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Manual of the IBTS North Eastern Atlantic Surveys

Version 4.0

IBTSWG

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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1 Introduction

The International Bottom Trawl Survey Working Group is an expert group under ICES with the responsibility of coordinating demersal fisheries surveys within large areas of the North Sea and NE Atlantic. The first survey to be annually coordinated was the International Young Fish Survey (IYFS), which was conducted in the North Sea and Skagerrak/Kattegat from 1966 onwards. A procedural manual was developed for use by scientists involved in this survey.

In 1994, the IBTSWG assumed responsibility for coordinating Western and Southern division surveys, covering grounds from West of Scotland in the north, to the Gulf of Cádiz and Portugal in the south. Consequently, in 1995, the IBTS manual was revised for a fifth time in order to clarify certain aspects of surveys in the North Sea and Skagerrak/Kattegat and at the same time review the manual to establish whether the same IBTS procedures could be applied to Subareas 6, 7, and 8 and Division 9a. It was decided that some aspects of the manual applied equally to all areas but other procedures required dedicated text. These specific procedures were provided in Appendix IX of that document as a draft.

At the 1999 IBTS Working Group meeting in Lisbon, Portugal, due to the considerable difficulties in merging the protocols used in the North Sea with those used in the Western and Southern divisions, it was decided that two manuals should be maintained: one relating to the North Sea and the other to the Western and Southern IBTS areas (i.e. NE Atlantic). It was also decided that this latter document should be based on the manual produced in the SESITS project (Evaluation of demersal resources of Southwestern Europe from standardized groundfish surveys - Study contract 96-029), that in the present document is referred to as 1st draft.

At the 2002 IBTS Working Group meeting in Dublin, the Manual for the International Bottom Trawl Surveys in the Western and Southern Areas was adopted as Revision 2. Since then several further survey changes have been proposed and adopted within the area, including changes in survey designs, surveys being discontinued and vessels replaced. Therefore, at the 2017 IBTS meeting in Copenhagen it was decided to undertake a further third revision of the manual to be adopted before the 2018 IBTSWG meeting in Galway. Version 3 of the Manual for the Northeast Atlantic has been revised during these years, but further changes in design, vessels and surveys hampered issuing the new version. Following these delays, the IBTS 2017 meeting a final revision has been compiled to reflect both changes in Northeast Atlantic surveys and to tailor the manual to the format and requirements of the ICES Survey Protocols Series. Also it was decided to include as an annex (Annex 9) the draft of what would be the inclusion in the manual of the Irish Survey for Anglers and Megrim (IE-IAMS), that was been presented during the 2017 IBTSWG to be considered for the coordination under the IBTS umbrella (ICES, 2017).

2 Objectives

"IBTSWG coordinates fishery-independent multispecies bottom-trawl surveys within the ICES area. These surveys aim to provide ICES assessment and science groups with consistent and standardized data for examining spatial and temporal changes in (a) the distribution and relative abundance of fish and fish assemblages; and (b) the biological parameters of commercial fish species, for stock assessment purposes.

In terms of groundfish surveys coordinated by IBTS, the main objectives are:

1. To determine the distribution and relative abundance of prerecruits of the main commercial species and provide recruitment indices;
2. To monitor changes in the stocks of commercial fish species independently of commercial fisheries data;
3. To monitor the distribution and relative abundance of all fish species and selected invertebrates;
4. To collect data for the determination of biological parameters for selected species;
5. To collect hydrographical and environmental information.

Coordination under IBTSWG

For a survey to be considered for coordination under IBTSWG on the Northeast Atlantic it should fulfil the following criteria:

a) be carried out in the ICES Areas 6 to 9;

b) a brief outline of the management need/context for the survey should be provided in the recommendations of the report of an ICES assessment or expert working group;

c) to be an otter trawl survey [while noting that there may be other working groups better placed to coordinate some bottom-trawl surveys];

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

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

f) make their data publicly available through the DATRAS database at ICES, and implement the relevant data quality checking;

g) attend and present data at the annual meetings of the IBTSWG;

h) the sponsoring assessment/expert working group(s) should confirm as early as practicable (e.g. within a five to six-year period for new surveys) that time-series or other data emanating from the survey is of value to their management of marine resources. Annual updates between the relevant working groups and IBTS is encouraged during this review period for newly adopted surveys.

2.1 History of the Northeastern Atlantic IBTS survey

In the 1999 IBTS Working Group meeting in Lisbon, due to the considerable difficulties in merging the protocols used in the North Sea with those used in the Western and Southern divisions, it was decided that two manuals should be maintained: one relating to the North Sea and the other to the Western and Southern IBTS areas (i.e. NE Atlantic). It was also decided that this latter document should be based on the manual produced in the SESITS project (Evaluation of demersal resources of Southwestern Europe from standardized groundfish surveys - Study contract 96-029), which this document refers as a first draft.

At the 2002 IBTS Working Group meeting in Dublin, the Manual for the International Bottom-trawl Surveys in the Western and Southern Areas was adopted as Revision II. In this revision the history of the changes of sampling design, gear and protocols in the different surveys were described individually in section 6. This approach is kept in this current manual, trying to keep sections in the order established in the IBTS manual regarding general procedures and protocols but also offering an overview of the changes in individual surveys. These are covered here in Section 7, together with the description of vessels and gears (Summary Table 7.1), areas covered by each survey (Figure7.1), and particularities in protocols.

Table 2.1 summarizes the surveys that are coordinated within the Northeast Atlantic IBTS area, quarters in which the surveys are carried out, and acronyms used within this manual and also those used in DATRAS (the Database of Trawl Surveys), an online database of trawl surveys with access to standard data products. Table 2.1 includes only surveys ongoing when this manual has been issued. Some surveys have been discontinued during the history of the IBTS Northeast Atlantic area, and details of these are provided in Annex 1.

Table 2.1. Summary of groundfish surveys in the Northeast Atlantic IBTS area

Survey	Division	Acronym	DATRAS Acronym(1)
Scottish Surveys			
Scottish Western Coast Survey - Q1 Rockall Survey ICES - Q3 Scottish Western Coast Survey - Q4	6a 6b 6a	UK-SCOWCGFS-Q1 UK-SCOROC-Q3 UK-SCOWCGFS-Q4	SWC-IBTS Q1 ROCKALL SWC-IBTS Q4
Northern Ireland surveys			
Northern Ireland Survey in the Irish Sea-Q1 Northern Ireland Survey in the Irish Sea-Q4	7a 7a	UK-NIGFS-Q1 UK-NIGFS-Q4	NIGFS Q1 NIGFS Q4
Irish survey			
Irish Survey - Q4	6a–7bgj	EI-IGFS-Q4	IE-IGFS
English Survey			
English Western IBTS survey – Q4	7a,e-h	UK-WIBTS-Q4(2)	
French surveys			
French Survey in the Eastern English Channel - Q4 French Survey in the Celtic Sea and Bay of Biscay - Q4	7d 7fghj, 8ab	FR-CGFS-Q4 FR-EVHOE-Q4	FR-CGFS EVHOE
Spanish surveys			
Spanish Survey in the Porcupine Bank - Q3 Spanish Survey in Northern Spanish Shelf - Q4 Spanish Survey in the Gulf of Cadiz -Q1 Spanish Survey in the Gulf of Cadiz - Q4	7bck 8c, 9aN 9aS 9aS	SP-PORC--Q3 SP-NSGFS-Q4 SP-GCGFS-Q1 SP-GCGFS-Q4	SP-PORC SP-NORTH SP-ARSA Q1 SP-ARSA Q4
Portuguese surveys			
Portuguese Survey in Portuguese Shelf - Q4	9aMS	PT-PGFS--Q4	PT-IBTS

(1) DATRAS acronyms are shown in the table 2.1 as they are used to upload and download data from DATRAS

(2) Survey time-series discontinued in 2012 but still used in the assessment for some species.

2.2 Survey gear

In the IBTS manual Revision IX (ICES, 2015a) there is a complete protocol of GOV preparation and repair during the surveys. Although this protocol is meant for the GOV, it is considered a useful protocol for the different gears used in surveys included the IBTS Northeast Atlantic area (see Table 2.2 for a list of gears and their characteristics. Figures of gears used and their performance regarding vertical (headline height), and horizontal (door and wing) opening are included in Section 7 within

each survey description, to see the different gear designs used in the area). Figure 2.1 and Figure 2.2 show a graphical comparison of the behaviour of these parameters for all surveys in Northeast Atlantic IBTS made through regressions estimated using the statistical software R (R Core Team, 2017). The checking sheets included in Appendices II to VIb of the IBTS Manual, are also considered a valuable procedure in ensuring the correct functioning of the gear, so check sheets adapted for the different gears should be considered.

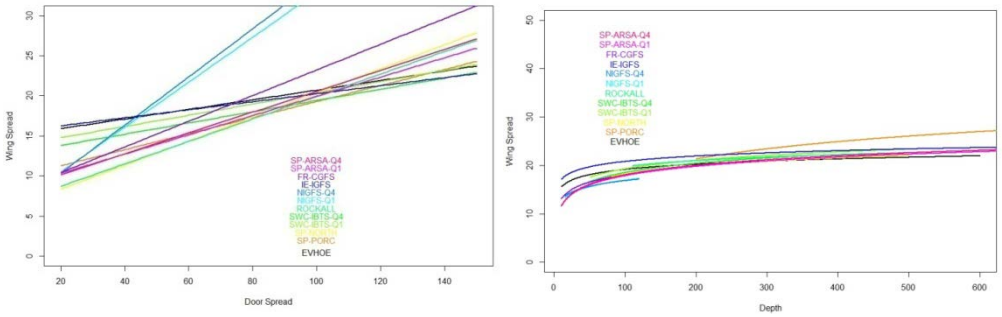


Figure 2.1. *left:* **Comparison of wing spread vs. Door spread for all the IBTS surveys in Northeast Atlantic.** *right:* **Comparison of regression lines between wing spread and depth for all IBTS surveys in Northeast Atlantic.**

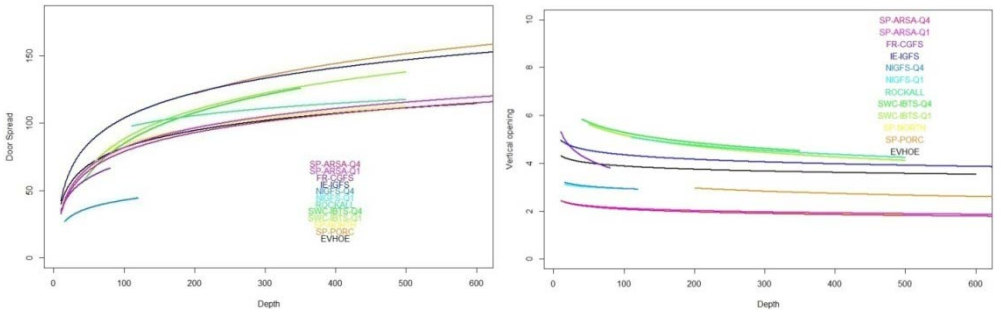


Figure 2.2. *left:* **Comparison of regression lines between door spread and depth for all IBTS surveys in Northeast Atlantic.** *right:* **Comparison of regression lines between vertical opening and depth for all IBTS surveys in Northeast Atlantic.**

Table 2.2. Sampling materials used in the groundfish surveys (see surveys acronyms in Table 2.1)

Country/Survey	IE-IGFS	UK-SCOWCGFS UK-SCOROC	UK-nigfs	Fr-EVHOE	Fr-CGFS	SP-NSGFS SP-GCGFS	Sp-Porc	PT-PGFS
Research Institute	MI	MSS	AFBI	Ifremer	Ifremer	IEO	IEO	IPMA
Equipment								
Research vessel	*Celtic Explorer*	*Scotia*	*Corystes*	*Thalassa*	*Thalassa*	*Miguel Oliver*	*Vizconde de Eza*	*Noruega*
Type	Stern trawler	Stern trawler	Double hulled	Stern Trawler	Stern Trawler	Stern Trawler	Stern Trawler	Stern trawler
GRT	2425	2619	1289	2803	2803	2495	1400	496
KW	4320	4455	2000	2200	2200	2×1000	1800	1100
Overall length (m)	65.5	68.6	52.5	73.65	73.65	70	53	47.5
Gear Type	GOV 36/47	GOV 36/47	Rock-hopper	GOV 36/47	GOV 36/47	BACA44/60	BACA 40/52	NCT
Depth range (m)	20–600	20–500	20–120	30–600	10–100	30–700(1)	150–800	30–500
Trawling speed (knots)	4	4	3	4	3.8	3	3.5	3.5
Doors weight (kg)	1450	1100	N/A	1350	1342	330	800	650
Doors surface (m^2)	5.3	4.5	N/A	4.5	4.5	1.81	4.5	3.75
Sweep length (m)	55/110	47/97	-	50 100	50	200	250	No
Diameter of Lower Bridle (mm)	22	20	18	22	22	No	18	16
Diameter of Upper Bridle (mm)	16	14	20	12	12	No	18	14

Country/Survey	IE-IGFS	UK-SCOWCGFS UK-SCOROC	UK-nigfs	Fr-EVHOE	Fr-CGFS	SP-NSGFS SP-GCGFS	Sp-Porc	PT-PGFS
Diameter of Middle Bridle (mm)	16	14	No	12	12		No	14
Exocet Kite	No	Yes	No	No	No		No	No
Floats in Headline	10x280 mm	20	No	18	24	25	12	80
Floats in Winglines	66x200 mm	20 + 20	No	24 +24	24 +24	15 + 15	50	80
Mean vertical opening (m)	4.3	4.6	3	4 4.1	4.5	2.0	3.5	4.6
Mean doorspread (m)	78/115	82	37	76.9 112.7	53.3	107.1	120.4	44.4
Mean horizontal opening (m)	19.5/21	19.6	N/A	18.7 20.5	15.3	18.9	20	15
Groundgear	Rubber disks	Rubber disks	Rubber disks	Rubber disks and Chains Rubber and metal disks	Rubber disks and bobbins	Synthetic wrapped wire core	Synthetic wrapped wire core double coat	Bobbins

The following flow diagram (Figure 2.3) can be used to describe the procedure for the preparation of the gear trawl prior to the survey and each haul.

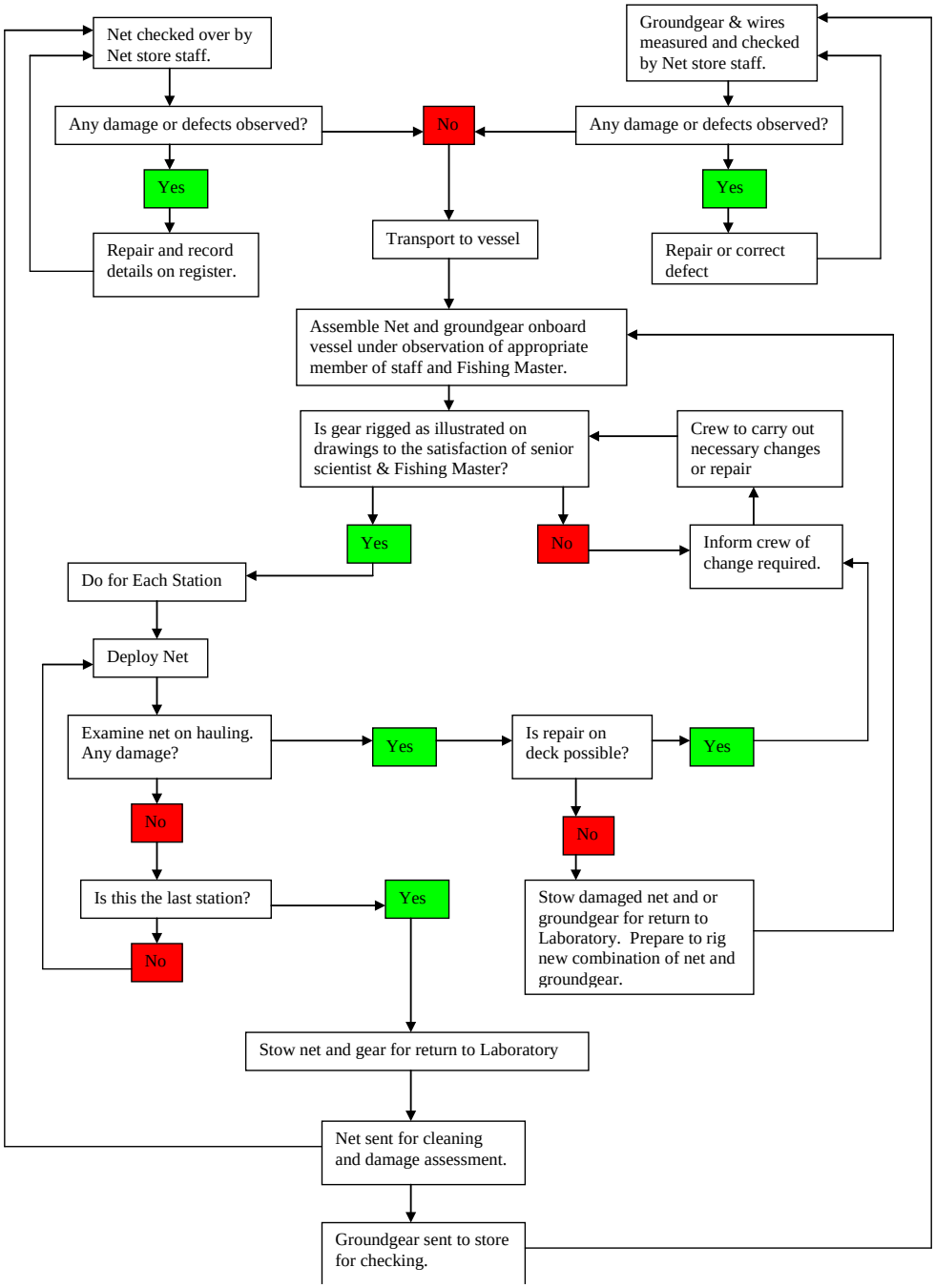


Figure 2.3. IBTS example of the gear preparation flow diagram, some require a gear expert, not always available.

2.3 Technical description of the hauls

It is suggested that all nations undertaking standardized surveys allocate some of the survey time to carrying out additional hauls at the start of the survey with the specific aim of ensuring that all standard elements of the groundfish survey are working correctly. This should include:

- Gear deployment: is the gear rigged correctly and being deployed and retrieved appropriately by the crew? Is the deck machinery all functioning?
- Ground contact: do the groundgear and doors indicate that the net is on the bottom and fishing correctly?
- Trawl sensors and CTDs: is all electronic equipment functioning correctly, and collecting meaningful data?
- Catch processing: are all elements of catch processing and data inputting functioning?

Though there are good reasons for having these additional hauls in the main survey area, for practical reasons they should be undertaken near the port of departure. This would then allow additional staff (including a gear technologist) to be present to fully check the gear and electronics, and would also save time in case something requires further attention. The start time of the haul is defined as the moment when the footrope clearance goes to zero and the gear starts fishing on the ground (due to problems in net monitoring equipment at the beginning of the time-series, Spanish (except Porcupine Survey) and Portuguese surveys start the haul from the moment the winches are locked). Stop time is defined as the start of pull back. Net monitoring should be used in all fishing operations in order to ensure effective and stable gear deployment (See section 2.4).

Haul duration varies from 30 minutes (Scotland, Ireland, France, North of Spain, and Portugal) to 60 minutes(South of Spain - Gulf of Cádiz: this was due to small catches and getting representative samples, but also with the reduced size of the area so more sampling stations would not benefit the survey), from 2015 hauls were set to 20 minutes in Porcupine survey given the large catches obtained with the 30 minutes of actual trawling, while Northern Ireland surveys use a fixed trawl distance of 3 nautical miles. Hauls are carried out during daylight were possible (given as from 15 minutes before sunrise to 15 minutes after sunset), although Q1 and Q4 surveys in the northern parts of the survey area have some exceptions due to the shorter daylight times in their latitudes. In these cases, a uniform time distribution each year is advised and Night hauls need to be entered as such in DATRAS and should not be used as standard IBTS hauls for direct comparison with daylight hauls. Towing mean speed ranges from 3.0 knots (North of Spain and Gulf of Cadiz and Northern Ireland) to 3.5 knots (Porcupine and Portugal) and 4 knots (France, Scotland and Ireland). Care should be taken to standardize data appropriately if comparing between surveys therefore, especially where trawls have different selectivity characteristics as well as how they are deployed.

Fish shoals located by sonar or echosounder should not influence fishing. Tows shorter than 15 minutes are considered invalid, with hauls from 15 to 45 minutes regarded as acceptable, assuming that there is no damage in the net.

2.4 Monitoring net geometry

All countries, except Portugal, use electronic equipment to monitor net geometry (e.g. SCANMAR, Marport) and all institutes routinely record headline height and door spread. It is recommended that wingspread also be recorded and reported. The man-

ual that is supplied with the monitoring equipment provides guidance on the correct way of attaching the sensors to the gear.

In order to ensure a valid tow, gear stability is crucial. **During the tow it is imperative that at least headline height and wing/door spread readings are monitored** continuously, and if required, trawling parameters should be adjusted to provide values that are within the accepted limits (e.g. by changing warp length, see individual surveys in Section 7 for accepted limits in different gears). If these readings are outside the recommended values for an unacceptable period of time (longer than 3 minutes, or a recurrent connection problem) it could mean that the gear has become fouled or damaged and should be hauled in. In circumstances where only one sensor seems problematic and the others are normal and stable the scientist in charge should use their experience and the data available to decide whether it is a single sensor problem or whether to haul back.

Another crucial feature affecting the behaviour of the gear is having good bottom contact from both doors back along the sweeps and over the whole groundrope, and this should be checked regularly. Proper contact of the trawl (doors, sweeps and net) on the seabed can be indicated by acoustic trawl sensors, wear (shining up) of any steel chains or shackles along the groundgear, and the presence of benthic organisms and flatfish in the catch.

It is recommended that the relevant underway vessel data, including all gear monitoring parameters that are recorded, should be saved to computer to allow (pre-filtered) mean/median values to be calculated and entered into the individual institutes' databases and in DATRAS HH records. These values should be calculated from the time the footrope makes ground contact to the time the gear is hauled. The following flow diagram (Figure 2.4) can be used to help in the process of using the net monitoring software and the units during a trawl haul.

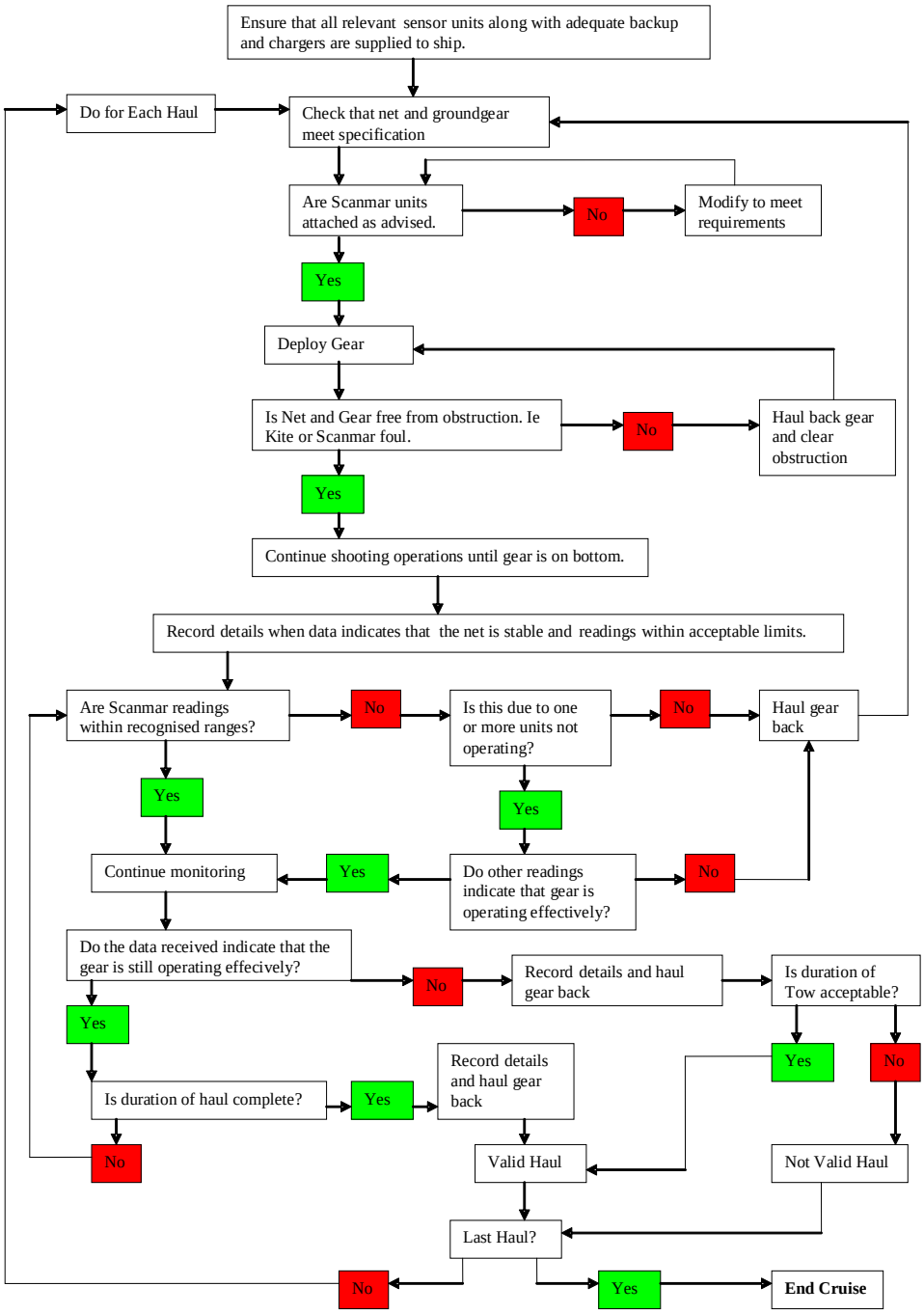


Figure 2.4. IBTS net monitoring system (e.g. SCANMAR) use flow diagram.

3 Sampling trawl catches

3.1 Catch sampling and sorting

Wherever possible, the entire catch is sorted, with fish and shellfish species identified to the lowest practicable taxonomic level that is possible in the field. In the case of a large catch of one dominant species, or larger catches in which a small number of species/size categories of species are sufficiently abundant, these can be subsampled, appropriately, with the rest of the catch fully examined for 'rare' species and any exceptionally small or large individuals of the species are then subsampled. Only in exceptional circumstances should an entire catch be subsampled, and these data should be flagged accordingly when submitted to the DATRAS database.

Apart from the commercial shellfish and cephalopod species listed in Table 3.1 and Table 3.2, many countries now sample other benthic invertebrate species caught in the gear. Although the different gears used in the different surveys are not equally effective for catching benthos for quantitative sampling, they can be used for some relative distribution information, remembering the limitations of the gears given the groundgear set up and the size of the meshes within the net construction. These samples can be collected as presence/absence data, or at a higher level (weights/numbers). It is at the discretion of the institute collecting the data to decide what means is most appropriate. The following flow diagram (Figure 3.1) can be used as a guide to dealing with the catch.

