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Version 10

The International Bottom Trawl Survey Working Group
(IBTSWG)

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CIEM Conseil International pour l'Exploration de la Mer

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Contents

1 Introduction

Overview of the survey

The International Bottom Trawl Survey (IBTS) in the North Sea has been conducted in the 1st quarter of the year since the beginning of the 1960s. The survey was first aimed at juvenile herring in the central and southern North Sea, but then the objectives of the survey were broadened to also provide recruitment indices for gadoids. The survey area was extended towards the northern North Sea and the Skagerrak/Kattegat in the 1980s. The full extent of the survey can be seen in Figure A1.1 in Annex 1. From 1991 to 1996, surveys were also conducted in the 2nd, 3rd, and 4th quarters, but since 1997, only the 1st and 3rd quarter surveys remained. The GOV trawl (chalut à Grande Ouverture Verticale) was introduced as the standard gear and the gear rigging and fishing method were standardized. However, some countries continued to use gears other than the GOV in the 3rd quarter IBTS until 1998. The table below shows the timing, countries, and ships that currently participate in the surveys.

Q1

COUNTRY	SHIP	DATES
Denmark	Dana	January-February
France	Thalassa II	January-February
Germany	Walther Herwig III	January-February
Netherlands	Tridens 2	January-February
Norway	G.O. Sars	January-February
UK Scotland	Scotia III	January-February
Sweden	Dana	January-February

Q3

COUNTRY	SHIP	DATES
Denmark	Dana	July-August
Germany	Walther Herwig III	July-August
Sweden	Dana	August
Norway	Johan Hjort	July
UK England	Endeavour	August-September
UK Scotland	Scotia III	July-August

A more detailed description of the history of the North Sea IBTS surveys can be found in Annex 2.

IBTSWG coordinates fishery-independent multi-species bottom-trawl surveys within the ICES area.

The main objectives of groundfish surveys coordinated by IBTSWG are:

1) To determine the distribution and relative abundance of pre-recruits of the main commercial species with a view of deriving 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;

6) To determine the abundance and distribution of late herring larvae (February North Sea survey).

For a survey to be considered to be coordinated under IBTSWG, it must fulfil the following criteria:

1) Be carried out within the ICES areas: IIIa, IV–IX;

2) An ICES assessment working group provides a brief outline of the management need/context for the survey;

3) Be an otter trawl survey, but note that there may be other working groups better placed to coordinate some bottom-trawl surveys;

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

5) Aims to enhance existing IBTS surveys and improve data collection for important stocks. For example, proposed surveys for inclusion within IBTSWG will (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;

6) Store data in the DATRAS database and participate in data quality checking;

7) Nations must attend and present data at the annual meetings of IBTSWG;

8) For those surveys that do not use a gear that is the standard for IBTS surveys, confirmation must be given from assessment working groups (e.g. after a five year period) that these surveys are still providing data of high quality that are used for assessment and provision of advice.

Use of the data

Annual abundance indices (in numbers per hour) by species and age group are routinely calculated in DATRAS by first averaging catch by age within rectangles and then averaging over species-specific standard areas, typically without weighting by sampling effort or adjustment for unsampled subareas in a given year or quarter. Weighting factors for the surface area of statistical rectangles at water depths between 10 m and 200 m are only applied for herring, sprat, and saithe.

2 IBTS survey

2.1 Current objectives

The International Bottom Trawl Survey Working Group (IBTSWG) coordinates fishery-independent multi-species bottom-trawl surveys within the ICES area, including a number of additional surveys in the Northeastern Atlantic. 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) of the biological parameters of commercial fish species for stock assessment purposes.

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

1) To determine the distribution and relative abundance of pre-recruits of the main commercial species with a view of deriving 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;
6) To determine the abundance and distribution of late herring larvae (February North Sea survey).

2.2 Survey design

The stratification of the survey grid has always been based on ICES statistical rectangles of roughly 30 x 30 nautical miles (1 degree longitude x 0.5 degree latitude). These rectangles were convenient to use for stratification of the survey because they were already being used for fisheries management purposes. Each rectangle is typically sampled by two different countries, so that at least two hauls are taken per rectangle. Only the Skagerrak and Kattegat is fished solely by Sweden, who sample more than once in every rectangle. Other areas that are sampled by a single country include west of Shetland during Q1 and Q3 (Scotland), and, during Q3, inshore areas near Scotland (Scotland), the edge of the Norwegian Trench (Norway), inshore areas near Denmark (Denmark), in the southern North Sea (Denmark, Germany, England); France typically is the only country that surveys the western English Channel. Areas are surveyed by a single country because of the large proportion of untrawlable area (and subsequent gear damage issues experienced by other nations) or for efficient, logistical purposes.

The allocation of rectangles to IBTS participants has changed slightly over the years. The last major reallocation occurred in 1991, but since then, at least one vessel that has routinely fished in that area has remained in every rectangle. The current rectangle allocation for the quarter 1 survey is shown in Figures A1.1 to A1.8 in Annex 1, while the quarter 3 allocation is shown in Figures A1.9 to A1.15.

The survey coordinator is responsible for the allocation of statistical rectangles to each country. Coordination takes place annually at the IBTSWG and also

immediately prior to and during the surveys. The survey coordinator is also responsible for ensuring adequate coverage during the survey by liaising with the national coordinators/survey cruise leaders.

Individual vessels survey for different durations due to various operational factors and staff 'rest' issues; however, surveys are generally undertaken during late January to late February for Q1 (target month February) and July/August for Q3 (target month August), with overlap occurring between most nations.

The vessels are free to choose any position in the rectangles as long as the hauls are separated by at least 10 nautical miles wherever this is possible. Tows in adjacent rectangles are separated by at least 10 miles. Countries must avoid clustering their stations between adjacent rectangles in order to reduce positive serial autocorrelation and thereby maximize survey precision.

Trawl tow locations are selected by the cruise leader for each individual country. The selection process is based on a semi-random format with each survey having a series of 'clear' (and in many circumstances previously visited) trawl sites. A list of international clear tow positions exists, but experience has shown that the single countries rely mostly on their own trawl tracks fished in previous surveys and tend to fish on positions from the previous year. In the unusual event that no 'clear' tow exists, the cruise leader may select to undertake a 'blind' tow on unknown ground after checking the proposed trawl track for hazardous seabed obstructions with acoustic methods. The cruise leader will select a site that allows the cruise to maximize efficiency and secure as many trawl hauls in the 'daylight' period prescribed to the day in question. This can result in a particular trawl site being the same one visited as in the previous year or alternatively, one that has not been visited for some years. However, some randomization of tow position within a rectangle is encouraged in order to decrease bias. National coordinators/survey cruise leaders are encouraged to utilize known trawl positions taken by other countries in previous years in order to increase the number of available positions within a rectangle.

Fishing is limited to daylight hours, i.e. from 15 min before sunrise to 15 min after sunset. Hauls that, for whatever reason, were not or will not be conducted during daylight hours are to be marked as non-standard in the DATRAS database.

2.3 GOV-trawl construction and rigging

The construction of the 36/47 GOV-trawl is shown in Figure 2.1. A set of check sheets (Annex 3 to 6b) is to be used for each trawl to maintain a standard rigged GOV. All dimensions of the GOV must be checked to ensure that it is rigged correctly on the vessel. When a new net is delivered check sheets 1 (Annex 3) and 2 (Annex 4) are filled in to ensure that the net is manufactured to the correct specification.

Details of the "Exocet" kite and suggestions how to attach the kite to the trawl are shown in Figure 2.2. Five floats with a buoyancy of 2.9 kg each are attached to the kite. If a kite other than the recommended one is used, then the lift of this kite must be the same as of the “Exocet” kite so that the configuration of the net conforms to expected parameters. Figure 2.7 illustrates the expected headline height and door spread limits for deployment depth.

Total buoyancy of the floats on the net is 172 kg. The floats should be spread evenly over the wings and the square.

The rigging is given in Figure 2.3. On board the vessel, when attaching the trawl to the bridles and doors, use check sheet 3 (Annex 5).

Historically during the first quarter survey, the length of the sweeps depended on the bottom depth:

- Sweeps including back-strops and connectors of a total length of 60 m are used in water depths less than 70 m,
- Sweeps including back-strops and connectors of a total length of 110m are used in deeper waters.

However, not all countries in Q1 are carrying out these changes (Table 2.3.1).

The different sweep lengths in Q1 were kept for reasons of consistency over the time-series. The effect of the different sweep lengths was, however, doubted and therefore not copied when the quarterly surveys started in 1991.In Q3, this change of sweep lengths was never applied. In Q3, sweeps including back-strops and connectors of a total length of 60 m are used throughout the survey area, except by Norway in 2011–2013.

The most important consideration is that the **net geometry is within the acceptable limits** for the depth of water (see Section 2.6 on monitoring net geometry). Since this has not always been achieved, in particular not when using the long sweeps, several countries have stopped to change sweep length during the Q1 surveys.

Table 2.3.1. Record of the historical change in sweep length during Q1 surveys (Yes = sweep lengths have been altered; No = sweep lengths were constant length).

YEAR	DENMARK	ENGLAND	FRANCE	GERMANY	NETHERLANDS	NORWAY	SCOTLAND	SWEDEN
1985	yes	yes	yes		yes	yes	no	yes
1986	yes	yes	yes		yes	yes	yes	yes
1987	yes	yes	yes		yes	yes	yes	yes
1988	yes	yes	yes		yes	yes	no	yes
1989	yes	yes	yes		yes	yes	no	yes
1990	yes	yes	yes		no	yes	no	yes
1991	yes	no	yes		yes	yes	yes	yes
1992	yes	no	yes		yes	yes	no	yes
1993	yes	no	no		no	yes	no	yes
1994	yes	no	no		no	yes	no	yes
1995	yes	no	no		no	yes	no	yes
1996	yes	no	no		no	yes	no	yes
1997	yes	no	no		no	yes	no	yes
1998	yes	no	no		no	yes	no	yes
1999	yes	no	no		no	yes	no	yes
2000	yes	no	no		no	yes	no	yes
2001	yes	no	no		no	yes	no	yes
2002	yes	no	no		no	yes	no	yes
2003	yes	no	no		no	yes	no	yes
2004	yes	no	no	yes	no	yes	no	yes
2005	yes	no	no	yes	no	yes	no	yes
2006	yes	x	no	yes	no	yes	no	yes
2007	yes	x	no	yes	no	yes	no	yes
2008	yes	x	no	yes	no	yes	no	yes
2009	yes	x	no	yes	no	yes	no	yes
2010	yes	x	no	yes	no	yes	no	yes
2011	yes	x	no	yes	no	yes	no	no
2012	yes	x	no	yes	no	yes	no	yes
2013	yes	x	no	no	no	yes	yes	yes
2014	yes	x	no	no	no	yes	no	yes
2015	no	x	no	no	no	yes	no	yes

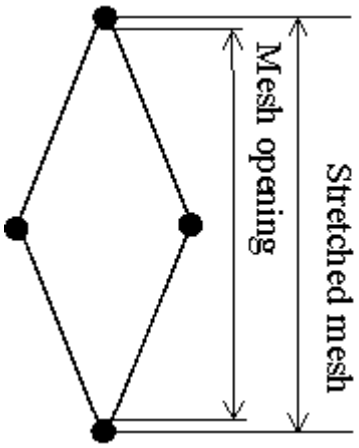
The standard groundrope with rubber discs (groundgear 'A') as shown in Figure 2.4 is used throughout the survey area. However, since 1985, Scotland have used groundgear 'B' on all stations north of 57° 30' North (Figure 2.5). Use check sheet (Annexes 6a and 6b) to ensure the groundgear is to specification. The extra weights in the groundrope are 70 kg in the square, 35 kg in each quarter and 35 kg in each forward wing-end. These weights should be evenly spread over the appropriate length of groundrope and this can be achieved by wrapping chain externally around the groundrope, using a thicker centre chain, or by interspersing the groundrope rubber discs with steel discs of the same diameter. Approximate weight in air is given for each section of the groundgear.

Proper contact of the groundgear might be indicated by use of acoustic devices, wearing on chains, and presence of benthic organisms and flatfish in the catch. The contact of the groundgear with the bottom can be greatly influenced by changing the length of the adjustment chain between the lower leg and the bumper bobbin.

The normal length of this chain is 2 metres but on rough ground it can be shortened to 1.7 metres; if the gear is fishing too light it can be lengthened to 2.2 metres. Shortening the chain means the net sits lighter upon the bottom, but care must be taken to maintain proper bottom contact throughout the tow duration.

For a proper performance of the net it is essential that the four upper bridles are of identical length, and regular checks must be made to ensure this. A total check of the trawl must be carried out prior to the survey. Technical drift has occurred and is catalogued in the 2015 IBTSWG Report (see Section 9: Gear Standardization; Annex 9, WD 3: ToR e – Gear Standardization – Net plans and gear components tables).

When checking the GOV mesh sizes, either during construction or on rigging the net, either an Omega net gauge or another standard net gauge should be used. See figure below for how to measure the mesh opening vs. the stretched mesh.



During measuring, a 5% tolerance is allowed. When using the Omega Gauge, please follow the manufacturers' instructions for correct use, as overstretching could be an issue. The net can be measured either wet or dry. This is a summary of the information taken from the working document presented at IBTSWG in 2008 (WD1: Mahé, J.C., Mortreux, S. 2008 – Review of measurement protocols for mesh size and effect of intensive use on the initial characteristics).

The lining of the codend should consist of 400 stretched meshes of 20 mm each, giving a total length of 8 m. The total circumference of the lining should be 600 meshes.

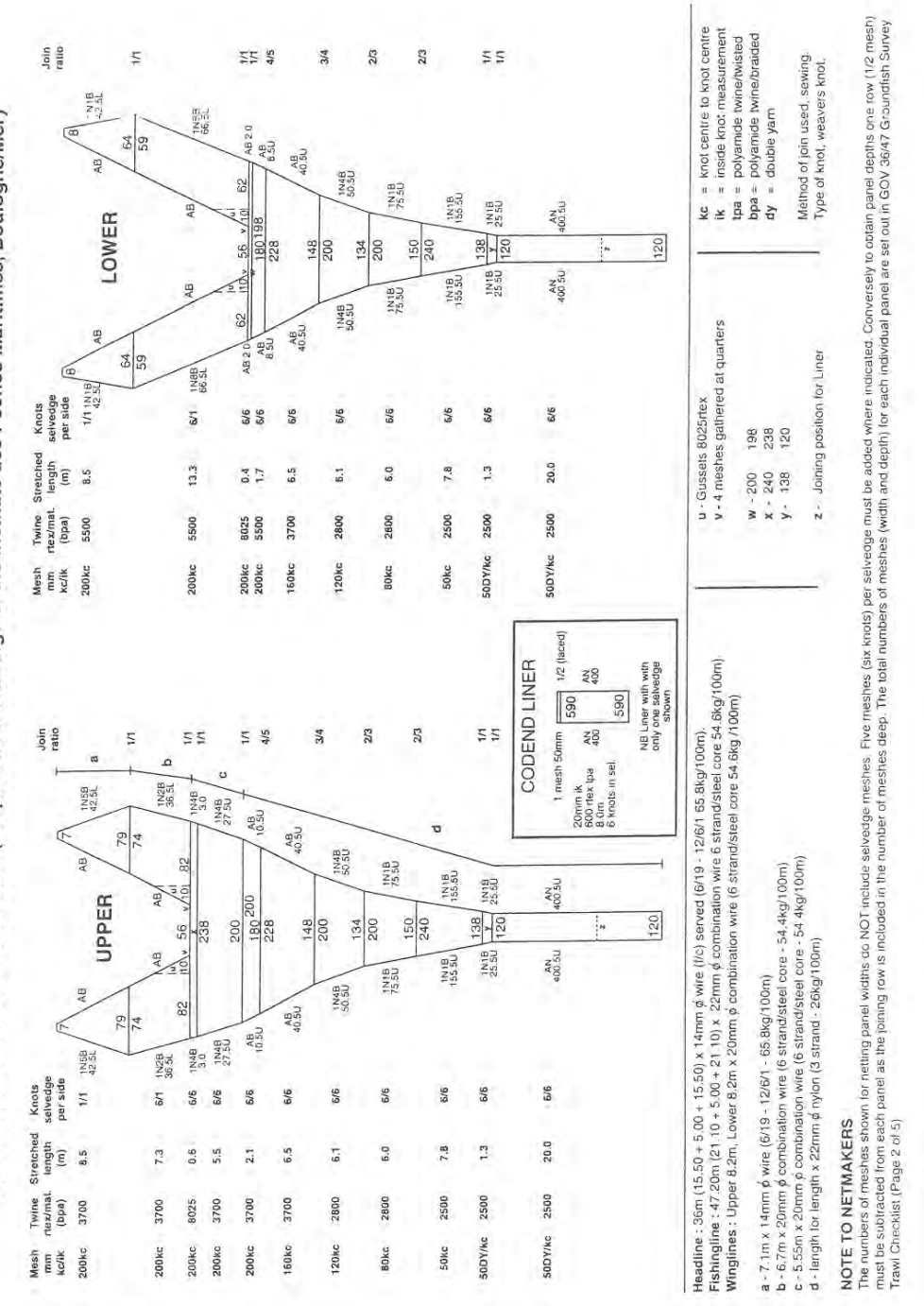


Figure 2.1. Construction of the 36/47 GOV Trawl.

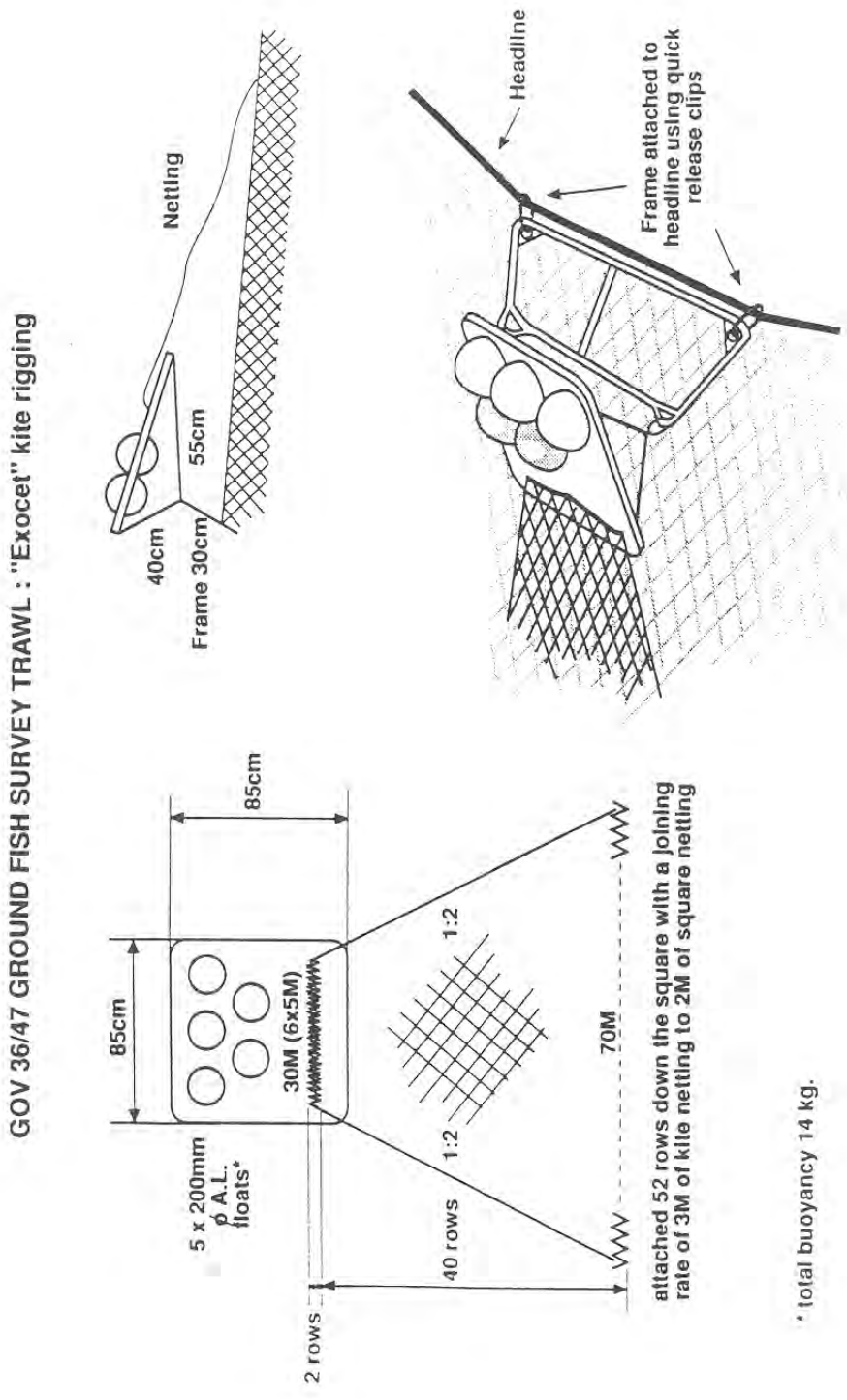


Figure 2.2. "Exocet" Kite for the 36/47 GOV Trawl.

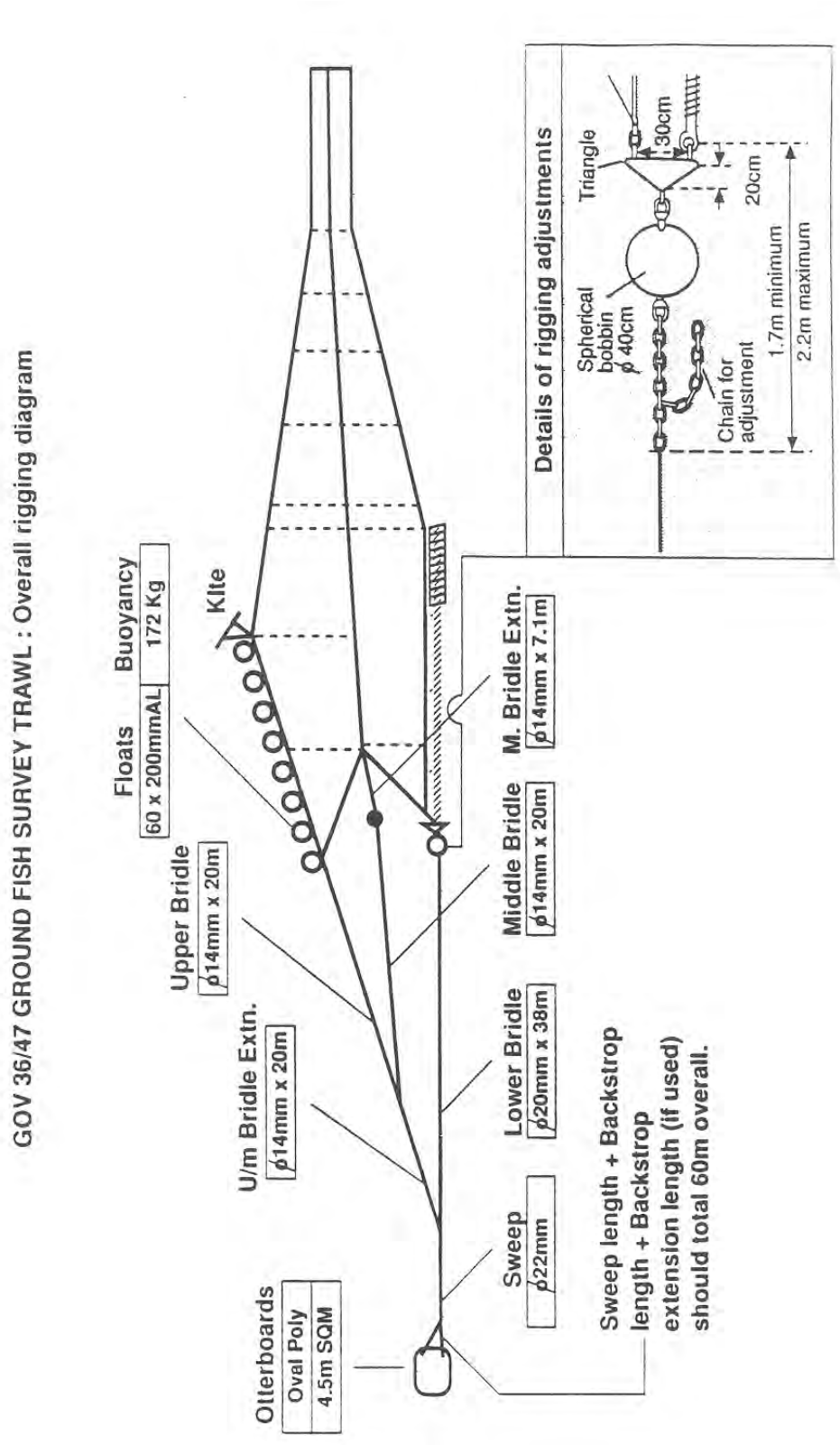


Figure 2.3. Rigging of the 36/47 GOV Trawl.

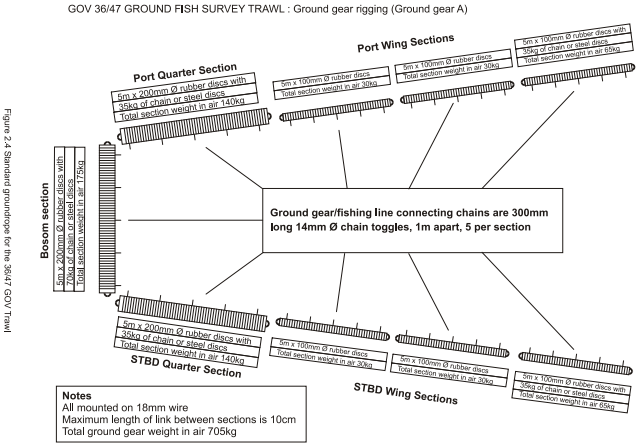
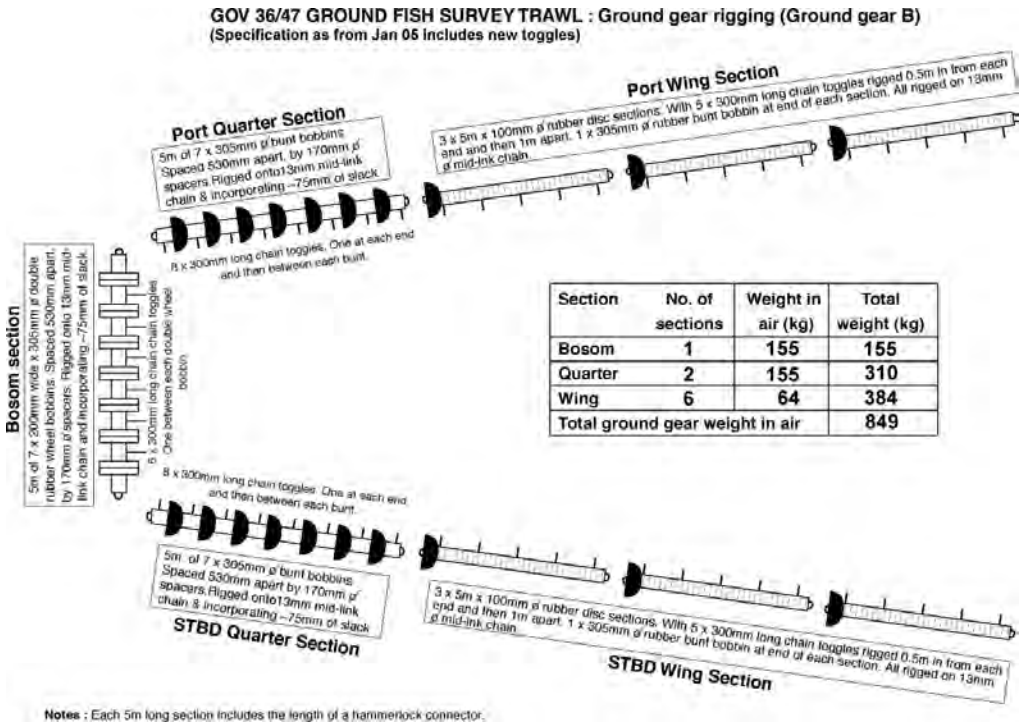


Figure 2.4 Standard groundrope for the 36/47 GOV Trawl

Figure 2.4. Standard groundrope for the 36/47 GOV trawl groundgear 'A'.



