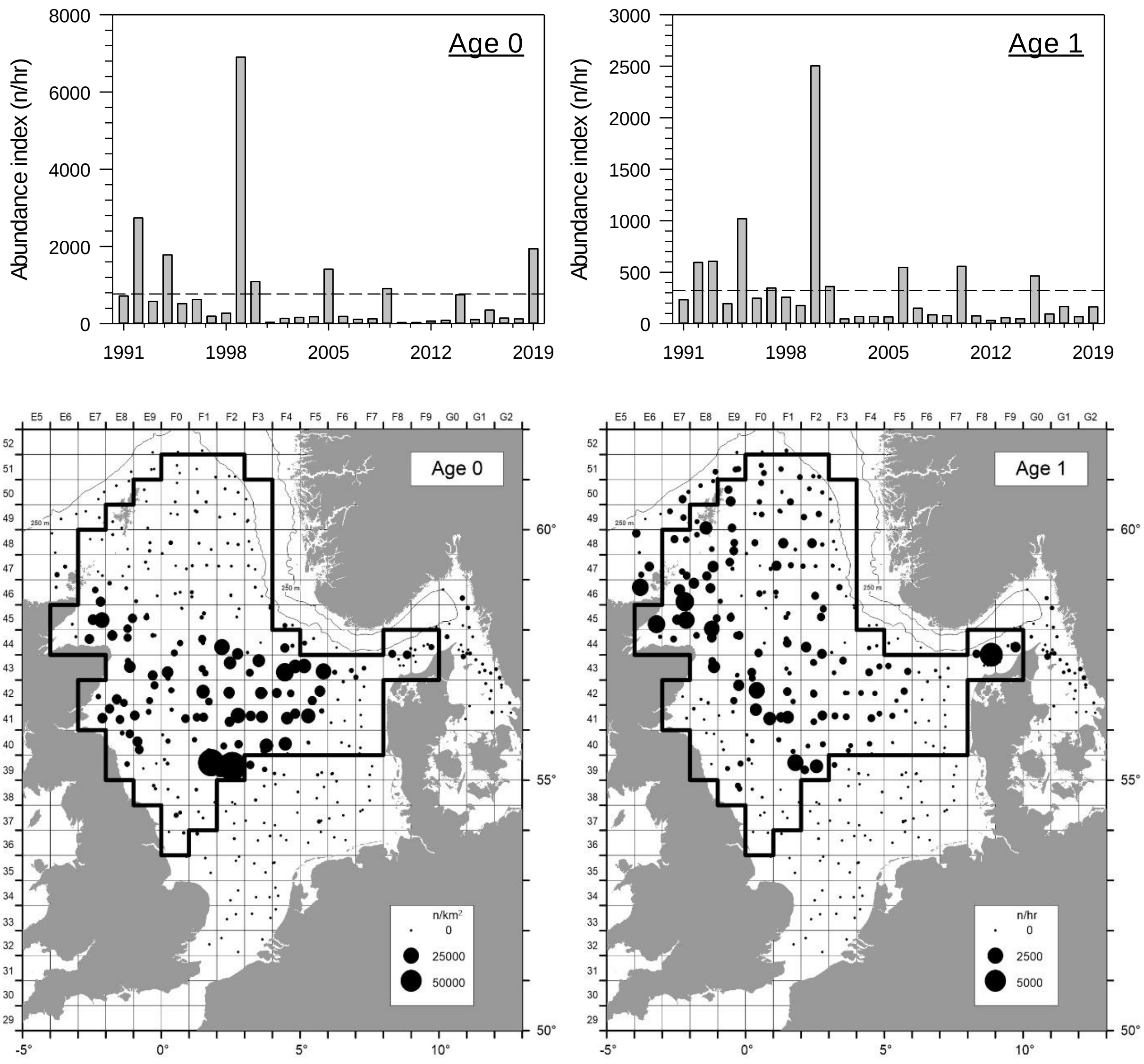


Figure A.4.5.1e. Abundance indices for haddock 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

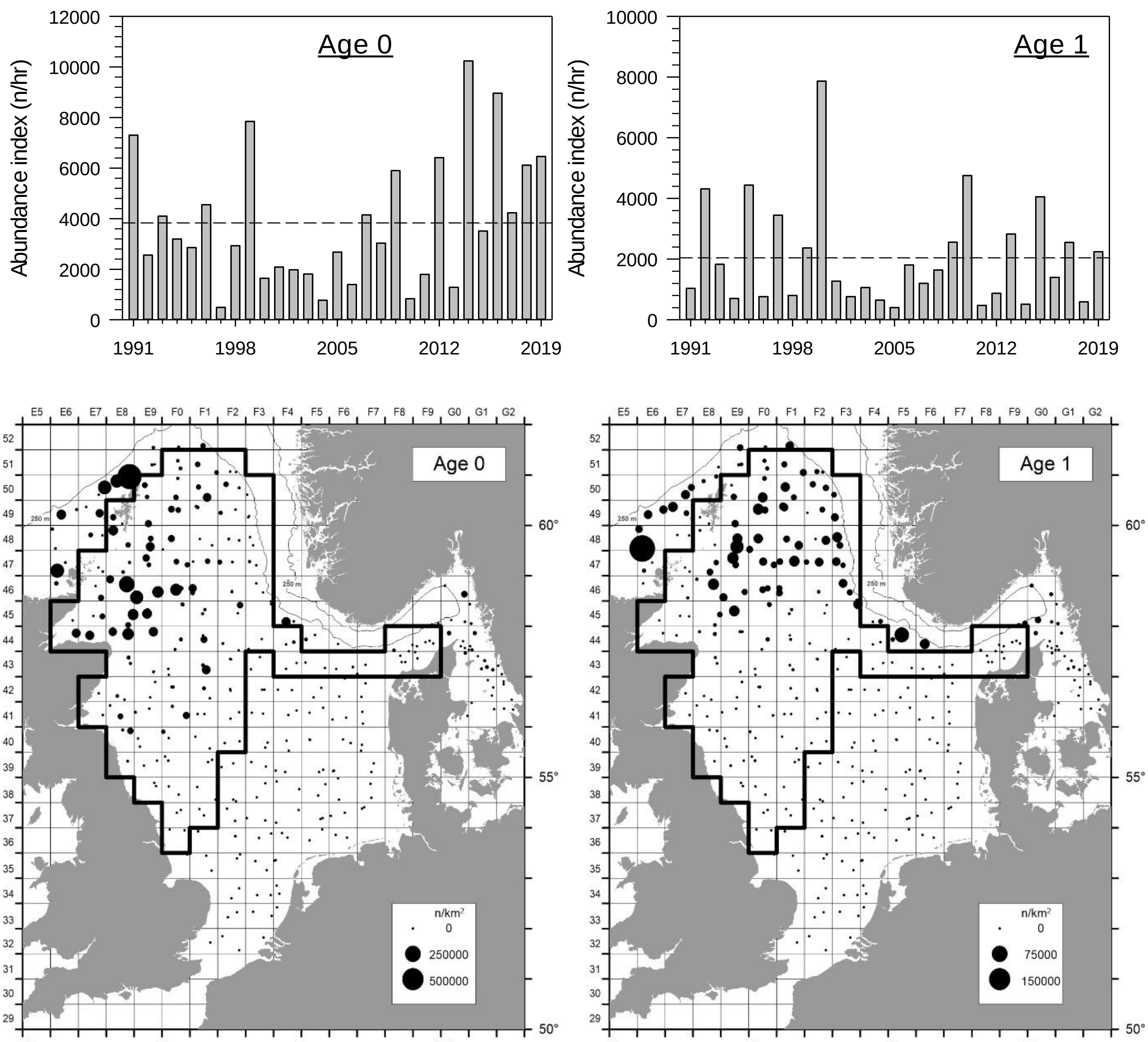


Figure A.4.5.1f. Abundance indices for Norway pout 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

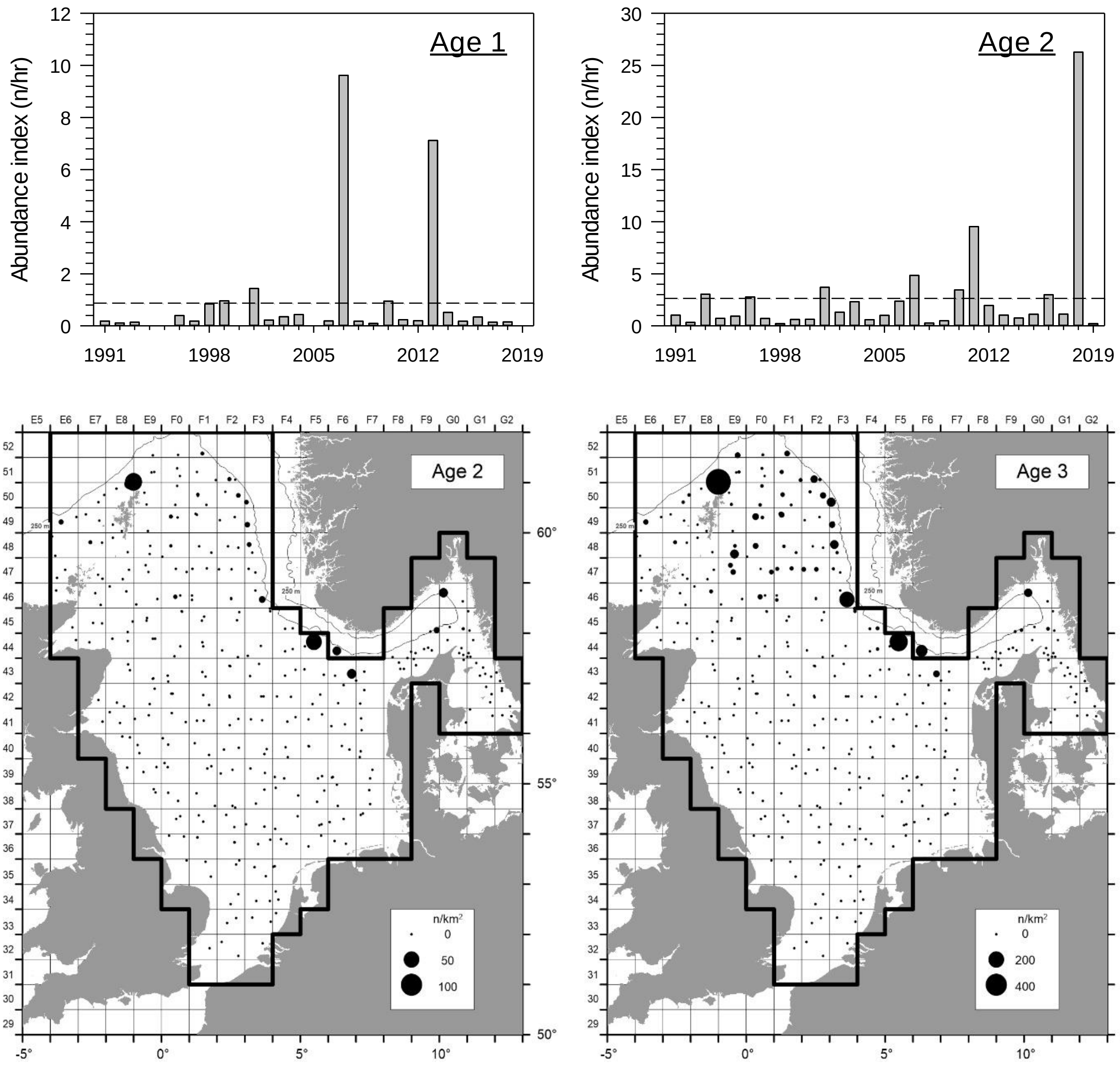


Figure A.4.5.1g. Abundance indices for saithe 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area; Note: Indices may differ from DATRAS standard indices due to a change in the index area for this species).

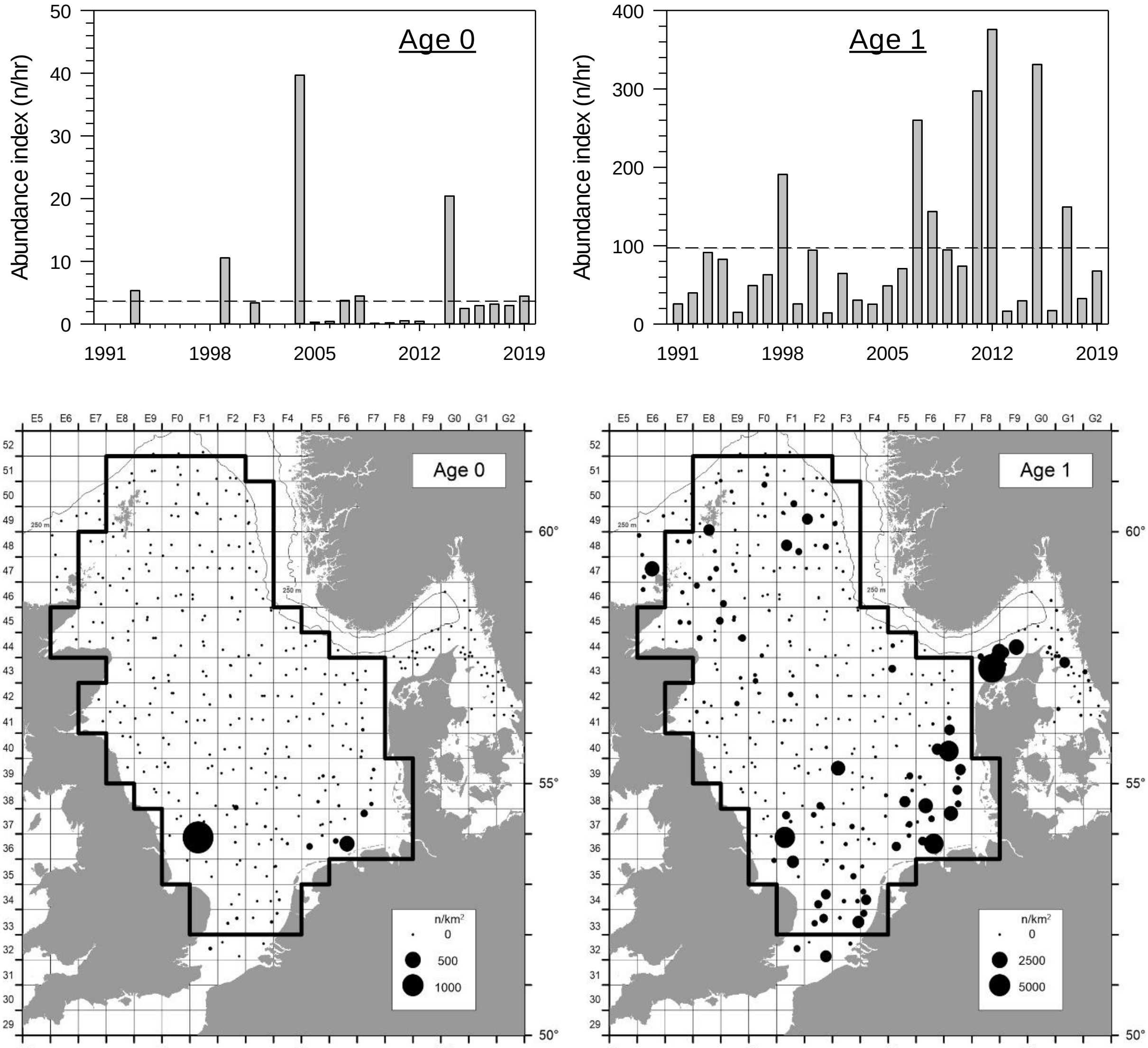


Figure A.4.5.1h. Abundance indices for mackerel 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area).

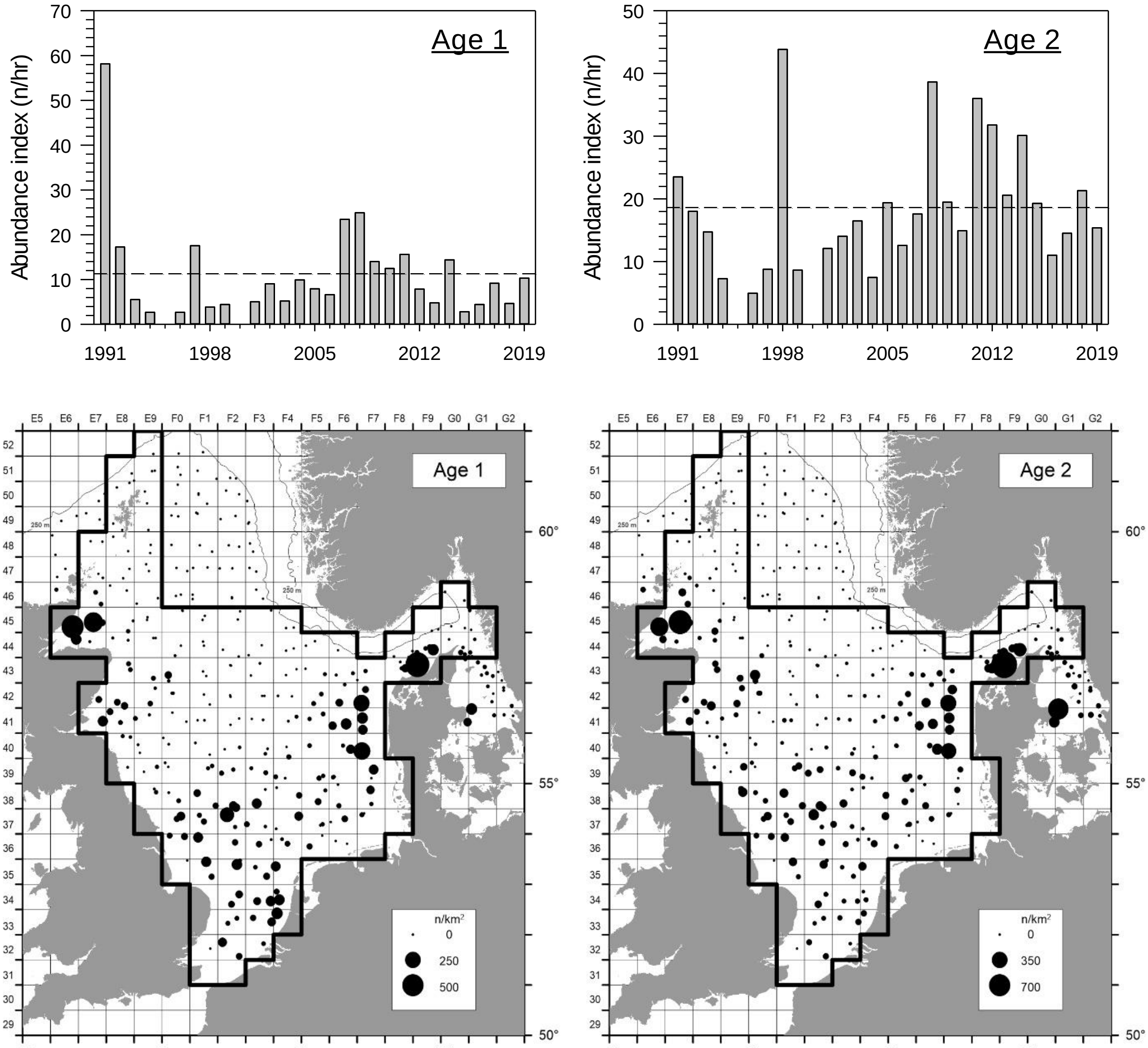


Figure 5.2.5.1i. Abundance indices for plaice 3Q NS-IBTS 1991-2019 (dashed lines represent mean) and distribution in 3Q 2019 (thick solid line represent the limit of the current index area; Note: Indices may differ from DATRAS standard indices due to a change in the index area for this species).

In the future, the indices should presented as number per swept-area instead of number per hour to account for the differences in door spread at depth between the countries considering the recommendations from ICES WGISDAA (ICES 2013) and WKSABI (ICES 2019b). In this respect some progress has been made but there are still years with missing information for the calculation of swept-area from single countries and years (ICES 2019b).

A.4.6 Other issues

A.4.6.1Staff exchange

No staff exchange has occurred during the 2019 Q3 surveys. However, IBTSWG continues to encourage staff exchange.

A.4.6.2Data 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 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.

Annex 5: NE Atlantic

A.5.1 General overview

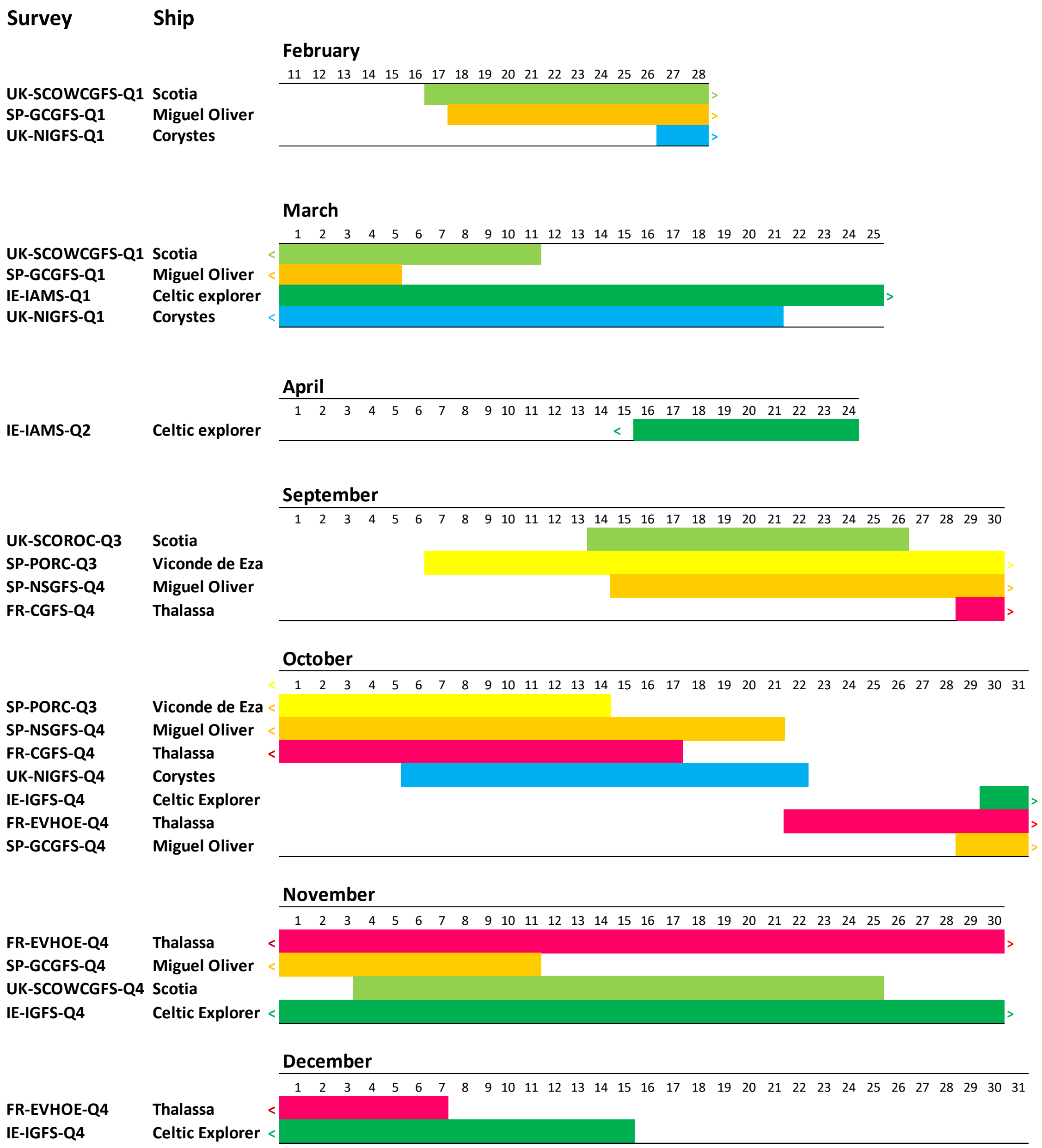
In 2019, six vessels from 5 nations performed 13 surveys along the Northeastern Atlantic (NEA) IBTS area. A total of 1071 valid hauls, out of the 1081 hauls planned, were accomplished over 341 days distributed between all quarters of 2019. See tables 5.4.1.1 and 5.4.1.2. In 2019 all surveys with the exception of the Portuguese quarter 4 survey (PT-PGFS-Q4) were undertaken with most of these being completed without significant issue. Four 1st quarter surveys (Scotland, Northern Ireland, Ireland and the Spanish survey in the Gulf of Cadiz) were operating in February and March with the Irish anglerfish survey once again extending into April. Scotland and Spain were also active during the 3rd quarter within the regions of Rockall and Porcupine bank and the Northern Spanish Coast, with France, Northern Ireland, Ireland, Scotland and Spain all active during quarter 4. Data from all surveys has been uploaded to DATRAS. Selected data tables (A.5.1.1 – A.5.1.4) summarizing biological as well as additional activities for all reported surveys are provided within the current section of this report however comprehensive and detailed information for all reported surveys including survey coverage plots and catch per unit of effort (CPUE) estimates for target species are presented within the individual cruise summary reports and these are located in sections A.5.2 – A.5.15. In lieu of a summary report for the Portuguese quarter 4 survey that did not go ahead in 2019 there is a statement outlining the various and significant impacts encountered as a result of this action.

Table A.5.1.1. Summary of surveys, hauls and days at sea per country performed in the IBTS Northeastern Atlantic area in 2019

Country	Survey	Hauls					Days
		Planned	Valid	Null	Additional	Total	
UK-Scotland	UK-SCOWCGFS-Q1	60	62	3	-	65	21/2*
	UK-SCOROC-Q3	40	44	1	-	45	13
	UK-SCOWCGFS-Q4	60	62	3	-	65	21/1*
UK-North Ireland	UK-NIGFS-Q1	61	61	-	-	61	23
	UK-NIGFS-Q4	61	63	-	-	63	17
Ireland	IE-IAMS-Q1	115	120	4	9	133	34
	IE-IGFS-Q4	171	161	2	4**	167	41
France	FR-CGFS-Q4	71	65	6	-	71	19
	FR-EVHOE-Q4	155	149	2	6	157	47
Spain	SP-PORC-Q3	80	79	2	-	81	38
	SP-NSGFS Q4	116	113	-	17	130	37
	SP-GCGFS-Q1	46	46	1	-	47	16
	SP-GCGFS-Q4	45	43	4	-	47	14
Portugal	PT-PGFS-Q4	-	-	-	-	-	-
Total		1081	1071	27	36	1128	341

* Additional days for moorings
**GOV replacement gear trial tows

Table A.5.1.2. Overview of the surveys performed during quarters 1, 2, 3 and 4 on the Northeastern Atlantic IBTS area in 2019.



Biological Sampling

Table A.5.1.3 provides an overview of the number of biological samples as reported per survey within the Northeastern Atlantic area during 2019.

Table A.5.1.3. Number of individuals sampled for maturity and/or age in 2019 surveys on NEatlIBTS.

Target species	UK-SCOW-CGFS-Q1	UK-SCOROC-Q3	UK-SCOW-CGFS-Q4	UK-NIGFS-Q1	UK-NIGFS-Q4	IE-IAMS-Q1	IE-IGFS-Q4	FR-CGFS-Q4	FR-EVHOE-Q4	SP-PORC-Q3	SP-NSGFS-Q4	SP-GCGFS-Q1	SP-GCGFS-Q4
Clupea harengus	865		229				293						
Gadus morhua	80	16**	83**	195	24	49	164	11	35				
Lepidorhombus boscii						237**			25	314	525		
Lepidorhombus whiffiagonis					6	1033	1495		506	661	643		
Lophius budegassa						524	312		270	43(2)	21		
Lophius piscatorius						1336	624		151	151(2)	39		
Melanogrammus aeglefinus	1754	1695**	1813**	903	765	747	2197		506				
Merlangius merlangus	1235	4**	1208**	1145	1161	297	1473	649	335				
Merluccius merluccius	346		318**	28	4	1636**	626		1046	665	594	286 1068*	319 1166*
Nephrops norvegicus										418*	62*	524(3)	286(3)
Pollachius virens	45	3**	25**	5*			13						
Scomber scombrus	281	30	367				462		228		397		
Sprattus sprattus	271**		153**										
Trachurus trachurus							859				489		
Additional species													
Argyrosomus regius									6				
Chelidonichthys cuculus				143	46			259	170				
Chelidonichthys lucerna													
Conger conger				11			159**			29	147**		
Dicentrarchus labrax							13*	206	88				
Dipturus batis cf. flossada	5†	98†	5†			96*	53*						
Dipturus batis cf. intermedia	73†		66†			215**	36						
Dipturus oxyrinchus		2†											
Engraulis encrasicolus											239		
Galeorhinus galeus			3†										
Glyptocephalus cynoglossus			57**			345**	460**		68				
Helicolenus dactylopterus										197	154		
Leucoraja fullonica		10†											

Target species	UK-SCOW-CGFS-Q1	UK-SCOROC-Q3	UK-SCOW-CGFS-Q4	UK-NIGFS-Q1	UK-NIGFS-Q4	IE-IAMS-Q1	IE-IGFS-Q4	FR-CGFS-Q4	FR-EVHOE-Q4	SP-PORC-Q3	SP-NSGFS-Q4	SP-GCGFS-Q1	SP-GCGFS-Q4
Leucoraja naevus	47†		24†	23*	16*		79*						
Micromesistius poutassou											517		
Microstomus kitt					17	312**	671		168				
Molva dypterygia													
Molva molva	72*		60**			269	48		6	7			
Mullus surmuletus								158	183		104		
Mustelus spp.	39†		4†										
Octopus vulgaris												343*	213*
Parapeeus longirostris												2353*	1941*
Phycis blennoides									222	244	166		
Pleuronectes platessa	195		167**	495	325	354	873	411					
Pollachius pollachius	3*			5		32	15**						
Raja brachyura	6†		6†	24*	48*	9*	22*						
Raja clavata	114†	46†	140†	107*	109*	306*	375*						
Raja montagui	101†		115†	186*	108*	238*	701*						
Sardina pilchardus													
Scomber colias											10		
Scophthalmus maximus	1*		1***	2*	2*	10**	21**		3				
Scophthalmus rhombus					13*	14**	24**		6				
Solea solea						4	249	262	193				
Sepia officinalis												485*	96*
Squalus acanthias	221†	2†	310†	3*	159*	512*							
Trisopterus esmarkii	332		484**										
Trisopterus luscus								165	165		320		
Zeus faber			64***	11	21	182**					41**		

† length, weight, sex and externally determined maturity only, * Samples collected for maturity only, ** No maturity data collected, ***length, weight and sex only, (2) Otoliths + Illicia, (3)Tagging

Additional Activities

Table A.5.1.4 gives an overview of the Additional activities performed in 2019 as reported per country/survey within the Northeastern Atlantic area.

Table A.5.1.4. Additional activities undertaken in 2019 surveys on NEatlIBTS

	UK-SCOWCGFS-Q1	UK-SCOROC-Q3	UK-SCOWCGFS-Q4	UK-NIGFS-Q1	UK-NIGFS-Q4	IE-IAMS-Q1	IE-IGFS-Q4	FR-CGFS-Q4	FR-EVHOE-Q4	SP-PORC-Q3	SP-NSGFS-Q4	SP-GCGFS-Q1
CTD (Temp+salinity)	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
Water sampler (Nutrients)								1				
Plankton sampling	X							1				
Benthos sampling		1		1	1	1	1	1	1	1	1	1
Observers: mammals, birds							X	1	X	1		
Additional biological data on fish	X	X	X	X	X	X	X	X	X	X	X	X
Fish stomach contents				X	X	X	X	X		1	X	X
Benthic samples (boxcore, video, dredge)		1				1	1	X	X	X	X	X
Jellyfish				1	1	1	1	1				
Hydrological transect						X	1	1		1	X	X
Acoustic for fish species	1		1				1	X	1			
Multibeam: seabed mapping						X	X	1				
Manta trawl; microplastics		X						X				
Acoustic mooring deployment	1		1			X	X					
Elasmobranch tagging				X	X	1	1	X				

1: Annually, X: Occasional

A.5.2 - Scotland –SCOWCGFS-Q1 2019

Nation:	**Scotland**	**Vessel:**	**Scotia**
Survey:	0319S (SCOWCGFS- Q1)	Dates:	17th February – 11th March 2019

Cruise:	Q1 West Coast Scotland survey aims to: • Collect data on the distribution, relative abundance and biological information 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 deployment of the Gulf 7 ichthyoplankton sampler in support of the triennial mackerel and horse mackerel egg survey (MEGS) in order to determine spawning densities of target species within the survey area. • Opportunistic retrieval of Compass moorings deployed in November 2018.
Gear details:	GOV incorporating groundgear D was used at all stations and was deployed on 65 occasions (see table A.5.2.1). Sweeps were 97m in all cases where the mean depth was >80m (n=57), otherwise 47m sweeps were used (n=8). 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 2019 survey utilizes a random-stratified survey design with approximately 60 primary trawl stations distributed within 11 sampling strata (see figure A.5.2.1). 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 station location. 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. Hauls were typically of 30 min duration however various factors (large pelagic fish marks, poor ground) resulted in lesser durations for 13 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 62 valid hauls that were achieved all but 2 of these were completed during daylight hours. There were 3 foul hauls, 1 of which (128) was aborted due to strong tides, with another (119) being as a result of bad ground where the belly was torn out from the net. Haul 124 was invalid due to the net being stuck fast on the bottom after only 12 minutes and was therefore short of the minimum duration for a valid tow of 15 minutes. The locations used for the valid trawl positions during this survey were a combination of established MSS and commercial trawled areas. On 20 occasions grounds were successfully used that previously were unfished by MSS. See figure A.5.2.1 for a plot of all survey tows. The CTD recorder (Seabird19+) was deployed at 57 out of the 62 valid trawling stations in order to obtain a temperature and salinity profile with the unit being deployed to within approximately 5m of the seabed. Hauls 80, 87, 102, 110, and 115 had no associated hydrography data. The gulf 7 was deployed on 35 occasions with 30 plankton samples taken in support of the triennial mackerel egg survey on locations in and around the continental shelf edge with 21 samples being successfully analysed back at MSS. Low numbers of stage 1 mackerel eggs were observed over the entire sampled area. Gulf deployment positions are provided in figure A.5.2.1. The data from these deployments contribute to the 2019 triennial international egg survey results. This is coordinated by the ICES Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS). 7 acoustic moorings were successfully located and retrieved by Scotia from 6 different locations from within the Minches area and without incident. This included an additional mooring from the Stanton location which had previously failed to communicate

	during earlier attempts at the end of 2018. In addition 6 new moorings were also successfully deployed back onto the same locations without incident. These are scheduled to be retrieved during a subsequent survey later in 2019. An additional deployment was made within the Clyde for an associated PhD project linked to the COMPASS project and will attempt (using the same moorings) to record acoustic signals of spawning gadoids and in particular cod in the Clyde. An acoustic mooring was deployed at a location in the outer Clyde area south of the Kintyre peninsula. A double oblique plankton sample was also obtained from the same location and this will be analysed for evidence of cod eggs. See figure A.5.2.1 for all mooring positions. All of the otoliths from the main commercial demersal species were aged at sea, the pelagic otoliths were aged back at the institute. All litter picked up in the trawl was classified, quantified and recorded then retained for appropriate disposal ashore. Misc Sampling: • Bobtail squid identification. All bobtail squid (Sepiolida) caught were preserved in 70% ethanol for identification at *Naturalis Biodiversity Centre, Leiden*. • Regional provenance testing. Collection of muscle samples from species of anglerfish (lophius spp). Aim is to develop a way of tracing the geographic origin of fish using stable isotopes – *Southampton University* • eDNA Collection from CTD seawater sampling . Additional water samples retained from CTD stations for analysis from throughout the entire survey area - *MSS/Aberdeen University* • eDNA sequencing project and mitochondrial DNA work on selected species – *Southampton University* • Retention of spring-spawning herring samples for ongoing morphometric and DNA stock profiling studies – *MSS* • Retention of Phakellid and Craniella sponges. Collaborative phylogenic study between *MSS and the Natural History Museum*. • PhD project within MSS investigating species diagnostics of Dipturus spp. - MSS
No. fish species recorded and notes on any rare species or unusual catches:	Catch Results *(2018 results presented in italics)* A total of 98 species were recorded for an overall catch weight of ~22.3 tonnes *(90, 28)*. Major species components in approximate tonnes included: haddock *Melanogrammus aeglefinus* – 5.56 *(5.87)*, mackerel *Scomber scombrus* – 0.44 *(3.6)*, cod *Gadus morhua* – 0.13 *(0.58)* Norway pout *Trisopterus esmarkii* - 1.72 *(1.3)*, whiting *Merlangius merlangus* – 1.65 *(2.9)*, herring *Clupea harengus* – 3.5 *(3.3)*, and scad *Trachurus trachurus* – 2.7 *(2.4)*. There was a notable absence of adult mackerel encountered during the survey. Overall, mackerel catches reported in 2019 (0.44T) were just over 10% of those reported in 2018 *(3.6T)* with most of those caught during 2019 being juvenile fish. The weight of whiting caught in 2019 (1.65T) was also sharply down when compared to both 2018 *(2.9T)* and also 2017 *(3.2T)*.

Similar trend was observed in the Clyde as 2017 and 2018 with gadoid species once again dominating the catches in hauls 125 – 127. Table A.5.2.2 provides overall catch rates per unit effort (CPUE) of the above species and several other major species.

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 6a. Results for all age classes of the major commercial gadoid species are shown in table A.5.2.3 while those of 1-groups only for period 2011-2017 are shown in table A.5.2.4. The overall CPUE by weight over the same period is displayed in table A.5.2.5. Contrasting signals were observed in the survey CPUE indices with increases in all the 1-group estimates abundance with the exception of saithe being reported. These were especially significant for both haddock and Norway pout with both reporting survey records as regards numbers per hour of 1-group individuals caught. Overall CPUE by weight (kgs/hr) was down for all species except Norway pout and was significantly lower for cod, whiting and saithe as compared with 2018 (see tables A.5.2.3 and A.5.2.4). Of interest elsewhere were stations 94 and 131. These both yielded significant numbers of starry smoothhound *(Mustelus asterias),* a species that is not generally caught in any great abundance during these surveys. In total 6138 biological observations on selected species were collected including a number collected in support of EU Data Collection Framework (DCF). A summary of numbers collected for all species is displayed in table A.5.2.6.

An interesting distraction and away from the marine arena was a Goldcrest *(Regulus regulus)* that was spotted on the sill of one of Scotia's bridge windows during trawl station 117, NW of Tory Island.