Table 3.1. Summary of species for which biological information is routinely collected per survey (see Surveys acronyms in Table 2.1)

Species	UK-SCOWCGFS	UK-SCOROC	UK-NIGFS	SP-PORC	IE-IGFS	FR-CGFS	FR-EVHOE	SP-NSGFS	PT-PGFS	SP-GCGFS
Clupea harengus	X	X			X					
Conger conger			X	X						
Dicentrarchus labrax			X		X	X				
Gadus morhua	X	X	X	X	X	X	X			
Glyptocephalus cynoglossus							X			
Helicolenus datylopterus				X						
Lepidorhombus boscii				X				X	X *	
Lepidorhombus whiffiagonis				X	X		X	X	X *	
Lophius budegassa				X	X		X	X	X *	
Lophius piscatorius				X	X		X	X	X *	
Melanogrammus aeglefinus	X	X	X	X	X		X			
Merlangius merlangus	X	X	X	X	X	X	X			
Merluccius merluccius	X		X	X	X		X	X	X	X
Micromessistius poutassou					X			X	X	
Microstomus kitt					X		X			
Molva molva			X	X	X		X			
Mullus surmuletus						X	X			
Pleuronectes platessa	X		X		X	X	X			
Pollachius pollachius			X		X		X			
Pollachius virens	X	X			X					
Scophthalmusmaximus	X		X		X					
Scomber colias									X	
Scomber scombrus	X			X	X			X	X	
Scophthalmus rhombus	X		X		X					
Solea solea					X	X	X			

Species	UK-SCOWCGFS	UK-SCOROC	UK-NIGFS	SP-PORC	IE-IGFS	FR-CGFS	FR-EVHOE	SP-NSGFS	PT-PGFS	SP-GCGFS
Sprattus sprattus	X									
Trachurus picturatus									X	
Trachurus trachurus					X			X	X	
Trisopterus esmarki	X									
Leucoraja naevus	X	X	X		X		X		X	
Raja montagui	X	X	X		X		X		X	
Raja clavata	X	X	X		X		X		X	
Raja microocellata							X		X	
Raja brachyura	X	X	X		X		X		X	
Dipturus batis(1)	X	X	X		X					
Mustelus mustelus	X	X								
Mustelus asterias	X	X			X					
Squalus acanthias			X		X					
Nephrops norvegicus				X	X		X	X	X *	X
Parapenaeus longirostris									X *	X
Penaeuskerathurus										X
Loligo vulgaris					X				X	X
Sepia officinalis					X			X	X	X
Octopus vulgaris								X	X	X
Eledone cirrhosa								X	X	X
Eledone moschata									X	X

*** not well sampled due to bottom-trawl net with rollers in the groundrope**

(1) including *Dipturus batis* complex at the moment

Table 3.2. Shellfish and cephalopods to be recorded during surveys

Aphial Code	Common name	Scientific name	recording	Measurement	Unit
CRUSTACEANS					
107275	Golden crab	*Cancer bellanius*	Male/Female	Carapace width	mm below
107276	Edible crab	*Cancer pagurus*	Male/Female	Carapace width	mm below
107369	Deep-water red crab	*Chaceonaffinis*	Male/Female	Carapace width	mm below
107253	European lobster	*Homarus gammarus*	Male/Female	Carapace length	mm below
107703	Crawfish/spiny lobster	*Palinurus elephas*	Male/Female	Carapace length	mm below
107704	Pink spiny lobster	*Palinurus mauritanicus*	Male/Female	Carapace length	mm below
107350	Spider crab	*Maja squinado* *Maja brachydactyla*[1]	Male/Female	Carapace length	mm below
107254	Norway lobster	*Nephrops norvegicus*	Male/Female	Carapace length	mm below
107205	Stone crab	*Lithodes maja*	Male/Female	Carapace length	mm below
BIVALVES					
140712	Edible scallop	*Pecten maximus*	Sexes combined	-	-
140687	Queen scallops	*Aequipecten opercularis*	Sexes combined	-	-
140658	Common oyster	*Ostrea edulis*	Sexes combined	-	-
CEPHALOPODS					
141444	Cuttlefish	*Sepia officinalis*	Sexes combined	Mantle length	cm below
141443	Cuttlefish	*Sepia elegans*	Sexes combined	Mantle length	cm below
141445	Cuttlefish	*Sepia orbignyana*	Sexes combined	Mantle length	cm below
-	Squids	*Teuthoidea*[2]	Sexes combined	Mantle length	cm below
140600	Lesser octopus	*Eledone cirrhosa*	Sexes combined	-	-
104605	Octopus	*Octopus vulgaris*	Sexes combined	-	-
-	Bobtail squids etc. [2]	*Sepiola/Rossia/Sepietta*	Sexes combined	-	-

[1] On FR-CGFS survey

[2] To species level where possible, though juveniles may need to be aggregated

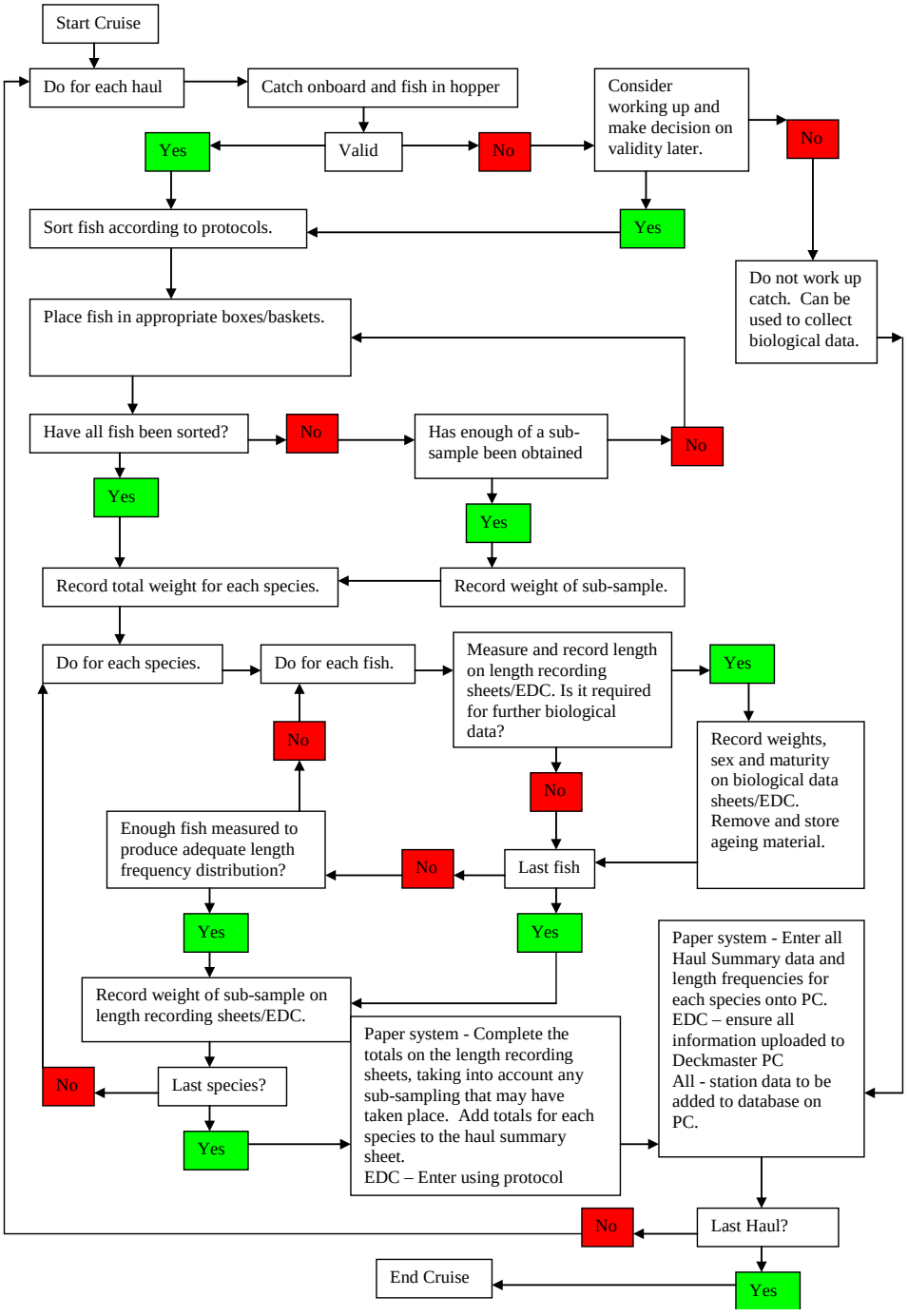


Figure 3.1. IBTS catch processing flow diagram.

3.2 Length composition

Length distributions are recorded for all fish species caught and selected commercial cephalopods and shellfish. Length is (except for those species described in sections 3.3 and 3.4) defined as total length, which is measured from the tip of snout to tip of the end of the caudal fin. Length is measured to the 0.5 cm below for herring, sprat, sardine and anchovy, and to 1 cm below for all other fish, cuttlefish and squid species. Crustaceans are measured to 0.1 cm below. When measuring shellfish species, figures 3.4.1 to 3.4.5 should be consulted to ensure the correct carapace measurement is taken.

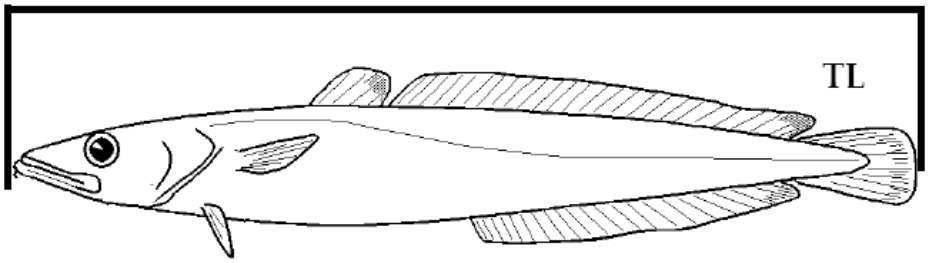


Figure 3.2. Diagram showing how to measure total length for groundfish species except those shown in section 3.3

It is recommended that elasmobranch species should be measured and weighed by sex.

After sorting the catch into species or species/sex, an accurate length distribution for each catch category is required. Where the numbers of individuals are too large for them all to be measured (due to time constraints etc.) a representative subsample is selected of ideally ≥10 times the number of length classes in the sample Gerritsen *et al*. (2006), although sampling a very limited length range could be adequately achieved with a smaller sample. In the event that a statistically representative subsample across all length classes in the catch cannot easily be selected, it may be necessary to further sort the species into two or more size grades or categories. The following two examples are used to describe incidences when grading or categorization may be required but are by no means exhaustive.

- **Example 1 -** A single species catch component consists of 999 fish in the length range 18–26 cm and one fish at 40 cm. It is evident that a random subsample of 100 fish when raised up will give either 10 or zero fish at 40 cm. The correct approach is to remove the one large fish and measure it separately, treating that sample as category 1, and take a subsample of 90 fish[1] from the remaining 998 fish (category 2). When measured and raised this provides an accurate assessment of the numbers caught at each length for this element of the catch.
- **Example 2** - A catch element consists of 994 fish in the length range 18–26 cm and 3 fish in the length range 10–12 cm and 3 fish in the length range 38–40 cm. It is evident that a single raised subsample of 150 fish could give anything between zero and 6 fish in the length ranges 10–12 cm and 38–40 cm. The correct approach is to remove the small and large fish and measure them as category 1, and then take a subsample of ca. 90 fish[1] from the remaining 988 fish (category 2). When measured and raised this provides an accurate assessment of the numbers caught in each length group for this element of the catch

In case of large catches (n >1000) of any species, the minimum sample size given above should be doubled.

Fish should always be identified to the species level. Only where this proves impractical within survey constraints should some problematic species be grouped by genus (e.g. sand gobies *Pomatoschistus* spp.) or higher taxonomic level (e.g. sandeels, Am-

[1]10 specimens × (26–18 cm) 9 length classes =90

modytidae), all these cases should be recorded with the appropriated taxonomic level in the AphiaID code when uploaded to DATRAS.

3.3 Measurement types for deep-water species

Due to the variety of body shapes and the fragility of the tails and fins of many deep-water fish species, some are not measured to total length. The majority of species encountered during the surveys are measured to the centimetre below using total length as the length unit **(**TL**)** (see diagram in Figure 3.2). Listed below are the species groupings that are not measured using total length complete with details of the length measurement collected for each.

Smooth heads and Searsids (Alepocephalidae and Searsidae)

SL-Standard Length. Measurement taken from the tip of the snout/anterior point of head to the end of the fleshy caudal peduncle (See Figure 3.3). Not to be confused with TL which includes the caudal fin rays. All smooth heads and Searsids are measured to the nearest whole cm below.

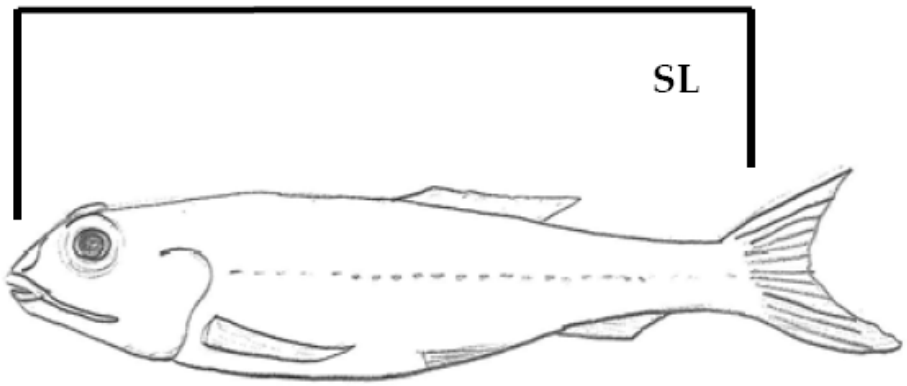


Figure 3.3. Measurement of Searsids and Alepocephalidae fish

Grenadiers (Macrouridae)- PAFL – Pre Anal Fin Length

Measurement taken from the tip of the snout to the first anal fin ray (See Figure 3.4). All grenadiers are measured to the nearest 0.5 cm below.

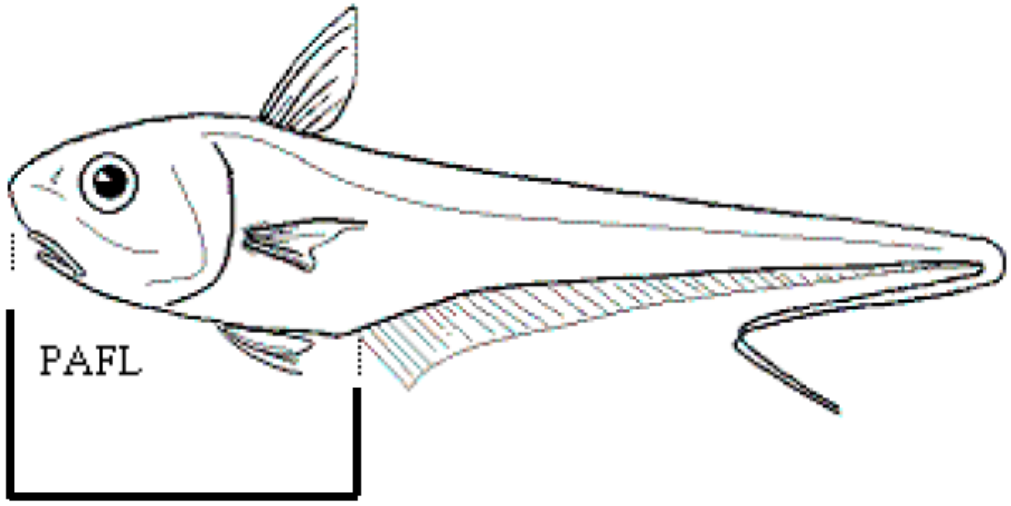


Figure 3.4. Measurement of grenadiers (Macrourid fish)

Chimaeridae (Rabbitfish) – PSCFL – Pre Supra Caudal Fin Length

Applies to all **Rabbitfish** except Rhinochimaeridae (see Figure 3.5). Measured from the tip of the snout to the point just before the start of the supra caudal fin.

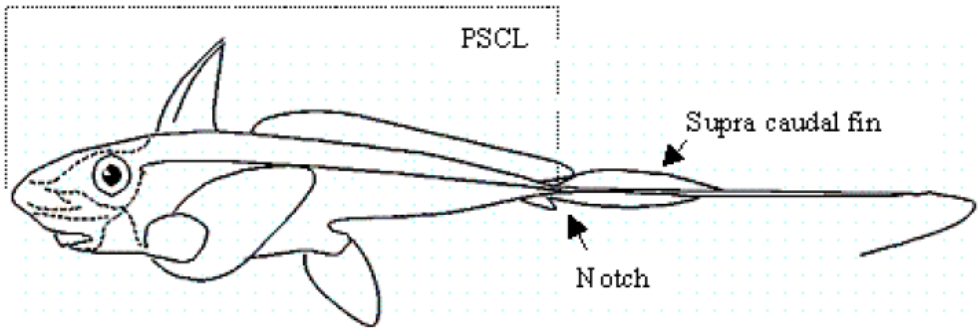


Figure 3.5. Measurement of rabbitfish (except Rhinochimaerids)

3.4 Measurement types for crustaceans and cephalopods

Figures 3.6 to 3.10 show the different measurements procedures for commercially important crustaceans measured to the mm below and cephalopods measured to the cm below.

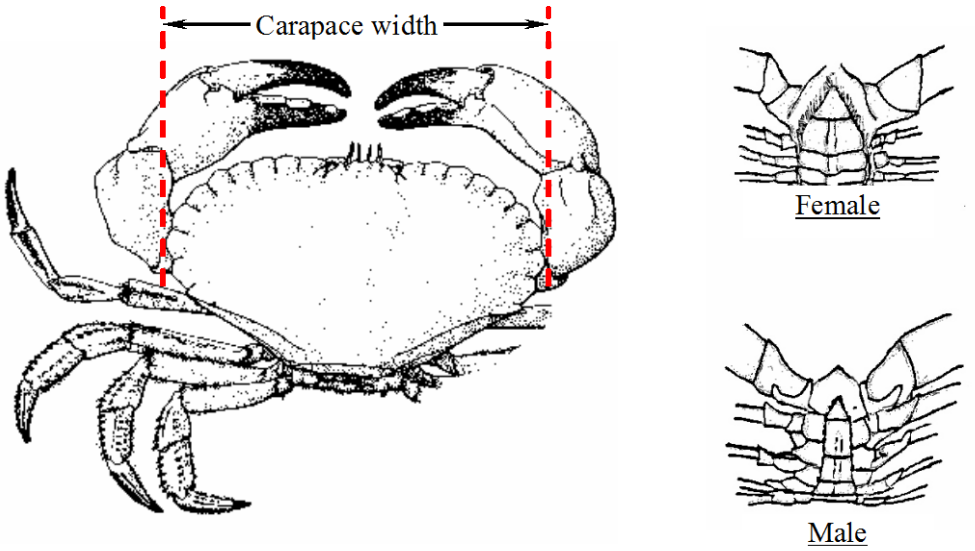


Figure 3.6 Measurement and sexing of *Cancer pagurus* to be measured to the lower mm

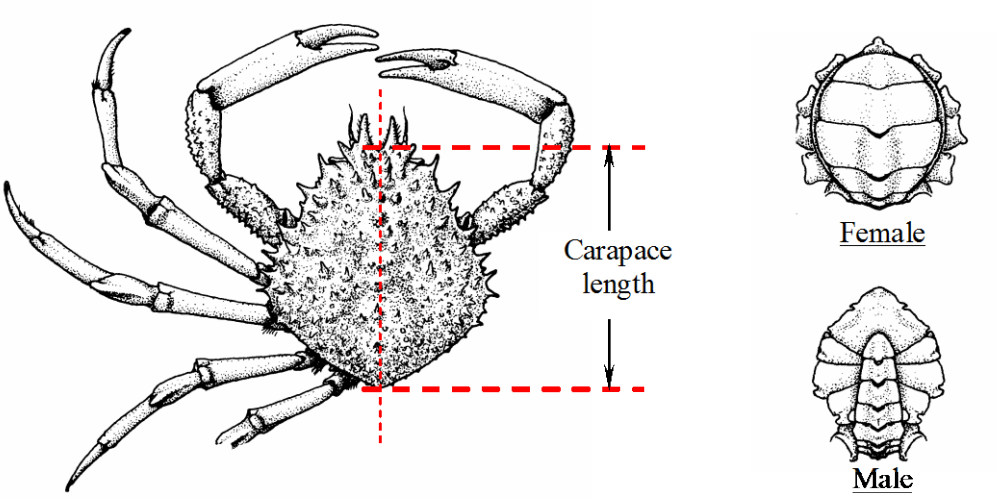


Figure 3.7 Measurement and sexing of *Maia squinado* to be measured to the lower mm

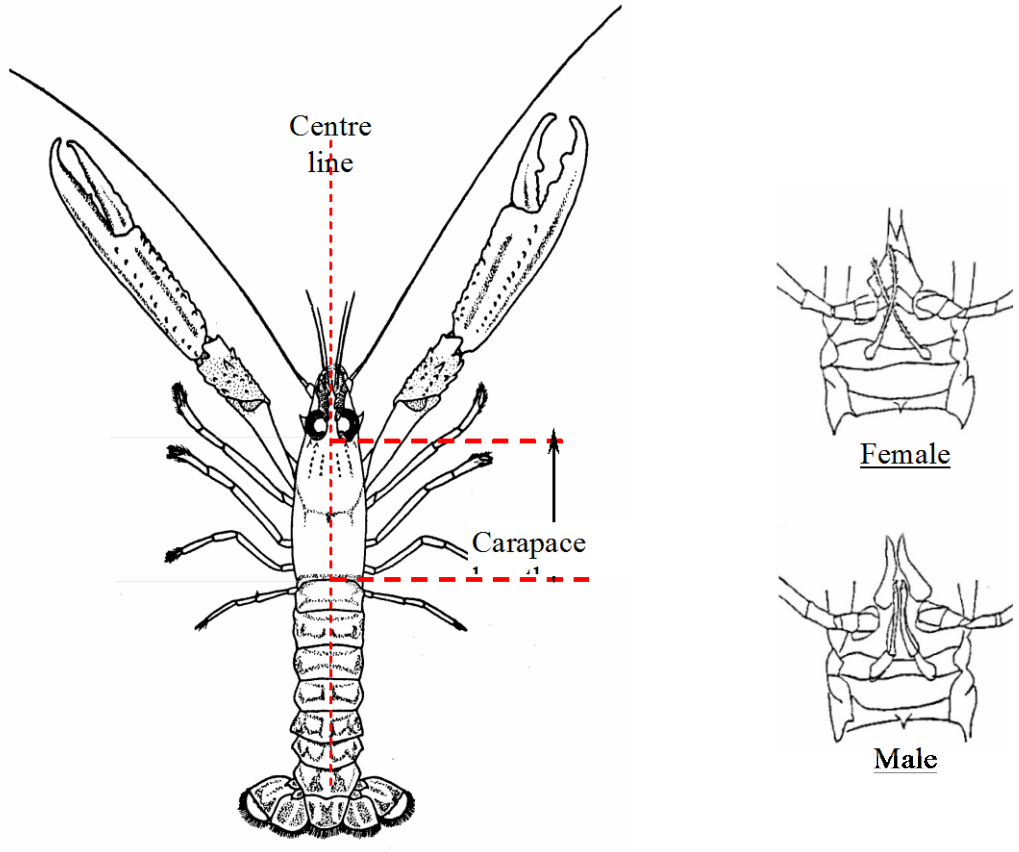


Figure 3.8 Measurement and sexing of *Nephrops norvegicus* to be measured to the lower mm

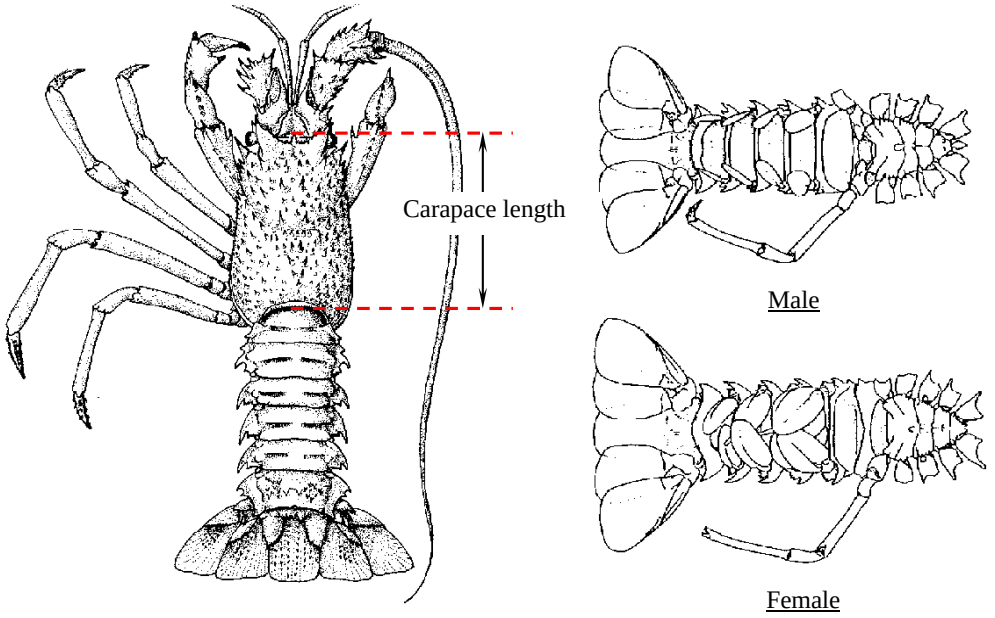


Figure 3.9 Measurement and sexing of *Palinurus* sp. and *Homarus gammarus* to be measured to the lower mm

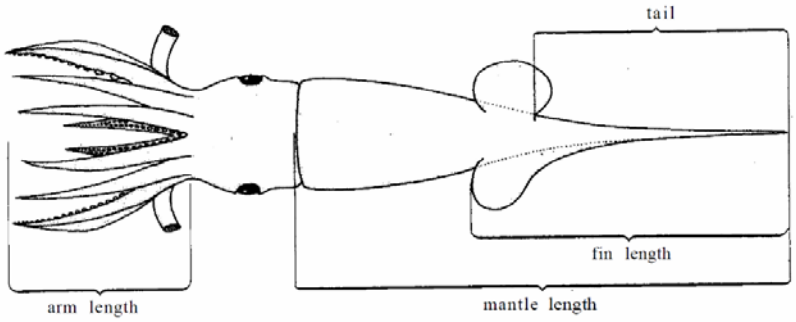


Figure 3.10 Measurement of Cephalopods mantle length to be measured to lower cm

3.5 Sampling for age, sex and maturity

Given the large area covered by the surveys in the Northeast Atlantic area, and the number of countries participating in the IBTS surveys, the list of species considered as target commercial species vary between surveys and countries. Table 3.1and Table 3.2 summarize the list of species considered as *target species* in each survey and that are sampled for age/sex/maturity and reflects the stocks assessed for management by ICES in each survey area. Nevertheless, given the varying and increasing requirements of the EU/Data Collection Framework (DCF), an updated list of species, annual target numbers and number achieved by species can be found in the latest IBTSWG reports.

General recommendations for Age, Sex and Maturity sampling are:

- For the smallest size groups, that presumably contain only one age group, the number of otoliths per length class may be reduced. Conversely more otoliths per length are required for the larger length classes;
- Targets should be set to ensure that data are collected from the entire survey area and avoid spatial bias (e.g. Gerritsen *et al.*, 2006);
- Sex, maturity and weight data should be reported for all target species for which age data are collected. Maturity stages should be reported according to the maturity scales given in the appropriated workshop for each target species updated annually in the IBTSWG reports;
- Participants are encouraged to collect age samples also from any other species deemed important to the DCF.

4 Indices estimation

4.1 Computation of abundance indices at age

Equations for the computation of global Survey abundance indices given below taken from the EVHOE manual and IPROSTSPROJECT Report (Mahe *et al.,* 2001). The algorithms summarized here are considered to be a valid summary for indices in the Northeast Atlantic area, with the exception of those surveys where the design is not area stratified and Scottish surveys that use a different algorithm for the application of the ALKs (see section 7.1.1).Other basis for stratification are also used in the NE Atlantic Area such as ICES Rectangles (e.g. FR-CGFS) or combinations of depth stratification and substratum type (Northern Ireland).

4.2 First phase, computation of average numbers at length and associated variances

Estimation of average numbers at length *j* for a group of *h* strata (stratified mean $\overline{E}_j$) and its variance $V(\overline{E}_j)$) is computed according to the random sampling strategy described by Cochran (1977) for computation of global indices:

For each length class *j* :

$$\overline{E}_j = \frac{1}{A} * \sum_h A_h * \overline{E}_{jh} \quad (1)$$

$$V(\overline{E}_j) = \frac{1}{A^2} * \sum_h \left(\frac{A_h^2 * V(\overline{E}_{jh})}{N_h} \right) \quad (2)$$

where :

A_h = area of stratum *h*

A = total area of the group of strata *st*

$\overline{E}_{jh}$ = mean number per haul (weighted to standard to duration in shorter hauls) in length *j* for stratum *h*

N_h = number of hauls in stratum *h*

$V(\overline{E}_{jh})$ = variance of the mean number in length class *j* for stratum *h*

4.3 Second phase, building the age–length key, computation of the proportions at age *i* per length class *j* and associated variances

For each length class *j* the proportion of age *i* and its variance is computed:

$$p_{ij} = n_{ij} / n_j \quad (3)$$

$$V(p_{ij}) = \frac{p_{ij}(1 - p_{ij})}{n_j} \quad (4)$$

Error! Bookmark not defined.where:

n_{ij} = number of otoliths of age *i* in the length class *j*

n_j = total number of otolith in the length class *j*

4.4 Third phase, computation of mean numbers-at-age and the associated variances

The mean numbers-at-age are given by:

$$\overline{E_i} = \sum_j \overline{E}_j * p_{ij}$$

The associated variance:

$$V\left(\overline{E_i}\right) = \sum_j \left[V\left(\overline{E_j}\right) p_{ij}^2 + \overline{E}_j^2 V\left(p_{ij}\right) + V\left(p_{ij}\right) V\left(\overline{E_j}\right) \right] \tag{5}$$

These computations are done by sex, for some species, and the total age composition is given for each age *i* by:

$$\overline{Et}_i = \overline{Em}_i + \overline{Ef}_i$$

Its variance:

$$V\left(\overline{Et_i}\right) = V\left(\overline{Em_i}\right) + V\left(\overline{Ef_i}\right) \tag{6}$$

The sampling being independent on sex the covariance is not considered.

5 Environmental data

5.1 Hydrographic data

After each fishing haul, the following minimum hydrographical data are collected: surface temperature, bottom temperature, surface salinity and bottom salinity. When using a CTD-probe for measuring temperature and salinity, an appropriate calibration should be undertaken (Saunders *et al.,* 1991).

Some laboratories use a net-mounted mini CTD for collecting surface and bottom temperature and salinity at all fishing stations, although CTD casts are still useful to provide vertical profiles. Some laboratories undertake CTD casts for every fishing station, although given the restrictive daylight in quarters 1 and 4, some laboratories only undertake CTD casts before the first station and after the last station each day.

The sampling design should aim to resolve the following processes:

- Coastal Upwelling
- Ekman divergence near the capes
- Fluxes over the shelf, slope currents and circulation in the off-slope area
- Mesoscale features

CTD sampling station distribution should satisfy the requirements of high resolution sampling along tracks to separate mesoscale features. As a general recommendation, some guidelines are proposed in this manual, although details depend on the individual surveys. The required separation between sampling points is of 10–15 km and the distance of tracks off-the-shelf-break no more than 30–40 km. In order to detect upwelling phenomenon in regions where the shelf is narrow (less than 15 km) at least two sampling points should be performed from the coast to the shelf break. Homogeneous distribution of CTD stations at both sides of the most prominent capes are also conducted to investigate Ekman divergence processes. To evaluate the slope currents, at least three CTD casts are done in the following manner: one over the shelf, the second over the shelf break (200 m depth) and the third off-the-shelf break. Equal separation distance among stations is convenient.

CTD stations outside the continental shelf are conducted during Spanish surveys in perpendicular profiles to the coast, with a minimum of two casts in the open ocean. Whenever possible, information relative to the estimation of primary production is also collected. Accordingly, to maximize the opportunities whereas on the survey, it is recommended the CTD system has a fluorimeter and oxygen sensor, as well as at least one Niskin bottle (1.5 l) attached to the CTD cable at a depth of 40 m.

To avoid the aliasing or subsample effect and to improve the data analysis, CTD sampling stations are homogeneously distributed over the study area, avoiding large uncovered areas. CTD casts sampled at stations over the shelf area cover the whole water column, from surface to bottom. When stations and CTD casts are beyond the slope, samples should be conducted to at least 400 m bottom depth.

Since 1992, the following additional environmental data have been sought, although not collected in all surveys: surface current direction, surface current speed, bottom current direction, bottom current speed, wind direction, windspeed, swell direction, and swell height. The above parameters should be reported in the 'Haul Information file HH' (Annex 3).