Section	No. of sections	Weight in air (kg)	Total weight (kg)
Bosom	1	155	155
Quarter	2	155	310
Wing	6	64	384
Total ground gear weight in air			849

Figure 2.5. Groundrope for the 36/47 GOV trawl groundgear 'B'.

2.4 Gear quality control

2.4.1 Before and during the survey

The flow diagram can be used to describe the procedure for the preparation of the GOV trawl prior to the survey and each haul (Figure 2.6).

The table below presents a short description for each country of the procedure for the preparation of the gear before and during the survey.

PROCEDURE FOR THE PREPARATION OF THE GEAR BEFORE AND DURING THE SURVEY	
Denmark	Before the survey: Primary and spare trawls are visually inspected when taken onboard. A primary (with groundgear A) and a secondary trawl (with groundgear B or A) are checked for correct rigging when taken on the two net drums by the fishing master. During the survey: Nets are checked and measured according the check sheets 1–3 if the correct door spread and vertical net opening cannot be achieved or after damages by the fishing master. The control sheets are given to scientist in charge.
England	Before the survey: The primary net and a spare net are pulled out at the net store. The net manager along with the primary and secondary scientists in charge check the net using the specification sheets in Annex 3 to 6b of this manual During the survey: The flow diagram in Figure 2.6 is followed. The damages and repairs are reported on the specification sheet, which is given to the scientist in charge at the end of the survey.
France	Before the survey: The net, which has its own specification sheet, is prepared by the fishing master and checked in presence of the scientist in charge. During the survey, the procedure is followed according to the flow diagram. The damages and repairs are reported on the specification sheet, which is given to the scientist in charge at the end of the survey. A copy is sent to the technologists team.
Germany	Before the survey: The primary net and spare nets are transported aboard from the net store and prepared by the ship's crew (netmaker) according to the IBTS manual. The chief scientist does not conduct a formal control, but a visual inspection of the rigged net on deck. During the survey, small net damages are repaired directly after each haul; in the case of larger damages, the replacement net is rigged. No documentation is made of net damages, but the haul is marked invalid if the captain / chief scientist assume that the haul has been affected by the damage.
The Netherlands	Before the survey: The primary net and a spare net are checked by the IMARES gear technician together with the crew on board following the specification sheets 3 and 4 of this manual. During the survey: The crew rigs, controls, and repairs the net if necessary.
Norway	Norway revised its procedures in 2015. Before the survey, primary and spare nets (4 in total) are pulled out at the net store. Primary nets are visually inspected by the trawl master and a gear technician, if present, on the vessel. The survey coordinator and gear technician ensure the trawl master has the necessary information to rig the gear properly. Gear calibration trials are performed prior to starting the survey to ensure all gear, including sensors, are working properly. During the survey: The crew rigs, controls, and repairs the net if necessary. All repairs are noted in gear specification sheets and added to the 'trawl history' binder that follows each set of gear. If a net is excessively damaged, a replacement is rigged and calibrated before use. The trawl history binder is delivered to the gear store with the nets at the end of the survey; nets are then inspected and repaired, if needed. The haul is marked invalid if the captain/science survey leader deem that the catch has been affected by the damage.

PROCEDURE FOR THE PREPARATION OF THE GEAR BEFORE AND DURING THE SURVEY	
Scotland	On each IBTS survey, four GOV trawls are carried aboard Scotia and rotated each cruise so they all get similar soak time. Any trawls used during the preceding survey are fully checked over by staff in the Marine Laboratory Netstore and given a full overhaul. Prior to each survey, all wires and groundgear sections are inspected and measured and if found defective replaced or re-rigged. Prior to the start of each survey, the initial rigging aboard the vessel is undertaken by the crew in the presence of either a gear technologist, scientist in charge (SIC), or nominated competent deputy. During the rigging, a member of scientific staff ensures the gear conforms to the standard trawl/gear rigging plan and acts as a point of contact between the vessel and net store to resolve any queries or problems. Gear technologists at the Laboratory have drafted a rigging manual that details how every component connects together to fully rig the GOV (from trawl door to codline) for Scottish surveys. This manual is more detailed than the IBTS manual and is intended to act as an aid for RV vessel crews and scientists to ensure consistency on every survey. As standard practice on every survey, one member of the scientific staff is allocated responsibility to act as deck person. This role includes observing shooting and hauling of the gear, along with operating the SCANMAR and bottom contact instrumentation and relaying any issues to the SIC. During the survey, the procedures as detailed in the flow diagram (2.6) are followed. An electronic haul-by-haul record (Net check form) is kept by the deck person for each trawl used and this details any damage sustained and repairs or replacements made to the fishing gear. A copy of this file is given to the SIC at the end of the cruise.
Sweden	Before the survey: Both GOV-trawls are given a complete overhaul by the netmaker on a yearly basis, if possible with the cruise leader present. During the survey: The flow diagram in Figure 2.6 is followed, except that the fishing master with onboard crew rig the trawl alone. The fishing master and the cruise leader compile a post-cruise trawl status list for the trawls that have been used to make sure that faulty or worn parts of the netting and the rig are replaced prior to next survey.

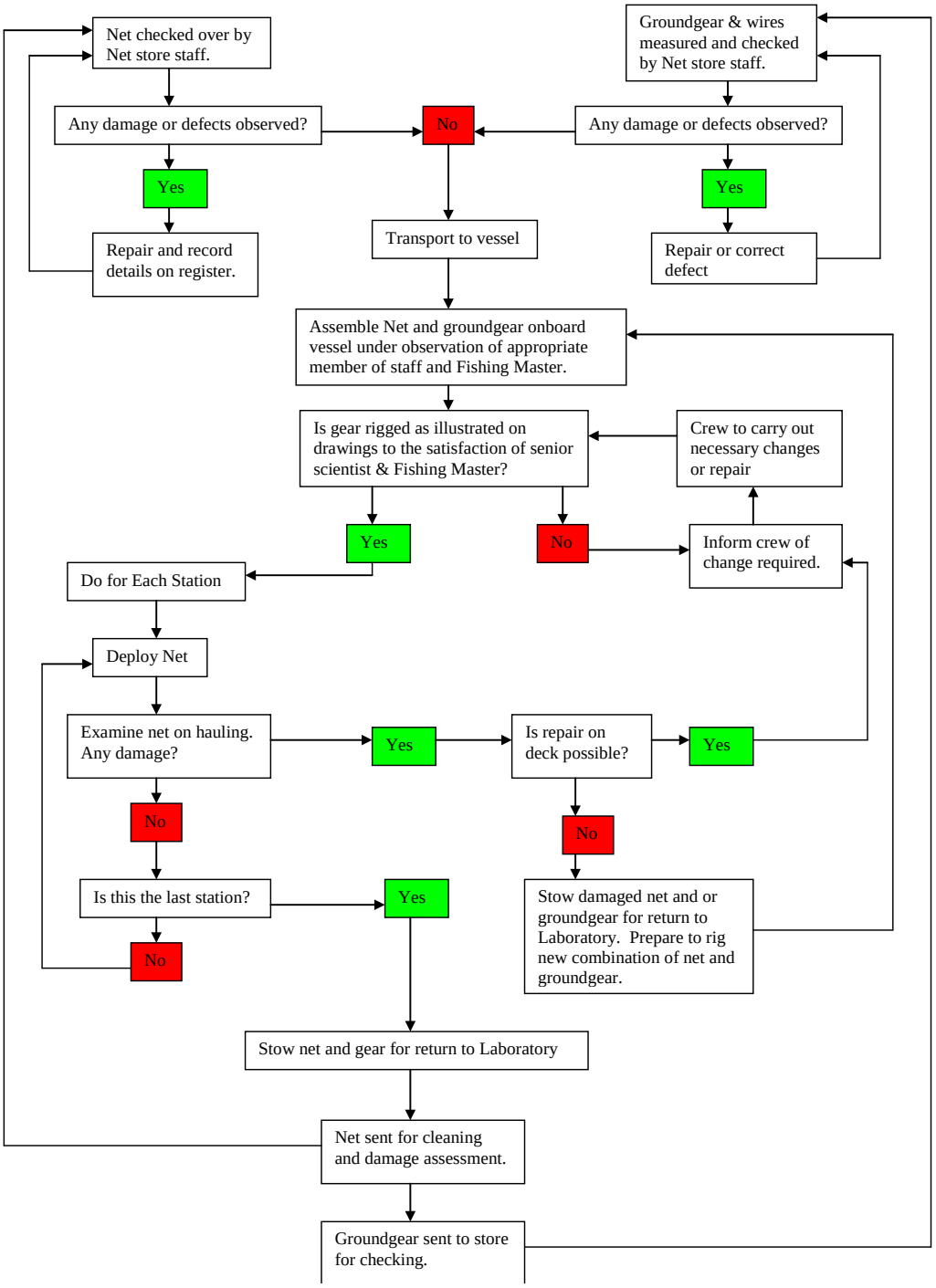


Figure 2.6. IBTS GOV preparation flow diagram.

2.4.2 Quality control during the survey

The GOV trawls are generally used for several surveys during the year. They must be regularly checked by the fishing crew in relation with scientists and/or gear technologists. Each gear must have a specification sheet where all modifications or damage occurred during a survey are registered.

2.4.3 Quality control after a survey

Each country has its own protocol for quality control of the net. The procedure implemented is described in the table below.

FREQUENCY OF THE QUALITY CONTROL AND BRIEF DESCRIPTION OF THE PROCEDURE AFTER THE SURVEY	
Denmark	At the end of the survey: If necessary, repairs are specified by the fishing master and discussed with the scientist in charge.
England	Before the next survey, the main trawl and the spare trawl are completely checked by the net store personnel under the responsibility of the Scientist in Charge. Results are recorded and kept on file by the net store manager and the Scientist in Charge of that survey. Trawls are identified by a specific number assigned when originally received by the net store after initial purchase.
France	Since 2010, a new quality control procedure was implemented at Ifremer. Once a year, all trawls are completely checked by the crew under the responsibility of the gear technologists. A detailed protocol describes all controls that must be done. Results are sent to the cruise leaders and uploaded on the Ifremer Intranet site. Trawls are identified by a specific number (acquisition year and order number)
Germany	During and after each survey, the netmaker/ captain inform the chief scientist if net material needs to be purchased for replacement.
The Netherlands	At the end of the survey: If necessary, repairs are specified by the fishing master and discussed with the scientist in charge.
Norway	Norway revised its procedures in 2014. The nets are checked by the net store personnel and a gear technician after the survey. Results are recorded and kept on file – electronic and in the 'trawl history' binder that follows each set of gear; gears are numbered for identification. Any specific problems that need resolution are brought up to the trawl forum for discussion and solving.
Scotland	Prior to each survey, any used trawl gear is thoroughly inspected and, where required, repaired or replaced by Marine Lab net store personnel supervised by the store manager. Results are recorded and kept on file by the net sore manager. All trawls have a unique number identifier and all wires are tagged with their details (length and diameter). All newly purchased trawl gear is inspected by the net store manager prior to being brought into stock. Revised quality control protocols were introduced during 2003 and these firmed up procedures with regard to rigging and operation of all survey gears during Marine Laboratory cruises. As mentioned in the previous section, a rigging manual specific to the Scottish GOV has been drafted and acts as a master specification when RV crew are rigging and operating the fishing gear.
Sweden	Due to our recent loss of our own ship, routines have changed. Previously the nets were stored in the Board of Fisheries facilities and transported once a year to a local netmaker who checked/adjusted the trawl. Our nets are now stored at the a netmaker in Hirtshals (easy access to Dana) and checked/adjusted by them if needed or at least, once a year.

2.4.3.1 Quality control steps

Checking procedures have to follow several steps and each piece of the net has to be verified, as well as the rigging, the doors, the salvages, panel frames, and the groundrope. Sheets presented from Annex 3 to Annex 6b are to be used as a guide to check the trawl.

The trawl must be stretched out on the ground. It is recommended that all pieces are measured by the same person. Each piece is defined by its length, thread strength, shape, meshing, and identification number indicated on a reference plan.

Different controls made by each country are described in the following tables.

	NET PANELS
Denmark	As specified in the IBTS manual.
England	The size of each panel is calculated according to the mesh number. Selvedge meshes are not included. To be valid, the mesh number must be identical as the values described in the original net diagrams (Section 2.3). The net is measured dry and not damp. Meshing control consists in measuring 20 meshes consecutively. A bronze mesh gauge is used to measure the height of the meshes from front to back. An average is taken from the 20 meshes recorded and the tolerance between nominal value and effective value is ±5%.
France	The size of each panel is calculated according to the mesh number. Selvedge meshes are not included. To be valid, the mesh number must be identical as the nominal values. Otherwise, a second numbering has to be done. The tolerance between nominal value and effective value is : ± 1 mesh for the base ± 0.5 mesh for the height, for each piece except the codend. ± 2 meshes for the GOV 36/47 codend. ± 10 meshes for the double codend. The thread strength, is checked comparing the thread of each piece and standard commercial samples Each part of the net must be dampened regularly (uniformly) before being measured. Meshing control consists in measuring 20 meshes consecutively. The zero of the ruler placed on the upper mesh knot and the measurement is read below the opposite knot. Piece meshing is calculated working out the average of the consecutive 20 meshes. The millimetre is the unit used to measure the mesh and the tolerance between nominal value and effective value is ±5%.
Germany	No formal procedure has been specified in writing; control in responsibility of netmaker.
The Netherlands	As specified in the IBTS manual.
Norway	As specified in IBTS manual as of 2014. If a new net is needed, the gear store arranges for its purchase from the Norwegian netmaker, ensuring conformity with the standard net plan.
Scotland	All netting used to repair or renew GOV trawls is purchased by the Marine Laboratory net store from an outside supplier. It is specified from the manufacturer as full mesh size and subsequently measured (meshes per 1m) on delivery by the net store manager to ensure conformity with the standard net plan. After each cruise, the netting panels of every used trawl are inspected and if found to be stretched or distorted, replaced. No ± mesh tolerances are used as every panel must conform to the number of meshes and length described in the standard net diagrams.
Sweden	Lacking gear technical personal in our institute, we leave the trawl with our trawlnet store, who checks the trawl and suggests what adjustments are needed in line with the net diagrams agreed within the IBTS manual

	SALVAGES AND PANEL FRAMES
Denmark	As specified in the IBTS manual
England	Salvages and panel frames are attached along parts of the net. Each is stretched and measured with a tape measure from eye to eye. The unit is the centimetre and tolerance between nominal value and effective value is ±5 cm. On the same part of the trawl, the port side and the starboard must be equal and difference does not exceed ± 5 cm.
France	Lines are attached along parts of the net. Each of them is stretched and measured with a decameter from eye to eye. The unit is the centimetre and tolerance between nominal value and effective value is ±5 cm. The diameter is controlled with a caliper rule and tolerance between nominal value and effective value is ±5mm. On the same part of the trawl, the port side and the startboard must be equal and difference does not exceed ± 5 cm.
Germany	See above
The Netherlands	As specified in the IBTS manual
Norway	As specified in IBTS manual
Scotland	Selvedge and panel framelines are attached along parts of the trawl. All are measured to the exact value specified in the standard plan. After a survey, each used trawl is returned to the laboratory net store, where all lengths and diameters are checked and, if different from the standard plan, replaced. Particular attention is made to checks along the nylon (PA) selvedge rope sections as these shrink and are replaced regularly. When selvedge ropes are replaced on one side of the gear, the opposite side is automatically replaced.
Sweden	Lacking gear technician in our institute, we leave the trawl with our netmaker, who checks the trawl and suggests what adjustments are needed in line with the net diagrams agreed within the IBTS manual

	THE GROUNDROPE
Denmark	Once measured, not re-measured unless damaged.
England	The groundrope is stretched on the floor and its different parts measured with a tape measure. The unit is the centimetre and the tolerance does not exceed ± 5 cm.
France	The groundrope is stretched on the floor and its different parts measured with a decameter. The unit is the centimetre and the tolerance does not exceed ± 5 cm. The weight of the groundrope could be only estimated. Its load must be well distributed on the square and equal between the port side and the starboard wings.
Germany	See above
The Netherlands	Once measured not re-measured unless damaged.
Norway	Once measured not re-measured unless damaged.
Scotland	Two sets of each groundrope (A and B) are available for each survey They are checked and measured twice per year, the unit is the centimetre and the tolerance does not exceed + 3 cm.
Sweden	Lacking gear technical personal in our institute, we leave the trawl with our trawlnet store, who checks the trawl and suggests what adjustments are needed in line with the net diagrams agreed within the IBTS manual

	THE RIGGING
Denmark	Once measured, not re-measured unless damaged.
England	Each part of the rigging (bridles and sweeps) are stretched on the floor. They are measured with a tape measure in the same procedure as the frames. The unit is the centimetre and the tolerance value is ± 0.5%. The port side and the starboard symmetry must be checked and difference does not exceed ± 2 cm.
France	Each part is defined by a specific number (example in table below) which will be stamped on each coupler's cables. Each part of the rigging is stretched on the floor. They are measured with a decameter in the same procedure as the lines. The unit is the centimetre and the tolerance value is ± 0.5%. The port side and the starboard symmetry must be checked and difference does not exceed ± 2 cm. The diameter is controlled with a caliper rule and tolerance between nominal value and effective value is ±2mm
Germany	See above
The Netherlands	Once measured, not re-measured unless damaged.
Norway	Once measured, not re-measured unless damaged.
Scotland	Each part of the rigging (bridles and sweeps) are checked and inspected by the net store manager prior to a survey. They are measured with a tape measure in the same procedure as the frames. The unit is the centimetre and the tolerance value is + 0.3% or, if less than the required length, it's condemned and removed from service. All acceptable components are then tagged and ready for dispatch down to vessel for rigging. When rigging the gear prior to starting the survey, the scientific desk person in conjunction with the Fishing Master ensures the gear is rigged to the correct specification.
Sweden	Each part of the rigging (bridles and sweeps) is measured with a tape measure and the port and starboard symmetry checked. If needed, they are adjusted by our trawlnet store.

	THE DOORS
Denmark	Once weighed, no further measurements taken
England	Each pair of door is identified by the same number. The doors are only weighed when repaired. A scale is used to weigh the doors (in kilo). Tolerance interval between the nominal value and the effective value is ± 5% for each door. The length and the height of the doors, as well as the back-strops, are measured. The unit is the centimetre and the tolerance value is 5 cm. Differences between the port side and the starboard back-strops does not exceed 5 cm.
France	Each pair of door is identified by the same number. At the first time, the size and the weight are checked without rigging. For further controls, it will be possible to control the weight with the rigging. A scale is used to weigh the doors (in kilo). Tolerance interval between the nominal value and the effective value is ± 5% for each door. The length and the height of the doors as well as the back-strops are measured. The unit is the centimetre and the tolerance value is 5 cm. Differences between the port side and the starboard back-strops does not exceed 5 cm. The weight between the 2 doors does not exceed 2%
Germany	No regular inspection of doors.
The Netherlands	Once weighed, no further measurements taken
Norway	Once weighed, no further measurements taken.
Scotland	Each set of polyvalent doors are identified by a unique number with the port door and starboard doors being given an odd and even value respectively. The doors are only weighed when new or repaired, but unless otherwise damaged, the policy is to change out the keels every 5 years. Tolerance interval between the nominal value and the effective value is ± 5% for each door. The Marine Lab has 2 sets of polyvalent doors and each set are always fished as a pair and never mixed. If a door is damaged or lost, then it is replaced using the unique Morgere identifier, which relates back to original production in the factory. The length and the height of the doors, as well as the back-strops, are measured. The unit is the centimetre and the tolerance value is 3 cm. Differences between the port side and the starboard back-strops does not exceed 3 cm.
Sweden	The doors are checked for damages and measured/weighed if repairs are done.

Summary of quality controls used for GOV.

		Net Tolerance %		Rigging Tolerance %			
	Control Frequency	Size & length	Meshes size	Salvages and frames	Groundrope	Rigging	Doors
Denmark	As required	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets
England	Annually	± 5% (length)	± 2 meshes	± 5 cm (length) difference port side / starboard ± 5 cm	± 5 cm (length)	± 5% (length)	± 5% (each door) ± 2% (between the 2 doors)
Scotland	Prior to every survey	0%	Must conform to length and count of meshes in standard net plan.	Length must match standard net plan otherwise replaced.	+ 3 cm (length)	+0.3% (length)	± 5% (each door)
Netherlands	As required	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets
Germany	Before each survey (Q1, Q3)	Expert judgement of netmaker	Expert judgement of netmaker	Expert judgement of netmaker	Expert judgement of netmaker	Expert judgement of netmaker	Expert judgement of netmaker
Norway	As required	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets
Sweden	As required	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets	As described in check sheets
France	Every Year (since 2010)	± 5% (length)	Base : ± 1 mesh Height : ± 1 mesh Codend : ± 2 meshes Double codend : ± 10 meshes	± 5 cm (length) difference port side / starboard ± 5 cm	± 5 cm (length)	± 5% (length) ±2mm. (diameter)	± 5% (each door) ± 2% (between the 2 doors)

2.5 Standard fishing method

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 includes:

- 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: are 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.

Standard fishing speed is 4 knots measured as trawl speed over the ground. The recommended speed is set as a target and actual (ground) speed and distance towed must be monitored and reported. With tide and weather effecting the average speed of a vessel, as a guide, the minimum trawl speed should not go below 3.5 knots and the maximum should not exceed 4.5 knots, with the average for the entire tow being as close to 4 knots as possible. It is also recommended that, if possible, the speed of the trawl through the water should be monitored and reported.

The maximum fishing depth for standard stations in the North Sea is 200 m and in Division IIIa 250 m.

A standard tow is fished for 30 minutes. Start time is defined as the moment when the vertical net opening and doorspread are stable. Stop time is defined as the start of the winches hauling the net back in. It may be acceptable to fish for less than this i.e. haul early for safety reasons or in the case of very large catches, however, any tow under 15 minutes is either invalid or tagged as non-standard and reasons are stated. Tows under 15 minutes are not included in index calculations and therefore a second valid station must be attempted in that rectangle.

As a minimum, vertical net opening and doorspread are to be monitored at as high a rate as possible (e.g. 1-second intervals are recommended) and, after appropriate filtering for invalid values, the mean value is reported. It is recommended that wingspread is also measured. In order to ensure that the gear performs correctly, the net geometry should be within tolerances set out in Section 2.6.

Conduct trawling operations during daylight hours, although some institutes may wish to trawl both during the day and night. Note that night-time hauls are not valid IBTS hauls for index calculations. Night-time hauls need to be entered as such and should not be used as standard IBTS hauls or for direct comparison with daylight hauls. In the morning, the net cannot be shot earlier than 15 minutes before sunrise.

At the end of the day, the net must be hauled within 15 minutes after the time of sunset. A software package that calculates sunrise and sunset, called “RiseAndSet”, is available from IMARES, but many other are available and may be used. In order to make a quick calculation, the daylight hours for various periods can be calculated with reference to current latitude and the text table below:

Daylight period in UTC at 0 degrees longitude:

Dates		South of 57° 30' N			North of 57° 30' N		
		Sunrise		Sunset	Sunrise		Sunset
01–10	Jan	08.09	-	15.58	08.45	-	15.25
10–20	Jan	08.01	-	16.17	08.31	-	15.45
21–31	Jan	07.47	-	16.35	08.15	-	16.07
01–10	Feb	07.29	-	16.58	07.49	-	16.36
11–20	Feb	07.08	-	17.20	07.23	-	17.05
21–28	Feb	06.47	-	17.41	06.55	-	17.30
01–10	Mar	06.27	-	17.57	06.32	-	17.50
11–20	Mar	06.03	-	18.18	06.05	-	18.15
21–31	Mar	05.35	-	18.38	05.32	-	18.39
01–10	July	03.15	-	20.55	02.28	-	21.40
11–20	July	03.26	-	20.47	02.49	-	21.24
21–31	July	03.41	-	20.33	03.08	-	21.03
01–10	Aug	04.00	-	20.12	03.34	-	20.38
11–20	Aug	04.19	-	19.50	03.59	-	20.09
21–31	Aug	04.37	-	19.26	04.23	-	19.42
01–10	Sep	04.57	-	19.00	04.48	-	19.09
11–20	Sep	05.16	-	18.34	05.12	-	18.38
21–30	Sep	05.35	-	18.08	05.35	-	18.08

Source: 'The Times Atlas' 1972, p 33.

For each degree longitude west, 4 minutes should be added and for each degree longitude east, 4 minutes should be subtracted.

2.6 Monitoring net geometry

All countries must use electronic equipment to monitor net geometry (e.g. SCANMAR). On all IBTS hauls, headline height over bottom (vertical net opening), ground clearance, and doorspread are to be recorded. The sensor manual should be referred to for the correct method for attaching the units to the gear. In order to ensure a valid tow, gear stability is crucial. **During the tow, it is imperative that net geometry is measured.** The user should continuously monitor net performance during a tow and, if needed, adjust the trawling conditions to return to accepted limits (e.g. by changing warp length). The amount of warp deployed at depth to obtain these values can vary between vessels, e.g. Scotland uses a ratio of 3.5 times the depth plus 30 m for warp out. However, each country should produce a table that corresponds to their own needs. If the readings remain outside the recommended values for an unacceptable period of time it could mean that the gear has become fouled or damaged and should be hauled in. Constant monitoring of the gear is necessary to build up a baseline of gear performance for the national coordinators/cruise leaders, making it easier to spot abnormal gear behaviour while on a survey. Each country should aim to keep their gear performance within the bounds of what is considered normal for their gear.

Figure 2.7 shows the recommended ranges of the headline height and door spread of the GOV relating to the depth of water. This should be used as a guide to ensure optimum gear performance. Table 2.6.1 details the formula and parameters used to create the bounds shown in Figure 2.7, allowing the user to determine how their gear operates in relation to the recommended range.

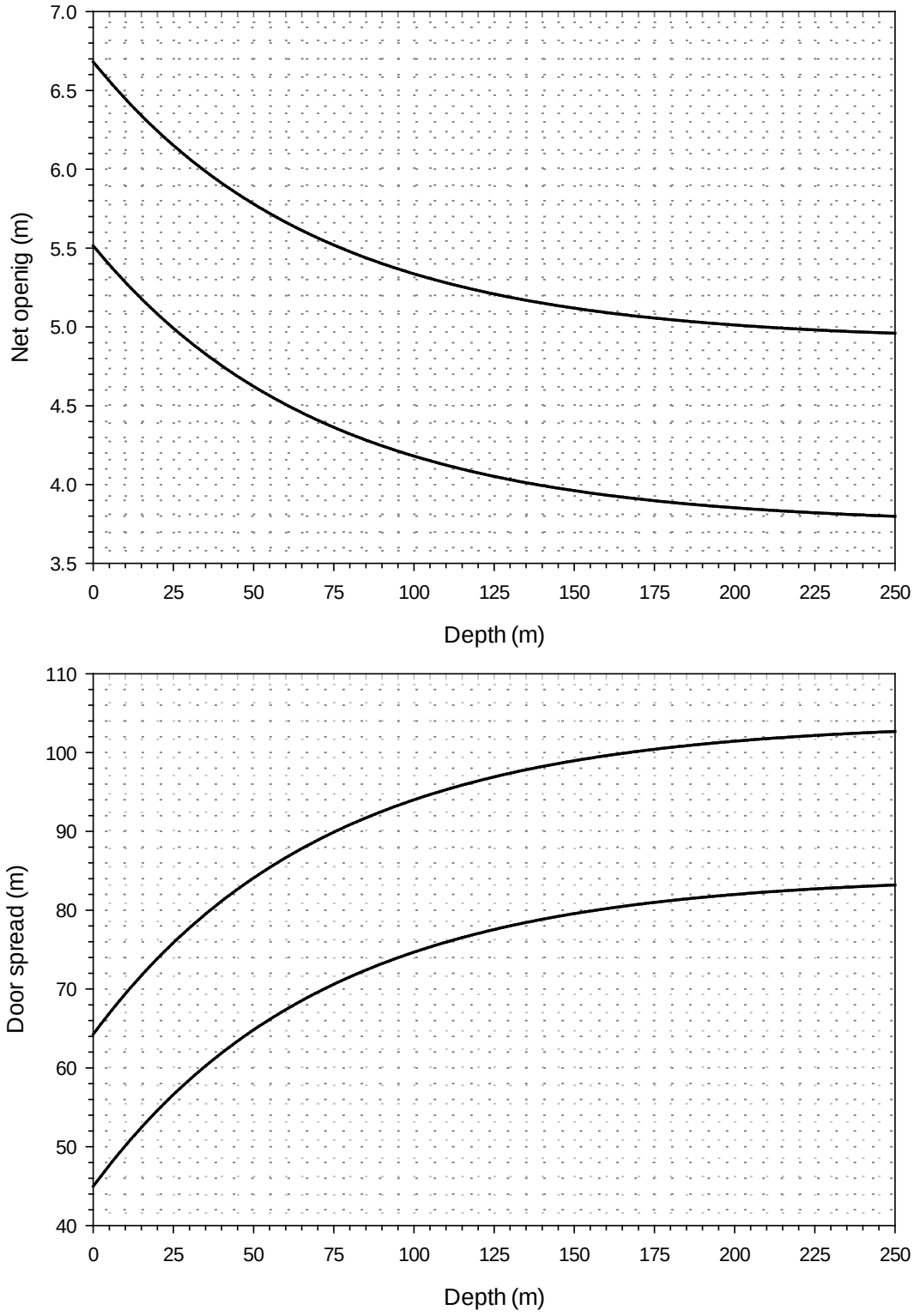


Figure 2.7. Recommended upper and lower limits of vertical net opening and door spread in relation to depth.

