

North Sea hydro acoustic  
herring survey  
Survey report for R/V  
"TRIDENS"  
24 June - 19 July 2013

S.M.M. Fässler and A.S. Couperus

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IMARES Wageningen UR

(IMARES - Institute for Marine Resources & Ecosystem Studies)

Client:

Ministerie van EZ  
T.a.v. Ir. D.J. van der Stelt  
Postbus 20401  
2500 EK 's-Gravenhage

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P.O. Box 68  
1970 AB IJmuiden  
Phone: +31 (0)317 48 09 00  
Fax: +31 (0)317 48 73 26  
E-Mail: [imares@wur.nl](mailto:imares@wur.nl)  
[www.imares.wur.nl](http://www.imares.wur.nl)

P.O. Box 77  
4400 AB Yerseke  
Phone: +31 (0)317 48 09 00  
Fax: +31 (0)317 48 73 59  
E-Mail: [imares@wur.nl](mailto:imares@wur.nl)  
[www.imares.wur.nl](http://www.imares.wur.nl)

P.O. Box 57  
1780 AB Den Helder  
Phone: +31 (0)317 48 09 00  
Fax: +31 (0)223 63 06 87  
E-Mail: [imares@wur.nl](mailto:imares@wur.nl)  
[www.imares.wur.nl](http://www.imares.wur.nl)

P.O. Box 167  
1790 AD Den Burg Texel  
Phone: +31 (0)317 48 09 00  
Fax: +31 (0)317 48 73 62  
E-Mail: [imares@wur.nl](mailto:imares@wur.nl)  
[www.imares.wur.nl](http://www.imares.wur.nl)

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## 1. Introduction

The Dutch Institute for Marine Resources & Ecosystem Studies (IMARES) has been participating in the international North Sea acoustic survey for herring since 1991. Participants in this survey are Scotland, Norway, Germany, Denmark, The Netherlands and Ireland. The survey is part of the EU data collection framework (DCF) and is coordinated by the Working Group for International Pelagic Surveys (WGIPS, formerly PGIPS/PGHERS). The aim of this survey is to provide an abundance estimate of the whole North Sea herring population. This estimate is used as a tuning index by the ICES Herring Assessment Working Group (HAWG) in its assessment of the population size. In this report the results are presented for the survey in the central North Sea, carried out by the Dutch vessel R/V Tridens.

### *Cruise plan*

The survey was split into two periods of 1 and 3 weeks. The first week was used for acoustic equipment calibration in a fjord in southern Norway. The executed cruise track and hydrographical positions are presented in Figures 1a and 1b. The actual surveyed transects may differ from the planned transects.

## 2. Methods

### 2.1 Scientific Staff

| Name                  | Organisation | Role                      | Wk 26 | Wk 27 | Wk 28 | Wk 29 |
|-----------------------|--------------|---------------------------|-------|-------|-------|-------|
| Sascha Fässler        | IMARES       | Cruise leader & Acoustics | x     | x     | x     | x     |
| Dirk Burggraaf        | IMARES       | Technician & Acoustics    | x     | x     | x     | x     |
| Daniel Benden         | IMARES       | ICT                       | x     |       |       |       |
| Ineke de Jonge        | Guest        |                           | x     |       |       |       |
| Bram Couperus         | IMARES       | Cruise leader & Acoustics |       | x     | x     | x     |
| Hendrik-Jan Westerink | IMARES       | Fish lab                  |       | x     | x     | x     |
| Ciaran Cronin         | Cork Ecology | Bird surveyor             |       | x     |       |       |
| Tim Sykes             | Cork Ecology | Bird surveyor             |       | x     | x     |       |

### 2.2 Narrative

The first week of the whole 4 week survey period was used for calibration of the acoustic equipment in a sheltered location in south-eastern Norway. Tridens departed from Scheveningen on Monday 24 June and steamed up north-east towards the proposed calibration location in the bay of Kristiansand, Norway. Arrival in Kristiansand was in the evening on Tuesday 25th June. Calibration of the acoustic equipment took place during the whole day on 26th June and was completed before the vessel departed again with the pilot on board at 20:00 UTC. Conditions at the calibration site were very favourable and good calibration results could be achieved. ETA in Scheveningen was on Friday 28th June at 02:00 UTC. Tridens left Scheveningen again the following Monday to execute the survey.