Table A.5.2.1: Number of stations surveyed/gear during 0319S

				Valid			**%**
			Stations	Stations	Additional	Invalid	Stations
ICES Divisions	Strata	Gear	Planned	Achieved	Stations	Stations	Achieved
6a	All	GOV-D	62	62	0	3	100

Table A.5.2.2. Overall CPUE of major components of combined catch Q1 2019

Species	Common name	kg/hr	no/hr
Melanogrammus aeglefinus	Haddock	189	1255
Scomber scombrus	Mackerel	14.9	175.3
Gadus morhua	Cod	4.5	2.7
Trisopterus esmarkii	Norway Pout	59	4901
Merlangius merlangus	Whiting	56	479
Clupea harengus	Herring	121	819
Trachurus trachurus	Horse Mackerel	91	682
Scyliorhinus canicula	Lesser Spotted Dogfish	42	80
Pleuronectes platessa	Plaice	6.2	36
Eutrigla gurnardus	Grey Gurnard	20	190
Capros aper	Boar Fish	9.1	175
Squalus acanthias	Spurdog	9.5	15.1
Pollachius virens	Saithe	2.2	1.6
Merluccius merluccius	Hake	11.8	67.5
Dipturus intermedia	Flapper Skate	7.5	2.9
Loligo ssp	Long Finned Squid	8.5	82.5
Raja montagui	Spotted Ray	7.1	7.5
Lophius piscatorius	Angler	7	2.5
Sprattus sprattus	Sprat	1.4	303
Raja clavata	Thornback Ray	5.7	4.3
Chelidonichthys cuculus	Red Gurnard	6.3	22
Micromesistius poutassou	Blue Whiting	9.1	118
Limanda limanda	Common Dab	3.3	45
Microstomus kitt	Lemon Sole	2.9	20
Lepidorhombus whiffiagonis	Megrim	5.6	17.7

Table A.5.2.3. CPUE indices (nos/hr) by year class of major demersal species Q1 2019

Age	Cod	Haddock	Whiting	Saithe	N. Pout
0	0	0	0	0	0
1	1	763	323	0	4693
2	0.42	61	67	0	647
3	0.69	82	58	1	162
4	0.2	40	19	0.36	2
5	0.32	218	10	0.2	0
6	0.03	1	2	0.17	0
7	0	0.2	0	0	0
8	0.03	0.15	0	0.04	0
9	0	0	0.03	0	0
10	0	0.82	0.03	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0

Table A.5.2.4. CPUE indices (nos/hr fishing) of 1-groups of major demersal species since 2011

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cod	0.05	1.4	2	1.1	0.82	0.47	0.29	0.17	1
Haddock	2.4	14.7	5.2	53	680	56	217	39.8	763
Whiting	22.2	344	5.5	580	254	323	497	196	323
Saithe	0.0	0.0	0.04	0.0	0.0	0.0	0.0	1.28	0
N. Pout	173	1012	4238	2136	4649	3245	4370	538	4693

Table A.5.2.5. CPUE indices (kg/hrs fishing) of major demersal species since 2011

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cod	9.6	21.2	29.3	11.6	72.5	44.1	190.5	20.4	4.5
Haddock	148.8	153.4	180.0	113.7	169.2	191	324.6	206	189
Whiting	49.3	46.9	63.8	35.0	58.7	96.9	109.7	100	56
Saithe	10.8	6.1	15.2	25.0	24.0	17.1	16.2	42.5	2.18
N. Pout	280.9	131.1	130.7	125.8	65.4	73.9	126.8	44.1	58.6

Table A.5.2.6. Numbers of biological observations per species collected during 0319S. These consist of length, weight, sex and age, unless:

Species	No.	Species	No.
Melanogrammus aeglefinus	1754	**Scophthalmus maximus	1
Merlangius merlangus	1235	**Scophthalmus rhombus	-
Gadus morhua	80	†Dipturus flossada	5
Pollachius virens	45	†Dipturus intermedia	73
Trisopterus esmarkii	332	†Leucoraja naevus	47
Clupea harengus	865	†Mustelus asterias	39
Sprattus sprattus	271	†Raja brachyura	6
Scomber scombrus	281	†Raja clavata	114
*Merluccius merluccius	346	†Raja montagui	101
Pleuronectes platessa	195	†Squalus acanthias	221
**Pollachius pollachius	3	†Galeorhinus galeus	-
**Molva molva	72		

* 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

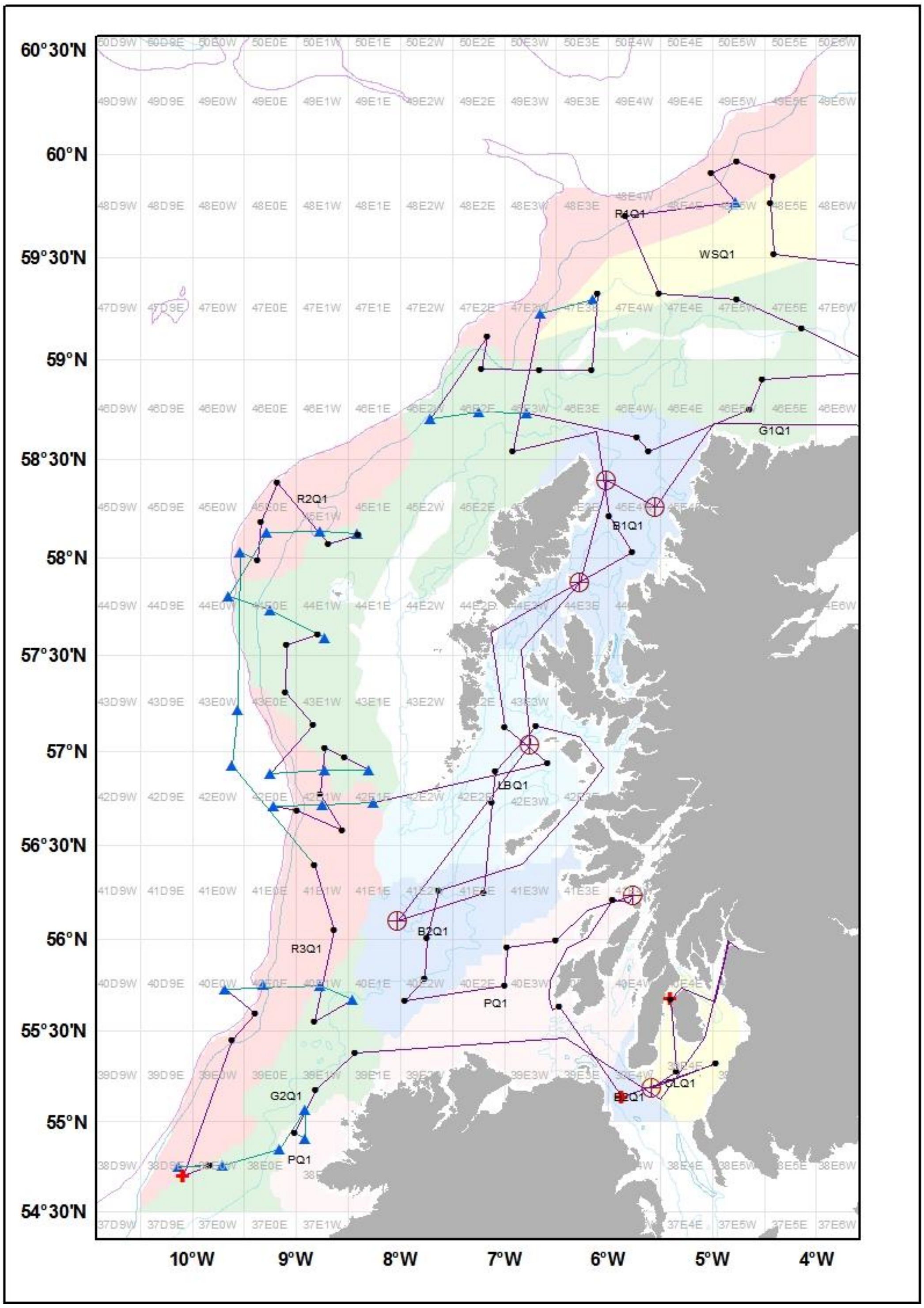


Figure A.5.2.1. 0319S survey map showing survey strata (coloured polygons).

Valid trawl positions are denoted using black dots with invalid hauls denoted by a red cross. Blue triangles represent Gulf 7 sample locations. Crossed circles denote sites where COMPASS or affiliated moorings were successfully recovered/deployed. Cruisetrack for survey 0319S is also included.

A.5.3 – Northern Ireland –NI IBTS-Q1 2019

Nation:	**Northern Ireland**	**Vessel:**	**Corystes**
Survey:	Groundfish Survey C01019	Dates:	February 27 – March 22, 2019

Cruise	• 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.
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. Gear and towing procedures were those employed on all previous AFBI groundfish surveys.
Notes from survey (e.g. problems, additional work etc.):	**Demersal Survey** A stratified survey with fixed station positions was employed. The survey was divided into strata defined by length and substratum (see figure A.5.3.1). The species composition of the catch at each station was determined, and length frequencies were recorded for each species. All cod, majority of hake and subsamples of haddock and whiting were taken for recording length, weight, sex and maturity stages and for the removal of otoliths for ageing. The level of infestation of whiting and cod by external parasites was estimated from biological samples collected at each station. For all hauls fishing was carried out during daylight commencing each day at first light. 61 valid hauls were completed, 20 stations were towed for one hour and 37 stations were 20 minute tows. Stations 77 and 247 were trawled for 2.5 nm. 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 2.5 – 3.4 m. Trawl parameters were consistent with previous surveys. Cod and whiting taken for biological analysis were screened for external

<table>
<tr><td></td><td>parasites. Trawl data and length frequencies were archived using the newly developed groundfish survey database. Preliminary indices of abundance for 0-group and 1-group cod, whiting and haddock were obtained from the length distributions. More accurate indices will be available once the otoliths collected during the cruise have been aged.

Additional Sampling:
All litter picked up in the trawl was classified, quantified and recorded and uploaded to the national MSS litter database from where it will eventually be uploaded to DATRAS. The litter was retained onboard for appropriate disposal ashore.
Additional biological data and stomach samples were taken for foodweb analysis.
Elasmobranchs fit for tagging were measured, weighed, tagged and released.</td></tr>
<tr><td>Number of fish species recorded and notes on any rare species or unusual catches:</td><td>A total of 132 species were recorded during the survey of which 75 were species that were measured for length frequencies.

Biological data were recorded for a number of species in accordance with the requirements of the EU Data Regulations. A total of 3,420 biological samples were taken during the survey. See table A.5.3.2</td></tr>
</table>

Table A.5.3.1: Number of stations surveyed/gear during C01019

				Valid			**%**	
			Stations	Stations	Additional	Invalid	Stations	
ICES Divisions	Strata	Gear	Planned	Achieved	Stations	Stations	Achieved	Comments
7a		Rockhopper	61	61	0	0	100	

Table A.5.3.2 CO1019 biological sampling.

Data are weight/length/sex/maturity/age except * where age data were not collected, ** where no maturity data collected, ***weight/length/sex.

Species	Nos	Species	Nos
Gadus morhua	195	*Psetta maximus*	2***
Merlangius merlangus	1145	*Raja brachyura*	54***
Melanogrammus aeglefinus	903	*Raja clavata*	107***
Merluccius merluccius	28*	*Raja montagui*	186***
Pollachius pollachius	5*	*Raja naevus*	10***
Molva molva	-	*Squalus acanthias*	3***
Zeus faber	4		
Scophthalmus rhombus	22		
Pleuronectes platessa	495		
Microstomus kitt	115		
Lepidorhombus whiffiagonis	3		
Chelidonichthys cuculus	143		

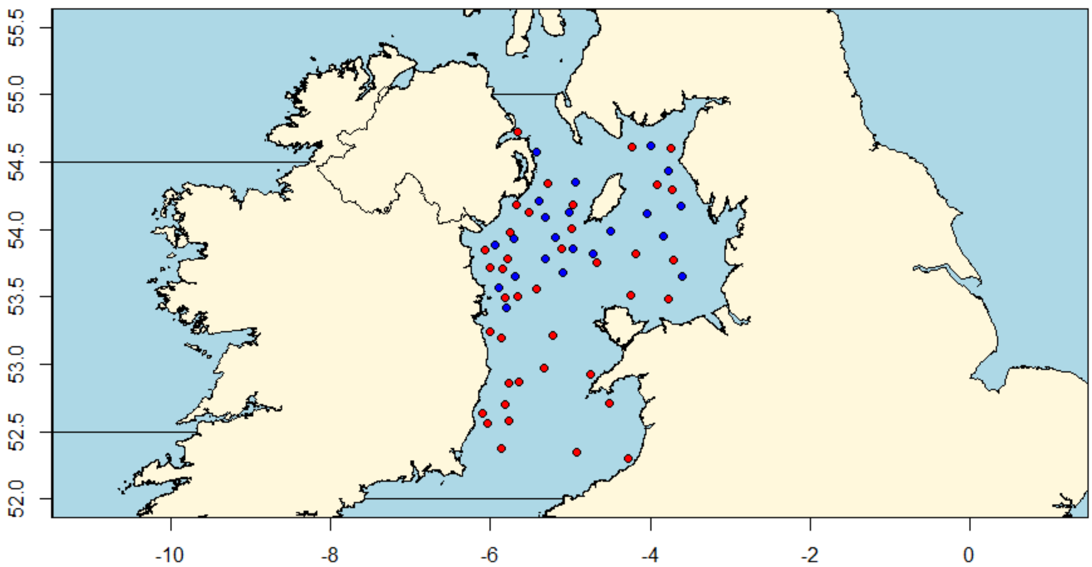


Figure A.5.3.1: - Map of Groundfish Station completed during CO1019. Red dots denote stations towed for 1 hour (3nm), blue dots denote stations towed for 20 minutes (1nm).

A.5.4 - Ireland: Irish Anglerfish and Megrim Survey Q1 – IAMS2019

Nation:	Ireland	Vessel:	Celtic Explorer
Survey:	IAMS	Dates:	1st Mar– 26th Mar 2019 (7b,c,j,k) 16th – 24th April 2019 (6a)

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 6a (south of 58°N) and 7 (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 Irish Anglerfish and Megrim Survey (IE-IAMS-Q1) data uploaded to DATRAS is in progress. 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 Sur-veys, SISP 15 (ICES, 2017).

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.):	• 84hrs weather downtime; 10hrs downtime due to gear damage; 4 hrs technical downtime • Additional deep water transects (500-1,500m) were added to survey protocols (3 additional days have been added to legs 1 and 2 to facilitate this work). This work is funded independently through EMFF. • In the middle of the Porcupine Bank there is some very soft ground. This may cause the gear to dig in (the door sensors getting unstable are observed); when this happens the protocol is to reduce the warp to lift the gear a bit more. If this doesn't work, increase the speed a bit, e.g. up to 3.4-3.5 knots. • The duration of leg 3 (6a) has been reduced due to over-sampling relative to the Scottish effort; the target has been reduced from 50 to 40 stations. • In case of extreme work pressure, there is an option to only process target species (MON, WAF, MEG; no catch weights or samples for other species). These stations will be flagged with validity code 'T' (This did not occur during IAMS 2019). • There has been some inconsistency in recording the end of the tow in the past. Some SiCs recorded the end of the tow as the time when the gear is being hauled back, others as the time the gear lifts off the ground. It will be necessary to analyse the sensor data and apply corrections to the historic data in terms of tow length. From 2019 onwards, the end of the tow is being recorded as the time at lift-off.
Number of fish species recorded and notes on any rare species or unusual catches:	In 2019, 85 species of fish, 31 elasmobranch, 10 cephalopod and 44 other species/groups were recorded. The following unusual species were recorded: Malacoraja kreffti; Amblyraja radiate; Rostroraja alba; Aldrovandia affinis; Hydrolagus pallidus; Nemichthys scolopaceus.

Table A.5.4.1 Stations fished (aim to complete 115 valid tows per year)

ICES Divisions	Strata	Valid Tows	Stratum area (km^2)	Swept-area (km^2)
6a	VIa_Shelf_L	19	37,003	9.2
6a	VIa_Shelf_M	9	4,746	4.2
6a	VIa_Slope_H	13	3,114	7.2
6a	VIa_Slope_M	9	3,044	4.8
7bcjk	VII_Shelf_H	17	50,764	8.7
7bcjk	VII_Shelf_L	14	42,034	8.0
7bcjk	VII_Shelf_M	5	14,621	2.5
7bcjk	VII_Slope_H	25	35,768	13.5
7bcjk	VII_Slope_M	9	29,406	5.7
6a	DeepArea4	(5)	Additional Sampling	
7c	DeepArea5	(4)	Additional Sampling	
	TOTAL	120+(9)	220,500	62.1

Table A.5.4.2 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**	96	*Molva molva*	269
*Dipturus intermedia***	215	*Pleuronectes platessa*	354
Gadus morhua	49	*Pollachius pollachius*	32
*Glyptocephalus cynoglossus***	345	*Pollachius virens*	92
*Lepidorhombus boscii***	237	*Raja brachyura**	9
Lepidorhombus whiffiagonis	1033	*Raja clavata**	306
*Leucoraja naevus**	597	*Raja montagui**	238
Lophius budegassa	524	*Raja undulata***	1
Lophius piscatorius	1336	*Scophthalmus maximus (psetta) maxima)***	10
Melanogrammus aeglefinus	747	*Scophthalmus rhombus***	14
Merlangius merlangus	297	*Solea solea*	4
*Merluccius merluccius***	1636	*Squalus acanthias**	512
*Microstomus kitt***	312		

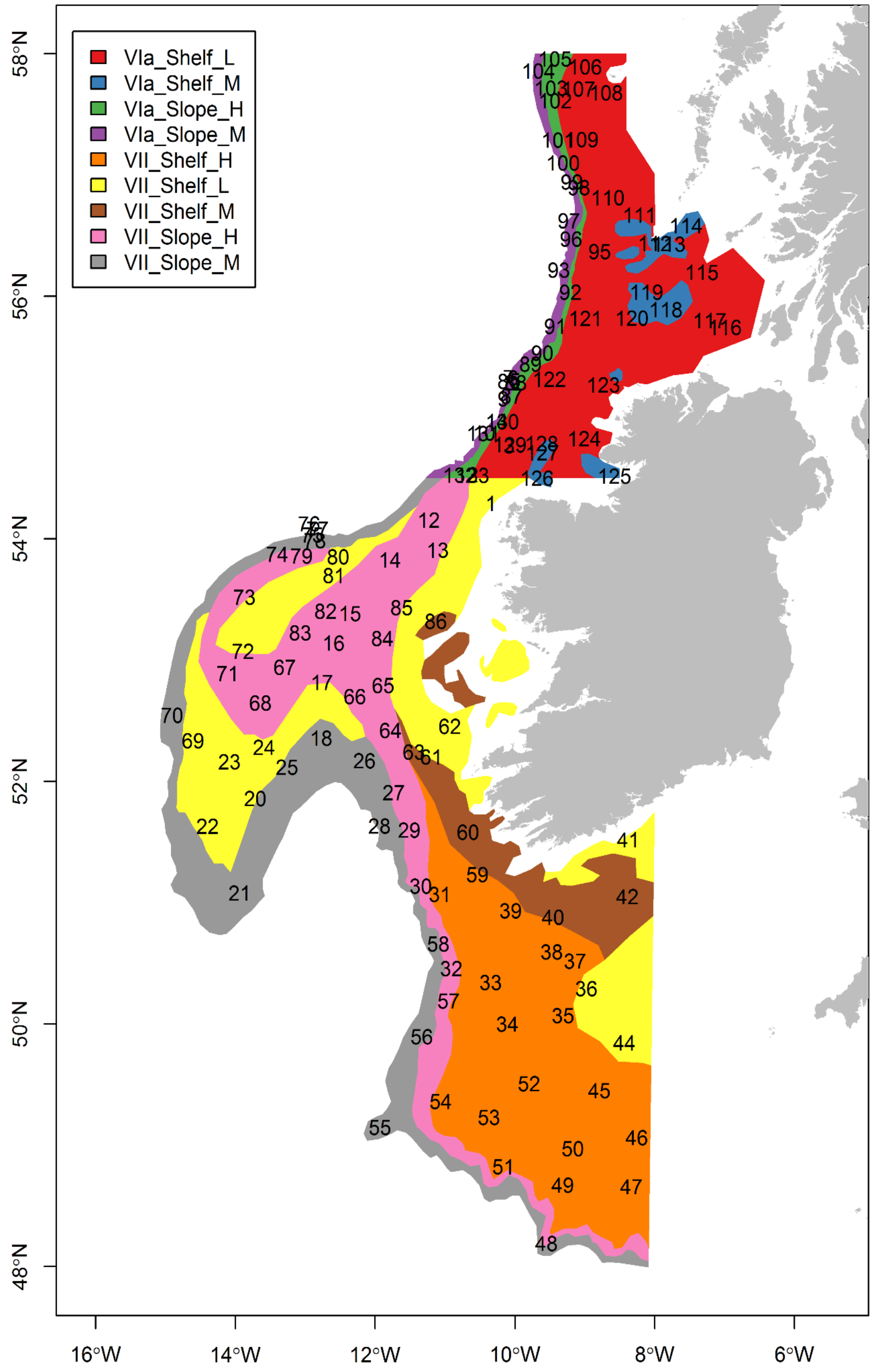


Figure A.5.4.1 - Map of valid survey stations completed by the Irish Anglerfish and Megrim Survey in 2019. The numbers refer to the haul number.

Table A.5.4.3 Table 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), *L whiffiagonis* (MEG) and *L boscii* (Lbi).

Stratum	Stratum area	Num hauls	Swept area	CatchNum MON	CatchNum WAF	CatchNum MEG	CatchNum LBI
VIa_Shelf_L	37,003	19	9.2	231 38	119		0
VIa_Shelf_M	4,746	9	4.2	187 36	49		0
VIa_Slope_H	3,114	13	7.2	246 72	511		24
VIa_Slope_M	3,044	9	4.8	150 0	122		5
VII_Shelf_H	50,764	17	8.7	43 157	158		40
VII_Shelf_L	42,034	14	8.0	146 49	128		155
VII_Shelf_M	14,621	5	2.5	25 46	49		3
VII_Slope_H	35,768	25	13.5	170 163	297		110
VII_Slope_M	29,406	9	5.7	95 2	31		20
Total	220,500	120	62.1	1293 563	1464		357

Table A.5.4.4 - Estimated numbers (millions) and biomass (kT) in the survey area, with CV and confidence intervals (CIlo and CIhi). Only fish >500g live weight (approximately 32cm) were included in the estimate.

	L piscatorius		*L budegassa*	
	6a	7	6a	7
NumMln	6.857	10.214	1.190	10.777
NumCV	17.76%	26.52%	26.18%	17.94%
BiomKT	5.348	21.502	0.967	8.658
BiomCV	12.95%	7.86%	32.79%	11.46%

A.5.5 – Spain – SP GCGFS Q1 2019

Nation:	SP (Spain)	Vessel:	Miguel Oliver
Survey:	SP-GCGFS-Q1 (ARSA 0319)	Dates:	18 February - 05 March 2019
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 9a). 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 (350 Kg).		
Notes from survey (e.g. problems, additional work etc.):	Hydrographic data at each trawl station was collected using a net-mounted CTD. Additionally, 67 dredges were carried out with a box-corer.		
Number of fish species recorded and notes on any rare species or unusual catches:	Overall a total of 149 fish species, 54 crustaceans and 62 molluscs were recorded.		

Table A.5.5.1 - 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	46	46	-	1	100%	
	TOTAL		46	46	-	1	100%	

Table A.5.5.2 – Biological samples (length, weight, sex, maturity and age material)

Species	Age	Species	Age
Merluccius merluccius	286	*Sepia officinalis**	485
*Merluccius merluccius**	1068	*Octopus vulgaris**	343
*Parapenaeus longirostris**	2353		
*Nephrops norvegicus***	524		

(*) Maturity only

(**) Tagging

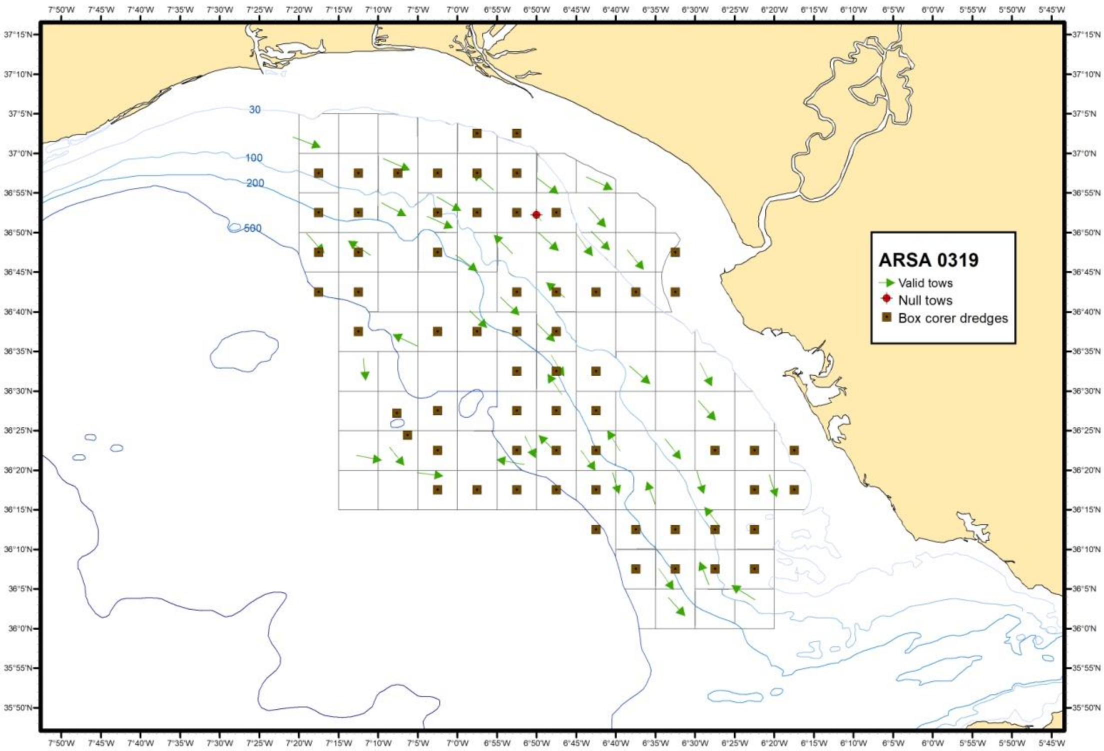


Figure A.5.5.1 - Trawl stations in Q1 Gulf of Cadiz 2019 survey.

Table A.5.5.2 – Biomass and abundance estimates for ARSA 0319

			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} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Biomass and number estimates								
Merluccius merluccius	All	46	2.57	-11.2	3.2	64.8	-14.6	29.3
Micromesistius poutassou	All	46	11.33	1529.5	-73.3	171.4	2000.4	-87.9
Nephrops norvegicus	All	46	0.28	243.8	-53.9	7.7	245.9	-66.6
Parapenaeus longirostris	All	46	2.53	313.9	411.1	559.0	300.8	501.6
Octopus vulgaris	All	46	1.94	1038.2	5.6	3.5	1475.0	15.8
Loligo vulgaris	All	46	0.19	-11.9	-45.4	0.8	-84.8	11.1
Sepia officinalis	All	46	1.85	270.0	113.6	5.3	336.5	121.1

y_i, year estimate (2019); $\mathbf{y_{i-1}}$, previous year estimate (2018); $\mathbf{y_{(i,i-1)}}$, Average of last two year estimates (2019 and 2018); $\mathbf{y_{(i-2,i-3,i-4)}}$, Average of the previous three year estimates (2017, 2016 and 2015).

A.5.6 – Scotland – SCOROC Q3 2019

Nation:	**Scotland**	**Vessel:**	**Scotia**
Survey:	1319S (Rockall Haddock)	Dates:	14th - 26th September 2019

Cruise:	Q3 Rockall 2019 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. • To deploy a sea surface microplastic sampling catamaran on an opportunistic basis.
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, wingspread, 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 2019 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 44 valid trawls completed (Table A.5.6.1) with all fishing taking place during daylight hours. Figure A.5.6.2 displays sampling strata, trawl positions, sediment grab positions and microplastic sampling locations. A total of 45 trawl stations were undertaken with the GOV, 44 of which valid (table A.5.6.1), the haul invalid being successfully repeated. Of the valid hauls, 43 were the standard duration of 30 minutes and 1 was shorter (17 minutes) due to dense fish marks being encountered on the sounder and Trawleye. The majority of programmed primary stations were successfully completed (39) with a secondary position selected for 1 station due to excessive steaming distance to reach the core station. The numbers of trawls completed by depth stratum are as follows. (R1 – 5, R2 – 21, R3 – 10, R4 – 4). In addition, 4 extra trawl stations were 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. The 4 stations were undertaken with increasing depth however, none yielded haddock. This year Haddock recruits were observed to be ~52% lower than in 2018, it itself being significantly lower than the preceding two years. Haddock juveniles were observed in reasonable numbers over the entire upper bank, with a ~39% increase in age 1 individuals compared with 2018 however again the CPUE index is significantly down on the 2017 estimates as well as being less than the series average for the new survey. A positive observation is that numbers of 2+ individuals, although

	being 23% lower than in 2018, are still 43% higher than the series average (Figure A.5.6.1 & Table A.5.6.3). The full 2019 CPUE age disaggregated index for haddock as well as the other major commercial species is provided in Table A.5.6.3. Ages were recorded for haddock, whiting, cod and saithe along with sex, and weight data. Data on other species sampled for biological information are summarized in Table A.5.6.4. CTD casts (n=26) were made at selected stations to give a representative coverage of the bank over the depth range surveyed. All otoliths of bar mackerel were aged onboard. Sediment grabs were attempted from 137 deployments during periods when the vessel was not fishing. Of these, 74 produced viable sediment samples over a depth range of 136-503m (Figure A.5.6.2). All litter picked up in the trawl was classified, quantified and recorded and uploaded to the national MSS litter database from where it will eventually be uploaded to DATRAS. The litter was retained onboard for appropriate disposal ashore. The microplastics catamaran was deployed 7 times during the survey to sample surface water for the presence of microplastics when the weather was favorable. Additional biological measurements, mucus swabs (for genetic analysis) and photographs of the iris of all Blue Skate (Dipturus cf. flossada) were collected for stock identity investigations. All Axinellid sponges were collected for a collaborative project with the Natural History Museum examining their genetics. Additional sediment was retained from the grab sampling to examine for the presence of microplastics.
No. fish species recorded and notes on any rare species or unusual catches:	Overall, 53 species were caught during the survey for a total catch weight of ~23.5 tonnes. There were large catches overall of Haddock (~7.1 tonnes), Norway Haddock (*Sebastes viviparous*, ~4.3 tonnes) and blue whiting (*Micromesistius poutassou*, ~4.2 tonnes). During 1319S very few Cod (*Gadus morhua*, ~84kg, 16 fish) and Saithe (*Pollachius virens*, ~43kg, 3 fish) were caught. The numbers of Cod, although very low, are a significant increase compared to the previous years. 2.7kg of Whiting (*Merlangius merlangus* were observed during the survey, which equated to 4 fish and this reflected a significant reduction on recent years. No 0-groups of the three commercially valuable species above were observed during 1319S. CPUEs for selected species are provided in table A.5.6.2.

Table A.5.6.1. Number of stations surveyed/gear 1319S.

ICES Division	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
VIb	All	GOV-D	40	44	4	1	110	Invalid haul successfully repeated

Table A.5.6.2. CPUE data (all strata combined) for major species caught during 1319S.

Species	CPUE no's/h	CPUE kg/h
Haddock (Melanogrammus aeglefinus)	1565.4	326.3
Norway Haddock (Sebastes viviparus)	3934.7	198.4
Blue Whiting (Micromesistius poutassou)	3050.4	193.3
Lesser Argentine (Argentina sphyraena)	894.4	59.8
Grey Gurnard (Eutrigla gurnardus)	234	54.1
Rabbit Ratfish (Chimaera monstrosa)	39	54
Blue-mouth (Helicolenus dactylopterus)	608.2	37.2
Blue Skate (Dipturus flossada)	4.5	26.3
Poor Cod (Trisopterus minutus)	333.5	22.7
Angler (Monk fish) (Lophius piscatorius)	5.2	22.1
Silvery Pout (Gadiculus argenteus)	554.8	14.4
Megrim (Lepidorhombus whiffiagonis)	45.2	11.3
Greater Argentine (Argentina silus)	67.4	8.7
Ling (Molva molva)	1.9	8.3
Raitts Sandeel (Ammodytes marinus)	679	6.1
Long Finned Squid (Loligo forbesii)	100.6	4.8
Thornback Ray (Raja clavata)	2.1	4.5
Lemon Sole (Microstomus kitt)	39.6	4.4
Cod (Gadus morhua)	0.7	3.8
Witch (Glyptocephalus cynoglossus)	11.5	2.4
Saithe (Pollachius virens)	0.1	2

Table A.5.6.3. Rounded CPUE indices (no. per 10 hrs fishing) by age for Rockall haddock 2019 plus that of other major commercial species.

Age	Haddock No./10 hr.	Cod No./10 hr.	Saithe No./10 hr.	Whiting No./10 hr.
0	2933.151	0	0	0
1	4003.818	1.117	0	0.531
2	2934.861	0.922	0	0.307
3	5806.468	2.432	0	0.307
4	107.408	0.307	0	0
5	131.199	0	0	0
6	317.023	0	0	0
7	136.858	0	0	0
8	40.283	0	0	0
9	0	0	0	0
10	0.307	0	0.589	0
11	0.589	0	0	0
12	0	0	0	0
13	0.307	0	0	0
14	0	0	0.307	0
15	0	0	0.307	0

Table A.5.6.4. Numbers of biological observations per species collected during 1319S. Data are weight/length/sex/maturity/age except * where age data were not collected.

Species	Biodata	Species	Biodata
Gadus morhua	*16*	*Dipturus flossada*	*98**
Melanogrammus aeglefinus	*1695*	*Dipturus oxyrinchus*	*2**
Merlangius merlangus	*4*	*Leucoraja fullonica*	*10**
Pollachius virens	*3*	*Raja clavata*	*46**
Scomber scombrus	*30*	*Squalus acanthias*	*2**

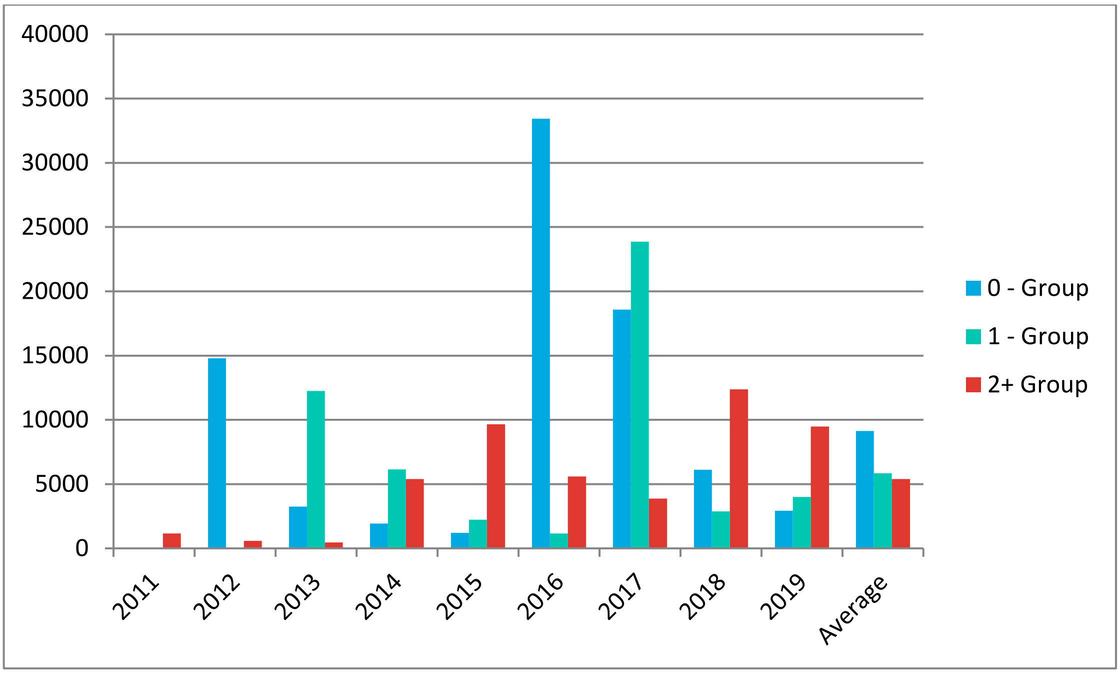


Figure A.5.6.1. Indices of age 0, 1 and 2+ group haddock (numbers caught per 10 hours fishing) at Rockall in 2019 shown relative to the previous years and the average since 2011 (beginning of new survey design).

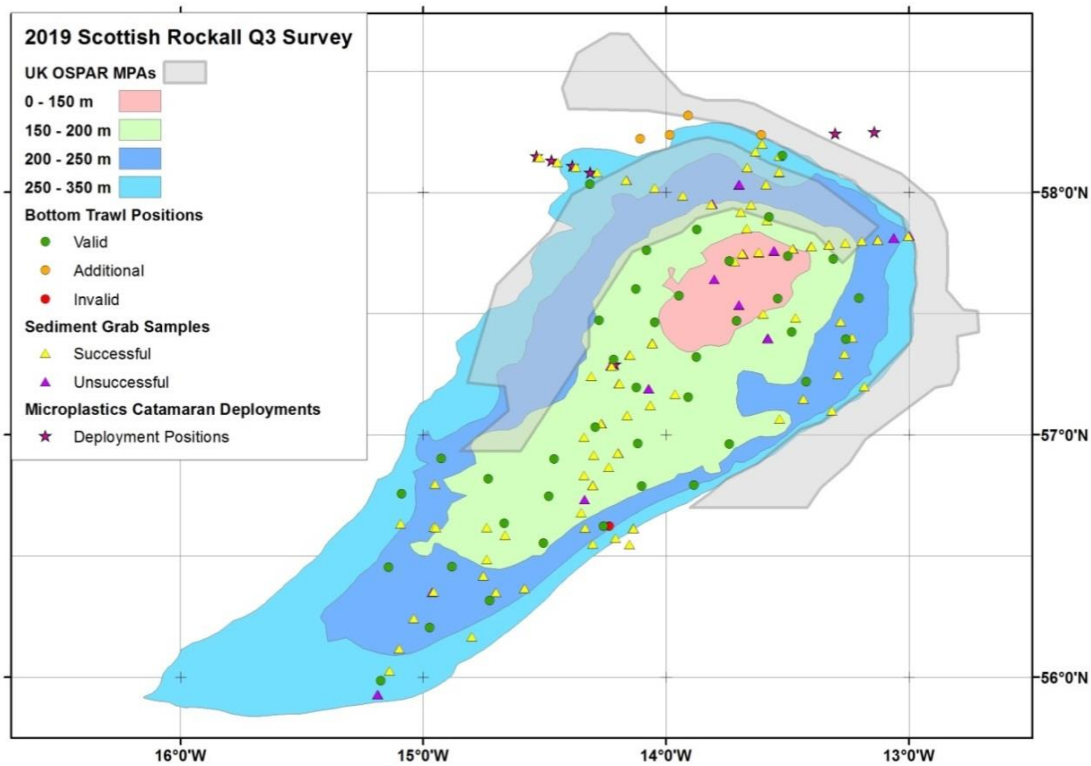


Figure A.5.6.2. Survey strata, UK OSPAR MPAs, trawl positions, sediment grab positions and microplastics catamaran deployment positions undertaken at Rockall during 1319S.

A.5.7 – Spain – SP-PORC- Q3 2019

Nation:	SP (Spain)	Vessel:	Vizconde de Eza
Survey:	SP-PORC-Q3 (Porcupine 19)	Dates:	07 September - 14 October 2019
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 7b-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 2019 survey, especially on the second leg. This year the reduction in tow duration implemented three years ago to 20 minutes from 30 minutes after ground contact has been maintained. Additional work undertaken included 70 CTD casts, at most trawl stations, 3 within the non-trawlable area, and 5 in three 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 95 fish species, 4 crustaceans, 28 molluscs, 26 echinoderms and 42 species of other invertebrates were identified.		

Table A.5.7.1 - 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	Porcupinebaca	80	79	-	2	99%	

Table A.5.7.2 - Biological samples (length, weight, sex, maturity and age material)

Species	Age	Species	Age
Merluccius merluccius	665	*Molva molva*	7
Lepidorhombus whiffiagonis	661	*Conger conger*	29
Lepidorhombus boscii	314	*Helicolenus dactylopterus*	197
Lophius budegassa	43	*Phycis blennoides*	244
Lophius piscatorius	151	*Nephrops norvegicus**	418

(*)Maturity only.

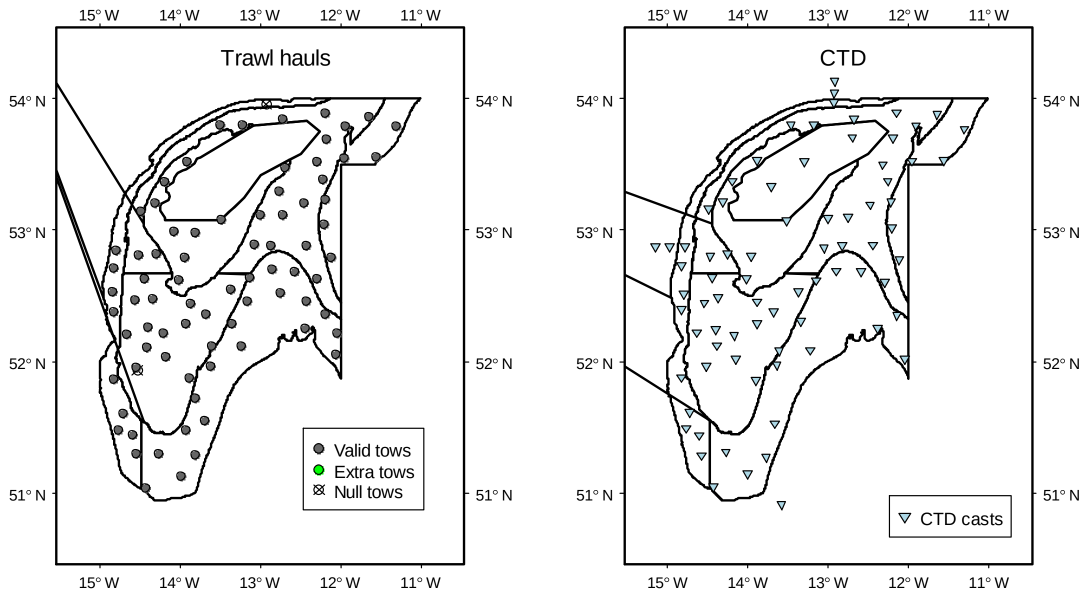


Figure A.5.7.1 a) Trawl stations in Spanish Porcupine 2019 survey and b) CTD

Table A.5.7.3 - Biomass and abundance estimates for Porcupine 19

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} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Merlucciusmerluccius	All	79	31.11	6.3	-47.4	39.0	-33.9	-31.4
Lepidorhombuswhiffiagonis	All	79	13.64	22.3	-11.4	205.1	1.2	8.8
Lepidorhombusboscii	All	79	14.07	26.9	0.6	149.9	28.4	2.5
Lophiusbudegassa	All	79	1.18	45.7	-23.1	0.9	6.3	7.6
Lophiuspiscatorius	All	79	16.53	7.1	-19.0	4.1	-4.0	-22.0
Micromesistiuspoutassou	All	79	489.16	4.3	-16.0	4598.4	-9.2	-26.2
Nephropsnorvegicus	All	79	2.35	-21.4	151.9	75.6	-30.2	104.6

y_i, year estimate (2019); y_{i-1}, previous year estimate (2018); $y_{(i,i-1)}$, Average of last two year estimates (2019 and 2018); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2017, 2016 and 2015).

