# ICES IBTSWG REPORT 2016

ACOM/SCICOM STEERING GROUP ON INTEGRATED ECOSYSTEM OBSERVATION AND MONITORING

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# First Interim Report of the International Bottom Trawl Survey Working Group (IBTSWG)

4–8 April 2016

Sète, France

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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IBTS

INTERNATIONAL-BOTTOM-TRAWL-SURVEY

## Executive summary

The report presents summaries of the national contributions in 2015–2016 and planning for 2016–2017 for the surveys coordinated by the International Bottom Trawl Survey Working Group (IBTSWG). In the North Sea, the International Bottom Trawl Surveys are performed in quarters 1 and 3; in the northeastern Atlantic they are conducted in quarters 1, 3, and 4 with a suite of 13 surveys covering shelf areas from north of Scotland to the Gulf of Cádiz. Highlights and problems of the 2015–2016 surveys have been or will be brought to the attention of the relevant assessment groups before their next meeting.

**North Sea Q3, 2015:** Six nations (using five vessels) participated and performed 352 valid GOV hauls in planned rectangles. In rectangles with two hauls allocated, tow duration of one of the hauls was reduced to 15 min while 30 min tow duration was maintained for the other one. Denmark, Germany, Norway, and Scotland participated in this exercise. The introduction of 15 min tows allowed to extend the survey area and resulted in a much more balanced coverage of the North Sea than in previous years. Several vessels have reported larger number of hake, especially in the northern North Sea. No major changes in the rectangle allocation scheme are planned and a continuation of the distribution of 15 and 30 min tows is suggested for 2016.

**North Sea Q1, 2016:** Seven nations (using six vessels) participated and performed 363 valid GOV hauls and 661 MIK hauls, covering the period between 13 January and 25 February 2016. The weather during the 2016 IBTS was not great, especially the Germans experienced weather related problems. All rectangles were covered by at least 1 GOV haul and all planned rectangles were covered by at least 1 MIK haul. Norway has extended the coverage northwards by covering three additional rectangles (52E9, 52F0, 52F1). Dutch used Cefas Endeavour (with the Dutch gear combined with the doors from Endeavour), providing less time for the Dutch to execute their survey. During the survey, the French offered to cover a number of stations in the Channel to help the Dutch with their reduced time.

**NeAtl 2015:** Eight vessels from five countries performed 13 surveys along the Northeastern Atlantic IBTS area. A total of 1089 out of the 1081 hauls planned, were accomplished within 326 days at sea distributed between the first, third and fourth quarters.

The IBTSWG has produced three manuals, where the Manual for the North Sea IBTS and the northeastern Atlantic IBTS are currently being revised. These two manuals will be submitted to ICES in their newest version until the end of 2016.

IBTSWG regularly examines various aspects of data quality. Individual cases of inconsistencies or questionable data are being highlighted in the report, and the respective survey participants are asked to check and correct their national data and re-upload the revised data to DATRAS.

The development of a swept-area based abundance index has been advanced. The goal of this effort is to be able to provide this index in addition to the traditional haul-duration based index. National datasets of net geometry and towed distance have almost been completed for the agreed years (2004 to present), in order to produce a 'flex file' as an additional data product besides the regular DATRAS output. During the current year, the flex file will be quality-controlled, and initial comparisons of cpue values based on tow duration vs. swept-area will be performed.

# 1 Administrative details

**Working Group name**

International Bottom Trawl Survey Working Group (IBTSWG)

**Year of Appointment within the current cycle**

2016

**Reporting year within the current cycle (1, 2 or 3)**

1

**Chair(s)**

Kai Wieland, Denmark

Corina Chaves, Portugal

**Meeting venue**

Sète, France

**Meeting dates**

4–8 April 2016

## 2 Terms of Reference a) – i)

| ToR | Description | Background | Science plan topics addressed | 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 | Intersessional planning of Q1- and Q3- surveys; communication of coordinator with cruise leaders; combing the results of individual nations into an overall survey summary. | 30 | Recurrent annual update | 1) Survey summary including collected data and description of alterations to the plan, to relevant assessment-WGs (WGHMM, WGCSE, WGNEW, WGNSSK, HAWG, WGDEEP, WGEF, WGEEL, WGCEPH, WGHANSA) and SCICOM.<br>2) Indices for the relevant species to assessment WGs (see above)<br>3) Planning of the upcoming surveys for the survey coordinators and cruise leaders. |
| b | Review IBTS SISP manuals and consider additional updates and improvements in survey design and standardization | Intersessional activity, ongoing in order to improve survey quality | 31 | Permanently ongoing | Updated version of survey manual, whenever substantial changes are made (intersessionally) |
| c | Address DATRAS-related topics in cooperation with DUAP: data quality checks and the progress in re-uploading corrected datasets, quality checks of indices calculated, and prioritizing further developments in DATRAS. | 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 | 30 | Multi-annual activity, supported by WKDATR workshop in January of 2013 to solve issues with highest priorities; | 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 (Compare Action List in 2013 report).<br>Once data quality control routines are estabished, annual check of recent survey data. |
| d | Produce a swept-area-based index (instead of haul time-based index) to be explored in collaboration with the WGISDAA | Swept-area is suggested as an alternative to haul time, because it would remove possible bias resulting from different riggings or gear specifications. In order to evaluate the effect changing to new indices, IBTSWG intends to liase with relevant stock coordinators or assessment groups at ICES. | 28 | 1 year | Manuscript for paper or CRR, analysing the<br>potential advantages of moving to swept-area-based standardization. To be presented to assessment groups for evaluation by 2016. |

| ToR | Description | Background | Science plan topics addressed | Duration | Expected deliverables |
|---|---|---|---|---|---|
| e | Analyse and report on the effect of variable sweep length, groundgears and GOV riggings between the participating countries | Some aspects of the gear applied in the surveys are not required to be standardized. The effect of these variations are to be evaluated. Partly, different standards for sweep lengths have been applied in Q1 vs. Q3 surveys, and different groundgears and riggings are applied.<br>(For this ToR, the IBTS WG seeks support from gear technology experts and welcomes their contribution, in particular for advice on a potential change of the survey gear.) | 28 | 2 years | Working document(s) by 2016, Manuscript or CRR by 2017 |
| f | Evaluate the present scheme of collection of age and other biological data | Analysis of spatial distribution of sampling of age and other biological data, options to increase efficiency and minimum required sample sizes | | 2 years | Working document(s) by 2016, Manuscript by 2017 |
| g | 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. | Specific issues to be addressed include: Effect of tow duration; Suitability of species-specific index areas; Stratification and optimal spatial distribution of effort. | | 3 years | Paper on tow duration experiment in NS-IBTS 3Q 2015 by 2016,<br>Manuscript for paper or CRR by 2018. |
| h | Data overviews | ICES is building an overview of the different data products and how the information flows from survey to advice, and input is needed from the survey groups in this process. | 25, 27 | Sept 2016 | Quality assure the data product overviews |
| i | Give input to WKSUREP on data reporting guidelines. | The information flow between data users and the data providers needs to be strengthened | 31 | Sept 2016 | Comment on WKSUREP draft data reporting guidelines. |

# 3 Summary of Work plan

| | |
|---|---|
| **Year 1 (2016)** | Evaluate the effect of changing to swept-area-based indices for additional examples/stocks, particularly linked to WGISDAA and benchmark process (ToR d).<br>Evaluate the results of the tow duration experiment from the ns-ibts 3Q 2015 survey. |
| **Year 2** | Continue analyses of different GOV configurations (ToR e). |
| **Year 3** | Complete the evaluation of the current survey design and explore modifications or alternative survey designs (ToR g), Update survey manuals if necessary (ToRs e, f, and g) |
| **Recurrent annual activity** | Updates for ToRs a, b, and c. |

# 4 List of Outcomes and Achievements of the WG in this delivery period

- Description of survey products: Survey summaries of IBTS-coordinated surveys for Q3/Q4 2015 and Q1 2016;
- Updates of survey manual for the International Bottom Trawl Surveys in the North Sea and in the northeastern Atlantic Areas. Northeastern Atlantic to be submitted to review by SGESST by June 2016;
- Review of WKPIMP outcome (Workshop to plan an integrated monitoring plan in the North Sea in the third quarter), initiated by WGISUR 2015, and held in February 2016;
- Tow duration experiment in Q3 2015 has been conducted and analysed;
- Initial analysis on the efficiency of the current sampling scheme of otoliths in the NS-IBTS has been performed;
- NS-IBTS data on net geometry since 2004 has been cleaned and a interpolation routines for missing values have been established;
- Swept-area based cpue has been used in the analyses of the NS-IBTS 3Q 2015 tow duration experiment.

# 5 Coordination of North Sea and northeastern Atlantic surveys (ToR a)

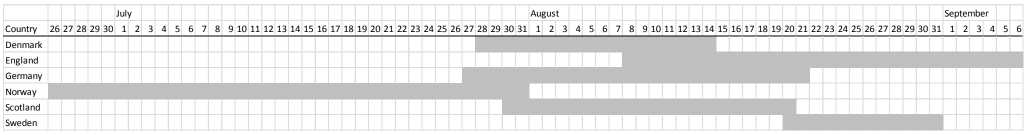
## 5.1 North Sea Q3

### 5.1.1 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. During daytime, a bottom trawl is used. This is the GOV (Grand Ouverture Verticale), with standard groundgear A for normal bottom conditions or groundgear B for rough ground. A CTD was deployed at most trawl stations to collect temperature and salinity profiles. Age data were collected for cod, haddock, whiting, saithe, Norway pout, herring, mackerel, and sprat, and a number of additional species.

Six nations (using five vessels) participated in the quarter 3 survey in 2015: Dana (Denmark and Sweden), Walther Herwig III (Germany), Johan Hjort (Norway), Cefas Endeavour (England) and Scotia (Scotland). The overall survey period extended from 26 June to 6 September (Table 5.1.1.1).

**Table 5.1.1.1. Overview of the surveys performed during the North Sea IBTS Q3 survey in 2015.**




In total, 352 valid GOV hauls were made in the planned rectangles (Table 5.1.1.2). IBTSWG 2015 decided that for North Sea rectangles to which two hauls were allocated, tow duration of one of the two hauls was reduced to 15 min while 30 min tow duration was maintained for the other one. Denmark, Germany Norway, and Scotland participated in this exercise while the sampling by England and Sweden was not changed. The introduction of 15 min tows allowed to extend the survey area and resulted in a much more balanced coverage of the North Sea than in previous years (WD1) while some rectangles in the Skagerrak and Kattegat did not achieve coverage of two hauls (Figure 5.1.1.1). The latter, however, may be considered as less important because those rectangles have a relative small area with depths < 200 m which is the maximum limit according to the manual (45F9), are largely covered by land (41G0 and 45G1) or are not fishable with the GOV (42G0).

Biological data are collected for a large number of species, for most of these species length, weight, gender and maturity and age material was collected (Tables 5.1.1.3 and 5.1.1.4). For some species, however, the otoliths have yet not read and thus age information has to be submitted to DATRAS at a later time.

**Table 5.1.1.2. Overview of the GOV stations fished in the North Sea IBTS Q3 survey in 2015 (*: Relative to the number of tows proposed in the manual).**

| ICES Division | Country | Gear used | Number of tows proposed (Manual) | Number of proposed valid tows | Number of additional valid tows | Proportion of achieved valid tows (%) * | Proportion of valid 15 min tows (%) |
|---|---|---|---|---|---|---|---|
| 3a | SWE | GOV-A | 36 | 36 | 10 | 128 | 0 |
| 3a | DEN | GOV-A | - | - | 5 | 125 | 0 |
| 4a,b,c | DEN | GOV-A | 47 | 47 | 7 | 125 | 53 |
| 4a,b,c | ENG | GOV-A | 76 | 76 | 0 | 100 | 0 |
| 4a,b,c | GFR | GOV-A | 29 | 29 | 4 | 114 | 76 |
| 4a,b | NOR | GOV-A | 47 | 47 | 1 | 102 | 73 |
| 4a | SCO | GOV-B | 44 | 44 | 5 | 108 | 62 |
| 4b | SCO | GOV-A | 40 | 40 | 2 | 108 | 62 |

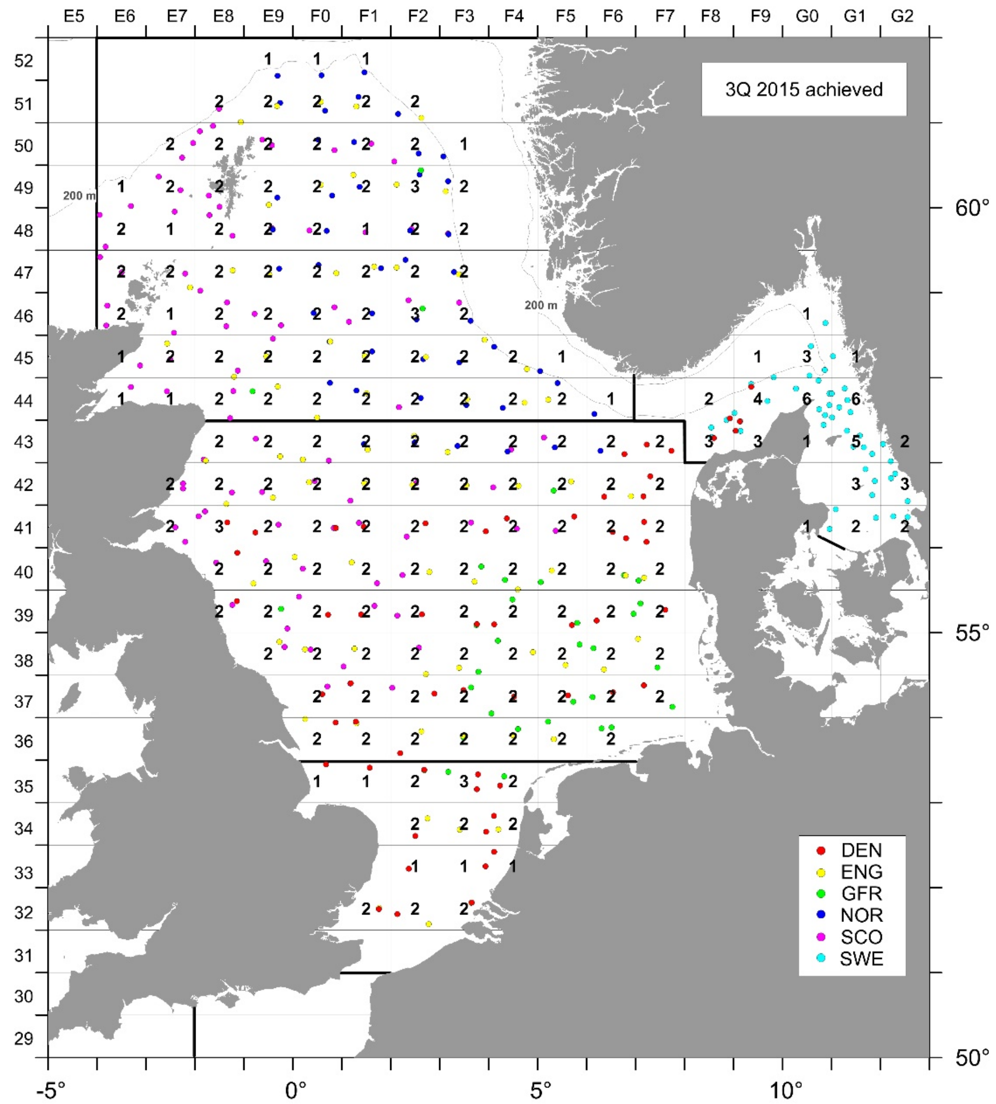



**Figure 5.1.1.1 Number of hauls per ICES rectangle with GOV during the North Sea IBTS Q3 2015 and the start positions of the GOV stations by country (Thick lines indicate borders of ICES Divisions in the North Sea (4a,b,c), the Skagerrak/Kattegat (3a) and the English Channel (7d)).**

**Table 5.1.1.3. Overview of age samples collected during the North Sea IBTS Q3 survey in 2015.**

| Species | DEN | ENG | GFR | NOR | SCO | SWE | Total |
|---|---|---|---|---|---|---|---|
| *Clupea harengus* | 791 | 1296 | 240 | 178 | 1284 | 1340 | 5129 |
| *Sprattus sprattus* | 488 | 464 | 168 | | 374 | 683 | 2177 |
| *Gadus morhua* | 120 | 450 | 21 | 358 | 514 | 680 | 2143 |
| *Merlangius merlangus* | 436 | 1478 | 344 | 433 | 1420 | 461 | 4572 |
| *Melanogrammus aeglefinus* | 99 | 1265 | 71 | 447 | 1425 | 188 | 3495 |
| *Trisopterus esmarki* | 30 | 379 | 22 | 236 | 421 | 132 | 1220 |
| *Pollachius virens* | 6 | 502 | 11 | 375 | 479 | 162 | 1535 |
| *Merluccius merluccius* | 29 | 399 | | | 301 | 183 | 912 |
| *Scomber scombrus* | 333 | 352 | 167 | 101 | 578 | | 1531 |
| *Pleuronectes platessa* | 688 | 1249 | 250 | | 280 | 743 | 3210 |
| *Limanda limanda* | | 238 | | | | | 238 |
| *Glyptocephalus cynoglossus* | 20 | 41 | | | | 63 | 124 |
| *Solea solea* | 32 | | | | | 4 | 36 |
| *Microstomus kitt* | | 233 | | | | | 233 |
| *Scopthalmus maximus* | 14 | 3 | | | | | 17 |
| *Scophtalmus rhombus* | 4 | 11 | | | | | 15 |
| *Chelidonichthys cuculus* | | 40 | | | | | 40 |
| *Chelidonichthys lucerna* | | 27 | | | | | 27 |
| *Eutrigla gurnadus* | | 235 | | | | | 235 |
| *Mullus surmuletus* | | 20 | | | 8 | | 28 |
| *Lophius piscatorius* | 7 | 70 | | | | | 77 |
| *Lophius budegassa* | | | | | | | 0 |
| *Zeus faber* | | | | | 4 | | 4 |
| *Molva molva* | | 23 | | | | | 23 |
| *Engraulis encrasicolus* | | | 17 | | | | 17 |

**Table 5.1.1.4. Overview of additional individual length, weight and/or maturity data collected other than the regular measurements specified in the manual during the North Sea IBTS Q3 survey in 2015 (*: correct species names under discussion, underlined numbers: length an d weight only).**

| Species | DEN | ENG | GFR | NOR | SCO | SWE | Total |
|---|---|---|---|---|---|---|---|
| *Hippoglossus hippoglossus* | | | | | 1 | | 1 |
| *Squalus acanthias* | | 2 | <u>19</u> | 2 | 41 | | 64 |
| *Scyliorhinus canicula* | | 98 | <u>20</u> | 2 | | | 120 |
| *Raja montagui* | | 28 | | | 31 | | 59 |
| *Leucoraja naevus* | | 32 | <u>4</u> | 6 | 26 | | 68 |
| *Amblyraja radiata* | | 97 | <u>14</u> | 69 | 51 | | 231 |
| *Dipturus intermedia** | | 2 | | | 3 | | 5 |
| *Raja clavata* | | 116 | <u>3</u> | | 5 | | 124 |
| *Lithodes maja* | | | <u>8</u> | 22 | | | 30 |
| *Nephrops norvegicus* | | | <u>14</u> | | | | 14 |
| *Mustelus asterias* | | 17 | <u>2</u> | | | | 19 |
| *Etmopterus spinax* | | | | 42 | | | 42 |
| *Lophius piscatorius* | | | 1 | | | | 1 |
| *Merluccius merluccius* | | | 10 | 288 | 301 | | 599 |
| *Microstomus kitt* | | | 110 | | | | 110 |
| *Scopthalmus maximus* | | | 6 | | | | 6 |
| *Scopthalmus rhombus* | | | 2 | | | | 2 |
| *Crystallogobius linearis* | | | | 2 | | | 2 |
| *Galeus melastomus* | | | | 4 | | | 4 |
| *Limanda limanda* | | | | 33 | | | 33 |
| *Micromesistius poutassou* | | | | 85 | | | 85 |
| *Trachurus trachurus* | | | | 1 | | | 1 |

### 5.1.2 Issues and problems

There were no major issues and problems.

### 5.1.3 Ecosystem considerations

Several vessels have reported large number of hake, especially in the northern North Sea, and as corroborated by the numbers of otoliths taken (Table 5.1.1.3). The potential implications of this increase in hake in relation to potential ecosystem interactions with other commercial gadoids and on fleet behaviour could usefully be considered.

### 5.1.4 Additional activities

All countries collected seabed litter from the GOV tows and collected CTD (temperature and salinity, oxygen for some countries) at all GOV stations when possible. A list of other additional activities is given in Table 5.1.4.1.

**Table 5.1.4.1. Overview of additional activities in the North Sea IBTS Q3 survey in 2015 (Water samples for CTD calibration not explicitly listed, x: routinely, (x): *ad hoc* studies).**

| Activity | DEN | ENG | GFR | NOR | SCO | SWE |
|---|---|---|---|---|---|---|
| CTD | x | x | x | x | x | x |
| Seafloor Litter | x | x | x | x | x | x |
| Water sampler (Nutrients, Chlorophyll) | | (x) | | x | x | |
| Collection of fish stomachs | | | | | | (x) |
| Collection of fish tissue (genetics) | (x) | | | (x) | (x) | |
| Jellyfish from GOV catches | | (x) | | x | | |
| Plankton biodiversity | | | | | | |
| Epibenthos (beamtrawl) | | | x | | | |
| Sediment (VanVeen grab) | | | x | | | |
| Seabirds | | | x | | | |
| Marine mammals | | | | | | |
| Zooplankton (MIK) | | | | x | | |
| Hydrological transect | | | | x | | |
| Acoustics (Ichthyofauna) | | x | | x | | |
| Video recordings of fish behaviour inside the trawl | (x) | | | | | |

### 5.1.5 Gear geometry

The current manual 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. Missing observations of these parameters are listed in Table 5.1.5.1.

**Table 5.1.5.1. Number of valid tows with missing gear parameters (No sensors for wing spread available for Denmark and Norway).**

| Parameter | DEN | ENG | GFR | NOR | SCO | SWE |
|---|---|---|---|---|---|---|
| Door spread | 0 | 0 | 5 | 0 | 0 | 0 |
| Net opening | 0 | 3 | 0 | 0 | 17 | 0 |
| Wing spread | 59 | 20 | 0 | 48 | 2 | 1 |

The results shown in Figure 5.1.5.1c indicate that Denmark, England, Germany, and Scotland had no serious problem in achieving the theoretical values for door spread and net opening for almost all tows they made. For Norway and Sweden, almost all observations of door spread were within or close to the theoretical limits while net opening was consistently too low.

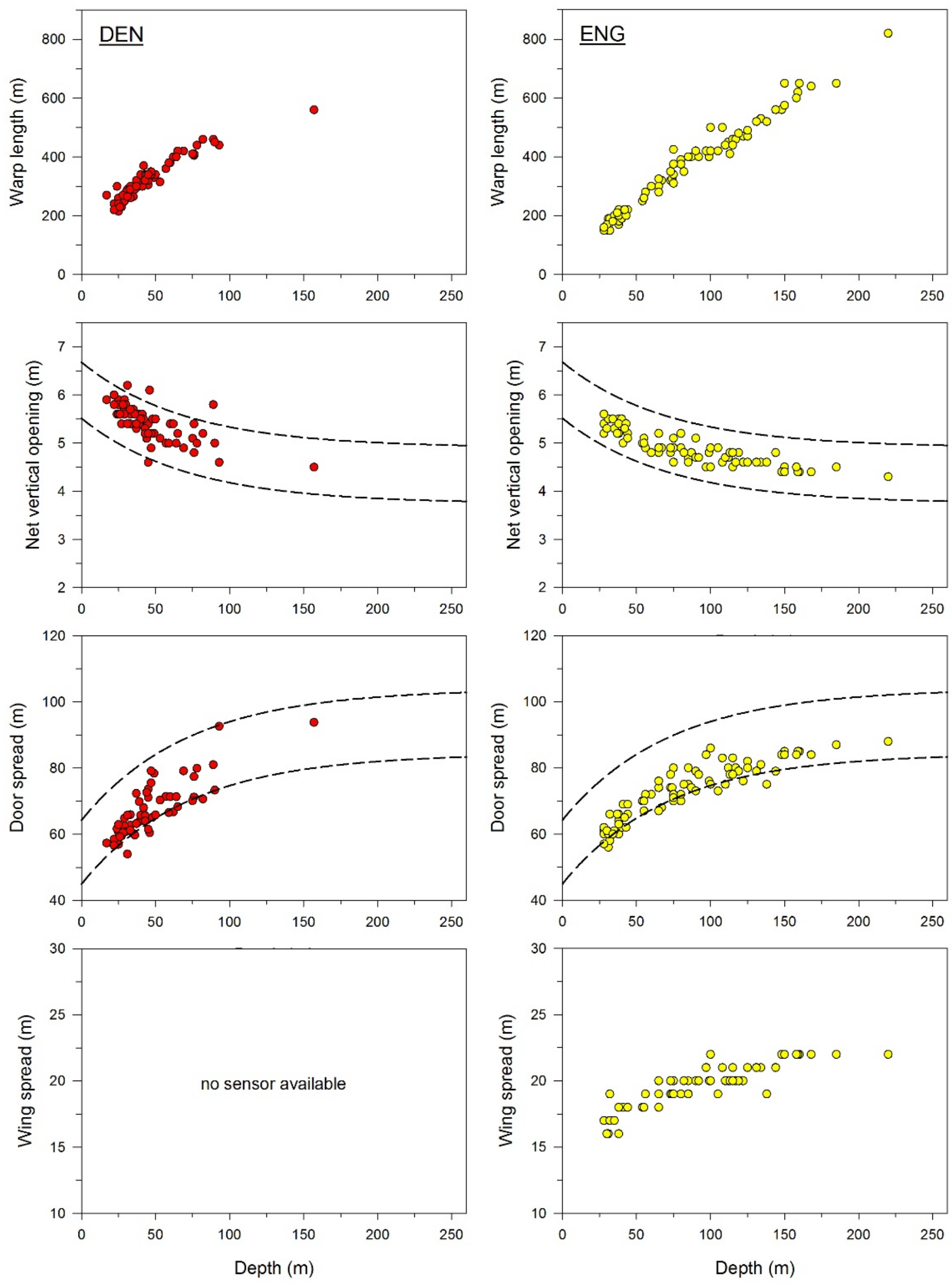



**Figure 5.1.5.1a. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2015 – Denmark and England (dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual).**

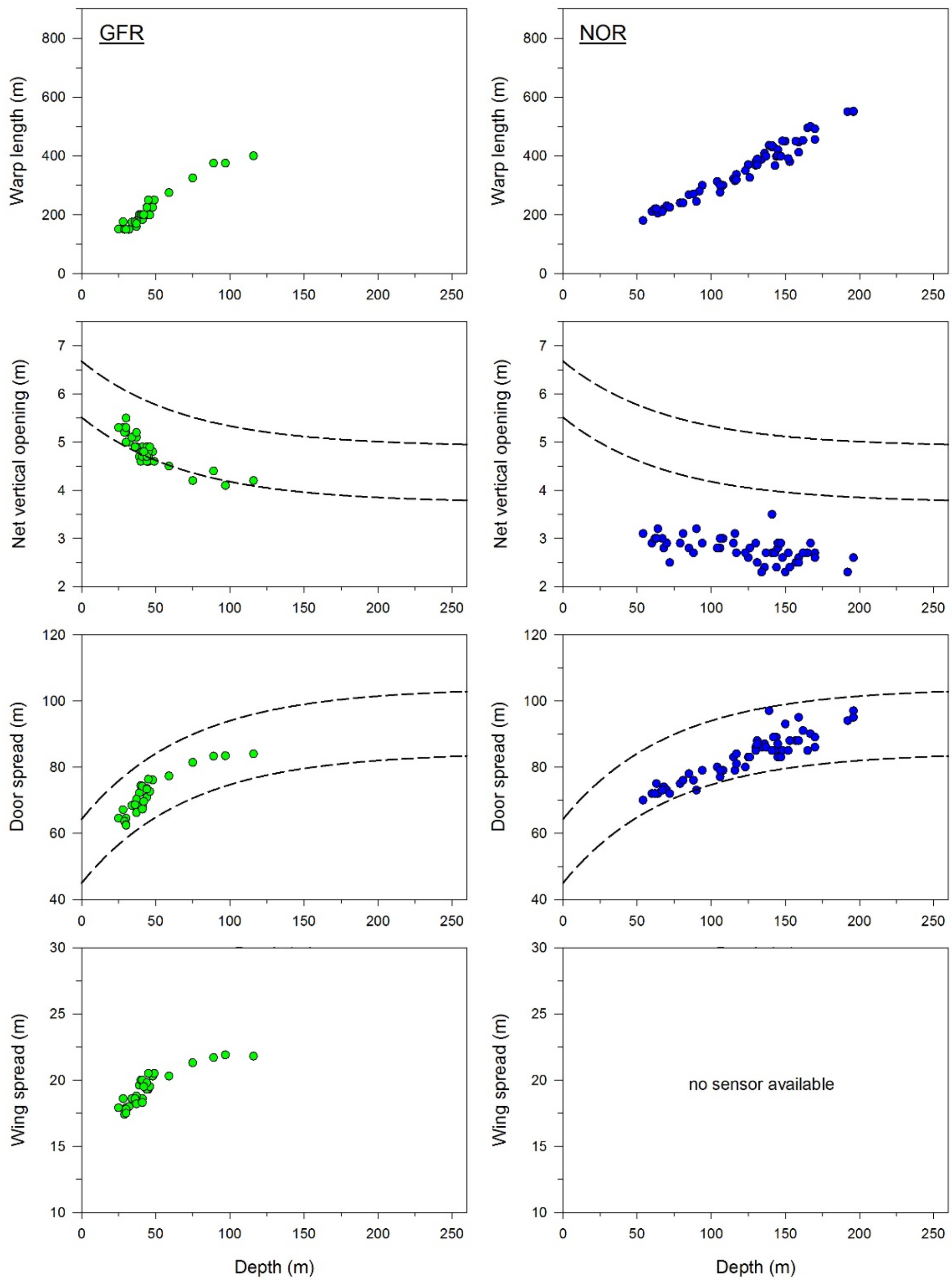



**Figure 5.1.5.1b. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2015 – Germany and Norway (dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual).**

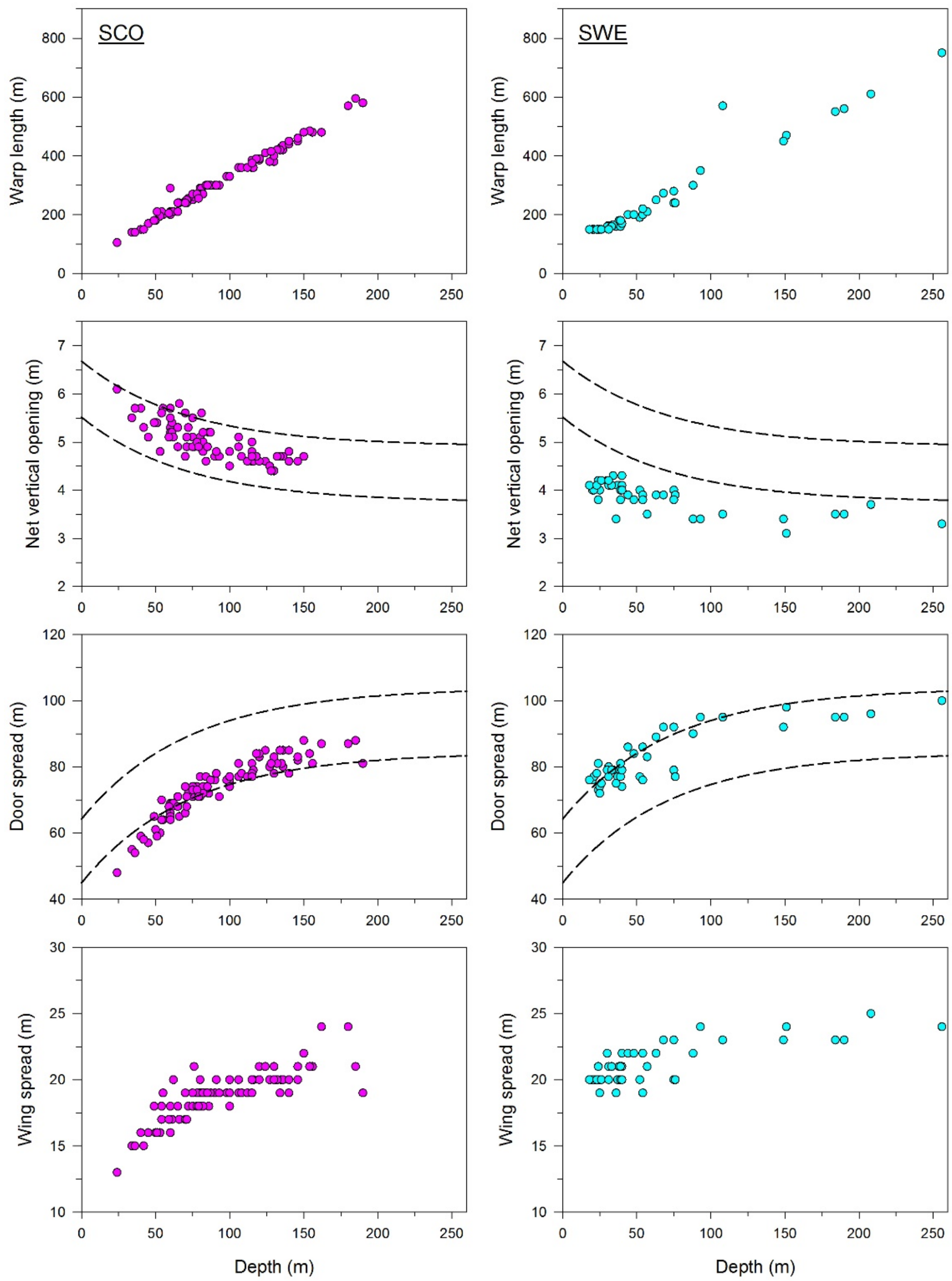



**Figure 5.1.5.1c. Warp length and net geometry related to depth by country for the North Sea IBTS Q3 2015 –Scotland and Sweden (dashed lines: theoretical lower and upper limits for the standard GOV 36/47 based on flume tank experiments, see manual).**

### 5.1.6 GOV standard indices and distribution of target species

The indices for the YOY recruits of the NS-IBTS standard species based on the 2015 quarter 3 survey are shown in Figure 5.1.6.1. Only for whiting, Norway pout, and mackerel 0-group indices above or close to the long-term average were found while in particular for cod both in the North Sea and the Kattegat (ICES Division 3a south) very low values (< 1 fish/h) were recorded. However, not all of these 0-group indices are meaningful due to low catchability and because some of the species only occur sporadically in the IBTS index at this age and time of the year.

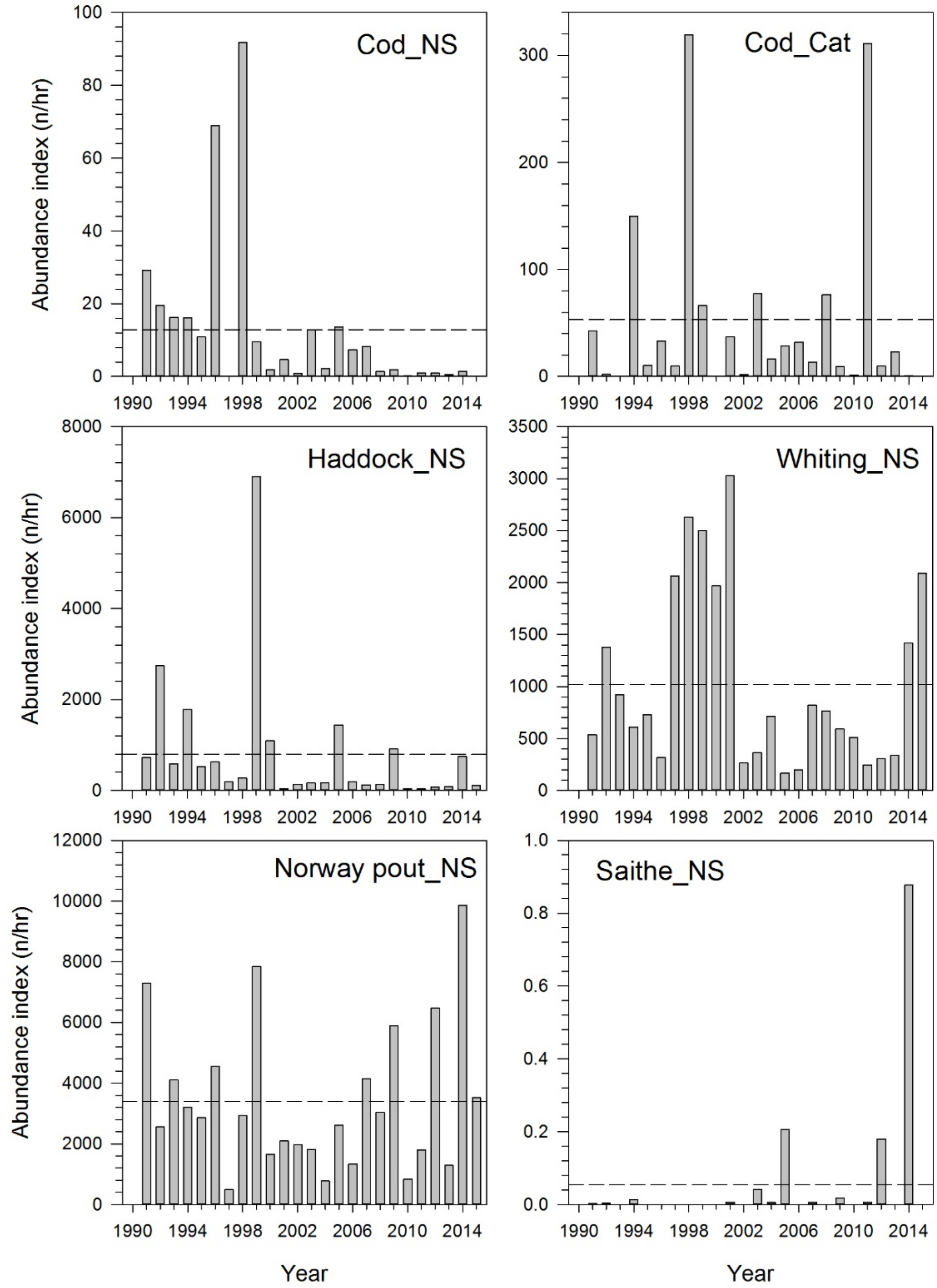



**Figure 5.1.6.1a. Abundance indices for 0-group cod, haddock, whiting, Norway pout and saithe caught during the quarter 3 IBTS survey in the North Sea (NS) and Kattegat (Cat) (dashed lines: mean values 1991–2015, see http://vocab.ices.dk/ for definition of the indices and Figure 5.1.6.3 for the species-specific standard areas).**

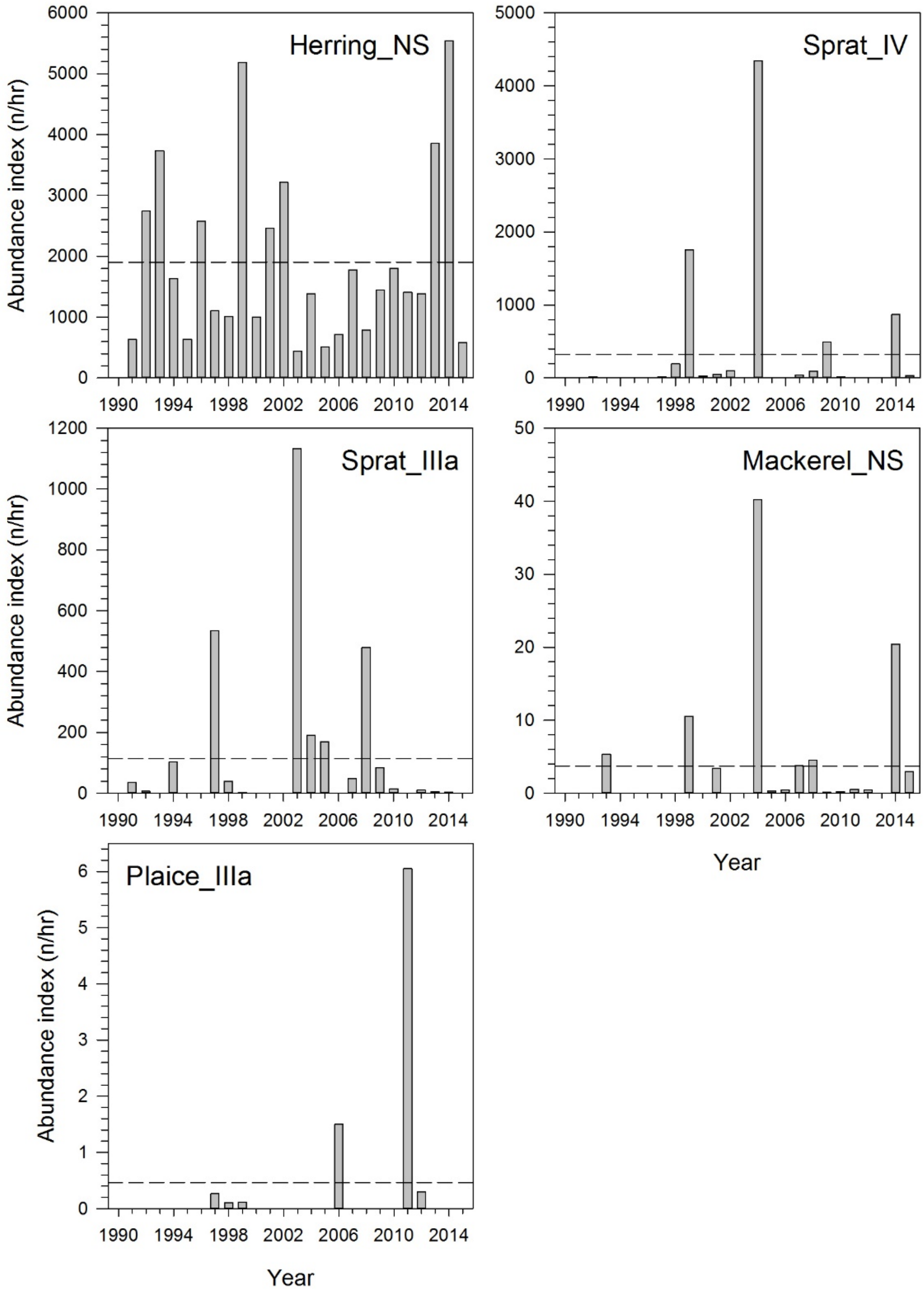



**Figure 5.1.6.1b. Abundance indices for 0-group herring, sprat, mackerel and plaice caught during the quarter 3 IBTS survey in the North Sea (NS, 4) and the Skagerrak (3a) (dashed lines: mean values 1991–2015, no data for plaice 1991–1996 and 2000, see http://vocab.ices.dk/ for the definition of indices and Figure 5.1.6.3 for the species-specific standard areas).**

At age 1, the indices for haddock, Norway pout, herring, sprat in division 4 and in particular mackerel were above the long-term average (Figure 5.1.6.2).

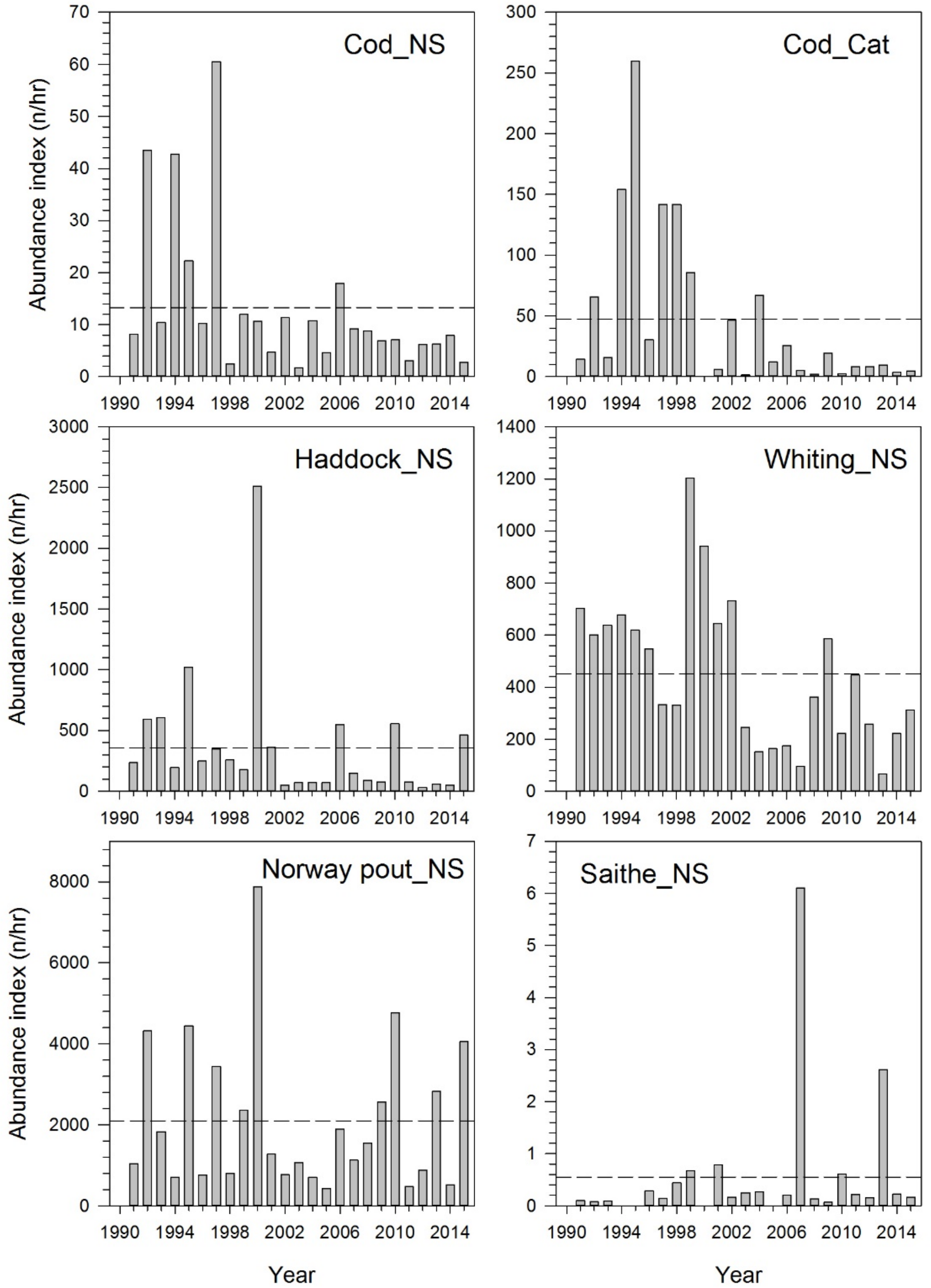



**Figure 5.1.6.2a. Abundance indices for 1-group cod, haddock, whiting, Norway pout, and saithe caught during the quarter 3 IBTS survey in the North Sea (NS) and Kattegat (Cat) (dashed lines: mean values 1991–2015, see http://vocab.ices.dk/ for definition of the indices and Figure 5.1.6.3 for the species-specific standard areas).**

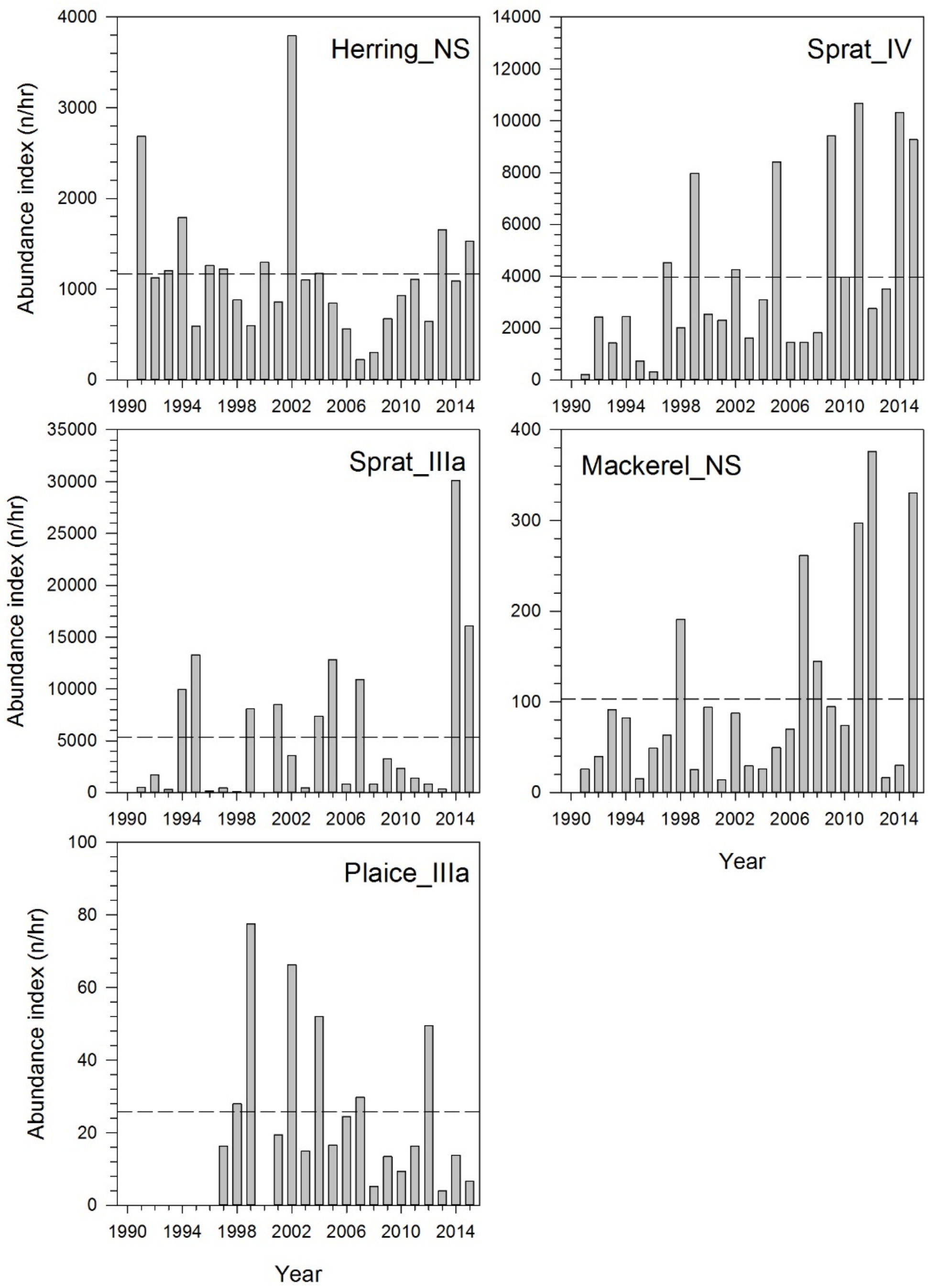



**Figure 5.1.6.2b. Abundance indices for 1-group herring, sprat, mackerel, and plaice caught during the quarter 3 IBTS survey in the North Sea (NS) and Skagerrak/Kattegat (3a) (dashed lines: mean values 1991–2015, no data for plaice 1991–1996 and 2000, see http://vocab.ices.dk/ for the definition of indices and Figure 5.1.6.3 for the species-specific standard areas).**

Distribution plots (Figure 5.1.6) indicate that, for some target species, high densities were found outside the actual index areas, particularly for cod, haddock, whiting and Norway pout this may warrant a revision of the species-specific areas on which the standard indices as calculated in DATRAS is based. It should further be noted that, the DATRAS download of cpue by age and haul does not include data for rectangles 45F5 and 44F6, which are outside the current roundfish area boundaries, although valid tows have been made there.

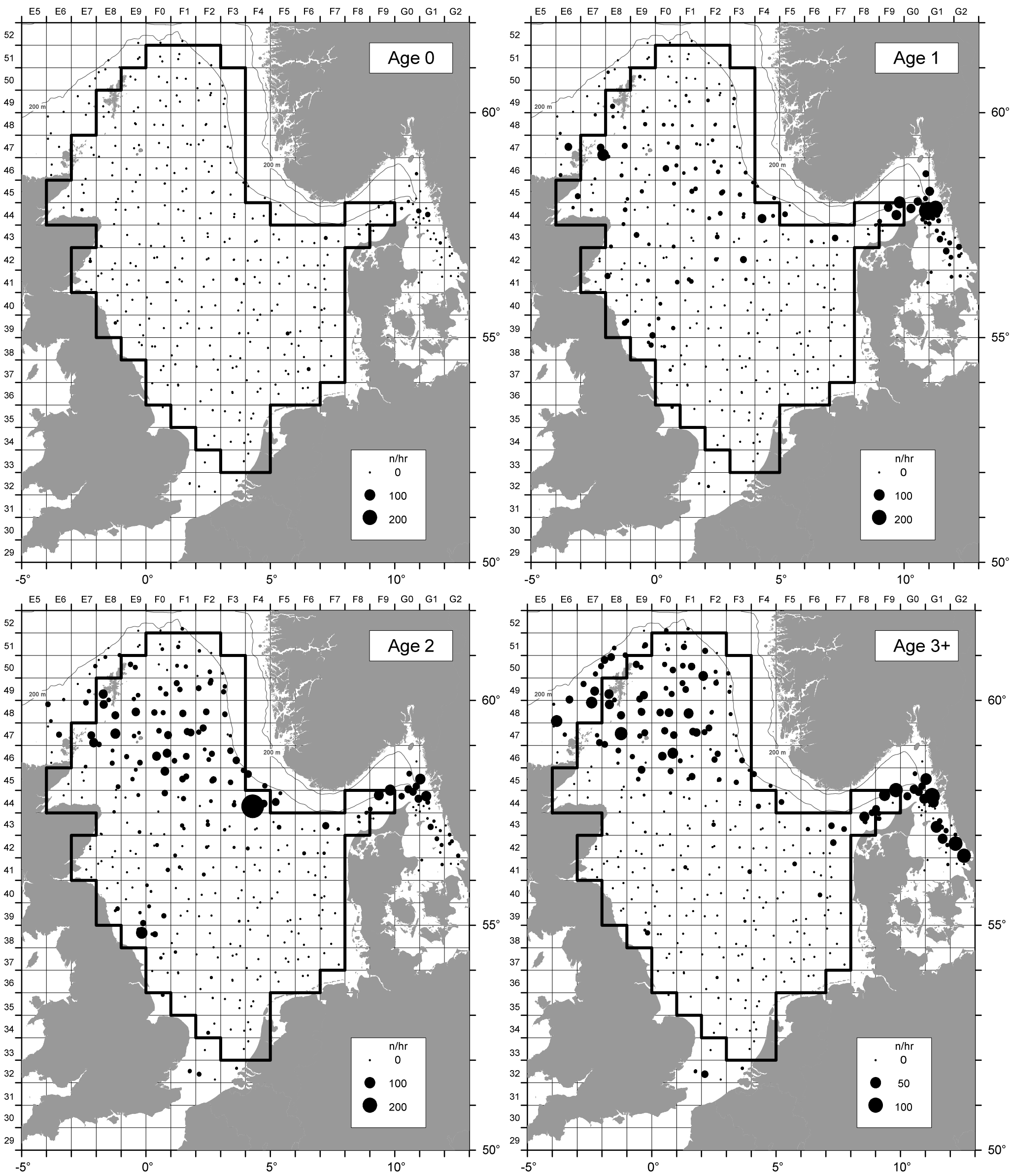



**Figure 5.1.6.3a. Distribution of cod in the quarter 3 IBTS 2015 (thick line: NS cod index area).**

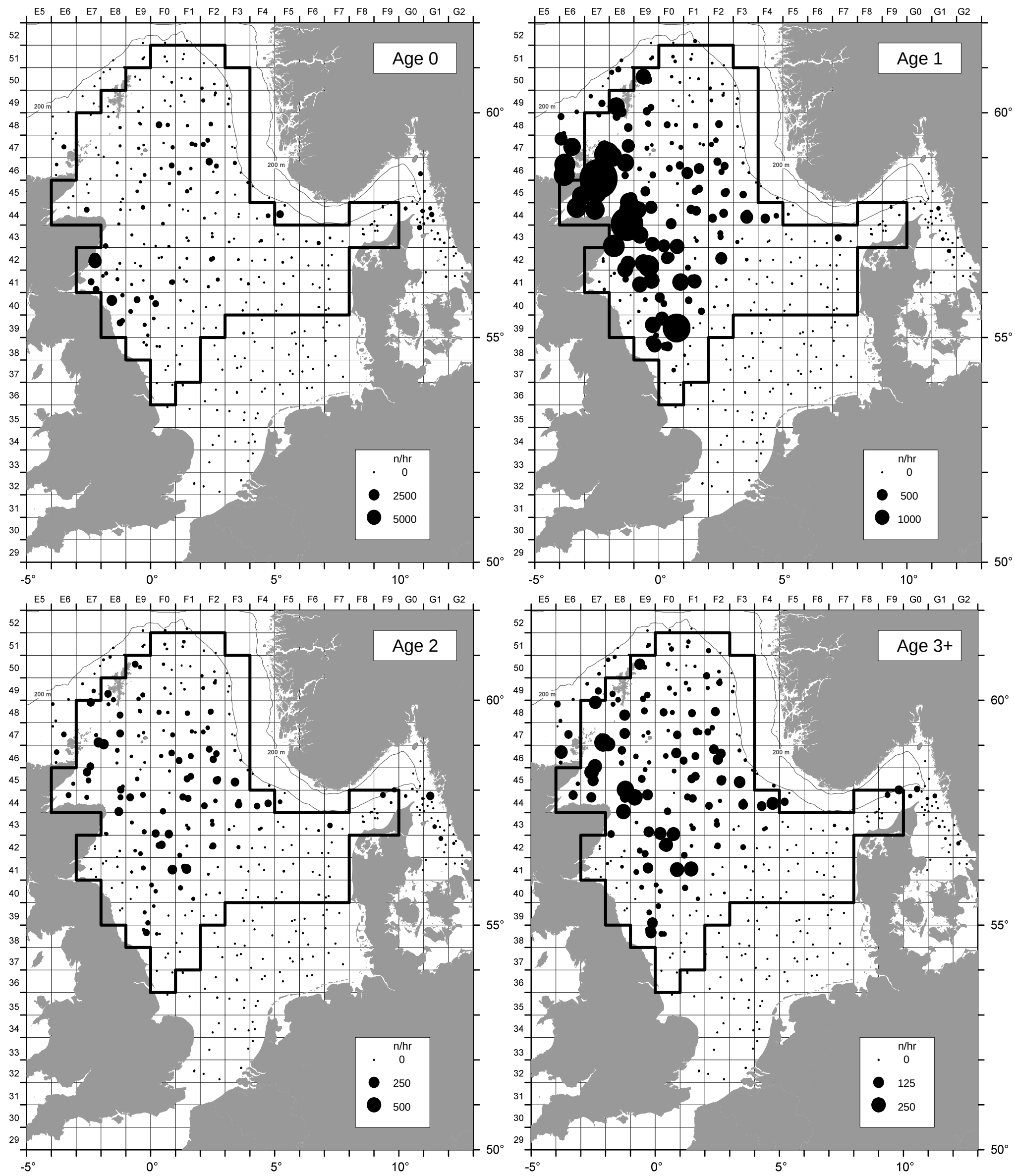



**Figure 5.1.6.3b. Distribution of haddock in the quarter 3 IBTS 2015 (thick line: NS haddock index area).**

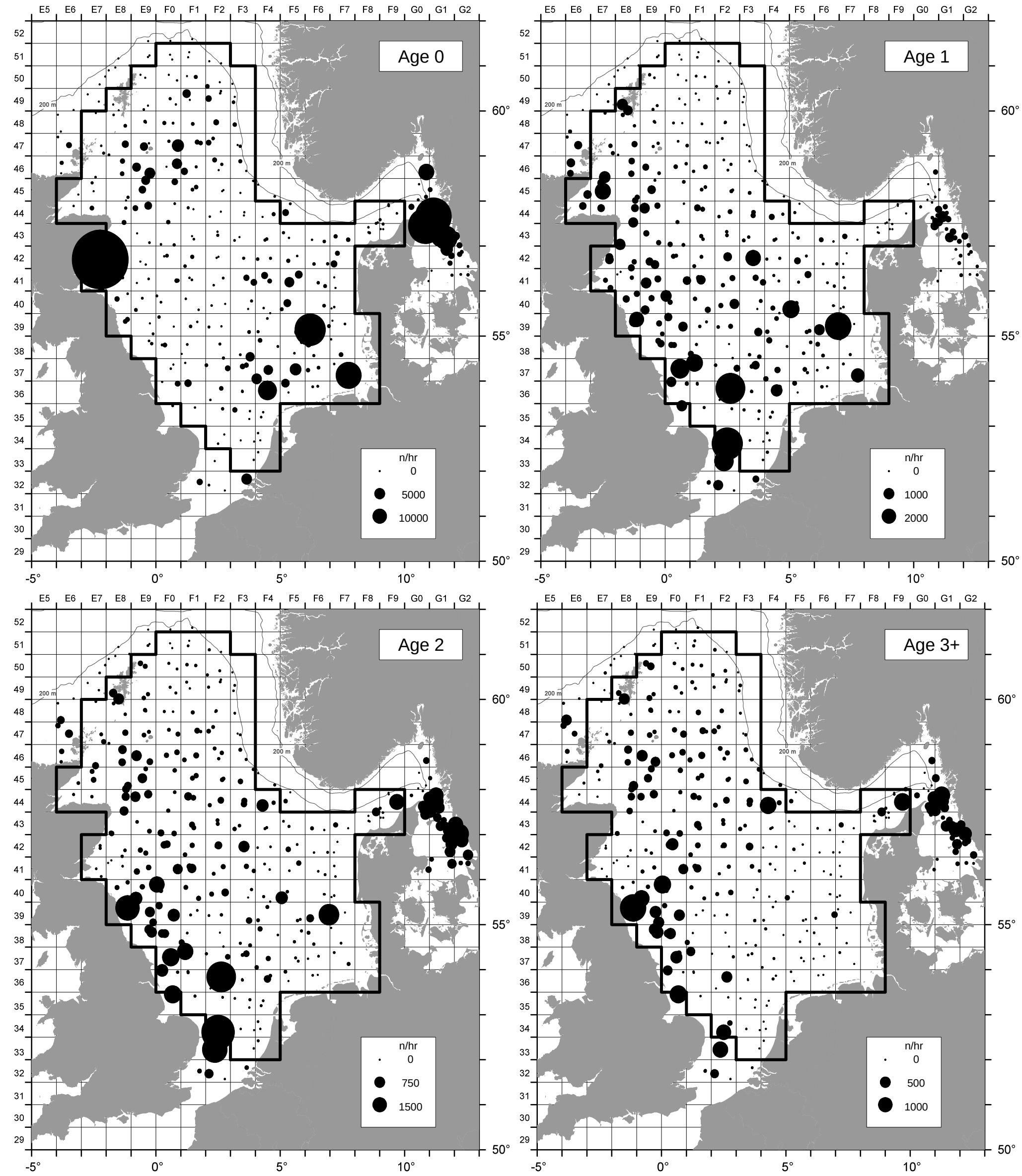



**Figure 5.1.6.3c. Distribution of whiting in the quarter 3 IBTS 2015 (thick line: NS whiting index area).**

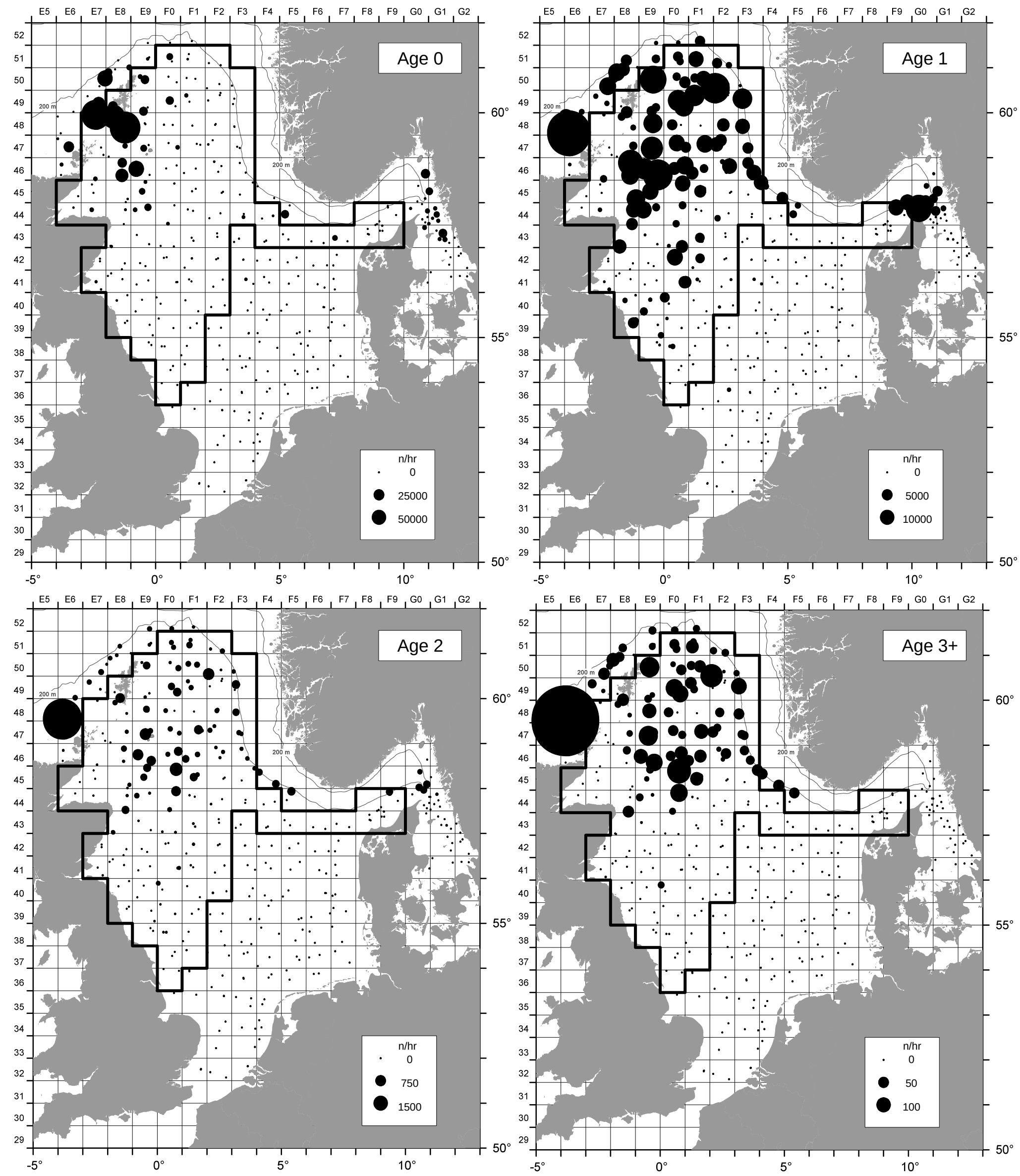



**Figure 5.1.6.3d. Distribution of Norway pout in the quarter 3 IBTS 2015 (thick line: NS Norway pout index area).**

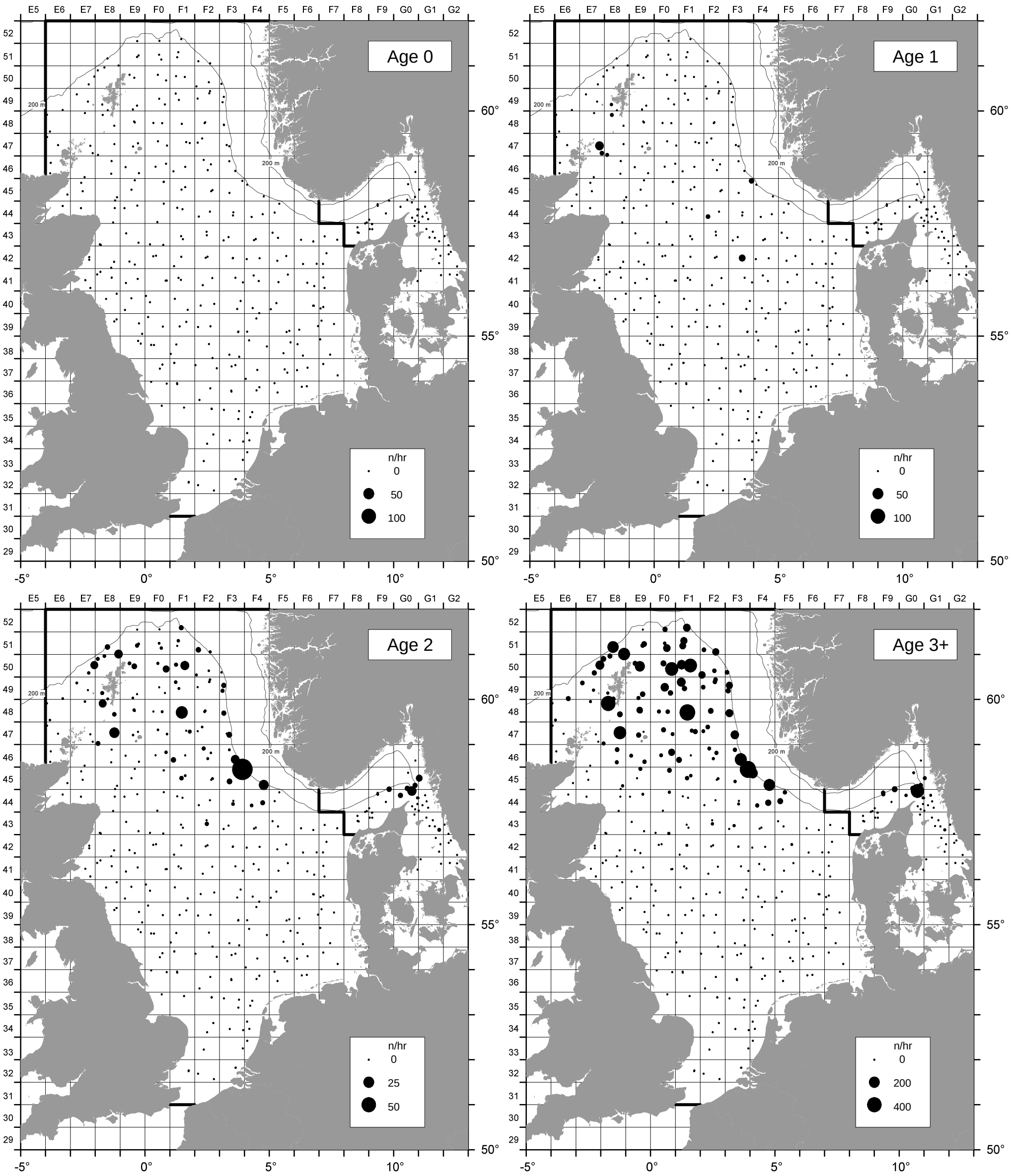



**Figure 5.1.6.3e. Distribution of saithe in the quarter 3 IBTS 2015 (thick line: ICES North Sea (area IV) border.**

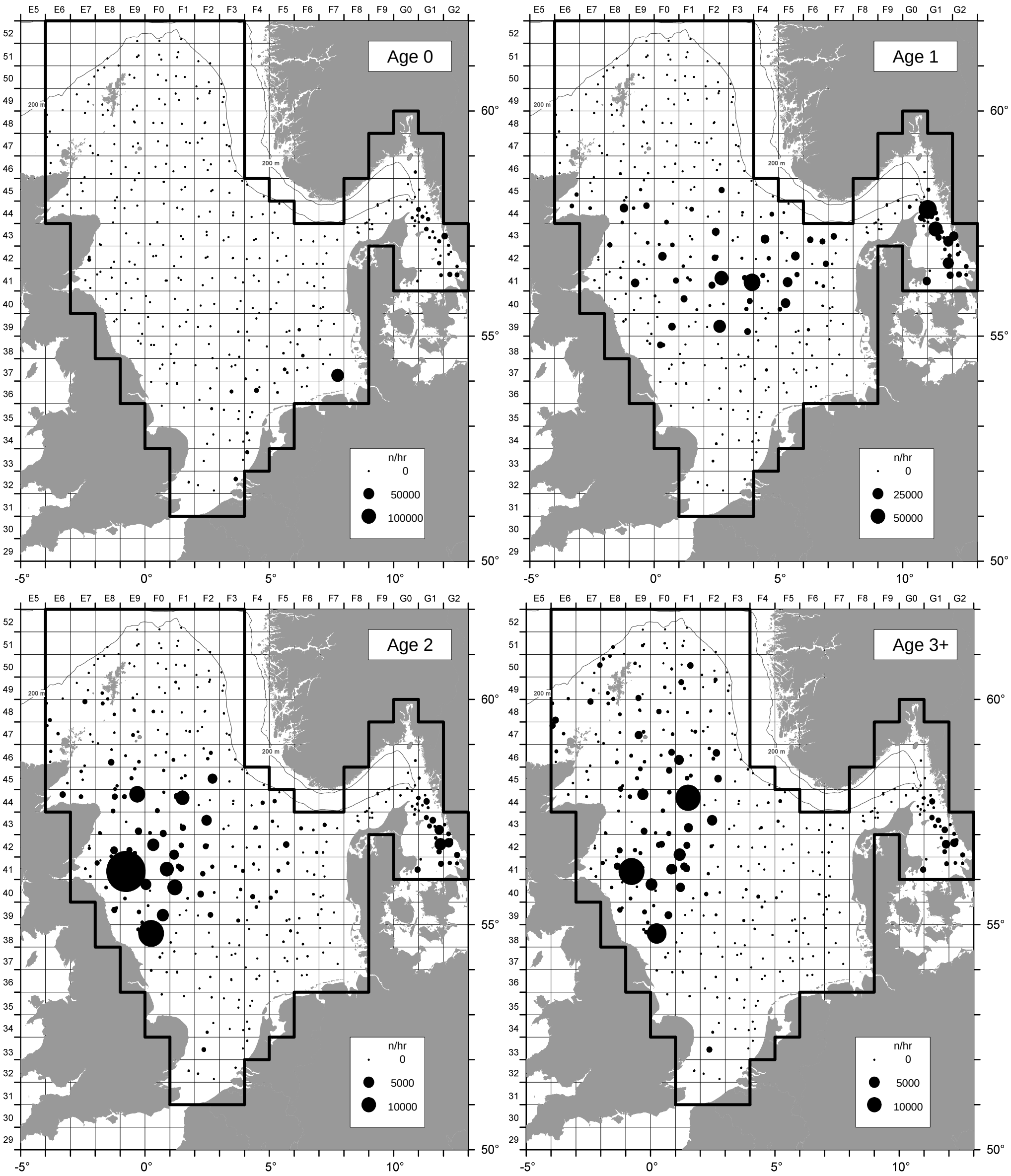



**Figure 5.1.6.3f. Distribution of herring in the quarter 3 IBTS 2015 (thick line: NS herring index area in the 3rd quarter).**

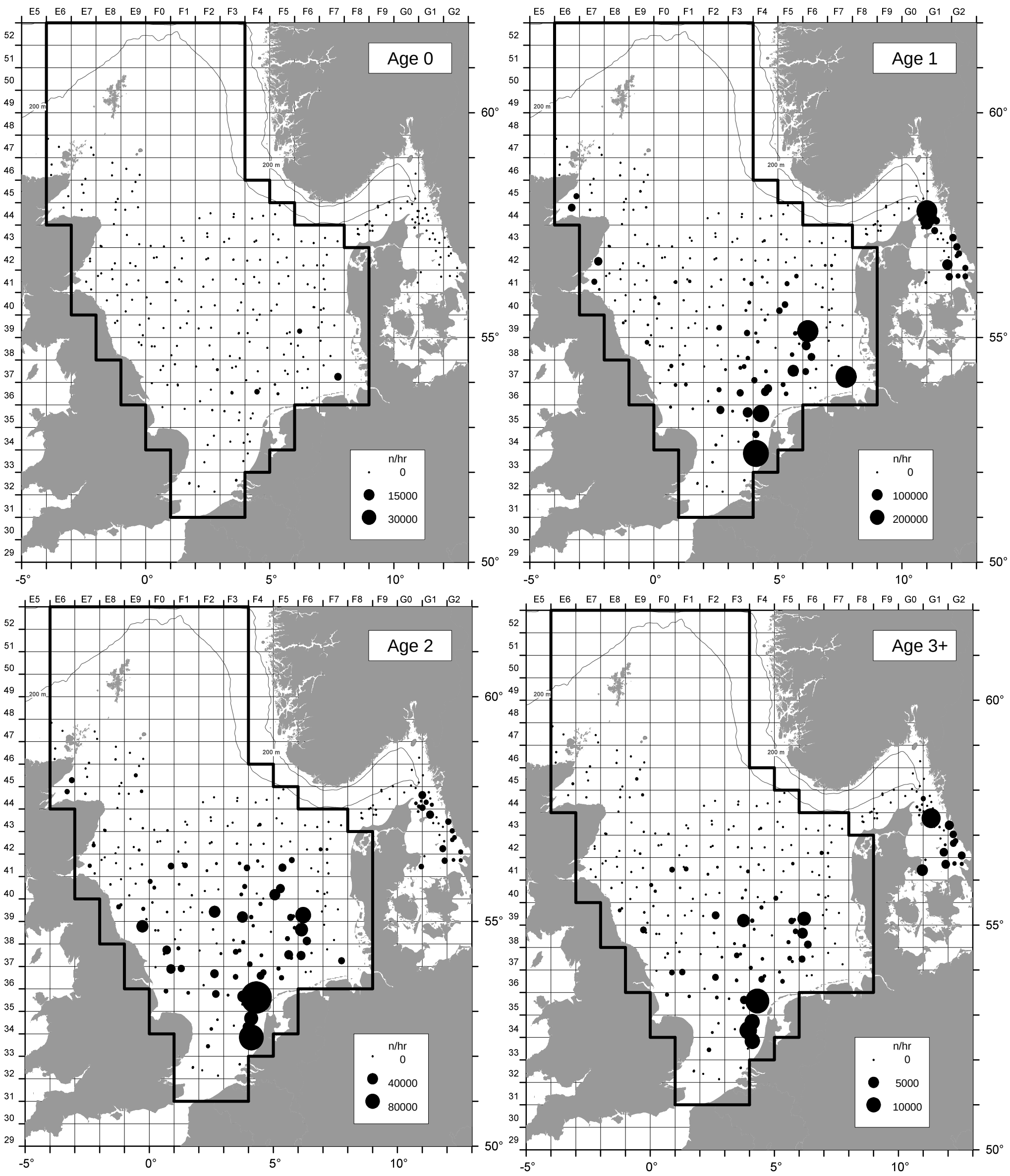



**Figure 5.1.6.3g. Distribution of sprat in the quarter 3 IBTS 2015 (thick line: NS sprat index area).**

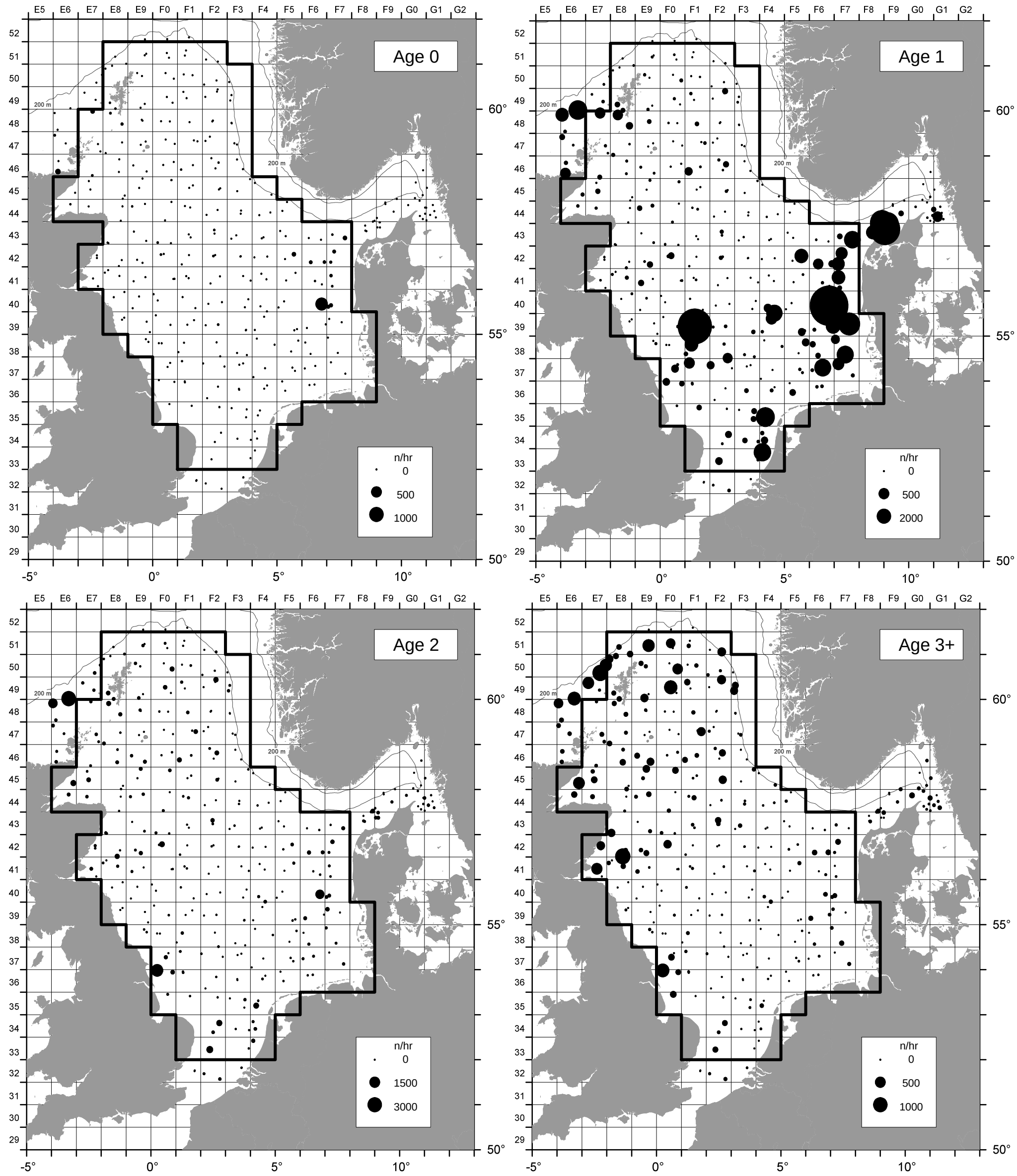



**Figure 5.1.6.3h. Distribution of mackerel in the quarter 3 IBTS 2015 (thick line: NS mackerel index area).**

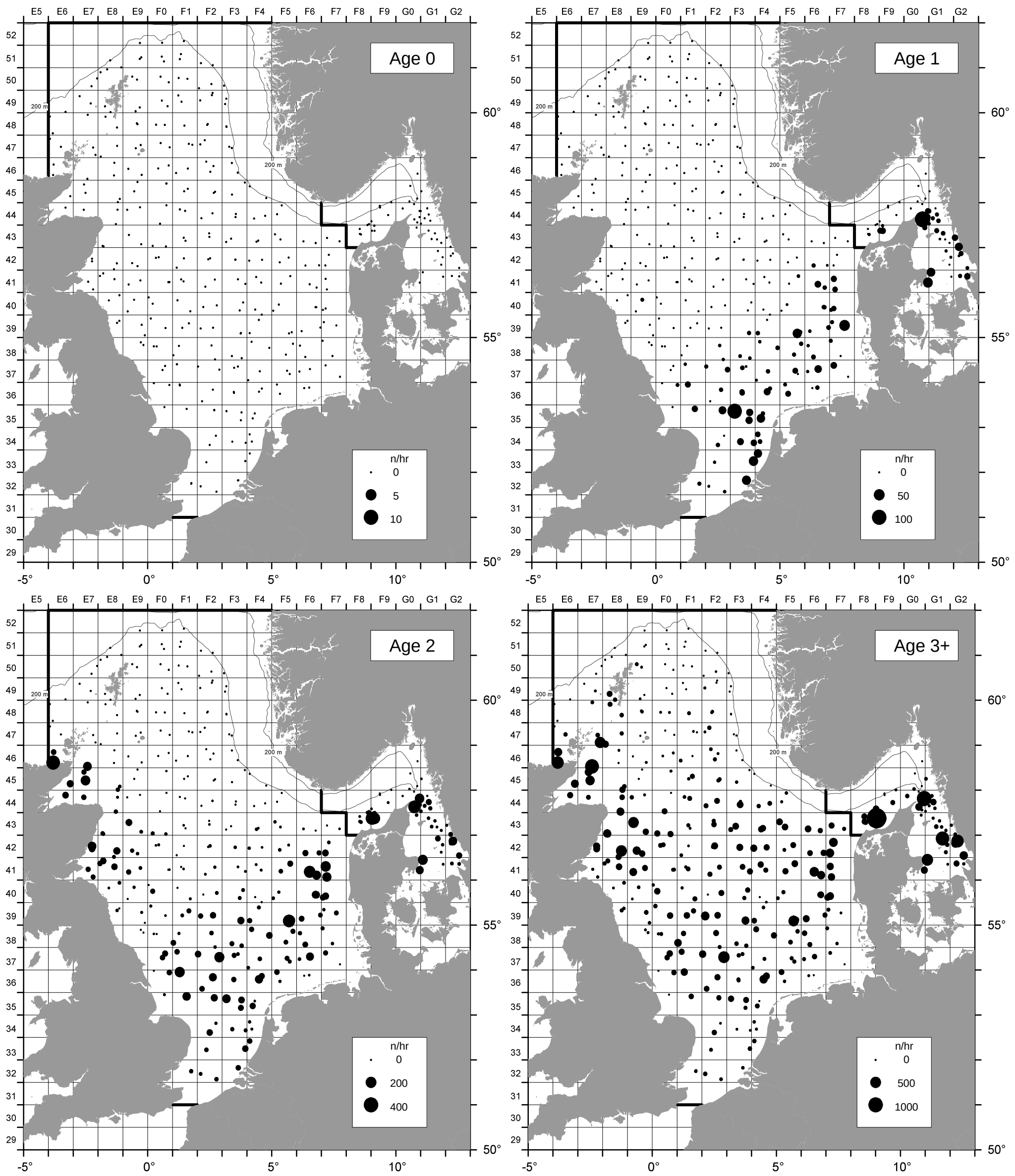



**Figure 5.1.6.3i. Distribution of plaice in the quarter 3 IBTS 2015 (thick line: ICES North Sea (ICES Area 4 border).**

### 5.1.7 Planning and participation in 2016

All regularly contributing countries intend to participate in the quarter 3 2016 NS-IBTS survey program. Below is a table showing the expected program dates for each country for this year.

| | | |
|---|---|---|
| England | Cefas Endeavour | 8 August to 6 September |
| Denmark | Dana | 2 August to 19 August |
| Germany | Walther Herwig III | 21 July to 19 August |
| Norway | Johan Hjort | 15 July to 13 August |
| Scotland | Scotia | 5 August to 25 August |
| Sweden | Dana | 22 August to 2 September |

No major changes in the rectangle allocation scheme are planned and a continuation of the distribution of 15 and 30 min tows is suggested for 2016 (Figure 5.1.7.1). However, a final version of this of the sampling scheme will provided to the survey participants by the NS-IBTS 3Q coordinator first in June 2016.

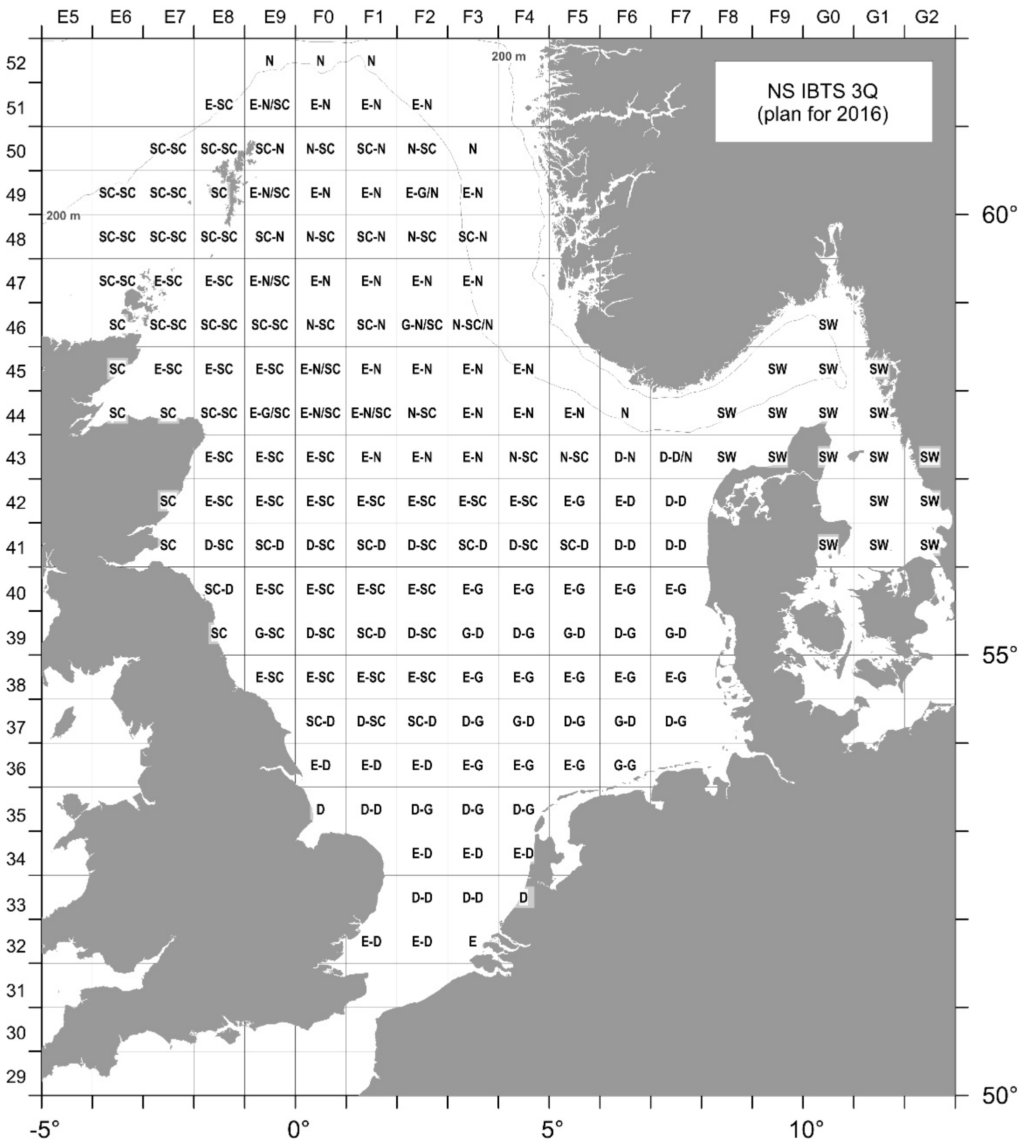



**Figure 5.1.7.1. Tentatively planned rectangle allocation by country for the 3Q survey in 2015 (D: Denmark, E: England, G: Germany, N: Norway, SC: Scotland, SW: Sweden; country named first in a rectangle is supposed to conduct a standard 30 min tow whereas the second country should conduct a 15 min tow; preliminary version).**

## 5.1.8 Other issues

### 5.1.8.1 Staff exchange

No staff exchange has occurred during the 2015 Q3 surveys, and no concrete plans are there yet to have an exchange in 2016. However, IBTSWG continues to encourage staff exchange.

#### 5.1.8.2 Data exchange

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 at least for the NS-IBTS main target species including the age information are usually submitted to DATRAS within 2 to 3 weeks after completion of the survey.

## 5.2 North Sea Q1

### 5.2.1 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 Areas IIIa, IV, and VIId. During daytime, a bottom trawl was used. This is the GOV (Grand Ouverture Verticale), with groundgear A or B. 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 full quarter 1, 2016 fleet consisted of six vessels: “Dana” (Sweden+ Denmark), “G.O. Sars” (Norway), “Scotia” (Scotland), “Thalassa” (France), “Cefas Endeavour” (Netherlands) and “Walther Herwig III” (Germany). The survey covered the period 13 January to 25 February 2016 (Table 5.2.1.1).

The weather during the 2016 IBTS was not great, especially the Germans experienced weather related problems. However, it still resulted in a total of 377 GOV of which 14 were invalid (Table 5.2.1.2) and 661 MIK (Table 5.2.1.3) hauls were carried out (Figures 5.2.1.1 and 5.2.1.2). All rectangles were covered by at least 1 GOV haul and all planned rectangles were covered by at least 1 MIK haul. Norway has extended the coverage northwards by covering three additional rectangles (52E9, 52F0, 52F1).

Biological data are collected from a number of species, for most of these species length, weight, gender, and maturity and age material was collected (Table 5.2.1.4). An impression of the catches is given in Figure 5.2.1.3, by presenting the total catch in kilogrammes.

A specific comment is to be made on the Dutch participation in 2016: Regularly the Dutch use the vessel RV Tridens II, however this was refitted at the time of the survey. Therefore as in 2015, the Cefas Endeavour was used (with the Dutch gear combined with the doors from Endeavour), providing less time for the Dutch to execute their survey. During the survey, the French offered to cover a number of stations in the Channel to help the Dutch with their reduced time. So in the southern part there is a number of rectangles covered twice by France, in contrast to previous years.

**Table 5.2.1.1. Overview of the surveys performed during the North Sea IBTS Q1 survey in 2016.**

| | | January | | | | | | | | | | | | | | | | | | | | | February | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| country | Vessel | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 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 |
| Sweden | Dana | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| France | Thalassa II | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Norway | G.O. Sars | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Germany | Walther Herwig III | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scotland | Scotia III | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | Dana | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | Tridens 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Table 5.2.1.2. Overview of the GOV stations fish in the North Sea IBTS Q1 survey in 2016.**

| ICES Divisions | Country | Gear | Tows planned | Valid | Additional | Invalid | % stations fished |
|---|---|---|---|---|---|---|---|
| **3a** | SWE | GOV-A | 38 | 38 | 8 | | 121% |
| | DEN | GOV-A | 0 | | 3 | | |
| **4** | GFR | GOV-A | 76 | 48 | | | 63% |
| | NOR | GOV-A | 42 | 42 | 11 | 6 | 126% |
| | FRA | GOV-A | 56 | 57 | | 1 | 102% |
| | DEN | GOV-A | 40 | 38 | | | 95% |
| | NED | GOV-A | 49 | 49 | 1 | 1 | 102% |
| | SCO | GOV-A | 14 | 14 | | 1 | 100% |
| | SCO | GOV-B | 43 | 41 | 2 | 2 | 100% |
| **7d** | FRA | GOV-A | 5 | 5 | 2 | 2 | 140% |
| | NED | GOV-A | 5 | 1 | | 1 | 20% |

**Table 5.2.1.3. Overview of the MIK stations fish in the North Sea IBTS Q1 survey in 2016.**

| ICES Divisions | Country | Gear | Tows planned | Valid | Additional | Invalid | % stations fished |
|---|---|---|---|---|---|---|---|
| **3a** | SWE | MIK | 57 | 62 | | | 109% |
| | DEN | MIK | 0 | 4 | | | |
| **4** | GFR | MIK | 154 | 100 | | | 65% |
| | NOR | MIK | 80 | 110 | | | 138% |
| | FRA | MIK | 110 | 95 | | | 86% |
| | DEN | MIK | 78 | 78 | | | 100% |
| | NED | MIK | 98 | 90 | | 3 | 92% |
| | SCO | MIK | 112 | 99 | | | 88% |
| **7d** | FRA | MIK | 10 | 23 | | | 230% |
| | NED | MIK | 10 | 0 | | | 0% |

**Table 5.2.1.4. Overview of individual length, weight and/or maturity and/or age samples collected during the North Sea IBTS Q1 survey in 2016.**

| Species | DEN | FRA | GFR | NED | NOR | SCO | SWE | Total |
|---|---|---|---|---|---|---|---|---|
| *Clupea harengus* | 863 | 553 | 703 | 544 | 567 | 648 | 1452 | 5330 |
| *Merlangius merlangus* | 310 | 605 | 290 | 463 | 734 | 681 | 477 | 3560 |
| *Sprattus sprattus* | 523 | 434 | 364 | 602 | 331 | 72 | 888 | 3214 |
| *Pleuronectes platessa* | 719 | 384 | 225 | 390 | | 174 | 683 | 2575 |
| *Melanogrammus aeglefinus* | 112 | 86 | 223 | 103 | 688 | 852 | 259 | 2323 |
| *Gadus morhua* | 64 | 52 | 152 | 93 | 329 | 579 | 785 | 2054 |
| *Trisopterus esmarkii* | 74 | 46 | 80 | 49 | 376 | 376 | 142 | 1143 |
| *Pollachius virens* | 2 | | 15 | | 434 | 136 | 87 | 674 |
| *Microstomus kitt* | 157 | 99 | 162 | | | 118 | 36 | 572 |
| *Scomber scombrus* | 6 | | 85 | 13 | 397 | 45 | | 546 |
| *Eutrigla gurnardus* | | | 421 | | | | | 421 |
| *Merluccius merluccius* | | | 34 | 3 | | 110 | 105 | 252 |
| *Trachinus draco* | | | | | | | 171 | 171 |
| *Ammodytes marinus* | | | | 105 | | | | 105 |
| *Glyptocephalus cynoglossus* | 18 | | | | | | 84 | 102 |
| *Solea solea* | 19 | 9 | | | | | 64 | 92 |
| *Raja montagui* | | | 4 | | | 77 | | 81 |
| *Engraulis encrasicolus* | | | 70 | | | | | 70 |
| *Lophius piscatorius* | 1 | | 14 | | | 54 | | 69 |
| *Amblyraja radiata* | | | 24 | | 27 | 16 | | 67 |
| *Nephrops norvegicus* | | | | | 65 | | | 65 |
| *Trachurus trachurus* | | | | | 65 | | | 65 |
| *Sardina pilchardus* | | | 58 | | | | | 58 |
| *Lepidorhombus whiffiagonis* | | | | | | 57 | | 57 |
| *Scyliorhinus canicula* | | | 29 | | 15 | 9 | | 53 |
| *Ammodytes tobianus* | | | | 51 | | | | 51 |
| *Buglossidium luteum* | | | | 48 | | | | 48 |
| *Leucoraja naevus* | | | 1 | | 3 | 42 | | 46 |
| *Squalus acanthias* | | | 38 | | 3 | 3 | | 44 |
| *Scophthalmus maximus* | 13 | 6 | 2 | 10 | | | | 31 |
| *Mullus surmuletus* | | 30 | | | | | | 30 |
| *Dicentrarchus labrax* | | 23 | | | | | | 23 |
| *Chelidonichthys cuculus* | | 21 | | | | | | 21 |
| *Arnoglossus laterna* | | | | 20 | | | | 20 |
| *Mustelus asterias* | | | 3 | | 2 | 14 | | 19 |
| *Lithodes maja* | | | | | 18 | | | 18 |
| *Scophthalmus rhombus* | | 4 | 3 | 3 | | | | 10 |
| *Dipturus intermedia* | | | | | | 10 | | 10 |
| *Rossia macrosoma* | | | | | 9 | | | 9 |
| *Dipturus flossada* | | | | | | 1 | | 1 |
| *Galeus melastomus* | | | | | 1 | | | 1 |
| *Leucoraja fullonica* | | | | | | 1 | | 1 |
| *Raja brachyura* | | | | | | 1 | | 1 |
| *Pollachius pollahius* | | 1 | | | | | | 1 |

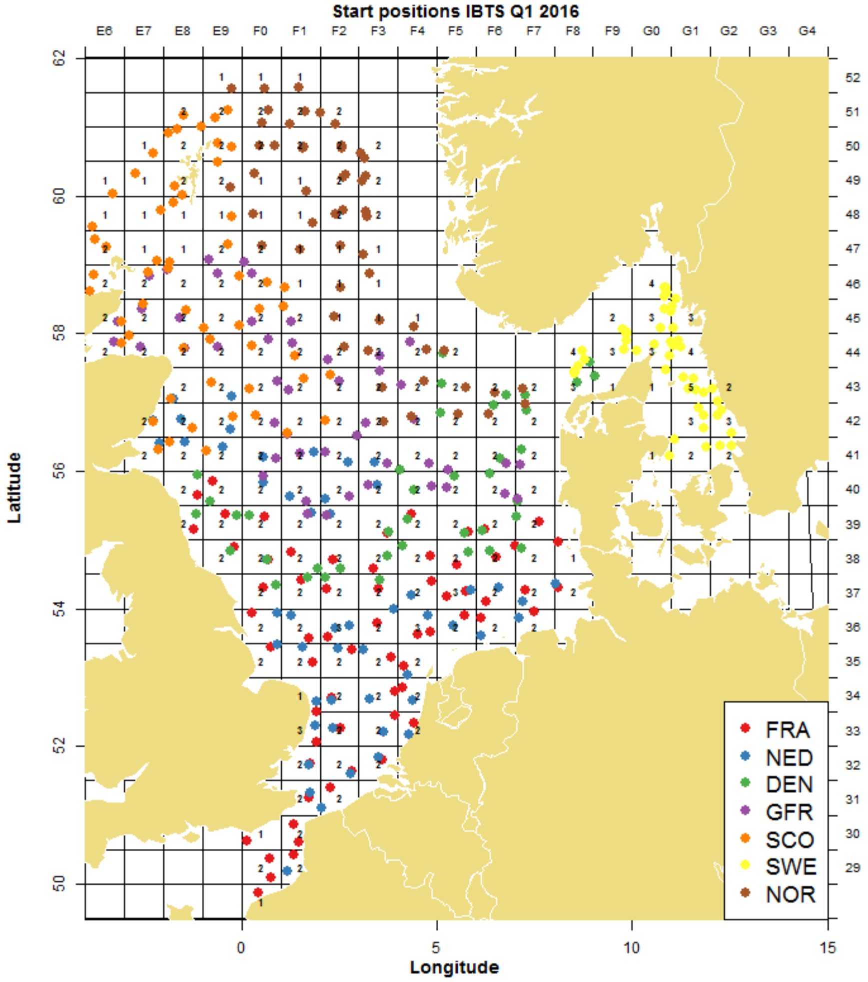



**Figure** 5.2.1.1. **Number of hauls per ICES-rectangle with GOV during the North Sea IBTS Q1 2016 and the start positions of the trawls by country.**

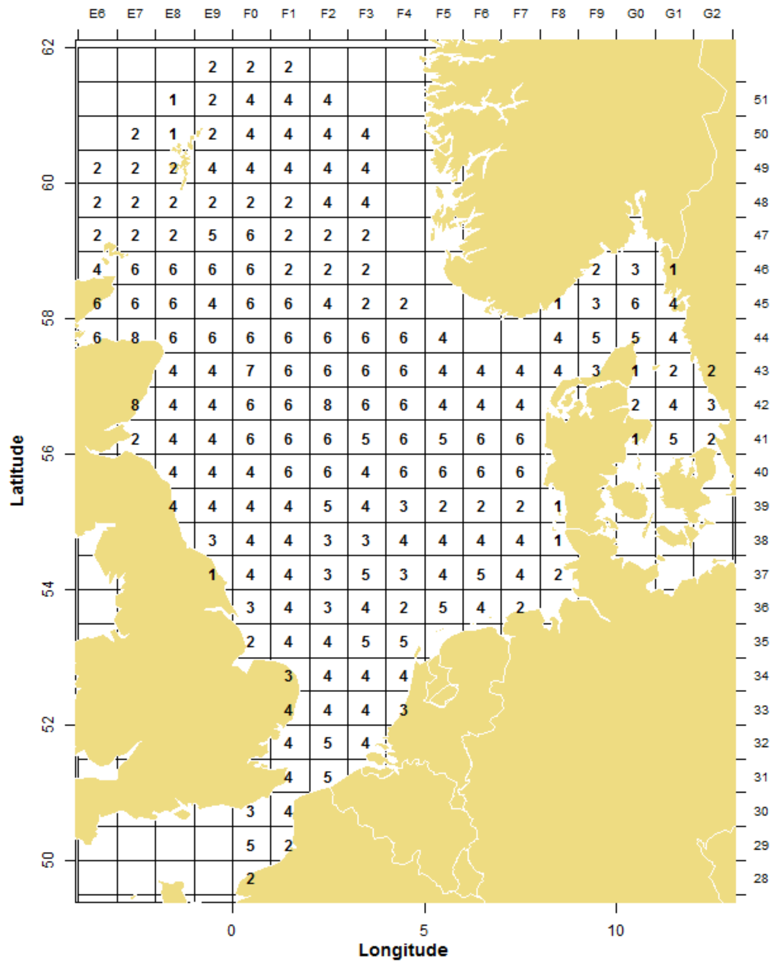



**Figure 5.2.1.2 Number of hauls per ICES-rectangle with MIK during the North Sea IBTS Q1 2016.**

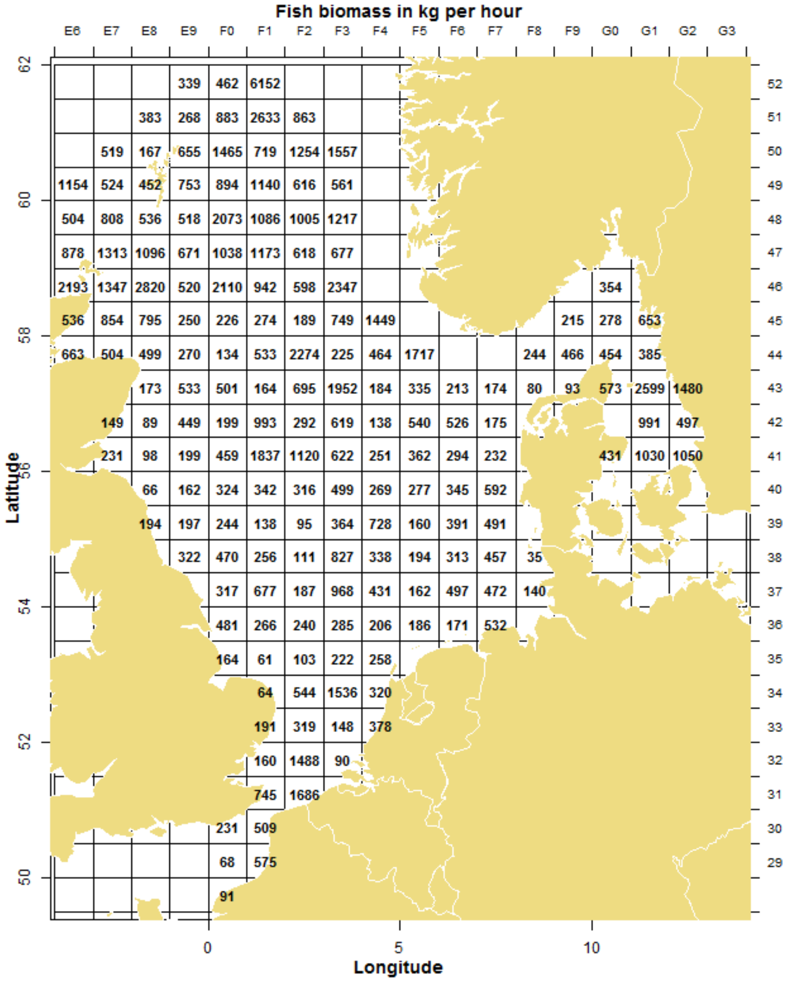



**Figure 5.2.1.3. Distribution of fish biomass in IBTS hauls by rectangle in the North Sea, Q1 2016 (values standardized to kg per hour haul duration; mean per rectangle).**

### 5.2.2 Issues and problems encountered

The German participation was severely affected by very rough weather. Only 63% and 66% of the MIK sampling could be completed. The resulting sampling gaps could partly be remedied by Scotland who took over 1 GOV and Norway who were able to complete 11 GOV and 26 MIK of the German obligations.