Details of environmental data should be submitted to the Hydrographic Service of ICES according to established procedures. The national hydrographic station number

must be reported in Record Type 1 to allow the link to be made between haul data and environmental data.

5.1.1 Additional activities

Table 5.1. gives an overview of the Additional activities performed the different Northeast Atlantic surveys as reported per country/survey during the IBTSWG 2017 meeting (ICES, 2017).

Table 5.1. Additional activities performed in NEatl IBTS, as reported per country/survey within the 2017 IBTSWG meeting

	UK-Sco			**UK-NIGFS**		**Irl**	**Fr**		**Sp**				**Pt**
	Q1	Q3	Q4	Q1	Q4	IGFS	CGFS	EVHOE	Porc	NS	GC Q1	GC Q4	PGFS
CTD (Temp+salinity)	1	1	1	1	1	1	1	1	1	1	1	1	1
Seafloor Litter	1	1	1	1	1	1	1	1	1	1	1	1	1
Water sampler (Nutrients)							1	X					
Egg samples (Small fine-meshed ringnet, CUFES)							1						
Non-commercial benthic invertebrates				1	1	1	1	1	1	1	1	1	1
Observers: mammals, birds							1	1	X	1			
Additional biological data on fish	X	X	X	X	X	X	X	X	X	X		X	X
Fish stomach contents				X	X		X	X		1	X	X	X
Benthic samples (box corer, video, dredge)		1					X	X	X	X			
Zoo and phytoplankton							1	1					
Jellyfish				X	X	X	1	X	X				1
Hydrological transect						1				X	X	X	
Acoustic for fish species	1		1			X		X	X				X
Multibeam: seabed mapping						X		1	X				X

1: Every year, 2: biannual, 3 every three years, X: occasional

6 Exchange specifications for IBTS data

Three distinct types of computer records have been defined for standard storage of the IBTS data:

- Type 1: HH - Record with detailed haul information (Annex 3)
- Type 2: HL -Length frequency data (Annex 4)
- Type 3: CA - Sex-maturity-age-length keys (SMALK) (Annex 5)

The summaries of the formats of these record types are given in the annexes given above, and detailed descriptions can also be found at the ICES webpage: http://dome.ices.dk/datsu/selRep.aspx.

When data are submitted to ICES it is important to give details of the data, such as the number of records of each record type, and the number of CA-records per species.

Hydrological data: CTD casts performed and the Cruise Summary Report (i.e. Roscop files) should be submitted to ICES as soon as possible after the end of the Cruise.

7 Individual survey protocols

This section presents a short summary of the specific protocols from each of the surveys carried out in the Northeast Atlantic area of IBTS. Table 7.1 and Figure 7.1 and 7.2 summarize the geographic sectors and the area covered by each of the IBTS Surveys.

Table 7.1. Area of the geographic sectors used in the IBTS SW Areas – See Annex 6 for a complete table of strata and sampling areas.

Country	Survey	DATRAS Acronym[1]	Geographic sector	
			Name	Area (km^2)
UK - Scotland	UK-SCOWCGFS UK-SCOROCGFS	SWC-IBTS ROCKALL	Overall area[3]	99 949 – 102 316 21 694
UK - Northern Ireland	UK-NIGFS	NIGFS	Overall area [3]	44 952
Ireland	IE-IGFS	IE-IGFS	Northwest (6a) West (7b) Celtic Sea (7fgj)	167 673 105 065 280 742
Spain (Irish waters)	SP-PORC	SP-PORC	Porc-N Porc-S	25 080 20 877
UK – England[1]	UK-WIBTS			[2]
France	FR-CGFS	FR-CGFS	Eastern Channel (7d)	33 211
France	FR-EVHOE Celtic Sea	EVHOE	Cn Cc Cs	35 115 54 535 68 871
France	FR-EVHOE Bay of Biscay	EVHOE	Gn Gs	56 820 14 470
Spain	SP-NSGFS Cantabrian Sea	SP-NORTH	AB PA EP	2460 4614 5352
Spain	SP-NSGFS Galician Shelf	SP-NORTH	FE MF	7774 4139
Portugal	PT-PGFS	PT-IBTS	PN PW PS	11 245 5837 7296
Spain	SP-GCGFS	SP-ARSA	CA	7224
			Total [4]	1 054 151

(1) DATRAS acronyms are shown in the table as they are used to upload and download data from DATRAS
(2) Survey discontinued in 2012 but still used in the assessment of some stocks
(3) Stratification based on depth and substratum type, area not used to stratify the indices.
(4) Details on the areas of sectors and strata on individual survey descriptions
(4) Total refers to the surveys using the areas in indices estimation and design, not overall area. Besides some survey areas are overlapped, and therefore total area is smaller than the total surveyed for all the surveys.

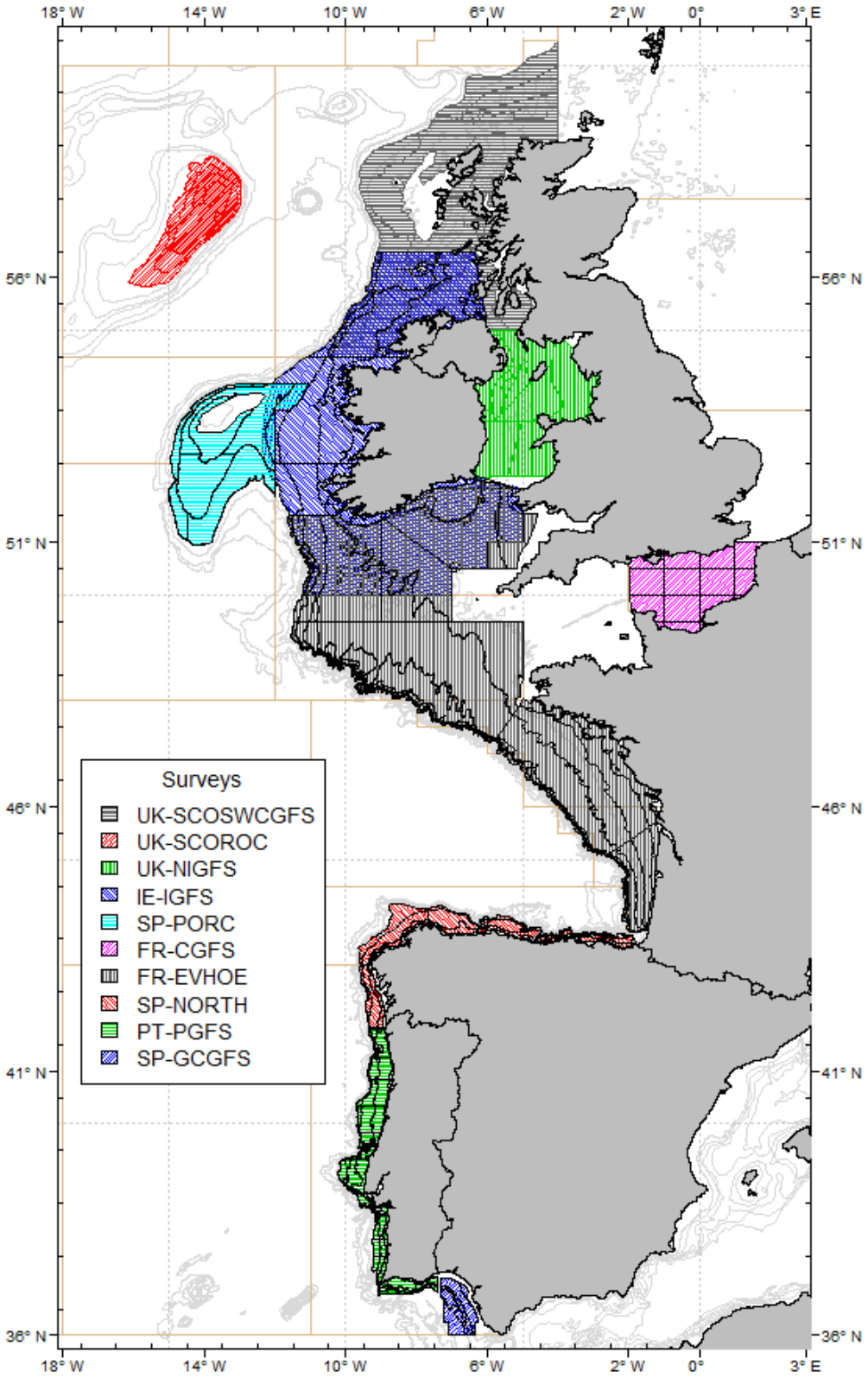


Figure 7.1. Coverage of the bottom-trawl surveys included in the Northeast Atlantic IBTS area with general geographic stratification used.

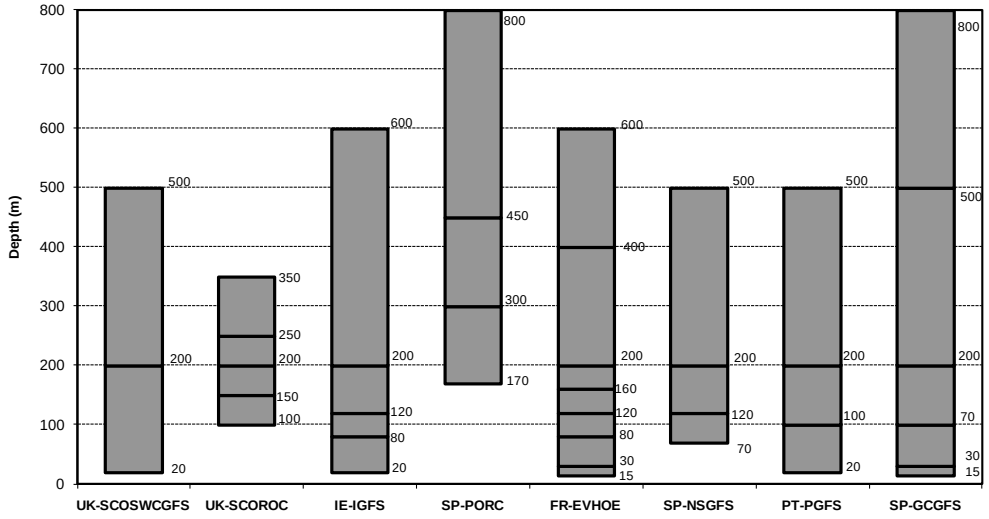


Figure 7.2. Bathymetric stratification used by each area/survey. See acronyms an details in Figure 7.1 and Table 7.1 to see the area covered by each survey.UK-NIGFS and FR-CGFS not included since stratification is not mainly bathymetric

7.1 Scottish West Coast Groundfish Survey (Division 6a) (UK-SCOWCGFS) and Scottish Rockall Survey (Division 6b) (UK-SCOROC)

7.1.1 Current survey design

From 2011 both the Q1 and Q4 Scottish West Coast Groundfish Surveys in ICES Subarea 6a (UK-SCOWCGFS) have utilized a random stratified survey design with station positions being randomly distributed within a series of 'a priori' sampling strata. Tentative K – means clustering of density data for hauls from the previous 'fixed station' surveys time-series (1996–2010) was carried out separately for each survey in order to create a series of meaningful faunal strata. The species of primary interest are juvenile gadoids and therefore the focus of the analysis was on the demersal species: cod, haddock, whiting, saithe, and hake. For the Q1 survey, in addition to the existing time-series data from the established survey, 2 dedicated charter surveys conducted in 2010 within the same geographical area and temporal period were also used to complement the Q1 survey data. All fish densities were standardized (they were given as log numbers per 30 minutes trawling). To account for year-to-year differences in abundance, these densities were then expressed in relation to the average density for a given species/size class and in a given survey/year. As a result, maps of the typical distribution could be generated for the five demersal species based on these analyses of the historical data. This resulted in 4 clusters for the Q1 survey and 4 for the Q4 survey. After completion of the second year of random stratified surveys in 2012 the analyses were repeated incorporating the 2 years of new survey data from 2011 and 2012. The post – stratification resulted in the creation of an additional stratum for the Q1 survey which now has 5 strata whereas the number of Q4 strata remained the same at 4. In addition to these biological strata an additional 2 strata were created around 2 closed areas off the west coast of Scotland, the Windsock and Clyde strata (Figures 7.3 and 7.4). Additional sampling is also carried out in ICES Area 7b as part of the Q4 survey in stratum GY, however this is to assess juvenile mackerel recruitment and is not included in the 6A index calculation for that survey.

Both surveys are allocated approximately 60 primary trawl stations with the sampling effort being distributed among strata to maximize the precision of the fish density estimates with more sampling effort allocated to the larger geographical strata as

well as those with a higher within-stratum variance. In addition, secondary station positions were also created in the likely event that any of the primary locations prove to be unsuitable for trawling. In the process of sampling effort allocation, each individual polygon (Figures 7.3 and 7.4) was treated separately (for instance "R1", "R2" and "R3" rather than just "R"). Only in the case of some very small patches (for example, the most southern patches of "P" and "B2" were they combined with the nearby larger polygon, especially if they were less intensively sampled in the past. All these polygons are further referred to as "strata". In addition, the two closed areas, the Windsock (WS) and the Clyde (CL), were treated as separate strata. Effectively, these strata were formed to further allocate sampling effort:

Q1: "R1", "R2", "R3" "G1", "G2", "B1", "B2", "LB", "P", "WS" and "CL" (Figure 7.1.1a)

Q4: "R1", "R2", "G1", "G2", "G3", "G4", "B1", "B2", "LB", "WS", "CL" and "GY" (Figure 7.1.1b)

To maximize the precision of the fish density estimates for the total survey area, survey effort was allocated among strata in such a way that the proportion of the samples in each stratum (n_i/n) was given by

$$n_i/n = \frac{A_i s_i}{\sum_{i=1}^{S} A_i s_i}$$

where A_i = area (m^2) of stratum i, s_i = standard deviation within stratum i, S = number of strata (Gunderson, 1993). Thus, more sampling effort was allocated to bigger strata and those with a higher within-stratum variance. The selection of stations was carried out randomly in each stratum (given the number of hauls per stratum), and with the constraint that the minimum distance between two nearest stations was 10 nm. This ensured that each possible sample point had an equal chance of being selected; and that there was an even coverage of samples throughout the strata (avoiding clustering of samples and concomitant large open spaces without samples).

Q3 Scottish Rockall Haddock Survey (UK-SCOROC-Q3)

The Q3 Scottish Rockall Haddock Survey (UK-SCOROC-Q3) is primarily a juvenile haddock survey conducted in ICES Subarea 6b. Since 2011 the SCOROC has utilized a random stratified survey design with station positions being randomly distributed within a series of 'a priori' sampling strata. Prior to this the survey employed a fixed station format with a bathymetric limit of 240 m. Evidence from other surveys undertaken on Rockall Bank (notably the Q2 MSS monkfish survey) raised concerns that the existing survey was missing significant components of the Rockall haddock stock found in depths greater than 240 m. The observed haddock distribution raised the idea of increasing the precision of the survey through stratification. The survey design was thus revised in 2011 and the upper limit has now been set to 350 m resulting in four sampling strata: 0–150, 151–200, 201–250, and 251–350 m denoted as "R1", "R2", "R3" and "R4", respectively (Figure 7.5)

With regard to how to allocate sampling effort between strata one should use approximate multiples of sampling intensity allocated according to abundance in each stratum as estimated from the existing Rockall survey data. Sampling intensity was thus modified with k samples per unit area in low density strata, k*2 samples per unit area in medium density strata and k*3 in high. The proportion of the samples in each stratum (n_i/n) was given by

$$n_i/n = \frac{A_i m_i}{\sum_{i=1}^{h} A_i m_i}$$

where A_i = area (m^2) of stratum i, m_i = number samples per unit area within stratum i(with $m_1 = 1$, $m_2 = 2$, $m_3 = 3$, $m_4 = 2$, h = number of strata.

Within strata, the samples were chosen at random within strips of equal area. This ensures that each possible sample point has an equal chance of being selected; and also that there is an even coverage of samples throughout the strata (avoiding clustering of samples and concomitant large open spaces without samples).On agreeing the above points, and assuming a similar number of stations to previous Rockall surveys (n = 40) the allocation for each stratum should be as shown on the table below.

Table 7.2. Depth strata used on Rockall surveys

Strata	Depth range (m)	number of stations
R1	0–150	3
R2	151–200	16
R3	201–250	10
R4	251–350	11

Index calculation

This calculation is applied to all 3 Scottish West Coast Groundfish Surveys in both ICES Subareas 6a and also 6b. Numbers at length (the length frequencies LF) per haul are standardized to numbers per one hour towing. In previous years, all otoliths from all hauls in a given demersal sampling area were combined to create an age length key (ALK) for that area (Holmes, 2008). With the current design, all otoliths taken within each of the survey strata are combined to form a strata specific ALK. This ALK is applied to all LFs in the stratum individually to produce age frequencies for each haul. Finally, for each stratum the age frequencies are summed, the values divided by the number of valid hauls to provide numbers-at-age per hour. This procedure can be summarized as

$$CPUE_{i,a} = \frac{\sum_{h=1}^{H_i} \sum_{l=l_{\min}}^{l=l_{\max}} N_{a,l,h}}{H_i}$$

where $N_{a,l,h}$ is the number of fish-at-age a and length l caught during haul h, H_i is the number of valid hauls in stratum i and $CPUE_{i,a}$ is the catch per unit of effort of fish-at-age *a* in stratum i.

For each age, the age frequency for each stratum is raised by the number of valid hauls in the area. These raised frequencies are then summed and the result divided by the total number of valid hauls in the assessment region. The final index value for each age is given by:

$$I_a = \frac{\sum_{i=1}^{S} (CPUE_{i,a} \times A_i)}{\sum_{i=1}^{S} A_i}$$

where A_i = area (m^2) of stratum *i* and S = number of strata.

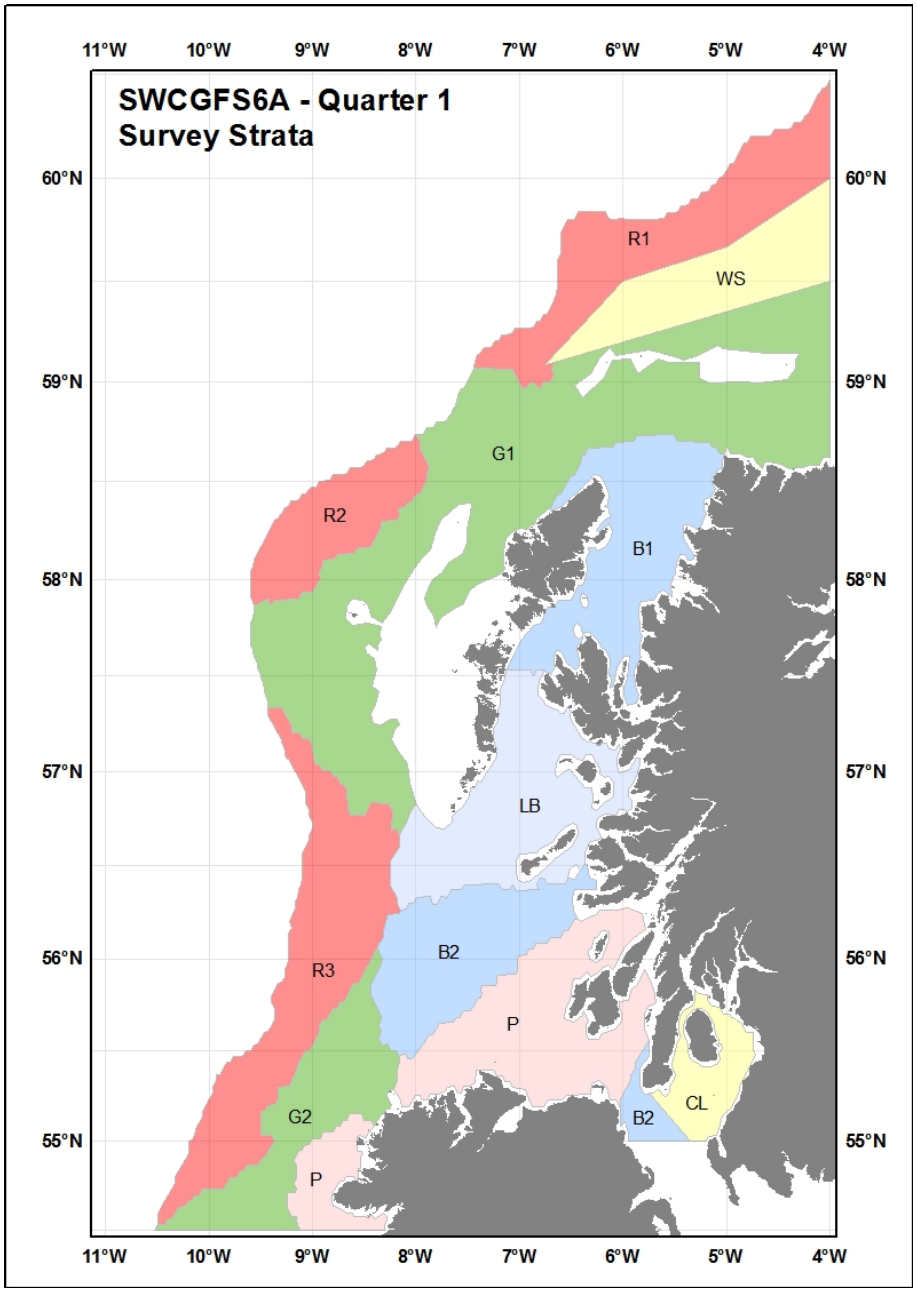


Figure 7.3. Strata in UK-SCOWCGFS- Q1. White areas within the survey area denote unfishable areas.

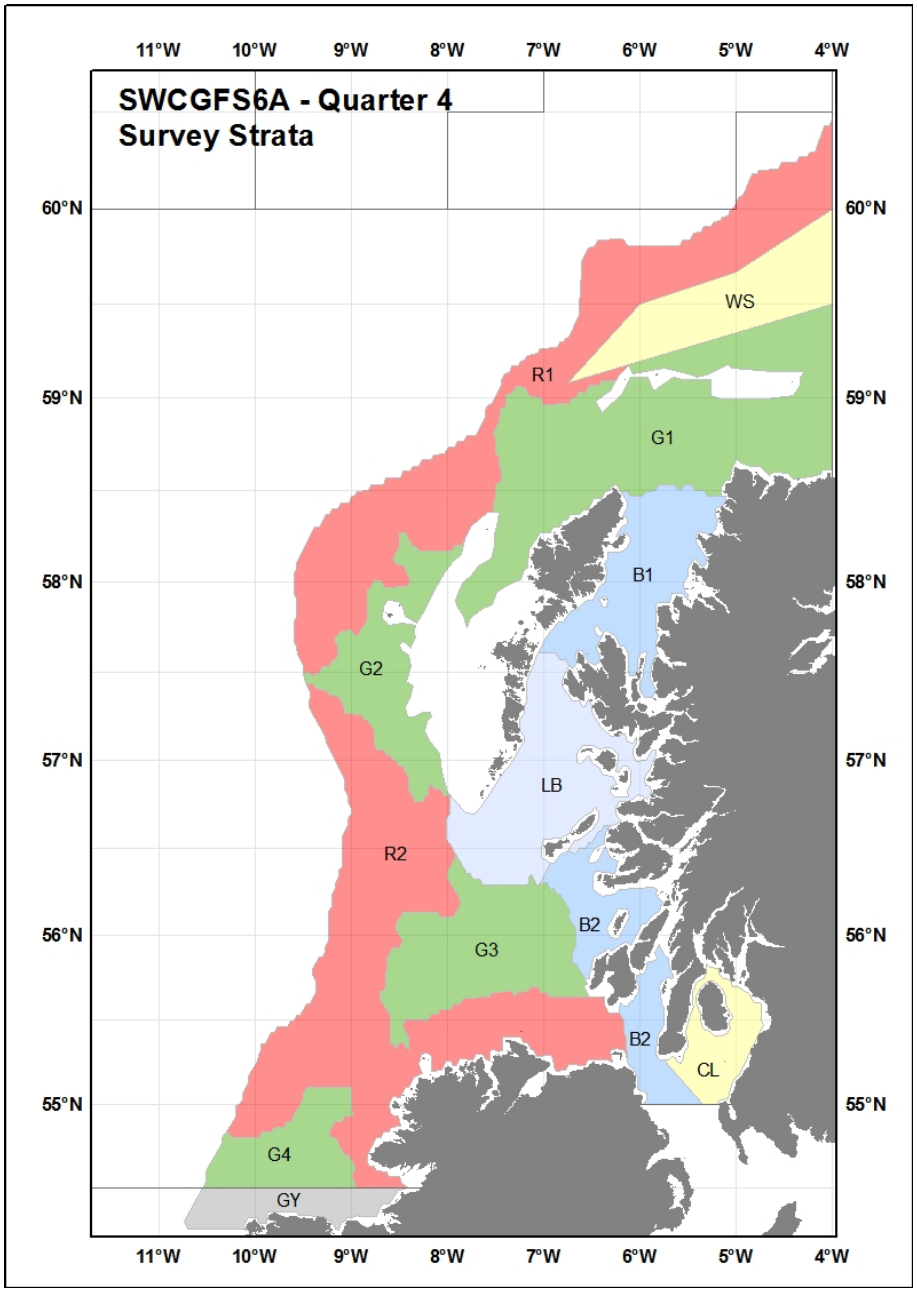


Figure 7.4. Strata in UK-SCOWCGFS- Q4. White areas within the survey area denote unfishable areas. Also includes the stratum GY within ICES Subarea 7b that is not included in the index calculation.

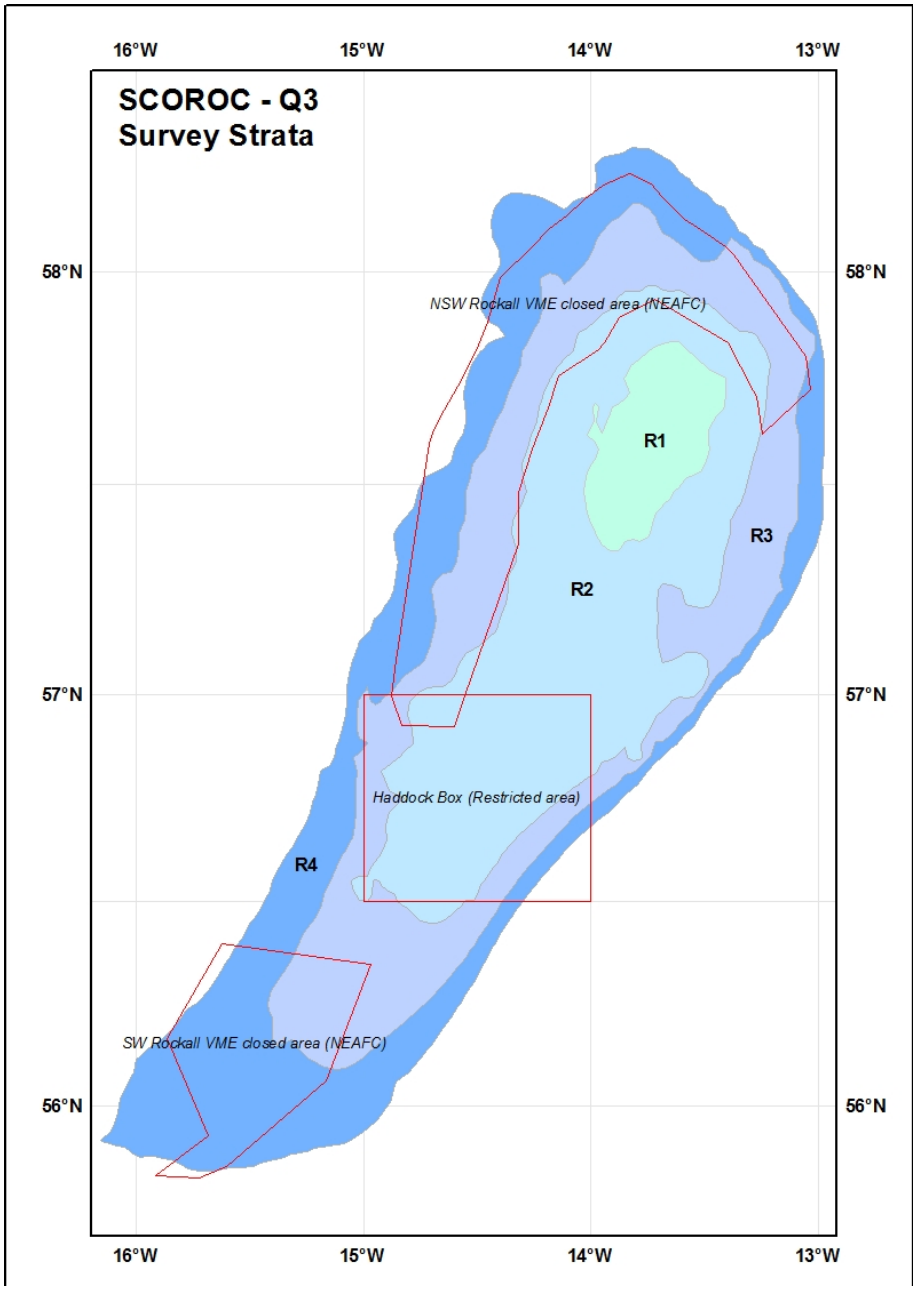


Figure 7.5. Strata in UK-SCOROC-Q3. The red polygons show protected areas (including the Rockall Haddock Box).

7.1.2 Vessel and gear

Since 1998 *MRV Scotia III* has been used to complete all the Scottish West Coast Groundfish Surveys (SWCGFS) undertaken by Marine Scotland, Science (MSS) in ICES Subareas 6a and 6b., with trawl duration set at 30 minutes. Prior to this the standard duration on all programmed MSS bottom-trawl surveys was 60 minutes.

Groundgear

All three surveys are undertaken using the standard 36/47 GOV research trawl but with a modified groundgear (groundgear – D) more suited to the hard and often undulating topography encountered within ICES Divisions 6a and 6b. This gear consists of 530 mm, 450 mm and 350 mm rubber hoppers with 15 m × 150 mm rubber leg sections along each wing.