Table 2.6.1. Definition of recommended upper and lower limits of vertical net opening and door spread in relation to depth (y = a + b * exp(-c * z), where y is net opening or door spread and z is depth in meters).

	Net opening limits		Door spread limits	
Coefficient	upper	lower	upper	lower
a	3.7461	4.9088	84.3842	103.9178
b	1.7689	1.7727	-39.4195	-39.6521
c	0.0140	-0.0142	0.0140	0.0139

It is recommended that the entire data stream, including all the net sensor parameters, are recorded to allow mean values to be calculated and entered into the individual institutes' databases. These values are calculated from the time the gear has stabilized on the bottom to the time the gear is hauled. Data screening must also be done; the 2009 SGSTS report, Section 4.2.1, gives guidance on how to carry this out. Data from these calculations are to be sent to DATRAS with the standard upload from institutes databases.

The following flow diagram should be used to help in the process of using net performance sensors and units during a GOV haul (Figure 2.8).

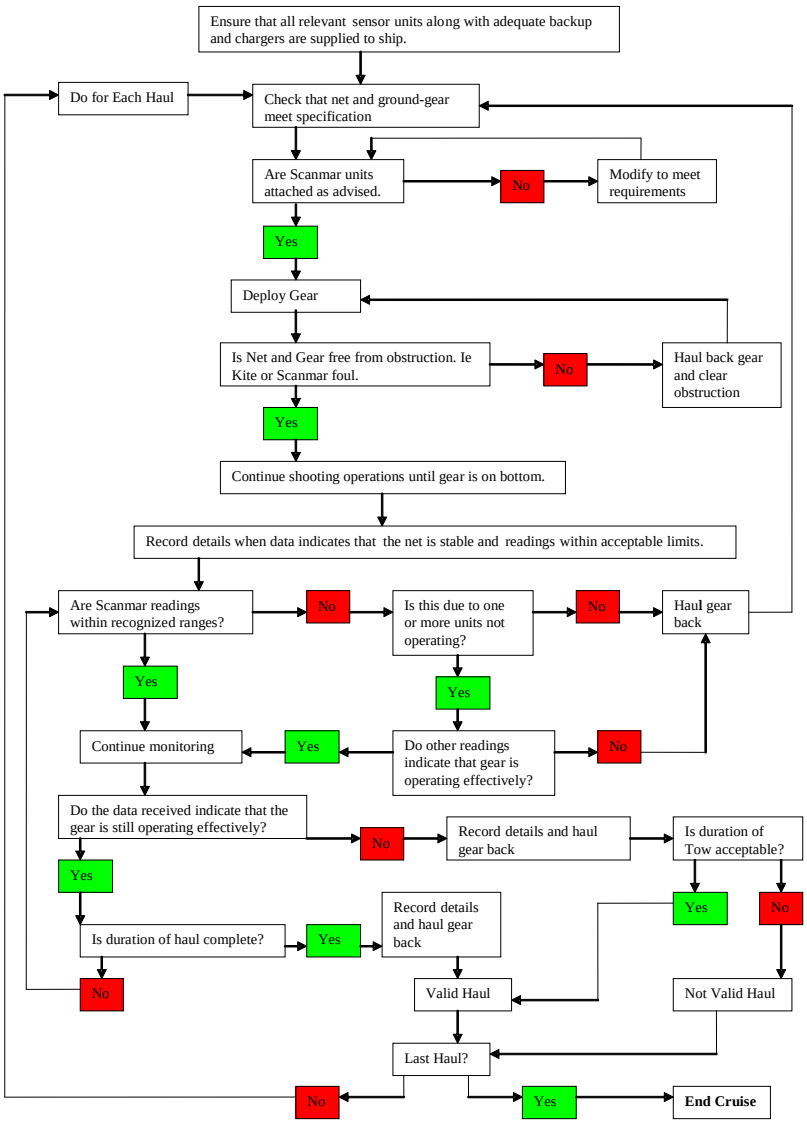


Figure 2.8. IBTS flow diagram for use of data from net performance sensors.

2.7 Fishing positions

Most statistical rectangles contain a number of possible tows that are deemed to be free of obstruction. In some rectangles sampling may be further stratified due to significant changes in seabed depth, which may, in turn, cause variations in the fish population. Vessels are free to choose any positions in the rectangles that they are surveying if hauls are sufficiently far apart from each other. In rectangles or strata that are to be sampled more than once by the same vessel, it is recommended that valid hauls are separated by at least one day or by at least 10 miles. Tows conducted by the same vessel in adjacent rectangles must also be separated by at least 10 miles, except where one country takes more than 2 tows per rectangles. Survey partners are encouraged to exchange information on available clear tows between vessels in order to increase the variance in fishing positions used. Countries must avoid clustering tow positions between adjacent rectangles in order to reduce positive serial autocorrelation and thereby maximize survey precision. Fish shoals located by sonar or echosounder must not influence fishing locations.

3 Sampling of GOV-trawl catches

3.1 Catch sorting and sampling

The catch from all valid hauls must be fully sorted where practicable. The entire catch is sorted, with fish and shellfish species identified to the lowest taxonomic level possible. For larger catches, a selection of species/size categories of species may be identified as being sufficiently abundant that they can be subsampled appropriately. If the entire catch cannot be sorted, then the data must be flagged accordingly when submitted to the DATRAS database. Annexes 7 and 8 show tables of the current catch processing procedures of each nation for the quarter 1 and quarter 3 surveys.

All fish in the catch must be identified to species. Only if this proves impossible may some be grouped by genus or larger taxonomic group (e.g. *Pomatoschistus*, Ammodytidae). Table 3.1.1 lists the shellfish and cephalopods that must also be sorted, measured, and included in the data submission to DATRAS. Although standardized data collection for fish is well established in IBTS protocols (see below), there is no standardized approach to the submission of data on the catches and size distribution of other invertebrate species (those not in Table 3.1.1). Some national laboratories record other invertebrate species as "benthos", while some sort and identify to species or family level. No agreed protocols for the collection and submission of data exist because the levels of taxonomic expertise on board vessels can be variable. The GOV is not an effective gear for catching benthos for quantitative sampling, but it can be used for some crude distribution information, as long as the limitations of the gear are taken into consideration, e.g. the type and rigging of the groundgear, the size of the net meshes. These data may be collected as presence/absence or weights/numbers. It is at the discretion of the institute collecting the data to decide what means is most appropriate. Hence, national laboratories collecting information on benthos should continue to do so, though such data should not be reported to DATRAS until rigorous quality assurance and reporting procedures are in place, so as to ensure that data are of high quality.

Table 3.1.1. Shellfish and cephalopods to be recorded and/or measured during surveys.

APHIAID	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	*Chaceon affinis*	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 (Maia) squinado*	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	–	–

APHIAID	COMMON NAME	SCIENTIFIC NAME	RECORDING	MEASUREMENT	UNIT
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*(*)	Sexes combined	Mantle length	cm below
416668	Squids	*Loligo forbesii*	Sexes combined	Mantle length	cm below
140271	Squids	*Loligo vulgaris*	Sexes combined	Mantle length	cm below
153131	Squids	*Alloteuthis subulata*	Sexes combined	Mantle length	cm below
140625	Squids	*Todaropsis eblanae*	Sexes combined	Mantle length	cm below
140624	Squids	*Todarodes sagittatus*	Sexes combined	Mantle length	cm below
140621	Squids	*Illex coindetii*	Sexes combined	Mantle length	cm below
140600	Lesser octopus	*Eledone cirrhosa*	Sexes combined	–	–
140605	Octopus	*Octopus vulgaris*	Sexes combined	–	–
–	Bobtail squids etc. (*)	*Sepiola/Rossia/Sepietta*	Sexes combined	–	–
141454	Bobtail squids	*Sepiola atlantica*	Sexes	Mantle length	cm below
141452	Bobtail squids	*Sepietta oweniana*	Sexes	Mantle length	cm below
141449	Bobtail squids	*Rossia macrosoma*	Sexes	Mantle length	cm below

(*) Identification to species level where possible, though juveniles may need to be aggregated.

The following flow diagram can be used as a guide to dealing with the catch (Figure 3.1).

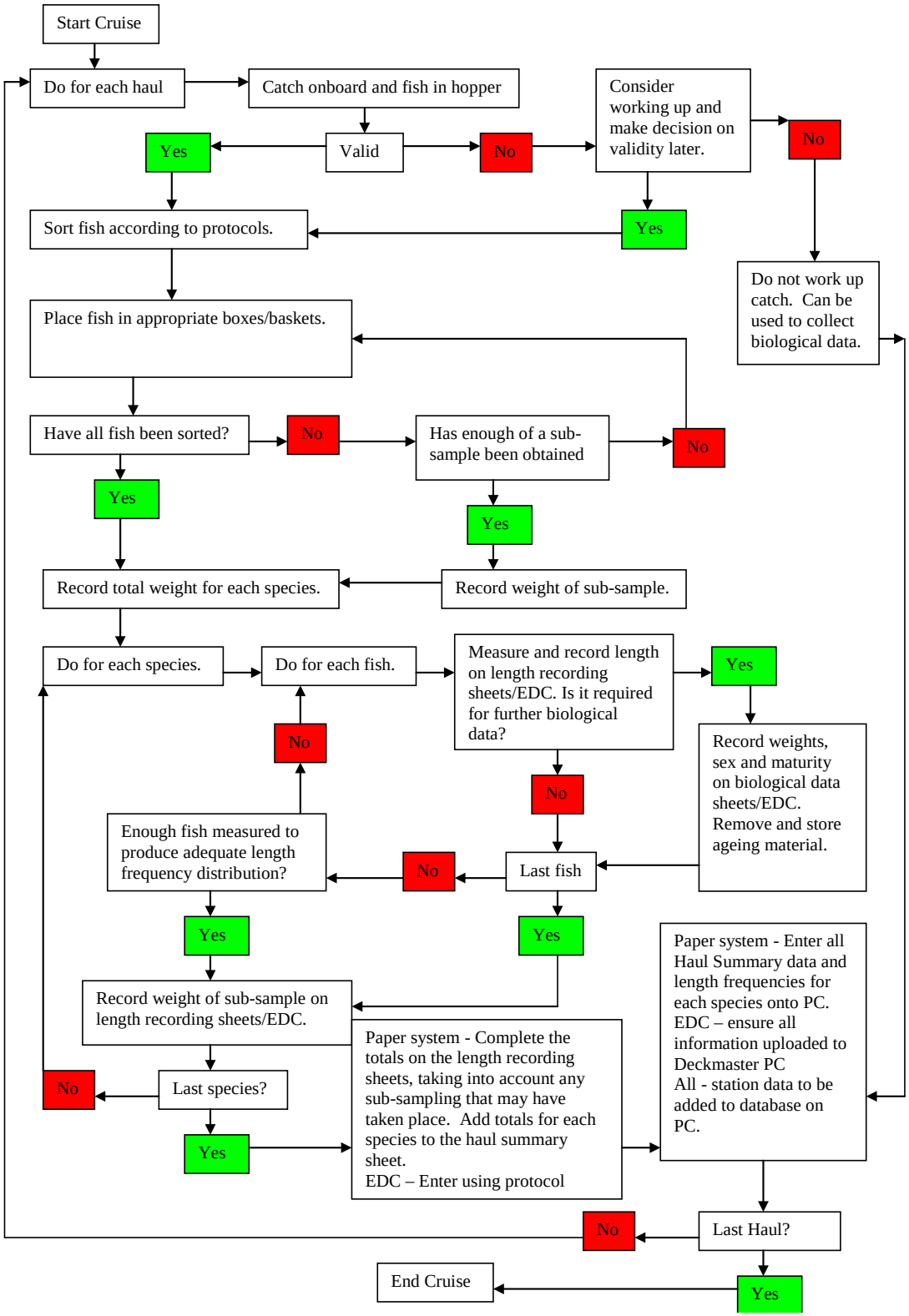


Figure 3.1. IBTS catch processing flow diagram.

3.2 Length composition

Length distributions are recorded for **all fish species caught**. Length is defined as total length, measured from tip of snout to tip of caudal fin, for all fish species other

than those described in Section 3.4. Length is measured to 0.1 cm below for shellfish, to 0.5 cm below for herring and sprat, and to 1 cm below for all other species. When measuring shellfish species, consult Figures 3.2 to 3.5 to ensure the correct carapace measurement is taken. When measuring cephalopods, use mantle length (see Figure 3.6).

Elasmobranchs and shellfish are to be measured and weighed by sex.

After sorting the catch into species or species/sex, a length distribution for each catch category that accurately represents the length distribution of the catch must be obtained. Where the numbers of individuals are too large for them all to be measured, a representative subsample is selected of at least 75 fish, although sampling a very limited length range could be adequately achieved with less. A proper representation of the given length distribution is key.

In the event that a truly representative subsample cannot be selected, it will 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:

1) A catch consists of 999 fish in the length range 18–26 cm and one fish at 40 cm. A single subsample of 100 fish, when raised, will give either 10 or 0 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 from the remaining 999 fish (category 2). When measured and raised, this provides an accurate assessment of the numbers caught at each length for catch.

2) A catch 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. A single raised subsample of 100 fish could give anything between 0 and 10 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 from the remaining 994 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, it is recommended that the minimum sample size given above (75 individuals) should be doubled. This will help to ensure that any extremes of the length range are covered.

3.3 Sampling for age, sex, and maturity

Otolith samples are to be collected from each trawl station by all nations. Both otoliths from each fish are to be collected. Care should be taken not to extract otoliths from fish that exhibit length deformities.

Where possible, nations are to collect 1 otolith per 1 cm length group (0.5 cm length group for herring and sprat) from each trawl haul. Where this is not possible, the following minimum sampling levels for the target species are to be maintained for each trawl station:

Species	Minimum number of otoliths to be taken per Roundfish Area
herring	8 otoliths per 1/2 cm group
sprat	16 otoliths per 1/2 cm group 8.0–11.0 cm
	12 otoliths per 1/2 cm group >11.0 cm
mackerel	8 otoliths per 1 cm group
cod	8 otoliths per 1 cm group
haddock	8 otoliths per 1 cm group
whiting	8 otoliths per 1 cm group
Norway pout	8 otoliths per 1 cm group
saithe	8 otoliths per 1 cm group
Plaice	8 otoliths per 1 cm group

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 group are required for the larger length classes.* If nations are collecting 1 otolith per cm (or per 0.5 cm for herring and sprat), then additional samples from the upper tail of the size distribution are not needed.

Participants are encouraged to collect age samples from other commercially important species, such as sole, lemon sole, and any other species deemed important to the EU Data Collection Framework (DCF) or specified by the IBTS working group.

Sex, maturity, and weight data are to be reported for all target species for which age data are collected, especially for surveys that take place during the spawning period of that species. Maturity stages should be reported according to the maturity scales given in Annexes 9 and 10, however this key is targeted at roundfish. For flatfish species, refer to the Report of the Workshop on Sexual Maturity Staging of sole, plaice, dab and flounder, ICES CM 2012/ACOM:50.

3.4 Measurement types for invertebrates

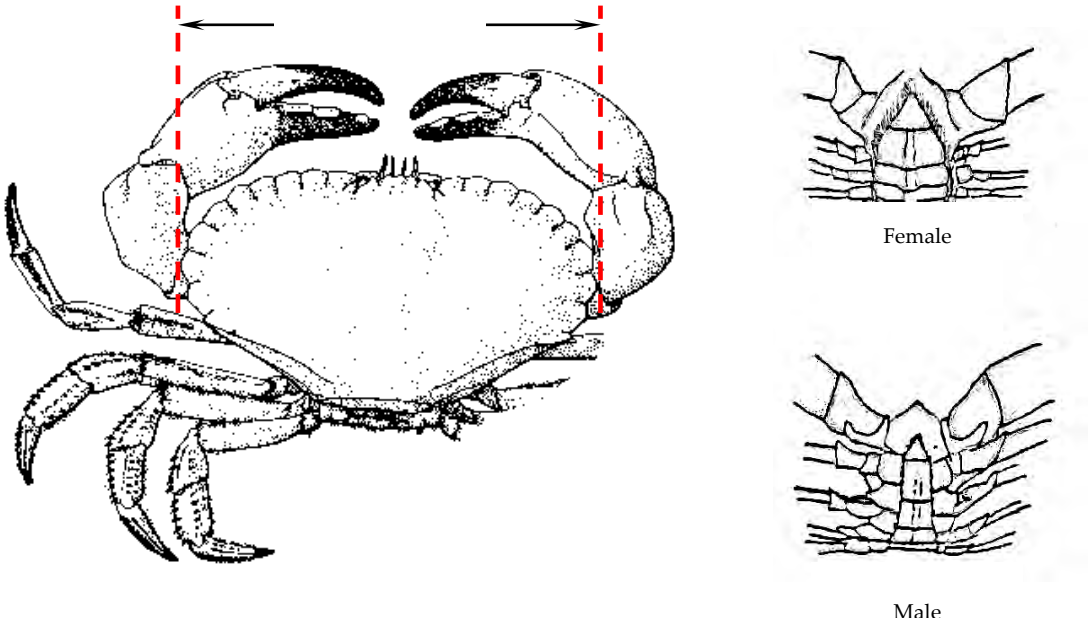


Figure 3.2. Measurement and sexing of *Cancer pagurus.* Size to be measured to the lower mm.

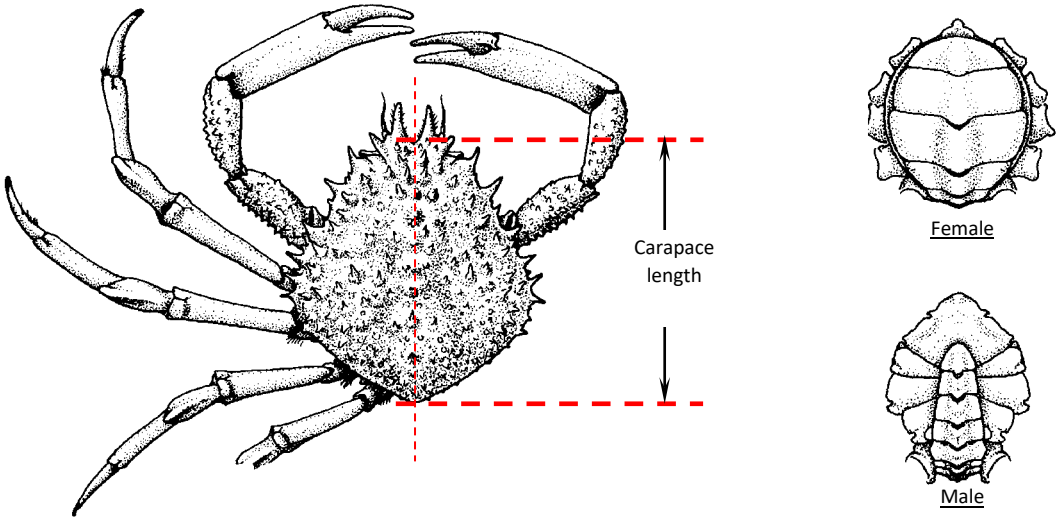


Figure 3.3. Measurement and sexing of *Maia squinado.* Size to be measured to the lower mm. *Lithodes maja* measured along the same carapace position.

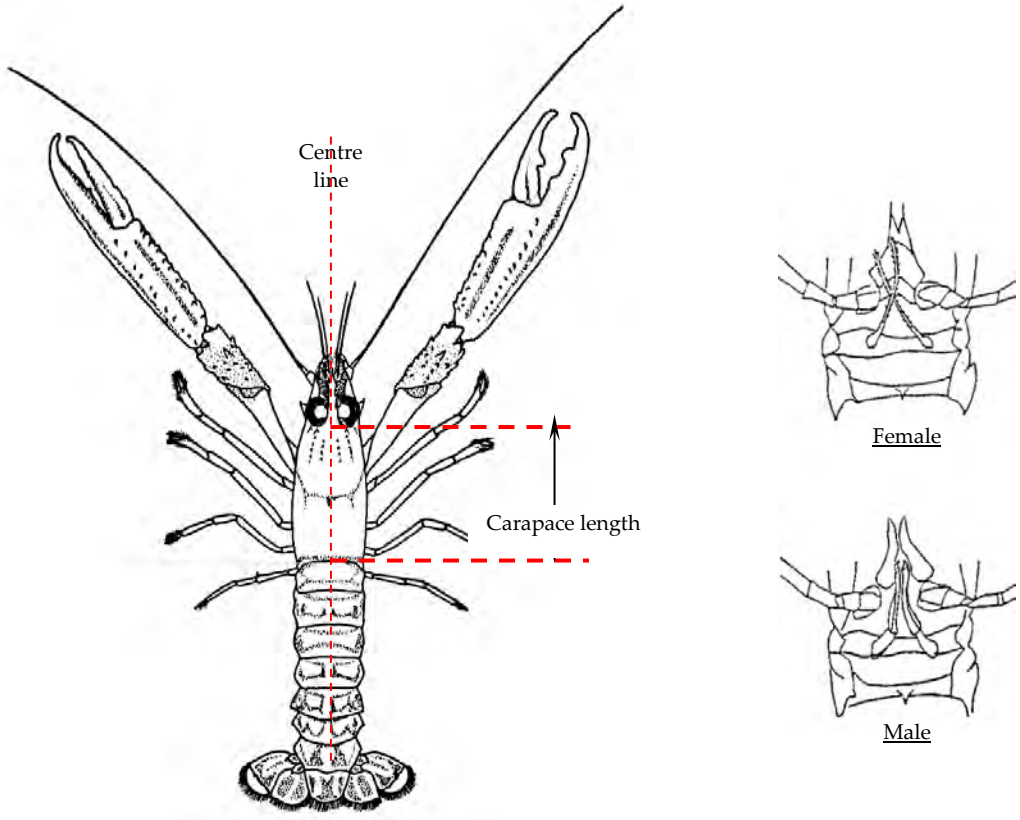


Figure 3.4. Measurement and sexing of *Nephrops norvegicus* and *Homarus gammarus* Size to be measured to the lower mm.

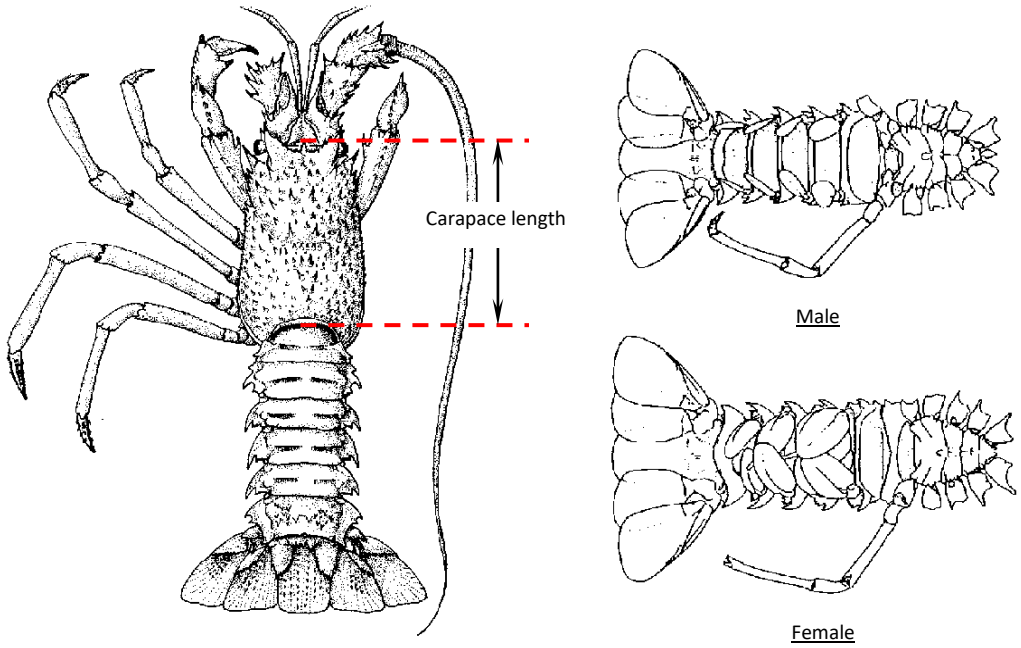


Figure 3.5. Measurement and sexing of *Palinurus* spp. Size to be measured to the lower mm.

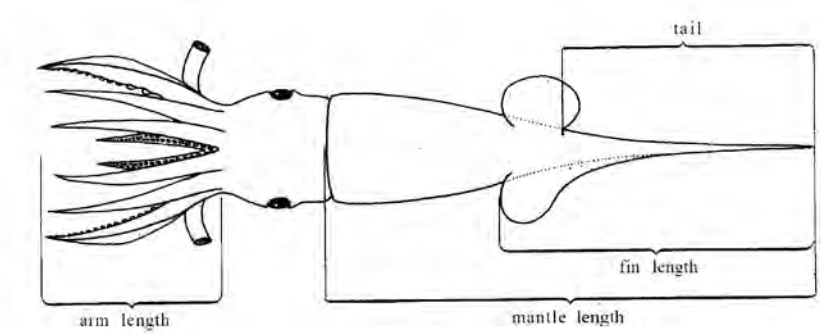
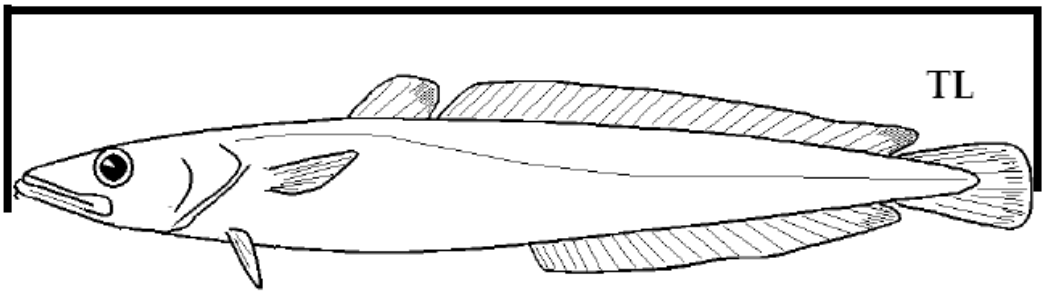


Figure 3.6. Measurement of Cephalopods; mantle length to be measured to lower cm.

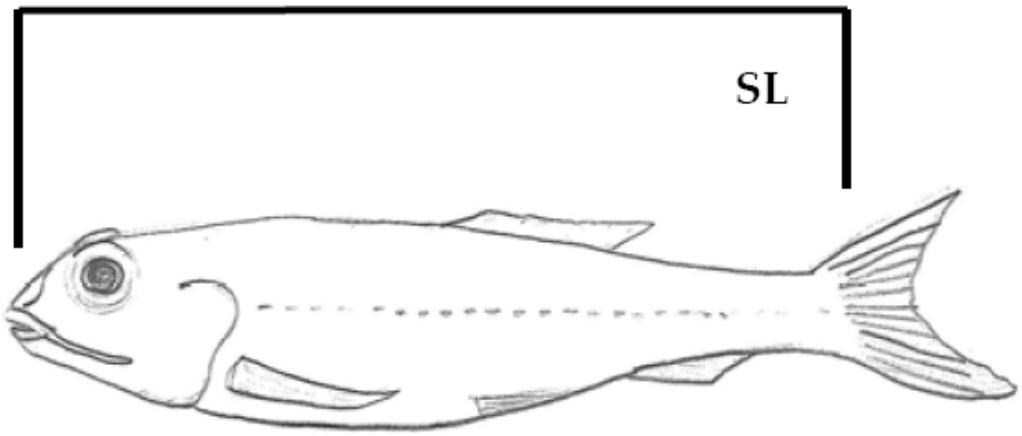
3.5 Measurement types for deep-water species



The majority of species encountered during the deep-water surveys are measured to the centimetre below using total length as the length qualifier **(TL;** see diagram directly above). There are, however, some exceptions. As a result of the great variety of body shapes of deep-water fish species and the fragility of their tails and fins, some species are not measured to total length. Listed below are the respective taxa, with details of the length measurements to be collected for each. Historically, these species, if caught, may not have been measured to this protocol and care should be taken if using data for these species.