The Swedish, after last year's battering the wing sensors, fixed the sensors in aluminium shells and mounted right in front of the tip of the wing. This arrangement proved to be very successful, the wings seemed to be very stable and valid data were collected on all hauls.

The French did 15 additional tows of 15 min and the Dutch did 1 additional 15 min tow.

### 5.2.3 Additional activities

Next to the GOV and MIK tows, all countries have collected additional data. All countries collected seabed 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 5.2.3.1.

**Table 5.2.3.1. Overview of additional activities in the North Sea IBTS Q1 survey in 2015.**

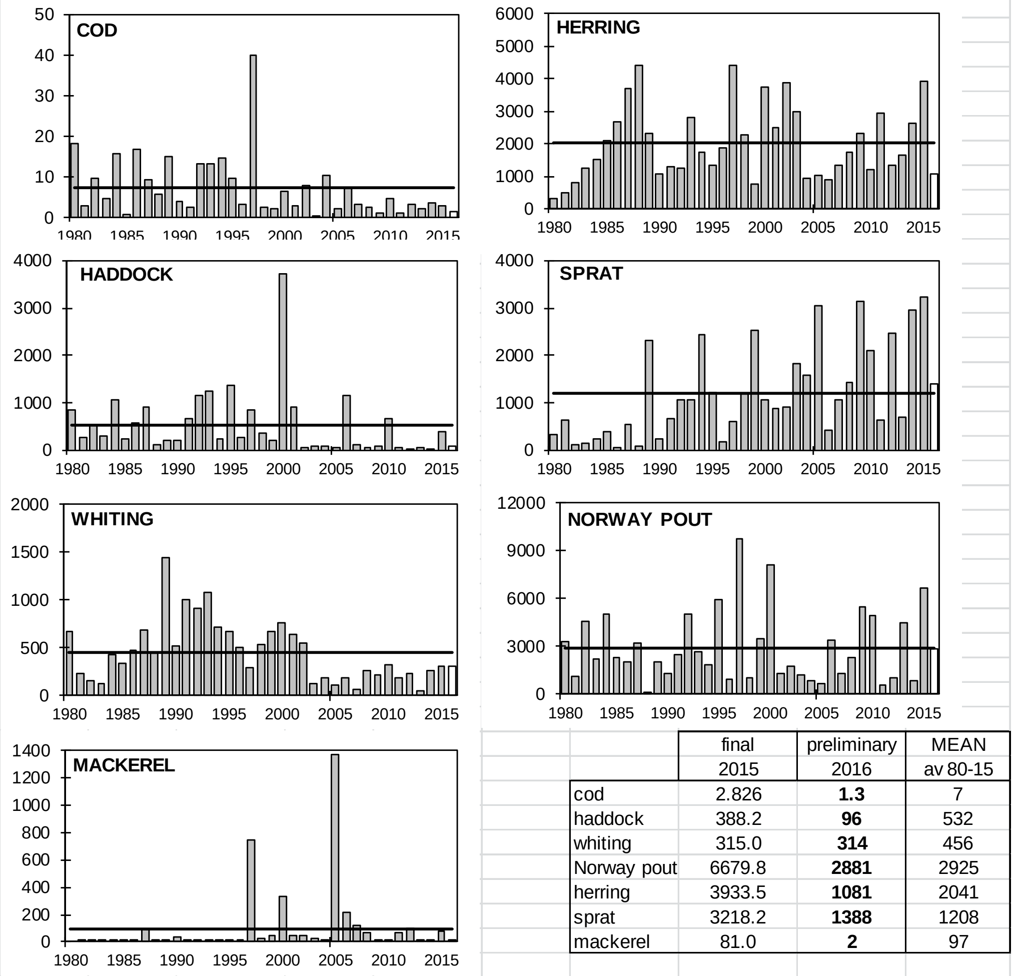
| ACTIVITY | GFR | NOR | SCO | DEN | NED | SWE | FRA |
|---|---|---|---|---|---|---|---|
| **CTD (temperature+salinity)** | x | x | x | x | x | x | x |
| **Seafloor Litter** | x | x | x | x | x | x | x |
| **Water sampler (Nutrients)** | | x | x | | | | |
| **Egg samples (Small fine-meshed ringnet, CUFES)** | | x | | | x | | x |
| **Taken as bycatch benthic animals** | | x | | | x | | |
| **Observers for mammals and/or birds** | | | | | | | x |
| **Additional biological data on fish** | | x | x | | | x | |
| **Benthic samples (boxcore, video, dredge)** | | | | | | | |
| **Zoo and phytoplankton** | | (x) | | | | | x |
| **Jellyfish** | | x | | | | | x |
| **Hydrological transect** | | x | | | | | |

### 5.2.4 GOV

The preliminary indices for the recruits of seven commercial species based on the 2016 quarter 1 survey are shown in Figure 5.2.4.1. According to these preliminary results, sprat and Norway pout are around the average values. All the other species are below the long-term average.

**International Bottom Trawl Survey: 1-group indices as average N/hour fishing** 4/4/2016

*1980-2015 Final indices, 2016 preliminary values based on:* 360 hauls




| | final 2015 | preliminary 2016 | MEAN av 80-15 |
|---|---|---|---|
| cod | 2.826 | **1.3** | 7 |
| haddock | 388.2 | **96** | 532 |
| whiting | 315.0 | **314** | 456 |
| Norway pout | 6679.8 | **2881** | 2925 |
| herring | 3933.5 | **1081** | 2041 |
| sprat | 3218.2 | **1388** | 1208 |
| mackerel | 81.0 | **2** | 97 |

**Figure 5.2.4.1. Time-series of indices for 1-group (1-ring) herring, sprat, haddock, cod, whiting, Norway pout, and mackerel caught during the quarter 1 IBTS survey in the North Sea, Skagerrak and Kattegat. Indices for the last year are preliminary, and based on a length split of the catches.**

### 5.2.5 MIK

For the ICES Herring Assessment Working Group for the area South of 62°N (HAWG), the IBTS survey provides recruitment indices and abundance estimates of adults of herring and sprat. Sampling at night with fine-meshed nets (MIK; Midwater Ringnet) was implemented from 1977 onwards, and the catch of herring larvae has been used for the estimation of 0-ringer abundance in the survey area. The 0-ringer abundance (IBTS-0 index) the total abundance of 0-ringers in the survey area is used as recruitment index for the North Sea herring stock. Index values are calculated as described in the HAWG report of 1996 (ICES, 1996/ACFM:10).

This year, 661 depth-integrated hauls were completed with the MIK-net. The coverage of the survey area was very good with at least 2 hauls in most of ICES rectangles in the North Sea as well as in Kattegat and Skagerrak. Few rectangles were only sampled once while there were no rectangles that could not be sampled at all. Index values are calculated as described in detail in the Stock Annex. This year, there were 66 hauls from the area south of 54°N with mean larval length < 20 mm which had to be excluded from the index calculation as specified in the calculation procedure. The index is, thus, calculated from the results of 595 hauls, and 4 rectangles, 30F0, 34F4, 36F4 and 36F6, in the Southern Bight and southern North Sea are not accounted for in the index calculation. These small larvae in the southern area are thought to be larvae of the Downs component of North Sea herring. The exclusion of these stations from the index should provide that the Downs component is not accounted for in the IBTS0 index.

Larvae measured between 7 and 39 mm standard length (SL). Contrasting to the previous years, the smallest larvae < 10 mm were much less numerous, while large numbers of medium sized larvae around 18 mm SL were caught. The smallest larvae were chiefly caught in 7d and in the Southern Bight. The medium sized larvae appeared chiefly and in large quantities in a band stretching along the Dutch, German, and Danish coasts as far North as north of 56°N. This resulted in a large number of stations with mean larval sizes < 20 mm SL north of 54°N that had, thus, to be kept in the index calculation. These small larvae can be assumed to represent the Downs larvae. Larger larvae were comparatively rare and much less abundant.

The new index value of 0-ringer abundance of the 2015 year class is estimated at 99.8. This index is much larger than last year's estimate for the 2014 year class. It is 92.5% of the long-term mean, and would indicate at the second highest recruitment since the 2001 year class. Overall, the larval herring abundance was low. Larvae were predominantly found in the more coastal areas in the North Sea, while the central North Sea, but also Kattegat and Skagerrak were almost devoid of larvae. Only in a few rectangles of the Southern Bight and in the German Bight mean abundance was exceptionally high. Only six of the rectangles in those areas (35F4, 39F6, 38F6, 38F7, 34F3, and 37F6) with most of the larvae around or less than 20 mm SL contributed to more than 65% of the total index (Figure 5.2.5.1). It is obvious that similarly to the high index in 2014, this year's 0-ringer index has to be treated with some care (see above).

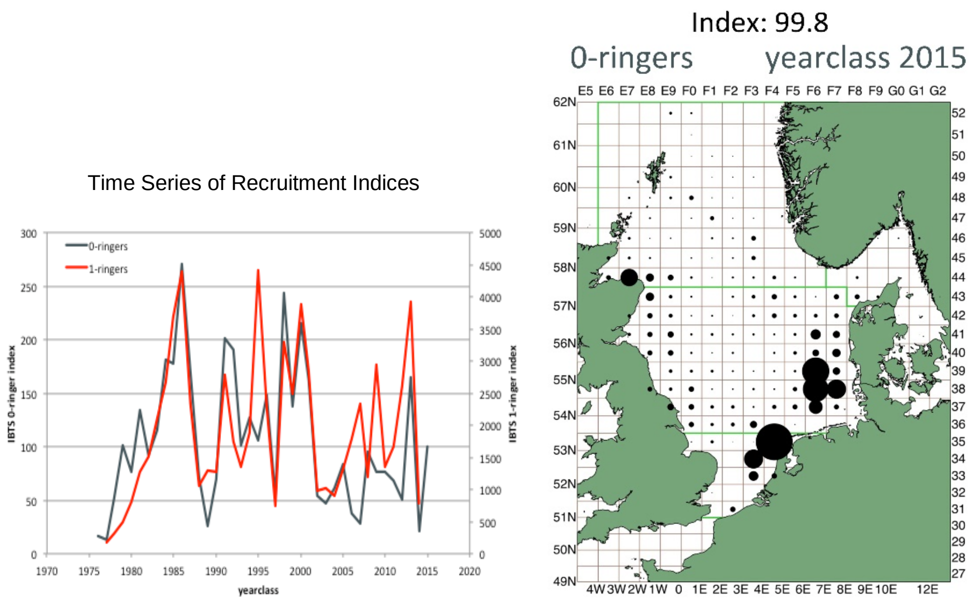



**Figure 5.2.5.1. Distribution of MIK caught herring larvae during the IBTS Q1 2016 (right) and the time-series of herring larvae and 1-ringers since 1976 (left).**

### 5.2.6 Planning and Participation in 2017

The French have announced to reduce their amount of days-at-sea available for the IBTS. The have announced to reduce their total available time from 26 days to minimally 20 days, which might even further reduce. Currently, their plan is to change the survey by leaving out the tows they yearly execute in the Seine Bay outside the IBTS area, this normally costs them 2 days. The rest of the survey they plan to organize as it was, leaving from Boulogne entering the Channel from the south, half way the trip have a one day crew exchange in Scheveningen and return back in Boulogne the last day. Effectively, this results in a minimum of 18 days available for fishing in the IBTS area. Currently, they on average are able to fish 3 GOV tows and 6-7 MIK tows during good days. At max, this results in 54 GOV tows and 126 MIK tows. Their current allocation is 61 GOV tows and 122 MIK tows. Thus even in the most optimal situation they are unable to cover their full share.

It is an unwanted situation when countries decide to reduce their effort for the survey. As this will affect the possibility to meet the objectives of the survey and put more pressure upon the other participants who are also under time pressure already. So far, time reductions have been coped more or less successfully. Less successful is how is coped with the German situation, were their available time has not been sufficient to cover their program for years now. Despite that, the program has stayed as it was and other countries offered to cover some of the German stations when possible. Some years this was possible in other years it resulted in a reduced number of tows in the northern North Sea, which is the area providing information for all the target species.

It is an option to deal with the French reduction similarly as is dealt with previous reductions, e.g. keep the program as it is, and follow the guidelines in the manual to have each rectangle covered by two countries on paper. In that case, good weather is required, and there is large pressure on the other countries to cover the tow positions that France (and Germany) will miss.

IBTSWG's strong opinion is however that it is no longer feasible to maintain the current program. It is clear to us that this will result in a reduction of tows and very likely in reduction of coverage of the ICES-rectangles. Therefore, IBTSWG proposes to loosen the current guidelines, rethink the current distribution of rectangles over countries and increase the number of rectangles covered by a single country.

**Cons:**

- Country specific time-series in fixed areas will be broken;
- Increased risk of losing spatial coverage as more rectangles are covered by a single country, in case of terrible weather or ship issues;
- Reduced overlap might hide differences in vessel/gear effects and species identification;
- Increased risk in reduction in the number of MIK tows as for a large number of rectangles it will be difficult to get 4 stations in with the current guidelines of 10 nm apart and 5 nm from the border of the rectangle;
- Countries will see a reduced spatial area of the North Sea, likely narrowing their view on the whole North Sea ecosystem.

**Pros:**

- Increased number of tows in the same amount of time;

- More likely to manage the full coverage of the survey area under normal conditions;
- Reduction in travel distance and with that a reduction in fuel consumption (8–16 k litres per day);
- A smaller local area, might increase for some countries the emphasis on national waters;
- Loosening the guidelines in the manual required to set new guidelines on which the distribution of rectangles takes places:
- Double coverage of the rectangles in the North Sea, except for partial rectangles were only a single safe tow is available;
- Spatial overlap between countries needs to be minimally 15 rectangles (except for Sweden who in the old situation had no overlap);
- Efficient distribution of the rectangles, related to the home harbour and potential mid trip brakes.

Following the new guidelines, the next maps show a first suggestion for reallocation of the rectangles and tows over the countries. The generated overlap between countries and countries doubling the same rectangle is shown in Table 5.2.6.1. Sweden has the lowest overlap of only two rectangles with Denmark, what is an increase compared to the old program. Than France has the lowest overlap of 16 rectangles with other countries. The total number of tows has reduced due to lower effort in a number of rectangle consisting of mainly land (Figure 5.2.6.1). For all but one of these rectangles effort was reduced from two to one tow, the effort in 38E8 has been removed from the scheme but this rectangle hasn't been fished in the last years either. The reduction resulted in 8 tows less for France. Germany and Scotland exchanged a single tow, were Germany lost one and Scotland got one more. For the other countries, the number of tows stayed the same.

**Table 5.2.6.1. The overlap between countries and in bold the number of rectangles covered twice by that single country in the proposed distribution of rectangles for IBTS Q1 2017.**

| | FRA | NED | NOR | SCO | DEN | SWE | GFR |
|---|---|---|---|---|---|---|---|
| **FRA** | 17 | 14 | 0 | 0 | 2 | 0 | 0 |
| **NED** | | 10 | 0 | 2 | 13 | 0 | 4 |
| **NOR** | | | 6 | 4 | 2 | 0 | 21 |
| **SCO** | | | | 10 | 0 | 0 | 25 |
| **DEN** | | | | | 2 | 2 | 15 |
| **SWE** | | | | | | | 0 |
| **GFR** | | | | | | | 5 |

This new allocation will reduce the comparability with earlier years, however also in those years swaps in rectangle took place. As a certain amount of overlap for each country is assured in the new guidelines potential vessel/country effects can be estimated and incorporated in a modelled index. This however requires adjustments of the current calculations of the indices and the current data products. As the otolith collection scheme has already changed to a tow-by-tow scheme there is no need to adjust this scheme with this new allocation of rectangles.

The view on the North Sea ecosystem has long been one of the main reasons behind the large spatial coverage most countries had. A reduced view affects individual scientists as well as the national institutes. This can be overcome by putting larger emphasis on staff exchanges, the reduced time pressure might free time and budget to put this addition emphasis on organising staff exchange. Furthermore, this is the proposal for 2017 alone, we will work on a rotating scheme such that countries can fish in slightly different areas each years and see a larger area of the North Sea. For example, in 2017 France covers the southern English coast and the Netherlands covers the Dutch coast and German Bight, this might be the other way around in 2018. As country/vessel affects are taken into the model such a rotating scheme should not affect the calculation of the index.

One of the major benefits is that with increasing the number of tows per rectangle and reducing the spatial extend of the survey area by vessel the distance travelled will be reduced. This increases the number of tows that can be done in the same amount of time, or vessels can steam more economically and ecologically. With some vessel using up to 16 k litter per day, steaming more economically might have a significant effect on the budget and the amount of $CO_2$ produced. When this is less of an incentive, maintaining vessel speed will likely result in more downtime that can be used for additional sampling for fish or MSFD indicators.

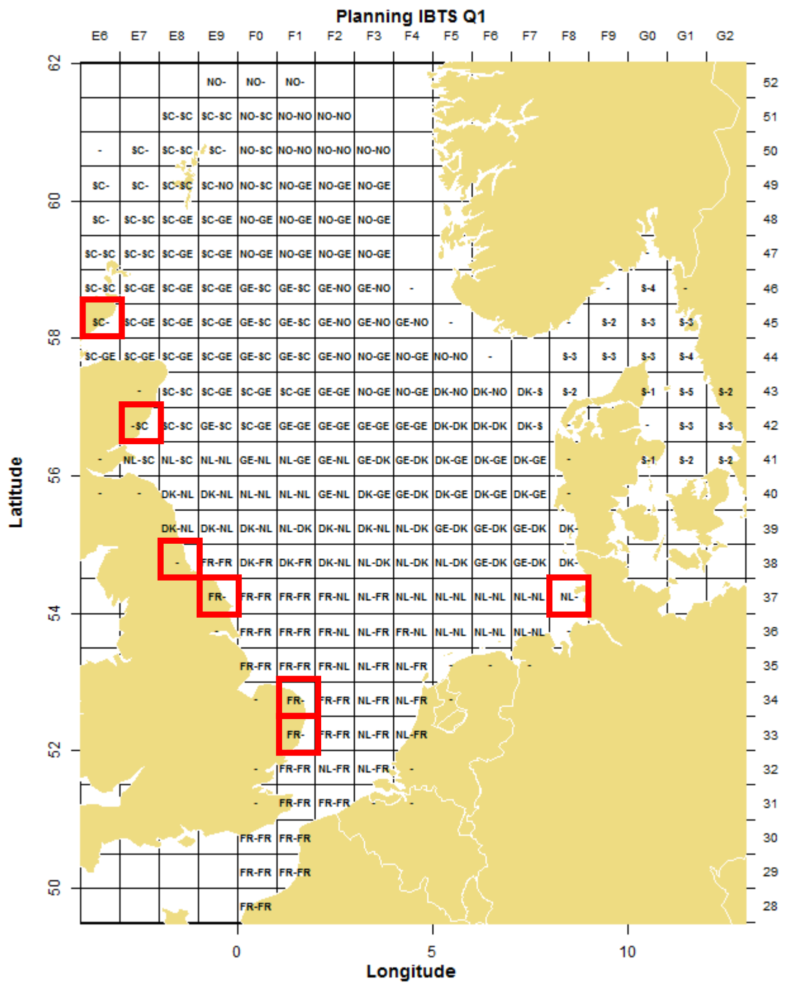



**Figure 5.2.6.1. Preliminary rectangles allocation map for Q1 2017, in red the rectangles in which effort has been reduced.**

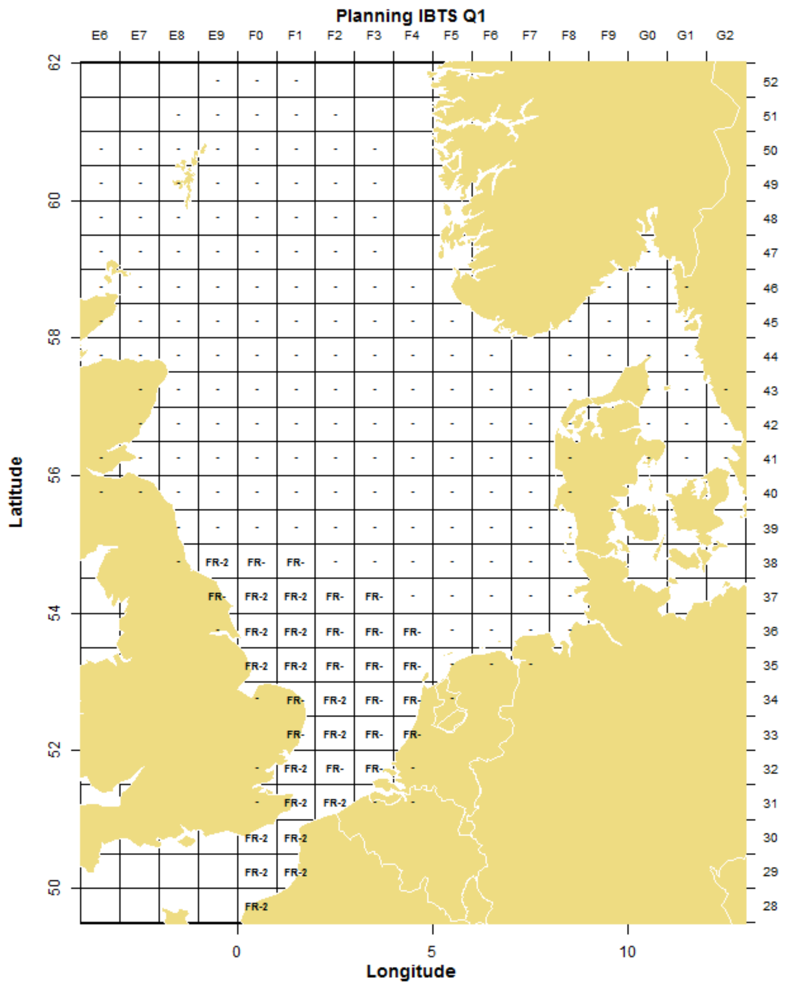



Figure 5.2.6.2. Preliminary rectangles allocation map for France in Q1 2017.

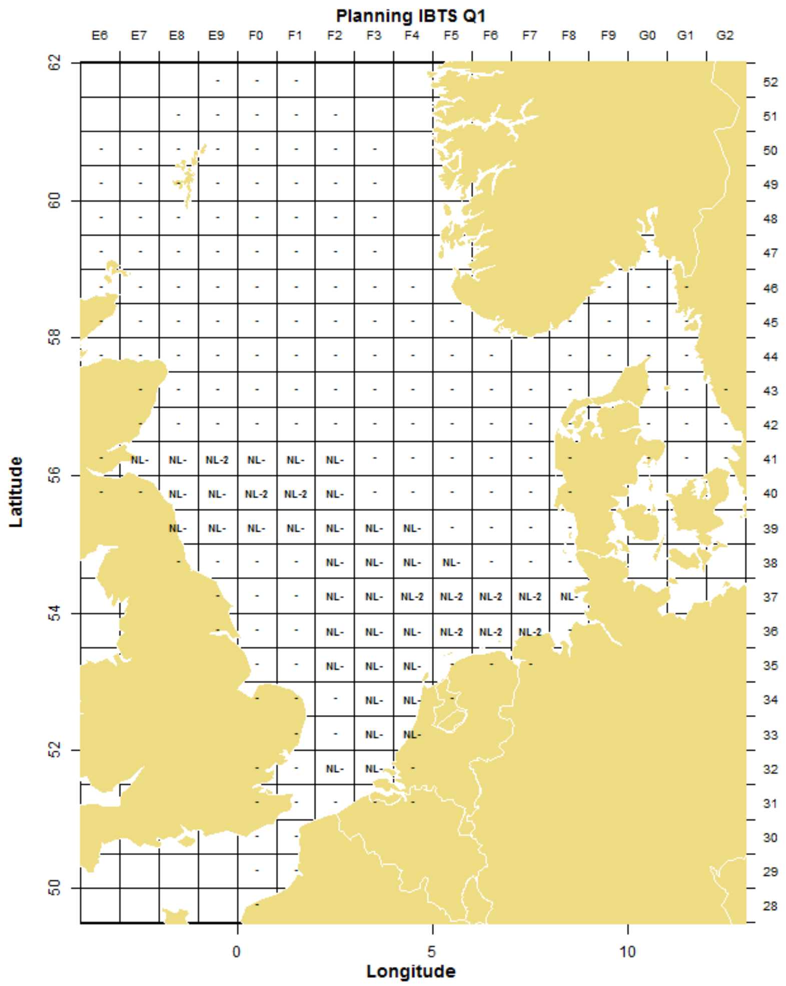



**Figure 5.2.6.3. Preliminary rectangles allocation map for the Netherlands in Q1 2017.**

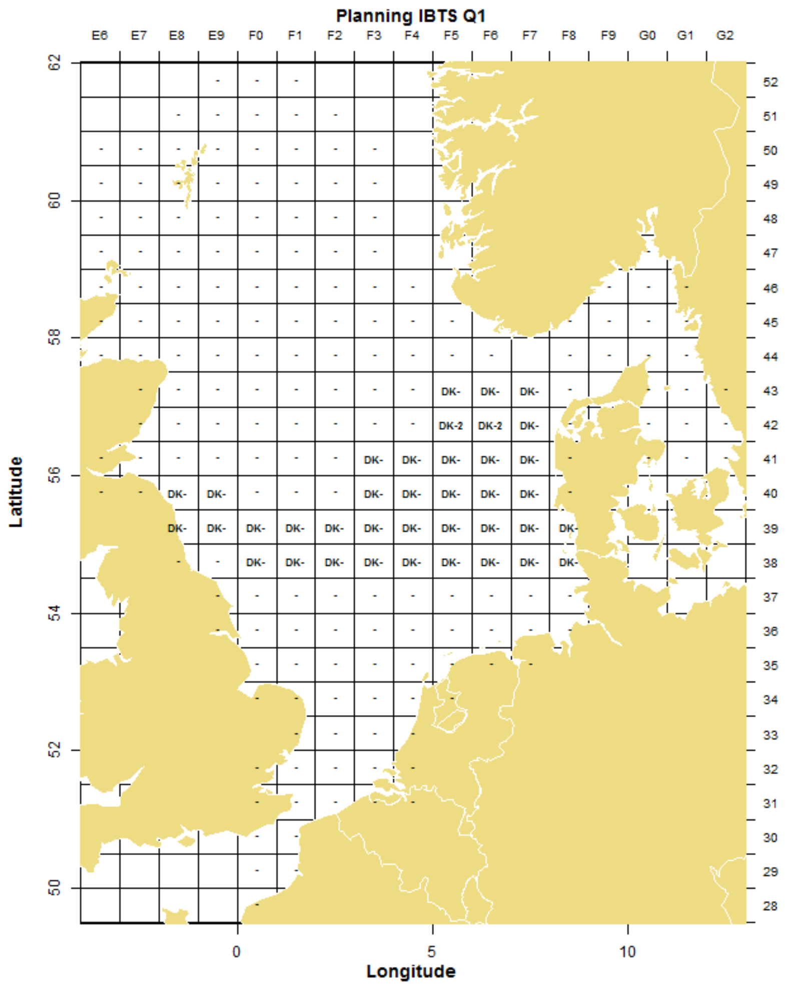



**Figure 5.2.6.4. Preliminary rectangle allocation map for Denmark in Q1 2017**

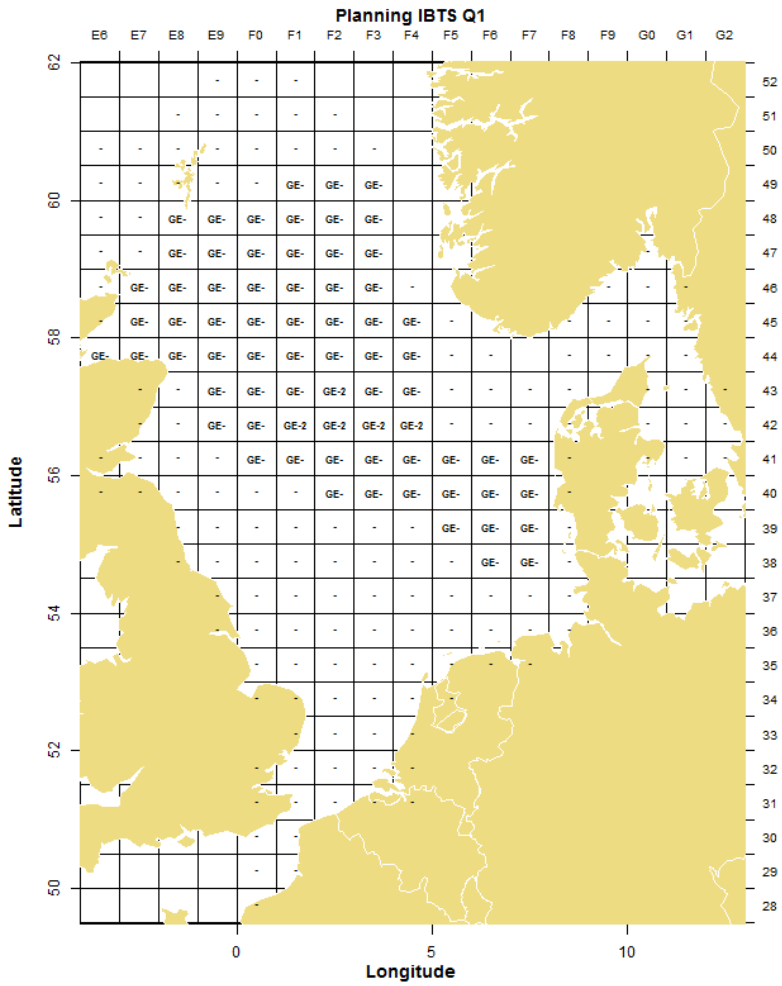



**Figure 5.2.6.5. Preliminary rectangle allocation map for Germany in Q1 2017.**

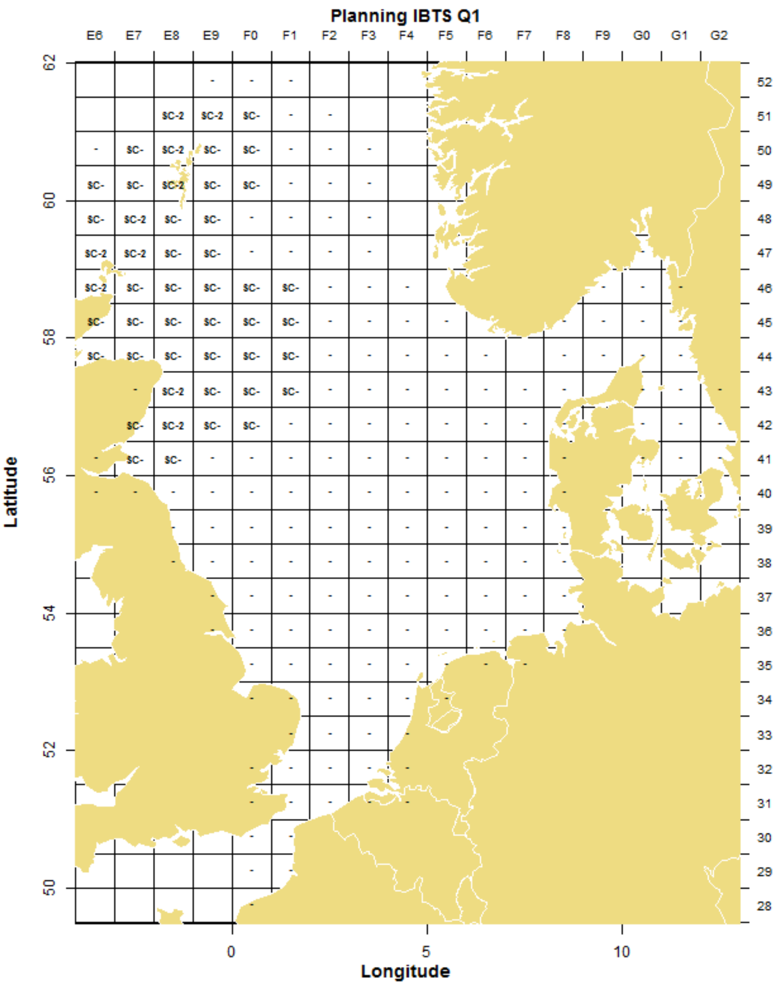



**Figure 5.2.6.6. Preliminary rectangle allocation map for Scotland in Q1 2017.**

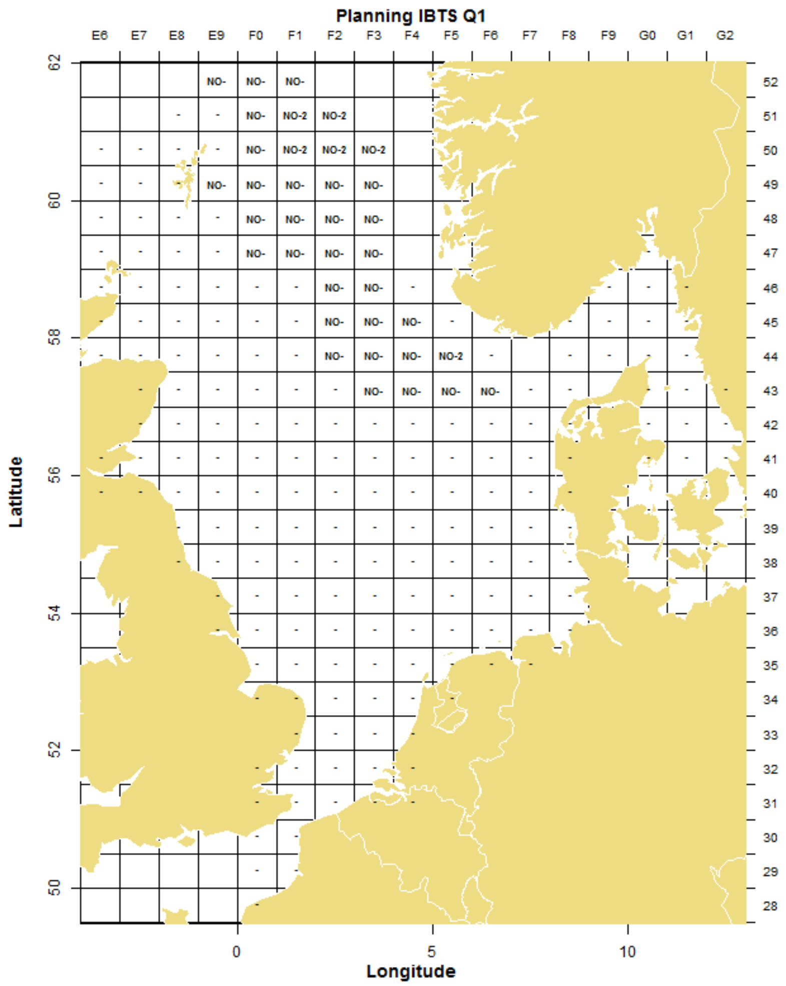



**Figure 5.2.6.7. Preliminary rectangle allocation map for Norway in Q1 2017.**

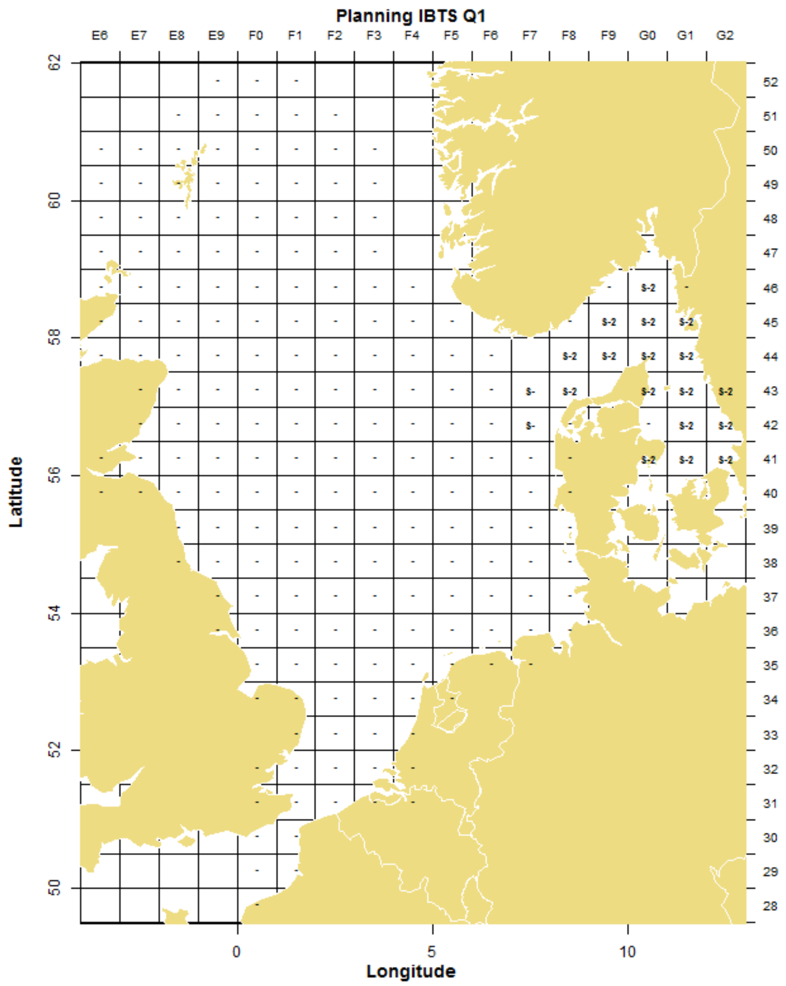



**Figure 5.2.6.8. Preliminary rectangles allocation map for Sweden in Q1 2017.**

### 5.2.7 Actions and Recommendations

- Country/ship specific relationships between depth and gear geometry have been determined to estimate the swept-area. These relationships should be incorporated in the on board systems to validate the new readings compared to the countries specific guidelines. They should also be incorporated in next year's geometric plots.
- The new allocation maps should be discussed in the national institutes, by the assessment groups and other relevant groups as the egg and larvae groups and those related to the MSFD.
- It is recommendation to model the ALK for the roundfish species for which the otolith sampling scheme has changed.

### 5.2.8 References

ICES 1996. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES CM 1996/ACFM:10.

ICES 2009. Report of the International Bottom Trawl Survey Working Group (IBTSWG). ICES CM 2009/RMC:04

## 5.3 North Eastern Atlantic

### 5.3.1 General overview

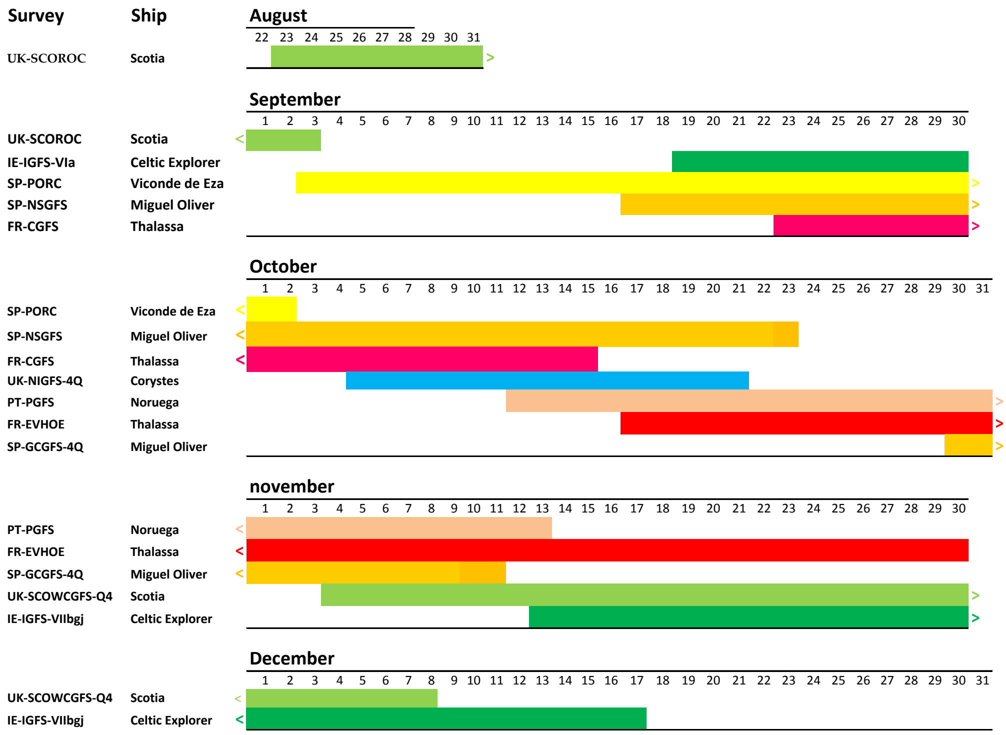
In 2015, eight vessels from five countries performed 13 surveys along the northeastern Atlantic IBTS area. A total of 1089 out of the 1081 hauls planned, were accomplished within 326 days at sea distributed between the first, third and fourth quarters (Table  and Table ).

In 2015, all surveys were performed, including as in previous years three 1st quarter surveys (Scotland, northern Ireland, and Spanish survey on the Gulf of Cadiz), and also the usual 3rd quarter surveys (UK-ScoRock and SP-Porc) and 4th quarter surveys. Survey coverage was slightly smaller than in the previous year, partly due to bad weather meaning less hauls in the case of the Irish survey, IE-IGFS (reduced from 170 last year to 146 in 2015) and the FR-EVHOE survey that only achieved 148 of the 156 planned and also the change of vessel in the French survey. In the case of the FR-CGFS the change of vessel from the vessel used all along the FR-CGFS time-series, the RV Gwen Drez, to the larger RV Thalassa also used in the EVHOE survey, meant some changes in the number of hauls and survey design to adapt the series.

**Table 5.3.1.1. Summary of surveys, hauls and days at sea per country performed in the IBTS northeastern Atlantic area in 2015.**

| Country | Survey | Hauls | | | | Days |
|---|---|---|---|---|---|---|
| | | Planned | Valid | Null | Total | |
| **UK-Scotland** | UK-SCOWCGFS-Q1 | 64 | 62 | 2 | 64 | 21 |
| | UK-SCOROCQ3 | 40 | 43 | 1 | 44 | 12 |
| | UK-SCOWCGFS-Q4 | 60 | 58 | 2 | 60 | 34 |
| **UK-North Ireland** | UK-NIGFS-Q1 | 61 | 59 | 1 | 61 | 17 |
| | UK-NIGFS-Q4 | 61 | 62+1 | 5 | 68 | 22 |
| **Ireland** | IE-IGFS-Q4 | 171 | 146 | 7 | 153 | 47 |
| **France** | FR-CGFS-Q4 | 74 | 73 (18) | 1 | 91 | 23 |
| | FR-EVHOE-Q4 | 156 | 148 | 0 | 148 | 44 |
| **Spain** | SP-PORC-Q3 | 80 | 80 | 0 | 88 | 29 |
| | SP-NSGFS Q4 | 136 | 115 | 1 | 136 | 36 |
| | SP-GCGFS-Q1 | 43 | 43 | 0 | 43 | 13 |
| | SP-GCGFS-Q4 | 45 | 43 | 0 | 43 | 13 |
| **Portugal** | PT-PGFS-Q4 | 90 | 89 | 1 | 90 | 30 |
| **Total** | | **1 081** | **1 021** | **22** | **1 089** | **341** |

**Table 5.3.1.2. Overview of the surveys performed during quarters 3 and 4 on the northeastern Atlantic IBTS area in 2015.**




## 5.3.2 Survey summaries by country

### 5.3.2.1 UK-Scotland: UK-SCOWCGFS-Q1(Western Division Bottom-trawl Survey Q1)

| | | | |
|---|---|---|---|
| **Nation:** | Scotland | **Vessel:** | Scotia |
| **Survey:** | 0315S (WC IBTS Q1) | **Dates:** | 16 February – 09 March 2015 |

| | |
|---|---|
| Cruise: | Q3 West Coast Scotland survey aims to:<br>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 6a and 7b.<br>Obtain temperature and salinity data from the surface and near seabed at each trawling station<br>Collect additional biological data in connection with the EU data collection framework (DCF). |
| Gear details: | GOV incorporating groundgear D was used at all stations. Sweeps were 97 m in all cases where the mean depth was > 80 m, otherwise 47 m sweeps were used. The following parameters were recorded during each tow using SCANMAR: headline height, wing spread, door spread and distance covered. A bottom contact sensor was attached to the groundgear and downloaded each tow. |
| Notes from survey (e.g. problems, additional work etc.): | The 2015 survey design was random-stratified with primary trawl locations randomly distributed within 10 sampling strata. 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 64 trawls undertaken (Table 5.3.2.1.1) with all fishing taking place during daylight hours. Weather and sea conditions were poor for the majority of the survey however a total of 62 valid hauls were achieved. There were 2 foul hauls both of which had valid substitute hauls made in the appropriate strata. However the sea conditions to the north of St Kilda on 6 March necessitated dropping 2 stations and making a shift from the area. These consisted of 1 from each of two adjacent strata: Green 1 and Red 2. Figure 5.3.2.1.1 displays sampling strata, trawl locations and haul numbers<br>A CTD was deployed at 48 of the 62 valid stations obtain a vertical temperature and salinity profile with sea conditions at 14 stations being too poor for successful deployment. The ships thermosalinograph was running throughout the entire survey to record surface temperature and salinity data<br>All demersal otoliths were aged at sea whereas pelagic otoliths were aged back at the institute.<br>•All litter picked up in the trawl was classified, quantified and recorded then retained for appropriate disposal ashore.<br>•All smooth-hounds *Mustelus asterias* (n = 14) were examined as part of PhD focusing on the migration patterns and trophic ecology of the genus (Aberdeen University).<br>•30 samples of mackerel *Scomber scombrus*, herring *Clupea harengus*, haddock and Sprat *Sprattus sprattus* were collected for assessment of parasitic burden and diversity (Napier University).<br>•Approximately 1000 whiting *Merlangius merlangus* were frozen whole for a project looking into what is sustaining gadoid biomass in the Firth of Clyde (Marine Scotland Science).<br>•Tissue and otolith samples of Red Mullet *Mullus surmuletus* (n = 2) and Pollock *Pollachius pollachius* (n = 8) were collected for genetic studies (Museum National d'Histoire Naturelle, Concarneau, France) |
| No. fish species recorded and notes on any rare species or unusual catches: | A total of 95 species were caught for an overall catch weight of ~ 21.1 tonnes. Major components (approximate tonnes) included: haddock (5.0), cod *Gadus morhua* (2.1) Norway pout *Trisopterus esmarkii* (1.9), whiting (1.7), blue whiting *Micromesistius poutassou* (1.5), and horse mackerel *Trachurus trachurus* (~1.2). Catches of herring and mackerel were relatively low. Of note were a large catch of cod from haul 71 (1.53 tonnes) and a male six-gilled shark (*Hexanchus griseus*) from haul 79. **Error! Not a valid result for table.** to Table 5.3.2.1.5 illustrate cpue indices and quantify the biological data collected. |

**Table 5.3.2.1.1. Number of stations surveyed/gear**

| | | | | Valid | | | % | |
|---|---|---|---|---|---|---|---|---|
| ICES Divisions | Strata | Gear | Stations Planned | Stations Achieved | Additional Station | Invalid Stations | Stations Achieved | Comments |
| 6a-7b | All | GOV-D | 64 | 62 | 0 | 2 | 97 | 2 foul hauls redone. 2 stations dropped. |

**Table 5.3.2.1.2. cpue of major components of combined catch.**

| Species | Common name | kg/h | no/h |
|---|---|---|---|
| *Melanogrammus aeglefinus* | Haddock | 169 | 926 |
| *Gadus morhua* | Cod | 73 | 24 |
| *Trisopterus esmarkii* | Norway Pout | 65 | 4 868 |
| *Merlangius merlangus* | Whiting | 59 | 416 |
| *Micromesistius poutassou* | Blue Whiting | 52 | 2 806 |
| *Trachurus trachurus* | Horse Mackerel | 40 | 157 |
| *Scyliorhinus canicula* | Lesser Spotted Dogfish | 37 | 68 |
| *Clupea harengus* | Herring | 29 | 377 |
| *Pollachius virens* | Saithe | 24 | 15 |
| *Eutrigla gurnardus* | Grey Gurnard | 21 | 242 |
| *Scomber scombrus* | Mackerel | 21 | 97 |
| *Merluccius merluccius* | Hake | 15 | 23 |
| *Loligo spp* | Long Finned Squid | 13 | 82 |
| *Pleuronectes platessa* | Plaice | 12 | 84 |
| *Chelidonichthys cuculus* | Red Gurnard | 10 | 36 |
| *Dipturus intermedia* | Flapper Skate | 9 | 2 |
| *Raja montagui* | Spotted Ray | 8 | 11 |
| *Limanda limanda* | Common Dab | 7 | 107 |
| *Capros aper* | Boarfish | 5 | 82 |

**Table 5.3.2.1.3. cpue indices (no./10 hrs) by year class of major commercial demersal species.**

| Age | *G. morhua* | *M. aeglefinus* | *M. merlangus* | *P. virens* | *T. esmarkii* |
|---|---|---|---|---|---|
| 0 | na | na | na | na | na |
| 1 | 8.2 | 6 800 | 2 545 | 0 | 46 492 |
| 2 | 36.4 | 379 | 760 | 4.6 | 4 273 |
| 3 | 70.7 | 201 | 285 | 61.7 | 3 847 |
| 4 | 37.7 | 63.1 | 259 | 24.6 | 0 |
| 5 | 23.2 | 38.6 | 65.2 | 16.9 | 0 |
| 6 | 13.0 | 1 699 | 57.5 | 11.5 | 0 |
| 7 | 2.5 | 10.4 | 8.5 | 3.1 | 0 |
| 8 | 0 | 5.4 | 3.5 | 0.8 | 0 |
| 9 | 0 | 7.1 | 0 | 0.4 | 0 |
| 10 | 0 | 25.7 | 0 | 0.4 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 |

**Table 5.3.2.1.4. cpue indices (numbers/10 hrs fishing) of 1-groups as above since 2011.**

| Species | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| *Gadus morhua* | 0.5 | 14.0 | 20.0 | 11.4 | 8.2 |
| *Melanogrammus aeglefinus* | 23.8 | 147 | 52.5 | 529 | 6 800 |
| *Merlangius merlangus* | 222 | 3 441 | 552 | 5805 | 2 545 |
| *Pollachius virens* | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 |
| *Trisopterus esmarkii* | 1 726 | 10 119 | 42 379 | 21 365 | 46 492 |

**Table 5.3.2.1.5. Numbers of biological observations per species collected during 0315S.**

| Species | No. | Species | No. |
|---|---|---|---|
| *Melanogrammus aeglefinus* | 1 245 | †*Leucoraja naevus* | 46 |
| *Merlangius merlangus* | 940 | †*Mustelus asterias* | 14 |
| *Gadus morhua* | 440 | †*Raja brachyura* | 11 |
| *Pollachius virens* | 107 | †*Raja clavata* | 94 |
| *Trisopterus esmarkii* | 563 | †*Raja montagui* | 250 |
| *Clupea harengus* | 533 | †*Squalus acanthias* | 82 |
| *Sprattus sprattus* | 386 | ‡*Eutrigla gurnardus* | 91 |
| *Scomber scombrus* | 170 | ‡*Chelidonichthys cuculus* | 103 |
| **Merluccius merluccius* | 345 | ‡*Mullus surmuletus* | 1 |
| †*Dipturus flossada* | 10 | ‡*Pollachius pollachius* | 5 |
| †*Dipturus intermedia* | 52 | ‡*Scophthalmus maximus* | 1 |
| †*Galeorhinus galeus* | 1 | ‡*Scophthalmus rhombus* | 4 |
| †*Hexanchus griseus* | 1 | ‡*Zeus faber* | 80 |

**Observations consist of length, weight, sex and age, unless:**

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

**† length, weight, sex and externally determined maturity only**

**‡ length, weight, sex, maturity plus otoliths retained but not age**

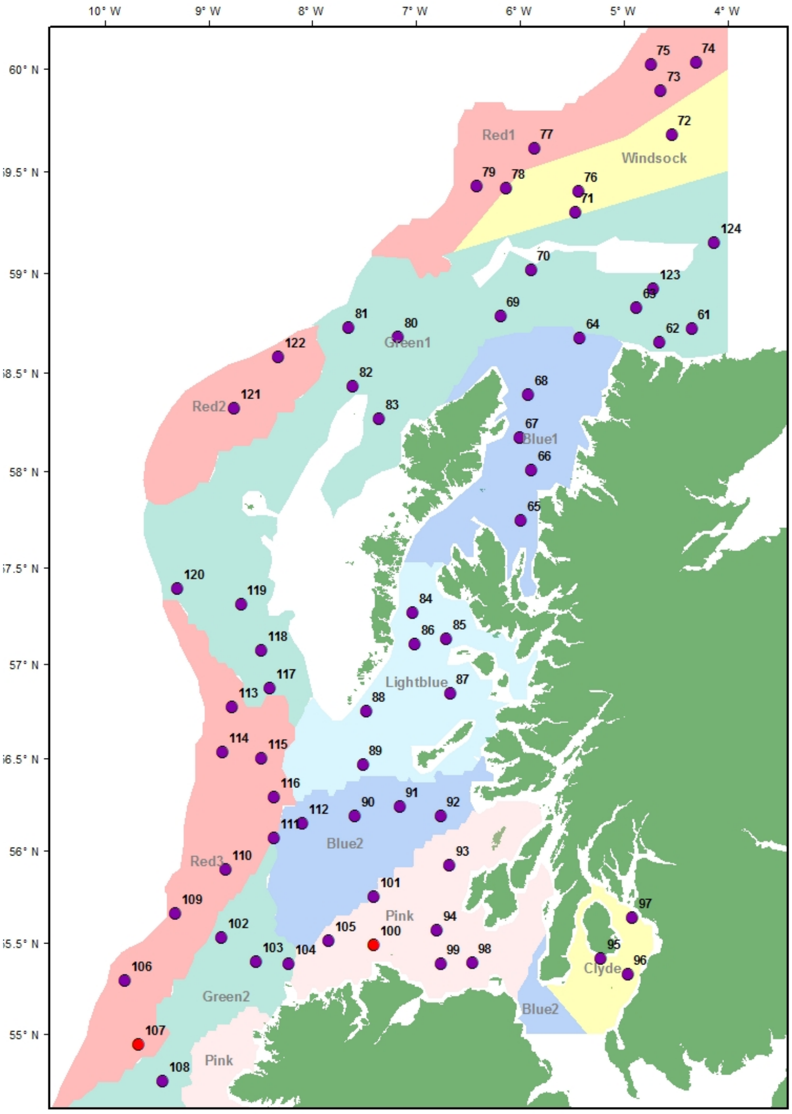



**Figure 5.3.2.1.1. 0315S survey map showing survey strata (coloured polygons), approximate mid-points of haul positions valid (purple circles) and foul (red circles) with haul numbers.**

## 5.3.2.2 UK-Scotland: UK-SCORoc-Q3(West of Scotland Rockall Survey Q3)

| | | | |
|---|---|---|---|
| **Nation:** | Scotland | **Vessel:** | Scotia |
| **Survey:** | 1115S (Rockall Haddock) | **Dates:** | 23 August – 03 September 2015 |

| | |
|---|---|
| Cruise: | Q3 Rockall2015 survey aims to:<br>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 6b.<br>Obtain temperature and salinity data from the surface and near seabed at selected trawling stations<br>Collect additional biological data in connection with the EU data collection framework (DCF).<br>To undertake sediment sampling on an opportunistic basis when the vessel was not fishing |
| Gear details: | GOV incorporating groundgear D was used at all stations. Sweeps were 97 m in all cases. The following parameters were recorded during each tow using SCANMAR: headline height, wing spread, door spread and distance covered. A bottom contact sensor was attached to the groundgear and downloaded each tow. |
| Notes from survey (e.g. problems, additional work etc.): | The 2015 survey design was random-stratified with primary trawl locations randomly distributed within 4 sampling strata defined by depth contour: 0–150 m, 150–200 m, 200–250 m, 250–350 m.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 45 trawls undertaken (Table 5.3.2.2.) with all fishing taking place during daylight hours. The total includes 2 additional hauls made outside the survey area were undertaken in response to observations of haddock from these areas during the Rockall anglerfish survey of April 2015 (0415S). Hauls 325 (390 m, 6 kg of haddock caught) and haul 342 (395 m, no haddock caught), suggest a patchy distribution and relatively small densities of haddock at depths > 350 m at this time of year. One haul was considered void (unmanageable) with a clean catch of an estimated 15–20 tonnes of grey gurnard (*Eutrigla gurnardus*); this does not form part of the dataset. All analysis and data to follow refers to valid hauls made within the standard survey area only. Figure 5.3.2.2.2.1 displays sampling strata, trawl locations and haul numbers.<br>Ages were recorded for haddock, mackerel *Scomber scombrus*, whiting, cod,and saithe along with sex, and weight data. Tissue samples of cod (n = 6) and whiting (n = 50) were obtained for molecular studies. Data on other species sampled for biological information are summarized in Table 5.3.2.2.<br>Haddock recruitment was observed spread over the upper bank however the cpue indices (Table 5.3.2.22.3) for these were the lowest since 2012 and below the average over the 5 year period since the new survey design was instigated (Figure 5.3.2.1.1). Catches of 1 to 3 year-old fish were good and of a generally consistent level over the survey area reflecting the relatively good recruitment of the previous three years. There were a small amount of haddock ages 7 years or older however the survey encountered very few between the ages of 4–6 years. Again this is consistent with observations over the previous several years of surveys at Rockall.<br>CTD casts (n = 20) were made at selected stations to give a representative coverage of the bank over the depth range surveyed. The ships thermosalinograph was running throughout the entire survey to record surface temperature and salinity data.<br>Sediment samples were attempted from a total of 83 positions during night periods. Of these 69 produced viable sediment samples over 150–620 m depth (Figure 5.3.2.2.2). Sampling was undertaken with a van Veen grab initially, switching to Day Grab when this became beset by mechanical problems. Sediment samples will be processed back at the laboratory.<br>All otoliths were aged back at the marine lab.<br>All litter picked up in the trawl was classified, quantified and recorded then retained for appropriate disposal ashore |
| No. fish species recorded and notes | Overall a total of 51 species were caught during the survey for a total catch weight of ~ 44.4 tonnes. There were large catches (approximate tonnes) of blue whiting *Micromesistius poutassou* (18), haddock (7), and grey gurnards (5). This excludes the estimated 15–20 tonnes gurnard catch which could not be worked up. Few cod *Gadus morhua*, (~ 42 kg) and saithe *Pollachius virens* (~ 18 kg) were caught. As with |

| | |
|---|---|
| on any rare species or unusual catches: | the previous two years minor amounts of whiting *Merlangius merlangius* (~ 4 kg) were observed. Catch per unit of effort (cpue) for major species are summarized in Table 5.3.2.2.2. cpue indices for 0 and 1-gp haddock are illustrated in Figure 5.3.2.2.1. |

**Table 5.3.2.2. Number of stations surveyed/gear.**

| | | | | VALID | | | % | |
|---|---|---|---|---|---|---|---|---|
| **ICES Divisions** | **Strata** | **Gear** | **Stations Planned** | **Stations Achieved** | **Additional Stations** | **Invalid Stations** | **Stations Achieved** | **Comments** |
| **6b** | All | GOV-D | 40 | 42 | 2* | 1 | 105 | * outside survey area. |

**Table 5.3.2.2.2. Overall cpue of major species.**

| | | mean | mean |
|---|---|---|---|
| Species | Strata | kg/h | no/h |
| *Micromesistius poutassou* | All | 851 | 19 892 |
| *Melanogrammusa eglefinus* | All | 329 | 1 353 |
| *Eutrigla gurnardus* | All | 234 | 980 |
| *Sebastes viviparus* | All | 230 | 3 430 |
| *Argentina sphyraena* | All | 67 | 1 052 |
| *Gadiculus argenteus thori* | All | 53 | 2 499 |
| *Trisopterus minutus* | All | 40 | 732 |
| *Chimaera monstrosa* | All | 23 | 26 |
| *Loligo* spp. | All | 16 | 63 |
| *Lophius piscatorius* | All | 15 | 5 |
| *Lepidorhombus whiffiagonis* | All | 15 | 91 |
| *Helicolenus dactylopterus* | All | 13 | 197 |
| *Microstomus kitt* | All | 11 | 103 |
| *Gadus morhua* | All | 2 | 0.2 |
| *Molva molva* | All | 2 | 4 |

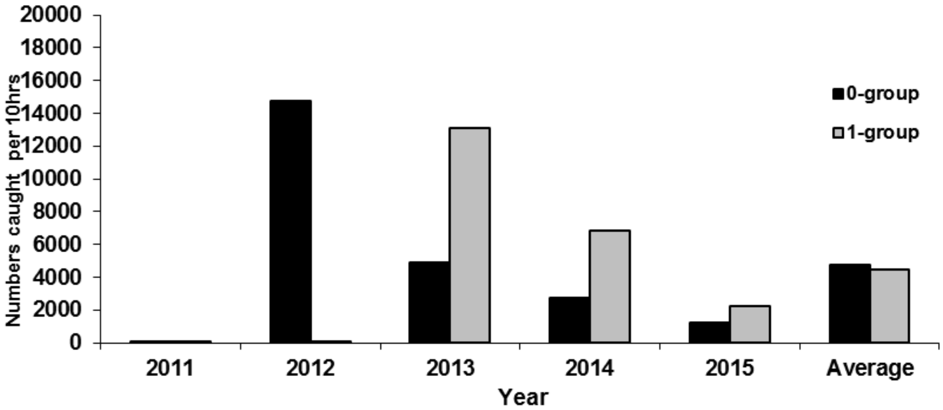



**Figure 5.3.2.2.1. Indices of 0 and 1-group haddock at Rockall in 2015 shown relative to the previous years and the average since 2011 (beginning of new survey design).**

**Table 5.3.2.22.3. Rounded cpue indices (no. per 10 hrs fishing) by age for Rockall haddock 2011–2015(actual values).**

| Age | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| **0** | 5.3 | 14 779 | 3 248 | 1 926 | 1 212 |
| **1** | 16.3 | 2.2 | 12 259 | 6 146 | 2 238 |
| **2** | 138 | 8.5 | 7.9 | 5 275 | 5 390 |
| **3** | 17.9 | 55.8 | 22.1 | 3.8 | 4 195 |
| **4** | 68.0 | 9.6 | 36.6 | 0 | 0 |
| **5** | 101 | 59.3 | 22.6 | 8.8 | 0 |
| **6** | 816 | 32.0 | 28.0 | 0 | 8.6 |
| **7** | 2.6 | 413 | 71.7 | 6.6 | 0.5 |
| **8** | 2.7 | 5.3 | 273 | 6.4 | 6.4 |
| **9** | 2.7 | 0.4 | 0.5 | 94.3 | 1.6 |
| **10** | 0 | 0 | 0 | 0.5 | 42.2 |
| **11** | 0 | 5.8 | 1.1 | 0.6 | 0.5 |
| **12** | 0 | 0 | 1.0 | 0 | 0 |
| **13** | 0 | 0 | 0 | 1.0 | 0 |

**Table 5.3.2.2. Numbers of biological observations per species collected during 1115S. Data are weight/length/sex/maturity/age except * where age data were not collected.**

| Species | Biodata | Species | Biodata |
|---|---|---|---|
| ***Gadus morhua*** | 5 | *Dipturus flossada* | 34* |
| ***Melanogrammus aeglefinus*** | 1 052 | *Dipturus oxyrinchus* | 10* |
| ***Merlangius merlangus*** | 26 | *Leucoraja fullonica* | 4* |
| ***Pollachius virens*** | 2 | *Raja clavata* | 7* |
| ***Scomber scombrus*** | 7 | | |

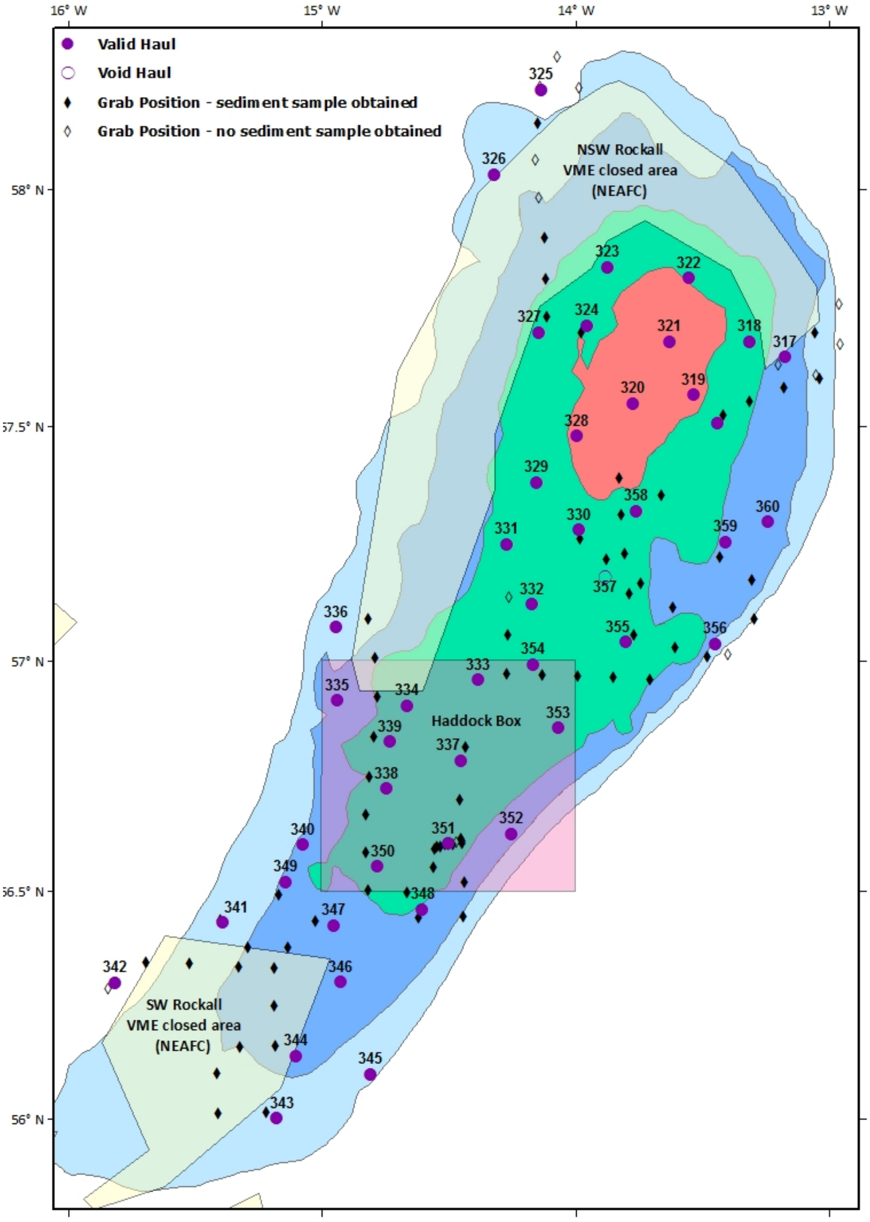



**Figure 5.3.2.2.2. Survey strata, NEAFC closed areas, trawl positions with haul numbers of stations and grab positions undertaken at Rockall during 1115S. Red area = 0–150 m, green = 150–200 m, blue = 200–250 m, light blue = 250–350 m and white = > 350 m (outside the standard survey area).**

### 5.3.2.3 UK-Scotland: UK-SCOWCGFS-Q4(Western Division Bottom-trawl Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | UK (Scotland) | **Vessel:** | Scotia |
| **Survey:** | 1715S | **Dates:** | 4 November – 8 December 2015 |

| | |
|---|---|
| Cruise | Q4 Scottish Western Coast 6a random stratified survey aims to collect data on the distribution, relative abundance and biological information (in connection with EU Data Directive 1639/2001) on a range of fish species in ICES areas 6a and 7b. Age data were collected for cod, haddock, whiting, saithe, hake, horse mackerel (scad), Norway pout, herring, mackerel, and sprat. A CTD was deployed at each trawl station to collect temperature and salinity profiles. |
| Gear details: | The GOV was used throughout the cruise with groundgear “D” (Rock-hoppers). Sweeps were 97 m except where the water depth was ≤ 80 m where 47 m sweeps were deployed. Headline height, wingend and door spread were monitored by SCANMAR acoustic instrumentation and distance covered using the vessels GPS navigation system. 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 2015 survey design was the same as that used since 2011 using a random-stratified survey design with primary trawl locations randomly distributed within 12 sampling strata (Figure 5.3.2. below). Trawls were undertaken on suitable ground as near to the specified sampling position as was practicable and within a radius of 5 nautical miles of the sample position. If for any reason the trawl could not be undertaken at the primary site due to poor ground or creels then the nearest replacement was chosen from a list of secondary random positions. Fishing was carried out during daylight commencing each day at first light however due to logistical reasons and necessitated a relaxation of this policy with the result that 1 out of the 58 valid tows were conducted out with daylight period. During the cruise 2 hauls were classified as foul due to gear damage, but due to the prevailing poor weather conditions limiting vessel transit time throughout the cruise no additional stations were available to compensate for these lost stations. Sweep length was altered according to bottom depth. 80 m is the cut off for deploying the 110 m sweep rig, standardizing the configuration with the Irish 6a survey. This resulted in 13 out of the 58 valid tows being completed using the 60 m sweep rig and the remaining deeper 45 stations completed using the 110 m sweep rig.<br>All demersal and pelagic otoliths were processed at sea but were subsequently aged back at the institute. All haul summary data and length frequencies were entered at sea via the Electronic Data Collection system. A CTD was deployed at 55 stations to obtain a vertical temperature and salinity profile. However, one deployment was abandoned due to the vessels dynamic positioning system shutting down due to the weather conditions. |
| Number of fish species recorded and notes on any rare species or unusual catches: | A total of 96 species were caught during the survey with an overall catch weight of 32.1 tonnes. There were large catches overall of haddock (~ 6.15 tonnes), Norway pout (~ 2.99 tonnes), boar fish (~ 3.72 tonnes), mackerel (~ 4.27 tonnes), and blue whiting (7.13 tonnes). CPUE indices are shown in tables 5.3.2.3.2 , 5.3.2.3.3 and 5.3.2.3.5.<br>Biological data were recorded for a number of species (Tab. 5.3.2.3.4) in accordance with the requirements of the EU Data Regulations.<br>Catch of significant note were the significant increase in the numbers of ‘0’ and ‘1’ group haddock across the survey area and quantities of skate/rays encountered. |

**Table 5.3.2.3.3.1. Number of stations fished.**

| | | | | Valid | | | % |
|---|---|---|---|---|---|---|---|
| **ICES Divisions** | **Strata** | **Gear** | **Stations Planned** | **Stations Achieved** | **Additional Stations** | **Invalid Stations** | **Stations Achieved** |
| **6a** | 11 | GOV-D | 56 | 54 | 0 | 2 | 96 |
| **7b** | 1 | GOV-D | 4 | 4 | 0 | 0 | 100 |

**Table 5.3.2.3.2.cpue indices (no./10hrs) by year class for major species Q4 WC survey in 2015.**

| Age | Nos./10 h | | | | |
|---|---|---|---|---|---|
| | *G. morhua* | *M. aeglefinnus* | *M. merlangus* | *P. virens* | *T. esmarkii* |
| 0 | 3.64 | 2 185.23 | 4 263.12 | 0.42 | 129 475.00 |
| 1 | 28.17 | 9 955.86 | 2 793.58 | 5.04 | 14 814.30 |
| 2 | 52.53 | 585.75 | 727.09 | 5.00 | 388.37 |
| 3 | 34.22 | 101.46 | 114.94 | 11.55 | 77.58 |
| 4 | 10.58 | 41.02 | 90.77 | 2.11 | 0.00 |
| 5 | 4.24 | 23.42 | 20.19 | 0.35 | 0.00 |
| 6 | 5.27 | 1 105.86 | 27.09 | 0.00 | 0.00 |
| 7 | 1.18 | 2.82 | 1.24 | 0.00 | 0.00 |
| 8 | 0.59 | 3.34 | 0.00 | 0.00 | 0.00 |
| 9 | 0.26 | 1.13 | 0.00 | 0.00 | 0.00 |
| 10 | 0.00 | 6.61 | 0.00 | 0.00 | 0.00 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 5.3.2.3.3.cpue indices (numbers/10hrs fishing) of 1-groups for Q4 since 2011.**

| Species | 2011 | 2012 | 2013* | 2014 | 2015 |
|---|---|---|---|---|---|
| *Gadus morhua* | 10.03 | 19.78 | 13.98 | 23.65 | 28.17 |
| *Melanogrammus aeglefinus* | 39.21 | 114.77 | 69.58 | 678.72 | 9 955.86 |
| *Merlangius merlangus* | 119.47 | 963.95 | 124.96 | 1 517.81 | 2 793.58 |
| *Polachius virens* | 0.00 | 1.05 | 0.00 | 0.36 | 5.04 |
| *Trisopterus esmarkii* | 2 192.53 | 7 213.86 | 1 343.88 | 2 669.71 | 14 814.30 |

*** Note – Q4 survey 2014 was not completed only covered half of the sampling area**

**Table 5.3.2.3.4. Q4 SCOWCGFS biological sampling 2015. Data are weight/length/sex/maturity/age except * where age data were not collected.**

| Species | Nos | Species | Nos |
|---|---|---|---|
| *Gadus morhua* | 385 | *Sprattus sprattus* | 335 |
| *Merlangius merlangus* | 852 | *Galeorhinus galeus* | 4* |
| *Melanogrammus aeglefinus* | 1 396 | *Scophthalmus maximus* | 3* |
| *Merluccius merluccius* | 279 | *Scophthalmus rhombus* | 10* |
| *Trisopterus esmarkii* | 628 | *Raja brachyura* | 18* |
| *Pollachius virens* | 60 | *Leucoraja naevus* | 74* |
| *Molva molva* | 83 | *Dipturus intermedia* | 45* |
| *Zeus faber* | 44 | *Dipturus flossada* | 7* |
| *Scomber scombrus* | 191 | *Raja clavata* | 85* |
| *Clupea harengus* | 331 | *Raja montagui* | 323* |
| *Trachurus trachurus* | 153 | *Mustelus* spp. | 9* |

**Table 5.3.2.3.5. Q4 cpue data for major species: 2015.**

| Species | Strata | Mean nos/h | Mean kgs/h |
|---|---|---|---|
| *Trisopterus esmarkii* (Norway Pout) | All | 11 504.1 | 119.7 |
| *Capros aper* (Boar Fish) | All | 2 747.1 | 148.1 |
| *Micromesistius poutassou* (Blue Whiting) | All | 2 000.9 | 75.8 |
| *Melanogrammus aeglefinus*(Haddock) | All | 1 482.7 | 287.8 |
| *Trachurus trachurus* (Horse Mackerel, Scad) | All | 1 002.1 | 91.0 |
| *Merlangius merlangus* (Whiting) | All | 949.8 | 90.4 |
| *Loligo forbesii* (Long Finned Squid) | All | 620.8 | 7.8 |
| *Trisopterus minutus* (Poor Cod) | All | 580.0 | 11.5 |
| *Scomber scombrus* (Mackerel) | All | 419.1 | 21.2 |
| *Gadiculus argenteus thori* (Silvery Pout) | All | 373.5 | 5.1 |
| *Clupea harengus* (Herring) | All | 243.2 | 53.4 |
| *Sprattus sprattus* (Sprat) | All | 129.8 | 0.7 |
| *Eutrigla gurnardus* (Grey Gurnard) | All | 127.7 | 14.5 |
| Ommastrephidae (Short Finned Squid) | All | 106.0 | 6.0 |
| *Scyliorhinuscanicula* (Lesser Spotted Dogfish) | All | 101.8 | 54.5 |
| *Argentina sphyraena* (Lesser Argentine) | All | 67.7 | 3.4 |
| *Pleuronectes platessa* (Plaice) | All | 66.0 | 11.6 |
| *Limanda limanda* (Common Dab) | All | 59.9 | 4.6 |
| *Argentina silus* (Greater Argentine) | All | 58.0 | 4.6 |
| *Chelidonichthys cuculus* (Red Gurnard) | All | 42.1 | 11.9 |
| *Nephrops norvegicus* (Norway Lobster) | All | 37.1 | 0.8 |
| *Hippoglossoides platessoides* (Long Rough Dab) | All | 32.7 | 0.6 |
| *Pandalus* spp. ( Pandalusunidentified) | All | 30.4 | 0.1 |
| *Helicolenus dactylopterus* (Blue-mouth) | All | 24.3 | 2.5 |
| Pasiphaeidae (Glass Shrimps) | All | 23.2 | < 0.1 |
| *Merluccius merluccius* (Hake) | All | 15.7 | 13.8 |
| *Gadus morhua* (Cod) | All | 15.6 | 38.2 |
| Crangonidae (Brown shrimps) | All | 15.3 | < 0.1 |
| *Lepidorhombus whiffiagonis*(Megrim) | All | 13.8 | 3.6 |
| *Microstomus kitt* (Lemon Sole) | All | 12.7 | 2.5 |
| *Raja montagui*(Spotted Ray) | All | 11.5 | 10.9 |
| *Aequipecten opercularis* (Queen scallops) | All | 6.6 | 0.2 |
| *Squalus acanthias* (Spurdog) | All | 6.3 | 8.2 |
| *Lophius piscatorius* (Angler, Monk fish) | All | 4.6 | 9.4 |

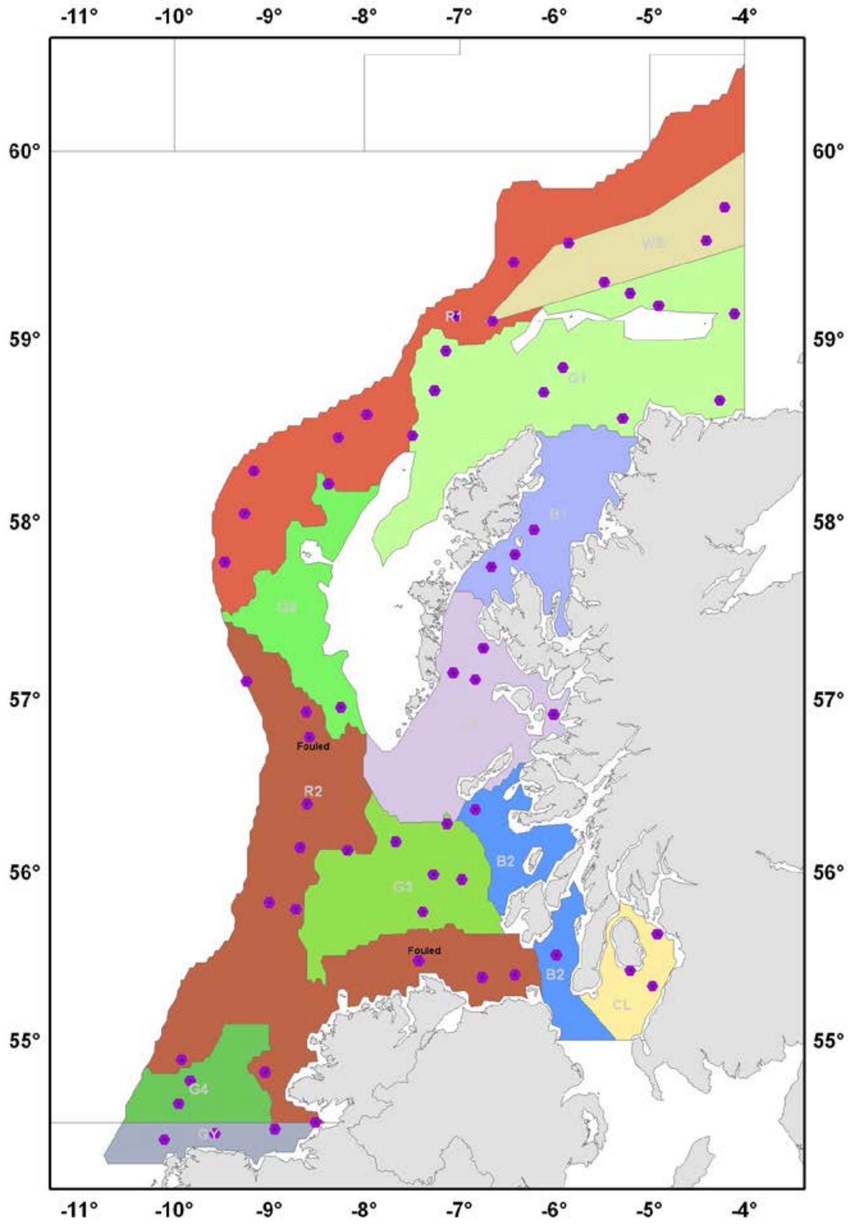



**Figure 5.3.2.1. Trawl stations completed during the Q4 WC – IBTS 2015 (1715S).**

### 5.3.2.4 UK -Northern Ireland: UK-NIGFS -Q1 (Northern Irish Groundfish Survey Q1)

| | | | |
|---|---|---|---|
| **Nation:** | UK (Northern Ireland) | **Vessel:** | RV Corystes |
| **Survey:** | 10/15 | **Dates:** | 01–22 March 2015 |

| | |
|---|---|
| Cruise | Q1Irish Sea survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in ICES division 7a. The primary species are cod, haddock, and whiting, herring and plaice. |
| Gear details: | Rock-hopper otter trawl with a 17 m footrope fitted with 250 mm non-rotating rubber discs. SCANMAR sensors were fitted to gear and trawl parameters recorded, this included trawl eye and wing end distance sensor. |
| Notes from survey (e.g. problems, additional work etc.): | Three days were lost during the survey with engine problems. Despite the extreme windy weather at the start of the survey steady progress was made. Very little gear damage and relatively good sea conditions from the middle of the survey meant very little fishing time was lost. Temperature and salinity were recorded at each station.<br>Additional work included quantifying external parasite loads in whiting and cod by area and collected tissue samples from cod and hake for a genetics study. Daily collection of clean seawater samples were taken daily for National Oceanography Centre, Liverpool. Whiting samples from each ICES rectangle were collected for student studies. |
| Number of fish species recorded and notes on any rare species or unusual catches: | Overall, 67 species of fish were recorded during the survey. |

Detailed results are listed in tables 5.3.2.4.1 and 5.3.2.4.2.

**Table 5.3.2.4.1.Stations fished (aims: to complete 61 valid tows per survey, see Fig. 5.3.2.4.1. for sampling lovcations).**

| ICES Divisions | Strata | Gear | Tows Planned | Valid | Additional | Invalid | % stations fished | comments |
|---|---|---|---|---|---|---|---|---|
| 7a | | Otter trawl | 61 | 59 | 0 | 1 | 97 | |
| | TOTAL | | 61 | 59 | 0 | 1 | 97 | |

**Table 5.3.2.4.2.Number of biological samples (maturity and age material, *maturity only).**

| Species | Age and Maturity | Species | Age and Maturity |
|---|---|---|---|
| *Gadus morhua* | 504 | *Squalus acanthias* | 15 |
| *Melanogrammus aeglefinus* | 1 064 | *Chelidonichthys cuculus* | 84 |
| *Pleuronectes platessa* | 417 | *Microstomaus kitt* | 107 |
| *Merlangius merlangus* | 1 410 | *Lepidorhombus whiffiagonis* | 5 |
| *Merluccius merluccius* | 6 | | |
| *Scophthalmus rhombus* | 26 | *Raja brachyura* | 12* |
| *Conger conger* | 4 | *Leucoraja naevus* | 38* |
| *Pollachius pollachius* | 12 | *Raja montagui* | 149* |
| *Zeus faber* | 9 | *Raja clavata* | 183* |

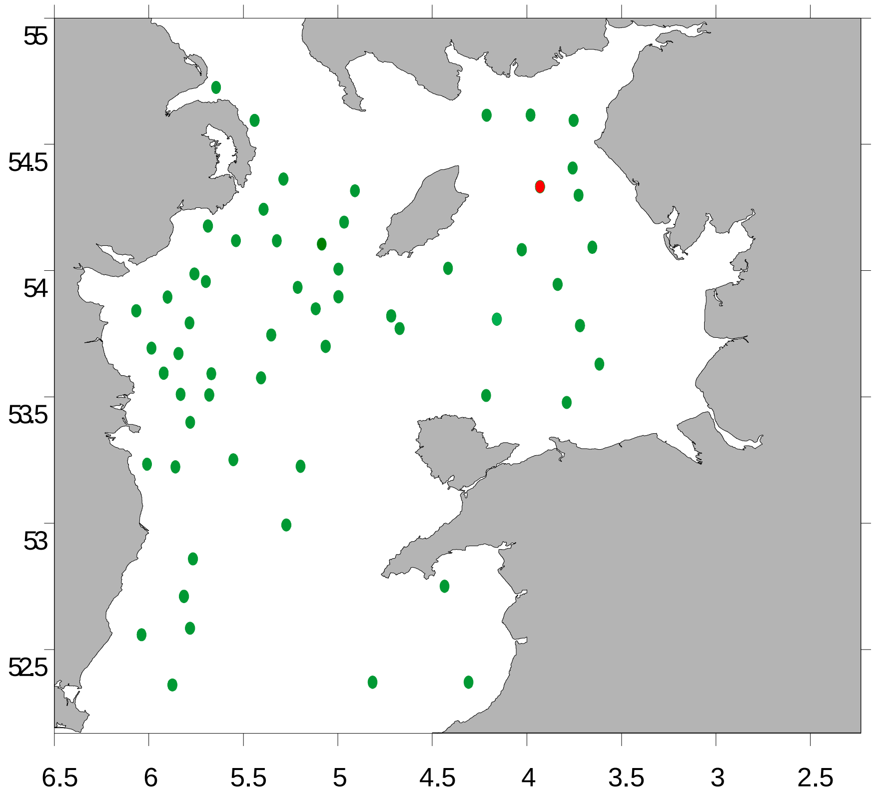



**Figure 5.3.2.1. Map of valid survey stations completed during the 2015 northern Irish quarter 1 groundfish survey (red circle is a repeat station).**

### 5.3.2.5 UK -Northern Ireland: UK-NIGFS -Q4 (Northern Irish Groundfish Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | UK (Northern Ireland) | **Vessel:** | RV Corystes |
| **Survey:** | 41/15 | **Dates:** | 05–21 October 2015 |

| | |
|---|---|
| Cruise | Q4 Irish Sea survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in ICES division 7a. The primary species are cod, haddock, and whiting, herring and plaice. |
| Gear details: | Rock-hopper otter trawl with a 17 m footrope fitted with 250 mm non-rotating rubber discs. SCANMAR sensors were fitted to gear and trawl parameters recorded, including trawl eye and wing end distance sensors. |
| Notes from survey (e.g. problems, additional work etc.): | Exceptional weather and sea conditions meant very little fishing time was lost overall. 67 tows were completed of which 5 were repeated and one new station was added to the survey.<br>Additional work included quantifying external parasite loads in whiting and cod by area.Temperature and salinity were recorded at each station. 26 *Lophius piscatorius* were examined for *Spraguea lophii* parasite, numbers and stages were recorded. |
| Number of fish species recorded and notes on any rare species or unusual catches: | Overall, 66 species of fish were recorded during the survey. |

Detailed results are listed in tables 5.3.2.5.1 and 5.3.2.5.2.

**Table 5.3.2.5.1. Stations fished (aims: to complete 61 valid tows per survey, see figure 5.3.2.5.1 for sampling locations).**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Additional | Invalid | % stations fished | comments |
|---|---|---|---|---|---|---|---|---|
| 7a | All | Rock-hopper | 61 | 62 | 1 | 5 | 100 | |
| | Total | | 61 | 62 | 1 | 5 | 100 | |

**Table 5.3.2.5.2. Number of biological samples (maturity and age material, *maturity only).**

| Species | Age and Maturity | Species | Age and Maturity |
|---|---|---|---|
| *Gadus morhua* | 77 | *Pollachius pollachius* | 3 |
| *Melanogrammus aeglefinus* | 1 033 | *Zeus faber* | 14 |
| *Pleuronectes platessa* | 324 | *Chelidonichthys cuculus* | 86 |
| *Merlangius merlangus* | 1 337 | *Microstomus kitt* | 43 |
| *Merluccius merluccius* | 12 | *Lepidorhombus whiffiagonis* | 1 |
| *Scophthalmus rhombus* | 14 | *Raja montagui* | 98* |
| *Scophthalmus maximus* | 2 | *Raja clavata* | 114* |
| *Conger conger* | 5 | *Raja brachyura* | 32* |
| *Squalus acanthias* | 30 | *Leucoraja naevus* | 15* |

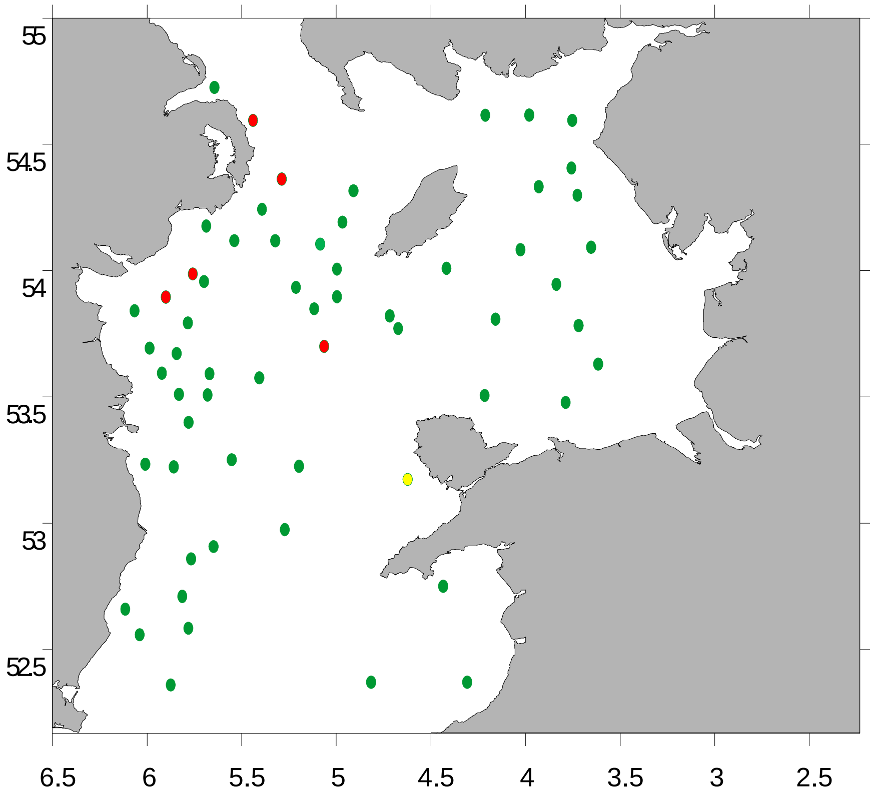



**Figure 5.3.2.5.1. Map of valid survey stations completed during the 2014 northern Irish quarter 4 groundfish survey. (red circle is a repeat station and yellow circle is a new station).**

### 5.3.2.6 Ireland: IE-IGFS-Q4 (Irish Groundfish Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | Ireland | **Vessel:** | Celtic Explorer |
| **Survey:** | IGFS | **Dates:** | 19 Sept – 30Sept (6a)<br>13 Nov – 17 Dec (7b,g,j) |

| | |
|---|---|
| Cruise | The Q4 Irish Groundfish survey collects data on the distribution, relative abundance and biological parameters of commercial fish in 6a south, 7b and 7g,j north. The indicess currently utilized by assessment WG's are for haddock, whiting, plaice, cod, hake andsole. Survey data are also provided for white and black anglerfish, megrim, lemon sole, saithe, ling, blue whiting, and a number of elasmobranchs as well as several pelagics (herring, horse mackerel, and mackerel). An additional deep-water strata (200–600 m) was added in 2005 and is recently incoporated into the main survey area for index calculation. |
| Gear details: | Two gear survey since 2004, using GOV groundgear "A" for areas 7b,g,j; and "D"for area 6a. |
| Notes from survey (e.g. problems, additional work etc.): | Significant weather disruption in 2015 during Legs 2-4 with six days being lost in total. However, issuing of a Marine Notice prior to the survey seemed to vastly reduce conflicts with static gear.<br>Pentagon winch system PC failed with the loss of a few hours, plus warp parted on one side with loss of few hours to crop both side and re-splice. |
| Number of fish species recorded | In 2015, 88 species of fish, 18 elasmobranch, 9 cephalopod and 53 crustacean species/groups were caught. |

| | |
|---|---|
| and notes on any rare species or unusual catches: | The most significant change in 6a was increased numbers of juvenile haddock (563%) and blue whiting (359%) over the recent 5 year term. Kg/h was also significantly increased for blue whiting mainly consisting of fish 10-20 cm in length. Whiting was also up to 200% in numbers and Kg/h over the 5 yr mean.<br>In ICES Area 7 again horse mackerel (*Trachurus trachurus*) numbers show an increase (642%) and 573% in kg/h. All other gadoid and pelagic species are within the normal interannual fluctuations. |

**Table 5.3.2.6.1. 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 | 47 | 0 | 3 | 111 | |
| **7b,c** | All | A | 38 | 25 | 0 | 0 | 65 | |
| **7g** | All | A | 48 | 41 | 0 | 2 | 89 | |
| **7j** | All | A | 40 | 33 | 0 | 2 | 87 | |
| | Total | | 171 | 146 | 0 | 7 | 88 | |

**Table 5.3.2.6.2 Biological samples (length, weight, sex, maturity, and age material); maturity* (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.** |
| *Chelidonichthys (aspitrigla) cuculus*** | 222 | *Microstomus kitt* | 554 |
| *Clupea harengus* | 409 | *Molva molva* | 94 |
| *Conger conger*** | 52 | *Pleuronectes platessa* | 1 021 |
| *Dicentrarchus labrax* | 76 | *Pollachius pollachius*** | 9 |
| *Dipturus flossada** | 33 | *Pollachius virens* | 102 |
| *Dipturus intermedia*** | 20 | *Raja brachyura** | 29 |
| *Gadus morhua* | 97 | *Raja clavata** | 343 |
| *Glyptocephalus cynoglossus*** | 321 | *Raja montagui** | 675 |
| *Lepidorhombus whiffiagonis* | 807 | *Scomber scombrus* | 674 |
| *Leucoraja naevus** | 163 | *Scophthalmus maximus*** | 44 |
| *Lophius budegassa* | 195 | *Scophthalmus rhombus*** | 70 |
| *Lophius piscatorius* | 398 | *Solea solea* | 103 |
| *Melanogrammus aeglefinus* | 2 211 | *Squalus acanthias** | 385 |
| *Merlangius merlangus* | 1 758 | *Trachurus trachurus* | 1 091 |
| *Merluccius merluccius* | 574 | *Zeus faber*** | 243 |
| *Micromesistius poutassou* | 705 | | |

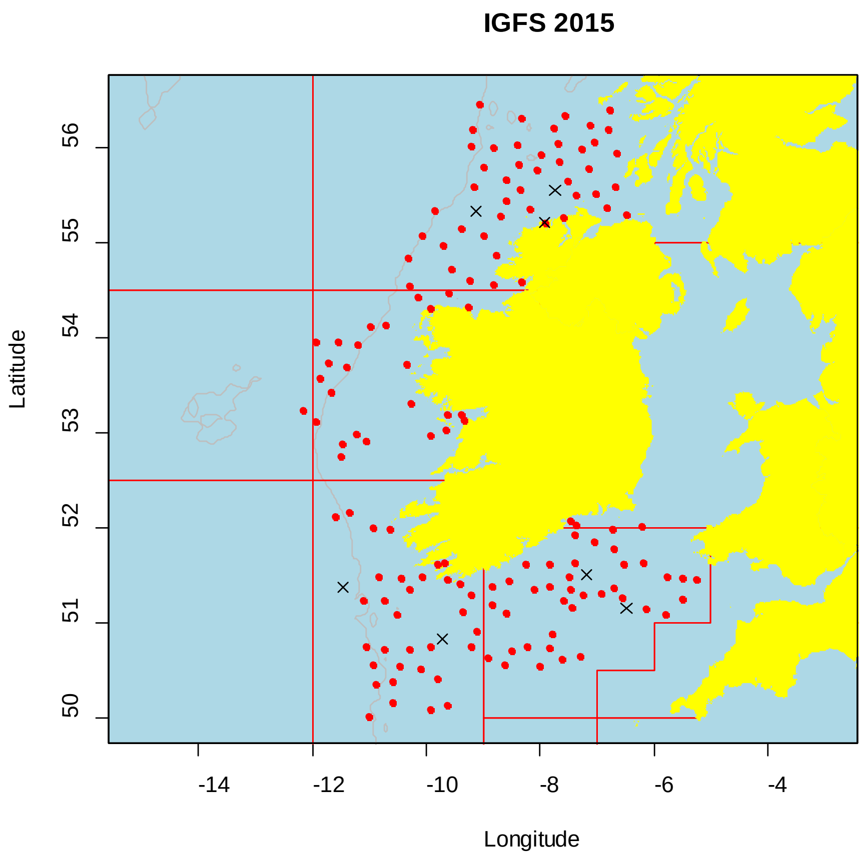



**Figure 5.3.2.6.1. Map of Survey Stations completed by the Irish Groundfish Survey in 2015. Valid = red circles; Invalid = black crosses.**

**Table 5.3.2.6.3. Biomass and abundance indices.**

| BIOMASS AND NUMBER ESTIMATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Biomass index | | | Number index | | |
| Species | Strata | Valid tows | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | kg/h | % | % | No/h | % | % |
| *Gadus morhua* | 6a | 47 | 1.8 | -77.1 | 17.5 | 1.4 | -81.3 | 7.9 |
| *Melanogrammus aeglefinus* | 6a | 47 | 530.1 | 186.3 | 157.5 | 2 692.3 | 17.1 | 563.0 |
| *Clupea harengus* | 6a | 47 | 195.5 | -17.2 | -34.8 | 1 301.6 | -12.9 | -35.3 |
| *Merluccius merluccius* | 6a | 47 | 7.9 | -68.0 | -31.8 | 15.8 | -73.9 | -60.5 |
| *Trachurus trachurus* | 6a | 47 | 153.9 | -19.5 | -42.5 | 3 028.0 | 208.5 | 25.1 |
| *Scomber scombrus* | 6a | 47 | 319.3 | 515.8 | -40.7 | 2 396.6 | 251.6 | -42.9 |
| *Lepidorhombus whiffiagonis* | 6a | 47 | 1.5 | -26.4 | -18.1 | 5.5 | -6.8 | -22.8 |
| *Lophius piscatorius* | 6a | 47 | 2.4 | -37.7 | 61.5 | 2.8 | -28.2 | 159.6 |
| *Pleuronectes platessa* | 6a | 47 | 6.4 | -43.9 | -52.8 | 36.6 | -52.6 | -48.5 |
| *Solea solea* | 6a | 47 | 0.1 | -88.3 | -36.2 | 0.3 | -86.8 | -43.9 |
| *Micromesistius poutassou* | 6a | 47 | 818.8 | 850.4 | 432.9 | 18 559.6 | 361.2 | 358.7 |
| *Merlangius merlangus* | 6a | 47 | 301.5 | 30.1 | 250.2 | 1 930.6 | -22.7 | 212.4 |
| *Gadus morhua* | 7bgj | 99 | 3.9 | -44.4 | -22.7 | 1.2 | -67.9 | -17.3 |
| *Melanogrammus aeglefinus* | 7bgj | 99 | 139.0 | -9.9 | 10.6 | 1 245.1 | 62.2 | 9.8 |
| *Clupea harengus* | 7bgj | 99 | 12.5 | -36.3 | -41.7 | 245.6 | 49.2 | -44.6 |
| *Merluccius merluccius* | 7bgj | 99 | 17.2 | -27.1 | -37.4 | 153.0 | 18.0 | -69.5 |
| *Trachurus trachurus* | 7bgj | 99 | 213.1 | 301.3 | 573.5 | 6 800.2 | 496.3 | 642.7 |
| *Scomber scombrus* | 7bgj | 99 | 54.6 | -33.8 | -54.0 | 946.6 | -33.5 | -59.0 |
| *Lepidorhombus whiffiagonis* | 7bgj | 99 | 3.8 | 18.1 | -15.9 | 21.7 | 21.9 | -5.8 |
| *Lophius piscatorius* | 7bgj | 99 | 6.4 | -0.1 | -8.7 | 7.1 | -10.8 | 51.5 |
| *Pleuronectes platessa* | 7bgj | 99 | 15.0 | 41.4 | 40.8 | 83.3 | 66.5 | 31.6 |
| *Solea solea* | 7bgj | 99 | 0.5 | -16.9 | 15.9 | 2.0 | -26.0 | 2.6 |
| *Micromesistius poutassou* | 7bgj | 99 | 57.6 | -15.9 | 47.3 | 1 452.4 | -50.1 | 50.2 |
| *Merlangius merlangus* | 7bgj | 99 | 107.8 | -30.4 | -6.8 | 871.4 | -9.5 | -29.6 |

**Year estimate 2015 (yi); previous year estimate 2014 (yi-1); average of last two years estimate (y(i,i-1)); average of the previous three year estimates 2011-13 (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.**

#### 5.3.2.7 France: FR-CGFS-Q4 (The Channel Groundfish Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | France | **Vessel:** | RV Thalassa |
| **Survey:** | CGFS 2015 | **Dates:** | 23 Sept - 15 Oct 2015 |

| | |
|---|---|
| Cruise | CGFS bottom-trawl survey aims to collect data on the distribution and relative abundance, and biological information of commercial fish in the Eastern English channel (ICES Division 7d). The primary target species are plaice and red mullet, which abundance indices are estimated by age, as well as cod, whiting, sea bass, cuttlefish, squids, and elasmobranchs. Data are also collected for several other demersal and pelagic fish species and invertebrates. Since 2015, CTD and plankton nets are realized at each station. |
| Survey Design | This survey follows a fixed stratified sampling design, with 74 stations since 2015 (88 stations before) distributed among the ICES statistical rectangles used as strata, with the number of station per stratum depending of its surface. |
| Geardetails: | GOV 36/47 with no kite (6 extra floats instead) and a groundgear with 250 mm bobbins. Marport sensors for door, wing, and vertical net opening |
| Notes from survey (e.g. problems, additional work etc.): | In 2015, a change of vessel occurred, from the RV *Gwen Drez* to the larger RV *Thalassa*. The GOV gear has been enlarged, but the relative geometry remained similar.<br>Weather conditions were good during the survey. The following sampling was done:<br>73 valid trawls in the eastern English Channel with GOV 36 x 47<br>18 valid trawls in the Western English Channel with GOV 36 x 49, in order to test a different gear to be used for sampling area 7e<br>Wastes were counted and weighted at each trawl station.<br>Benthos was sorted and identified at each trawl station.<br>103 hydrology stations (deploying hydrological probe, niskin bottle and plankton WP2 net).<br>296 samples of subsurface water, in order to get fish eggs, along the vessel trajectory.<br>During daylight, two observers were also continuously recording seabirds and marine mammals. |
| Number of fish species recorded and notes on any rare species or unusual catches: | |

**Table 5.3.2.7.1. Stations fished.**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Invalid | Additional | % stations fished | comments |
|---|---|---|---|---|---|---|---|---|
| 7d | 30F1 | GOV 36/47 | 8 | 8 | | | 100% | |
| | 29F1 | | 1 | 1 | | | 100% | |
| | 28F1 | | 1 | 1 | | | 100% | |
| | 30F0 | | 7 | 7 | | | 100% | |
| | 29F0 | | 8 | 8 | | | 100% | |
| | 28F0 | | 6 | 6 | | | 100% | |
| | 30E9 | | 7 | 7 | | | 100% | |
| | 29E9 | | 7 | 7 | | | 100% | |
| | 28E9 | | 9 | 8 | 1 | | 100% | |
| | 27E9 | | 8 | 8 | | | 100% | |
| | 29E8 | | 3 | 3 | | | 100% | |
| | 28E8 | | 3 | 3 | | | 100% | |
| | 27E8 | | 1 | 1 | | | 100% | |
| | TOTAL (7d) | | 74 | 73 | 1 | | 100% | |
| 7e | | GOV 36/49 | | 18 | 1 | | | Experimental hauls for the western channel |

**Table 5.3.2.7.2. Biological samples.**

| Number of biological samples (maturity and age material), from 7d | | | |
|---|---|---|---|
| *Merlangius merlangus* | 295 | *Scophthalmus rhombus* | 4 |
| *Gadus morhua* | 79 | *Chelidonichthys cuculus* | 95 |
| *Trisopterus luscus* | 71 | *Mullus surmuletus* | 102 |
| *Pleuronectes platessa* | 389 | *Dicentrachus labrax* 62 (scales) | 6 |
| *Solea solea* | 50 | *Microstomus kitt* | 36 |