Wire Sweep Rig

The Rockall survey is conducted exclusively in depths greater than 100 m whereas on the Scottish West Coast surveys approximately 80% of tows are made in depths greater than 80 m. Historically, only 47 m sweeps were used throughout all Scottish western surveys, despite the IBTS recommendation that for trawls conducted in depths greater than 70 m that the 97 m sweep rig be used. Starting from 2011, the new configuration, in an effort to maintain net geometry parameters (wing end spread and headline height) and groundgear bottom contact, utilizes both 47 m and 97 m sweep rigs. Although the IBTS recommends a depth of 70 m as the cut-off for changing the sweep length, the current survey has aimed to standardize with the current Irish Groundfish survey in 6a in deploying the long sweeps on all stations where the depth is in excess of 80 m. This has been implemented for all MSS - GOV surveys in ICES Divisions 6a and 6b.

GOV Trawl

No modifications have been made to the GOV trawl frame ropes or the mesh sizes used in the different netting panel sections. The only alteration from the previous trawl design is the incorporation of tearing strips and guard meshes constructed from 5 mm high tenacity double braided polyethylene twine. The mesh sizes of the double netting panels corresponded to the mesh sizes being replaced. To maintain consistency with the old netting the overall dimensions of the double netting panels, tearing strips and guard panels were determined by stretched length and not mesh counts. Double netting has also been inserted into upper/lower wing tips, 6 mesh deep guard inserted into upper/lower 1st wing sections, 1st belly section, 2nd belly section tearing strip and 5 mesh deep headline guard (Figure 7.6).

This strengthening of the netting in the panels around the fishing line coupled with the other modifications made to both groundgear and sweep rig afford the GOV the best possible chance of being able to complete a comprehensively stratified and random bottom-trawl survey that will aim to sample all fishable areas within ICES Divisions 6a and 6b.

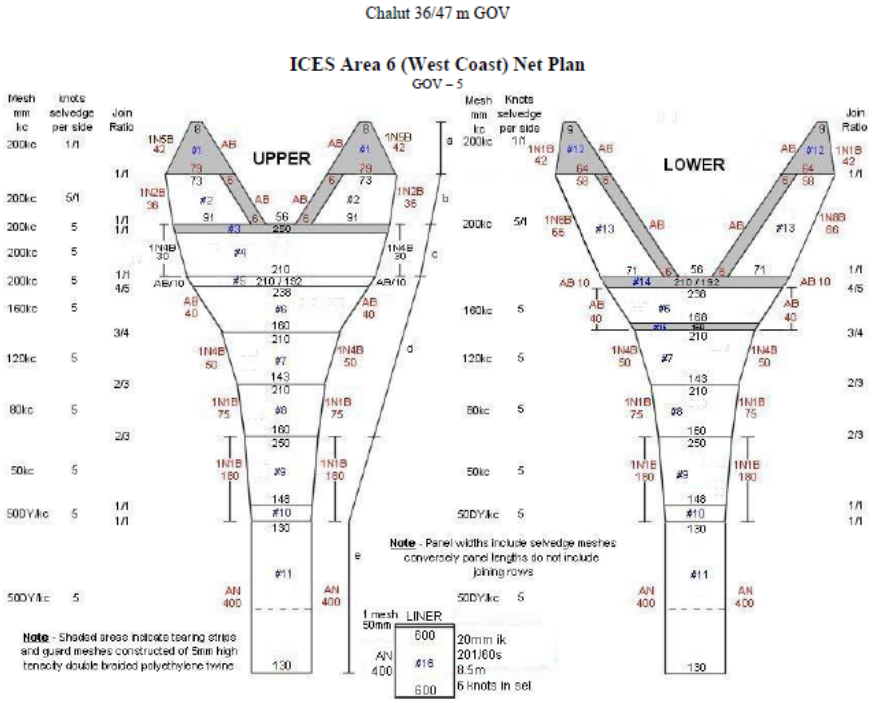


Figure 7.6. Net diagram of strengthened GOV used by MSS on UK-SCOWCGFS (Q1 and Q4) and UK-SCOROC (Q3)

7.1.3 Technical description of the hauls

See general description for the haul protocols. Figure 7.7 shows the behaviour of the GOV on the *MRV Scotia III* on the SCOWCGFS - Q4, while Figure 7.8 shows the behaviour on the SCOROC-Q3 (Rockall) survey, where given the different depth range only long sweeps are used.

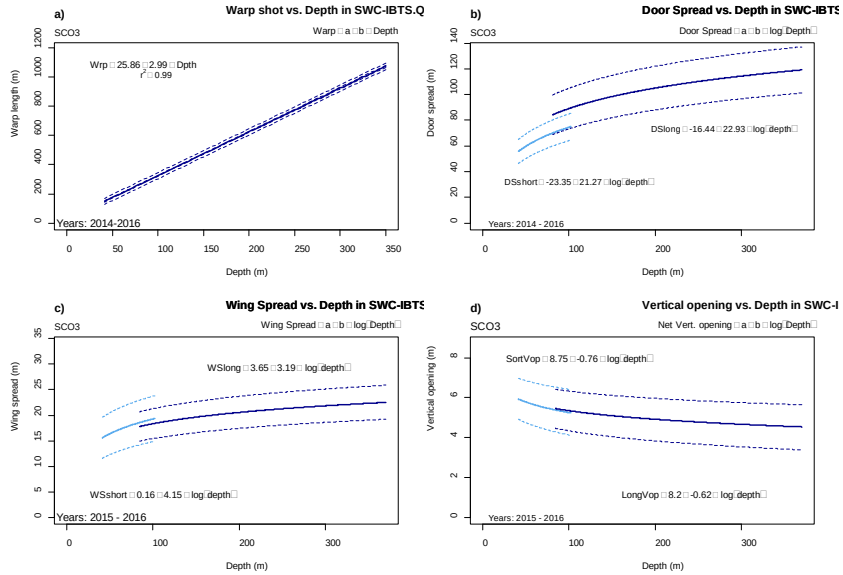


Figure 7.7. Plots presenting warp shot and GOV behaviour on the MRV *Scotia* III during the SCOWCGFS – Q4 survey on the 4th quarter, similar behaviour is found on 1st quarter surveys. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using *lm* R function. The light blue lines correspond to depths using the short sweeps, dark blue correspond to depths using large sweeps. Equations from b) to d) are estimated using R function *nls*. Confidence intervals with R functions *confint.nls* and *predict.lm*.

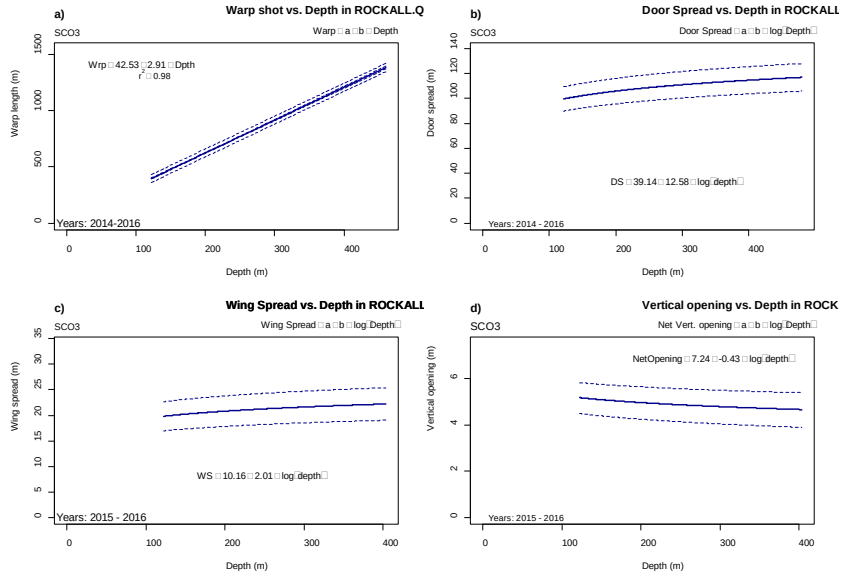


Figure 7.8. Plots presenting warp shot and GOV behaviour on the MRV *Scotia* III during the SCOROC – Q3 survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using lm R function. The light blue lines correspond to depths using the short sweeps, dark blue correspond to depths using large sweeps. Equations from b) to d) are estimated using R function *nls*. Confidence intervals with functions *confint.nls* and *predict.lm*.

7.1.4 Database

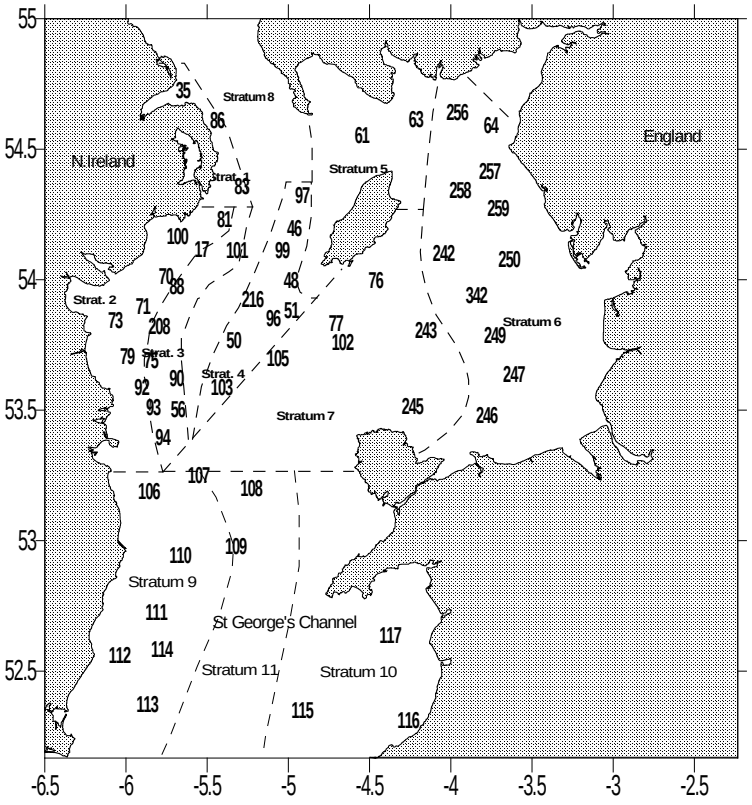
Trawl surveillance data are recorded utilizing an in-house recording system called RADOS. In addition to the summarized outputs produced at the end of the haul, all the raw chronological and SCANMAR instrumentation data are also retained and archived on board. From 2013, all biological data obtained from the standard trawl surveys will be recorded and then processed using the Cefas EDC (electronic data capture) and FSS (Fishing Survey System). This is an integrated SQL database. All survey data are uploaded first to the national database before being screened and then uploaded into DATRAS.

7.2 Northern Ireland Groundfish Survey in the Irish Sea (Division 7a) (UK-NIGFS)

The survey covers the Irish Sea area and St. George's Channel in ICES Division 7a, surveying all depths in the area. The surveys are carried twice every year in quarters 1 and 4, though the 1st quarter survey was not considered for cofunding in 2007 Data Collection Regulation (see SGRN 2007) and this decision has been extended to 2009 DCF, posing some problems to the continuity of 1st quarter time-series.

7.2.1 Sampling design nowadays

The sampling design is stratified with fixed-position stations (Figure 7.9). Stratification is by depth and seabed type. The primary objective is to achieve a 3.0 nautical mile tow between settlement of the net on the seabed and lifting off the seabed, in a time as close to 60 minutes as possible. This is to achieve a consistent balance between speed of the net over the ground and flow-rate of water through the net. Stations in the St George's Channel are 1 nautical mile at 3 knots and as close to 20 minutes as possible. The number of stations is 46 in northern Irish Sea and 15 in St George's Channel. Tows are fished during daylight hours only.



Key to strata:
1. Irish Coast (N), <100m, Mixed sediments
2. Irish Coast, < 50m, sand and finer sediments
3. Irish Coast, 50 - 100m, Muddy sediments
4. W and SW Isle of Man, 50 - 100m, mud and muddy sand
5. N Isle of Man, <50m, gravel sediments
6. Eastern Irish Sea, <50m, sand and finer sediments
7. S. Isle of Man, <100m, gravel sediments
8. Deep western channel and North Channel >100m
9. St George's Channel west; sandy/mixed sediments; <100m
10. St George's Channel east; sandy/mixed sediments; <100m
11. St George's Channel central; >100m; various hard and soft sediments.

Figure 7.9. Stratification used in Northern Ireland surveys

7.2.2 Vessel and gear

Currently the surveys are carried out on the RV *Corystes,* a 52.5 m double hulled research vessel with Diesel-Electric engine.

The fishing gear is a rock-hopper otter trawl (Figure 7.10) with a 17 m footrope fitted with 250 mm non-rotating rubber discs. The gear has a mean vertical opening of 3 m. The door spread varies from around 25 m at 20 m depth to 40 m at 80 m depth. A 20 mm (inside mesh) codend is fitted. SCANMAR sensors are fitted to the gear and trawl parameters are recorded. A warp length appropriate to the depth is used: usually 3 to 3.5 times the depth. Figure 7.11 presents the gear behaviour regarding vertical and horizontal opening during the UK-NIGFS surveys.

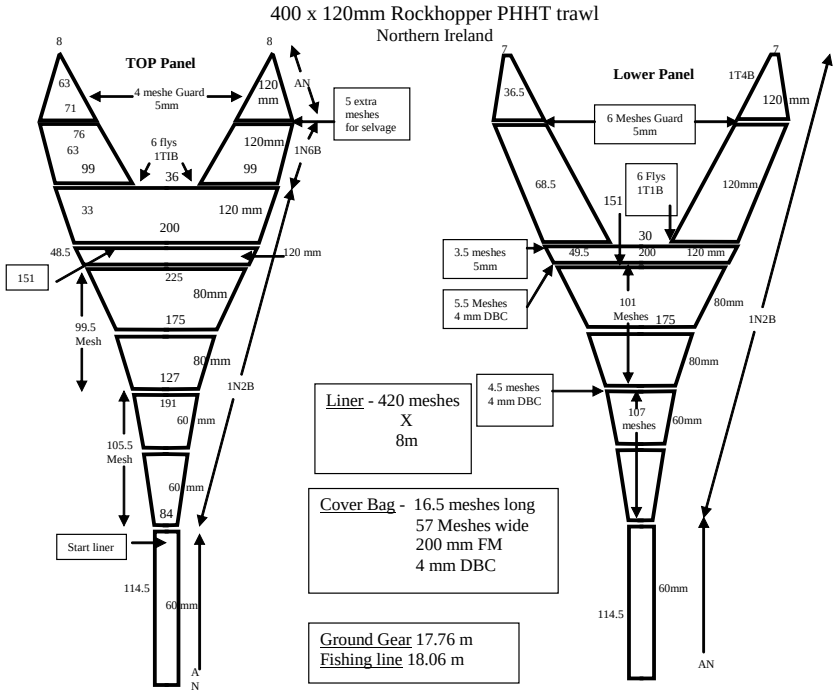


Figure 7.10. Scheme of the rock-hopper PHHT trawl gear used in North-Ireland surveys

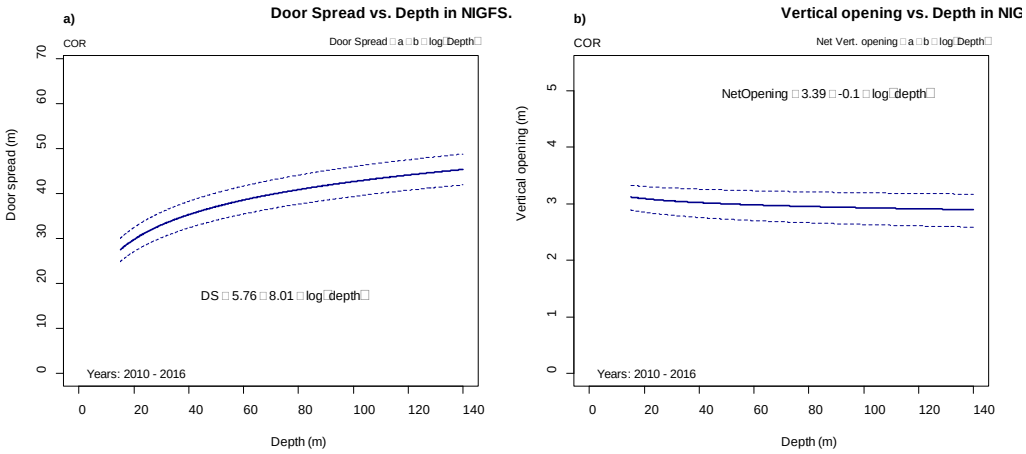


Figure 7.11. Plots presenting warp shot and behaviour of the PPHT gear on the RV *Corystes* during NIGFS surveys. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Equations are estimated using R stats function *nls*. Confidence intervals with function *confint.nls*.

7.2.3 Database

Northern Ireland surveys station and catch data are archived on board using an Oracle database developed during 2001 and 2002. Until recently biological data were entered on shore using a separate Oracle database, biological data are now entered using the new SQL database, which was developed in 2009.

7.4 Irish Groundfish Survey (Divisions 6a-7bgj)

7.4.1 Sampling design nowadays

The Irish Groundfish Survey (IE-IGFS) uses a semi-random depth stratified survey design. Stations are selected from historical clear survey tow data combined with additional information from the fishing industry and national multibeam survey work. Initially data from the first year of the current survey were combined with two years of the preceding commercial survey's data to post stratify the IGFS area. Depth and latitude were used as explanatory variables to initially group catches and define strata. Following De'ath (2002), Multivariate Regression Tree analysis (MRT) using Manhattan distances suggested clustering broadly in line with ICES divisions in terms of latitude with the addition of depth boundaries at 30 m, 80 m, and 120 m. The shallow 30 m strata would have resulted in very few samples annually. Also, at that time the sweeps on the GOV were doubled from 55 m to 110 m at haul depths over 75 m as per recommendations in the IBTS manual. Therefore, the 75 m was taken as the boundary for the coastal strata so that gear would be consistent within a strata and sufficient samples should be available annually for realistic precision estimation.

Haul allocation uses a buffered, semi-random design such as that described by Kingsley *et al*. (2004), where the number of stations per strata is proportional to the area, resulting in a final design with 17 strata (Figure 7.12). Depth boundaries are 0–80 m, 81–120 m, 121–200 m, and 201–600 m corresponding to Coastal, Medium, Deep, and Slope respectively. In total 170 stations are allocated annually with 75% of these being selected at random from the historical survey tow positions. A further 25% are selected randomly using the statistical package R. Clear ground is sought within 10nm of the allocated point using commercial data supplied to the Marine Institute as well as multibeam data from the ongoing National Seabed Survey program.

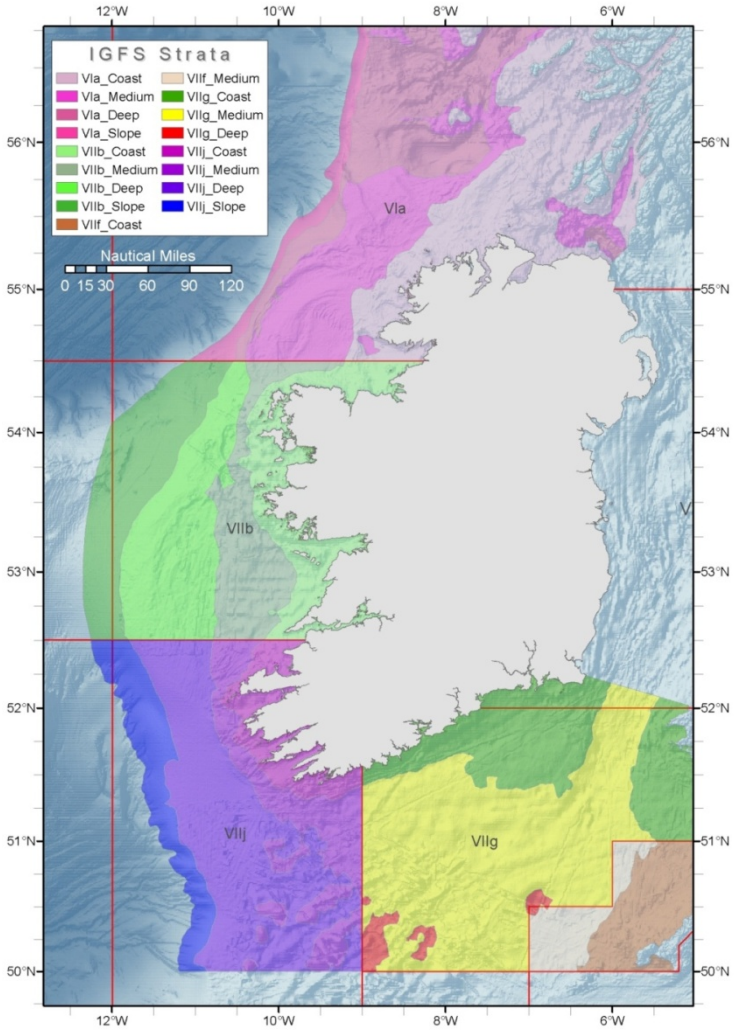


Figure 7.12. Map of IE-IGFS strata from 2009. Coastal strata (20–80 m) was modified from 20–75 m as per IBTS for IGFS09, and new areas calculated. The new strata will be used to post stratify the IGFS for calculation of precision. Medium strata 81–120 m; Deep strata 121–200 m; Slope strata 201–600 m.

Areas of the different substrata have been re-estimated after the changes in depth limits used for IGFS-2009 and are presented in Table 7.1.

7.4.2 Vessel and gear

The IGFS is carried out on board the RV *Celtic Explorer*, a 65 m vessel with 4320 KW engine power. The gear used is the GOV 36/47, similar to the one used in other Northeastern Atlantic areas for the IBTS and in the North Sea (Figure 7.18 for the GOV used in EVHOE survey), two differences in groundgear have been adopted since IGFS 2004, and should be borne in mind when interpreting indices:

1. Groundgear "A" (200 mm disks in centre) is the one used in most of the area, but the low catches of target species such as cod prompted adjustment of the GOV toggle chains from IGFS04 onwards to a single chain link, as well as lack of technical information to support the evolution or requirement for such a gap.
2. Given the IGFS was a new time-series a modified groundgear "D" (16" disks in centre) was developed by the MI and MSS (formerly MARLAB) and implemented since IGFS04 in area 6a exclusively. As with rig A, operated outside 6a, the foot-

rope is attached to the fishing-line by a single chain link. In all other aspects the trawls are rigged and operated as per the guidelines set out in the IBTS manual.

In line with the IBTS recommendations, sweeps are lengthened to maintain trawl geometry in deeper water, from 55 m up to depths of 80 m to 110 m in deeper water (See Figure 7.13 showing the behaviour of the gear).

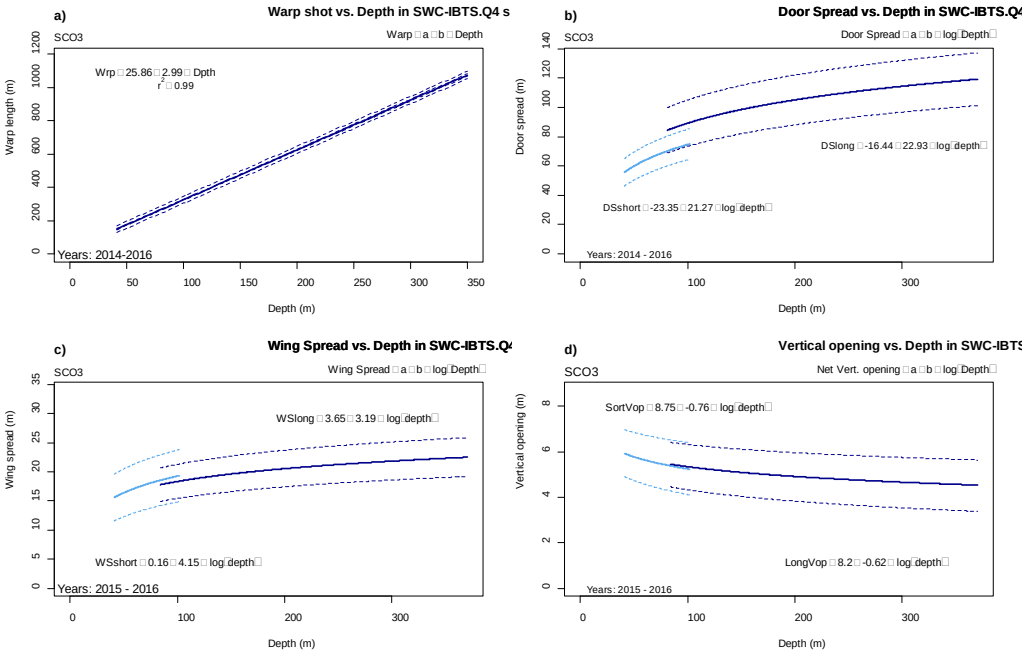


Figure 7.13. Plots presenting warp shot and GOV behaviour on the RV *Celtic Explorer* during IE-IGFS survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using lm R function. The light blue lines correspond to depths using the short sweeps, dark blue correspond to depths using large sweeps. Equations from b) to d) are estimated using R function *nls*. Confidence intervals with functions *confint* and *predict.lm*.

7.4.3 Technical description of the hauls

Once the gear is on board, the aim is to sort everything to species level. Nevertheless in cases where catch is particularly large, and one or more tows for the day would have to be dropped to process it, the catch will be run through the fish sorting room with portions being kept aside at regular intervals to ensure a reliable sample is achieved from throughout the original catch. Alternatively, where there is significant bulk of 2-3 related species which are error prone to separate quickly, these can be treated initially as a mixture (single species grouping) and a precise ratio identified from a subsample of this mixture used to back calculate the original total catch weights.

Outside these two rare scenarios described above, all species are separated in the catch and weighed. All fish, elasmobranchs, commercial cephalopods and some invertebrates are also subsampled and measured to produce a length frequency by species for each haul. Age and maturity data are also acquired for many commercially managed stocks and this list is available and updated in the survey summaries in the IBTS annual reports.

7.4.4 Database storage

All catch weight data are entered directly into an Access database while sorting the catch. Data for each sample are then also entered directly onto Access databases via electronic measuring boards. Catch and individual sample data are then consolidated and compared after each tow for quality assurance. All catch data for the day are then loaded to a central SQLServer 2008 Survey database which also contains all other positional and gear parameter metadata for the tows. Navigation and gear monitoring information are logged directly from the SCANMAR and navigation devices into SQLServer.

7.5 Spanish Groundfish Survey in the Porcupine bank (Divisions 7b,k) (SP-PorcGFS)

The Spanish Groundfish Survey in the Porcupine bank (SP-Porc) covers ICES Division 7c,k and a small portion of 7b corresponding to the Porcupine Bank and the adjacent area in western Irish waters from longitude 12°W to 15°W and from latitude 51°N to 54°N, covering depths between 180 and 800 m at the end of the third quarter (September), and the beginning of 4th quarter.

7.5.1 Sampling design nowadays

The whole area (ca. 45 900 km^2) has been separated in two geographical sectors and three depth strata (less than 300 m shallower haul ca. 180 m, 300–450 m and 450–800 m), resulting in 5 strata, given that there are no grounds shallower than 300 m in the southern geographical sector (Figure 7.14). The aim is to carry out 80 hauls per year, using a random stratified sampling design with allocation proportional to the strata area following a buffered random sampling procedure (as proposed by Kingsley *et al.*, 2004) to avoid the selection of adjacent 5×5 nm rectangles, and a minimum of two stations per stratum.