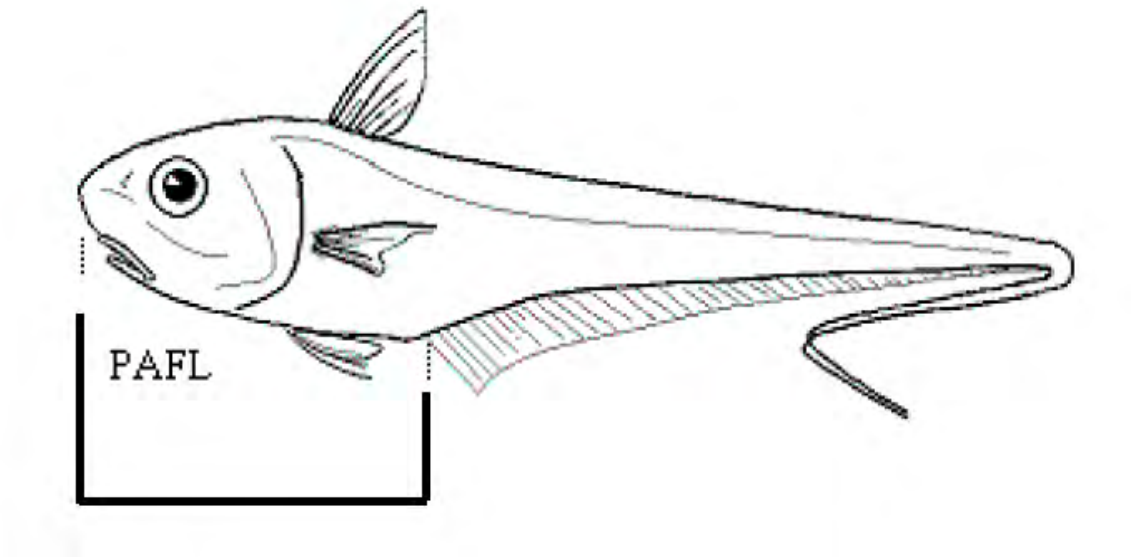
3.5.1 Smoothheads and Searsids (*Alepocephalidae* and *Searsidae*)

Standard length (**SL**) measurement taken from the tip of snout/anterior point of head to the end of the fleshy caudal peduncle. Not to be confused with TL which includes the caudal fin rays. All smoothheads and searsids are measured to the nearest whole cm below.



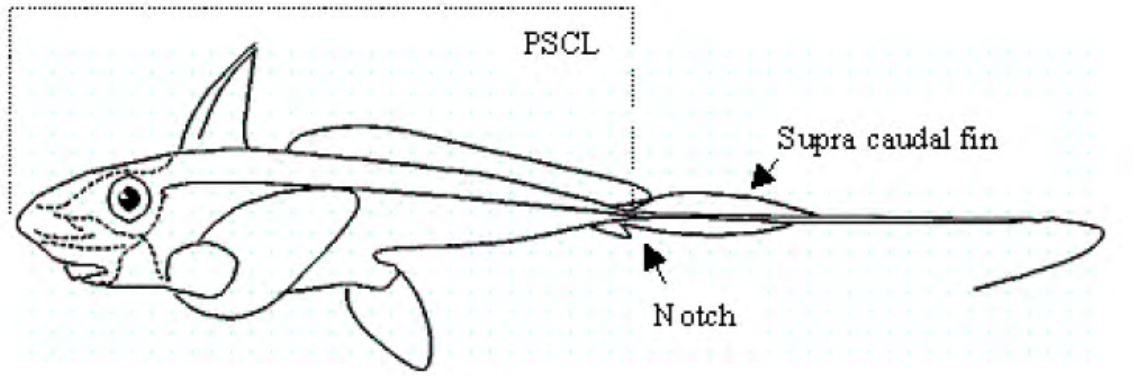
3.5.2 Grenadiers (*Macrouridae*)

Measurement taken from the tip of the snout to the first anal fin ray (Pre Anal Fin Length, **PAFL**; see diagram below). All grenadiers are measured to the nearest 0.5 cm below.



3.5.3 Chimaeridae (Rabbitfish)

All **Rabbitfish** except Rhinochimaeridae are measured to pre-supra caudal fin length (**PSCFL**), which is from the tip of the snout to the point just before the start of the supra caudal fin (see diagram below). All Chimaerida are measured to the nearest cm below.



3.6 Collection of marine litter from trawl

Marine litter is one of the MSFD descriptors. With this in mind, from 2011, all North Sea IBTS surveys collect data on marine litter captured in the GOV trawl. Annex 11 outlines the categories and description of the categories to be collected at each station. Photos of litter in each trawl sample are optional, not mandatory. Once collected these data can be sent to each institutes marine litter co-coordinator, to be forward to ICES. The litter data collection procedures are currently in revision, therefore, survey co-ordinators must ensure they are up to date with the current procedures (see ICES website) prior to the survey.

4 MIK net

4.1 Q1 sampling

The MIK net is midwater ring net and is the standard gear for the sampling of fish larvae during the International Bottom Trawl Survey in the first quarter.

A separate manual on all procedures and protocols regarding the MIK sampling on quarter 1 IBTS surveys has been developed. This is available on the ICES webpage. All nations sampling during IBTS Q1 must follow the protocols outlined in this documentation.

5 Environmental data

Either before or after each GOV trawl, the following minimum hydrographical data are to be collected:

- surface temperature
- bottom temperature
- surface salinity
- bottom salinity

When using a CTD-probe for measuring temperature and salinity, an appropriate calibration should be undertaken.

Participants are recommended to collect nutrient samples during the International Bottom Trawl Survey in the first quarter. For further specifications, they should contact the ICES Data Centre.

Since 1992 the following additional environmental data are sought:

- surface current direction
- surface current speed
- bottom current direction
- bottom current speed
- wind direction
- windspeed
- swell direction
- swell height

The above parameters, if collected, are reported in the 'Haul Information file HH' (Annex 12).

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 12)
Type 2: HL – Length frequency data (Annex 13)
Type 3: CA – Sex-maturity-age–length keys (SMALK; Annex 14)

The summaries of the formats of these record types are given in the appendices and detailed descriptions can also be found at the ICES web page: http://www.ices.dk/datacentre/datsu/selrep.asp.

Provisional data obtained from the North Sea and Skagerrak/Kattegat should be submitted to the quarterly coordinator as soon as possible after completion of the cruise. Annex 15 lists the sampling areas and standard areas for the calculation of abundance indices (using Figures 6.1 to 6.4 and A2.2 for guidance) and Annex 16 lists the length splits for the various target species. Final data should only be submitted to the ICES Data Centre after the national institute has checked the data; data are further checked using official checking programs issued by ICES within DATRAS, but institutes **must** instigate their own data checking routines and not rely solely on those within DATRAS.

NB: Details of environmental data should be submitted to the ICES Data Centre 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.

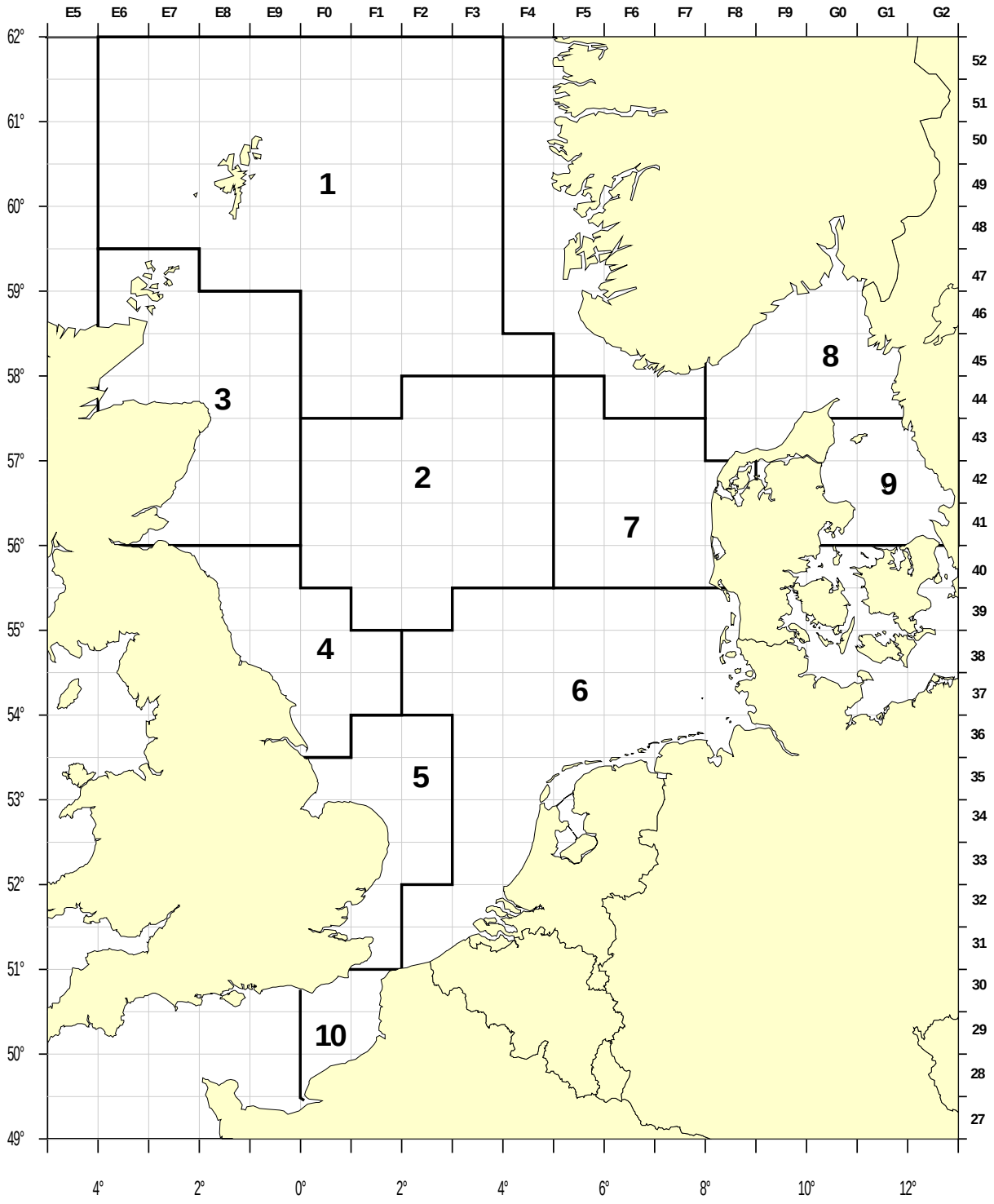


Figure 6.1. Standard Roundfish Areas used for roundfish since 1980, for all standard species since 1991. Additional RFA 10 was added in 2009. Application of the roundfish areas is described in the document: NS-IBTS indices calculation procedure (2013), available at: http://www.ices.dk/marine-data/Documents/DATRAS/Indices_Calculation_Steps_IBTS.pdf.

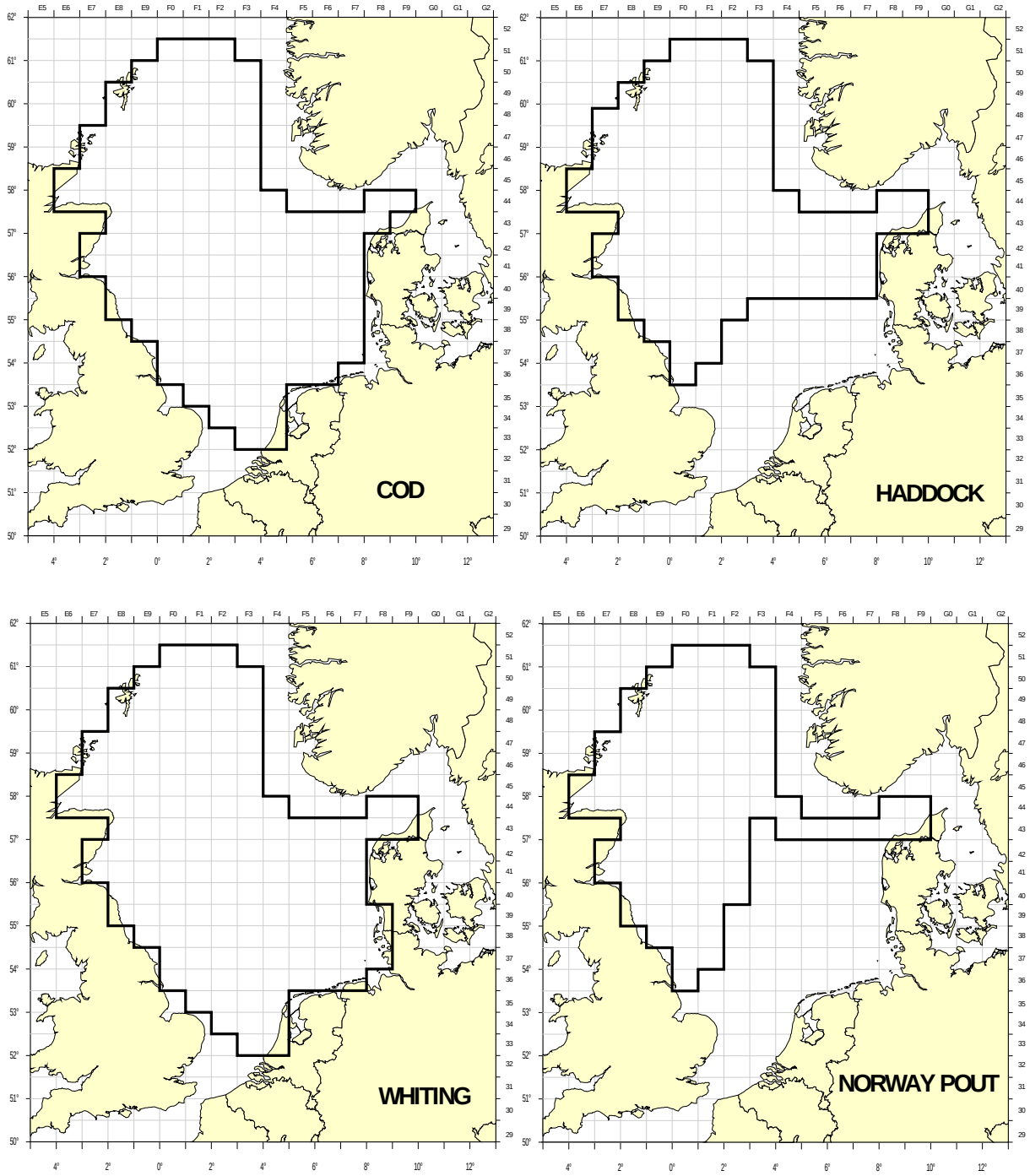


Figure 6.2. Current standard areas for the calculation of the IBTS abundance indices. Information obtained from DATRAS database at ICES.

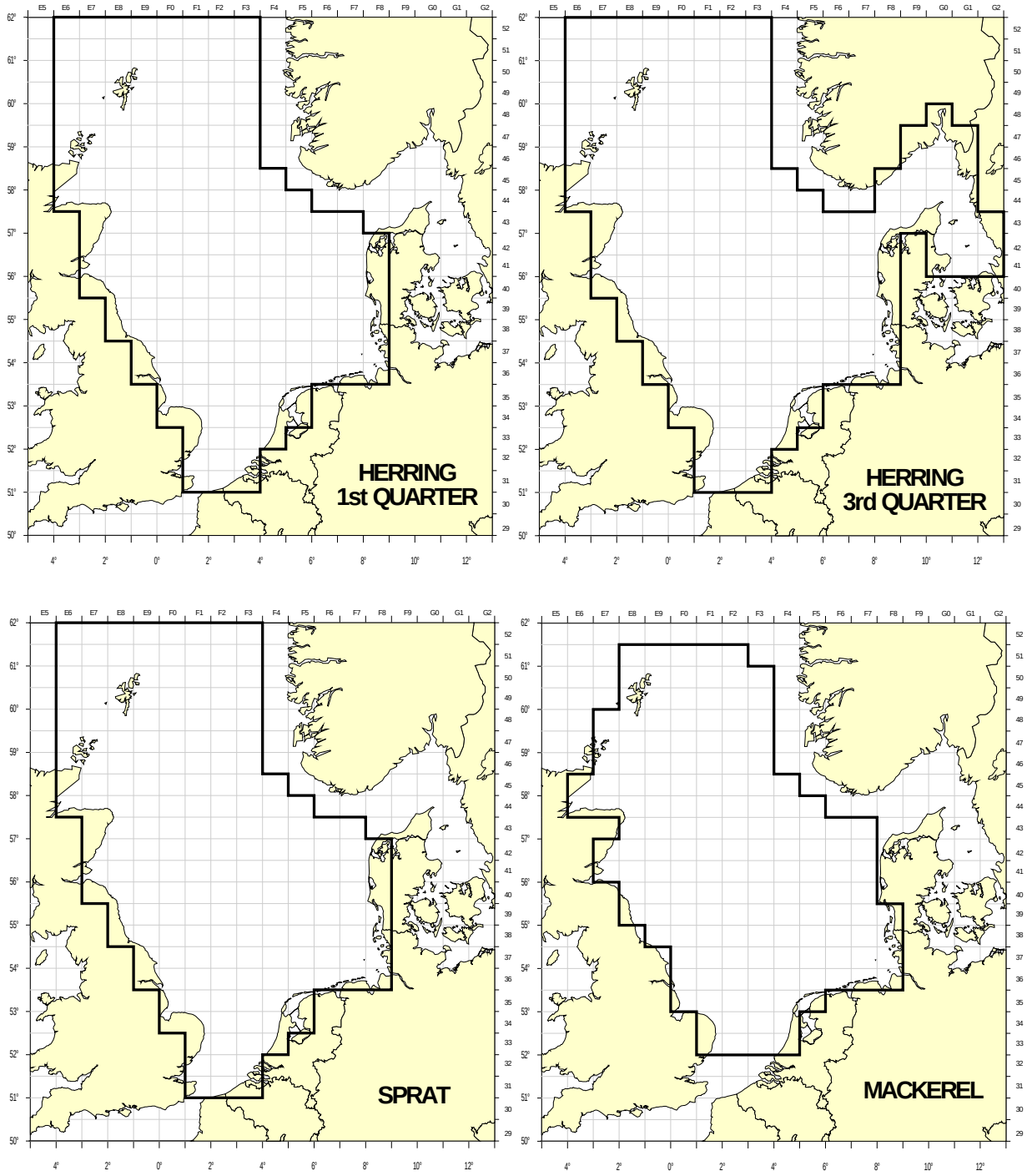


Figure 6.2 Continued.

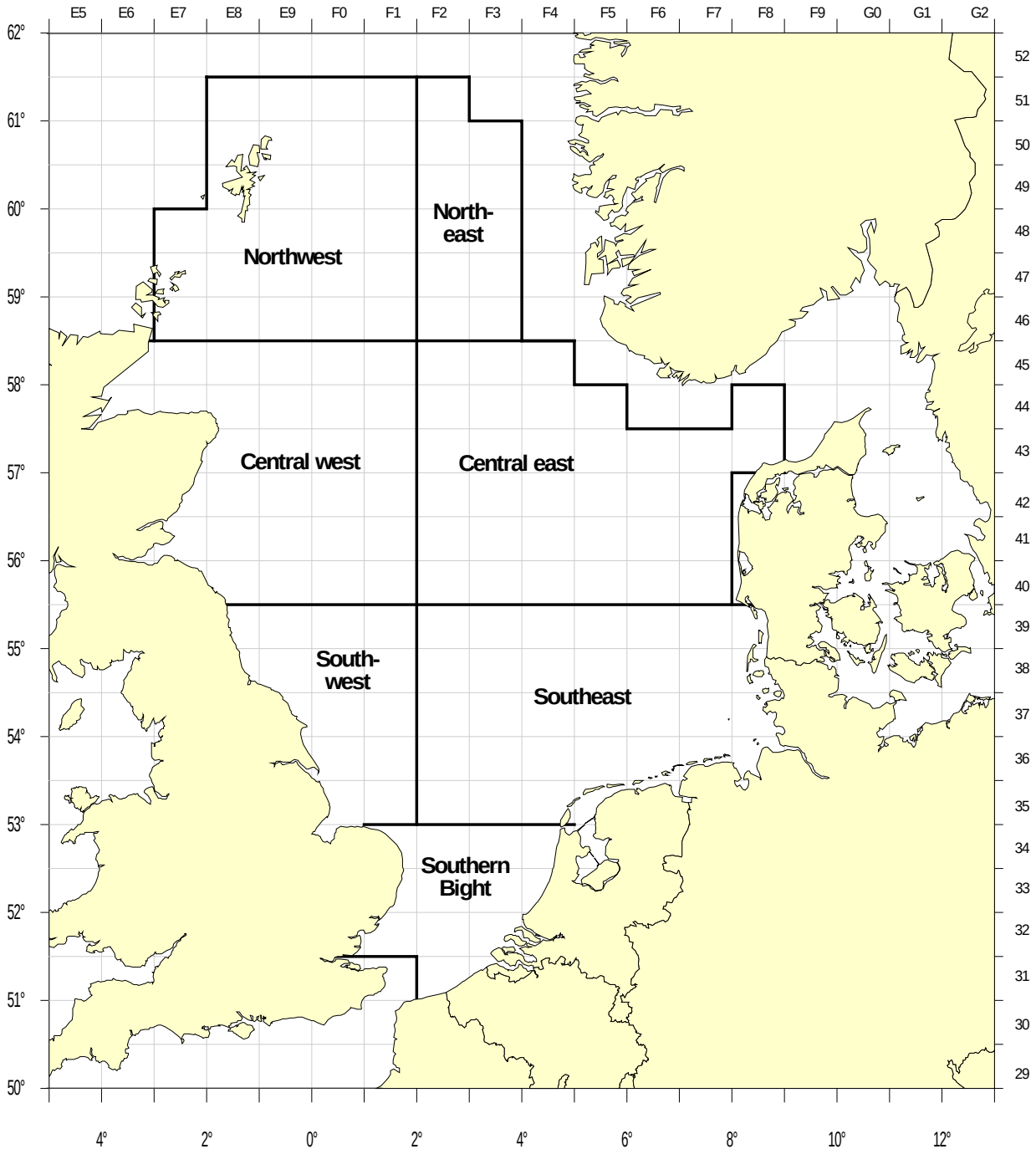


Figure 6.3. Subareas used for the calculation of abundance indices of herring larvae.

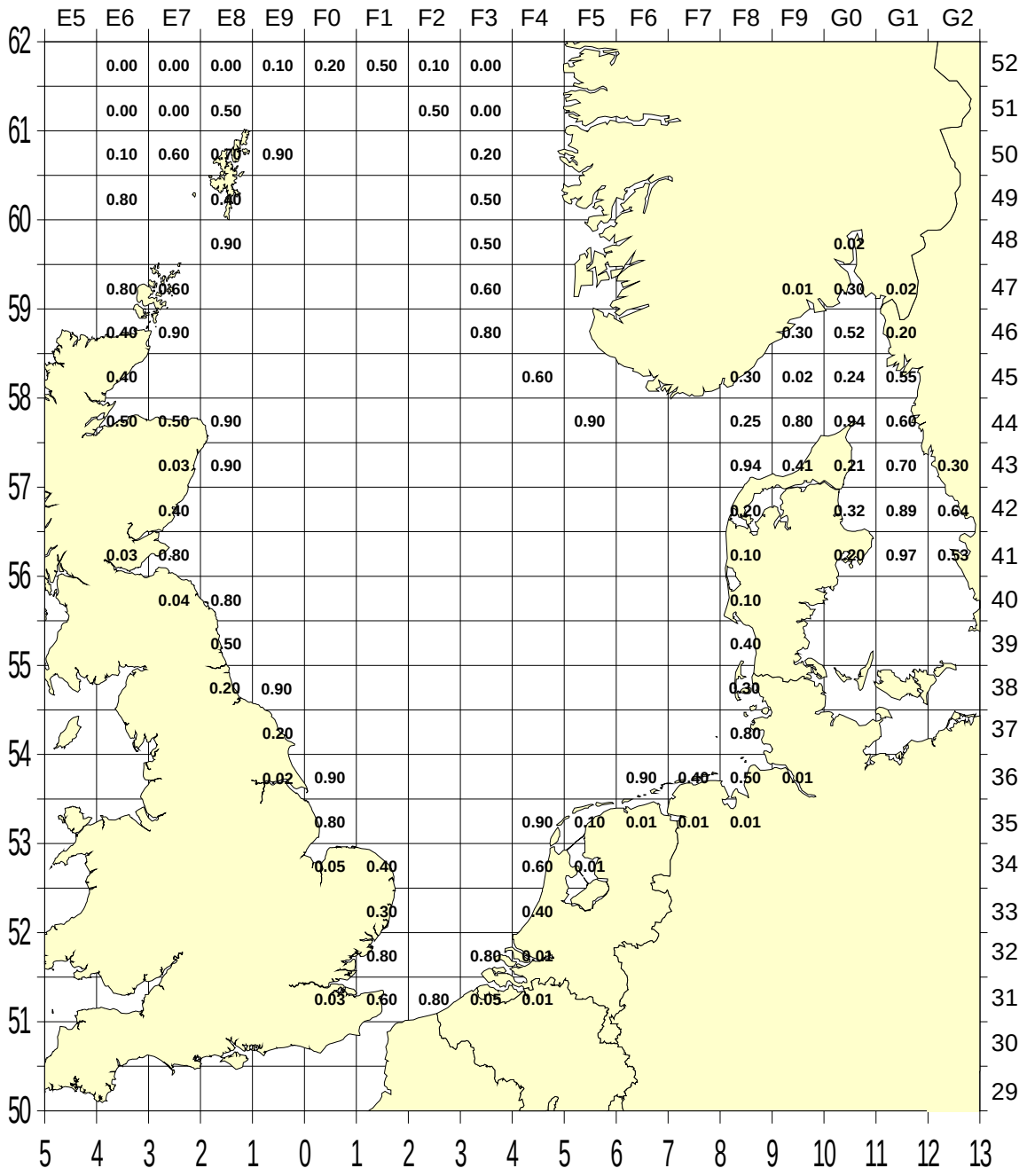


Figure 6.4. Rectangles with weightings used for calculation of the abundance indices of herring larvae.

7 References

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ICES. 2012b. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp.

ICES. 2012c. Manual for the Midwater Ring Net sampling during IBTS Q1. Revision 1. 16 p.

ICES. 2013. Manual for the Midwater Ring Net sampling during IBTS Q1. Series of ICES Survey Protocols. SISP 2-MIK 2. 18 pp.

Annex 1: Current rectangle allocation between nations

The current quarter 1 allocation of the different nations is shown in Figures A1.1 to A1.8, while the quarter 3 surveys are in Figures A1.9 to A1.15.