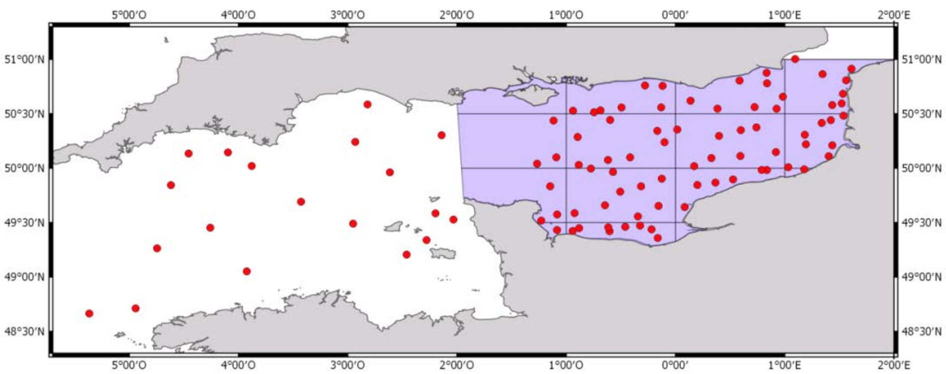



**Figure 5.3.2.7.1. Sampling stations (red dots) of the CGFS 2015 survey. Stations in the 7d area (with statistical rectangles highlighted) correspond to the sampling design, while stations in the area 7e (Western Channel) are experimental tows.**

#### 5.3.2.8 France: FR-EVHOE-Q4 (Celtic Sea/Bay of Biscay Groundfish Survey Q4)

| **Nation:** | France | **Vessel:** | Thalassa |
|---|---|---|---|
| **Survey:** | EVHOE 2015 | **Dates:** | 17 October – 30 November 2015 |

| | |
|---|---|
| Cruise | EVHOE Groundfish survey aims to collect data on the distribution and relative abundance, and biological information of all fish and selected commercial invertebrates in subareas 7f-j 8a,b. The primary species are hake, monkfish, anglerfish, megrim, cod, haddock, and whiting, with data also collected for all other demersal and pelagic fish. Sampling design is stratified random. |
| Gear details: | A GOV with standard Groundgear (A) but no kite replaced by 6 extra floats.<br>Marport sensors for door, wing, and vertical net opening |
| Notes from survey (e.g. problems, additional work etc.): | No significant problems during the survey. Poor weather in the end of the survey restricted fishing one day. Three hauls were not validated : two because of trawl damage , one because of the haul shorted due to strong detection.<br>96 % of the initial program was realized. (151 hauls of 156 planned).<br>95% valid.<br>During the survey :<br>-149 CTD temperature and salinity profile were achieved;<br>- 29 "boxes" with multibeam echosounder in bathymetric were recorded;<br>- Trawl information (Marport) were collected during all the hauls.<br>- Mammals and birds observations during the legs 1 and 2.<br>- Additional works for MSFD were realized:<br>CUFES device (Continuous Underwater Fish Egg Sampler)<br>Manta net for collecting surface microplastics was put up during the first and second legs.<br>Samples of zoo- and phytoplankton were collected during the legs one and two.<br>Bongo net was deployed during the third leg in Celtic Sea for collecting juveniles fish.<br>- Wastes were counted and weighted at each trawl station.<br>- Benthos was sorted and identified at each trawl station. |
| Number of fish species recorded and notes on any rare species or unusual catches: | 160 species were recorded.<br>Additional work on selected species: muscle samples and stomach contents |

**Table 5.3.2.8.1.Stations fished.**

| ICES Divisions | Strata | Tows planned | Valid | Additional | % stations fished | comments |
|---|---|---|---|---|---|---|
| **7** | Cc3 | 9 | 7 | | 78% | |
| | Cc4 | 20 | 16 | | 80% | |
| | Cc5 | 3 | 3 | | 100% | |
| | Cc6 | 3 | 3 | | 100% | |
| | Cc7 | 2 | 2 | | 100% | |
| | Cn2 | 7 | 6 | | 86% | |
| | Cn3 | 7 | 5 | | 71% | |
| | Cs4 | 20 | 18 | | 90% | |
| | Cs5 | 10 | 11 | 1 | 110% | |
| | Cs6 | 3 | 3 | | 100% | |
| | Cs7 | 2 | 2 | | 150% | |
| **8** | Gn1 | 3 | 3 | | 100% | |
| | Gn2 | 4 | 4 | | 100% | |
| | Gn3 | 16 | 16 | | 100% | |
| | Gn4 | 21 | 22 | 1 | 105% | |
| | Gn5 | 3 | 3 | | 100% | |
| | Gn6 | 2 | 3 | 1 | 150% | |
| | Gn7 | 2 | 2 | | 100% | |
| | Gs1 | 3 | 3 | | 100% | |
| | Gs2 | 3 | 3 | | 100% | |
| | Gs3 | 3 | 4 | 1 | 133% | |
| | Gs4 | 3 | 4 | 1 | 133% | |
| | Gs5 | 2 | 2 | | 100% | |
| | Gs6 | 2 | 1 | | 50% | |
| | Gs7 | 2 | 2 | | 100% | |
| TOTAL | | 156 | 148 | | 95% | |

**Table 5.3.2.8.2. Biological samples.**

| Number of biological samples (maturity and age material, *no reading): | | | |
|---|---|---|---|
| **Species** | **Age** | **Species** | **Age** |
| *Merluccius merluccius* | 1 016* | *Lophius piscatorius* | 141* |
| *Gadus morhua* | 46 | *Solea solea* | 126 |
| *Melanogrammus aeglefinus* | 451 | *Pleuronectes platessa* | 146 |
| *Merlangius merlangus* | 660 | *Chelidonichyis cuculus* | 198 |
| *Lepidorhombus whiffiagonis* | 389 | *Microstomus kitt* | 171 |
| *Lophius budegassa* | 137* | *Glyptocephalus cynoglossus* | 62 |
| *Dicentrarchus labrax* | 32 | *Mullus surmuletus* | 91 |
| *Phycis blennoides* | 157 | | |

#### 5.3.2.9 Spain: SP-PORC-Q3 (The Porcupine Groundfish Survey Q3)

| | | | |
|---|---|---|---|
| **Nation :** | SP (Spain) | **Vessel:** | VIZCONDEDE EZA |
| **Survey:** | SP-PORC-Q3 (P15) | **Dates:** | 3 September - 02 October 2015 |

| | |
|---|---|
| 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 collected for several other demersal fish species and invertebrates. |
| Survey Design | This 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 (Otter trawl gear) |
| Notes from survey (e.g. problems, additional work etc.): | Weather conditions were good during most of 2015 survey. Additional work undertaken included 85 CTD casts at most trawl stations, 3 within the non-trawlable area, and 8 in 4 perpendicular radials to obtain a general image of the hydrography.<br>Visual surveys for marine megafauna were undertaken during the survey. A total of 138 hours of dedicated surveying was conducted. A total of 87 sighting events occurred. 8 different marine mammal species were identified. |
| Number of fish species recorded and notes on any rare species or unusual catches: | Overall a total of 102 fish species, 46 crustaceans, 31 molluscs, 26 echinoderms and 21 species of other invertebrates were identified. |

**Table 5.3.2.9.1. Stations fished (aim: to complete 80 valid tows per year).**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Additional | Invalid | % stations fished | Comments |
|---|---|---|---|---|---|---|---|---|
| 9a | All | Porcupine baca | 80 | 80 | 5 | 3 | 106% | Also available by depth |
| | TOTAL | | 80 | 80 | 5 | 3 | 106% | |

**Table 5.3.2.9.2. Biological samples taken during the survey.**

| Species | Age | Species | Age |
|---|---|---|---|
| *Merluccius merluccius* | 1012 | *Molva molva* | 93 |
| *Lepidorhombus whiffiagonis* | 736 | *Conger conger* | 33 |
| *Lepidorhombus boscii* | 304 | *Helicolenus dactylopterus* | 183 |
| *Lophius budegassa* | 71 | *Phycis blennoides* | 247 |
| *Lophius piscatorius* | 442 | *Nephrops norvegicus** | 263 |
| *Lophius* sp. | 27 | | |

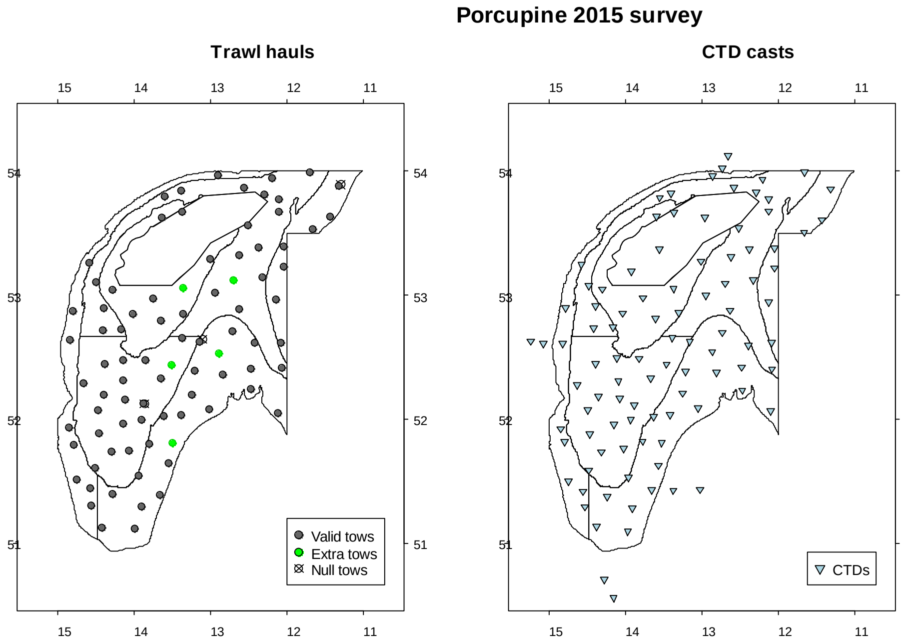



**Figure 5.3.2.3.1. Trawl stations in Porcupine 2015 survey (left panel), CTD stations in relation to trawl stations (right panel).**

**Table 5.3.2.9.3. Biomass and abundance indices.**

| Biomass and number estimates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Biomass index** | | | **Number index** | | |
| **Species** | Strata | **Valid tows** | $y_i$ | $y_i/y_{i-1}$ % | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | kg/0.5h | | % | n/0.5h | % | % |
| *Merluccius merluccius* | All | 80 | 68.49 | -22.8 | 44.8 | 67.4 | -37.7 | 36.1 |
| *Lepidorhombus boscii* | All | 80 | 14.24 | 0.4 | 37.8 | 159.5 | 1.0 | 11.5 |
| *L. whiffiagonis* | All | 80 | 13.07 | -17.2 | 14.7 | 163.4 | -2.4 | 9.9 |
| *Lophius budegassa* | All | 80 | 1.77 | -7.8 | 46.4 | 0.9 | -37.3 | 111.3 |
| *Lophius piscatorius* | All | 80 | 19.80 | -8.1 | 46.0 | 5.0 | -21.2 | 53.2 |
| *Micromesistius poutassou* | All | 80 | 656.98 | 118.3 | 103.8 | 8411.5 | 199.0 | 118.2 |
| *Nephrops norvegicus* | All | 80 | 0.30 | -45.5 | -23.7 | 9.9 | -43.0 | 4.4 |

**$y_i$, year estimate (2015); $y_{i-1}$, previous year estimate (2014); $y_{(i,i-1)}$, Average of last two year estimates (2015 and 2014); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2013, 2011, and 2010, for no survey in 2012).**

### 5.3.2.10 Spain: SP-NSGFS-Q4 (Spanish North Coast Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | SP (Spain) | **Vessel:** | Miguel Oliver |
| **Survey:** | SP-NSGFS-Q4 (N15) | **Dates:** | 17 September - 23 October 2015 |

| | |
|---|---|
| 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.): | 2015 was the third year the RV Miguel Oliver was used to perform the survey instead the RV Cornide de Saavedra, after the intercalibration performed last year, 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…<br>As in previous years, three additional hauls were undertaken to cover shallow stations between 30 and 70 m, (though gillnets in some of the hauls planed, reduced the sampling in shallow waters) and 14 deeper stations, between 500 and 700 m.<br>Additional work undertaken included CTD casts at all trawl stations and dredges carried out with a boxcorer to create a grid of sediment and in some areas infauna samples.<br>Seabirds census was also carried out during fishing manoeuvres.<br>Analyses of stomach contents of main demersal species was performed in all hauls during the survey.<br>Callibration hauls in the French EEZ were carried on 19 October by the RV Miguel Oliver. While the Fench Vessel carried her hauls on 23 and 24 October. |
| Number of fish species recorded and notes on any rare species or unusual catches: | A total of 240 species were captured, 86 fish species, 50 crustaceans, 37 molluscs, 30 echinoderms and 38 other invertebrates. |

**Table 5.3.2.10.1. Stations fished (aim: to complete 116 valid tows per year).**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Additional | Invalid | % stations fished | Comments |
|---|---|---|---|---|---|---|---|---|
| 8c | All | Standard baca | 96 | 95 | 18 | 1 | 99% | Also available by depth |
| 9a North | All | Standard baca | 20 | 20 | 3 | - | 100% | |
| | TOTAL | | 116 | 115 | 3 | 1 | 106% | |

**(1) Additional 20 hauls on shallow and deep grounds and 4 inter-calibration hauls in French EEZ, actually 3 in 8b and 1 in 8c**

**Table 5.3.2.10.2. Biological samples collected during the survey.**

| Species | Age | Species | Age |
|---|---|---|---|
| *Merluccius merluccius* | 950 | *Scomber scombrus* | 605 |
| *Lepidorhombus whiffiagonis* | 486 (471*) | *Scomber colias* | 216 |
| *Lepidorhombus boscii* | 562 (543*) | *Zeus faber* | 63 |
| *Lophius budegassa* | 47 | *Trisopterus luscus* | 251 |
| *Lophius piscatorius* | 71 | *Helicolenus dactylopterus* | 181 |
| *Trachurus trachurus* | 843 | *Phycis blennoides* | 155 |
| *Micromesistius poutassou* | 1 056 | *Conger conger* | 201 |
| *Engraulis encrasicolus* | 301 | | |

**(*) Otoliths read for the ALK.**

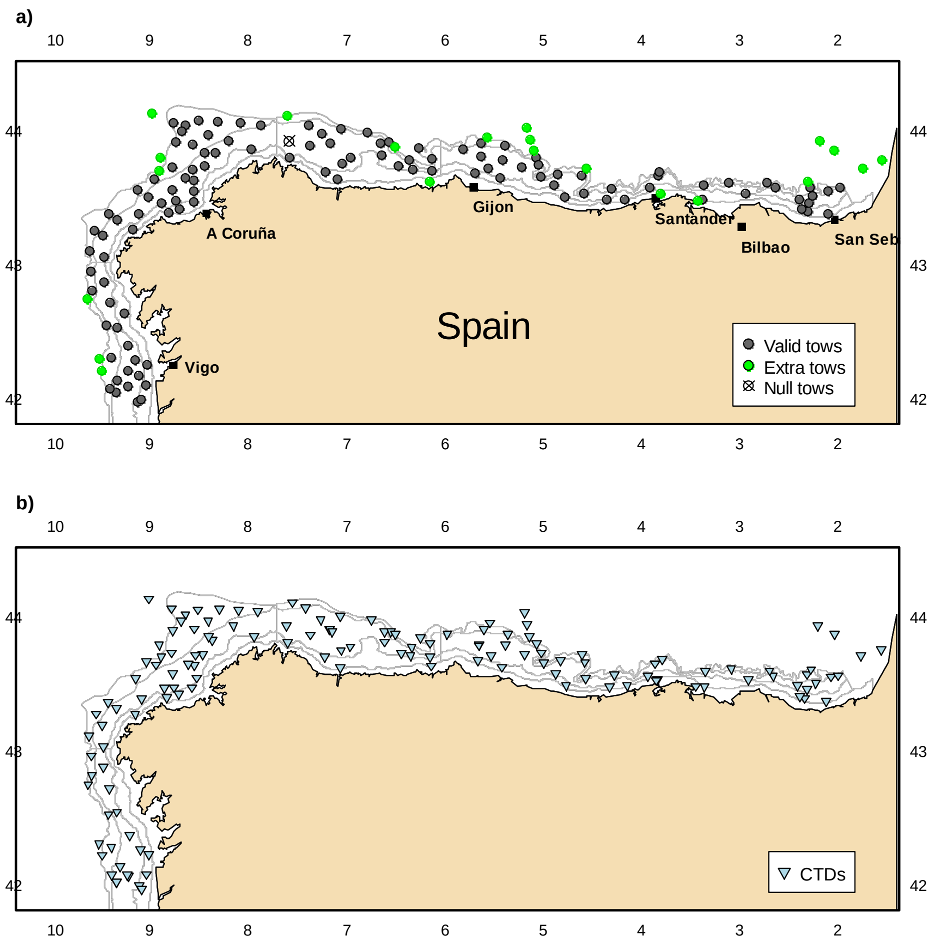



**Figure 5.3.2.4.1. Trawl stations in northern Spanish Shelf 2015 survey, b) CTD stations in relation to trawl stations**

**Table 5.3.2.10.3. Biomass and number estimates.**

| BIOMASS AND NUMBER ESTIMATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Biomass index | | | Number index | | |
| **Species** | **Strata** | **Valid tows** | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | **kg/0.5h** | % | % | **n/0.5h** | % | % |
| *Merluccius merluccius* | 9aN | 20 | 15.75 | 220.1 | -22.5 | 609.3 | 232.1 | 14.9 |
| *Lepidorhombus boscii* | 9aN | 20 | 4.33 | 4.6 | -0.7 | 89.3 | 23.0 | 29.4 |
| *L. whiffiagonis* | 9aN | 20 | 0.02 | -71.4 | -15.6 | 0.1 | -80.0 | -47.1 |
| *Lophius budegassa* | 9aN | 20 | 0.07 | -68.2 | -63.8 | 0.0 | -55.6 | -55.7 |
| *Lophius piscatorius* | 9aN | 20 | 0.13 | 1200.0 | -80.7 | 0.1 | 44.4 | -55.4 |
| *Micromesistius poutassou* | 9aN | 20 | 142.77 | 194.5 | 197.8 | 4 016.1 | 131.4 | 150.9 |
| *Nephrops norvegicus* | 9aN | 20 | 0.01 | 0.0 | -50.0 | 0.2 | 33.3 | -35.4 |
| *Trachurus trachurus* | 9aN | 20 | 6.26 | -40.3 | 1 168.2 | 65.8 | -39.0 | 1143.7 |
| *Scomber scombrus* | 9aN | 20 | 0.74 | -94.1 | -1.6 | 5.0 | -97.3 | -18.9 |
| *Merluccius merluccius* | 8c | 95 | 8.67 | 149.9 | -6.2 | 260.7 | 363.5 | -20.9 |
| *Lepidorhombus boscii* | 8c | 95 | 4.68 | -4.1 | -28.2 | 74.9 | 12.5 | -26.6 |
| *L. whiffiagonis* | 8c | 95 | 2.23 | 38.5 | -16.3 | 36.9 | 240.1 | 40.7 |
| *Lophius budegassa* | 8c | 95 | 0.65 | -49.6 | 4.7 | 0.4 | -58.8 | -30.5 |
| *Lophius piscatorius* | 8c | 95 | 1.35 | -28.6 | 6.6 | 0.7 | -54.4 | -37.8 |
| *Micromesistius poutassou* | 8c | 95 | 190.00 | 49.1 | 213.6 | 7 772.2 | 71.0 | 361.5 |
| *Nephrops norvegicus* | 8c | 95 | 0.05 | -16.7 | 37.5 | 0.8 | -15.2 | 13.3 |
| *Trachurus trachurus* | 8c | 95 | 92.47 | 146.1 | 1 029.5 | 2 682.3 | 282.1 | 716.3 |
| *Scomber scombrus* | 8c | 95 | 1.91 | -71.5 | 65.8 | 9.7 | -90.2 | 30.9 |

**$y_i$, year estimate (2015); $y_{i-1}$, previous year estimate (2014); $y_{(i,i-1)}$, Average of last two year estimates (2015 and 2014); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2013, 2011 and 2010, for no survey in 2012).**

### 5.3.2.11 Spain: SP-GCGFS-Q1 (Spanish Gulf of Cadiz Bottom-trawl Survey Q1)

| | | | |
|---|---|---|---|
| **Nation:** | Spain | **Vessel:** | RV Miguel Oliver |
| **Survey:** | SP-GCGFS-Q1 (ARSA 0315) | **Dates:** | 24 February - 08 March 2015 |

| | |
|---|---|
| Cruise | Spanish Gulf of Cadiz bottom-trawl survey aim to collect data on the distribution, relative abundance and biological information of commercial fish, crustaceans and cephalopods in the Gulf of Cadiz area (ICES Division 9a). The primary species are hake, horse mackerel, mackerel, Spanish mackerel, wedge sole, sea breams, and crustaceans as rose and red shrimps, Norway lobster and cephalopod molluscs. Data and abundance indices are also estimated and reported for other demersal fish species and invertebrates. |
| Survey Design | This 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 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.): | Sediment samples were collected with a collector attached to the groundgear. Temperature and salinity data were also collected during each tow with a CTD attached to the gear. Additionally 54 CTD casts were carried out in the survey area. |
| Number of fish species recorded and notes on any rare species or unusual catches: | A total of 323 species were captured, 134 fish species, 56 crustaceans, 62 molluscs, 23 echinoderms and 45 other invertebrates. Unusual large catches of blue whiting were recorded in a few tows during the cruise. |

**Table 5.3.2.11.1. Stations fished (aim: to complete 41 valid tows per year).**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Additional | Invalid | % stations fished | Comments |
|---|---|---|---|---|---|---|---|---|
| 9a | All | Standard baca | 43 | 43 | - | - | 100% | Also available by depth |
| | TOTAL | | 43 | 43 | - | - | 100% | |

**Table 5.3.2.11.2. Biological samples taken during the survey.**

| Species | Age | Maturity only |
|---|---|---|
| *Merluccius merluccius* | 345 | 2 726 |
| *Parapenaeus longirostris* | | 578 |
| *Nephrops norvegicus* | | 517 |
| *Octopus vulgaris* | | 90 |
| *Sepia officinalis* | | 49 |

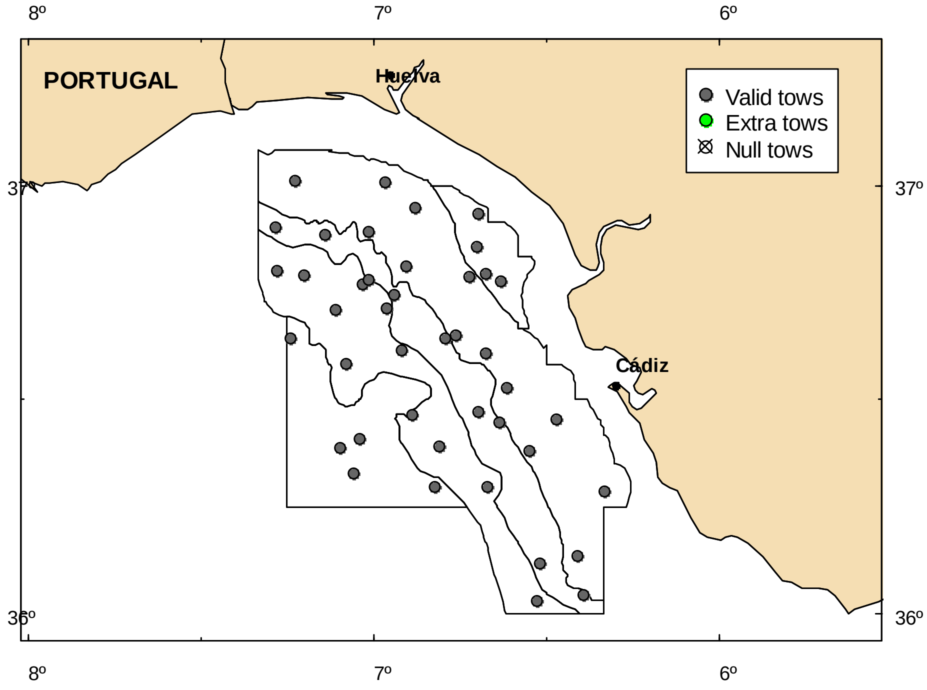



**Figure 5.3.2.5.1. Map of sampling grid and station positions.**

**Table 5.3.2.11.3. Biomass and number estimates.**

| | | | Biomass index | | | Number index | | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Strata** | **Valid tows** | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | **kg/0.5h** | % | % | **n/0.5h** | % | % |
| *Merluccius merluccius* | All | 43 | 3.01 | 0 | 41.5 | 91.53 | 120.1 | 96.7 |
| *Micromesistius poutassou* | All | 43 | 26.23 | 3 2681.3 | 214.4 | 752.82 | 12 5369.2 | 295.4 |
| *Nephrops norvegicus* | All | 43 | 0.26 | -33.3 | 290 | 9.84 | -7.4 | 268 |
| *Parapenaeus longirostris* | All | 43 | 0.21 | -54.4 | -71.5 | 36.1 | -65.4 | -62.6 |
| *Octopus vulgaris* | All | 43 | 0.76 | 7.9 | -61.7 | 1.02 | 19.3 | -69.6 |
| *Loligo vulgaris* | All | 43 | 0.38 | 52 | 31.3 | 2.62 | 49.4 | 3.8 |
| *Sepia officinalis* | All | 43 | 0.28 | -52.1 | -23.7 | 0.62 | -67.5 | -18.6 |

**$y_i$, year estimate (2015); $y_{i-1}$, previous year estimate (2014); $y_{(i,i-1)}$, Average of last two year estimates (2015 and 2014); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2013, 2011 and 2010, for no survey in 2012).**

### 5.3.2.12 Spain: Sp-GCGFS-Q4: (Spanish Gulf of Cadiz Bottom-trawl Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | SP (Spain) | **Vessel:** | RV Miguel Oliver |
| **Survey:** | SP-GCGFS-Q4 (ARSA 1115) | **Dates:** | 30 October - 12 November 2015 |

| | |
|---|---|
| Cruise | Spanish Gulf of Cadiz bottom-trawl survey aim to collect data on the distribution, relative abundance and biological information of commercial fish, crustaceans and cephalopods in the Gulf of Cadiz area (ICES Division 9a). The primary species are hake, horse mackerel, mackerel, Spanish mackerel, wedge sole, sea breams, and crustaceans as rose and red shrimps, Norway lobster and cephalopod molluscs. Data and abundance indices are also estimated and reported for other demersal fish species and invertebrates. |
| Survey Design | This 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 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.): | Sediment samples were collected with a collector attached to the groundgear. Temperature and salinity data were also collected during each tow with a CTD attached to the gear. Additionally 54 CTD casts were carried out in the survey area. |
| Number of fish species recorded and notes on any rare species or unusual catches: | A total of 350 species were captured, 155 fish species, 59 crustaceans, 56 molluscs, 27 echinoderms and 53 other invertebrates. An unusual large catch of blue whiting was recorded in one tow during the cruise. |

**Table 5.3.2.11.4. Stations fished (aim: to complete 41 valid tows per year).**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Additional | Invalid | % stations fished | Comments |
|---|---|---|---|---|---|---|---|---|
| 9a | All | Standard baca | 43 | 43 | - | - | 100% | Also available by depth |
| | TOTAL | | 43 | 43 | - | - | 100% | |

**Table 5.3.2.11.5. Biological samples taken during the survey.**

| Species | Age | Maturity only |
|---|---|---|
| *Merluccius merluccius* | 371 | 1 148 |
| *Parapenaeus longirostris* | | 927 |
| *Nephrops norvegicus* | | 198 |
| *Octopus vulgaris* | | 308 |
| *Loligo vulgaris* | | 1 169 |
| *Sepia officinalis* | | 552 |

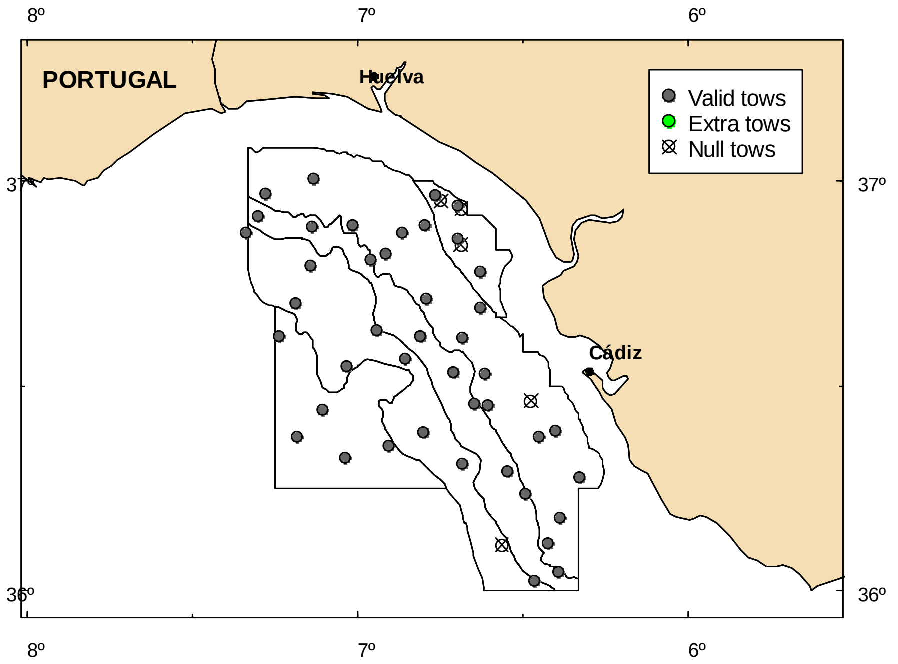



**Figure 5.3.2.6.1.Map of sampling grid and station positions.**

**Table 5.3.2.11.6. Biomass and number estimates.**

| BIOMASS AND NUMBER ESTIMATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Biomass index** | | | **Number index** | | |
| **Species** | **Strata** | **Valid tows** | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | **kg/0.5h** | % | % | **n/0.5h** | % | % |
| *Merluccius merluccius* | ALL | 43 | 6.79 | 45.4 | 64.6 | 125.13 | 160.9 | 22.9 |
| *Micromesistius poutassou* | ALL | 43 | 15.11 | 388 | 661.5 | 601.22 | 589.1 | 1655.4 |
| *Nephrops norvegicus* | ALL | 43 | 0.19 | -46.4 | 156.5 | 7.36 | -45.3 | 149.6 |
| *Parapenaeus longirostris* | ALL | 43 | 0.17 | -42.4 | -74 | 38.05 | 10.7 | -77.2 |
| *Octopus vulgaris* | ALL | 43 | 1.09 | 102.8 | -62.2 | 1.73 | 64.3 | -72.8 |
| *Loligo vulgaris* | ALL | 43 | 1.99 | 180.3 | 54 | 14.07 | 124 | 72.6 |
| *Sepia officinalis* | ALL | 43 | 0.39 | -71.2 | 16.9 | 0.59 | -80.8 | -13.9 |

**$y_i$, year estimate (2015); $y_{i-1}$, previous year estimate (2014); $y_{(i,i-1)}$, Average of last two year estimates (2015 and 2014); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2013, 2011 and 2010, for no survey in 2012).**

#### 5.3.2.13 Portugal: PT-PGFS-Q4 (Portuguese Autumn Groundfish Survey Q4)

| | | | |
|---|---|---|---|
| **Nation:** | Portugal | **Vessel:** | RV Noruega |
| **Survey:** | Autumn 2015 | **Dates:** | 12 October – 13 November 2015 |

| | |
|---|---|
| Cruise | Autumn Groundfish survey aims to estimate the abundance and distribution of hake and horse mackerel recruits, indices of abundance and biomass of the most important commercial species, biological parameters, e.g. maturity, ages, sex-ratio, weight, food habits, and biodiversity indicators. The primary species are hake, horse mackerel, blue whiting, mackerel, and Spanish mackerel. Other data are also collected for several other demersal fish species and invertebrates. |
| Area | Portuguese continental waters (ICES Division 9a), from 20 to 500 m depth. |
| Survey design | 96 fishing stations, 66 at fixed (grid) positions and 30 at random.<br>Tow duration is 30 min, with a trawl speed of 3.5 knots, during day light. |
| Gear details | NCT (Norwegian Campbell Trawl) gear with rollers in the groundrope. The mean horizontal opening between the wings is 14.7 m and the mean vertical opening is 4.4 m. Codend mesh size is 20 mm. |
| Notes from survey (e.g. problems, additional work etc.) | 5 stations could not be performed due to static gears present in the area.<br>Survey was interrupted for 8 days due to bad weather.<br>Temperature was recorded with a CTD (Conductivity, Temperature, Depth) equipment: – 96 CTDs Stations took place in the final position of each fishing station.<br>SCANMAR equipment was used in most stations. |
| Number of fish species recorded and notes on any rare species or unusual catches: | Overall, 110 species of fish, 20 of cephalopods, and 31 of crustaceans were recorded during the survey.<br>35 species of other groups were recorded, e.g. Echinodermata, Cnidarians, Bivalves, Gastropods, Polychaeta, Ascidians, and Nudibranchia.<br>Unusually high captures of hake were caught on the northern part of Portugal, with especially remarkable catches of large hakes in two hauls |

**Table 5.3.2.11.7. Stations fished.**

| ICES Divisions | Strata | Gear | Tows planned | Valid | Invalid | % stations fished | comments |
|---|---|---|---|---|---|---|---|
| 9a | ALL | NCT | 96 | 89 | 1 | 94 | Also available by depth and geographical strata |

**Figure 5.3.2.7.1. Map of sampling grid and station positions.**

**Table 5.3.2.11.8. Number of biological samples (maturity and age material).**

| Species | Samples | Maturity | Otoliths |
| --- | --- | --- | --- |
| *Merluccius merluccius* | 63 | 1 084 | 937 |
| *Trachurus trachurus* | 31 | 1 067 | 573 |
| *Micromesistius poutassou* | 22 | 1 095 | 697 |
| *Scomber colias* | 2 | 3 | 3 |
| *Scomber scombrus* | 2 | 62 | 62 |

**Table 5.3.2.11.9. Biomass and abundance indices.**

| BIOMASS AND NUMBER ESTIMATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Biomass index | | | Number index | | |
| Species | Strata | Valid tows | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ | $y_i$ | $y_i/y_{i-1}$ | $y_{(i,i-1)}/y_{(i-2,i-3,i-4)}$ |
| | | | kg/h | % | % | n/h | % | % |
| *Merluccius merluccius* | 9a | 90 | 37.2 | 117.7 | -12.1 | 602.1 | 207.6 | 1.4 |
| *Trachurus trachurus* | | 90 | 43.9 | 93.3 | -26.3 | 1478.9 | 421.1 | 20.7 |
| *Trachurus picturatus* | | 90 | 57.1 | 210.0 | 531.4 | 1 602.6 | 199.9 | 975.4 |
| *M. poutassou* | | 90 | 100.8 | 188.4 | 19.4 | 2 536.5 | 133.2 | 12.1 |
| *Scomber scombrus* | | 90 | 1.1 | -25.5 | -65.6 | 49.2 | -83.6 | -33.6 |
| *Scomber colias* | | 90 | 3.8 | -75.7 | -41.4 | 10.4 | -14.5 | -75.0 |
| *Lepidorhombus boscii* | | 90 | 0.1 | 30.4 | 43.3 | 2.1 | 43.4 | 58.0 |
| *L. whiffiagonis* | | 90 | 0.0 | 59.0 | 2233.7 | 0.1 | -31.2 | 714.1 |
| *Lophius budegassa* | | 90 | 0.0 | NA | NA | 0.0 | NA | NA |
| *Lophius piscatorius* | | 90 | 0.0 | NA | NA | 0.0 | NA | NA |
| *Nephrops norvegicus* | | 90 | 0.0 | 237.8 | -64.0 | 0.9 | 340.7 | -65.0 |

**$y_i$, year estimate (2015); $y_{i-1}$, previous year estimate (2014); $y_{(i,i-1)}$, Average of last two year estimates (2015 and 2014); $y_{(i-2,i-3,i-4)}$, Average of the previous three year estimates (2013, 2011, and 2010, for no survey in 2012.**

### 5.3.3 Results

#### 5.3.3.1 Biological samples

Table 5.3.3.1.1 gives an overview of the number of biological samples as reported per country/survey within the northeastern Atlantic area (in Section5.3.2).

**Table 5.3.3.1.1. Number of individuals sampled for maturity and/or age in 2014.**

| | UK-Sco | | | UK-NIGFS | | Irl | Fr | | Sp | | | | Pt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Q1** | **Q3** | **Q4** | **Q1** | **Q4** | **IGFS** | **CGFS** | **EVHOE** | **PORC** | **NS** | **GC Q1** | **GC Q4** | |
| **Target species** | | | | | | | | | | | | | |
| *Clupea harengus* | 533 | | 331 | | | 409 | | | | | | | |
| *Gadus morhua* | 440 | 5 | 385 | 504 | 77 | 97 | 79 | 46 | | | | | |
| *Lepidorhombus boscii* | | | | | | | | | 304 | 543 | | | |
| *Lepidorhombus whiffiagonis* | | | | 5 | 1 | 807 | | 389 | 736 | 471 | | | |
| *Lophius budegassa* | | | | | | 195 | | 137* | 71 | 47 | | | |
| *Lophius piscatorius* | | | | | | 398 | | 141* | 442 | 71 | | | |
| *Melanogrammus aeglefinus* | 1 245 | 1 052 | 1 396 | 1 064 | 1 033 | 2 211 | | 451 | | | | | |
| *Merlangius merlangus* | 940 | 26 | 832 | 1 410 | 1 337 | 1 758 | 295 | 660 | | | | | |
| *Merluccius merluccius* | 345 | | 279 | 6 | 12 | 574 | | 1 016* | 1 012 | 950 | 345 | 371 | 937 |
| *Nephrops norvegicus* | | | | | | | | | 263 | | 517 | 198 | |
| *Pollachius virens* | 107 | 2 | 60 | | | 102 | | | | | | | |
| *Scomber scombrus* | 170 | 7 | 191 | | | 674 | | | | 605 | | | 62 |
| *Sprattus sprattus* | 386 | | 335 | | | | | | | | | | |
| *Trachurus trachurus* | | | 153 | | | 1 091 | | | | 843 | | | 573 |
| *Trisopterus esmarkii* | 563 | | 682 | | | | | | | | | | |
| **Additional species** | | | | | | | | | | | | | |
| *Argentina silus* | | | | | | | | | | | | | |
| *Argentina sphyraena* | | | | | | | | | | | | | |
| *Chelidonichthys cuculus* | 103 | | | 84 | 86 | 222 | 95 | 198 | | | | | |
| *Conger conger* | | | | 4 | 5 | 52 | | | 33 | 201 | | | |
| *Dicentrarchus labrax* | | | | | | 76 | 6 | 32 | | | | | |
| *Dipturusbatis cf. flossada* | 10 | 34 | 7 | | | 33 | | | | | | | |
| *Dipturusbatis cf.intermedia* | 52 | | 45 | | | 20 | | | | | | | |
| *Dipturus* | | 10 | | | | | | | | | | | |

| | UK-Sco | | | UK-NIGFS | | Irl | Fr | | Sp | | | | Pt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q3 | Q4 | Q1 | Q4 | IGFS | CGFS | EVHOE | PorC | NS | GC Q1 | GC Q4 | |
| *oxyrinchus* | | | | | | | | | | | | | |
| *Eledone cirrhosa* | | | | | | | | | | | | | |
| *Engraulis encrasicolus* | | | | | | | | | | 301 | | | |
| *Eutrigla gurnardus* | 91 | | | | | | | | | | | | |
| *Gadiculus argenteus* | | | | | | | | | | | | | |
| *Galeorhinus galeus* | 1 | | 4 | | | | | | | | | | |
| *Glyptocephaluscy noglossus* | | | | | | 321 | | 62 | | | | | |
| *Helicolenus dactylopterus* | | | | | | | | | 183 | 181 | | | |
| *Hexanchus grieseus* | 1 | | | | | | | | | | | | |
| *Leucoraja circularis* | | | | | | | | | | | | | |
| *Leucoraja fullonica* | | 4 | | | | | | | | | | | |
| *Leucoraja naevus* | 46 | | | 38 | 15 | 163 | | | | | | | |
| *Limanda limanda* | | | | | | | | | | | | | |
| *Loligo forbesi* | | | | | | | | | | | | | |
| *Loligo vulgaris* | | | | | | | | | | | | 1169 | |
| *Micromesistius poutassou* | | | | | | 705 | | | | 1056 | | | 697 |
| *Microstomus kitt* | | | | 107 | 43 | | 36 | 171 | | | | | |
| *Molva molva* | | | 83 | | | 94 | | | 93 | | | | |
| *Mullus surmuletus* | 1 | | | | | | 102 | 91 | | | | | |
| *Mustelus spp.* | 14 | | 9 | | | | | | | | | | |
| *Octopus vulgaris* | | | | | | | | | | | 90 | 308 | |
| *Parapenaeus longirostris* | | | | | | | | | | | 578 | 927 | |
| *Phycis blennoides* | | | | | | | | 157 | 247 | 155 | | | |
| *Pleuronectes platessa* | | | | 417 | 324 | 1 021 | 389 | 146 | | | | | |
| *Pollachius pollachius* | 5 | | | 12 | 3 | 9 | | | | | | | |
| *Raja brachyura* | 11 | | 18 | 12 | 32 | 29 | | | | | | | |
| *Raja clavata* | 94 | 7 | 85 | 183 | 114 | 343 | | | | | | | |
| *Raja montagui* | 250 | | 323 | 149 | 98 | 675 | | | | | | | |
| *Scomber colias* | | | | | | | | | | 216 | | | 3 |
| *Scophthalmus maximus* | | | 3 | | 2 | 44 | | | | | | | |
| *Scophthalmus rhombus* | 4 | | 10 | 26 | 14 | 70 | 4 | | | | | | |
| *Sepia officinalis* | | | | | | | | | | | 49 | 552 | |

| | UK-Sco | | | UK-NIGFS | | IRL | FR | | SP | | | | PT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Q1** | **Q3** | **Q4** | **Q1** | **Q4** | **IGFS** | **CGFS** | **EVHOE** | **PORC** | **NS** | **GC Q1** | **GC Q4** | |
| *Solea solea* | | | | | | 103 | 50 | 126 | | | | | |
| *Squalus acanthias* | 82 | | | 15 | 30 | 385 | | | | | | | |
| *Trisopterus luscus* | | | | | | | 71 | | | 251 | | | |
| *Trisopterus minutus* | | | | | | | | | | | | | |
| *Zeus faber* | 80 | | 44 | 9 | 14 | 243 | | | | 63 | | | |

*** Samples collected for maturity only**

**(2) Otoliths + Illicia**

### 5.3.4 Participation planned for 2016–2017

| Survey | Code | Starting | Ending | expected hauls | Planned Intercal |
|---|---|---|---|---|---|
| UK-Scotland Rockall | UK-SCROCQ3 | 28/08/16 | 08/09/16 | 40 | - |
| UK-Scotland West (aut.) | UK -SCOWCQ4 | 17/11/16 | 07/12/16 | 60 | - |
| UK-Scotland West (spring) | UK-SCOWCQ1 | 14/02/17 | 06/03/17 | 60 | - |
| UK-North Ireland (aut.) | UK-NIGFS Q4 | 03/10/16 | 21/10/16 | 60 | - |
| UK-North Ireland (spring) | UK-NIGFS Q1 | 01/03/17 | 23/03/17 | 60 | - |
| Ireland – Groundfish Survey Via | IE-IGFS | 25/09/16 | 06/10/16 | 45 | - |
| Ireland – Groundfish Survey VIIb,g,j | IE-IGFS | 14/11/16 | 18/12/16 | 125 | - |
| France – EVHOE | FR-EVHOE | XX/10/16 | XX/12/16 | 155 | - |
| France - Western Channel | FR-CGFS | | | 110 | - |
| Spain – Porcupine | SP-PORC | 07/09/16 | 08/10/16 | 80 | - |
| Spain - North Coast | SP-NSGFS | 17/09/16 | 23/10/16 | 116 | - |
| Spain - Gulf of Cádiz (Spring) | SP-GCGFS Q1 | XX/02/16 | XX/03/16 | 43 | - |
| Spain - Gulf of Cádiz (Aut.) | SP-GCGFS Q4 | XX/10/16 | XX/11/16 | 43 | - |
| Portugal -(Aut.) | PT-PGFS | 04/10/16 | 03/11/16 | 96 | - |

**Intercal: intercalibration between vessels**

### 5.3.5 Other business

#### 5.3.5.1 Proposed change in tow duration UK-NIGFS

An analysis of catch weights, species length frequencies, and species diversity from a tow duration experiment conducted in the Irish Sea during 2002–2006 was presented at IBTSWG 2015. There was no observed significant effect of reduced tow duration on catch rates, mean species length or species diversity. A recommendation is made that tow duration can be reduced in northern Irish Groundfish Survey quarter 1 survey. A reduction in tow duration from 1hr to 20 minutes would allow the survey to be carried out more efficiently, while providing opportunity to investigate benefits of station distribution and allocation within existing strata.

#### 5.3.5.2 Proposed change in tow duration SP-PorcGFS

When Porcupine Survey started in 2001 there were many problems with the net monitoring system due to the depth of hauls (200–800 m), so it was decided to start counting the haul at the end of shooting the warp, and this was the procedure in successive surveys, although Simrad ITI was used in all hauls it was not possible to log the values and only vertical opening and door spread was recorded as a mean value for the haul taking notes of parameters at regular intervals, although many times there were no response from the Simrad ITI. From 2004 Simrad ITI values were logged together with GPS track during most hauls, these values were saved and were used in 2013 to review tow durations in the survey from 2004 to 2013, using gear parameters logs was performed. As a result tow durations in those years was significantly reduced. Abundance indices were weighted to 30 min duration. In 2014 and 2015 tow duration was 30 minutes from gear-bottom contact, it had an important impact in actual catches that were 50 t per survey as a mean in these 2004–2013, but not when they are compared with 2004–2013 time weighted catches. Nevertheless, 30 minutes hauls have caused important workload increase meaning around 90 t in 2014 and 115 t in 2015, causing big difficulties to process all the catches, and taking the sampling to commercial proportions. Therefore a reduction in tow duration from 30 minutes after gear ground contact to 20 minutes would allow the survey to be carried out more efficiently as has been also proposed for the groundfish survey in the Irish Sea (UK-NIGFS), that would still be consistent with the time-series up to now and also would made sense in sample size, that with the current protocols it is clearly much larger than needed to obtain a representative sample.

#### 5.3.5.3 Changes in FR-EVHOE, FR-CGFS

A presentation was made of how the EVHOE survey sampling design will be modified from 2016 to optimize the time at sea, ensure consistent spatial coverage and harmonize the variance of abundance indices across sampling strata. For this sampling, stations will be reallocated between strata. Based on an initial random allocation proportional to stratum surface area using a small grid, the stations will be kept fixed in future. For each fixed sampling station, several trawl paths exist and will be used depending on weather conditions, tides, etc. Thus though moving to a fixed station design, there will be variations between years in the actual trawl path. The group approved this change. Depending on how survey indices are calculated moving to a fixed station design might result in changes to the variance estimator but not the stratified mean estimator.

#### 5.3.5.4 Coordination of IAMS by IBTSWG

The Marine Institute (Ireland) has started a trawl survey (the Irish Anglerfish and Megrim Survey; IAMS) which aimed at providing a biomass index for anglerfish in megrim in ICES Subarea 7 and potentially to contribute to the Scottish Irish Anglerfish and Megrim Industry Science Survey (SIAMISS) in Division 6a. Ireland requests that the IBTSWG to formally coordinate and provide peer review on the IAMS survey series in preparation for it feeding into ICES assessment and advice.

The IBTSWG report ICES 2007 (page 79) lists the criteria to facilitate coordination of new trawl surveys:

*"Any request for coordination within WGIBTS should first be approved by a relevant ICES assessment working group."* WGBIE to provide brief outline of the management need/context for the survey (utility and importance to assessment process):

The survey is designed to provide abundance indices for anglerfish and megrim. Once the time-series is of sufficient length, this survey series will probably provide the most appropriate tuning index for both species. For WGBIE, the relevant stocks are given below with their current stock coordinators:

| Stock | Description | Coordinator |
|---|---|---|
| anb-78ab | Black-bellied anglerfish (*Lophius budegassa*) in Divisions 7b–k and 8a,b,d | Joana Silva |
| anp-78ab | White anglerfish (*Lophius piscatorius*) in Divisions 7b–k and 8a,b,d | Agurtzane Urtizberea Ijurco |
| mgw-78 | Megrim (*Lepidorhombus whiffiagonis*) in Divisions 7b–k and 8a,b,d | Ane Iriondo |

The ICES advice for anb-78ab and anp-78ab is based solely on the EVHOE survey. The WGBIE 2016 report states that *"the EVHOE-WIBTS-Q4 survey mainly covers the shelf area in the Celtic Sea and Bay of Biscay. […] However, adult anglerfish are known to migrate down the slope as they grow, and this is where the majority of the fishery occurs. The survey is a good index of recruitment for the stock and may not reflect the trends in the adult biomass. The Q1 Irish Anglerfish and Megrim Survey (IAMS) is specifically designed to provide an abundance index for anglerfish and it is expected that this survey will be used in future assessments."*

It is a bottom-trawl survey (noting that some crustacean trawl surveys and coastal surveys may be better included within other ICES working groups, such as WGBEAM, WGBIFS etc.);

The survey uses a demersal otter trawl (based on commercially used anglerfish trawls). WGIBTS is the most appropriate ICES working group to facilitate the coordination of this survey as the survey design is similar to existing IBTS surveys and there is no other ICES working group dealing with similar surveys.

The survey either has appropriate sampling methods and protocols (including gear descriptions) that conform to the standards encouraged by the IBTSWG, or that can be improved after joining IBTSWG;

The gear specifications, sampling methods and protocols are fully documented. An IAMS manual can be developed over time and reviewed by IBTSWG. Data collection, quality control and data management follow similar procedures to the Irish Groundfish Survey.

The survey should aim to enhance existing IBTS surveys and improve data collection for important stocks. For example, proposed surveys for inclusion within IBTSWG should (i) overlap and extend existing surveys and use comparable gear, or (ii) operate on more specific grounds/times of year with a gear more appropriate to the target species;

The survey is aimed to improve the data collection of valuable anglerfish and megrim stocks (combined TAC > 60 000 t ≈ €200M). The survey overlaps spatially with other IBTS surveys but the gear used on existing IBTS surveys has relatively poor selectivity for anglerfish and megrim. The use of a tickler chain on the IAMS survey greatly increases the catchability for these species. Additionally, the IAMS survey has better coverage in deeper water (> 500–1000 m) than the existing surveys, providing better coverage of the older age classes of anglerfish and megrim.

Submit their data to the DATRAS database;

The survey data will be submitted to DATRAS;

Attend and present data at the annual meetings of IBTSWG;

The Marine Institute will commit to attending and presenting at IBTSWG.

Assessment working groups should confirm (e.g. after a 5-year period) that any surveys targeting specific stocks and not using gears used in the standard IBTS surveys are still providing data of high quality and use to the assessment.

The time-series is not long enough yet, but WGBIE has agreed to communicate the usefulness of the survey to IBTSWG in due time.

#### 5.3.5.5 Intercalibration experiments

In 2015 (as in 2008, 2009, 2013, and 2014), 8–9 comparison hauls were expected to be performed in the adjacent area between FR-EVHOE and SP-NSGFS surveys as recommended in 2006 by IBTSWG (ICES, 2006). The original plan was to perform the hauls with the shortest interval between the French and Spanish vessel. In 2015, the RV Thalassa could not perform the hauls on the Spanish shelf, therefore only the information from the RV Miguel Oliver on the French shelf can be presented. Hauls on the French shelf by the RV Miguel Oliver were performed on 19 October, while the corresponding hauls were performed by the RV Thalassa on 23 and 24 October.

Due to problems in processing the information and coordinating the work between both institutes the overall report will be presented and the utility of using this approach to compare the results between vessels working in adjacent but not overlapped survey areas will be assessed. For the moment comparison hauls will not be performed in 2016.

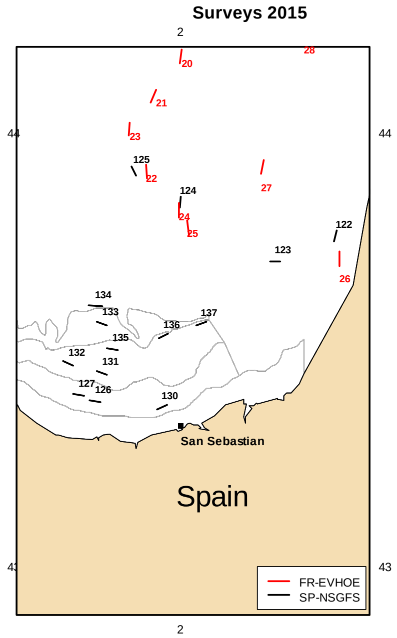



**Figure 5.3.5.1. Map showing the positions of the "comparison" hauls performed by the RV Miguel Oliver and the RV Thalassa in the SP-NSGFS and FR-EVHOE surveys on the French shelf in Autumn 2015.**

### 5.3.6 Actions and Recommendations

Actions: ask regional coordination meeting for the data collection what is done with the otoliths and maturity data from other species not required within the DCR and data calls for assessment working groups.

### 5.3.7 References

ICES. 2006. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 27-31 March 2006, Lysekil, Sweden. ICES CM 2006/RMC:03, Ref. ACFM. 298 pp.

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ICES. 2012. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 27–30 March 2012, Lorient, France. ICES CM 2012/SSGESST:03. 323 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.

## 5.4 Combined North Sea and northeastern Atlantic survey results

Catches from latest bottom-trawl surveys (IBTS) in the North Sea and the northeastern Atlantic areas covered by the IBTS (Table 5.3.5.51 and Figure 5.3.7.) are mapped and presented in Annex 6. This year the Scottish survey on Rockall Q3 has been included as in last year. New plots presenting a summary of the length distributions per ICES divisions and survey, and their evolution between 2011 and 2015 (see an example in Figure 5.3.7.1).

Regarding distribution of abundances, results are in general patterns and distribution similar to those from the previous years. Most remarkable differences (comparison with ICES, 2015, Annex 5) are related with recruitment signals of different species, some good recruitment are apparent, as is the case of haddock in different areas. The abundance of hake recruits, increases in many areas from what was observed in the last two years, but still far from the outstanding recruitments found in 2012 (Figure A.6.13. in Annex 6), remarkable catches of large hake were also detected in different areas but especially in the Portuguese survey.

**Table 5.3.5.51. 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 area).**

| Scientific | Common | Code | Fig No | Length Split (<cm) |
|---|---|---|---|---|
| *Clupea harengus* | Herring | HER | 8–10 | 17.5 |
| *Gadus morhua* | Atlantic Cod | COD | 2–4 | 23 |
| *Galeorhinus galeus* | Tope Shark | GAG | 48 | |
| *Galeus melastomus* | Blackmouthed dogfish | DBM | 56 | |
| *Lepidorhombus boscii* | Four-Spotted Megrim | LBI | 23–25 | 19 |
| *Lepidorhombus whiffiagonis* | Megrim | MEG | 20–22 | 21 |
| *Leucoraja naevus* | Cuckoo Ray | CUR | 44–45 | |
| *Lophius budegassa* | Black-bellied Anglerfish | WAF | 29–31 | 20 |
| *Lophius piscatorius* | Anglerfish (Monk) | MON | 26–28 | 20 |
| *Merlangus merlangius* | Whiting | WHG | 35–37 | 20 |
| *Melanogrammus aeglefinus* | Haddock | HAD | 5–7 | 20 |
| *Merluccius merluccius* | European hake | HKE | 12–13 | 20 |
| *Micromesistius poutassou* | Blue whiting | WHB | 38–40 | 19 |
| *Mustelus* spp. | Smooth Hounds | SDS | 49 | |
| *Nephrops norvegicus* | Norway Lobster | NEP | 41 | |
| *Pleuronectes platessa* | European Plaice | PLE | 32–34 | 12 |
| *Raja clavata* | Thornback ray (Roker) | THR | 50–51 | |
| *Raja microocellata* | Painted/Small Eyed Ray | PTR | 52 | |
| *Raja montagui* | Spotted Ray | SDR | 53 | |
| *Raja undulata* | Undulate Ray | UNR | 54 | |
| *Scomber scombrus* | European Mackerel | MAC | 17–19 | 24 |
| *Scyliorhinus canicula* | Lesser Spotted Dogfish | LSD | 42–43 | |
| *Scyliorhnus stellaris* | Nurse Hound | DGN | 55 | |
| *Sprattus sprattus* | European sprat | SPR | 57–58 | |
| *Squalus acanthias* | Spurdog | DGS | 46–47 | |
| *Trachurus picturatus* | Blue Jack Mackerel | JAA | 60 | |
| *Trachurus trachurus* | Horse Mackerel (Scad) | HOM | 14–16 | 15 |
| *Trisopterus esmarkii* | Norway pout | NPO | 59 | |

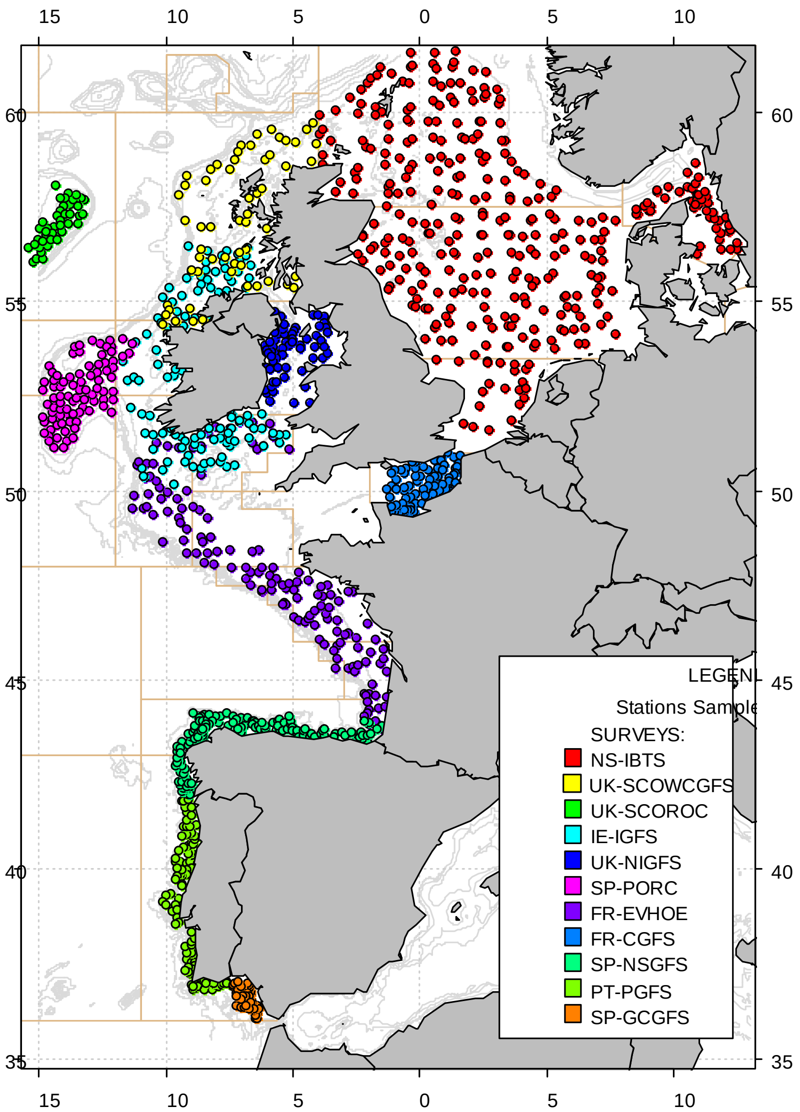


**Figure 5.3.7. Station positions for the IBTS carried out in the northeastern Atlantic and North Sea area in summer/autumn of 2015.**

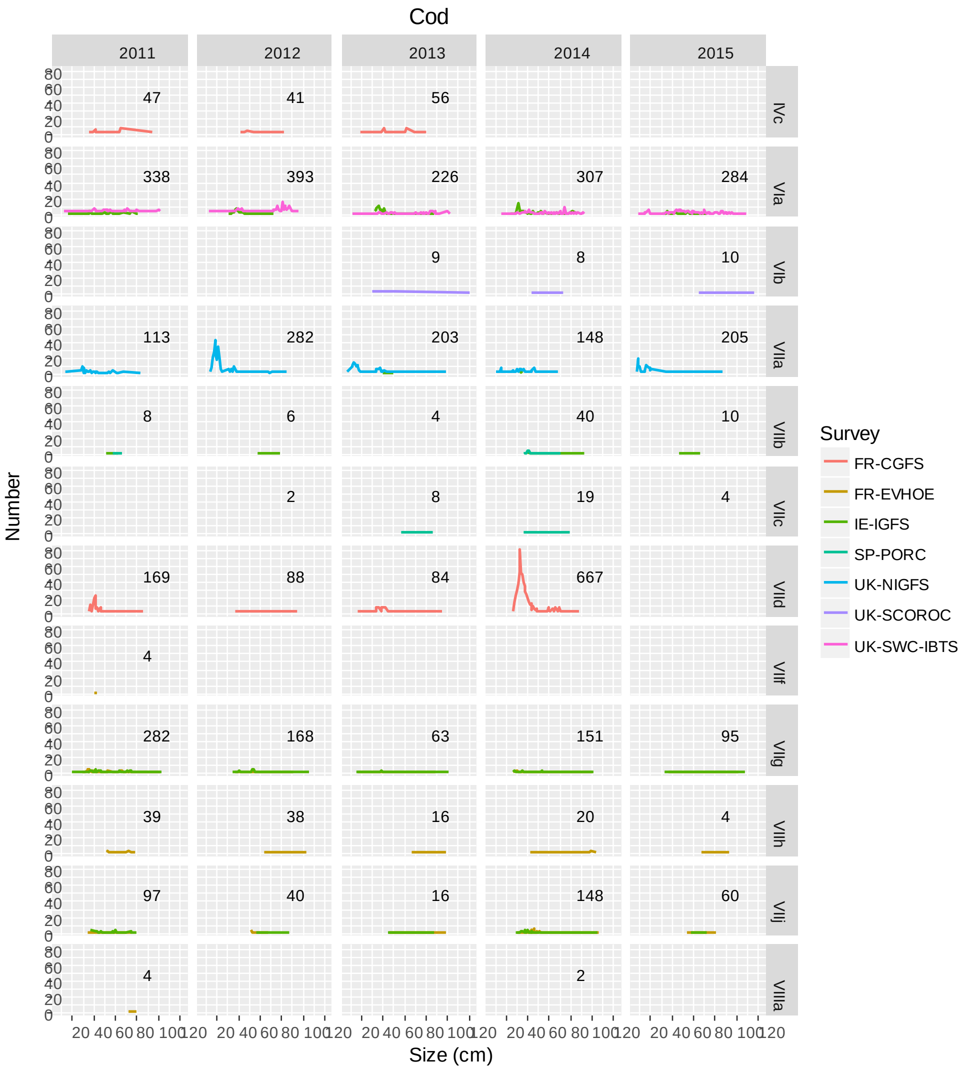


**Figure 5.3.7.1. Example of the length distribution graphs per ICES subareas and surveys presented in Annex 6: Length distributions of cod, *Gadus morhua*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

# 6 Survey Manuals (ToR b)

## 6.1 Manual for the North Sea IBTS

A revision of the current manual for the NS-IBTS (ICES 2015 SISP 10 – IBTS IX) has started and is planned to be finished by the end of 2016. In addition to a general update and correction of some minor errors, missing information (e.g. the trawl rigging) will be supplemented. On the other hand, material which is not directly related to the survey itself will be removed. This includes the maps of the species-specific standard area and other information related to the calculation of abundance indices because this issue are not considered as a part of a survey manual and should be given in DATRAS Procedure Documents instead. The reason for this is that these items are subject to change depending on the outcome of benchmark assessments and area not a result of discussion within the IBTSWG.

## 6.2 Manual for the Northeast Atlantic IBTS

A final draft of a revised manual for the Northeast Atlantic IBTS has almost been completed and will be submitted to ICES in due course.

# 7 DATRAS and related issues on data quality (ToR c)

## 7.1 DATRAS status and overview

Recent updates and improvements in DATRAS are listed in detail in WD1. The improvements cover earlier recommendations from the IBTSWG and this is gratefully acknowledged. The IBTSWG was further informed about potentially erroneous data and gaps in DATRAS for pre-2004 years (e.g. missing individual weight-at-length data for saithe, see WD1).

## 7.2 Data quality checks of recent North Sea IBTS data

Summary data on cpue per length per haul data for 2015 and 2016 were downloaded from DATRAS (4 April 2016) for preliminary data checking.

### 7.2.1 Length errors and potential length errors

Most of the length errors observed (Table 7.2.1.1) were due to incorrect length units being ascribed to various crustaceans. There were also two records of fish that appear to have been unmeasured or smaller than would be expected, and these records could usefully be checked.

**Table 7.2.1.1 Questionable length records in recent North Sea IBTS data.**

| Survey–Year–Quarter–Vessel–Haul | Species | Length (mm) | Comment |
|---|---|---|---|
| NS-IBTS-2015-Q1-DAN2-16 | *Alloteuthis subulata* | 180 | Lengths potentially too high. Potential misidentifications or other input errors |
| NS-IBTS-2015-Q3-SCO3-223 | *Limanda limanda* | 540 | |
| NS-IBTS-2016-Q1-ENDN-34 | *Cancer pagurus* | 1 120 | Incorrect units, should be mm |
| NS-IBTS-2015-Q1-THA2-39 | *Cancer pagurus* | 980 | |
| NS-IBTS-2015-Q1-THA2-14 | *Pecten maximus* | 1 030 | |
| NS-IBTS-2015-Q3-SCO3-266 | *Nephrops norvegicus* | 700 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 260 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 270 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 310 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 320 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 380 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 390 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 420 | |
| NS-IBTS-2016-Q1-SCO3-51 | *Nephrops norvegicus* | 460 | |
| NS-IBTS-2015-Q1-ENDN-7 | *Gasterosteus aculeatus* | 00 | Should fish have been measured |
| NS-IBTS-2015-Q1-THA2-84 | *Pholis gunnellus* | 10 | Small specimen |

### 7.2.2 Incorrect species codes or species names

There are still records of *Gadiculus thori* (SCO3), but this nominal species is currently viewed as a synonym of *G. argenteus*. There has been confusion between suggested subspecies *Gadiculus argenteus thori* and *G. a. argenteus*, although there is no published scientific justification to elevate these nominal subspecies to species level (Raitt, 1964; Cohen *et al.*, 1990; Mercader and Vinyoles, 2008). Hence, data should be reported as *Gadiculus argenteus*.

Records of Arctic sculpin *Myoxocephalus scorpioides* from the southern parts of the study area (NS-IBTS, 2016, Q1, THA2, hauls 44, 45, 46, 51, 57, 60, 75) are likely erroneous, and may relate to a different cottid.

Records of smooth-hound *Mustelus mustelus* are questionable, as recent genetic (Farrell, 2009) and biological (McCully Phillips and Ellis, 2015) studies have failed to find authenticated evidence of this species north of the Bay of Biscay. Hence, data for *M. mustelus* would better refer to *M. asterias*. This affects NS-IBTS-Q1 DAN2 (hauls 13, 17), SCO3 (haul 17), WAH3 (haul 25) and NS-IBTS-2015-Q3-DAN2 (hauls 16, 18, 19, 20, 22).

Records of *Lycodes vahlii* (DAN2, DANS; multiple hauls) refer to *L. gracilis* (as reported correctly by other vessels: 58G2, JHJ). See Carl (2002) for the revision of these species.

### 7.2.3 Unnecessary use of higher taxonomic recording (e.g. Genus/Family) level

Trawl surveys should only record species to the most detailed taxonomic level possible. While most sea-going staff can reasonably be expected to identify the majority of species to species-level, some problematic taxa or damaged specimens can only be identified reliably to genus/family. Hence, data recorded as *Pomatoschistus* spp. or Ammodytidae are to be expected.

Some genera, however, only have a single species in the North Sea or are commonly occurring and easily identified species. Such errors likely relate to using different numeric codes when uploading data to DATRAS. As noted last year, data from END have been uploaded as genus for four species, although these data were collected at species level.

| Reported | Year/Quarter | Vessel | Comment |
|---|---|---|---|
| *Trigla* | 2015/Q3 | END | Data refer to tub gurnard *C. lucerna* |
| *Chelidonichthys* | 2015/Q3 | END | Data refer to red gurnard *C. cuculus* |
| *Eutrigla* | 2015/Q3 | END | Data refer to grey gurnard *E. gurnardus* |
| *Echiichthys* | 2015/Q3 | END | Data refer to lesser weever *E. vipera* |

### 7.2.4 Use of multiple names for a single species

Some species have been uploaded using alternative synonyms or alternative spellings:

Most vessels (DAN2, DANS, END, ENDN, SCO3) reported *Loligo forbesii*, with one vessel (THA2) reporting this species as *L. forbesi*. The former is viewed as the correct spelling.

Data for Norwegian topknot have been reported as *Phrynorhombus norvegicus* (ENDN, SCO3, WAH3) or *Zeugopterus norvegicus* (58G2, DANS). While WoRMS accepts the former as the valid scientific name, the 'Catalog of Fishes' (http://www.calacademy.org/scientists/projects/catalog-of-fishes) accepts the latter. Further clarification on this issue is required. While DATRAS has normally followed

WoRMS, the 'Catalog of Fishes' is the more accurate source of taxonomic information for fish.

### 7.2.5 Taxonomic issues regarding common skate

Two papers (Iglésias *et al.*, 2010; Griffiths *et al.*, 2010) have shown that the 'common skate complex' comprises two distinct species, and data for these species have been confounded since these two species were synonymised in the 1920s. One of these papers referred to the two species as *D.* cf. *flossada* (common or blue skate) and *D.* cf. *intermedia* (flapper skate). However, this has not been accepted, as the specific name 'batis' is a Linnean name and the International Commission on Zoological Nomenclature (ICZN) is unlikely to accept the loss of a Linnean name.

The ICES Working Group on Elasmobranch Fishes (WGEF) currently uses *Dipturus batis* (cf. *flossada*) to refer to the smaller of the two species (this species will likely remain as *D. batis* when the taxonomic status is finalized) and *Dipturus* cf. *intermedia* for the larger of the two species. *Dipturus batis*-complex is used when referring to data that may refer to either of the two species.

When uploading data to DATRAS, the following guidelines could be followed:

- Data for the smaller of the two species (i.e. the form described by Iglésias *et al.*, 2010 as *Dipturus* cf. *flossada*) should be uploaded as *Dipturus batis;*
- Data for the larger of the two species (i.e. the form described by Iglésias *et al.*, 2010 as *Dipturus* cf. *intermedia*) should be uploaded as *Dipturus intermedia* (although this is scientific name is currently considered 'Invalid');
- Data for the genus (i.e. if the species has not been identified accurately) should be uploaded at genus level only (*Dipturus* spp.).

### 7.2.6 Unusual records

Table 7.2.2.1 shows some of the more interesting species records, with comments on their validity.

**Table 7.2.2.1. Unusual fish records that have either been verified or could usefully be checked.**

| Species | Survey–Year–Quarter–Vessel–Haul | Length | n.h$^{-1}$ | Comments |
|---|---|---|---|---|
| *Octopus vulgaris* | NS-IBTS-2015-Q1-58G2-75 | 40 | 2 | Record to be confirmed |
| *Pagellus erythrinus* | NS-IBTS-2015-Q1-THA2-12 | 100 | 2 | Other surveys have found this species in VIIe, but records for 29F0 could usefully be confirmed |
| *Pagellus erythrinus* | NS-IBTS-2015-Q1-THA2-14 | 90 | 2 | |
| *Pagellus erythrinus* | NS-IBTS-2015-Q1-THA2-14 | 110 | 2 | |
| *Polyprion americanus* | NS-IBTS-2015-Q3-DANS-20 | 620 | 2 | Record confirmed by Sweden |
| *Sarda sarda* | NS-IBTS-2015-Q3-DAN2-32 | 520 | 2 | Record confirmed by Denmark |
| *Scomber japonicas* | NS-IBTS-2015-Q3-END-124 | 390 | 2 | Record confirmed by UK, but it should refer to *Scomber colias* |
| *Trachipterus arcticus* | NS-IBTS-2015-Q1-SCO3-5 | 550 | 2 | Record confirmed by Scotland |

### 7.2.7 Cephalopods and shellfish

There is still much variation in the recording and measuring of cephalopods and other shellfish. The recording (by size) of five crustaceans (*Lithodes maja, Cancer pagurus, Homarus gammarus, Maja brachydactyla,* and *Nephrops norvegicus*) and one bivalve (*Pecten maximus*) appears to occur consistently across vessels.

Size data for two species have been recorded inconsistently (*Aequipecten opercularis* and *Necora puber*). Size data and species names for cephalopods have also been more inconsistent.

Data for *Illex illecebrosus* (reported by END) likely refer to *Illex coindetii*, as *I. illecebrosus* occurs in the NW Atlantic and *I. coindetii* is considered to be the only member of the genus in the NE Atlantic (Jereb and Roper, 2010).

There was one record of *Octopus vulgaris* (see above), which may be questionable.

There have been an increasing number of taxonomic categories reported for sepiolids, with some nations also measuring members of this family. While some nations work with taxonomic specialists to verify species identifications, the accuracy of the identifications of other records for this family is questionable.

### 7.2.8 References

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Raitt, D. F. S. 1964. A comparison of Gadiculus from Scottish and Mediterranean waters. Journal of the Marine Biological Association of the United Kingdom, 44: 693–709.

## 7.3 Data quality issues and gaps in previous years

A pilot project which aims to produce quality assured Groundfish Survey Monitoring and Assessment data products (GFSM&A DP) for use in the derivation of MSFD was presented to the working group. Quality Assurance documentation is currently being compiled which aims to produce a quality assured dataset for use in MSFD assessment. The BEAM data providers have been instrumental in bringing the DATRAS database closer to the national standard datasets through uploading their corrected data to the DATRAS database. Changes such as correcting species codes, correcting length records, and correcting distance records to match the national database entries, were made. There are two separate steps in the quality control procedure. (a) Data are checked at the national institution with the original data (as far as possible), then corrected and re-uploaded to DATRAS. By checking this existing data genuine mistakes have been identified. For example, a 70 cm *Leucoraja lentiginosa* was actually a *Rajella lintea*. (b) In some cases for a variety of reasons it is not possible to check the original data. In these cases the second step is applied, this is when in individual cases where direct comparisons of historic data are impossible, but expert judgement is needed to achieve consistency and plausibility throughout the dataset. When a reported data point are considered to be highly unlikely, for example a 28 cm *B. luteum* (Solenette) which has an FSS code of SOL is most likely to be a Dover Sole (DSO). The expert judgement is to change this record to Dover Sole and retain the 28 cm fish within the records. This error was picked up by screening the $L_{max}$ for every species. Many of these changes have already been made in the DATRAS database, but issues arose with uploading historic data for many of the institutions and some resubmissions of historical data have yet to be completed. When all of the corrected data have been compiled the next step is estimating missing values in the haul chronology and biological datasets. This is completed using a variety of methods outlined in the presentation given and detailed in the MSFD Quality Assurance GFSM&A DP documentation, which the working group has been asked to provide feedback on.

Figure 7.3.1.1 describes the process within ICES and OSPAR to produce the GFSM&A DP. The reviews and feedback from the ICES community is an important aspect of the quality assurance process currently being undertaken. The IBTS and BEAM working group participants have been asked to assess this draft documentation and assure that the methods and protocols being applied to produce the GFSM&A DP are suitable for their individual datasets, and where possible provide suggestions and improvements to the protocols to develop the methodology for data quality assurance which can then be applied to the GFSM&S DP and directly to the DATRAS database. Where information relevant to individual surveys is not available within the documentation, and could have consequences for how the data should be used, the BEAM working group have been asked to provide details of this for inclusion in the quality assurance documentation.

Recommendations have been outlined and discussed at the working group the relevant parties to address each of these recommendations have been identified and an action point has been made to inform relevant parties of these recommendations (bullet points below).

**WGIBTS**

- All available data should be uploaded to DATRAS for use in MSFD GES assessment;
- A common standard to estimate missing parameters should be used;
- Historical data quality should be addressed within the group;
- Increase annual coverage in ICES Rectangles that just miss out in the survey selection criteria (details will be included in the documentation and sent to the relevant national data providers, for their information).

**ICES Data Centre**

- Added transparency to changes made to DATRAS data;
- Added L-max checks to DATRAS screening;
- New working group for Data Quality within DATRAS;
- Table of changes made to the DATRAS as a result of the aforementioned screening process should be published on the DATRAS portal.

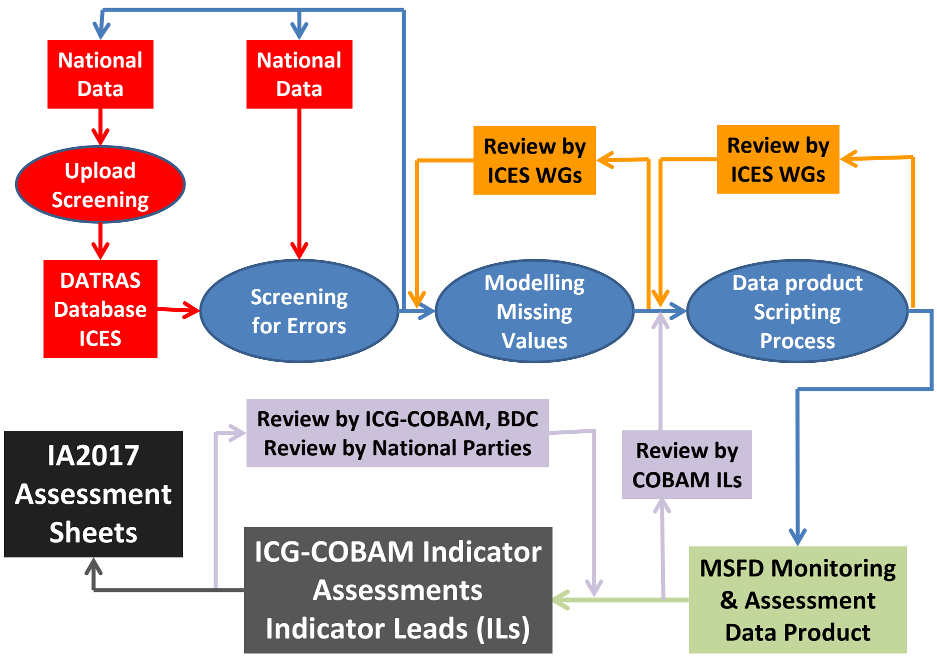


**Figure 7.3.1.1. Overview of the full groundfish survey monitoring and assessment process.**

## 7.4 Future work

During recent benchmark assessments (e.g. for saithe) and the compilation of the MSFD dataset several potential data errors and data gaps were discovered. While many countries have already corrected data submitted to DATRAS for the survey years 2004 to present, corrections and adding data for the years 2003 and earlier is incomplete. Due to changes in data formats both in DATRAS and in national databases, these corrections and additions cannot always easily be done and may be time consuming in some cases. However, the IBTSWG encourage the national data providers to correct and fill data gaps also for the pre-2004 period with high priority (see Annex 4 Action list items 5 and 6).

# 8 Development of a swept-area based index (ToR d)

## 8.1 Progress in data preparation

During the 2014 IBTS meeting, the decision was made to progress with creation of a data product that would provide the necessary information to allow the calculation of abundance indices using swept-area. This has been requested by assessment WG's as well as WGISDAA. Prior to this being possible it was first necessary for all institutes to check their existing data for a reference period which was set at the years from 2004 to 2014 (+2015) (2004 being the date that the current exchange format was established). All net geometry values as well as records for towed distance were plotted and anomalous records checked and if necessary removed during this process. The checked and corrected surveys were then required to be re-uploaded (in some cases this was an opportunity for hitherto missing net geometry data which may originally have been collected but not necessarily uploaded to DATRAS to be uploaded). Any subsequent gaps in the trawl geometry distance measurements (wings and door spread) or the distance records would of course then need to be estimated. The goal being a 10-year period within which there was a dataset that was available and fit for purpose as regards the creation of a cpue index using swept-area instead of the normal cpue based upon time spent on the bottom. It was decided that only observed data should be submitted and held within DATRAS, but that a series of simple formulae should be provided by each survey to allow DATRAS to fill in the gaps in the data where required.

The initial focus was on the participants of the North Sea IBTS surveys Q1 and Q3 with an agreed deadline for all the resubmissions to be uploaded to DATRAS by October 2014, together with the accompanying algorithms being provided to the ICES Data Centre. Subsequent to this deadline the Data Centre then published a procedural document which was presented to the group in 2015 and outlined precisely the verified algorithms that had been quality checked by the Data Centre and were therefore already in use within this new product which was called the "flex – file". This summary document of verified algorithms is located within the background documents for the 2015 meeting documents under the ToR d folder and is called cpue by swept-area algorithms. In addition, each participant presented a working document detailing the processes and methodology used to provide each algorithm. These can be found in Annex 7 of the 2015 IBTSWG report.

While this situation represents significant progress as regards the provision of the necessary algorithms by most of the North Sea participants in 2015, the picture for 2016 remains far from settled with several nations still to complete the process through either seeking to improve on the current submitted algorithms or as a result of other data related issues that have resulted in the process not yet being completed. Table 8.1.1 below provides the current flex-file submission status for the North Sea participants.

The net result is that the flex-file for the North Sea survey is still not complete. This delay in completion has meant that any comparative analysis that was originally programmed for 2016 will almost certainly now be postponed until 2017.

**Table 8.1.1. Current status of North Sea flex-file submissions.**

| | DEN | SWE | NOR | ENG | SCO | NED | FRA | GFR |
|---|---|---|---|---|---|---|---|---|
| **Checked submitted files** | x | x | x | x | x | x | x | x |
| **Provided formulas** | x | x | % | x | x | % | % | x |
| **Implemented formulas** | x | x | | x | x | | | x |
| **Calculated product** | x | x | | x | x | % | % | x |
| **Need to review by country** | | | | | | | | |

**x= Done**
**%=In progress**

## 8.2 Future work

### Action points:

(1) All North Sea participants have to complete the submission process detailed in the table above, up to and including the point where the calculated product has been verified and accepted by the ICES Data Centre. The agreed deadline for the completion of this work is **1 September 2016**.

(2) All Northeast Atlantic survey participants should endeavor to complete the same process as that undertaken by the North Sea in 2014–2015 and by the same deadline if at all possible. Examples of submitted working documents together with the subsequent ICES procedural document for reference can be found on the IBTSWG 2015 SharePoint.

# 9 Sweep length (ToR e)

No activities so far have been conducted because the swept-area based cpue series have been delayed due to missing interpolation routines for single countries and surveys.

# 10 Evaluate the present scheme of collection of age and other biological data (ToR f)

## 10.1 Revision of otolith collection scheme in the NS-IBTS

So far, age data have been collected based on roundfish areas, and the current scheme dictates to collect a specific number of otoliths per 1-cm or 0.5-cm class by country within these spatial units. As multiple countries fish in the same roundfish area this often results in a large number of otoliths and conversely if a country only fish in a few rectangles in a given round fish area then it is the case that the sampled otoliths will originate in a small number of hauls. During the IBTSWG 2015 meeting, strong arguments have been brought forward to avoid clustered sampling and to investigate to what extent the number of otoliths collected could be reduced if instead they were collected by station, as is the case on other surveys (Aanes and Vølstad, 2015). Results from a preliminary analysis conducted during the 2015 meeting for whiting in roundfish area 1 supported the proposal to sample otoliths by station rather than by roundfish area, and to reduce the number of otoliths sampled for smaller-sized fish by moving to wider size classes of 5-cm in the investigated case for whiting < 30 cm (van Hal, 2015). This analysis has been expanded to include all whiting and herring for the Q1 and Q3 NS-IBTS in 2010, 2013, and 2015 (WD2, this report). In contrast to the preliminary analyses in 2015, which suggested that a reduced sampling scheme could be sufficient, this extended analysis does not fully support the reduction of the total amount otoliths but indicates that station-specific sampling is required to continue to facilitate further analysis. Therefore, we will continue the station-specific sampling in the NS-IBTS, and details on e.g. the length grouping for the target species will be provided to the participants by the Q1 and Q3 coordinators prior to the surveys.

### References

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## 10.2 Current technical developments for improving data quality

Following a presentation from Ifremer on refitting the fish lab on RV "Thalassa" for data collection and quality checking (QC), including use of electronic measuring boards, the general topic was expanded upon. Significant resources are being allocated by individual institutes under one or more data collection program(s), while the resources available to improve efficiency, quality, and standardization of data collection through automated systems is highly variable.

The advantages of standardizing QC across data collection feeding into a single sampling program have long been discussed were highlighted again. Likewise, the earlier potential issues can be highlighted in the collection process the more effective and accurate the solutions can be. Near real-time management via a well-developed electronic data capture in the field therefore offers an optimal solution both in data accuracy and resource efficiency.

While several commercial options are available they can be extremely costly and offer varying levels of functionality and flexibility. Fisheries science now inhabiting a world of increasingly open source and highly flexible data analysis is making the business case for expensive proprietary systems increasingly difficult. However, the experience across project teams and institutes of the individual efforts towards automation and data checks cannot be overstated.

Recommendations from the group are:

i. To convene a workshop to promote pooling of resources towards developing and standardizing fisheries data collection; and

ii. To investigate further opportunities under the "Strengthening regional cooperation in the area of fisheries data collection" funding call (see below).

**Reference:**

Strengthening regional cooperation in the area of fisheries data collection

| Type | Action grant with a call for proposals |
|---|---|
| Budget | € 2.000.000 |
| Priorities of the year, objectives pursued and expected results | The call will involve up to 6 grants aiming at strengthening regional or EU cooperation between Member States to:<br>Conduct intersessional work between the annual Regional Coordination Meetings or meetings of the Planning Group for Economic Issues;<br>Further develop regional and/or EU-wide tools, including databases, and processes for Data Collection Framework (DCF) data collection, management, storage and transmission;<br>Further develop and test an operational framework for establishing and coordinating statistically-sound sampling programmes at a regional or EU scale;<br>Trial the collection of new variables that may be required under reformed Common Fisheries Policy (CFP). |
| Essential eligibility, selection and award criteria | Eligibility criteria:<br>Proposals must be submitted and implemented by partners who are public authorities or private bodies of at least three coastal Member States.<br>Proposals should involve relevant authorities at the appropriate level (international, national and/or regional) engaged in fisheries activities that involve DCF data collection planning, implementing, managing, processing, analysing or transmitting, in the selected sea area(s). Proposals should include coordination with the implementation of the INSPIRE directive 2007/2/EC at national and cross-border level.<br>Proposals should demonstrate the cross-border nature of the proposed project, inter alia through the proposed partnership composition and the selected geographic area(s) which must be characterized by multiple and cross-border activities (existing or potential).<br>Selection criteria:<br>Applicants must have the financial capacity and the professional competencies and qualifications required to implement and complete the proposed projects.<br>Award criteria:<br>Relevance of the proposal to the objectives of the call. Added value and innovation.<br>Proposed working methodology to achieve a timely and successful implementation of the projects.<br>Adequacy of the resources (personnel, equipment, vessels where relevant, financial etc.). Adequacy of the organization and management structure proposed for the projects. Adequacy of the dissemination plan. |
| Implementation | The action will be implemented by DG MARE |
| Cofinancing involved | Maximum 90% |
| Indicative timetable | Call for proposals to be launched in the second quarter of 2016. |

# 11 Survey design (ToR g)

## 11.1 IBTS/MEDITS seminar

Survey design issues such as stratification and standardization of the survey trawl were discussion during a joint seminar between IBTS and MEDITS (Mediterranean International Trawl Survey) participants.

The 1Q NS-IBTS started already in 1960 and has undergone several changes during its history. It has been conducted annually since 1966 focusing on the distribution of juvenile herring in the North Sea and in 1969 the Skagerrak and the Kattegat were added to the survey area. The objectives were subsequently widened to include gadoids and other target species. Different trawls and tow durations were used and first since 1982 all countries used the GOV. The 3Q NS-IBTS began in 1991 combining several national surveys. Also here, different trawl and tow durations were used until 1998, and first since 2004 the survey became reasonably standardized. Stratification into statistical rectangles with the goal that two different countries fish the rectangles where the exaction station positions are not determined randomly in advance is the same for both of the two surveys.

Surveys in the western and southern areas were coordinated since 1994 and merged into the northeastern Atlantic IBTS in 2010. The different surveys are carried out by national institutes, are carried out at different times of the year and have only small spatial overlap. Most of the surveys follow a depth stratified random design, some are using the GOV and almost all provide swept-area based abundance indices for a variety of species.

The MEDITS started in 1994 with four countries and was extended in the following years involving 16 institutes. The survey is carried out annually since 2010 in collaboration of nine countries using research and commercial vessels. The survey scheme is a depth stratified random approach divided into geographical subareas, all countries use the standard GOC-73 trawl and tow duration, data collection and analysis are highly standardized. The survey provides swept-area abundance indices for several demersal fish and shellfish species.

## 11.2 Tow duration

### 11.2.1 NS-IBTS 3Q 2015

IBTSWG 2015 agreed to conduct an experiment on tow duration during the NS-IBTS Q3 2015. Evidence exists for other surveys that benefitted from changing to shorter tow duration (IBTSWG Report 2015 section 10.3. for a thorough discussion on the pros and cons). The majority of the IBTSWG considered the risk that the experiment would impair the quality of the long-term survey dataset sufficiently small.

In order to warrant a thorough comparison with the current methodology, a plan was formulated whereby in each ICES rectangle one of the two assigned hauls would remain a 30 min tow, whereas the duration of the second would be reduced to a 15 minutes. England and Sweden decided to retain tow duration for all of their hauls at 30 min and thus no mixed two durations were planned for the Skagerrak, which is almost exclusively covered by Sweden, while in the North Sea the proportion of 15 min tows conducted by Denmark, Germany, Norway, and Scotland was about 50%. The 15 min tows were either placed in rectangles in which England was supposed to conduct a 30 min or, in the remaining rectangles not allocated to England, a balanced share of nominal 30 min tows (20 to 32 min in practice, Figure 11.2.1.1) and nominal 15 min tows (15 to 17 min in practice, Figure 11.2.1.1) were achieved except for rectangles 46F3 and 43F4 where unintentionally only two 15 min tows have been conducted due to a misunderstanding in communication between the countries involved (Figure 11.2.1.2).

The time saved due to the shorter tows was used by Germany and Norway to extend their normal area coverage while Denmark and Scotland made additional hauls primarily in rectangles where they usually are the only country. Overall, the implementation of the short tows resulted in a higher total number of rectangles covered and a more balanced distribution of the number of tows between the rectangles than in previous years, while the total area fished decreased only slightly. (Figure 11.2.1.3).

Preliminary analyses were conducted immediately after the data had become available in DATRAS and were based on the paired tows of different duration by rectangle. They indicated neither a significant effect of tow duration on the abundance indices of NS-IBTS target species, nor on the total number of species recorded (WD3). More in-depth analysis for cod and whiting (WD4), haddock and Norway pout (WD5) and saithe, plaice, sprat, herring, and mackerel (WD6) confirmed in general the preliminary results for the abundance indices by age except for Norway pout age 1, for which the catch rate was significantly lower in the short tows than in the standard tows. Furthermore, no indication was found that the shorter tow were less efficient than the standard 30 min tows for catching larger and/or older fish. Species richness on the other hand appeared to be slightly lower in the short than in the long tows due to the smaller fished area (Figure 11.2.1.4) and an increase by about 31% of the number of the short tows would be needed to catch the same number of species than in the long tows (WD7). However, all these analyses were based on a relative limited amount of data, and it was agreed that more data are needed before conclusive results can be obtained.

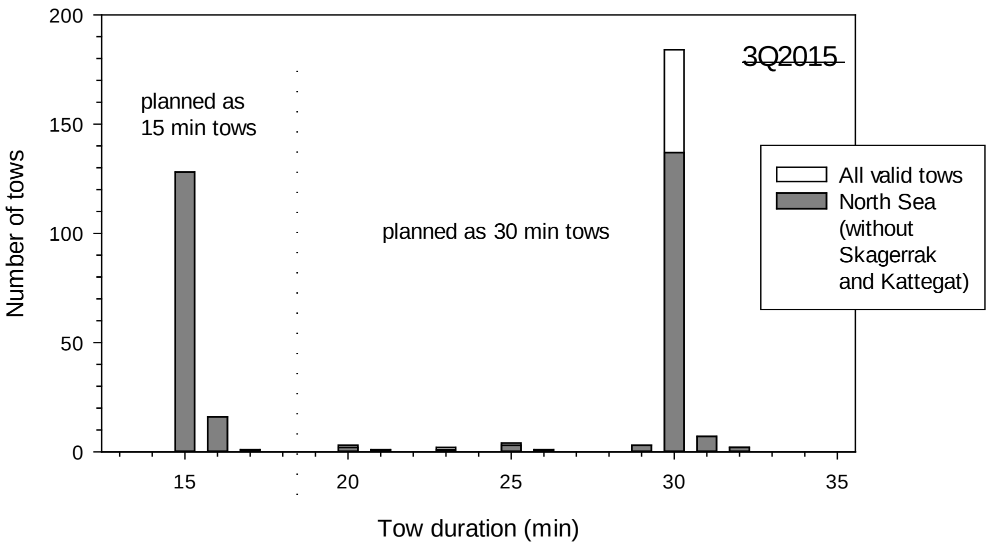


**Figure 11.2.1.1. Frequency distribution of tow durations, NS-IBTS 3Q2015.**

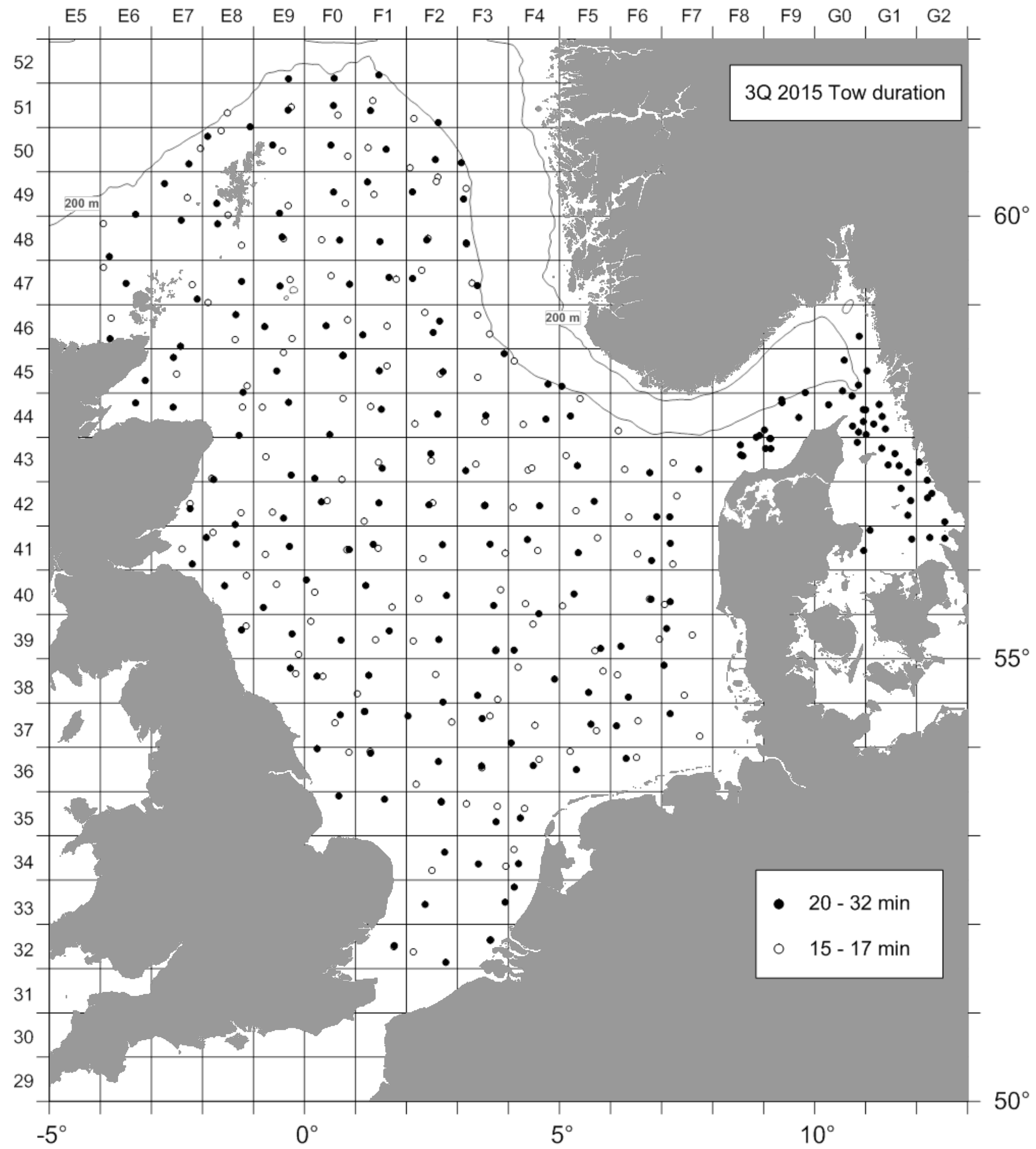


**Figure 11.2.1.2. Achieved distribution of hauls by tow duration, NS-IBTS 3Q2015.**

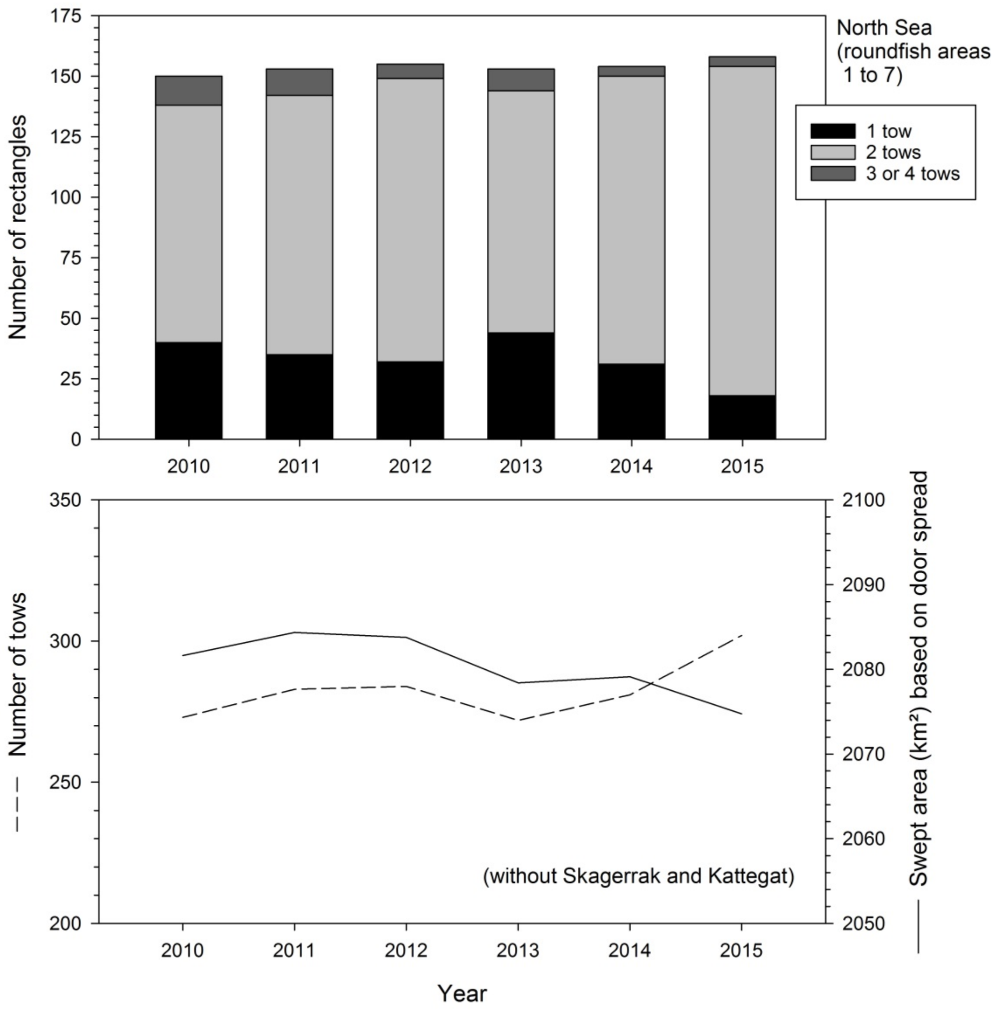


**Figure 11.2.1.3. Changes in survey performance, NS-IBTS 2010 to 2015.**

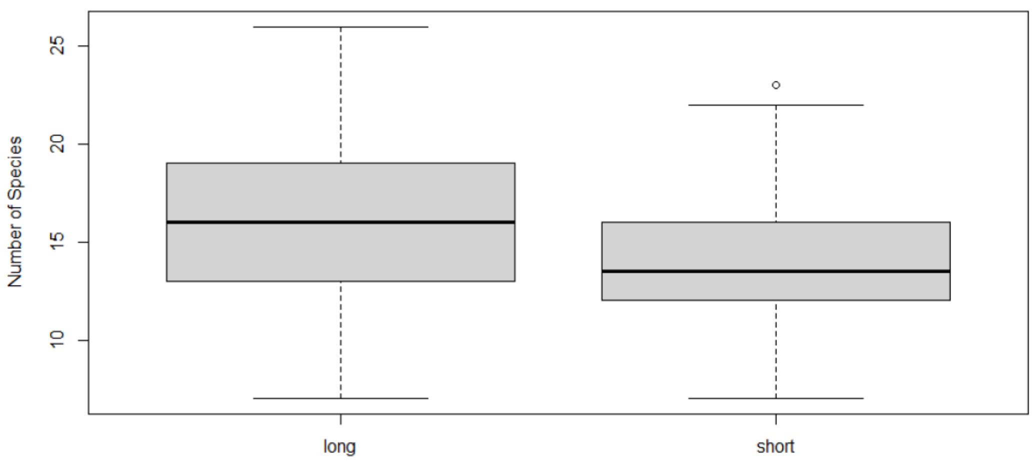


**Figure 11.2.1.4. Mean number of species recorded in the nominal 30 min and the nominal 15 min tows.**

### 11.2.2 NS-IBTS 1Q 2016

France conducted some additional 15 min tows during the 1st quarter NS-IBTS in 2016. These tows were paired with standard tows within the same rectangle and the results of the analysis of the 15-paired observations indicated that the short tows caught fewer species, the catch rates in numbers and weight were larger and the individuals caught were smaller (WD8). These findings were in contradiction to what was found for the 3Q 2015 NS-IBTS, and the reasons for this were not quite clear. It was argued that there is a catch outside the nominal tow duration and that this 'zero tow length catch' is proportionally larger for the 15 min tows than for the 30 min tows. However, clear evidence of such an effect is not well described in the literature as discussed during the IBTSWG meeting in 2015 (IBTSWG report 2015). The 'end' or 'zero tow length' effect is likely gear and vessel specific depending on trawl setting and hauling procedures.

### 11.2.3 Other areas

In an experiment comparing 20 min with 1 h tows on 42 stations in the Irish Sea no significant effects of tow duration on mean fish length, average catch weight and species diversity (WD9). This is in accordance with the results of the majority of published studies (IBTSWG report 2015 for references).

## 11.3 Response to outcome from WGISUR and WKPIMP on modifying the 3Q NS-IBTS towards an ecosystem survey

The objectives of the INS-IBTS have been widened and the type of information collected during the surveys has increased during its history. For example, the collection of marine litter has become a standard procedure for all participating countries, is internationally coordinated and the data are stored in DATRAS. Furthermore, most countries collect some additional ecosystem information during their surveys (Section 5) for national interests but this is so far not internationally coordinated.

IBTSWG participants have joint the work of WGISUR and the WGISUR have been discussed on the IBTSWG meetings, mainly considering which types of additional ecosystem information can be collected without extra ship time and which types of work would require additional ship time or equipment and staff.

Among other arguments, one motivation for the tow duration experiment in the 3rd quarter NS-IBTS 2015 (Section 11.2) has been to provide the data for allowing analyses whether the implementation of reduced towing time would safe time for other sampling without reducing the quality of the survey results for assessment purposes. The preliminary results from the tow duration experiment suggest that the shorter tows (15 min) are almost as good as the standard tows (30 min) but that it appears to be necessary that the total fished area should be the same and that consequently the total number of tows have to be increased by about 30 % if solely 15 min tows are made. Hence, almost no time can be saved for additional ecosystem sampling just by reducing the tow duration from 30 to 15 min.

An alternative measure for saving ship time for other sampling could be to use a trawl mounted CTD instead of the conducting a CTD station on each trawl track. Here, however, concerns may arise from the users of the data even if the precision of the sensors of the trawl mounted CTD is the same than for the standard vertically operated CTD.

It may, however, be possible to obtain the abundance indices of the target species for assessment purposes with sufficient precision and fulfil the requests for monitoring biodiversity if the stratification of the survey and the station allocation to those habitats which are accessible with the GOV, is changed conduction more hauls in highly variable areas and less in homogeneous ones. Such work has been initiated and further analyses using on swept-area based cpue, which is expected to become available for all countries in the near future (Section 8), are planned for the coming two years. These analyses could be based on the stratification proposed by WKPIMP (Figure 11.3.1).