The survey continued according the planned transects till Wednesday 17 July. Arrival in Scheveningen on Thursday 18 July at 13:30 UTC, one day ahead of schedule due to the perfect weather conditions and good performance of the scientific acoustic equipment. Unfortunately we were not able to fish on high concentrations of herring (sprat?) schools on the last transect, when the ETA was set and the net trawl was already cleaned and out of operation. The text table below summarizes the departures and arrivals at the ports.

| From         | Date       | Time (UTC) | To           | Date       | Time (UTC) |
|--------------|------------|------------|--------------|------------|------------|
| Scheveningen | 24-06-2013 | 10:00      | Scheveningen | 28-06-2013 | 10:00      |
| Scheveningen | 1-07-2013  | 13:00      | Aberdeen     | 6-07-2013  | 18:00      |
| Aberdeen     | 8-7-2013   | 6:00       | Newcastle    | 13-07-2013 | 22:00      |
| Newcastle    | 15-07-2013 | 10:00      | Scheveningen | 18-07-2013 | 13:30      |

Since 2010, cruise leaders keep a weblog during the survey, which can be found at:  
<http://herringsurvey.blogspot.nl>

## 2.3 Deviations from the cruiseplan

Tridens arrived one day earlier than planned in the port of Scheveningen due to the nice weather conditions and lack of hampering due to damage of the equipment.

## 2.4 Survey Design

The actual survey was carried out from 1<sup>st</sup> July to 17<sup>th</sup> July 2013, covering an area east of Great Britain from latitude 54°25' to 58°24' North and from longitude 3° West (off the Scottish/English coast) to 6° East between 55°30' and 56°30' North. Following the survey design since 2005, a stratified survey design with random start was applied. Parallel transects along latitudinal lines were used with spacing set at 15 or 30 nmi, depending on expected herring distribution from previous years. Acoustic data from transects running north-south close to the shore (that is parallel to the depth isoclines) were excluded from the dataset. The actual cruise track, trawl - and hydrographical station positions is presented in Figure 1.

## 2.5 Calibration of acoustic equipment

The calibration of the three transducers (38, 120, and 200 kHz) mounted in the towed body was executed in Kristiansand Bay. Conditions allowed for an optimal and good calibration of the frequencies. For logistic reasons the 333 kHz was not calibrated, but calibration results from the previous year applied instead. Transducer settings of the 38 kHz used for echo-integration during the survey are given in Table 1.

## 2.6 Acoustic data collection

### *Data collection*

A Simrad 38 kHz split beam transducer was operated in a towed body (type "Shark") 5-6 m under the water surface. Acoustic data were collected with a Simrad EK60 scientific echo sounder and post-processed with the LSSS software to produce acoustic area densities (NASC) at 1 nautical mile intervals. The settings of the EK60 are listed in Table 1. The EK60 received the vessel speed from the ship's GPS. An average survey speed of 10.0 knots was used.

All echoes were recorded with a threshold of -70dB up to a depth of 150 meters below the transducer. A ping rate of 0.6 sec was used during the entire survey. This ping rate has proven most suitable at the depths of 50 - 150 m observed in most of the area covered.

**NOTE:** As in previous years, electric noise was an issue at the higher frequencies used. The noise mask recordings and present significant problems for multi-frequency data analysis. A solution to this problem would be the use of an acoustic drop keel (presently unavailable on Tridens) to allow a more permanent setup of the acoustic equipment and a shorter cable length.

## 2.7 Biological data collection

### *Fishing*

The acoustic recordings were verified by fishing with a 2000 mesh pelagic trawl with 20 mm meshes in the cod-end. Fishing was carried out to identify species-composition of major recordings observed on the echo sounder and to obtain biological samples of herring and sprat. In general, after it was decided to make a tow with a pelagic trawl, the vessel turned and fished back on its track line. If the recordings showed schools, a Simrad SD570 sonar was used in order to track schools that were swimming away from the track line. In all hauls, the footrope was very close to the ground with vertical net openings varying from 20 to 30 m (specifications are listed in the PGHERS manual).

A Furuno FS20/25 trawl sonar (vertical and horizontal scan direction) was used to monitor catch performance.

### *Comments*

Fishing in shallow and rocky areas is an issue. At present it is sometimes not possible to collect samples, i.e. in the Moray Firth area. For next year we propose to take a bottom trawl with us in addition to the pelagic 2000M net. The GOV net is a suitable net for this purpose. It could be rolled off one of the two net-winchs before departure.

During this survey it was often very difficult to fish on the target schools. The main reason is that it is not possible with the omnidirectional sonar currently installed on board Tridens to track the schools reliably after the vessel turns to shoot the net. This affects the quality of the survey and makes collection of representative biological samples more difficult. The current sonar is a high frequency sonar with a short range (< 1 Nm). Additionally, this sonar (dating back 1997) is outdated and there are currently more updated and sophisticated scientific sonars on the market. In addition to the recommended installation of an acoustic drop keel, we recommend to replace the current sonar for a low frequency sonar which has the typical feature of a longer range (3-4 Nm), for example the scientific sonar 'Simrad SX90'.