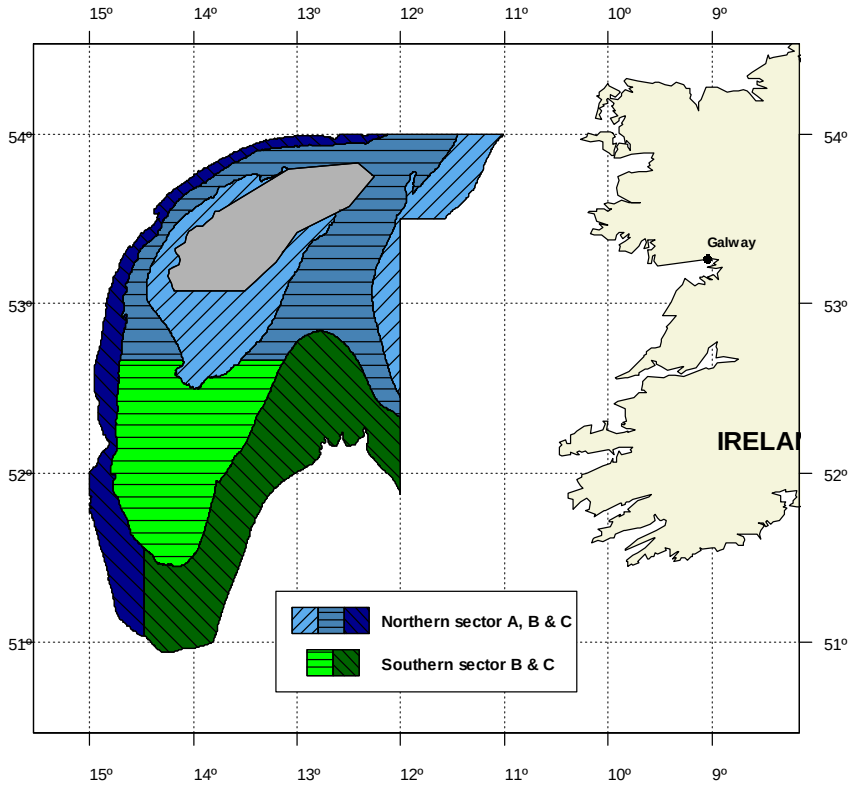
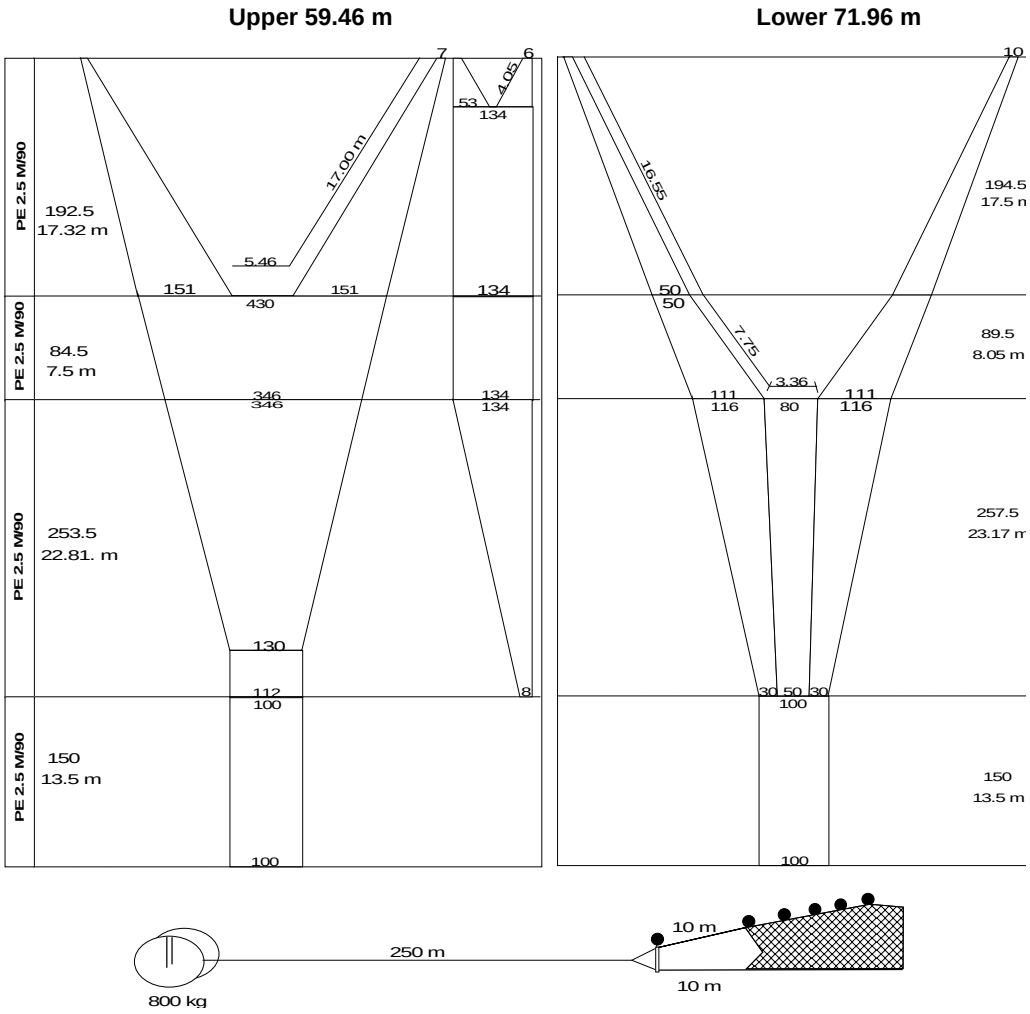


Figure 7.14. Stratification used in the Porcupine Spanish surveys. In each geographical strata bathymetric strata are: a) less than 300 m, b) 301–450 m and c) 451–800 m

7.5.2 Vessel and gear

The Spanish Groundfish Survey in the Porcupine bank is carried out on the RV *Vizconde de Eza*. This vessel is a stern trawler of 53 m length and 13.5 m wide with gross tonnage of 1400 t. The fishing gear used is a Porcupine baca[2] 40/52 with 39.46 m footrope and a 51.96 headline (Figure 7.15). Doors are oval with 800 kg and 4.5 m² surface. Diameter of warp used is 20 mm, of sweeps is 55 mm and the groundrope 98 mm with a double synthetic coat. Codend mesh size is 20 mm.

[2] Spanish type of otter trawl



(*) On the lateral columns (left for upper and lateral panels, right for the lower panel) first figure corresponds to the number of meshes or knots and the second one to the length (m)

Floats: 11 (280 mm) on the headline every 50 cm + 34 (200 mm) on the wings every 50 cm + 16 (200 mm) on the wings every 100 cm + 1 additional float (200 mm) at each butterfly.

Sweeps: 250 m, combination rope with 6 strings Eurosteel (Stainless steel core), 55 mm ∅. (630 kg/250 m).

Groundrope: 26 mm ∅, with double nylon coat and 50 kg of 12 mm chains.

Bridles: Upper 10 m, 14 mm ∅. Lower 10 m, 18 mm ∅ with single nylon coat.

Figure 7.15. Scheme of the Porcupine baca (otter trawl) 60/72 trawl gear used in the Porcupine survey.

7.5.3 Technical description of the hauls

Hauls last 20 minutes from observation of ground contact of the net through Marport net monitoring sensors to the start of pulling back the gear. The length of warp shot is based on a linear relationship with the depth (warp = 88.1 + Depth × 2.59, see Figure 7.16a). Trawl speed is 3.5 kn. Door spread (Figure 7.16b) is 133.7 m (±1.2 m),wing-spread (Figure 7.16c) is 23.3 m (±0.7 m) and mean vertical opening (Figure 7.16d) is 2.93m (±0.03 m). Marport sensors for vertical opening, door spread, depth, and temperature are used regularly, wing spread sensors have been used occasionally at the beginning of the series and regularly only in 2016.

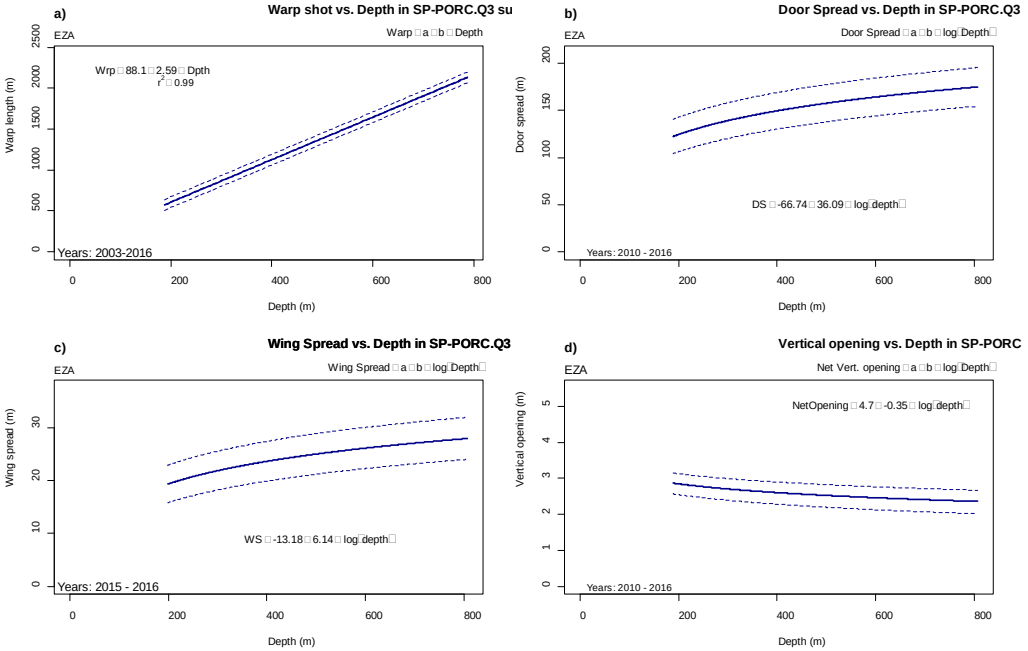


Figure 7.16. Plots presenting warp shot and Porcupine baca gear behaviour on the RV *Vizconde de Eza* during Porcupine survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using *lm* R function. Equations from b) to d) are estimated using *nls* R. Confidence intervals with confint.nls and *predict.lm*.

7.5.4 Database storage

Data are stored on board and logged on a software package specifically created in Harbour for this purpose (CAMP: files in dBase III format). Vessel performance during the hauls (GPS position, speed, depth, haul track, sampler used, gear behaviour, activity as shooting, trawling or pulling back, etc.) is logged directly using a software developed specifically for scientific bottom-trawl surveys, called PescaWin, that allows logging all these data during the haul manoeuvres.

Once ashore, data from the IBTS Surveys are transferred to the general IEO Database Application SIRENO. Both software input procedures, CAMP and SIRENO, include data checking and data quality controls through filters implemented in the software tools used, these include:

1. Haul position vs. geographical sector allocation and depths ranges vs. strata allocation;
2. Differences between speed vs. expected tow distance and positions;
3. Catch weight vs. estimated weight of the sampled length distribution using L-W regressions when available.

Spanish data uploaded to DATRAS are limited to haul information, length distributions by sex and biological information related to species routinely provided to the assessment Working Groups.

7.6 French Channel Groundfish Survey (divisions 7d and 4c) (FR-CGFS)

The French Channel Groundfish Survey (FR-CGFS) covers the Eastern English Channel area, corresponding to the ICES Division 7d.From 1988 to 2014, it has been conducted annually during October on board the RV *Gwen Drez*, extending from the south of the North Sea in ICES Division 4c to the Eastern English Channel in Division

7d. Since 2015 onwards, the survey is conducted on the RV *Thalassa* and no longer covers the south of the North Sea (ICES Division 4c – see Annex 1 for details on vessel change).

7.6.1 Sampling design nowadays

The survey covers the Eastern English Channel (ICES Divisions 7d), a shallow area with maximum depth of about 80 m. The survey follows a fixed stratified sampling strategy, using the ICES statistical rectangles as strata (Figure 7.17), with one station per rectangle of 15′ latitude x 15′ longitude to ensure a good coverage of the area and a number of stations per strata proportional to the stratum surface. The fishing hauls have been initially chosen using professional fishing plans or found by prospecting, and the stations have been kept fixed since. The total number of stations was 88 from 1988 to 2014, and is 74 nowadays. The reduction of stations number has not changed the coherence of abundance-at-age indices for plaice and red mullet (see Annex 1).

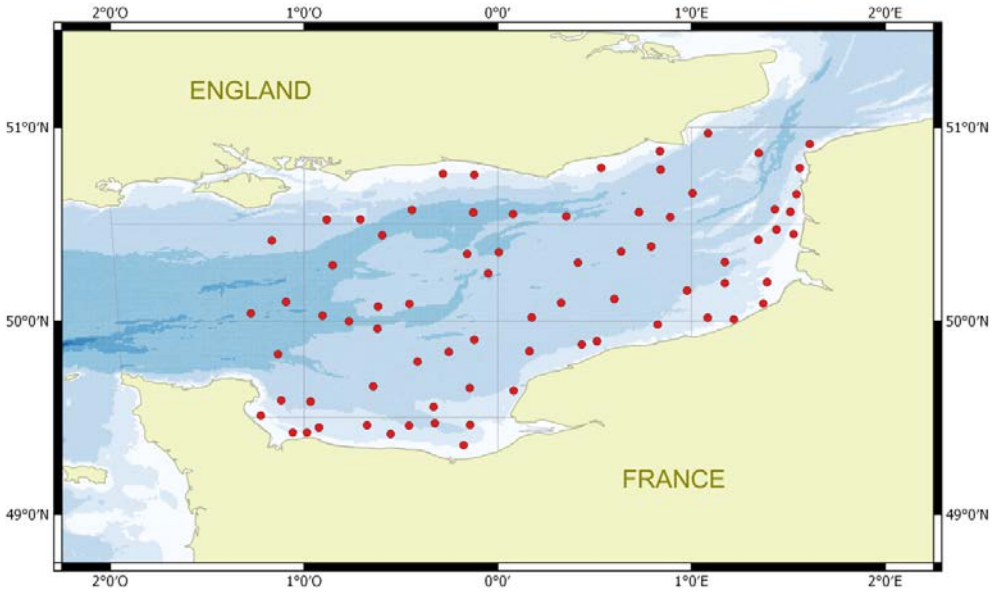
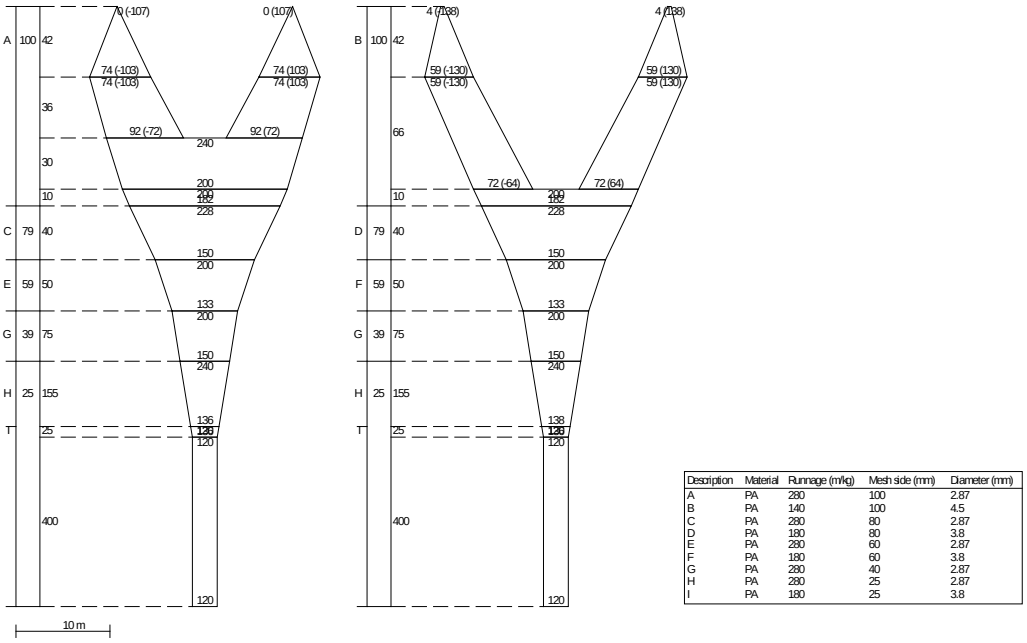


Figure 7.17. Area covered and ICES rectangles used in the stratification used in the French Channel Groundfish survey

7.6.2 Vessel and gear

The FR-CGFS survey is carried out with RV *Thalassa*, a stern trawler of 73.7 m long by 14.9 m wide.



Description	Material	Runnage (m/kg)	Mesh side (mm)	Diameter (mm)
A	PA	280	100	2.87
B	PA	140	100	4.5
C	PA	280	80	2.87
D	PA	180	80	3.8
E	PA	280	60	2.87
F	PA	180	60	3.8
G	PA	280	40	2.87
H	PA	280	25	2.87
I	PA	180	25	3.8

Figure 7.18.Scheme of the GOV 36/47 trawl gear used in the FR-CGFS surveys

The trawl is a GOV 36/47, as described in the IBTS Survey manual and displayed in Figure 7.18, except that the exocet Kite is replaced by 12 additional 4L floats. In average, the gear has a horizontal opening around 15.3 m and a vertical opening of 4.5 m. The doors are plane-oval of 1342 kg. The net is fitted with a 20 mm codend liner. Due to the nature of the substratum, the ground gear has been adapted from IBTS standard and is composed of 250 mm bobbins in the center (Figure 7.19).

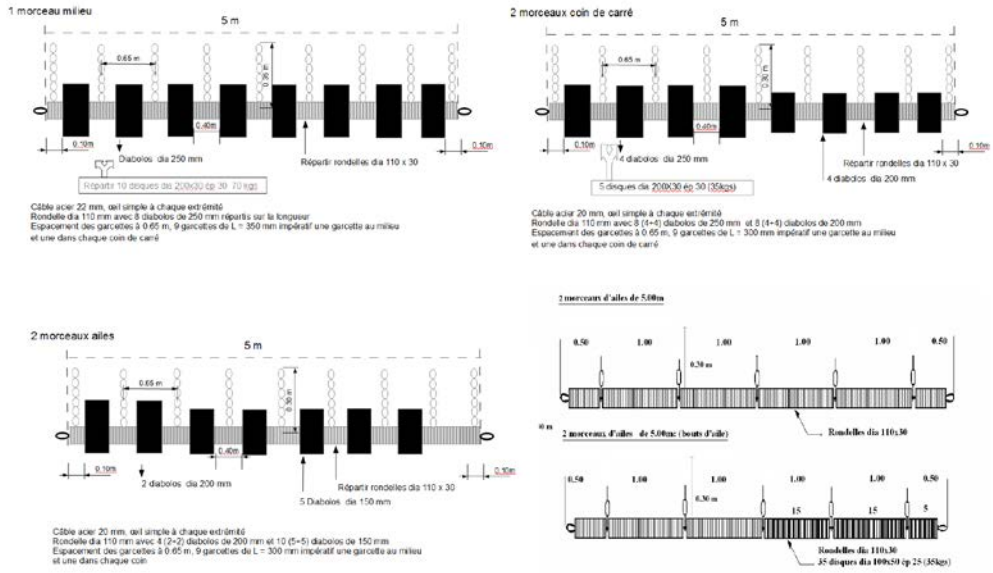


Figure 7.19. Scheme of the groundgear used in the FR-CGFS survey

7.6.3 Technical description of the hauls

Hauls are realized during daylight for 30 minutes at a towing speed of 3.8 knots in average (between 3.5 and 4 knots). Marport sensors allow monitoring door spread, wing spread and net opening (See Figure 7.20 showing the behaviour of the gear). Catch is processed and data collected according to general protocols (see Table 3.1

regarding samples and species targeted and collected). All species caught, including benthos invertebrates, are identified and weighed. All fish, elasmobranchs, commercial cephalopods, and some invertebrates are also subsampled and measured to produce a length frequency by species for each haul. Biological sampling includes age and maturity determination for some commercial species.

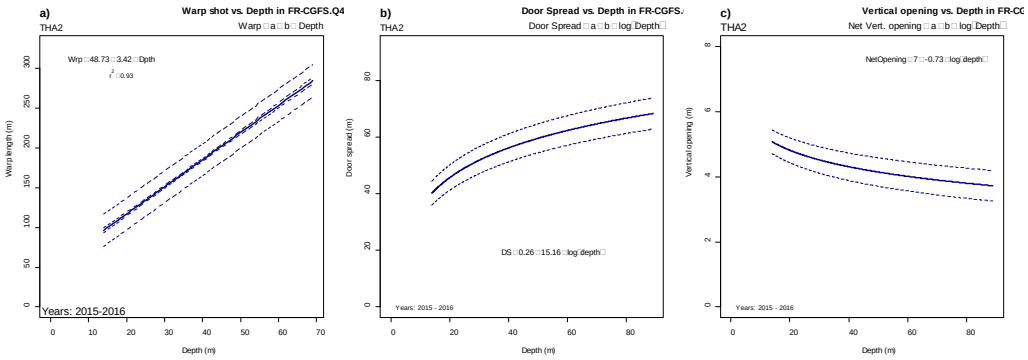


Figure 7.20. Plots presenting warp shot and GOV behaviour on the RV *Thalassa* during FR-CGFS survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using *lm* R function. Equations from b) and c) are estimated using *nls* R. Confidence intervals with confint.nls and *predict.lm*.

7.6.4 Database storage

Catch data are stored on board in the dedicated software *Allegro*, while hauls and navigation information (GPS position, speed, depth, trawl geometry…)are recorded by the vessel software CASINO. At the end of the survey, both data sources are matched and transformed in the international format in order to be uploaded to DATRAS.

7.6.5 French Channel Groundfish Survey: changes in sampling design and protocols

The vessel used to carry out the FR-CGFS survey has changed in 2015. From 1988 to 2014, the RV *Gwen drez*, a stern trawler 24 m length, was used to sample 88 stations in the area with the GOV 19.7/25.9. The area sampled during this period included very shallow stations close to the coast as well as some stations in the south of Division 4c.

In order to ensure continuity of the time-series despite the change of vessel, an intercalibration between RV *Gwen drez* and RV *Thalassa* was undertaken in 2014 with 32 paired tows realized. From 2015 onwards, the FR-CGFS survey is carried out on the RV *Thalassa* with 74 stations kept from the initial sampling design (stations from Division 4c were removed from the sampling design, as well as few very coastal stations from Division 7d). The 36/47 GOV used is a larger version of the initial gear, with the groundgear relative characteristics kept (250 mm bobbins in the center).

7.7 French Groundfish Survey in the Celtic Sea and Bay of Biscay (Divisions 7fghj; 8ab) (FR-EVHOE)

The French Groundfish Survey in the Celtic Sea and Bay of Biscay (FR-EVHOE) covers the Celtic Sea with ICES Divisions 7fghj, and the French part of the Bay of Biscay in Divisions 8ab. The surveys are conducted from 15 to 600 m depth, usually in the fourth quarter, starting at the end of October.

7.7.1 Sampling design nowadays

The stratification scheme adopted defines a geographic stratification that separates the Bay of Biscay in 2 areas and the Celtic Sea into 3 areas according to the Figure 7.21 and six depth strata (Table 7.3 and Figure 7.22).

Figure 7.21. Stratification used in the Bay of Biscay and in the Celtic Sea for the French surveys.

Table 7.3. Bathymetric strata in EVHOE Survey.

Depth Stratum	Depth Range
1	20–30 m
2	31–80 m
3	81–120 m
4	121–160 m
5	161–200 m
6	201–400 m
7	401–600 m

During the period 1987–2015, the sampling strategy was based on a stratified random allocation, the number of stations per stratum being optimized by a Neyman allocation on numbers variance averaged on the 4 most important commercial species (hake, the two species of monkfish and northern megrim) with a minimum of two stations per stratum. The aim is to carry out 140 stations per year, depending on time available at sea.

From 2016 onward, sampling strategy has been modified from the randomly stratified sampling strategy on an annual basis to a fixed sampling strategy one. The 2016

randomly selected set of points (Figure 7.22, total number of stations = 154) has been utilized as the reference for sampling stations for the next years. As far as strata, position and numbers of selected points are based on the same reference than previous years, modifications of sampling design won't theoretically be detectable in 2016 as compared to the whole time-series. The few sampled points into the deeper strata for the Celtic part (strata Cs7,Cc7 and Cn7) of the survey were not included into the new sampling design, as well as the points sampled in some part of the shallowest strata of the Bay of Biscay (e.g. points that were occasionally done into some enclosed bays). To complete strata coverage, 4 additional hauls have been added to the initial set of sampling points in the central-eastern part of the Celtic sea.

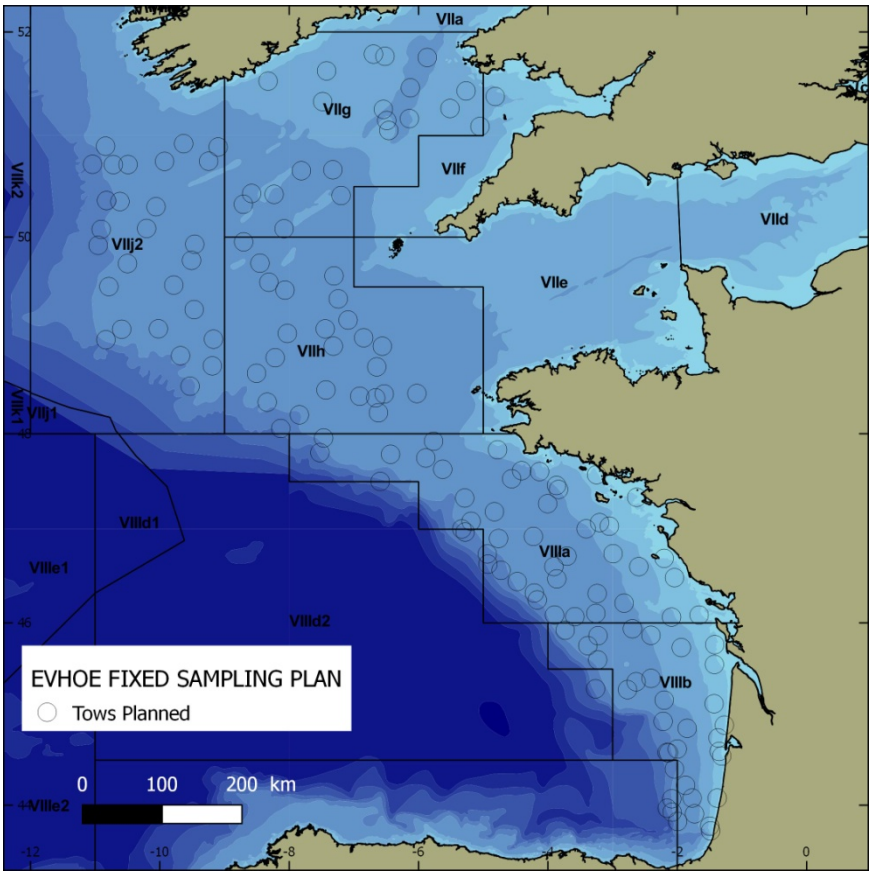


Figure 7.22. Planned stations in the fixed sampling plan (O, n = 154) from EVHOE 2016 onward. ICES areas are indicated (in Roman numerals).

7.7.2 Vessel and gear

The EVHOE is carried out with RV *Thalassa*, a stern trawler of 73.7 m long by 14.9 m wide, gross tonnage of 3022 t.

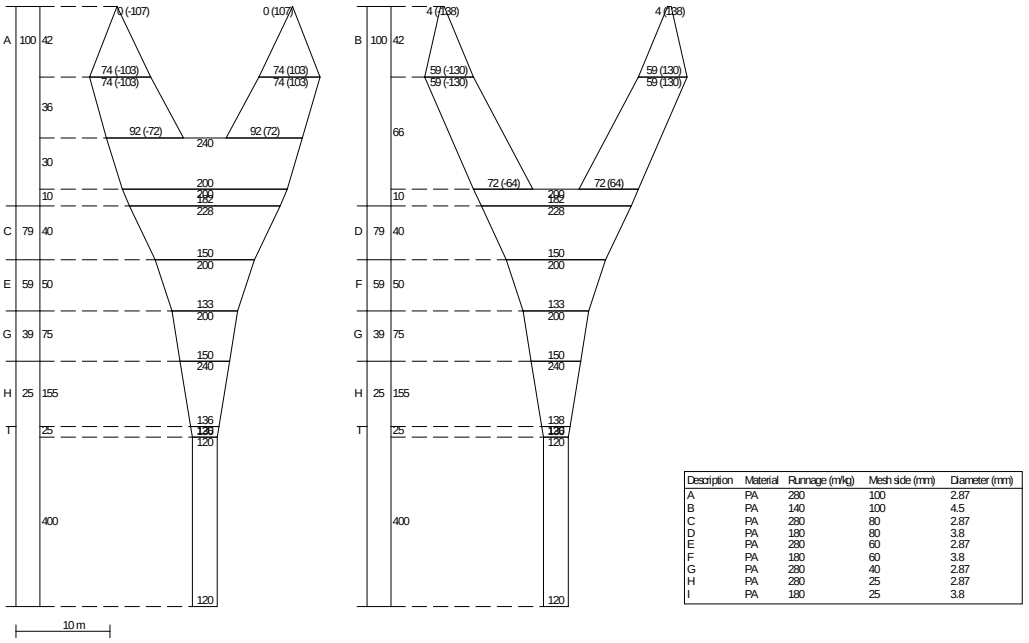


Figure 7.23.Scheme of the GOV 36/47 trawl gear used in the French surveys

The trawl is a GOV 36/47, as described in the IBTS Survey manual and shown in Figure 7.23,except that the Exocet Kite is replaced by additional buoyancy 66 floats instead of 60, and weight of Marport sensors placed in the middle of the headline has been balanced by adding 21 4l floats (Figure 7.24). Generally, the gear has a horizontal opening around 20 m and a vertical opening of 4 m. The doors are plane-oval of 1350 kg. The net is fitted with a 20 mm codend liner.

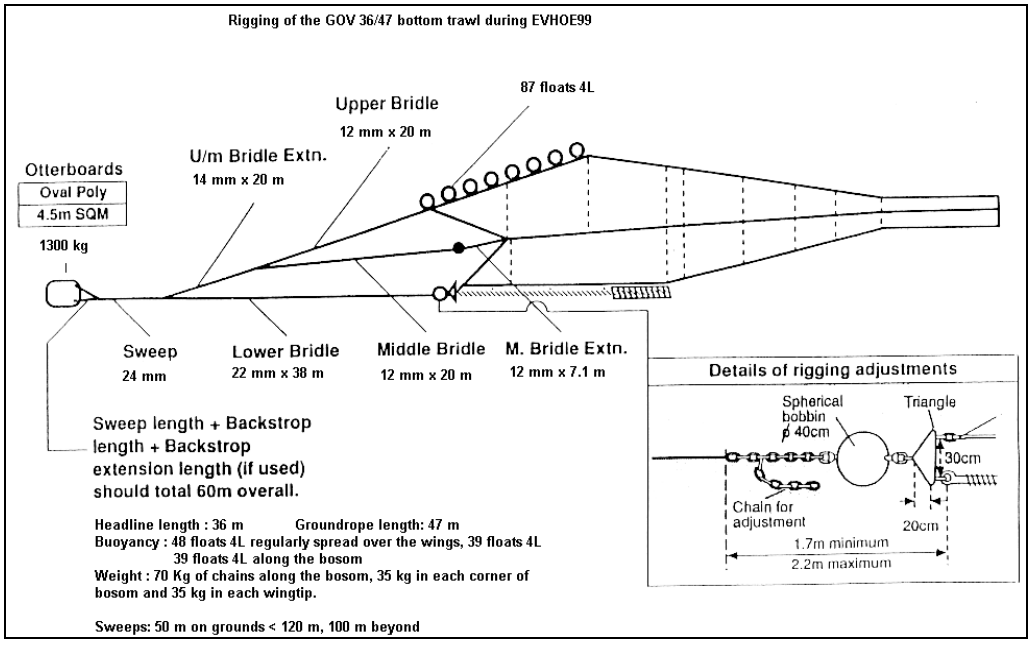


Figure 7.24. Rigging of GOV 36/47 used during EVHOE surveys

7.7.3 Technical description of the hauls

The stations are straight tows, 30 minutes long and are carried during daylight at a towing speed of 4 knots. During the stations, the gear parameters are monitored by SCANMAR and Marport in recent years and the parameters are stored in the vessel

computer system. The parameters that are monitored are door spread, wing spread, headline height, height of groundrope, Figure 7.25 presents the behaviour of these gear parameters. Additionally, a number of navigational parameters were also monitored.