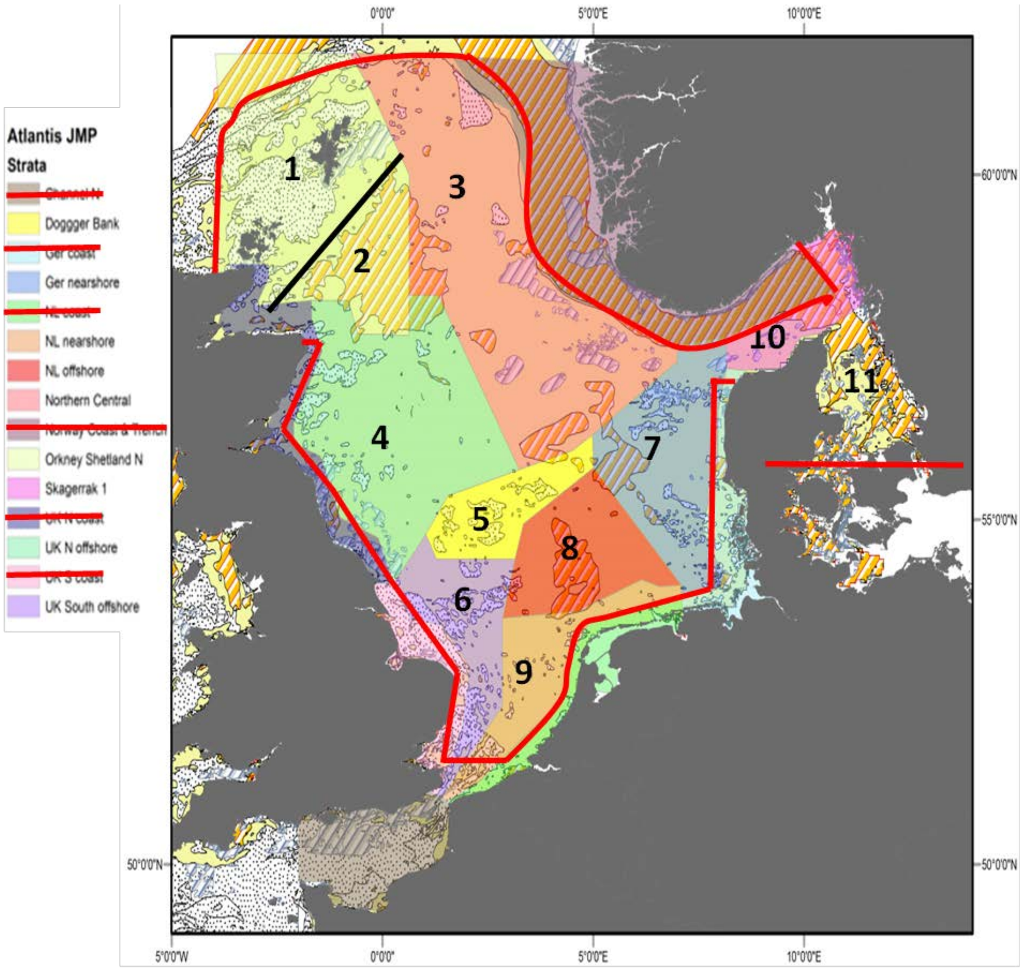


**Figure 11.3.1. Stratification suggested by WKPIMP for the 3Q NS-IBTS (modified Atlantis JMP strata).**

WKIMP suggested that all of the additional ecosystem variables have to be sampled on each of the fishing stations. This is not fully understood by the IBTSWG participants. Another concern is that the IBTSWG cannot see at the moment that is ensured the results from the collection of additional ecological parameters will be used in an internationally coordinated way. Thus, considering the risk to decrease the quality of the standard survey results for assessment purposes including the information required for MSFD indicators, the IBTSWG decided to wait with the implementation further changes of the NS-IBTS design until more information have become available, partly from own analyses but also based on advice from other ICES Expert Groups such as WGISDAA, WGNSSK, HAWG, WGWIDE, WGEF, and WGISUR.

## 11.4 Replacement of vessels and change of stratification

The French Channel Groundfish Survey (CGFS) introduced in 1988 has been conducted with RV Gwen Diaz (26 m length) until 2014. This vessel is no longer available for the CGFS and the survey has been conducted with RV Thalassa (75 m) in 2015 (Section 5.3 for more details on the survey). An intercalibration experiment between the two vessels with 32 paired tows was done in 2014. Due to the change towards a much larger vessel some changes in the survey design had to be adopted, i.e. some of the shallow (< 15 m) water stations had to be dropped because they are not accessible with RV Thalassa even at high tide. 74 of the initial 88 stations from the fixed stratified design were retained and the results of a comparative analysis indicate that the change of vessel did not impair the quality of the survey and its suitability for assessment purposes.

Several countries will replace their research vessels in the coming years and may then face problems to maintain consistency of their survey results. For the NS-IBTS this will be Germany, Sweden, and Denmark. Intensive intercalibration experiments between the old and the new vessel will not be possible in every case because they are time consuming, the high costs running two vessels in parallel for some time and logistic problems related to sufficient availability of qualified staff for such experiments. Furthermore, previous experiments have shown that it is not always possible to obtain sufficiently precisely estimates for all species and length or size groups to provide acceptable conversion factors, and in such a case it may be sensible to simply ignore the possible effect of a change of a vessel (ICES CM 2004/B:07 WKSAD Report 2004). The design of the NS-IBTS with the aim that each rectangle is fished by two different vessels may allow investigating a vessel effect based on dataseries before and after one of the two vessel fishing in the same area has changed. This, however, requires that the current rectangle allocation to the two countries is maintained beyond the time one of the countries has replaced its vessel. Whether this is an appropriate and cost-effective approach warrants further discussion.

# 12 Data overviews (ToR h)

Generic issues on data overviews of the North Sea and the northeastern Atlantic IBTS are provided in the survey manuals:

**Manual for the International Bottom-trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII:**

http://ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20(SISP)/SISP1-IBTSVIII.pdf

**Manual for the Midwater Ringnet sampling during IBTS Q1. Series of ICES Survey Protocols SISP 2-MIK 2:**

http://www.ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20(SISP)/SISP%202%20MIK2.pdf

**Manual for the International Bottom-trawl Surveys in the Western and Southern Areas. Addendum 2: IBTS manual on the western and southern areas 2010:**

http://ices.dk/marine-data/Documents/DATRAS%20Manuals/Addendum_2_Manual_IBTS_Western_and_Southern_Areas_Revision_III.pdf

In relation to how survey data have informed the assessment and advisory process for any specific stocks assessed by ICES Expert Groups, the annual report of the relevant assessment working groups, or benchmark reports, should be consulted.

# 13 Data reporting guidelines and Input to WKSUREP (ToR i)

The information on the data collected on the annual surveys coordinated by IBTSWG is already collated in a standardized format and are presented in separated sections for the North Sea IBTS in the 1st and 3rd quarter and the Northeast Atlantic IBTS in the annual reports.

Since 2014, IBTSWG has provided a summary of noticeable observations from the most recent NS-IBTS surveys and expectations related to the planning of the coming surveys. This summary is sent to the relevant assessment working groups shortly after the annual IBTSWG meeting. An example is given in Annex 5.

The NS-IBTS and NE Atlantic survey manuals are currently being revised. Along with these revisions input to the Workshop to establish reporting guidelines from survey groups (WKSUREP) can be provided but the IBTSWG does not actually see the necessity to produce additional summaries to assessment WGs.

# 14 Revisions to the work plan and justification

The swept-area based cpue product for the NS-IBTS has been delayed due to missing interpolations routines for some countries and surveys and some outstanding revisions of input data on net geometry. The product is now expected to be delivered in year 2.

# 15 Next meetings

Venue and date of the next meeting were tentatively set to ICES Headquarter in Copenhagen, Denmark, from 27 to 31 March 2017. Alternative dates are 20 to 24 March and 3 to 7 April and an alternative venue would be Lysekil, Sweden. Final decision is to be made after the ICES ASC 2016.

No decisions on the venue and meeting dates for 2018 have yet been made.

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# Annex 2: Agenda adopted

| Monday, 4/4 | | | | |
|---|---|---|---|---|
| 9:00 | | Start, setting-up IT | Plenary | |
| | | Welcome and housekeeping,<br>Overview of meeting ToRs,<br>Recommendations from other WGs,<br>Adoption of agenda,<br>Appointment of ToR leaders | *Introduction:* | *Kai, Corina, Yves* |
| 10:30 | COFFEE | | | |
| 11:00 | | **ToR a** - Survey coordination | Plenary | |
| | | Draft reports on previous surveys (Northeastern Atlantic 2015, NS Q1 2016, NS Q3 2015) | *Lead:* | *Francisco, Ralf, Kai* |
| 12:00 | | **ToR d** – Swept-area index | Plenary | |
| | | Outstanding national reports and/or decisions on estimating missing values for the years since 2004, Update of DATRAS Procedure Document on NS-IBTS swept-area calculation from 2014 | *Lead:* | *National representatives* |
| | | Improving trawl geometry measurements with MARPORT | *Presentation* | *Yves, Michele, Morgan* |
| 13:00 | LUNCH | | | |
| 14:30 | | **ToR g** - Survey design | Plenary | |
| | | Results from tow duration experiment in NS Q3 2015 | *Presentations:* | *Kai,*<br>*National representatives* |
| 15:30 | COFFEE | | | |
| 16:00 | | **ToR g** - Survey design (Tow duration) cont. | | |
| | | Results from NIGFS Q4 | *Presentation* | *Mathieu* |
| | | **ToR a** - Survey coordination | | |
| | | Change of vessel and adaption of survey design during CGFS | Plenary<br>*Presentation* | <br>*Morgane* |
| | | Preparation of final reports on previous surveys (Northeastern Atlantic 2015, NS Q1 2016 and NS Q3 2015) | Subgroups<br>*Lead:* | *Francisco/Corina*<br>*Ralf/Kai* |

| Tuesday, 5/4 | | | | |
|---|---|---|---|---|
| 9:00 | | **Seminar IBTS/MEDITS** | <u>*Plenary*</u> | |
| | | Welcome<br>History, design and current status of:<br>MEDITS<br>Northeastern IBTS | ***Presentations:*** | ***NN***<br>***Francisco*** |
| 10:30 | COFFEE | | | |
| 11:00 | | North Sea 1Q<br>North Sea 3Q | | ***Ralf***<br>***Kai/Jennifer*** |
| | | MSFD monitoring product | ***Presentation:*** | ***Meadhbh*** |
| | | Summary discussion and closure of the seminar | | |
| 13:00 | LUNCH | | | |
| 14:30 | | **ToR c** – DATRAS related topics | <u>*Plenary*</u> | |
| | | Changes and improvements in DATRAS | ***Lead/Presentation:*** | ***Vaishav*** |
| | | Correction of HH (and HL/CA) records 2004 to present | | ***National representatives*** |
| 15:30 | COFFEE | | | |
| 16:00 | | **ToR c** – DATRAS related topics (cont.) | | |
| | | Correction of HH, HL and CA records including the years prior to 2004, e.g.<br>- Raising factors (response to mail from the ICES DATRAS Administration 11/1)<br>- Sweep length (mail from Meadhbh 18/1) and maximum length<br>Inclusion of rectangles 45F5 and 44F6 in roundfish areas 1 and/or 7<br>Species identification errors | <u>*Plenary*</u> | ***Vaishav***<br>***Meadhbh***<br>***Jennifer, Kai***<br>***Jim*** |

| Wednesday, 6/4 | | | | |
|---|---|---|---|---|
| 9:00 | | **ToR f** – Collection of biological data | _Plenary_ | |
| | | Sampling efficiency and minimum required sample size<br>Current work on improving data quality | ***Lead/Presentations:*** | ***Ralf***<br>***Verena*** |
| | | **ToR g** - Survey design | _Plenary_ | |
| | | Possible change in EVHOE sampling scheme | ***Presentation:*** | ***Verena*** |
| 10:30 | COFFEE | | | |
| 11:00 | | **ToR d** – Swept-area index | _Plenary_ | |
| | | Discussion on progress and decisions on future work | ***Lead:*** | ***Area coordinators*** |
| | | **ToR b – Survey Manuals** | _Plenary_ | |
| | | Discussion on necessity of an update of SISP's:<br>North Sea<br>Northeast Atlantic | ***Lead:*** | ***Barbara***<br>***Francisco*** |
| | | **General** | _Plenary_ | |
| | | Recommendations from other WG's, e.g. Inclusion of Irish/Scottish VII survey for anglerfish and megrim in IBTSWG surveys | ***Lead:*** | ***Kai, Anne, Corina*** |
| 13:00 | LUNCH | | | |
| 14:30 | | **ToR g** - Survey design | _Plenary_ | |
| | | Outcome from<br>- WGISUR<br>- WKPIMP | ***Lead/Presentations:*** | ***Anne***<br>***Corina/Anne***<br>***Ingeborg (via web)*** |
| 15:30 | COFFEE | | | |
| 16:00 | | **ToR a** - Survey coordination | _Subgroups_ | |
| | | Planning the next surveys:<br>- Northeast Atlantic 2016<br>- North Sea 3Q 2016 and North Sea 1Q 2017, Reduction of days at sea NS 1Q | ***Lead:*** | ***Francisco, Corina***<br>***Jennifer, Ralf, Yves*** |
| | | Preparing reports:<br>ToR a: - Northeast Atlantic 2015<br>- NS 1Q 2016<br>- NS 3Q 2015<br>ToR c: DATRAS related issues<br>IBTS/MEDITS seminar | _Subgroups_<br>***Lead:*** | ***Francisco, ….***<br>***Ralf, …***<br>***Kai, Jennifer, ….***<br>***Vaishav, Jim, …***<br>***Corina, …*** |

| Thursday, 7/4 | | | | |
|---|---|---|---|---|
| 9:00 | | **Outstanding issues** | Plenary | |
| | | Discussion and presentations, e.g. | | |
| | | **ToR h** Data Views | ***Lead:*** | ***NN*** |
| | | **ToR i** Input to WGSUREP | | ***NN*** |
| | | Response to recommendations from other WG's | ***Lead:*** | ***Anne, Corina, Kai*** |
| 10:30 | COFFEE | | | |
| 11:00 | | Preparation of contributions for report:<br>**ToR b** (Survey manuals)<br>**ToR d** (Swept-area index)<br>**ToR f** (Collection of biological data) | Subgroups<br>***Lead:*** | ***Francisco, Jennifer***<br>***Dave ?***<br>***Ralf, Verena*** |
| 13:00 | LUNCH | | | |
| 14:30 | | Presentation of draft report for: | Plenary | |
| | | Survey sections for **ToR a** (Survey coordination) | ***Lead:*** | ***Area coordinators*** |
| | | **ToR b** (Manuals) | ***Lead:*** | ***Francisco, Barbara*** |
| | | **ToR c** (DATRAS) | ***Lead:*** | ***Jim, NN*** |
| 15:30 | COFFEE | | | |
| 16:00 | | Presentation of draft report for: | Plenary | |
| | | **ToR d** (Swept-area index) | ***Lead:*** | ***Dave?*** |
| | | **ToR f** (Collection of biological data) | ***Lead:*** | ***Ralf*** |
| | | **ToR e** (Effect of variable sweep lengths, groundgears etc.) | ***Lead:*** | ***Dave?*** |
| | | Discussion and decisions on future work for ToR's d, e and f | | |

| Friday, 8/4 | | | | |
|---|---|---|---|---|
| 9:00 | | Update of remaining parts of report, e.g. | Plenary | |
| | | **ToR h** (Data Views) | ***Lead:*** | ***NN*** |
| | | **ToR i** (Input to WGSUREP) | ***Lead:*** | ***NN*** |
| 10:30 | COFFEE | | | |
| 11:00 | | Report | Plenary | |
| | | Change / adoption of final sections for<br>- ToR's h and i<br>- Response to other WG's | ***Lead:*** | ***ToR coordinators***<br>***Corina, Kai*** |
| 13:00 | LUNCH | | | |
| 14:30 | | Date and venue of next meeting | Plenary | |
| | | Change / adoption of final sections of the report | ***Lead:*** | ***Kai, Corina*** |
| 15:30 | COFFEE | | | |
| 16:00 | | Closure of the meeting | | |

# Annex 3: Recommendations

| RECOMMENDATION | ADRESSED TO |
|---|---|
| 1. Extension of NS-IBTS roundfish area 7 with rectangle 44F6 and include the data from this rectangle in all DATRAS products. | ICES Data Centre |
| 2. Advice on continuation of collection of otoliths and other biological data for plaice in all NS-IBTS roundfish areas or only in the Skagerrak and Kattegat (roundfish areas 8 and 9). | WGNSSK |
| 3. Provide information on the most suitable limits of NS-IBTS species-specific standard areas based on recent benmarck assessments. | WGNSSK |
| 4. Establish a workshop on recent technical developments for improving data collection and data quality at sea (WKSEATEC). | SCICOM |
| 5. Advice on improving the standardization of the collection of marine litter and provision of a photographic field guide for the identification of marine litter categories. | ICES Data Centre, SCICOM |
| 6. Add swept area-based cpue for the NS-IBTS as a downloadable product in DATRAS. | ICES Data Centre |

# Annex 4: Action list

| | Action | Addressed to | Action latest before |
|---|---|---|---|
| 1 | Information to National Institutes and ICES assessment WG's (WGNSSK, HAWG, WGSAM) on plan for continuation of using 15 min tows in 3Q NS-IBTS. | IBTSWG chairs, NS-IBTS 3Q coordinator | 15 April 2016,<br>Feedback to coordinator by 1 June 2016 |
| 2 | Information of National Institutes and ICES assessment WG's (WGNSSK, HAWG, WGSAM) on change of effort and area allocation between countries in 1Q NS-IBTS due to reduction of available ship time for France. | IBTSWG chairs,<br>NS-IBTS 1Q coordinator | 15 April 2016,<br>Feedback to coordinator by 1 December 2016 |
| 3 | Re-define NS-IBTS roundfish area 7 to include rectangle 44F6, update map for NS-IBTS roundfish areas. | ICES data centre, NS-IBTS 3Q coordinator | asap |
| 4 | Check flex file with input data for NS-IBTS swept-area estimation and provide update if necessary. | National representatives | 1 September 2016 |
| 5 | NS-IBTS correction of errors or data gaps identified in the MFSD data product:<br>- Catch weight raising factors<br>- Maximum length<br>- Sweep length,<br>re-submission to DATRAS if necessary or report directly to ICES data centre. | National survey data providers | asap |
| 6 | Cleaning of pre-2004 NS-IBTS data in DATRAS database and adding missing information for Q1 1990–2003 and for Q3 1992–2003. These data are needed for the benchmarks and assessments of data limited stocks.<br>Re-submission may also include other missing information such as gear parameters and environmental data (incl. check of data units). | National data providers | asap |
| 7 | Update of NS-IBTS survey manual. | Anne, Jennifer;<br>To be proof read by the other NS subgroup members | End of 2016 |
| 8 | Add missing information on the GOV rigging to NS-IBTS survey manual. | Rob, Finlay | End of 2016 |
| 9 | Submit manual for Northeast Atlantic IBTS to SISP series. | Area coordinator and subgroup members | End of 2016 |
| 10 | Further explore options to decrease effort in sampling and reading of otoliths for assessed NS species while maintaining (or improving) quality of calculated age–length keys. | Ralf | To be presented at IBTSWG meeting in 2017 |
| 11 | Explore effects of changing total number of tows in the NS-IBTS and re-stratification on the quality (CV) | Anne and subgroup | Ongoing until end of the present 3 |

| | Action | Addressed to | Action latest before |
|---|---|---|---|
| | of survey indices. | members | year term (2018) |
| 12 | Explore methods for a cost efficient calibration when vessels are replaced. | National representatives | Ongoing until end of the present 3 year term (2018) |
| 13 | Response to recommendations and requests from other ICES WG's. | IBTSWG chairs | Ongoing until next meeting |
| 14 | Initiate a workshop on recent technical developments for improving data collection and data quality control at sea (WKSEATEC) to ICES. | IBTSWG chairs based on proposal provided by group members by 1 June 2016 | 1 August 2016 |
| 15 | The next revision of the manual for the North Sea-IBTS will prescribe the use of sensors to measure wing spread throughout the fishing hauls. Where not yet in place, nets need to be equipped with the respective distance sensors at the wings. | National institutes conducting North Sea IBTS | Before 1Q NS-IBTS 2017 |
| 16 | Provide country-specific limits of gear geometry (door spread, wing spread, net opening) in respect to depth (± 1 standard error for e.g. 10 m depth bins). | National representatives (in coordination with Jennifer for the NS-IBTS) | Before IBTSWG meeting in 2017 |

## Annex 5: Summary information for Assessment WG's

During their 2014 meeting, the IBTSWG decided together with representatives from assessment WG's to produce a "summary of summaries" to inform the assessment WGs – specifically WGNSSK and HAWG - in a very brief document about key observations or significant alterations of IBTS survey data that may be relevant to the stock assessment. In 2016, this document will also go to WGSAM and to the national representatives. We ask for comments on the proposed changes in the Q3 2016 and Q1 2017 surveys. Comments should be sent to the Q3 coordinator (Jennifer Devine) not later than 1 June 2016 and to the Q1 coordinator (Ralf van Hal) not later than 1 December 2016.

This document highlights under (1) comments on the Q3 and Q1 surveys of the preceding year. The more extended survey summaries will become available in the IBTSWG report.

### (1) Noticeable observations during 2015 Q3/2016 Q1 IBTS surveys and plans for 2016 Q3/2017 Q1 surveys

#### IBTS Q3, 2015 – Report

No major issues or technical problems.

Biological data: High abundance of hake was noted by several of the nations. High abundance of 0-group whiting and haddock were noted; fish were small for their age.

Tow duration experiment: (the entire survey area has been fish with a target of 1 haul per rectangle of 30-min duration, 1 haul of 15-min duration). Preliminary analyses showed no significant differences in abundance or length frequencies between 15- and 30-min tows, but it was acknowledged that the statistical power was low. Preliminary analyses on biodiversity indicated that the resulting reduction in total fished area had an effect on recorded species richness. In-depth analyses are planned to be presented at the ICES annual science conference 2016 and during the 2017 IBTSWG.

#### IBTS Q3, 2016 – Plan

Survey participants are still deciding whether the tow duration experiment will continue in 2016. Three nations have indicated that they are willing to continue to do 15 min tows. In these cases, the goal is to increase the number of tows and diversify the area coverage and explore options to reduce the uncertainty associated with the abundance indices by increasing the total number of tows. If only three nations will use 15 min tows, the total number of tows taken will be less than in 2015 and some rectangles can be covered only by 1 tow. If all the four nations which participated in the tow duration experiment in 2015 continue with in 2016 most of the rectangles can be covered by one 30 min and one 15 min tow, and the expectation is that this would also yield approximately 15% additional tows compared to pre – 2015 years.

#### IBTS Q1, 2016 – Report

Spatial coverage: All rectangles planned to be covered, including three new northern rectangles, were fished at least ones. A small part of the rectangles has not been fished twice, which include the Channel area and a part of the northern area.

Biological data: Otolith collection has changed for whiting, haddock, plaice, and Norway pout. The scheme has changed to a tow-by-tow collection rather than the stratification by roundfish area. For these species, the majority of the participants changed the number of otoliths to be collected into 2- per 5-cm class up to a species-specific length and then 1 per cm-class, per tow. This results in a reduced number of otoliths but an improved spatial coverage. This change will likely require a modelled ALK, rather than current description of the ALK calculation, in which missing lengths are borrowed from neighboring roundfish areas.

MIK Results: The unusually high occurrence of small to medium sized herring larvae - presumably all of Downs origin - in North Sea areas north of 54°N, resulted in a moderately high but possibly severely biased MIK index. The result underscores the need to replace the current algorithm for calculating the MIK herring larvae index. From similar herring larvae distributions as in Q1 2016, the current algorithm will always produce a biased recruitment index. This was intensively discussed already at the 2016 Herring Assessment Working Group (HAWG). A "Workshop on North Sea herring larvae surveys, data needs and execution [WKHERLARS] is being proposed to ACOM to be carried out before end of 2016. The workshop should review information currently available from the two North Sea larvae surveys (IHLS and IBTS MIK) and provide protocols for possible modifications in survey design and resulting data utilization in order to provide robust SSB and recruitment estimates for the North Sea herring stock.

#### IBTS Q1, 2017 – Plan

Planning 2017: France has informed IBTSWG about their need to reduce the effort in the IBTS Q1 by 6 days. This hampers the execution of the survey according to the manual. IBTSWG has looked at this and advices to change the allocation of rectangles over the countries acknowledging that this compensation increases the number of rectangles fished by a single country. Next to that, the total number of tows will be reduced with 8, which are planned to be removed from rectangles largely covered by land. In these rectangles, both surveying countries have fished the same location for a number of years on a row.

Tow duration experiment: France conducted 15 additional tows of 15 min duration and the Netherlands did 1, which can be included in the analysis of tow duration effects.

### (2) Change of list of target species

IBTSWG considered removing plaice from the list of NS-IBTS target species. Consequently, some countries may then stop or drastically reduce the collection of age and other individual biological data for this species. However, final decision on this matter is postponed until the outcome of the benchmark for plaice in 2017 in respect to the suitability of the NS-IBTS for the assessment of plaice is known.

# Annex 6: Maps of species distribution and length frequencies in 2015

**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 areas encompassed by surveys coordinated within the IBTSWG (North Sea and northeastern Atlantic Areas).**

| Scientific | Common | Code | Fig No | Length Split (< cm) |
|---|---|---|---|---|
| *Clupea harengus* | Herring | HER | 8-10 | 17.5 |
| *Gadus morhua* | Atlantic Cod | COD | 2-4 | 23 |
| *Galeorhinus galeus* | Tope Shark | GAG | 48 | |
| *Galeus melastomus* | Blackmouthed dogfish | DBM | 56 | |
| *Lepidorhombus boscii* | Four-Spotted Megrim | LBI | 23-25 | 19 |
| *Lepidorhombus whiffiagonis* | Megrim | MEG | 20-22 | 21 |
| *Leucoraja naevus* | Cuckoo Ray | CUR | 44-45 | |
| *Lophius budegassa* | Black-bellied Anglerfish | WAF | 29-31 | 20 |
| *Lophius piscatorius* | Anglerfish (Monk) | MON | 26-28 | 20 |
| *Merlangus merlangius* | Whiting | WHG | 35-37 | 20 |
| *Melanogrammus aeglefinus* | Haddock | HAD | 5-7 | 20 |
| *Merluccius merluccius* | European hake | HKE | 12-13 | 20 |
| *Micromesistius poutassou* | Blue whiting | WHB | 38-40 | 19 |
| *Mustelus* spp. | Smooth Hounds | SDS | 49 | |
| *Nephrops norvegicus* | Norway Lobster | NEP | 41 | |
| *Pleuronectes platessa* | European Plaice | PLE | 32-34 | 12 |
| *Raja clavata* | Thornback ray (Roker) | THR | 50-51 | |
| *Raja microocellata* | Painted/Small Eyed Ray | PTR | 52 | |
| *Raja montagui* | Spotted Ray | SDR | 53 | |
| *Raja undulata* | Undulate Ray | UNR | 54 | |
| *Scomber scombrus* | European Mackerel | MAC | 17-19 | 24 |
| *Scyliorhinus canicula* | Lesser Spotted Dogfish | LSD | 42-43 | |
| *Scyliorhnus stellaris* | Nurse Hound | DGN | 55 | |
| *Sprattus sprattus* | European sprat | SPR | 57-58 | |
| *Squalus acanthias* | Spurdog | DGS | 46-47 | |
| *Trachurus picturatus* | Blue Jack Mackerel | JAA | 60 | |
| *Trachurus trachurus* | Horse Mackerel (Scad) | HOM | 14-16 | 15 |
| *Trisopterus smarkii* | Norway pout | NPO | 59 | |

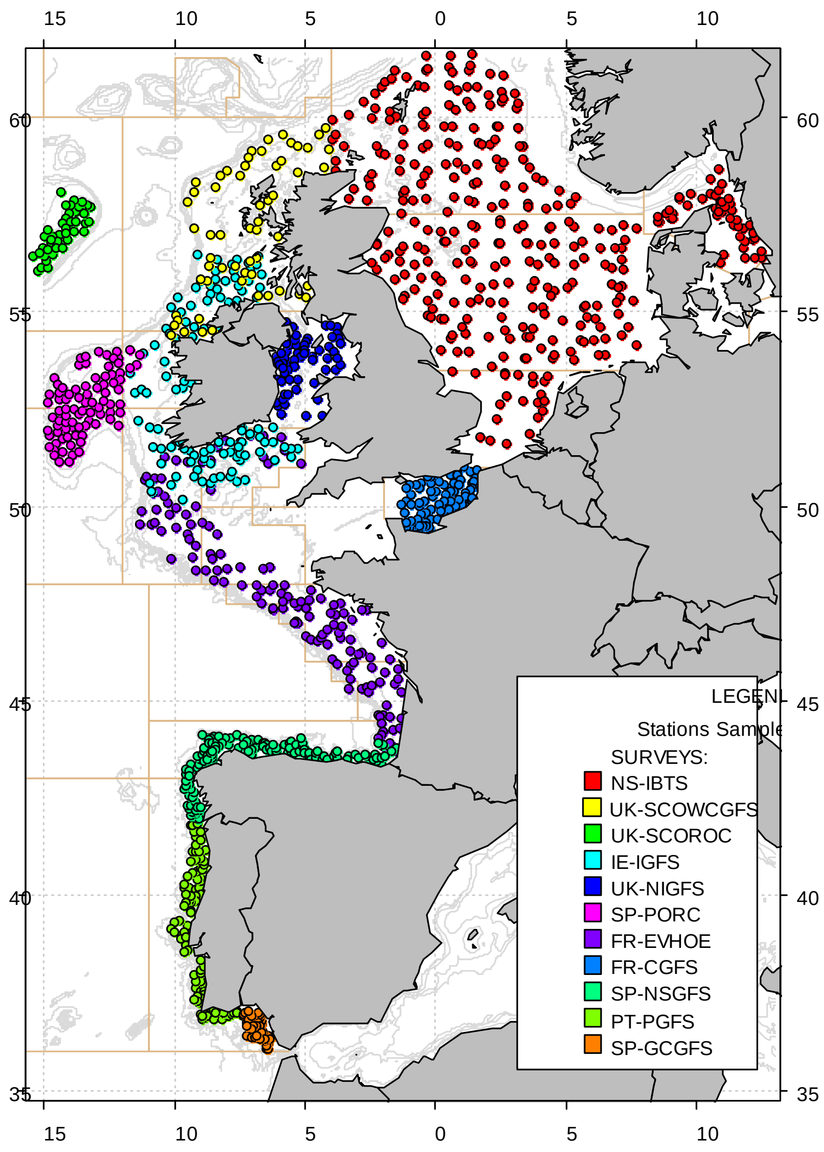



**Figure A.6.1. Station positions for the IBTS carried out in the northeastern Atlantic and North Sea area in summer/autumn of 2015. Quarters 3 and 4.**

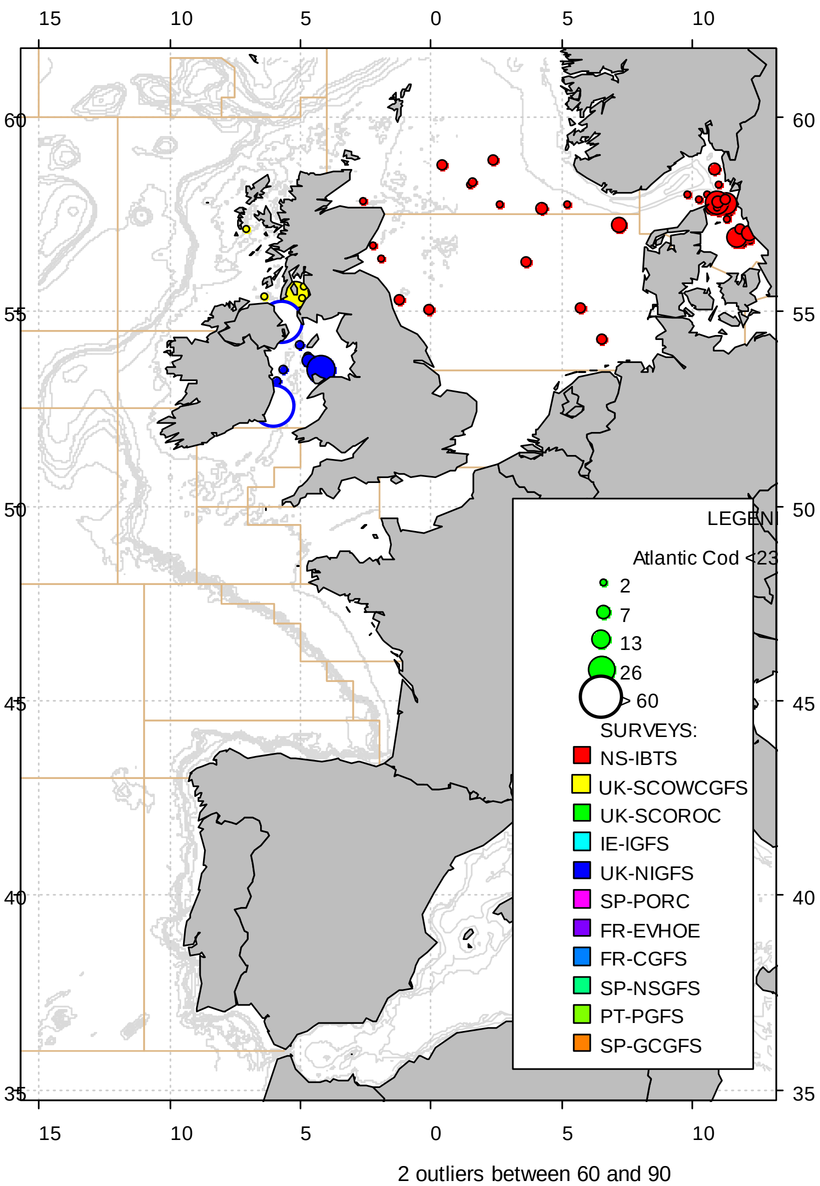



**Figure A.6.2. Catches in numbers per hour of 0-group Cod, *Gadus morhua* (< 23 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

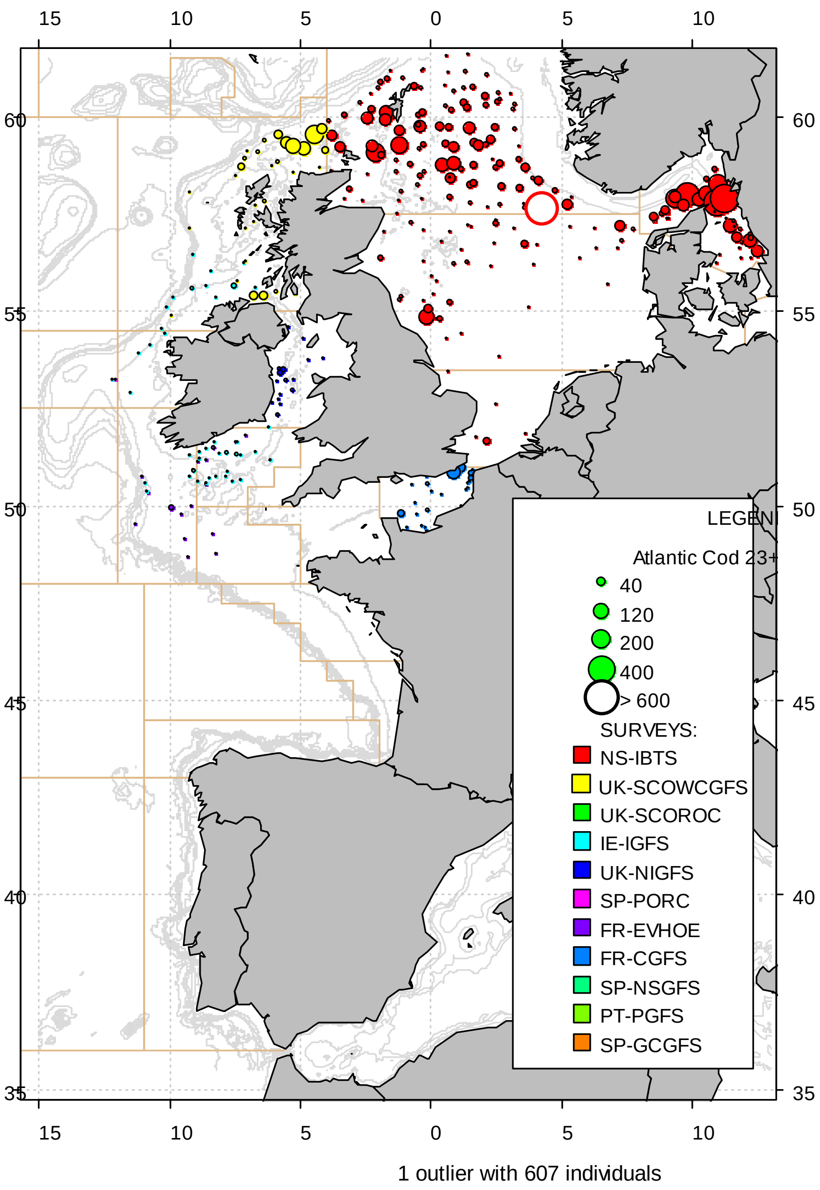



**Figure A.6.3. Catches in numbers per hour of 1+ cod, *Gadus morhua* (≥ 23 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

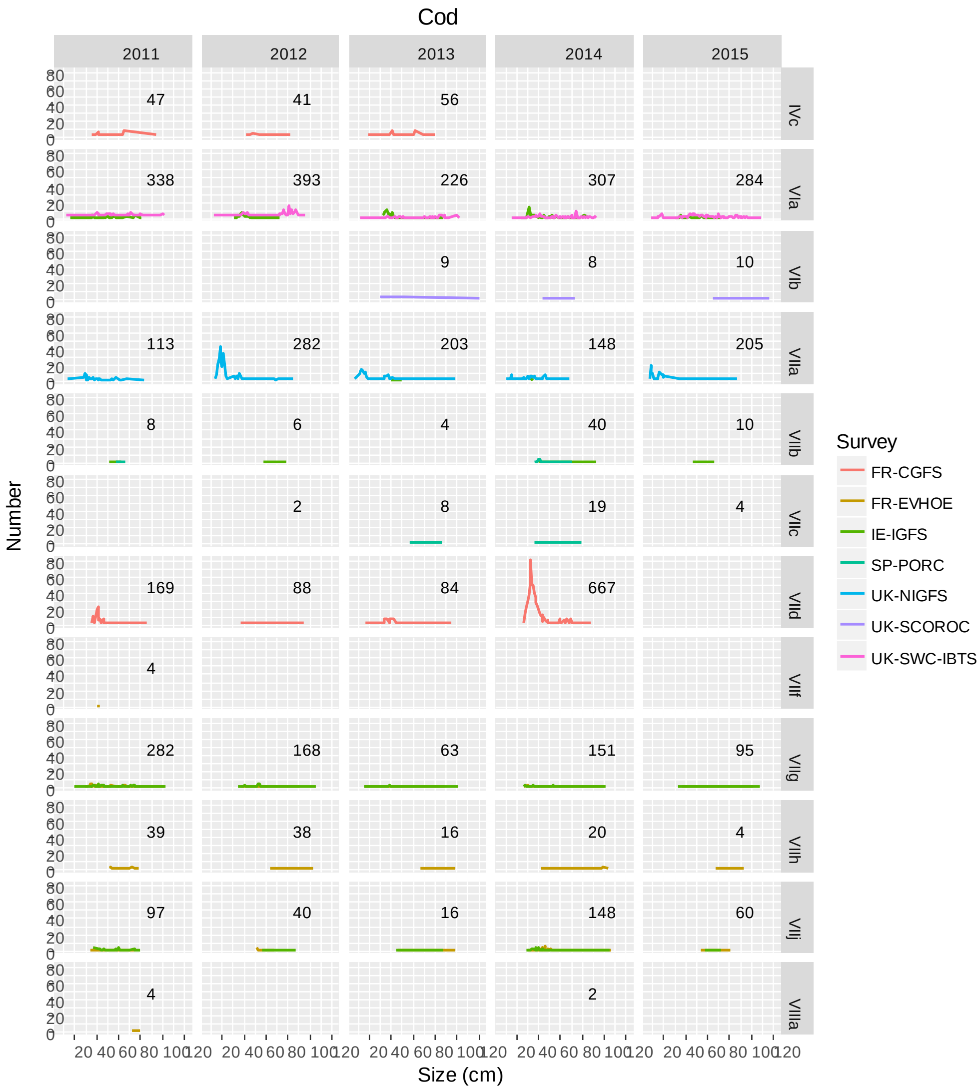



**Figure A.6.4. Length distributions of cod, *Gadus morhua*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

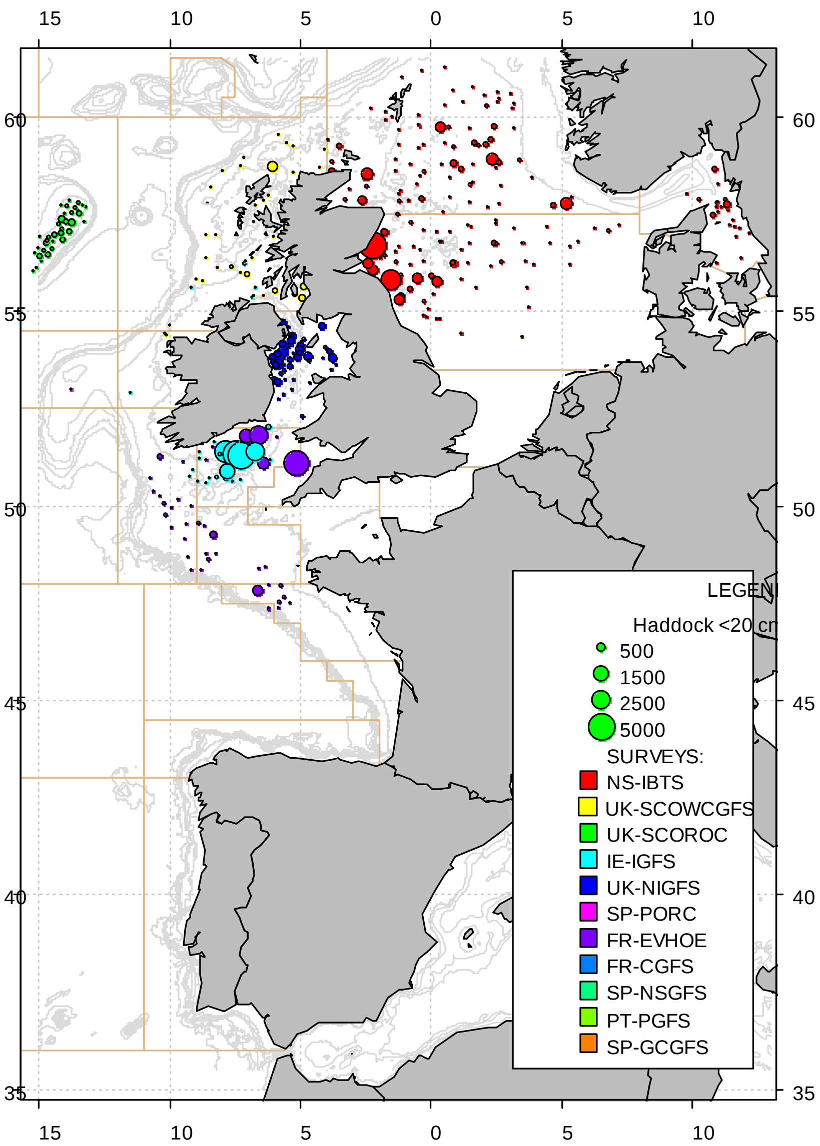



**Figure A.6.5. Catches in numbers per hour of 0-group haddock, *Melanogrammus aeglefinus* (< 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

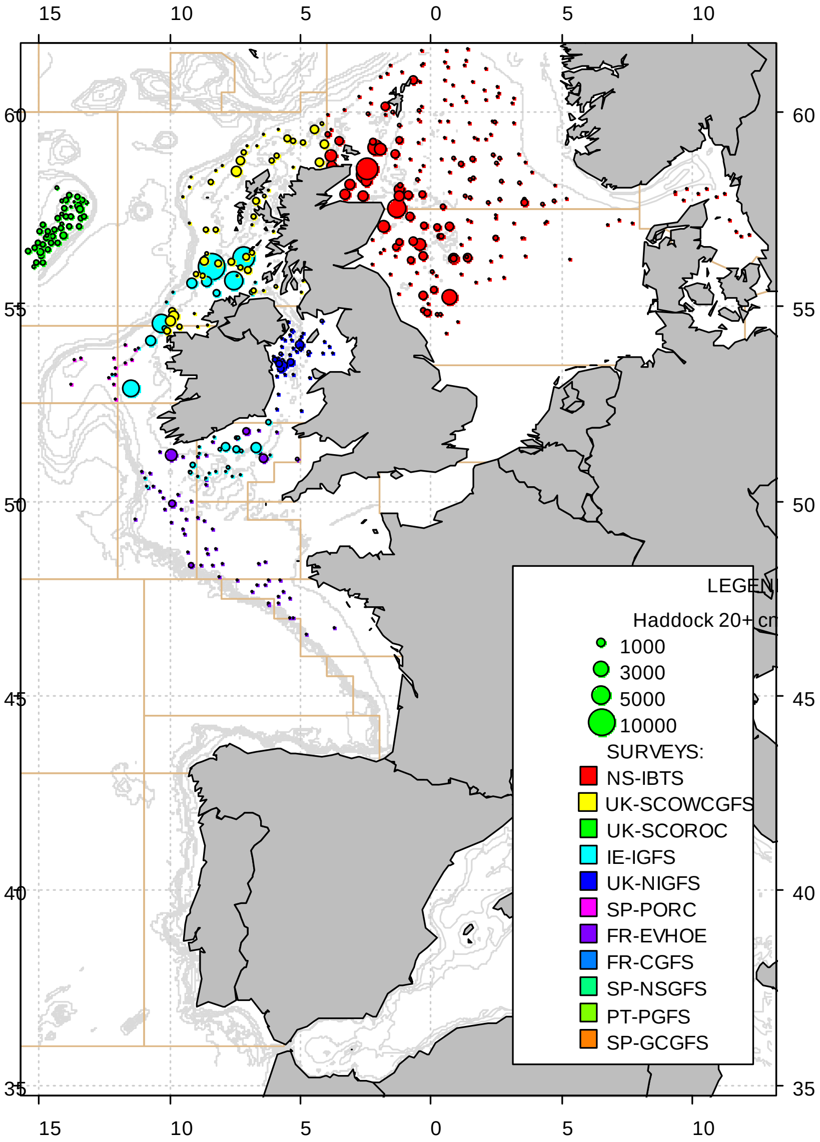



**Figure A.6.6. Catches in numbers per hour of 1+ group haddock, *Melanogrammus aeglefinus* (≥ 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

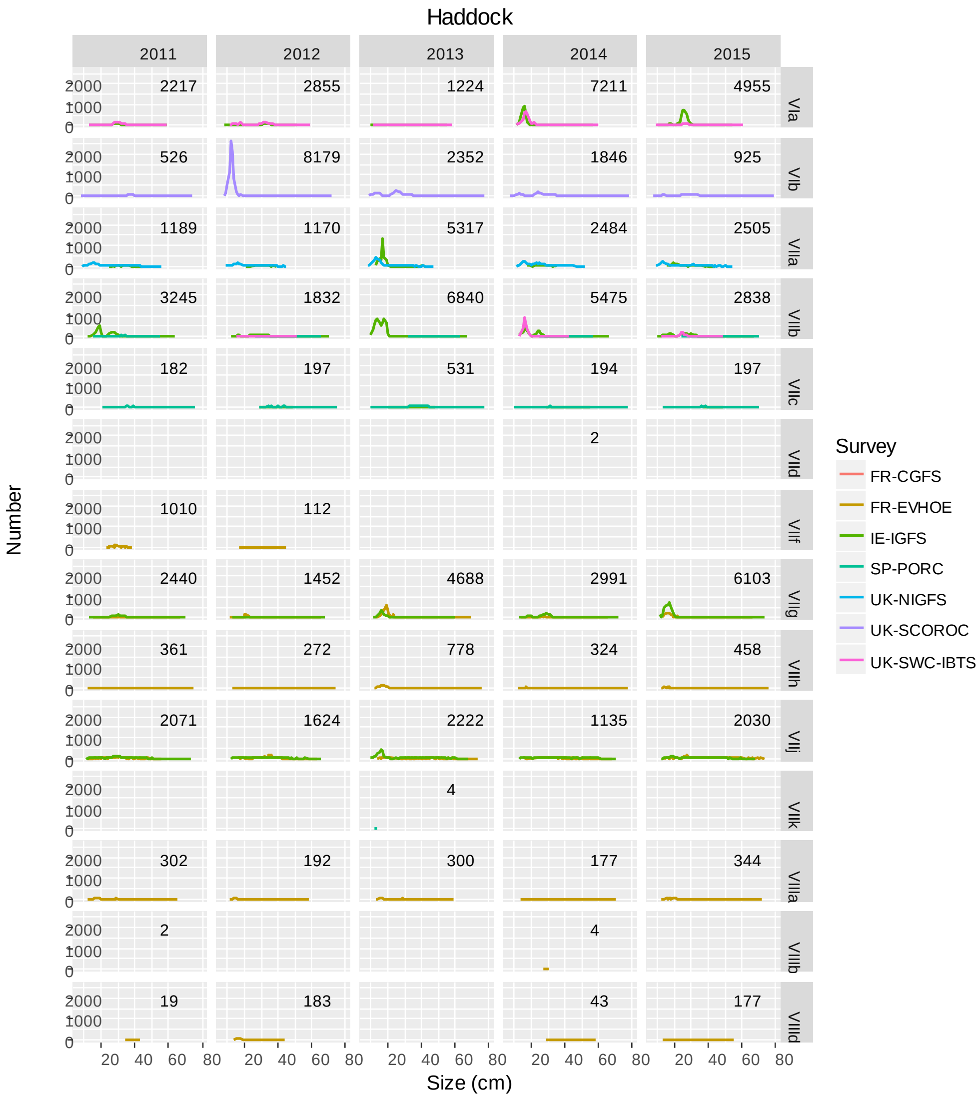



**Figure A.6.7. Length distributions of haddock, *Melanogrammus aeglefinus* per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

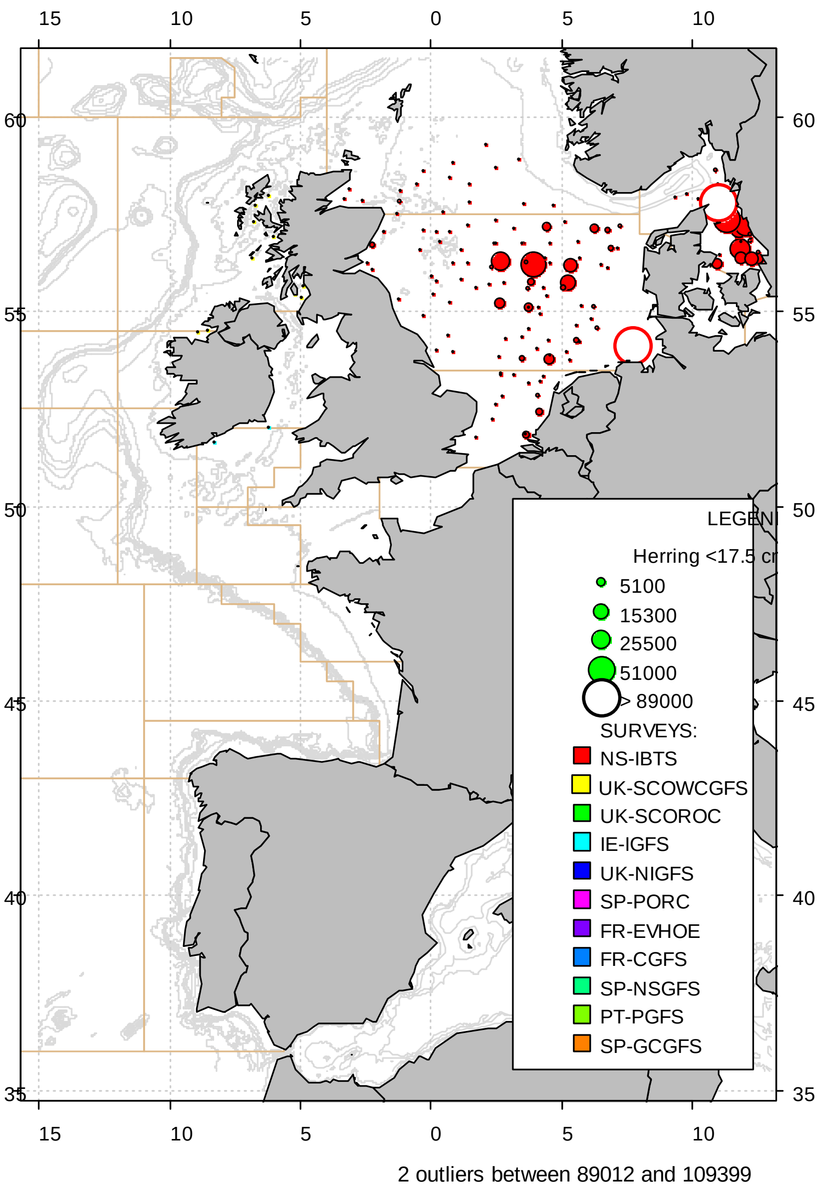



**Figure A.6.8. Catches in numbers per hour of 0-group herring, *Clupea harengus* (< 17.5 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

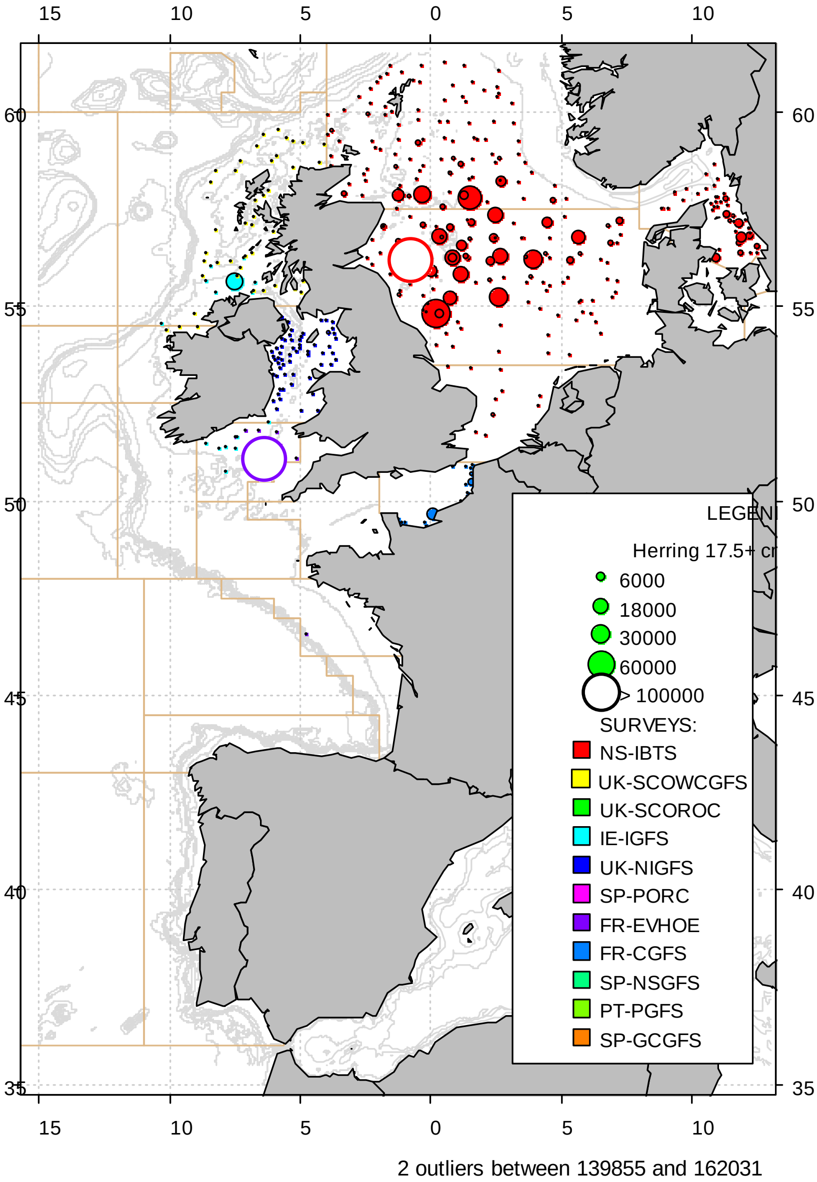



**Figure A.6.9. Catches in numbers per hour of 1+ group herring, *Clupea harengus* (≥ 17.5 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

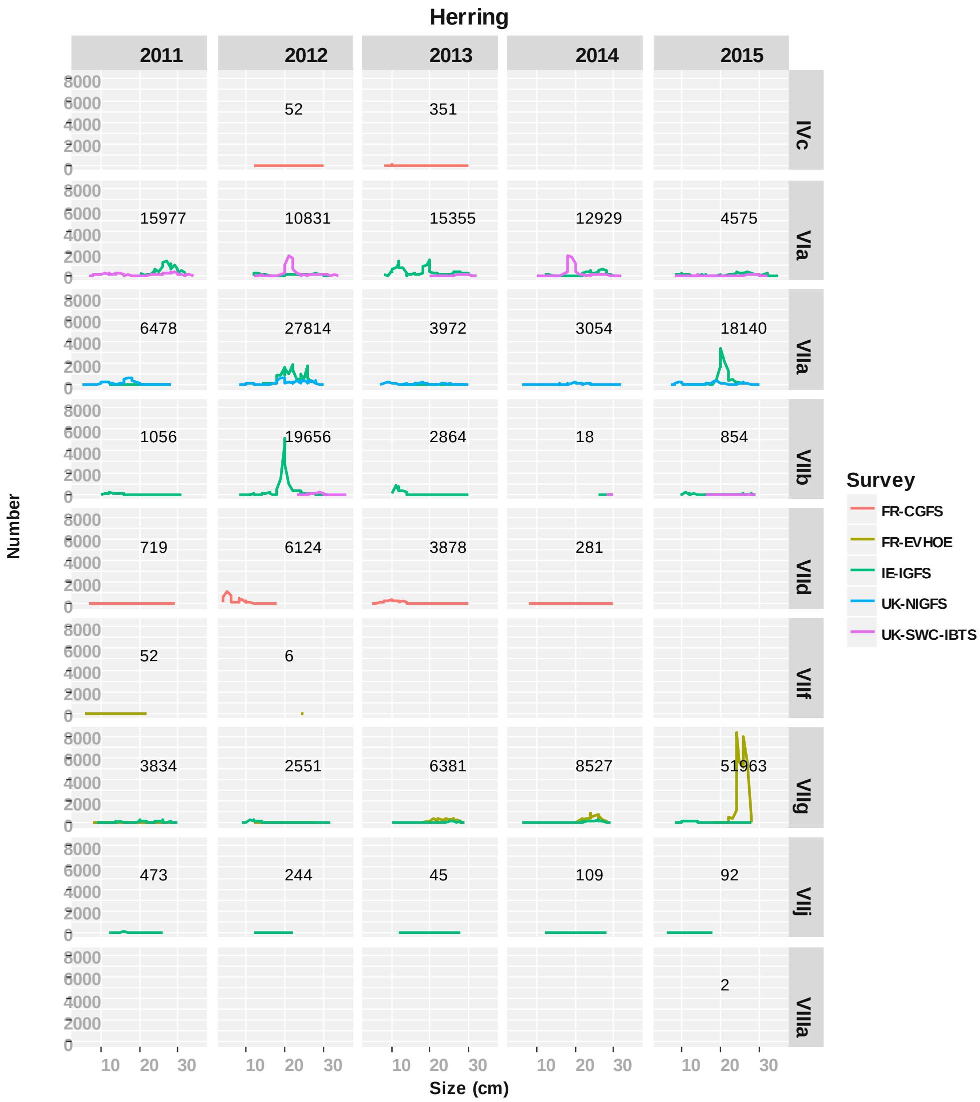



**Figure A.6.10. Length distributions of herring, *Clupea harengus* per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

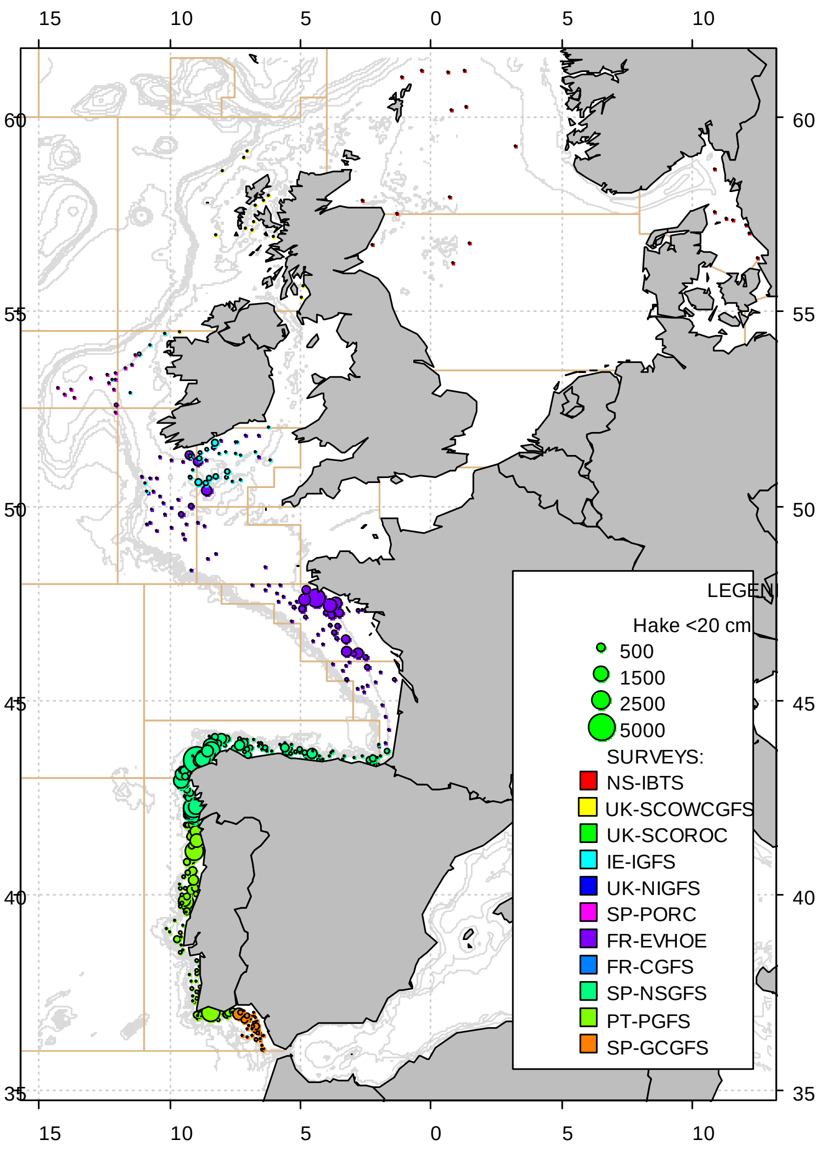



**Figure A.6.11. Catches in numbers per hour of 0-group Europan hake, *Merluccius merluccius* (< 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

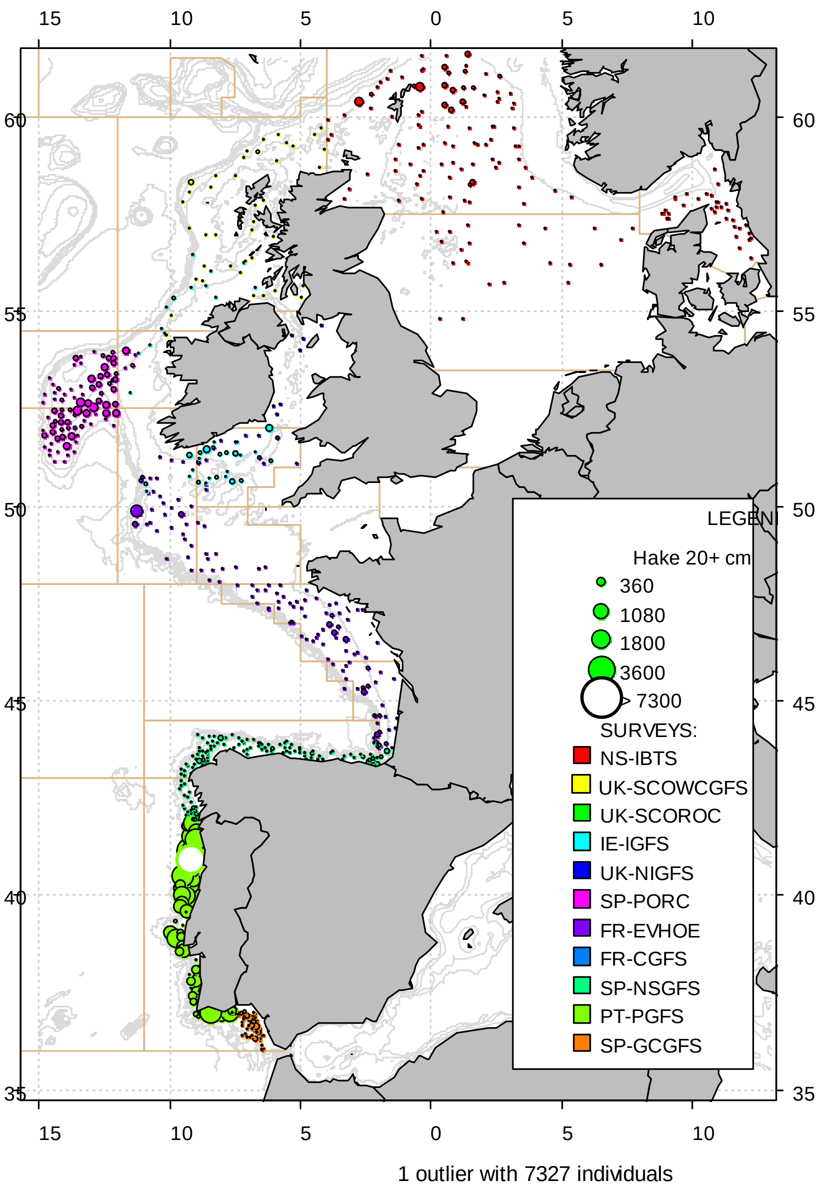



**Figure A.6.12. Catches in numbers per hour of 1+ group hake, *Merluccius merluccius* (≥ 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

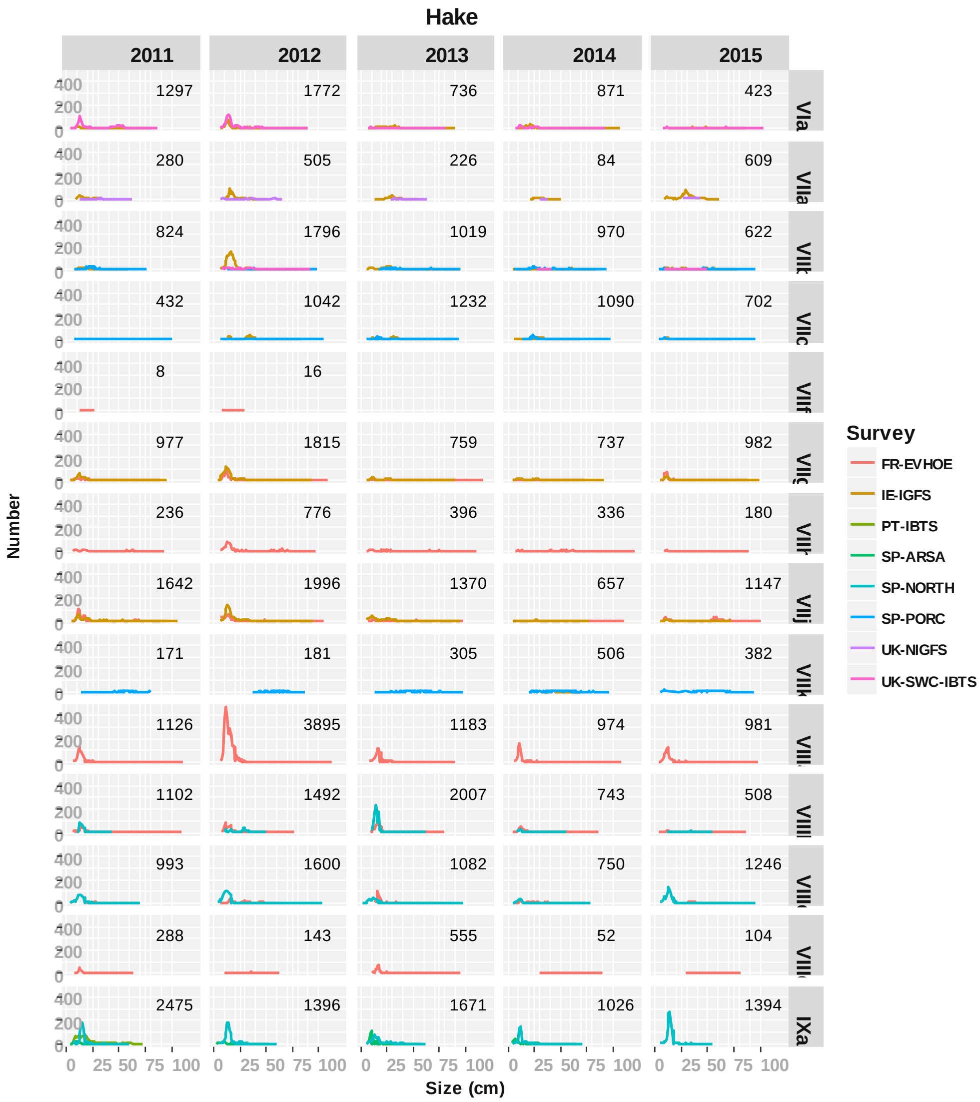



**Figure A.6.13. Length distributions of hake, *Merluccius merluccius* per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

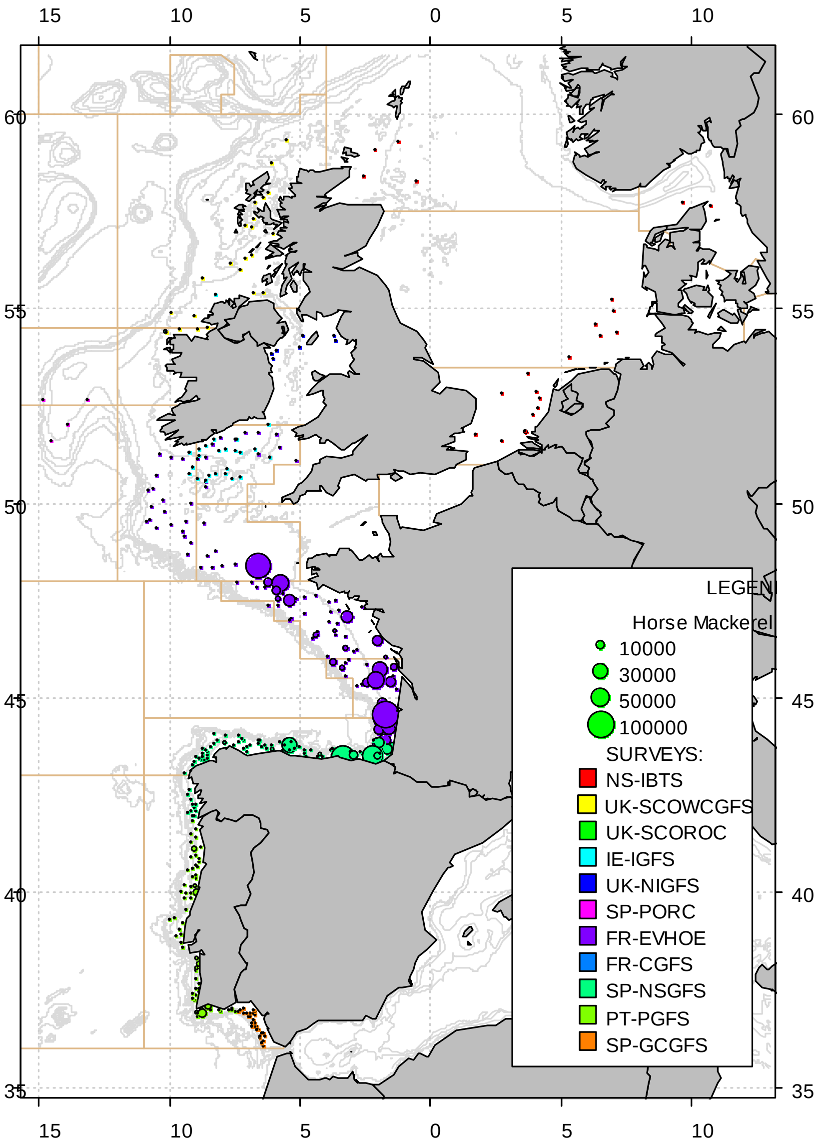



**Figure A.6.14. Catches in numbers per hour of 0-group horse mackerel, T*rachurus trachurus* (< 15 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

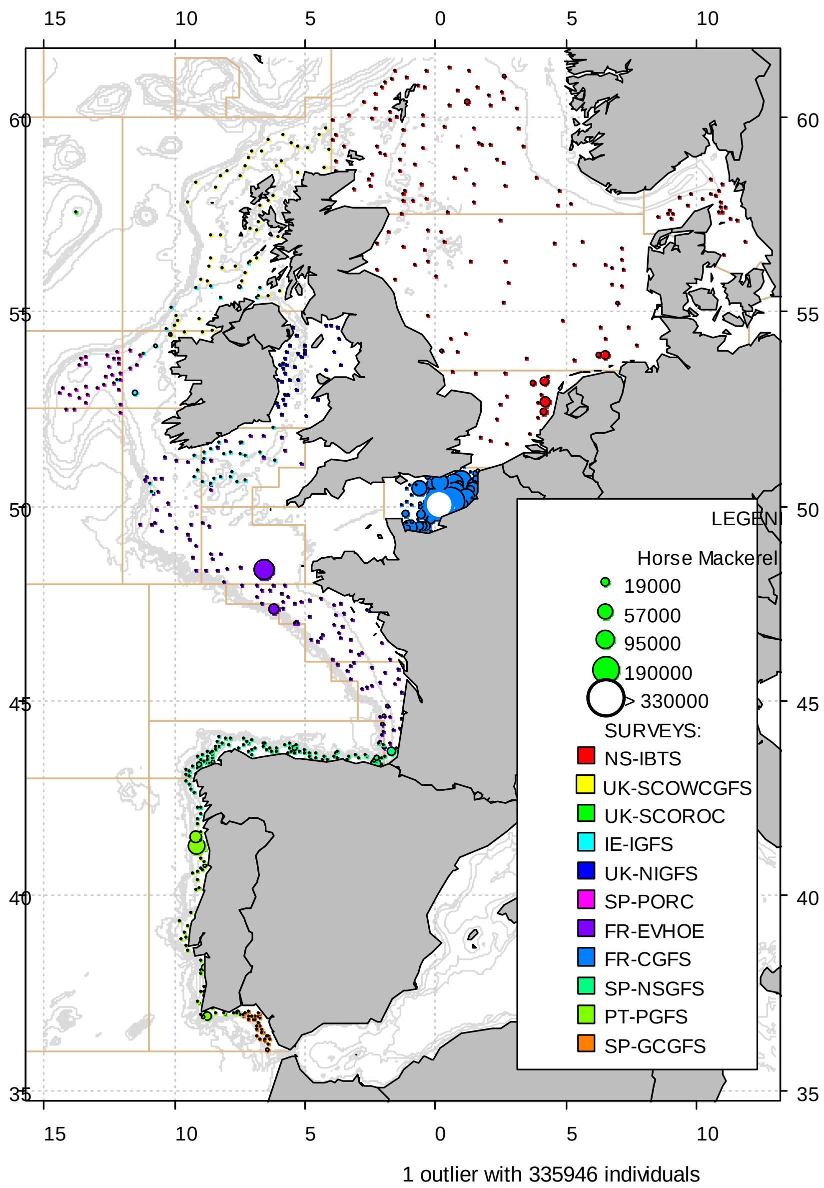



**Figure A.6.15. Catches in numbers per hour of 1+ group horse mackerel, *Trachurus trachurus* (≥ 15 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

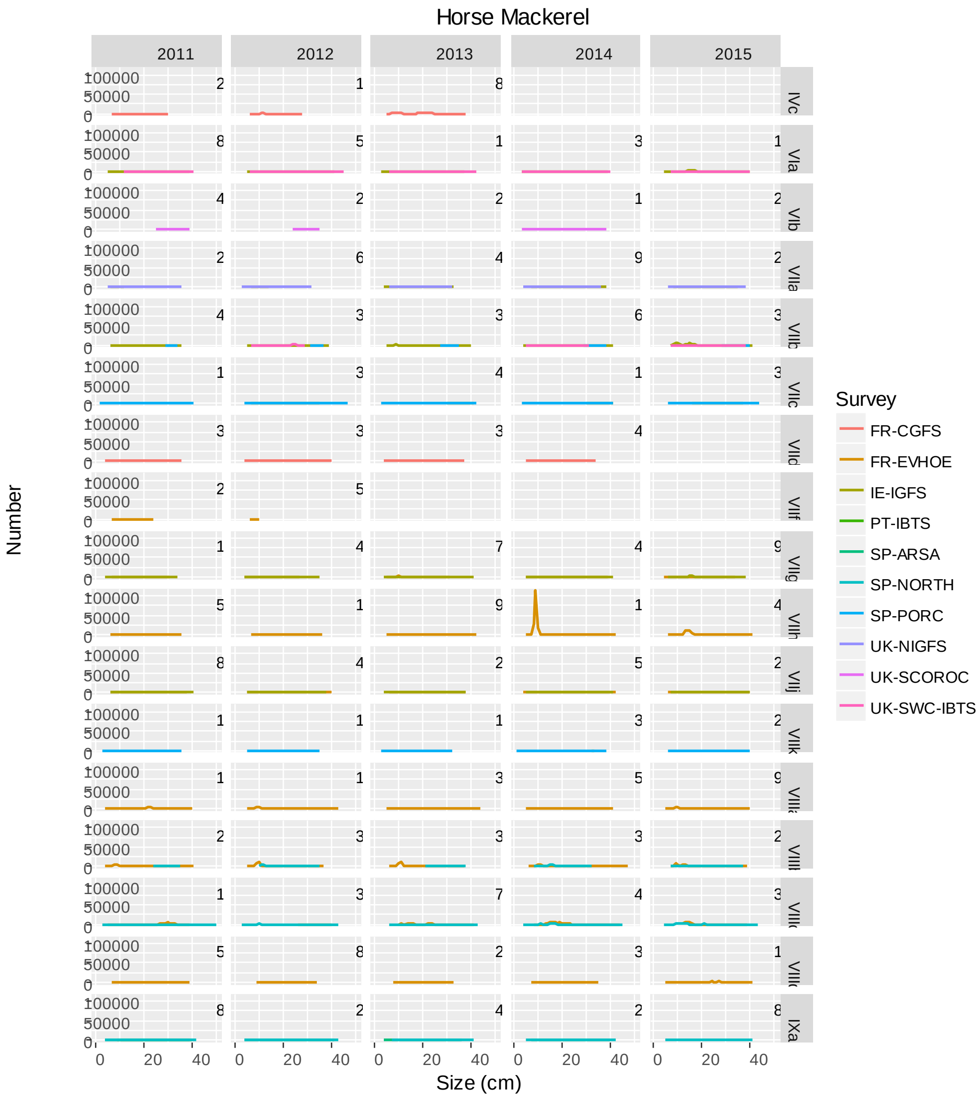



**Figure A.6.16. Length distributions of horse mackerel, *Trachurus trachurus* per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

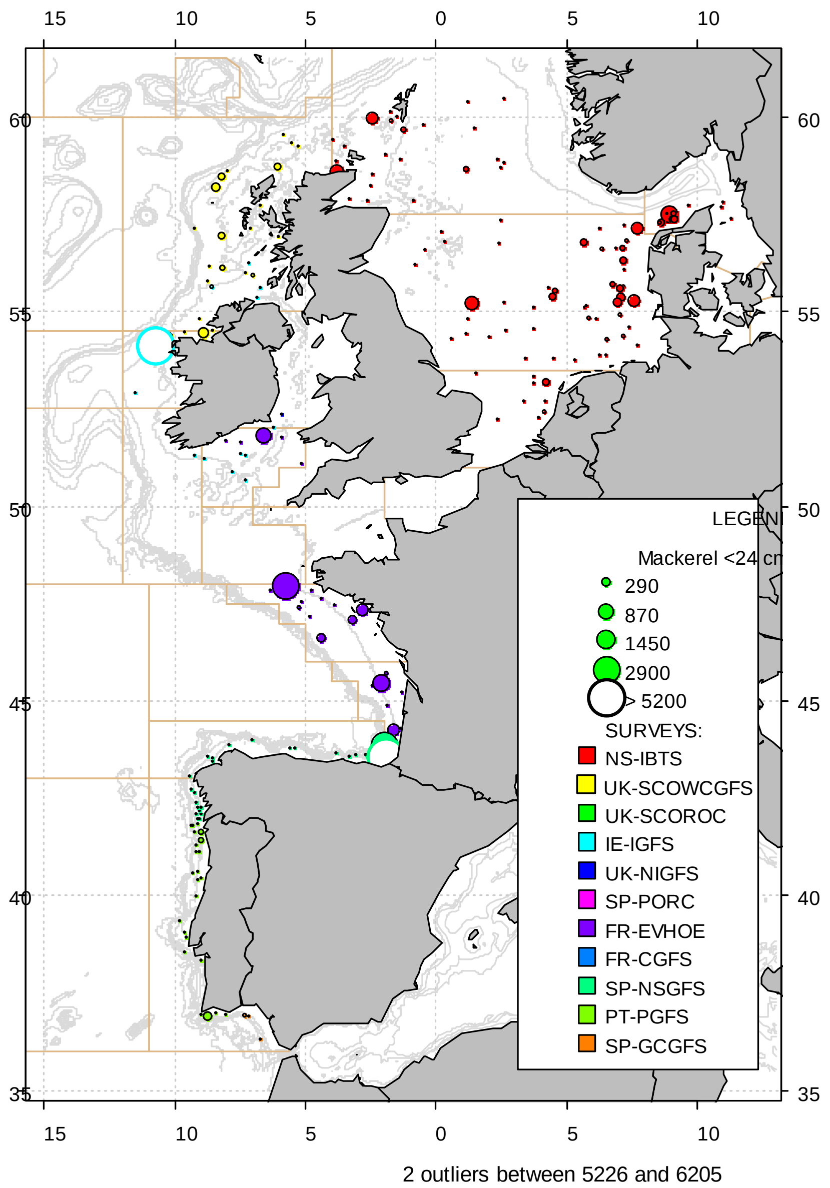



**Figure A.6.17. Catches in numbers per hour of 0-group mackerel, *Scomber scombrus* (< 24 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

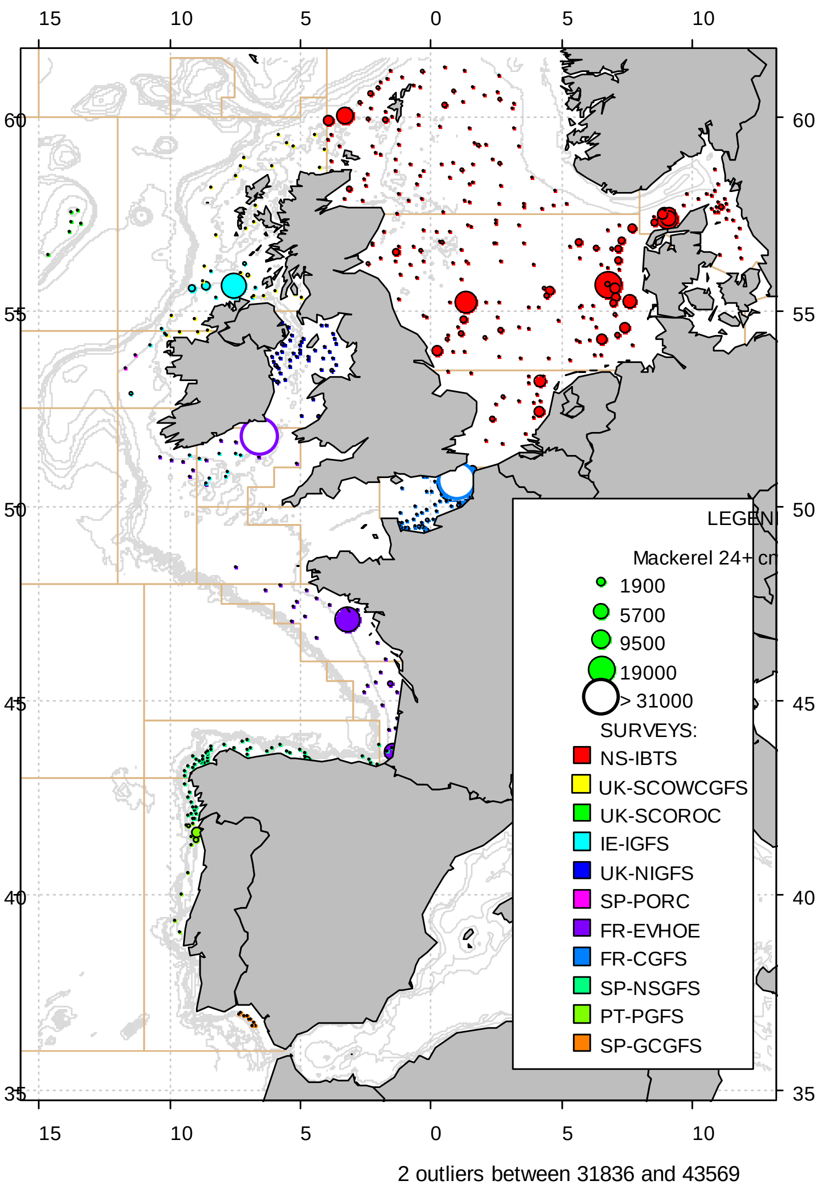



**Figure A.6.18. Catches in numbers per hour of 1+ group mackerel, *Scomber scombrus* (≥ 24 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**


**Figure A.6.19. Length distributions of mackerel, *Scomber scombrus* per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

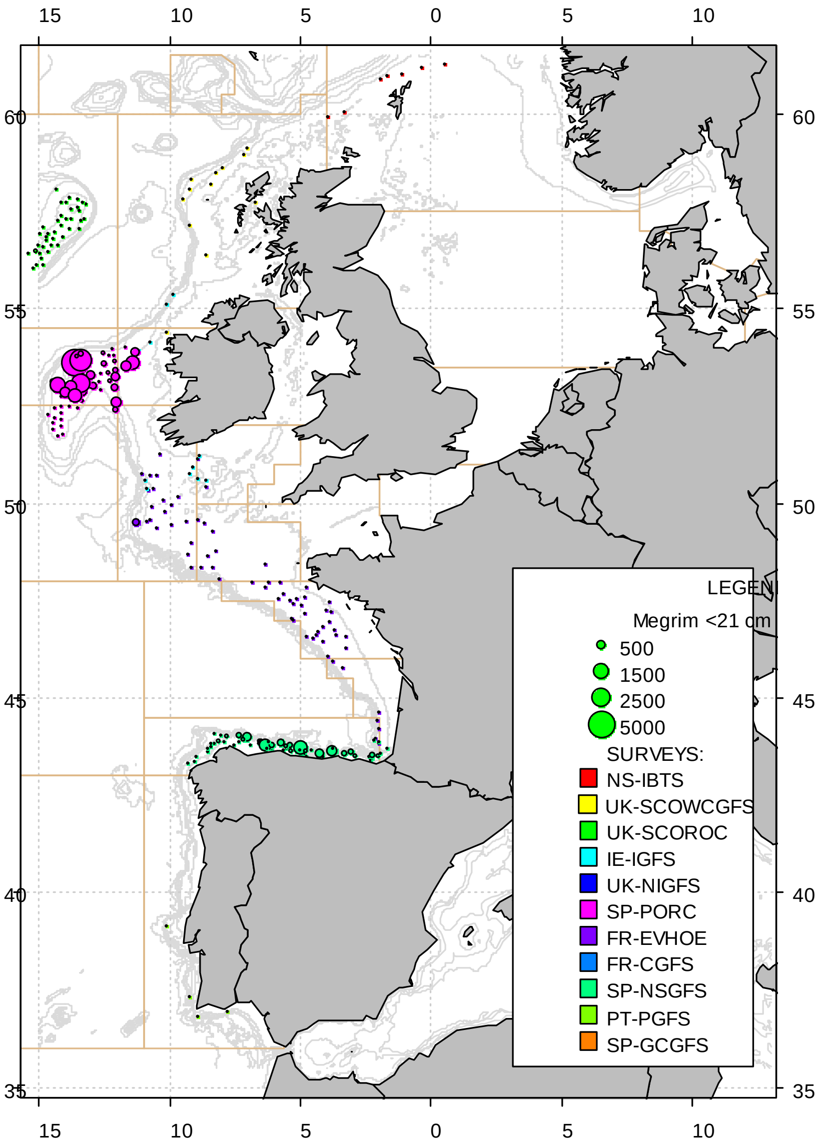



**Figure A.6.20. Catches in numbers per hour of megrim recruits, *Lepidorhombus whiffiagonis* (< 21 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

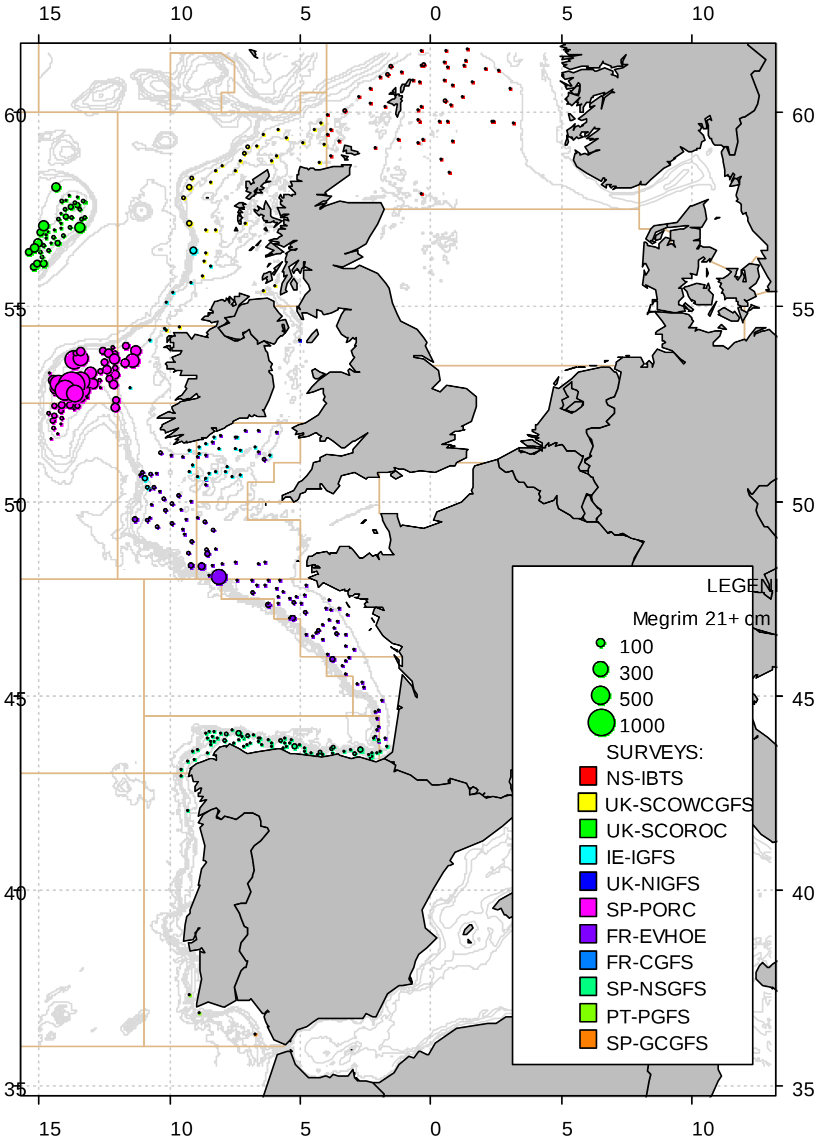



**Figure A.6.21. Catches in numbers per hour of 2+ group megrim, *Lepidorhombus whiffiagonis* (≥ 21 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

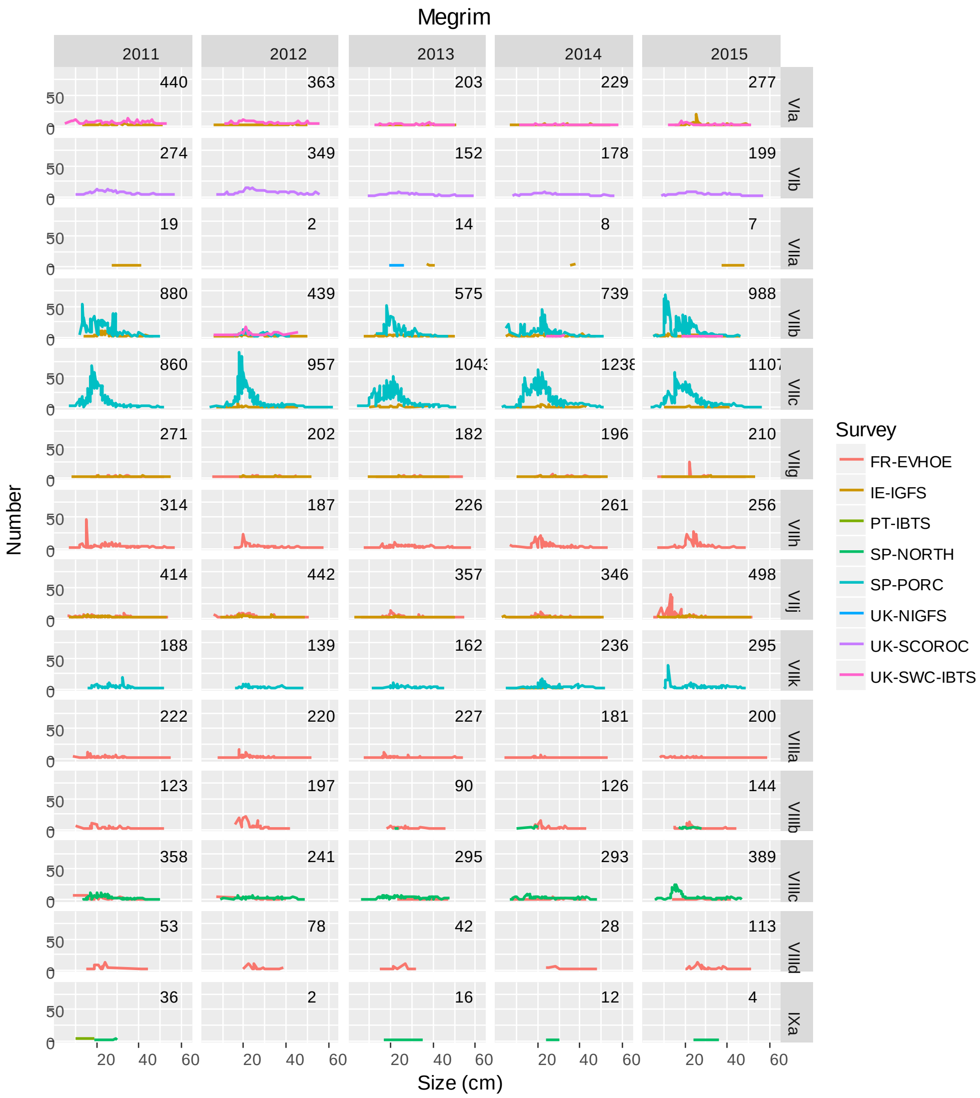



**Figure A.6.22. Length distributions of megrim, *Lepidorhombus whiffiagonis*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

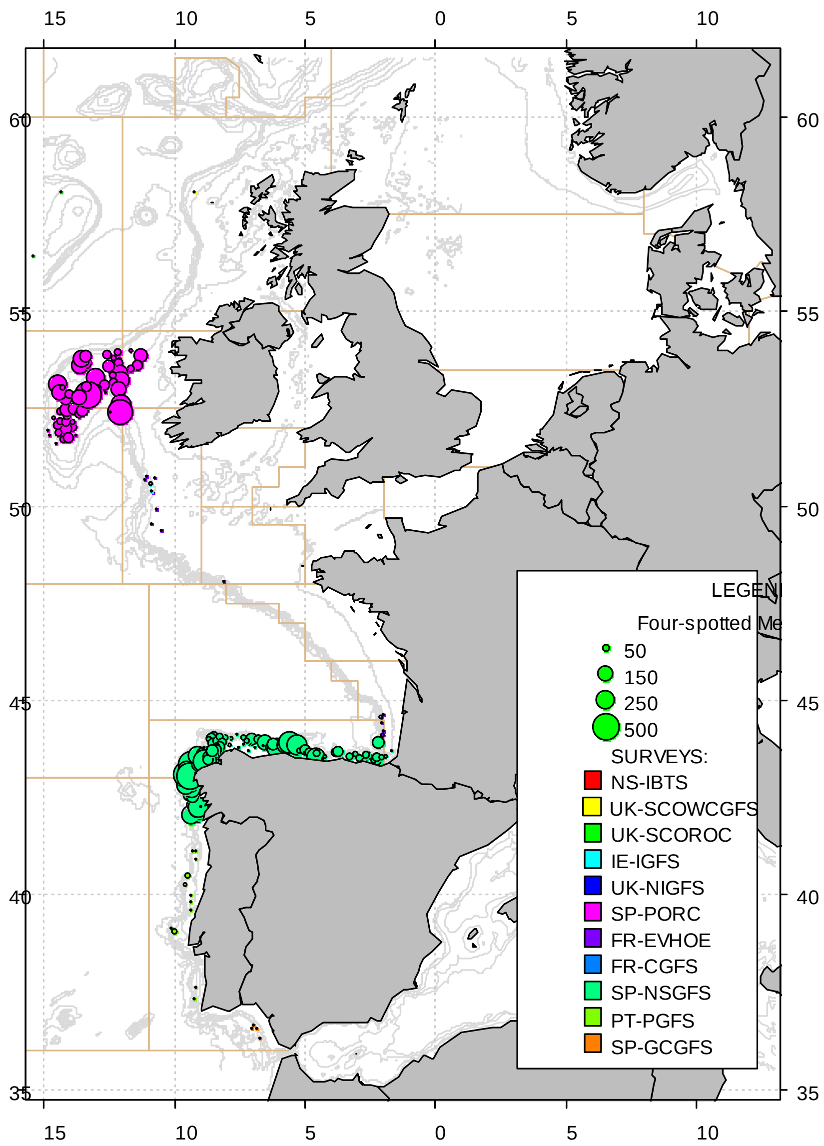



**Figure A.6.23. Catches in numbers per hour of recruits of four-spotted megrim, *Lepidorhombus boscii* (< 19 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

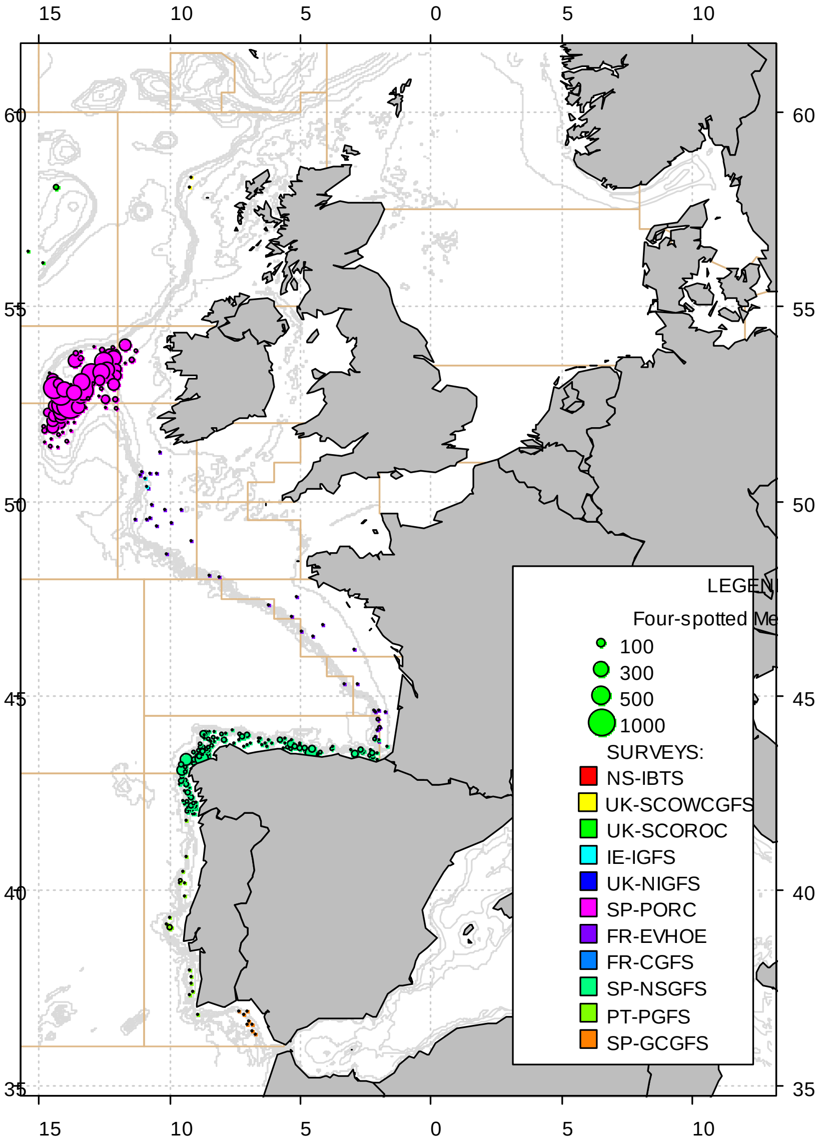



**Figure A.6.24. Catches in numbers per hour of 2+ group four-spotted megrim, *Lepidorhombus boscii* (≥ 19 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

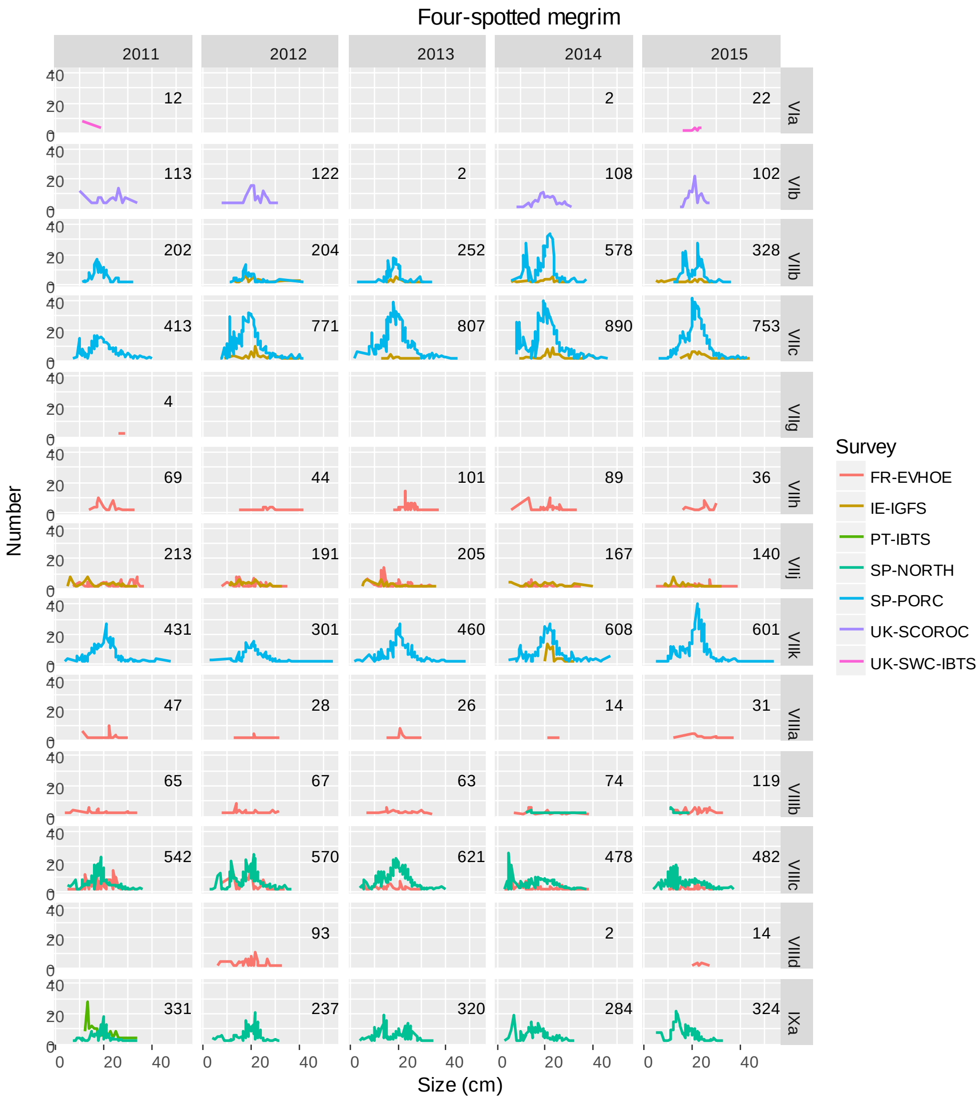



**Figure A.6.25. Length distributions of four-spotted megrim, *Lepidorhombus boscii*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