#### *Biological samples*

For all fish:

- Total weight of the catch, split up by species
- 150 to 250 specimens for individual length measurement. Depending on the catch weight, a subsample technique is used, based on weights.
- Stratified samples of 5 fish per length class were taken from the 150-250 herring and sprat. The following parameters are sampled from these fish:
  - Age of herring and sprat, by means of otolith reading
  - Gender
  - Maturity stage

Sample ID's used: 2013.5400521 – 2011.5400542

## **2.8 Hydrographical data**

Hydrographical data were collected at 47 stations, all at fixed locations (Figure 1b). A Seabird CTD device, type SBE 9plus. It had been successfully calibrated in advance by the manufacturer. Conductivity, temperature and depth were measured.

## **2.9 Data handling, analysis and presentation**

#### *Data analysis*

The echograms were scrutinized with Large Scale Survey System (LSSS) software.

For each ICES rectangle, species composition and length distribution were determined as the un-weighted mean of all trawl results for this rectangle. From these distributions the mean acoustic backscattering cross-section "sigma" ( $\sigma_{bs}$ ) was calculated according to the target strength-length relationships (TS) recommended by the ICES Working Group on International Pelagic Surveys.

The numbers of herring and sprat per ICES rectangle were calculated by dividing the NASC within each rectangle by the overall  $\sigma_{bs}$  in the corresponding rectangle.

The biological samples used for stock structure and biomass calculations were grouped in 4 strata for herring and 2 strata for sprat, based on similar length frequency distribution in the area (Figure 2a & 2b). The numbers per year/maturity class were calculated, based on the age/length key for each stratum. For each separate stratum the mean weight per year/maturity class was then calculated.

### 3. Results

#### 3.1 Acoustic data results

Largest herring concentrations were found in the northern part of the Dutch survey area and close to the Devil's Holes (rectangle with highest concentration: 41E9) (Figure 3a). Sprat was found primarily close to the coast in the southern part of the survey area (rectangle with highest concentration: 38E9) (Figure 3b). Unlike in 2010, amounts of observed aggregations of Norway pout in the survey area were insignificant.

#### 3.2 Trawl data results

In total, 22 trawl hauls were conducted. Herring was found in 15 hauls in which all more than 20 herring samples were taken. Sprat was found in 4 hauls, however only 2 of them (hauls 15 and 22) contained enough samples (>20) to be deemed representative for analyses. The trawl list is presented in Table 2a, the catch weights per haul and species are presented in Table 2b and the length frequency proportions used in the analysis for herring are presented in Table 2c. Norway pout was observed in 9 trawls but generally in insignificant amounts. The biological samples contained a total of 908 herring and 62 sprat that were collected and used for length, age, weight, sex and maturity keys.

#### 3.3 Stock estimates

The stock biomass estimate of **herring** found in the Tridens survey area:

|                |       |                 |
|----------------|-------|-----------------|
| Immature       | 77.8  | thousand tonnes |
| Spawning stock | 624.5 | thousand tonnes |

The stock biomass estimate of **sprat** found in the Tridens survey area:

|                |      |                 |
|----------------|------|-----------------|
| Immature       | 0.0  | thousand tonnes |
| Spawning stock | 16.9 | thousand tonnes |

The total estimated biomass of herring in the survey area covered by R/V Tridens was about 5% lower than in the previous year, when the contribution of immature herring was much higher at 336.4 thousand tonnes. The biomass of mature fish in 2013 was about 55% higher compared to 2012. The most likely explanation for this is that mature herring in the international survey area had a more southern distribution than in previous years.

The total biomass of sprat observed was about 8x less than the amount observed in the previous year (132.1 thousand tonnes) in the Tridens survey area. Observed levels are comparable to those seen in 2011. No immature fish were observed in the Tridens survey area this year.

Figure 4 shows the estimated numbers and biomass of herring by ICES rectangle in the area surveyed by R/V Tridens. Table 3 summarizes stock estimates per stratum and Tables 4 and 5 summarise the sub stock estimates for herring and sprat.

#### 3.4 Equipment damage

No damage of any significance occurred.