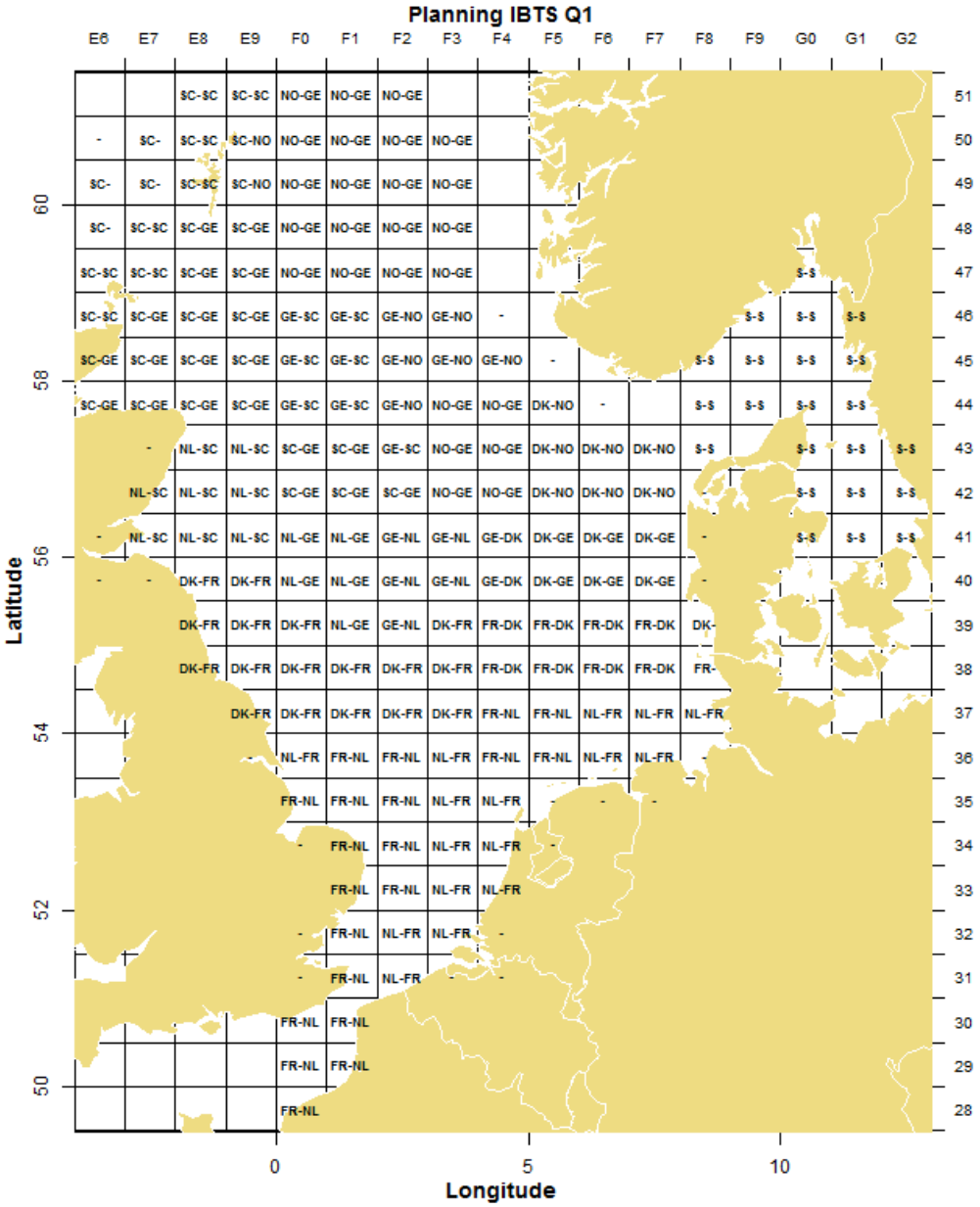


Figure A1.1. IBTS Quarter 1 Proposed Survey Grid all participants. Applied from 2013.

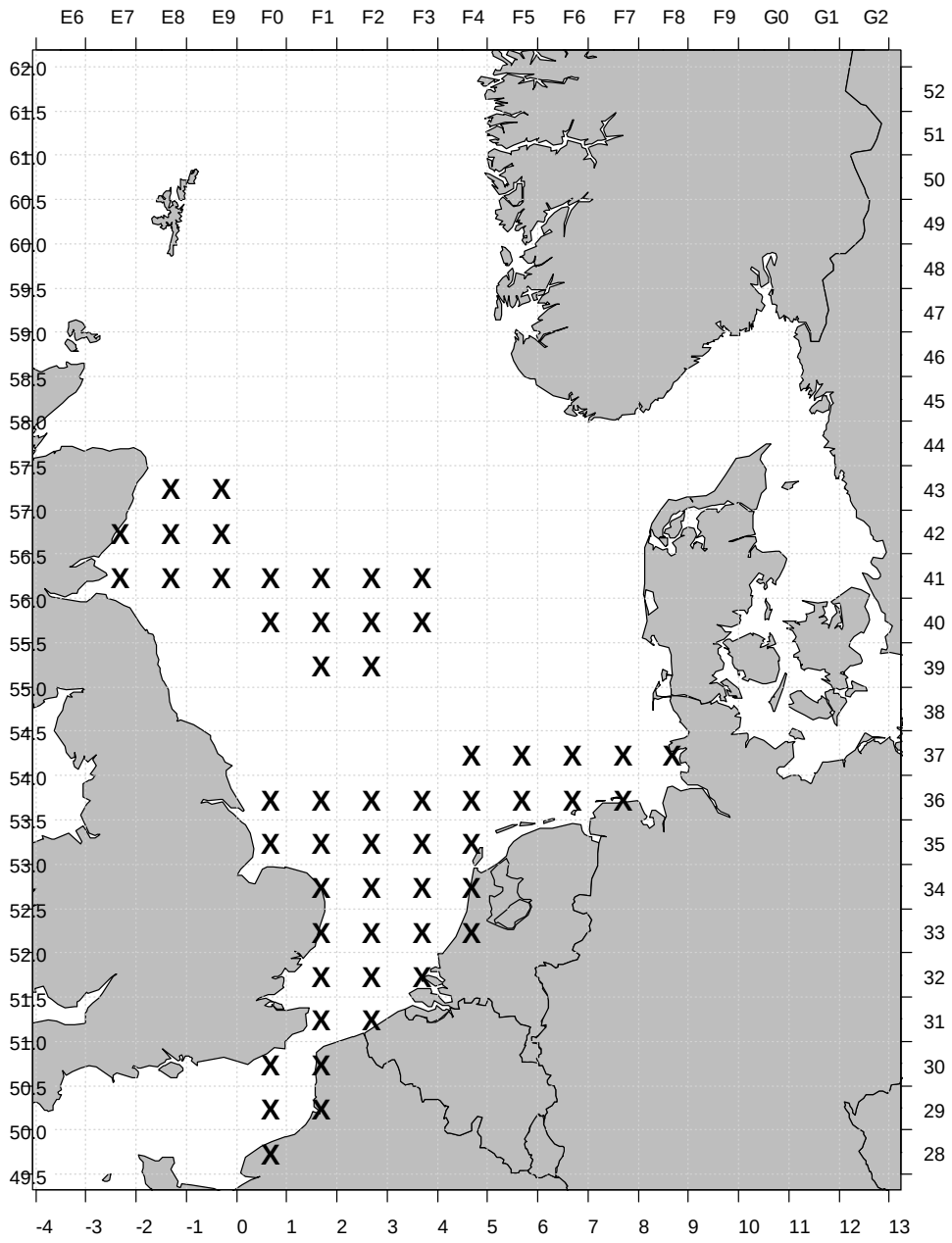


Figure A1.2. IBTS Quarter 1 Proposed Survey Grid – Netherlands. Applied from 2013 Q1.

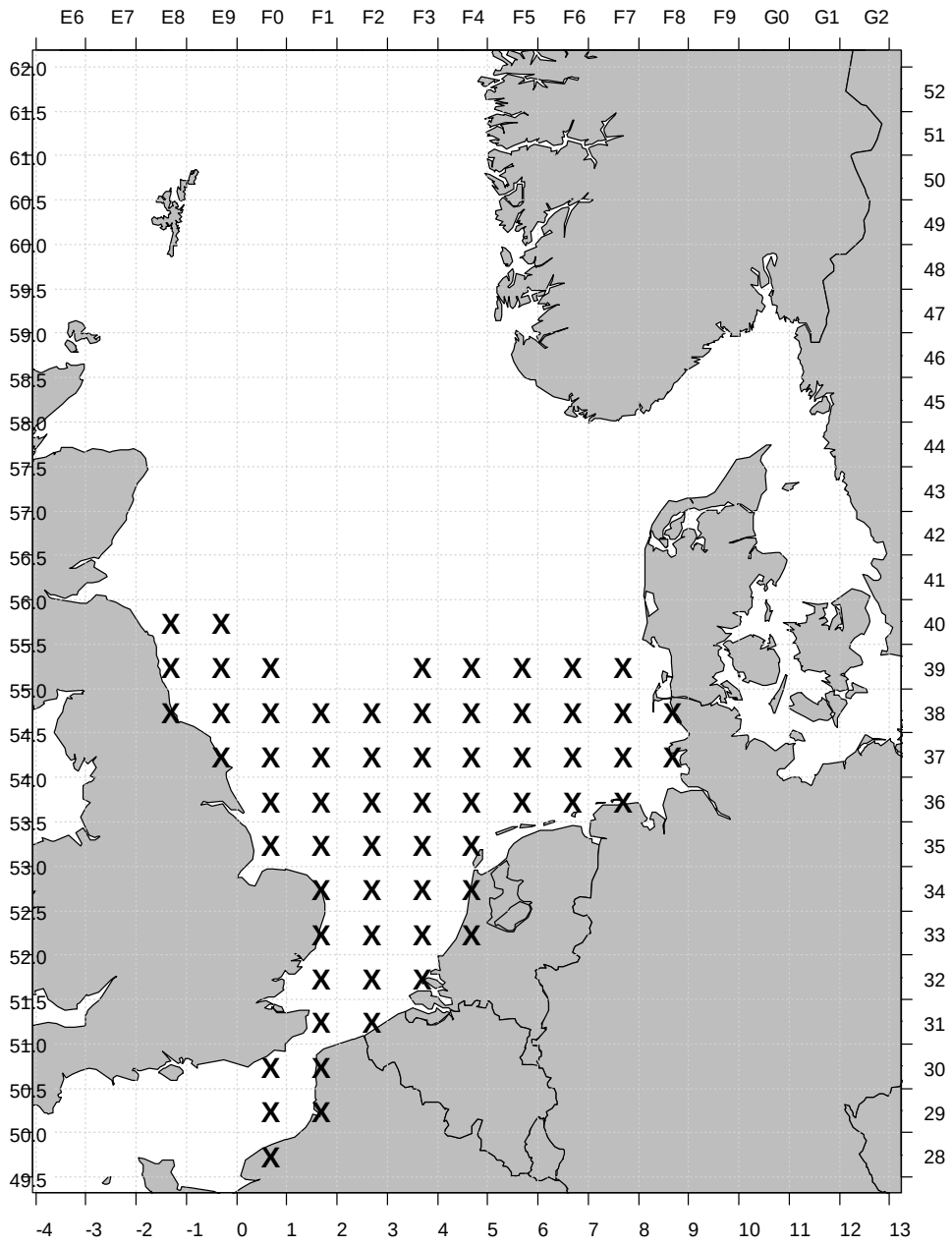


Figure A1.3. IBTS Quarter 1 Proposed Survey Grid – France. Applied from 2013 Q1.

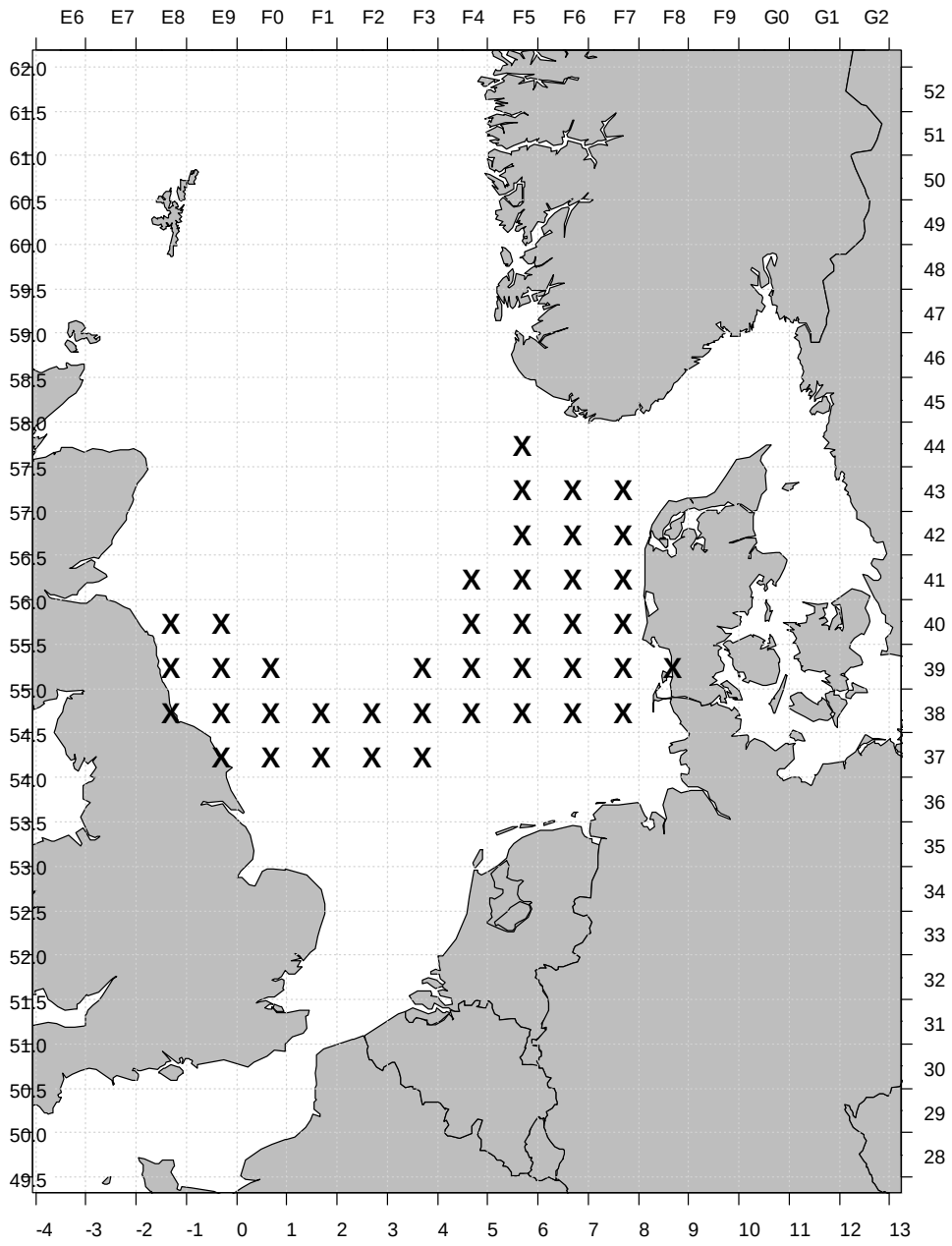


Figure A1.4. IBTS Quarter 1 Proposed Survey Grid – Denmark. Applied from 2013 Q1.

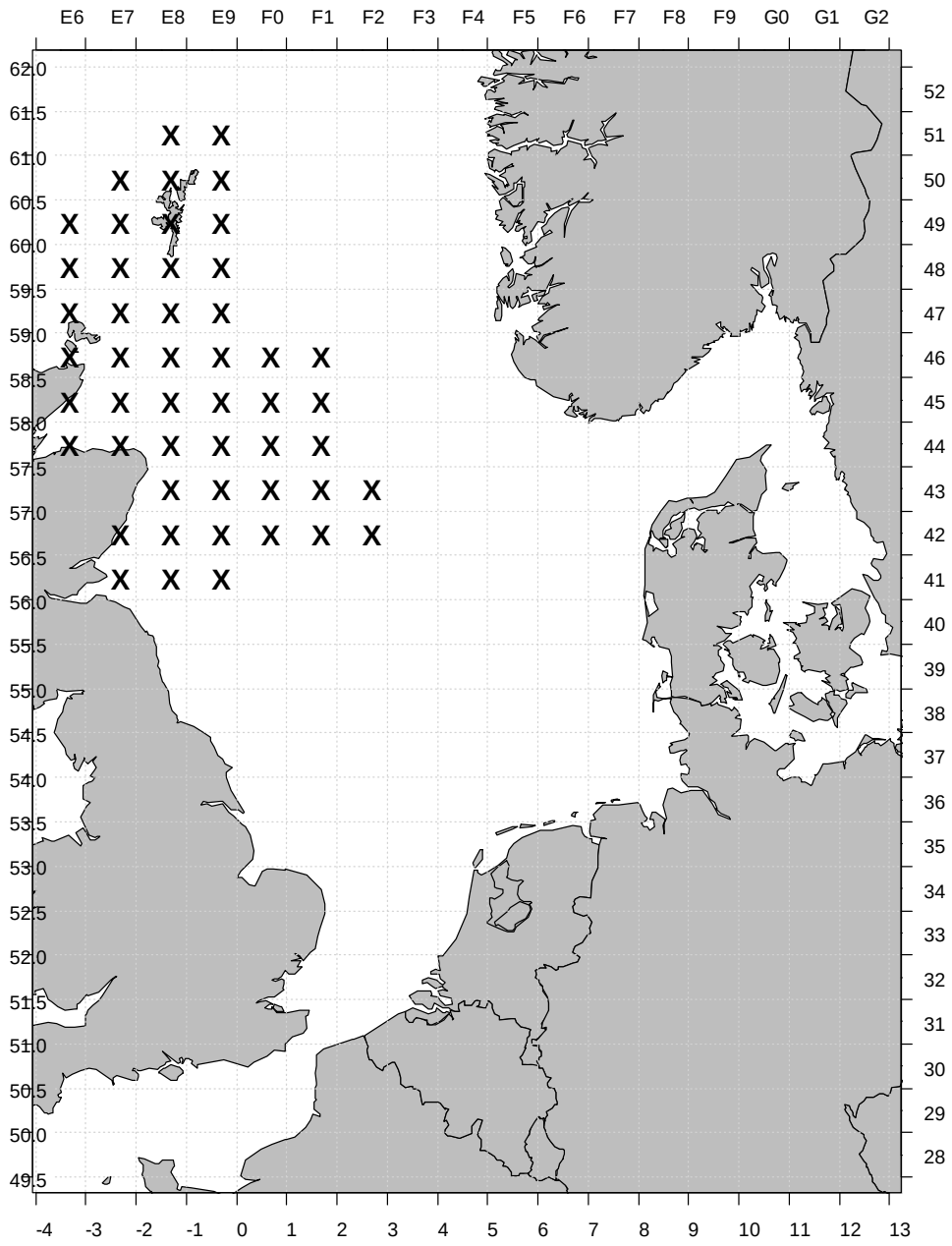


Figure A1.5. IBTS Quarter 1 Proposed Survey Grid – Scotland. Applied from 2013 Q1.

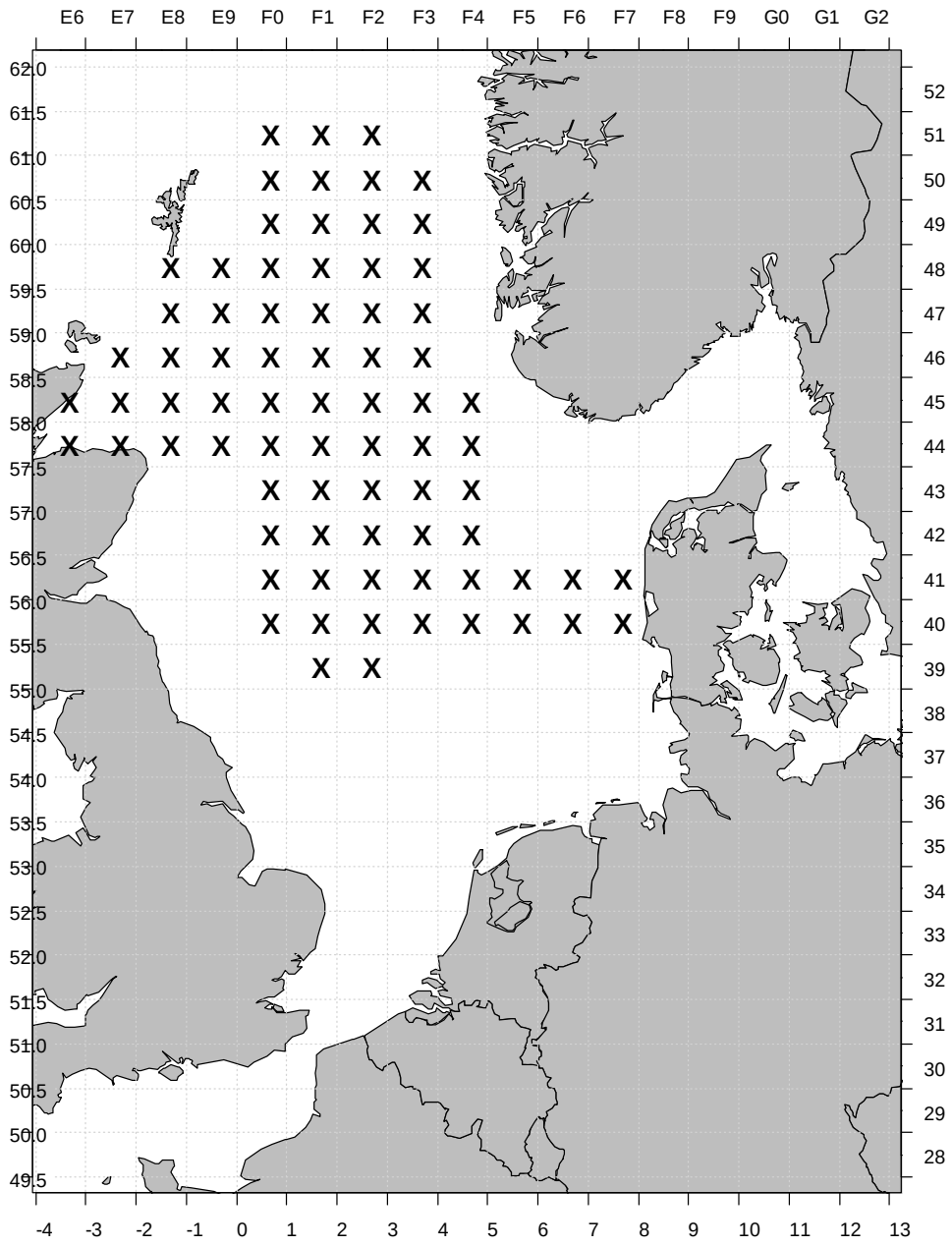


Figure A1.6. IBTS Quarter 1 Proposed Survey Grid – Germany. Applied from 2013 Q1.

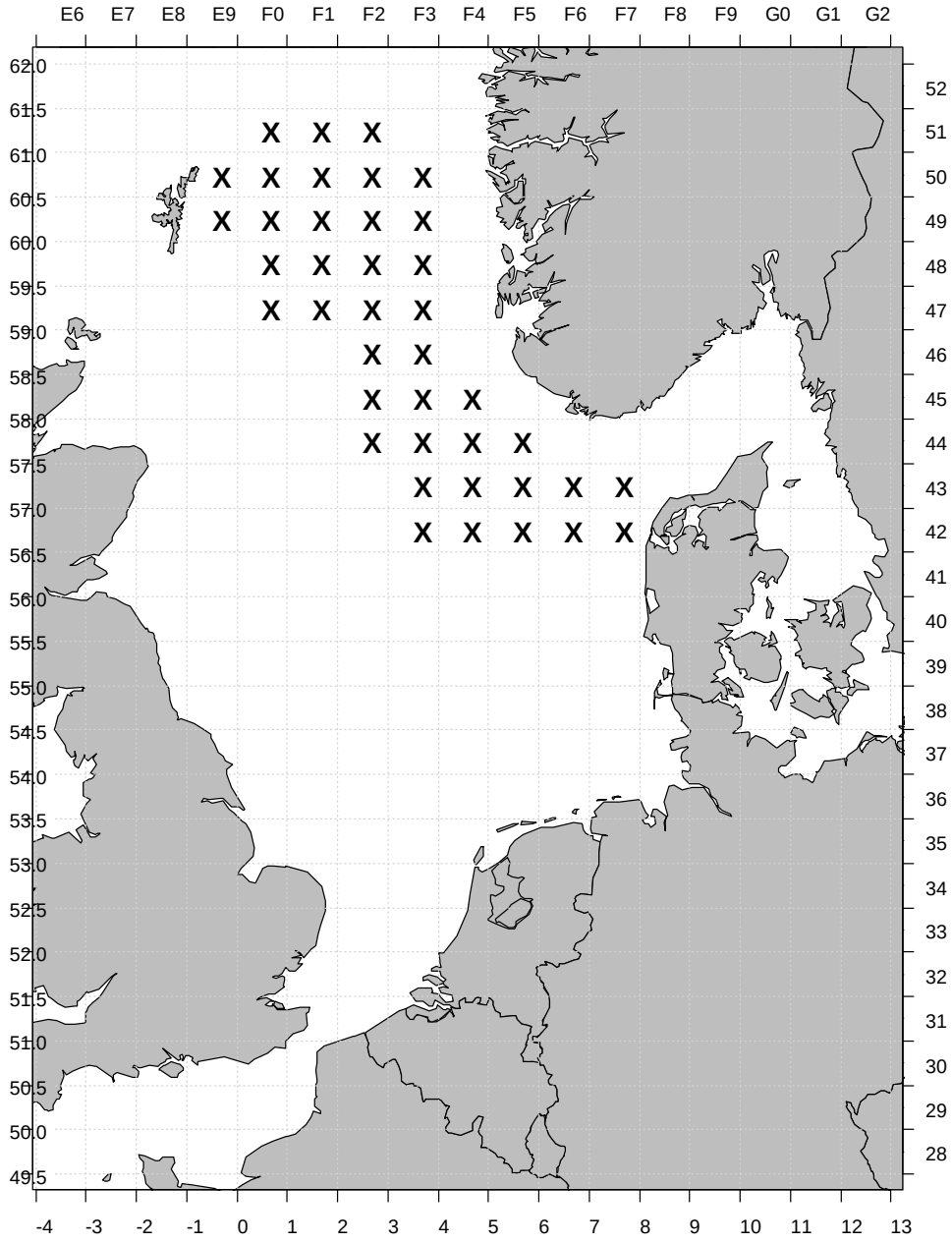


Figure A1.7. IBTS Quarter 1 Proposed Survey Grid – Norway. Applied from 2013 Q1.

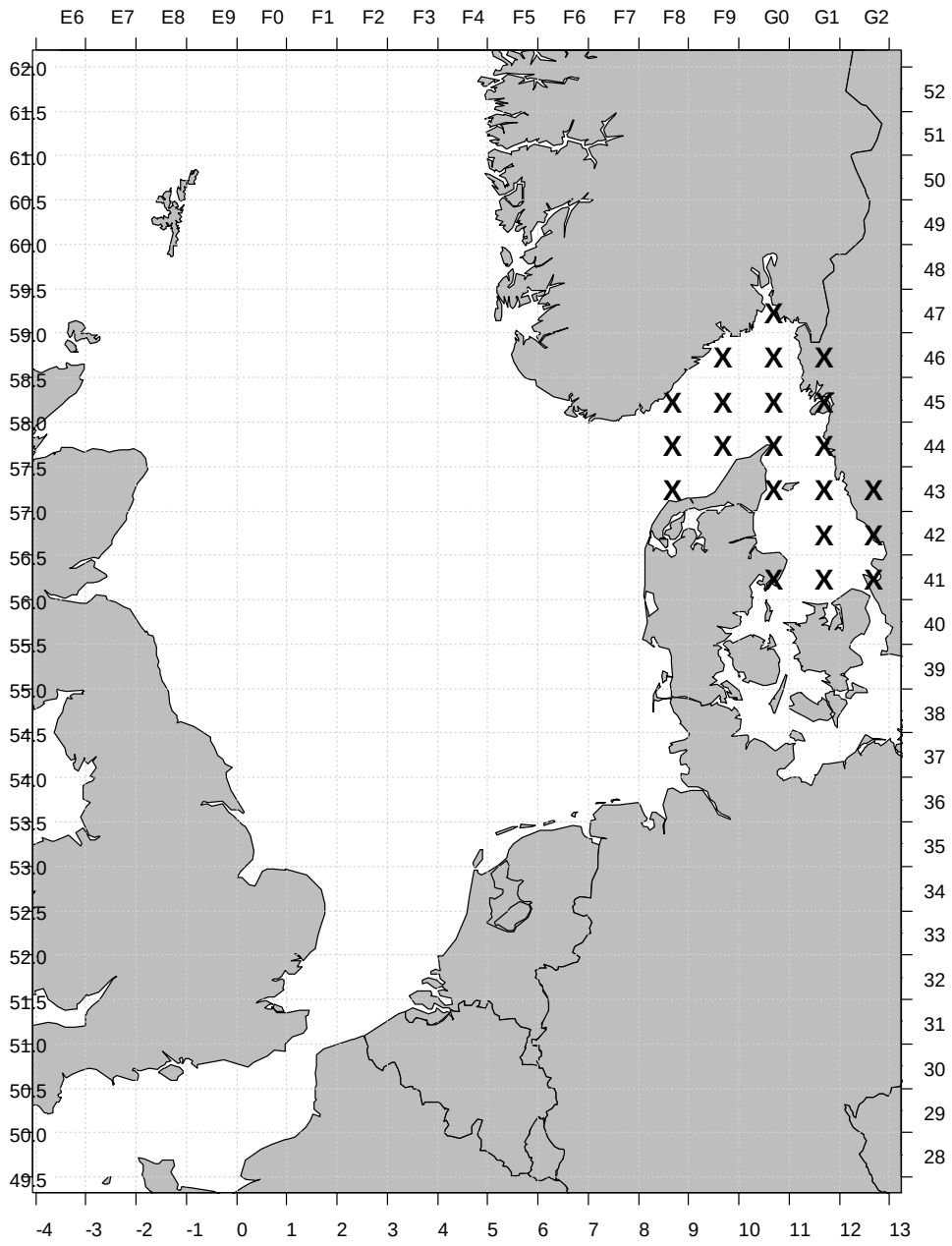


Figure A1.8. IBTS Quarter 1 Proposed Survey Grid – Sweden. Applied from 2013 Q1.