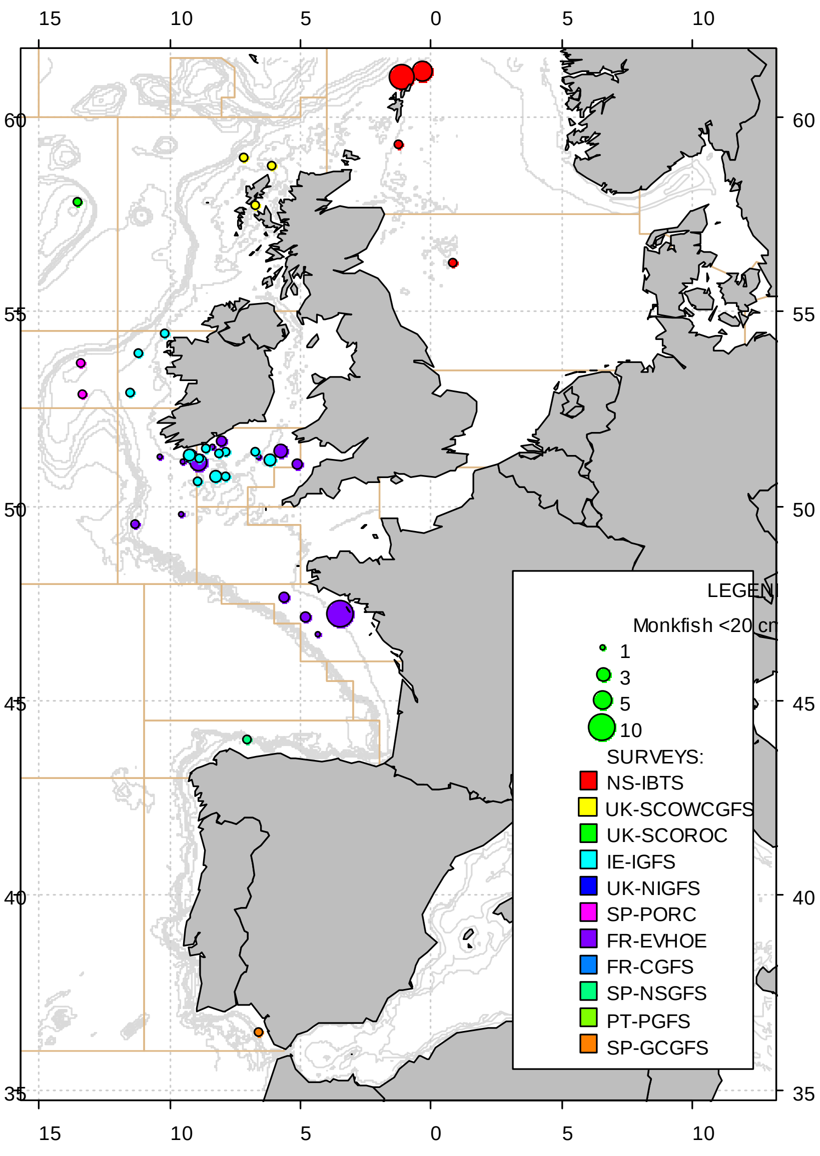



**Figure A.6.26. Catches in numbers per hour of 0-group monkfish, *Lophius piscatorius* (< 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

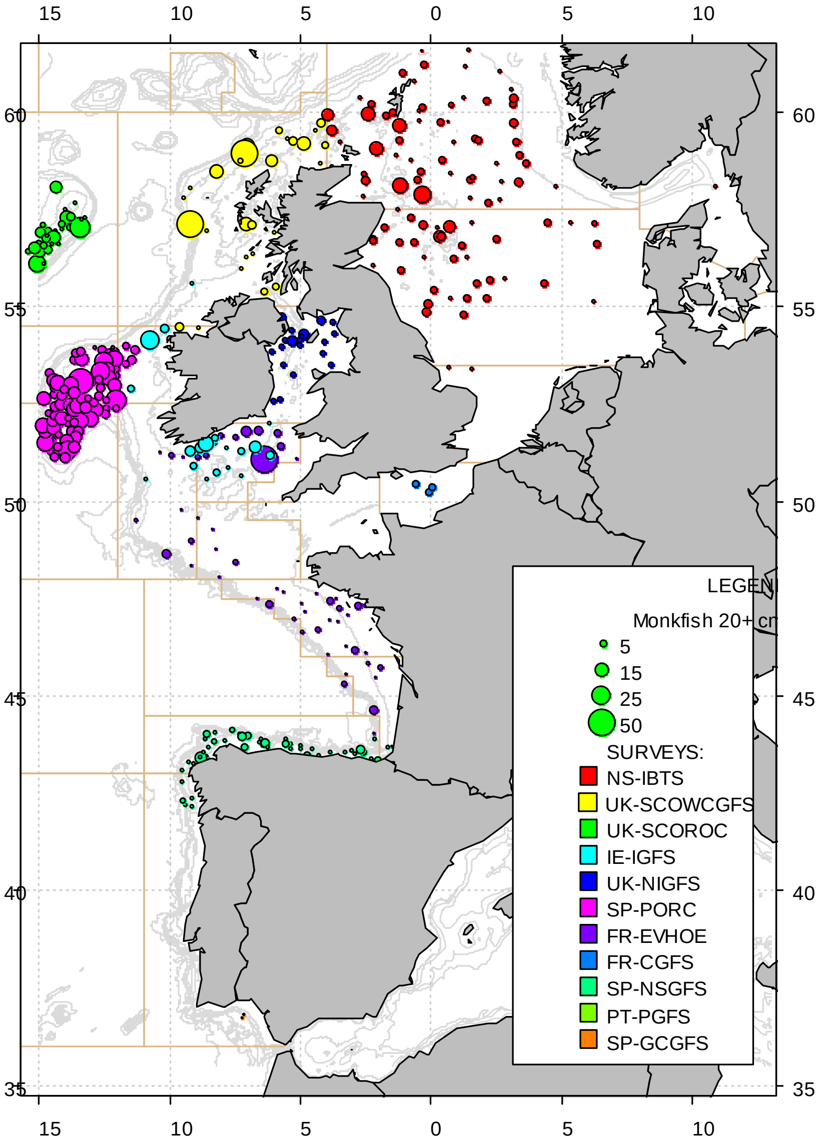



**Figure A.6.27. Catches in numbers per hour of 1+ group monkfish, *Lophius piscatorius* (≥ 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

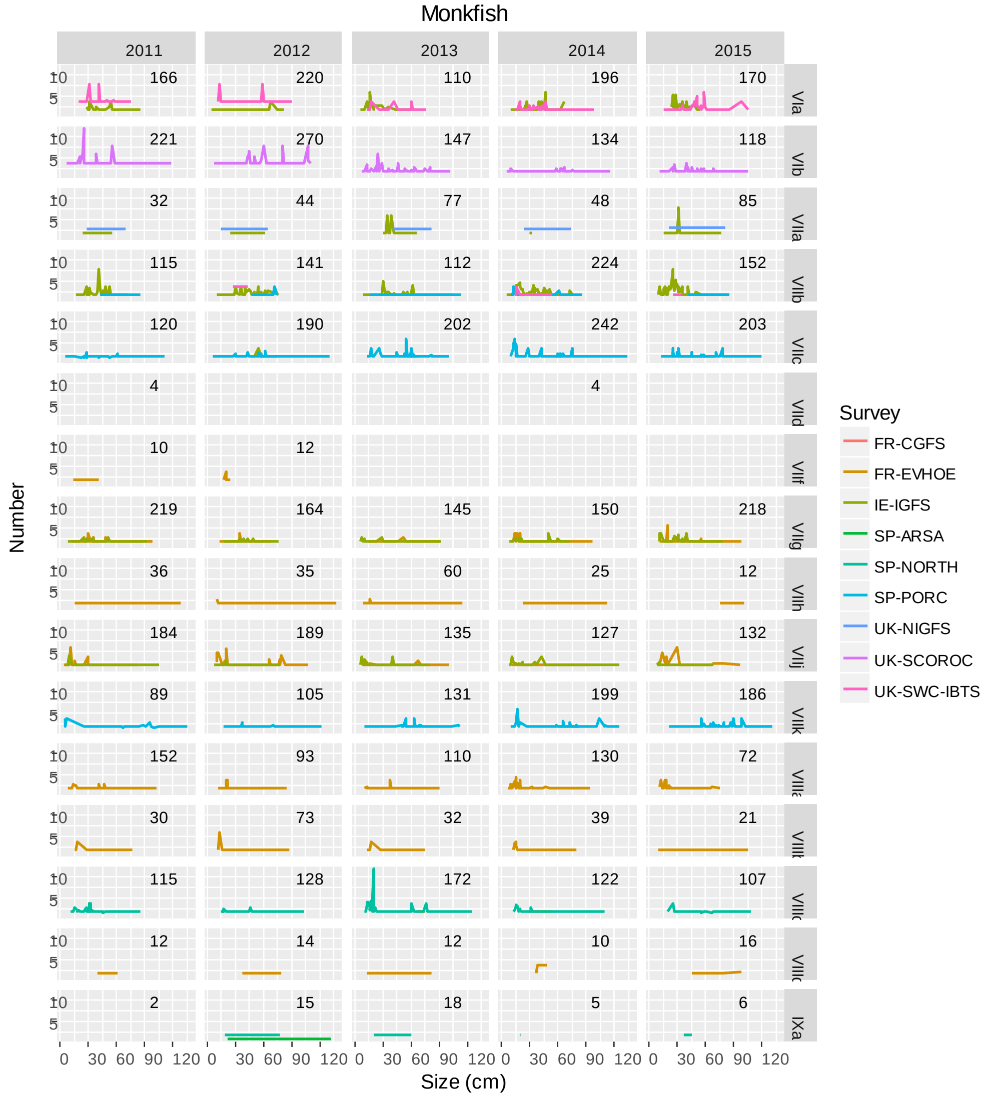



**Figure A.6.28. Length distributions of monkfish, *Lophius piscatorius*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

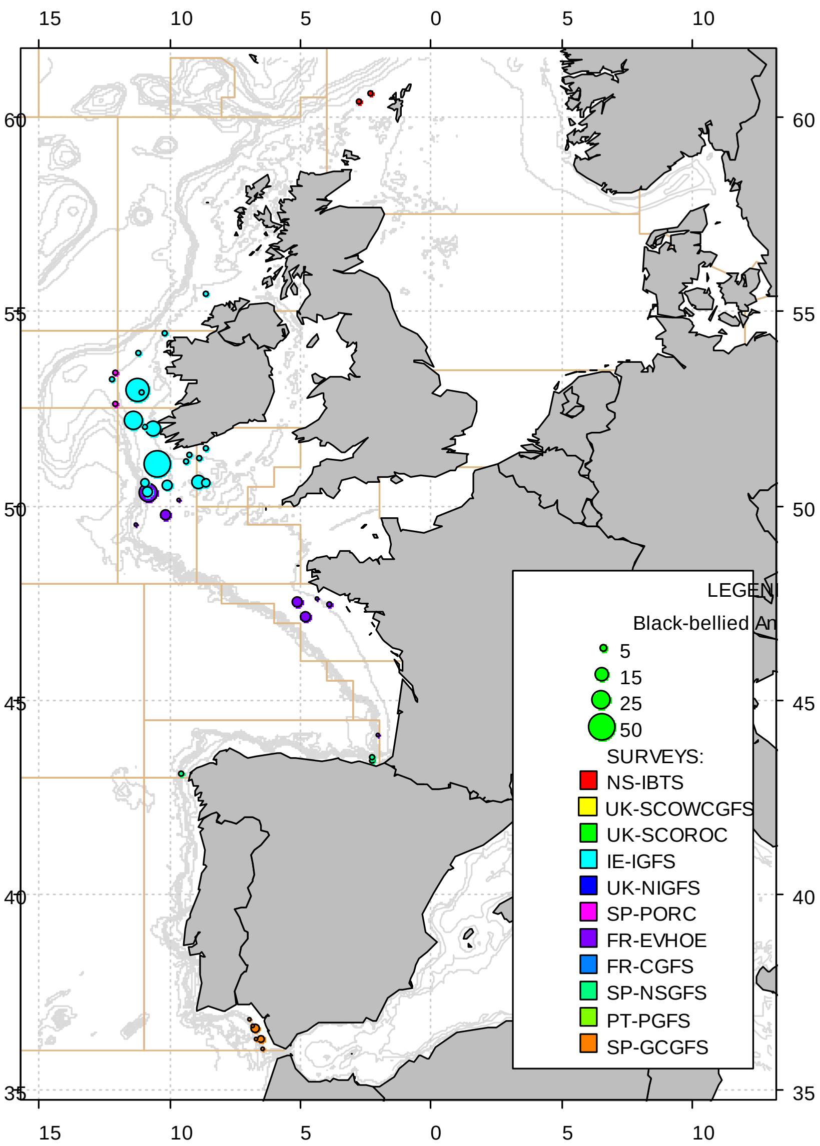



**Figure A.6.29. Catches in numbers per hour of 0-group black-bellied anglerfish, *Lophius budegassa* (< 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

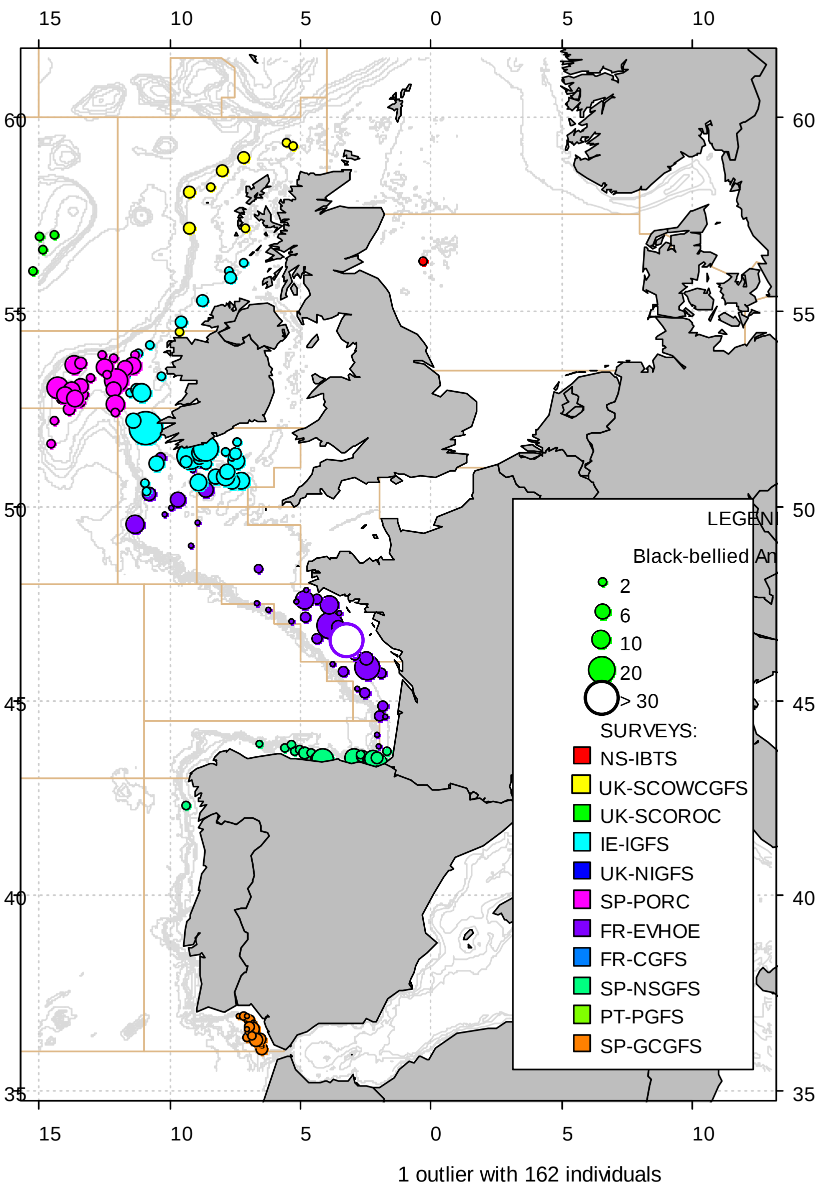



**Figure A.6.30. Catches in numbers per hour of 1+ group black-bellied anglerfish, *Lophius budegassa* (≥ 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

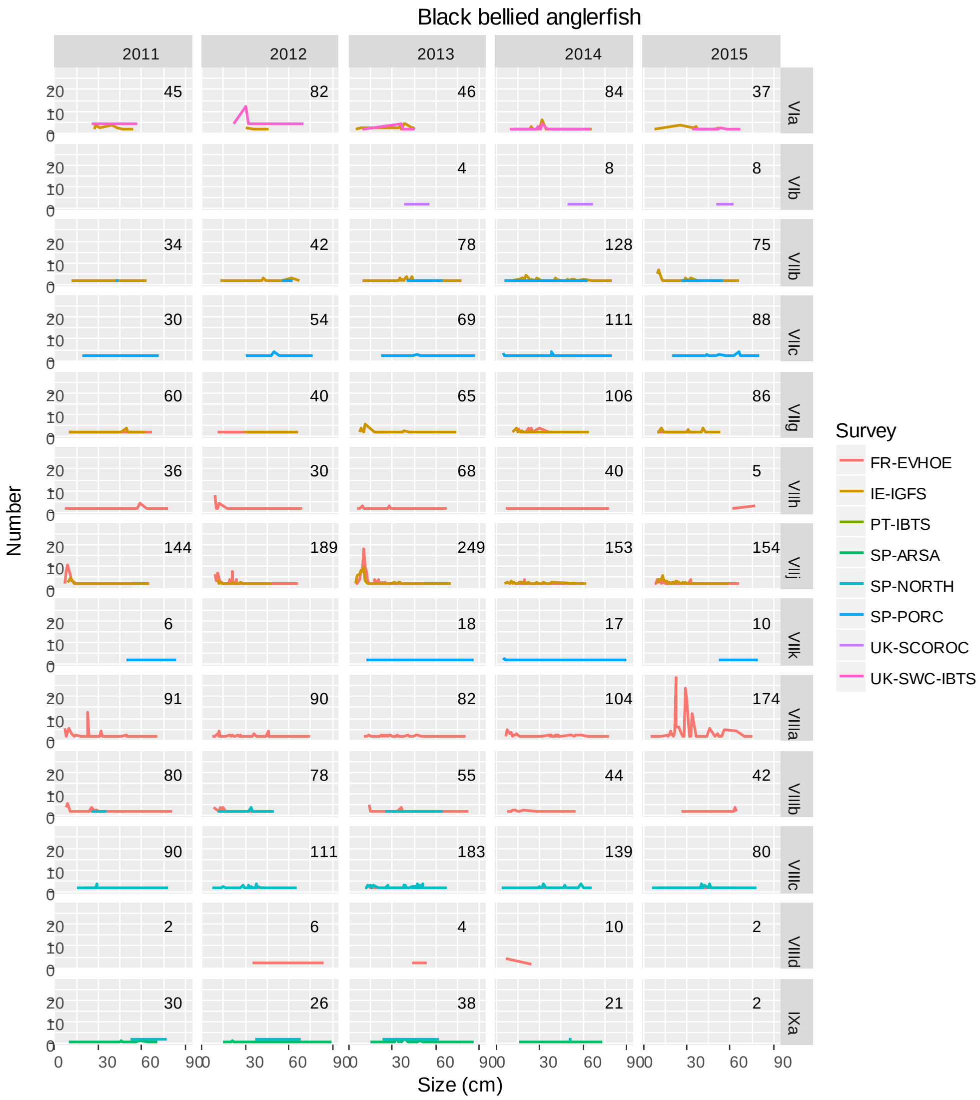



**Figure A.6.31. Length distributions of black-bellied anglerfish, *Lophius budegassa*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

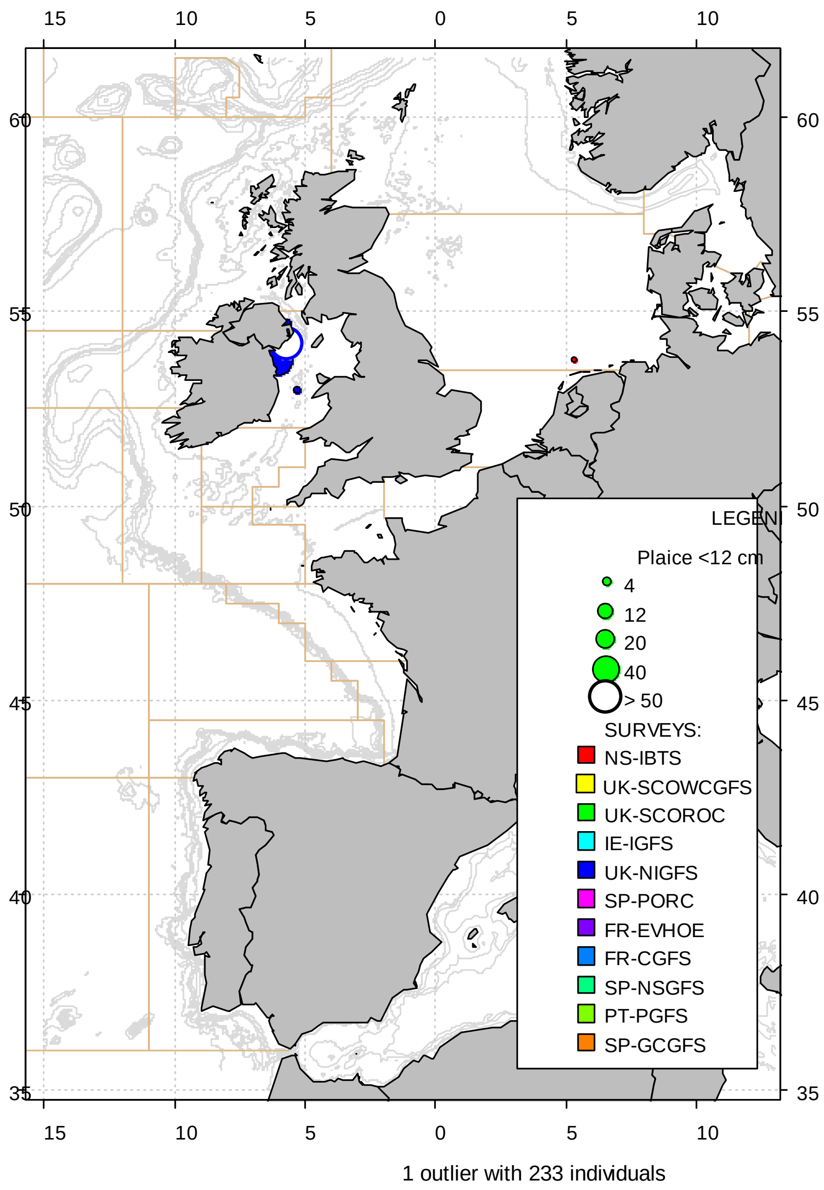



**Figure A.6.32. Catches in numbers per hour of 0-group plaice, *Pleuronectes platessa* (< 12 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

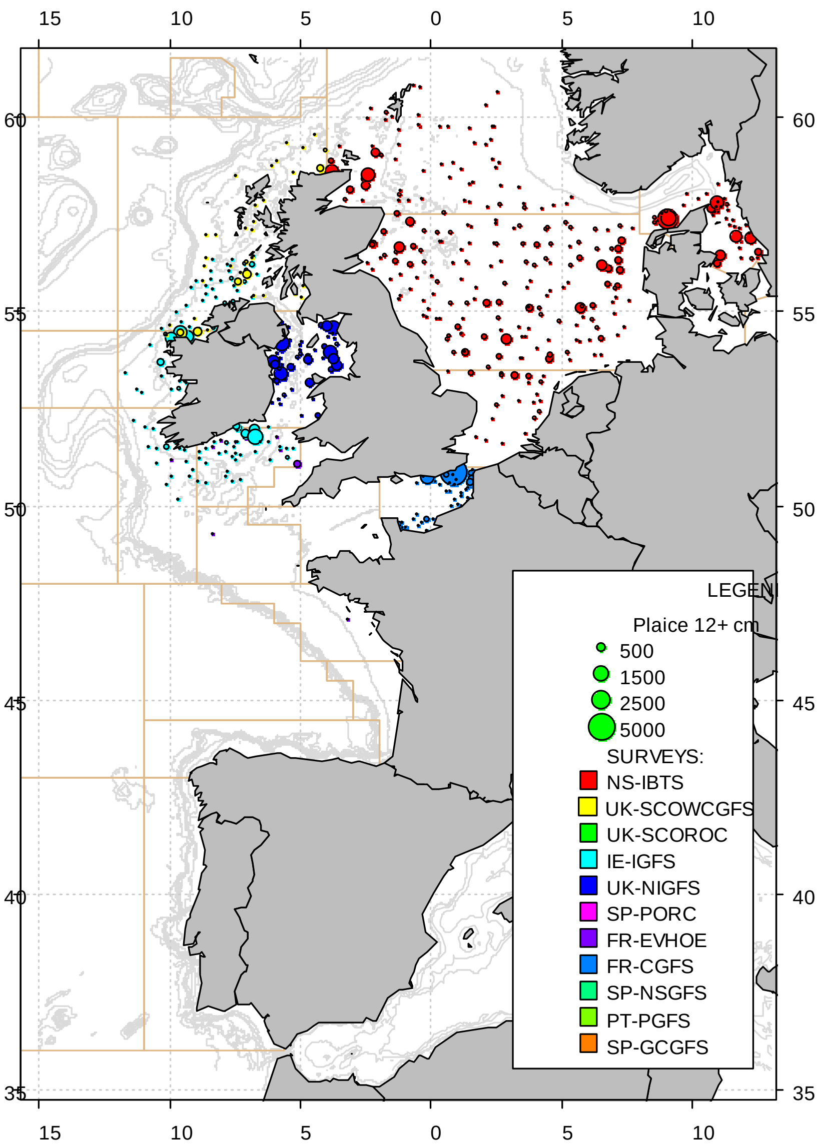



**Figure A.6.33. Catches in numbers per hour of 1+ group plaice, *Pleuronectes platessa* (≥ 12 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

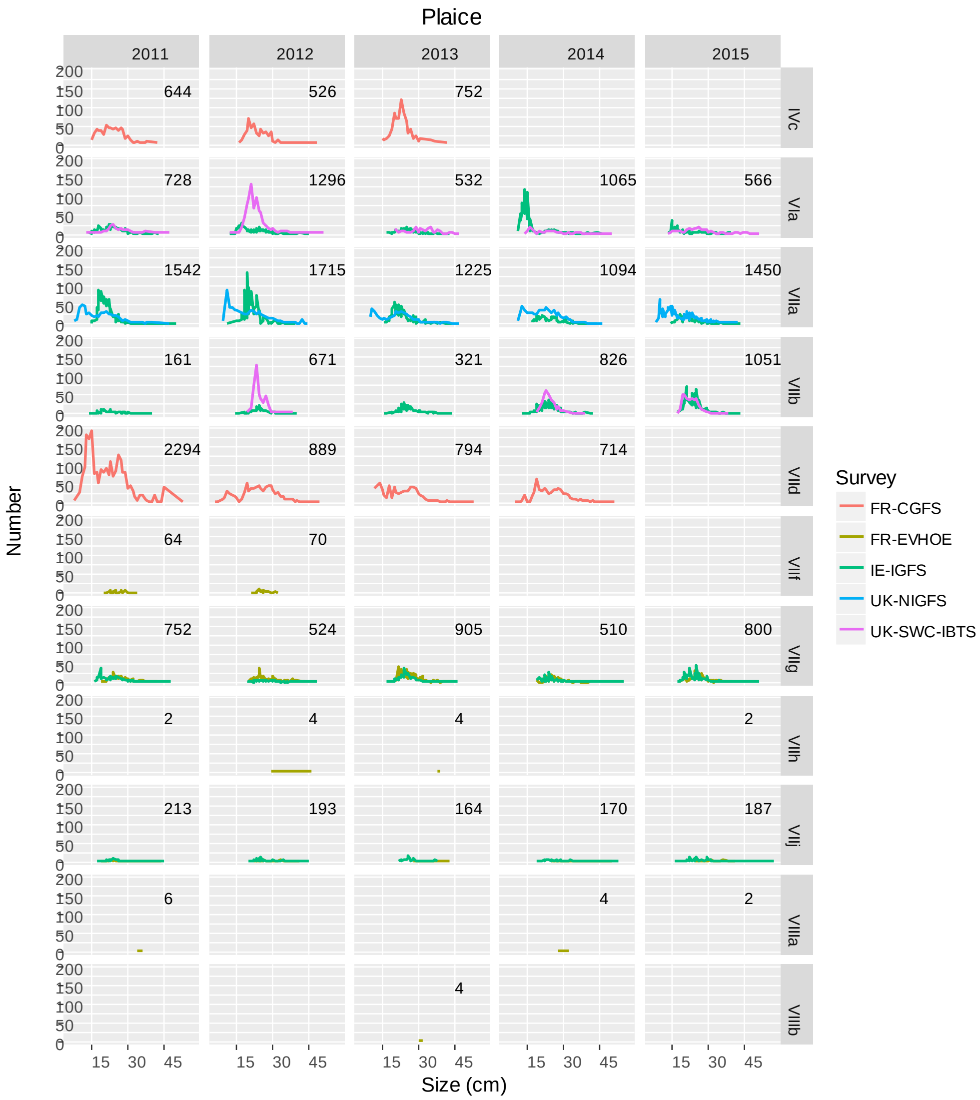



**Figure A.6.34. Length distributions of plaice, *Pleuronectes platessa*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

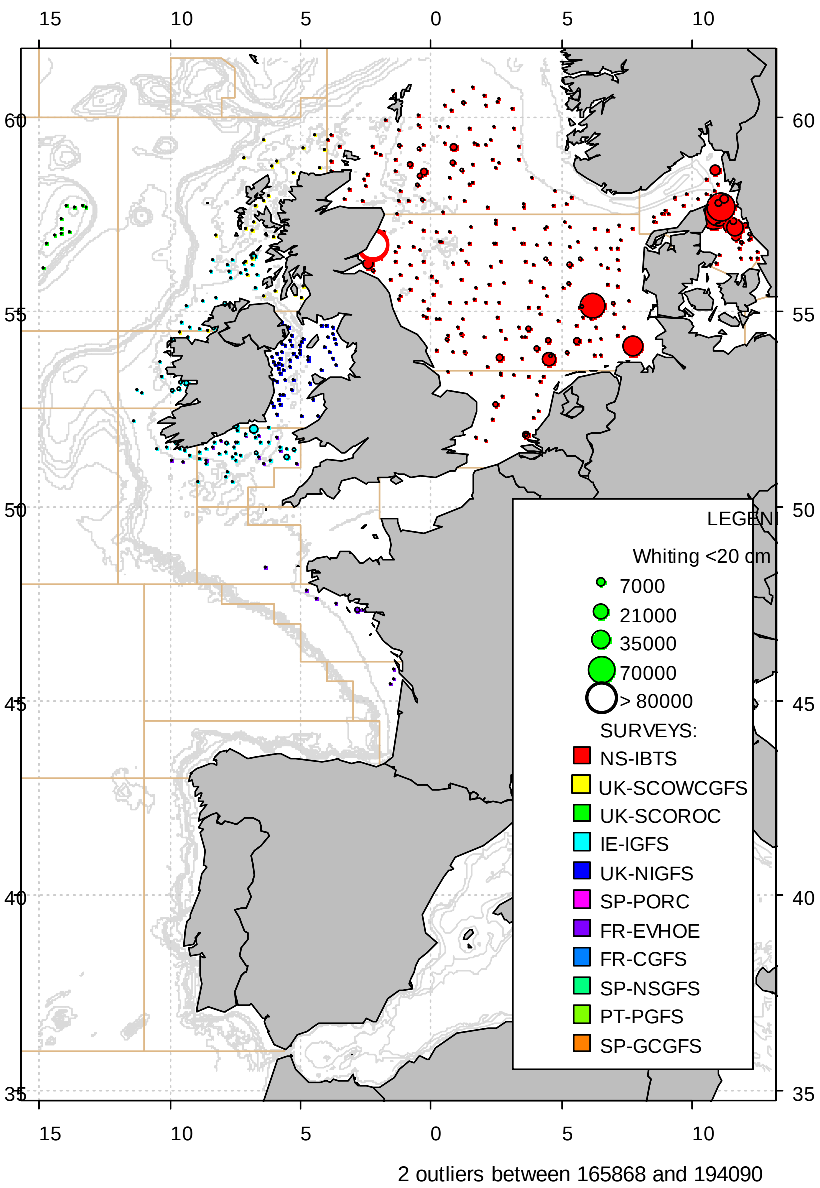



**Figure A.6.35. Catches in numbers per hour of 0-group whiting, *Merlangius merlangus* (< 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

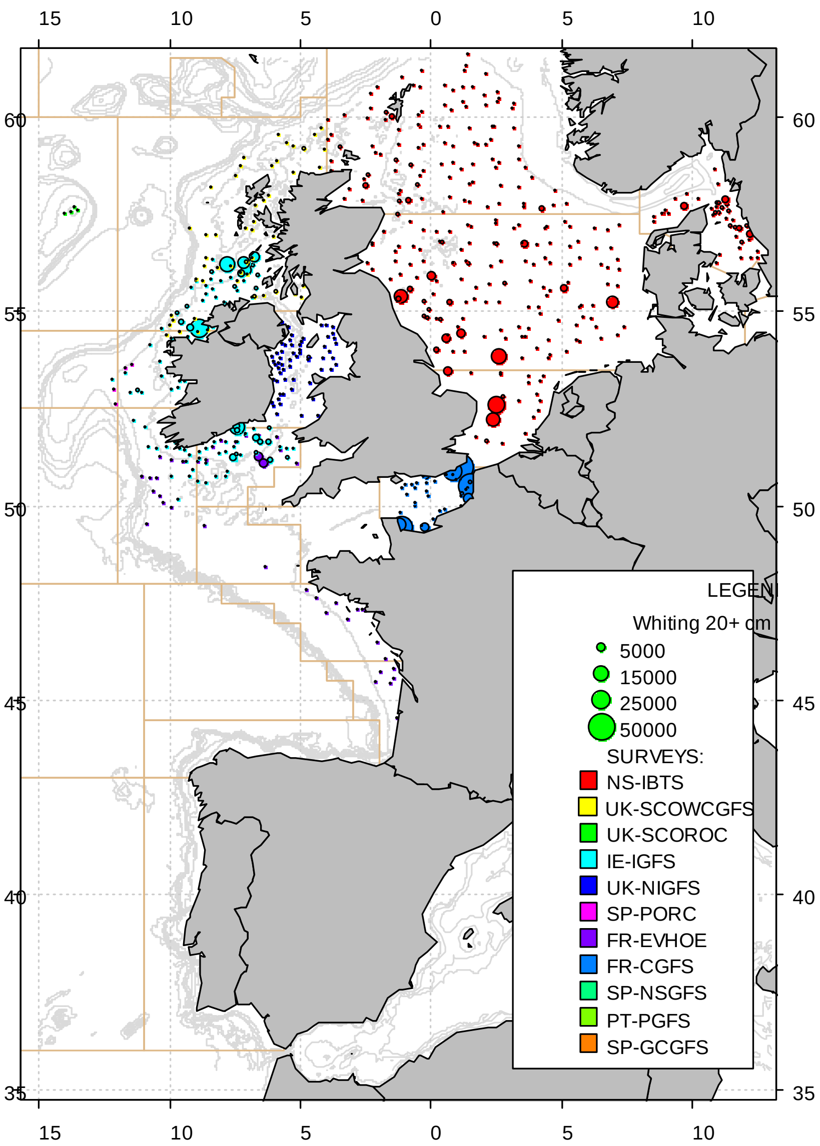



**Figure A.6.36. Catches in numbers per hour of 1+ group whiting, *Merlangius merlangus* (≥ 20 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

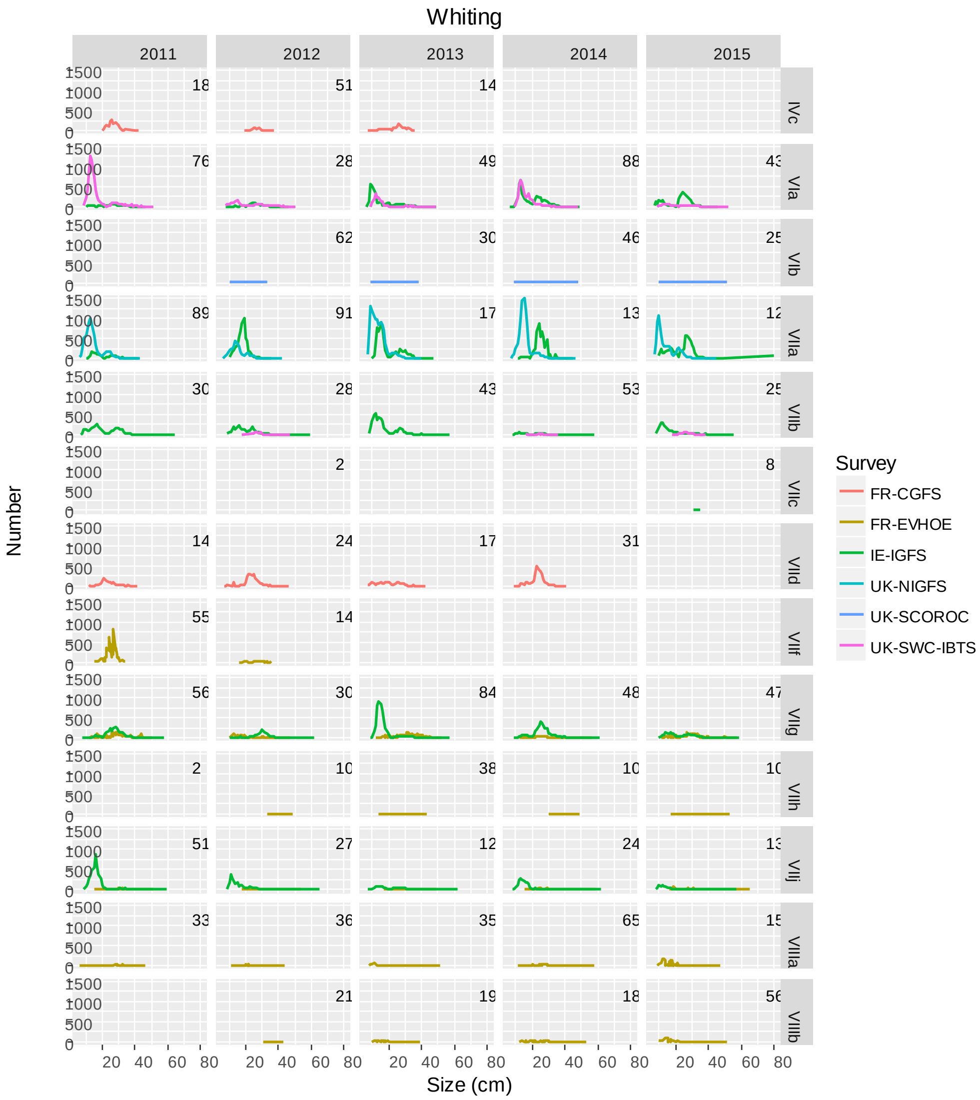



**Figure A.6.37. Length distributions of whiting, *Merlangius merlangus*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

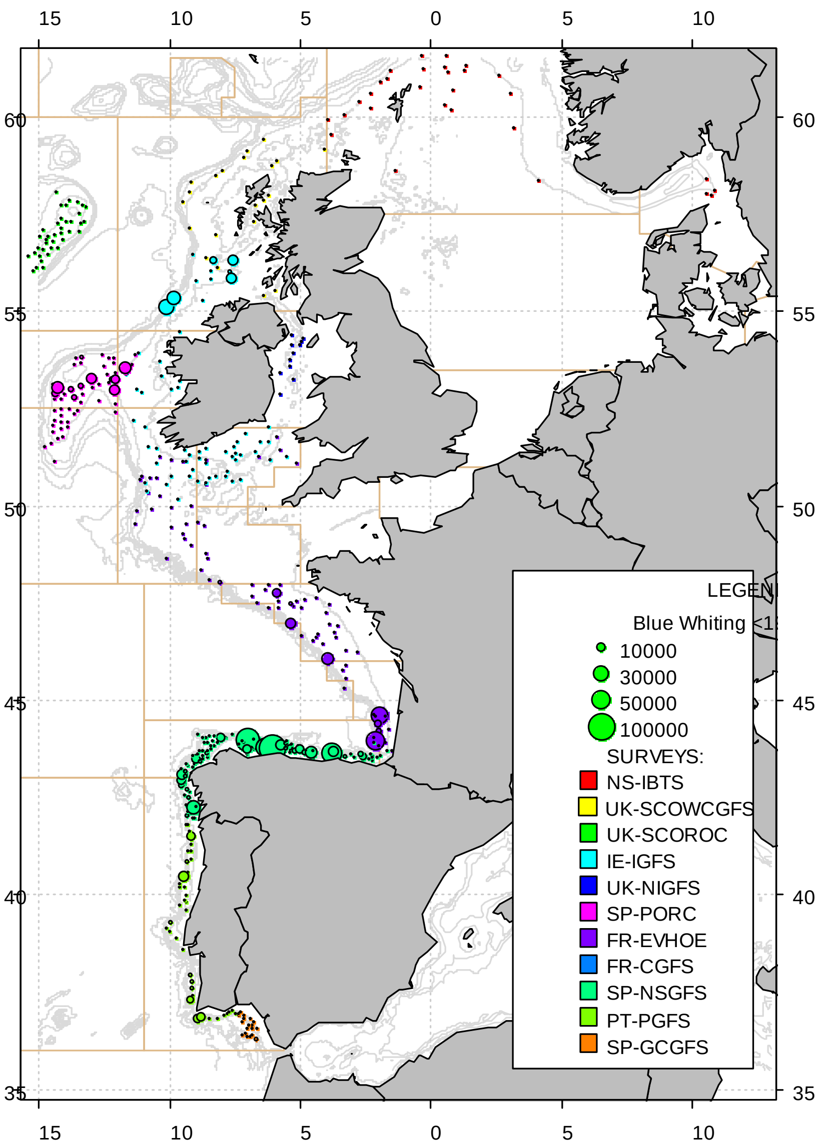



**Figure A.6.38. Catches in numbers per hour of 0-group blue whiting, *Micromesistius poutassou* (< 19 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

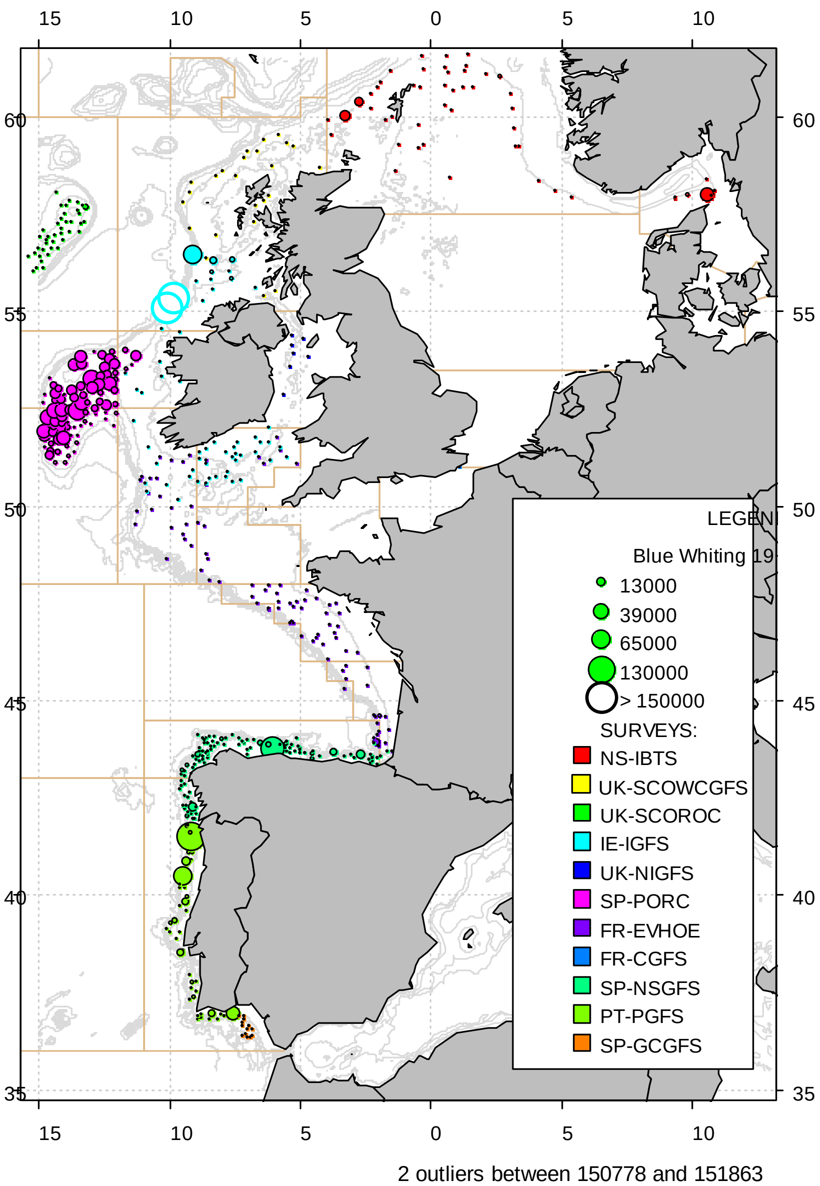



**Figure A.6.39. Catches in numbers per hour of 1+ group blue whiting, *Micromesistius poutassou* (≥ 19 cm), in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

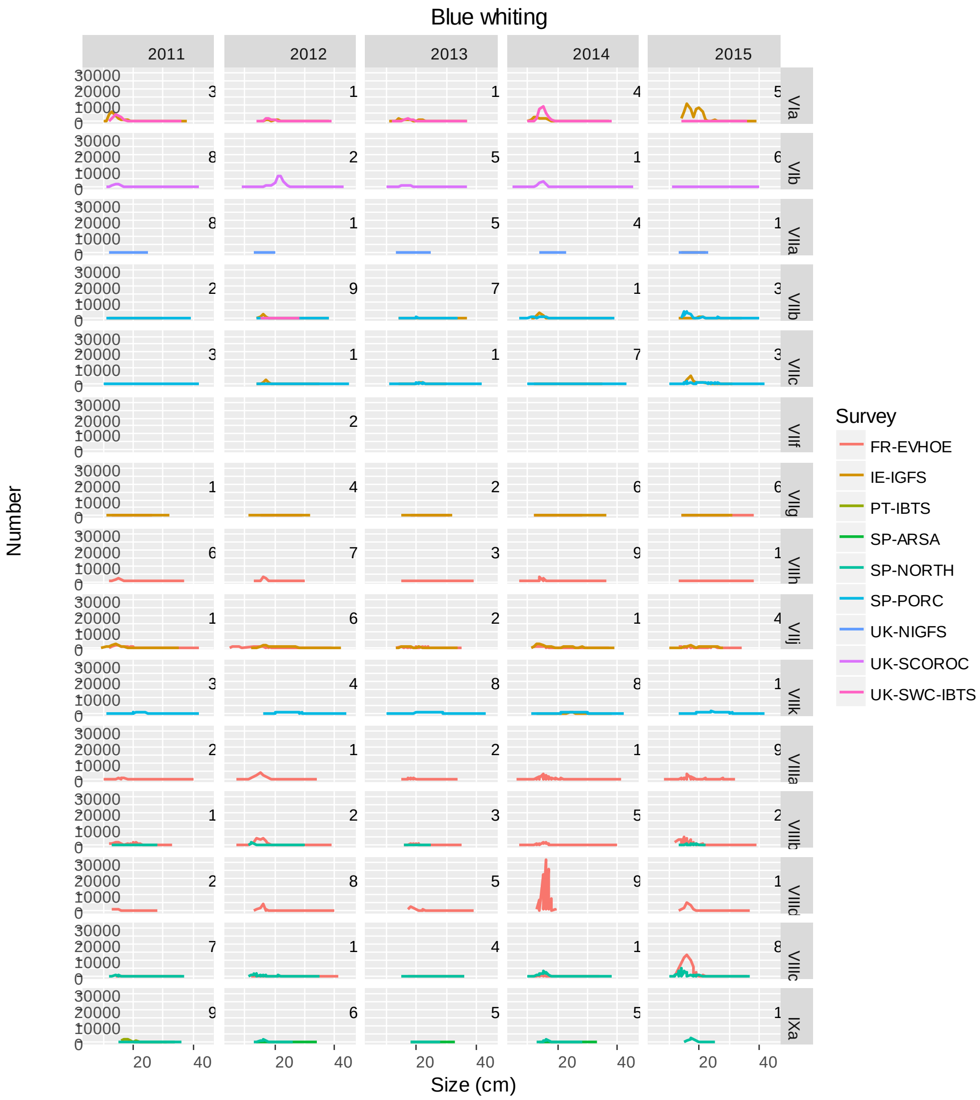



**Figure A.6.40. Length distributions of blue whiting, *Micromesistius poutassou*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

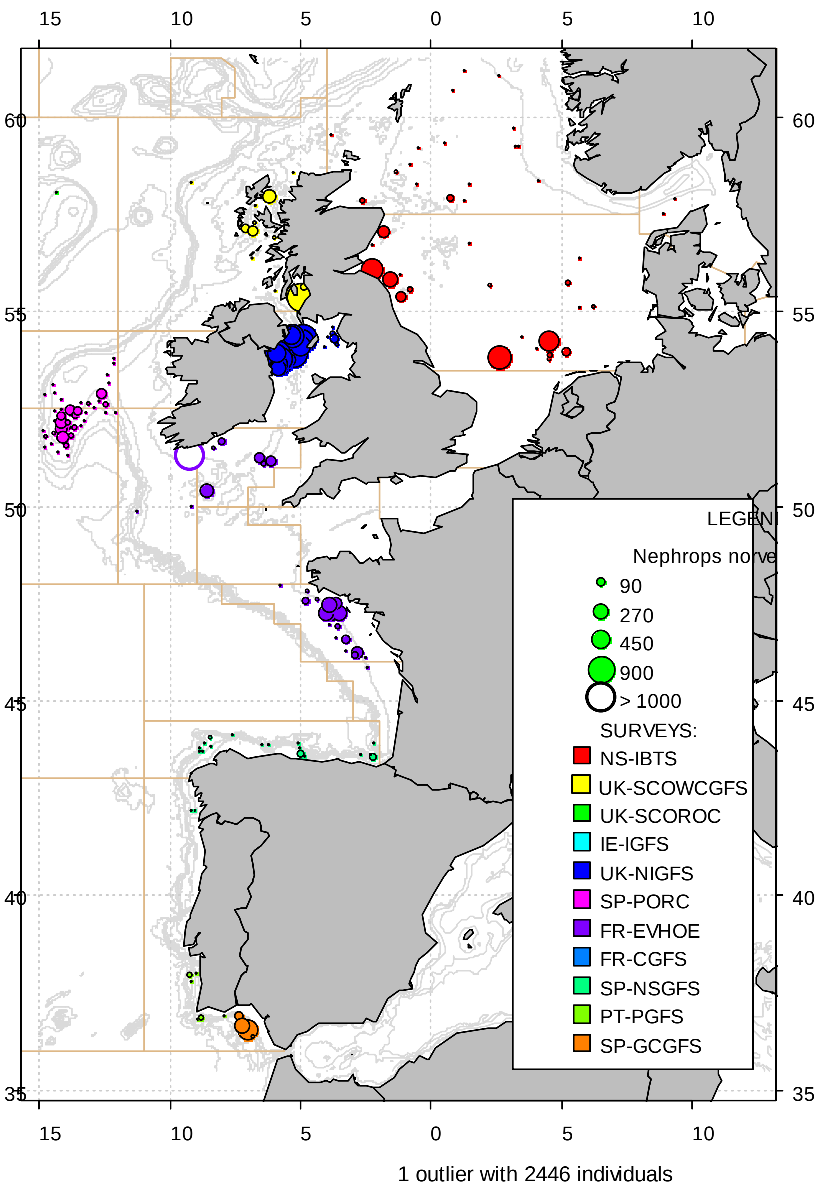



**Figure A.6.41. Catches in numbers per hour of Norway lobster, *Nephrops norvegicus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

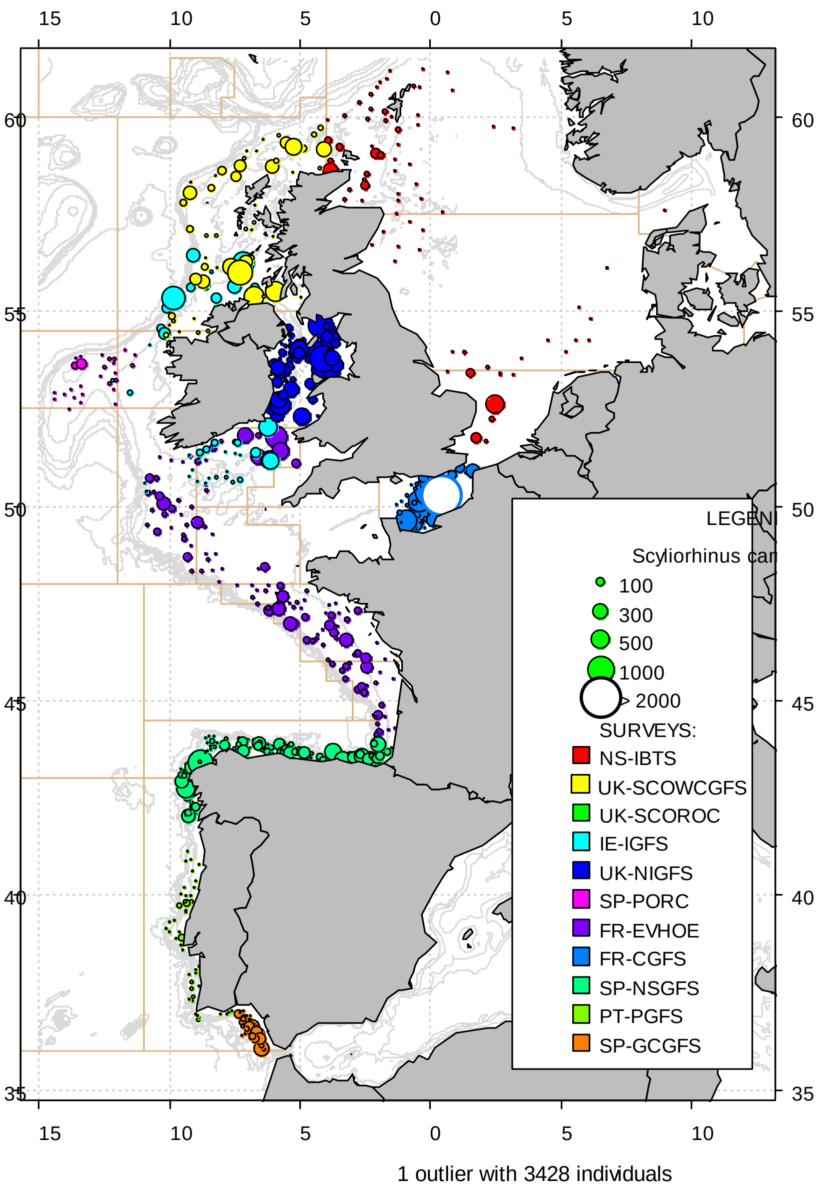



**Figure A.6.42. Catches in numbers per hour of lesser spotted dogfish, *Scyliorhinus canicula*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**


**Figure A.6.43. Length distributions of lesser spotted dogfish, *Scyliorhinus canicula*, per ICES Sub-area in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

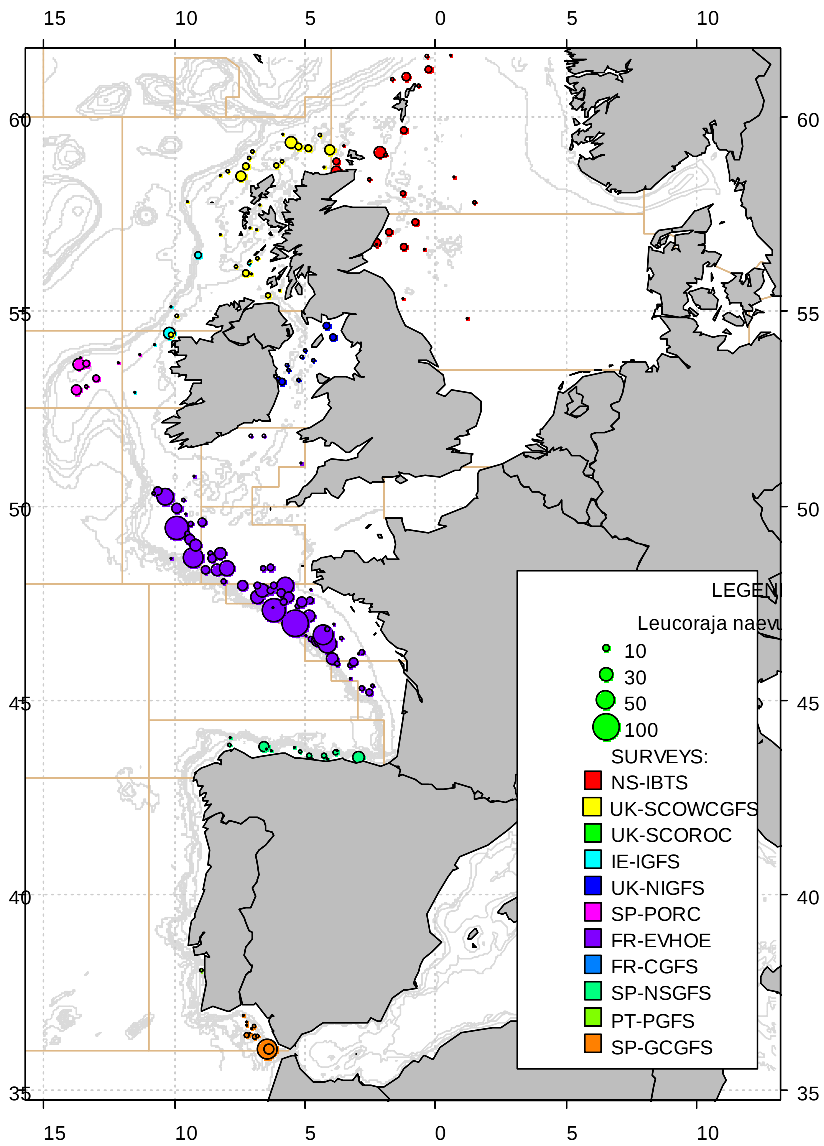



**Figure A.6.44. Catches in numbers per hour of cuckoo ray, *Leucoraja naevus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

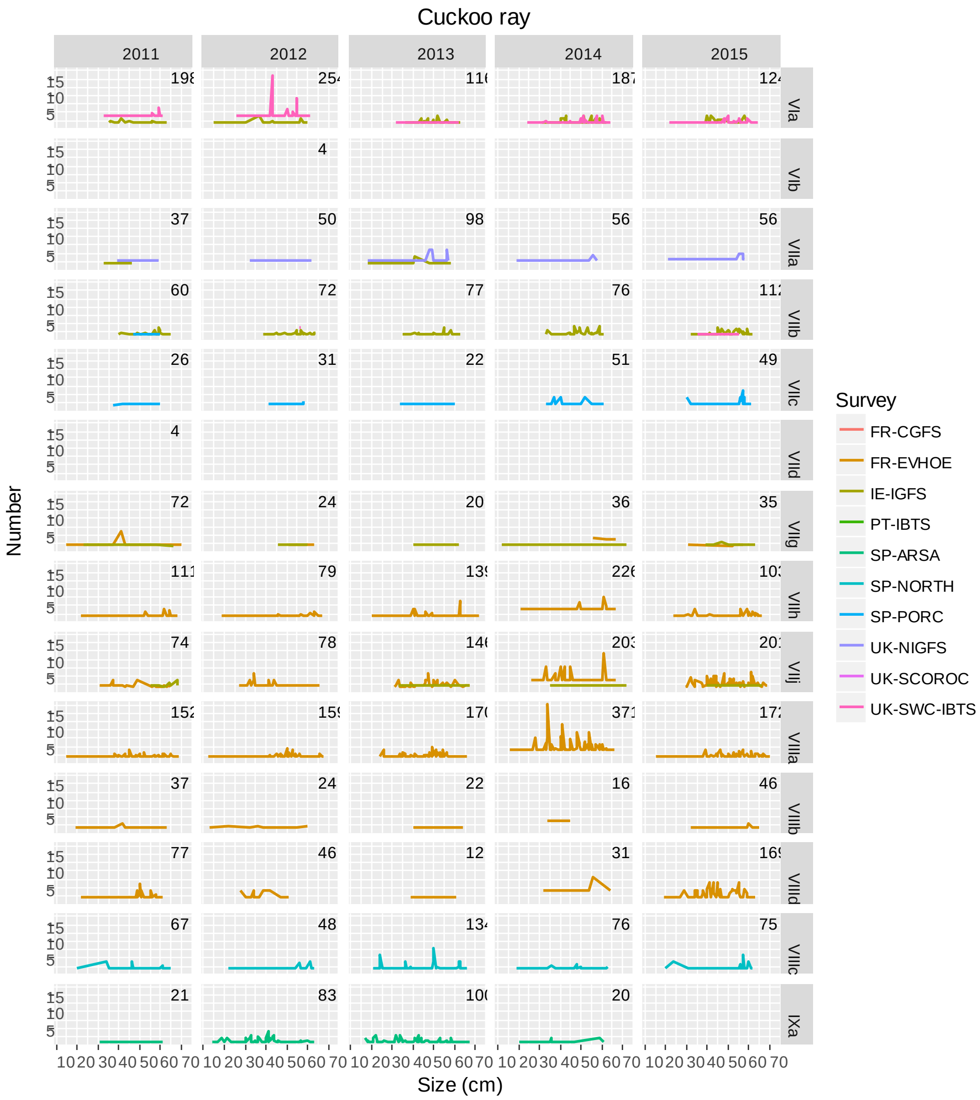



**Figure A.6.45. Length distributions of cuckoo ray, *Leucoraja naevus*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

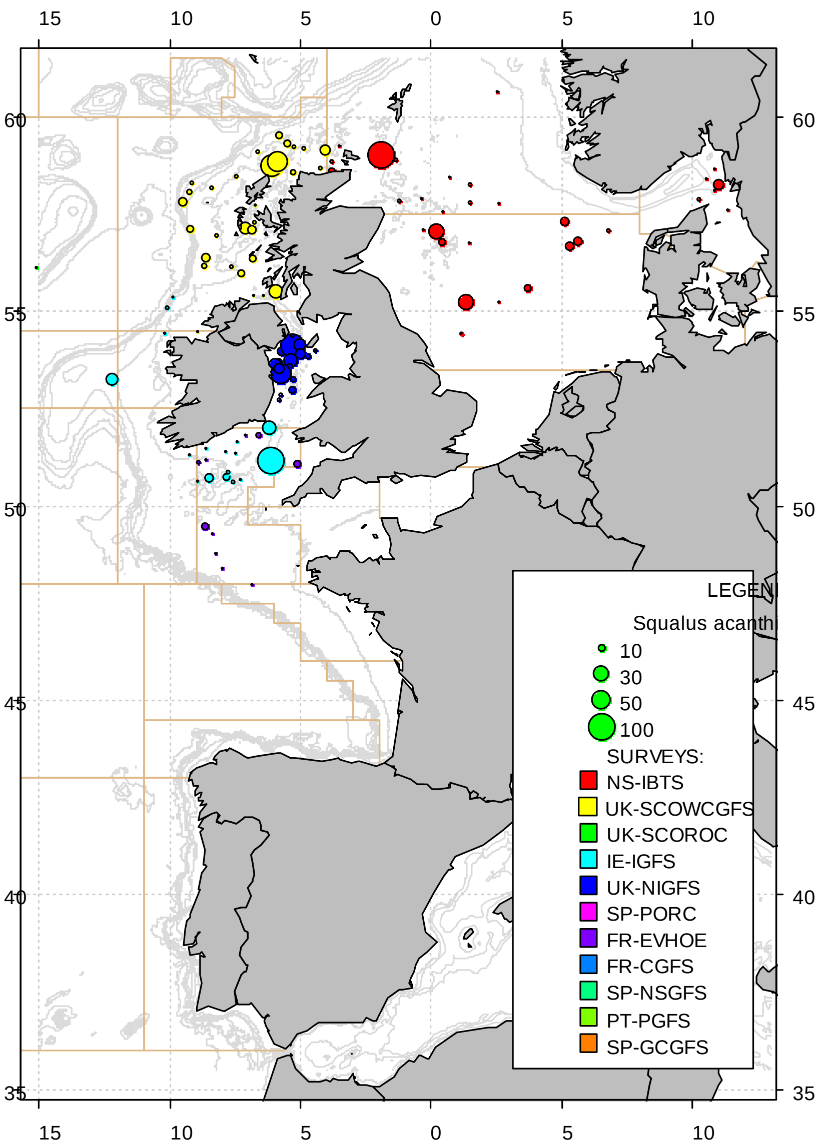



**Figure A.6.46. Catches in numbers per hour per hour of spurdog, *Squalus acanthias*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

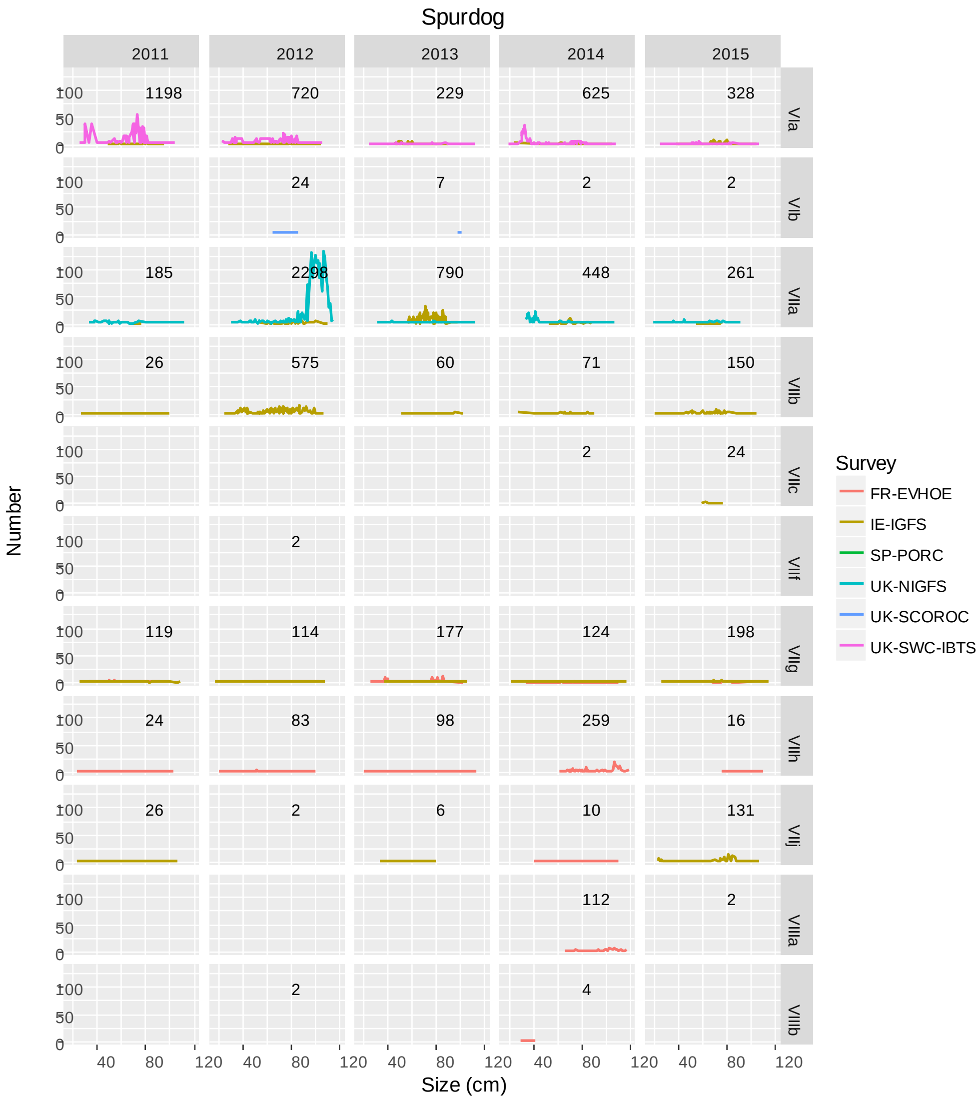



**Figure A.6.47. Length distributions of spurdog, *Squalus acanthias*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

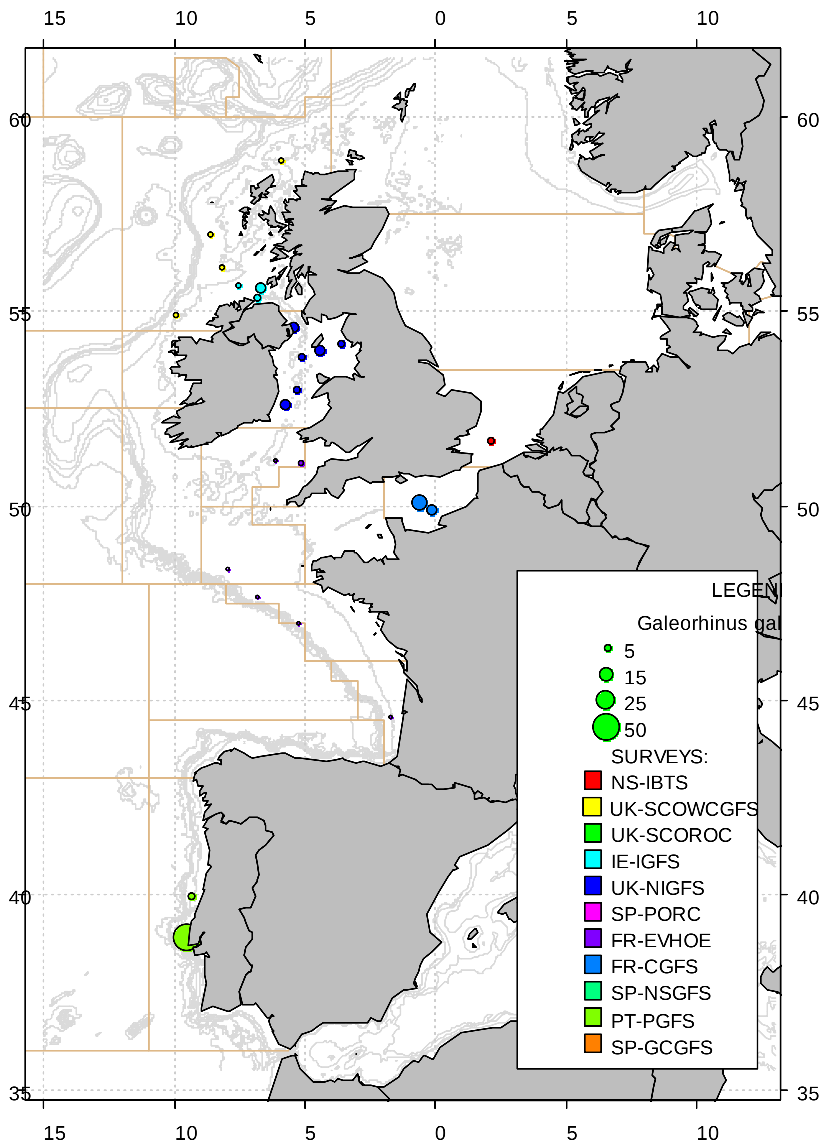



**Figure A.6.48. Catches in numbers per hour per hour of tope, *Galeorhinus galeus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

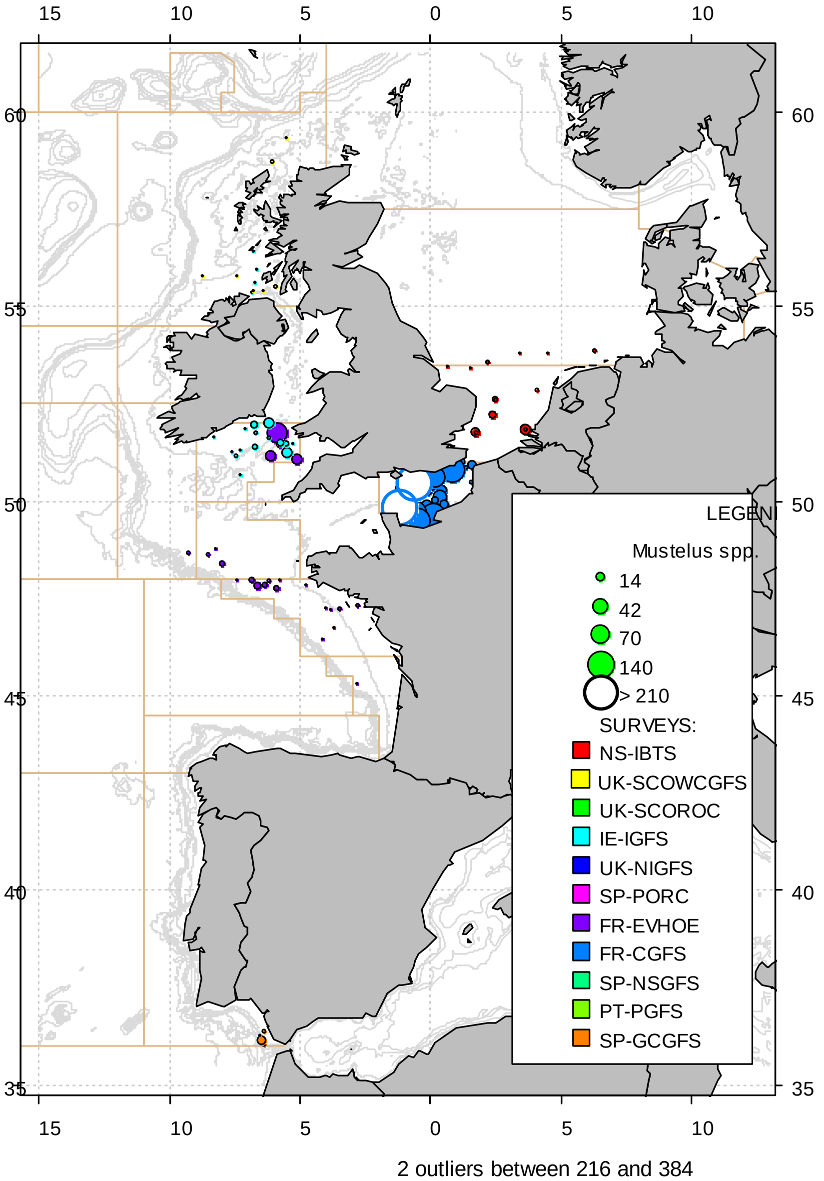



**Figure A.6.49. Catches in numbers per hour per hour of smooth-hound, *Mustelus* spp. in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey. Data from the northern part of the region are assumed to refer to *M. asterias*, and the southernmost record likely to be *M. Mustelus*.**

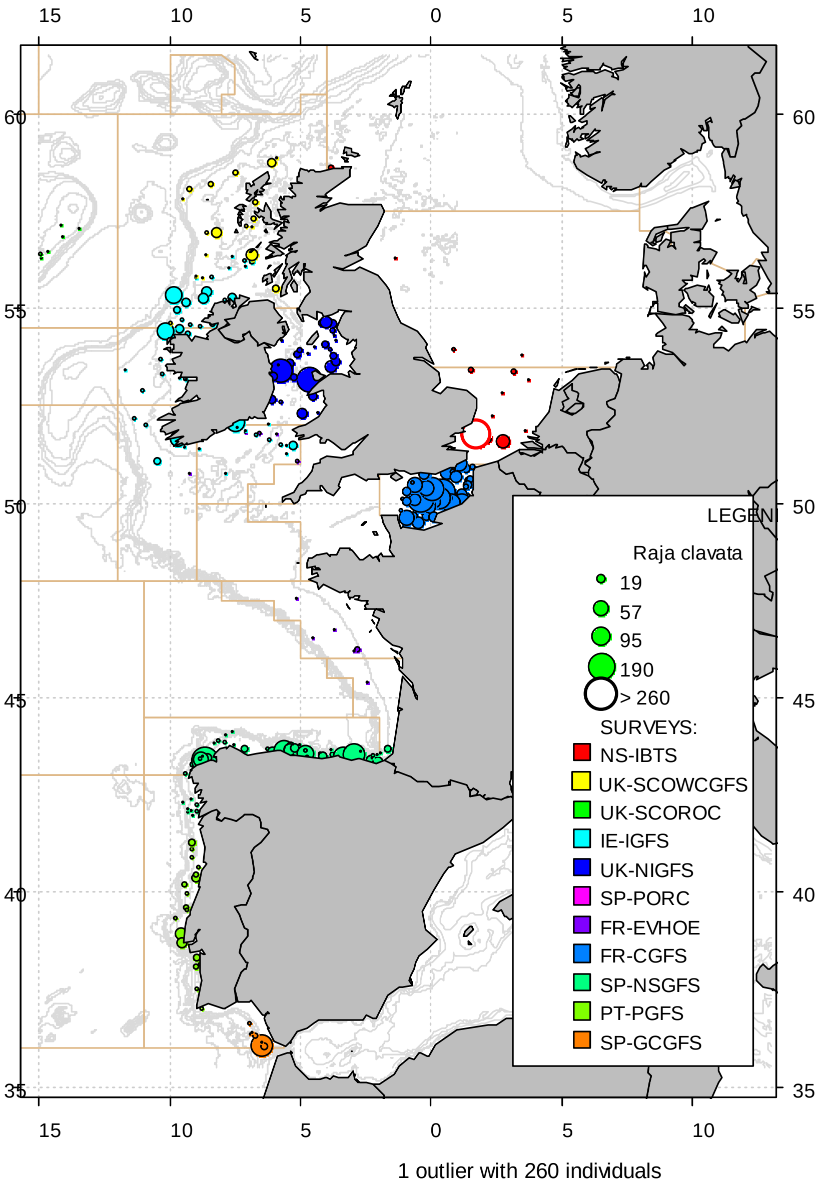



**Figure A.6.50. Catches in numbers per hour per hour of thornback ray, *Raja clavata*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

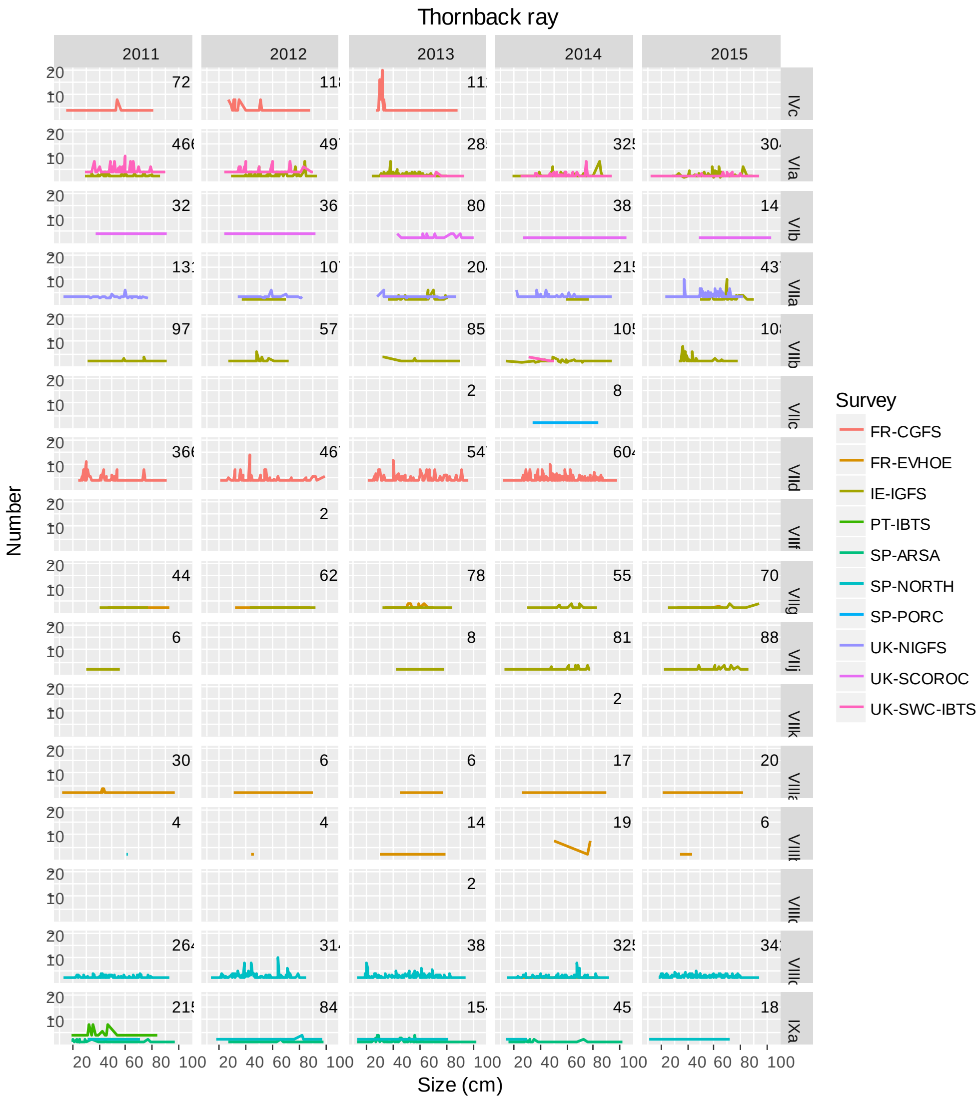



**Figure A.6.51. Length distributions of thornback ray, *Raja clavata*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

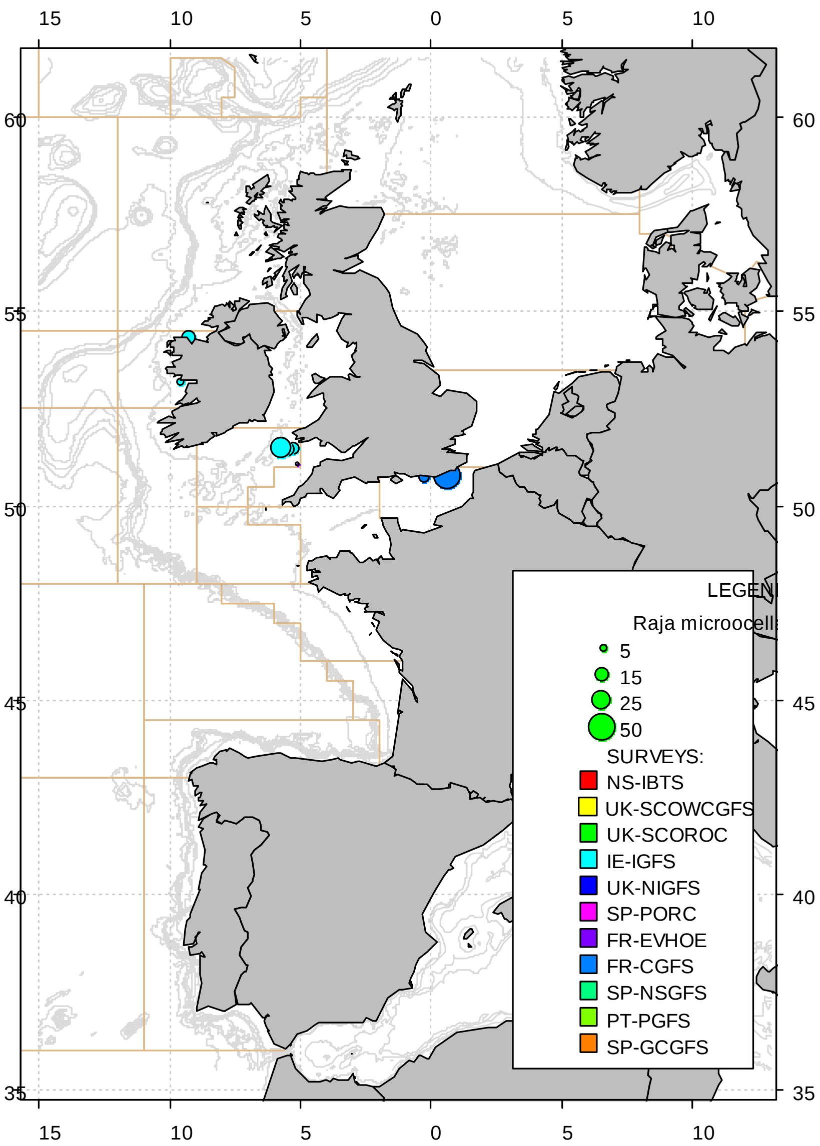



**Figure A.6.52. Catches in numbers per hour per hour of small eyed ray, *Raja microocellata*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

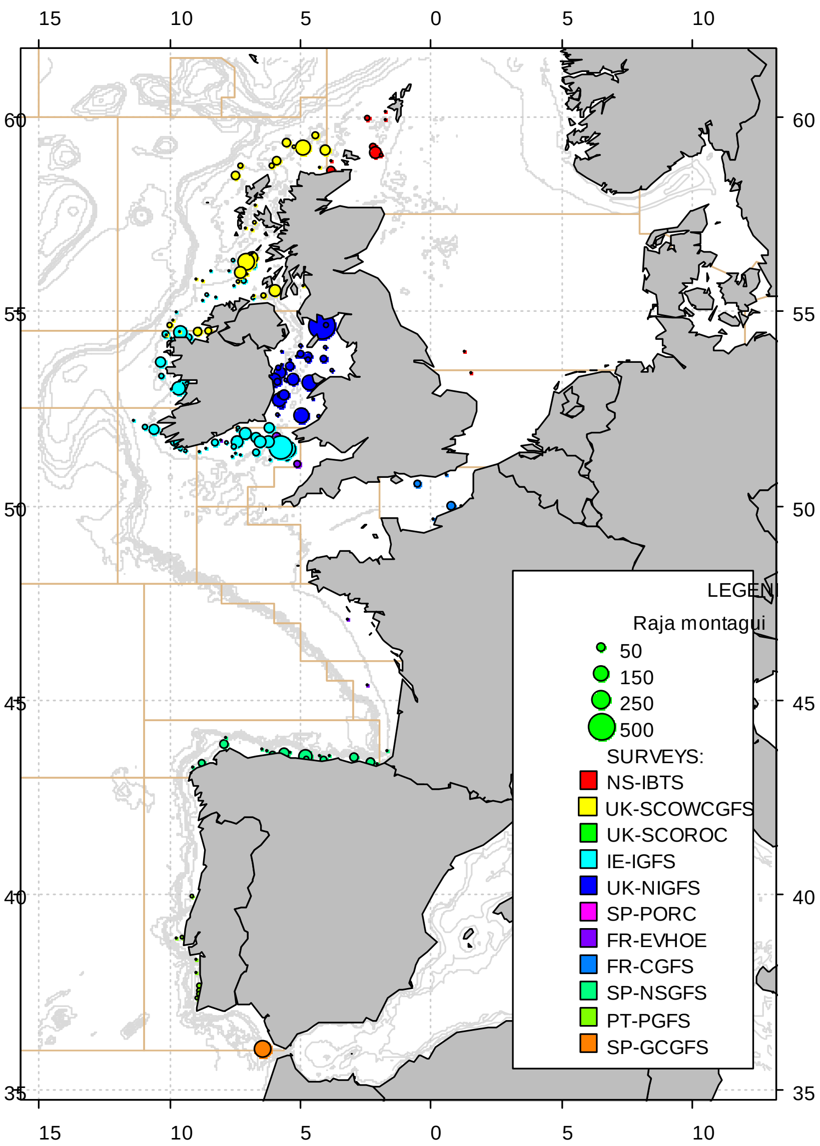



**Figure A.6.53. Catches in numbers per hour per hour of spotted ray, *Raja montagui*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore the map does not reflect proportional abundance in all the areas but within each survey.**

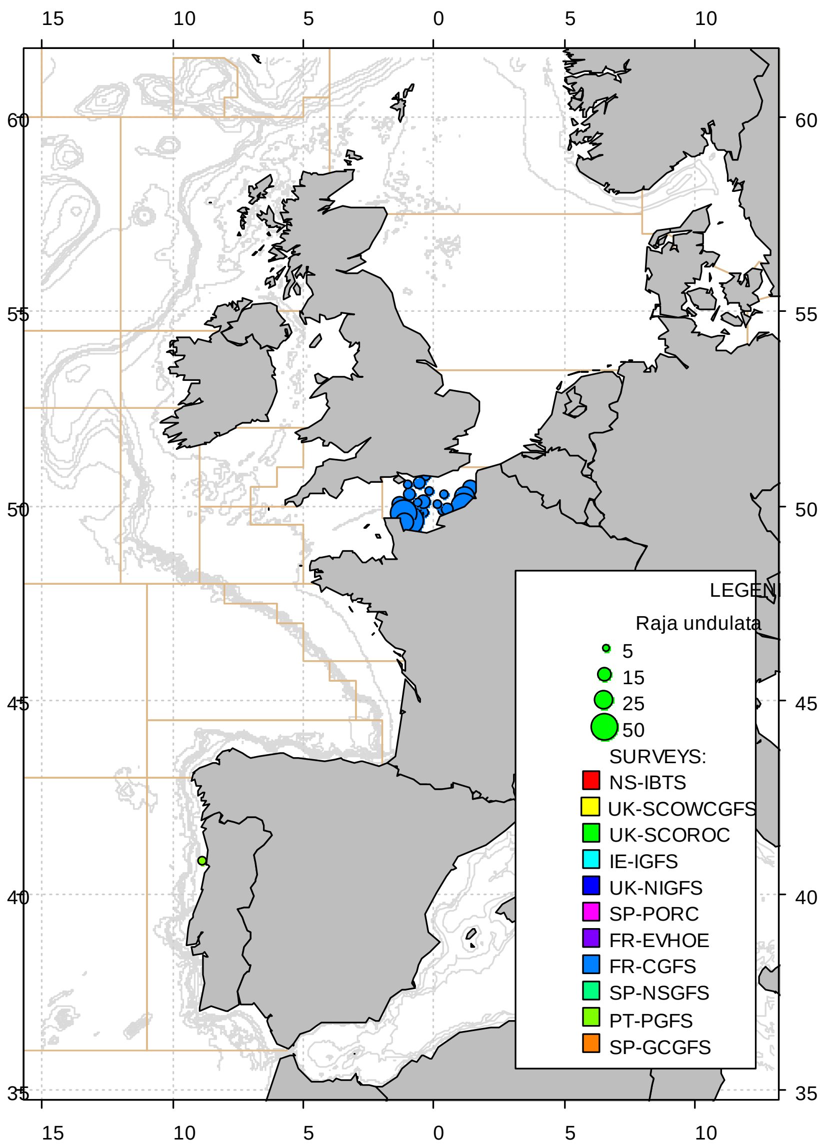



**Figure A.6.54. Catches in numbers per hour per hour of undulate ray, *Raja undulata*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

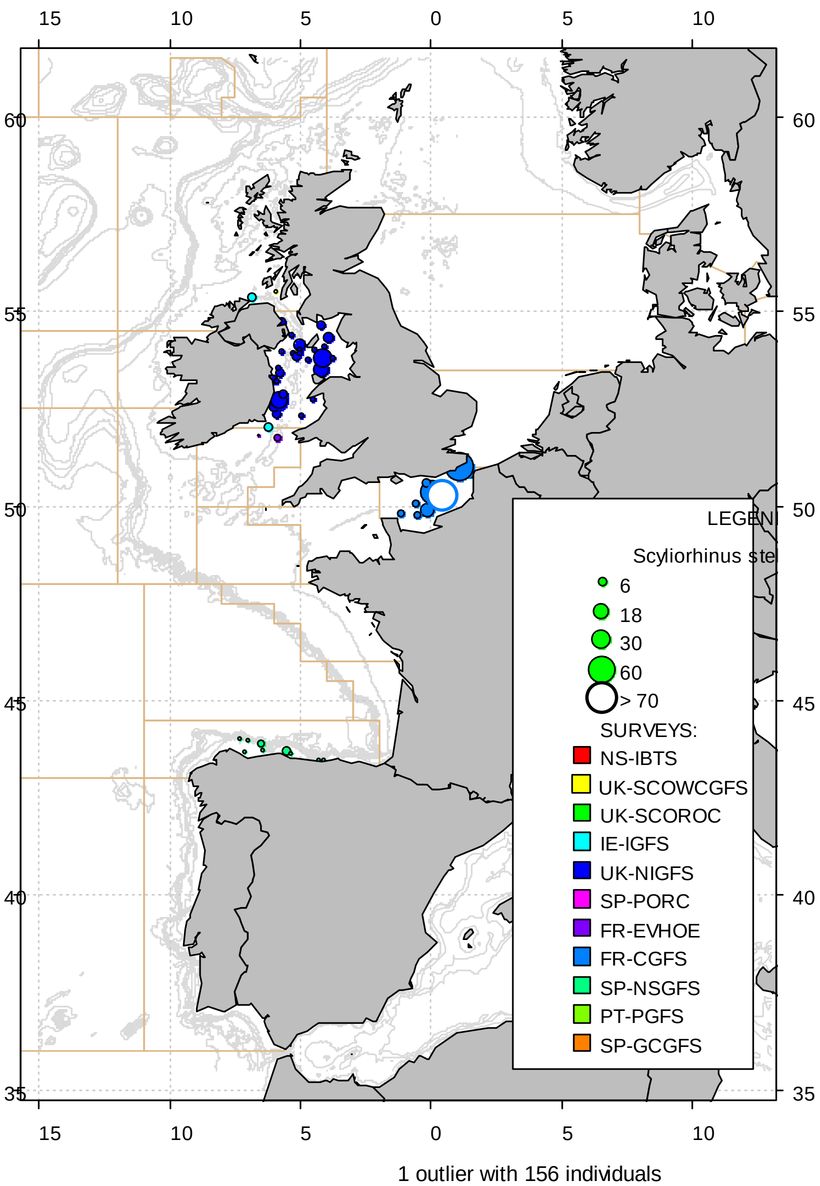



**Figure A.6.55. Catches in numbers per hour per hour of nurse hound, *Scyliorhinus stellaris*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

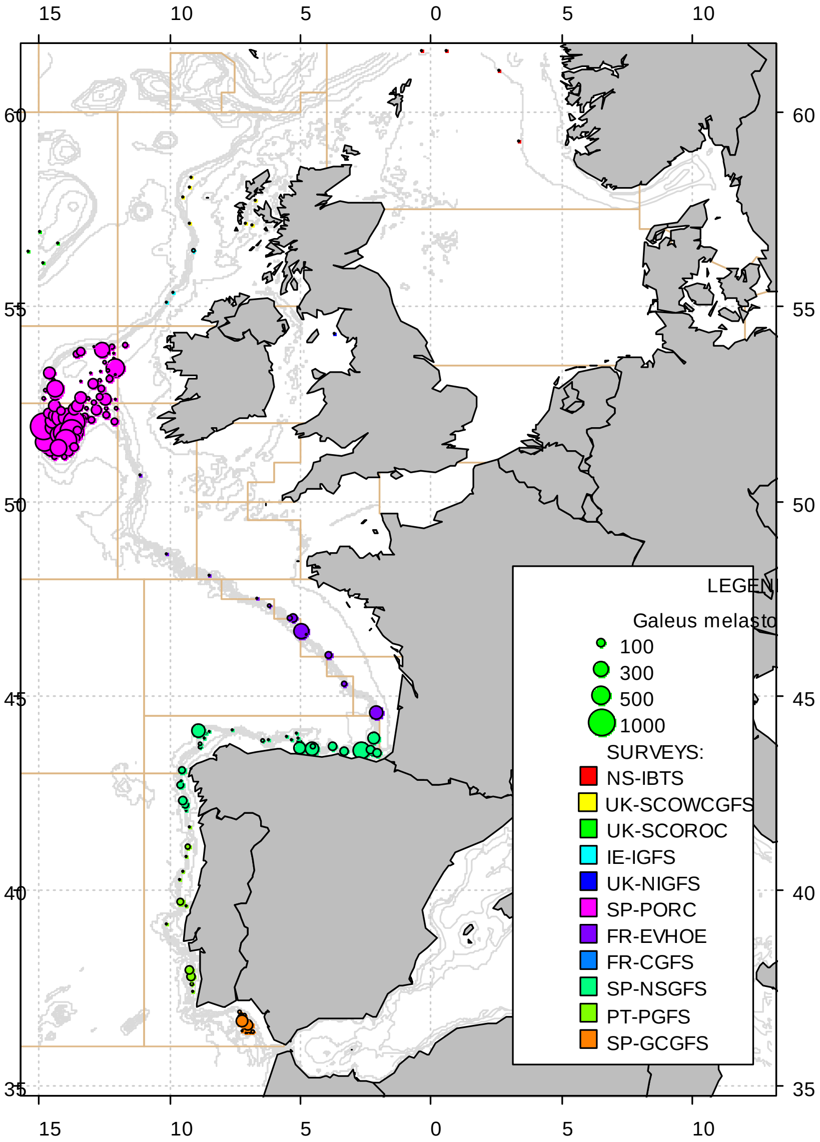



**Figure A.6.56. Catches in numbers per hour per hour of Blackmouthed dogfish, *Galeus melastomus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

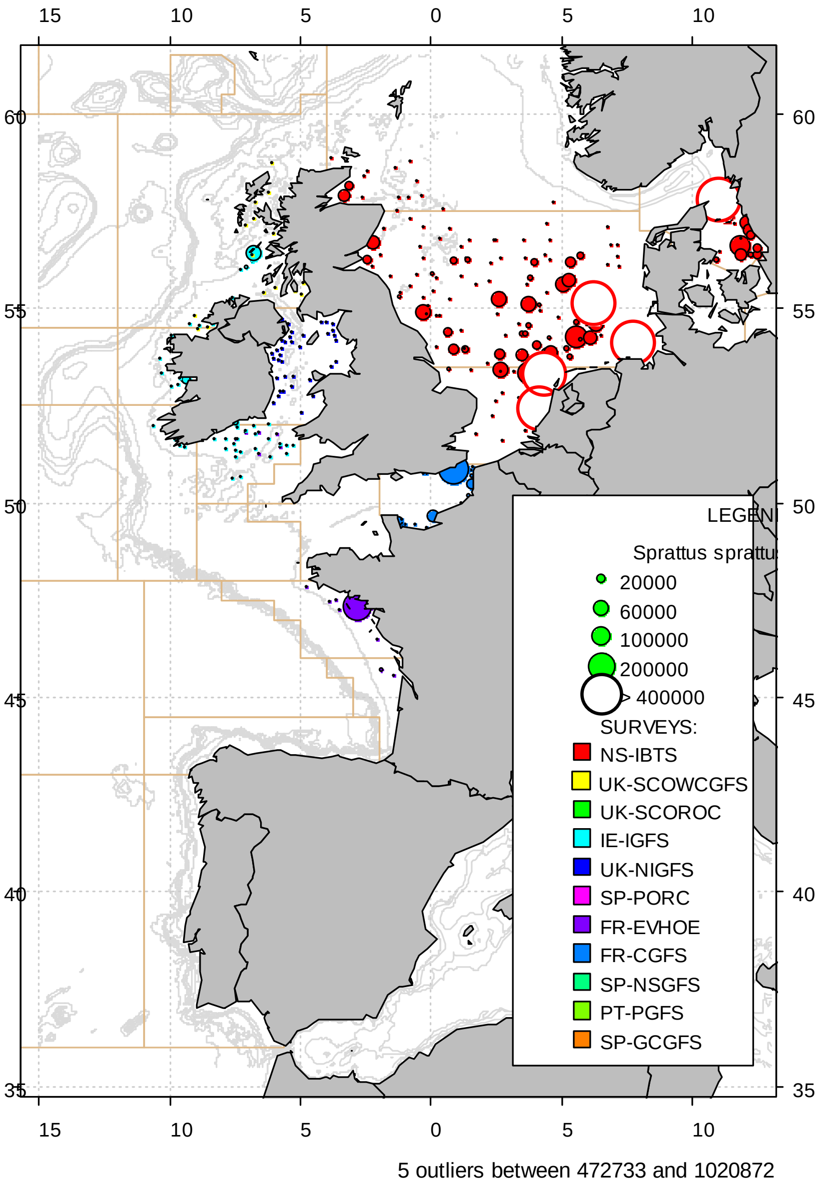



**Figure A.6.57. Catches in numbers per hour per hour of European sprat, *Sprattus sprattus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

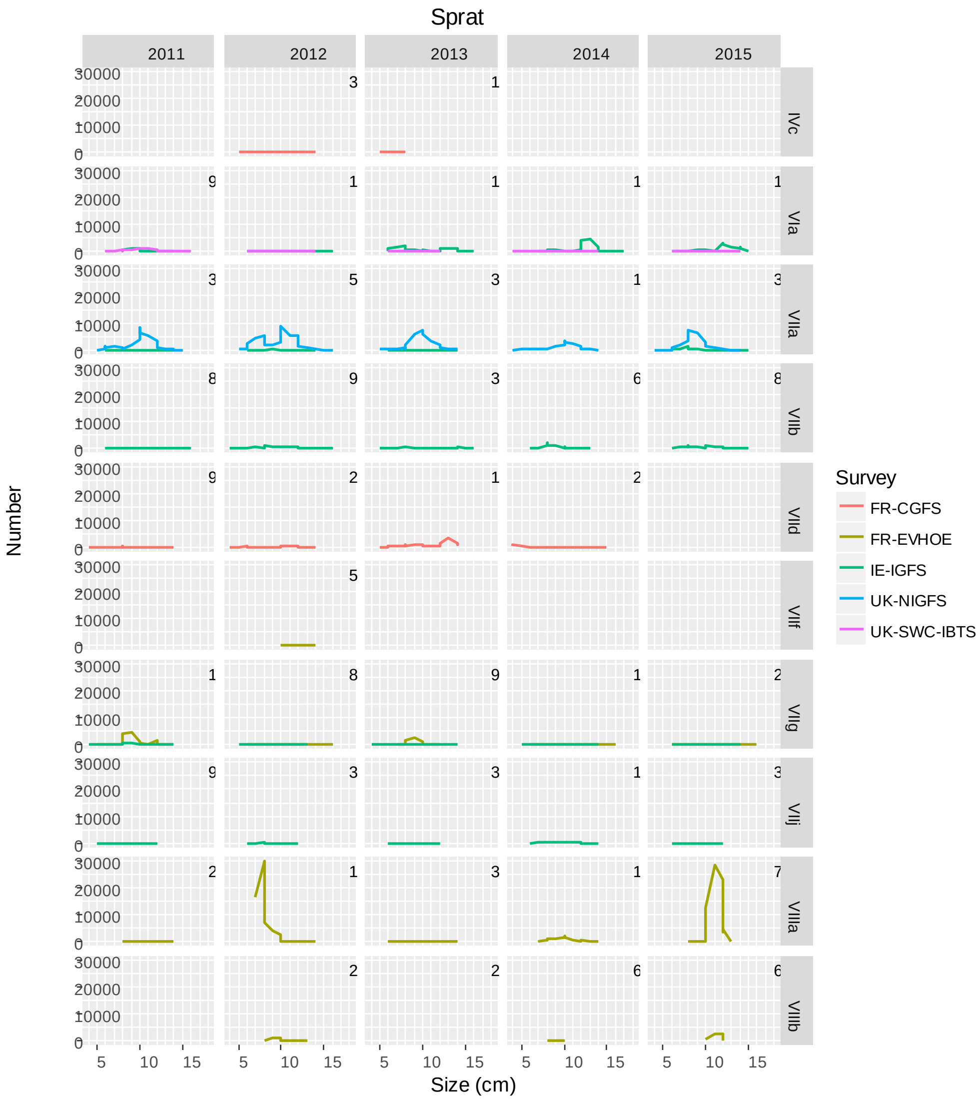



**Figure A.6.58. Length distributions of sprat, *Sprattus sprattus*, per ICES Subarea in the NeAtl surveys (North Sea IBTS not included) during the last five years, each panel presents the surveys occurring. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the lines do not reflect proportional abundance in all the areas but within each survey. The number in each panel corresponds to the sum of the mean stratified number of individuals caught in one-hour haul in the surveys carried out in that subdivision.**

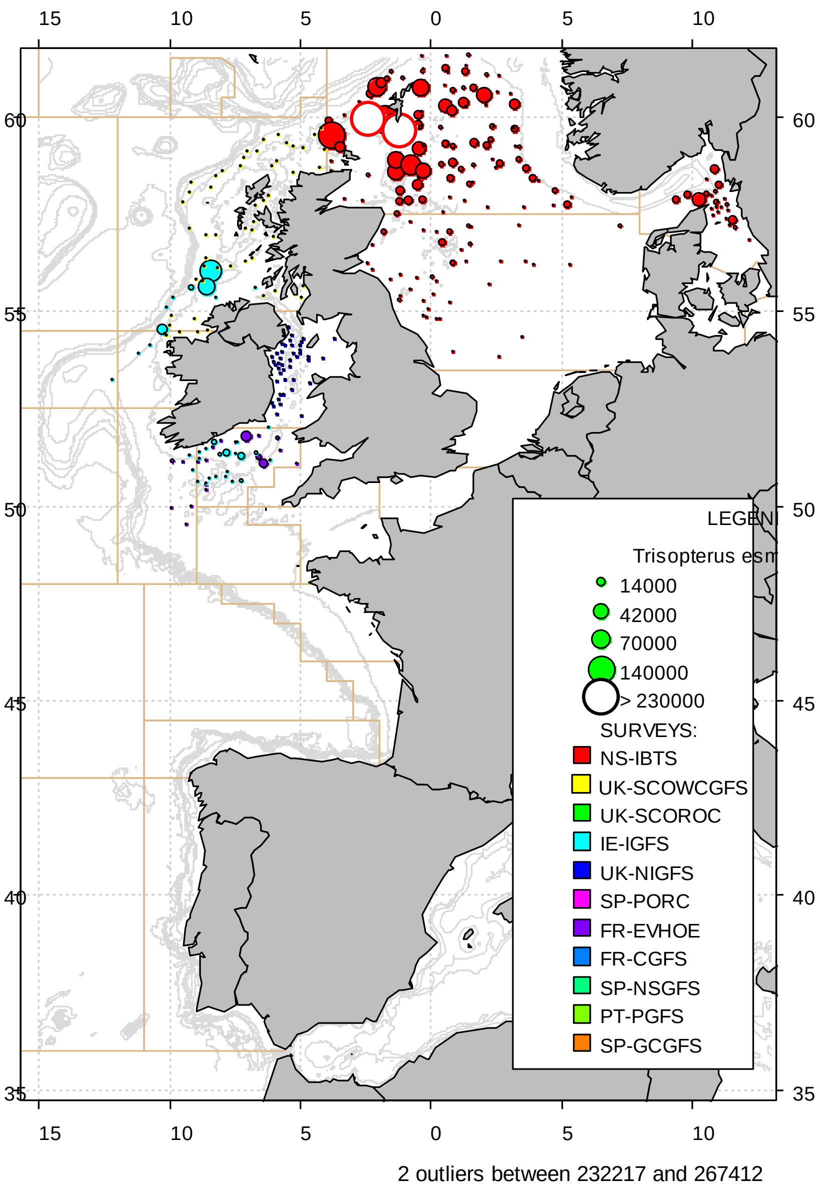



**Figure A.6.59. Catches in numbers per hour per hour of Norway pout, *Trisopterus esmarkii*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

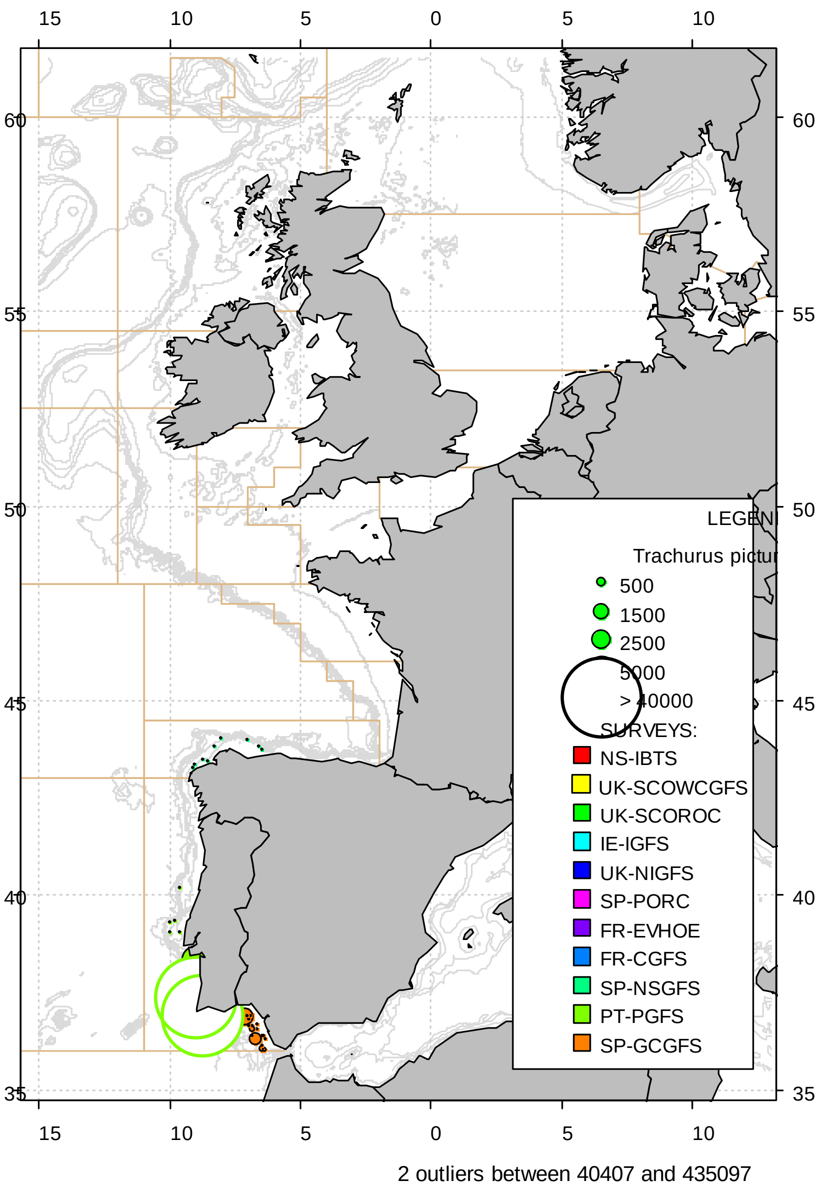



**Figure A.6.60. Catches in numbers per hour per hour of blue jack mackerel, *Trachurus picturatus*, in summer/autumn 2015 IBTS. The catchability of the different gears used in the NeAtl surveys is not constant; therefore, the map does not reflect proportional abundance in all the areas but within each survey.**

# Annex 7: Gear geometry plots northeastern Atlantic IBTS

In this Annex information about gear geometry from the northeastern Atlantic IBTS area is presented together with the plots that have been developed for two purposes: (1) visualizing gear geometry data and highlight potential need for correction after initial data upload to DATRAS; (2) visualizing gear geometry in annual survey summaries.