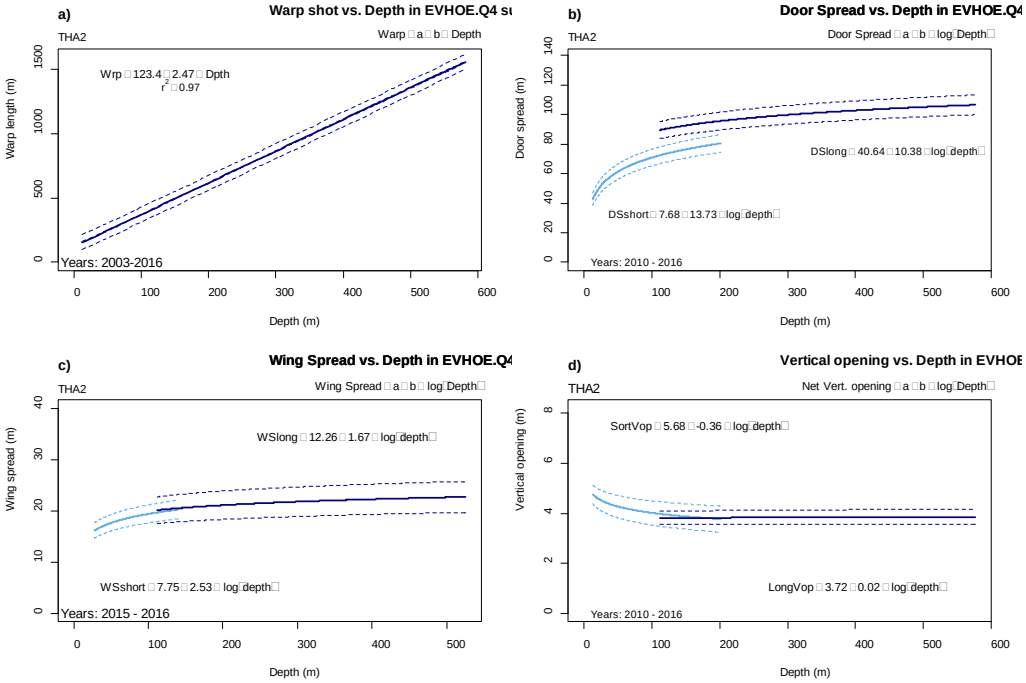


Figure 7.25. Plots presenting warp shot and GOV behaviour on the RV *Thalassa* during EVHOE survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using lm R function. The light blue lines correspond to depths using the short sweeps, dark blue correspond to depths using large sweeps. Equations from b) to d) are estimated using R function *nls*. Confidence intervals with functions *confint.nls* and *predict.lm*.

7.7.4 Biological data and sampling protocols with target species

All species of fish are measured, and for some species other biological measurements are made (individual weight, maturity, measurement by sex, ageing material). All commercial species are sexed when measured and the ageing material collection follows a stratified allocation by length class and by sex, with separate ALKs per sex constructed.

7.7.5 Database storage

All information is recorded on board with a generic Ifremer software and database for fisheries surveys data ("Allegro Campagne" software, https://forge.codelutin.com/projects/tutti), and reported to DATRAS.

7.8 Northern Spanish Shelf Groundfish Survey in the Cantabrian Sea and Off Galicia (Divisions 8c and Northern part of 9a) (SP-NSGFS or SP-NORTH)

The northern Spanish shelf groundfish survey on the Cantabrian Sea and off Galicia SP-NSGFS covers the northern Spanish shelf comprised in ICES Division 8c and the northern part of 9a, including the Cantabrian Sea and off Galicia waters. The surveys are conducted from 30 to 800 m depth, usually starting at the end of the third quarter (second fortnight of September) and ending in the fourth quarter (by the end of October).

7.8.1 Sampling design nowadays

The stratification is based on five geographical sectors between the Portuguese border at Miño river, and French border at Bidasoa river (Figure 7.26) and three bathymetric strata defined between 70 and 500 m (Figure 7.27) with additional stations that, depending on vessel time available at sea, are usually carried out to cover the scarce trawlable grounds in the study area on shallower (30–70 m) and deeper (500 and 800 m) grounds.

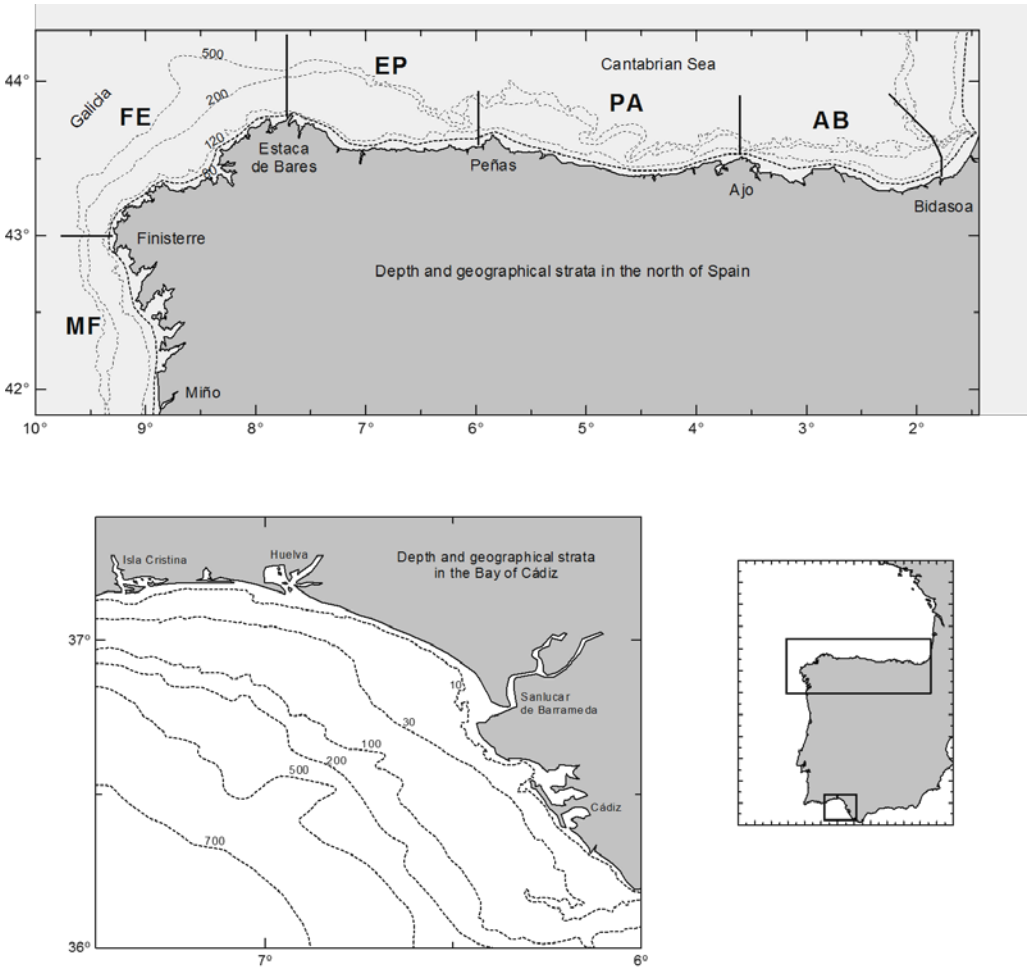


Figure 7.26. Stratification used in the Spanish surveys in the Iberian Shelf See Gulf of Cadiz description in section 7.9.

The number of stations per strata is proportional to the strata area with an approximated coverage of 5.4 hauls for every 1000 km² (ca. 120 hauls per survey), and are allocated with a semi-random design with some fix stations to ensure the coverage of hake nursery areas in different parts of the northern Spanish shelf.

7.8.2 Vessel and gear

Since 2013, the SP-NSGFS has been carried out on board the RV *Miguel Oliver* that replaced the RV *Cornide de Saavedra*, used in the previous surveys in the time-series. The gear used is a Baca trawl 44/60 with a 43.6 m footrope and a 60.1 m headline (Figure 7.27). Thyborøn Polyvalent trawl doors weighting 330 kg replaced the traditional wooden doors used previously to 2013. The diameter of warp used is 22 mm (1.9 kg.m-1). An inner 10 mm (20 mm stretched) mesh codend liner is used to prevent

the escape of small individuals (overall summary of present vessel/gear specifications for all surveys in Table 2.2).

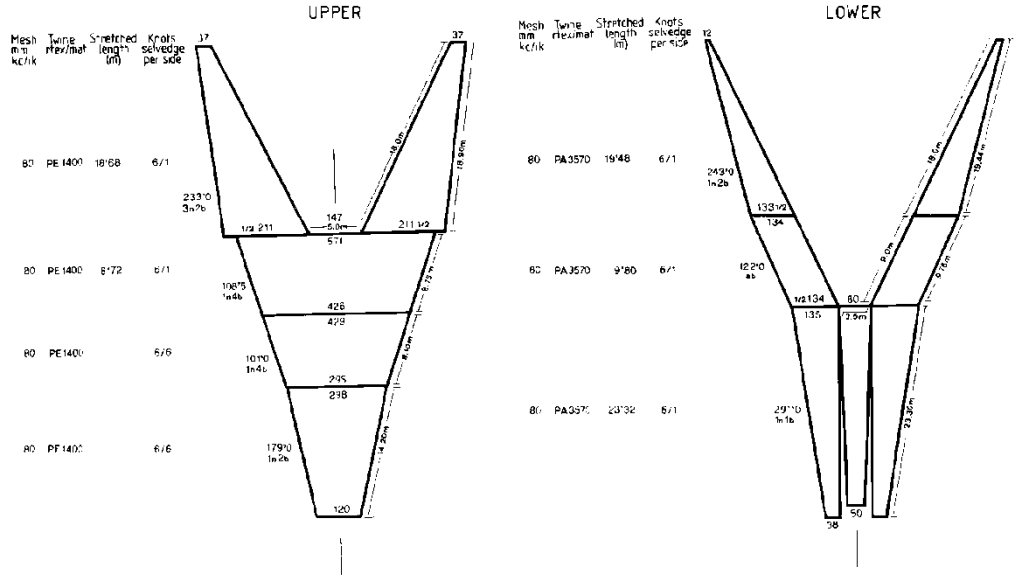


Figure 7.27. Scheme of the Baca 44/60 trawl gear used during the Spanish surveys in the Iberian shelf.

7.8.3 Technical description of the hauls

Hauls last 30 minutes from the end of shooting the gear and the warp (locking the winches), and the start of pulling back the gear. The length of warp shot is based on a power relationship with the depth (warp = 130.94 + 2.18 × Depth). Trawl speed is 3 kn. Vertical opening of the net varies around 1.8–2.1 m, horizontal opening around 17–21 m, and doors spread 107 m, varying with depth. SCANMAR, and nowadays MARPORT, sensors for vertical, wing spread and door spread openings (only from 2013 and occasionally before the change to Thyborøn doors). Depth and temperature sensors are also used regularly. Figure 7.28 shows the behaviour of these gear parameters. Haul duration in extra-hauls in grounds deeper than 500 m (not considered in the calculation of standard stratified abundance indices) is set to 45 min to allow time for the gear to make ground contact and stabilize.

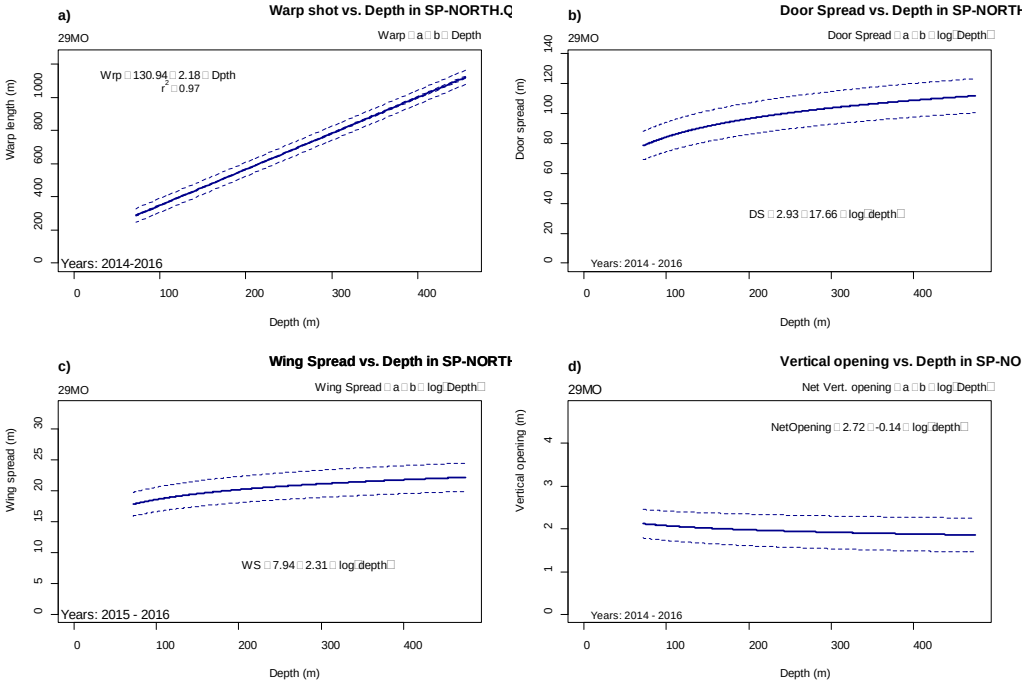


Figure 7.28. Plots presenting warp shot and standard baca gear behaviour on the RV *Miguel Oliver* during SP-NGFS survey. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using *lm* R function. Equations from b) to d) are estimated using *nls* R. Confidence intervals with *confint.nls*. Years previous to 2013 were carried out on board the RV *Cornide de Saavedra*. Confidence intervals with functions *confint* and *predict.lm*.

7.8.4 Biological data and sampling protocols with target species

Fish, *Nephrops,* and some other crustaceans and cephalopods according to this manual specification are sampled to species level and measured; while other crustaceans, molluscs and other invertebrates are identified to the lowest taxonomic level possible and weighed, and depending on the catch, a subsample is counted to record the numbers caught.

7.8.5 Database storage

See section 7.4.4.

7.9 Portuguese Groundfish Survey (Divisions 9a) (PT-PGFS or PT-IBTS)

The Portuguese Groundfish Survey (PT-PGFS) covers Division 9a in Portuguese continental waters. The survey is mainly conducted at the beginning of the 4th quarter, in October. The area surveyed extends from latitude 41°20'N to 36°30'N, and from 20 to 500 m in depth.

7.9.1 Sampling design nowadays

The present sampling scheme (Figure 7.29) was implemented in 2005, based on a systematic and stratified random sampling, to facilitate the use of geostatistical models and to overcome the difficulties in the estimation of the variance. Additionally, it provides consistency compared with the former 48 strata. The new sampling scheme includes depths from 20 to 500 m, since the main objective of the survey is to estimate recruitment indices for hake and horse mackerel. The mixed systematic and stratified sampling scheme comprises 66 trawl positions distributed over a fixed grid with 5′

per 5' miles, corresponding to repeat trawl positions, and 30 random trawl positions, all with a tow duration of 30 minutes.

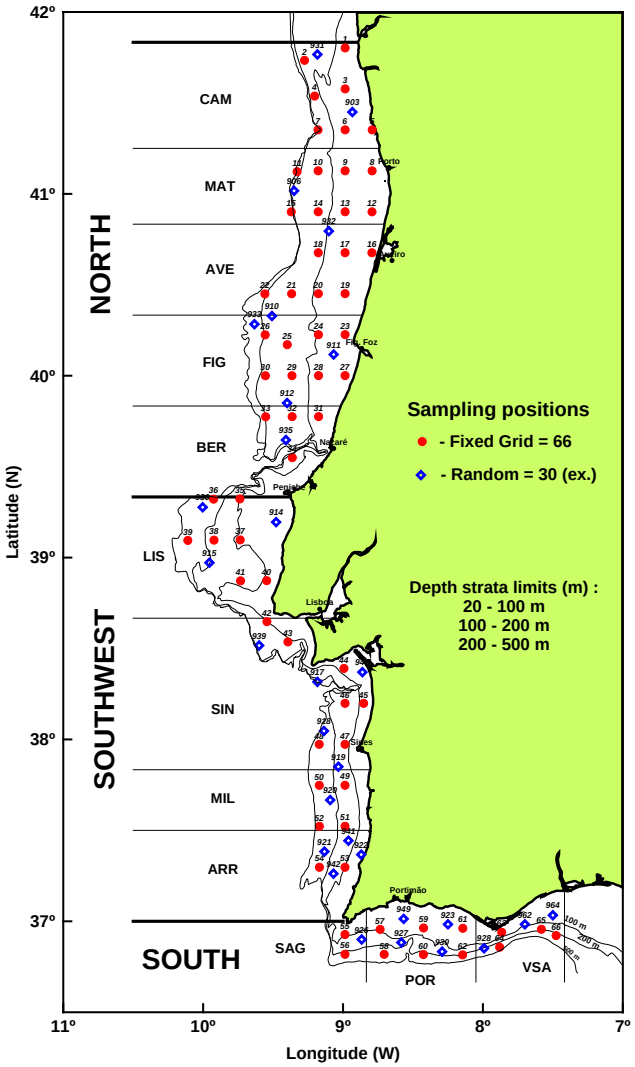


Figure 7.29. Sampling design used in the Portuguese surveys

7.9.2 Vessel and gear

The surveys are carried with the RV *Noruega*, a stern trawler of 47.5 m length, 1500 horse power and 495 G.T.R. The fishing gear used is a bottom trawl (type Norwegian Campell Trawl 1800/96 NCT) with a 20 mm codend mesh size. The main characteristic of this gear is the groundrope with bobbins. The mean vertical opening is 4.6 m and the mean horizontal opening between wings and doors is 15.1 m and 44.4 m, respectively. The polyvalent trawl doors used are rectangular (2.7 m x 1.58 m) with an area of 3.75 m^2 and weighting 650 kg (Figure 7.30,overall summary of present vessel/gear specifications for all surveys in Table 2.2).

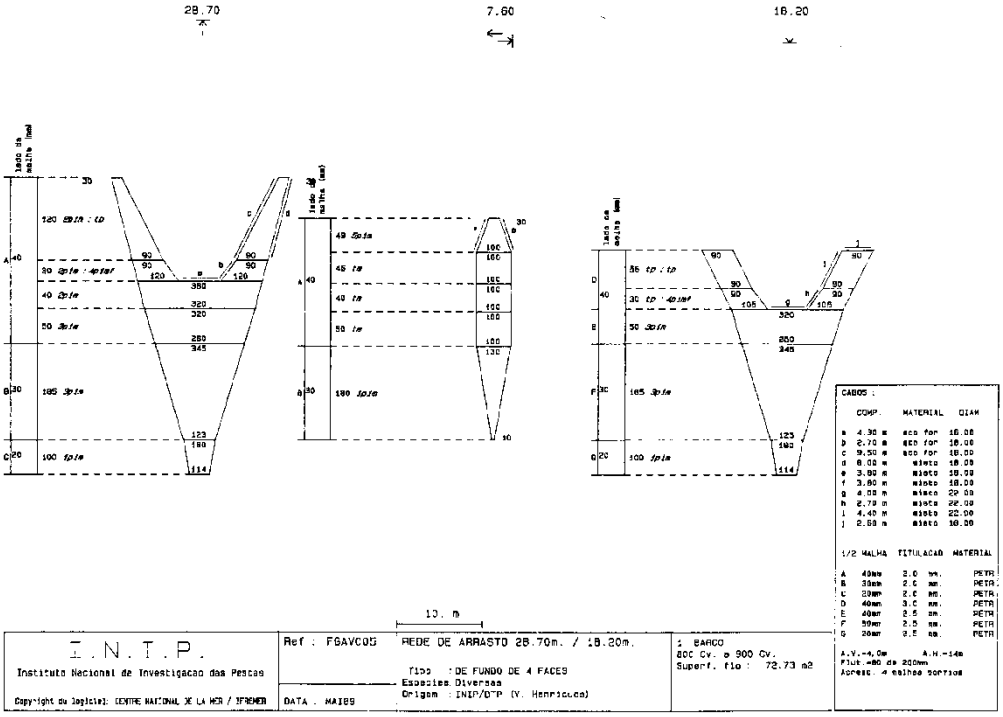


Figure 7.30. Scheme of the NCT trawl gear used in Portuguese surveys

7.9.3 Technical description of the hauls

Fishing operations are carried out during daylight at a towing mean speed of 3.5 knots. Hauls last 30 minutes from the end of shooting the gear and the warp (locking the winches), and the start of pulling back the gear. SCANMAR sensors for vertical opening, horizontal opening, doors spread and depth are used. Oceanographic stations take place at the end of each fishing station using a CTD equipment in order to collect temperature and salinity data by depth to be used in biological studies.

7.9.4 Biological data and sampling protocols with target species

Fish, cephalopods, and some species of crustaceans are sampled to species level and measured while other crustaceans, molluscs and other invertebrates are identified to the lowest taxonomic level possible and weighed, and depending on the catch, a subsample is counted to record the numbers caught.

IPMA is committed to a responsible practice in animal welfare while conducting research on board institutional vessels, and is particularly committed to the reduction of the number of animals used in research (following but not restricted to EU Directive 2010/63). Therefore, whenever research requirements do not imply killing an animal, an assessment of the chances of survival is made on a case by case basis, and all animals deemed fit to survive are released as soon as possible in a responsible and pain-free manner, additionally ensuring a measure of protection from the marine avifauna. Apart from any marine mammal or reptile (which are released without study), species belonging to the fish subclass Elasmobranchii, most molluscs and the Crustacean class Malacostraca are high prioritized in research, and released after a swift assessment of condition.

7.9.5 Database storage

Data are stored on a MS-Access database. Data checking and data quality controls include:

1. Haul position vs. geographical sector allocation and depths ranges vs. strata allocation;
2. Catch weight vs. estimated weight of the sampled length distribution.

Portuguese data are uploaded to DATRAS and include all species in the catch, plus SMALK data for species routinely provided to the assessment Working groups. Errors detected in the upload are being corrected to ensure best quality in the data provided.

7.10 Southern Spanish Groundfish Survey on the Gulf of Cadiz (Sourthern part of Division 9a) (SP-GCGFS or SP-ARSA)

The Southern Spanish Groundfish Survey on the Gulf of Cádiz (SP-GCGFS) is conducted in the southern part of ICES Division 9a, the Gulf of Cádiz. The covered area extends from 15 m to 800 m depth, during spring (March) and autumn (November).

7.10.1 Sampling design nowadays

The whole area (7224 km^2) has been separated into five depth strata (15–30, 31–100, 101–200, 201–500 and 501–800 m). The sampling design is random stratified with proportional allocation with a total of 42 fishing stations according to the design shown in Figure 7.26.

7.10.2 Vessel and gear

The SP-GCGFS has been usually carried out with RV *Cornide de Saavedra*, but from 2013 it has been carried out on the RV *Miguel Oliver* as in SP-NSGFS. The gear used is also the one used in SP-NSGFS, a Baca trawl 44/60 with a 43.6 m footrope and a 60.1 m headline (Figure 7.30). Thyborøn polyvalent trawl doors weighing 330 kg with a surface area of 1.8 m^2 were used since 2008, instead of the traditional wooden ones used in SP-NSGFS up to the change of vessel. The diameter of warp used is 22 mm (1.9 $kg.m^{-1}$). An inner 10 mm mesh codend liner is used to prevent the escape of small individuals (overall summary of present vessel/gear specifications for all surveys in Table 2.2).Two different sets of sweeps are used depending on depth: 100 m sweeps from 20 m to 40 m, 200 m sweeps for hauls deeper than 40 m.

7.10.3 Technical description of the hauls

Hauls last 60 minutes from the end of shooting the gear and the warp (locking the winches), and the start of hauling back the gear. The length of warp shot is based on a power relationship with the depth (warp = 103.99 + Depth × 2.21). Trawl speed is 3 kn. Vertical opening of the net varies around 1.8–2.2 m, horizontal opening around 17–21 m, and doors spread 107 m, varying with depth. SCANMAR (nowadays MARPORT) sensors for vertical opening, horizontal opening, depth and temperature are used regularly. Figure 7.31 presents the behaviour of these gear parameters during the quarter 4 survey, similar data are available for the 1st quarter survey. Since 2004 depth, temperature and salinity are recorded by CTD situated on the net.

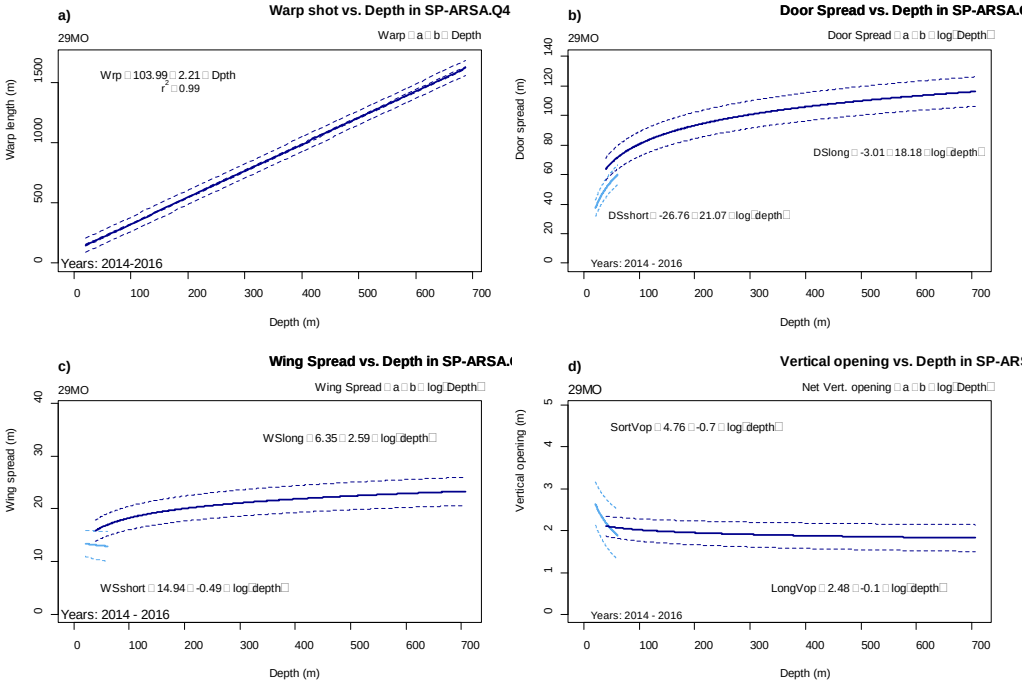


Figure 7.31. Plots presenting warp shot and standard baca gear behaviour on the RV *Miguel Oliver* during SP-ARSA 4th quarter survey, results from the 1st quarter survey do not present significant differences. Equations are estimated using the data from the years shown on the bottom left corner of each graph. Warp vs. Depth equation is estimated using *lm* R function. The light blue lines correspond to depths using the short sweeps, dark blue correspond to depths using large sweeps. Equations from b) to d) are estimated using *nls* R. Confidence intervals estimated using R functions *confint.nls* and *predict.lm*. Years previous to 2013 were carried out on the RV *Cornide de Saavedra*.

7.10.4 Database storage

Same as database storage section in 7.4.4 but using a specifically created software developed in Access (WinCAMP).

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Annex 1: History of the Northeastern Atlantic IBTS Surveys

This annex is a summary of the changes in sampling protocols and design of the different surveys that have been part of the Northeast Atlantic IBTS. Different sections correspond to each survey including surveys series discontinued like UK-SWIBTS and different Q1 surveys.

Scottish surveys history: changes in sampling design and protocols

The UK-SCOWCGFS- Q1 survey has been running since 1981 and up until 2011 this was performed utilizing a repeat station format and using the 36/47 GOV survey trawl together with the west coast groundgear 'C' rig, and 60m wire sweeps. Similarly the UK-SCOWCGFS- Q4 and UK-SCOROC-Q3 (Rockall Haddock survey) have been undertaken since 1990 and 1999 respectively, once again using the GOV survey trawl with the same configuration as that used in Q1. Trawl stations were selected at one tow per rectangle based on a library of clear tows. Latterly all of the west coast surveys initiated limited depth stratification involving statistical rectangles displaying substantial internal depth variation being sampled twice at different depths. The Scottish Rockall Survey samples a relatively small area, in the order of eight ICES rectangles and although the sampling intensity per rectangle was very much higher than the surveys being undertaken in ICES Subarea 6a it was still a repeat station survey design. From 2011, all 3 surveys have been completed using the random stratified survey design as described at the start of this section together with Groundgear D and utilizing both long (97 m) and short (47 m) wire sweep rigs with the cut-off for changing being set at 80 m depth. This also standardizes with the current Irish Groundfish Survey (IGFS) which also surveys within ICES Subarea 6a.

Ireland groundfish survey history: changes in sampling design and protocols

- Historically the Irish groundfish survey area covered the Irish Sea (7a), the west of Scotland (56.5N) down to 50N in the Celtic Sea and out to the 200 m contour along the continental shelf. Prior to 2003, Irish groundfish survey data were collected by the Marine Institute (MI) from two commercial vessel charters covering ICES Areas 6a, 7b,j and one research vessel survey within ICES areas 7a,g.
- Given certain limitations aboard different commercial charters, a decision was made to instigate a new time-series with the arrival in 2003 of a new 65 m research vessel, the RV *Celtic Explorer*. Starting in 2003, the IGFS amalgamated the historical survey areas into a single six-week survey totalling 170 stations. This new time-series became the Irish Groundfish Survey (IGFS).
- Analysis in the Celtic Sea area by Ifremer using additional ground type variables resulted in some modification of the FR-EVHOE survey design (Poulard and Mahé, 2004). It was agreed that similar minor modifications would be standardized also across the Irish Survey area and the 75 m contour was adjusted to 80 m and for simplicity this is now the depth at which sweeps are changed also.
- There was increasing survey vessel effort in the Irish Sea at that time and therefore the opportunity was discussed and agreed at IBTS to reallocate IGFS resources from 7a to the Atlantic area and northern Celtic Sea in 2005. A number of stocks of interest to assessment working groups such as monkfish (*Lophius piscatorius*), megrim (*Lepidorhombus whiffiagonis*) and hake (*Mer-*

luccius merluccius) were known to be distributed beyond the then existing 200 m range of the survey. In order to more adequately survey these stocks and avoid interrupting the ongoing time-series, the effort transferred from 7a was entirely allocated to a new stratum beyond the shelf edge, extending the survey down the slope from 200 m to the 600 m contour (Figure 7.12). Consequently, a time-series for a new deeper stratum was built in parallel, but independently, and is being incorporated where appropriate via the ICES benchmark process.