A.5.8 - Scotland –SCOWCGFS-Q4 2019

Nation:	**Scotland**	**Vessel:**	**Scotia**
Survey:	1719S (SCOWCGFS- Q4)	Dates:	04 – 25 November 2019

Cruise	Q4 Scottish Western Coast VIa random stratified survey aims to collect data on the distribution, relative abundance and biological information on a range of fish species in ICES areas 6a and 7b. Age data were collected for cod, haddock, whiting, saithe, Norway pout, plaice, herring, mackerel and sprat. A CTD was deployed at each trawl station (except 4) to collect temperature and salinity profiles. Opportunistic retrieval and deployment of two COMPASS moorings.
Gear details:	The GOV incorporating the standard "Exocet" kite was used throughout the cruise with groundgear "D" (Rockhoppers). Sweeps were 97m except where the water depth was <=80m where 47m sweeps were deployed, standardizing 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 groundgear centre and monitored contact with the seabed.
Notes from survey (e.g. problems, additional work etc.):	The 2019 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 fishing was carried out during daylight commencing each day at first light. During the survey three hauls were classified as foul. In ICES area 7b, haul 410 due to a torn belly and within ICES area Via haul 405 due to a torn belly and 419 due to a torn starboard wing. During the second half of the cruise and between a few trawl stations steaming time was slowed due to prevailing weather conditions. Furthermore, in some survey areas significant shoals of mackerel were encountered and on others poor sea-bed conditions (hard ground) which limited a number of hauls to less than 30. A total of 62 valid hauls were completed during the cruise, which was 2 more than the number allocated for this survey, with the daily cruise track given in Figure A.5.8.1. The 97m sweep rig was used for 56 hauls and the m rig for 9 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. At most trawl stations the CTD was deployed in order to obtain temperature and salinity profile data through the water column. Calibration samples were also collected from the surface during the CTD deployments. During the cruise the CTD was deployed at 59 tow stations but not for 4 due to the prevailing weather conditions or to give sufficient steaming time between stations and thereby ensuring a valid daylight haul was completed. Additional Sampling: • All litter picked up in the trawl was classified, quantified and recorded and uploaded to the national MSS litter database from where it will eventually be uploaded to DATRAS. The litter was retained onboard for appropriate disposal ashore. • All shells were collected, labelled and frozen for species identification ashore. • Additional biological data, genetics and iris photographs were collected for *Dipturus intermedius* and *Dipturus flossada* for population analysis. • Herring and mackerel were retained and frozen from The Minch for toxicology analysis. • All bobtail squid were collected for a collaborative project with Naturalis Leiden looking at the genetics and populations of Bobtails on the West Coast of Scotland and Rockall. • Additional sampling of *Loligo* sp., Ommastrephids and *Alloteuthis* sp. were undertaken for population studies. All *Loligo* sp. over 40cm were retained for analysis by Graham Pierce. • CCTV footage was collected for measured fish species to assist in machine learning software. • 2 COMPASS moorings successfully retrieved from the Minches and another 2 deployed within the areas of Stanton Bank and also the Clyde.
Number of fish species recorded	A total of 56 species were caught during the survey with an overall catch weight of 28.14 tonnes. There were large catches overall of haddock (~6.935 tonnes), whiting (~2.189 tonnes), Norway pout (~2.51 tonnes).

and notes on any rare species or unusual catches:	Biological data were recorded for a number of species in accordance with the requirements of the EU Data Regulations. A total of 6502 biological samples were taken during the survey.

Table A.5.8.1. Numbers of stations fished

ICES Division	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
6a	11	GOV-D	56	58	0	2	104	
7b	1	GOV-D	4	4	0	1	100	

Table A.5.8.2. CPUE indices (no./1hrs) by year class for major species Q4 WC survey in 2019.

Age	Cod	Haddock	Nos/hr Whiting	Saithe	N. Pout
0	0.0351	145.6597	744.3785	0	4640.5013
1	1.765	627.486	195.5341	0.0832	1796.5741
2	0.1402	43.6334	27.1628	0.0672	36.8127
3	0.3246	67.2003	30.5474	0.5667	0.0416
4	0.3457	23.2168	4.2613	0.0256	0
5	0.1814	185.0005	3.3871	0	0
6	0.0627	1.6931	0.4943	0.0689	0
7	0.0363	0.3318	0.0981	0.0376	0
8	0	0.0544	0	0	0
9	0	0.1984	0	0	0
10	0	0	0.04712	0	0
11	0	0	0	0	0
12	0	00.0496	0	0.0313	0

Table A.5.8.3. CPUE indices (numbers/1hrs fishing) of 1-groups for Q4 since 2013

Species	2013*	2014	2015	2016	2017	2018	2019
Cod	1.4	2.37	2.82	0.62	1.00	0.4569	1.765
Haddock	6.96	67.87	995.59	93.55	168.82	98.9114	627.486
Whiting	12.5	151.78	279.36	241.54	294.29	50.2522	195.5341
Saithe	0	0.04	0.50	0.06	0	0.0363	0.0832
Norway Pout	134.39	266.97	1481.43	1227.48	48.7	96.7608	1796.5741

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

Table A.5.8.4. Numbers of biological observations per species collected during 1719S. These consist of length, weight, sex and age, unless: * where age data were not collected, ** where no maturity data collected, ***weight/length/sex or † weight/length/sex/maturity(external only).

Species	Nos	Species	Nos
***Gadus morhua*	83	*†Raja microocellata*	1
***Merlangius merlangus*	1208	*†Galeorhinus galeus*	3
***Melanogrammus aeglefinus*	1813	****Psetta maximus*	1
****Merluccius merluccius*	318	***Glyptocephalus cynoglossus*	57
***Trisopterus esmarkii*	484	*†Raja brachyura*	6
***Pollachius virens*	25	*†Leucoraja naevus*	24
****Molva molva*	60	*†Dipturus intermedia*	66
****Zeus faber*	64	*†Dipturus flossada*	5
Scomber scombrus	367	*†Raja clavata*	140
Clupea harengus	229	*†Raja montagui*	115
***Pleuronectes platessa*	167	*†Mustelus asterias*	4
***Sprattus sprattus*	153	*†Squalus acanthias*	310
**Loligo forbesii*	799		

Table A.5.8.4. Q4 CPUE data for major species 2019

Q4 CPUE data for major species 2019		
Species	**no.s/hr**	**kgs/hr**
Haddock (*Melanogrammus aeglefinus*)	1062.5	236.3
Norway Pout (*Trisopterus esmarkii*)	5787.1	85.5
Mackerel (*Scomber scombrus*)	1637.3	69.2
Blue Whiting (*Micromesistius poutassou*)	1251.7	50.9
Spurdog (*Squalus acanthias*)	63.3	47
Grey Gurnard (*Eutrigla gurnardus*)	137.8	16.4
Flapper Skate (*Dipturus intermedia*)	2.2	11.8
Hake (*Merluccius merluccius*)	249.8	8.5
Poor Cod (*Trisopterus minutus*)	612.4	8.1
Thornback Ray (*Raja clavata*)	5.3	5.6
Red Gurnard (*Chelidonichthys cuculus*)	16.3	4.6
Angler (Monk fish) (*Lophius piscatorius*)	2.7	4.4
Greater Argentine (*Argentina silus*)	16.3	3.1
Megrim (*Lepidorhombus whiffiagonis*)	9.4	2.8
Rabbit Ratfish (*Chimaera monstrosa*)	2	1.8
Saithe (*Pollachius virens*)	0.9	1.5
Blue Skate (*Dipturus flossada*)	0.2	1.2
Cuckoo Ray (*Leucoraja naevus*)	1	1.1

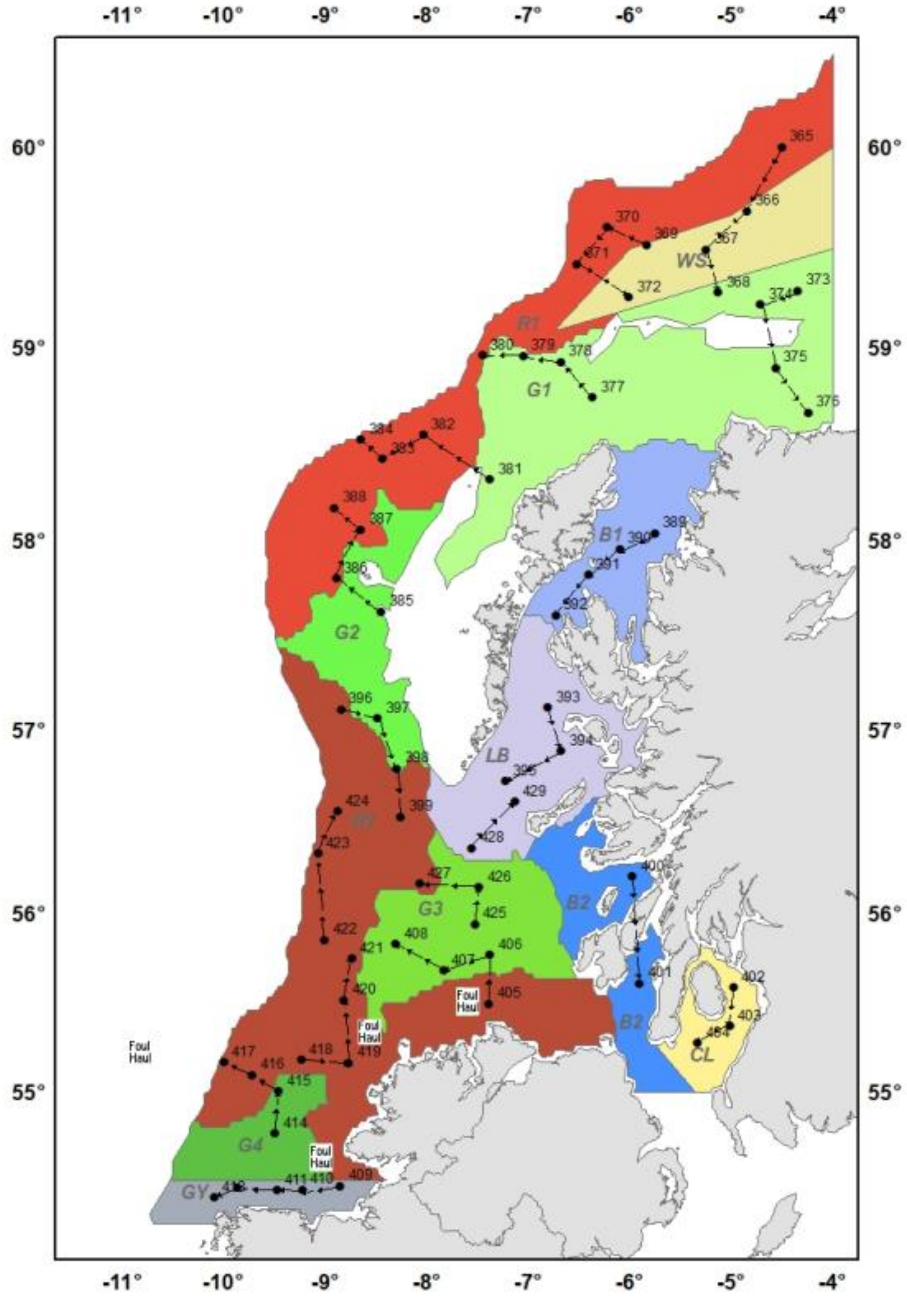


Figure A.5.8.1. Trawl stations completed during the Q4 WC with daily cruise track – IBTS 2019 (1719S) the 3 invalid hauls are marked 'Foul Haul'. (Note - The colour shading indicates the 12 different sampling strata covered by this survey)

A.5.9 – Northern Ireland – NI IBTS Q4 2019

Nation:	**Northern Ireland**	**Vessel:**	**Corystes**
Survey:	Groundfish Survey C04119	Dates:	07 – 22 October

Cruise	Objectives: • 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.
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. Gear and towing procedures were those employed on all previous AFBI groundfish surveys.
Notes from survey (e.g. problems, additional work etc.):	A stratified survey with fixed station positions was employed. The survey was divided into strata defined by length and substratum. The species composition of the catch at each station was determined, and length frequencies were recorded for each species. All cod, majority of hake and subsamples of haddock and whiting were taken for recording length, weight, sex and maturity stages and for the removal of otoliths for ageing. The level of infestation of whiting and cod by external parasites was estimated from biological samples collected at each station. For all hauls fishing was carried out during daylight commencing each day at first light. 62 valid hauls were completed, one haul was repeated. All tows were 20 minute. 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 2.5 – 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. Preliminary indices of abundance for 0-group and

	1-group cod, whiting and haddock were obtained from the length distributions . More accurate indices will be available once the otoliths collected during the cruise have been aged. At slack times, during the survey, scientific staff processed 13 herring landing samples. These were loaded on-board, before the survey commenced. Additional Sampling: • All litter picked up in the trawl was classified, quantified and recorded and uploaded to the national MSS litter database from where it will eventually be uploaded to DATRAS. The litter was retained onboard for appropriate disposal ashore. • Additional biological data and stomach samples were taken for foodweb analysis. • Elasmobranchs fit for tagging were measured, weighed, tagged and released.
Number of fish species recorded and notes on any rare species or unusual catches:	A total of 124 species were recorded during the survey of which 70 were species that were measured for length frequencies. Biological data were recorded for a number of species in accordance with the requirements of the EU Data Regulations. A total of 2,831 biological samples were taken during the survey.

Table A.5.9.1 Number of stations fished during C04119

ICES Division	Strata	Gear	Stations Planned	Valid Stations Achieved	Additional Stations	Invalid Stations	% Stations Achieved	Comments
7a		Rockhopper	62	62	0	0	100	

Table A.5.9.2 CO4119 biological sampling. Data are weight/length/sex/maturity/age except * where age data were not collected, ** where no maturity data collected, ***weight/length/sex.

Species	Nos	Species	Nos
Gadus morhua	24	*Psetta maximus*	2
Merlangius merlangus	1160	*Raja brachyura*	48***
Melanogrammus aeglefinus	764	*Raja clavata*	109***
Merluccius merluccius	4	*Raja montagui*	107***
Pollachius pollachius	0	*Raja naevus*	16***
Molva molva	0	*Squalus acanthias*	152***
Zeus faber	21		
Scophthalmus rhombus	13		
Pleuronectes platessa	325		
Microstomus kitt	17		
Lepidorhombus whiffiagonis	6		
Chelidonichthys cuculus	46		

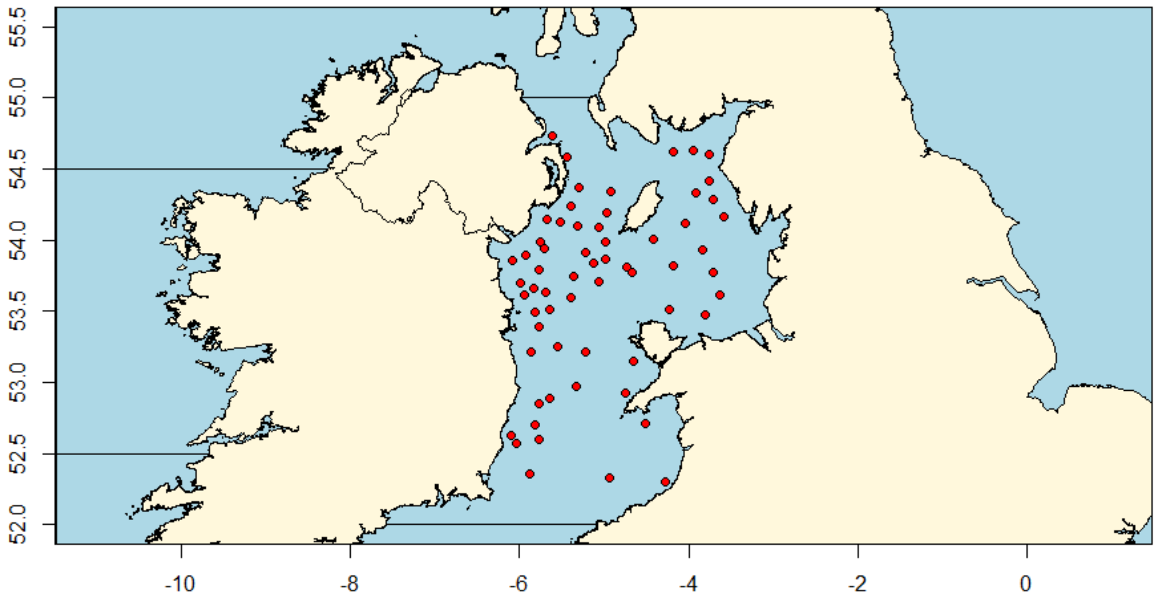


Figure A.5.9.1: - Map of Groundfish Stations completed during CO1019.

A.5.10 - Ireland: Irish Groundfish Survey Q4 – IGFSS2019

Nation:	**Ireland**	**Vessel:**	**Celtic Explorer**
Survey:	IE-IGFS	Dates:	30th October – 15th December 2019

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, 7b & 7g,j north. The indices currently utilized by assessment WG's are for haddock, whiting, plaice, cod, hake and sole. Survey data are 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 groundgear "A" for areas 7b,g & j; and a hopper gear "D"for area 6a.
Notes from survey (e.g. problems, additional work etc.):	Four full days lost to bad weather during 2019 with a few hours and slow operations at other times. Overall the weather overall started well, but became poor for later legs. Four additional tows were done on the first day to test the new IBTS survey trawl design before shipping to Aberdeen for scheduled sea trials there. Separately then there was an issue with the EVHOE survey so some extra effort was allocated to the southern part of the survey to avoid data gaps for that area.
Number of fish species recorded and notes on any rare species or unusual catches:	In 2019, 87 species of fish, 18 elasmobranch, 9 cephalopod and 49 crustacean and 150 other species/groups were caught. Overall the IGFS survey catches in 2019 were similar to the previous year with no major increases or drops in abundance of the main target species (see table A.5.10.3 below). The most significant increase in VIa was an increase in herring (*Clupea harengus*) in terms of both biomass (214%) and numbers (386%) on 2018, although still decreased over the 5 year average. Most species however still appear on a downward trend over the recent 5 years. For the Celtic Sea and West of Ireland (7b,g,j) again herring are showing a good increase in numbers over the 5 year average with significant increases also for haddock, mackerel and megrim. The values for herring and haddock however is for numbers, not biomass, indicating a likely increase in juveniles rather than adults in the fishery. These indices are coarse, but the overall perception during the survey in 2019 was for an avergae fishing year by recent standards. Patches of reasonable fishing, but nothing to stand out for any area or species.

Table A.5.10.1: Stations fished (aim to complete 170 valid tows per year)

ICES Divisions	Strata	Gear	Tows planned	Valid	Additional	Invalid	% stations fished	comments
6a	All	D	45	37	0	0	104	
7b,c	All	A	38	30	4*	1	89	
7g	All	A	48	49	0	1	104	
7j	All	A	40	35	0	0	87	
	TOTAL		171	161	4	2	95	

**Additional tows in 7b,c were non-standard IBTS tows done as part of gear trials for new survey trawl.*

Table A.5.10.2: Biological samples (length, weight, sex, maturity and age material); maturty* (length, weight, sex and maturity); length weight only (length and weight).**

Species	No.	Species	No.
Clupea harengus	293	*Microstomus kitt*	671
*Conger conger***	159	*Molva molva*	48
Dicentrarchus labrax	13	*Pleuronectes platessa*	873
*Dipturus flossada**	53	*Pollachius pollachius***	15
*Dipturus intermedia***	36	*Pollachius virens*	13
Gadus morhua	164	*Raja brachyura**	22
*Glyptocephalus cynoglossus***	460	*Raja clavata**	375
Lepidorhombus whiffiagonis	1495	*Raja montagui**	701
*Leucoraja naevus**	79	*Scomber scombrus*	462
Lophius budegassa	312	*Scophthalmus maximus (psetta maxima)***	21
Lophius piscatorius	624	*Scophthalmus rhombus***	24
Melanogrammus aeglefinus	2197	*Solea solea*	249
Merlangius merlangus	1473	*Squalus acanthias**	1013
Merluccius merluccius	626	*Trachurus trachurus*	859

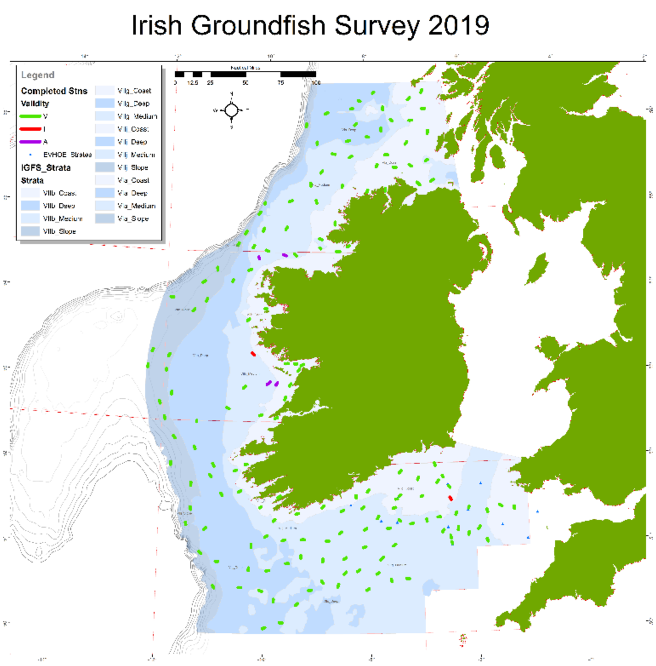


Figure A.5.10.1: Map of Survey Stations completed by the Irish Groundfish Survey in 2019. Valid = red circles; Invalid = black crosses; Additional = blue triangles.

Table A.5.10.3: Abundance in biomass and number of main species during 2019 IGFS compared with previous years.

Biomass and number estimates								
			Biomass index			Number index		
Species	Strata	Valid tows	y_i kg/Hr	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %	y_i No/Hr	y_i/y_{i-1} %	$y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ %
Gadus morhua	VIa	47	1.7	-21.3	-46.5	1.9	7.8	-25.0
Melanogrammus aeglefinus	VIa	47	239.6	23.5	-51.9	941.6	12.8	-53.4
Clupea harengus	VIa	47	41.7	214.8	-79.7	1295.4	385.7	-21.7
Merluccius merluccius	VIa	47	5.6	-13.8	-24.6	44.2	100.8	15.6
Trachurus trachurus	VIa	47	190.5	-67.4	35.2	1637.5	-57.4	-14.7
Scomber scombrus	VIa	47	140.5	15.4	-37.8	1859.8	-34.3	-6.8
Lepidorhombus whiffiagonis	VIa	47	1.7	-3.8	-2.1	9.7	-11.3	50.9
Lophius piscatorius	VIa	47	1.7	8.4	-56.8	1.5	15.8	-52.9
Pleuronectes platessa	VIa	47	5.6	-51.6	-39.7	32.6	-52.0	-41.3
Solea solea	VIa	47	0.3	-23.3	-3.3	1.1	-29.7	14.2
Micromesistius poutassou	VIa	47	90.7	371.5	-83.0	1951.4	461.3	-83.8
Merlangius merlangus	VIa	47	138.8	-21.8	-31.7	1673.7	17.4	-0.3
Gadus morhua	VIIbgj	114	2.7	37.9	-57.2	2.4	313.6	-11.9
Melanogrammus aeglefinus	VIIbgj	114	254.9	156.4	54.7	1823.6	7.0	146.5
Clupea harengus	VIIbgj	114	5.9	-58.2	95.9	139.6	-86.1	428.5
Merluccius merluccius	VIIbgj	114	20.5	-33.3	7.6	137.7	4.4	-45.6
Trachurus trachurus	VIIbgj	114	195.9	42.3	-11.9	2229.8	-7.4	-52.8
Scomber scombrus	VIIbgj	114	89.4	-22.4	213.7	1942.7	-5.5	195.4
Lepidorhombus whiffiagonis	VIIbgj	114	5.0	9.4	21.7	46.9	-5.8	75.1
Lophius piscatorius	VIIbgj	114	8.9	22.4	1.1	12.3	18.5	45.9
Pleuronectes platessa	VIIbgj	114	5.0	-44.3	-37.9	24.5	-58.4	-34.2
Solea solea	VIIbgj	114	0.7	9.0	9.6	4.0	3.8	59.9
Micromesistius poutassou	VIIbgj	114	69.5	239.3	-15.8	1244.3	226.5	-20.2
Merlangius merlangus	VIIbgj	114	62.0	131.0	-45.2	603.2	13.3	-27.5

Year estimate 2019 (y_i); previous year estimate 2018 (y_{i-1}); average of last two years estimate ($y_{(i,i-1)}$); average of the previous three year estimates 2015-17 ($y_{(i-2,i-3,i-4)}$). 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.5.11 - France – East English Channel Survey Q4 – FRCGFS 2019

Nation:	**France**	**Vessel:**	**THALASSA II**
Survey:	CGFS19	Dates:	29/09/2019 to 17/10/2019
Cruise	Participation to the Eastern French English Channel Q4 survey. France sampled both the Eastern and Western English Channel. Trawling was carried out during the day and some MIK nets were deployed at night. CTD was deployed at each trawl station to collect temperature and salinity profiles. Age data were collected for 8 species.		
Gear details:	The gear used is the standard GOV 36/47 with groundgear A, Exocet kite and with Marport sensors to record doors, wings and vertical openning parameters.		
Notes from survey (e.g. problems, additional work etc.):	The Thalassa left Cherbourg (France) on September 29th. The Eastern Channel was covered with 71 GOV hauls stations including 66 validated. At each trawl a CTD was deployed. *Additional works* : - The CUFES device (Continuous Underwater Fish Egg Sampler) was used during all the survey (day and night) and samples were scanned on board. - Plankton samples were collected for analysis on the planktonic foodweb structure (110 stations with a plankton net (20µm), WP2 and Fluoroprobe) - Microplastic was collected with a Manta net - Mammals and birds observations were collected throughout the survey.		
Number of fish species recorded and notes on any rare species or unusual catches:	90 different fish's species were recorded (sharks and rays included). Cephalopods and shellfish were also measured and benthic fauna identified within each haul.		

Table A.5.11.1: Stations fished

ICES Divisions	Strata	Gear	Tows planned	Valid	Invalid	% stations fished	comments
7d	ICES squares	GOV	71	65	6	92%	

Table A.5.11.2: Number of biological samples (weight, maturity and age material (otoliths)

Species	Age	Species	Age
Merlangus merlangius	649	Gadus morhua	11
Mullus surmuletus	158	Dicentrarchus labrax	206
Pleuronnectes platessa	411	Chelidonichthys cuculus	259
Trisopterus luscus	165	Solea Solea	262

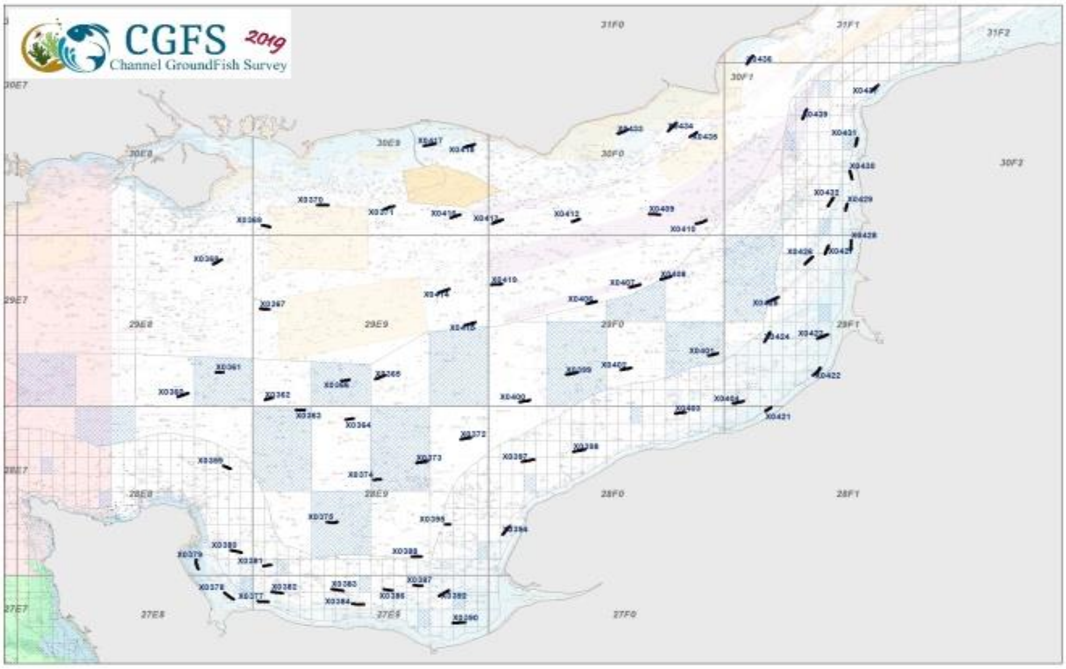


Figure A.5.11.1: GOV hauls FRCGFS-Q4 2019

A.5.12 - France – EVHOE Q4 2019

Nation:	**France**	**Vessel:**	**Thalassa 2**
Survey:	EVHOE 2019	Dates:	21 October – 7 December 2019
Cruise	Realized on the R/V Thalassa each year in autumn, 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, monkfish, 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 Groundgear (A) but no kite replaced by 6 extra floats. The boards have been replaced by new equivalent ones and the groundgear 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 have been utilized to record doors, wings, and vertical net opening.		
Notes from survey (e.g. problems, additional work etc.):	Due to a social movement, the 3rd part of the survey was delayed by 2 days on the initial plan, caught up by a lengthening of the survey of the same duration. A total of 151 hauls have been realized and 96.1% of them were validated (table A.5.12.1). Additional weather problems forced N / O Thalassa to stop operations for a total of 2.5 days. In order to reduce the risk of undersampling certain strata of the Celtic sea, we coordinated our efforts with the Irish IGFS survey taking place at the same time. Thanks to the reactivity of the IGFS team, the sampling not carried out by EVHOE in strata of the northern Celtic Sea (Cn2 and Cn3) have been fully or partially compensated (Table A.5.12.1). 97.4 % of the initial program have been realized and validated (151 valid hauls of 155 initially planned). Among the 151 hauls realized, 2 hauls were not validated because of trawl damage or shorted hauls due to strong pelagic fish acoustic detection. We implemented this year a strategy based on live acoustics in order to detect strong aggregations of pelagic fish and avoid the risk of damage and sorting difficulties. When strong acoustic detections have been observed we reduced the length of the tow trying to keep the time accepted as valid (≥20 minutes) or sometimes by stopping the trawling in progress. 15 hauls were made this way with a duration from 20 to 26 minutes. The following additional data collection has been performed: - A total number of 4528 biological samples (otoliths, scales and/or illicia) have been realized (table A.5.12.2). For the second consecutive year, the addition of samples 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. -151 CTD temperature and salinity profile - during transects and trawling hauls continuous records with multibeam echosounder to collect data for pelagic ecosystem - Wastes were counted and weighted at each trawl station. - Invertebrates ("benthos", 208 taxa) were sorted, identified counted and weighted at the lowest taxonomic level (mostly species) for each trawled station. - 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: • 22 Manta net hauls for collecting surface microplastics was put up during first and second leg • 31 samples with WP2 net for zoo and phytoplancton were collected during parts one and two. • transects with CUFES device (Continuous Underwater Fish Egg Sampler) • 46 vertical profiles with "SBE 19 Bathysonde" to collect temperature, phytoplancton, particle densities ... • 15 Additional vertical profiles with “SBE 19 Bathysonde” were done to collect water samples for eDNA analysis test • 46 Photo/Video transects with PAGURE sledge and 3 with SCAMPI for deeper areas • 29 “profiles boxes” with multibeam echosounder to collect bathymetry and reflectivity data • 6 mesopelagic hauls at the shelf break • acoustic transects (ME70 echo-sounder) for water column - Additional samples and observations have been collected on a set of selected species : muscle, stomach contents, fish morphometry, sharks and rays tagging.
Number of fish species recorded and notes on any rare species or unusual catches:	About 139 fish and 15 cephalopods taxa were recorded. Only 15 fish or cephalopods species represented 88% of the total biomass caught (Figure A.5.12.3) and, similarly to previous years, with a high dominance of small demersal-pelagic species (*Capros aper*, *Trachurus trachurus*, *Engraulis encrasicolus*). The biomass of demersal fish was dominated by 4 species: hake (*Merluccius merluccius*), haddock (*Melanogrammus aeglefinus*) especially in the celtic Sea (Figure A.5.12.4), the small-spotted catshark (*Scyliorhinus canicula*) and the poor cod (*Trisopterus minutus)*. Compared to previous years, we can note the exceptional catches of lobster (*Palinurus elephas*) with a total number of catches and an occurrence almost 3 times higher than the values of the previous year (already a stronger year than the time-series). Stronger catches of certain rays

	must also be reported such as *Raja undaluta* (with a significantly higher occurrence also) or *Dasyatis pastinaca* or for the shark *Squalus acanthias*. The total catches of Ilex were also particularly strong this year (with an exceptional catch of around 2 tonnes in one haul), this level of catch following a regular increase during the last 6 years. For some others species, the increase in total abundance and biomass observed in previous years continued in 2019, this is the case for example for *Chimaera monstrosa* (mostly small sized individuals).

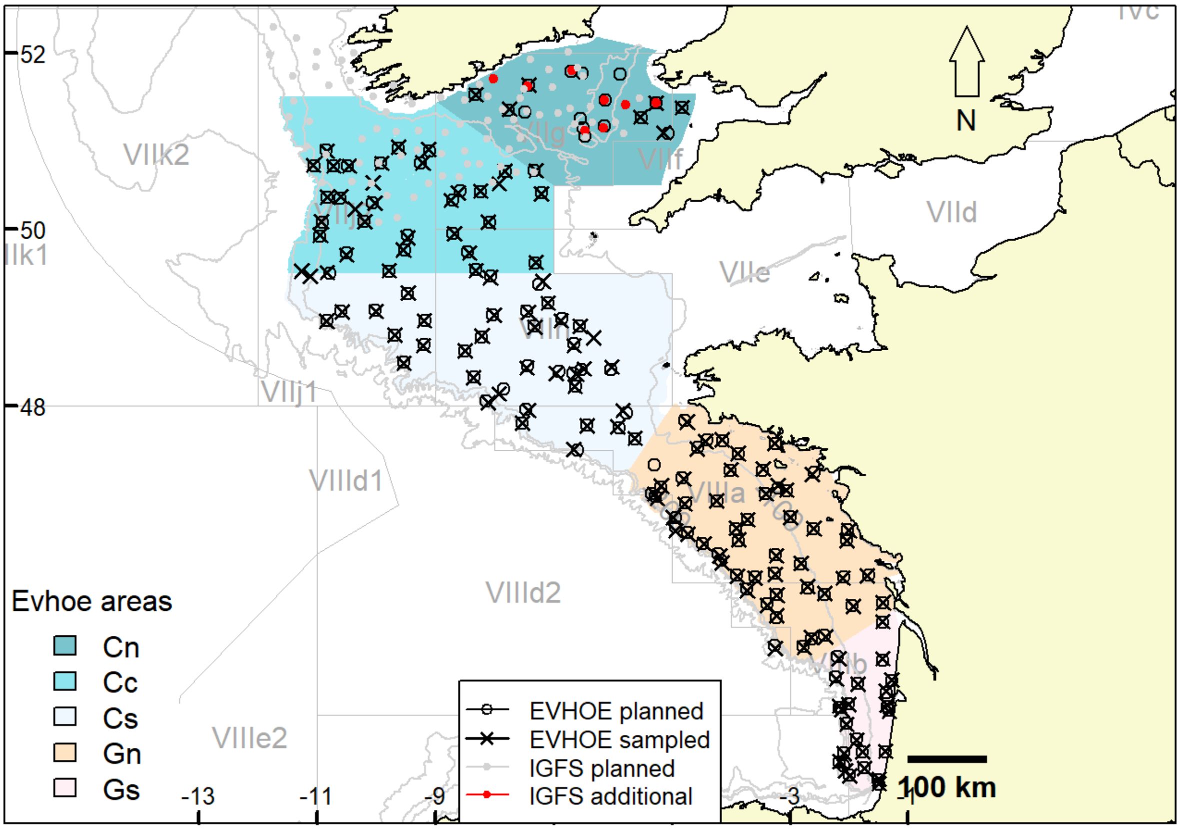


Figure A.5.12.1: Planned stations in the fixed sampling plan (o) and validated tows (x) for EVHOE 2018. ICES areas as well as EVHOE strata (Gs, Gn, Cs, Cc, Cn) are indicated. Red points indicate additional sampling stations covered by the Irish survey IGFS.

Table A.5.12.1: Trawling stations planned, realized and validated for the whole EVHOE 2019 survey.

Strata	ICES divisions	GEAR (Sweep lenght)	TOW planned	Realized	Valid	Additional	%Stations sampled (valid)
Cc	7g,h,j	GOV	30	34	33	4	110
Cc3	7g,h,j	GOV (100m)	8	9	9	1	112
Cc4	7g,h,j	GOV (100m)	15	17	17	2	113
Cc5	7g,h,j	GOV (100m)	4	4	4	0	100
Cc6	7g,h,j	GOV (100m)	3	4	3	1	100
Cn	7g,h,j	GOV (m)	16	7	7	0	44 (94% with IGFS)

	7g,h,j	GOV (50m)	7	5	5	0	71 (143% with IGFS) *
Cn3	7g,h,j	GOV (50m)	9	2	2	0	22 (56% with IGFS)**
Cs	7g,h,j	GOV (m)	35	37	37	2	106
Cs4	7g,h,j	GOV (100m)	24	25	25	1	104
Cs5	7g,h,j	GOV (100m)	7	7	7	0	100
Cs6	7g,h,j	GOV (100m)	4	5	5	1	125
Gn	8a,b	GOV (m)	51	50	49	0	96
Gn1	8a,b	GOV (50m)	5	5	5	0	100
Gn2	8a,b	GOV (50m)	5	5	5	0	100
Gn3	8a,b	GOV (50m)	14	14	13	0	93
Gn4	8a,b	GOV (100m)	20	19	19	0	95
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
Gs	8a,b	GOV (m)	23	23	23	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	151	149	6	96.1

* 5 additional stations from IGFS

** 3 additional stations from IGFS

Table A.5.12.2: Biological observations for species sampled (sex, maturity and collected material for aging) in the ICES Division 8ab and 7fghj

Species	Female	Male	Not sexed	Undeter-mined	Total number of sam-ples	Type of mate-rial
Argyrosomus regius	0	0	0	5	6	Otolith
Chelidonichthys cuculus	100	50	10	21	170	Otolith
Dicentrarchus labrax	49	40	0	0	88	Scales
Gadus morhua	21	13	0	1	35	Otolith
Glyptocephalus cyno-glossus	42	26	0	0	68	Otolith
Lepidorhombus boscii	36	20	0	0	25	Otolith
Lepidorhombus whiffiag-onis	414	148	0	41	506	Otolith
Lophius budegassa	125	101	0	60	270	Illicia
Lophius piscatorius	55	73	0	35	151	Illicia
Melanogrammus aeglefi-nus	280	200	0	43	506	Otolith
Merlangius merlangus	161	137	0	36	335	Otolith
Merluccius merluccius	481	428	0	255	1046	Otolith
Microstomus kitt	82	90	0	3	168	Otolith
Molva molva	0	5	0	0	6	Otolith
Mullus surmuletus	93	79	2	28	183	Otolith
Phycis blennoides	157	48	1	22	222	Otolith
Scomber scombrus	114	88	0	56	228	Otolith
Scophthalmus maximus	2	1	0	0	3	Otolith
Scophthalmus rhombus	3	3	0	0	6	Otolith
Solea solea	117	78	0	0	193	Otolith
Trisopterus luscus	96	69	3	22	165	Otolith

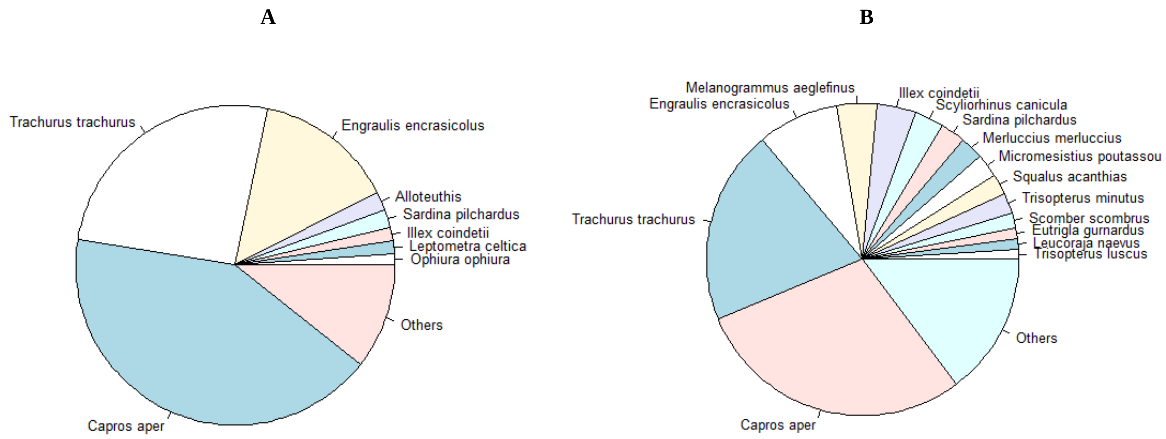


Figure A.5.12.2 - Species dominance over the entire "EVHOE" sampled area in term of (A) abundance and (B) biomass (B).