Table 1. Simrad EK60 calibration settings used on the 2013 North Sea herring acoustic survey on R/V Tridens.

```
# Calibration Version 2.1.0.12
#
# Date: 26-6-2013
#
# Comments:
#
# Reference Target:
# TS -42.30 dB Min. Distance 9.60 m
# TS Deviation 5.0 dB Max. Distance 13.70 m
#
# Transducer: ES38B Serial No. 38
# Frequency 38000 Hz Beamtype Split
# Gain 26.00 dB Two Way Beam Angle -20.6 dB
# Athw. Angle Sens. 21.90 Along. Angle Sens. 21.90
# Athw. Beam Angle 6.86 deg Along. Beam Angle 6.50 deg
# Athw. Offset Angle 0.00 deg Along. Offset Angle -0.18 deg
# SaCorrection 0.00 dB Depth 0.00 m
#
# Transceiver: GPT 38 kHz 009072017a3b 2-1 ES38B
# Pulse Duration 0.512 ms Sample Interval 0.096 m
# Power 2000 W Receiver Bandwidth 3.28 kHz
#
# Sounder Type:
# EK60 Version 2.2.0
#
# TS Detection:
# Min. Value -50.0 dB Min. Spacing 100 %
# Max. Beam Comp. 6.0 dB Min. Echolength 30 %
# Max. Phase Dev. 10.0 Max. Echolength 230 %
#
# Environment:
# Absorption Coeff. 7.3 dB/km Sound Velocity 1500.7 m/s
#
# Beam Model results:
# Transducer Gain = 25.25 dB SaCorrection = -0.63 dB
# Athw. Beam Angle = 7.21 deg Along. Beam Angle = 7.11 deg
# Athw. Offset Angle = -0.05 deg Along. Offset Angle = -0.02 deg
#
# Data deviation from beam model:
# RMS = 0.24 dB
# Max = 0.90 dB No. = 189 Athw. = 2.3 deg Along = 3.8 deg
# Min = -1.26 dB No. = 254 Athw. = 3.7 deg Along = 2.0 deg
#
# Data deviation from polynomial model:
# RMS = 0.23 dB
# Max = 0.84 dB No. = 189 Athw. = 2.3 deg Along = 3.8 deg
# Min = -1.43 dB No. = 254 Athw. = 3.7 deg Along = 2.0 deg
```

Table 2a. Details of the trawl hauls taken on R/V Tridens during the North Sea herring acoustic survey 2013.

| haul nr | day | month | year | hour | minute | haul duration | lat   | lon   | depth | wind direction | wind force | gear          |
|---------|-----|-------|------|------|--------|---------------|-------|-------|-------|----------------|------------|---------------|
| 1       | 2   | 7     | 2013 | 16   | 59     | 24            | 58.24 | 1.27  | 102   | 23             | 7          | pelagic trawl |
| 2       | 3   | 7     | 2013 | 3    | 7      | 41            | 58.23 | 0.18  | 119   | 158            | 7          | pelagic trawl |
| 3       | 3   | 7     | 2013 | 7    | 42     | 21            | 58.23 | -0.3  | 132   | 203            | 2          | pelagic trawl |
| 4       | 3   | 7     | 2013 | 12   | 1      | 47            | 58.23 | -1.3  | 132   | 203            | 2          | pelagic trawl |
| 5       | 4   | 7     | 2013 | 5    | 35     | 46            | 58.12 | -1.36 | 76    | 180            | 9          | pelagic trawl |
| 6       | 4   | 7     | 2013 | 10   | 3      | 56            | 58.12 | -0.47 | 76    | 180            | 9          | pelagic trawl |
| 7       | 5   | 7     | 2013 | 6    | 21     | 32            | 57.54 | 0.56  | 130   | 270            | 4          | pelagic trawl |
| 8       | 5   | 7     | 2013 | 19   | 27     | 69            | 57.55 | -2.07 | 77    | 180            | 1          | pelagic trawl |
| 9       | 6   | 7     | 2013 | 7    | 41     | 32            | 57.51 | -3    | 80    | 135            | 4          | pelagic trawl |
| 10      | 8   | 7     | 2013 | 8    | 7      | 48            | 57.25 | -0.58 | 66    | 203            | 2          | pelagic trawl |
| 11      | 8   | 7     | 2013 | 12   | 58     | 40            | 57.24 | -0.01 | 66    | 23             | 2          | pelagic trawl |
| 12      | 8   | 7     | 2013 | 17   | 18     | 27            | 57.25 | 0.49  | 86    | 23             | 2          | pelagic trawl |
| 13      | 9   | 7     | 2013 | 7    | 10     | 39            | 56.55 | 1.33  | 93    | 158            | 2          | pelagic trawl |
| 14      | 9   | 7     | 2013 | 18   | 11     | 35            | 56.55 | -1.18 | 62    | 158            | 2          | pelagic trawl |
| 15      | 10  | 7     | 2013 | 4    | 53     | 60            | 56.24 | -2.05 | 60    | 158            | 7          | pelagic trawl |
| 16      | 10  | 7     | 2013 | 12   | 36     | 98            | 56.25 | -0.15 | 74    | 359            | 1          | pelagic trawl |
| 17      | 13  | 7     | 2013 | 5    | 47     | 117           | 55.54 | -0.55 | 69    | 338            | 2          | pelagic trawl |
| 18      | 15  | 7     | 2013 | 14   | 25     | 37            | 55.25 | -0.45 | 90    | 359            | 1          | pelagic trawl |
| 19      | 16  | 7     | 2013 | 5    | 40     | 77            | 55.24 | 1.28  | 74    | 248            | 2          | pelagic trawl |
| 20      | 16  | 7     | 2013 | 16   | 41     | 72            | 54.54 | 0.2   | 74    | 359            | 1          | pelagic trawl |
| 21      | 17  | 7     | 2013 | 4    | 16     | 37            | 54.54 | -0.36 | 60    | 359            | 1          | pelagic trawl |
| 22      | 17  | 7     | 2013 | 8    | 7      | 35            | 54.47 | -0.47 | 60    | 359            | 1          | pelagic trawl |