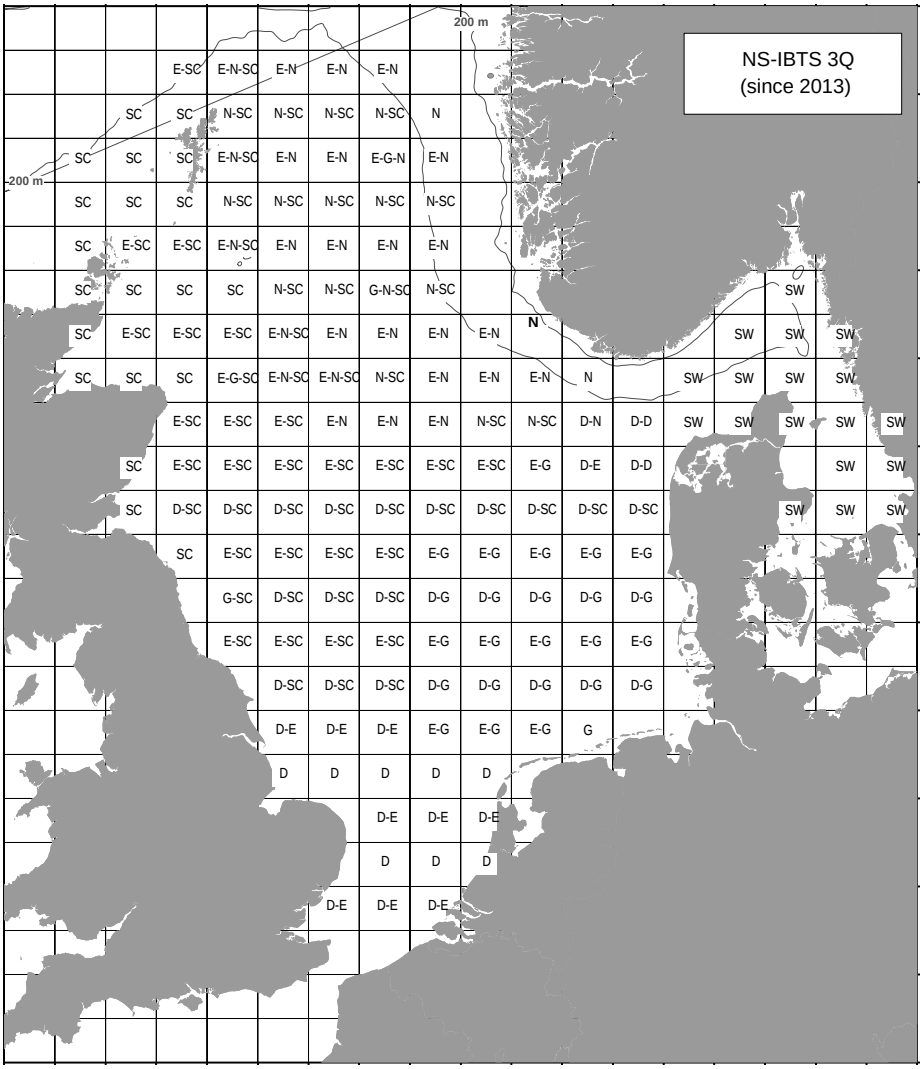


Figure A1.9. IBTS Quarter 3 Proposed Survey Grid all participants. Applied from 2013 Q3.

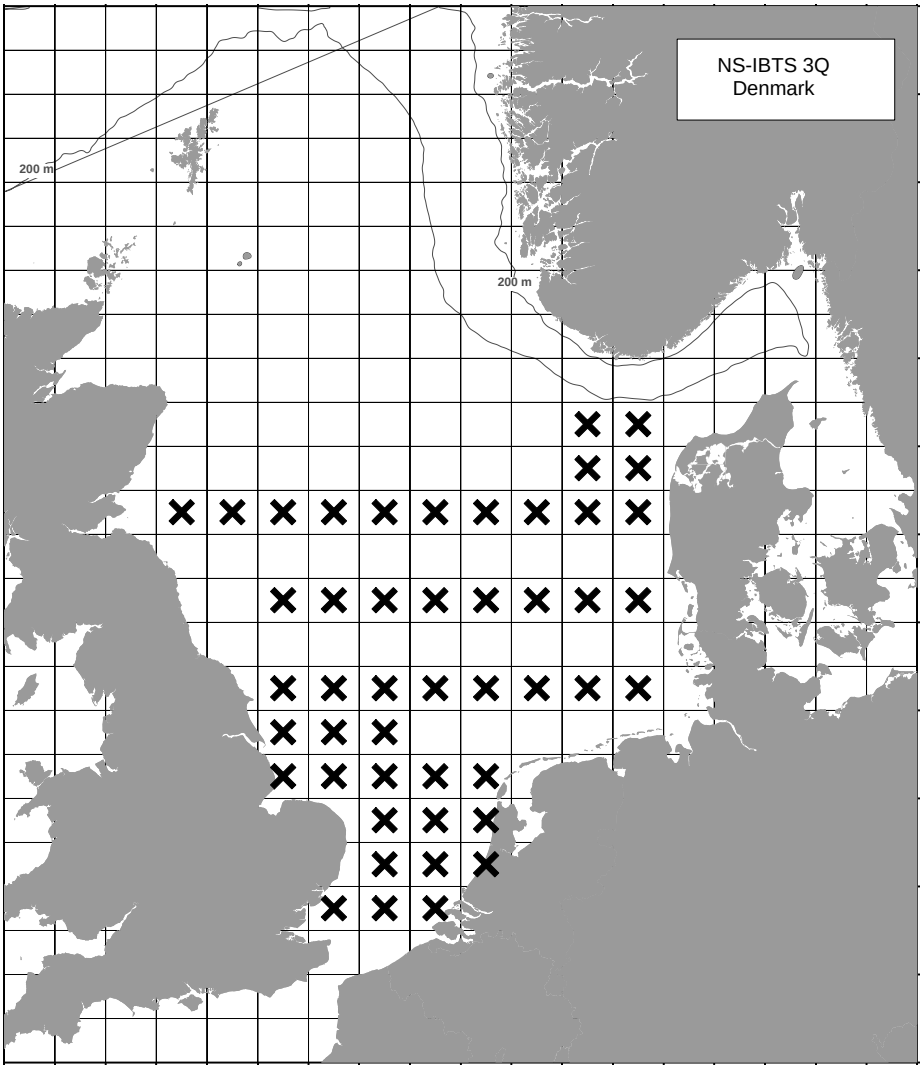


Figure A1.10. IBTS Quarter 3 Proposed Survey Grid – Denmark. Applied from 2005 Q3.

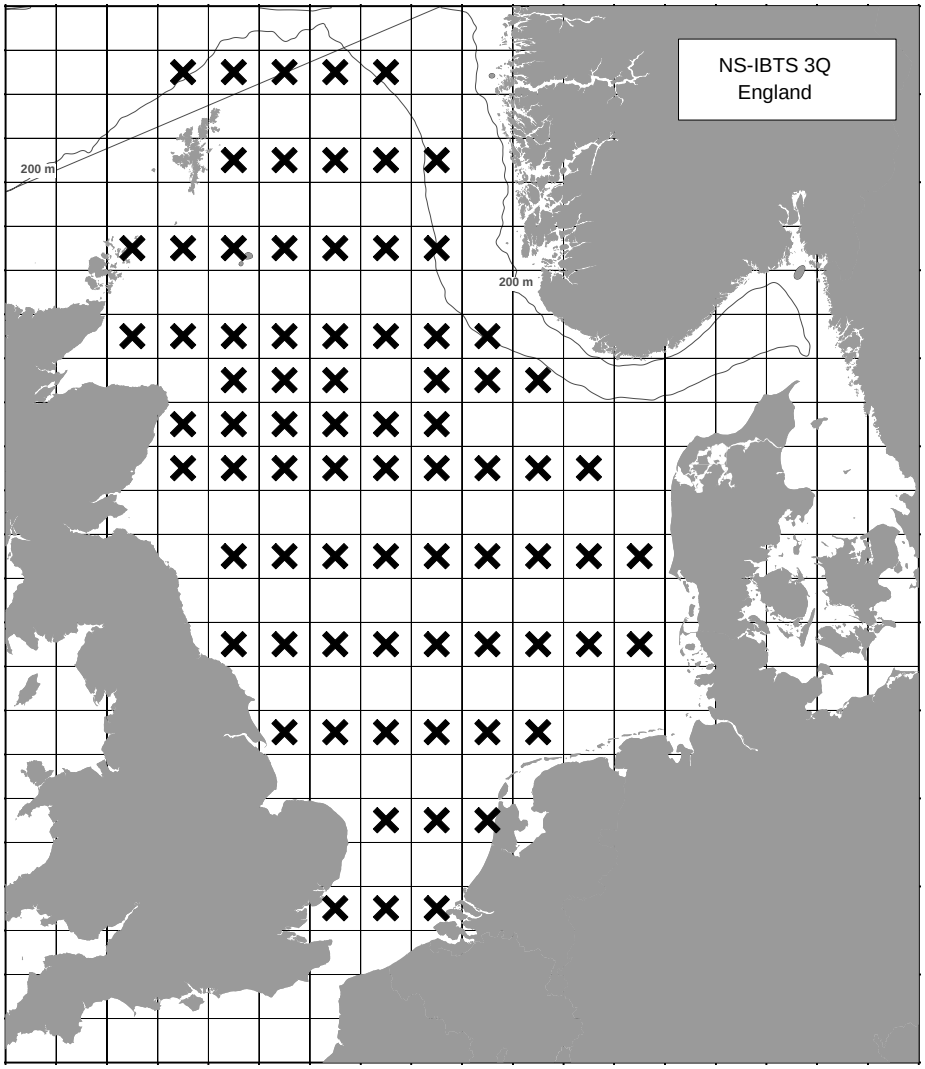


Figure A1.11. IBTS Quarter 3 Proposed Survey Grid – England. Applied from 2013 Q3.

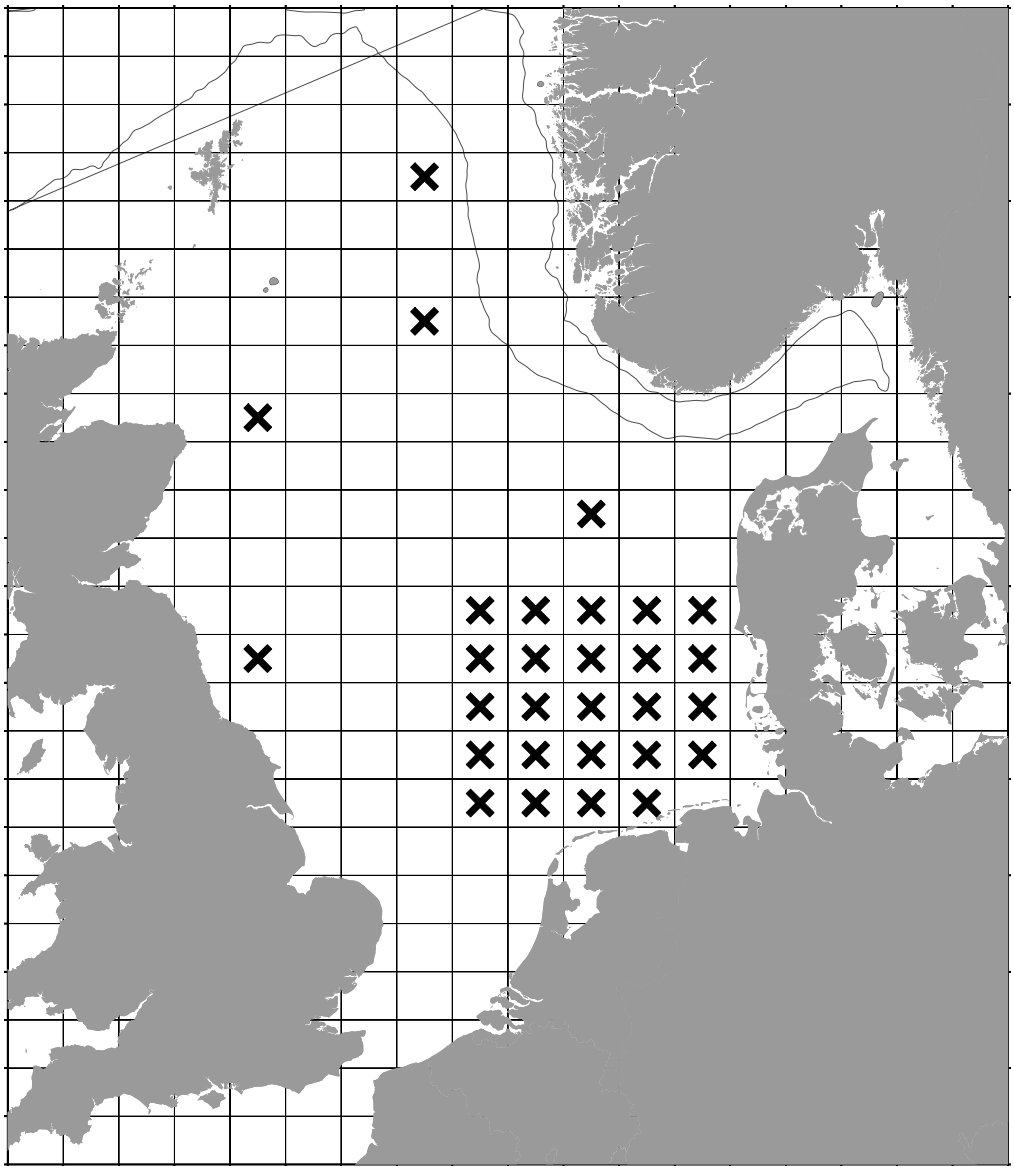


Figure A1.12. IBTS Quarter 3 Proposed Survey Grid – Germany. Applied from 2005 Q3.

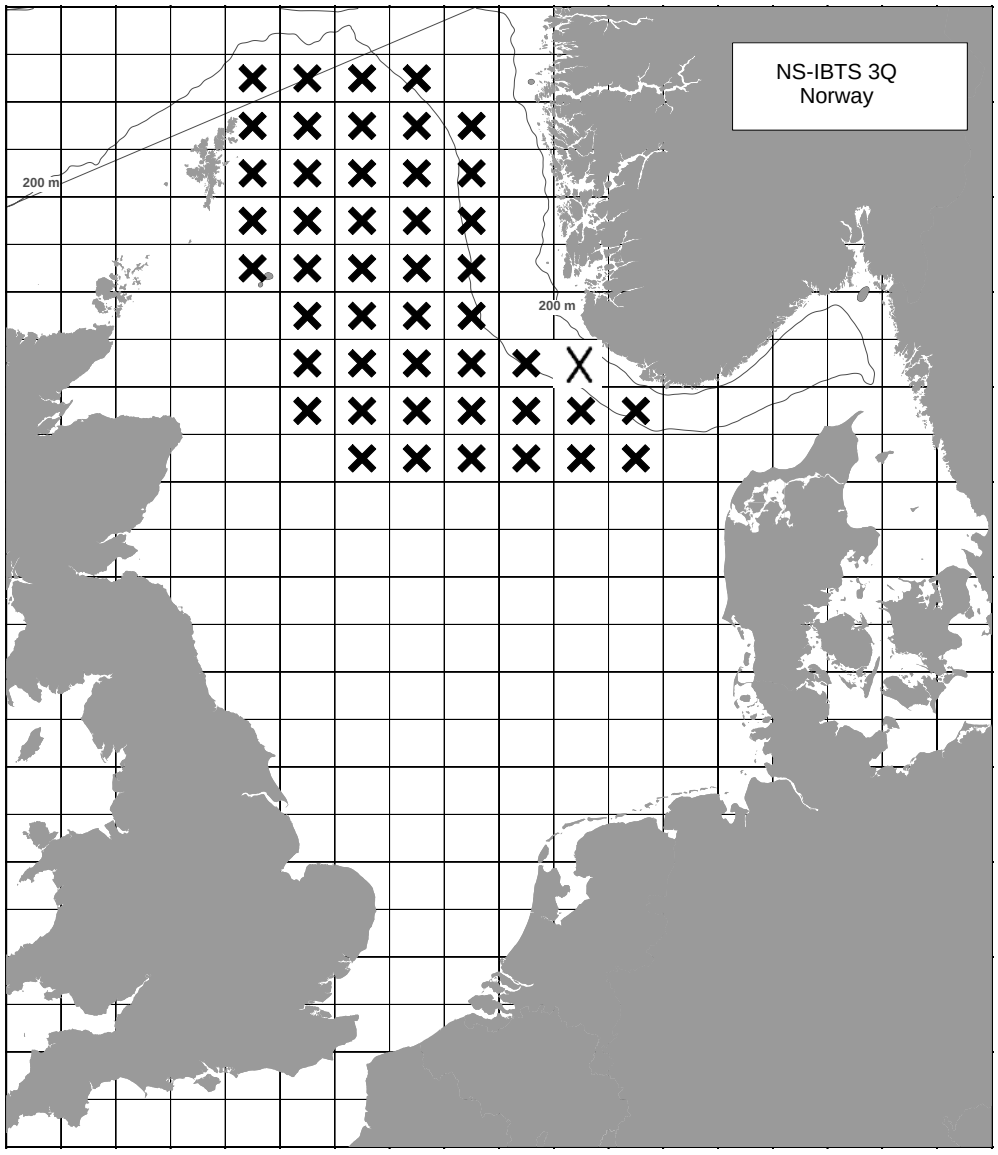


Figure A1.13. IBTS Quarter 3 Proposed Survey Grid – Norway. Applied from 2013 Q3.

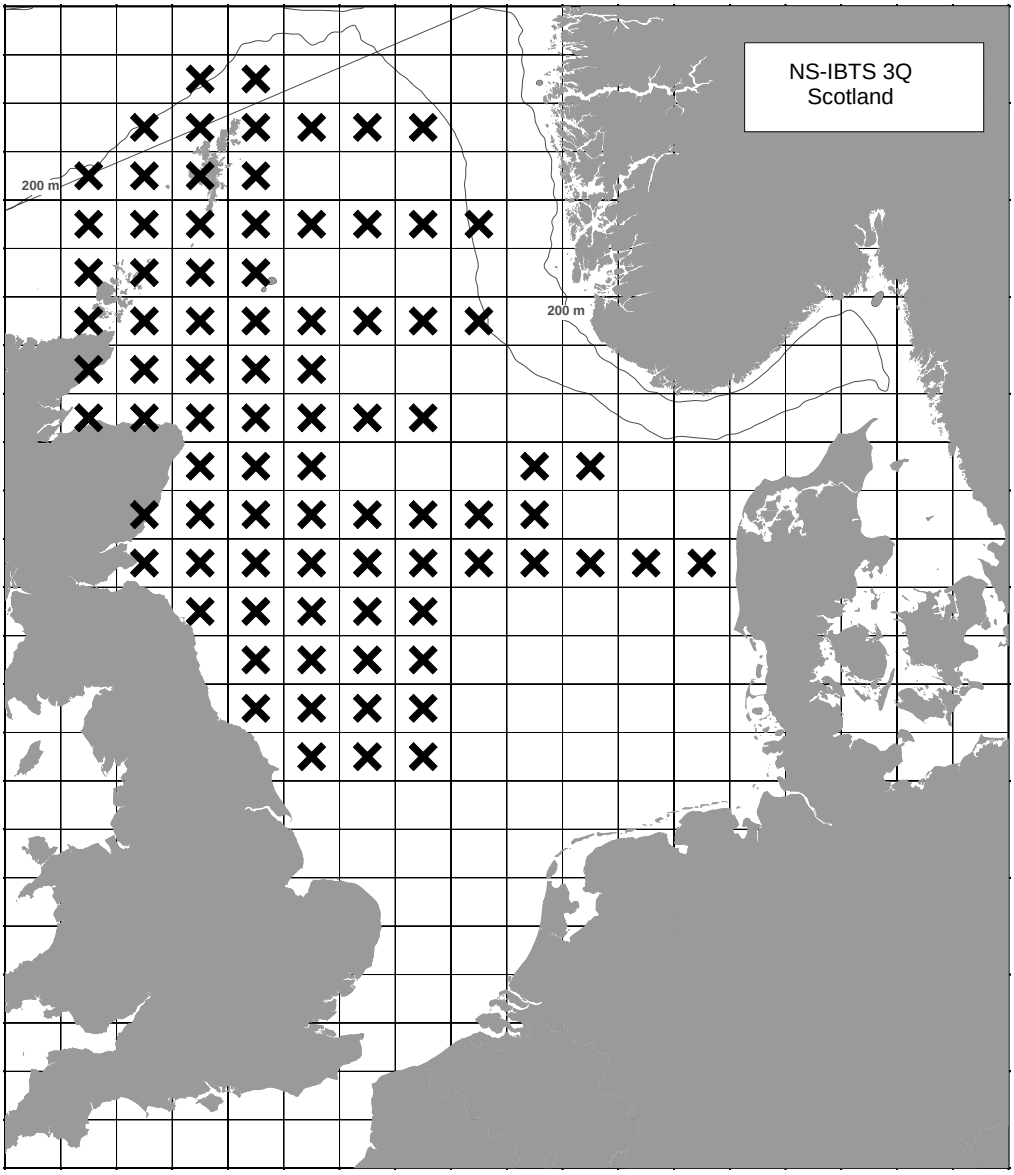


Figure A1.14. IBTS Quarter 3 2004 Proposed Survey Grid – Scotland. Applied from 2011 Q3.

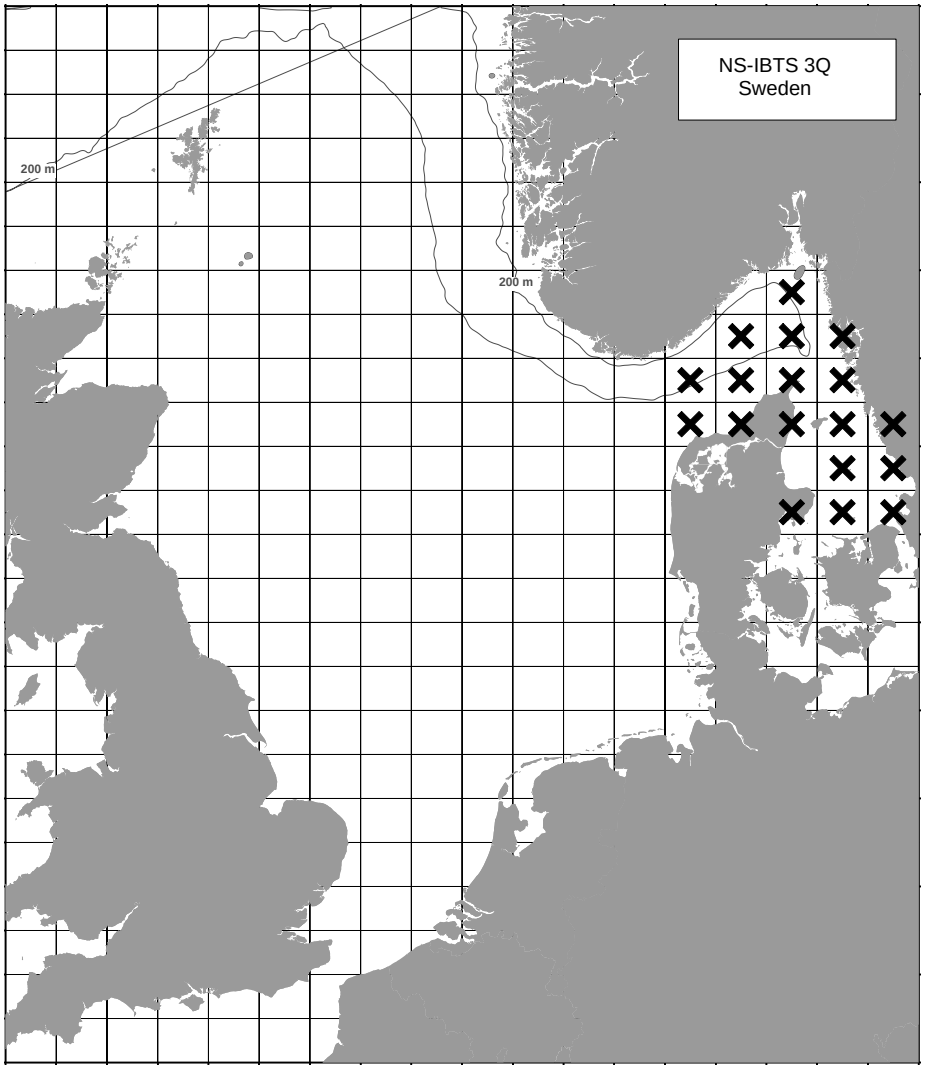


Figure A1.15. IBTS Quarter 3 2004 Proposed Survey Grid – Sweden. Applied from 2005 Q3.

Annex 2: History of the IBTSWG survey and manual

History of the survey

Objectives and procedures

The following account has been adapted from Heessen *et al.* (1997).

In the spring and autumn of the years 1960 and 1961, a series of four large international research vessel trawl surveys were organized under the auspices of ICES to map the distribution of juvenile herring *Clupea harengus* in the North Sea and to investigate the links between herring nursery grounds and the adult populations (ICES, 1963).

In the following years, most of the countries participating in the former exercise continued similar surveys. From 1966 onwards these surveys were conducted annually with the objective of obtaining annual recruitment indices for the combined North Sea herring stocks. Gradually, more countries started to participate in the survey, which was named the International Young Herring Survey (IYHS). For the first few years, sampling was restricted to the southern and central North Sea and, beginning in 1969, the Skagerrak and Kattegat.

Although the emphasis from the start of the surveys focused mainly on herring, data collected for whiting *Merlangius merlangus* were also analysed. In the course of the 1970s it was realized that the IYHS could provide recruitment indices not only for herring, but also for roundfish species such as cod *Gadus morhua*, haddock *Melanogrammus aeglefinus,* and whiting. This growing interest resulted in a northwards extension of the survey area to cover more of the known distribution of juvenile haddock in the North Sea, as well as that of Norway pout *Trisopterus esmarkii*. The whole North Sea, Skagerrak, and Kattegat have been surveyed since 1974.

In 1981, the survey was renamed the International Young Fish Survey (IYFS), the first manual was produced (ICES, 1981b), and, in 1984, the ICES 'Working Group on Young Herring Surveys' and the "Gadoid 1-Group Working Group" were combined to form the International Young Fish Survey Working Group.

In 1990, the IYFS Working Group evaluated the usefulness of a number of bottom-trawl surveys in the North Sea, Skagerrak, and Kattegat (ICES, 1990). Apart from the international IYFS, these surveys were comprised of at least seven national surveys. The IYFS WG proposed to combine the IYFS and the national surveys in Quarterly Coordinated Surveys in the North Sea, Skagerrak, and Kattegat, which were to be called the International Bottom Trawl Surveys (IBTS). It was recommended that quarterly surveys should run for a period of five years. These surveys should provide a full description of the seasonal distribution of the stocks sampled, which was considered urgently necessary for the further improvement of multispecies assessments and the development of spatially disaggregated assessment models.

This proposal resulted in a series of six years with quarterly surveys, which, with a few exceptions, covered the whole survey area in the North Sea, Skagerrak, and Kattegat (ICES, 1996). Subsequently, it has proved impossible to maintain these high levels of research vessel effort, especially as research budgets have decreased in

most countries and, from 1997, the majority of countries have only carried out a survey twice a year; a first quarter survey (January-February) and a third quarter survey (August-September).