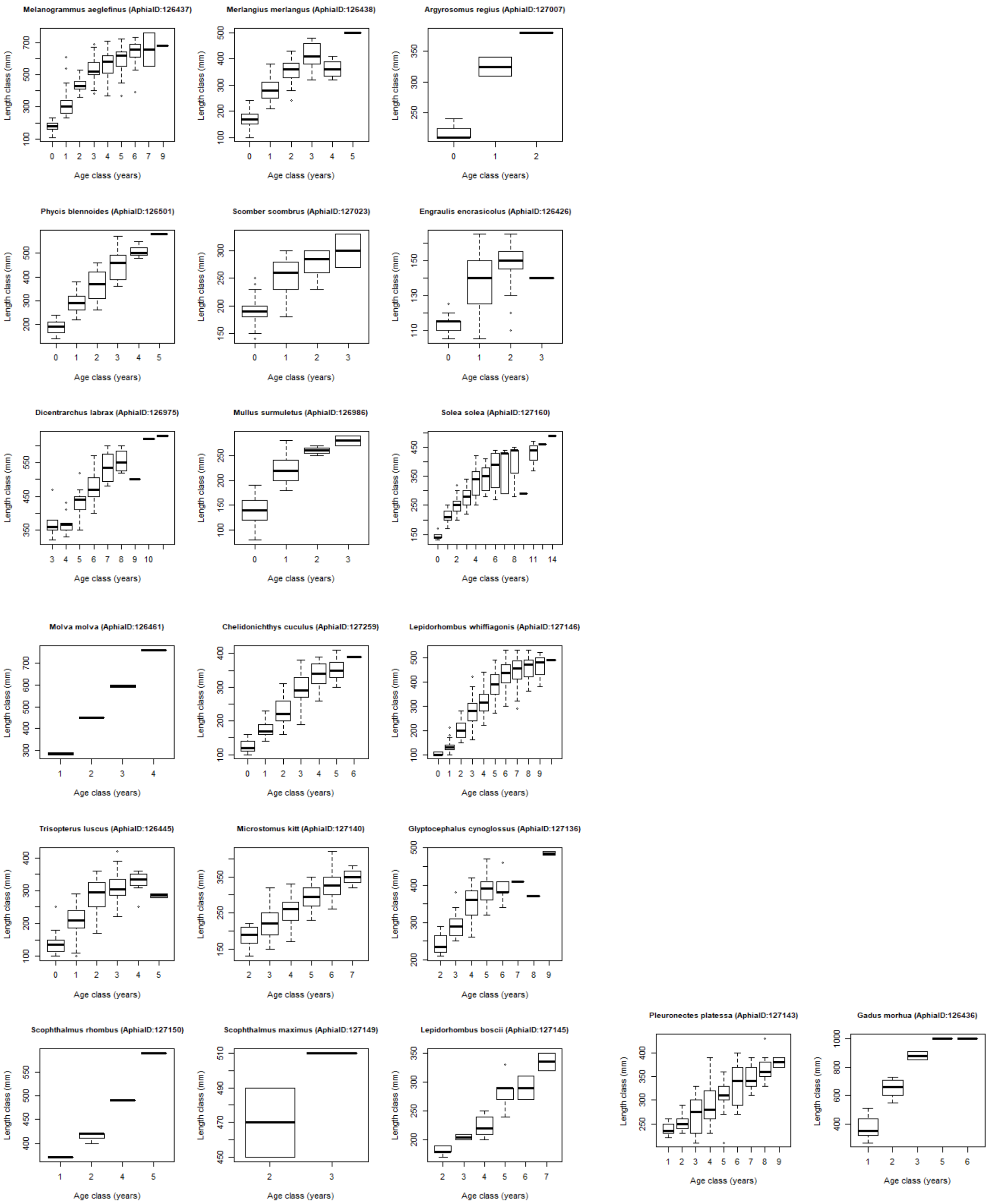


Figure A.5.12.3 - Length-at-age relationships for sampled species during EVHOE 2019

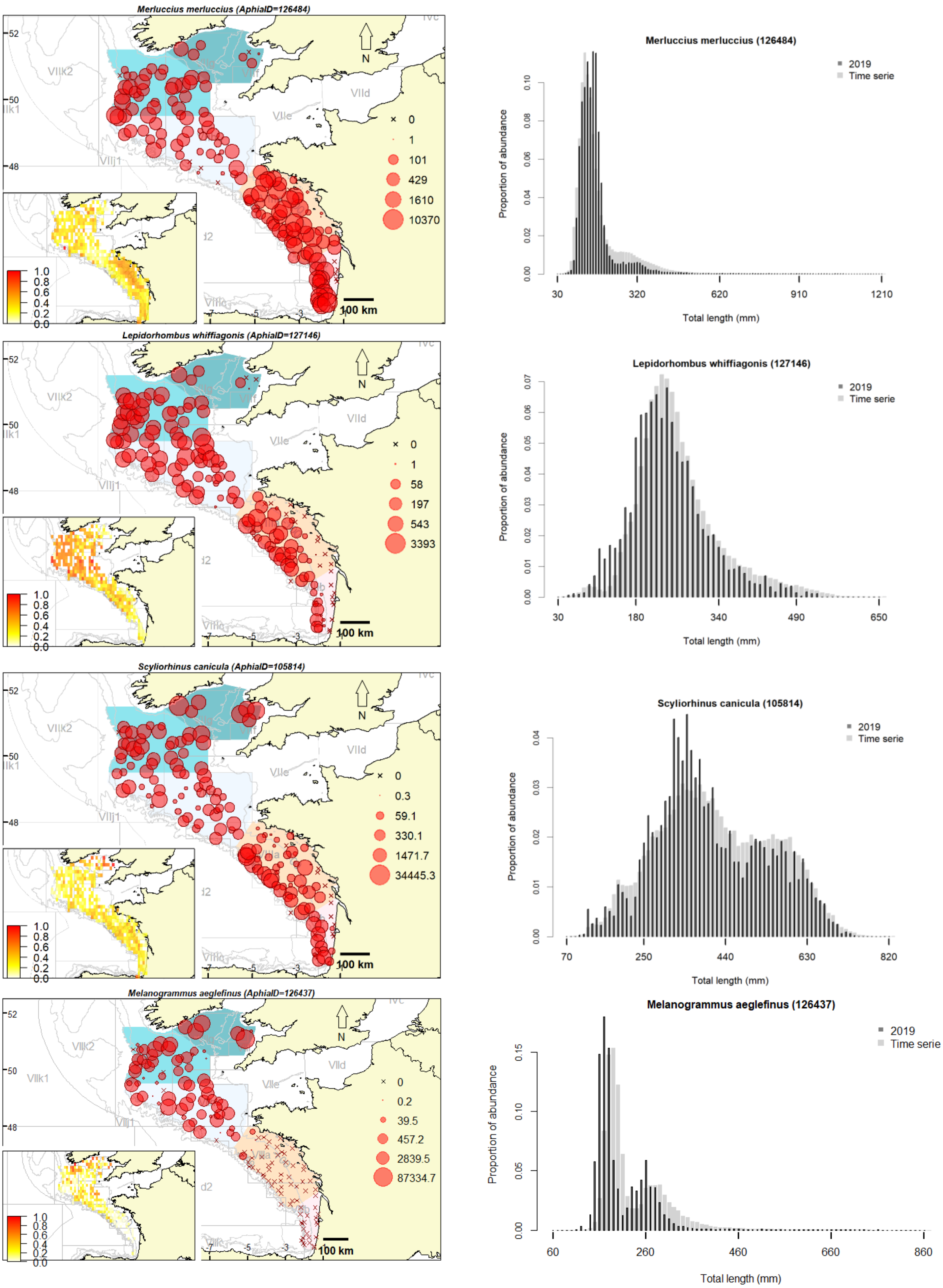


Figure A.5.12.4: Spatial distribution of biomass and barplot giving size distribution (logarithm of abundance by size class) for the 4 main demersal species (selected from total biomass proportion) caught during IBTS Q4 (EVOE) survey in 2019 and displaying significant differences as compared to the whole time-series (1997-2018).

A.5.13 - Spain – NSGFS Q4 2019

Nation:	SP (Spain)	Vessel:	Miguel Oliver
Survey:	SP-NSGFS-Q4 (N19)	Dates:	15 Sept -21 October 2019
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:	Standard baca 36/40 with Thyborøn doors		
Notes from survey (e.g. problems, additional work etc.):	2019 survey was performed on the R/V *Miguel Oliver* was used to perform the survey instead 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, catfish As in previous years, 3 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, 94 fish taxa with 82 species, 45 crustaceans taxa with 42 species , 41 molluscs taxa with 35 species, 40 echinoderms taxa with 35 species and 48 other invertebrates taxa with 30 species.		

Table A.5.13.1. Stations fished (aim: to complete 116 valid tows per year)

ICES Divisions	Strata	Gear	Tows planned	Valid	Additional	Invalid	% stations fished
8c	All	Standard baca	96	92	15[(1)]	0	98%
9a North	All	Standard baca	20	20	2	0	99%
8b	All	Standard baca	0	1	0	0	Na
	TOTAL		116	112	17	0	112%

Table A.5.13.2. Biological samples (length, weight, sex, maturity and age material)

Species	Age	Species	Age
Merluccius merluccius	594	*Scomber scombrus*	397
Lepidorhombus whiffiagonis	643	*Mullus surmuletus*	104
Lepidorhombus boscii	525	*Scomber colias*	10
Lophius budegassa	21	*Zeus faber***	41
Lophius piscatorius	39	*Trisopterus luscus*	320
Trachurus trachurus	489	*Helicolenus dactylopterus*	154
Micromesistius poutassou	517	*Phycis blennoides*	166
Engraulis encrasicolus	239	*Conger conger***	147
*Nephrops norvegicus****	62		

(*) Otoliths read for the ALK.

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

(***) No age reading for *Nephrops*

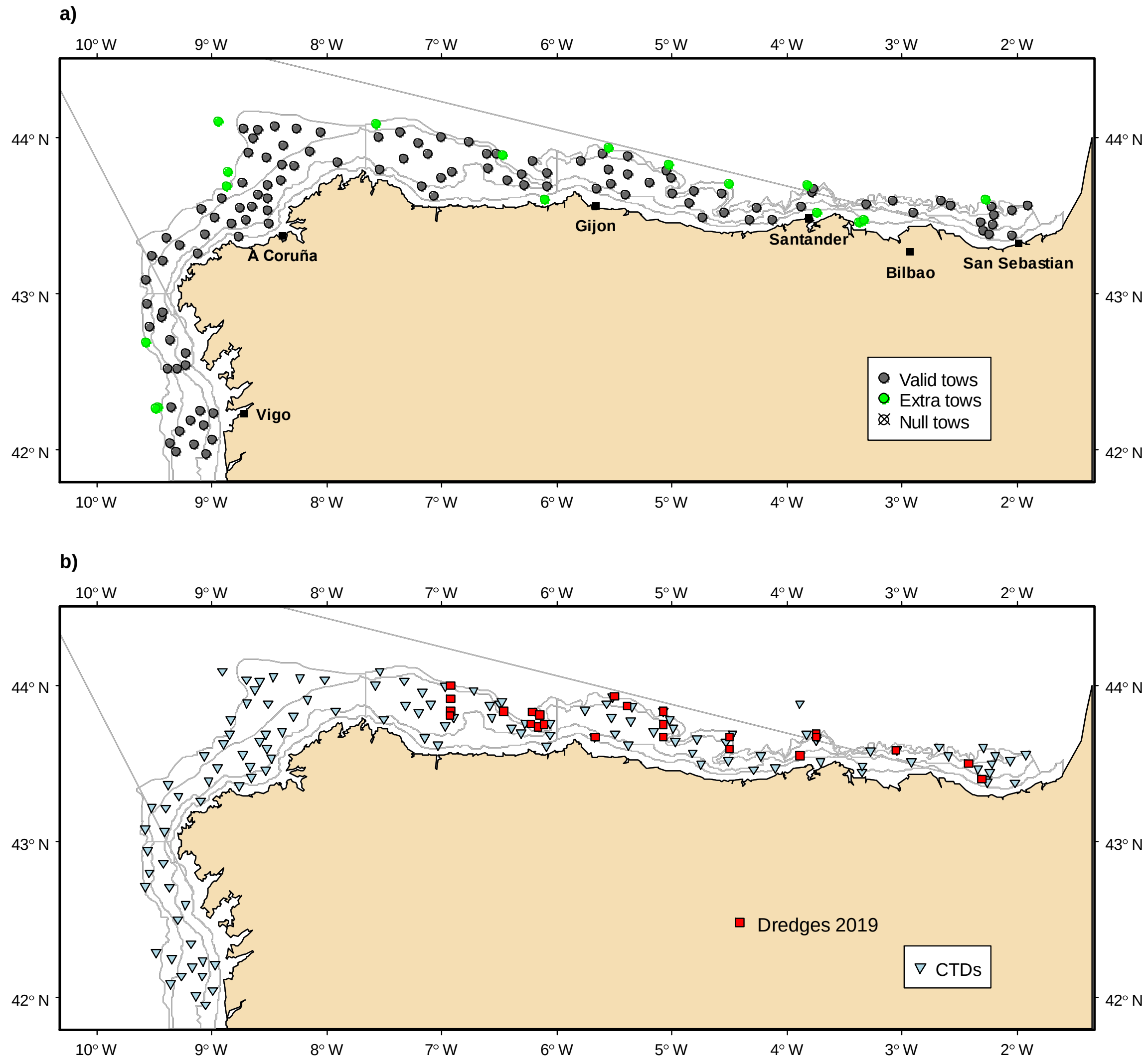


Figure A.5.13.1. a) Trawl stations in northern Spanish Shelf 2019 survey, b) CTD and dredge stations.

Table A.5.13.3 - Biomass and abundance estimates for N19

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	9aN	20	6.05	-14.8	-11.3	165.5	-47.3	16.2
Lepidorhombus boscii	9aN	20	5.96	6.4	13.6	106.4	15.7	13.7
Lepidorhombus whiffiagonis	9aN	20	4.69	14.4	32.0	54.8	10.8	4.7
Lophius budegassa	9aN	20	0.47	-46.0	5.2	0.2	-37.5	-37.1
Lophius piscatorius	9aN	20	0.64	-12.3	-28.6	0.4	171.4	-35.0
Micromesistius poutassou	9aN	20	33.09	-85.5	6.2	653.9	-90.5	-2.9
Trachurus trachurus	9aN	20	9.15	-81.9	-34.1	176.8	-84.1	-42.2
Scomber scombrus	9aN	20	2.38	167.4	-14.4	37.8	272.7	-50.2
Nephrops norvegicus	9aN	20	0.05	66.7	0.0	0.9	30.9	2.8
Merluccius merluccius	8c	92	4.20	20.0	-65.2	153.8	-35.1	-42.1
Lepidorhombus boscii	8c	92	4.79	16.0	-24.2	78.9	16.0	-36.1
Lepidorhombus whiffiagonis	8c	92	0.18	63.6	61.1	3.4	320.0	121.3
Lophius budegassa	8c	92	0.23	-23.3	165.0	0.1	-70.6	-40.0
Lophius piscatorius	8c	92	0.00	-100.0	33.3	0.0	-100.0	-85.4
Micromesistius poutassou	8c	92	16.00	-80.3	-32.0	332.0	-87.9	-19.1
Trachurus trachurus	8c	92	0.96	1820.0	-99.0	5.2	1336.1	-99.5
Scomber scombrus	8c	92	0.66	-29.8	-82.2	2.6	-77.4	-87.6
Nephrops norvegicus	8c	92	0.02	733.3	-16.0	0.3	440.0	2.1
Merluccius merluccius	Total	112	5.73	-11.6	-24.1	163.5	-45.7	1.4
Lepidorhombus boscii	Total	112	5.76	7.9	6.3	101.7	15.7	3.0
Lepidorhombus whiffiagonis	Total	112	3.92	14.6	32.3	45.9	11.9	5.2
Lophius budegassa	Total	112	0.43	-44.2	11.1	0.2	-41.4	-38.4
Lophius piscatorius	Total	112	0.53	-17.2	-28.1	0.3	146.2	-36.3
Micromesistius poutassou	Total	112	30.15	-85.2	2.1	598.5	-90.3	-4.4
Trachurus trachurus	Total	112	7.75	-81.5	-46.3	147.3	-84.0	-47.5
Scomber scombrus	Total	112	2.08	131.1	-36.5	31.7	206.9	-57.5
Nephrops norvegicus	Total	112	0.04	100.0	-25.0	0.8	36.8	1.8

$\mathbf{y_i}$, year estimate (2019); $\mathbf{y_{i-1}}$, previous year estimate (2018); $\mathbf{y_{(i,i-1)}}$, Average of last two year estimates (2019 and 2018); $\mathbf{y_{(i-2,i-3,i-4)}}$, Average of the previous three year estimates (2017, 2016 and 2015).

A.5.14 – Spain – SP GCGFS Q4 2019

Nation:	SP (Spain)	Vessel:	Miguel Oliver
Survey:	SP-GCGFS-Q4 (ARSA 1119)	Dates:	29 October - 11 November 2019
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 9a). 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 (350 Kg).		

Notes from survey (e.g. problems, additional work etc.):	Hydrographic data at each trawl station was collected using a net-mounted CTD. Additionally, 56 dredges were carried out with a box-corer.
Number of fish species recorded and notes on any rare species or unusual catches:	Overall a total of 156 fish species, 49 crustaceans and 58 molluscs were recorded.

Table A.5.14.1. Stations fished (aim: to complete 45 valid tows per year)

ICES Divisions	Strata	Gear	Tows planned	Valid	Additional	Invalid	% stations fished	comments
9aS	All	Baca 44/60	45	43	-	4	96%	

Table A.5.14.2. Biological samples (length, weight, sex, maturity and age material)

Species	Age	Species	Age
Merluccius merluccius	319	*Sepia officinalis**	96
*Merluccius merluccius**	1166	*Octopus vulgaris**	213
*Parapenaeus longirostris**	1941		
*Nephrops norvegicus***	286		

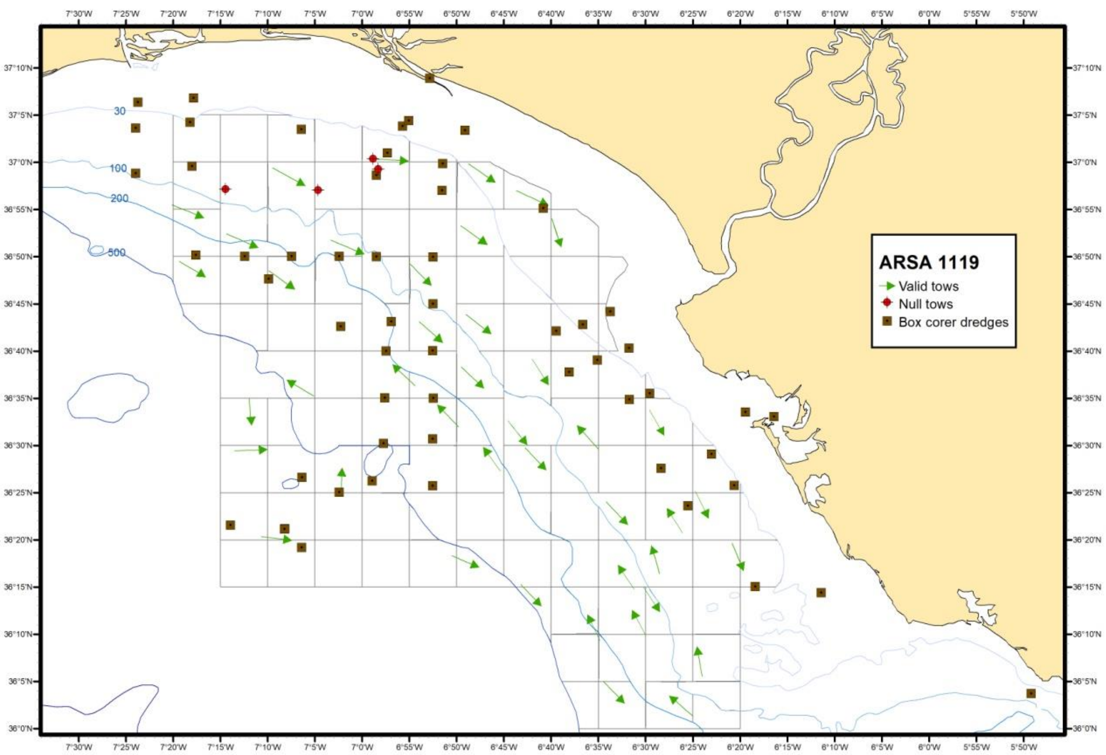


Figure A.5.14.1 - Trawl stations in Q4 Gulf of Cadiz 2019 survey.

Table A.5.14.3 – Biomass and abundance estimates for ARSA 1119

			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	43	4.07	1.8	-0.1	192.6	434.6	27.7
Micromesistius poutassou	All	43	2.91	-35.2	-72.1	45.4	-59.0	-75.4
Nephrops norvegicus	All	43	0.41	24.6	-15.4	15.8	20.9	-12.8
Parapenaeus longirostris	All	43	0.81	-45.6	196.8	127.8	-59.9	141.0
Octopus vulgaris	All	43	0.64	-41.2	-26.9	1.2	-63.2	23.2
Loligo vulgaris	All	43	1.82	25.1	44.9	27.5	164.2	128.6
Sepia officinalis	All	43	1.29	34.6	21.1	4.1	26.4	25.7

$\mathbf{y_i}$, year estimate (2019); $\mathbf{y_{i-1}}$, previous year estimate (2018); $\mathbf{y_{(i,i-1)}}$, Average of last two year estimates (2019 and 2018); $\mathbf{y_{(i-2,i-3,i-4)}}$, Average of the previous three year estimates (2017, 2016 and 2015).

A.5.15 – Portugal- PT PGFS Q4 2019

The Portuguese Autumn Groundfish Survey (PT-GFS), undertaken every year since 1979, aims to estimate indices of abundance and biomass of demersal species, focus-sing in providing the necessary information for stock assessment of commercial spe-cies. This survey is the most important source regarding information for biodiversity, biological parameters, food habits and distribution for a large number of marine species on the Portuguese shelf and slope.

This survey was not carried out in 2019, having important negative affects by:

- disrupting the time-series of the distribution and abundance for a large number of marine species in the Portuguese waters;
- disrupting the time-series of abundance indices independent from the fishery for commercial species;
- disabling the update of stock assessments of hake, horse mackerel and blue whiting (these resources are shared with other countries, thus having also a multinational negative affect);
- preventing the use of this time-series for the advice on data-limited stocks;
- compromising the estimation of the DCF indicators and the MSFD descriptors necessary to provide an evaluation of the Good Environmental Status (GES) for the Portuguese mainland coast.

IBTSWG recognizes all the efforts made by IPMA during 2019 to overcome the administrative and legal constraints of national scope that turned unfeasible the hiring of fishing and vessel crew on time to undertake 2019 PT-GFS. However, IBTSWG is aware of the current operability of RV Noruega or RV Mar Portugal and the plan to conduct PT-GFS in autumn 2020.

Annex 6: Maps of species distribution in 2019

Table A.6.1. Species for which distribution maps have been produced, with length split for prerecruit (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 Northeastern Atlantic Areas).

Scientific	Common	Code	Fig No	Length Split (<cm)
Capros aper	Boarfish	BOC	44	
Clupea harengus	Herring	HER	6-7	17.5
Conger conger	Conger	COE	45	
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	35	
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 spp.	Smooth Hound	SMH	34	
Nephrops norvegicus	Norway Lobster	NEP	28	
Pleuronectes platessa	European Plaice	PLE	22-23	12
Raja brachyura	Broadnose skate	RJH	40	
Raja clavata	Thornback ray (Roker)	THR	36	
Raja microocellata	Painted/Small Eyed Ray	PTR	37	
Raja montagui	Spotted Ray	SDR	38	
Raja undulata	Undulate Ray	UNR	39	
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	41	
Squalus acanthias	Spurdog	DGS	32	
Trachurus picturatus	Blue Jack Mackerel	JAA	43	
Trachurus trachurus	Horse Mackerel (Scad)	HOM	10-11	15
Trisopterus smarkii	Norway pout	NPO	42	
Zeus faber	John Dory	JOD	46	

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

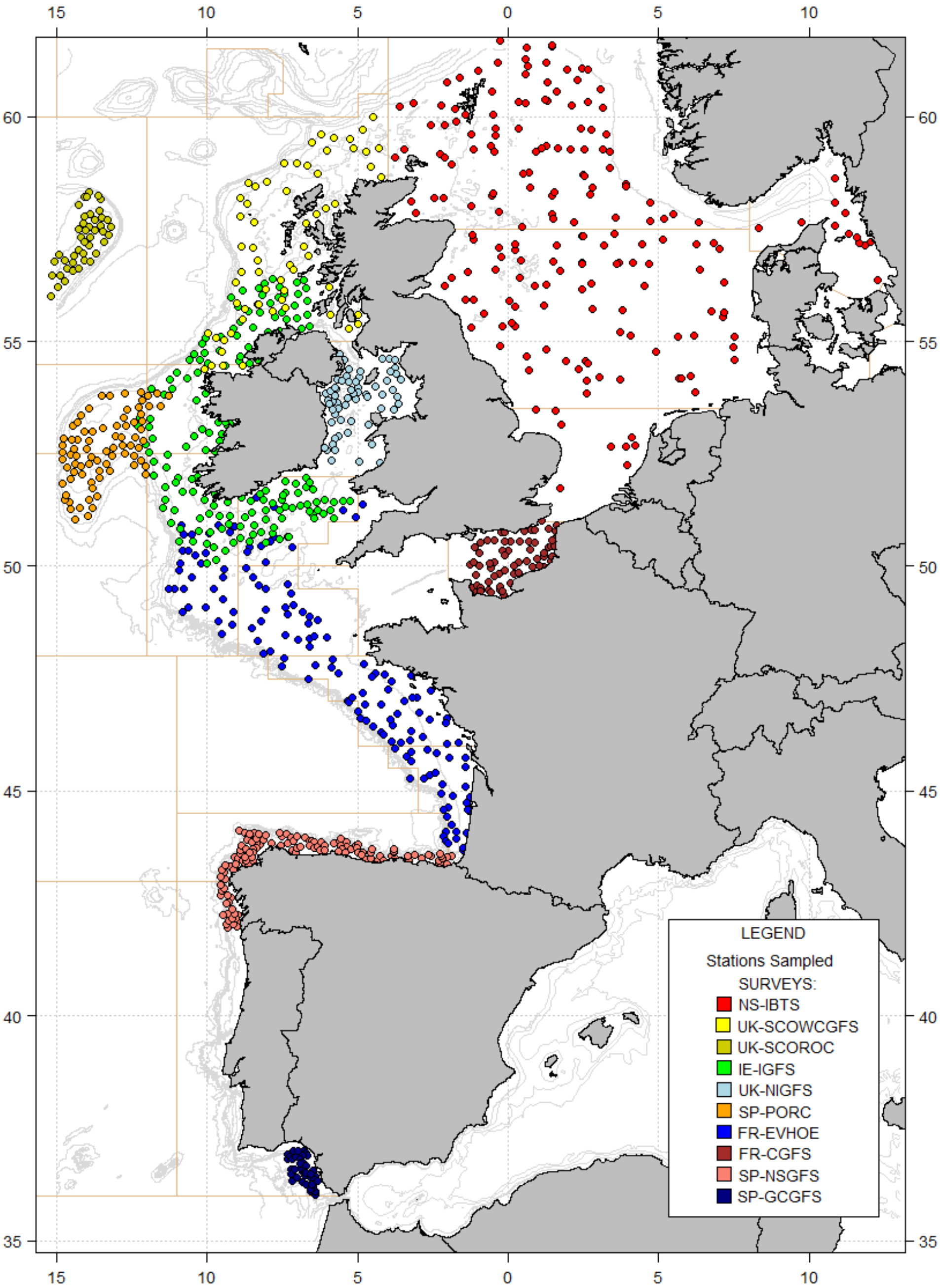


Figure A.6.1. Station positions for the IBTSurveys carried out in the North Eastern Atlantic and North Sea area in summer/autumn of 2019: Quarters 3 and 4.

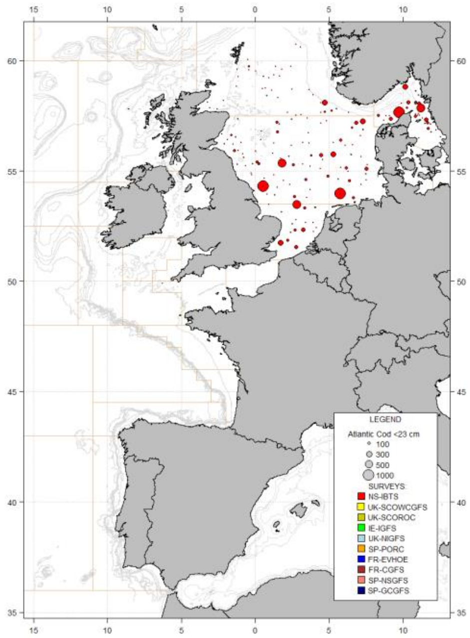


Figure A.6.2. Catches in numbers per hour of 0-group Cod, *Gadus morhua* (<23cm), in summer/autumn 2019 IBTSurveys.

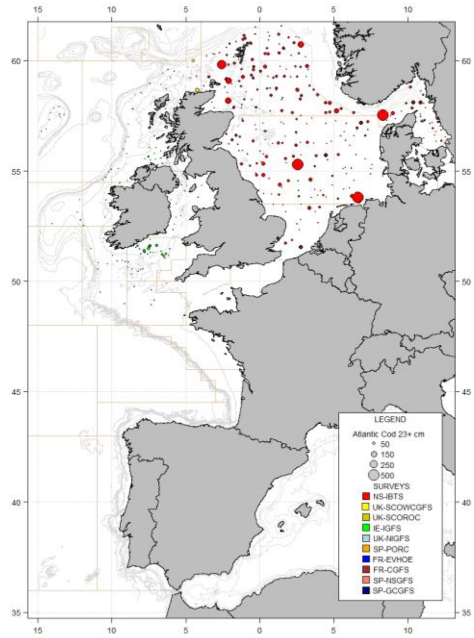


Figure A.6.3. Catches in numbers per hour of 1+ cod, *Gadus morhua* (≥23cm), in summer/autumn 2019 IBTSurveys.

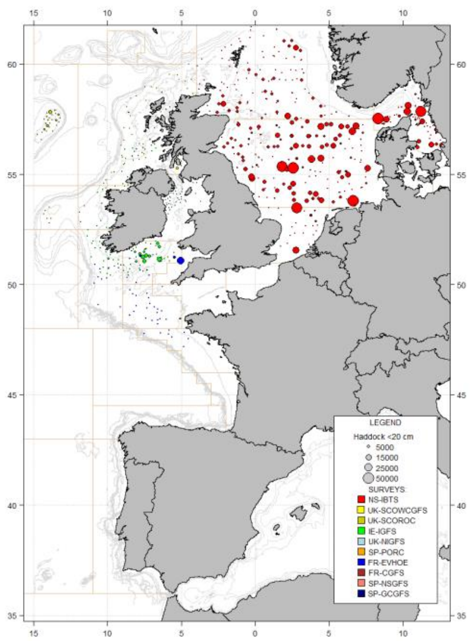


Figure A.6.4. Catches in numbers per hour of 0-group haddock, *Melanogrammus aeglefinus* (<20cm), in summer/autumn 2019 IBTSurveys.

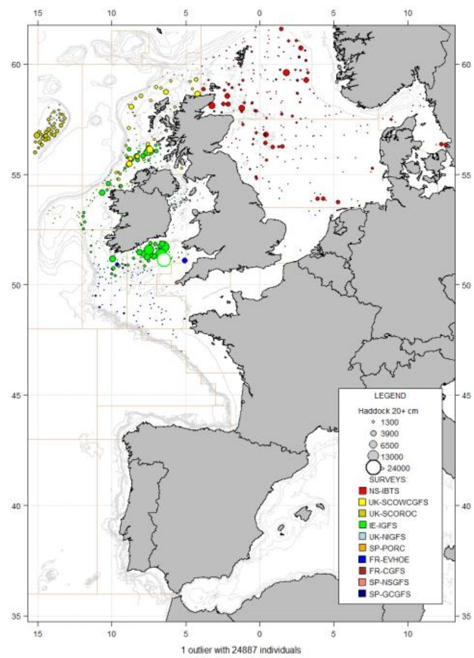


Figure A.6.5. Catches in numbers per hour of 1+ group haddock, *Melanogrammus aeglefinus* (≥20cm), in summer/autumn 2019 IBTSurveys.

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

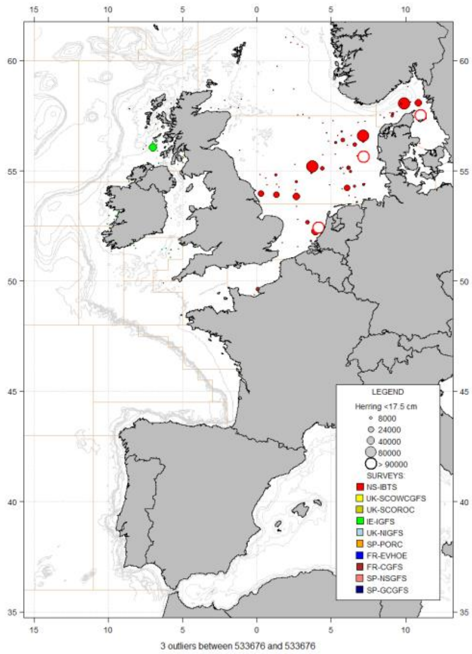


Figure A.6.6. Catches in numbers per hour of 0-group herring, *Clupea harengus* (<17.5 cm), in summer/autumn 2019 IBTSurveys.

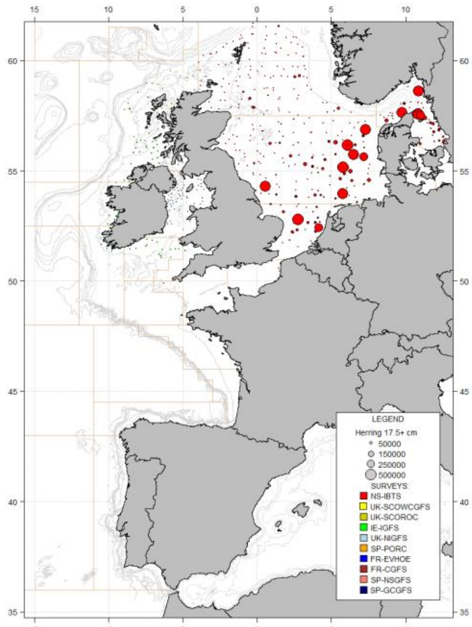


Figure A.6.7. Catches in numbers per hour of 1+ group herring, *Clupea harengus* (≥17.5 cm), in summer/autumn 2019 IBTSurveys.

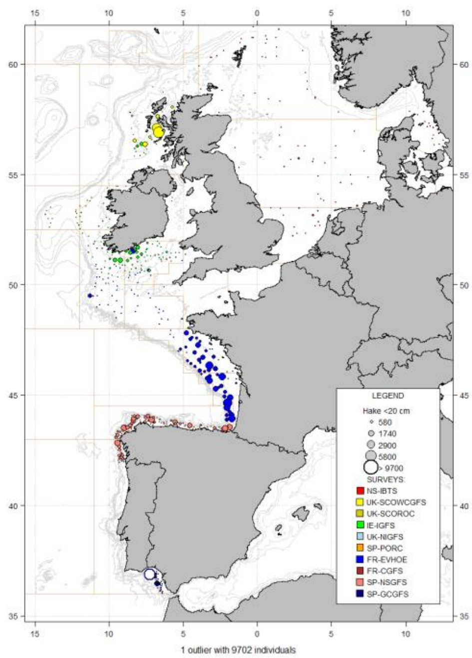


Figure A.6.8. Catches in numbers per hour of 0-group European hake, *Merluccius merluccius* (<20cm), in summer/autumn 2019 IBTSurveys.

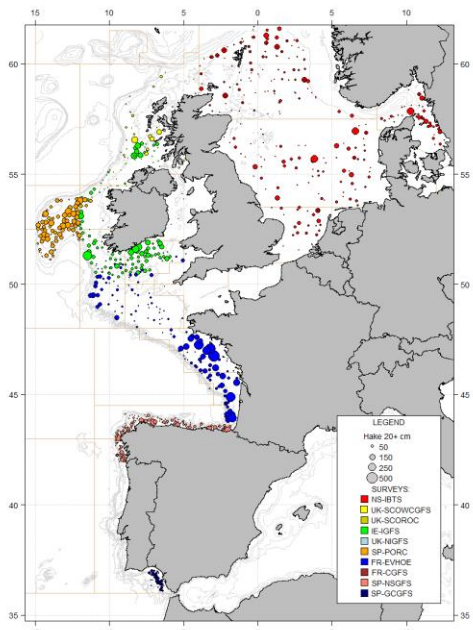


Figure A.6.9. Catches in numbers per hour of 1+ group European hake, *Merluccius merluccius* (≥20cm), in summer/autumn 2019 IBTSurveys.

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

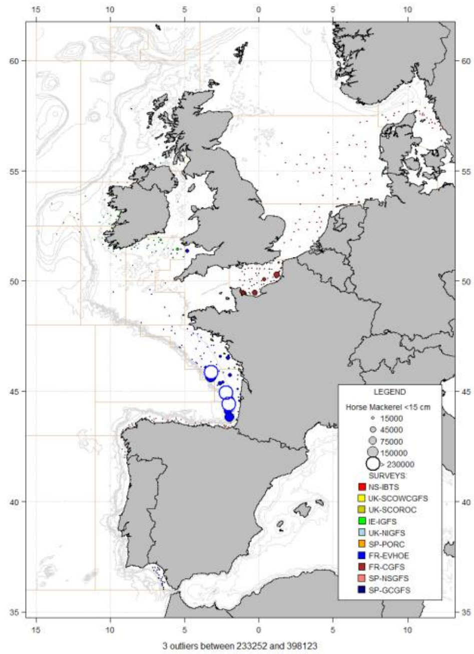


Figure A.6.10. Catches in numbers per hour of 0-group horse mackerel, T*rachurus trachurus* (<15 cm), in summer/autumn 2019 IBTSurveys.

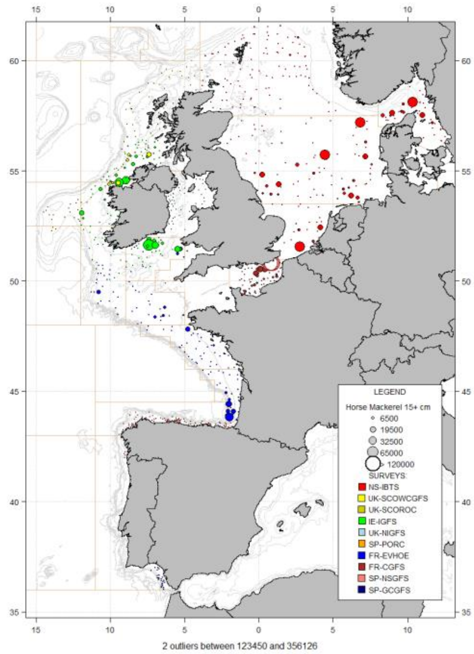


Figure A.6.11. Catches in numbers per hour of 1+ group horse mackerel, *Trachurus trachurus* (≥ 15 cm), in summer/autumn 2018 IBTSurveys.

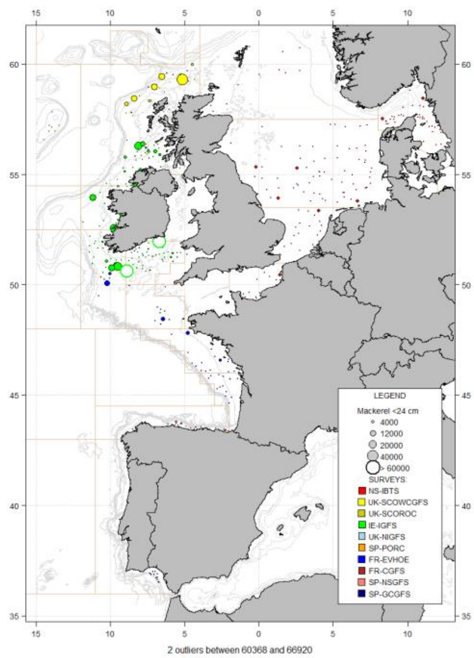


Figure A.6.12. Catches in numbers per hour of 0-group mackerel, *Scomber scombrus* (<24 cm), in summer/autumn 2019 IBTSurveys.

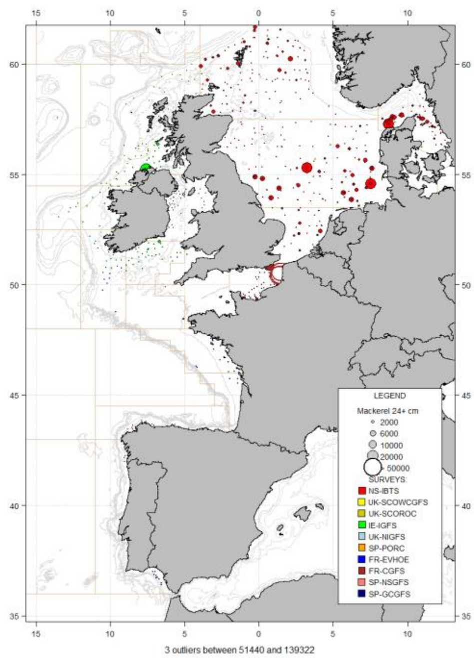


Figure A.6.13. Catches in numbers per hour of 1+ group mackerel, *Scomber scombrus* (≥24 cm), in summer/autumn 2019 IBTSurveys.

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

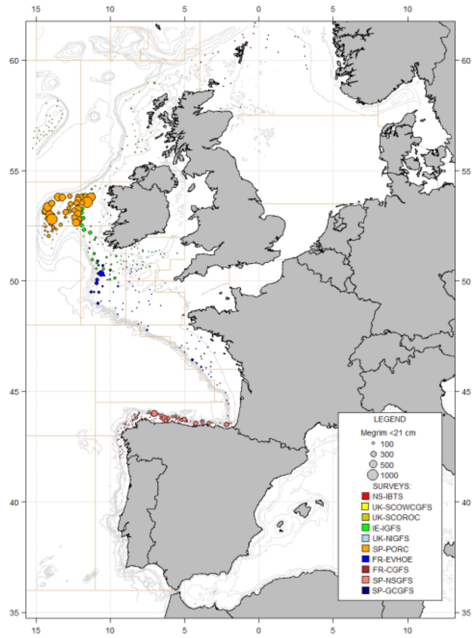


Figure A.6.14. Catches in numbers per hour of megrim recruits, *Lepidorhombus whiffiagonis* (<21 cm), in summer/autumn 2019 IBTSurveys.

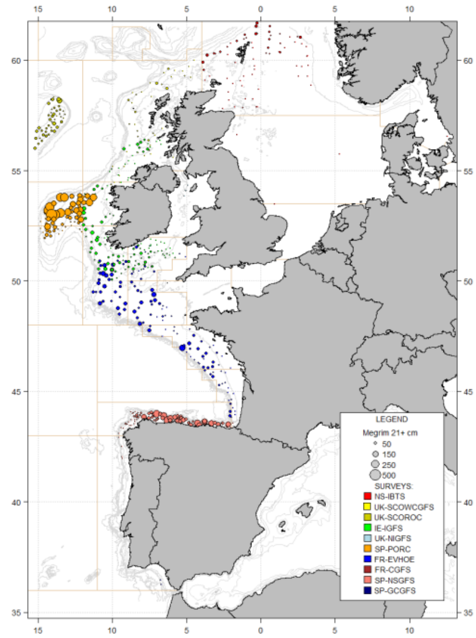


Figure A.6.15. Catches in numbers per hour of 2+ group megrim, *Lepidorhombus whiffiagonis* (≥21cm), in summer/autumn 2019 IBTSurveys.