The plots present the data available from the ongoing year including if available: door spread, wingspread, vertical opening, and warp length shoot per depth. Confidence intervals are estimated using a Loess model (Jacoby, 2000). The change of sweep length with depth is presented with different symbols and confidence intervals, and historical data from a reference period are presented altogether if available.

**References**

Jacoby, W.G. 2000. Loess: a nonparametric, graphical tool for depicting relationships between variables. Electoral Studies 19, 577–613.

**Table A.7.1. Information on gear geometry available in DATRAS and ongoing revisions**

| SURVEY | YEARS USED IN FIGS. | STATE IN DATRAS |
|---|---|---|
| UK-SCOSWC-Q4 | 2013–2015 (new series) | Partial, available from 1990 but different sweep lengths. New series is available (also 1st Q) |
| UK-SCOROC-Q3 | 2013–2015 (new series) | Partial available from 1999 but different sweep lengths. New series is available |
| IE-IGFS-Q3-4 | 2011–13, 2015 | Available from 2003 |
| UK-NIGFS-Q4 | 2009–12, 2015 | Available from 2009 only doorspread data before 2015. (Also 1st Q) |
| FR-CGFS-Q4 | 2015 (new series change vessel and gear) | Partial available from 1988 but new series from 2015 |
| FR-EVHOE-Q4 | 1997–2015 | Available from 1997 |
| SP-PORC-Q3 | 2009–13, 2015 | Only vert+doors available from 2001–2015 |
| SP-NSGFS-Q3-4 | 2014–2015 (change vessel 2013–4) | Only vert+doors (wings in 2015) data available from 2001 |
| SP-GCGFS | 2014–2015 (change vessel 2013–4) | Data from previous years are uploaded from 2003 (also 1st Q) |
| PT-GFS-Q4 | | No data (due to lack of equipment) |

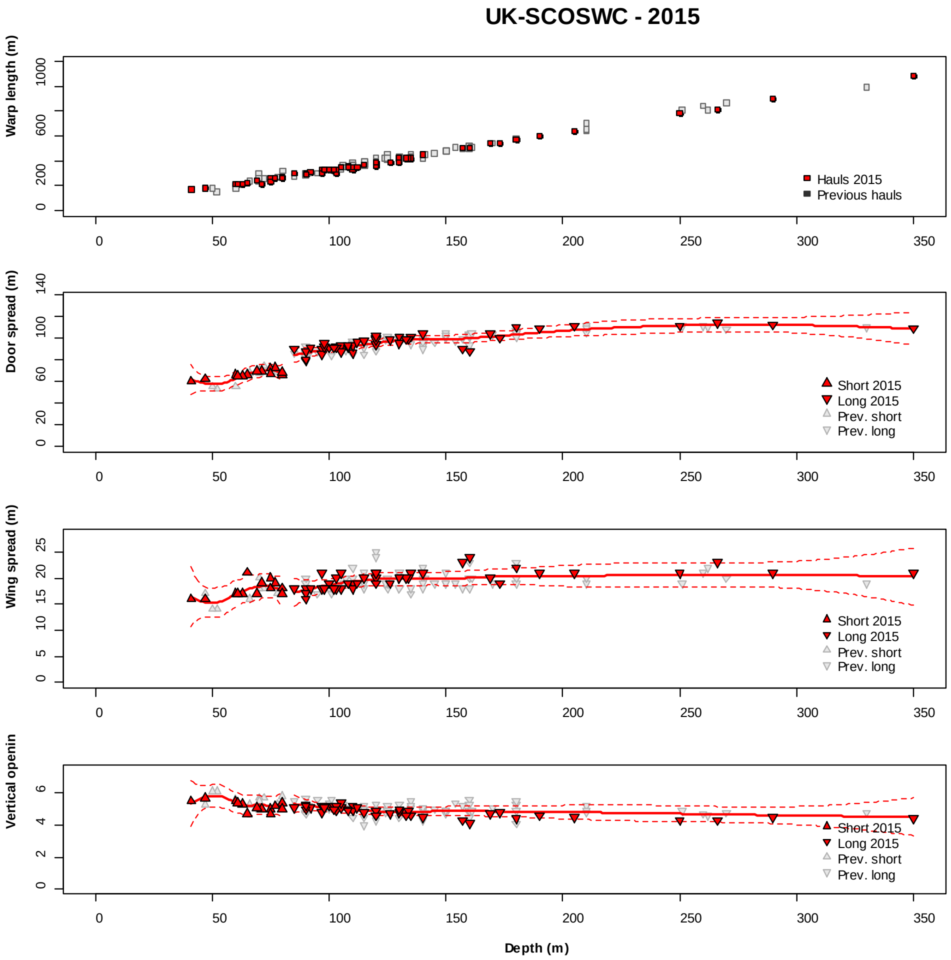



**Figure A.7.1. Graphs showing the information available in DATRAS on warp length and gear geometry from SCO-SWC-IBTS in 2015, data from 2013–2014 are shown in grey on the background. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E.**

**Table A.7.2. Summary of data used on Figure A.7.1.**

| Survey: UK-SCOSWC | Year | | |
|---|---|---|---|
| **Sweep length** | **2013** | **2014** | **2015** |
| 47 m | 1 | 11 | 14 |
| 97 m | 25 | 50 | 46 |
| Total hauls | 26 | 61 | 60 |

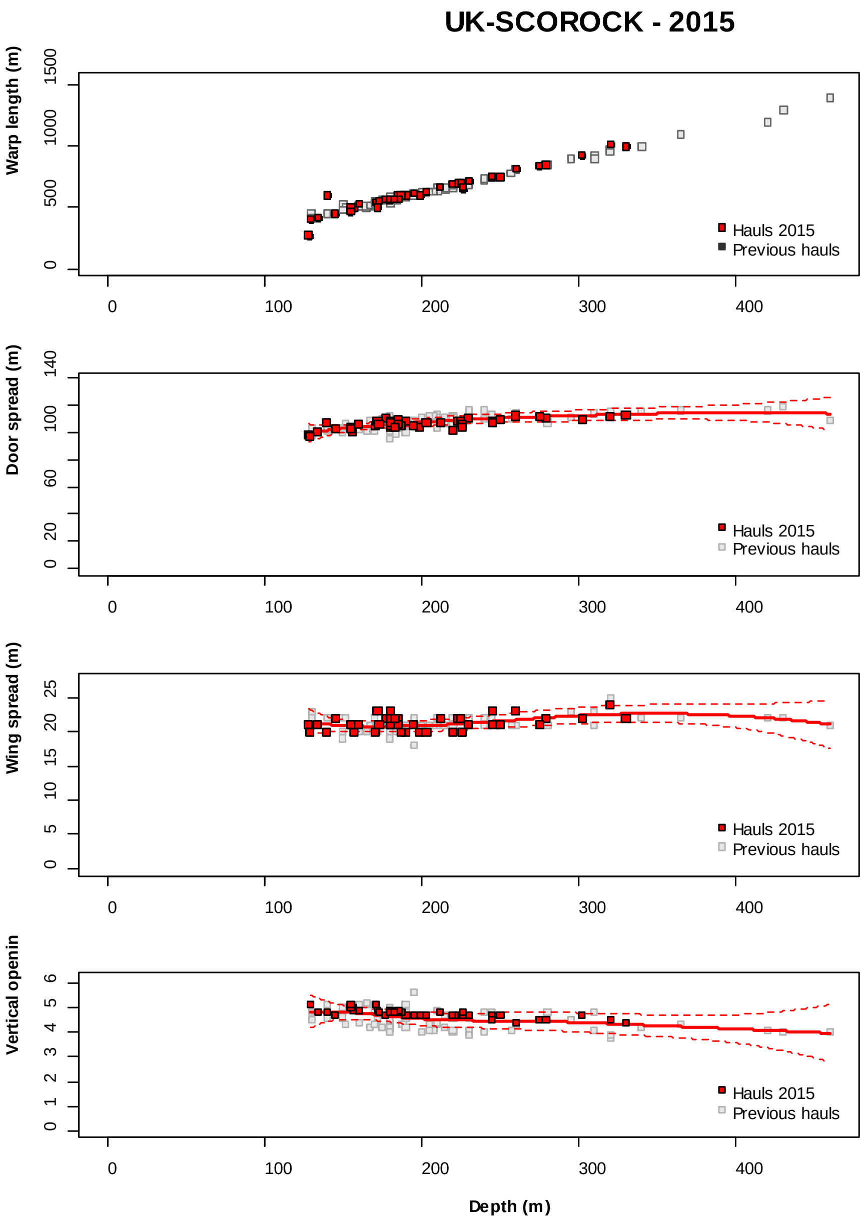



**Figure A.7.2. Graphs showing the information available in DATRAS on warp length and gear geometry from UK-SCOROC in 2015, data from 2013-2014 are shown in grey on the background. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E.**

**Table A.7.3. Summary of data used on Figure A.7.2.**

| Survey: UK-SCOROCK | Year | | |
|---|---|---|---|
| **Sweep length** | **2013** | **2014** | **2015** |
| 97 m | 31 | 48 | 43 |
| Total hauls | 31 | 48 | 43 |

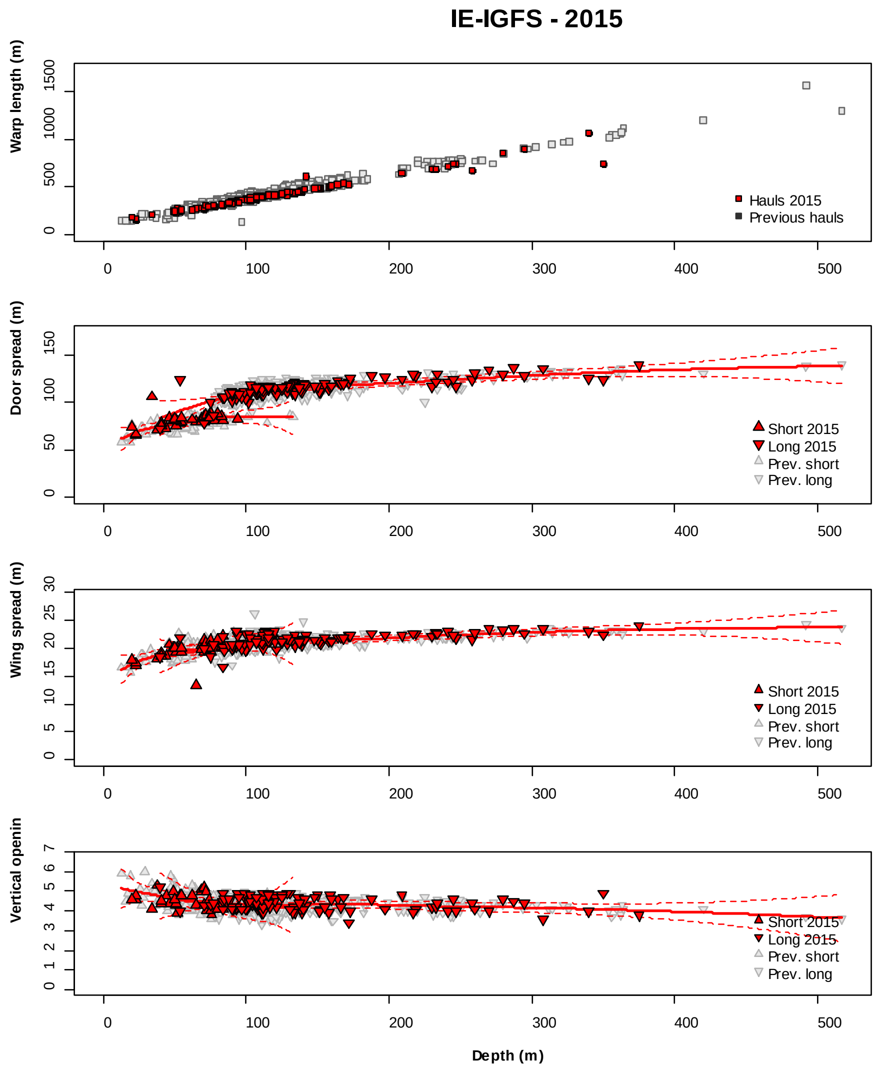



**Figure A.7.3. Graphs showing the information available in DATRAS about warp length and gear geometry from IRL-IGFS in 2014, showing the change due to the two different sweep lengths used in the survey. Confidence interval bands of door spread, wing spread and vertical opening were estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E. The broadening of the bands at the end of the intervals are due to the effect of the mentioned change of sweep length at ~80 m.**

**Table A.7.4. Summary of data used on Figure A.7.3.**

| Survey: IE-IGFS | Year | | | |
|---|---|---|---|---|
| **Sweep length** | **2011** | **2012** | **2013** | **2015** |
| 55 m | 45 | 46 | 44 | 36 |
| 110 m | 114 | 126 | 132 | 110 |
| Total hauls | 159 | 172 | 176 | 146 |

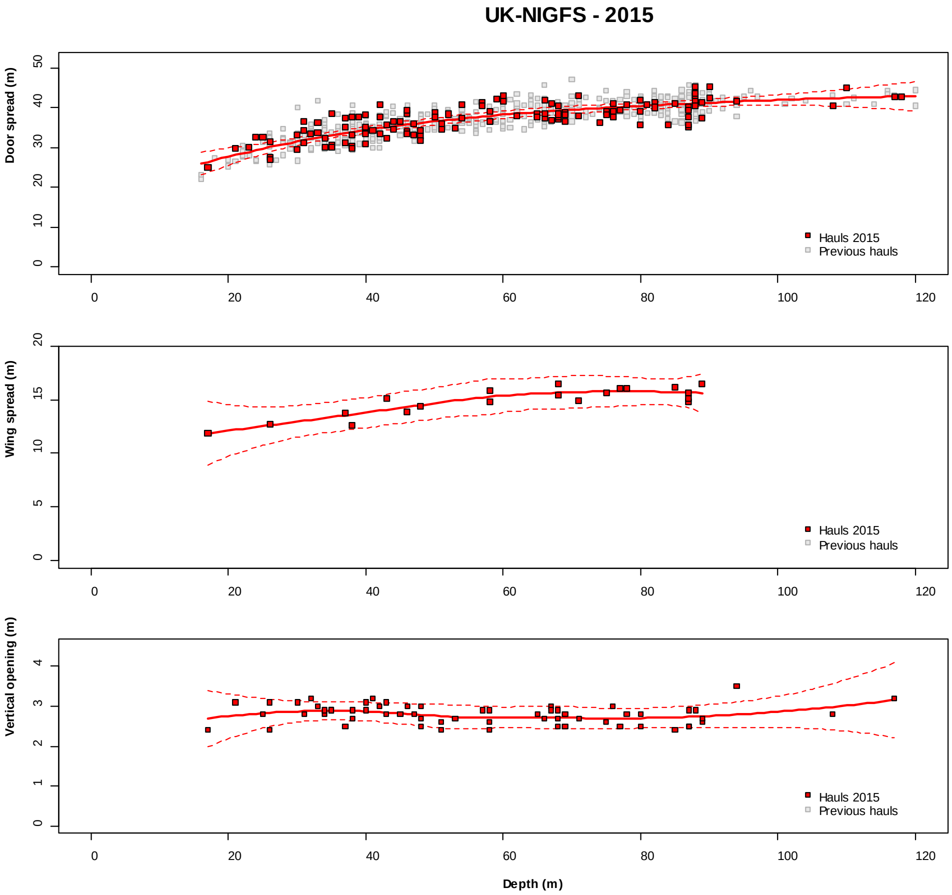



**Figure A.7.4. Graphs showing the information available in DATRAS about gear geometry from UK-NIGFS in 2015, showing also in grey on the background data from 2009-12. From previous years only information on door spread has been reported to DATRAS. In 2015 data were measured and provided for wing spread and vertical opening. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E.**

**Table A.7.5.** **Summary of data used on figure A.7.4.**

| Survey: UK-NIGFS | Year | | | | |
|---|---|---|---|---|---|
| | **2009** | **2010** | **2011** | **2012** | **2015** |
| Total hauls | 122 | 121 | 119 | 126 | 127 |

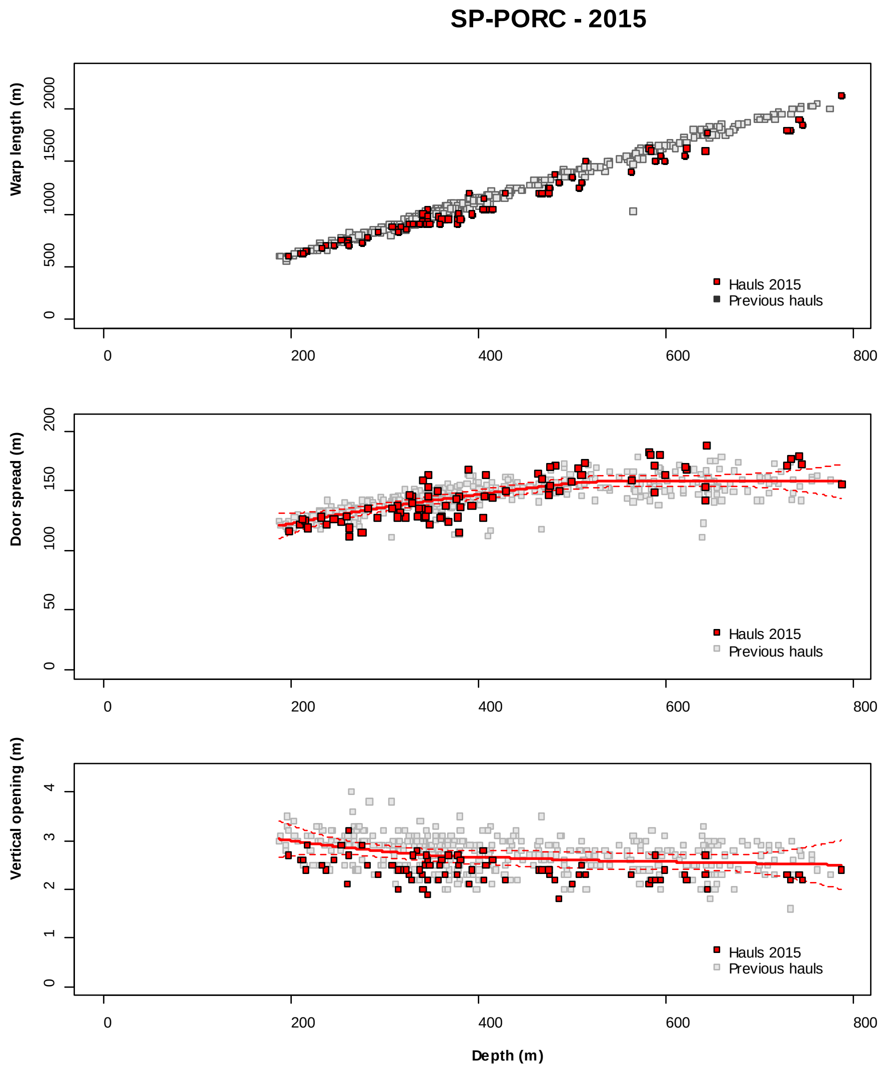
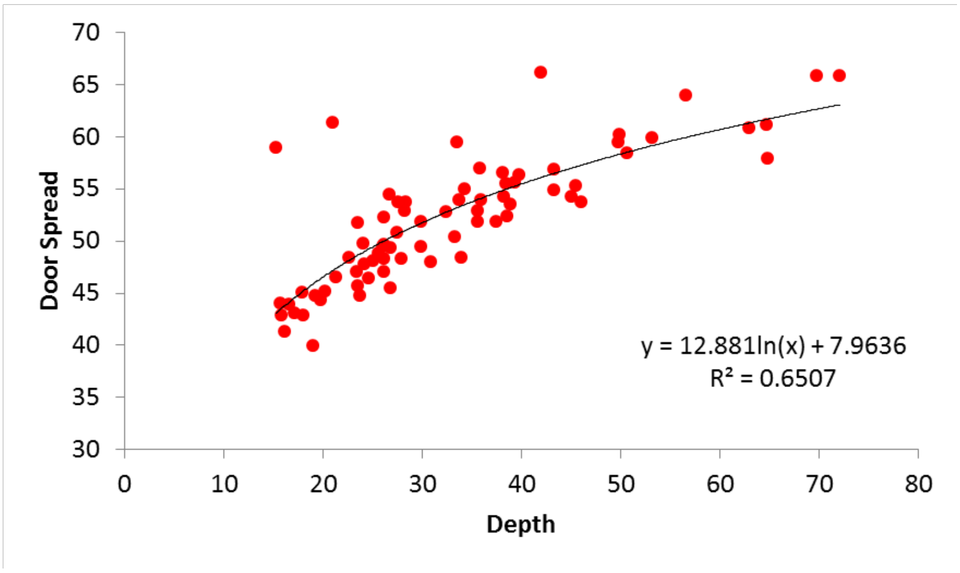



**Figure A.7.5. Graphs showing the information available in DATRAS about warp length and gear geometry from SP-Porc in 2015 including historical data grey on the background from 2009–2013. Confidence interval bands of door spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E. Wing spread information currently is not recorded in this survey.**

**Table A.7.6.** Summary of data used on Figure A.7.5.

| Survey: SP-Porc | Year | | | | |
|---|---|---|---|---|---|
| **Sweep length** | **2009** | **2010** | **2011** | **2012** | **2013** | **2015** |
| 250 m | 80 | 80 | 80 | 80 | 80 | 80 |
| Total | 80 | 80 | 80 | 80 | 80 | 80 |



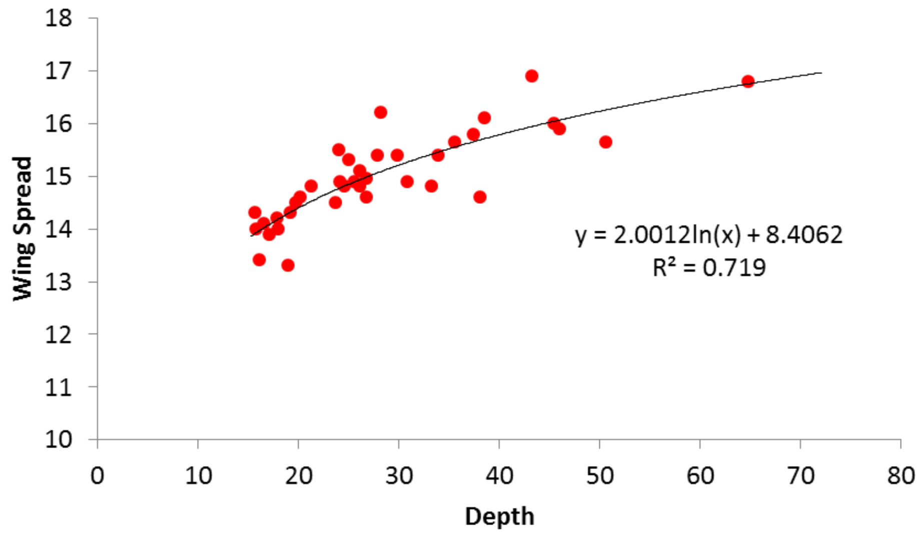




**Figure A.7.6. Graphs showing the information about gear geometry from FR-CGFS in 2015. This was the first year FR-CGFS was performed on board the RV Thalassa instead of the RV Gwen Drez used for this survey in all the survey time-series from 1988. Formulae in the figures are the regressions of door and wing spread vs. depth estimated from the results depicted in the graphs.**

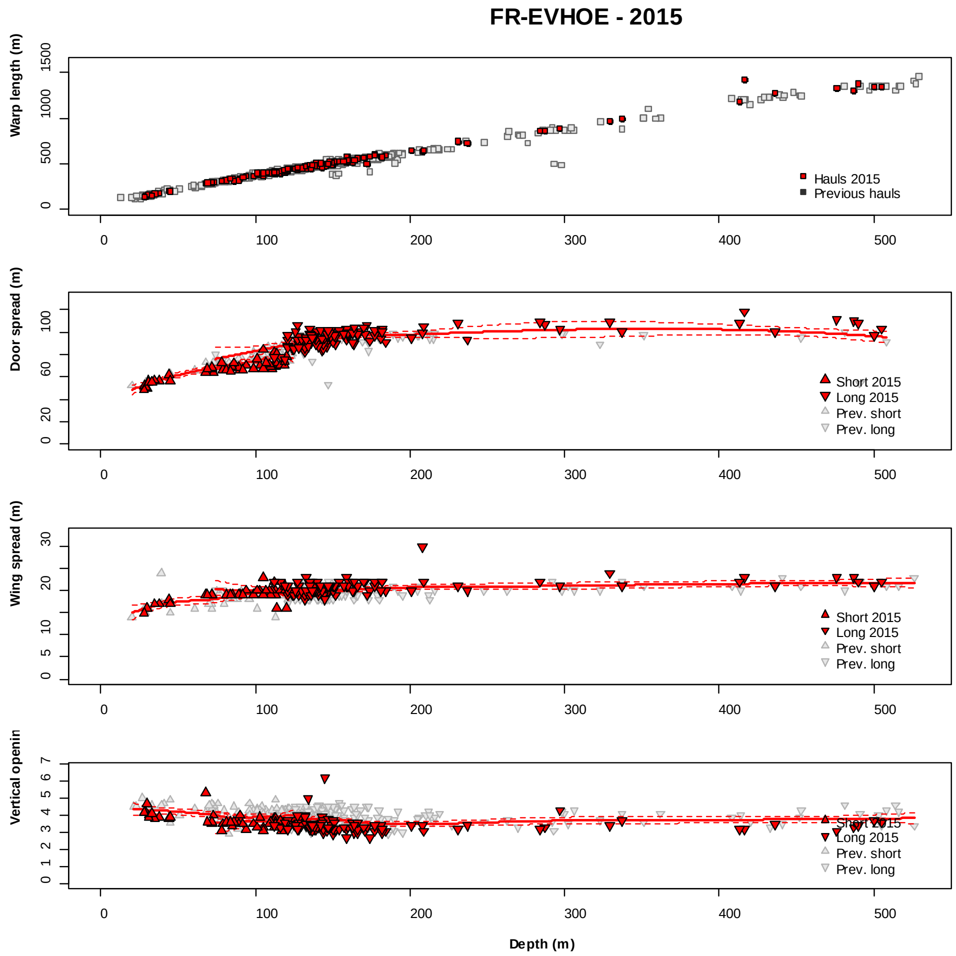



**Figure A.7.7. Graphs showing information available in DATRAS about warp length and gear geometry from FR-EVHOE in 2015, marking the difference between the two warp lengths used in the survey. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E. Comparison with previous years, in grey on the background, are from 2009–2012.**

**Table A.7.7.** **Summary of data used on Figure A.7.7.**

| Survey: FR-EVHOE | Year | | | | | |
|---|---|---|---|---|---|---|
| **Sweep length** | **2009** | **2010** | **2011** | **2012** | **2013** | **2015** |
| 50 m | 45 | 50 | 57 | 53 | 46 | 49 |
| 100 m | 90 | 89 | 93 | 77 | 92 | 101 |
| Total | 135 | 139 | 150 | 130 | 138 | 150 |

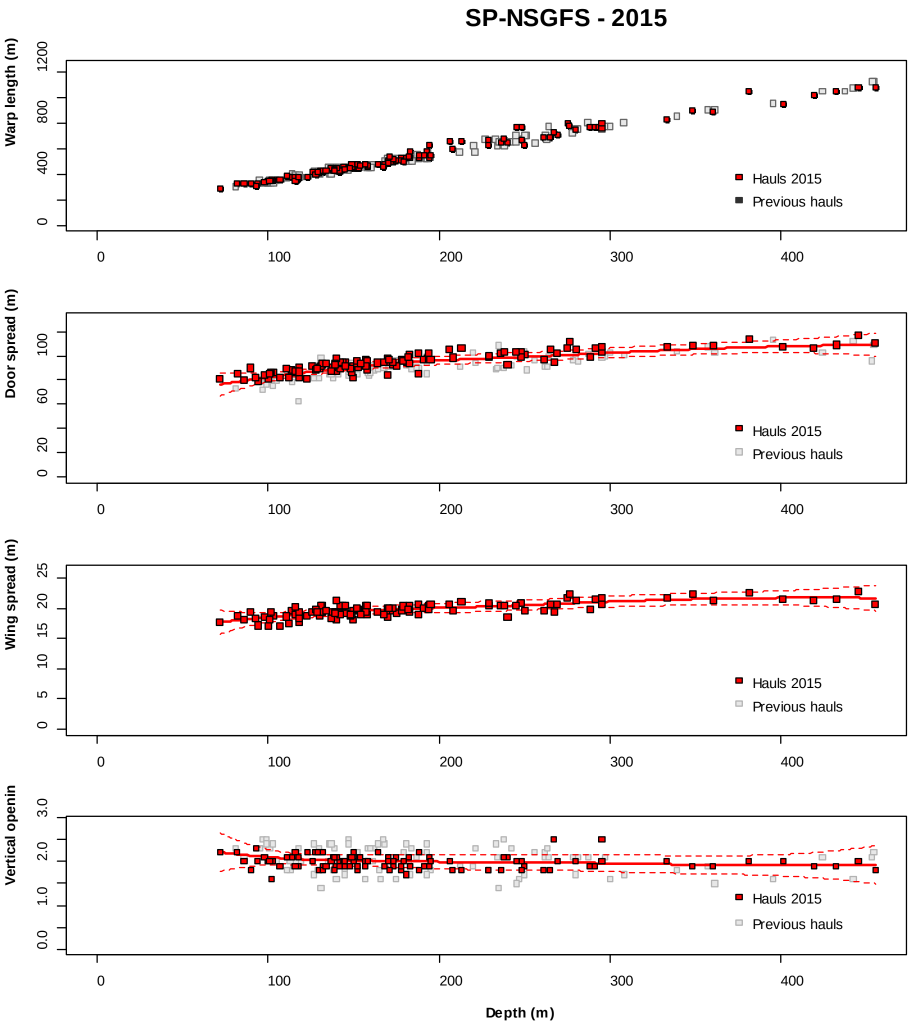



**Figure A.7.8. Graphs showing the information available in DATRAS about warp length and gear geometry from SP-NORTH in 2015 including historical data from 2014, the other year the survey has been performed with the RV Miguel Oliver and the standard sweeps. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E. Wingspread was monitored only in 2015.**

**Table A.7.8. Summary of data used on Figure A.7.8.**

| Survey: SP-NSGFS | Year | |
|---|---|---|
| **Sweep length** | **2014** | **2015** |
| 200 m | 116 | 115 |
| Total | 116 | 115 |

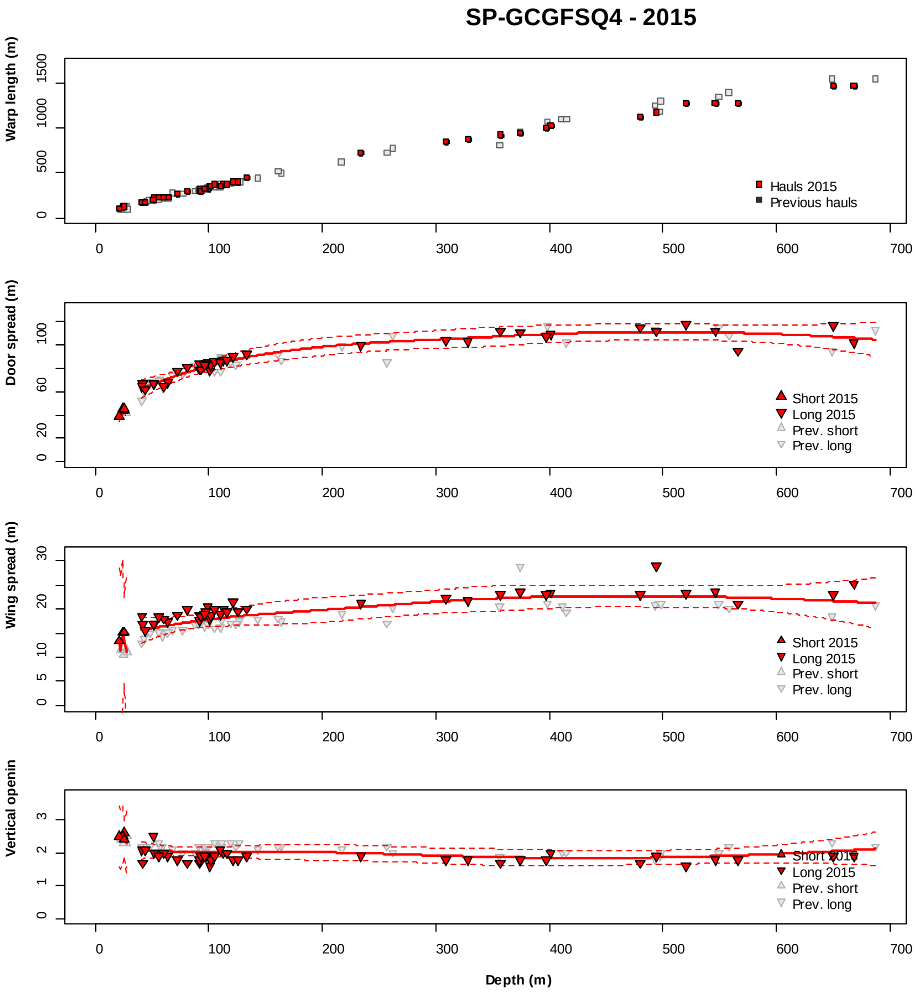



**Figure A.7.9. Graphs showing the information available in DATRAS about warp length and gear geometry from SP-GCGFS in 2015 including data from 2014, the other year performed with the RV Miguel Oliver and the standard sweeps. Confidence interval bands of door spread, wing spread and vertical opening estimated with a Loess smoother procedure, applying a multiplier x5 of the estimated model S.E.**

**Table A.7.9. Summary of data used on Figure A.7.9.**

| SURVEY: SP-GCGFSQ4 | YEAR | |
|---|---|---|
| **Sweep length** | **2014** | **2015** |
| 100 m | 4 | 4 |
| 200 m | 41 | 39 |
| Total | 45 | 43 |

## Annex 8: Working documents presented at the 2016 IBTSWG meeting

WD1: DATRAS status and overview (V. Soni)

WD2: Otolith collection of target species in the IBTS (R. van Hal)

WD3: Effect of tow duration NS-IBTS 3Q2015 – Preliminary analyses (K. Wieland)

WD4: Effect of tow duration on catch rates of whiting and cod in the NS-IBTS 3Q2015 (K. Wieland)

WD5: Data analysis for haddock and Norway pout from tow duration experiment NS-IBTS 3rd quarter 2015 (A. Jaworski and F. Burns)

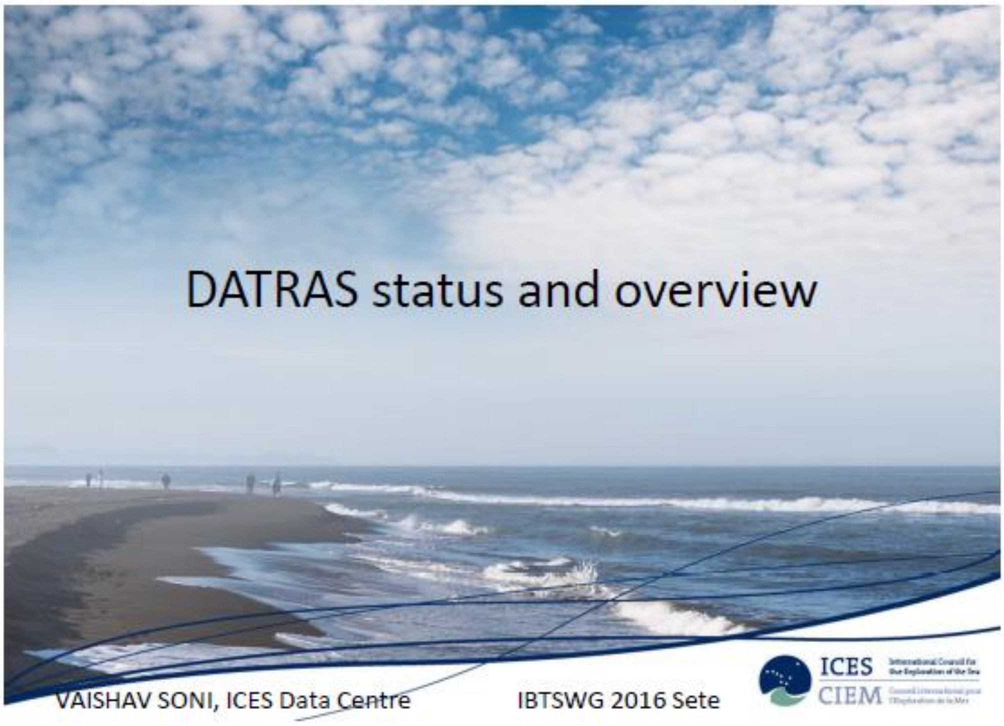
WD6: North Sea IBTS Q3 tow duration experiment 2015 (J. Devine and M. Pennington)

WD7: Data analysis for species richness from tow duration experiment NS-IBTS 3rd quarter 2015 (M. Moriarty)

WD8: French haul duration comparison Q1 (V. Trenkel)

WD9: VIIa groundfish tow duration experiment (M. Lundy and P.-J. Schon)

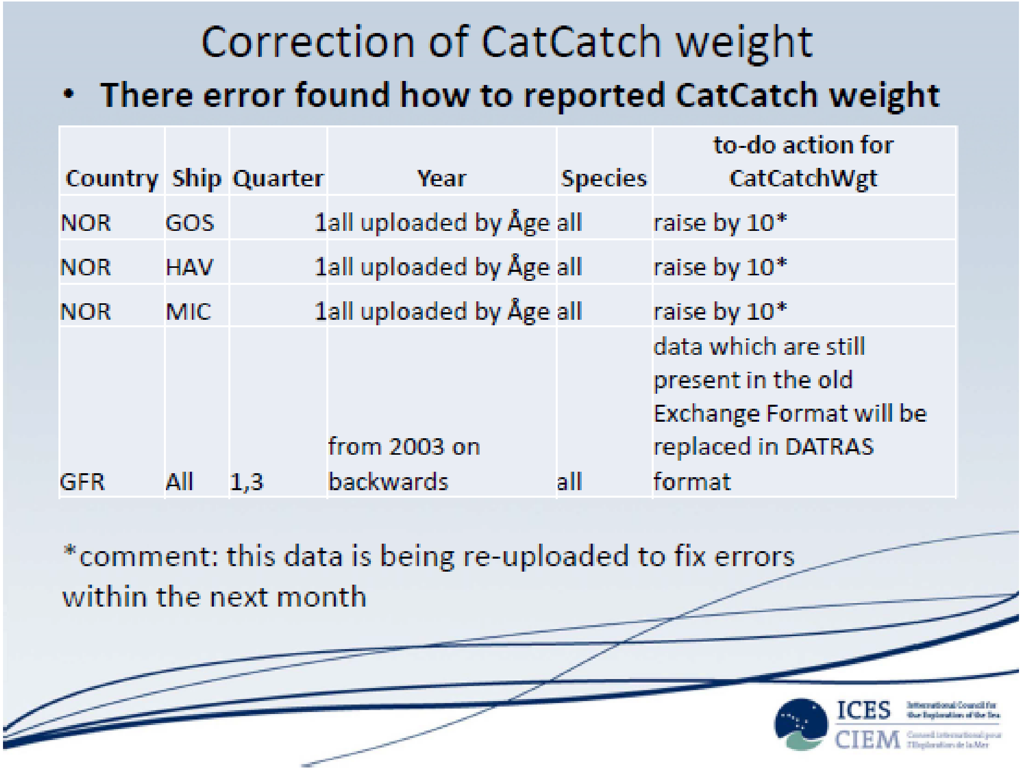
## WD1: DATRAS status and overview (V. Soni)




### Litter data

- Improved data screening procedures and defined new checks base on position, and new references
- Cross check against submitted Trawl HH record
- Exchange data available on promptly soon after upload
- HH and LT record are in the same file.

| Q1 | DEN | SWE | NOR | ENG | SCO | NED | FRA | GFR |
|---|---|---|---|---|---|---|---|---|
| 2012 | | x | | | x | | x | |
| 2013 | x | x | x | | x | x | x | |
| 2014 | x | x | x | | x | x | x | |
| 2015 | x | x | x | | | x | | |
| 2016 | x | x | | | | | | |
| Q3 | | | | | | | | |
| 2011 | | | | | | | | x |
| 2012 | | x | | x | x | | | x |
| 2013 | x | x | x | x | x | | | x |
| 2014 | x | x | x | x | x | | | x |
| 2015 | x | x | x | | | | | |


Correction of CatCatch weight
• There error found how to reported CatCatch weight

| Country | Ship | Quarter | Year | Species | to-do action for CatCatchWgt |
|---|---|---|---|---|---|
| NOR | GOS | 1 | all uploaded by Åge | all | raise by 10* |
| NOR | HAV | 1 | all uploaded by Åge | all | raise by 10* |
| NOR | MIC | 1 | all uploaded by Åge | all | raise by 10* |
| GFR | All | 1,3 | from 2003 on backwards | all | data which are still present in the old Exchange Format will be replaced in DATRAS format |

*comment: this data is being re-uploaded to fix errors within the next month
ICES
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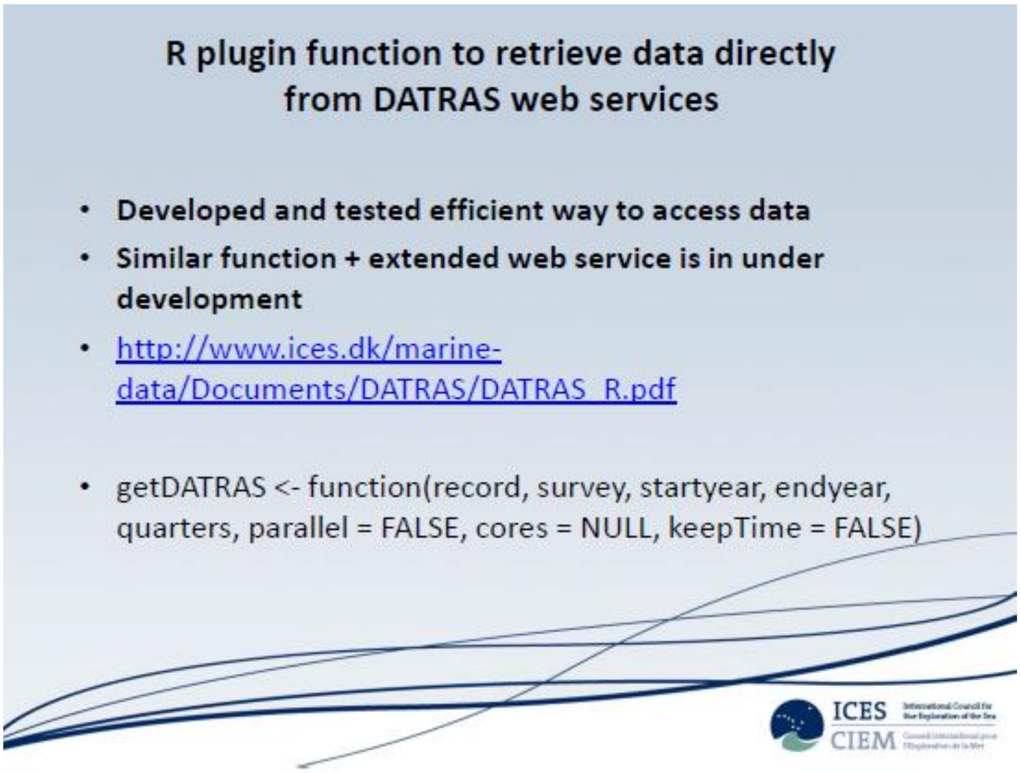
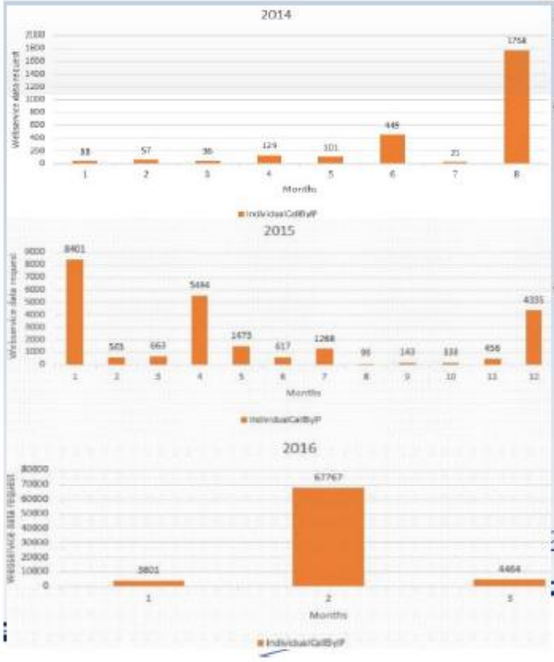

R plugin function to retrieve data directly from DATRAS web services
• Developed and tested efficient way to access data
• Similar function + extended web service is in under development
• http://www.ices.dk/marine-data/Documents/DATRAS/DATRAS_R.pdf
• getDATRAS <- function(record, survey, startyear, endyear, quarters, parallel = FALSE, cores = NULL, keepTime = FALSE)
ICES
CIEM



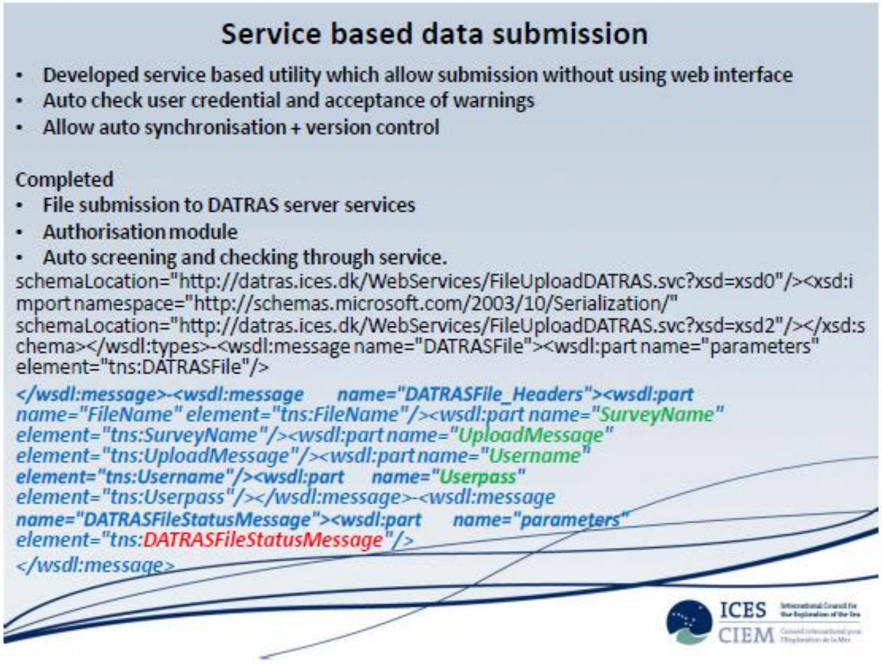

## DATRAS web services usage

- **WCF services which made faster and efficient way to access data, and help easy maintenances.**
- **Data user of service are growing, so shared memory load.**

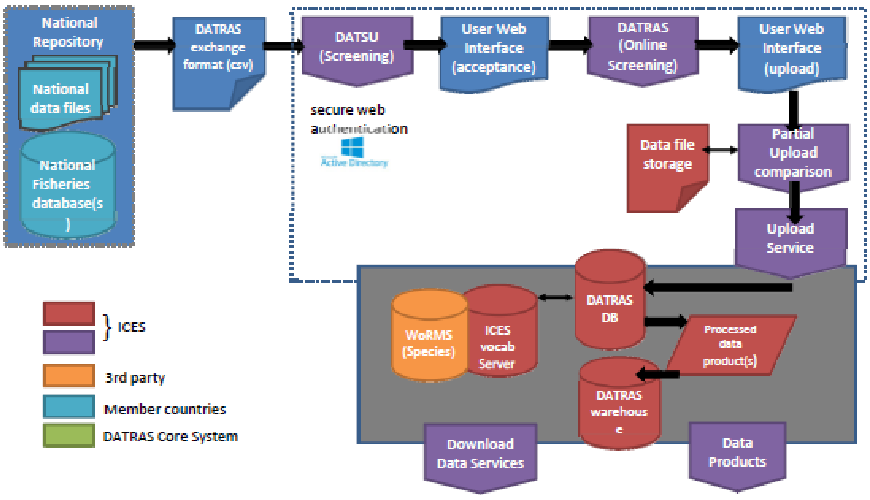
## Data versions comparison utility

Task is completed in test environment and going to present WGNSSK 2016 and DIG meeting

- Request by expert working group and data submitters
- Extension of status page ( Reported species and comment information)
- Comparison of current version data with previous version and show differences on the fly.
- Drill down comparison on all level CPUE,ALK data an Indices
- If there is more than 5% variation email goes to groups.
- Submitter gets email after each submission about comparison report.




Service based data submission continue..



### Saithe individual weight data missing

**Within the IBTSWG, when looking at saithe data for the benchmark assessment, the issue has come up that information of individual weight was missing for the earlier years (specifically, earlier than 2004), while age and maturity information are present in DATRAS, and hence individual measurements for the respective fish exist.**

**Apparently, the old exchange format before 2004 didn't allow for uploading individual weight data. Yet, individual weight data are available in national databases for those years. The same will be true for other assessed species.**

**We therefore would like to address this issue in the next IBTSWG meeting**

### Saithe individual weight data missing cont…

| Year | Quarter | DEN | SCO | SWE | NED | ENG | FRA | GFR | NOR | Year | Quarter | DEN | SCO | SWE | NED | ENG | FRA | GFR | NOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1974 | 1 | | 3 | | | | | | | 1995 | 1 | | 7 | | | | | 304 | 98 |
| 1975 | 1 | | 10 | | | | | | | 1996 | 1 | | 51 | | | | | | 132 |
| 1977 | 1 | | | | | | | | 91 | 1997 | 1 | | 8 | | | | | | 154 |
| 1979 | 1 | | | | | 19 | | | | 1998 | 1 | | 26 | | | | | 326 | 160 |
| 1980 | 1 | | 127 | | | | | | | 1999 | 1 | | 70 | | | | | 237 | 129 |
| 1981 | 1 | | 1 | | | | | | 72 | 2000 | 1 | | 62 | | | | | | 186 |
| 1982 | 1 | | 58 | | | | | | 14 | 2001 | 1 | 7 | 2 | | | 1 | | 246 | 82 |
| 1984 | 1 | | 23 | | | | | | 86 | 2002 | 1 | | 140 | | | | | 360 | 107 |
| 1985 | 1 | | 18 | | | | | | | 2003 | 1 | 3 | 70 | | | | | 254 | 74 |
| 1986 | 1 | | 36 | | | | | | | 2004 | 1 | | 49 | | | | | 1 | |
| 1987 | 1 | | 21 | | | 1 | | | | 2005 | 1 | | 143 | | | | | | |
| 1988 | 1 | | 10 | | | | | | | 2006 | 1 | | 7 | | | | | | |
| 1989 | 1 | | 36 | | | | 22 | | | 2007 | 1 | | 72 | | | | | | |
| 1990 | 1 | | 8 | | | | 14 | | | 2008 | 1 | | 112 | | | | | | |
| 1991 | 1 | | 48 | | | | | | | 2009 | 1 | | 10 | | | | | | |
| 1992 | 1 | | 12 | | | | | | 150 | 2010 | 1 | | 21 | | | | | | |
| 1993 | 1 | | 117 | | | | | 267 | 109 | 2011 | 1 | | | | | | 21 | | |
| 1994 | 1 | | 34 | | | | | 206 | 127 | 2012 | 1 | | 29 | | | | | | |
| 1995 | 1 | | 7 | | | | | 304 | 98 | 2013 | 1 | | | 1 | | | | | |
| 1996 | 1 | | 51 | | | | | | 132 | 2015 | 1 | | | | | | | 1 | |

## Saithe individual weight data missing

| Year | Quarter | DEN | SCO | SWE | NED | ENG | FRA | GFR | NOR | Year | Quarter | DEN | SCO | SWE | NED | ENG | FRA | GFR | NOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 2 | | 136 | | | 97 | | | | 1991 | 3 | | 205 | | | 165 | | | |
| 1992 | 2 | | 70 | | | | | 166 | 149 | 1992 | 3 | | 394 | | | 187 | | | |
| 1993 | 2 | | 154 | | | | | 1 | 226 | 1993 | 3 | | 521 | | | 303 | | | |
| 1994 | 2 | | 154 | | | | | 94 | 209 | 1994 | 3 | | 350 | | | 174 | | | |
| 1995 | 2 | | 67 | | | | | 40 | 201 | 1995 | 3 | | 515 | | | 332 | | | |
| 1996 | 2 | | 89 | | | | | | 123 | 1996 | 3 | | 456 | | | 240 | | 1 | |
| 1997 | 2 | | 37 | | | | | | 87 | 1997 | 3 | | 637 | | | 276 | | | |
| | | | | | | | | | | 1998 | 3 | | 296 | | | 239 | | | |
| 1991 | 4 | | | | | 78 | | | 199 | 1999 | 3 | | 140 | | | 202 | | 25 | 172 |
| 1992 | 4 | | | | | 173 | | | 215 | 2000 | 3 | | 208 | | | 227 | | | 218 |
| 1993 | 4 | 64 | | | | 212 | | | 356 | 2001 | 3 | | 356 | | | 325 | | 79 | 279 |
| 1994 | 4 | 12 | | | | 144 | | | 167 | 2002 | 3 | | 228 | | | 375 | | 43 | 180 |
| 1995 | 4 | 125 | | | | 178 | | | 126 | 2003 | 3 | 2 | 247 | | | 287 | | 18 | 178 |
| 1996 | 4 | 180 | | | | 155 | | | 162 | 2004 | 3 | | 247 | | | 228 | | | |
| | | | | | | | | | | 2005 | 3 | | 273 | | | | | | |
| | | | | | | | | | | 2006 | 3 | | 292 | | | | | | |
| | | | | | | | | | | 2007 | 3 | | 183 | | | | | | |
| | | | | | | | | | | 2008 | 3 | | 148 | | | 2 | | | |
| | | | | | | | | | | 2009 | 3 | | 113 | | | | | | |
| | | | | | | | | | | 2010 | 3 | | 2 | | | 5 | | | |
| | | | | | | | | | | 2011 | 3 | | | | | 2 | | | |
| | | | | | | | | | | 2012 | 3 | | 2 | | | 3 | | | |
| | | | | | | | | | | 2013 | 3 | | | | | 3 | | | |
| | | | | | | | | | | 2014 | 3 | | | | | 1 | | | |

## Swept area base calculation

- Countries formula of calculated Doorspread,WingSpread and distance are implemented into the database
- Products are calculated and sent it around to the national submitters
- Combine data file generated and it is on SharePoint ->Sweptarea
- Need to do:

  -Apply Norwegian formula

  -Apply new changes in the formula for those counties who revise their formulas

  -CPUE by Swept Area need to develop

ICES CIEM

## WD2: Otolith collection of target species in the IBTS (R. van Hal)

## Working document otolith collection of target species in the IBTS

### Introduction

The International Bottom Trawl Survey (IBTS) collects otoliths of target fish species to establish the age of individual fish to provide an age-based index, which is used in the assessments. Only a small fraction of the catch is typically analysed for age as this is a costly and time-consuming process. With the otoliths of this fraction of the catch an Age-Length-Key (ALK), e.g. the percentage of otoliths of a particular length of the fish were of age1, age2, etc. is constructed. This ALK is than used to transform the total numbers-at-length, which is collected of the whole catch into numbers-at-age.

The ALK for the IBTS is not constructed for the whole survey area, instead multiple ALKs are constructed for smaller spatial units, the so called roundfish areas (RFA). These roundfish areas are based on historic stock structures of some of the target species. In line with that the current IBTS otolith sampling scheme is based on the RFA, while the stratification unit of the survey is a smaller unit, the ICES rectangle which is fished twice by two different countries (Figure 1). The current scheme dictates the collection of a specific number of otoliths per cm- or 0.5 cm-class by country by RFA. As the rectangles are distributed by country and not the RFA, multiple countries fish in the same RFA resulting in large numbers of otolith samples collected. Despite of that, it happens that otoliths are not collected from length classes (0.5 cm or cm) caught within a RFA. As a result, gaps occur in the ALK, which are filled by borrowing from neighbouring areas.

Despite the guidelines in the manual, the sampling method varies between country and between species. Scotland and Norway adopted a station-specific sampling scheme ensuring to collect at least the number of otoliths at length by RFA. The other countries tried to meet the required numbers by sampling from a selection of tows. Often the first tow in which the species is caught in a RFA is sampled intensively, while in the following tows it is tried to fill up the missing otoliths. This often results in a skewed number of otoliths per tow. If known that the species and length classes are likely to be caught more in that RFA the intensity with which the first tow is sampled is reduced. For the pelagic species sprat, herring, and mackerel, the Netherlands sampled the otoliths by groups of 25, which is convenient for the way they further process the otoliths. This often results in a small number of tows within a RFA being sampled.

The current otolith sampling scheme combined with differences in sampling methods used between countries reduces the flexibility in the survey. Exchanging rectangles between countries, when weather or mechanical issues affect the execution of the original program, could reduce or enhance the number of otoliths collected within a RFA. The number of otoltihs collected will change if the proposals to alter the overall distribution of sampling stations, to increase the number of rectangles covered twice by a single country and to reduce the number of countries fishing within a RFA are agreed upon. Similarly, when fixed spatial distribution by country is relaxed and becomes variable between years.

Furthermore, age at length has been observed to vary spatially and temporally (Aanes and Vølstad, 2015) and as shown in west of Ireland haddock that the consequences of this bias would have been a nearly twofold overestimate of the 2003 year class, and an underestimate of the spawning stock by 15% (Gerritsen *et al.*, 2006). Since with the current routine of preparing one ALK for an entire RFA, variance within a RFA cannot be considered. Typically, the lengths and ages of fish sampled in clusters exhibit positive intra-cluster correlation, which can drastically reduce the effective sample sizes for estimating length- and age-compositions (e.g. Pennington and Vølstad, 1994; Aanes and Pennington, 2003). This calls for a station-specific sampling scheme.

Aanes and Vølstad (2015) found no gain in precision from collecting 10 instead of only 1 otolith per 5-cm length class. While this result obviously depends on species and geographical area tested, it appears promising to conduct an analogous analysis for the IBTS, where the concept of the effective sample size would be used to calculate how many specimens are needed to be aged to maintain the same level of precision as with the original number sampled. There is strong evidence to suggest that the number of otoliths per length class sampled in the IBTS could be significantly reduced without any significant loss in precision of the overall estimates being recorded. This would be beneficial as processing the otoliths is costly and time-consuming, but also to reduce the number of experimental animals required.

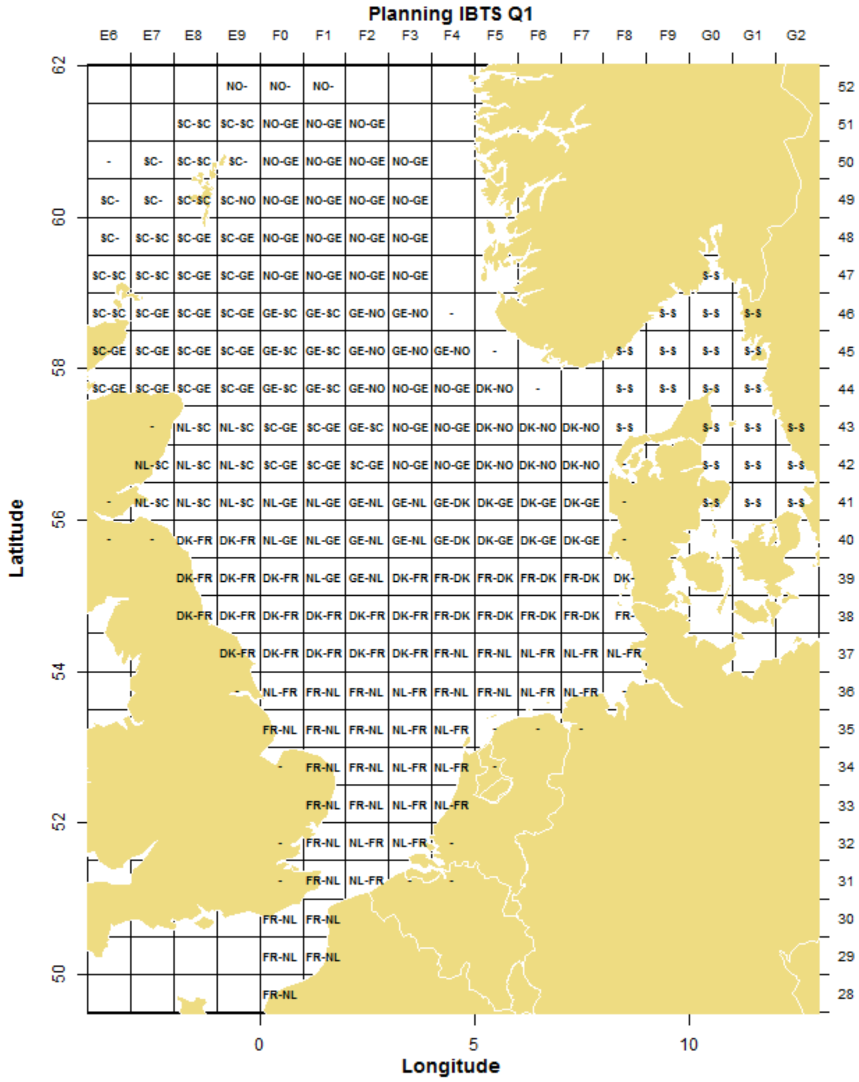



**Figure 1. Spatial distribution of the ICES-rectangles in the IBTS Q1 over the participating countries. SC = Scotland, GE = Germany, NO = Norway, DK = Denmark, FR = France, NL = The Netherlands, S = Sweden.**

A preliminary analysis had been conducted during the 2015 IBTSWG (ICES, 2015), which provided results supporting this proposal. A subset of the Q3 North Sea IBTS data from Scotland had been used, where the otolith collection was conducted using a 'by station' sampling scheme. Post-subsampling of fewer individuals allowed testing for the effect of the number of individuals aged per length group and per station. Results obtained during the preliminary study for the species whiting, haddock, and Norway pout suggested that a reduced sampling scheme could be sufficient. In this, sampling per haul is prerequisite. Then, for some of the smallest size classes, otolith collection may be omitted altogether, and medium-sized fish, wider size classes (5 cm) can be appropriate, whereas for the largest individuals, narrower size classes (1 cm) would again be recommended.

Here, we have extended upon this preliminary analysis. We used the full set of samples of a single year and quarter and created a real population of the specific species based on this. From this population we bootstrapped the otoliths according to the original sampling scheme and in a by station-specific sampling scheme varying the number of otoliths taken from length classes. Using the current method of estimating the ALK and a by station modelled ALK the population was reconstructed to estimate the variance created by the different methods.

## Method

IBTS Q1 and Q3 data of whiting and herring stored in the DATRAS database were used. The used data were the tow information (HH), the length measurements of fish (HL) and the ALK data product. Using these data a "real" population was established for each year. The ALK by RFA was combined with the length measurements by tow and every measured fish was given an Age. The "real" population existed of number by length and age for each tow. Because the ALK was created for each RFA, the real population has no local stock structure.

This "real" population was than sampled according to the manual, the sampling was done randomly from all fish in the RFA for that country. Each country fishing in a RFA collects up to a maximum of 8 otoliths per cm-class, or in case of herring 0.5 cm-class. While this gives the maximum number of otoliths collected for the catches in that specific year, it is likely that in the field not all countries collect the maximum number for all length-classes. The sampling was bootstrapped without replacement 501 times. Then for each of the bootstraps the ALK by RFA was constructed and used to create the numbers-at-age.

The same bootstrapping was done, but then by tow from which a defined number of otoliths per length class was taken (Table 1). These otoliths were than combined into an ALK by RFA to calculate the numbers-at-age similarly as done in the current situation. In the third method the otolith sampling was the same but than an ALK was modelled by tow using a multinominal model explaining age by an interaction term of (longitude*latitude)*Length.

Following Aanes and Vølstad (1994), a goodness-of-fit statistic F was used to identify which of the methods produced the most accurate estimate of the age of the "real" population.

$$F = \sum_{a=1}^{6} \frac{(\hat{P}a - Pa)^2}{Pa}$$

Where $\hat{P}a$ is the proportion-at-age a of the estimated population, and Pa is the proportion-at-age a of the "real" population. F is zero for $\hat{P}$ = P and increases with increasing difference between the estimated and "real" proportion-at-age.

**Table 1. The methods used for sampling the "real" population, indicating in columns 3 and 4,up to what length 5-cm classes are used, and the number of otoliths collected per 5-cm class. Columns 5 and 6 show from which length 1-cm or 0.5-cm-classes are used, with the number of otoliths collected from each of these length classes. The last column shows the number of otoliths the method would have resulted in for the 2010 surveys.**

| SPECIES | METHOD | 5CM | # OTOLITHS | 1 CM | #OTOLITHS | TOTAL OTOLITHS 2010 |
|---|---|---|---|---|---|---|
| Whiting | Base | | | all | 8 | Q1 5003; Q3 4536 |
| | 1 | < 30 | 2 | > 29 | 1 | Q1 2572; Q3 2766 |
| | 2 | < 10 | 1 | > 9 | 1 | Q1 4037; Q3 3105 |

| SPECIES | METHOD | 5CM | # OTOLITHS | 0.5 CM | #OTOLITHS | TOTAL OTOLITHS 2010 |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Herring | Base | | | all | 8 | Q1 4892; Q3 4450 |
| | 1 | > 25 | 2 | > 25 | 1 | Q1 1741; Q3 1800 |

## Results

In the Appendix, the results of the various methods for whiting and herring using the 2010, 2013, and 2015 ICES data are presented. For each method by year and quarter the estimated numbers-at-age and the numbers-at-age of the "real" population are given in panel A of all figures. The "real" population, which describes the original data from which the otoliths are sampled created based on the years specific data from the ICES database, is presented as a red dot in all of the figures. This point serves as a reference to which to compare the estimated numbers-at-age.

In the first glance the boxplots showing the variation created by the bootstraps follow the pattern in the red dots. In most cases in Q1 the largest number being age 1, and in Q3 the largest number being age 0. Figure b shows the estimated values divided by the "real" population, the red dot is thus 1. Here, the discrepancy between the estimations and the "real" population become visible. It is often clear that the red dot is not even within the boxplot, indicating that in those cases the majority of the estimations over- or underestimate the "real" population. This is already the case the base method (the current situation) in which the largest number of otoliths is collected and is visible in all the other methods as well. The boxplots showing the discrepancies become bigger at the larger ages, while the difference in total numbers-at-age become smaller as the "real" population has less fish at these ages.

The median F statistic for whiting (Table 2) gives a clear picture that the base method is better than the other methods. Only for Q1 2013 the model 1 creating the ALK in the current way is surprisingly slightly better. The modelled data are all cases worse than using the current method for the ALK. Comparing model 1 and model 2, where model 2 collects more otoliths indicates that a larger number of otoliths improves the estimations.

**Table 2. The median F statistic for the various methods used to estimate the numbers-at-age for whiting. The lower the values the closer the estimate is to the "real" population.**

| | | | BASE | MODEL1 | MODEL1 | MODEL2 |
|---|---|---|---|---|---|---|
| | | | current | current | modelled | modelled |
| Whiting | Q1 | 2010 | 0.0055 | 0.0120 | 0.0225 | 0.0143 |
| | Q1 | 2013 | 0.0150 | 0.0147 | 0.0335 | 0.0138 |
| | Q1 | 2015 | 0.0074 | 0.0108 | 0.0181 | |
| | Q3 | 2010 | 0.0009 | 0.0027 | 0.0072 | 0.0030 |
| | Q3 | 2013 | 0.0019 | 0.0023 | 0.0040 | 0.0030 |
| | Q3 | 2015 | 0.0024 | 0.0037 | 0.0088 | |

The median F statistic for herring shows a different picture than the values for whiting (Table 3). For Q1 2015 and Q3 2013 model 1 with the current way of estimating the ALK preforms surprisingly better than the base model. This is a surprise as less otoliths are collected in this method. The model 1 with a modelled ALK performs best in Q1 2013 and performs better than model 1 with the current modelling method in Q1 2010 and Q3 2015.

Table 3. The median F statistic for the various method used to estimate the numbers-at-age for herring. The lower the values the closer the estimate is to the "real" population. **Error! Not a valid link.**The differences in F statistic are clear but very variable. The absolute difference in proportion-at-age is small. An example is the Q3 2015 for whiting: here age 1 shows underestimation, while age 2 shows overestimation. The proportion-at–age 1 of the "real" population is 0.1244940 and for age 2 is 0.09532597. The range shown by the estimates for age 1 is 0.1044134-0.1282833, and for age 2 0.09436893-0.11694229. For age 5 for example the range is 0.005398927-0.008927476. This is the reason that the graphs of proportion-at-age as shown in the working document of last year did not show much difference.

## Discussion

The current analyses provide a perturbing image of the current and the proposed otolith sampling methods. In all cases clear over and underestimation of the "real" population occurs, which in absolute numbers is larger in the smaller age classes but larger in percentages compared to the "real" population in the larger length classes. In most cases the current method performed slightly better than the proposed methods, except for some surprising results were less otoliths resulted consistently in better predictions.

The expected improvements using a model to create the ALKs are not seen. Limited effort is placed in getting the best model. A model including spatial aspects was chosen, as expected to be a good model to incorporate spatial aspects, and was used throughout the exercise. The models were not evaluated based on their fit on individual bootstraps neither on the whole dataset. Thus there is space for improvement in the modelling exercise. Furthermore, the current model using longitude and latitude assumes some logical spatial correlation in the age at length e.g. some stock structure. However, the otoliths were collected with the RFA scheme potentially collecting all otoliths from a small number of spatial locations, followed by randomly distributing these otoliths over the tows within a RFA. Thus any form of natural stock structure required for a meaningful model is removed as a result spatial correlation does not exist in the "real" population and thus cannot be modelled. The current method is thus not a good way to show the capabilities of modelling the ALKs. It would be preferred to have the spatially explicit data of the full survey area to allow the spatial modelling. Therefore, the current advice is to change the sampling scheme to a station-specific scheme which should provide these data and redo the analyses on these data.

The used methods to sample the "real" population are based on strictly following the guidelines. Therefore, the maximum number of otoliths (if that length class is present) are sampled by each country. Thus even countries sampling a single tow in a RFA will sample the maximum number of otoliths if present. In practice it will be very difficult to follow the guidelines as strict. It is more realistic that a country with a small number of tows in a RFA will sample a smaller number of otoliths. Furthermore, it is nearly impossible to search larger catches for all fish of a specific length class. When subsampling of a catch is used, of a smaller known portion of the catch the length is measured and subsequently recorded with a multiplication factor. Here, the values after multiplication are used to sample the otoliths from thus also of the rare or aggregated (catching that length class only in a single tow) length classes the maximum number of otoliths is used. While it is more realistic that a smaller number is collected in the field. For example for whiting in 2010, 2862 (Q1) and 4216 (Q3) were collected in the field, while the maximum has resulted in 5003 (Q1) and 4536

(Q3). Especially in Q1 less otoliths were collected. Herring shows the same with 3287 (Q1) and 3995 (Q3) collected in the field and 4892 (Q1) and 4450 (Q3) according to optimal sampling. The same will occur in the proposed methods, however as here sampling is done by haul requiring less otoliths of a length class it is likely that especially in the range of the 5-cm class all otoliths will be collected as even with subsampling it is likely that the required number of fish in that length class will be encountered. It is more realistic to expect that the guidelines of the by tow scheme collecting less otoliths per length class will be met, than that the current sampling scheme will be met fully. Which is actually one of the reasons behind the large number of otoliths per length class.

Measuring error in determining the age of otolith is a known issue. In workshops where the international experts in determining the age based on the otolith compare their results there is discrepancy between the outcomes. The size of this error differs between species and ages, as there is large variation between the species in how well otoliths. The latest workshop for whiting test showed an overall agreement of 75% between the experienced age readers, with some specific otoliths resulting in only a 38% agreement (Smith 2015; http://www.ices.dk/community/Documents/Whg%20report%20final%20Oct%202015.pdf). For herring, there was a difference in the where the samples were coming from. The agreement ranged between very low up to 92% (Raitaniemi and Halling, 2005 http://www.ices.dk/community/Documents/PGCCDBS/her.agewk2005.pdf). This error is not incorporated in the current, nor in the proposed methods. The error might have a larger effect when a smaller number of otoliths is used, and especially when by haul ALK are created. This is an aspect that needs to be considered in further analysis.

Changing the otolith sampling scheme not only affects the age information analysed here. It will also affect the information collected for weight, sex and maturity of the species. It is expected that collecting these data by haul will likely improve the data quality rather than reducing it. Reducing the number of fish being sampled is likely to reduce the data quality for these parameters. If this is perturbing is to be tested here. It is expected that the proposed amount are still sufficient to at least estimate the sex ratios. For weight (condition studies) and maturity it might become an issue. Additional data on this can be collected, without much effort and costs involved. Collection of weight can be done without cutting the fish and then these fish will not fall under the experimental animal laws. Information on maturity will require cutting the fish and visually inspecting the reproductive organs. Therefore, these fish will fall under the experimental animal laws.

## Conclusion

Overall these analyses show that the current and proposed methods all result in bias in the estimates of numbers-at-age. Furthermore, it is shown that a reduction in the number of otoliths not necessarily results in worse estimates. However, in most cases the current method collecting the most otoliths performs best.

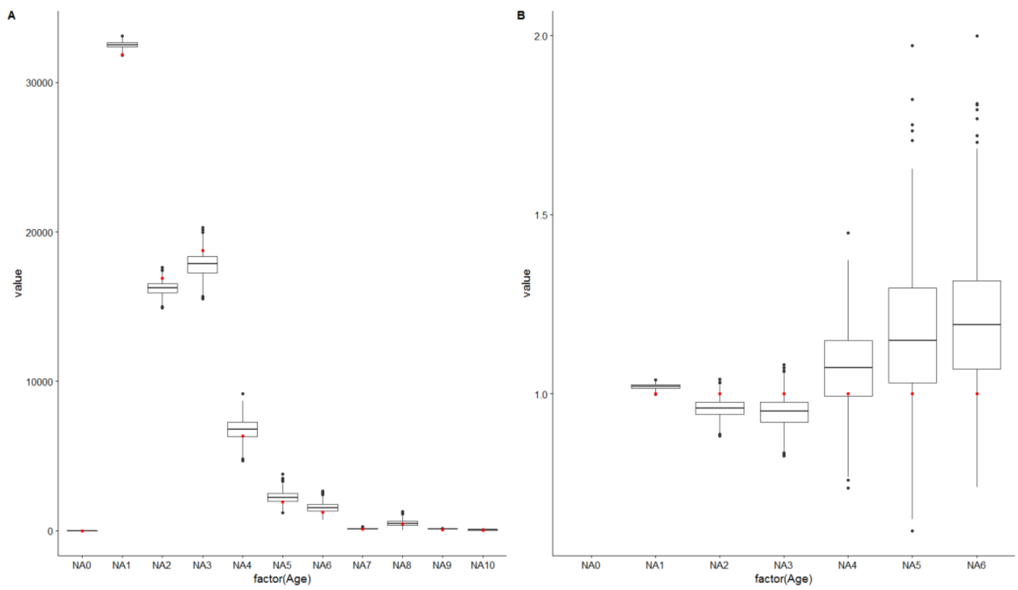
The analyses were unable to incorporate spatial aspects. Therefore, we propose to follow other studies using similar data showing spatial differences in age at length. Based on this we propose to change to a station-specific sampling scheme (similar to last year's proposal), which would allow the evaluation of spatial aspects in the coming years. Changing to a station-specific sampling scheme makes it easier to change the spatial distribution of tows between countries (see proposal for Q1 2017) without affecting the number of otoliths to be collected.

The analysis indicates that reducing the amount of otoliths compared to the maximum in the current guidelines is not preferred. However, changing to a station-specific sampling requires guidelines on the samples to be collected. Therefore, it is suggested to follow the proposal of last year for whiting, haddock and Norway pout. Which is similar to the method 1 used here for whiting (< 30 cm 2 per 5 cm class and 1 per cm class for larger lengths) and also to follow method 1 for herring (< 25 cm 2 per 5 cm class and 1 0.5 cm class for larger lengths). But to realize that, these numbers are on the low side and in case of larger catches of larger fish to collect more per length class (as the variation in larger ages is larger). And to sample additional otoliths at smaller lengths when the number of otoliths become very low compared to original numbers caught over the whole area, creating similar bias as exists in the current sampling by RFA. Another option is to collect 3 otoliths per 5 cm class from the start, with the risk of increasing the number of otoliths collected compared to the current way of sampling.

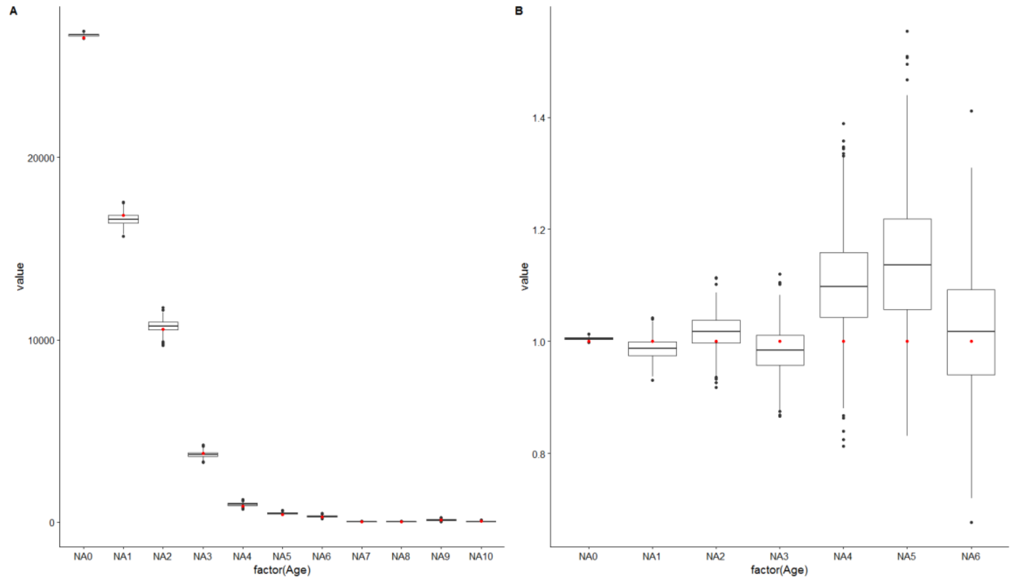
Additional work is required on the model used to estimate the ALK by tow. This could be done next year when station-specific data becomes available. Next to the coordinates also depth aspects could then be included in estimating the ALK. Furthermore, similar analysis are required for the other target species, Norway pout, haddock and sprat. There is no need to analyse cod, as the numbers of cod currently caught are so low that most are already collected.

## Whiting

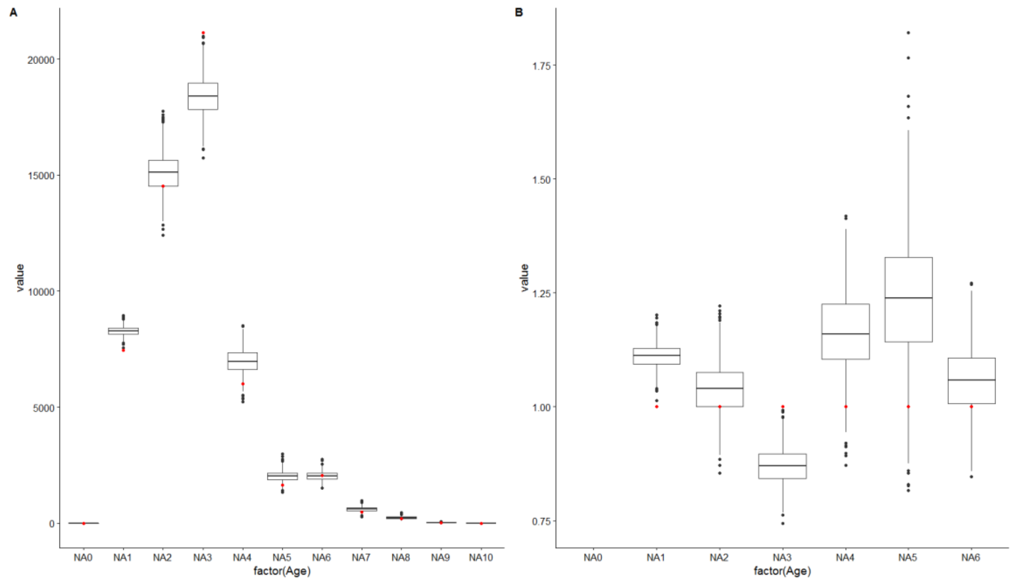
### Base method



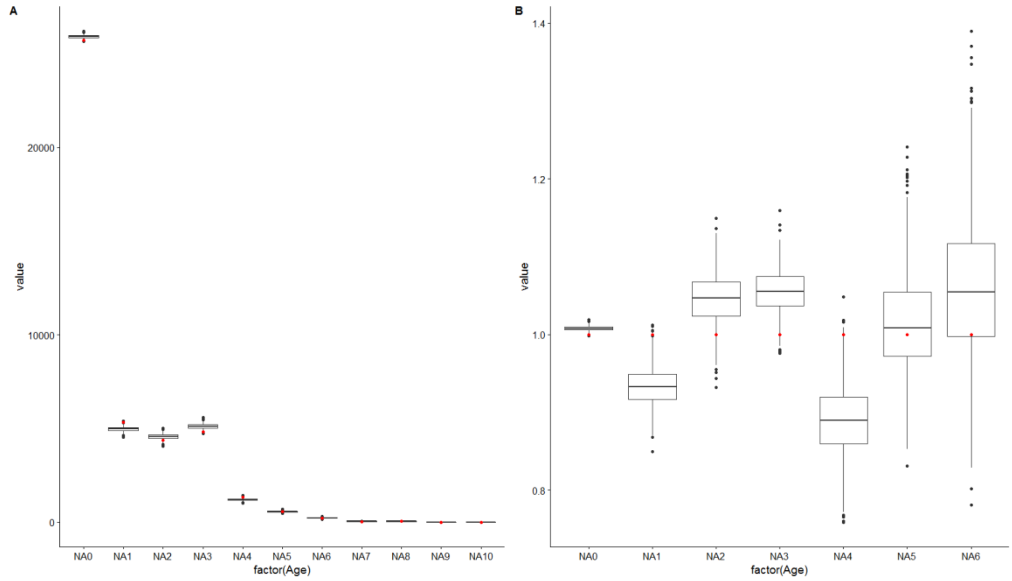

**2010: Q1 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



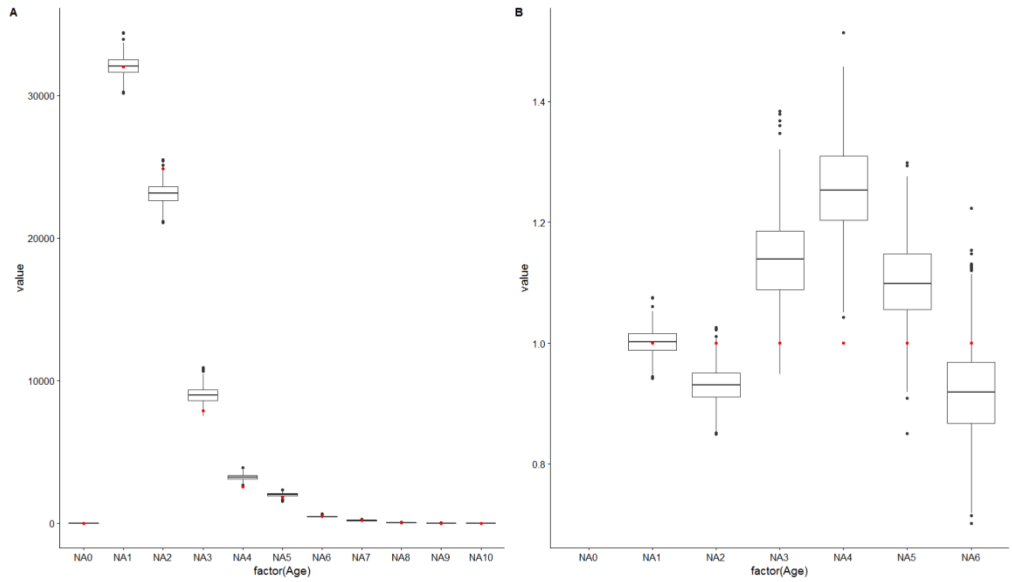

**2010: Q3 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



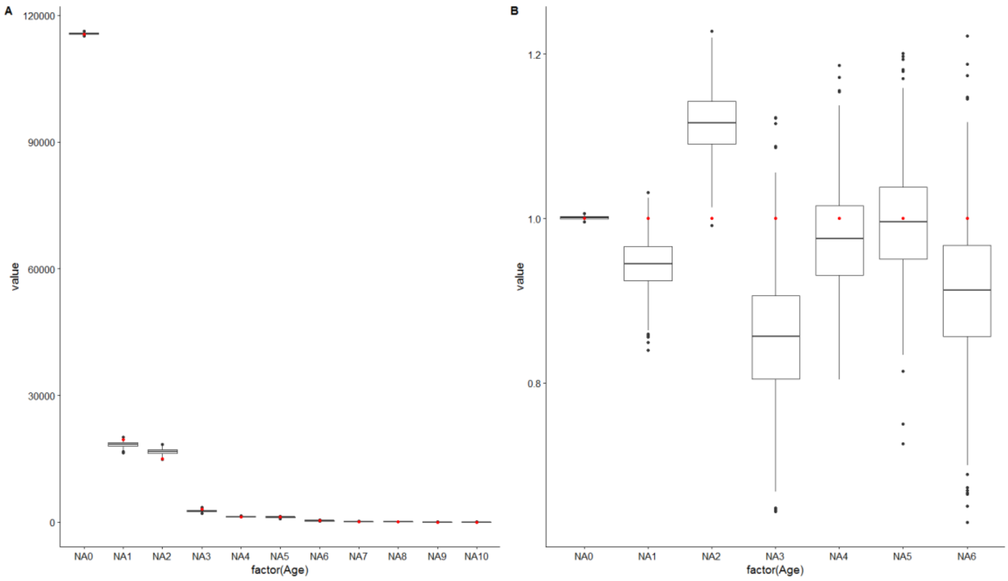

**2013: Q1 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

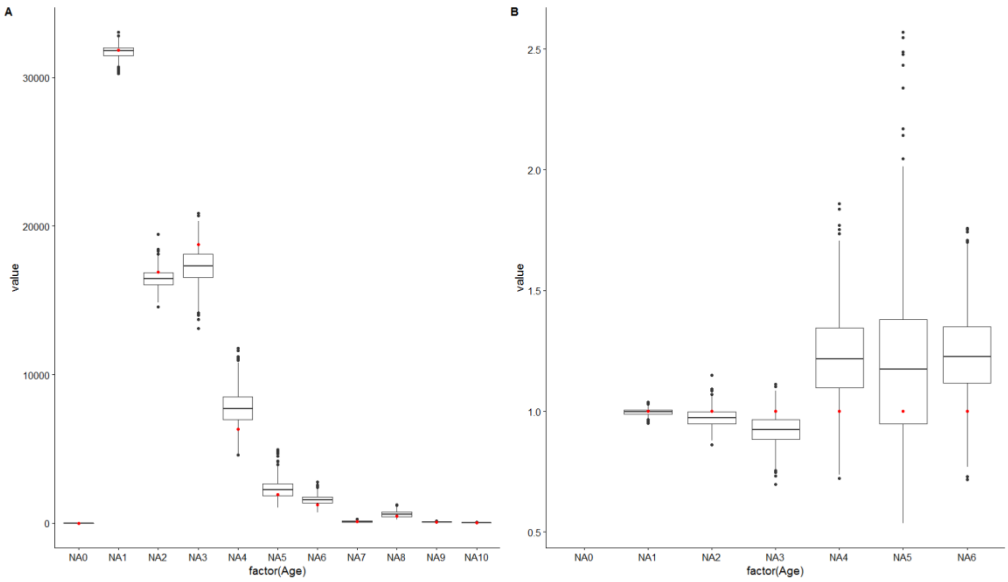



**2015: Q1 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

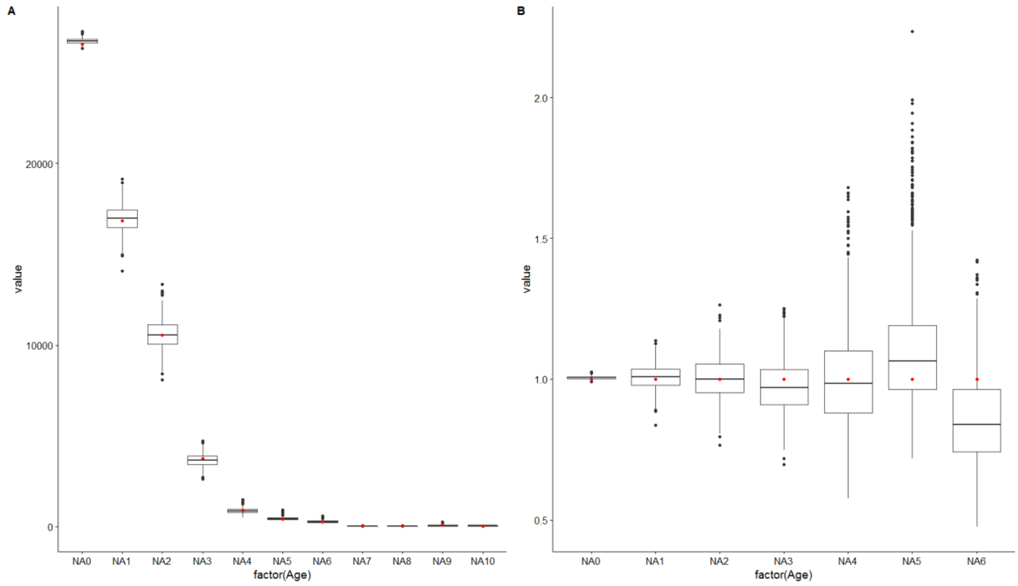



**2015: Q3 Whiting, otolith selection using the base method, current situation. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

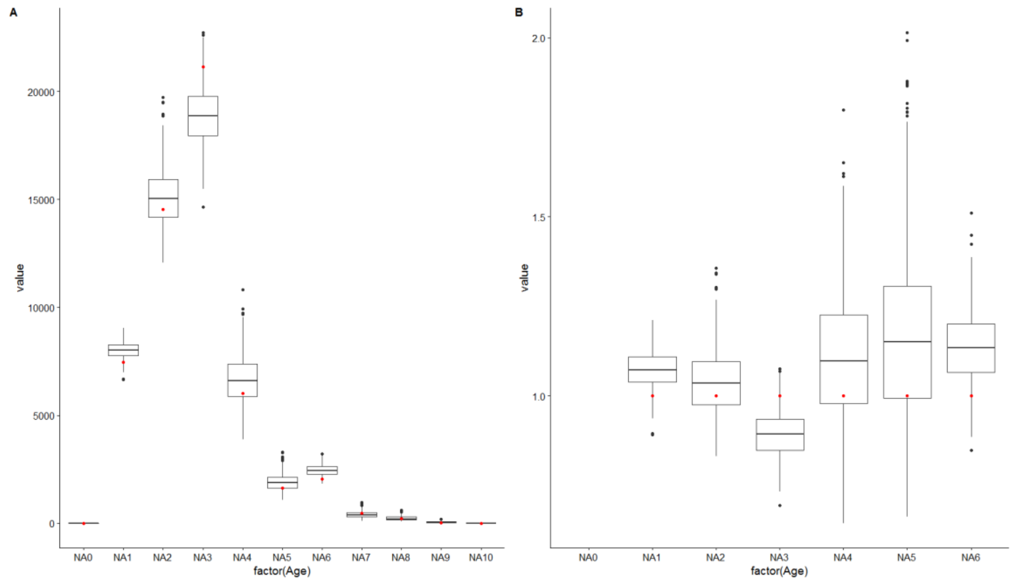
Method 1 current ALK



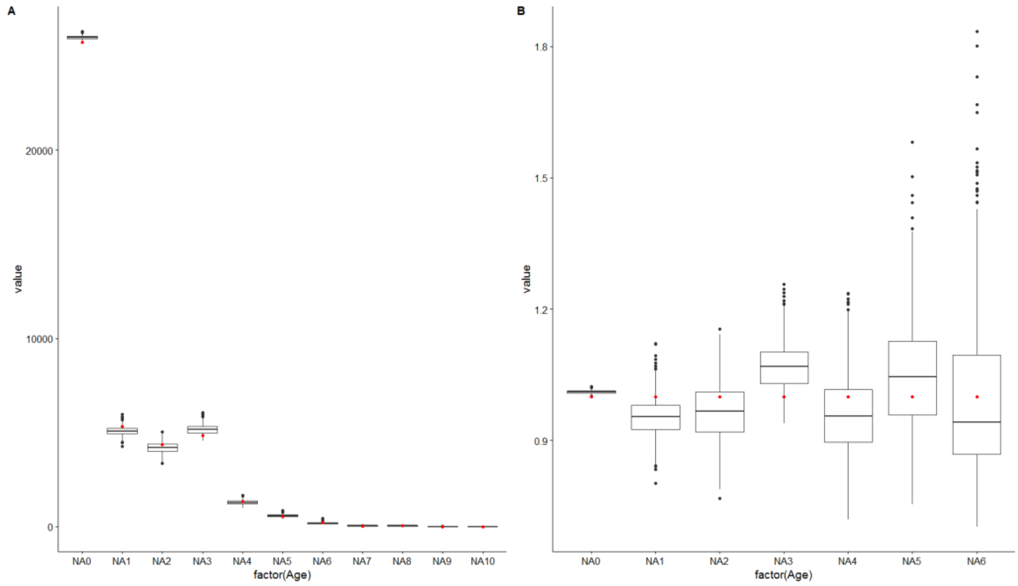

**2010: Q1 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



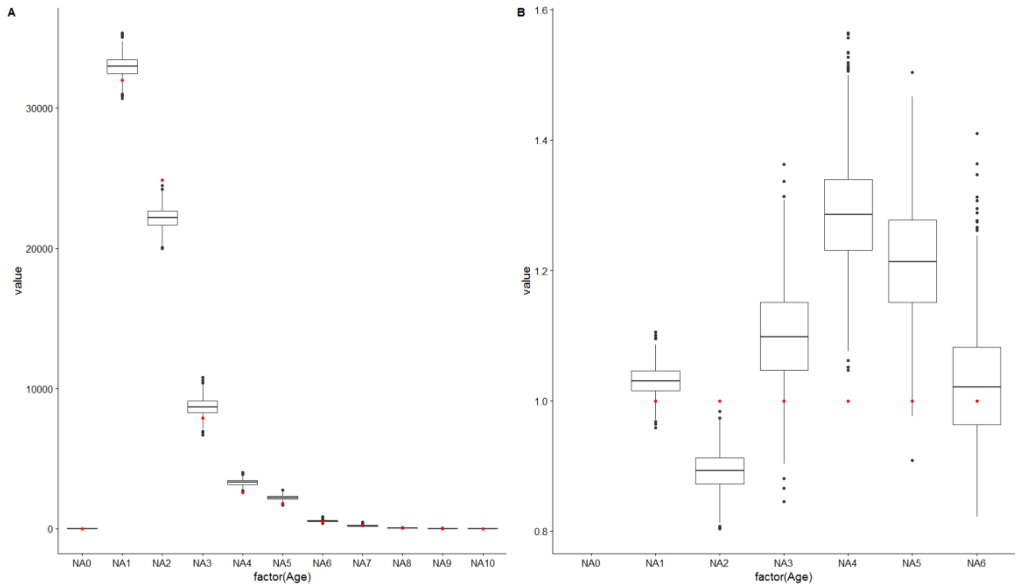

**2010: Q3 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



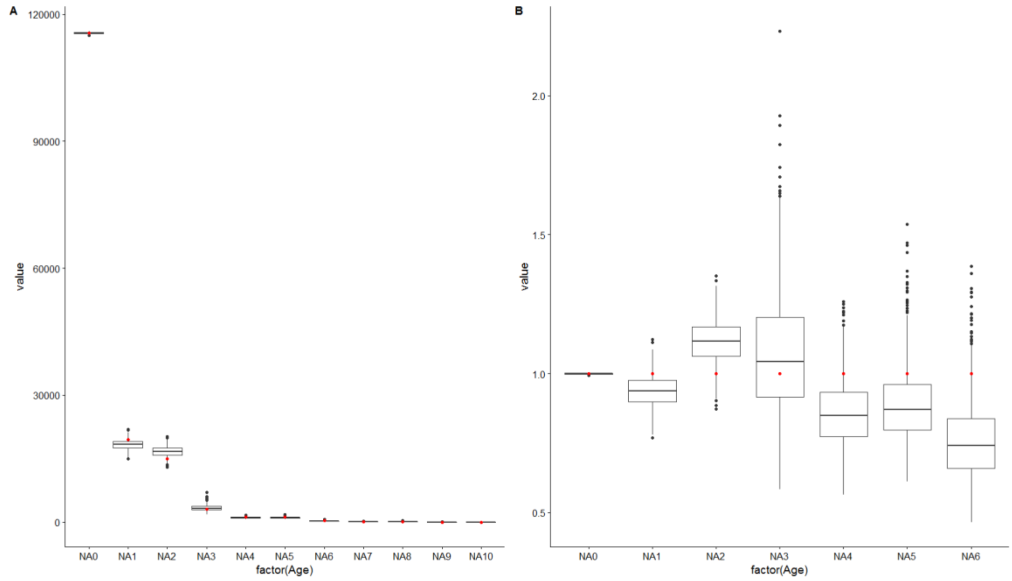

**2013: Q1 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

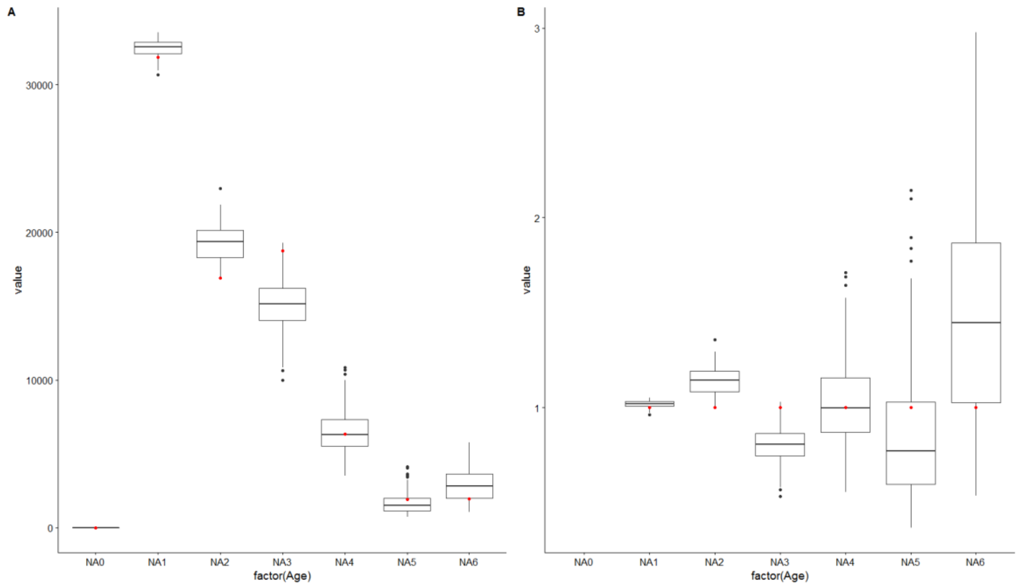



**2015: Q1 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

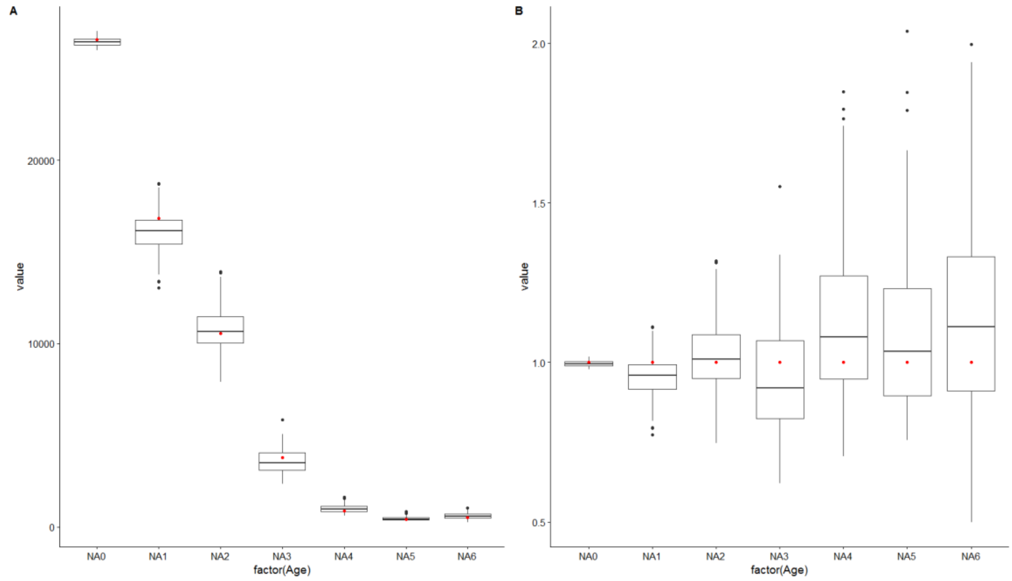



**2015: Q3 Whiting, otolith selection using method 1 current method of creating the ALK. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