Table A2.1 shows the timeline of significant events in the history of the IBTS and table A2.2 shows the history of the how the surveys have been carried out.

Having evolved from a herring survey, where only pelagic data were collected, the IBTS survey dataset is now made up of data collected on all finfish species. However, this current level of sampling has evolved gradually. In the manual revision VI, sampling was defined by two groups, 'standard' and 'closed bycatch'. Because all participants now sample all finfish species in one way or another, these have not been defined in this revision.

Coverage of the whole survey area was almost complete for every quarter of the years 1991–1996. In quarters 2 and 4 in 1997, however, the total effort was at a much lower level and limited to the contributions of a few nations. Since 1997, the surveys have been conducted in quarters 1 and 3, only.

In 2006, the French began to carry out additional tows in the Eastern English Channel in quarter 1 as part of the standard IBTS survey. This proved successful and, from 2007, the RV 'Thalassa' carried out 8 GOV trawls and 20 MIK stations. During the IBTSWG in 2009, Roundfish Area 10 was created to cover these new stations fished by France and the Netherlands.

Since the beginning of the century, a number of countries have noted that the gear parameter tables within the historic North Sea IBTS survey manuals had been difficult to adhere to when trawling. Between 2007 and 2010, an analysis was carried out to assess whether new tables or a new definition of the standard parameters for towing were needed. Ultimately during the 2010 working group, it was decided that the standard tow would be re-defined with achievable gear parameters. In this revision of the manual, the old warp out to headline height and doorspread plots have been removed and replaced with plots of headline height and door spread corresponding to depth, which should be used as a guide for optimum gear geometry (Figure 2.7). It should be noted that Norway has not been able to achieve gear parameters within these limits, but their gear performance is considered normal for their gear.

History of the survey gear

Before the IBTS was coordinated fully, many survey gears were used. In 1960, the Netherlands used a Dutch Herring Trawl. Germany started a survey in the North Sea in 1966 and used a Herring Trawl. In 1967, UK (England) and UK (Scotland) joined and used the Dutch herring Trawl. By 1969, three differently rigged Dutch Herring trawls and one Herring Trawl were being used in the North Sea to carry out the herring surveys. As the surveys moved away from concentrating on just herring, there was a move away from the herring trawls to a more multipurpose gear. In 1976, six different survey gears were being used by eight different nations. Then, in 1978, one multipurpose gear began to be used by more nations and, by 1983, all nations participating in the quarter 1 IYFS were using the GOV 36/47, albeit with slightly different rigging configurations of the sweep lengths. Since then, the GOV

has been the recommended standard gear of the IBTS and by 1992, the GOV was used in all quarters of the IBTS.

Survey design

The stratification of the survey grid has always been based on ICES statistical rectangles of roughly 30 x 30 nautical miles (one degree longitude x 0.5 degree latitude). Each rectangle is usually fished by the ships of two different countries, so that at least two hauls are typically taken per rectangle. Only Sweden, fishing in the Skagerrak and Kattegat, sample their area as a single country, trawling more than once in every rectangle.

The design of the quarter 1 survey has gradually changed over the years. In 1974, the survey was still very much a herring survey (ICES, 1974). In that year, the IYHS WG decided to use three strata, which depended on the amount of herring caught in previous years and was, in total, 214 hauls. After some years, this design was dropped and for several years, four hauls per rectangle were made in the southeastern North Sea (between 50°30' and 57°N, and 4° and 8°E), the most important area for juvenile herring, while the remaining survey area was sampled with two hauls per rectangle. At the beginning of 1991, part of the research vessel effort from quarter 1 was shifted to the other quarters and, from that year, the target was to have at least two hauls per rectangle over the whole survey area.

The allocation of stations to IBTS participants has changed slightly over the years. The latest major reallocation occurred in 1991, but, since then, the survey has tried to keep at least one vessel in every subarea in which it had fished in the most recent years. The current quarter 1 allocation of the different nations is shown in Figure A1.1 to A1.8, while the quarter 3 surveys are in Figures A1.9 to A1.15. For a more detailed history of stations sampled by country, data can be downloaded from the ICES Data Centre DATRAS database and plotted by country and year.

For the quarter 2 and 4 surveys, three different grids were introduced (ICES, 1990): the 'coarse' grid, based on the English Groundfish Surveys, which covers half of the rectangles in the North Sea; the 'complementary coarse grid', which covers the half not completed by England; and a grid that consists of all the neighbouring rectangles in a certain area (as used, for example, in the Scottish Groundfish Surveys). The idea was that at least four vessels should participate in every quarter: one vessel should fish the coarse grid, one the complementary coarse grid, one all the rectangles in the southern half of the North Sea, and one in the Northern half. In this way, all rectangles would be fished twice by two different vessels. Only the quarter 3 surveys have had this coverage since 1997.

Initially, one-hour trawl tows were made, but in 1976, some participants changed to 30-minute tows. This change was, in part, due to the gadoid outburst, which contributed to increased catches, to allow nations the opportunity to carry out more hauls in a day, and to reduce gear damage. Following this cut in towing time, a recommendation was made at the IYHS- and Gadoid I-Group working groups in 1977 and all countries (with the exception of Scotland) reduced the standard haul duration in 1978to 30 minutes. Scotland continued to make one-hour hauls until 1998, when they changed to a new vessel and standardized tows to 30 minutes.

Fishing is usually limited to daylight hours, i.e. from 15 min before sunrise to 15 min after sunset, but countries that initially did not participate in the sampling of herring larvae in the 1st quarter fished at night until 1999. Nations initially sampled roundfish and herring otoliths according to the statistical rectangle allocation in Figures A2.1 and A2.2.

Table A2.1. Chronology of the International Bottom Trawl Survey (Overview)

1960–1961	Spring and autumn trawl surveys to map distribution of herring
1966	International Young Herring Survey (IYHS): Annual surveys in the southern and central North Sea established to obtain recruitment indices for the combined North Sea herring stocks.
1969	Skagerrak and Kattegat included in survey area
1970s	Several different survey trawls being used by various institutes carrying out surveys in the North Sea, Skagerrak and Kattegat; e.g. the Dutch Herring Trawl, GOV, Herring Trawl
1974	Northern North Sea included in survey area to collect data for gadoids
1975	Recommendation for participants in IYHS to use Isaacs–Kidd midwater net to fish for herring larvae at night
1976	Some nations start to fish 30-minute tows in order to reduce gear damage and increase numbers of hauls per day
1977	IYHS Working Group and Gadoid I-Group Working Group recommend that all participants change to ½ hour tow duration. Working groups also recommend that, from 1978, the GOV trawl be the standard gear for future surveys. At least 4 countries were to use this gear in 1978, with other participants changing over to the GOV at the earliest possible time.
1981	Survey was renamed the International Young Fish Survey (IYFS)
1983	All Quarter 1 participants use standard GOV.
1984	ICES 'Working Group on Young Herring Surveys' and the 'Gadoid 1-Group Working Group' were combined to form the International Young Fish Survey (IYFS) Working Group.
1990	IYFS WG proposed to combine the IYFS and other national surveys into Quarterly Coordinated Surveys in the North Sea, Skagerrak and Kattegat, which were to be called the International Bottom Trawl Surveys (IBTS).
1991–1996	Quarterly surveys undertaken
1992	All participating countries now using GOV as standard survey gear for all quarters.
1997	National financial constraints reduce coordinated surveys to quarter 1 and quarter 3 with target coverage of 2 hauls per ICES rectangle per survey.
2001	Western Areas IBTS coordinated surveys first manual produced.
2008	France extend Q1 survey area into the Eastern English Channel.
2009	Norway unable to participate in Q3 IBTS. Eastern English Channel area cover by France recognized as new Roundfish Area (RFA) 10.
2011	Start of regular collection of marine litter data from GOV trawl
2013	Minor reallocation of rectangles between Norway, Scotland and Germany.

Table A2.2. History of the North Sea IBTS surveys (Overview).

Year(s)		Frequency	Region	Fishing gear used	Pelagic gear (larvae)	Tow duration	Survey name	ICES WG	Reference
From	to					[min]			
1960	1961	twice annually							ICES (1963) - ICES 1963. International Young Herring Surveys. Report of Working Group meeting in IJmuiden, 26–27 March, 1963. ICES CM 1963/Herring Committee:101
1965	1968	annually	Southern/ central North Sea			60	International Young Herring Survey	WG on Young Herring Surveys	
1969		annually	Southern/ central North Sea, Skagerrak, Kattegat			60			
1974		annually	Entire North Sea, Skagerrak, Kattegat	various		60			
1975		annually			MIK as standard for larvae	60			
1976		annually				30 (some) / 60			
1977		annually		GOV recommended as standard		30 (all except one country) / 60			ICES. 1977. Report of the Working Group on North Sea Young Herring Surveys. ICES CM 1977/H:11
1978		annually		GOV used by 4 vessels		30 (all except one country) / 60			
1981		annually				30 (all except one country) / 60	International Young Fish Survey (IYFS)	WG on Young Herring Surveys; Gadoid 1-Group WG	
1983	current			GOV used by all nations		30 (all except one country) / 60			
1984		annually				30 (all except one country) / 60		IYFS WG	
1991	1996	quarterly				30 (all except one country) / 60	International Bottom Trawl Survey (IBTS)		ICES CM 1990/H:3, ICES CM 1996/H:01

Year(s)		Frequency	Region	Fishing gear used	Pelagic gear (larvae)	Tow duration	Survey name	ICES WG	Reference
From	to					[min]			
1997	1998	twice annually				30 (all except one country) / 60			Heessen, H.J.L., J. Dalskov and R.M. Cook (1997). The International Bottom Trawl Survey in the North Sea, the Skagerrak and Kattegat. ICES CM 1997/Y:31
1999	current	twice annually				30			

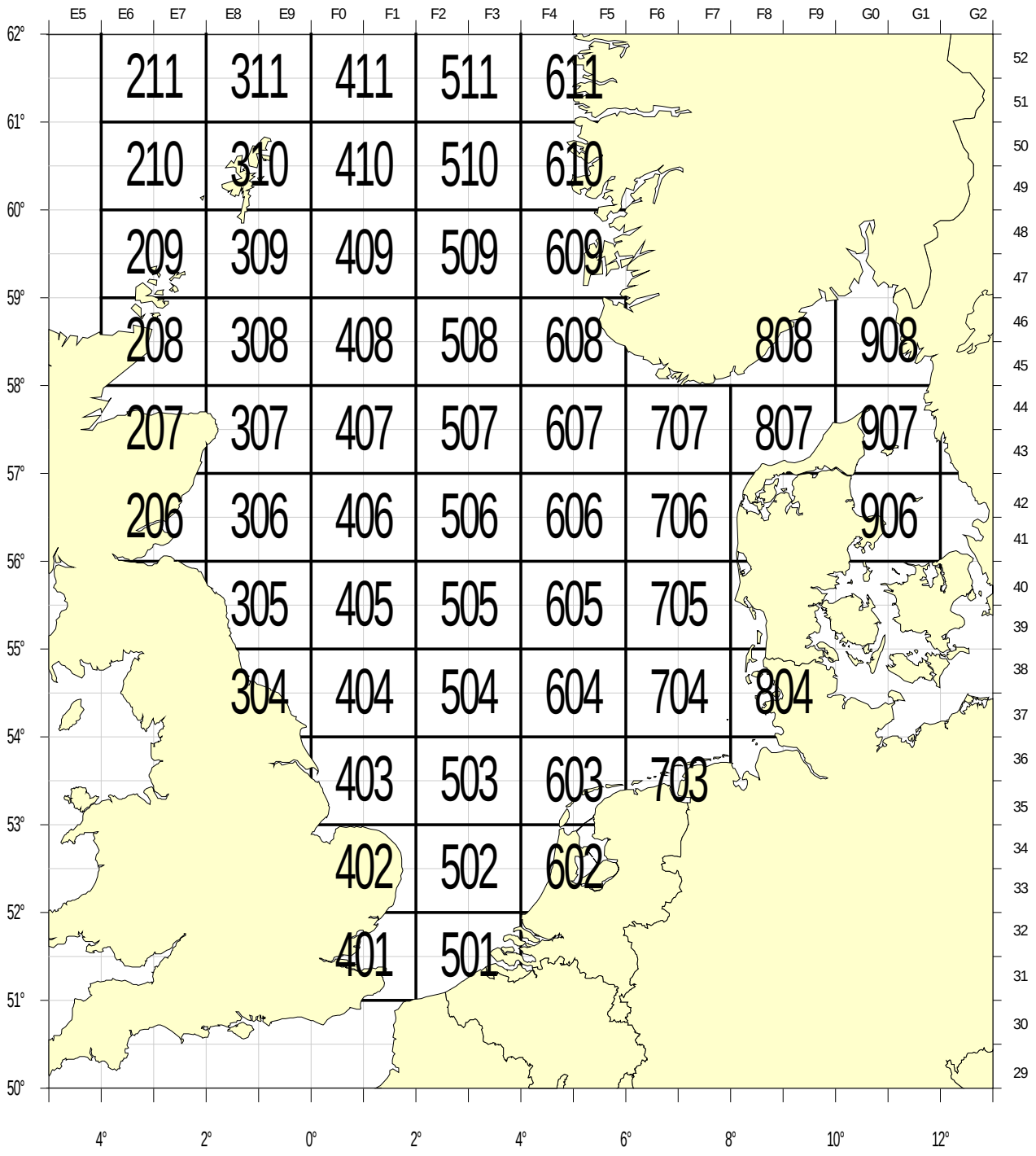


Figure A2.1. Otolith sampling areas for herring, from the beginning of the survey through 1982, and for roundfish through 1979.

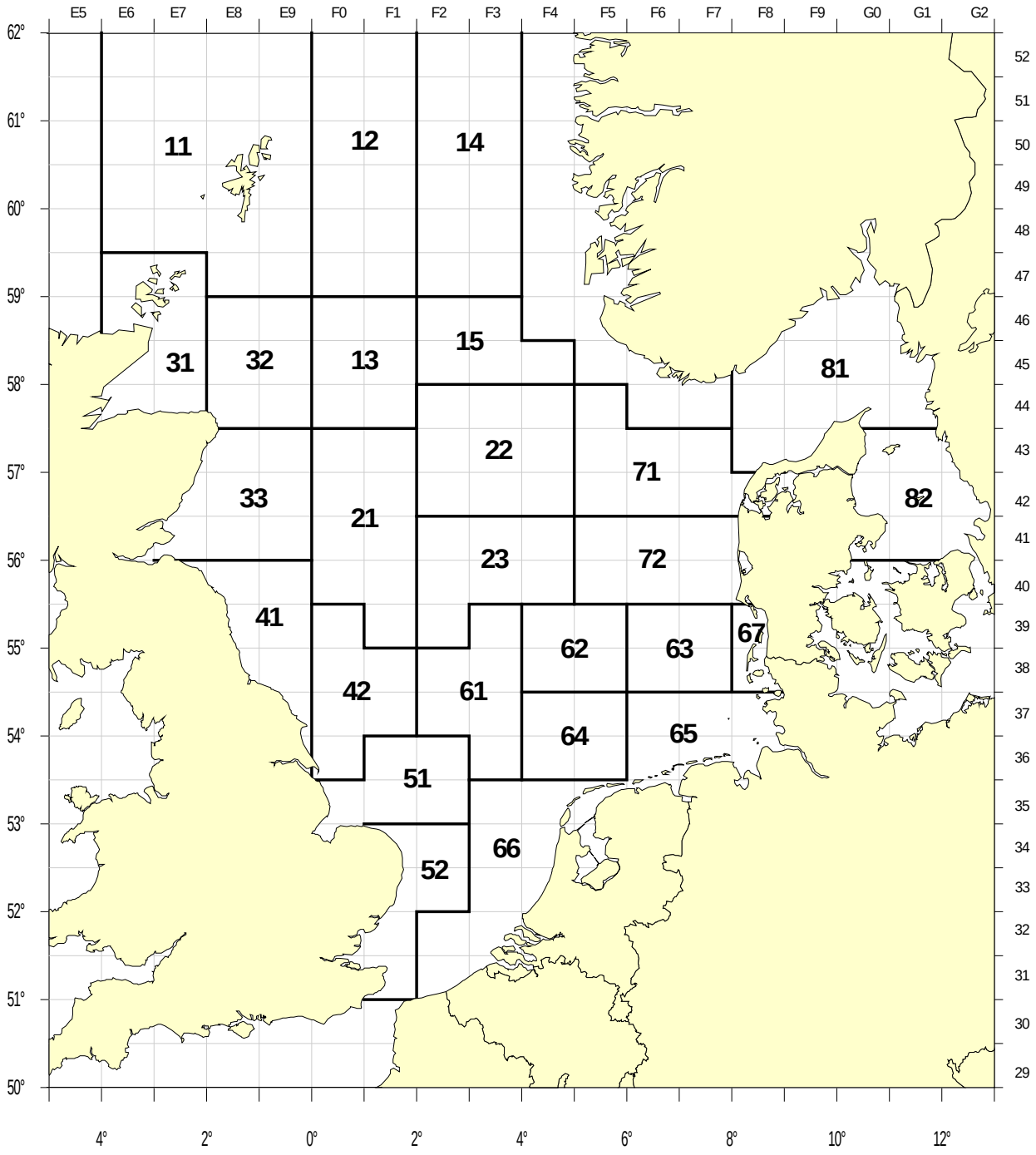


Figure A2.2. Herring Sampling Areas: used for the period 1983–1990.

History of the survey manual

The International Bottom Trawl Survey Working Group, formerly known as the International Young Fish Survey Working Group, has the responsibility of coordinating various research vessel surveys conducted within certain ICES areas. The first survey to be coordinated was the International Young Fish Survey (IYFS), which was conducted in the North Sea and Skagerrak/Kattegat in February of each year, starting in the late 1960s. A procedural manual was produced for the use of scientists involved in this survey. In 1991, this cooperative programme was expanded to include the three other quarter surveys in the North Sea and Skagerrak/Kattegat. This necessitated major alterations to the manual. The revised edition was published as ICES CM 1992/H:3. Table A2.3 shows the history of the North Sea manual, revised as international cooperation developed.

During the Annual Science Conference in 1994 in St John's, Newfoundland, the recommendation was made that the International Bottom Trawl Survey Working Group should also incorporate the coordination of bottom-trawl surveys in ICES Sub-Areas VI, VII, VIII, and Division IXa (these areas are designated as the western and southern areas).

In 1995, the manual was revised for a fifth time to clarify certain aspects of the surveys in the North Sea and Skagerrak/Kattegat. At the same time, the opportunity was taken to review the manual, to establish whether the same procedures could be applied to Sub-Areas VI, VII, VIII, and Division IXa. Some aspects of the manual applied equally to all areas, but other procedures required dedicated text. At the same time, it was decided that a manual for the western and southern areas required further discussion and input from countries closely associated with these areas. Consequently, procedures unique to the western and southern areas were provided in Annex XI of the fifth revision as a draft awaiting approval by all participants.

At the IBTS Working Group meeting in 1999 (Lisbon 7–10 April), it was apparent that a single manual covering such an extensive area was inappropriate. As corrections and amendments were outstanding for the North Sea IBTS Manual, the opportunity was taken to revise the document (the sixth revision).

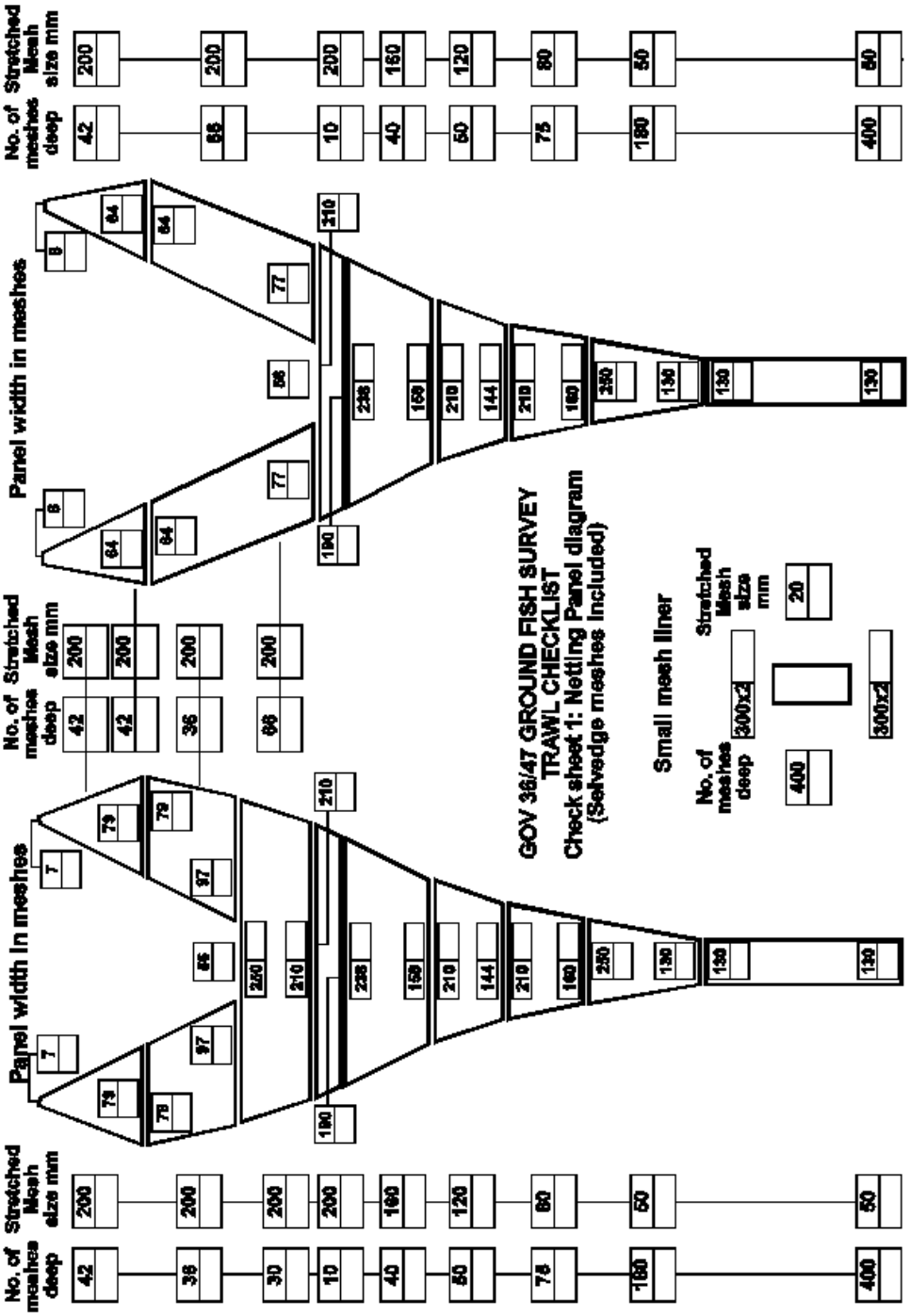
A separate manual for the western and southern waters was originally produced for the IBTS meeting in Dublin in 2002, but was updated in 2010 and is now separately available. Also during 2002, other major revisions were required to the North Sea manual (the seventh revision) and these were completed in 2004.

In 2012, the procedure for deploying the MIK net was removed from the IBTS manual and a new MIK-dedicated manual was produced. This is available from the ICES website.

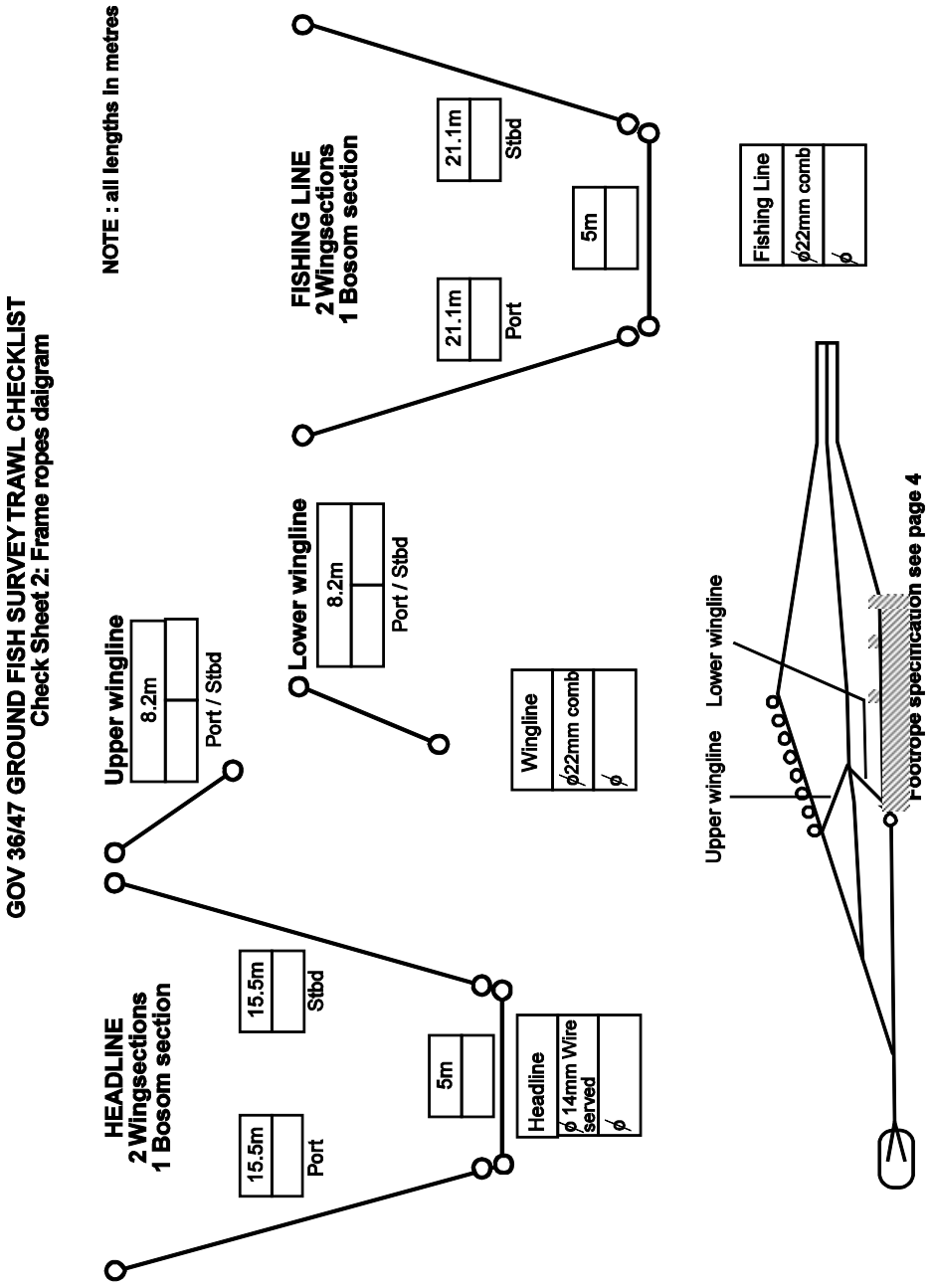
Table A2.3. History of North Sea Survey Manuals revisions.

YEAR OF PUBLICATION	VERSION	SURVEY NAME	REFERENCE
1978	I	North Sea Young Fish Surveys	Manual for the ICES North Sea Young Fish Surveys, 1. edition. A. Corten (Ref. #/ citation unknown)
1981	II	International Young Fish Survey (IYFS)	Manual for the International Young Fish Surveys in the North Sea, Skagerrak and Kattegat. ICES CM 1981/H:9
1986	III	IYFS	Manual of the International Young Fish Survey in the North Sea, Skagerrak and Kattegat, 3rd revision. ICES CM 1986/H:2
1992	IV	IBTS	Manual for the International Bottom Trawl Surveys. Revision IV, Addendum to ICES CM 1992/H: 3
1996	V	IBTS	Manual for the International Bottom Trawl Surveys. Revision V, Addendum to ICES CM 1996/H:1
1999	VI	IBTS	Manual for the International Bottom Trawl Surveys. Revision VI, ICES CM 1999/D:2
2004	VII	IBTS	Manual for the International Bottom Trawl Surveys. Revision VII, ICES CM 2006/RMC:03
2010	VIII	IBTS	ICES. 2012b. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp.
2012	VIII	IBTS	ICES. 2012b. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp.
2012	VIII	IBTS	ICES. 2012b. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp. ICES. 2012c. Manual for the Midwater Ring Net sampling during IBTS Q1. Revision 1. 16 p.
2013	VIII	IBTS	ICES. 2013. Manual for the Midwater Ring Net sampling during IBTS Q1. Series of ICES Survey Protocols. SISP 2-MIK 2. 18 pp.