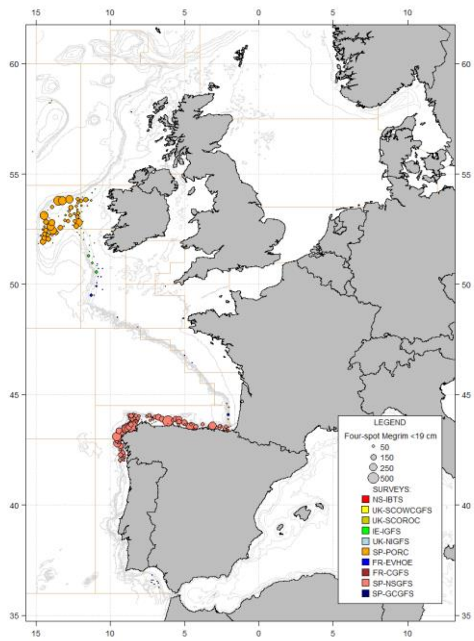


Figure A.6.16. Catches in numbers per hour of recruits of four-spotted megrim, *Lepidorhombus boscii* (<19 cm), in summer/autumn 2019 IBTSurveys.

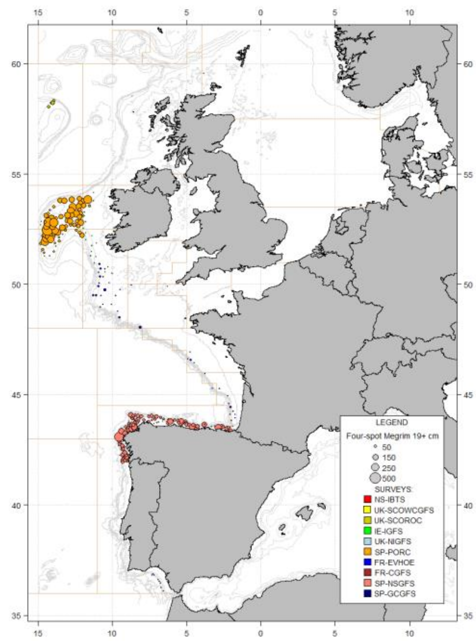


Figure A.6.17. Catches in numbers per hour of 2+ group four-spotted megrim, *Lepidorhombus boscii* (≥19 cm), in summer/autumn 2019 IBTSurveys.

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

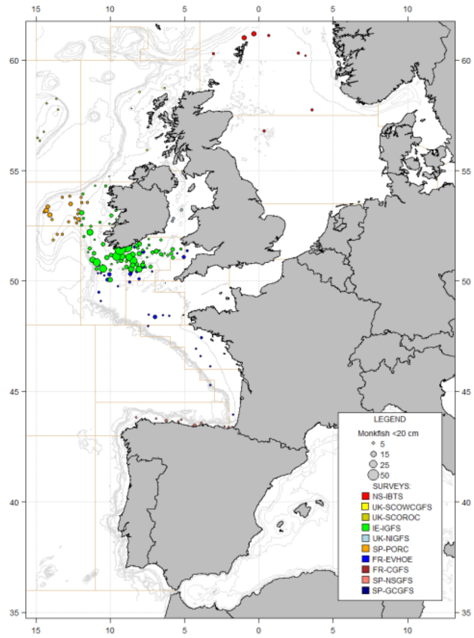


Figure A.6.18. Catches in numbers per hour of 0-group monkfish, *Lophius piscatorius* (<20 cm), in summer/autumn 2019 IBTSurveys.

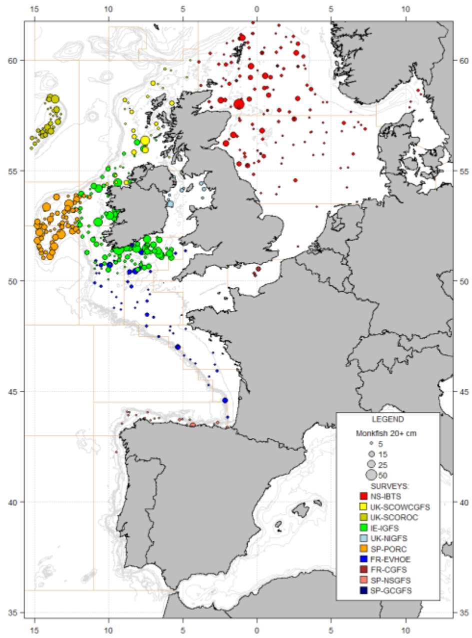


Figure A.6.19. Catches in numbers per hour of 1+ group monkfish, *Lophius piscatorius* (≥20 cm), in summer/autumn 2019 IBTSurveys.

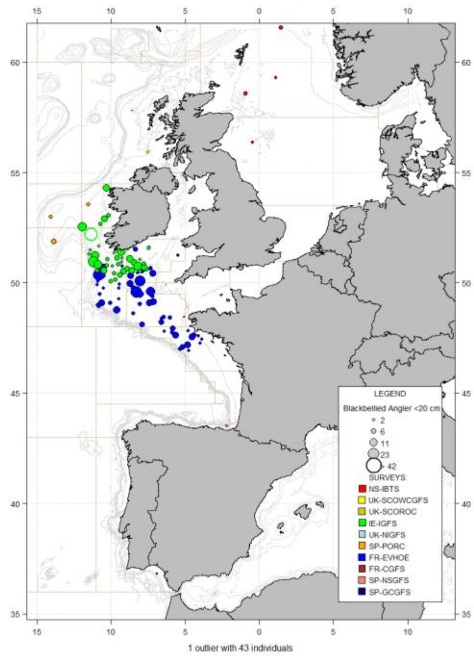


Figure A.6.20. Catches in numbers per hour of 0-group black-bellied anglerfish, *Lophius budegassa* (<20 cm), in summer/autumn 2019 IBTSurveys.

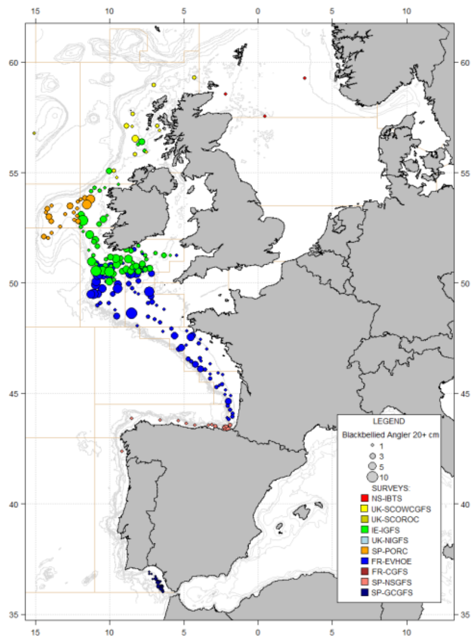


Figure A.6.21. Catches in numbers per hour of 1+ group black-bellied anglerfish, *Lophius budegassa* (≥20 cm), in summer/autumn 2019 IBTSurveys.

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

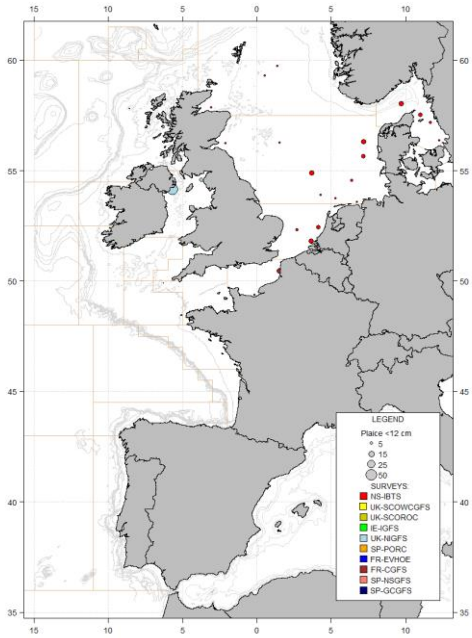


Figure A.6.22. Catches in numbers per hour of 0-group plaice, *Pleuronectes platessa* (<12 cm), in summer/autumn 2019 IBTSurveys.

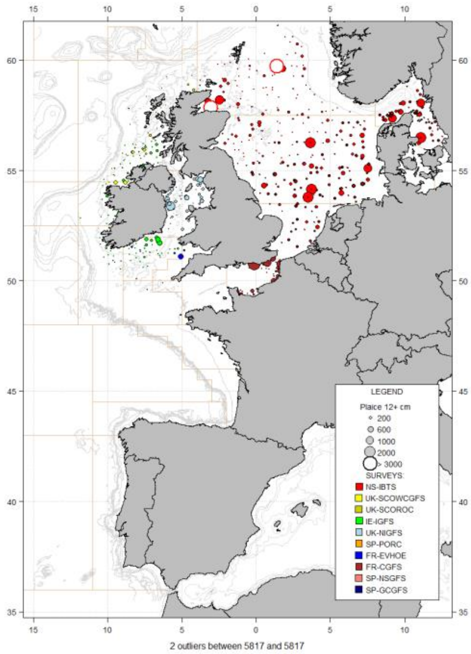


Figure A.6.23. Catches in numbers per hour of 1+ group plaice, *Pleuronectes platessa* (≥12 cm), in summer/autumn 2019 IBTSurveys.

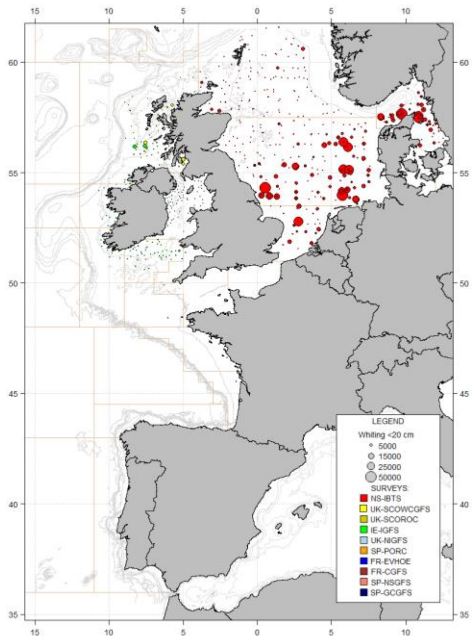


Figure A.6.24. Catches in numbers per hour of 0-group whiting, *Merlangius merlangus* (<20 cm), in summer/autumn 2019 IBTSurveys.

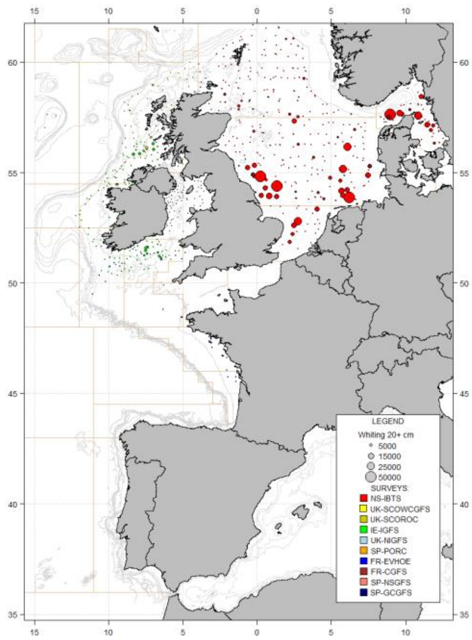


Figure A.6.25. Catches in numbers per hour of 1+ group whiting, *Merlangius merlangus* (≥20 cm), in summer/autumn 2019 IBTSurveys.

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

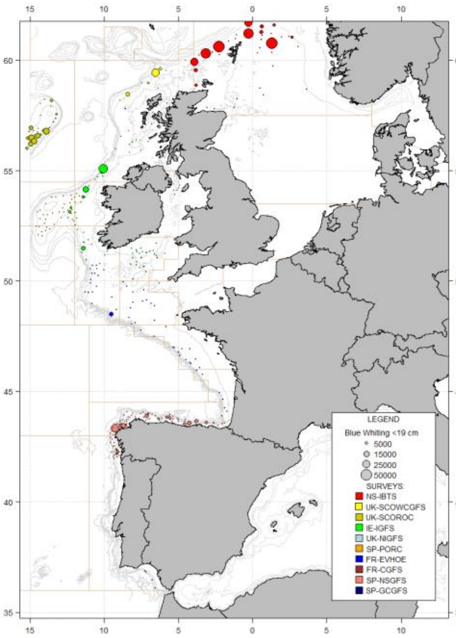


Figure A.6.26. Catches in numbers per hour of 0-group blue whiting, *Micromesistius poutassou* (<19 cm), in summer/autumn 2019 IBTSurveys.

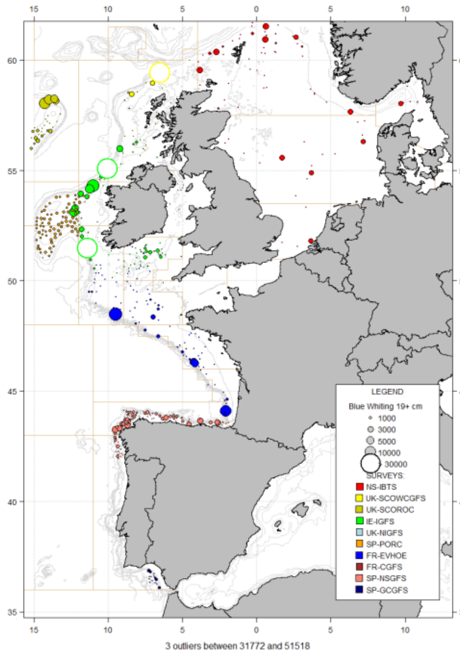


Figure A.6.27. Catches in numbers per hour of 1+ group blue whiting, *Micromesistius poutassou* (≥19 cm), in summer/autumn 2019 IBTSurveys.

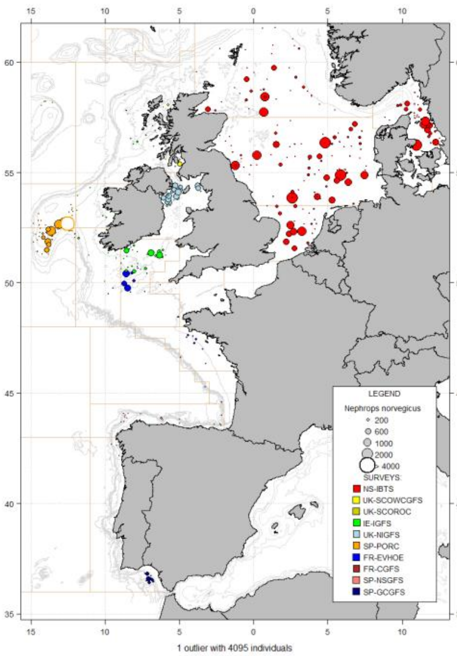


Figure A.6.28. Catches in numbers per hour of Norway lobster, *Nephrops norvegicus*, in summer/autumn 2019 IBTSurveys.

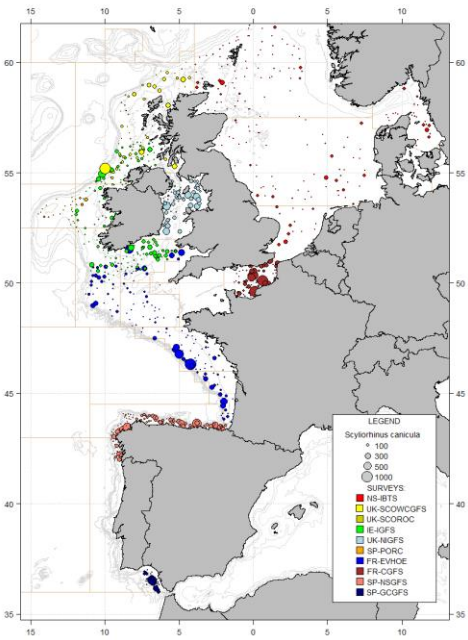


Figure A.6.29. Catches in numbers per hour of lesser spotted dogfish, *Scyliorhinus canicula*, in summer/autumn 2019 IBTSurveys.

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

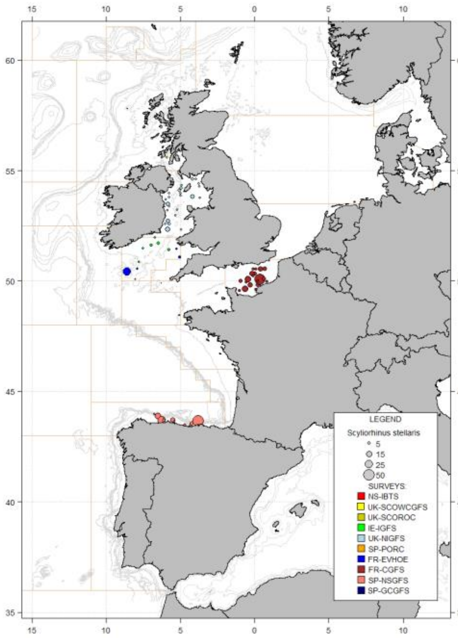


Figure A.6.30. Catches in numbers per hour of nurse hound, *Scyliorhinus stellaris*, in summer/autumn 2019 IBTSurveys.

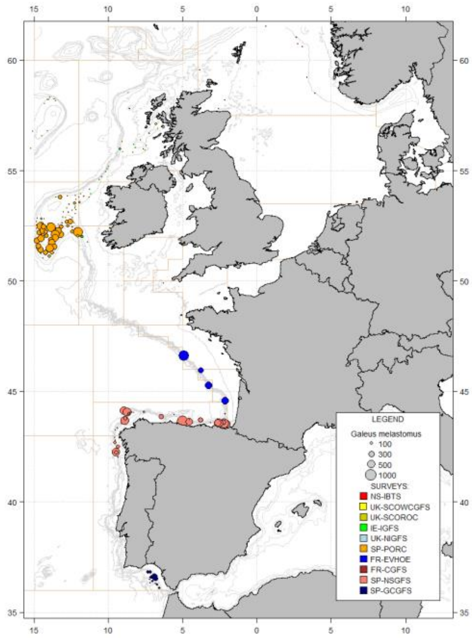


Figure A.6.31. Catches in numbers per hour of Black-mouthed dogfish, *Galeus melastomus*, in summer/autumn 2019 IBTSurveys.

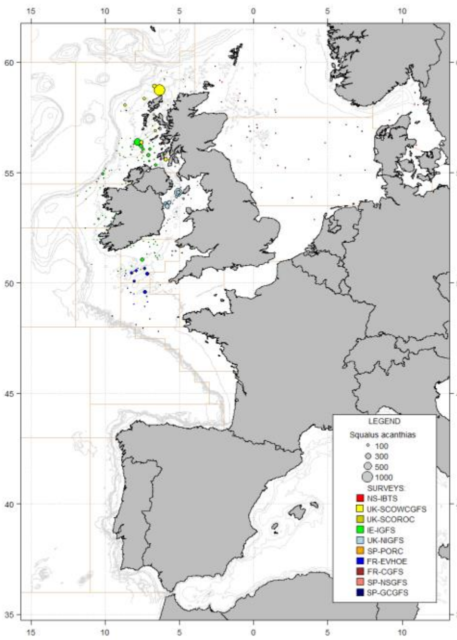


Figure A.6.32. Catches in numbers per hour of spurdog, *Squalus acanthias*, in summer/autumn 2019 IBTSurveys.

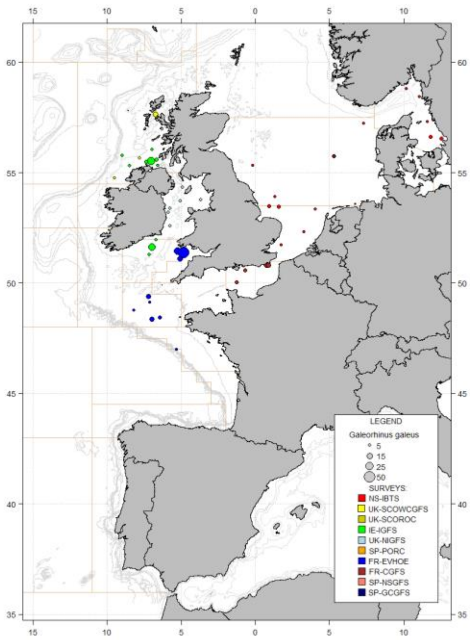


Figure A.6.33. Catches in numbers per hour of tope, *Galeorhinus galeus*, in summer/autumn 2019 IBTSurveys.

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

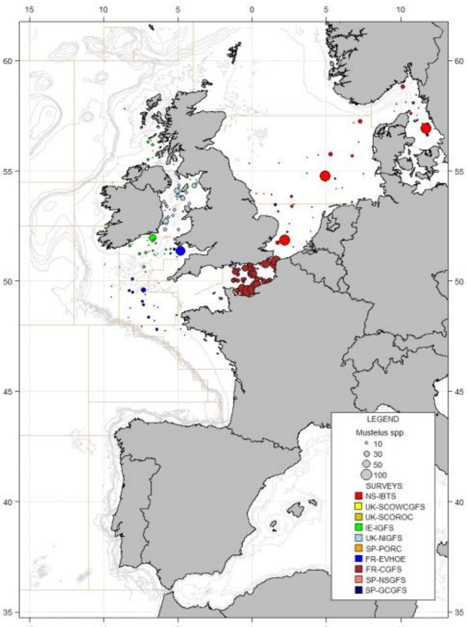


Figure A.6.34. Catches in numbers per hour of smooth-hound, *Mustelus* spp. in summer/autumn 2019 IBTSurveys.

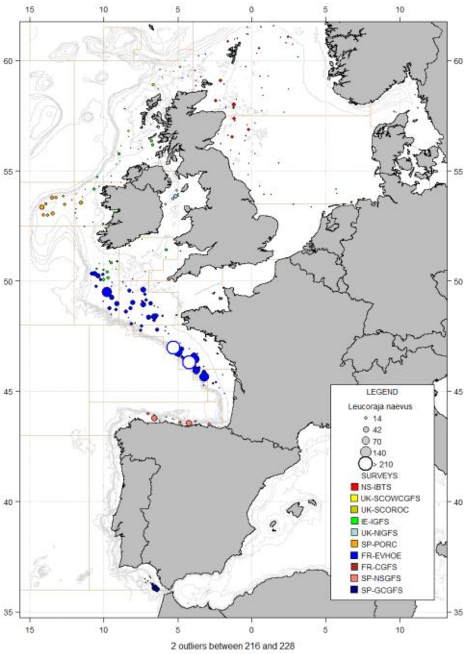


Figure A.6.35. Catches in numbers per hour ofcuckoo ray, *Leucoraja naevus*, in summer/autumn 2019 IBTSurveys.

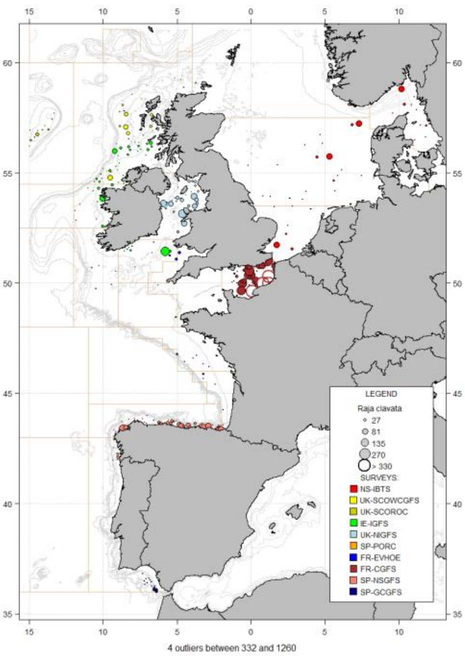


Figure A.6.36. Catches in numbers per hour of thornback ray, *Raja clavata*, in summer/autumn 2018 IBTSurveys.

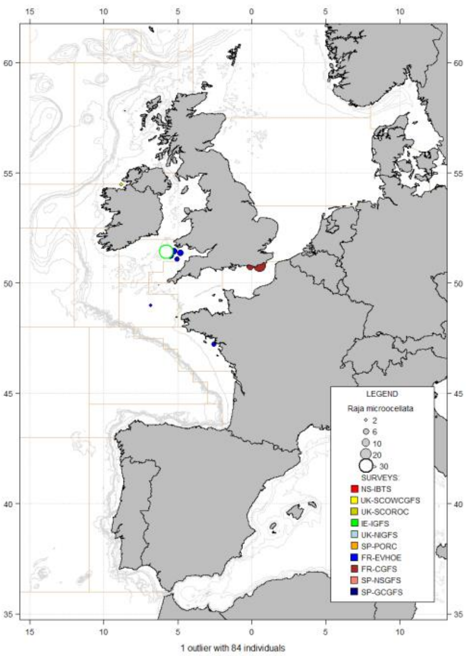


Figure A.6.37. Catches in numbers per hour of small eyed ray, *Raja microocellata*, in summer/autumn 2018 IBTSurveys.

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

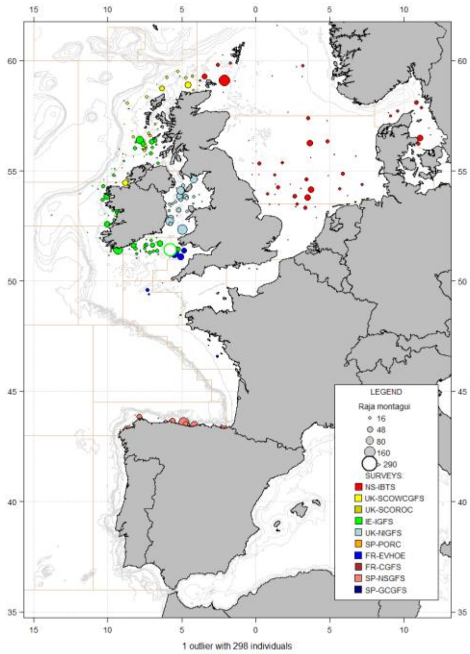


Figure A.6.38. Catches in numbers per hour of spotted ray, *Raja montagui*, in summer/autumn 2019 IBTSurveys.

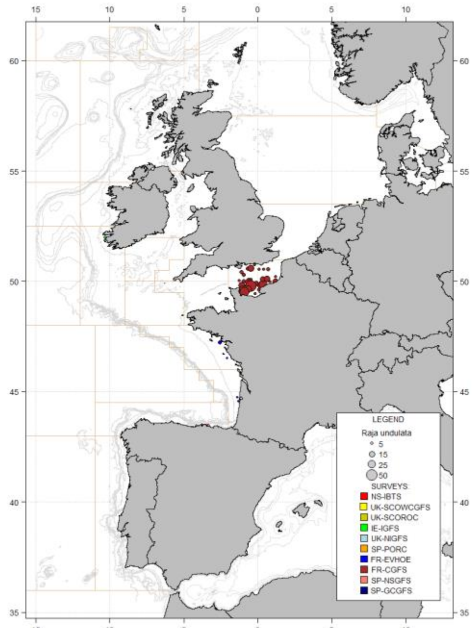


Figure A.6.39. Catches in numbers per hour of undulate ray, *Raja undulata*, in summer/autumn 2019 IBTSurveys.

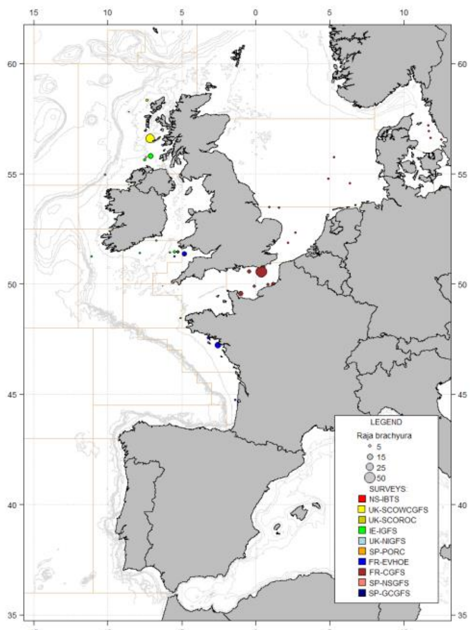


Figure A.6.40. Catches in numbers per hour of Broadnose skate, *Raja brachyura*, in summer/autumn 2019 IBTSurveys.

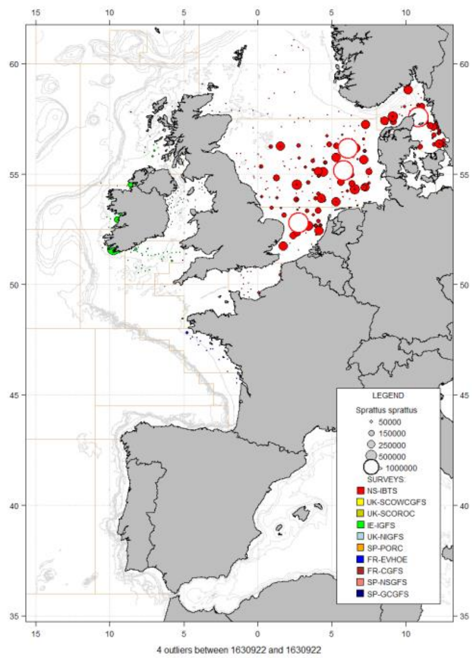


Figure A.6.41. Catches in numbers per hour of European sprat, *Sprattus sprattus*, in summer/autumn 2019 IBTSurveys.

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

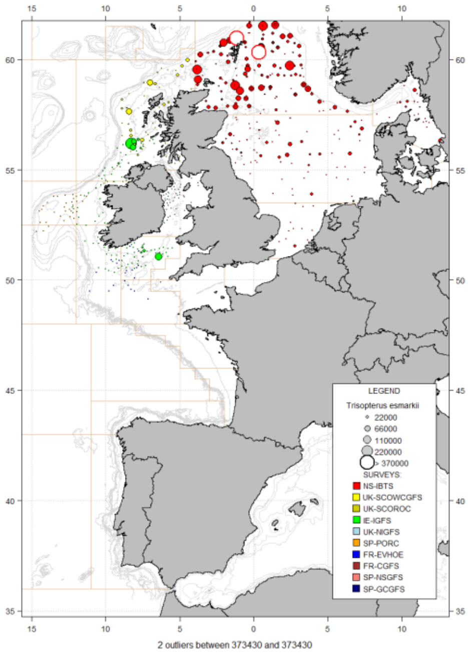


Figure A.6.42. Catches in numbers per hour of Norway pout, *Trisopterus esmarkii*, in summer/autumn 2019 IBTSurveys.

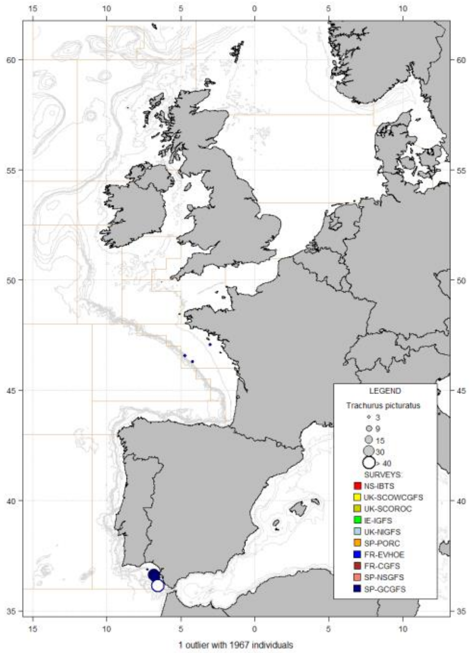


Figure A.6.43. Catches in numbers per hour of blue jack mackerel, *Trachurus picturatus*, in summer/autumn 2019 IBTSurveys.

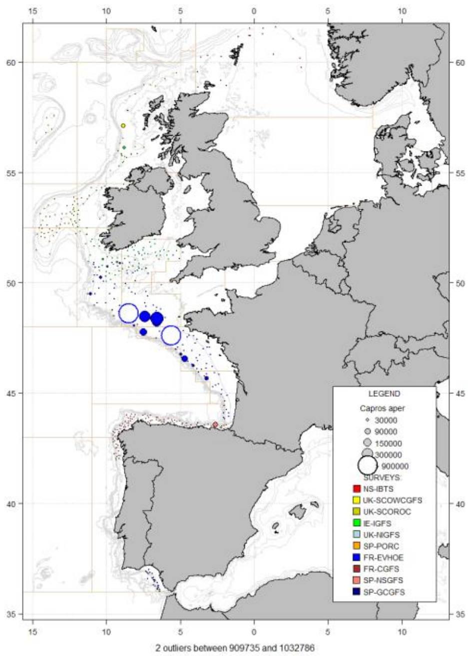


Figure A.6.44. Catches in numbers per hour of Boarfish, *Capros aper*, in summer/autumn 2019 IBTSurveys.

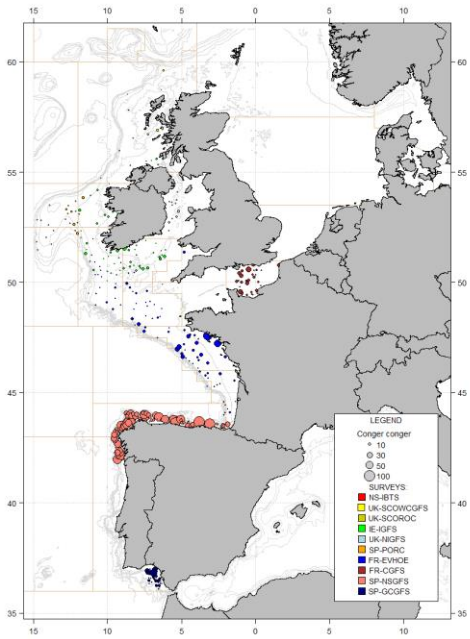


Figure A.6.45. Catches in numbers per hour of Conger, *Conger conger*, in summer/autumn 2019 IBTSurveys.

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

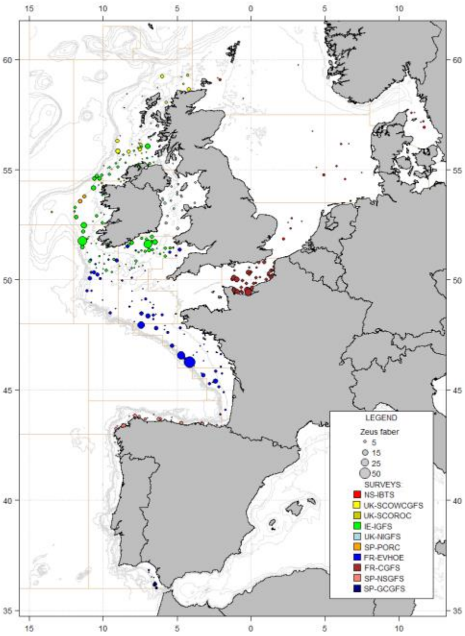


Figure A.6.46. Catches in numbers per hour of John Dory, *Zeus faber*, in summer/autumn 2019 IBTSurveys.

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

Annex 7: Filling gaps for the estimation of swept area by tow in the North Sea IBTS 2004 to present

Kai Wieland, DTU Aqua, Section for Monitoring and Data, Hirtshals

Introduction

IBTSWG agreed in 2013 to move from n/hr based indices towards swept-area based indices (ICES 2013) following a recommendation from WGISDAA and WKDATR (ICES 2014). Effort for providing quality checked information required for the estimation of swept-area started in 2014 and updated information was provided to IBTSWG in 2015 (ICES 2015). However, several gaps in the dataset were identified during WKSABI in early 2019 (ICES 2019). Here, a new format for the so-called flexfile was agreed and a new version of the flexfile have become available in 2020 from DATRAS.

Material and Methods

A recent version of the flexfile (DATRAS download 10 Jan 2020) was checked for missing survey data against updated HH records in the exchange files as uploaded to DATRAS by the single countries. Only valid tows were considered. The focus was on swept-area based on door spread. For wing spread, observed values were missing for many countries and years to a large extent and algorithms for estimating missing values were not available for several country/year/quarter combinations.

Results

Estimation of missing values for door spread in the flexfile was based on algorithms provided by the national representation to the ICES Data Centre in 2015 covering the period 2004-2014. However, several countries began after 2014 to introduce changes in e.g. the net material (polyethylene instead of nylon) or replacing the kite with Vonin flyers (ICES 2018). The current version of DATRAS does not allow documentation of such changes. Furthermore, new country/vessel combinations occurred and thus new survey specific algorithms may be more appropriate to estimate single missing values than the previous ones on which the flexfile is based.

Quarter 1 surveys

Missing and erroneous information in the flexfile for the quarter 1 NS-IBTS is listed in Table 1.

Table 1: Missing information by year and country/vessel for quarter 1 surveys.

Quarter	Year(s)	Country/Vessel	Distance	Door spread	Action needed
1	2004 - 2008	NOR/Håkon Mosby surveys missing in flexfile	NOR: Not measured, Neither haul end position nor SOG available, i.e. distance cannot be calculated	NOR: 3 missing observations (for tows with long (110m) sweep length, No algorithm available, data are not cleaned (Figure 1)	NOR to check what is possible to provide the missing information, DATA centre to add NOR survey
1	2009	NOR/GO Sars:	NOR: Not measured,	All ok	NOR to check whether information on distance,

		Swept-area missing in flexfile for all tows	Neither haul end position nor SOG available, i.e. distance cannot be calculated		haul end position and/or SOG can be made available, DATA centre to add NOR survey
1	2010- 2011	Complete, but zero values of wing spread for NOR/GO Sars in flexfile	All ok	All ok	Data Centre to replace zero values of wing spread with empty cells
1	2012	NOR/GO Sars, Swept-area missing in flexfile for all tows	NOR: Not measured, Neither haul end position nor SOG available, i.e. distance cannot be calculated	All ok	NOR to check whether information on distance, haul end position and/or SOG can be made available
1	2013- 2014	Complete, but zero values of wing spread for NOR/GO Sars in flexfile	All ok	All ok	Data Centre to replace zero values of wing spread with empty cells
1	2015	Complete, but zero values of wing spread for NOR/GO Sars in flexfile (although some observations available in HH records)	All ok	All ok	Data Centre to replace zero values of wing spread with empty cells,
1	2016	NOR/GO Sars missing in flexfile (although information available in HH records)	All ok in HH records except 1 missing value for NED (calculated in flexfile)	All ok in HH records except: FRA: 1 outlier and 1 missing value	Data Centre to add NOR/GO Sars, FRA to check 1 outlier and which algorithm should be used (Figure 2 or the old one) and report to Data Centre
1	2017	NOR/ENDW (Endeavour) missing in flexfile (although information available in HH records)	All ok in HH records except 3 missing values for NED (calculated in flexfile)	All ok in HH records except: NOR: 2 outliers and 13 missing values NED: 3 missing values GFR: 3 missing values	Data Centre to add NOR/ENDW, NOR to check Figure 3 (and 2 outliers DS=1 and DS=102, re-submission of HH records) NED to check Figure 4 GFR to check Figure 5 and report to Data Centre

1	2018	NOR/GO Sars missing in flexfile (although information available in HH records) No door (and wing) spread for 6 GFR tows	All ok in HH records In flexfile 6 missing values for GFR (although information on e.g. SOG available in HH records)	All ok in HH records except: NOR: 1missing value SCO: 1 missing value FRA: 1 missing value NED: 4 missing values	Data Centre to add NOR/GO Sars and add calculated distances for GFR, NOR to check Figure 6 SCO to check Figure 7 (and 1 outlier Depth=280, re-submission of HH records) FRA to check Figure 8 NED to check Figure 9 and report to Data Centre
1	2019	NOR/GO Sars missing in flexfile (although information available in HH records) All stations duplicated for the other countries in the flexfile	All ok in HH records except 3 missing values for NED (calculated in flexfile)	All ok in HH records except: FRA: 1 missing value NED: 1 outlier and 1 missing value	Data Centre to add NOR/GO Sars and remove duplicates, FRA to check Figure 10 NED to check Figure 11 (*Checked and corrected in Datras)* and report to Data Centre

Quarter 3 surveys

Table 2.Missing and erroneous information in the flexfile for the quarter 3 NS-IBTS

Quarter	Year(s)	Country/Vessel	Distance	Door spread	Action needed
3	2004- 2005	NOR/Håkon Mosby: surveys missing in flexfile	NOR: Not measured, Neither haul end position nor SOG available, i.e. distance cannot be calculated	NOR: 3 missing observations for tows with short (60m) sweep length, No algorithm available, data are not cleaned (Figure 12)	NOR to check what is possible to provide the missing information, Data Centre to add NOR survey
3	2006- 2008	NOR/Johan Hjort: Swept-area missing in flexfile for all tows, zero values for calculated door and wing spread	NOR: Not measured, Neither haul end position nor SOG available, i.e. distance cannot be calculated	NOR: zero values for all tows in flexfile, no door spread data in HH records, no specific algorithm available to calculate door spread from e.g. depth	NOR to check what is possible to provide the missing information, Data Centre to remove zero values for calculated door and wing spread with empty cells
3	2009- 2011	Complete, but zero values of wing spread for NOR/Johan Hjort in flexfile	All ok	All ok	Data Centre to replace zero values of wing spread with empty cells
3	2012	NOR/Johan Hjort missing in flexfile although data in HH records for distance and door spread	All ok in HH records except: DEN: 3 missing values (calculated in flexfile)	All ok in HH records except: SCO: 1 missing value (calculated in flexfile)	Data Centre to add NOR/Johan Hjort

3	2013	Complete, but 1 missing value for door spread (and swept-area) and zero values of wing spread for NOR/Johan Hjort	All ok in HH records except: NOR: 1 missing value (calculated in flexfile)	All ok except: NOR: 1 missing value (not calculated in flexfile) at which most likely strapping was used	Data Centre to replace zero values of wing spread with empty cells NOR to check Figure 13 and report to Data Centre
3	2014	NOR/Johan Hjort missing in flexfile although data in HH records for distance and door spread	All ok in HH records except: NOR: 1 potential outlier (haul 362: 1236 m for 30 min tow)	All ok in HH records except: ENG: 2 missing values (calculated in flexfile)	Data Centre to add NOR/Johan Hjort, NOR to check distance for haul 362
3	2015	NOR/Johan Hjort missing in flexfile although data in HH records for distance and door spread	All ok in HH records	All ok in HH records except: SCO: 1 missing value GFR: 5 missing values	Data Centre to add NOR/Johan Hjort, SCO to check Figure 14 GFR to check Figure 15 and report to Data Centre
3	2016	NOR/Johan Hjort missing in flexfile although data in HH records for distance and door spread	All ok in HH records	All ok in HH records except: SWE: 1 missing value NOR: 1 missing value GFR: 5 missing values	Data Centre to add NOR/Johan Hjort, SWE to check Figure 16 NOR to check Figure 17 GFR to check Figure 18 and report to Data Centre
3	2017	NOR/GO Sars missing in flexfile although data in HH records for distance and door spread	All ok in HH records	All ok in HH records except: ENG: 3 missing values	Data Centre to add NOR/GO Sars, ENG to check Figure 19 and report to Data Centre
3	2018	NOR/GO Sars missing in flexfile although data in HH records for distance and door spread, No door (and wing) spread for 6 GFR tows	All ok in HH records except: GFR: 4 missing values (not calculated in flexfile although information on e.g. SOG available in HH records)	All ok in HH records except: NOR: 18 missing values ENG: 3 missing values	Data Centre to add NOR/GO Sars and missing values for GFR, NOR to check Figure 20 ENG to check Figure 21 and report to Data Centre
3	2019	So far not included in flexfile	All ok in HH records	All ok in HH records except: ENG: 5 missing values	Data Centre to add, ENG to check Figure 22 and report to Data Centre

Additional potential errors based upon unlikely combinations of variables

Country	Quarter	Year	haul	Potential error	Check during WG
Scotland	1	2018	43	Depth vs Warplngt	Corrected
Scotland	3	2010	80	Depth vs Warplngt	Needs further checking
Germany	1	2010	19	Depth vs Warplngt	Will be corrected
Germany	1	2009	52	Depth vs Warplngt	Will be corrected
Norway	1	2013	22	Depth vs Door-spread	
France	1	2010	23	Depth vs Door-spread	Will be corrected
Sweden	1	2014	30	Doors vs Wing-spread	Will be corrected
England	3	2018	3	Doors vs Wing-spread	Agrees that it is an outlier, all option to check how-ever indicate it as correct.