Spanish survey on Porcupine Bank history: changes in sampling design and protocols

- In 2001, the IEO started the series of bottom-trawl surveys on the Porcupine bank to overcome the previous lack of sampling in this area. The original stratification was based on data on commercial catches sampled by observers in the previous years, and had three depth strata (less than 200 m, 200–400 m and 400–800 m, combined with two geographical sectors one in the outer part (W-NW) of the bank and the other in the inner part surrounding the Porcupine Sea bight (E-SW).
- In 2003, a new stratification was adopted following analysis of bottom-trawl faunal assemblages from the two first surveys in the area (Velasco and Serrano, 2003), the original strata were changed to: less than 300 m, 300–450 m, 450–800 m.
- In 2014, it was observed that the procedure considering the end of warp shooting as the start of the tow was producing a bias, since depending on the depth the time to ground contact varied considerably. Therefore, a revision of the real trawling time per haul, using the logs of the Simrad ITI net monitoring system, was accomplished to re-estimate the actual time trawled between ground contact and start of hauling back the gear. This revision was done only for 2004 to 2013, since data from the previous years did not permit to carry out the calculations. And a conversion factor was applied for these years.
- In 2016, after two years with the new procedure of 30 minutes of real trawl, and two years of huge catches. The catches were considered excessively large for the scientific sampling purpose of the survey, and also impractical given the workload implied, so it was decided to reduce actual trawling time to 20 minutes from net-ground contact to start of hauling back the net.

English western IBTS survey: changes in sampling design and protocols

The English western IBTS survey was discontinued in 2012 due to budget restrictions (ICES, 2013), and Cefas is working on a possible new survey series with a different timing and redefinition of the sampling area. The English Western IBTS survey covered ICES Divisions 7a,e-h with two different GOV rigging in different areas of the Celtic Sea/northern Irish Sea and a rock-hopper on the hard ground stations around the Cornish Peninsula. It was carried out on the RV *Cefas Endeavour*, a stern trawler 74 m in length with a gross tonnage of 1731 t. The survey was based on a previous one operated in the Celtic Sea (the southern part of the former grid) up to 2003 in quarter 1, trawling at fixed stations using a Portuguese high headline trawl (PHHT) with a tickler chain used on fine grounds, but not on coarser grounds. For further details of this survey, see Warnes and Jones (1995), and Tidd and Warnes (2006).

The English Q4 western IBTS survey was initiated in 2002 and trialled a baca trawl, although this gear was susceptible to gear damage on some of the coarser grounds in the Celtic Sea. In 2003, the survey was conducted on the RV *Cefas Endeavour* where a modified rock-hopper GOV was trialled, although the configuration of the rock-hopper discs was changed for subsequent years.

From 2004 up to its discontinuation in 2012, the survey used two gears – a 36/47 GOV trawl with groundgear A on fine ground stations in the Celtic Sea and northern Irish Sea, and - a modified 34/45 GOV trawl with groundgear D (Harley and Ellis, 2007) on hard ground stations around the Cornish Peninsula and in St George's Channel. From 2006, the nets were constructed from polyethylene (instead of nylon).

Given the lack of a ramp on the vessel, deployment and retrieval of the gear cannot be undertaken safely in poor sea conditions, and in 2006 severe weather restricted the amount of sampling that could be undertaken in the Celtic Sea.

French CGFS Survey: changes in sampling design and protocols

From 1988 to 2014, the FR-CGFS survey was conducted on the RV *Gwen drez*, a stern trawler of 24.5 m long, with a load displacement of 249 t and 440 Kw for propulsion. The gear was the GOV 19/25 with 19.7 m footrope and 25.9 m headline. Doors had a surface of 3.58 m² and weighted 650 kg. During this period, the survey was already following a fixed stratified sampling design, with 88 stations planned by the protocol covering the eastern English Channel (ICES Division 7d) and the south of the North Sea (ICES Division 4c) up to 51°15'N. The net opening was about 3 m and wing spread was 10 m in average.

Given the age of the RV *Gwen drez*, a change of vessel occurred in 2014/2015. An intercalibration was conducted in 2014, with 32 paired tows realized with RV *Gwen drez* and RV *Thalassa* towing simultaneously the same station, 200 m apart (see Working document 4 in annex 7 of IBTSWG 2015 report, ICES 2015b). Statistical analysis indicated that the CPUE, when expressed in abundance per swept-area, was similar for most species between the vessels. Catch of pelagic fish were notably higher with RV *Thalassa* due to the higher net opening. Despite the change of vessel and the subsequent use of a bigger trawl, the sampling design has been slightly modified: the south of the North Sea (ICES Division 4c) is no longer sampled as these tows were not used in stock assessment. Moreover, the total number of stations has been reduced down to 74 stations, but with caution in order to maintain consistency for abundance-at-age indices used by WGNSSK (see annex 9 of WGNSSK 2016, ICES, 2017). From 2015 onwards, the FR-CGFS survey is conducted on the RV *Thalassa*, which also allows CTD deployments and broader ecosystem sampling (plankton nets, top predators visual observations…).

French EVHOE Survey: changes in sampling design and protocols

- For the 1987 to 1996 period, the Survey EVHOE was conducted in the Bay of Biscay on an annual basis with the exception of the years 1993 and 1996. It has been conducted in the third or fourth quarter except in 1991 when it took place in May.
- In 1988 two surveys were conducted, one in May the other in October.
- The Celtic Sea was surveyed from 1990 to 1994 but the sampling was restricted to a small geographical area. The duration is between 40 to 45 days depending on year and ship availability.

- Since 1997, with the then recently commissioned RV *Thalassa*, the survey covered all the Celtic Sea and Bay of Biscay during the 4th quarter and the survey has been conducted covering depths from 20 m to 600 m

Northern Spanish shelf groundfish survey: changes in sampling design and protocols

- The IEO has performed bottom-trawl surveys on the northern Atlantic continental shelf waters of the Iberian Peninsula since 1974. But only from 1980 the surveys were dedicated to monitor the fishing resources of Divisions 8c and 9aNorth. Nevertheless, homogenous survey protocols for the whole area were established in 1983, that is considered the onset of the standardized monitoring used for assessment purposes.
- Two series of surveys, spring and autumn were started during the 1980s.
- Up to 1985, a codend cover of 20 mm mesh was used, since then it was placed as inner 10 mm (20 mm stretched) mesh codend.
- In 1989, the RV *Cornide de Saavedra* was renovated from her original 56 m (LL) and 990 GRT, to reach LL 67 m and 1133 GRT. Due to this renovation in 1987 there was no survey and the 1989 survey was carried out in the RV *Francisco de Paula Navarro*, a smaller stern trawler that only allowed a reduced sampling compared to the rest of the series. Intercalibration trials with both vessels were performed in 1990 survey, and conversion factors for the abundance indices for 1989 were estimated and the indices consequently corrected.
- Hydrographic sampling started in 1993 and has been carried out at each fishing station, and CTD casts following a radial sampling perpendicular to the coast are carried out in some years.
- In 1997, a new depth stratification was adopted following the results of the SESITS project (Sánchez, 1997).Original strata: 30–100 m, 101–200 m, 200–500 m; were changed to: 70–120 m, 121–200 m, 201–500 m. This change was introduced on the basis of depth patterns in fish assemblage, and lack of trawlable grounds shallower than 70 m. Haul allocation changed to keep it proportional to the new strata surface, and hauls shallower than 70 m were classified as additional hauls, not used in the estimation of the stratified abundances obtained from the survey.
- From 2013, the RV *Cornide de Saavedra* has been replaced by the RV *Miguel Oliver*, also a stern trawler, after an intercalibration performed between both vessels in 2012 on the Galician part of the SP-NGFS. During the intercalibration (Velasco, 2013), that also included the replacement of the traditional wooden doors by modern polyvalent Thybøron doors, differences were considered negligible compared to natural variability of the trawl catches, and the series was continued with the new vessel. Nevertheless, in 2013 a different and heavier groundgear was mistakenly used producing and overestimation of some benthic species.

Portuguese groundfish survey history: changes in sampling design and protocols

- The Portuguese groundfish surveys have been conducted since 1979, continuously in Autumn and partially in Winter and Summer. It has been carried out on board the RV *Noruega* and, in its absence, with the RV *Capricornio*. Initially the main objective of the survey was to estimate the abundance, and study the distribution, of the most important commercial spe-

cies in the Portuguese trawl fishery, i.e. hake, horse mackerel, blue whiting, sea bream, and Norway lobster. Recruitment indices of abundance and distribution for hake and horse mackerel were also evaluated in the autumn surveys. Additionally, trawl selectivity experiments for hake and horse mackerel with 40 mm mesh size, were also conducted during 1981 surveys using the covered codend method.

- A stratified random sampling design was used during 1979–1989, with two different sampling schemes: From 1979 to 1980 the surveyed area was divided into 15 strata, with the number of random hauls per stratum, based on the previous information of the relative abundance of the target species in each geographical area and on ship time available. Based on the statistical analysis of the previous surveys, the design was revised in 1981, in order to decrease the within stratum variance. The new sampling scheme consisted in 36 strata, with two random units sampled by stratum whenever possible, to allow an estimate of the standard error of the stratified mean by stratum. The new strata were smaller than the previous ones and can be combined for consistency with previous surveys. The goal of increasing the number of strata was to increase the probability of spreading the random sampled units to decrease the total variance of the species' mean abundance indices. The stratification was based on depth and geographical areas. The depth ranges used during 1979–1989 were 20–100 m, 101–200 m and 201–500 m. Each stratum was divided into units of approximately 25 nm^2, sequentially numbered.
- The tow duration was 60 minutes during 1979–1985 at a trawling speed of 3.5 knots, changing to 30 minutes during 1986–1988 (Cardador, 1983), and changed back again to 60 minutes in 1989 as it was observed that the large adults of horse mackerel were not caught in 30 minutes tows at this trawling speed. However in 2002 the tow duration moved to 30 minutes since autumn surveys are directed to recruitment estimates, and increasing the number of hauls per survey allows a better resolution on the estimate (Cardador, pers. comm.).
- From 1990 to 2004, the sampling design was based on fixed stations. A total of 97 fixed stations were planned, spread over 12 sectors. Each sector was subdivided into 4 depth ranges: 20–100 m, 101–200 m, 201–500 m and 501–750 m, with a total of 48 strata (the previous 36 strata from 1981–1989, plus 12 new strata from the 501–750 m depths in each sector). The positions of the 97 fixed stations were selected based on common stations made during 1981–1989 surveys and taking into account that at least two stations per stratum should be sampled. A maximum of 30 supplementary stations were planned, fixed in each season, to be carried out if ship time was available or to replace positions that due to particular factors were not possible to sample. Oceanographic stations took place at the end of each fishing station using a CTD equipment in order to record temperature and salinity data by depth to be used in biological studies. CTD sampling stations were also distributed all over the study area avoiding leaving large extensions uncovered, according to a scheme with 95 planned stations. CTD casts sampled at stations over the shelf area covered the whole water column, from surface to a maximum of 400 m.
- Winter surveys were conducted between 2005 and 2008, mainly to estimate the abundance and distribution pattern of hake and of other target species

in spawning season and to estimate maturity ogives. However, since 2009 the EU/ DCF excluded this survey for funding.
- PTGFS Q4 in 2012 was not performed due to problems with the RV *Noruega* and budgetary constraints.

Southern Spanish Groundfish Survey on the Gulf of Cádiz: changes in sampling design and protocols

- In 1992 the IEO started the spring series of bottom-trawl surveys in the Gulf of Cádiz. The autumn series was started in 1997.
- Hydrography sampling started in 1997.
- In 2003 the 4th quarter survey was not carried out due to the surveys to assess the impact of the Prestige oil spill on the Galician coast.
- In 2008 the traditional trawl doors used since 1992 (rectangular, 650 kg and 3.6 m^2) were replaced for new Thyborøn doors (330 kg and 1.8 m^2).
- In 2013: as in the northern Spanish shelf survey, the RV *Cornide de Saavedra* was replaced by the RV *Miguel Oliver*, although in this case the wooden doors had been previously replaced by the Thyborøn doors.

Annex 2: Catch Sampling summary for Northeast Atlantic IBTS Surveys

Surveys on ICES Divisions VI-VII		q4						q3		q1	
		FR-EVHOE	FR-CGFS	IE-IGFS east	IE-IGFS west	UK-NIGFS	UK-SCOSWCGFS	SP-SPORC	UK-SCOROC	UK-NIGFS	UK-SCOSWCGFS
Staffing	number available for catch processing	8/10	5	5	4	6	6	7/8	6	6	6
Hauls	Average number per day	4/5	5	4/6	6	4/5	4/5	3/4	4/5	4/5	4/5
Catch	retention in hopper or bin	y	y	y	y	y	y	y	y	y	y
	codend cleaned	y	y	y	y	y	y	y	y	y	y
	net cleaned	y	y	y	y	y	y	y	y	y	y
	cleanings added to catch	y	y	y	y	y	y	y	y	y	y
	total weight[a]	y	n	n	n	y	y	n	y	y	y
Sorting	'deckmaster' in charge[b]	y	y	y	y	y	y	y	y	y	y
	sorting facility - **b**ench or **c**onveyor	c	b	b/x	b	b	b	c	b	b	b
	complete sort upto no. bstkts	60	NA	50	sel	30	NA	NA	NA	30	NA
	small fish mixture sub sorting	y	y	y	y	y	y	y	y	y	y
	part of the catch discarded unprocessed[c]	n	y	n	n	y	n	n	n	y	n
Categories	by sex (1)[d]	y	y	y	y	n	y	y	n	n	n
	by size large or small[e]	y	y	y	y	y	n	y	y	y	y
	by size multi modal[f]	y	n	y	y	y	n	y	y	y	y
Sub sample	re-mix before selection	y	y	y	y	y	n	y	n	y	n
	selection random	y	y	y	y	y	y	y	y	y	y
Weighing	all catch components	y	y	y	y	y	y	y	y	y	y
	all sub samples	y	y	y	y	y	y	y	y	y	y
Measuring	all fish species (2)	y	n	y	n	n	y	y	y	n	y
	minimum sample size	100	NA	75	75	100	100	75	100	100	100
	commercial benthos	n	y	y	y	w	w/m/c	y	w/m/c	w	w/m/c
	cephalopods	c/m	y	y	n	w/c	n	y	w/c	w/c	w/c
	other benthos - **w**eigh, **c**ount, **o**bserve	n	w/c/o	n	n	w	n	w/c	n	w	n
Biological sampling	prescribed species (3)	y	y	y	y	y	y	y	y	y	y
	other species (4)	n	y/-om	y	y	y	y	n	y	y	y
	weight	n	y	y	y	y	y	n	y	y	y
	sex	y	y	y	y	y	y	y	y	y	y
	maturity	y	y	y	y	y	y	y	y	y	y
	age material	y	y	y	y	y	y	y	y	y	y
	ageing - at sea or ashore	a	a	a	a	a	s	a	s/a	a	s/a
Data capture	station detail - **e**lectronic or **p**aper/pencil	e	e/p	e/p	p	p	p	p	p	p	p
	catch detail - **e**lectronic or **p**aper/pencil	e	p	e	e	p	e	p	e	p	e
	length detail - **e**lectronic or **p**aper/pencil	p	p	e	e	p	e	p	e	p	e
	biological detail - **e**lectronic or **p**aper/pencil	p	p	e	e	p	e	p	e	p	e
	error checking	n	y	y	y	y	y	y	y	y	y
	back up	y	y	y	y	y	y	y	y	y	y

		q4						q3		q1	
		FR-EVHOE	FR-CGFS	IE-IGFS east	IE-IGFS west	UK-NIGFS	UK-SCOSWCGFS	SP-SPORC	UK-SCOROC	UK-NIGFS	UK-SCOSWCGFS
(1) Categories by sex	anglers	y	n	n	n	n	n	n	n	n	n
	cod	y	y	n	n	n	n	n	n	n	n
	dab	n	n	n	n	n	n	n	n	n	n
	elasmobranchs	y	y	y	y	y	y	y	y	y	y
	haddock	y	n	n	n	n	n	n	n	n	n
	hake	y	n	n	n	n	n	n	n	n	n
	lemon sole	n	n	y	y	n	n	n	n	n	n
	megrim	n	n	y	y	n	n	n	n	n	n
	nephrops	y	n	n	n	y	y	n	y	y	y
	plaice	y	y	n	n	y	n	n	n	y	n
	sole	y	y	n	n	n	n	n	n	n	n
	whiting	y	y	n	n	n	n	n	n	n	n
(2) Measuring 0.5cm	anchovy	y	y	y	y	y	n	y	n	y	n
	herring	y	y	y	y	y	y	n	y	y	y
	pilchard	y	y	y	y	y	n	y	n	y	n
	sprat	y	y	y	y	y	y	n	y	y	y
(2) Measuring mm	commercial benthos	n	n	n	n	n	y	n	y	n	y
	nephrops	y	n	n	n	y	y	n	y	y	y
(3) Prescribed species	anglers	y	n	y	y	n	n	y	n	n	n
	blue whiting	n	n	y	n	n	n	y	n	n	n
	cod	y	y	y	y	y	y/-m	n	y/-m	y	y
	haddock	y	n	y	y	y	y/-m	n	y/-m	y	y
	hake	y	n	y	y	y	n	y	n	y	n
	herring	n	n	y	y	n	y	n	y	n	y
	horse mackerel	n	n	y	n	n	n	y	n	n	n
	lemon sole	n	n	y	y	y	n	n	n	y	n
	mackerel	n	n	y	y	n	y	y	y	n	y
	megrim	y	n	y	y	n	n	y	n	n	n
	nephrops	n	n	y	n	n	n	y	n	n	n
	plaice	n	y	y	y	y	n	n	n	y	n
	saithe	n	n	y	y	n	y/-m	n	y/-m	n	y
	sole	y	y	y	y	n	n	n	n	n	n
	spur dog	n	n	y	y	y	n	n	n	y	n
	whiting	y	y	y	y	y	y/-m	n	y/-m	y	y
(4) Other species	brill	n	n	y	n	y	y	n	y/-o	y	y/-o
	elasmobranchs	n	y/-om	y	y	y	y	n	y	y	y
	sprat	n	n	y	n	y	y	n	y	y	y
	turbot	n	n	y	n	y	y	n	y/-o	y	y/-o

See legend on next page

Surveys on ICES divisions VIII and IX

		q4				q1
		FR-EVHOE	PT-PGFS	SP-NSGFS	SP-GCGFS	SP-GCGFS
Staffing	number available for catch processing	8/10	8/10	8/10	6/8	6/8
Hauls	Average number per day	5/6	4	5	5	5
Catch	retention in hopper or bin	y	y	y	y	y
	codend cleaned	y	y	y	y	y
	net cleaned	y	y	y	y	y
	cleanings added to catch	y	y	y	y	y
Sorting	'deckmaster' in charge	y	y	y	y	y
	sorting facility - **b**ench or **c**onveyor	c	b	b	b	b
	complete sort upto no. bstkts	60	10	NA	40	40
	small fish mixture sub sorting	y	y	y	y	y
Categories	by sex (1)	y	y	y	y	y
	by size large or small	y	y	y	y	y
	by size multi modal	y	n	y	y	y
Sub sample	re-mix before selection	y	y	y	y	y
	selection random	y	y	y	y	y
Weighing	all catch components	y	y	y	y	y
	all sub samples	y	y	y	y	y
Measuring	all fish species (2)	y	y	y	y	y
	minimum sample size	100	100	75	75	75
	commercial benthos	n	y	y	y	y
	cephalopods	c/m	y	y	y	y
	other benthos - **w**eigh, **c**ount, **o**bserve	n	w/c	y	y	y
Biological sampling	prescribed species (3)	y	y	y	y	y
	other species (4)	n	y	y	y	y
	weight	n	y	n	n	n
	sex	y	y	y	y	y
	maturity	y	y	y	y	y
	age material	y	y	y	y	y
	ageing - at sea or ashore	a	a	a	a	a
Data capture	station detail - **e**lectronic or **p**aper/pencil	e	e/p	e/p	e/p	e/p
	catch detail - **e**lectronic or **p**aper/pencil	e	p	p	p	p
	length detail - **e**lectronic or **p**aper/pencil	p	p	p	p	p
	biological detail - **e**lectronic or **p**aper/pencil	p	p	p	p	p
	error checking	n	y	y	y	y
	back up	y	y	y	y	y

		q4				q1
		FR-EVHOE	PT-PGFS	SP-NSGFS	SP-GCGFS	SP-GCGFS
(1) Categories by sex	anglers	y	n	n	n	n
	elasmobranchs	y	y	y	y	y
	hake	y	n	n	n	n
	megrims	y	n	n	n	n
	nephrops	n	y	y	y	y
	red shrimp	n	y	n	y	y
	rose shrimp	n	y	n	y	y
	sole	y	n	n	n	n
	whiting	y	n	n	n	n
(2) Measuring 0.5cm	anchovy	y	y	y	y	y
	pilchard	y	y	y	y	y
	sprat	y	y	n	n	n
(2) Measuring mm	commercial benthos	n	n	y	y	y
	nephrops	y	d	n	n	n
	octopus/cuttlefish	n	y	n	n	n
	red shrimp	n	d	n	y	y
	rose shrimp	n	d	n	y	y
(3) Prescribed species	anglers	y	y	y	n	n
	blue whiting	n	y	y	y	y
	hake	y	y	y	y	y
	horse mackerel	n	y	y	y	y
	mackerel	n	y	y	y	y
	megrims	y	y	y	n	n
	nephrops	y	y	y	y	y
	octopus & cuttlefish	n	y	n	y	y
	red shrimp	n	y	n	y	y
	rose shrimp	n	y	n	y	y
	sole	y	n	n	n	n
	Spanish mackerel	n	y	n	y	y
	wedge sole	n	n	n	y	y
	whiting	y	n	n	n	n
(4) Other species	elasmobranchs	n	d	y	y	y

See legend on next page

Legend for catch sampling summary tables

y =	Yes
y/-o=	Yes but not otoliths
y/-m=	Yes but not maturity
n =	No
b =	Catch sorting on bench
c =	Catch sorting on conveyer belt
n =	count
w =	weight
o =	observation, qualitative notes
e =	electronically
p =	paper & pencil
d =	Species are separated by sex before length measuring takes place

Annex 3: Format in DATRAS for HAUL INFORMATION records

Explanations of the various field names and data types can be found on the ICES webpage: http://www.ices.dk/datacentre/datsu/selrep.asp

Record Type HH

Start/Order	Field Name	Width	Mandatory	Data Type
1	RecordType	2	✓	char
2	Quarter	1	✓	int
3	Country	3	✓	char
4	Ship	4	✓	char
5	Gear	6	✓	char
6	SweepLngt	3		int
7	GearExp	2		char
8	DoorType	2		char
9	StNo	6	✓	char
10	HaulNo	3	✓	int
11	Year	4	✓	char
12	Month	2	✓	int
13	Day	2	✓	int
14	TimeShot	4	✓	char
15	Stratum	4		char
16	HaulDur	3	✓	int
17	DayNight	2	✓	char
18	ShootLat	8	✓	decimal
19	ShootLong	9	✓	decimal
20	HaulLat	8	✓	decimal
21	HaulLong	9	✓	decimal
22	StatRec	4		char
23	Depth	4	✓	int
24	HaulVal	1	✓	char
25	HydroStNo	8	✓	char
26	StdSpecRecCode	1	✓	char
27	BycSpecRecCode	1	✓	char
28	DataType	2	✓	char
29	Netopening	4		decimal
30	Rigging	2		char
31	Tickler	2		int
32	Distance	4		int
33	Warplngt	4		int
34	Warpdia	2		int
35	WarpDen	2		int
36	DoorSurface	4		decimal
37	DoorWgt	4		int

Start/Order	Field Name	Width	Mandatory	Data Type
38	DoorSpread	3		int
39	WingSpread	2		int
40	Buoyancy	4		int
41	KiteDim	3		decimal
42	WgtGroundRope	4		int
43	TowDir	3		int
44	GroundSpeed	3		decimal
45	SpeedWater	3		decimal
46	SurCurDir	3		int
47	SurCurSpeed	4		decimal
48	BotCurDir	3		int
49	BotCurSpeed	4		decimal
50	WindDir	3		int
51	WindSpeed	3		int
52	SwellDir	3		int
53	SwellHeight	4		decimal
54	SurTemp	4		decimal
55	BotTemp	4		decimal
56	SurSal	5		decimal
57	BotSal	5		decimal
58	ThermoCline	2		char
59	ThClineDepth	4		int

Annex 4: Format in DATRAS for LENGTH FREQUENCY records

Explanations of the various field names and data types can be found on the ICES webpage: http://www.ices.dk/datacentre/datsu/selrep.asp

Record Type HL

Start/Order	Field Name	Width	Mandatory	Data Type
1	RecordType	2	✓	char
2	Quarter	1	✓	int
3	Country	3	✓	char
4	Ship	4	✓	char
5	Gear	6	✓	char
6	SweepLngt	3		int
7	GearExp	2		char
8	DoorType	2		char
9	StNo	6	✓	char
10	HaulNo	3	✓	int
11	Year	4	✓	char
12	SpecCodeType	1	✓	char
13	SpecCode	10	✓	char
14	SpecVal	2	✓	char
15	Sex	2		char
16	TotalNo	9		decimal
17	CatIdentifier	2	✓	int
18	NoMeas	3	✓	int
19	SubFactor	9	✓	decimal
20	SubWgt	6		int
21	CatCatchWgt	8	✓	int
22	LngtCode	2	✓	char
23	LngtClass	4	✓	decimal
24	HLNoAtLngt	6	✓	decimal

Annex 5: Format in DATRAS for SMALK records

Explanations of the various field names and data types can be found on the ICES webpage: http://www.ices.dk/datacentre/datsu/selrep.asp

N.B. When sending information on herring in 1st Quarter, number of rings should be substituted for age.

Record Type CA

Start/Order	Field Name	Width	Mandatory	Data Type
1	RecordType	2	✓	char
2	Quarter	1	✓	int
3	Country	3	✓	char
4	Ship	4	✓	char
5	Gear	6	✓	char
6	SweepLngt	3		int
7	GearExp	2		char
8	DoorType	2		char
9	StNo	6	✓	char
10	HaulNo	3	✓	int
11	Year	4	✓	char
12	SpecCodeType	1	✓	char
13	SpecCode	10	✓	char
14	AreaType	2	✓	char
15	AreaCode	4	✓	char
16	LngtCode	2	✓	char
17	LngtClass	4	✓	decimal
18	Sex	2	✓	char
19	Maturity	2	✓	char
20	PlusGr	2	✓	char
21	AgeRings	2	✓	int
22	CANoAtLngt	3	✓	int
23	IndWgt	5		decimal

Annex 6: Sampling areas of the IBTS Surveys on the Northeast Atlantic area

This Annex contains the size in square kilometres of the areas of sectors and strata in the different surveys as calculated from the shape files supplied by the survey responsible.