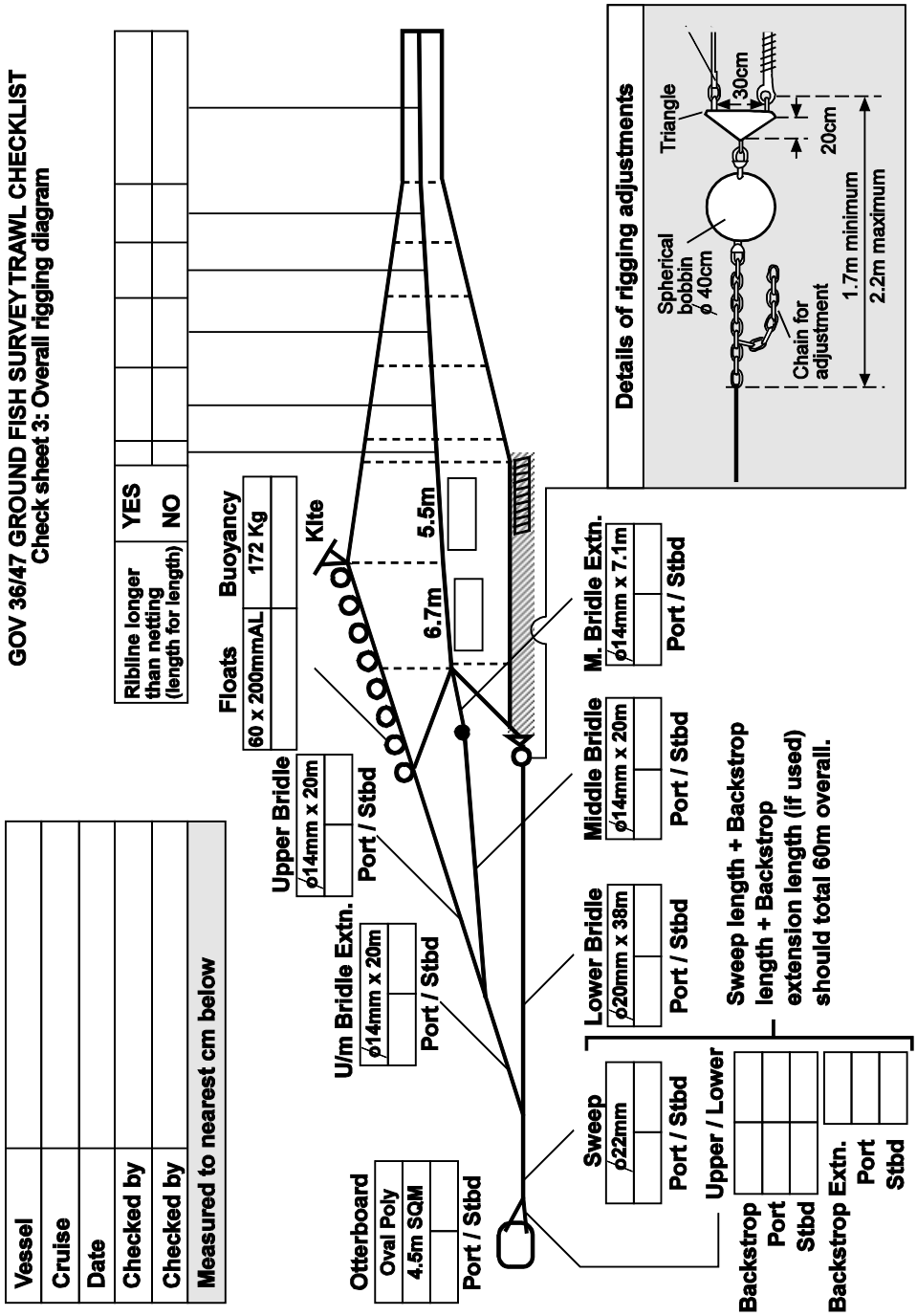
Annex 3: IBTS standard gear check sheet 1



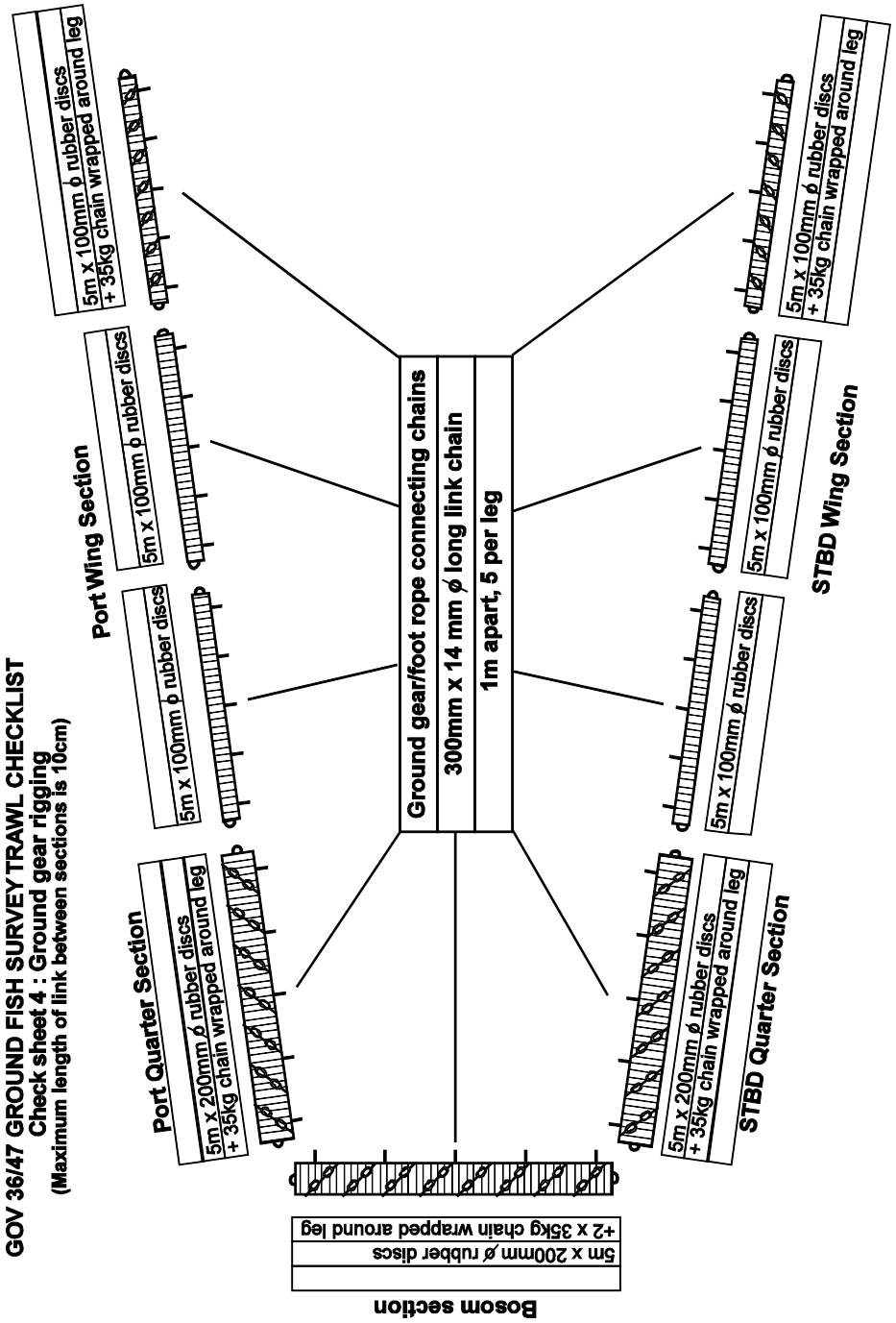
Annex 4: IBTS standard gear check sheet 2



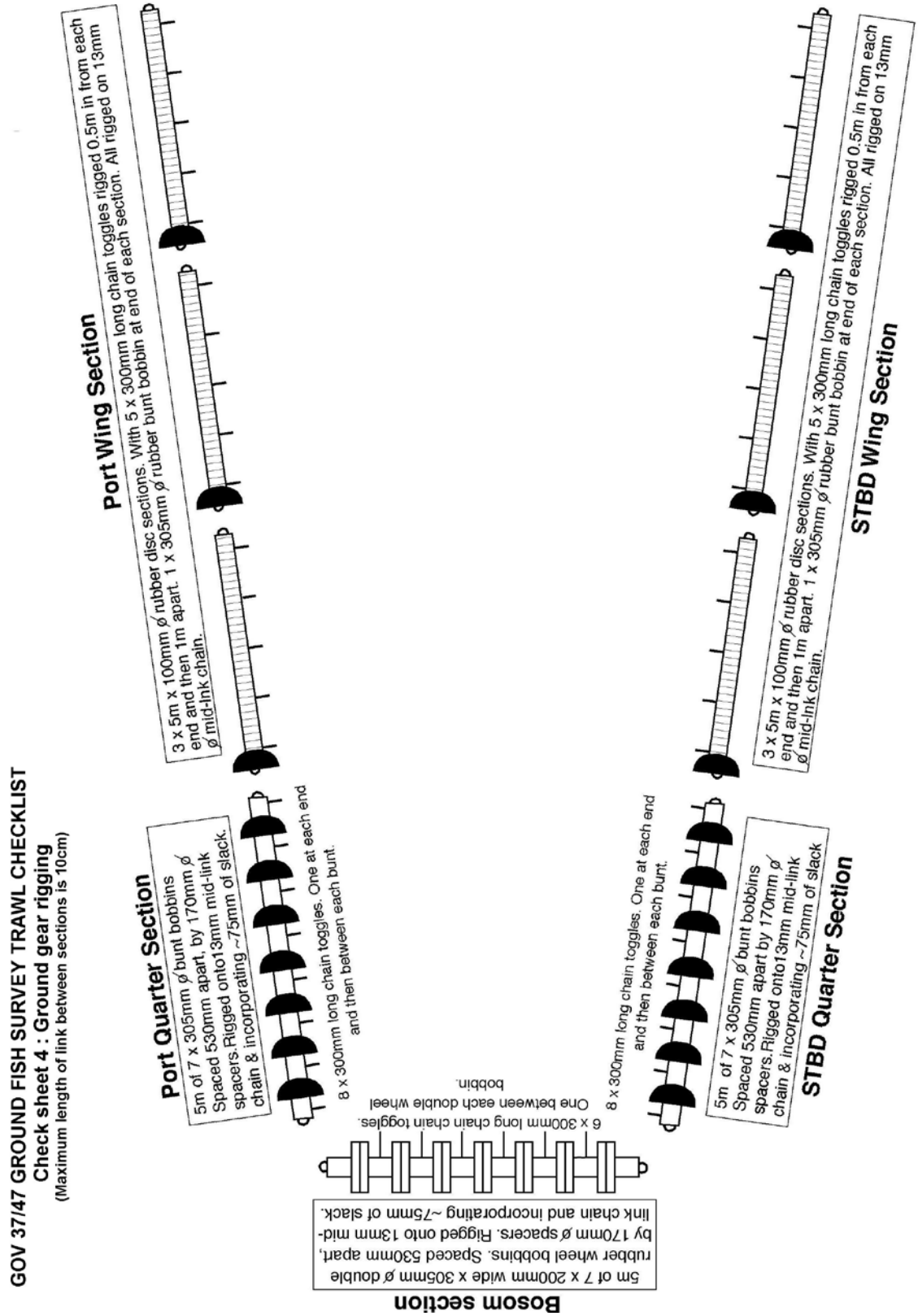
Annex 5: IBTS standard gear check sheet 3



Annex 6a: IBTS standard gear check sheet 4 – Groundgear A



Annex 6b: IBTS standard gear check sheet 4 – Groundgear B



Annex 7: Summary of catch processing per nation during North Sea Q1 IBTS

		Denmark	France	Germany	Netherlands	Norway	Sweden	UK(Scot)
Staffing	number available for catch processing	5	8/10	6	4	4	7/8	6
Hauls	Average number per day	3/4	4	3/4	4/5	3	4	4/5
Catch	retention in hopper or bin	y	y	y	y	y	y	y
	codend cleaned	y	y	y	y	y	y	y
	net cleaned	y	y	n	n	y	n	y
	cleanings added to catch	y	y	y	p	y	y	y
Sorting	'deckmaster' in charge	y	y	y	y	y	y	y
	sorting facility - **b**ench or conveyor	c	c	c	c	c	c	b
	complete sort upto approximate weight (kg)	300	600	1200	1200	n/a [1]	300	n/a [1]
	small fish mixture sub sorting	y	y	y	y	y	y	y
	part of the catch discarded unprocessed	n	n	n	n	n	n	n
Categories	by sex (1)	y	y	y	y	y [2]	y	y
	by size large or small	y	y	y	y	y	y	y
	by size multi modal	y	n	n	y	y	y	n
Sub sample	re-mix before selection	y	y	y	y	y	n	n
	selection random	y	y	y	y	y	y	y
Weighing	all catch components	y	y	y	n	y	y	y
	all sub samples	y	y	y	y	y	y	y
Measuring	all fish species (2)	y	y	y	y	y	y	y
	minimum sample size	75	100	100	50	100, 50 [3]	50	150
	commercial benthos	y	c	y	c	y	y	y
	cephalopods	y	c	y	c	y	y	y
	other benthos - **w**eigh, count, **o**bserve	n	c	o	c	w,c	o	n
Biological sampling	prescribed species (3)	y	y	y	y	y	y	y
	other species (4)	y	y	y	n	y	y	y
	weight	y	y	y	y	y	y	y
	sex	y	y	y	y	y	y	y
	maturity	y	y	y	y	y	y	y
	age material	y	y	y	y	y	y	y
	ageing - at sea or ashore	a	a	a	a	s/a	a	s
Data capture	station detail - **e**lectronic or **p**aper/pencil	e/p	e	e	e/p	e	p	e
	catch detail - **e**lectronic or **p**aper/pencil	p	e	p	e	e	p	e
	length detail - **e**lectronic or **p**aper/pencil	p	p	p	e	e	p	e
	biological detail - **e**lectronic or **p**aper/pencil	p	p	p	p	e	p	e
	error checking	y	y	y	y	y	y	y
	back up	y	y	y	y	y	y	y

		Denmark	France	Germany	Netherlands	Norway	Sweden	UK(Scot)
(1) Categories by sex	plaice	n	n	y	n	n	n	n
	dab	n	n	y	n	n	n	n
	elasmobranchs	y	y	y	y	y	y	y
(2) Measuring 0.5cm	herring	y	y	y	y	y	y	y
	sprat	y	y	y	y	y	y	y
	pilchard	n	y	y	n	n [4]	n	n
	anchovy	n	y	y	n	n	n	n
(2) Measuring mm	commercial benthos	y	y	y	n	y	y	n
(3) Prescribed species	cod	y	y	y	y	y	y	y
	haddock	y	y	y	y	y	y	y
	whiting	y	y	y	y	y	y	y
	saithe	y	y	y	y	y	y	y
	Norway pout	y	y	y	y	y	y	y
	herring	y	y	y	y	y	y	y
	sprat	y	y	y	y	y	y	y
	mackerel	y	y	y	y	y	y	y
	plaice	y	y	y	y	n	y	n
(4) Other species	dab	y	y	n	n	n	n	n
	brill	y	y	y	n	n [4]	n	n
	turbot	y	y	y	n	n	n	n
	lemon sole	y	y	y	n	n	n	n
	anglers	y	n	y	n	n	n	y
	elasmobranchs					n	y	
		n	y	n	n	n	n	n

Legend

y =	Yes
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

[1] No limit. Entire catch sorted and subsamples taken where necessary

[2] Elasmobranchs and Nephrops, as well as other shellfish according to the manual

[3] 100 for main species, for which biological data are taken; 50 otherwise

[4] Species does not occur in Norwegian catches

Annex 8: Summary of catch processing per nation during North Sea Q3 IBTS

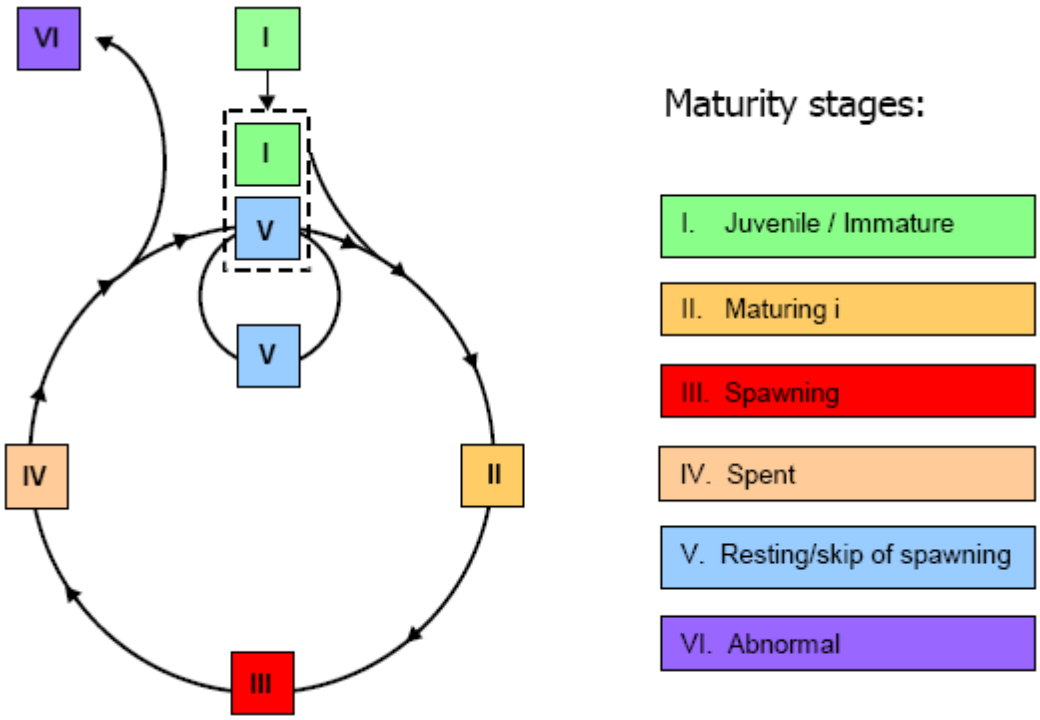
		Denmark	Germany	Norway	Sweden	UK(Eng)	UK(Scot)
Staffing	number available for catch processing	5	6	6	7/8	6/7	6
Hauls	Average number per day	3/4	4	4	4/5	3/4	4/5
Catch	retention in hopper or bin	y	y	y	y	y	y
	codend cleaned	y	y	y	y	y	y
	net cleaned	y	n	y	n	y	y
	cleanings added to catch	y	y	y	y	y	y
Sorting	'deckmaster' in charge	y	y	y	y	y	y
	sorting facility - **b**ench or **c**onveyor	c	c	b	c	b	b
	complete sort upto approximate weight (kg)	300	1200	n/a [1]	300	1200	n/a [1]
	small fish mixture sub sorting	y	y	y	y	y	y
	part of the catch discarded unprocessed	n	n	n	n	n	n
Categories	by sex (1)	y [2]	y	y [2]	y	y	y
	by size large or small	y	y	y	y	y	y
	by size multi modal	y	y	y	y	y	n
Sub sample	re-mix before selection	y	y	y	y	y	n
	selection random	y	y	y	y	y	y
Weighing	all catch components	y	y	y	y	y	y
	all sub samples	y	y	y	y	y	y
Measuring	all fish species (2)	y	y	y	y	y	y
	minimum sample size	75	100	100/50 [3]	50	75	150
	commercial benthos	y	y	y	y	y	n
	cephalopods	y	y	y	y	n	y
	other benthos - **w**eigh, **c**ount, **o**bserve	n	o	o,w,c	o	o	n
Biological sampling	prescribed species (3)	y	y	y	y	y	y
	other species (4)	y	y/n	y	y	y	y
	weight	y	y	y	y	y	y
	sex	y	y	y	y	y	y
	maturity [4]	y	y	y	y	y	y
	age material	y	y	y	y	y	y
	ageing - at sea or ashore	a	a	s/a	a	a	s
Data capture	station detail - **e**lectronic or **p**aper/pencil	e/p	e	e	p	p	e
	catch detail - **e**lectronic or **p**aper/pencil	p	p	e	p	e	e
	length detail - **e**lectronic or **p**aper/pencil	p	p	e	p	e	e
	biological detail - **e**lectronic or **p**aper/pencil	p	p	e	p	e	e
	error checking	y	y	y	y	y	y
	back up	y	y	y	y	y	y

		Denmark	Germany	Norway	Sweden	UK(Eng)	UK(Scot)
(1) Categories by sex	plaice	n	n	n	n	y	n
	dab	n	y	n	n	y	n
	elasmobranchs	y	y	y	y	y	y
(2) Measuring 0.5cm	herring	y	y	y	y	y	y
	sprat	y	y	y	y	y	y
	pilchard	n	y	n/a [5]	n	y	n
	anchovy	n	y	n	n	y	n
(2) Measuring mm	commercial benthos	y	y	y	y	y	n
(3) Prescribed species [#]	cod	y	y	y	y	y	y
	haddock	y	y	y	y	y	y
	whiting	y	y	y	y	y	y
	saithe	y	y	y	y	y	y
	Norway pout	y	y	y	y	y	y
	herring	y	y	y	y	y	y
	sprat	y	y	y	y	y	y
	mackerel	y	y	y	y	y	y
	plaice	y	y	n	y	y	n
(4) Other species	dab	n	n	n	n	y	n
	brill	y	y	n/a [5]	n	y	n
	turbot	y	y	n	n	y	n
	lemon sole	y	y	n	n	y	n
	anglers	y	y	n	n	y	y
	elasmobranchs	n	n	n	n	y	n

Legend		
	y =	Yes
	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

[1] No limit. Entire catch sorted and subsamples taken where necessary
[2] Elasmobranchs and Nephrops, as well as other shellfish according to the manual
[3] 100 for main species, for which biological data are taken; 50 otherwise
[4] In Q3, no maturity data are taken for cod, haddock, whiting, saithe, and plaice
[5] Species does not occur in Norwegian catches

Annex 9: Finfish (flatfish and roundfish) maturity key



Vector diagram showing the maturity cycle for finfish species using the new 6 stage maturity key.

The tables below give text descriptions of the stages for gadoid species, however, the differences between the flatfish species are diverse, so one table cannot describe the stages effectively. A full description of each of the stages for *Solea solea* (sole), *Pleuronectes plattessa* (plaice), *Limanda limanda* (dab), and *Platichthys flesus* (flounder) can be found on the ICES website (ICES, 2012).

Female maturity key stage descriptors for gadoid species.

Stage	Description of appearance of ovaries	Histology
1	Juvenile/Immature	
	No sex determination: juvenile below 15 cm, risk of mistaking gonads for bladder	Oogonia / PN
	Sex determination: Juvenile-transparent ovaries	PN
	Immature-translucent ovaries, coloration is pinkish to light orange, cast thin and clear. Blood vessels hardly discernible.	PN / CNR
2	Maturing: Firm, coloration ranges from reddish orange to creamy orange with granulated/oocytes clearly visible in tissue. Blood vessels larger and diversified.	CA / T
3	Spawning: Distended, few to many hydrated eggs visible in tissue among vitelogenic oocytes or in lumen, occasionally running.	FM / HYD / POF
4	Spent: Slack with greyish cast, rich in blood vessels.	POF, perhaps atresia, PN, CNR
5	Resting/Skip of spawning*: No visible development/similar to immature, but sometimes with a greyish cast.	PN, CNR, perhaps atresia
6	Abnormal*: Hard parts (connective tissue), only one lobe developed, intersex or similar, fecundity at least partially reduced.	Variable

*** Ecosystem state indicators.**

Male maturity key stage descriptors for gadoid species.

Stage	Description	Histology
1	Juvenile/Immature	
	No sex determination: juvenile below 15 cm, gonads difficult to identify	Germ cells / SG
	Sex determination: Juvenile-transparent ovaries	Germ cells / SG
	Immature-testes with developing frills, coloration is reddish to white, vascularisation is limited.	SG / SC1
2	Maturing: Whitish to almost opaque reddish-white, blood vessels more prominent, empty transparent spermatoducts.	SC1/ SC2 / ST, spermatids/non-motile flagellate SZ
3	Spawning: Opaque creamy white colour to reddish late in stage, semen visible in spermatoduct, milt often flows with light pressure.	Aligned ripe SZ proximally and in sperm duct, cyst, no lobule walls
4	Spent: Contracted, empty and flabby lobules, colour deep pink to reddish-purple, bloodshot, potentially with greyish cast.	Migrating germ cells/SG, interlobular walls thickens, atretic spermatozoa
5	Resting/Skip of spawning*: No visible development, spermatoduscts often with a greyish cast, similar to immature/early maturing.	Migrating germ cells/SG, resting cysts of SG and SC1
6	Abnormal*: Adipose tissue only one lobe developed, intersex or similar.	Variable

*** Ecosystem state indicators.**

Annex 10: Four stage maturity key for skates and rays (*Rajidae*)

STAGE	MALE	FEMALE
A	Immature: Claspers undeveloped, shorter than extreme tips of posterior margin of pelvic fin. Testes small and thread-shaped.	Immature: Ovaries small, gelatinous or granulated, but with no differentiated oocytes visible. Oviducts small and thread-shaped, width of shell gland not much greater than the width of the oviduct.
B	Maturing: Claspers longer than posterior margin of pelvic fin, their tips more structured, but the claspers are soft and flexible and the cartilaginous elements are not hardened. Testes enlarged, sperm ducts beginning to meander.	Maturing: Ovaries enlarged and with more transparent walls. Oocytes differentiated in various small sizes (<5mm). Oviducts small and thread-shaped, width of the shell gland greater than the width of the oviduct, but not hardened.
C	Mature: Claspers longer than posterior margin of pelvic fin, cartilaginous elements hardened and claspers stiff. Testes enlarged, sperm ducts meandering and tightly filled with sperm.	Mature: Ovaries large with enlarged oocytes (>5mm), with some very large, yolk-filled oocytes (ca. 10mm) also present. Uteri enlarged and wide, shell gland fully formed and hard.
D	Active: Claspers reddish and swollen, sperm present in clasper groove, or flows if pressure exerted on cloaca.	Active: Egg capsules beginning to form in shell gland and partially visible in uteri, or egg capsules fully formed and hardened and in oviducts/uteri.

Annex 11: Data sheet for collection of marine litter

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 12: Haul information

Explanations of the various field names and data types can be found on the ICES web page: 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
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

RECORD TYPE HH				
START/ORDER	FIELD NAME	WIDTH	MANDATORY	DATA TYPE
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 13: Length frequency information

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 14: Smalk

N.B. When sending information on herring in the first 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 15: Area type codes: Sampling areas and standard areas for the calculation of abundance indices

AREA TYPE CODES

0	=	ICES STATISTICAL RECTANGLES	SEE CM 1977/GEN:3.
1	=	Four Statistical Rectangles	See Figure 6.1
2	=	Standard Roundfish Areas	See Figure A2.2
3	=	Herring Sampling Areas	See Figure 6.3

NB: There has been confusion in the definition of herring areas in the past and, for some years, no ALKs were collected for areas 14, 15, and 67; in which case, these areas must be considered as subsets of 12, 13, and 63, respectively. The Skagerrak/ Kattegat areas have also not always been distinguished, in which case, the appropriate code should be 80. See Figure 6.3.

Annex 16: Length splits used to provide preliminary numbers-at-age

AGE	0-GROUP			1-GROUP			
QUARTER	2	3	4	1	2	3	4
Cod	11	18	23	25	33	38	44
Haddock	12	17	20	20	27	30	32
Whiting	9	17	20	20	23	24	26
Norway pout	-	13	14	15	15	16	20
Herring	-	15.5	17.5	20.0	21.0	23.0	24.5
Sprat	-	-	10.0	10.0	10.5	13.0	14.0
Mackerel	-	17	24	25	25	30	31
Saithe	-	22	25	25	25	33	38
Plaice	-	10	12	-	-	19	21

NB: The lengths indicated are 'less than' lengths: 0-group cod in quarter 2 are fish <11 cm.