Conclusions

It is not sure that all the gaps in the flexfile can be filled and further progress depends on the interest and available resources of the national laboratories and the ICES DATA Centre.

References

ICES 2013. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 8-12 April 2013, Lisbon, Portugal. ICES CM 2013/SSGESST:10. 272 pp.

ICES 2014. 2nd Interim Report of the International Bottom Trawl Survey Working Group (IBTSWG), 31 March - 4 April 2014, Hamburg, Germany. ICES CM 2014/SSGESST:11. 177 pp.

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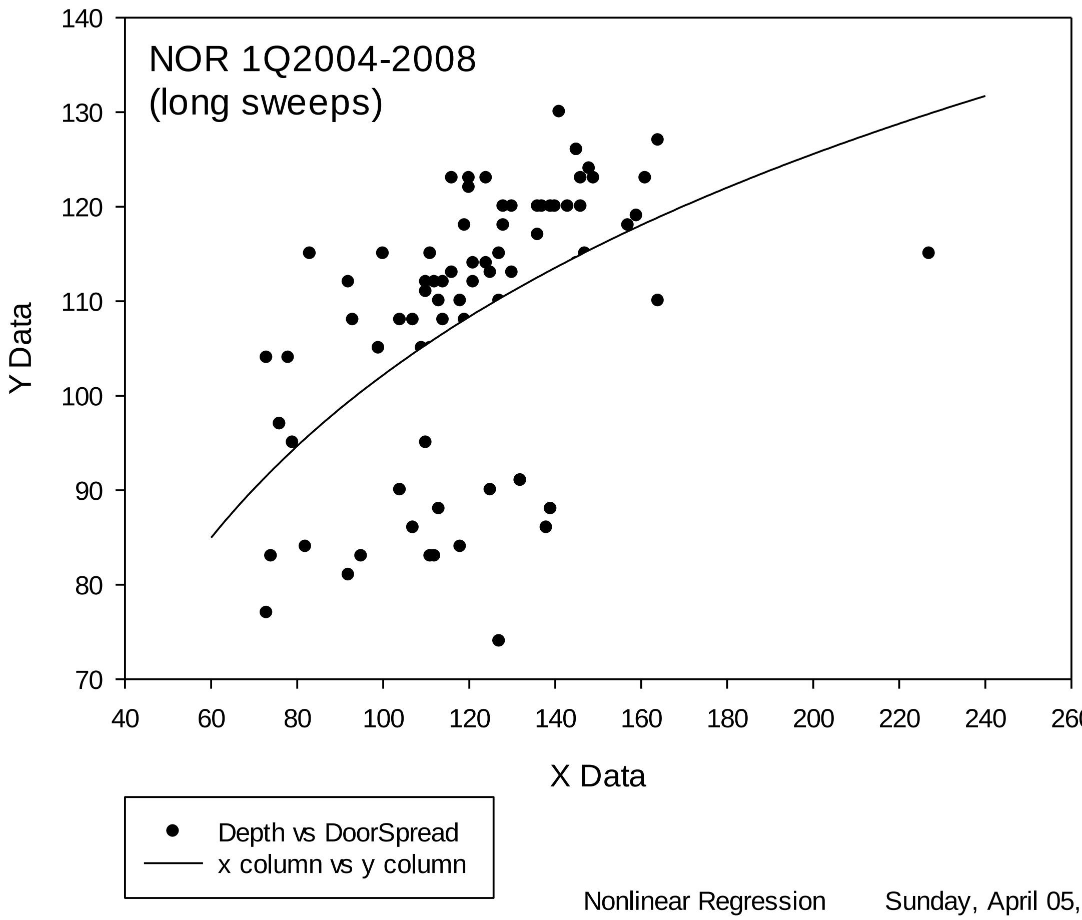
ICES 2019. Workshop on Methods to develop a swept-area based effort index (WKSABI). ICES Scientific Reports. 1:3. 24 pp. http://doi.org/10.17895/ices.pub.4902



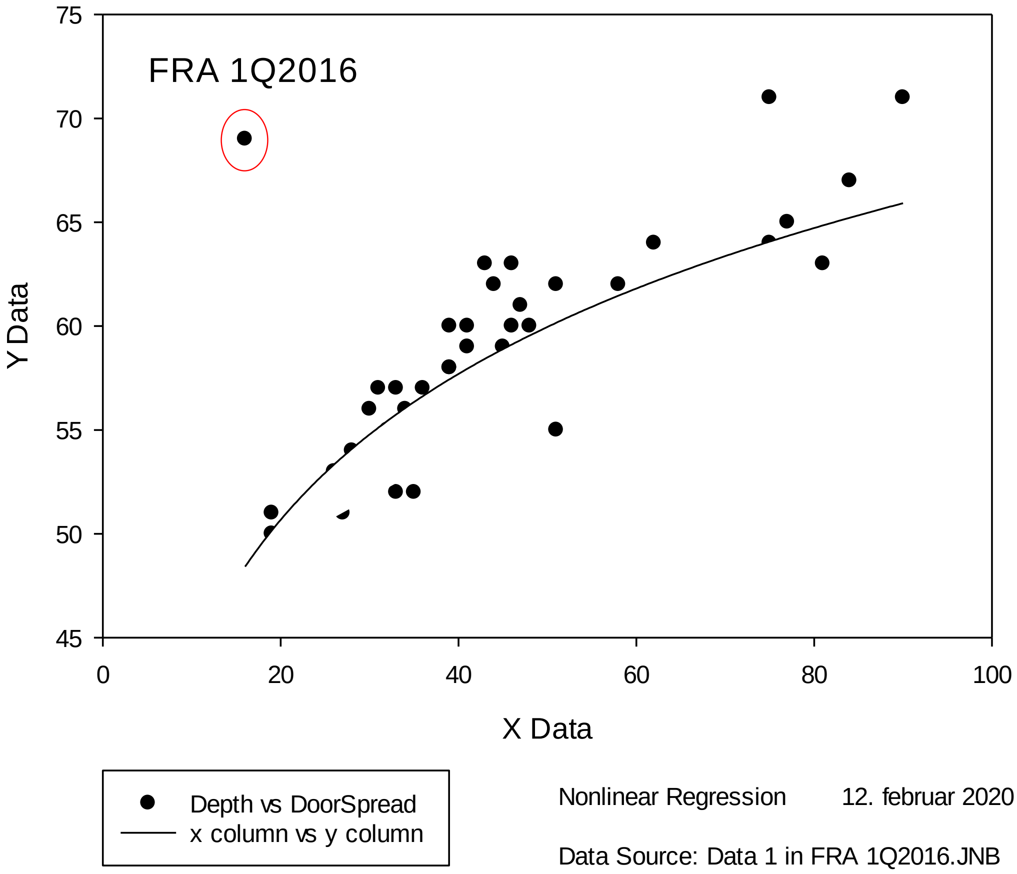
Nonlinear Regression Sunday, April 05, 2015, 17:28:09

Data Source: Data 4 in NOR HAV DoorSpreadDepth.JNB
Equation: User-Defined, log 2 Parameter I
f = if(x>0, y0+a*log(abs(x)), 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.521	0.271	0.262	11.828

	Coefficient	Std. Error	t	P
y0	-53.085	29.627	-1.792	0.0770
a	77.647	14.230	5.456	<0.0001

Figure 1



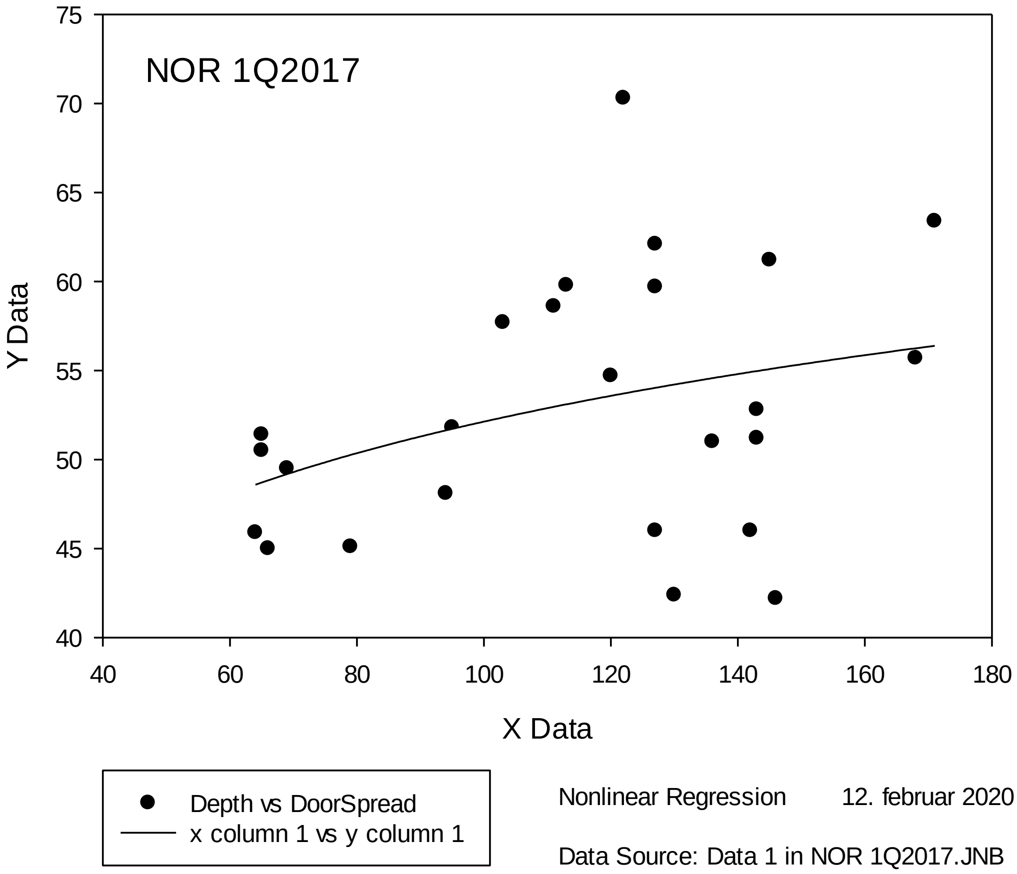
Nonlinear Regression 12. februar 2020 18:20:40

Data Source: Data 1 in FRA 1Q2016.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.733	0.538	0.530	3.533

	Coefficient	Std. Error	t	P
y0	20.344	4.442	4.580	<0.0001
a	23.319	2.791	8.356	<0.0001

Figure 2



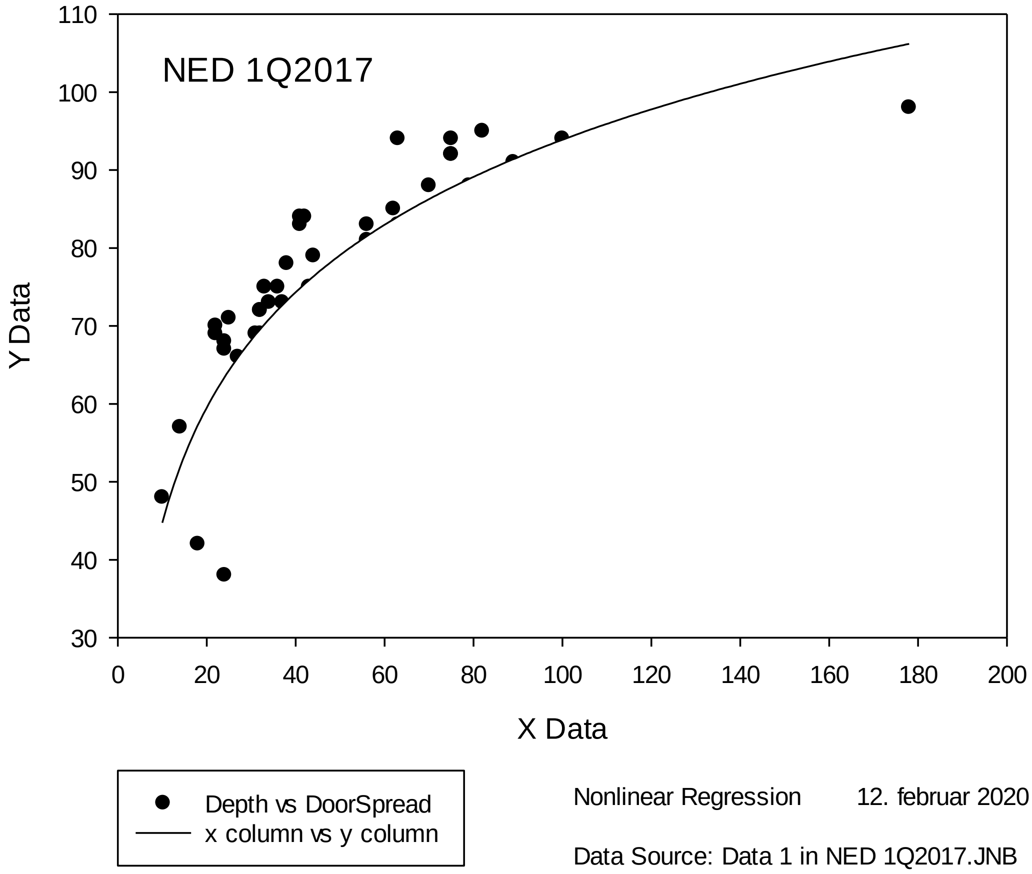
Nonlinear Regression 12. februar 2020 17:38:04

Data Source: Data 1 in NOR 1Q2017.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.343	0.118	0.079	6.978

	Coefficient	Std. Error	t	P
y0	15.572	21.334	0.730	0.4728
a	18.283	10.431	1.753	0.0930

Figure 3: 2 outliers (DS=1 (haul 29) and DS=102 (haul 7) removed!



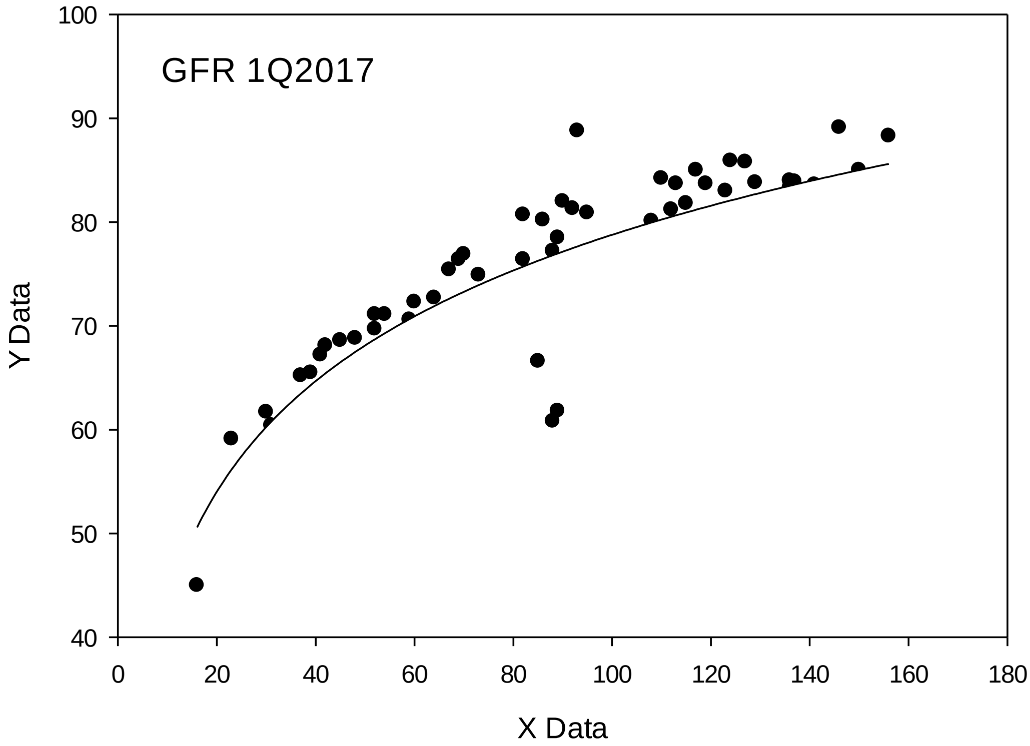
Nonlinear Regression 12. februar 2020 17:44:50

Data Source: Data 1 in NED 1Q2017.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.883	0.779	0.775	6.552

	Coefficient	Std. Error	t	P
y0	-4.367	6.093	-0.717	0.4768
a	49.133	3.701	13.276	<0.0001

Figure 4



● Depth vs DoorSpread
—— x column 1 vs y column 1

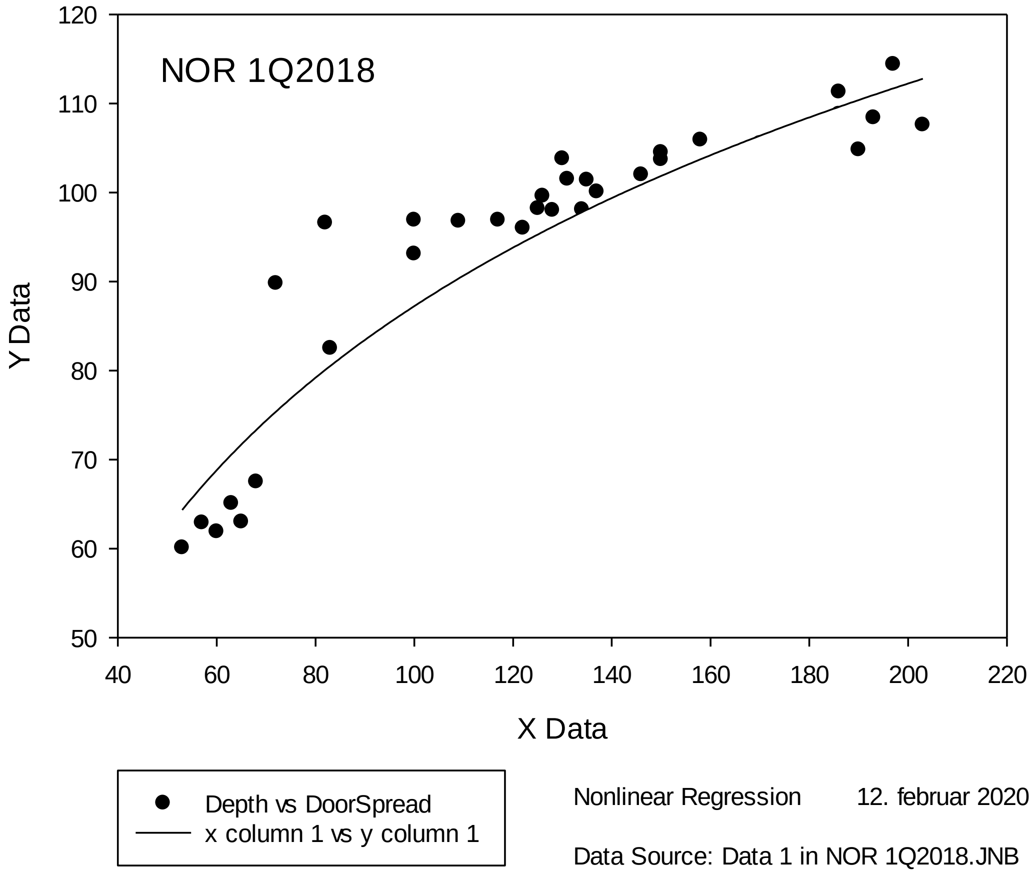
Nonlinear Regression 12. februar 2020 17:48:56

Data Source: Data 1 in GFR 1Q2017.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.873	0.762	0.759	4.155

	Coefficient	Std. Error	t	P
y0	7.952	4.588	1.733	0.0876
a	35.412	2.399	14.761	<0.0001

Figure 5



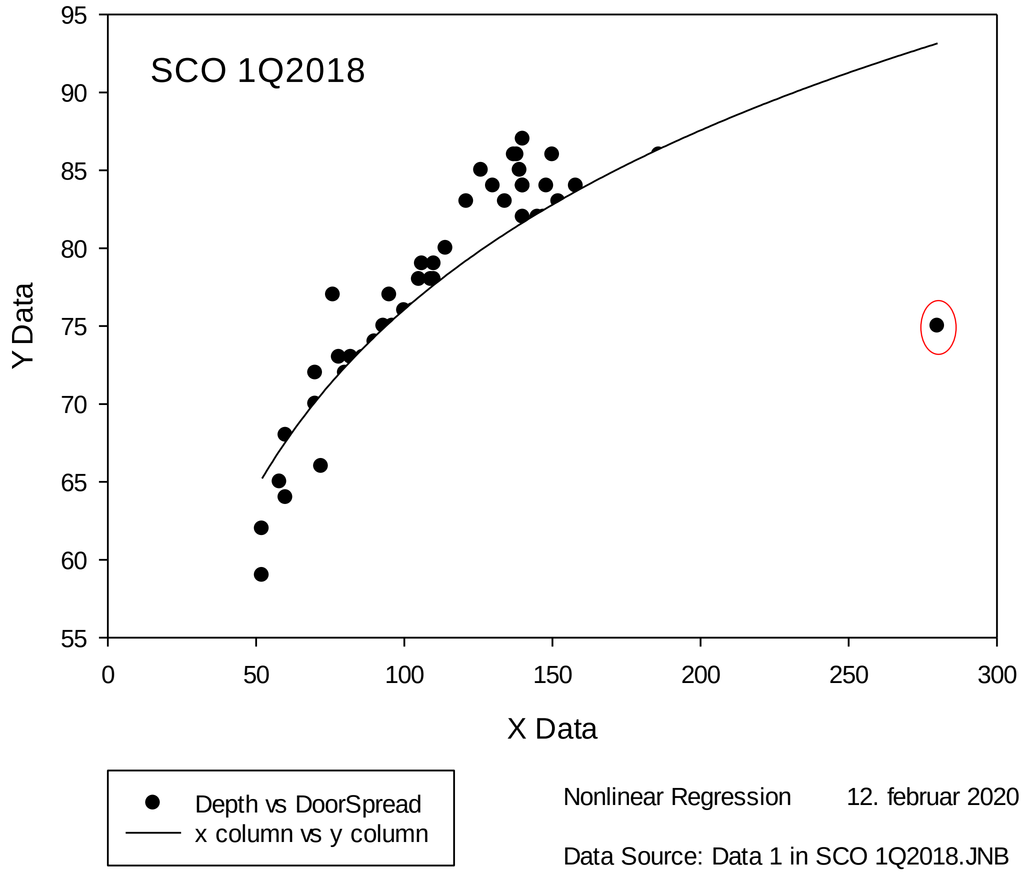
Nonlinear Regression 12. februar 2020 16:38:24

Data Source: Data 1 in NOR 1Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.927	0.859	0.856	5.088

	Coefficient	Std. Error	t	P
y0	-78.826	10.094	-7.809	<0.0001
a	83.038	4.813	17.252	<0.0001

Figure 6



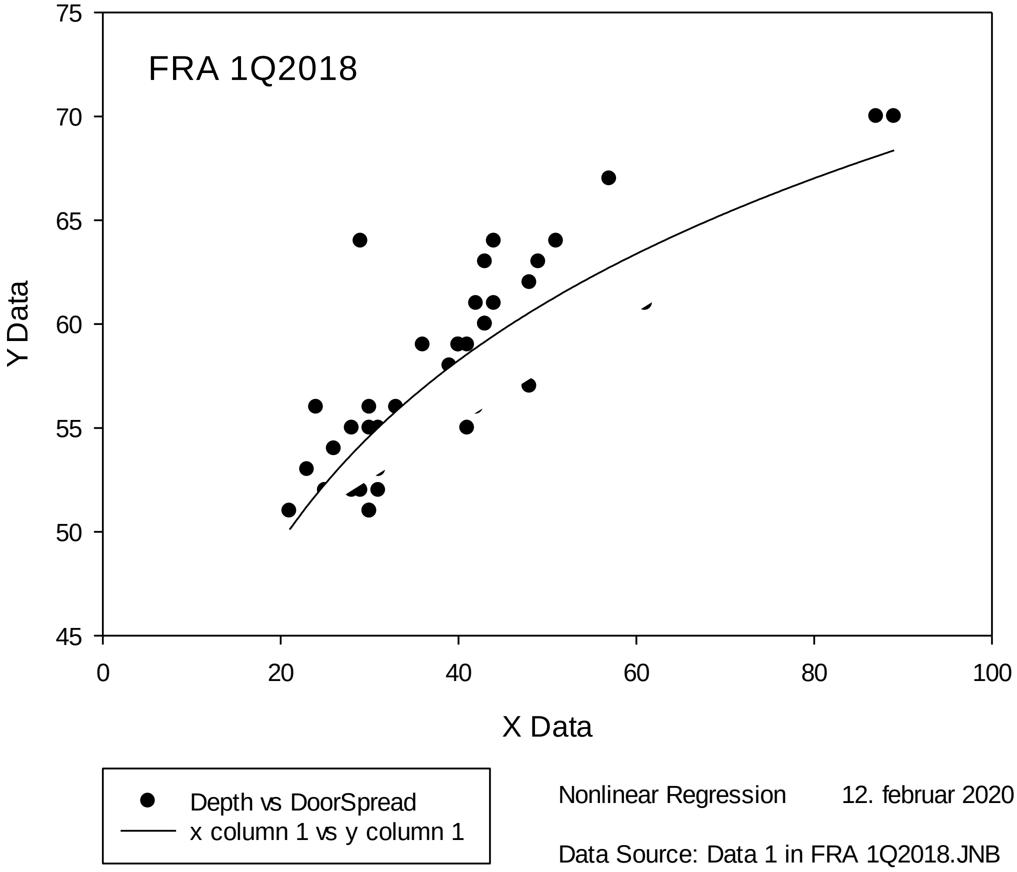
Nonlinear Regression 12. februar 2020 16:50:30

Data Source: Data 1 in SCO 1Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.857	0.735	0.730	3.531

	Coefficient	Std. Error	t	P
y0	-0.326	6.354	-0.051	0.9592
a	38.198	3.119	12.246	<0.0001

Figure 7



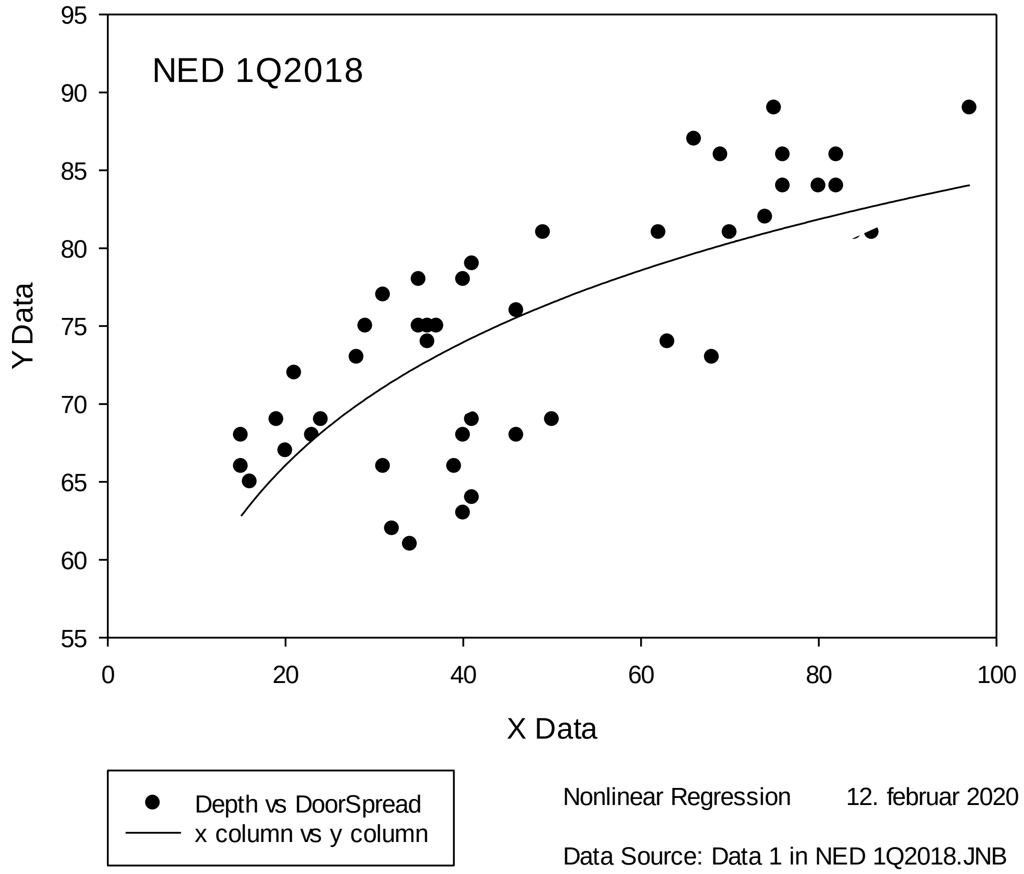
Nonlinear Regression 12. februar 2020 16:58:29

Data Source: Data 1 in FRA 1Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.830	0.689	0.683	2.562

	Coefficient	Std. Error	t	P
y0	11.616	4.314	2.693	0.0095
a	29.112	2.714	10.728	<0.0001

Figure 8



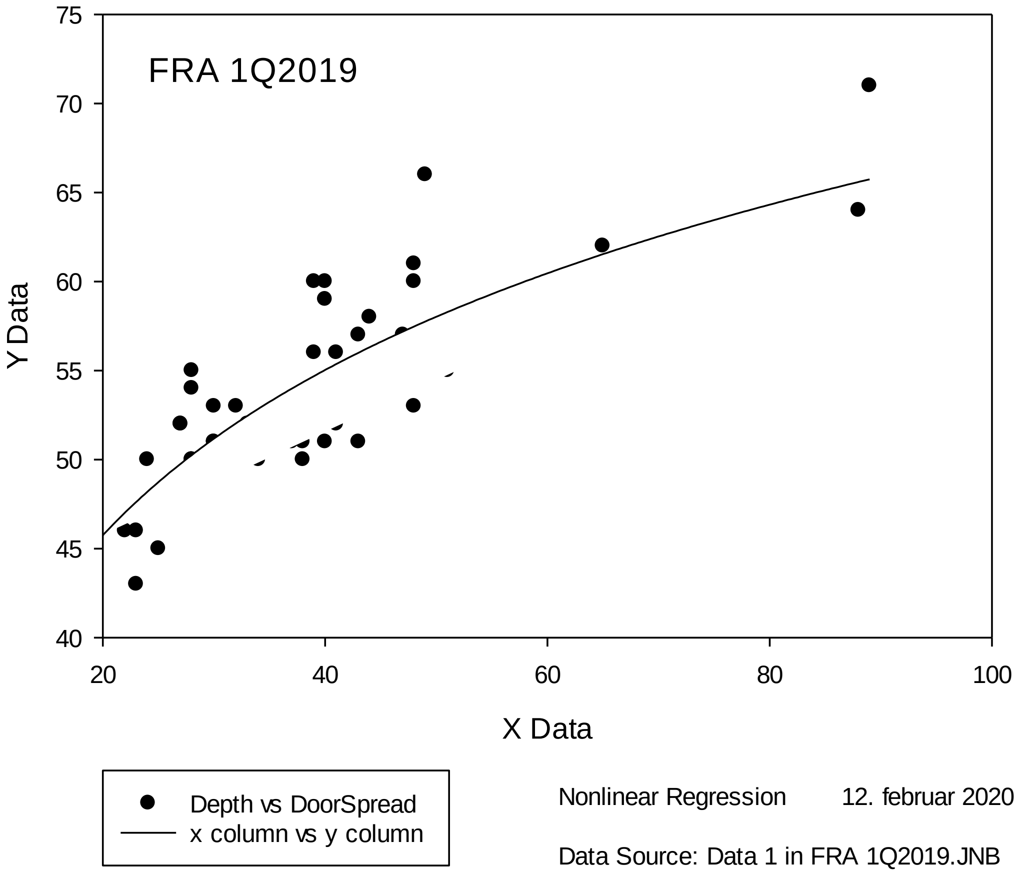
Nonlinear Regression 12. februar 2020 17:02:09

Data Source: Data 1 in NED 1Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.744	0.554	0.545	5.150

	Coefficient	Std. Error	t	P
y0	32.007	5.537	5.781	<0.0001
a	26.193	3.358	7.800	<0.0001

Figure 9



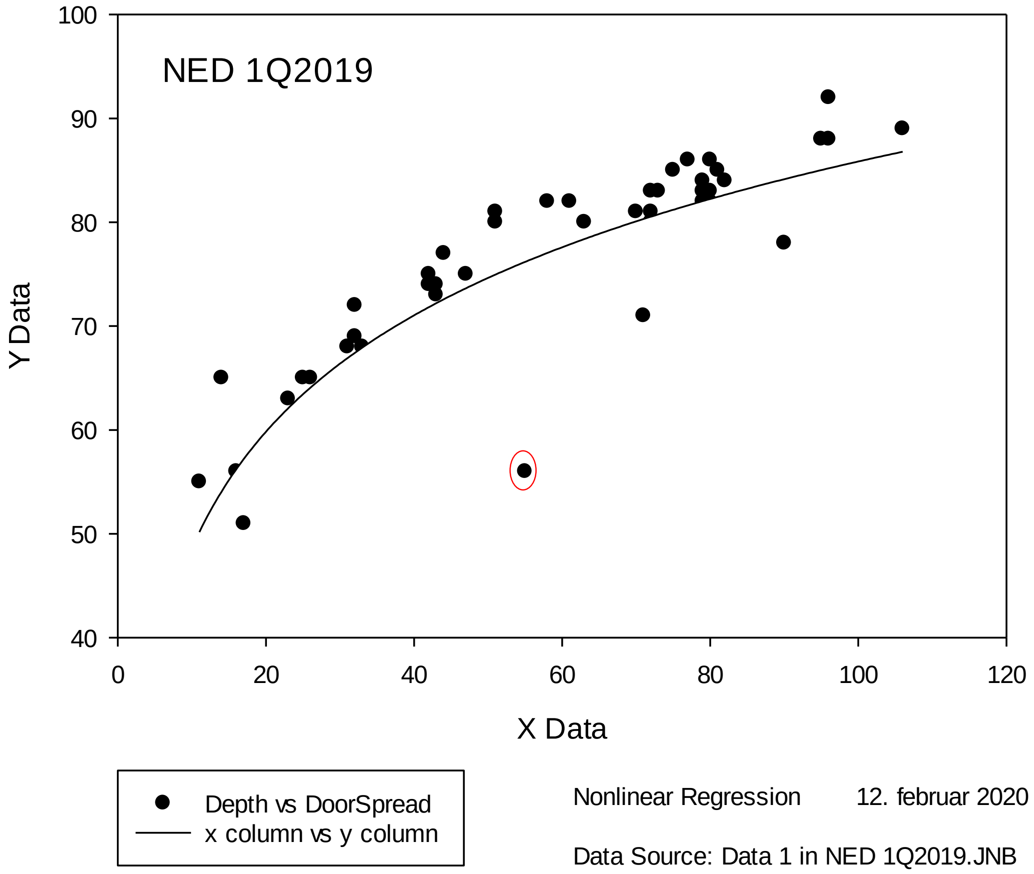
Nonlinear Regression 12. februar 2020 15:35:41

Data Source: Data 1 in FRA 1Q2019.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.813	0.660	0.653	3.247

	Coefficient	Std. Error	t	P
y0	5.644	4.921	1.147	0.2569
a	30.833	3.160	9.757	<0.0001

Figure 10



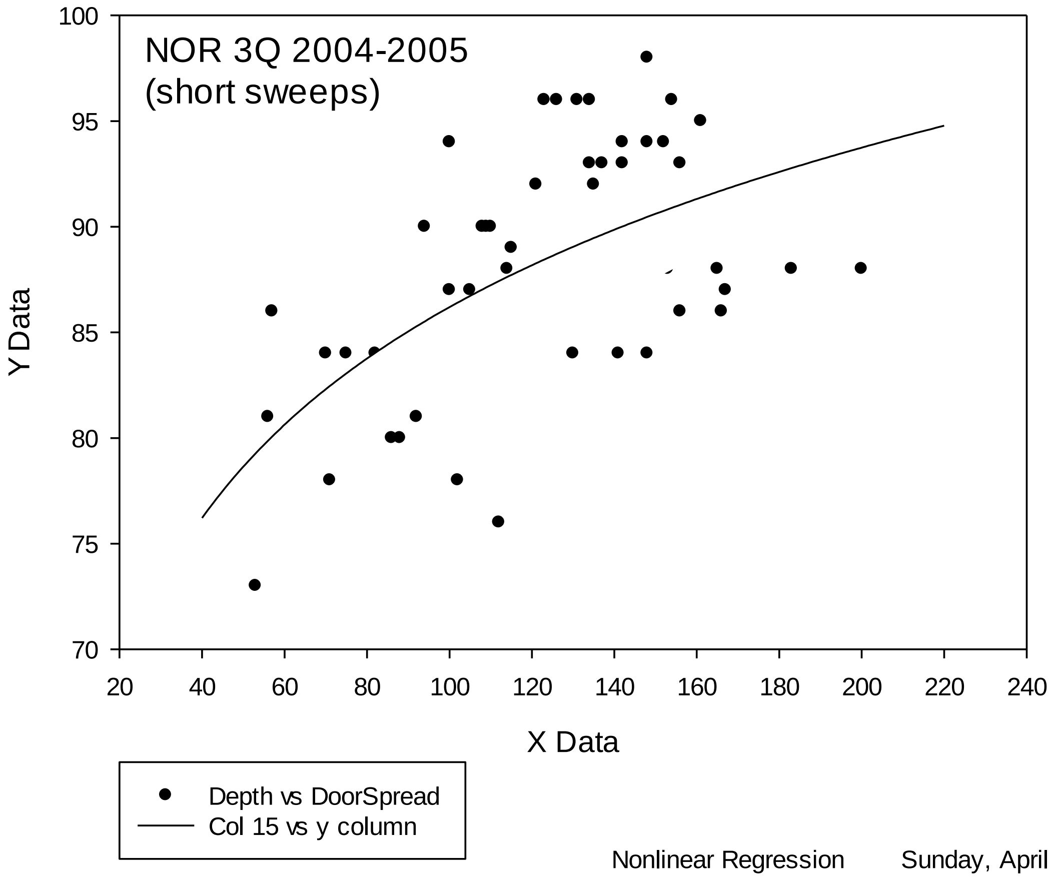
Nonlinear Regression 12. februar 2020 15:48:34

Data Source: Data 1 in NED 1Q2019.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.882	0.778	0.775	4.628

	Coefficient	Std. Error	t	P
y0	11.422	4.383	2.606	0.0115
a	37.215	2.563	14.522	<0.0001

Figure 11: Outlier is corrected, should have been 78meters.