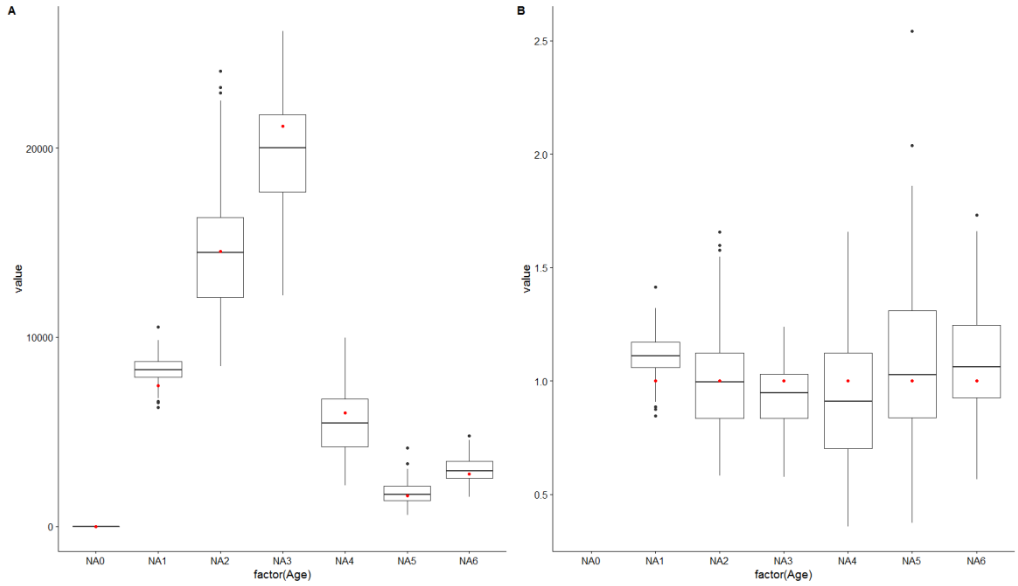
### Method 1 Modelled ALK



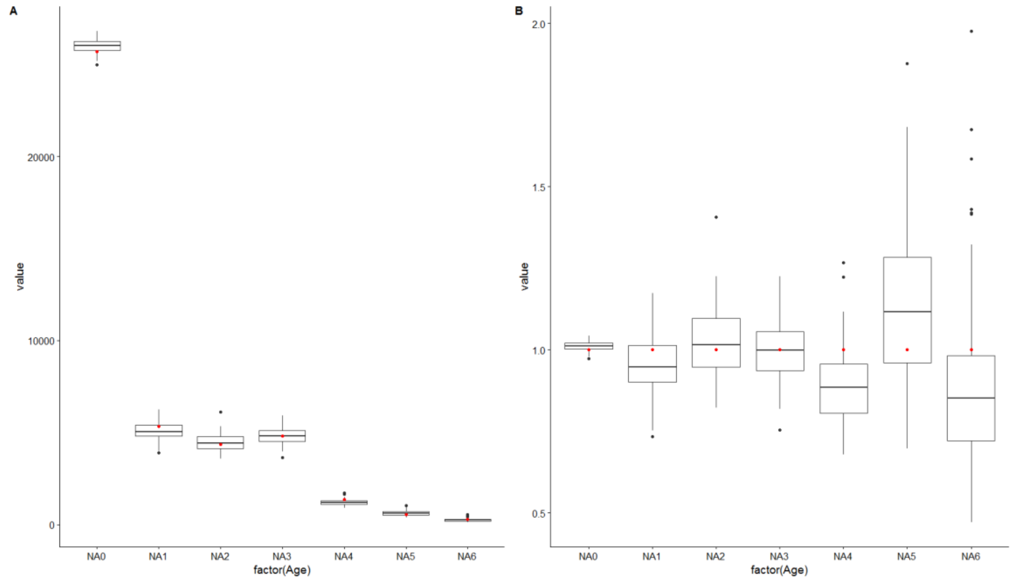

**2010: Q1 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



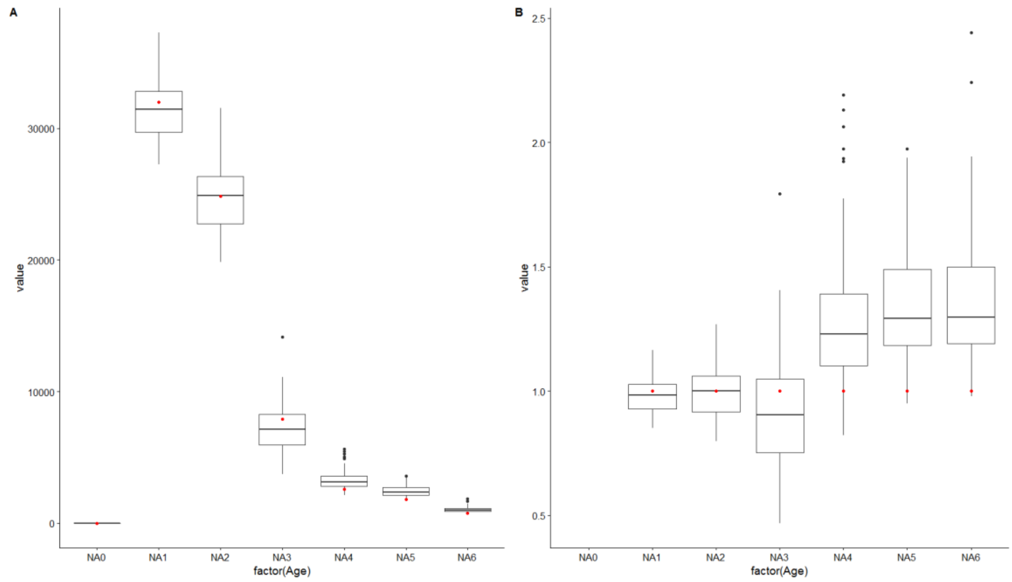

**2010: Q3 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



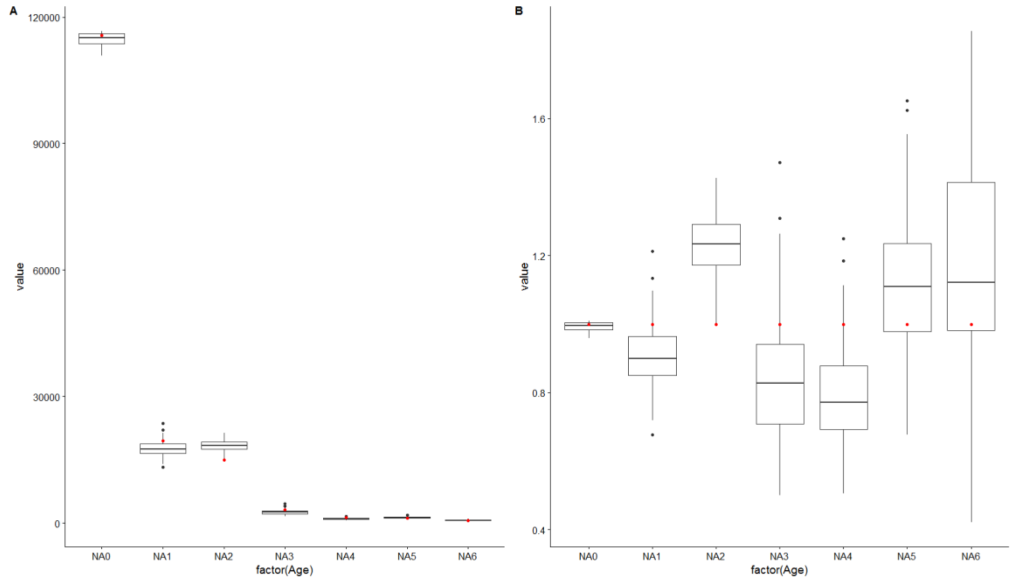

**2013: Q1 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

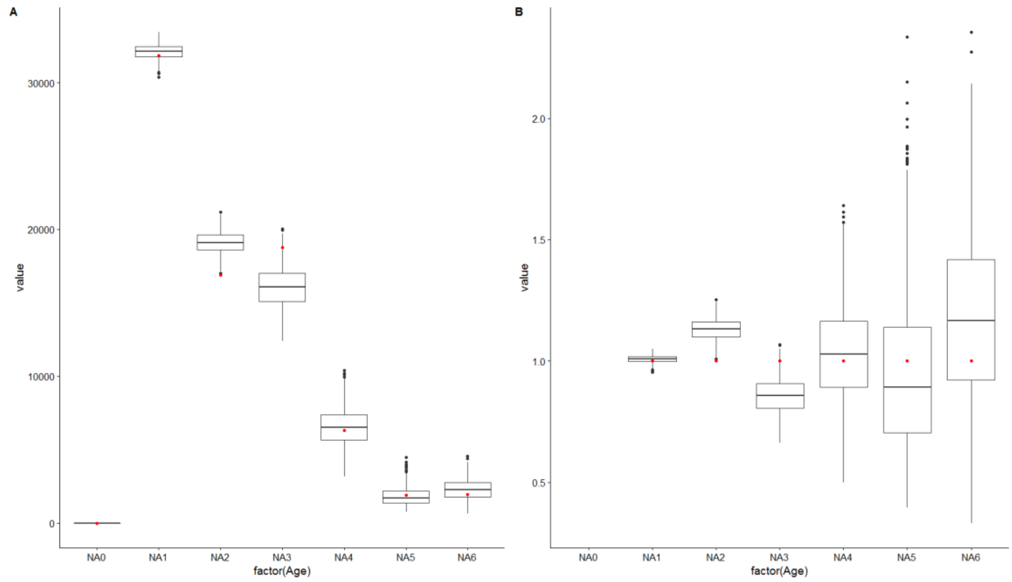



**2015: Q1 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

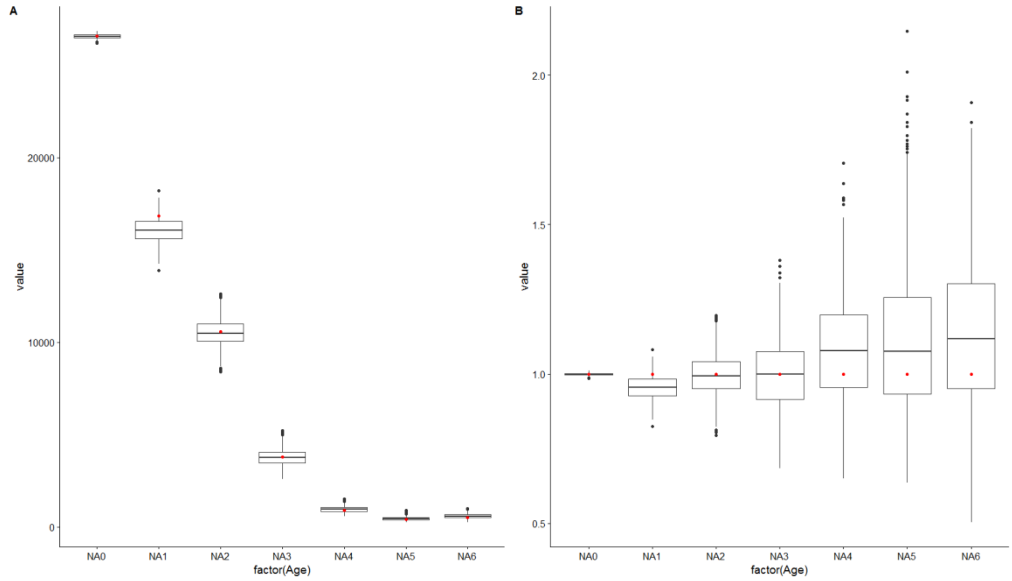



**2015: Q3 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

Method 2 Modelled ALK



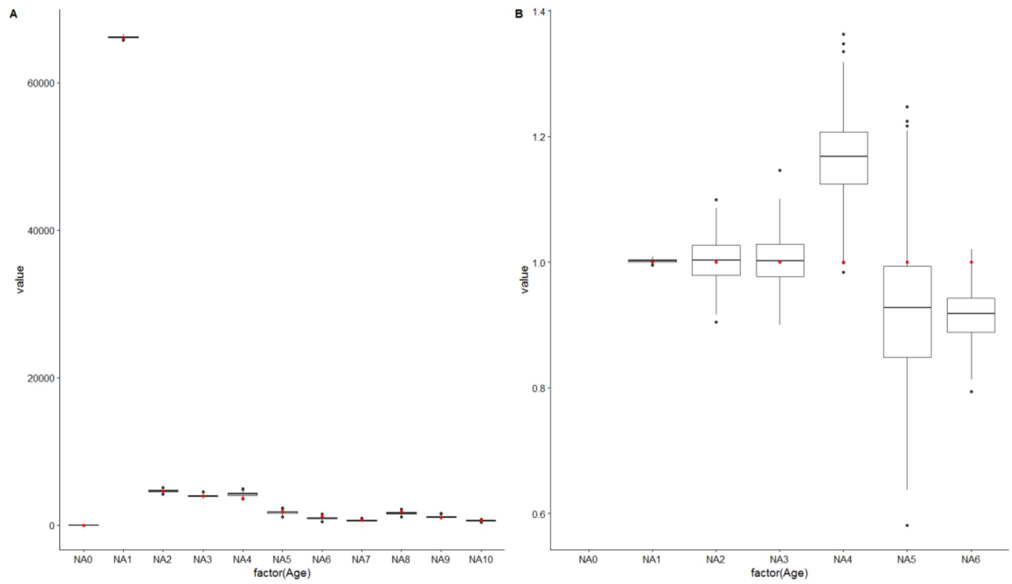

**2010: Q1 Whiting, otolith selection using method 2 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



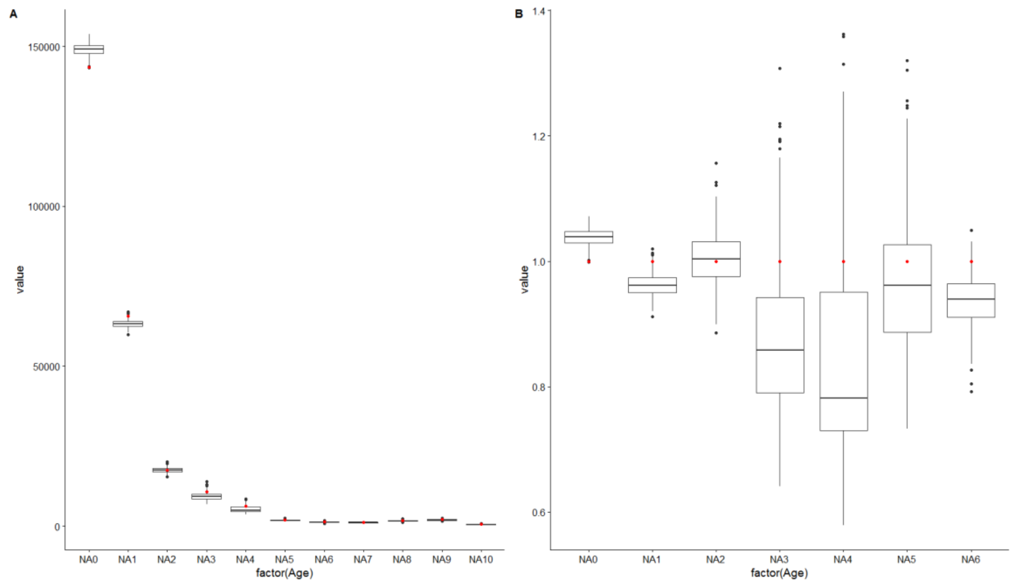

**2010: Q3 Whiting, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

## Herring

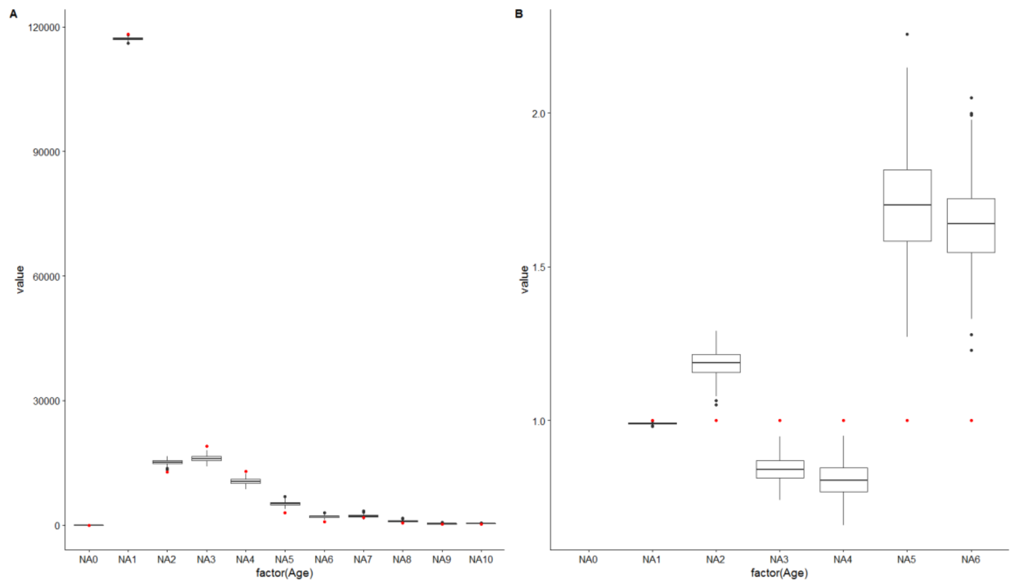
## Base method



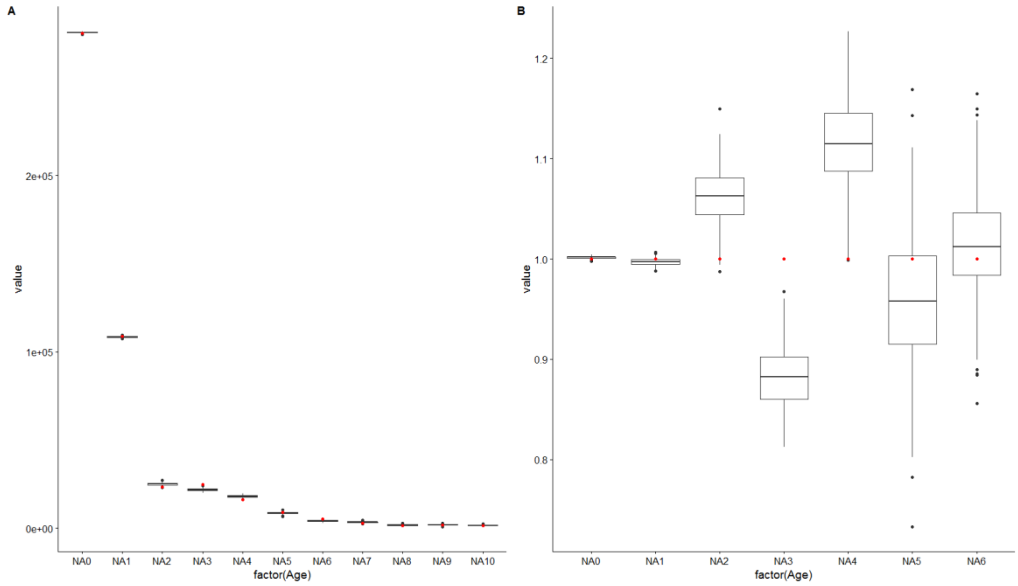

**2010: Q1 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**



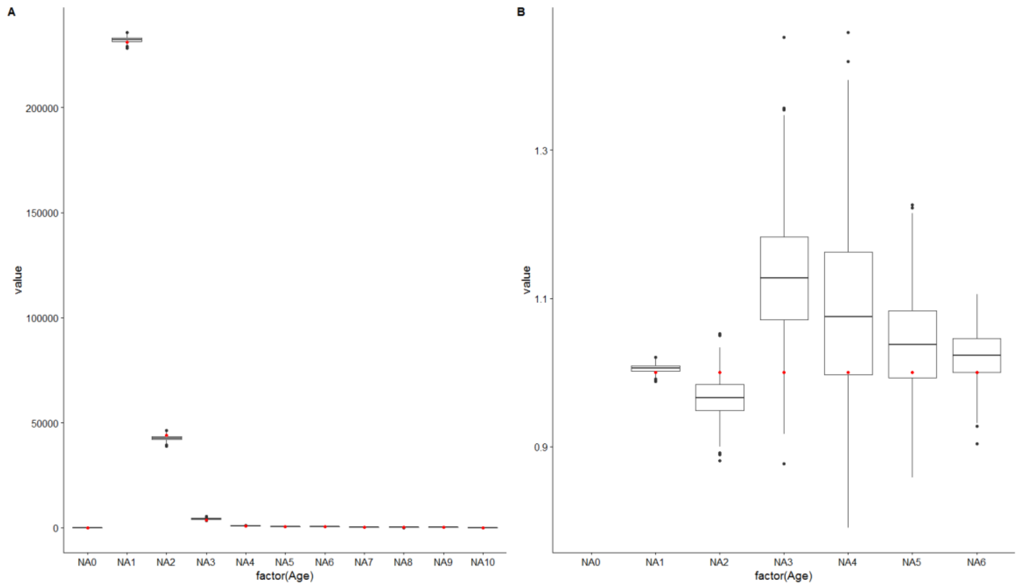

**2010: Q3 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**



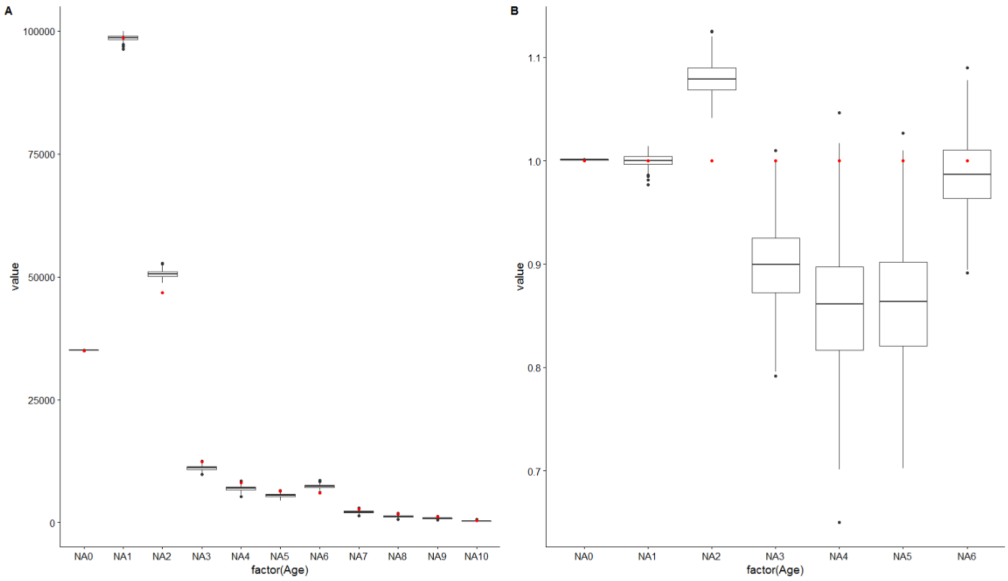

**2013: Q1 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

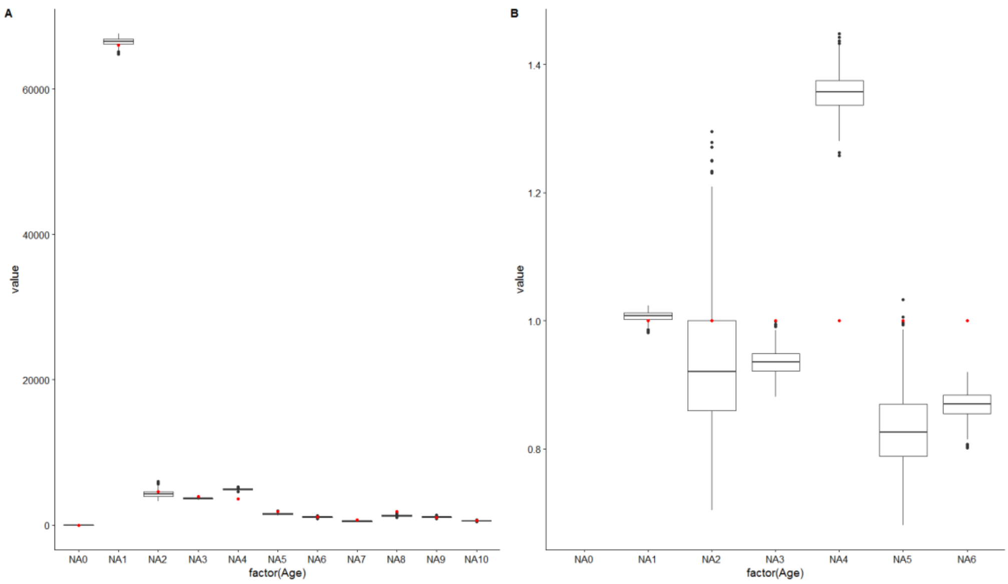



**2015: Q1 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

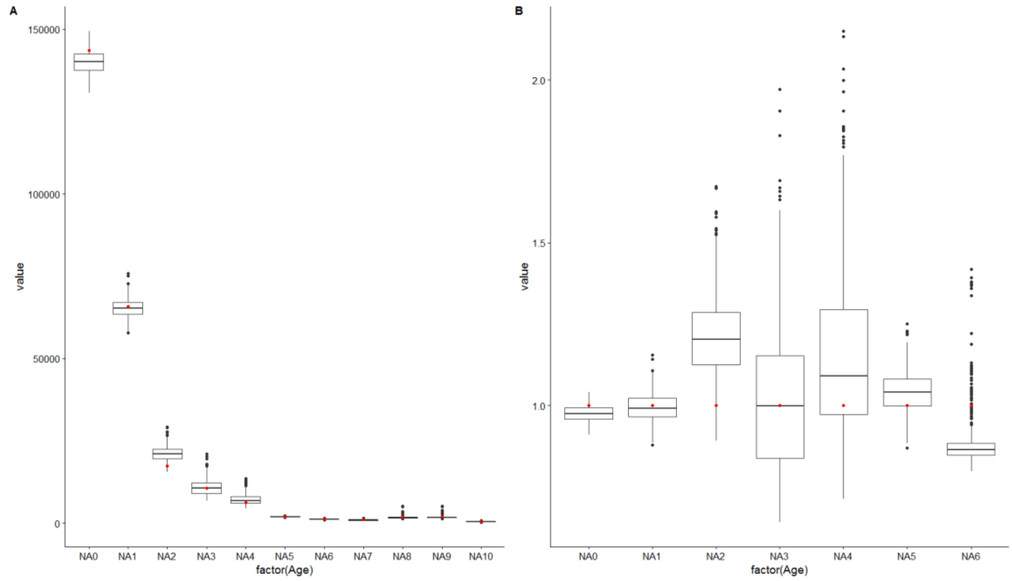



**2015: Q3 Herring, otolith selection using the base method, current situation. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

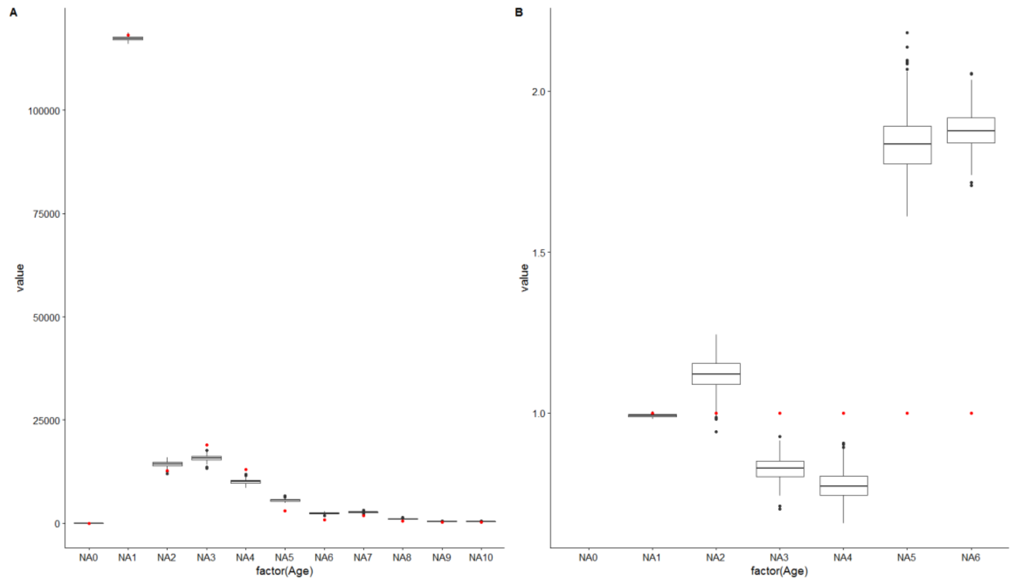
Model 1 current ALK



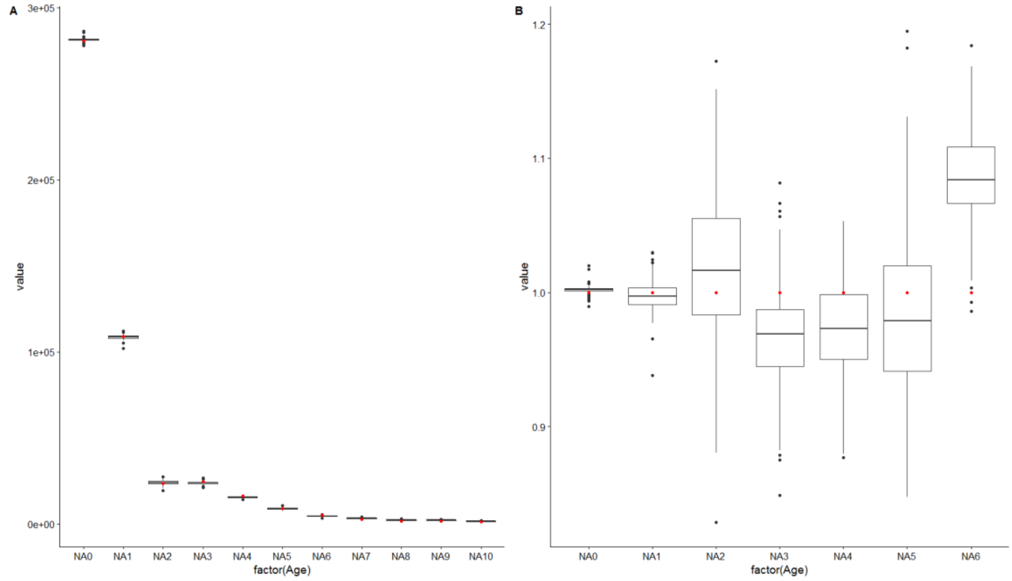

**2010: Q1 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**



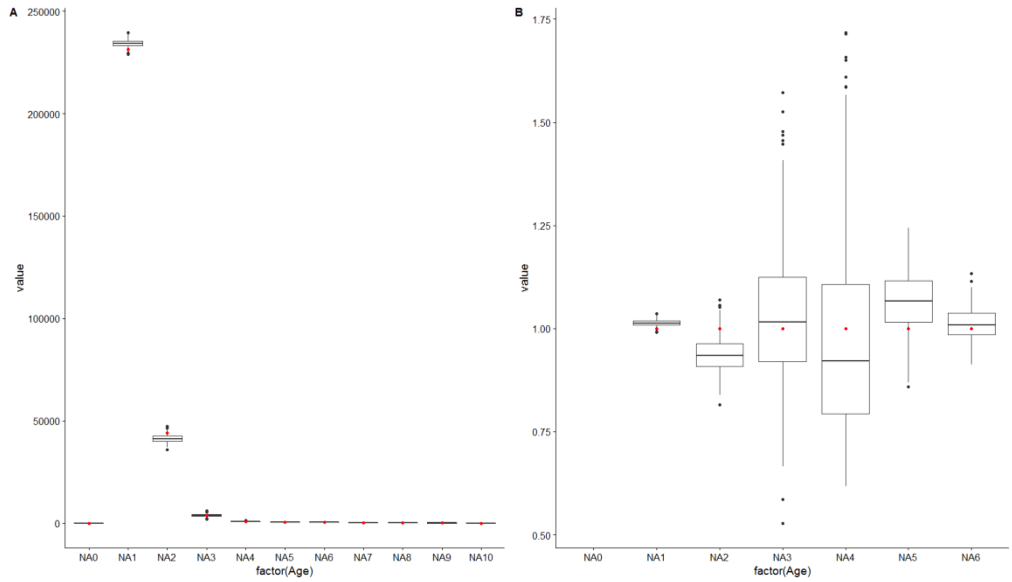

**2010: Q1 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**



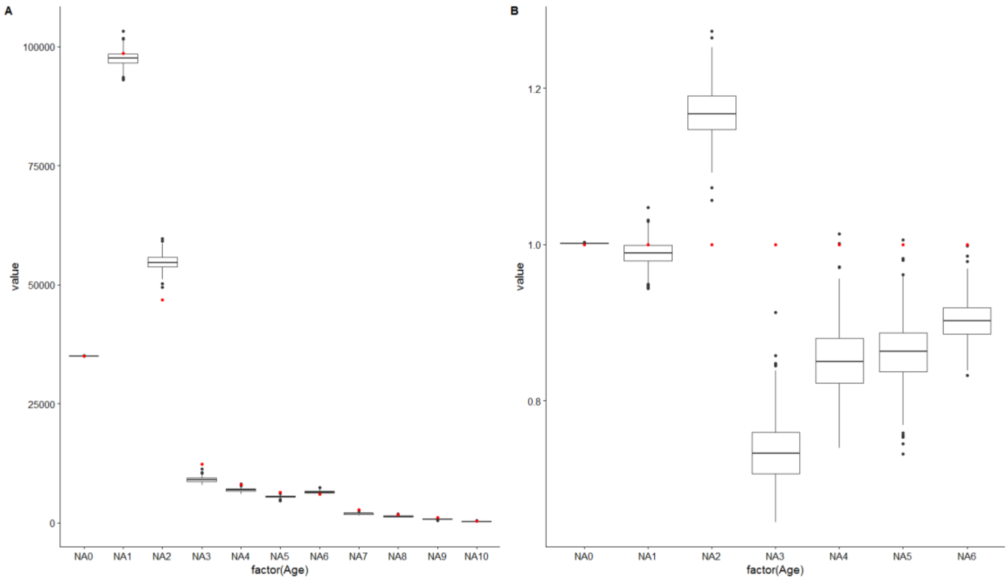

**2013: Q1 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

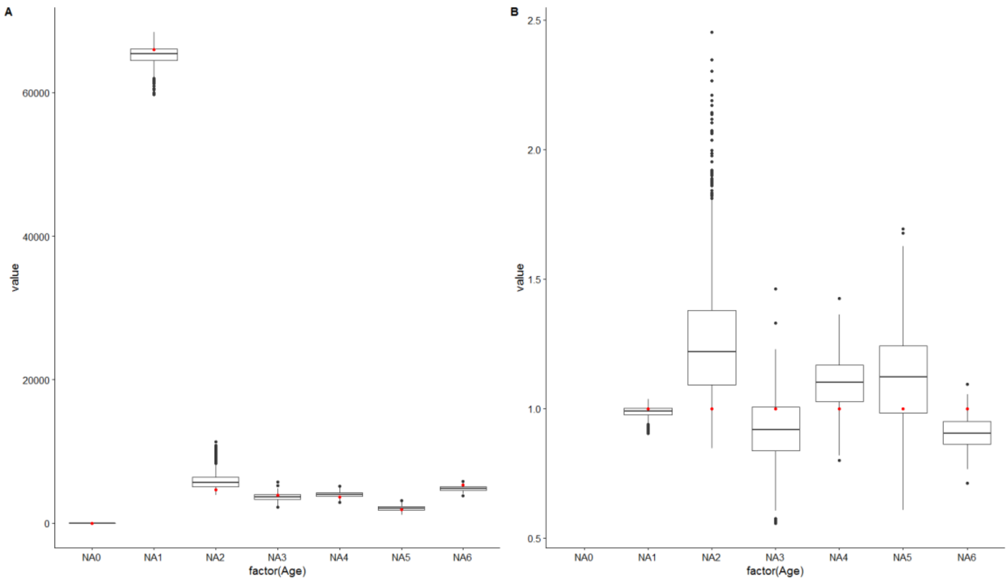



**2015: Q1 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

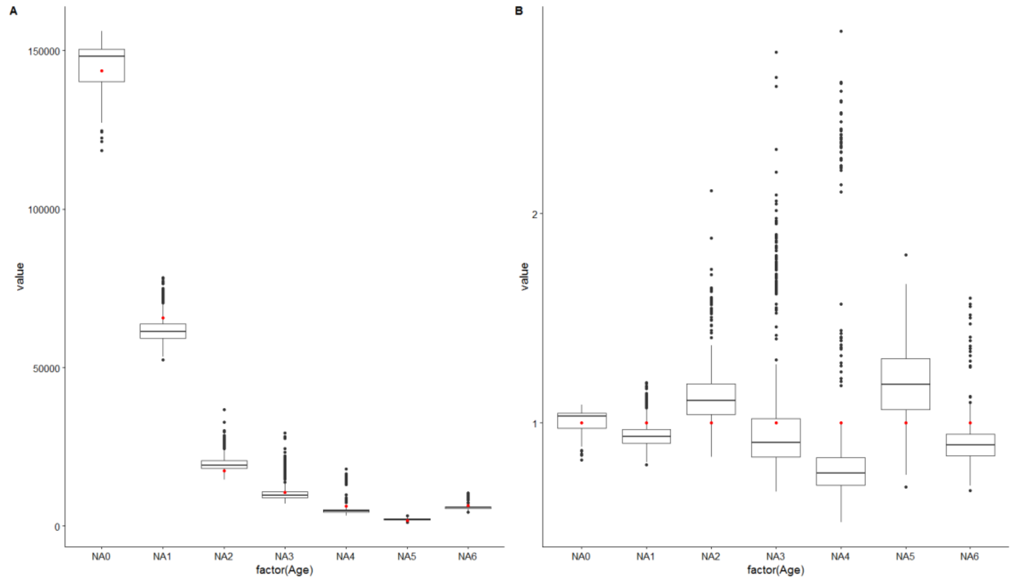



**2015: Q3 herring, otolith selection using method 1 current method of creating the ALK. A) absolute numbers-at-age and B) numbers-at-age divided by the original population. Red dots original population.**

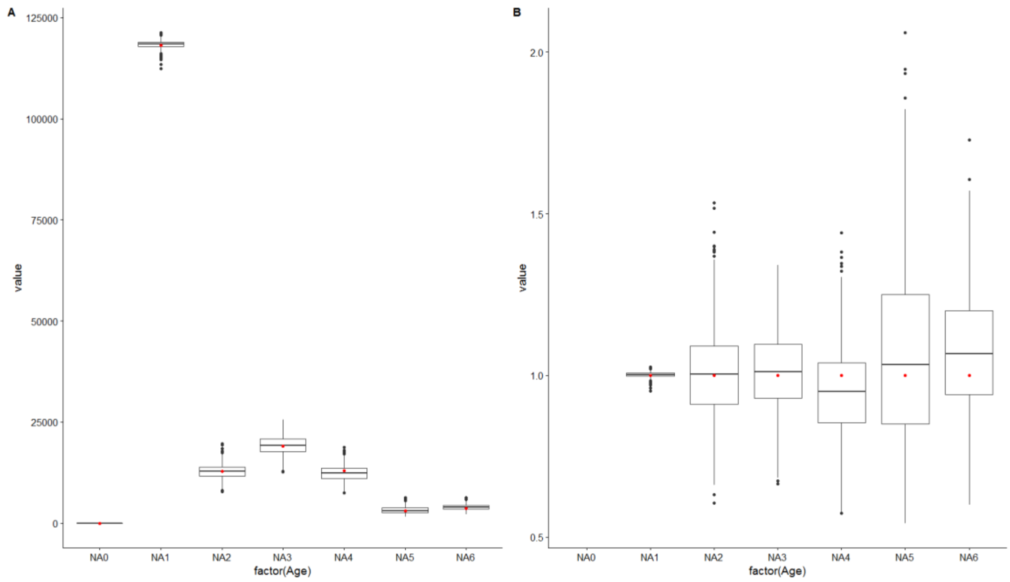
### Model 1 modelled ALK



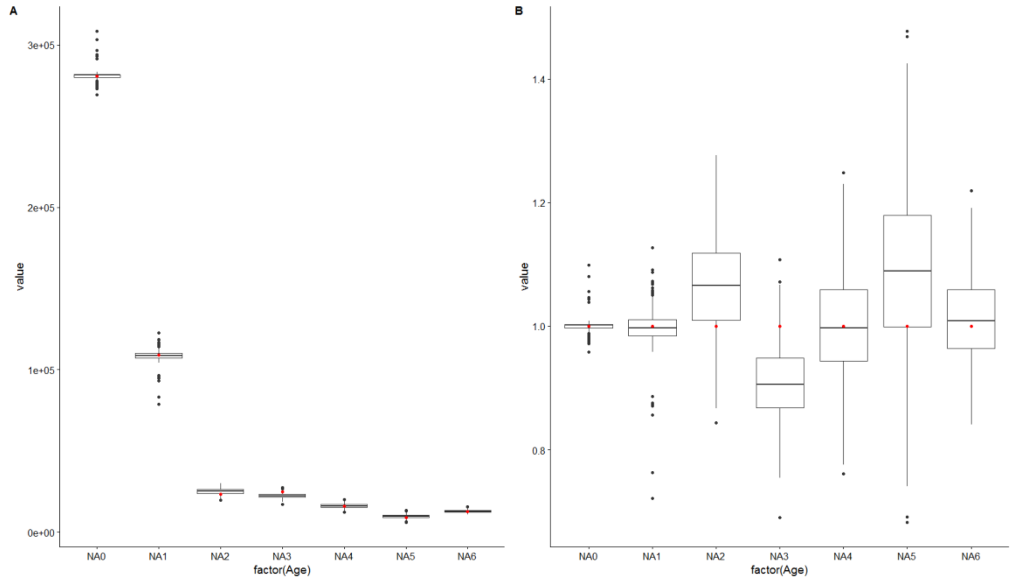

**2010: Q1 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



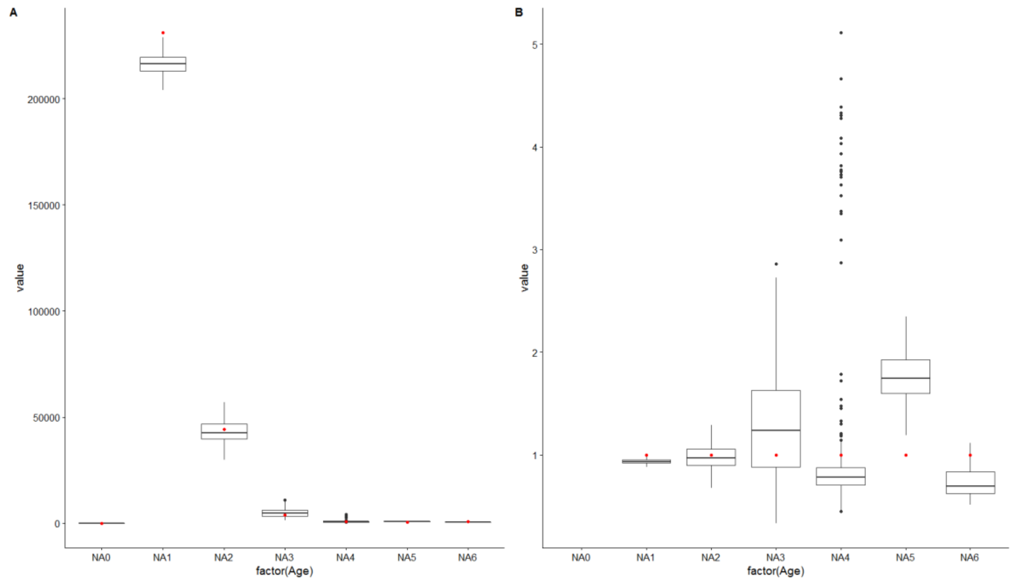

**2010: Q3 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**



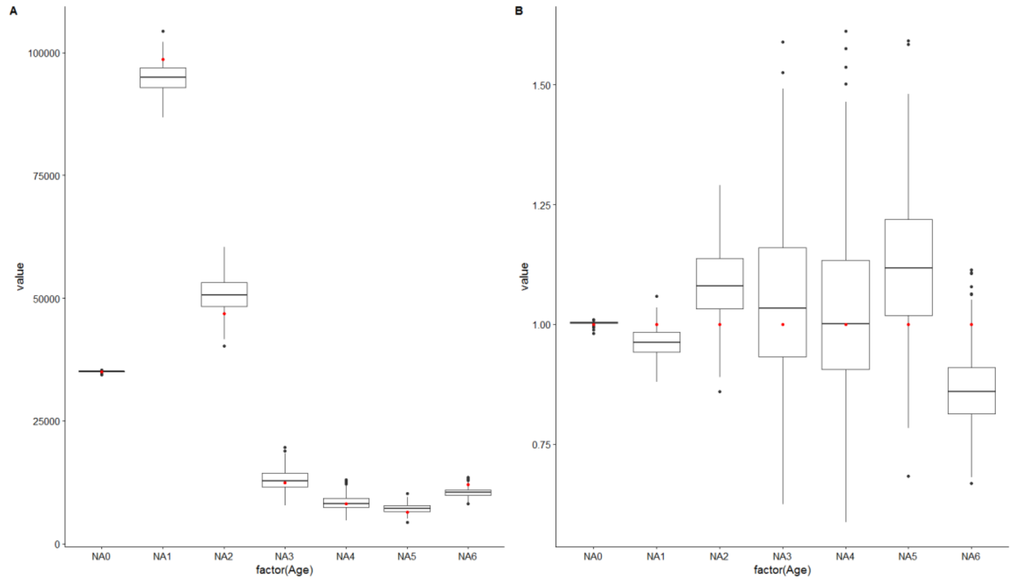

**2013: Q1 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2013: Q3 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2015: Q1 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**




**2015: Q3 herring, otolith selection using method 1 modelling the ALK by haul. Left absolute numbers-at-age and right numbers-at-age divided by the original population. Red dots original population.**

# WD3: Effect of tow duration NS-IBTS 3Q2015 - Preliminary analyses (K. Wieland)

## Introduction

IBTSWG 2015 agreed to conduct an experiment on tow duration in NS-IBTS Q3 2015, because evidence exists for other surveys that benefits arose from changing to shorter tow duration (see IBTSWG Report 2015 section 10.3. for a thorough discussion on the pros and cons). The majority of the IBTSWG considered the risk that the experiment would impair the quality of the long-term survey dataset sufficiently small. However, ICES WGNSSK had concerns about the approach and preliminary analyses focusing on the comparability of the standard indices were done just after completion of the experiment and the results were provided to ICES WGNSSK prior to their autumn update assessments.

## Material and Methods

In order to warrant a thorough comparison with the current methodology, it was planned that in each ICES rectangle one of the two assigned hauls remains a 30 min tow whereas the second is reduced to a 15 min tow. Sweden England wanted to keep tow duration for all of the hauls at 30 min and thus no mixed two durations were planned for the Skagerrak, which is almost exclusively covered by Sweden, while in the North Sea the proportion of 15 min tows conducted by Denmark, Germany, Norway and Scotland was about 50%. The 15 min tows were either placed in rectangles in which England was supposed to conduct a 30 min or, in the remaining rectangles not allocated to England, a balanced share of 30 and 15 min tows was planned.

The catch results of pairs of short and long tows conducted by the same country within a rectangle were compared using either Wilcoxon signed rank tests or paired t-tests depending on normality of the data. Abundance indices were calculated as the mean cpue in either number per h or number per km$^2$ for all hauls in a given tow duration group. This differs from the routine procedure for calculating standard indices, in which the means for the different statistical rectangles falling into species-specific standard areas are averaged. The cpue's by age for Norway pout, cod, whiting, haddock, and saithe based on the 15 and 30 min tows were then compared using either Mann–Whitney rank sum test or ordinary t-test or the same tests as above depending on the results of tests for normality and equal variances. All analyses were based on DATRAS data downloads from 24/9-2015 (HH records and cpue per age and haul (cpue missing for rectangles 45F5 and 44F6 in the download)). Potential effects of differences in depth, vessel and position were not considered in these preliminary analyses.

## Results

### Tow distribution and achieved area coverage

Similar to previous years, some of the planned 30 min tows were shortened for various reasons (Figure 1) and in one rectangle erroneously both mandatory tows were of 15 min duration while otherwise the original plan hold (Figure 2).

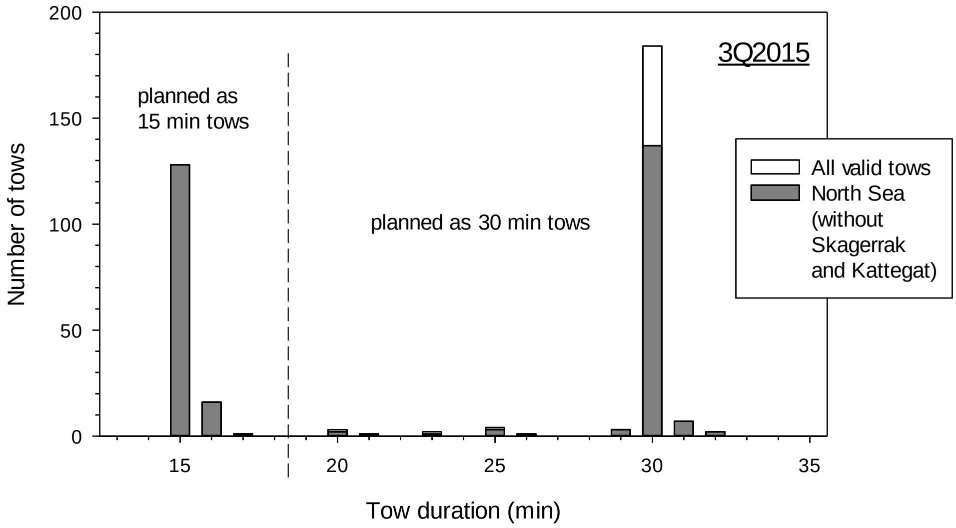



**Figure 1. Distribution of tow durations.**

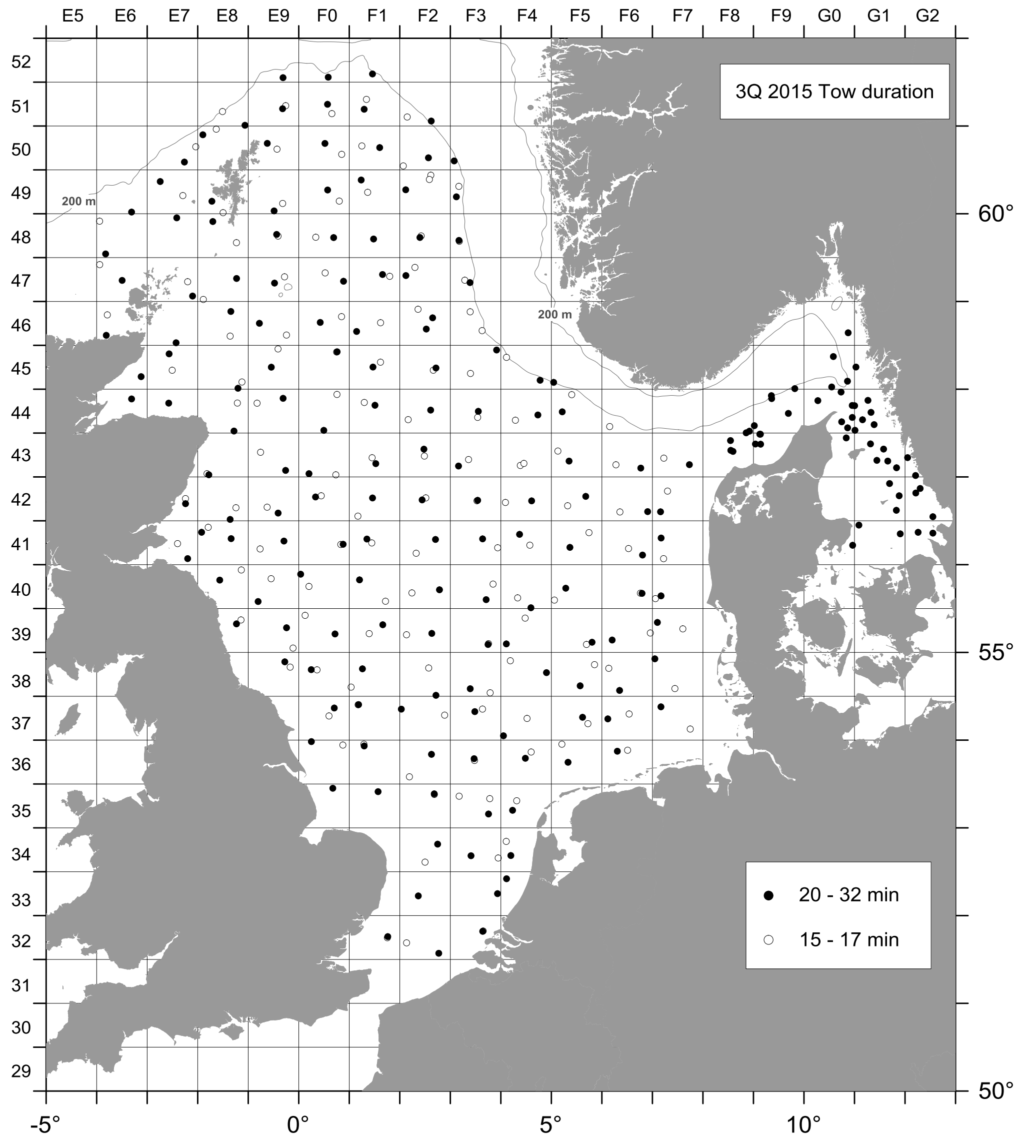



**Figure 2. Geographical distribution of hauls by tow duration.**

The time saved due to the shorter tows was used by Germany and Norway to extend their normal area coverage while Denmark and Scotland made additional hauls primarily in rectangles where they usually are the only country. Overall, the implementation of the short tows resulted in a higher total number of rectangles covered and a more balance distribution of the number of tows between the rectangles than in previous years while the total fished only slightly decreased (Figure 3).

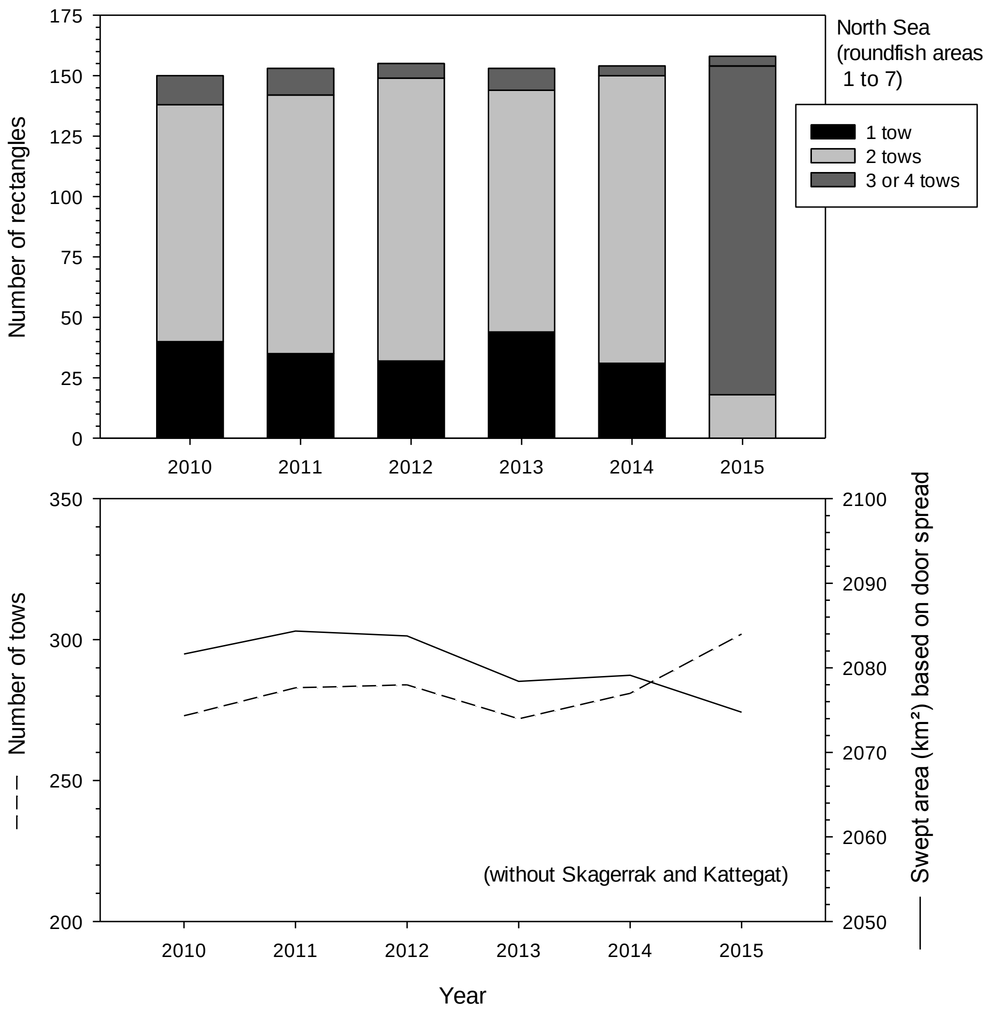



**Figure 3. Changes in survey performance.**

### Denmark – Results for 'paired' tows

**Table 1. Comparison of total biomass density, demersal and pelagic fish density for short and long tows conducted by Denmark in the same rectangle (Demersal fish species: including horse mackerel but no shellfish and squids, pelagic fish species: Herring, sprat, mackerel, anchovy, and sardine)**

| Rectangle | Tow duration (min) | Station Nr | Depth (m) | Catch weight all items (kg) | CPUE all items (kg/hr) | Catch weight (kg) | | Swept area ($km^2$) | CPUE ($kg/km^2$) | | Number of different species | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | demersal fish | pelagic fish | | demersal fish | pelagic fish | demersal fish | pelagic fish |
| 41F7 | 30.06 | 5 | 33.1 | 336.54 | 11.20 | 232.76 | 102.91 | 0.2250 | 1034.32 | 457.31 | 12 | 3 |
| | 15.05 | 7 | 28.8 | 188.90 | 12.55 | 183.48 | 3.38 | 0.1174 | 1563.30 | 28.81 | 8 | 3 |
| 41F6 | 30.08 | 8 | 39.4 | 322.92 | 10.74 | 298.36 | 17.52 | 0.2367 | 1260.67 | 74.02 | 10 | 4 |
| | 15.10 | 10 | 40.8 | 173.13 | 11.47 | 166.95 | 4.23 | 0.1233 | 1353.86 | 34.30 | 10 | 2 |
| 35F3 | 30.04 | 53 | 28.9 | 340.43 | 11.33 | 325.56 | 14.70 | 0.2346 | 1387.59 | 62.67 | 16 | 4 |
| | 15.15 | 57 | 27.6 | 424.00 | 27.99 | 51.08 | 363.87 | 0.1132 | 451.40 | 3215.34 | 10 | 2 |
| 42F7 | 30.14 | 4 | 34.6 | 193.91 | 6.43 | 86.81 | 106.26 | 0.2247 | 386.41 | 472.99 | 10 | 3 |
| | 15.10 | 105 | 30.6 | 155.61 | 10.31 | 97.34 | 57.16 | 0.1219 | 798.36 | 468.86 | 11 | 2 |
| 43F7 | 30.09 | 110 | 44.4 | 247.18 | 8.21 | 66.34 | 179.41 | 0.2319 | 286.07 | 773.67 | 8 | 1 |
| | 15.18 | 108 | 64.1 | 172.16 | 11.34 | 94.21 | 76.73 | 0.1360 | 692.70 | 564.15 | 10 | 2 |

The cpue (in $kg/km^2$) of demersal and pelagic fish species (Table 1) is not significant different between 30 min and 15 min tows (normality test failed $\Rightarrow$ Wilcoxon signed rank test used for both species groups), and also the total number of various demersal and pelagic fish species observed in the 30 and 15 min tows is not significant different (normality test passed $\Rightarrow$ paired t-test used for both species groups). However, the power of this statistical analysis is below the desired level due to the small number of pairs.

### Scotland – Results for 'paired' tows

The cpue (in $n/km^2$) for Norway pout (Table 2) is not significant different between 30 min and 15 min tows (normality test failed $\Rightarrow$ Wilcoxon signed rank test, also no significant differences in paired t-test ignoring the non-normality) for none of the age groups and also not if all ages were combined (same results for cpue in n/h). However, only 15 'pairs' of observations have available and the analysis does not account for differences in depth and position between the two classes of tow duration.

**Table 2. Comparison of Norway pout cpue from Scottish Ground Fish Survey (SGFS) for short and long tows conducted in the same rectangles.**

| | | | CPUE (n/hr) | | | | CPUE (n/km$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Rectangle | Tow duration (min) | Depth (m) | Age 0 | Age 1 | Age 2 | Age 3 | Age 0 | Age 1 | Age 2 | Age 3 |
| 50E9 | 30 | 108 | 2292 | 4504 | 7 | 19 | 4808 | 9449 | 14 | 40 |
| | 15 | 135 | 13756 | 39401 | 293 | 201 | 26420 | 75675 | 563 | 387 |
| 50E8 | 30 | 130 | 10420 | 14588 | 59 | 83 | 19242 | 26939 | 109 | 153 |
| | 15 | 136 | 0 | 7945 | 26 | 36 | 0 | 15422 | 51 | 70 |
| 50E7 | 30 | 154 | 0 | 14467 | 141 | 60 | 0 | 25283 | 246 | 105 |
| | 15 | 120 | 57990 | 3702 | 8 | 16 | 97472 | 6222 | 13 | 26 |
| 49E8 | 30 | 80 | 19462 | 0 | 0 | 0 | 41532 | 0 | 0 | 0 |
| | 15 | 134 | 2624 | 5936 | 541 | 63 | 4556 | 10306 | 938 | 110 |
| 49E7 | 30 | 180 | 0 | 647 | 96 | 29 | 0 | 1092 | 162 | 49 |
| | 15 | 130 | 36376 | 653 | 4 | 3 | 67121 | 1205 | 7 | 6 |
| 48E8 | 30 | 100 | 141760 | 2148 | 104 | 16 | 289990 | 4395 | 212 | 33 |
| | 15 | 100 | 266496 | 907 | 5 | 4 | 528234 | 1797 | 11 | 8 |
| 48E6 | 30 | 162 | 0 | 113943 | 13528 | 2719 | 0 | 190141 | 22575 | 4537 |
| | 15 | 156 | 0 | 9887 | 126 | 59 | 0 | 18595 | 236 | 112 |
| 47E6 | 30 | 100 | 23480 | 2157 | 46 | 9 | 46319 | 4255 | 91 | 18 |
| | 15 | 146 | 136 | 18653 | 63 | 0 | 248 | 33971 | 115 | 0 |
| 46E9 | 30 | 127 | 58816 | 21784 | 752 | 98 | 109470 | 40545 | 1400 | 181 |
| | 15 | 132 | 0 | 49626 | 529 | 141 | 0 | 91993 | 980 | 261 |
| 46E8 | 30 | 112 | 17532 | 33836 | 151 | 24 | 33268 | 64206 | 286 | 45 |
| | 15 | 115 | 38204 | 16234 | 14 | 0 | 72627 | 30861 | 27 | 0 |
| 46E6 | 30 | 54 | 4 | 0 | 0 | 0 | 9 | 0 | 0 | 0 |
| | 15 | 100 | 1100 | 141 | 5 | 1 | 2201 | 283 | 11 | 3 |
| 44E8 | 30 | 115 | 0 | 6034 | 327 | 57 | 0 | 11648 | 631 | 109 |
| | 15 | 106 | 208 | 11187 | 13 | 0 | 392 | 21105 | 24 | 0 |
| 42E7 | 30 | 60 | 0 | 2 | 0 | 0 | 0 | 5 | 0 | 0 |
| | 15 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41E8 | 30 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 15 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41E7 | 30 | 65 | 24 | 193 | 1 | 0 | 55 | 441 | 2 | 0 |
| | 15 | 59 | 364 | 28 | 0 | 0 | 812 | 62 | 0 | 0 |

## Combined international indices

### *Norway pout*

**Table 3a. Comparison of Norway pout cpue for short and long tows including all rectangles in roundfish areas 1 to 7.**

| | | All North Sea rectangles (roundfish areas 1 to 7) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Age 0 | | Age 1 | | Age 2 | | Age 3 | |
| Tow duration (min) | | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 |
| CPUE (n/hr) | mean | 3836 | 3038 | 3298 | 3062 | 138 | 51 | 32 | 14 |
| | sd | 22474 | 23397 | 10565 | 7753 | 1096 | 131 | 221 | 37 |
| CPUE (n/km$^2$) | mean | 7529 | 5817 | 5738 | 5541 | 233 | 88 | 53 | 24 |
| | sd | 45221 | 46019 | 17967 | 14180 | 1829 | 230 | 369 | 66 |
| | n | 154 | 140 | 154 | 140 | 154 | 140 | 154 | 140 |

The tests for equal variances passed but normality test failed in all cases. However, t-tests with cpue in n/km² and cpue in n/h do not indicate significant differences between tow durations whereas Mann–Whitney rank sum tests would suggest a significant tow duration effect for all age groups but the dataset has many zero catches from areas where Norway pout usually not occur.

**Table 3b. Comparison of Norway pout cpue for short and long tows excluding all rectangles where both tow duration gave a zero catch of one of the age groups.**

| | | Rectangles with both tow durations and non-zero catch of at least one age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Age 0 | | Age 1 | | Age 2 | | Age 3 | |
| Tow duration (min) | | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 |
| CPUE | mean | 4548 | 5452 | 6406 | 5390 | 268 | 91 | 61 | 25 |
| (n/hr) | sd | 17562 | 31028 | 14128 | 9714 | 1524 | 165 | 307 | 47 |
| CPUE | mean | 8774 | 10441 | 11137 | 9757 | 453 | 158 | 103 | 43 |
| ($n/km^2$) | sd | 35395 | 61050 | 23975 | 17795 | 2543 | 289 | 512 | 84 |
| | n | 78 | | | | | | | |

Here, t-test, paired t-tests and Wilcoxon signed rank tests do not indicate significant effects of tow duration on cpue. However, the power of the tests is low and the analysis does not account for position, depth and vessel effects.

*Cod*

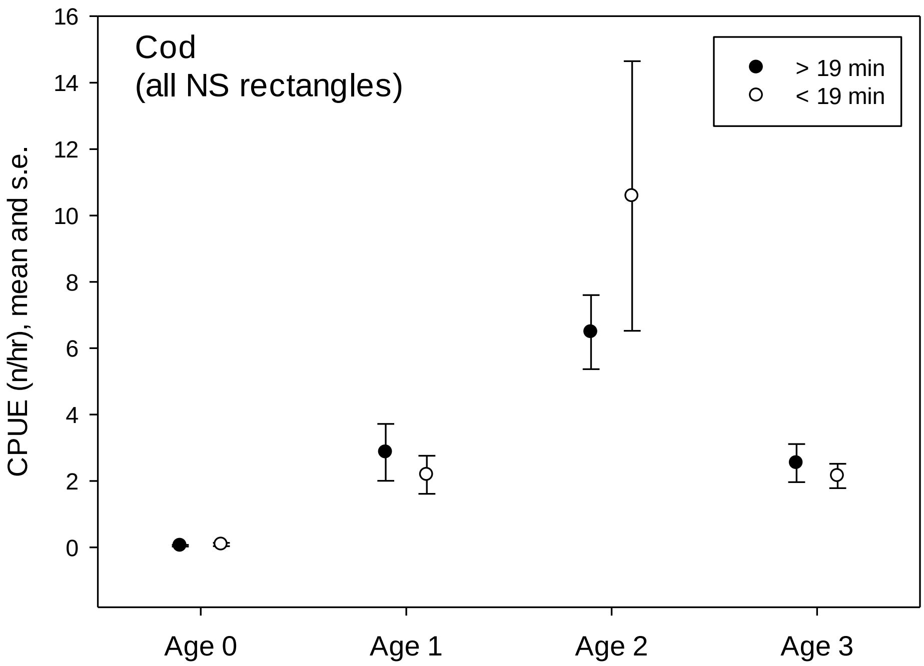



**Figure 4. Average cod cpue by age from short and long tows.**

For none of the age groups a significant difference between the two cpue's (Figure 4) was found (t-tests, Mann–Whitney rank sum tests).

*Whiting*

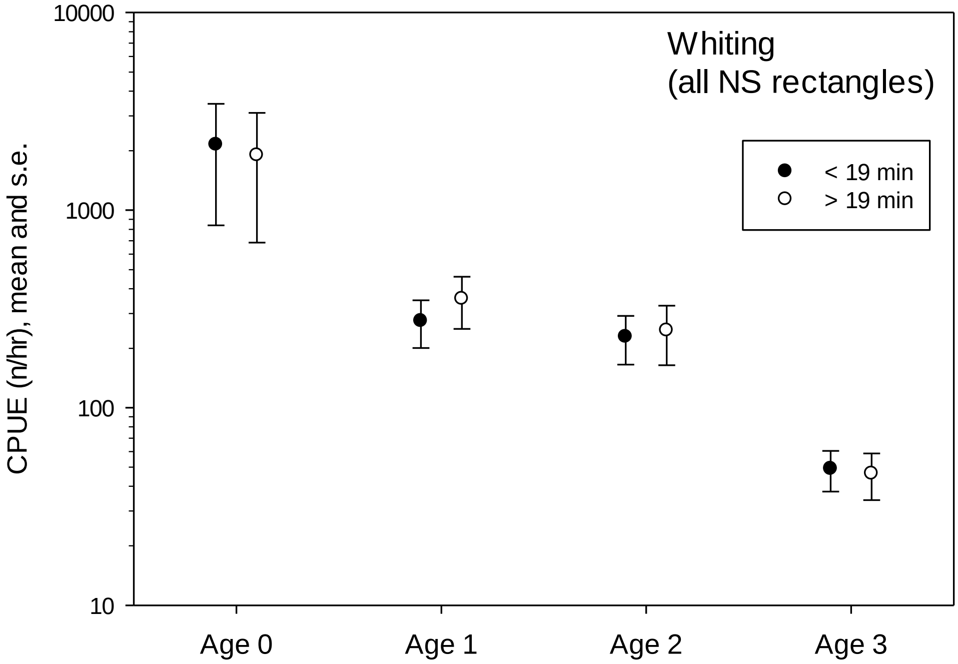
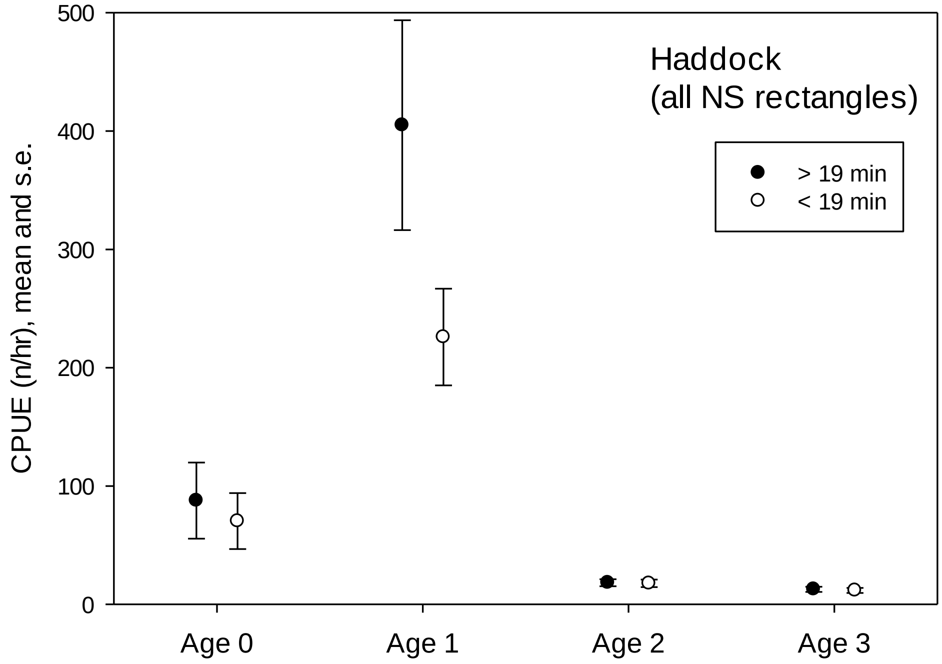



**Figure 5. Average whiting cpue by age from short and long tows.**

Similar results as for cod were obtained, i.e. for all age groups the difference in the two cpue's is not great enough for being significant (Figure 5).

*Haddock*



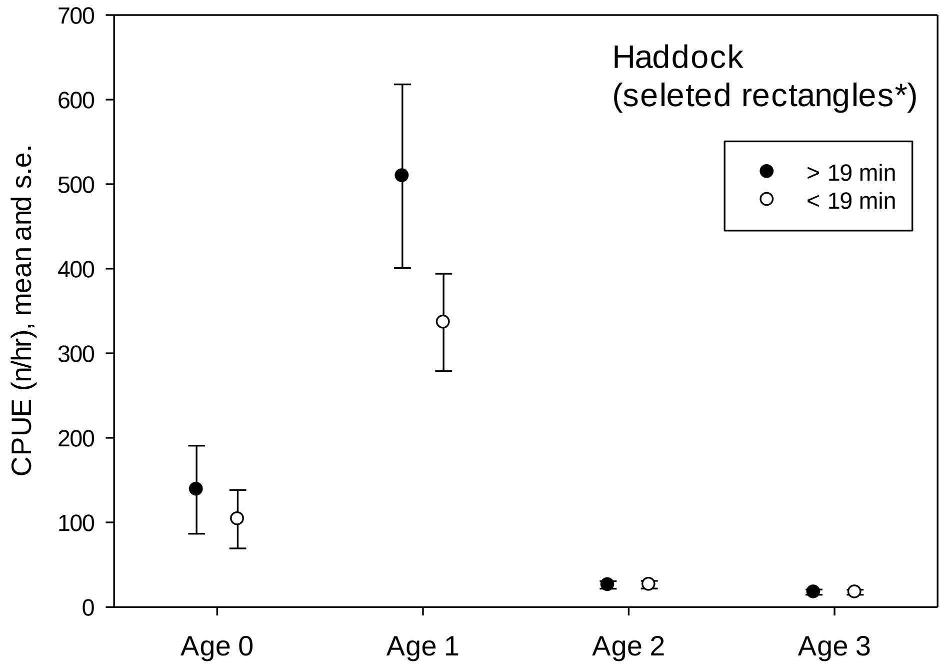




**Figure 6. Average haddock cpue by age from short and long tows (*: only rectangles with both tow durations and non-zero catch of at least one of the four age groups (n = 94))**

Similar results as for the other species were found, i.e. difference in the cpue's by age (Figure 6) were not great enough for being significant, even not for age 1 for which the largest difference was detected, irrespectively whether all North Sea rectangles are included or the reduced data excluding the many zero values from roundfish areas 5 and 6 where haddock usually do not occur is used.

*Saithe*

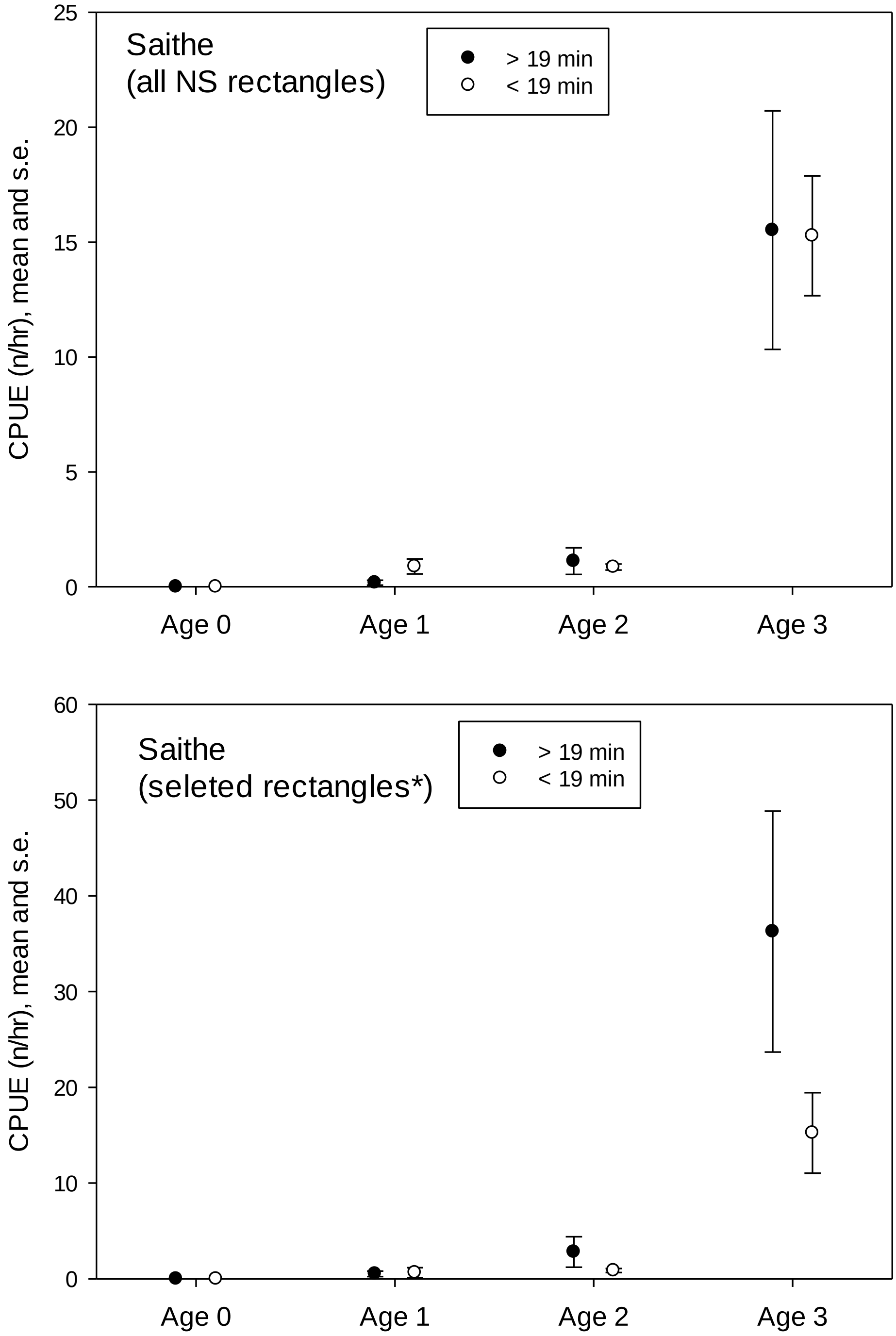



**Figure 7. Average saithe cpue by age from short and long tows (*: only rectangles with both tow durations and non-zero catch of at least one of the four age groups (n = 54)).**

Also for saithe, the difference of the two cpue series by age are not great enough for being significant, irrespectively whether all North Sea rectangles are included or the reduced dataset excluding the many zero values from areas where saithe do not occur is used, even not for age 3 (for which the largest difference was found in the reduced dataset).

## Conclusions

The preliminary analyses - encompassing the species Norway pout, cod, whiting, haddock, and saithe - did not indicate that cpue differs depending on tow duration. However, the power of the tests were low and potential effect of vessel, depth and geographical location were not included in the comparisons of average cpue. Hence, more sophisticated analysis methods should be applied and probably an extended dataset, i.e. one or two more years of data, may be needed before conclusive results can be obtained.

# WD4: Effect of tow duration on catch rates of whiting and cod in the NS-IBTS 3Q2015 (K. Wieland)

## Introduction

IBTSWG 2015 agreed to conduct an experiment on tow duration in NS-IBTS Q3 2015, because evidence exists for other surveys that benefits arose from changing to shorter tow duration (see IBTSWG Report 2015 section 10.3. for a thorough discussion on the pros and cons). Preliminary analyses did not indicate that introduction of 15 min tows in Q3 2015 impair the consistency of the survey indices (Wieland, WD1 IBTS WG 21016). However, the power of the tests were low and potential effect of vessel, depth and geographical location were not included in the comparisons of average cpue. To account for these covariates, GAM's have been used in the present analysis.

## Material and Methods

An almost geographically balanced distribution of nominal 15 and 30 min tows have available from the NS-IBTS 3Q2015 for roundfish areas 1 to 7. This dataset includes tows from 5 different vessels and usually 2 hauls per rectangle, one 30 min and one 15 min tow, were done by two different countries while in some rectangles the same country did a long and a short tow (IBTS WG 2016). The analysis has been based on DATRAS cpue per age per hauls and HH records (download 10 March 2016 with DATRAS date of calculation 4 March 2016), and the dataset comprises 300 hauls in total for roundfish areas 1 to 7.

Catch-at-age and effort by haul was analysed using GAM's with the following setup (subscript for haul omitted):

$g(\mu)$ = s(Depth) + s(Time of day) + s(Lon, Lat) + s(Tow duration) + f(Vessel) + off-set(log(Swept area))

where the expected response $\mu$ is $N_{Age}$ per haul for age 0, 1, 2, 3+.

A negative binominal distribution was used with a log link and log(Swept area) as offset assuming proportionality between catch in numbers and effort. The negative binominal distribution was chosen considering that the data are counts which include zero observations. Restrictions of the number of knots (k) determining the "wiggliness" of the curve (k = 5 for the 1D smoothers and k = 25 for the 2D smoother) were applied and a gamma of 1.4 was used to avoid overfitting.

## Results

### *Whiting $N_{Age}$*

Whiting was widely distributed in roundfish area 1–7 (IBTS WG 2016). For all age groups, depth, and geographical position have a highly significant effect on the catch rates while tow duration has not, and the corresponding QQ plots and histograms of the residuals look acceptable in all cases (Figures 1–4).

### *Cod $N_{Age}$*

Cod was missing in large parts of the area (IBTS WG 2016) and the dataset contains a high amount of zero observations. Tow duration has no significant effect on the catch rates but some of the QQ plots and the distribution of the residuals indicate problems with the model fits (Figures 5–8).

## Conclusions

No clear indication is obvious that the experimental 15 min tows are less representative than the standard 30 min for the catch rates at age for whiting and cod. However, the model diagnostics needs to be checked in more detail, in particular for cod, and alternative model set ups may be explored before conclusive results can be achieved. Nonetheless, it appears appropriate to continue with a balanced distribution of nominal 15 and 30 min tows in the future 3Q NS-IBTS surveys unless contradictory results are found for other IBTS target species.

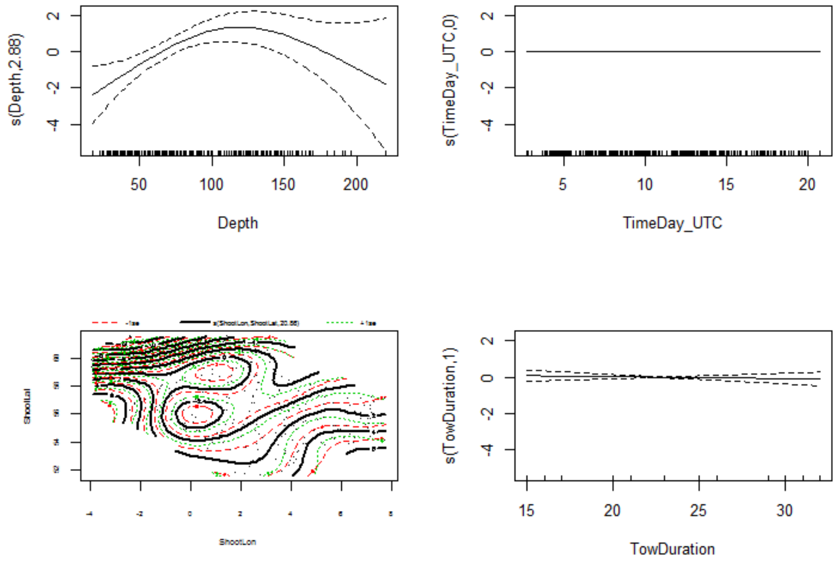



**Figure 1a. Whiting age 0 response (Time of day and tow duration not significant, vessel effects (relative to DAN2): JHJ and WAH3 significant, Deviance explained: 55.8%.**

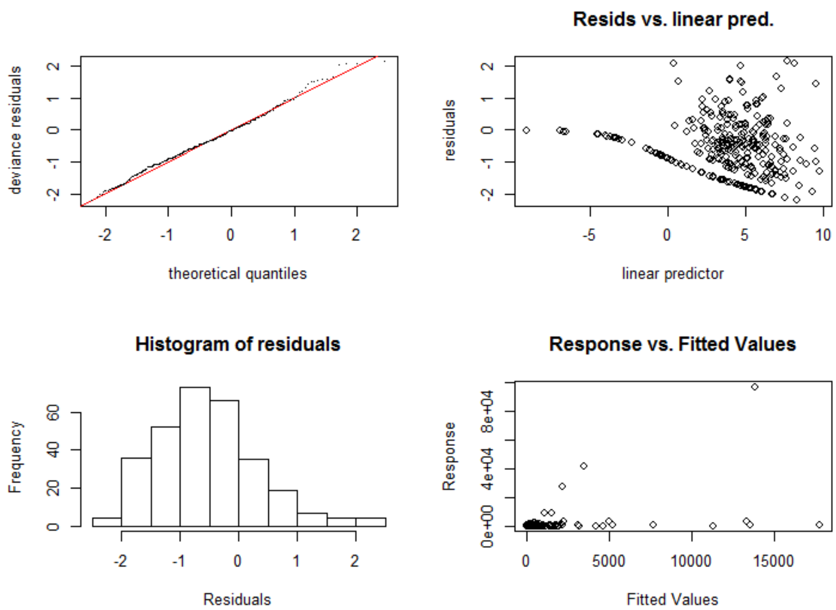



**Figure 1b. Whiting age 0 model diagnostics.**

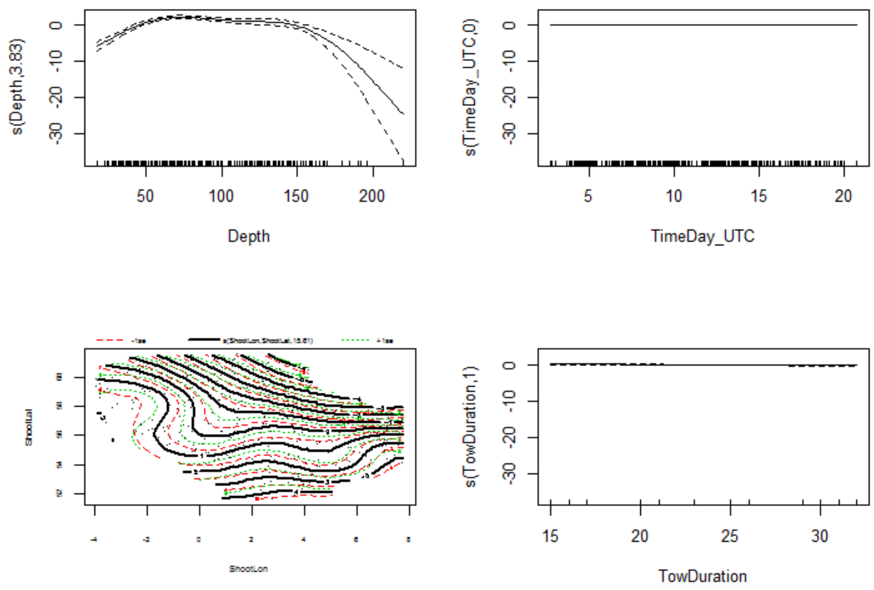



**Figure 2a. Whiting age 1 response (Time of day and tow duration not significant, vessel effects (relative to DAN2): WAH3 significant, Deviance explained: 61.3%.**

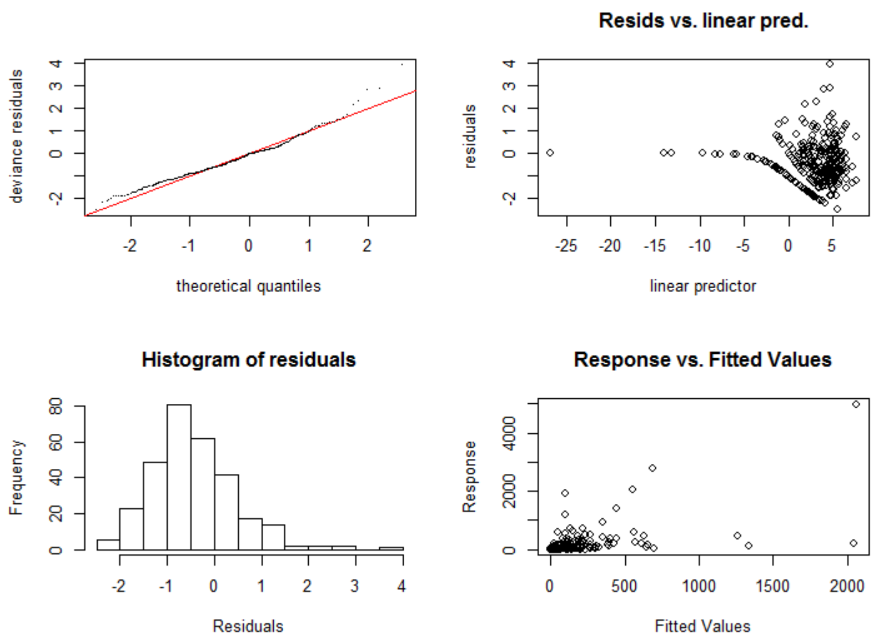



**Figure 2b. Whiting age 1 model diagnostics.**

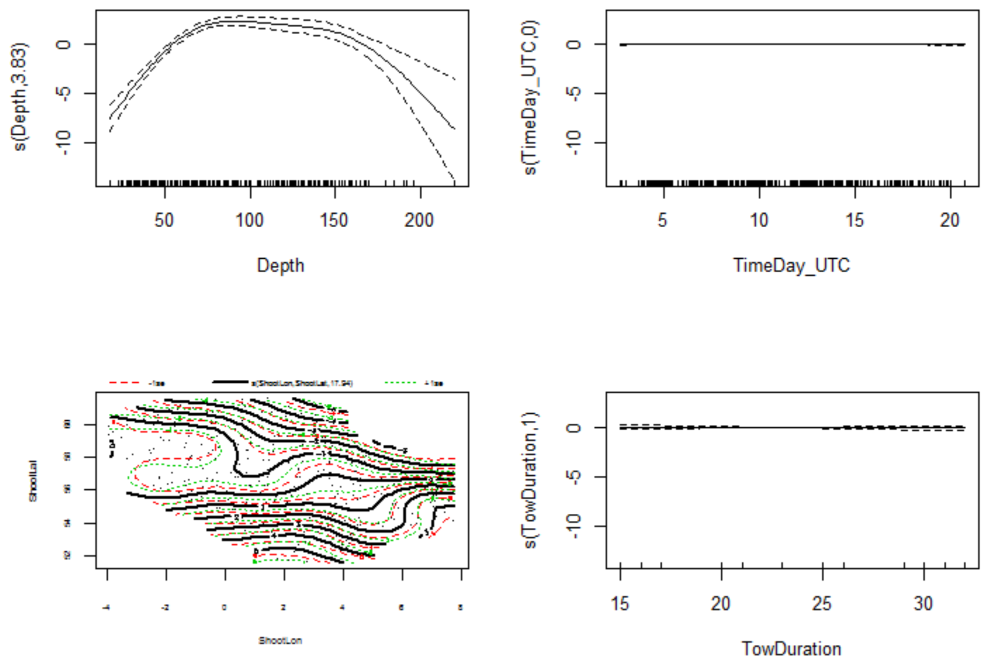



Figure 3a. Whiting age 2 response (Time of day and tow duration not significant, vessel effects (relative to DAN2): WAH3 significant, Deviance explained: 59.8%.

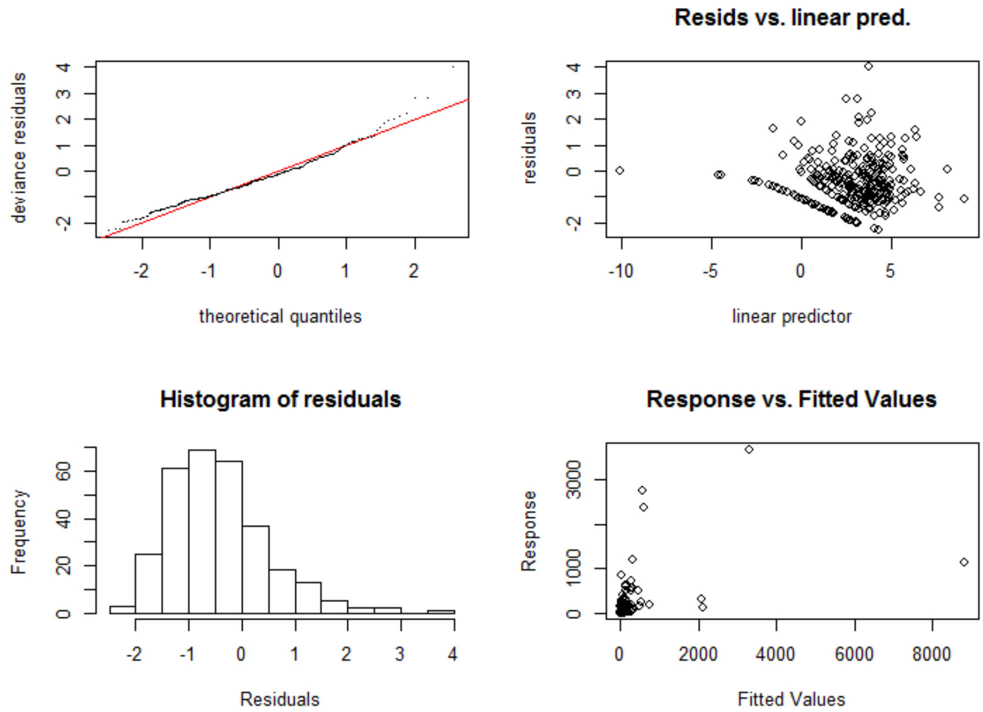



Figure 3b. Whiting age 2 model diagnostics.

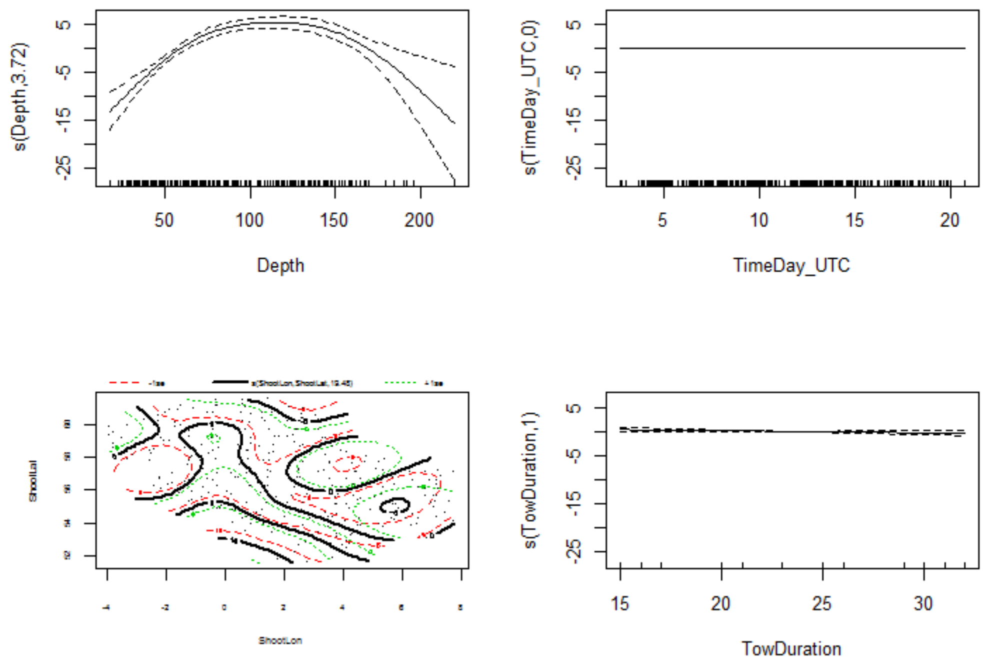



Figure 4a. Whiting age 3+ response (Time of day and tow duration not significant, vessel effects (relative to DAN2): END significant, Deviance explained: 75.1%.

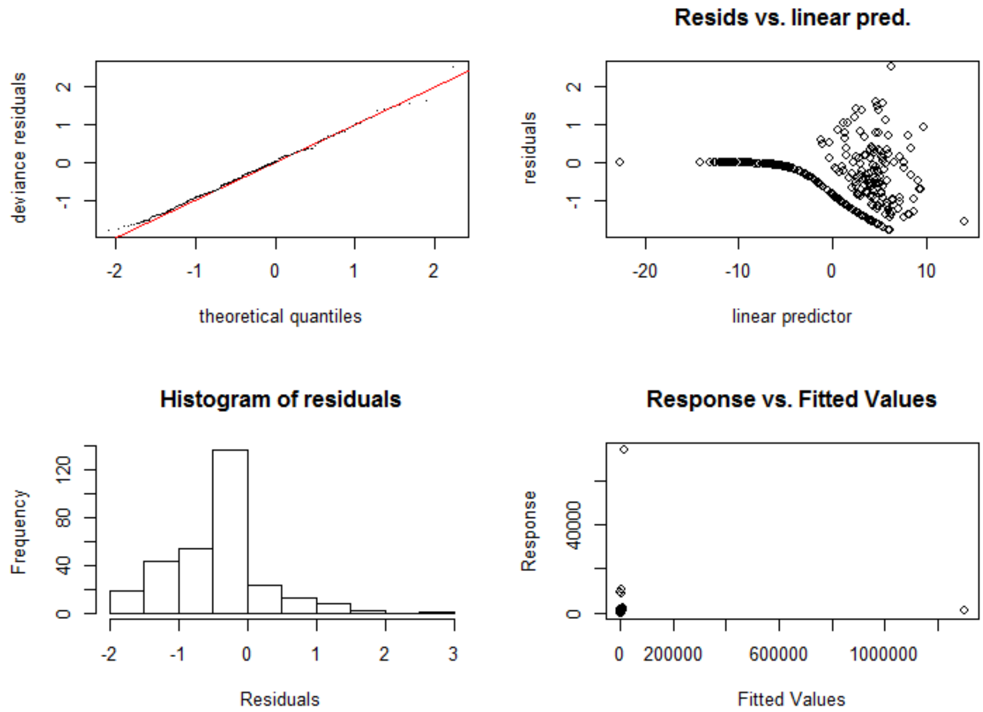



Figure 4b. Whiting age 3+ model diagnostics.