Table 2b. Trawl catches in kg on R/V Tridens during the North Sea herring acoustic survey 2013.

| haul no | date      | time UTC | latitude(N) | longitude | E/W | depth meters | duration min. | herring | N. pout | other gadoids | mackerel | sprat | others |
|---------|-----------|----------|-------------|-----------|-----|--------------|---------------|---------|---------|---------------|----------|-------|--------|
| 1       | 02-Jul-13 | 16.59    | 58.24       | 001.27    | E   | 102          | 24            | 152     | 12      | 1             |          |       |        |
| 2       | 03-Jul-13 | 03.07    | 58.23       | 000.18    | E   | 119          | 41            | 2487    | 13      | 2             | 0        |       |        |
| 3       | 03-Jul-13 | 07.42    | 58.23       | 000.30    | W   | 132          | 21            | 3700    |         | 8             | 4        |       |        |
| 4       | 03-Jul-13 | 12.01    | 58.23       | 001.30    | W   | 132          | 47            | 9586    | 173     | 393           | 849      |       |        |
| 5       | 04-Jul-13 | 05.35    | 58.12       | 001.36    | W   | 76           | 46            | 127     | 0       | 12            |          |       | 2      |
| 6       | 04-Jul-13 | 10.03    | 58.12       | 000.47    | W   | 76           | 56            | 7991    | 0       | 3             | 10       |       | 1      |
| 7       | 05-Jul-13 | 06.21    | 57.54       | 000.56    | E   | 130          | 32            | 185     | 18      | 3             | 0        |       |        |
| 8       | 05-Jul-13 | 19.27    | 57.55       | 002.07    | W   | 77           | 69            |         |         |               | 3        |       |        |
| 9       | 06-Jul-13 | 07.41    | 57.51       | 003.00    | W   | 80           | 32            |         | 3       | 1             | 8        |       | 0      |
| 10      | 08-Jul-13 | 08.07    | 57.25       | 000.58    | W   | 66           | 48            | 76      |         |               | 15       |       | 704    |
| 11      | 08-Jul-13 | 12.58    | 57.24       | 000.01    | W   | 66           | 40            | 1       |         | 3             | 31       |       |        |
| 12      | 08-Jul-13 | 17.18    | 57.25       | 000.49    | E   | 86           | 27            | 2262    |         |               |          |       |        |
| 13      | 09-Jul-13 | 07.10    | 56.55       | 001.33    | E   | 93           | 39            | 887     |         | 0             |          |       |        |
| 14      | 09-Jul-13 | 18.11    | 56.55       | 001.18    | W   | 62           | 35            |         |         | 1             |          |       |        |
| 15      | 10-Jul-13 | 04.53    | 56.24       | 002.05    | W   | 59.9         | 60            |         | 0       | 0             | 2        | 6     | 1      |
| 16      | 10-Jul-13 | 12.36    | 56.25       | 000.15    | W   | 74.09        | 98            | 10000   |         | 1             |          |       |        |
| 17      | 13-Jul-13 | 05.47    | 55.54       | 000.55    | W   | 68.8         | 117           |         |         |               | 1        |       |        |
| 18      | 15-Jul-13 | 14.25    | 55.25       | 000.45    | W   | 90.09        | 37            |         | 0       | 0             |          | 0     |        |
| 19      | 16-Jul-13 | 05.40    | 55.24       | 001.28    | E   | 74.19        | 77            | 1540    |         | 0             | 3        |       | 19     |
| 20      | 16-Jul-13 | 16.41    | 54.54       | 000.20    | E   | 74           | 72            | 160     |         |               | 0        |       |        |
| 21      | 17-Jul-13 | 04.16    | 54.54       | 000.36    | W   | 60           | 37            |         |         | 0             |          | 0     |        |
| 22      | 17-Jul-13 | 08.07    | 54.47       | 000.47    | W   | 60           | 35            | 674     |         |               |          | 880   | 74     |