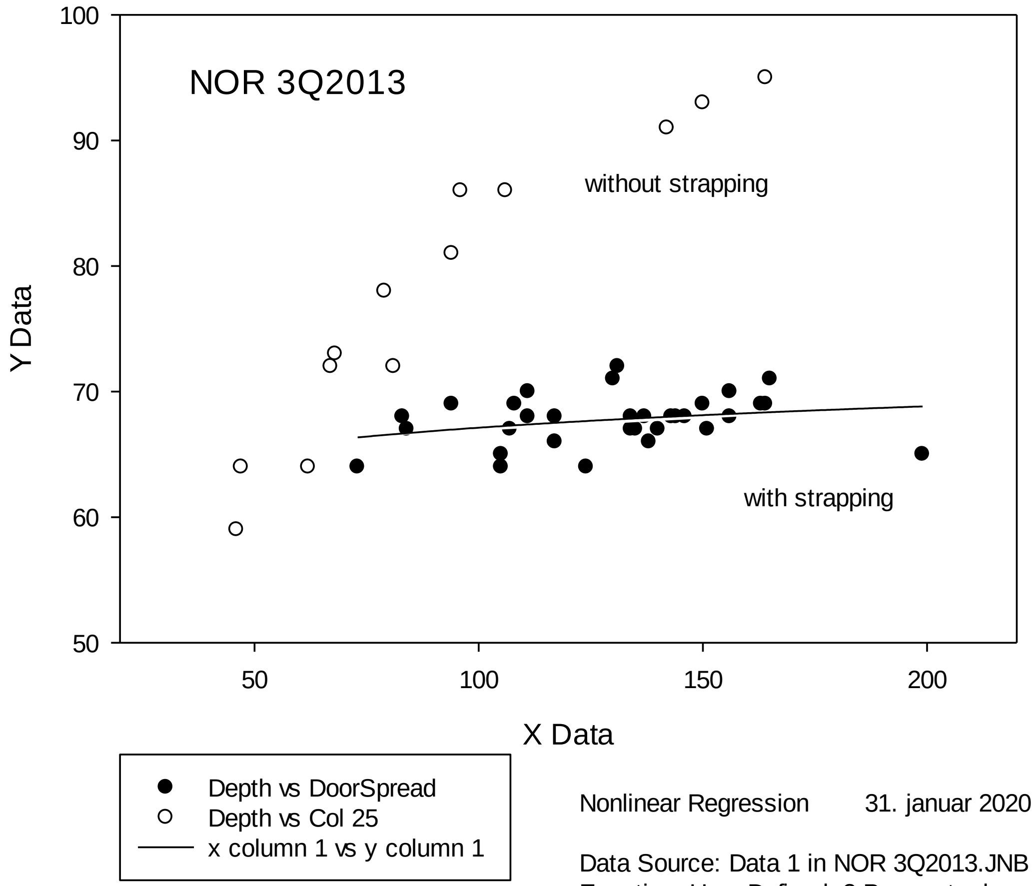
Nonlinear Regression Sunday, April 05, 2015, 17:06:12

Data Source: Data 3 in NOR HAV DoorSpreadDepth.JNB
Equation: User-Defined, log 2 Parameter I
f = if(x>0, y0+a*log(abs(x)), 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.579	0.335	0.323	4.605

	Coefficient	Std. Error	t	P
y0	36.050	9.967	3.617	0.0007
a	25.074	4.808	5.215	<0.0001

Figure 12



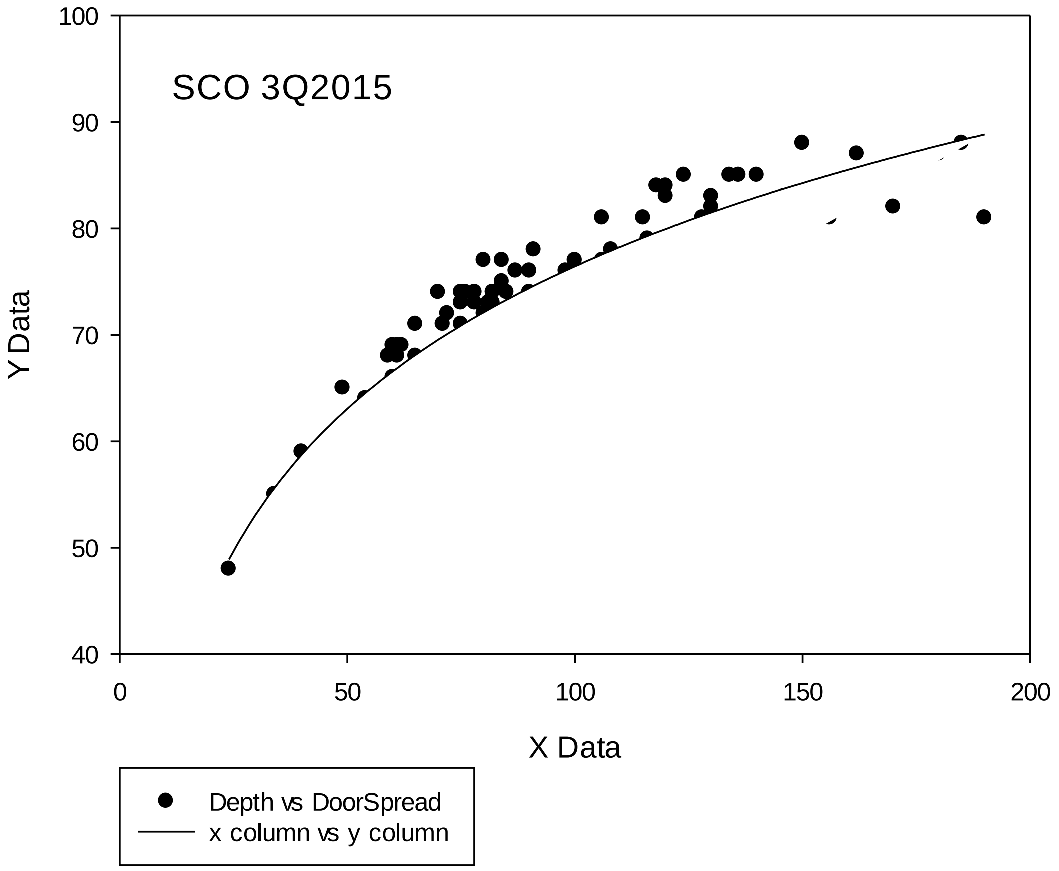
Nonlinear Regression 31. januar 2020 15:25:34

Data Source: Data 1 in NOR 3Q2013.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.274	0.075	0.045	1.959

	Coefficient	Std. Error	t	P
y0	55.805	7.628	7.316	<0.0001
a	5.664	3.623	1.564	0.1284

Figure 13



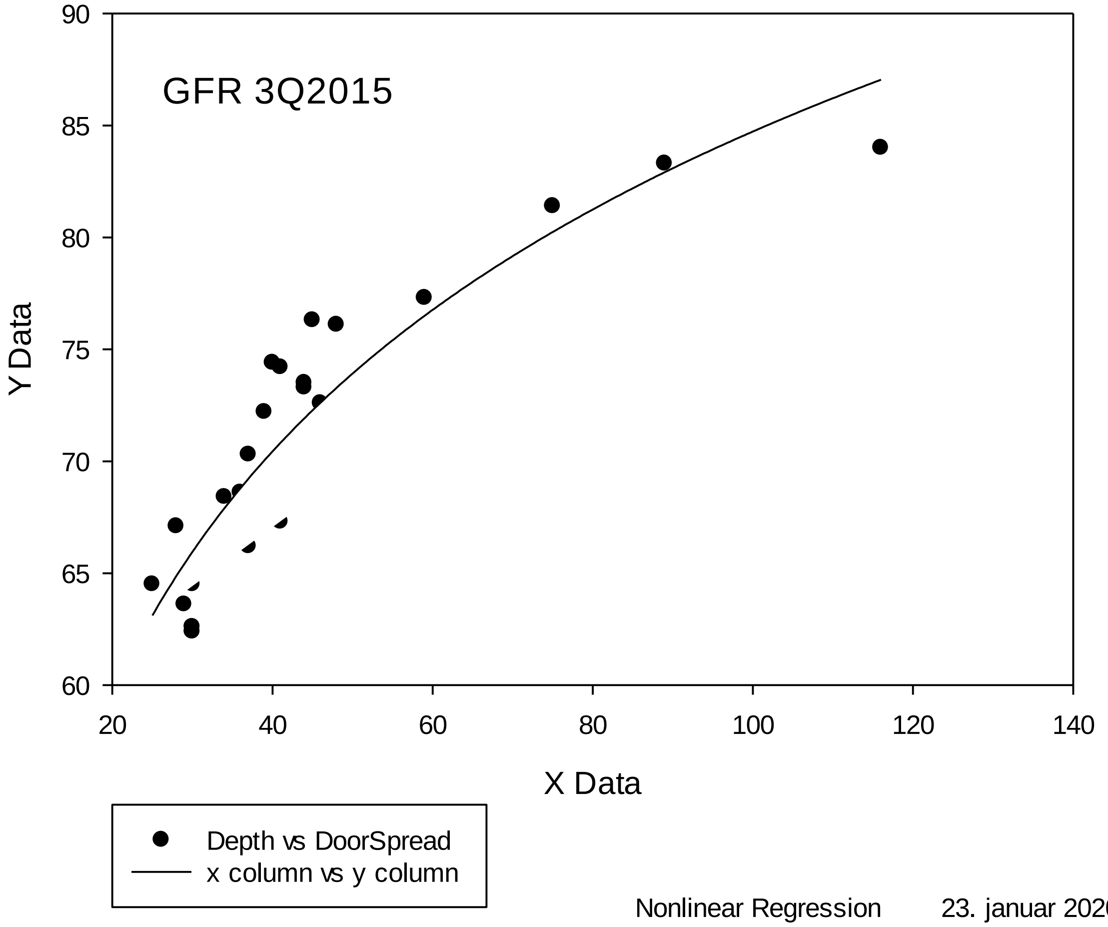
Nonlinear Regression 23. januar 2020 17:03:21

Data Source: Data 2 in NOR SCO GFR 3Q2015.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.954	0.911	0.910	2.502

	Coefficient	Std. Error	t	P
y0	-12.431	2.841	-4.376	<0.0001
a	44.438	1.456	30.518	<0.0001

Figure 14



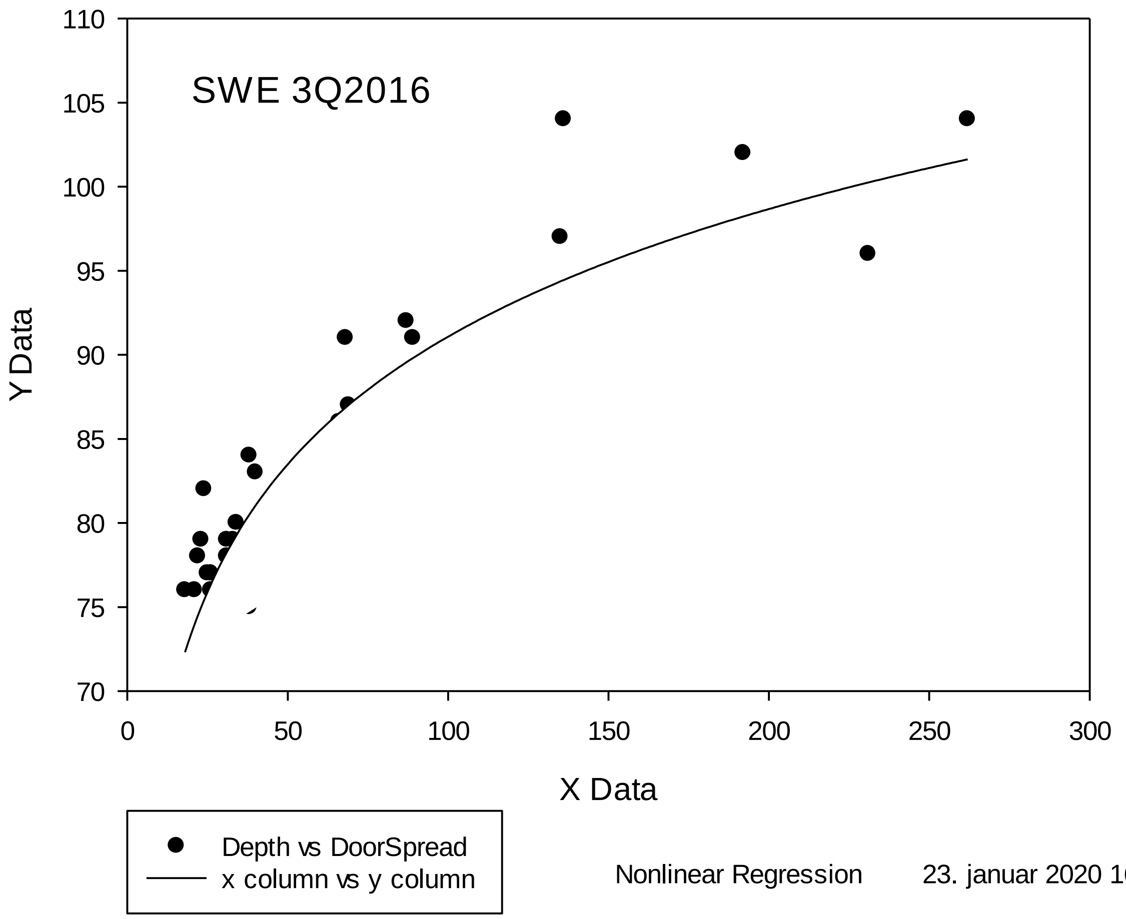
Nonlinear Regression 23. januar 2020 17:08:19

Data Source: Data 3 in NOR SCO GFR 3Q2015.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.931	0.867	0.861	2.340

	Coefficient	Std. Error	t	P
y0	12.917	4.537	2.847	0.0085
a	35.908	2.763	12.996	<0.0001

Figure 15



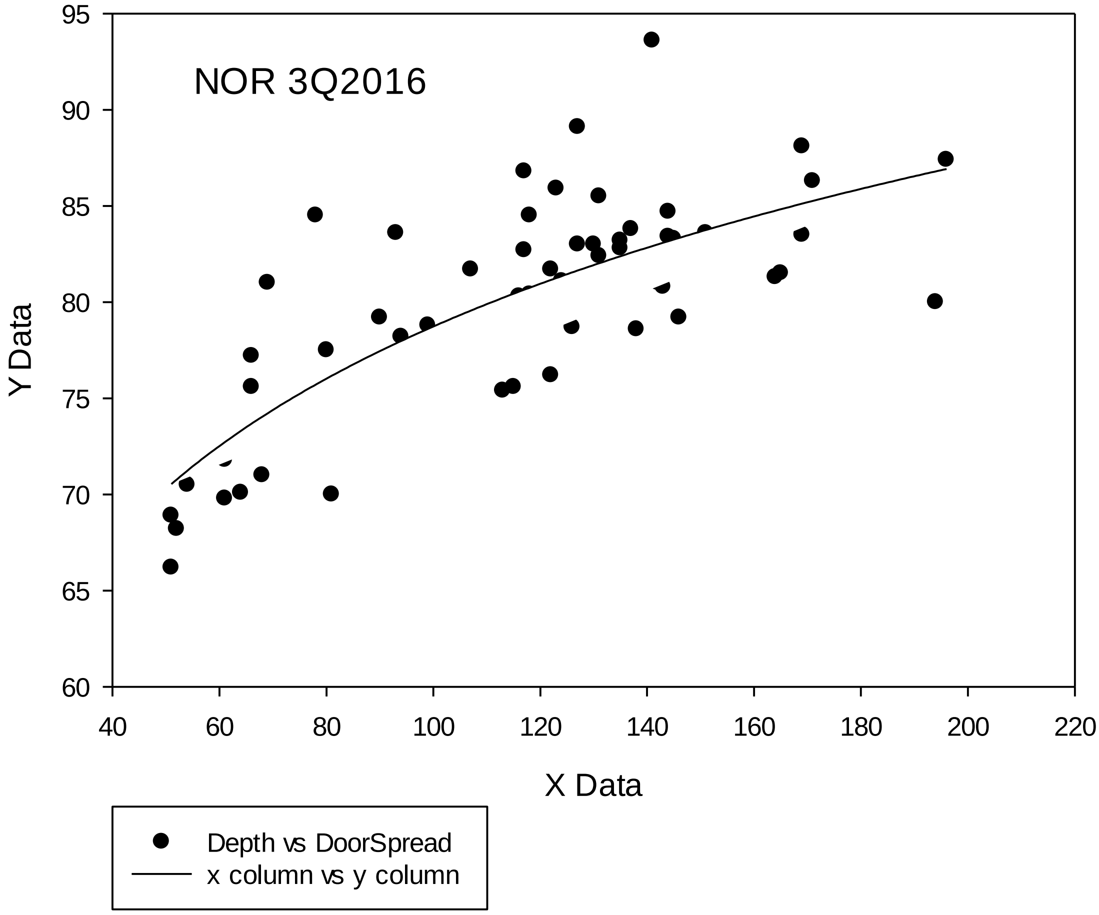
Nonlinear Regression 23. januar 2020 16:12:30

Data Source: Data 1 in SWE NOR GFR 3Q2016.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.916	0.840	0.836	3.259

	Coefficient	Std. Error	t	P
y0	40.671	2.902	14.013	<0.0001
a	25.208	1.698	14.846	<0.0001

Figure 16



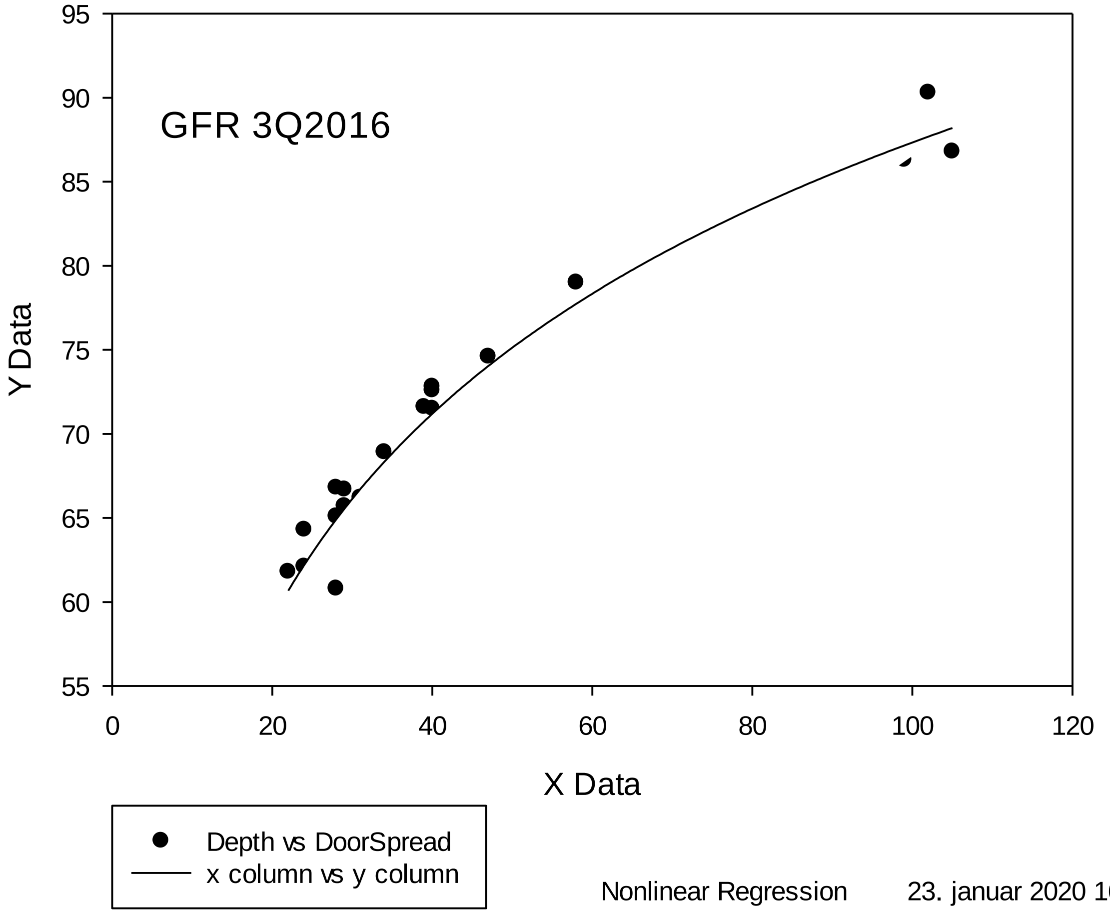
Nonlinear Regression 23. januar 2020 16:17:05

Data Source: Data 2 in SWE NOR GFR 3Q2016.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.776	0.603	0.596	3.481

	Coefficient	Std. Error	t	P
y0	22.710	5.880	3.862	0.0003
a	28.016	2.866	9.776	<0.0001

Figure 17



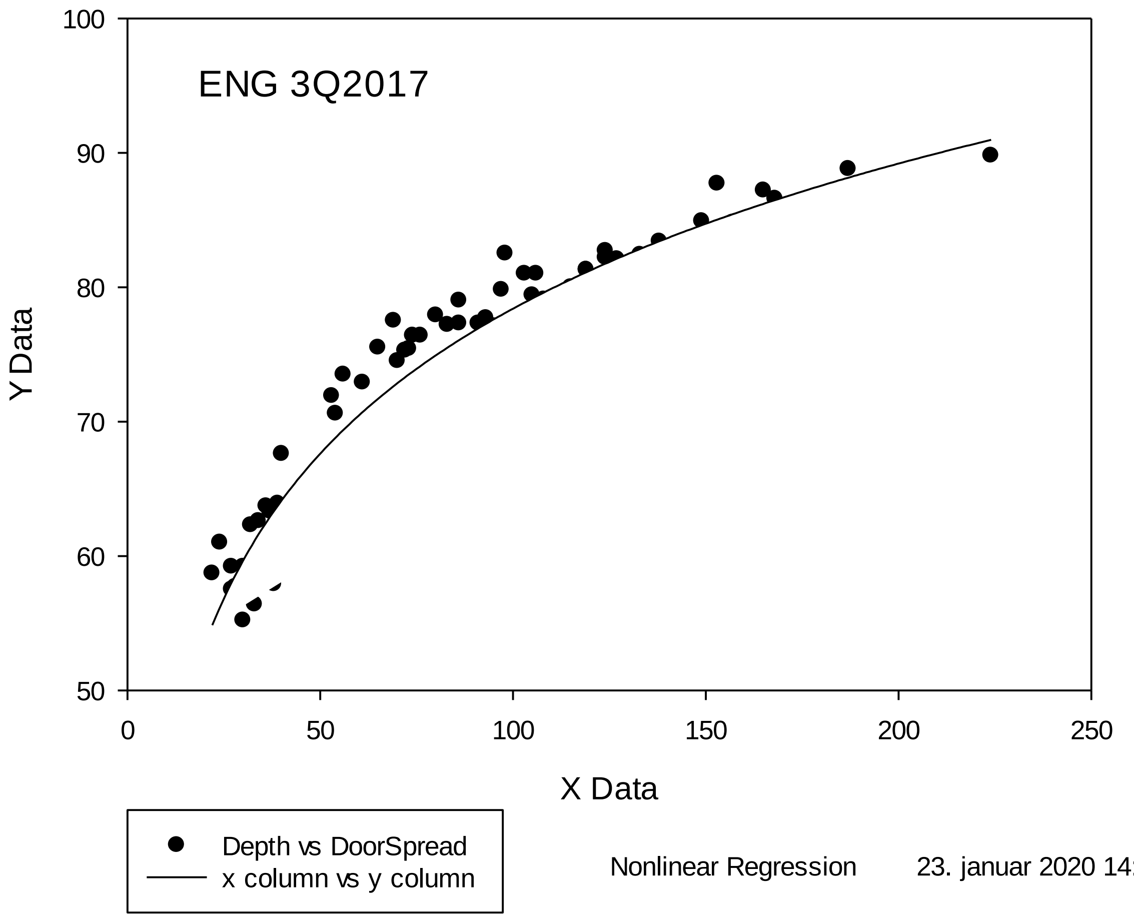
Nonlinear Regression 23. januar 2020 16:21:40

Data Source: Data 3 in SWE NOR GFR 3Q2016.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.976	0.953	0.951	1.791

	Coefficient	Std. Error	t	P
y0	6.256	3.134	1.996	0.0590
a	40.541	1.955	20.733	<0.0001

Figure 18



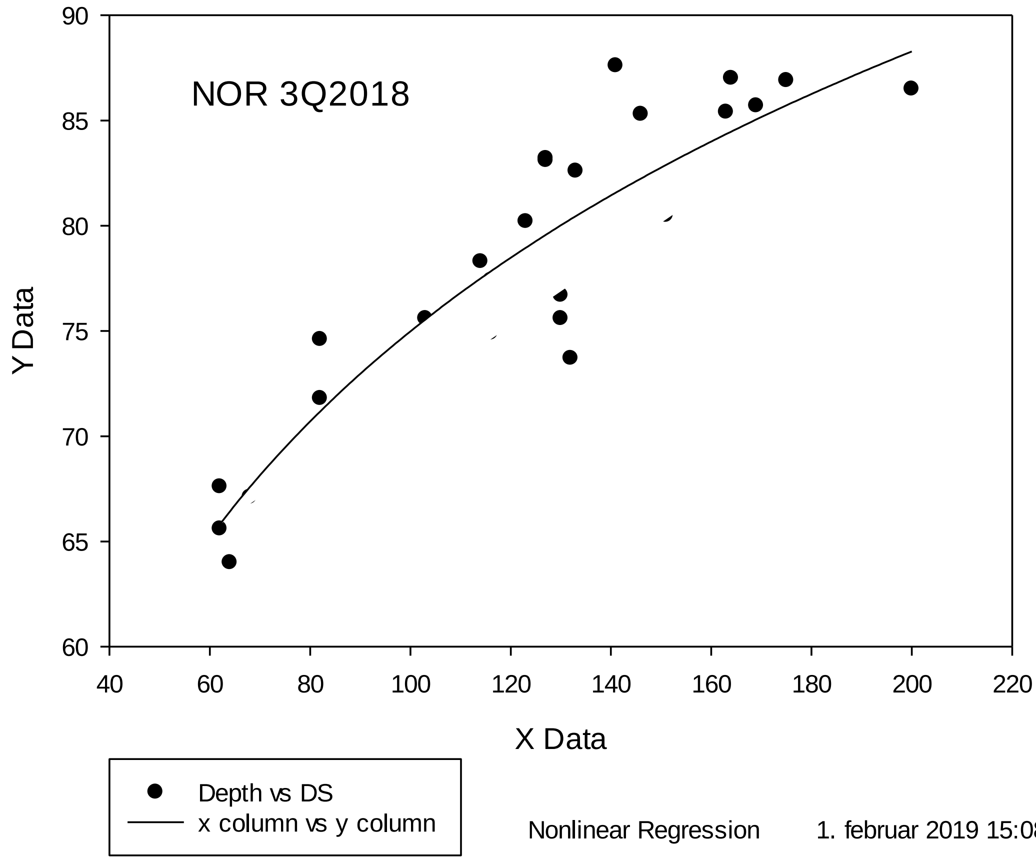
Nonlinear Regression 23. januar 2020 14:10:07

Data Source: Data 1 in ENG 3Q2017 HH with DS.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.963	0.927	0.926	2.582

	Coefficient	Std. Error	t	P
y0	6.751	2.207	3.059	0.0031
a	35.836	1.180	30.364	<0.0001

Figure 19



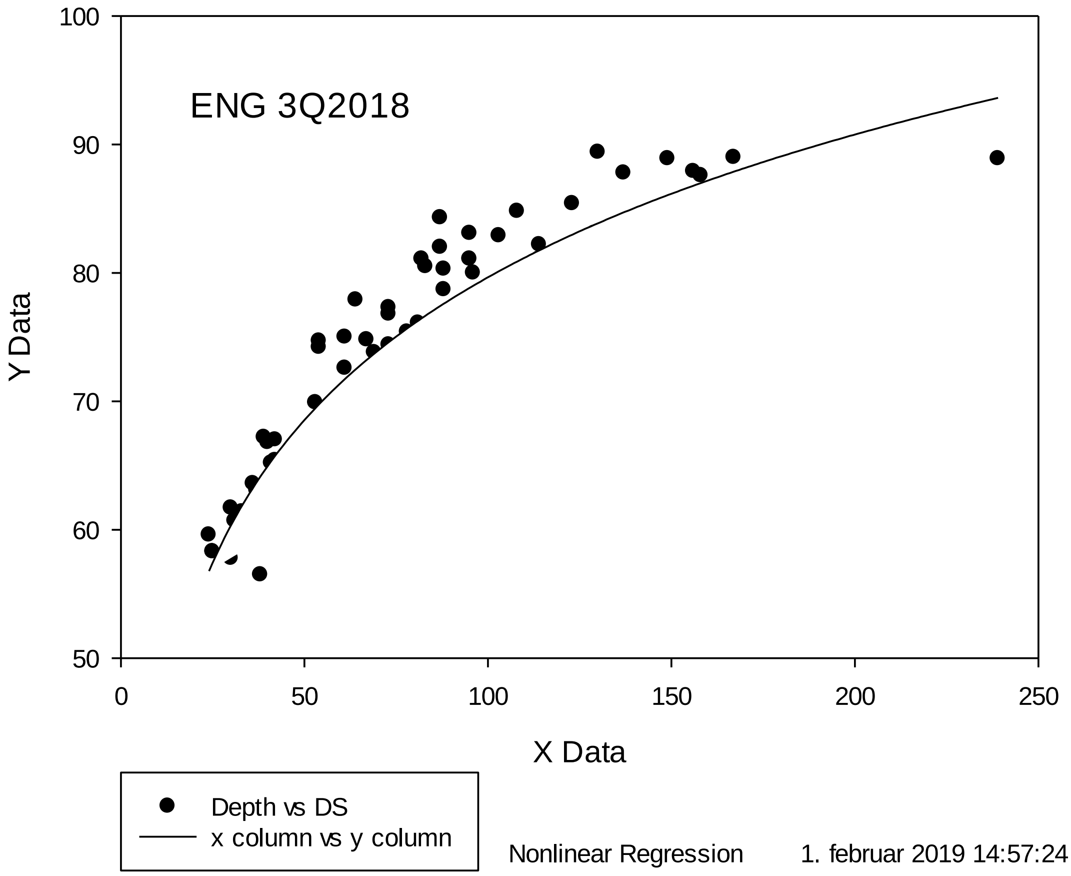
Nonlinear Regression 1. februar 2019 15:08:19

Data Source: Data 3 in Fig TrawlGeometry_all countries 3Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.914	0.835	0.829	2.744

	Coefficient	Std. Error	t	P
y0	-13.340	7.715	-1.729	0.0948
a	44.163	3.709	11.906	<0.0001

Figure 20



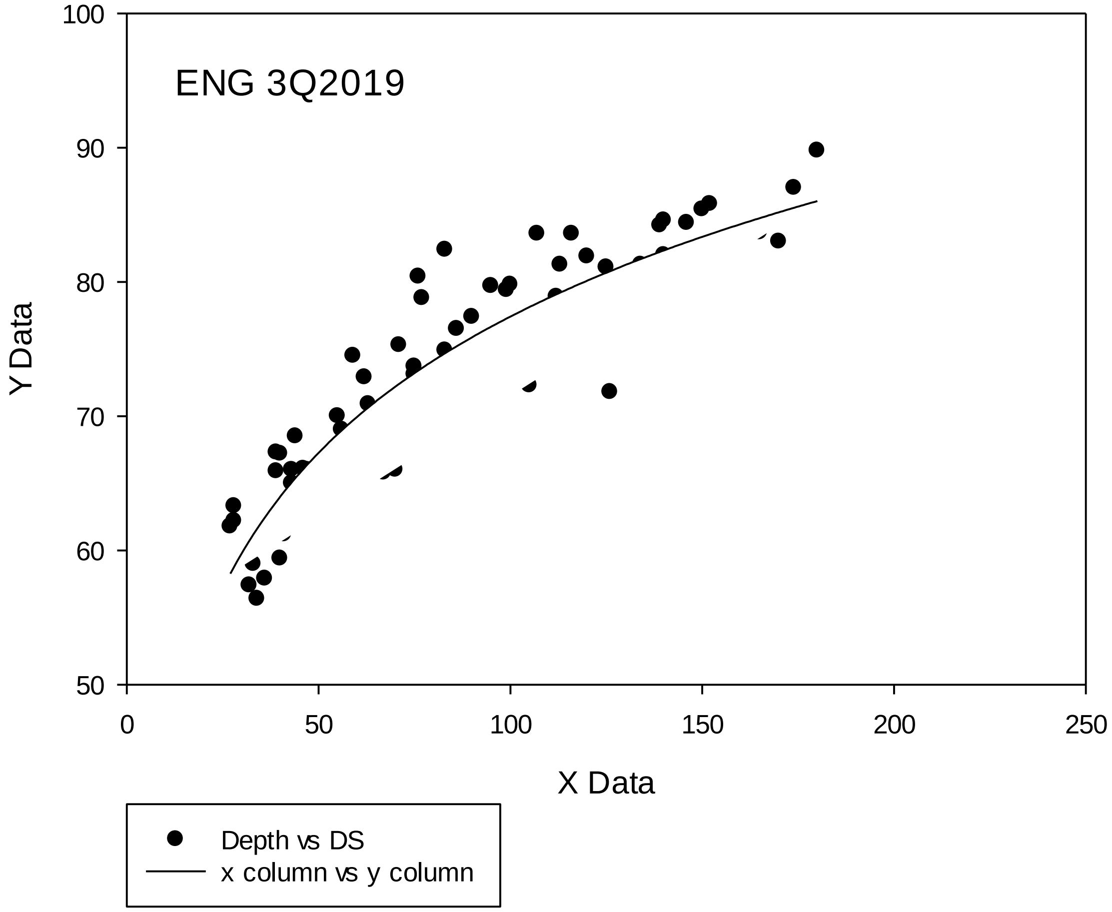
Nonlinear Regression 1. februar 2019 14:57:24

Data Source: Data 2 in Fig TrawlGeometry_all countries 3Q2018.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.945	0.893	0.891	3.092

	Coefficient	Std. Error	t	P
y0	5.855	2.786	2.102	0.0390
a	36.906	1.488	24.800	<0.0001

Figure 21



Nonlinear Regression 13. januar 2020 15:37:51

Data Source: Data 2 ENG in Fig TrawlGeometry by country 3Q2019.JNB
Equation: User-Defined; 2 Parameter log
f = if(x>0; y0+a*log(abs(x)); 0)

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.916	0.839	0.837	3.349

	Coefficient	Std. Error	t	P
y0	10.057	3.349	3.003	0.0037
a	33.688	1.765	19.091	<0.0001

Figure 22

Annex 8: NeAtl-IBTS Gear parameters to estimate swept-area indices. Review of data available in DATRAS

Francisco Velasco (IEO, Spain), Finlay Burns (Marine Scotland Science), David Stokes, Hans Gerritsen (Marine Institute, Ireland), Francisco Baldó (IEO), Pascal Laffargue (IFREMER, France).

Introduction

IBTSWG agreed in 2013 to move from n/hr based indices towards swept-area based indices (ICES 2013) following a recommendation from WGISDAA and WKDATR (ICES 2014). Effort for providing quality checked information required for the estimation of swept-area started in 2014 and updated information was provided to IBTSWG in 2015 (ICES 2015). However, several gaps in the dataset were identified during WKSABI in early 2019 (ICES 2019). Here, a new format for the so-called *flexfile* was agreed and a new version of the flexfile have become available in 2020 from DATRAS. In the case of the surveys from the Northeastern Atlantic there is still a need to build the flexfile and provide the formulas to fill the gaps on the flexfile, part of this information was reviewed in the Manual of the IBTS North Eastern Atlantic Surveys (ICES, 2017). The data from the surveys performed since the 2017 reference are included in this working document and the regressions are reviewed including also overall estimates for the surveys with two quarters, so the same model could be used for Q1 and Q4 surveys in the case of the Scottish West Coast Survey, Northern Ireland Survey and Spanish Survey on the Gulf of Cadiz.

Procedure to estimate swept-area abundances from NeAtlIBTS surveys

Proposed procedure to estimate the swept-area in each haul.

- Check values needed are present:
  a. Distance
     i. ShootLong-ShootLat
     ii. HaulLong-HaulLat
  b. HaulDur
  c. Speed
  d. DoorSpread
  e. WingSpread (wing spread information is unavailable in some surveys and only models for door spread are explored in this WD).
  f. Depth
- Check values for outliers
  a. Distance vs. points distance → if missing or outlier choose best option
  b. Distance vs. HaulDur*Speed→ if missing or outlier choose the best option
  c. DoorSpread & Wingspread → if missing or outlier calculate from Depth~Spread in Survey
- Calculate Swept-area DoorSpread (& WingSpread)
  a. DoorSpread× Distance × 10^{-6} km^2

Scottish Rockall survey (SCOROC Q3)

The Scottish groundfish survey on Rockall is performed in the third quarter and from 2011. Table 2 and Figure 1 show the number of hauls performed each year and the door spread per depth achieved in the hauls performed in each year.

Table 2. Number of hauls per year

	Year								
	2011	2012	2013	2014	2015	2016	2017	2018	2019
No. Hauls	45	36	31	47	42	48	41	41	44

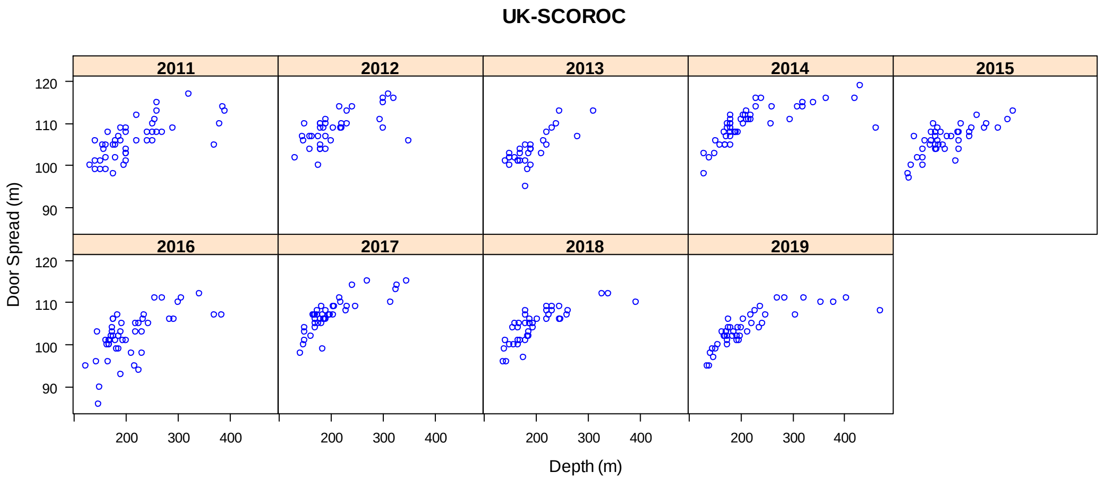


Figure 1. Door spread vs. depth per quarter along the time-series on the Scottish Rockall groundfish survey (2011-2019)

The gear configuration used on the SCOROC survey is equal to that used on the surveys performed on the SCOWCGFS Q1 and Q4 (see next section below), although only one set of sweeps are used since no depths shallower than 120 m are encountered.

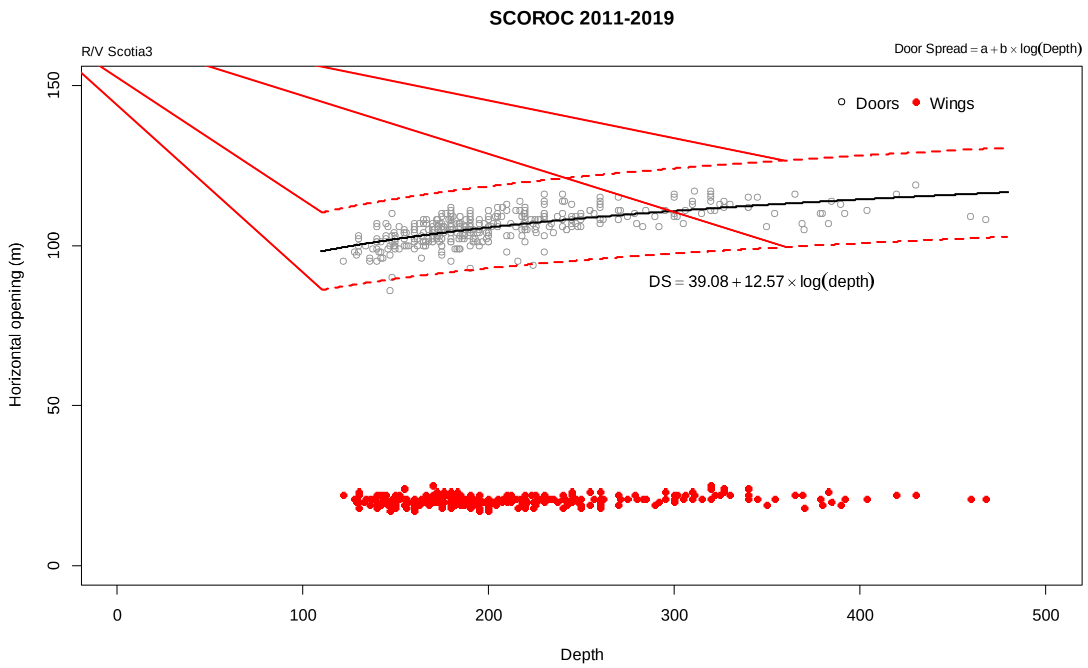


Figure 2. Horizontal spread (doors and wings) on Scottish Rockall survey with logarithmic regression model between doors spread and depth.

Figure 2 presents the behaviour of the gear in terms of horizontal spread vs.depth showing both wings and door spread on the survey. A logarithmic regression model between the doors opening and depth has been fitted.

Scottish West Coast surveys (SCOWCGFS) Q1 Q4 and combined

In the case of surveys that are performed in two different quarters, each one has been analysed individually and the combination of both quarters has also been tested. The Scottish groundfish surveys (SCOROC and SCOWCGFS) underwent a fairly significant change in 2011 that in addition to a change in survey design also delivered changes to sweep configuration and also groundgear. Therefore the data available for use with the current survey configuration only exists from 2011 onwards. On the SCOWCGFS Q1 and Q4 two different sets of sweeps are used. As shown on table 3 short sweeps (recorded as either 47/60 m) are used on depths shallower than 80 m, while the longer ones (recorded as either 97/110 m) are used on deeper hauls.

(Up to 2012/13 these were recorded with the backstrop and penant included (60/110), however since Q4 2013 only the length of the sweep wire has been recorded (47/97).)

Table 3. Number of hauls with different sweeps length used on the SCOWCGFS along the years according to data on DATRAS.

	Year								
SweepLngt	2011	2012	2013	2014	2015	2016	2017	2018	2019
47	-	-	1	20	21	22	14	20	15
60	12	10	8	-	-	-	-	-	-
97	-	-	24	101	99	101	103	96	109
110	100	120	59	-	-	-	-	-	-

Figure 3 shows that within each pair of sweeps (long and short) there were no significant differences in the door spread achieved. The whole dataset therefore will be combined according to sweep type with the gear opening parameters for each quarter being compared.