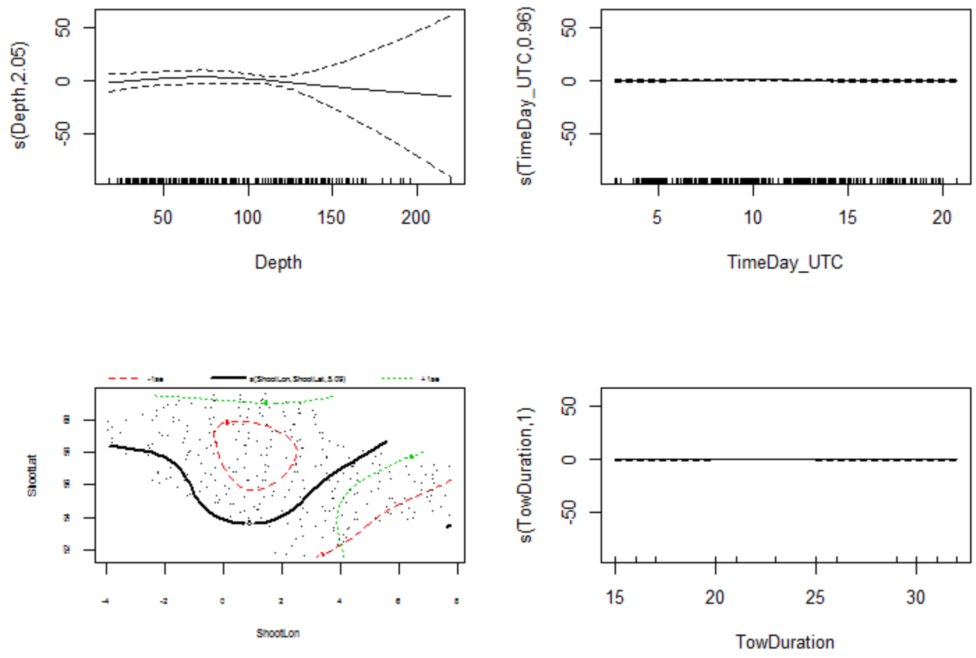



**Figure 5a. Cod age 0 response (Depth, time of day, geographical position and tow duration not significant, vessel effects (relative to DAN2): none, Deviance explained: 58.1%.**

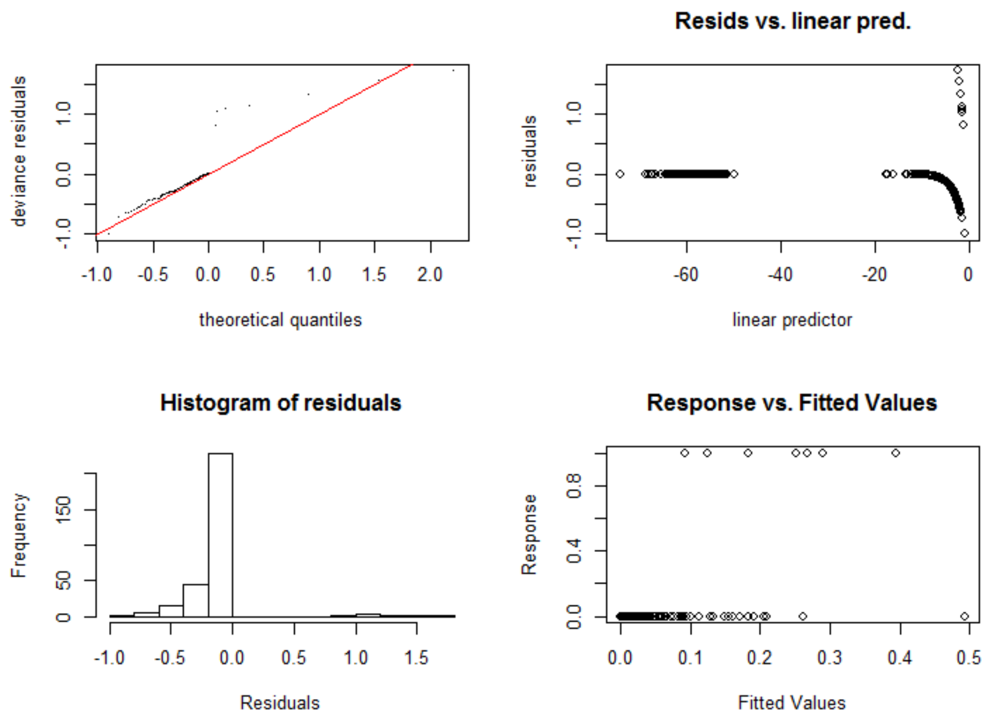



**Figure 5b. Cod age 0 model diagnostics.**

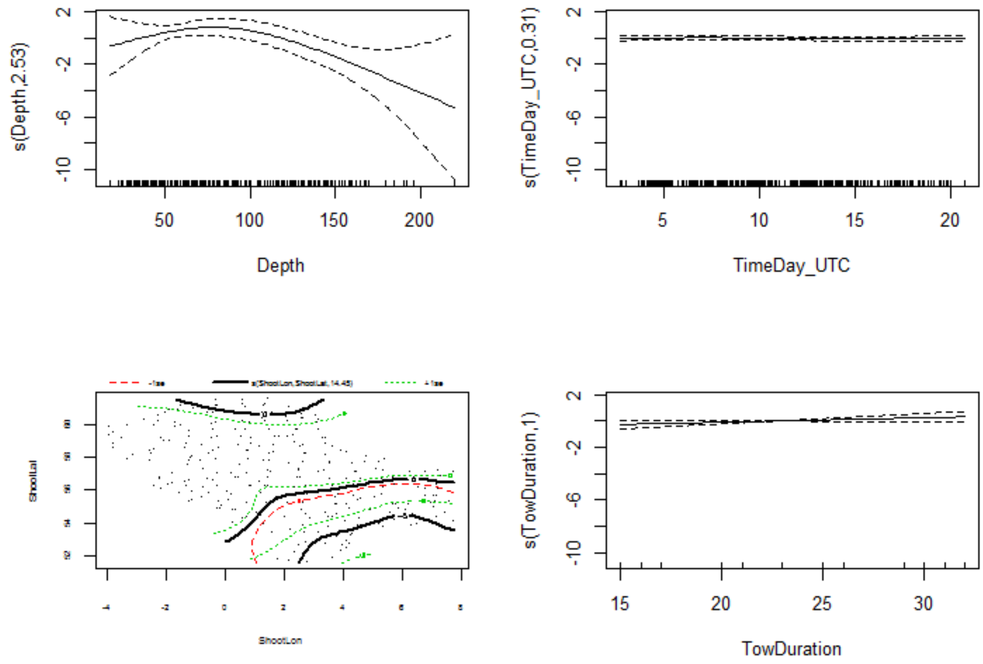



**Figure 6a. Cod age 1 response (Time of day and tow duration not significant, vessel effects (relative to DAN2): none, Deviance explained: 61.2%.**

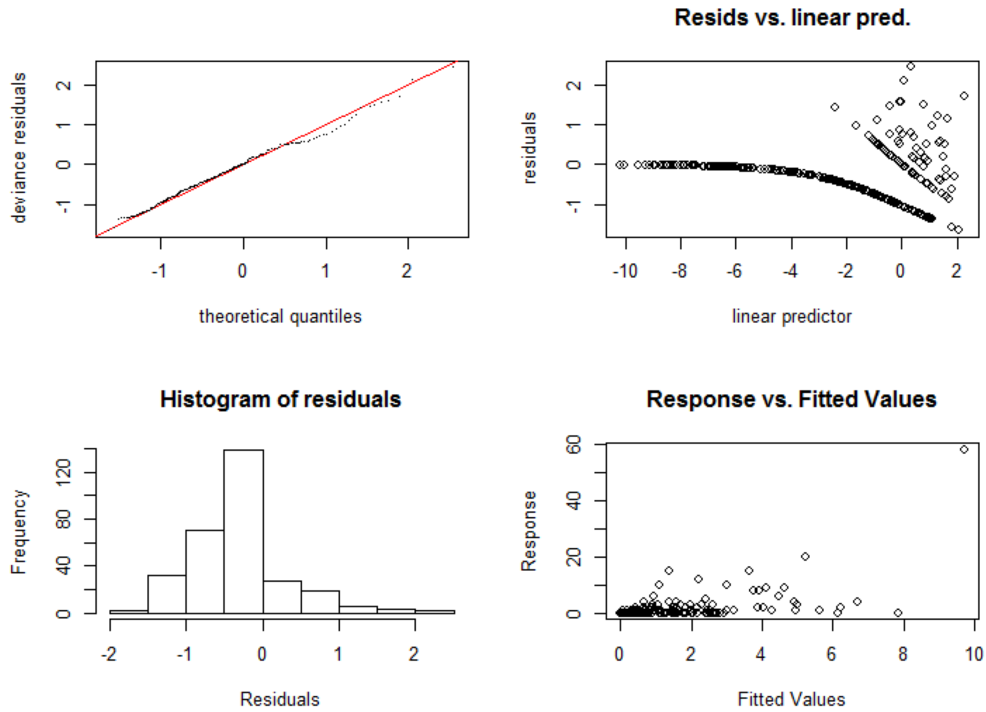



**Figure 6b. Cod age 1 model diagnostics.**

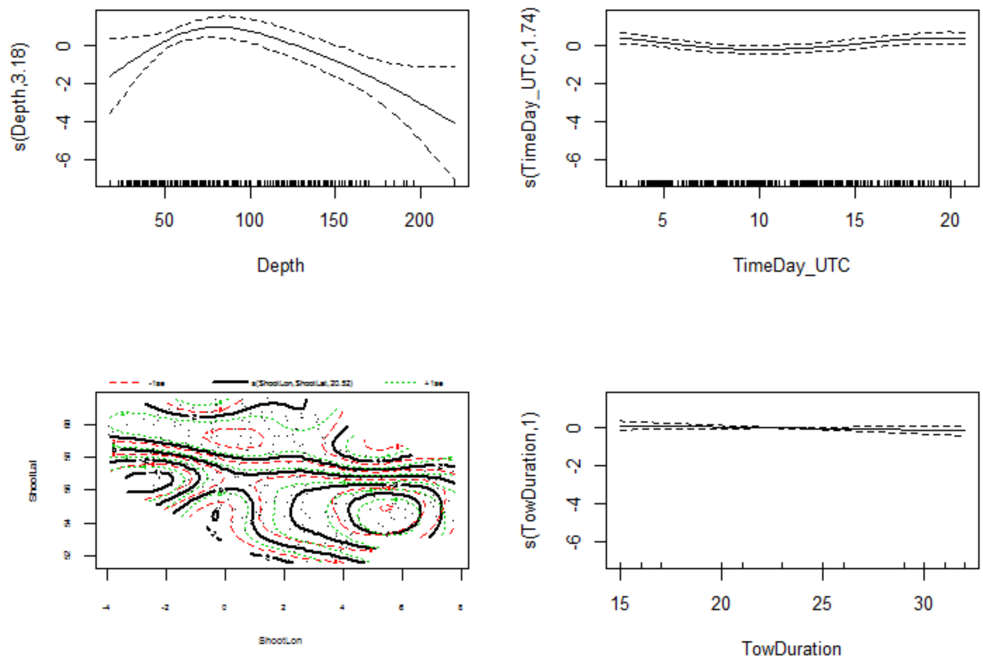



**Figure 7a. Cod age 2 response (Tow duration not significant, vessel effects (relative to DAN2): none, Deviance explained: 77.6%.**

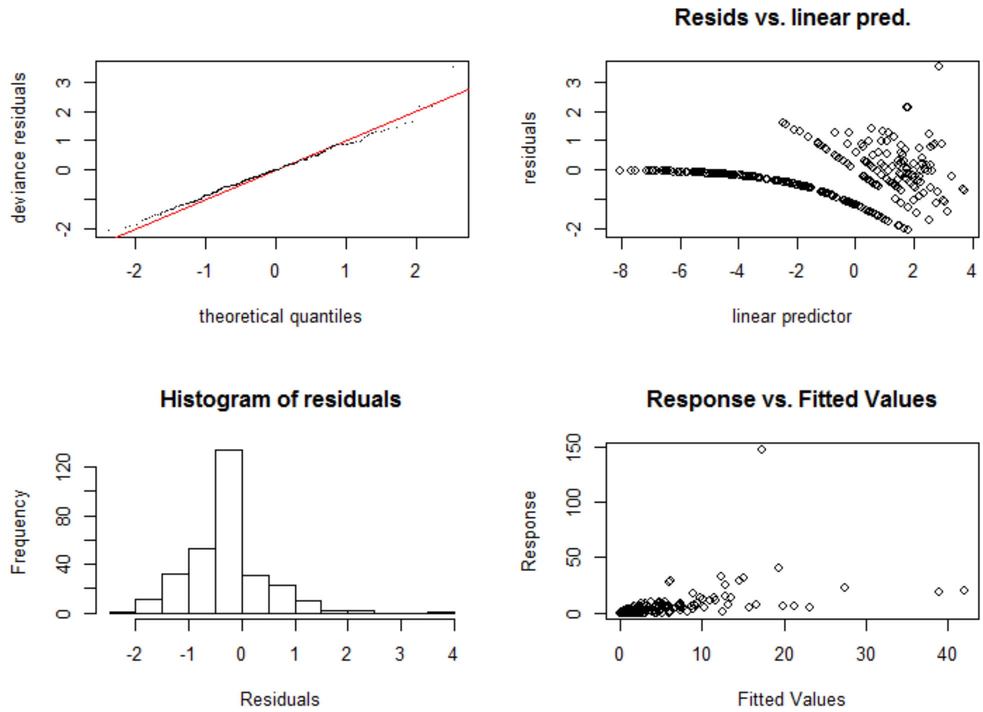



**Figure 7b. Cod age 2 model diagnostics.**

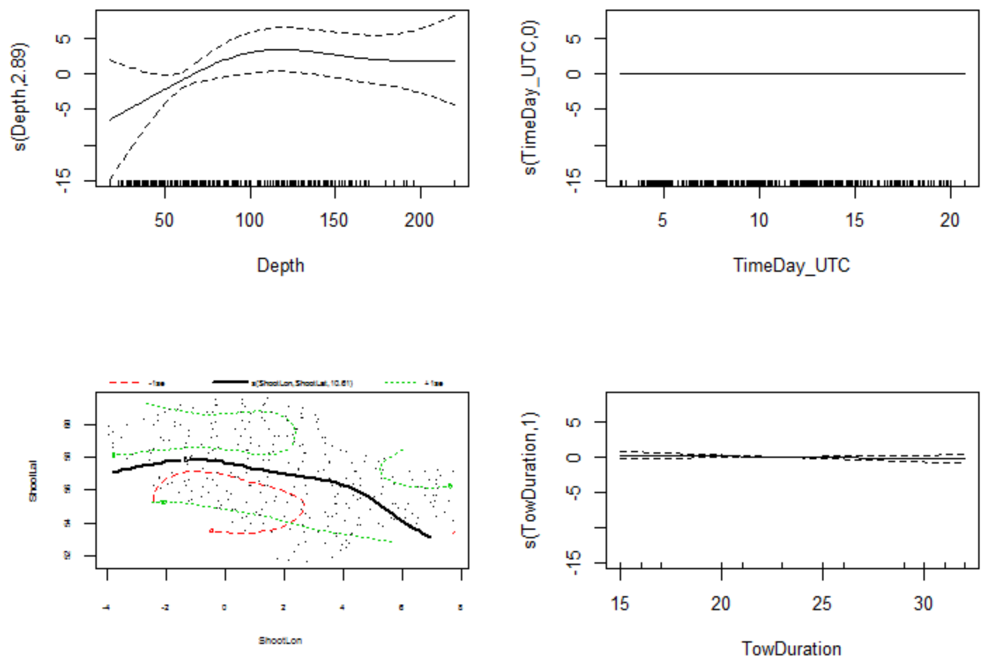



**Figure 8a. Cod age 3+ response (Depth, time of day and tow duration not significant, vessel effects (relative to DAN2): none, Deviance explained: 77.4 %.**

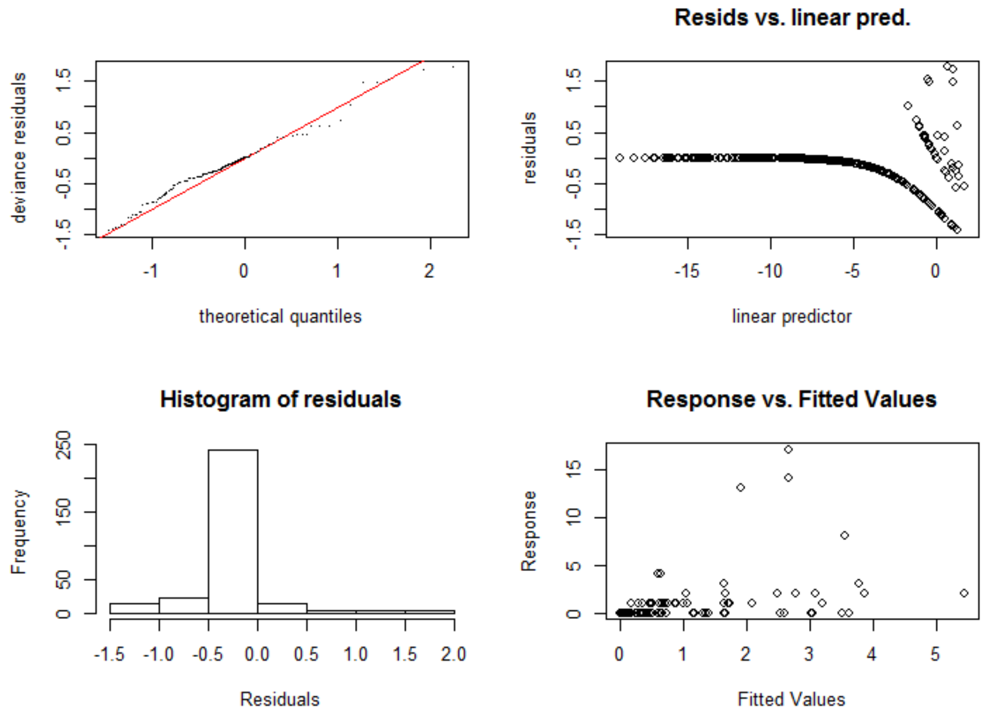



**Figure 8b. Cod age 3+ model diagnostics.**

## WD5: Data analysis for haddock and Norway pout from tow duration experiment NS-IBTS 3rd quarter 2015 (A. Jaworski and F. Burns)

### Introduction

During the meeting of the IBTSWG in 2015, it was proposed that a tow duration experiment be conducted during the Q3 2015 North Sea survey. This was subsequent to several discussions on survey design where the issue of tow duration on IBTS surveys was raised and whether, in fact, 30 minutes was the optimal duration for this survey. Obvious benefits of shorter tows include potentially increasing the total number of hauls undertaken during the survey as well as reducing the probability of gear damage and a reduction in the level of subsampling required. Several studies were discussed that examined the effects of reducing tow duration and on balance, it was decided to proceed with a similar study during Q3 2015.

### Data and Analysis

For all the North Sea rectangles within the Q3 survey area that were sampled twice, it was proposed that, within each rectangle, one trawl of a typical 30 minute duration would be completed with another being undertaken with a trawl duration of 15 minutes. The resultant dataset provided an almost 50/50 split across the entire survey area of both haul duration categories. In most instances, haul duration was of either 15 or 30 minutes, although several hauls were found to be of an intermediate duration and so the hauls were grouped in two categories, "short" (15–17 minutes) and "long" (20–32 minutes). A total of 352 valid hauls were completed during the survey. Removal of the Skaggerak and Kattegatt hauls reduced the number to 300 hauls that were then included in the analysis consisting of 156 "long" and 144 "short" hauls. MSS was tasked with analysing and comparing the catch rates for haddock (*Melanogrammus aeglefinus*) and Norway pout (*Trisopterus esmarkii*) from both haul duration categories and report the results to the IBTSWG in 2016.

For the analysis, the haul data included, among others, geographical position (longitude, latitude), depth (in m), haul number, vessel, statistical rectangle, tow duration (in minutes) and swept-area (in km$^2$). As has already been mentioned, this experiment only included hauls undertaken in the North Sea area. Therefore, hauls from Skagerrak and Kattegatt were excluded from the analysis. The catch data for each age group of the two species were expressed as recorded numbers, numbers per 30 minutes or numbers per km$^2$.

First, the observed numbers of fish, standardized to 1 km$^2$, were viewed. They varied with the haul depth and geographical position. The largest numbers were typically observed at intermediate depths (Figure 1). With no account given to the vessel or haul position, no obvious differences could be seen along the depth gradient between the two haul categories at this stage of the analysis. There were also some indications of non-linear relationships along the longitude and latitude gradients (not shown).

Further investigation of the data clearly demonstrated a non-linear relationship with respect to depth and geographical position and, consequently, additive modelling was deemed to be a suitable alternative to linear regression (Zuur *et al.*, 2007). A statistical model (a negative binomial GAM for counts with a log link function) was used to estimate catch. This was run separately for age groups as well as for an additional group "all ages" for both species. Due to the sparsity of age 5 Norway pout, these data were merged with age 4 Norway pout into one age group. The recorded numbers were the response variable in the model. The log of door swept-area was used as an offset. The explanatory variables included haul category, vessel, depth, and the interaction between longitude and latitude.

The model was formulated as:

NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Depth) + s(Lat, Long)

The likelihood based method REML was used to find the appropriate smoothness.

The significance of the haul category effect was tested (chi-square test) by comparing two models: the full model (with all the explanatory variables) and the reduced model in which the haul category was ignored.

All the analyses were conducted using the statistical package R (R Development Core Team, 2013). The package `mgcv` provided functions for generalized additive modelling.

## Results

The shape parameter (theta) in the negative binomial distribution was selected through optimization. It varied within a wide range from 0.4 to 28.0 for haddock and from 0.2 to 0.7 for Norway pout (Table 1). Both depth and geographical position explained a significant proportion of the variation in catch rate (see Figure 2 for depth).

The haul category ("long" vs. "short") hardly had an effect on catch rate (i.e. the number of fish per $km^2$). The modelled difference (on the log scale) between "long" and "short" hauls had both positive and negative values (Table 1, see also the model run in Annex 1). For all ages separately and for the aggregate age groups of haddock, there were some indications of the catch rate being higher in shorter hauls (by 2–35%). However, these differences were not statistically significant.

With regard to Norway pout, there were some indications of the catch rate being lower in shorter hauls (but not in age group 4–5). With the exception of age 1, these differences were not statistically significant. For age 1, the catch rate was significantly lower in shorter hauls by 40% ($p = 0.011$).

In conclusion, the available data for the two species show little evidence of the catch rate being different in the two haul categories.

## References

Zuur, A., Ieno, E. N. and Smith G. M., 2007. Analysing Ecological Data. Statistics for Biology and Health. Springer Science & Business Media.

R Core Team, 2013. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. <URL: http://www.R-project.org/>.

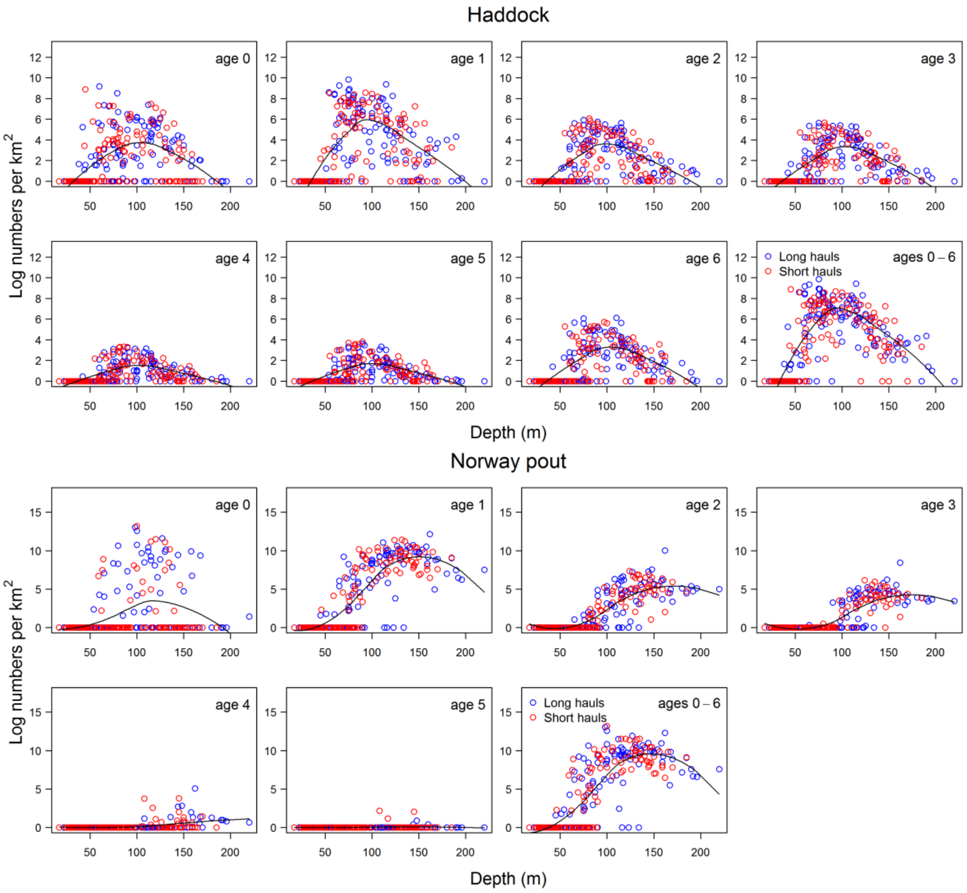



**Figure 1. Scatterplots of log numbers-at-age for haddock (upper panel) and Norway pout (lower panel). The points show observations in the two haul categories. The line represents a loess smoother (with a span of 0.95).**

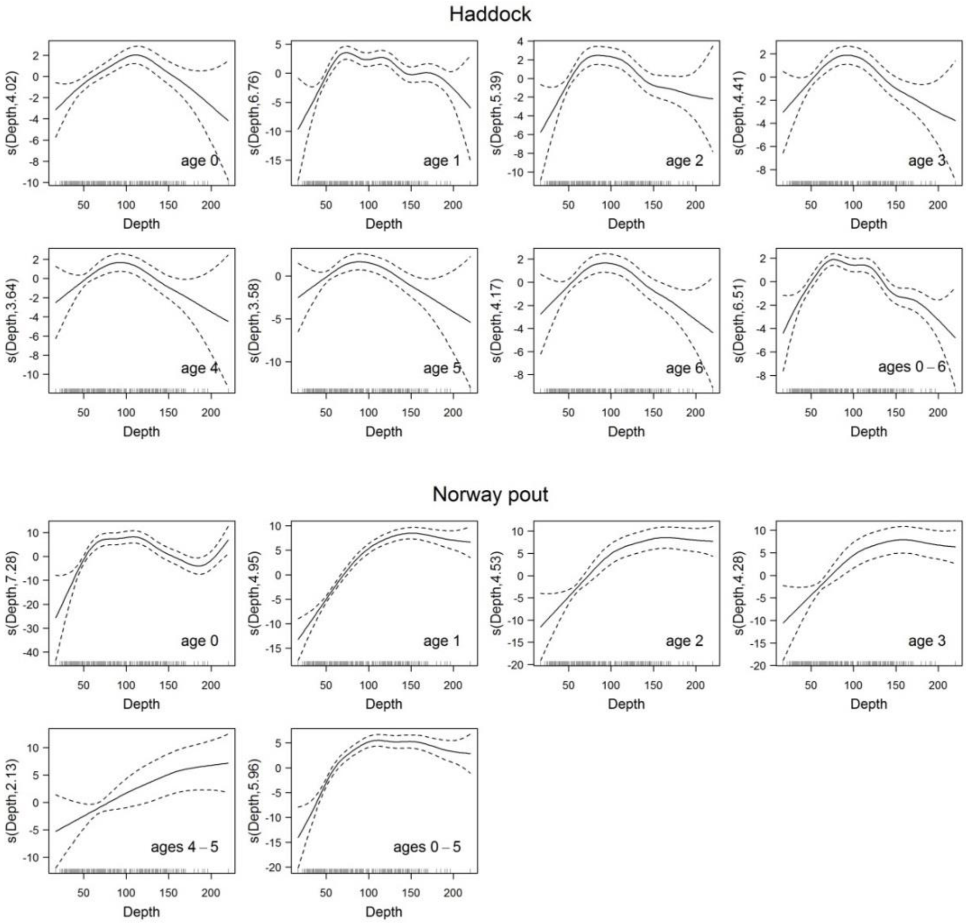



**Figure 2. Smoothing curves for depth for haddock (upper panel) and Norway pout (lower panel) in the GAM model with negative binomial distribution and log link. The dotted lines are 95% confidence bands.**

**Table 1. Summary of the GAM analysis for the difference in catch rate between long and short hauls, for haddock and Norway pout.**

| Species | Age | Theta parameter, $\Theta$ | Modelled difference between "long" and "short", $\underline{D}$ | exp($D$) | Deviance explained (%) | Proba-bility, $P$ |
|---|---|---|---|---|---|---|
| haddock | 0 | 0.433 | 0.019 | 1.02 | 76.5 | 0.863 |
| | 1 | 0.672 | 0.235 | 1.27 | 85.3 | 0.328 |
| | 2 | 1.037 | 0.199 | 1.22 | 79.5 | 0.391 |
| | 3 | 1.177 | 0.227 | 1.25 | 78.5 | 0.325 |
| | 4 | 28.015 | 0.300 | 1.35 | 62.7 | 0.163 |
| | 5 | 5.341 | 0.259 | 1.30 | 68.9 | 0.304 |
| | 6 | 1.076 | 0.293 | 1.34 | 79.5 | 0.254 |
| | 0–6 | 1.041 | 0.135 | 1.14 | 86.7 | 0.422 |
| Norway pout | 0 | 0.477 | –0.169 | 0.84 | 99.7 | 0.422 |
| | 1 | 0.313 | –0.914 | 0.40 | 78.4 | 0.011 |
| | 2 | 0.597 | –0.383 | 0.68 | 87.3 | 0.284 |
| | 3 | 0.711 | –0.377 | 0.68 | 87.6 | 0.224 |
| | 4–5 | 0.390 | 0.168 | 1.18 | 77.4 | 0.722 |
| | 0–5 | 0.230 | –0.067 | 0.94 | 95.1 | 0.613 |

# Annex 1. GAM analysis

## Haddock

```
##### Age 0

Family: Negative Binomial(0.433)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 20.48
4.02  total = 30.5

REML score: 696.0103

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)    2.08146  0.52023   4.001 6.31e-05 ***
 HaulCatShort  0.01869   0.29052   0.064     0.9487
 ShipEND       -0.87465  0.51124   -1.711    0.0871 .
 ShipJHJ       -2.40096  0.56957   -4.215 2.49e-05 ***
 ShipSCO3      -0.11276  0.47468   -0.238    0.8122
 ShipWAH3      -1.05010  0.74038   -1.418    0.1561
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat) 20.478 23.971
211.34  < 2e-16 ***
s(Depth)       4.022  5.018  30.66 1.13e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  -0.18     Deviance explained = 76.5%
REML score = 696.01  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df  Deviance Pr(>Chi)
 1   269.5     199.27
 2   270.5     199.30 -1.0003 -0.029837     0.863
df                        AIC
model1.gam 30.49939 1366.108
model2.gam 29.49907 1364.137

##### Age 1

Family: Negative Binomial(0.672)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 20.23
6.76  total = 32.99

REML score: 951.4171

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)    0.02443  0.96049   0.025    0.980
 HaulCatShort  0.23534   0.24061   0.978    0.328
 ShipEND       -0.40997  0.47039   -0.872   0.383
```

```
 ShipJHJ    -0.53194    0.50627   -1.051   0.293
 ShipSCO3   -0.14863    0.43201   -0.344   0.731
 ShipWAH3   -0.29749    0.76052   -0.391   0.696

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value s(Long,Lat) 20.23
22.721 307.08  <2e-16 ***
s(Depth)       6.76  7.508  94.95  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.395     Deviance explained = 85.3%
REML score = 951.42  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev           Df Deviance Pr(>Chi)
 1   267.01     202.96
 2   267.99     203.89 -0.98026 -0.93278    0.3275
df                        AIC
model1.gam 32.98989 1852.513
model2.gam 32.00962 1851.485

##### Age 2

Family: Negative Binomial(1.037)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 18.50
5.39  total = 29.88

REML score: 547.8146

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)  -0.13053  0.68749   -0.190   0.849
 HaulCatShort 0.19901   0.22427   0.887    0.375
 ShipEND      -0.17702  0.45308   -0.391   0.696
 ShipJHJ      -0.36034  0.49126   -0.734   0.463
 ShipSCO3     0.07308   0.43192   0.169    0.866
 ShipWAH3     -0.19097  0.67931   -0.281   0.779

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat) 18.497 21.650
133.21  < 2e-16 ***
s(Depth)       5.388  6.389  75.51 8.78e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.502     Deviance explained = 79.5%
REML score = 547.81  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev           Df Deviance Pr(>Chi)
 1   270.12     196.04
 2   271.11     196.77 -0.99278 -0.72641    0.3914
df                        AIC
model1.gam 29.88495 1041.819
model2.gam 28.89217 1040.560

##### Age 3

Family: Negative Binomial(1.177)
Link function: log
```

```
Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 18.02
4.41  total = 28.43

REML score: 497.6472

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   0.1388     0.6268    0.221    0.825
 HaulCatShort  0.2265     0.2174    1.042    0.298
 ShipEND       -0.3595    0.4447    -0.808   0.419
 ShipJHJ       -0.6031    0.4829    -1.249   0.212
 ShipSCO3      -0.2188    0.4237    -0.516   0.606
 ShipWAH3      -0.3711    0.6564    -0.565   0.572

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat) 18.02
21.239 115.17 7.46e-15 ***
s(Depth)       4.41   5.387   67.62 9.96e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.538     Deviance explained = 78.5%
REML score = 497.65  Scale est. = 1           n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev           Df Deviance Pr(>Chi)
 1   271.57     192.51
 2   272.55     193.47 -0.98633 -0.95245    0.3246
df                         AIC
model1.gam 28.43173 947.2787
model2.gam 27.44540 946.2585

##### Age 4

Family: Negative Binomial(28.015)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 15.52
3.64  total = 25.17

REML score: 220.5026

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   -0.8635    0.6610    -1.306   0.191
 HaulCatShort  0.3002     0.2404    1.249    0.212
 ShipEND       -0.5595    0.4359    -1.283   0.199
 ShipJHJ       -0.9778    0.5240    -1.866   0.062 .
 ShipSCO3      -0.6601    0.4297    -1.536   0.125
 ShipWAH3      -1.0816    0.7088    -1.526   0.127
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat) 15.525 19.034
46.57 0.000419 ***
s(Depth)       3.641   4.496   33.60 2.18e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.577     Deviance explained = 62.7%
REML score =  220.5  Scale est. = 1           n = 300
```

```
Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1   274.83     154.93
 2   275.94     157.06 -1.1049  -2.1371    0.1631
df                         AIC
model1.gam 25.16542 379.6361
model2.gam 24.06048 379.5634

##### Age 5

Family: Negative Binomial(5.341)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 17.46
3.58  total = 27.04

REML score: 246.9166

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   -1.4289    0.8868    -1.611   0.107
 HaulCatShort  0.2587     0.2370    1.091    0.275
 ShipEND       -0.5345    0.4485    -1.192   0.233
 ShipJHJ       -0.7464    0.5303    -1.408   0.159
 ShipSCO3      -0.4278    0.4289    -0.997   0.319
 ShipWAH3      -0.4364    0.6239    -0.700   0.484

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value s(Long,Lat) 17.464 20.511
54.51 6.62e-05 ***
s(Depth)       3.576  4.407  31.69 4.59e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.596     Deviance explained = 68.9%
REML score = 246.92  Scale est. = 1           n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev           Df Deviance Pr(>Chi)
 1   272.96     149.83
 2   273.94     150.86 -0.98023  -1.0287    0.3041
df                         AIC
model1.gam 27.03979 428.9450
model2.gam 26.05956 428.0133

##### Age 6

Family: Negative Binomial(1.076)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 18.63
4.17  total = 28.79

REML score: 503.4237

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)    -0.2544   0.7856  -0.324     0.746
 HaulCatShort    0.2933   0.2240      1.309  0.191
```

```
 ShipEND     -0.3009      0.4599    -0.654   0.513
 ShipJHJ     -0.7704      0.5011    -1.538   0.124
 ShipSCO3    -0.3203      0.4335    -0.739   0.460
 ShipWAH3    -0.4760      0.6807    -0.699   0.484

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat) 18.627 21.492
122.97 3.84e-16 ***
s(Depth)       4.165  5.113  49.33 2.52e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.542     Deviance explained = 79.5%
REML score = 503.42  Scale est. = 1           n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev           Df Deviance Pr(>Chi)
 1   271.21     185.45
 2   272.16     186.67 -0.94968  -1.2239     0.254
df                         AIC
model1.gam 28.79241 963.6371
model2.gam 27.84272 962.9616

##### Ages 0-6

Family: Negative Binomial(1.041)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 20.61
6.51  total = 33.12

REML score: 1153.541

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   3.7428     0.3664    10.214  < 2e-16 ***
 HaulCatShort  0.1351     0.1791    0.754   0.45080
 ShipEND       -1.0578    0.3339    -3.168  0.00153 **
 ShipJHJ       -1.5328    0.3621    -4.233  2.3e-05 ***
 ShipSCO3      -0.7310    0.3071    -2.380  0.01731 *
 ShipWAH3      -1.0782    0.5145    -2.096  0.03610 *
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value  s(Long,Lat) 20.61
23.873  383.8  <2e-16 ***
s(Depth)       6.51  7.533  123.6  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =     0.13   Deviance explained = 86.7%
REML score = 1153.5  Scale est. = 1           n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1   266.88     231.70
 2   267.92     232.39 -1.0399 -0.68825    0.4215
df                         AIC
model1.gam 33.11801 2262.554
model2.gam 32.07810 2261.163
```

## Norway pout

```
##### Age 0

Family: Negative Binomial(0.477)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 23.01
7.28  total = 36.29

REML score: 646.2641

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)  -10.0622   2.9501    -3.411 0.000648 ***
 HaulCatShort -0.1693    0.3782    -0.448 0.654451
 ShipEND      8.8004     2.3879    3.685 0.000228 ***
 ShipJHJ      0.8265     2.4258    0.341 0.733326
 ShipSCO3     6.7402     2.3613    2.854 0.004311 **
 ShipWAH3     7.4690     2.5903    2.883 0.003933 **
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value s(Long,Lat) 23.011
25.057  563.0  <2e-16 ***
s(Depth)       7.281  7.873  209.3  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  -21.5     Deviance explained = 99.7%
REML score = 646.26  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1   263.71     330.86
 2   264.77     331.56 -1.0587 -0.70628    0.4222
df                        AIC
model1.gam 36.29166 1229.597
model2.gam 35.23294 1228.186

##### Age 1

Family: Negative Binomial(0.313)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 7.07
4.95  total = 18.02

REML score: 1238.702

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|) (Intercept)
                3.6998     0.5742   6.444 1.17e-10 ***
 HaulCatShort  -0.9141    0.3306    -2.765   0.0057 **
 ShipEND       -1.2735    0.6047    -2.106   0.0352 *
 ShipJHJ       -0.7851    0.6638    -1.183   0.2369
 ShipSCO3      1.4088     0.5702    2.471    0.0135 *
 ShipWAH3      0.4565     0.9178    0.497    0.6189
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 Ap-

proximate significance of smooth terms:
```

```
edf Ref.df Chi.sq  p-value s(Long,Lat) 7.068
9.880  45.08 2.03e-06 ***
s(Depth)      4.952  6.007 317.70  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  -2.24     Deviance explained = 78.4%
REML score = 1238.7  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long,
Lat) + s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1     281.98   211.51
 2     283.31   218.82 -1.3252  -7.3103    0.0114 *
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
df                        AIC
model1.gam 18.01945 2481.987
model2.gam 16.69426 2486.646

##### Age 2

Family: Negative Binomial(0.597)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 8.96
4.53  total = 19.49

REML score: 565.0209

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   -1.4254    1.3410    -1.063   0.288
 HaulCatShort  -0.3834    0.3028    -1.266   0.205
 ShipEND       -0.4999    0.8327    -0.600   0.548
 ShipJHJ       -0.6230    0.8735    -0.713   0.476
 ShipSCO3      0.4457     0.8311    0.536    0.592
 ShipWAH3      0.6175     1.1189    0.552    0.581

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value s(Long,Lat) 8.960
11.87                        33.7 0.000711 ***
s(Depth)      4.531   5.43  122.9  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.222     Deviance explained = 87.3%
REML score = 565.02  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev         Df Deviance Pr(>Chi)
 1   280.51     151.02
 2   281.55     152.23 -1.041  -1.2093    0.2835
df                        AIC
model1.gam 19.49095 1121.434
model2.gam 18.44995 1120.562

##### Age 3

Family: Negative Binomial(0.711)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long,
```

```
      Lat) + s(Depth)

Estimated degrees of freedom: 7.45
4.28  total = 17.72

REML score: 379.1862

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)  -1.321e+02  9.132e+06  0.000    1.000
 HaulCatShort -3.765e-01  3.078e-01  -1.223   0.221
 ShipEND      1.289e+02   9.132e+06  0.000    1.000
 ShipJHJ      1.287e+02   9.132e+06  0.000    1.000
 ShipSCO3     1.297e+02   9.132e+06  0.000    1.000
 ShipWAH3     1.304e+02   9.132e+06  0.000    1.000

Approximate significance of smooth terms:
edf Ref.df Chi.sq  p-value  s(Long,Lat)
7.445  9.855  15.24                 0.117
s(Depth)      4.279  5.138  77.78 4.13e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.235     Deviance explained = 87.6%
REML score = 379.19  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
1      282.28     121.37
2      283.53     123.26 -1.2583   -1.887   0.2244
                   df      AIC
model1.gam 17.72419 791.1386
model2.gam 16.46590 790.5090

##### Ages 4-5

Family: Negative Binomial(0.39)
Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)

Estimated degrees of freedom: 8.72
2.13  total = 16.84

REML score: 45.27348

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)  -1.281e+02  9.132e+06   0.00    1.000
 HaulCatShort 1.684e-01   7.656e-01   0.22    0.826
 ShipEND      1.236e+02   9.132e+06   0.00    1.000
 ShipJHJ      1.241e+02   9.132e+06   0.00    1.000
 ShipSCO3     1.226e+02   9.132e+06   0.00    1.000
 ShipWAH3     -1.010e+00  1.483e+07   0.00    1.000

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value  s(Long,Lat) 8.717
11.267  27.24 0.00495 **
s(Depth)      2.126  2.655  14.43 0.00190 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.307     Deviance explained = 77.4%
REML score = 45.273  Scale est. = 1          n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship + s(Long, Lat)
+ s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
```

```
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1   283.16     49.492
 2   284.19     49.632 -1.0358 -0.14006    0.7222
df                        AIC
model1.gam 16.84260 164.3720
model2.gam 15.80681 162.4405

##### Ages 0-5

Family: Negative Binomi-
al(0.23) Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship +
s(Long, Lat) + s(Depth)

Estimated degrees of free-
dom: 6.26 5.96  total =
18.22

REML score: 1385.123

Family: Negative Binomi-
al(0.23) Link function: log

Formula:
NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship +
s(Long, Lat) + s(Depth)

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
 (Intercept)   4.6612     0.5870    7.941    2e-15 ***
 HaulCatShort  -0.0671    0.3664    -0.183   0.8547
 ShipEND       -1.1677    0.6354    -1.838   0.0661 .
 ShipJHJ       -1.1096    0.6905    -1.607   0.1081
 ShipSCO3      0.3170     0.6044    0.525    0.5999
 ShipWAH3      -1.3310    0.9934    -1.340   0.1803
 ---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(Long,Lat) 6.261  8.820  12.21      0.19
s(Depth)      5.956  7.002 132.56  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.276     Deviance explained =
95.1% REML score = 1385.1  Scale est. = 1
                        n = 300

Analysis of Deviance Table

Model 1: NumberAtAge ~ offset(log(SweptArea)) + HaulCat + Ship +
s(Long, Lat) + s(Depth)
Model 2: NumberAtAge ~ offset(log(SweptArea)) + Ship + s(Long, Lat) +
s(Depth)
Resid. Df Resid. Dev          Df Deviance Pr(>Chi)
 1   281.78     228.58
 2   282.88     228.89 -1.0936 -0.31381    0.6129
df                        AIC
model1.gam 18.21679 2773.911
model2.gam 17.12315 2772.037
```

# WD6: North Sea IBTS Q3 tow duration experiment 2015 (J. Devine and M. Pennington)


## Abstract

In trawl surveys, a cluster of fish are caught at each station; fish caught together tend to have more similar characteristics, such as length, age, stomach contents, than those in the entire population. When this is the case, the effective sample size for estimates of the frequency distribution of a population characteristic can, therefore, be much smaller than the number of fish sampled during a survey. On average for trawl surveys the effective sample size is approximately one fish per tow. Thus many more fish than necessary are measured at each station (location). One way to increase the effective sample size for these surveys and, hence, increase the precision of the length–frequency estimates, is to reduce tow duration and use the time saved to collect samples at more stations.


## Introduction

The North Sea IBTS surveys currently take place twice a year, Q1 (Jan-Mar) and Q3 (typically late Jul-Sept, but Norway begins in late June), with seven and six nations taking part in the surveys, respectively. Typically two nations survey each statistical rectangle although there are a few exceptions, e.g. Sweden in the Skagerrak, Scotland west of Shetland, and several other isolated rectangles throughout the survey area (Figure 1; see the latest IBTSWG manual, ICES 2015).

Based on numerous experiments, it has been observed that little is gained in the precision of estimates of relative abundance or estimates of biological characteristics, by towing longer than about 15 minutes at a station (Godø et al., 1990; Pennington and Vølstad, 1991, 1994; Gunderson, 1993; Goddard, 1997; Folmer and Pennington, 2000; Wieland and Storr-Paulsen, 2006). Therefore, a tow duration experiment embedded in the standard IBTS was planned for Q3 in 2015, which is detailed in the latest IBTSWG report

(ICES-IBTSWG 2015). An excerpt included here:

In order to warrant a thorough comparison with the current methodology, it has been planned that in each ICES rectangle, one of the two assigned hauls will remain at 30-min haul duration, whereas the second will be reduced to 15 min. Any freed-up survey time will, where logistically possible, be utilized to conduct additional hauls and to increase coverage of the fringe areas highlighted with the proposed extended index areas for assessed species (ICES-IBTSWG 2015).

The nation that was assigned the 30-min tow in each rectangle was the country that was listed first on map in the manual; however, there was some modification (Figure 1). Sweden and England did not participate in the tow duration experiment. This means that there are no 15 min tows in the Skagerrak and all of England’s stations were 30-minutes in duration. Because England surveys the entire North Sea (every other row of statistical rectangles), nations sharing those rectangles mainly had 15-min tows; tows of varying duration were not evenly distributed among the nations (Table 1). Scotland and Denmark were able to conduct true paired tows in several rectangles (5 stations for Denmark and 15 for Scotland).

## Methods

Data were pulled from the DATRAS database and the *DATRAS* R-package (Kristensen and Berg 2010) was used to prepare the data. Stations within a statistical rectangle were considered 'paired tows', however, data were also screened to prepare a second dataset; 128 stations within the same statistical rectangle and 20 nautical miles of each other (and 17 stations between 22-30 nautical miles from each other) were chosen (Figure 2).

Tows of duration 15–20 minutes were considered 15 minute tows, while those >= 20 min were considered 30 min tows (Table 1). Average tow time for tows classified as 15-min was 15.2 minutes (+/- 0.74), while for 30- min tows, average tow time was 29.8 minutes (+/- 1.4 minutes).

Data were first converted to raw data; DATRAS data contains a combination of raw and standardized to 60- minutes tow duration. Only mandatory species were retained in the data. This included all all fish, sharks, skates, rays, and cephalopods and a few species of crustaceans and molluscs (see ICES 2015). Counts and weights were then standardized to either 30-min or 15-min, depending on tow duration classification.

Analyses compared mean catch per tow in numbers and weights of all species, where 'All' included all IBTS mandatory species. Norway was also tasked with comparing 5 of the 8 fish species that have age sampling conducted: herring, sprat, mackerel, plaice, and saithe. Analyses for these five species included comparisons of mean catch per tow (in weight and numbers) and mean length per tow. Methods are those of Pennington et al. (2002).

## Results

Tables 3-5 show the results of the analyses. Tow duration was not significant for any of the analysis except for plaice (mean catch weight only), but only when using stations that were more closely paired (Table 3). Tow duration did not have a significant effect on the length distribution of fish caught and sampled (Table 5). The number of species caught average 15.8 species in 15 min tows and in the 30 min tows, 18.9 per tow.

## Conclusions

Tows of 15-min duration were deemed as representative as those of 30-min duration. Variation in duration of the standard tow causes little bias and adds little to the variance because typically around 97% of the variance is due to station to station variability and the remaining 3% is due to within station variation. In addition to increasing survey precision, additional benefits from reducing tow duration include:

Less gear and equipment wear and less fuel consumption.

One can tow in more places (cover more habitat).

Fewer large catches will have to be subsampled. It is very difficult to collect a representative subsample from a catch.

Shorter tows can be made at more locations in the survey area.

The problem of gear saturation will be reduced.

Because of intra-cluster correlation (i.e. small effective sizes), the amount of knowledge gained by sampling more fish at a station for estimating biological characteristics is low.

Why kill twice as many fish for no increase in survey precision or accuracy? (approximately 92 tons vs. 184 tons for the Q3 survey in 2015)

Perhaps the most important reason is the increased capability to obtain more biological information. That is, short tows require less sorting time, which will provide more time for taking other biological measurements.

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**Table 1. Number of stations by haul duration (in minutes) that were classified to either 15-min or 30-min in duration.**

**Classification**

| Haul duration | 15 minutes | 30 minutes |
|---|---|---|
| 15 | 128 | 0 |
| 16 | 16 | 0 |
| 17 | 1 | 0 |
| 20 | 3 | 0 |
| 21 | 0 | 1 |
| 23 | 0 | 2 |
| 25 | 0 | 4 |
| 26 | 0 | 1 |
| 29 | 0 | 3 |
| 30 | 0 | 184 |
| 31 | **0** | 7 |
| 32 | 0 | 2 |

**Table 2. Number of stations by country and hauls duration. Grey line in the table denotes the cut-off in duration between the 15-min and 30-min classification of tow duration.**

| Haul duration | DEN | ENG | GFR | NOR | SCO | SWE |
|---|---|---|---|---|---|---|
| 15 | 29 | 0 | 23 | 20 | 56 | 0 |
| 16 | 0 | 0 | 2 | 14 | 0 | 0 |
| 17 | 0 | 0 | 0 | 1 | 0 | 0 |
| 20 | 0 | 2 | 0 | 0 | 0 | 1 |
| 21 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23 | 0 | 0 | 0 | 1 | 0 | 1 |
| 25 | 1 | 2 | 0 | 0 | 0 | 1 |
| 26 | 0 | 1 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 3 | 0 | 0 |
| 30 | 28 | 69 | 7 | 4 | 34 | 42 |
| 31 | 1 | 2 | 1 | 3 | 0 | 0 |
| 32 | 0 | 0 | 0 | 2 | 0 | 0 |

**Table 3. Comparison of mean catch per tow (in weight), by the *n* 15 and 30 minute tows. Tows in a statistical rectangle where both catches were zero are not included. N.S and S.D. denote not significant and significant difference, respectively. The category "All" is the total catch of all the mandatory species, and All* denotes all mandatory species except sprat.**

| Species | N | $2\times X_{15WT.}$ (Kg / tow) | $S.E.(2\times X_{15WT.})$ | $X_{30.WT.}$ (Kg / tow) | $S.E.(X_{30WT.})$ | Significance (Pr. value, not paired) | Significance (Pr. value, paired) |
|---|---|---|---|---|---|---|---|
| All | 140 | 492.8 | 81.4 | 574.5 | 58.9 | N.S. (0.42) | N.S. (0.41) |
| Mackerel | 128 | 32.8 | 7.9 | 43.1 | 10.9 | N.S. (0.45) | N.S. (0.43) |
| Sprat | 77 | 148.1 | 64.8 | 90.7 | 33.6 | S.D. (0.43) | N.S. (0.44) |
| Herring | 133 | 137.6 | 76.4 | 177.2 | 50.4 | N.S. (0.67) | N.S. (0.67) |
| Plaice | 125 | 11.4 | 1.2 | 8.5 | 0.9 | N.S. (0.07) | S.D. (0.02) |
| Saithe | 58 | 32.0 | 6.9 | 41.4 | 9.1 | N.S. (0.40) | N.S. (0.30) |

**Table 4. Comparison of mean catch per tow (in numbers) by the *n* 15 and 30 minute tows. The tows in a statistical rectangle where both catches were zero are not included. N.S and S.D. denote not significant and significant difference, respectively. The "All" is the total catch of all the mandatory species, and All* denotes all mandatory species except sprat.**

| Species | N | $2\times X_{15NO.}$ (No./tow) | $S.E.(2\times X_{15NO.})$ | $X_{30.NO.}$ (No./tow) | $S.E.(X_{30NO.})$ | Significance (Pr. value, not paired) | Significance (Pr. value, paired) |
|---|---|---|---|---|---|---|---|
| All | 140 | 15 160 | 3 719 | 13 520 | 2 664 | N.S. (0.72) | N.S. (0.71) |
| Mackerel | 128 | 201.0 | 60.6 | 251.1 | 79.9 | N.S. (0.62) | N.S. (0.60) |
| Sprat | 77 | 13 520 | 5 826 | 9 073 | 3 952 | N.S. (0.53) | N.S. (0.54) |
| Herring | 133 | 1 690 | 712.8 | 1 765 | 403.6 | N.S. (0.93) | N.S. (0.93) |
| Plaice | 125 | 51.4 | 6.2 | 40.4 | 5.3 | N.S. (0.18) | N.S. (0.08) |
| Saithe | 58 | 22.4 | 5.0 | 36.0 | 9.5 | N.S. (0.21) | N.S. (0.17) |

**Table 5. Estimates of the mean length of fish caught in the 15 or the 30 minute tows. A ratio estimator, R was used to estimate mean length. The difference in the estimated means, R30-R15, was considered significant if the difference was greater than 2 times the standard error (SIGN.LEVEL).**

| Species | N15 | R15 | S.E.(R15) | N30 | R30 | S.E.(R30 | R30–R15 | S.E.(R30–R15 | SIGN. LEVEL |
|---|---|---|---|---|---|---|---|---|---|
| Mackerel | 92 | 26.29 | 0.63 | 116 | 26.85 | 0.60 | 0.56 | 0.87 | N.S. |
| Sprat | 64 | 10.86 | 0.25 | 74 | 10.38 | 0.25 | -0.48 | 0.34 | N.S. |
| Herring | 105 | 18.85 | 3.34 | 119 | 21.87 | 0.98 | 3.02 | 3.48 | N.S. |
| Plaice | 114 | 26.38 | 0.34 | 122 | 26.2 | 0.33 | -0.18 | 0.47 | N.S. |
| Saithe | 47 | 51.69 | 0.81 | 50 | 48.6 | 1.37 | -3.09 | 1.59 | N.S. |

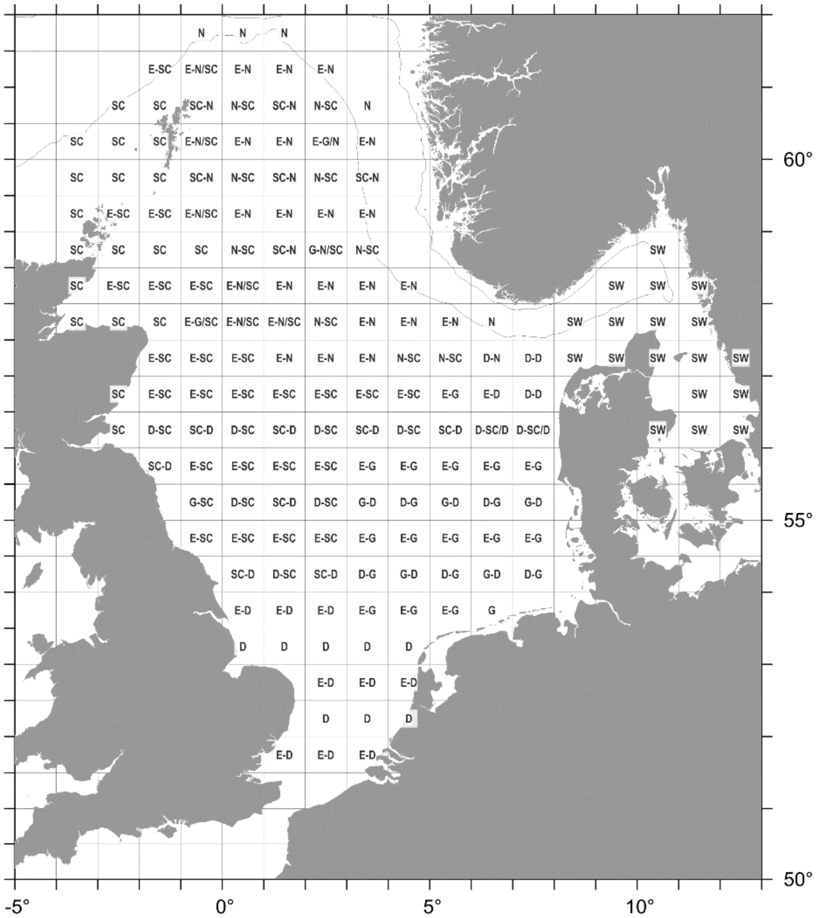


**Figure 1. 2015 IBTS Q3 proposed survey grid for all participants: D: Denmark, E: England, G: Germany, N: Norway, SC: Scotland, SW: Sweden. The country named first in the rectangle was to take the standard 30-min tow, whereas the second country could take the 15-min tow. England took only 30-min tows, therefore all countries sharing rectangles with England took the 15-min tow.**

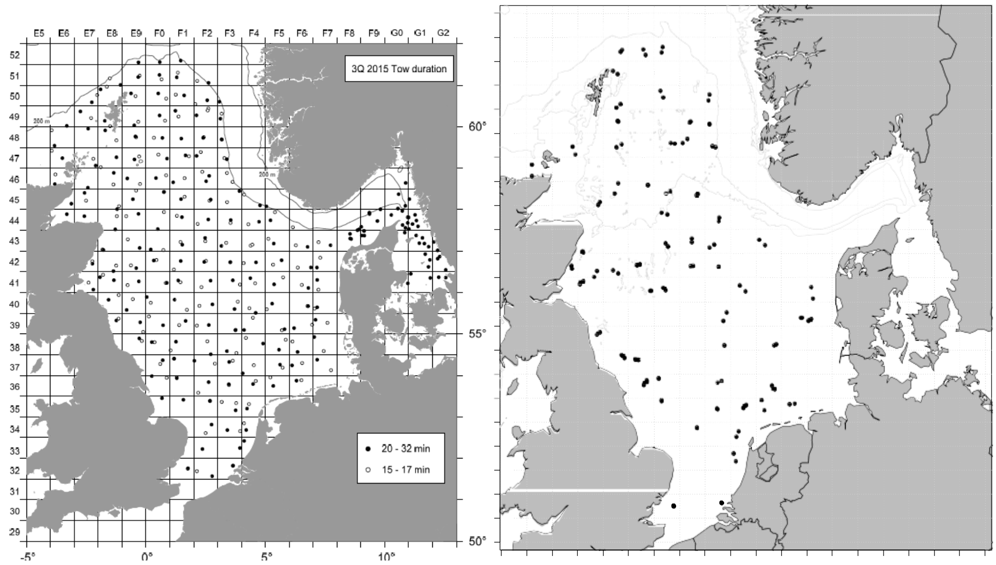


**Figure 2. (left) Distribution of 15- and 30-min tows during tow duration experiment, IBTS Q3 2015. (Right) Location of the tows within 15 nautical miles of each other.**

# WD7: Data analysis for species richness from tow duration experiment NS-IBTS 3rd quarter 2015 (M. Moriarty)

## Introduction

Maximizing survey resources in pressing economic conditions is a major concern at a national level. At the 2014 IBTSWG meeting a tow duration experiment was proposed to be conducted during the third quarter 2015 North Sea survey. This decision was made after discussions on survey design where the issue of tow duration on IBTS surveys was raised and whether in fact 30 minutes was the optimal duration for this survey. Benefits of shorter tows include potentially increasing the total number of hauls undertaken during the survey, reducing the likelihood of damaging gear and reducing the amount of subsampling required. Several studies were discussed that examined the effects of reducing tow duration and on balance it was decided to proceed with a similar study during the third quarter of the North Sea 2015 (ICES, 2014). The surveys are currently undertaken to meet fisheries management requirements under the Common Fisheries Policy (CFP) and Data Collection Framework (DCF), but from 2014 onwards they must also fulfil the Marine Strategy Framework Directive (MSFD) data collection needs for deriving and calculating indicators, as the national groundfish surveys have been nominated by their Member States (EC, 2008). This means that any consequences to changes in the current monitoring programs must be carefully considered prior to operational implementation.

Conserving and restoring biodiversity is a key objective of the MSFD, changes in survey design which affect our ability to monitor and assess trends in groundfish species richness may hamper research and development of appropriate indicators of species richness within our regional seas. Changes in the survey may have consequences on the interpretation of other MSFD indicators such as the LFI. Groundfish communities constitute a major fraction of marine biota in the size range 4g to 200kg, and they are important components of marine biodiversity. Groundfish communities are directly affected by human activity: it is well established that fishing has caused changes in fish community species composition, richness and evenness (Greenstreet and Hall, 1996; Greenstreet *et al.*, 1999; Greenstreet and Rogers, 2006), size composition (Greenstreet *et al.*, 2011; Shephard *et al.*, 2011), and life-history trait composition (Jennings *et al.*, 1999). Monitoring and assessment of fish communities will therefore be essential to demonstrating the achievement of GES across the waters of the Northeast Atlantic covered by the MSFD.

## Data and Analysis

Marine Scotland Science (MSS) was tasked with analysing and comparing the biodiversity of species from this tow duration experiment and report the results to the IBTSWG in 2016. For all the North Sea rectangles within the Q3 survey area that were sampled twice, it was proposed that within each rectangle one trawl of a typical 30 minute duration would be completed with another being undertaken with a trawl duration of 15 minutes. The resultant dataset provided an almost 50/50 split across the entire survey area of both haul duration categories. In most instances haul duration was of either 15 or 30 minutes although a few hauls were found to be of an intermediate duration and so the hauls were grouped in two categories, "short" (15–17 minutes) and "long" (20–32 minutes) A total of 352 valid hauls were completed during the survey. Removal of the Skaggerak and Kattegatt hauls reduced the number to 300 hauls, this was further reduced to 284 hauls, to address only the statistical rectangles where both a short haul and a long haul where completed. England reports a large number of non- commercial species to the family or genus level to DATRAS (see section 7). This includes *Dipturus,* Argentinidae, Gobiidae and *Pomatoschistus*, *Ammodytes*, *Chelidonichthys*, *Trigla*, *Echiichthys*, and *Eutrigla*. In most cases these codes can be attributed to only one species, to accomidate the English data all Argentinidae species are aggregated. Gobiidae and *Ammodytes a*re aggregated as best practice (Moriarty and Greenstreet, In prep)). This gives a a suite of hauls covering 140 ICES rectangles, consisting of 140 "long" and 144 "short" hauls. For this analysis, the haul data included, among others, geographical position (longitude, latitude), depth (m), haul number, vessel, statistical rectangle, tow duration (minutes) and swept-area (in km$^2$). As has already been mentioned this experiment only included hauls undertaken in the North Sea area, therefore hauls from Skagerrak and Kattegat were excluded from the analysis. The catch data for all species was expressed as recorded numbers, or numbers per km$^2$. All data were quality assured using the criteria set out in Moriarty and Greenstreet (In prep). Annex 1, table 1 lists the species included in this analysis.

All the analyses were conducted using the statistical package R (R Development Core Team, 2013). The package vegan provided functions for species richness analyses. The purpose of these analyses was to test if species richness varied between short and long tow durations. A Welch two sample t-test was performed to test the null hypothesis, "there is no difference in the mean species richness of short hauls and long hauls". The power of the t-test was also calculated, to assess the power associated with the level of sampling which has occurred. Species richness curves with confidence intervals were plotted against number of hauls for both "long" and "short" tows categories using a randomized method. Number of hauls required to sample 50 species using both "short" and "long" tows was calculated. And finally a Gleason semi-log function was fitted to the data for both "short" and "long" tows to predict the effect of shorter tows on species richness in the North Sea over 300 and 600 tows. Gleason semi – log plot;

$$s=c+z(\log A)$$

where "s" is the species richness count, "A" is the area sampled (number of hauls) and "c" and "z" are constants (see "estimate" column in table 1 for constants used.) is suitable for regional level species richness estimates such as the ICES statistical rectangle (Greenstreet and Piet, 2008). The Gleason semi – log is the appropriate function because sampling in the North Sea IBTS survey is not exhaustive, the average groundfish survey rarely includes more than 4 trawl samples per rectangle, each covering an area of 0.07km$^2$ (Greenstreet and Piet, 2008) as a result of this species saturation hasn't occurred in the North Sea IBTS survey, and an asymptote hasn't been reached.

**Table 1: Gleason semi-log function parameters for species richness of "short" and "long" tow categories.**

| Parameter | Estimate | Std. Error | t-value | Pr(> \|t\|) |
|---|---|---|---|---|
| c (long) z (long) | 15.95 | 0.53 | 29.88 | < 2e-16*** |
| c (short) z (short) | 0.36 | 0.009 | 39.10 | < 2e-16*** |
| | 17.5 | 0.53 | 32.79 | < 2e-16*** |
| | 0.31 | 0.008 | 36.15 | < 2e-16*** |

### Results (exc. England)

The haul category ("long" vs. "short") had an effect on species richness (i.e. the number of fish species caught per $km^2$). The species richness was consistently lower in the short hauls compared to the long hauls. The mean number of species in the long haul group is 16.3 species per haul, while in the short haul group the mean number of species per haul is 14.6. Using a Welch two sample t-test the null hypothesis that there are no difference in the means, i.e. that the species richness is not effected by haul duration is rejected and except the alternative hypothesis, that there is a difference in the means, i.e. the species richness is effected by the haul duration with a p-value of 0.019. The t-test power calculation suggests this test has a power of 0.64 given the sample sizes in each haul group. The overall richness within the "long" tow category is 70 species while in the "short" tow category the overall species richness is 60 species. This suggests that reducing the haul duration to 15 minutes as standard without increasing the number of hauls has the potential to affect the overall biodiversity within the survey time-series. The "long" tow category is 33% more effective at sampling species richness, this suggests that a 33% increase in the "short" tows would provide a similar species richness estimate. The Gleason-semi log function was used to predict potential species richness across the total survey area, which consists of 300 hauls, and look at the added effort which would be required if the "short" tow duration was made operational. To reach a species richness of 125 species using a "long" tow, 300 stations will need to be sampled. To get the same species richness with the "short" tow 600 stations would need to be sampled. The extrapolation of this function is quite high, more data would be very useful to add confidence to this result. Some taxonomic groups are very difficult to identify to species level, this includes the Gobiidae, and because of the difficulty in identification it is pragmatic to group these to family level, and this results in a decrease in the overall species richness estimates, which is consistent across the survey area.

### Results (inc. england)

The haul category ("long" vs. "short") had an effect on species richness (i.e. the number of fish species caught per $km^2$). The species richness was consistently lower in the short hauls compared to the long hauls. The box plot in figure 1 shows the number of species found in the short and long hauls. The mean in the long haul group is 16.23 species per haul, while in the short haul group the mean number of species per haul is 14.01. Using a Welch two sample t-test the null hypothesis that there are no difference in the means, i.e. that the species richness is not effected by haul duration is rejected and except the alternative hypothesis, that there is a difference in the means, i.e. the species richness is effected by the haul duration with a p-value of 9.31e-7. The t-test power calculation suggests this test has a power of 0.99 given the sample sizes in each haul group.

The overall richness within the "long" tow category is 78 species while in the "short" tow category the overall species richness is 72 species. This suggests that reducing the haul duration to 15mins as standard without increasing the number of hauls has the potential to affect the overall biodiversity within the survey time-series. Figure 2 highlights the difference in potential species richness within the two tow categories, showing the difference in ability to reach a species richness of 50 species. The "long" tow category is 31% more effective at sampling species richness, this suggests that a 31% increase in the "short" tows would provide a similar species richness estimate. The Gleason-semi log function was used to predict potential species richness across the total survey area, which consists of 300 hauls, and look at the added effort which would be required if the “short” tow duration was made operational. The curve plotted in figure 3 can be interpreted to mean that to reach a species richness of 95 species using a “long” tow, 270 stations will need to be sampled. To get the same species richness with the “short” tow 310 stations would need to be sampled. To reach a species richness of 110 species using a “long” tow, 500 stations will need to be sampled. To get the same species richness with the “short” tow 580 stations would need to be sampled. This would infer approximately a 15% increase in sampling to retain species diversity. The extrapolation of this function is quite high, more data would be very useful to add more confidence to this result. Some taxonomic groups are very difficult to identify to species level, this includes the Gobiidae and because of the difficulty in identification it is pragmatic to group these to family level, and this results in a decrease in the overall species richness estimates, which is consistent across the survey area.

Figure 4 shows the total number of species recorded in each statistical rectangle. This ranges from 11 species to 28 species, which highlights the natural variability of species richness in different areas, this may be depth and substrate related. With the inclusion of the English hauls the conclusion remains the same, the species richness was dependent of the haul category, being lower in short hauls.

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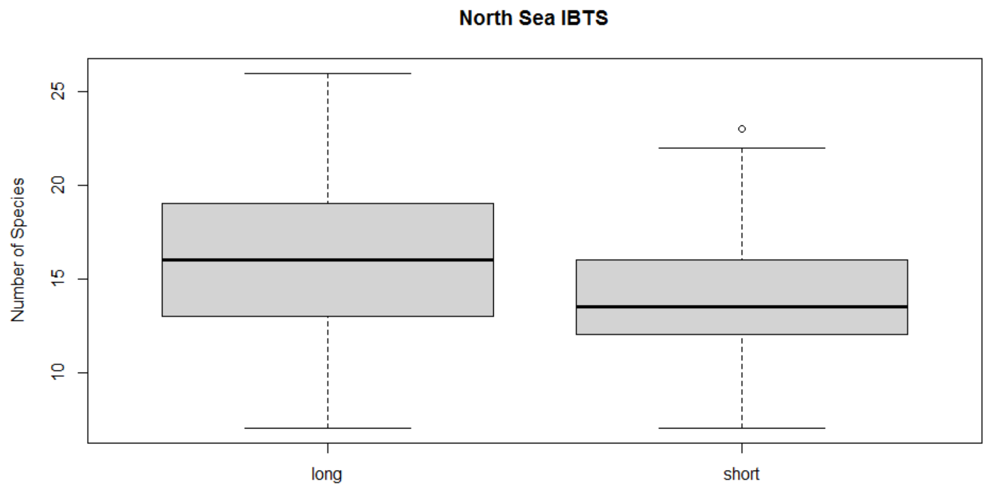



**Figure 1. Box plot showing spread of the number of species recorded in the long hauls beside the spread of species recorded in the short hauls. The mean number of species recorded in the long hauls was 16.23 while in the short hauls the mean is 14.01 species per haul.**

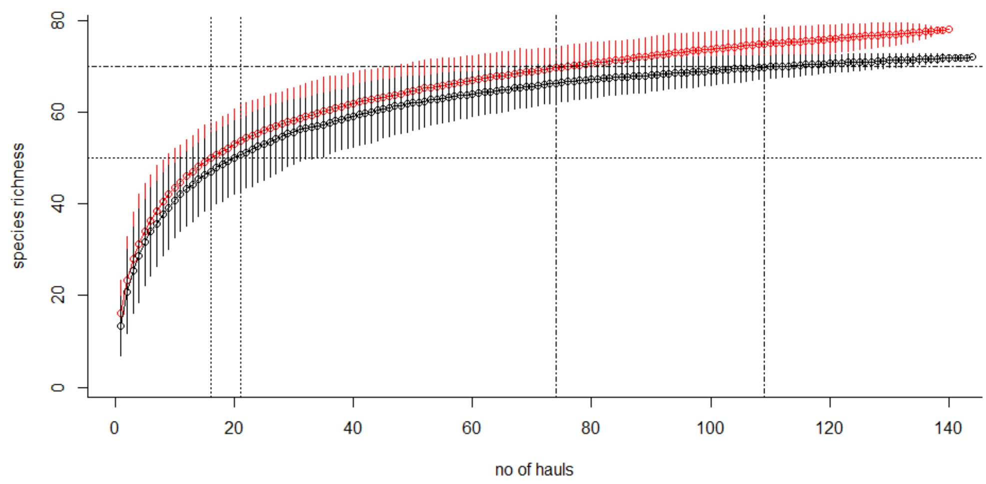



**Figure 2. Cumulative species richness curves for "long" tows in red and "short" tows in black. To reach a species richness of 50 species using the "long" tow category approximately 16 tows are needed. To reach a species richness of 50 species using the "short" tow category approximately 21 tows are needed. This represents a 31% increase in effort to collect the same number of species. To reach a species richness of 70 species using the "long" tow category approximately 74 tows are needed. To reach a species richness of 70 species using the "short" tow category approximately 109 tows are needed. This represents a 47% increase in effort to collect the same number of species.**

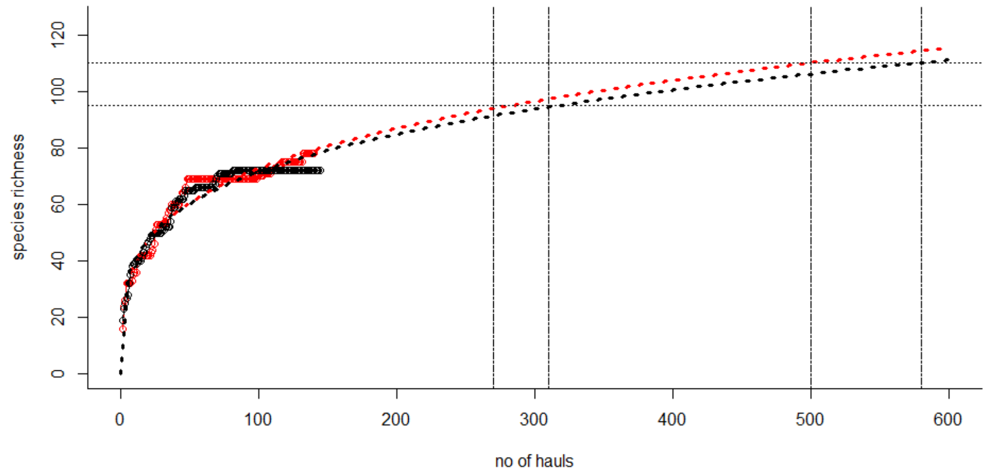



**Figure 3. "Long" tow (in red) and "short" tow (in black) cumulative species richness (collected) plotted by haul. The data are fitted using a Gleason-semi log function to predict the species richness at 300 hauls and 600 hauls respectively.**

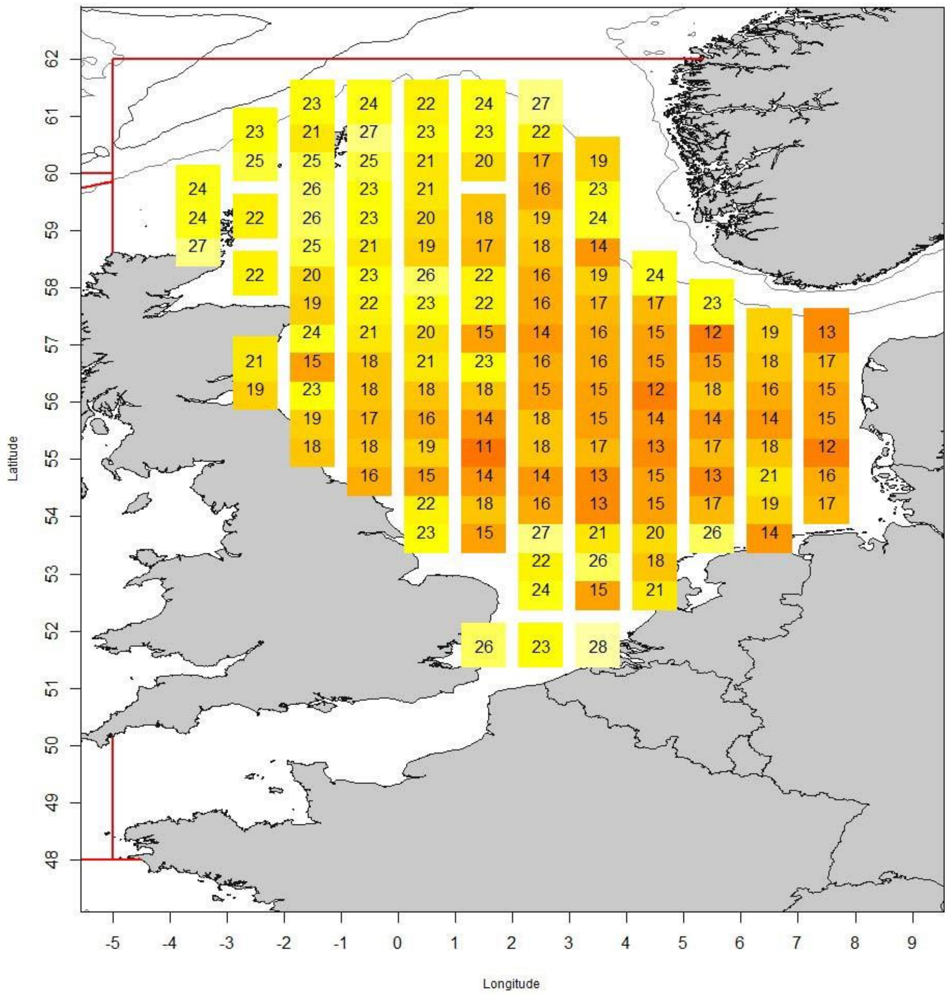



**Figure 4: Heat map showing total number of species recorded across all hauls in each statistical rectangle.**

## Annex 2. Species Lists

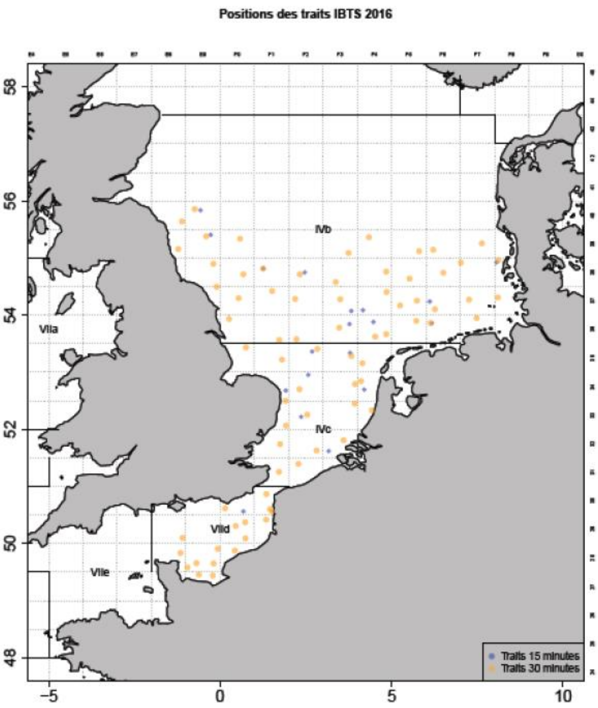
**Table 1: List of species included in the species richness analyses.**

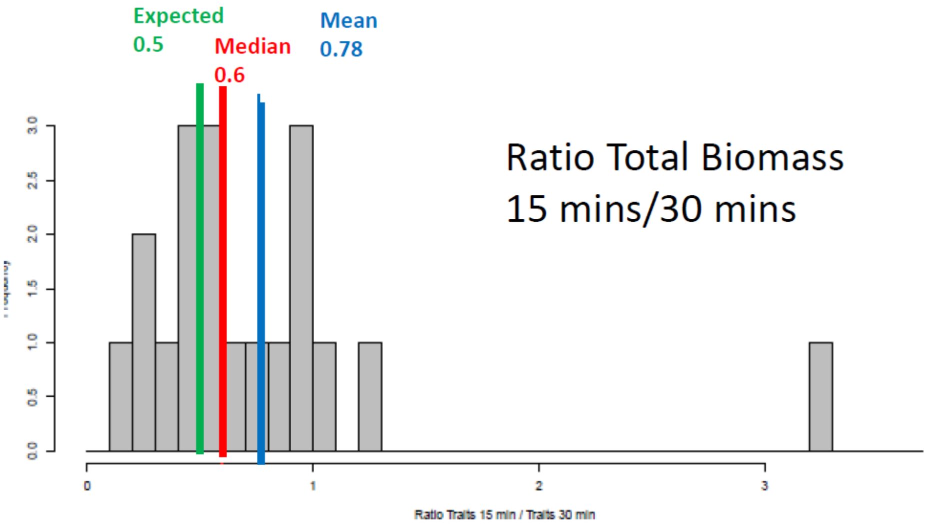
| Scientific Name | Long | Short | Total |
|---|---|---|---|
| Agonus cataphractus | 22 | 15 | 37 |
| Alosa alosa | 1 | 1 | 2 |
| Alosa fallax | 5 | 3 | 8 |
| Amblyraja radiata | 47 | 30 | 77 |
| Ammodytidae | 33 | 30 | 63 |
| Anarhichas lupus | 5 | 2 | 7 |
| Argentinidae | 54 | 50 | 104 |
| Arnoglossus laterna | 27 | 14 | 41 |
| Brosme brosme | | 1 | 1 |
| Buglossidium luteum | 32 | 27 | 59 |
| Callionymus lyra | 55 | 47 | 102 |
| Callionymus maculatus | 34 | 23 | 57 |
| Callionymus reticulatus | | 1 | 1 |
| Capros aper | 3 | 4 | 7 |
| Chelidonichthys cuculus | 11 | 9 | 20 |
| Chelidonichthys lucerna | 8 | 12 | 20 |
| Clupea harengus | 118 | 105 | 223 |
| Cyclopterus lumpus | 1 | 1 | 2 |
| Dipturus | 1 | | 1 |
| Echiichthys vipera | 22 | 18 | 40 |
| Enchelyopus cimbrius | 20 | 12 | 32 |
| Engraulis encrasicolus | 16 | 10 | 26 |
| Etmopterus spinax | | 1 | 1 |
| Eutrigla gurnardus | 135 | 133 | 268 |
| Gadiculus argenteus | 9 | 10 | 19 |
| Gadiculus thori | 3 | 6 | 9 |
| Gadus morhua | 76 | 76 | 152 |
| Galeorhinus galeus | | 1 | 1 |
| Galeus melastomus | 2 | | 2 |
| Glyptocephalus cynoglossus | 32 | 21 | 53 |
| Gobiidae | 3 | 4 | 7 |
| Helicolenus dactylopterus | 1 | | 1 |
| Hippoglossoides platessoides | 102 | 96 | 198 |
| Hippoglossus hippoglossus | 3 | 3 | 6 |
| Lampetra fluviatilis | 1 | 1 | 2 |
| Lepidorhombus whiffiagonis | 27 | 19 | 46 |
| Leptoclinus maculatus | 1 | | 1 |
| Leucoraja fullonica | 1 | | 1 |
| Leucoraja naevus | 15 | 8 | 23 |
| Limanda limanda | 116 | 113 | 229 |
| Lophius budegassa | 3 | | 3 |
| Lophius piscatorius | 51 | 41 | 92 |
| Lumpenus lampretaeformis | 3 | 6 | 9 |
| Lycodes gracilis | 1 | 4 | 5 |

| | | | |
|---|---|---|---|
| Maurolicus muelleri | | 4 | 4 |
| Melanogrammus aeglefinus | 91 | 88 | 179 |
| Merlangius merlangus | 129 | 131 | 260 |
| Merluccius merluccius | 53 | 56 | 109 |
| Micromesistius poutassou | 20 | 20 | 40 |
| Microstomus kitt | 115 | 105 | 220 |
| Molva molva | 21 | 20 | 41 |
| Mullus surmuletus | 24 | 19 | 43 |
| Mustelus asterias | 5 | 5 | 10 |
| Mustelus mustelus | | 4 | 4 |
| Myoxocephalus scorpius | 15 | 10 | 25 |
| Myxine glutinosa Pholis | 8 | 7 | 15 |
| gunnellus | 1 | | 1 |
| Phrynorhombus norvegicus | 1 | | 1 |
| Phycis blennoides | 3 | 2 | 5 |
| Platichthys flesus | 3 | 5 | 8 |
| Pleuronectes platessa | 115 | 109 | 224 |
| Pollachius pollachius | 2 | 4 | 6 |
| Pollachius virens | 47 | 46 | 93 |
| Raja clavata | 7 | 5 | 12 |
| Raja montagui | 5 | 3 | 8 |
| Salmo salar | 1 | | 1 |
| Sarda sarda | 1 | | 1 |
| Sardina pilchardus | 9 | 2 | 11 |
| Scomber japonicus | 1 | | 1 |
| Scomber scombrus | 109 | 87 | 196 |
| Scophthalmus maximus | 11 | 8 | 19 |
| Scophthalmus rhombus | 6 | 3 | 9 |
| Scyliorhinus canicula | 32 | 34 | 66 |
| Sebastes viviparus | 3 | 3 | 6 |
| Solea solea | 10 | 9 | 19 |
| Sprattus sprattus | 70 | 60 | 130 |
| Squalus acanthias | 19 | 8 | 27 |
| Trachinus draco | | 2 | 2 |
| Trachurus trachurus | 86 | 44 | 130 |
| Trigla lyra | 11 | | 11 |
| Triglops murrayi | 1 | | 1 |
| Trisopterus esmarkii | 69 | 69 | 138 |
| Trisopterus luscus | 2 | 5 | 7 |
| Trisopterus minutus | 30 | 26 | 56 |
| Zeus faber | 4 | 1 | 5 |
| | 2240 | 1962 | 4202 |

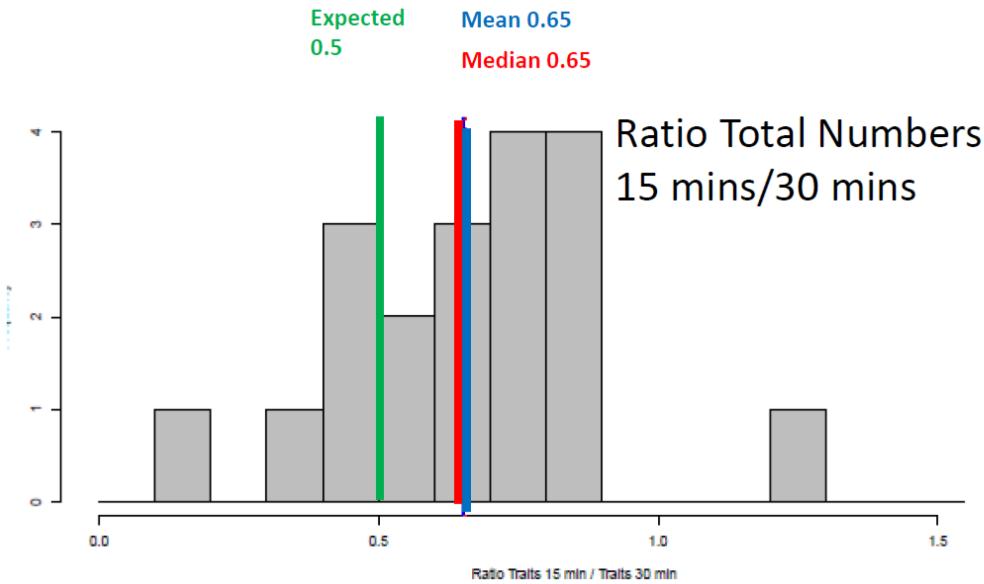
## WD8: French haul duration comparison Q1 (V. Trenkel)

**15 paired hauls**

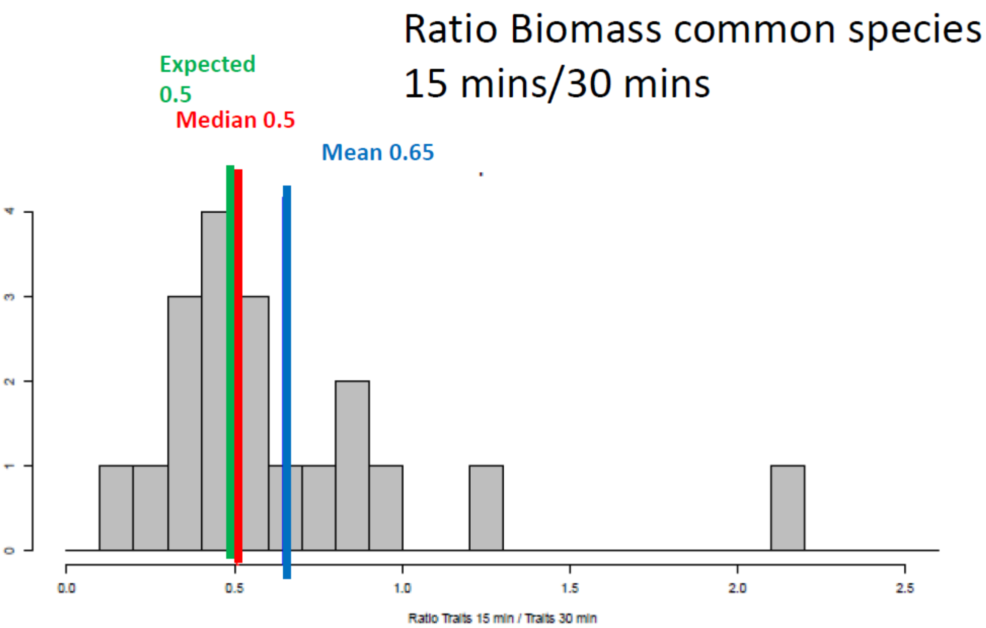




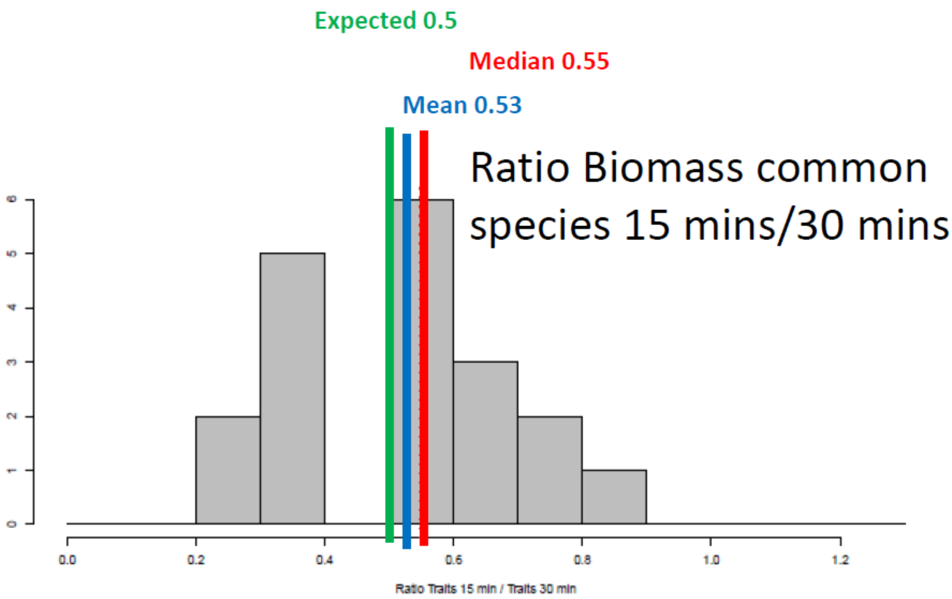

**15 mins hauls 50% larger catches compared to 30 mins**



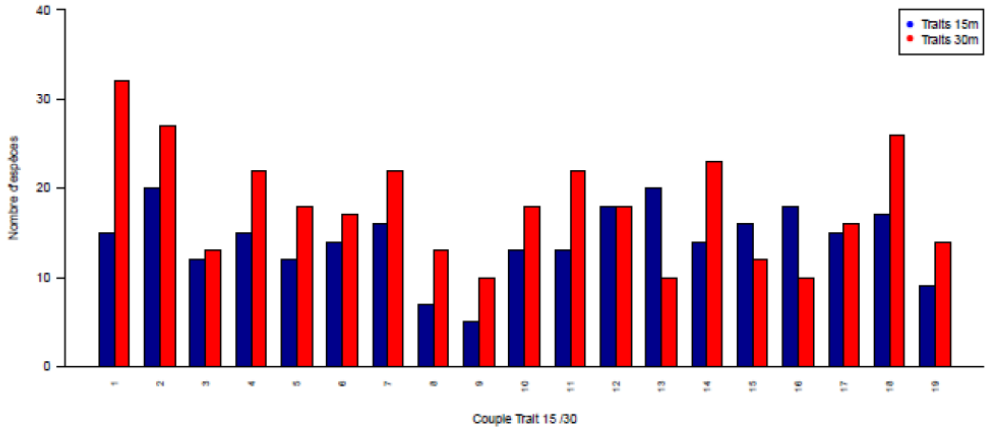

**15 mins hauls 30% larger catches compared to 30 mins**




**15 mins hauls 30% larger catches compared to 30 mins**

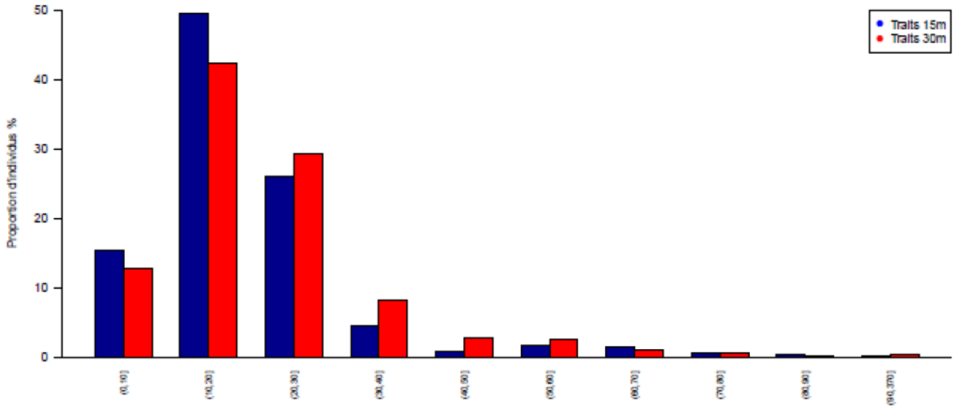


## Number of fish species per haul



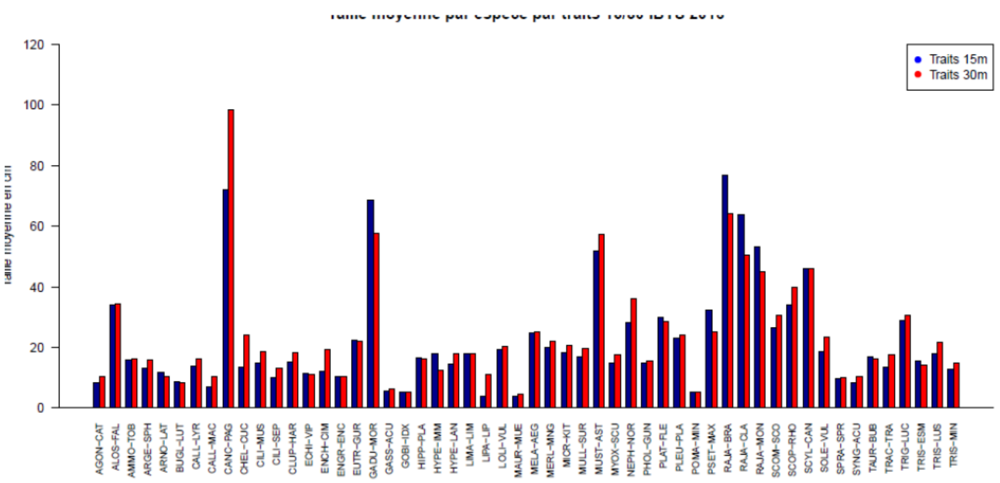

**15 mins hauls ~25% fewer species compared to 30 mins**

**Size distribution for all species**

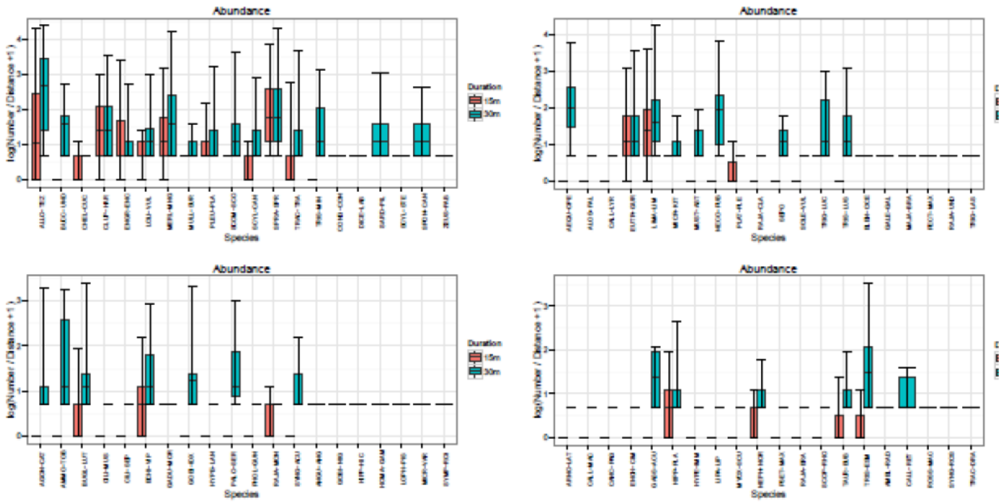



**15 mins hauls catch smaller individuals compared to 30 mins**

## Mean size by species




## 15 mins hauls catch smaller individuals compared to 30 mins by species




# Summary

15 min hauls compared to 30 mins hauls

- ❑ Catch fewer species
- ❑ Biomass and Numbers proportionally larger
- ❑ Individuals are smaller

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doi:10.1016/j.icesjms.2006.03.002

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# Short communication

## Estimating end effects in trawl catches

André Battaglia, Verena M. Trenkel, and Marie-Joëlle Rochet

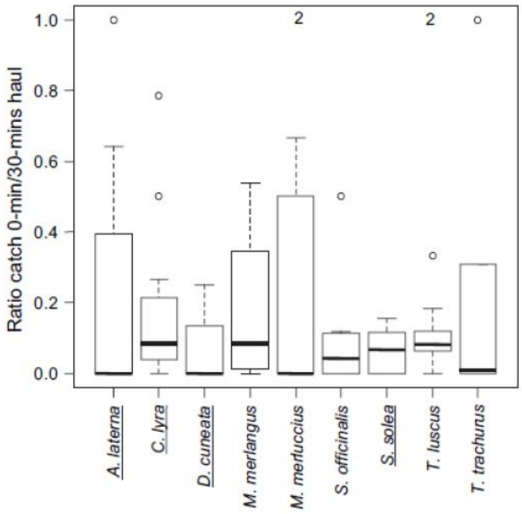
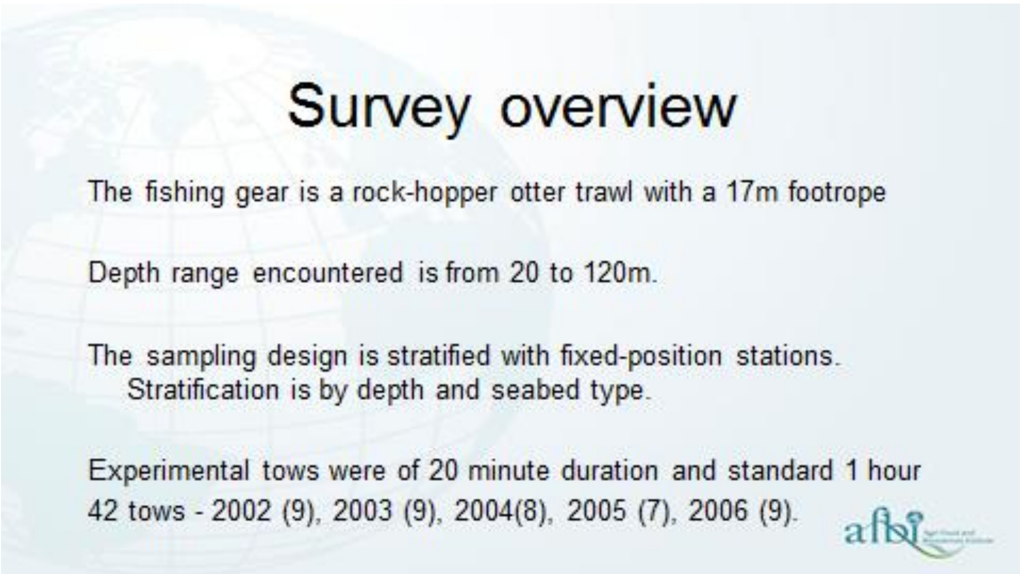
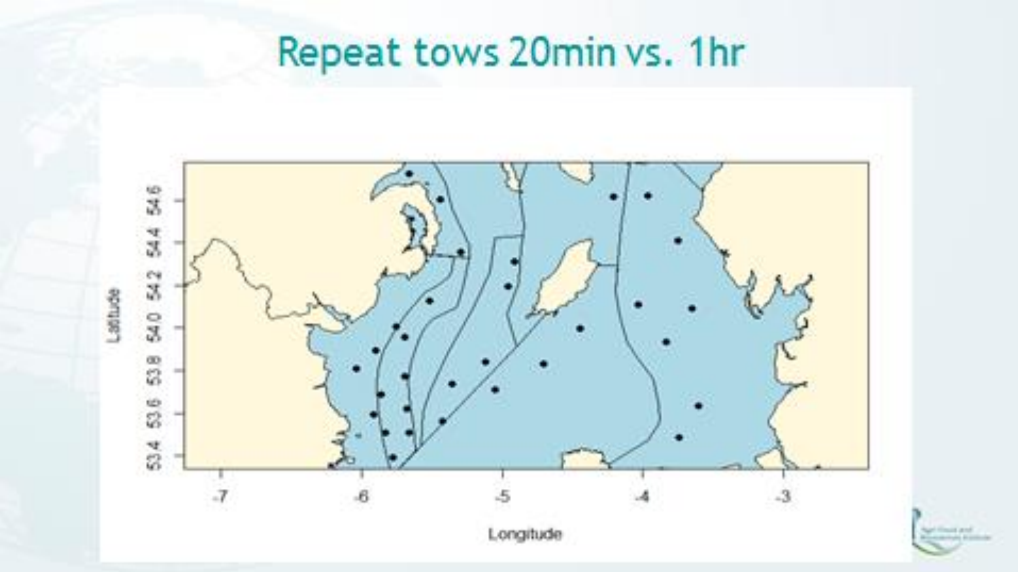


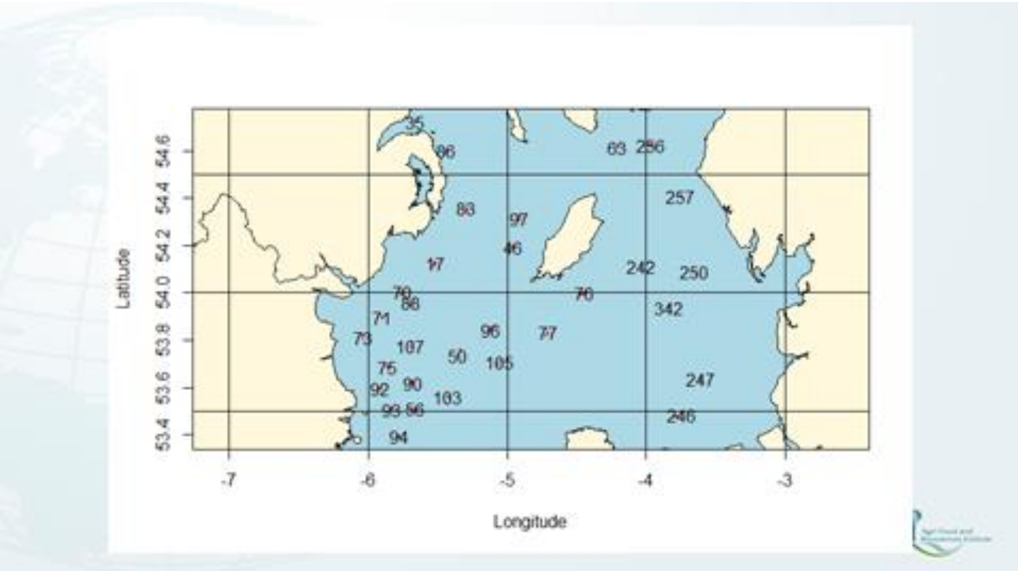

Table 3. Results of Kolmogorov–Smirnov tests for the difference in length distribution between zero- and full-duration hauls (November experiments).

| Species | Number caught in hauls of 0-min duration | Number caught per 30-min haul | Kolmogorov–Smirnov statistic | $p$ |
|---|---|---|---|---|
| *Arnoglossus laterna* | 200 | 305 | 0.196 | 0.612 |
| *Callionymus lyra* | 606 | 3 787 | 0.145 | 0.401 |
| *Dicologlossus cuneata* | 158 | 1 582 | 0.536 | 0.005 |
| *Merluccius merluccius* | 129 | 295 | 0.563 | 0.042 |
| *Merlangius merlangus* | 625 | 1 348 | 0.084 | 0.970 |
| *Solea solea* | 476 | 2 514 | 0.087 | 0.995 |
| *Trisopterus luscus* | 5674 | 22 569 | 0.069 | 0.133 |
| *Trisopterus minutus* | 231 | 1 213 | 0.081 | 1.000 |
| *Trachurus trachurus* | 116 | 2 038 | 0.330 | 0.123 |

## WD9: VIIa groundfish tow duration experiment (M. Lundy and P.-J. Schon)

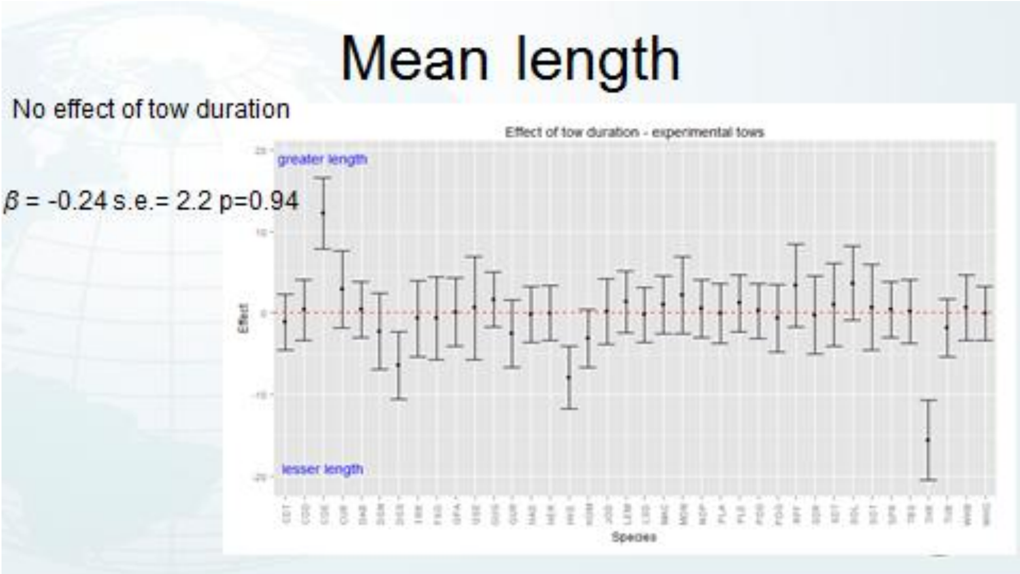



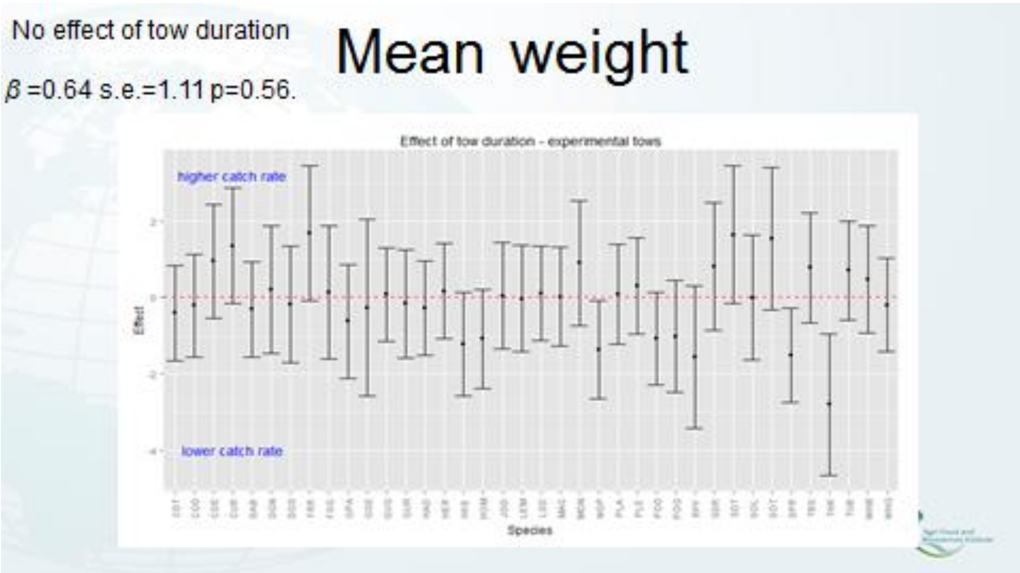


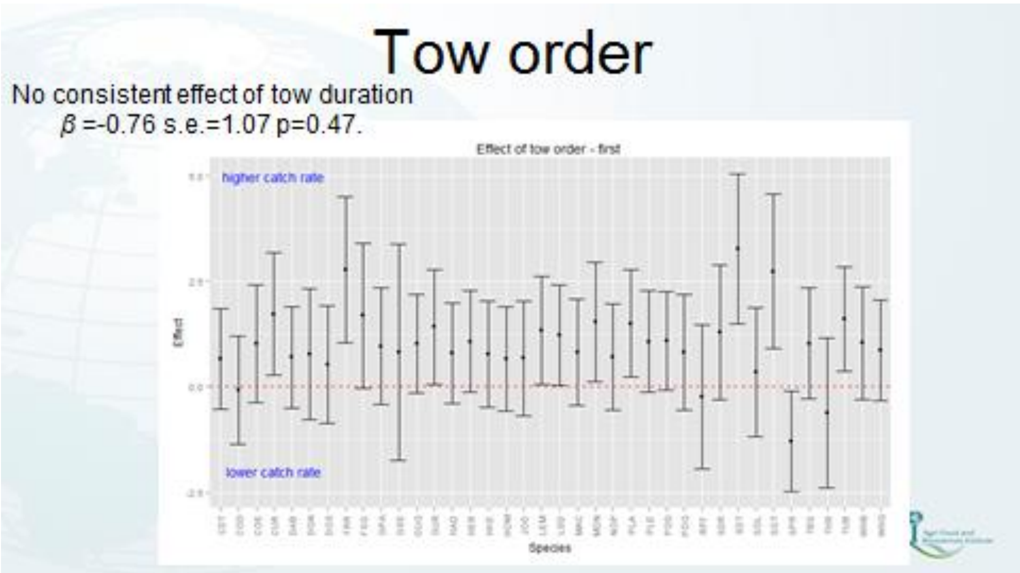




# Analysis

Generalised linear mixed models
- Response(s)
  - Mean length
  - Weight (log normal)
- Variables
  - Duration (factor)
  - Order (factor)
  - Station (random effect)
  - Strata
  - Year

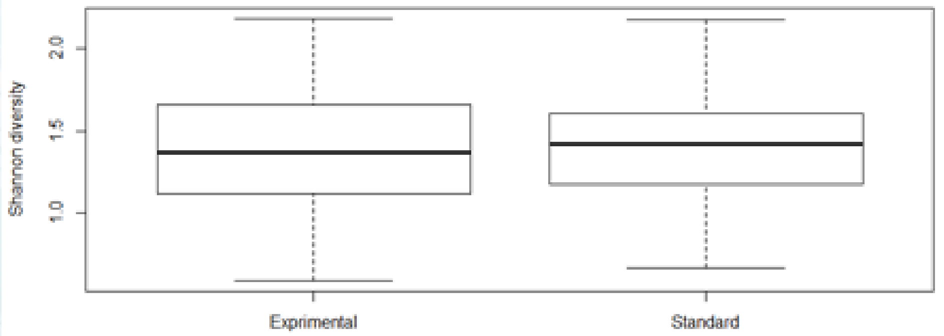

Mean length
No effect of tow duration
$\beta$ = -0.24 s.e.= 2.2 p=0.94
Effect of tow duration - experimental tows
greater length
lesser length
Effect
Species

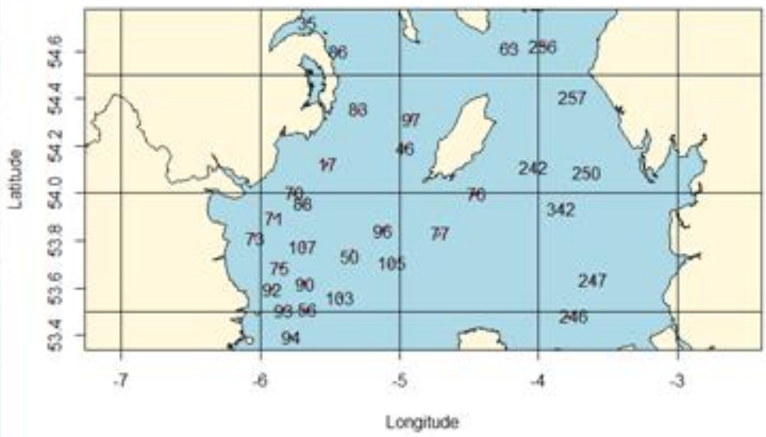

No effect of tow duration
$\beta$ =0.64 s.e.=1.11 p=0.56.
Mean weight
Effect of tow duration - experimental tows
higher catch rate
lower catch rate
Effect
Species


Tow order
No consistent effect of tow duration
$\beta$ =-0.76 s.e.=1.07 p=0.47.
Effect of tow order - first
higher catch rate
lower catch rate
Effect
Species

# Species diversity

No effect of tow duration
$\beta$ = -0.03, s.e.=0.04 p= df=0.51.




# Recommendations

- Reduced tow duration could increase survey efficiency
- Explore station leverage – survey design fully & coverage