Table 2c. Length frequency percentage proportions of **herring** by haul caught on R/V Tridens during the North Sea herring acoustic survey 2013.

| length/haul-no<br>proportion % | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 10   | 11   | 12   | 13   | 16   | 19   | 20   | 22   |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 13.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 14                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.4  |
| 14.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.8  |
| 15                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 3.5  |
| 15.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 3.9  |
| 16                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 6.2  |
| 16.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 8.9  |
| 17                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 12.4 |
| 17.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 1.6  | 0.0  | 12.4 |
| 18                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 2.6  | 0.0  | 11.2 |
| 18.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 8.9  | 0.0  | 6.2  |
| 19                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.9  | 12.5 | 0.6  | 5.4  |
| 19.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 19.8 | 11.1 | 6.2  |
| 20                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.4  | 25.5 | 26.9 | 5.4  |
| 20.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 17.2 | 20.5 | 7.7  |
| 21                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 3.9  | 5.7  | 21.1 | 2.7  |
| 21.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 3.6  | 5.3  | 3.1  |
| 22                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 1.3  | 3.0  | 0.5  | 3.5  | 1.9  |
| 22.5                           | 0.0  | 0.0  | 0.0  | 0.4  | 0.9  | 0.0  | 0.5  | 0.0  | 0.0  | 0.5  | 2.5  | 1.7  | 0.5  | 0.0  | 0.4  |
| 23                             | 0.0  | 0.0  | 0.0  | 0.4  | 2.3  | 0.5  | 0.0  | 0.0  | 2.4  | 1.5  | 4.2  | 5.2  | 0.5  | 2.3  | 0.0  |
| 23.5                           | 0.0  | 0.6  | 0.0  | 1.7  | 9.1  | 1.0  | 1.5  | 2.0  | 2.9  | 1.0  | 10.0 | 12.5 | 0.5  | 0.6  | 0.0  |
| 24                             | 0.6  | 0.0  | 0.6  | 9.5  | 14.6 | 6.2  | 4.6  | 1.0  | 9.6  | 5.9  | 17.2 | 15.5 | 0.0  | 0.0  | 0.0  |
| 24.5                           | 0.6  | 0.0  | 0.0  | 16.0 | 16.9 | 10.0 | 5.2  | 0.0  | 9.6  | 6.3  | 18.8 | 11.6 | 0.0  | 0.6  | 0.0  |
| 25                             | 1.2  | 1.3  | 5.6  | 19.5 | 21.0 | 11.4 | 8.8  | 38.2 | 18.7 | 12.7 | 16.3 | 12.9 | 0.0  | 1.8  | 0.4  |
| 25.5                           | 3.7  | 3.2  | 4.5  | 14.7 | 11.4 | 16.2 | 7.7  | 19.6 | 18.7 | 8.8  | 8.8  | 10.3 | 0.0  | 1.2  | 0.8  |
| 26                             | 4.3  | 2.6  | 9.0  | 15.6 | 8.2  | 20.0 | 7.2  | 20.6 | 17.7 | 11.2 | 8.8  | 6.9  | 0.0  | 1.2  | 0.4  |
| 26.5                           | 5.6  | 5.2  | 7.9  | 9.5  | 6.4  | 9.5  | 10.3 | 8.8  | 4.8  | 8.8  | 3.8  | 4.7  | 0.5  | 1.2  | 0.0  |
| 27                             | 6.2  | 8.4  | 9.6  | 6.1  | 2.7  | 9.0  | 9.3  | 5.9  | 8.1  | 9.3  | 4.2  | 2.2  | 0.0  | 0.6  | 0.0  |
| 27.5                           | 6.2  | 12.9 | 13.0 | 3.0  | 2.7  | 6.7  | 10.8 | 2.0  | 3.3  | 7.8  | 1.7  | 2.6  | 0.0  | 0.0  | 0.0  |
| 28                             | 8.6  | 14.2 | 13.0 | 2.6  | 1.8  | 3.8  | 10.8 | 1.0  | 2.4  | 10.2 | 1.3  | 1.3  | 0.0  | 1.8  | 0.0  |
| 28.5                           | 21.0 | 17.4 | 13.0 | 0.0  | 0.5  | 3.8  | 10.3 | 0.0  | 1.0  | 5.9  | 0.4  | 2.6  | 0.0  | 0.0  | 0.0  |
| 29                             | 17.9 | 12.3 | 9.0  | 0.4  | 0.5  | 0.5  | 5.7  | 0.0  | 0.5  | 6.8  | 0.8  | 0.4  | 0.0  | 0.0  | 0.0  |
| 29.5                           | 11.1 | 11.0 | 10.2 | 0.4  | 0.9  | 0.5  | 4.6  | 0.0  | 0.5  | 2.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 30                             | 9.3  | 6.5  | 3.4  | 0.0  | 0.0  | 0.0  | 1.5  | 1.0  | 0.0  | 1.0  | 0.0  | 0.4  | 0.0  | 0.0  | 0.0  |
| 30.5                           | 3.1  | 1.3  | 1.1  | 0.0  | 0.0  | 0.5  | 1.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 31                             | 0.0  | 0.6  | 0.0  | 0.0  | 0.0  | 0.5  | 0.0  | 0.0  | 0.0  | 0.5  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 31.5                           | 0.0  | 2.6  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 32                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 32.5                           | 0.6  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 33                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 33.5                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| 34                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| no in sample                   | 162  | 155  | 177  | 231  | 219  | 210  | 194  | 102  | 209  | 205  | 239  | 232  | 192  | 171  | 259  |