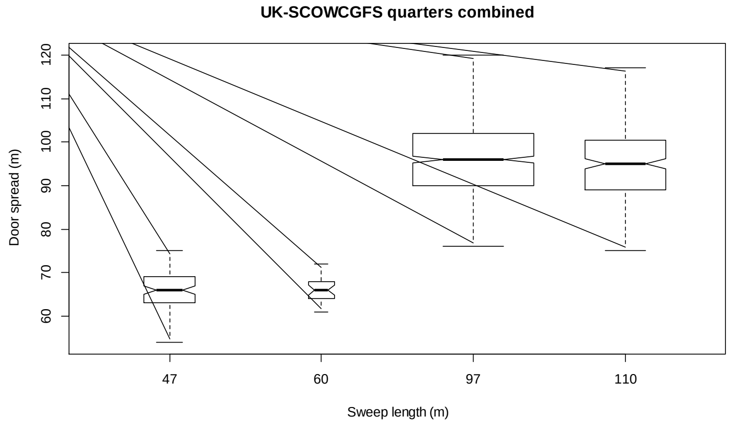


Figure 3. Door spread achieved with each set of sweeps used along the survey time-series (table 3)

Figure 4 presents the behaviour of the gear in terms of horizontal spread vs depth showing both sweeps and door spread on the survey in Quarter 1, Quarter 4 and combining both datasets. In the case of door spread a logarithmic model has been fitted in each case, obviously models are really close with no significant differences between them.

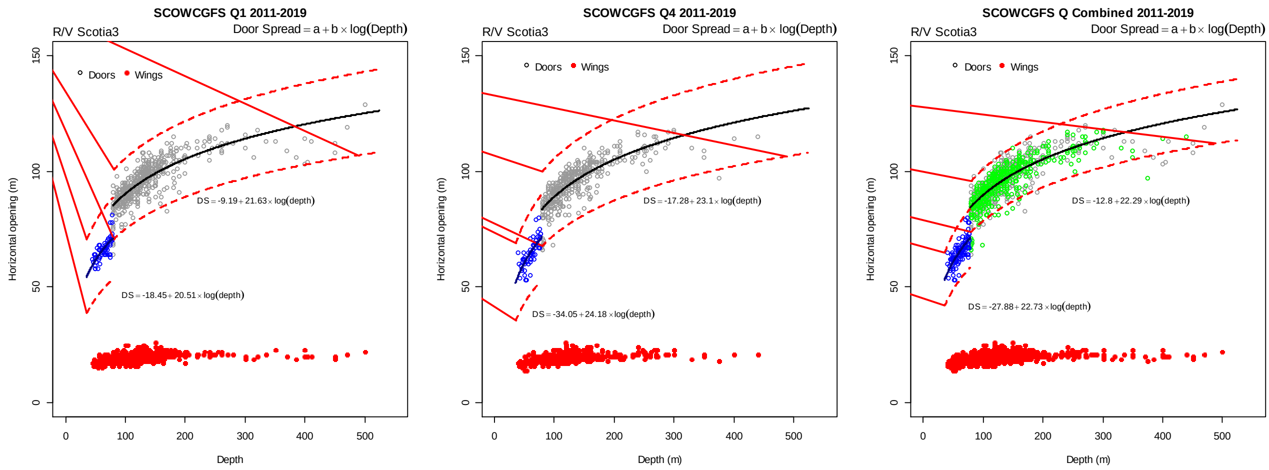


Figure 4. Horizontal spread (doors and wings) on Scottish west coast survey, quarter1 (left), quarter 2 (centre) and overall (right) with logarithmic regression models between doors spread and depth.

Northern Ireland surveys (NIGFS) Q1 Q4 and combined

As shown in Table 4 and figure 5, data for door spread for the Northern Ireland survey are only available from 2008, and in this year only for the 1st quarter, from figure 5 and 6 merging both quarters in one regression model would appear to be appropriate. Regarding missing data for Door spread, only 1 haul in 2008 1st Quarter and 1 in 2017 4th Quarter do not have information on door spread.

Table 4. Number of hauls per quarter and year

	Year													
Quarter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	1	1	1	53	60	61	61	59	54	55	59	62	62	62
4	-	1	1	-	61	59	58	60	58	57	62	62	58	59

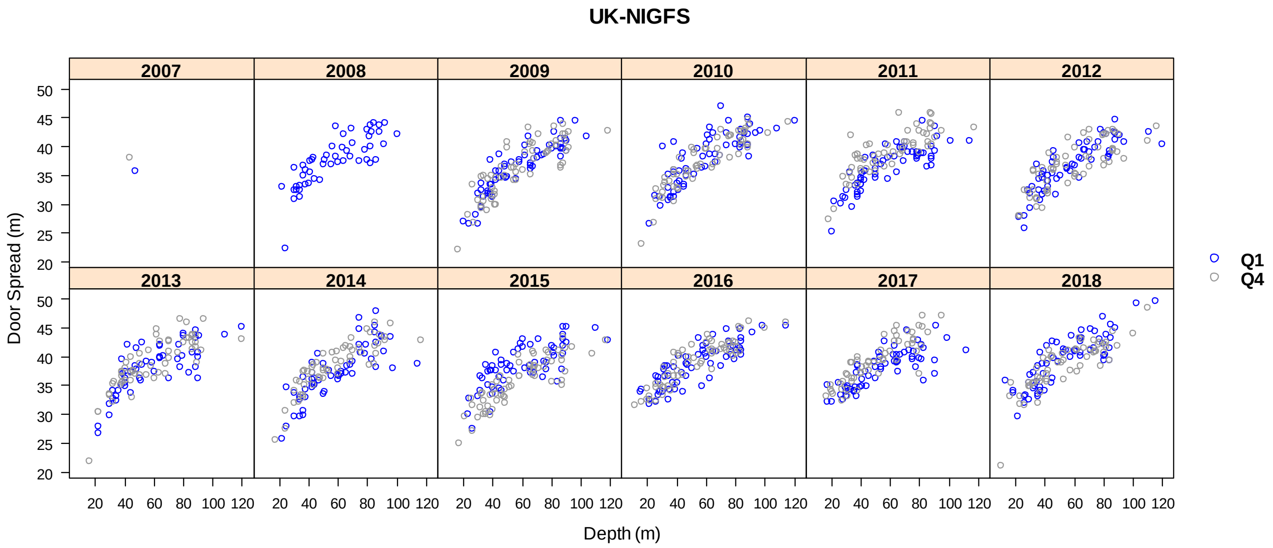


Figure 5. Door spread vs. depth per quarter along the time-series on the Northern Ireland groundfish survey (2007-2018)

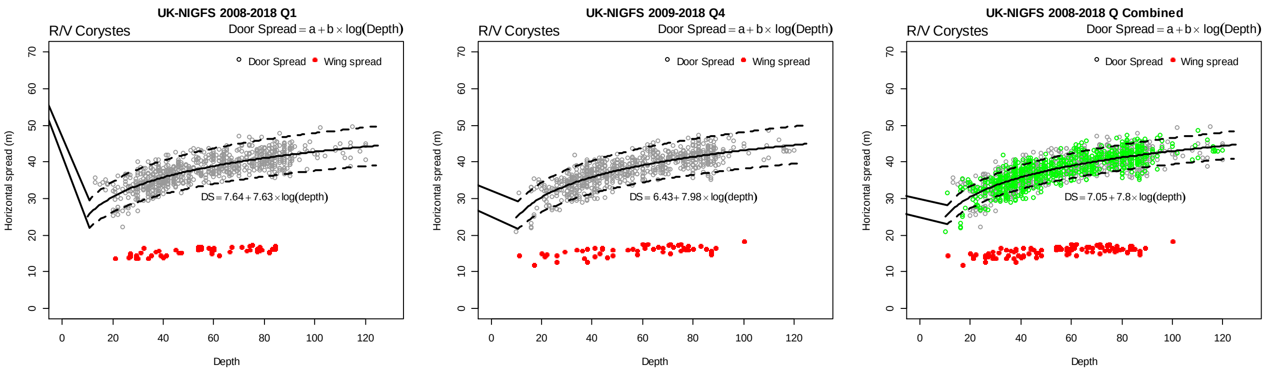


Figure 6. Horizontal spread (doors and wings) on Northern Ireland groundfish survey: quarter1 (left), quarter 2 (centre) and overall (right) with logarithmic regression models between doors spread and depth.

Irish survey (IGFS Q4)

As shown in table 5 in the case of the Irish Groundfish survey there are a few hauls without information on door spread that can be estimated using the data of the depth and door spread from all the hauls with data shown in figure 7.

Table 5.- Number of hauls per year without Door Spread data on the Irish Groundfish Survey from 2012

	Year							
	2012	2013	2014	2015	2016	2017	2018	2019
Hauls	1	1	3	0	0	1	12	2

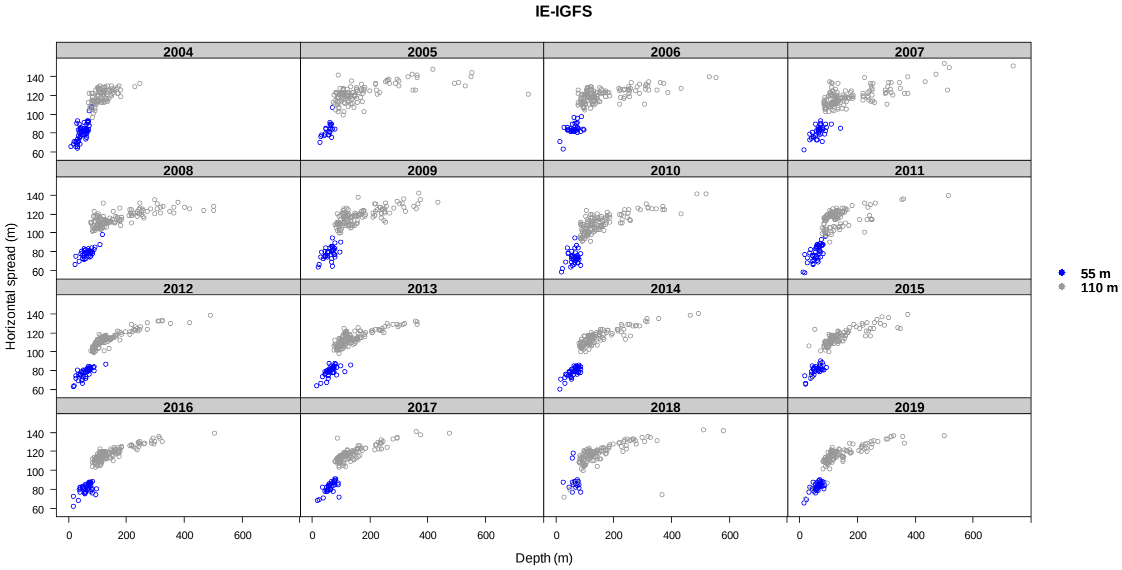


Figure 7. Data uploaded in DATRAS about Door spread vs. depth per along the time-series on the Ireland groundfish survey between 2004 and 2019. Showing the hauls performed with short (55 m) and long (110) sweeps.

In these cases some outliers are evident in the analysis presented in figure 8 where the models are explored for hauls performed with long or short sweeps.

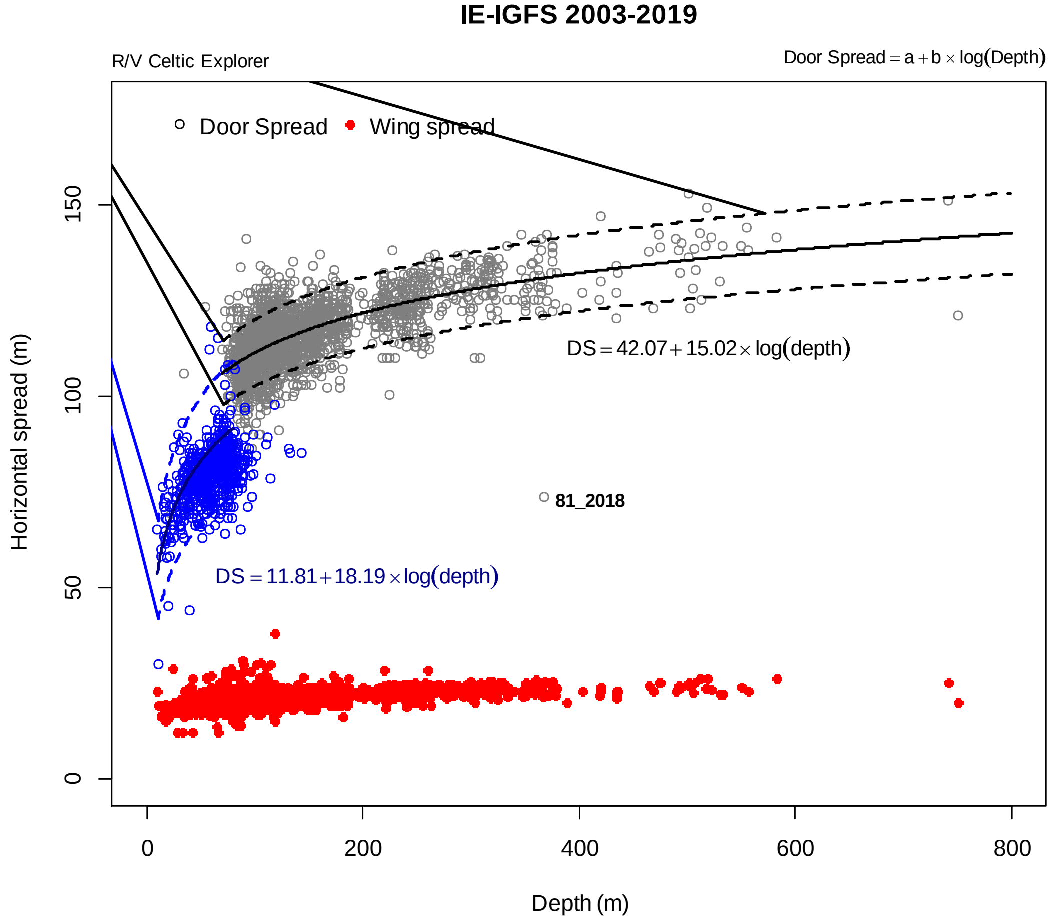


Figure 8. Relationship between horizontal spread and depth in the Irish groundfish survey. Showing sweeps and door spread, and also the regression model between the door spread and depth including models for long and short sweeps.

The Irish Anglerfish and Megrim Survey (IE-IAMS Q1/2)

In the case of the Irish angler and megrim survey the information uploaded in DATRAS is summarized in figure 9, in this case there is no sweeps change, but a change in warp to depth ratio that also produces a breakpoint: 3xdepth ratio is used up to 200m and then 2x depth + 200m after that.

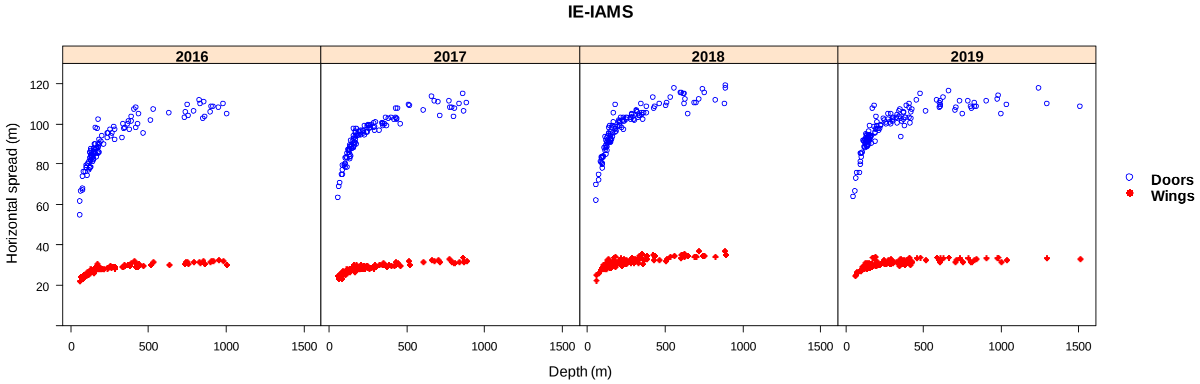


Figure 9. Data uploaded in DATRAS about horizontal spread (doors and wings) vs. depth per along the time-series on the Irish angler and megrim groundfish survey between 2016 and 2019.

Figure 10 presents the models for the doorspread vs. depth relationship divided in two diferent depth ranks since in the survey there is a change in the warp to depth ratio, 3 × depth up to 200 m, and 2 × depth after that, this change in the warp ratio has an effect similar to that of a sweep change. Nevertheless in the case of IE-IAMS survey there are no missing values for door spread data in DATRAS nor clear outliers.

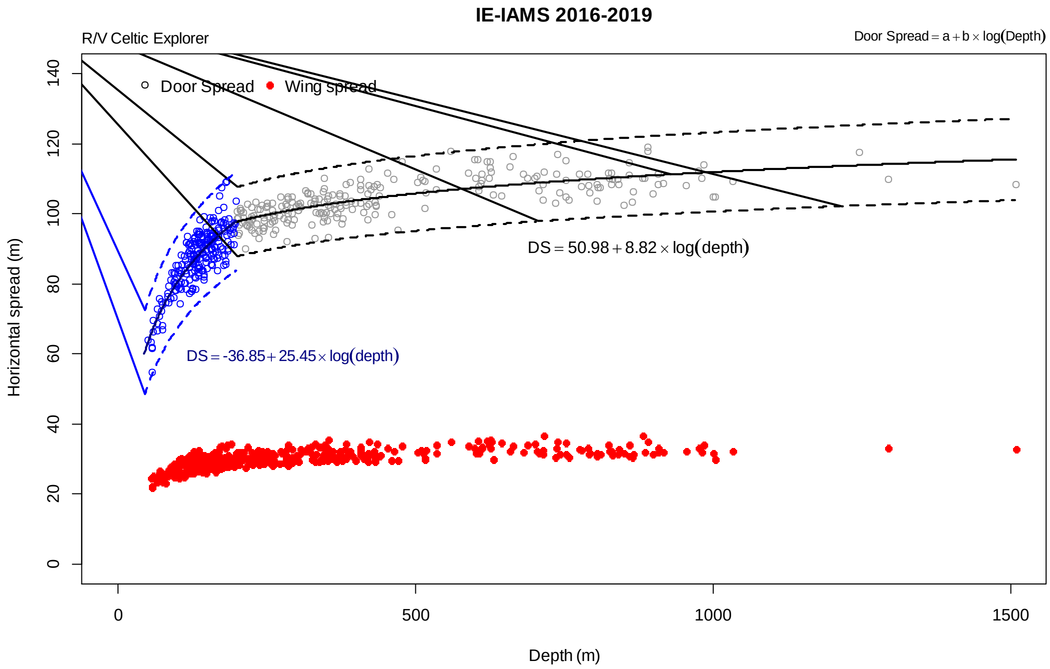


Figure 10. Relationship between horizontal spread and depth in the Irish angler and megrim survey. Showing sweeps and door spread, and also the regression model between the door spread and depth including models hauls performed shallower than 200 m and hauls deeper than 200 with different warp length to depth ratio.

Spanish Porcupine Survey (SP-PORC-Q3)

Table 6, figure 11 and 12 show the information about door spread and the hauls from the Spanish Porcupine survey uploaded in DATRAS between 2001 and 2019.

Table 6. Number of hauls with door spread vs depth information in DATRAS (2004-2019).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Data	31	5	37	61	72	72	77	60	79	80	79	78	77	79	80	79	80	80	79
Missing	52	81	44	9	6	7	3	23	1	0	1	1	3	1	0	1	0	0	0

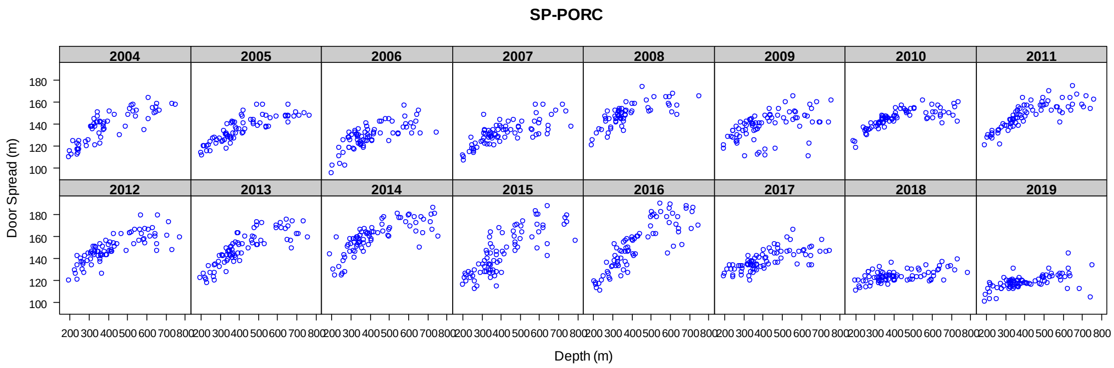


Figure 11. Data uploaded in DATRAS about door spread vs. depth per along the time-series on the Porcupine groundfish survey between 2004 and 2019.

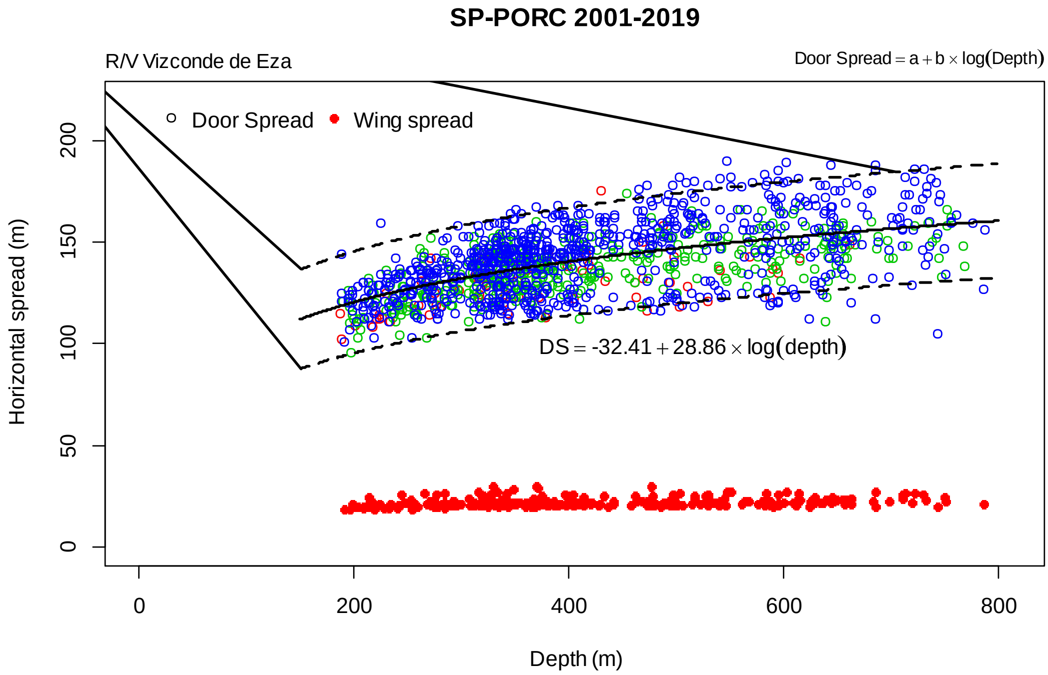


Figure 12. Relationship between horizontal spread and depth in Spanish Porcupine bank groundfish survey. Showing door spread vs. depth relationships and regression model

The French Channel Survey (FR-CGFS-Q4)

Table 6 and figure 13 present the information from the hauls performed in the French Channel survey between 2015 and 2019 about gear, door spread and depth relationship in DATRAS.

Table 7. Number of hauls per year on the French Channel Survey from 2015.

	Year				
	2015	2016	2017	2018	2019
Hauls	73	73	66	73	65

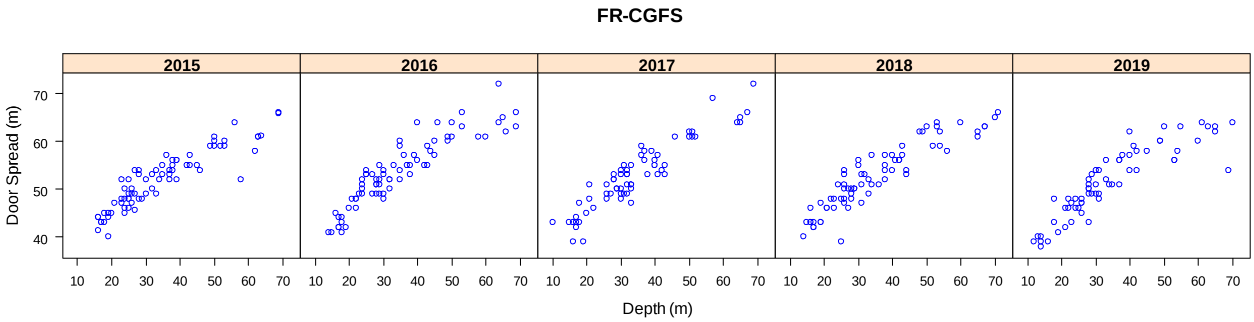


Figure 13. Data uploaded in DATRAS about door spread vs. depth per along the time-series on the French Channel groundfish survey between 2015 and 2019.

Figure 14 presents the relationship between door spread and depth together with the regression model between them.

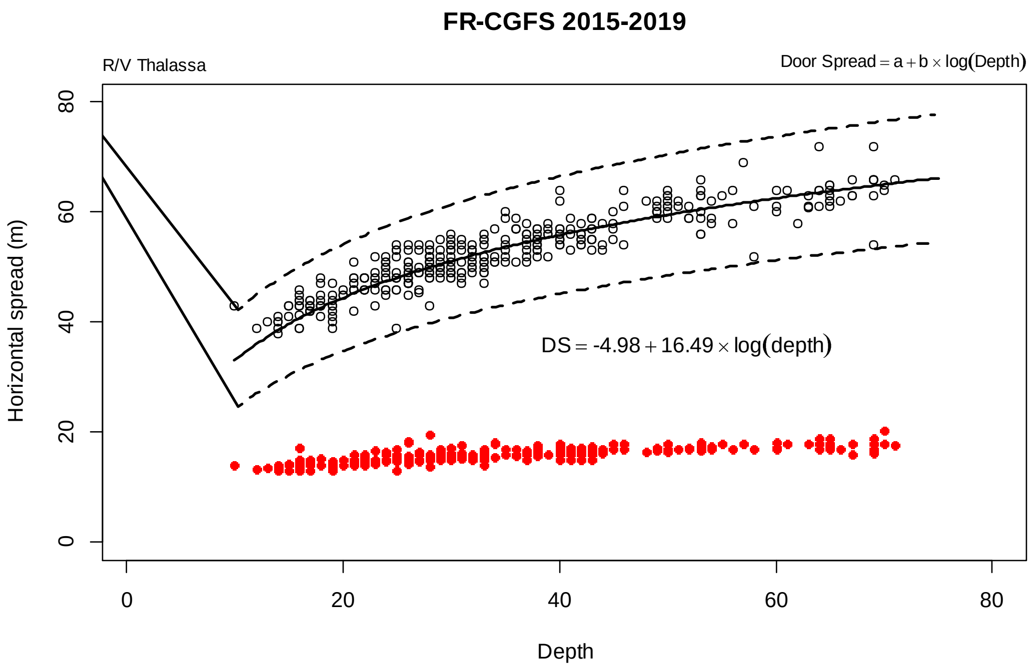


Figure 14. Horizontal spread (doors and wings) vs. depth in French Channel groundfish survey. And logarithmic regression model estimated with hauls between 2015 to 2019.

The French groundfish survey on the Bay of Biscay (FR-EVHOE-Q4)

Table 8 and figure 15 summarize and show the information available in DATRAS on door spread and depth in EVHOE surveys between 2000 and 2019. Including the missing data from those years.

Table 8.Hauls with data and missing info on door spread from FR-EVHOE between 2000 and 2019.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
NA	117	17	80	12	10	18	10	55	7	96
with data	4	134	72	136	128	125	117	90	140	39
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
NA	22	151	130	2	0	0	9	25	0	9
with data	117	0	0	138	155	148	148	0	155	140

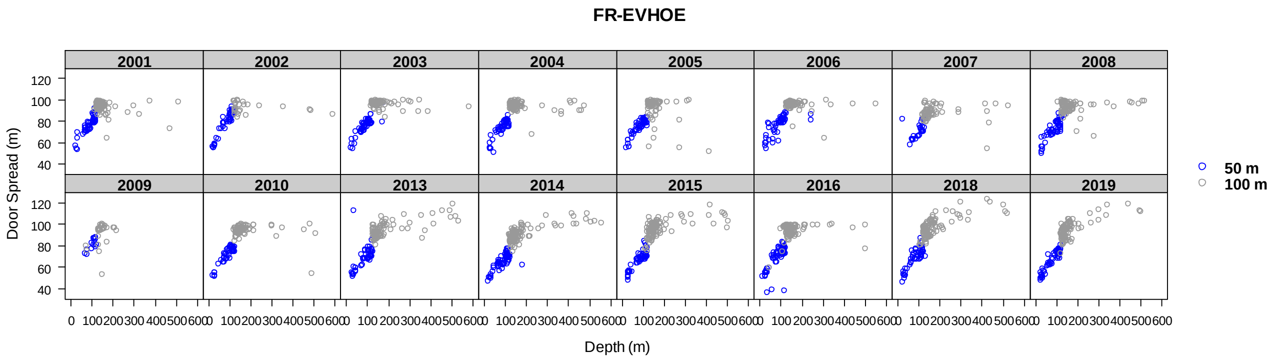


Figure 15. Data uploaded in DATRAS about door spread vs. depth along the time-series on the French EVHOE groundfish survey between 2001 and 2019 showing hauls performed with long and short sweeps

Figure 16 presents the regression model between horizontal opening (doors and wings) and depth from the data uploaded in DATRAS database.

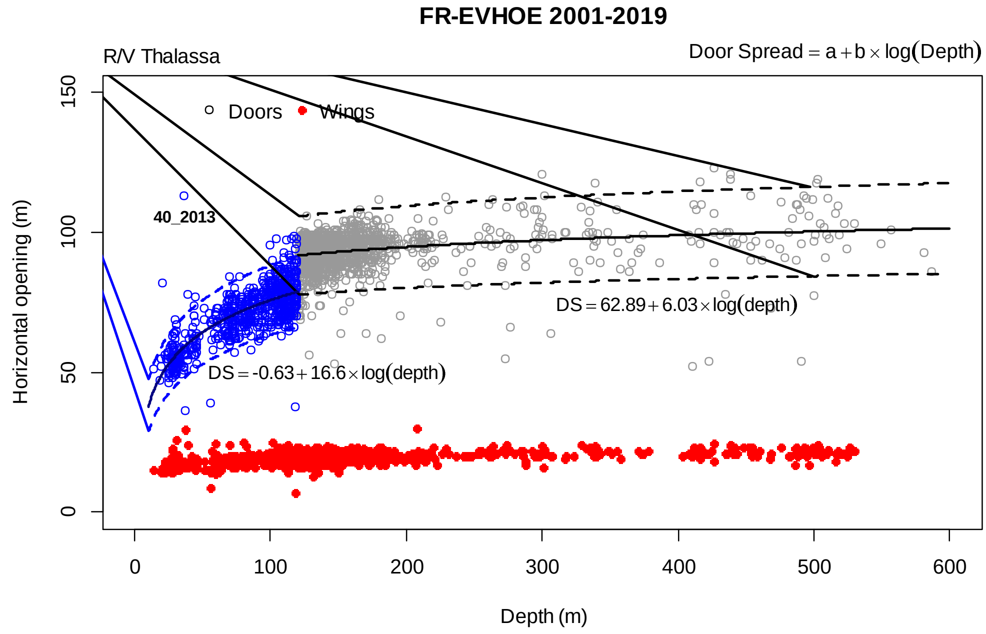


Figure 16. Horizontal spread (doors and wings) vs. depth in French EVHOE survey. And logarithmic regression model estimated with hauls between 2001 and 2019.

North Spanish groundfish survey on the Bay of Biscay (SPNSGFS-Q4)

Table 9 summarizes the hauls with missing door spread opening data on the Spanish groundfish survey on the northern Spain shelf, while figure 17 shows the data on door spread vs. depth in those same surveys. On hauls on the R/V *Cornide de Saavedra*, before 2013 door spread was not measured since wooden doors could not fit the Scanmar sensors that were only used on the wings in some hauls.

Table 9.- Number of hauls per year without Door Spread data on the North Spanish shelf Surveys from 2013

	Year						
	2013	2014	2015	2016	2017	2018	2019
Hauls	25	14	5	13	2	1	3

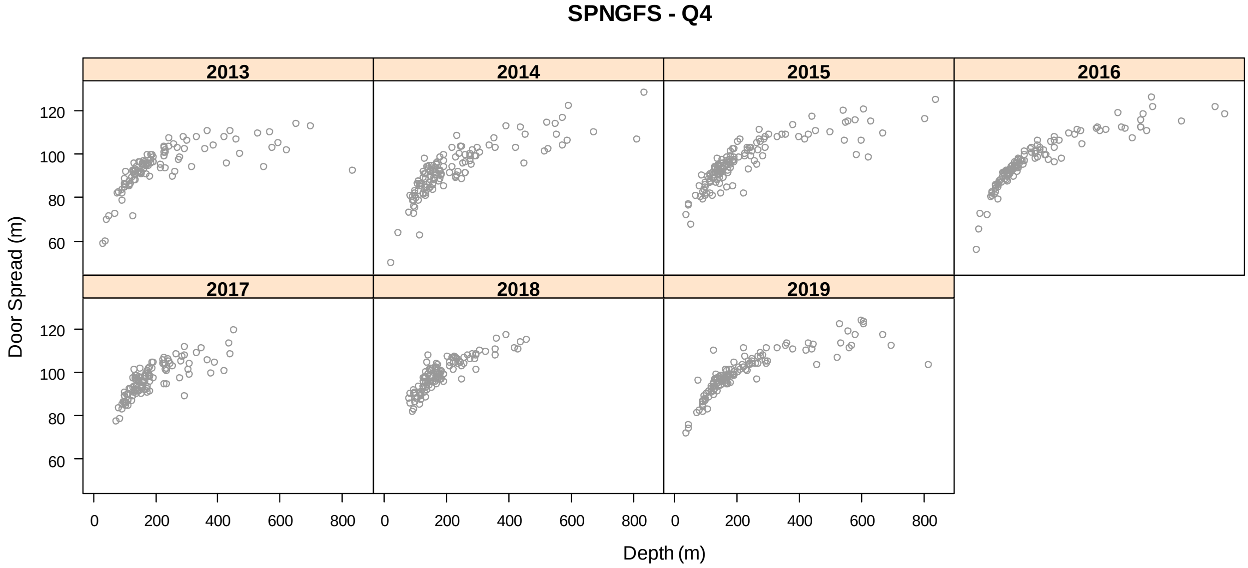


Figure 17. Data uploaded in DATRAS about door spread vs. depth along the time-series on the Spanish northern shelf groundfish survey since the change to the R/V *Miguel Oliver* in 2013 and 2019.

Figure 18 presents the regression model between door spread and depth estimated from the data shown in figure 17.

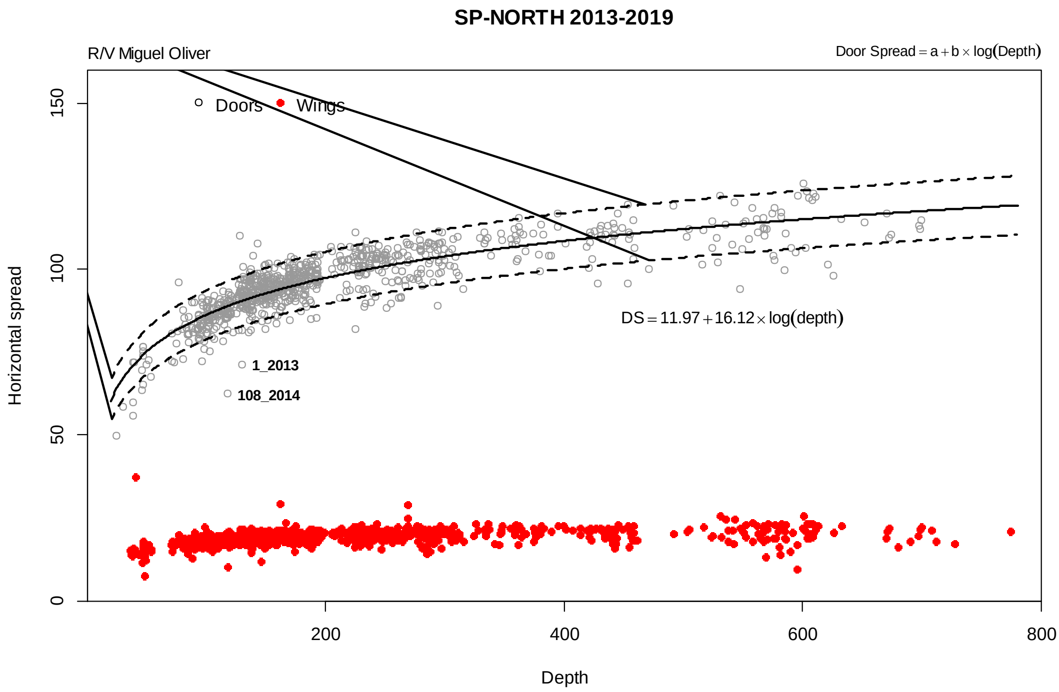


Figure 18. Horizontal spread (doors and wings) vs. depth in Northern Spanish shelf groundfish surveyand logarithmic regression model estimated with hauls between 2013 and 2019 performed on the R/V *Miguel Oliver*.

Gulf of Cadiz surveys Q1 and Q4 combined

Table 10 summarizes the data on door spread per quarter from the Gulf of Cadiz groundfish surveys available in DATRAS.

Table 10. Number of hauls per quarter and year with data on door spread, previous years were carried out on the R/V *Cornide de Saavedra*, and only wing spread info is available in some hauls.

	Year					
Quarter	**2013**	**2014**	**2016**	**2017**	**2018**	**2019**
1	-	37	43	45	41	46
4	3	32	45	44	45	43

Figure 19 shows the boxplots per quarter of door spread in the surveys on the Gulf of Cadiz in the years 2014 to 2019, door spread sensors were not available in 2015. The notches display a confidence interval around the median which is normally based on the median +/- 1.58*IQR/sqrt(n), notches are used to compare groups; if the notches of two boxes do not overlap, this is a strong evidence that the medians differ, it can be concluded that no significant difference between quarters are found within years.

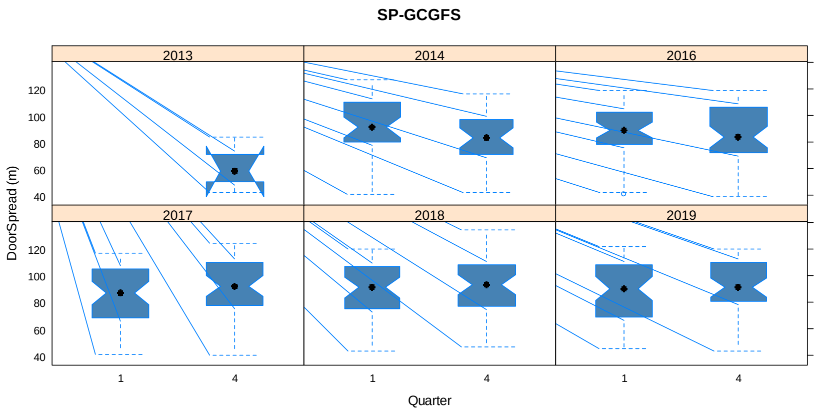


Figure 19. Boxplots of door spread per quarter and year on along surveys performed on the groundfish surveys on the Gulf of Cadiz since the change to the R/V *Miguel Oliver* between 2013 and 2019.

Figure 20 presents the relationships and logarithmic regressions between door spread and depth on the Gulf of Cadiz groundfish surveys, 1st quarter on the left panel, 4th quarter centre and combined for both quarters on the right panel.

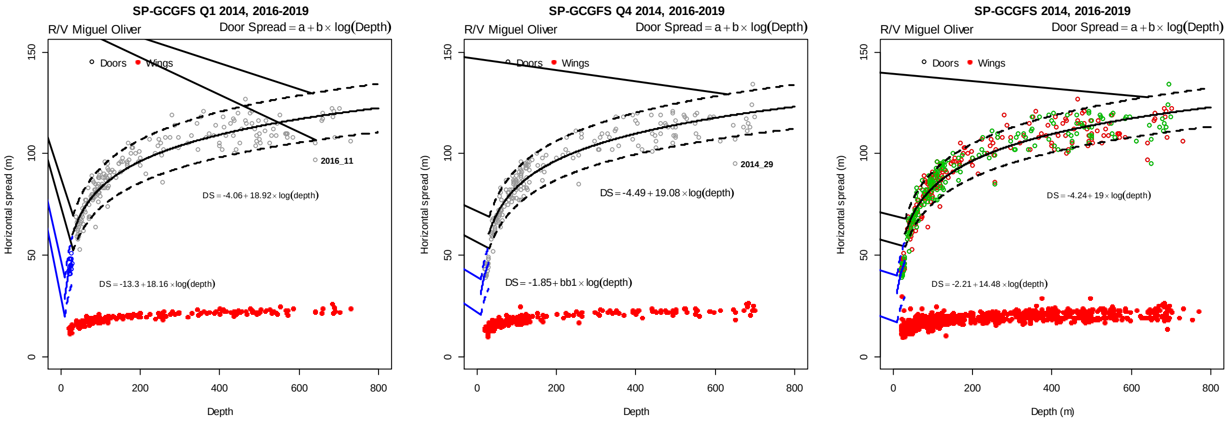


Figure 20. Horizontal spread (doors and wings) on Gulf of Cadiz groundfish surveys quarter1 (left), quarter 2 (center) and overall (right) with logarithmic regression models between doors spread and depth.

Conclusions

In order to produce a flexfile to explore swept-area indices for the different surveys on the North Eastern Atlantic surveys and in the same format as currently exists for the North Sea IBTS (Wieland 2020) further progress will very much depend on the interest and available resources of the national laboratories and the ICES DATA Centre.

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