Name	Second id	Stratum	Depth min	Depth max	Area km²(1)
UK-SCOWCGFS- Q1					
R2	0	0	0		4277.544
R1	1	0	0		7240.949
P	2	0	0		11 583.985
LB	3	0	0		8841.305
G2	4	0	0		7197.303
G1	5	0	0		25 547.714
CL	6	0	0		2601.782
B2	7	0	0		7526.528
WS	8	0	0		5112.437
B1	9	0	0		8301.033
R3	10	0	0		11 718.594
UK-SCOROC					
R1	0	0	0	150	1213.861
R2	1	0	151	200	7096.037
R3	2	0	201	250	6999.741
R4	3	0	250	350	6384.097
UK-SCOWCGFS-Q4					
LB	0	0	NA	NA	8348.762
G4	1	0	NA	NA	4140.469
G3	2	0	NA	NA	8485.148
G2	3	0	NA	NA	5476.617
G1	4	0	NA	NA	16 324.646
GY	5	0	NA	NA	2881.974
CL	6	0	NA	NA	2601.782
WS	7	0	NA	NA	5112.486
B2	8	0	NA	NA	5035.297
R2	9	0	NA	NA	22 655.403
B1	10	0	NA	NA	5586.912
R1	11	0	NA	NA	15 666.433
UK-NIGFS					
S1	Irish Coast (N), <100m, Mixed sediments				855.66
S2	Irish Coast, <50m, sand and finer sediments				2740.38
S3	Irish Coast, 50–100m, muddy sediments				1509.08
S4	W and SW Isle of Man, 50–100m, mud and muddy sand				1781.32
S5	N Isle of Man, <50m, gravel sediments				2965.59

Name	Second id	Stratum	Depth min	Depth max	Area km²(1)
S6	Eastern Irish Sea, <50m, sand and finer sediments				9336.36
S7	S. Isle of Man, <100m, gravel sediments				7109.55
S8	Deep western channel and North Channel >100m				3367.86
S9	St. George's Channel west; sandy/mixed sediments; <100m				7721.45
S10	St. George's Channel east; sandy/mixed sediments; <100m				7564.53
EI-IGFS					
7b	Deep	7b_Deep	120	200	32 933.04
7j	Slope	7j_Slope	200	600	17 963.27
7b	Slope	7b_Slope	200	600	28 245.66
6a	Slope	6a_Slope	200	600	7073.43
7j	Medium	7j_Medium	80	120	23 424.52
7j	Deep	7j_Deep	120	200	52 854.48
7j	Coast	7j_Coast	0	80	11 719.48
7b	Coast	7b_Coast	0	80	22 556.51
6a	Coast	6a_Coast	80	120	45 508.65
6a	Medium	6a_Medium	80	120	40 516.64
6a	Deep	6a_Deep	120	200	28 154.87
7b	Medium	7b_Medium	80	120	21 329.65
7g	Deep	7g_Deep	120	200	4117.01
7g	Medium	7g_Medium	80	120	84 073.82
7g	Coast	7g_Coast	0	80	39 662.14
SP-PORC					
11a	E	11aE	150	300	3191.828
11b	E	11bE	150	300	5601.458
12	F	12F	301	450	11 227.901
13	G	13G	451	800	5057.935
22	F	22F	301	450	9554.707
23	G	23G	451	800	11 322.385
FR-CGFS					
27E8					207
27E9					1336
27F0					174
28E8					2789
28E9					3999
28F0					1728
28F1					103
29E8					3865
29E9					3957
29F0					3957
29F1					2016
30E8					1593
30E9					2340
30F0					2679

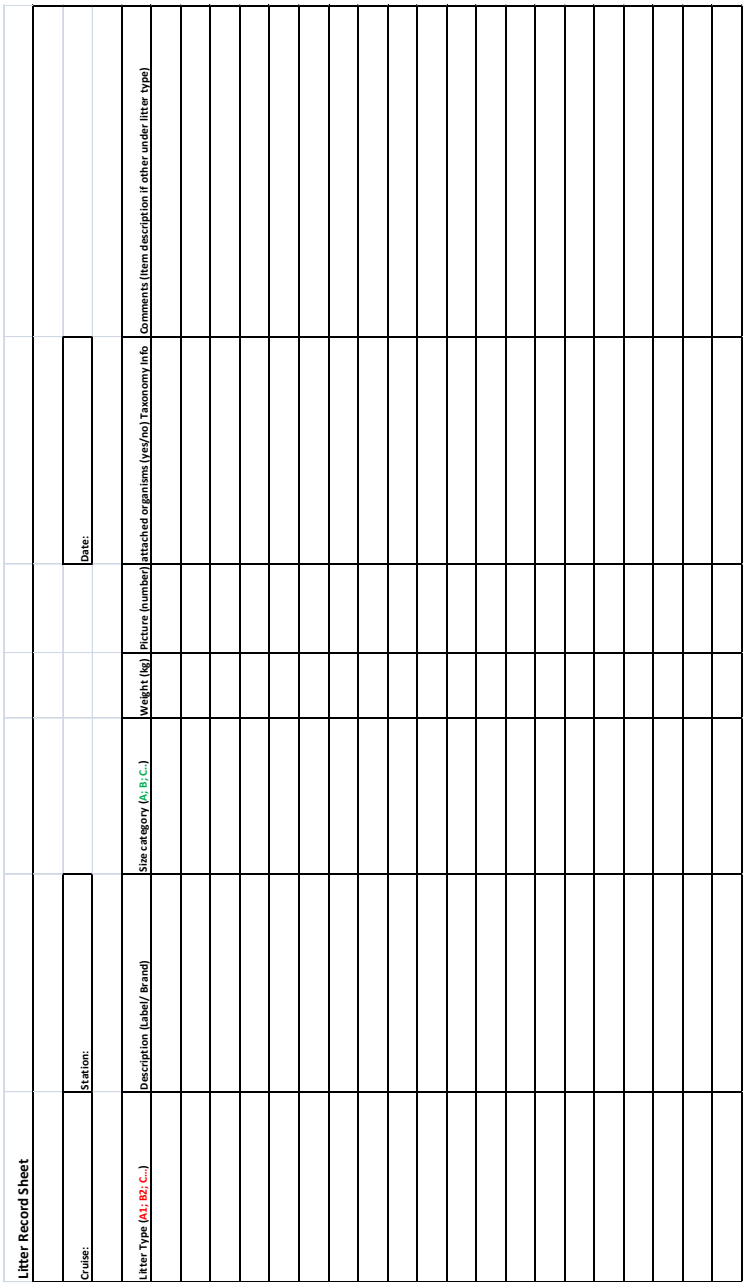
Name	Second id	Stratum	Depth min	Depth max	Area km²(1)
30F1					2468
FR-EVHOE					
Cc	3	Cc3w	81	120	4509.9322
Cc	4	Cc4w	121	160	20 465.1259
Cc	4	Cc4e	121	160	7776.0518
Cc	3	Cc3e	81	120	15 733.0216
Gn	1	Gn1	0	30	8197.2331
Gn	2	Gn2	31	80	11 763.9152
Gn	3	Gn3	81	120	17 316.379
Gn	4	Gn4	121	160	18 844.7115
Gn	5	Gn5	181	200	1611.6639
Gn	6	Gn6	201	400	1089.7359
Gn	7	Gn7	401	600	1691.0795
Gs	7	Gs7	401	600	654.4955
Gs	6	Gs6	201	400	597.9921
Gs	5	Gs5	181	200	440.7209
Gs	4	Gs4	121	160	2988.1664
Gs	3	Gs3	81	120	4007.3058
Gs	2	Gs2	31	80	4634.6981
Gs	1	Gs1	0	30	1957.5931
Cn	2	Cn2	31	80	7064.0954
Cn	2	Cn2	31	80	7671.7651
Cn	3	Cn3	81	120	22327.324
Cc	7	Cc7	401	600	1753.1662
Cc	6	Cc6	201	400	3501.7459
Cc	5	Cc5	181	200	5320.0653
Cs	7	Cs7	401	600	2574.9265
Cs	6	Cs6	201	400	4010.8563
Cs	5	Cs5	181	200	15 248.0634
Cs	4	Cs4	121	160	41 569.7042
Cs	3	Cs3	81	120	14 236.1706
SP-NSGFS					
MF	A	MFa	70	120	1181.16
MF	B	MFb	121	200	2190.28
MF	C	MFc	201	500	956.08
AB	A	ABa	70	120	908.41
AB	B	ABb	121	200	921.47
AB	C	ABc	201	500	538.62
PA	A	PAa	70	120	1024.13
PA	B	PAb	121	200	2623.40
EP	A	EPa	70	120	1273.65
FE	A	FEa	70	120	1137.91
PA	C	PAc	201	500	955.63

Name	Second id	Stratum	Depth min	Depth max	Area km²(1)
FE	B	FEb	121	200	3253.61
EP	B	EPb	121	200	3010.44
EP	C	EPc	201	500	665.88
FE	C	FEc	201	500	3400.49
PT-PGFS					
CAM	1	CAM1	20	100	1437.79
CAM	2	CAM2	101	200	634.70
CAM	3	CAM3	201	500	227.95
MAT	1	MAT1	20	100	1384.02
MAT	2	MAT2	101	200	861.67
MAT	3	MAT3	201	500	178.72
AVE	1	AVE1	20	100	1569.11
AVE	2	AVE2	101	200	1096.21
AVE	3	AVE3	201	500	266.11
FIG	1	FIG1	20	100	1379.04
FIG	2	FIG2	101	200	1607.91
FIG	3	FIG3	201	500	444.54
BER	1	BER1	20	100	916.98
BER	2	BER2	101	200	865.37
BER	3	BER3	201	500	371.86
LIS	1	LIS1	20	100	1550.08
LIS	2	LIS2	101	200	1561.12
LIS	3	LIS3	201	500	1072.83
SIN	1	SIN1	20	100	844.32
SIN	2	SIN2	101	200	1336.21
SIN	3	SIN3	201	500	780.28
MIL	1	MIL1	20	100	228.66
MIL	2	MIL2	101	200	483.70
MIL	3	MIL3	201	500	624.60
ARR	1	ARR1	20	100	569.03
ARR	2	ARR2	101	200	395.79
ARR	3	ARR3	201	500	480.45
SAG	1	SAG1	20	100	182.41
SAG	2	SAG2	101	200	222.34
SAG	3	SAG3	201	500	208.34
POR	1	POR1	20	100	1252.21
POR	2	POR2	101	200	401.46
POR	3	POR3	201	500	445.15
VSA	1	VSA1	20	100	530.08
VSA	2	VSA2	101	200	164.79
VSA	3	VSA3	201	500	306.75
SP-GCGFS					
SP-GCGFS	A		15	30	384.6255

Name	Second id	Stratum	Depth min	Depth max	Area km²(1)
SP-GCGFS	B		31	100	2651.6485
SP-GCGFS	C		101	200	1188.8886
SP-GCGFS	D		201	500	1691.5877
SP-GCGFS	E		501	800	2303.5919

(1) The areas are estimated from the shape files provided by the laboratories using a WGS84 projection, small differences could appear due to projections used in each laboratory.

Annex 7: Data Sheet for collection of marine litter



Litter Record Sheet

Cruise: Station: Date:

Litter Type (A1; B2; C..)	Description (Label/ Brand)	Size category (A; B; C..)	Weight (kg)	Picture (number)	attached organisms (yes/no)	Taxonomy info	Comments (Item description if other under litter type)

Litter overview			
A: Plastic	**B: Sanitary waste**	**C: Metals**	**Related size category**
A1. Bottle	B1. diapers	C1. Cans (food)	A: <5*5 cm= 25 cm^2
A2. Sheet	B2. cotton buds	C2. Cans (beverage)	B: <10*10 cm= 100 cm^2
A3. Bag	B3. cigarette butts	C3. Fishing related	C: <20*20 cm= 400 cm^2
A4. Caps/ lids	B4. condoms	C4. Drums	D: <50*50 cm= 2500 cm^2
A5. Fishing line (monofilamen	B5. syringes	C5. appliances	E: <100*100 cm= 10000 cm^2= 1 m^2
A6. Fishing line (entangled)	B6. sanitary towels/ tampon	C6. car parts	F: >100*100 cm = 10000 cm^2= 1 m^2
A7. Synthetic rope	B7. other	C7. cables	
A8. Fishing net		C8. other	
A9. Cable ties			
A10. Strapping band			
A11. crates and containers			
A12. other			
D: Rubber	**E: Glass/ Ceramics**	**F: Natural products**	**G: Miscellaneous**
D1. Boots	E1. Jar	F1. Wood (processed)	G1. Clothing/ rags
D2. Balloons	E2. Bottle	F2. Rope	G2. Shoes
D3. bobbins (fishing)	E3. piece	F3. Paper/ cardboard	G3. other
D4. tyre	E4. other	F4. pallets	
D5. glove		F5. other	
D6. other			

Annex 8: Intercalibration experiments in IBTS Northeastern Atlantic area

This Annex presents a short summary of the different intercalibration experiments performed between different vessels and/or gears in the IBTS Northeast Atlantic area. References are listed in the global reference list for this manual, Section 8.

Table 1. Intercalibration experiments -Type of experiments: 1= between gears, 2 = between gears/vessels

Area	Country	Institute	Year	Type	Gears	Res.Vessel	Contact	Reference
Bay of Biscay: 8c/8b	Spain-France	Ifremer IEO	2006–2015	2	GOV/ Standard Baca	*Thalassa*/ *Cornide de Saavedra*	Jean-Claude Mahé Francisco Velasco	Ongoing yearly
Bay of Biscay: 8c/8b	Spain-France	IEO Ifremer	1997	2	Standard Baca/ GOV	*Cornide de Saavedra* Old *Thalassa*	Francisco Sánchez Jean-Claude Mahé	Borges*et al.*, 1999
Porcupine Survey, 7bck	Spain-Ireland	IEO-Marine Institute	2005-2007	2	Porcupine baca GOV	*Vizconde de Eza* *Celtic Explorer*	Francisco Velasco Dave Stokes	IBTS 2006–2008
Porcupine Survey, 7bck	Spain	IEO	2003	1	Porcupine baca/Mod Porcupine baca	*Vizconde de Eza*	Francisco Velasco	SGSTG2004, ICES, 2004
Irish Sea	Scotland (UK) Ireland	FRS MI	2004	2	GOV	*Scotia* III *Celtic Explorer*	Finlay Burns D. Stokes	IBTS 2005, Burns and Stokes, 2005
Rockall/Shetland	Scotland	FRS/MSS	2006/2009	1	GOV*	*Scotia* III	Dave Reid R. Kynoch	IBTS 2012, Kynoch *et al.*, 2012
Orkney	Scotland	FRS/MSS	1998	2	GOV*	*Scotia*II/ *Scotia* III	A. F. Zuur R. J. Fryer	FRS Mar. Lab. Report 03/01

Area	Country	Institute	Year	Type	Gears	Res.Vessel	Contact	Reference
English Channel	France	Ifremer	2014	2	GOV 19/25 and GOV 36/47	*Gwen drez* *Thalassa*	Morgane Travers	IBTSWG 2015, WGNSSK 2016
ICES 7a and 7b	France Ireland Scotland	Ifremer MI FRS	1999/2000	2	GOV 36/47 and GOV 28.9/37**	*Thalassa* CelticVoyager *Scotia* II	J.C. Mahé D. Stokes K. Coull	IPROST Study
Portuguese waters -SW and South	Portugal	IPIMAR	1997/1998	1	NCT/GOV	*Noruega*	Fátima Cardador	Borges*et al.*, 1999
Portuguese waters - South and Spanish waters - Gulf Cadiz	Portugal /Spain	IPIMAR IEO	1997/1998	2	NCT/Baca	*Noruega* and *Cornide de Saavedra*	Fátima Cardador Francisco Sanchez	Borges*et al.*, 1999
Cantabrian Sea, 8c	Spain	IEO	1997	1	Standard Baca /GOV	*Cornide de Saavedra*	Francisco Sanchez	Borges*et al.*, 1999, Cardador *el al.*, 1999
Spanish waters Gulf of Cadiz	Spain	IEO	2000/2001	1	Baca / GOC 73	*Cornide de Saavedra*	Fernando Ramos	SGSTG2003 ICES, 2003
Portuguese waters - SW and South	Portugal	IPIMAR	2005	2	NCT/CAR	*NoruegaCapricornio*	Fátima Cardador	Cardador and Azevedo, 2006
Spanish waters Galicia	Spain	IEO	2012	2	Baca	*Cornide de Saavedra* and*Miguel Oliver*	Francisco Velasco	Velasco, 2013

*** Intra-calibration between a GOV 36/47 with groundgear C against an identical trawl with the newly developed groundgear D.**

**** The Irish vessel in this time-series used a scaled down GOV 28.9/37 due to vessel power.**

Annex 9: Irish Anglerfish and Megrim Survey (Divisions 6a, 7b,g,j,k) (IE-IAMS)

This annex presents the protocols and a draft manual of the Irish Anglerfish and Megrim Survey (IE-IAMS) that was presented to the group during the 2016 meeting and in 2017 presented the first report of results and this draft manual presented as working document to the IBTSWG.

Working document to IBTSWG 2017

Hans Gerritsen and Eoghan Kelly, Marine Institute, Ireland

Introduction

IBTSWG 2016 agreed to coordinate the Irish Anglerfish and Megrim Survey (IAMS) (section 5.3.5.4 of the 2016 report). It was also agreed that the IAMS protocols would be provided to IBTSWG in the same format as the IBTS manual revision IV. This document provides a first draft of these protocols.

Sampling design

The Irish Anglerfish and Megrim Survey (EI-IAMS) uses a random stratified survey design.

The survey stratification is based on the following considerations:

- Depth: 0–200 m; 200–500 m and 500–1000 m.
- Clearly defined fishing grounds (from VMS-logbook data: Gerritsen and Lordan, 2011; Gerritsen *et al.*, 2012) were identified as separate strata; an area with high fishing intensity surrounded by low fishing intensity signifies that the ecology on the fishing ground is likely to different from that of the surrounding area. Examples include the *Nephrops* grounds on the Porcupine, west of Aran and Labadie, as well the Stanton Banks and Stags grounds.
- Catch rates of the target species (anglerfish and megrim) from VMS-logbook data as well as IBTS and previous anglerfish and megrim surveys were also taken into account in determining the boundaries of the strata.
- Rocky bottom types are excluded from the survey area, which implies an assumption that the densities of the target species are zero those areas.
- Regions 6a and 7 are treated separately because they are comprise different assessment and TAC areas.

The density of sampling stations in each stratum was either low, medium (twice the low density) or high (four times the low density). These station densities were assigned to each stratum so that the number of stations in each stratum was approximately to be proportional to the expected standard deviation of the biomass estimate of the target species in the stratum.

Three strata with expected low abundance of the target species (Aran and Porcupine *Nephrops* grounds and the area of coarse sediment on the Porcupine Bank) were combined into a single stratum (7_Shelf_L) despite the differences in depth and bottom type. The strata are shown in Figure 1. The naming of the strata reflects the region (6a or 7), area (continental shelf or slope) and density of stations (Low, Medium, High).

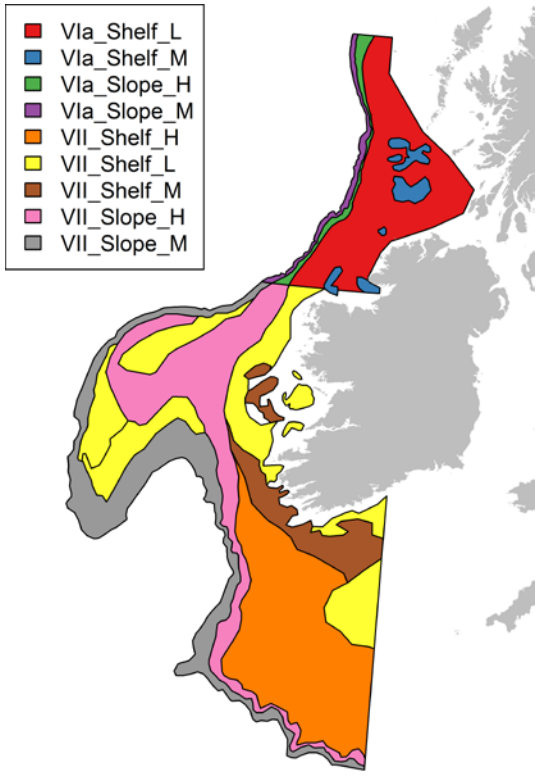


Figure 1.Stratification of the IE-IAMS survey area.

Random sampling stations are selected in the following way to ensure an even spatial distribution within each stratum: First, a 50 km buffer is created around the survey area – this avoids edge effects. Next 10 000 random positions are drawn. The pair of positions with the smallest nearest-neighbour distance is then identified and the point of this pair that is closest to the second-nearest neighbour is then eliminated. This procedure is repeated until there is only one position left. The positions are then assigned a ranking value which is the reverse of the order in which they were eliminated (so the last station to be eliminated gets rank = 1).

Next, the stations with the highest rank in each stratum are selected according to the target number of stations in each stratum. This procedure results in evenly spaced stations, regardless of the density of the stations. It also allows for adaptive sampling targets: if targets are unlikely to be met (e.g. due to bad weather), stations with lower ranks can be dropped preferentially.

Finally, a suitable tow track is picked to go through the randomly selected points. Where it was impossible to do so (e.g. underwater cables, passive gear, unsuitable bottom) it will be attempted to find a tow track that came within 1nm of the selected point.

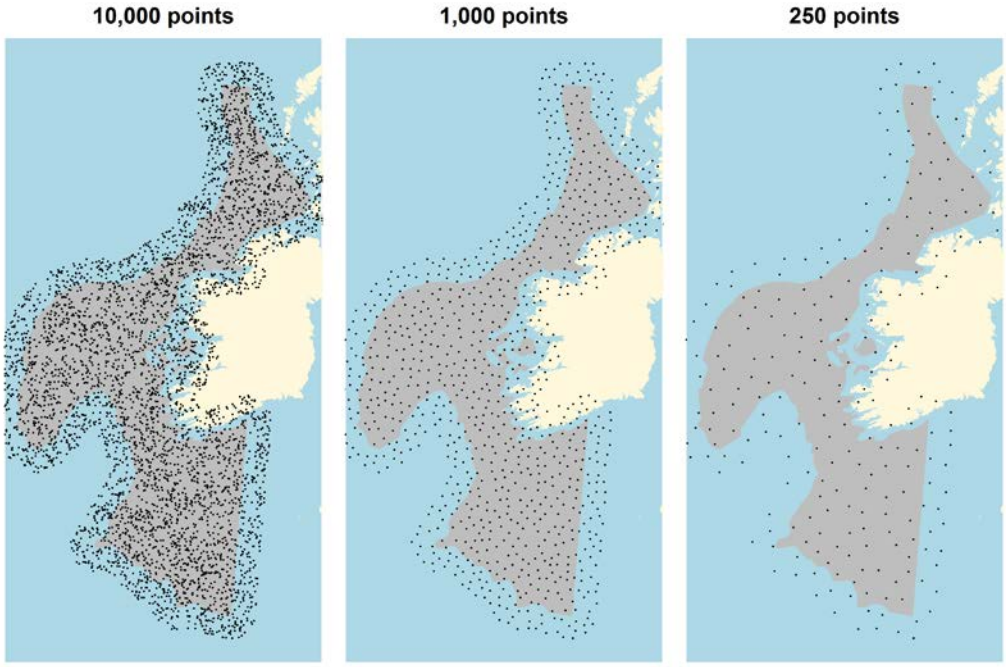


Figure 2. Illustration of the procedure for thinning out random points with the smallest nearest-neighbour distance.

Vessel and gear

The IAMS is carried out on board the RV *Celtic Explorer*, a 65 m vessel with 4320 KW engine power. The trawl is based on a standard commercial otter trawl used in the anglerfish fishery and is described in detail in Reid *et al.* (2007). The mesh size varies from 200 mm in the wings gradually reducing to 100 mm in the codend. The groundgear is fitted with 16'' rock-hopper disks and a 19 mm tickler chain is mounted between the wings, rigged to run ahead of the groundgear. The trawl doors were 5.25 m^2 Thyborøn Type 16 straight oval doors.

Technical description of the hauls

The gear was trawled at 3 kn for one hour at each station. The warp to depth ratio was 3/1 for depths up to 200 m, and 2/1 plus 200 m in deeper water.

Door spread, wing spread, headline height and bottom contact were monitored using SCANMAR and Marport trawl sensors (distance sensors in the doors and wing-ends, headline sensor and a trawl-eye sensor positioned on the top sheet directly over the footrope).

All fish and squid species are sorted and weighed. All demersal fish species are sampled for length. Biological data are collected for the species listed in the table 3 in the general section on catch sampling. Occurrence of the following vulnerable or sentinel invertebrate species are noted if present: sea pen, fan mussel and ocean quahog. Otherwise, invertebrate species are not recorded.

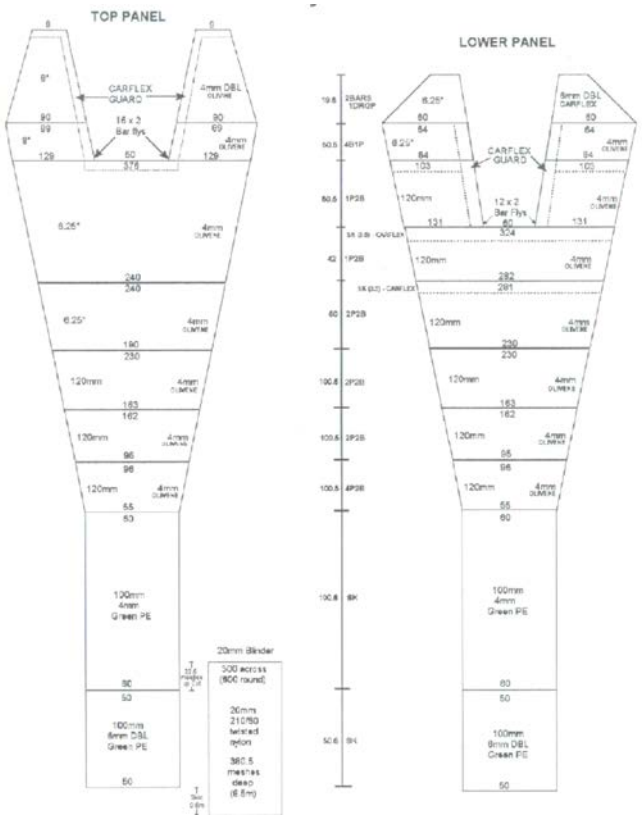


Figure 3. Net diagram of the Jackson trawl used on the IE-IAMS survey

Database storage

Station positions, heading and bottom depth were recorded at the moment the gear settled on the bottom and when the gear was hauled back. Tide and wind direction and speed, barometric pressure, heave, pitch and roll were recorded at the midpoint in the tow. The median values of the door spread, wing spread and headline height were recorded at the end of the tow. These measurements as well as bottom depth and GPS position are recorded in a SQL database at intervals of approximately 1 per second.

Catch weights, length frequency distributions and biological data were captured using the Cefas Electronic Data Capture (EDC) system and stored into local Access '97 databases before being imported into a central SQL database. The Cefas software FSS (Fishing Survey System) was used to enter station data and import catch data. In-house R code was used to quality check the data.

References

Gerritsen, H., & Lordan, C. (2010). Integrating vessel monitoring systems (VMS) data with daily catch data from logbooks to explore the spatial distribution of catch and effort at high resolution. ICES Journal of Marine Science: Journal du Conseil, fsq137.

Reid, D. G., V. J. Allen, D. J. Bova, E. G. Jones, R. J. Kynoch, K. J. Peach, P. G. Fernandes, and W. R. Turrell. "Anglerfish catchability for swept-area abundance estimates in a new survey trawl." ICES Journal of Marine Science: Journal du Conseil 64, no. 8 (2007): 1503-1511.

History of the IAMS: changes in sampling design and protocols

The Jackson trawl used in the IAMS survey was originally used for three anglerfish/megrim surveys (with various names) carried out on chartered trawlers in 2007, 2008, and 2009 by the Marine Institute in collaboration with Marine Laboratory,

Aberdeen, Scotland. In 2007 and 2008 areas 6a, 7bcjk were covered by the Marine Institute but in 2009 only 6a was covered.

In 2016 the IAMS survey series was initiated. This survey takes place on RV *Celtic Explorer*, its stratification is slightly different from the previous charter surveys. The IAMS survey also collects data on more species. Otherwise the survey design and data collection protocols are comparable.

For the 2017 survey, the trawl doors were slightly modified to increase their area and spreading power; this resulted in 5–8 m additional door spread, bringing it closer to the door spread achieved by the commercial trawlers (which used their own trawl doors).

In 2017 the headline was also replaced and the floats tidied up. This resulted in an increase in the mean headline height from 4.8 m to 5.4 m.

information on IE-IAMS to complete the tables in the current IBTS manual

Table 1. Summary of surveys in the Northeast Atlantic IBTS area

Survey	Division	Acronym
Irish surveys		
Irish Anglerfish and Megrim Survey - Quarter 1	6a - 7bcgk	EI-IAMS-Q1

Table 2. Sampling materials used in the groundfish surveys (see surveys acronyms in Table 1)

Country/Survey	IE-IAMS
Research Institute	MI
Equipment	
Research vessel	*Celtic Explorer*
Type	Stern trawler
GRT	2425
KW	4320
Overall length (m)	65.5
Gear Type	Jackson trawl
Depth range (m)	20–1000
Trawling speed (knots)	3
Doors weight (kg)	1700
Doors surface (m^2)	5.3
Sweep length (m)	66
Diameter of Lower Bridle (mm)	19mm chain
Diameter of Upper Bridle (mm)	18 mm wire
Diameter of Middle Bridle (mm)	none
Exocet Kite	No
Floats in Headline	180x200m heavy-duty
Floats in Winglines	
Mean vertical opening (m)	5.0
Mean doorspread (m)	91
Mean horizontal opening (m)	28
Groundgear	Rubber disks (and tickler chain)

Table 3. Summary of species for which biological information is routinely collected per survey (Only species sampled on the IE-IAMS are included)

Species	IE-IAMS
Gadus morhua	X
Lepidorhombus boscii	X
Lepidorhombus whiffiagonis	X
Lophius budegassa	X
Lophius piscatorius	X
Melanogrammus aeglefinus	X
Merlangius merlangus	X
Merluccius merluccius	X
Microstomus kitt	X
Molva molva	X
Pleuronectes platessa	X
Pollachius pollachius	X
Pollachius virens	X
Psetta maxima	X
Solea solea	X
Leucoraja naevus	X
Raja montagui	X
Raja clavata	X
Raja brachyura	X
Dipturus batis(1)	X
Squalus acanthias	X
Nephrops norvegicus	X

(1) including *Dipturus batis* **complex at the moment**

Table 7.1. Area of the geographic sectors used in the IBTS SW Areas – See Annex 6 for a complete table of strata and sampling areas.

COUNTRY	SURVEY	GEOGRAPHIC SECTOR	
		NAME	AREA (SQUARE KM)
Ireland	IE-IAMS	6a	49 023
		7bcjk	172 593

Catch Sampling summary table see Annex 2[1]

		IE-IAMS
Staffing	No. avail. for catch process	5/6
Catch	Retention in hopper bin	Y
	Codend cleaned	Y
	Net cleaned	Y
	Cleanings added to catch	Y
	Total weight*	N
Sorting	Deckmaster	Y
	Bench or conveyor	B
	Complete sort up to x	NA
	Small fish mix	y
	Part of catch discard-ed	n
Categories	By sex	Y
	L / S	Y
	Multimodal	y
Subsample	Re-mix before selec-tion	Y
	Selection random	y
weighing	All catch components	Y
	All sub samples	y
measuring	All fish species	n
	Minimum sample size	*
	Commercial benthos	n
	cephalopods	n
	Other benthos	v
Biological	Prescribed spp	Y
	Other spp	Y
	Weight	Y
	Sex	Y
	Maturity	Y
	Age material	Y
	Ageing sea/ashore	a
Data	Station	e/p
	Catch	E
	Length	E
	Biological	E
	Error check	Y
	backup	y

*** the number of size classes in the sample times 10**

(1) Abbreviations on table Annex 2

		IE-IAMS
By sex	anglers	N
	cod	N
	dab	N
	Elasmo	Y
	had	N
	hke	N
	lem	Y
	meg	Y
	Nep	Y
	ple	Y
	sol	Y
	whg	n
0.5cm	ane	NA
	her	NA
	pil	NA
	spr	NA
1mm	Benthos	na
	Nep	d
Prescribed spp	anglers	Y
	whb	N
	cod	Y
	had	Y
	hke	y-o
	her	N
	hom	N
	lem	D,y-o
	mac	N
	meg	Y
	Nep	D,y-o
	ple	Y
	pok	Y
	Sol	D,Y
	dgs	D,y-o
	whg	Y
others	bll	D,y-o
	Elasmo	D,Y-o
	spr	N
	tur	D,y-o