Table 3. Age/maturity-length keys for herring –Stratum A - D. Tridens, North Sea acoustic survey 2013.

| Age      | Year   | Stratum A        |                 |                   |       |                     |       |
|----------|--------|------------------|-----------------|-------------------|-------|---------------------|-------|
|          |        | Mean Length (cm) | Mean weight (g) | Number (millions) | %     | Biomass (1000 tons) | %     |
| 0I       | 2012im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 0M       | 2012ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 1I       | 2011im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 1M       | 2011ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 2I       | 2010im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 2M       | 2010ad | 25.8             | 142.0           | 296               | 19.6  | 42.069              | 16.2  |
| 3I       | 2009im | 24.7             | 108.9           | 5                 | 0.3   | 0.570               | 0.2   |
| 3M       | 2009ad | 26.3             | 148.7           | 414               | 27.3  | 61.497              | 23.6  |
| 4I       | 2008im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 4M       | 2008ad | 28.4             | 195.2           | 174               | 11.5  | 33.889              | 13.0  |
| 5I       | 2007im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5M       | 2007ad | 28.4             | 183.0           | 409               | 27.1  | 74.914              | 28.8  |
| 6M       | 2006   | 28.8             | 190.8           | 123               | 8.1   | 23.473              | 9.0   |
| 7M       | 2005   | 29.7             | 214.4           | 49                | 3.2   | 10.403              | 4.0   |
| 8M       | 2004   | 29.7             | 194.4           | 15                | 1.0   | 2.900               | 1.1   |
| 9M       | 2003   | 29.3             | 180.9           | 7                 | 0.4   | 1.180               | 0.5   |
| 10M      | 2002   | 29.7             | 205.7           | 12                | 0.8   | 2.487               | 1.0   |
| 11M      | 2001   | 31.0             | 266.0           | 1                 | 0.0   | 0.150               | 0.1   |
| 12+      | <2001  | 29.7             | 735.0           | 9                 | 0.6   | 6.645               | 2.6   |
| Mean     |        | 28.5             | 230.4           |                   |       |                     |       |
| Total    |        |                  |                 | 1513              | 100.0 | 260.179             | 100.0 |
| Immature |        |                  |                 | 5                 | 0.3   | 0.570               | 0.2   |
| Mature   |        |                  |                 | 1507              | 99.7  | 259.608             | 99.8  |

| Age      | Year   | Stratum B        |                 |                   |       |                     |       |
|----------|--------|------------------|-----------------|-------------------|-------|---------------------|-------|
|          |        | Mean Length (cm) | Mean weight (g) | Number (millions) | %     | Biomass (1000 tons) | %     |
| 0I       | 2012im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 0M       | 2012ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 1I       | 2011im | 20.3             | 65.1            | 12                | 0.5   | 0.812               | 0.2   |
| 1M       | 2011ad | 21.5             | 74.0            | 1                 | 0.0   | 0.062               | 0.0   |
| 2I       | 2010im | 22.5             | 88.8            | 53                | 2.0   | 4.719               | 1.3   |
| 2M       | 2010ad | 24.9             | 128.2           | 1169              | 43.3  | 149.857             | 41.4  |
| 3I       | 2009im | 25.0             | 129.0           | 12                | 0.5   | 1.575               | 0.4   |
| 3M       | 2009ad | 25.5             | 133.5           | 1159              | 42.9  | 154.674             | 42.8  |
| 4I       | 2008im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 4M       | 2008ad | 27.2             | 170.4           | 112               | 4.1   | 19.000              | 5.3   |
| 5I       | 2007im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5M       | 2007ad | 27.8             | 170.6           | 114               | 4.2   | 19.392              | 5.4   |
| 6M       | 2006   | 28.3             | 175.4           | 21                | 0.8   | 3.699               | 1.0   |
| 7M       | 2005   | 28.8             | 174.7           | 4                 | 0.1   | 0.619               | 0.2   |
| 8M       | 2004   | 26.7             | 166.2           | 12                | 0.4   | 1.976               | 0.5   |
| 9M       | 2003   | 27.9             | 167.9           | 23                | 0.8   | 3.825               | 1.1   |
| 10M      | 2002   | 28.4             | 175.5           | 9                 | 0.3   | 1.540               | 0.4   |
| 11M      | 2001   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 12+      | <2001  |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| Mean     |        | 25.8             | 140.0           |                   |       |                     |       |
| Total    |        |                  |                 | 2700              | 100.0 | 361.751             | 100.0 |
| Immature |        |                  |                 | 78                | 2.9   | 7.106               | 2.0   |
| Mature   |        |                  |                 | 2622              | 97.1  | 354.645             | 98.0  |

| Stratum C |        |                  |                 |                   |       |                     |       |
|-----------|--------|------------------|-----------------|-------------------|-------|---------------------|-------|
| Age       | Year   | Mean Length (cm) | Mean weight (g) | Number (millions) | %     | Biomass (1000 tons) | %     |
| 0I        | 2012im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 0M        | 2012ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 1I        | 2011im | 19.9             | 59.9            | 278               | 67.3  | 16.659              | 60.0  |
| 1M        | 2011ad | 21.2             | 73.7            | 11                | 2.7   | 0.823               | 3.0   |
| 2I        | 2010im | 20.5             | 67.6            | 89                | 21.5  | 6.014               | 21.6  |
| 2M        | 2010ad | 24.0             | 118.4           | 33                | 8.0   | 3.894               | 14.0  |
| 3I        | 2009im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 3M        | 2009ad | 28.0             | 189.0           | 2                 | 0.4   | 0.343               | 1.2   |
| 4I        | 2008im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 4M        | 2008ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5I        | 2007im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5M        | 2007ad | 27.0             | 132.0           | 0                 | 0.1   | 0.053               | 0.2   |
| 6M        | 2006   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 7M        | 2005   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 8M        | 2004   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 9M        | 2003   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 10M       | 2002   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 11M       | 2001   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 12+       | <2001  |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| Mean      |        | 23.4             | 106.8           |                   |       |                     |       |
| Total     |        |                  |                 | 413               | 100.0 | 27.787              | 100.0 |
| Immature  |        |                  |                 | 367               | 88.8  | 22.674              | 81.6  |
| Mature    |        |                  |                 | 46                | 11.2  | 5.113               | 18.4  |

| Stratum D |        |                  |                 |                   |       |                     |       |
|-----------|--------|------------------|-----------------|-------------------|-------|---------------------|-------|
| Age       | Year   | Mean Length (cm) | Mean weight (g) | Number (millions) | %     | Biomass (1000 tons) | %     |
| 0I        | 2012im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 0M        | 2012ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 1I        | 2011im | 17.9             | 46.4            | 991               | 93.4  | 45.948              | 87.4  |
| 1M        | 2011ad | 21.5             | 82.0            | 7                 | 0.6   | 0.537               | 1.0   |
| 2I        | 2010im | 21.3             | 75.5            | 20                | 1.9   | 1.515               | 2.9   |
| 2M        | 2010ad | 22.7             | 102.0           | 35                | 3.3   | 3.550               | 6.8   |
| 3I        | 2009im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 3M        | 2009ad | 25.3             | 125.5           | 8                 | 0.8   | 1.027               | 2.0   |
| 4I        | 2008im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 4M        | 2008ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5I        | 2007im |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 5M        | 2007ad |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 6M        | 2006   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 7M        | 2005   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 8M        | 2004   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 9M        | 2003   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 10M       | 2002   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 11M       | 2001   |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| 12+       | <2001  |                  |                 | 0                 | 0.0   | 0.000               | 0.0   |
| Mean      |        | 21.7             | 86.3            |                   |       |                     |       |
| Total     |        |                  |                 | 1060              | 100.0 | 52.577              | 100.0 |
| Immature  |        |                  |                 | 1011              | 95.3  | 47.463              | 90.3  |
| Mature    |        |                  |                 | 50                | 4.7   | 5.115               | 9.7   |

Table 4. Mean length, mean weight, biomass (thousands of tonnes) and numbers (millions) **herring** breakdown by age and maturity obtained during the July 2012 North Sea herring acoustic survey on R/V Tridens.

| Age      | Year   | Total area (all strata summarized) |       |                     |       |
|----------|--------|------------------------------------|-------|---------------------|-------|
|          |        | Number (millions)                  | %     | Biomass (1000 tons) | %     |
| 0I       | 2012im | 0                                  | 0.0   | 0.000               | 0.0   |
| 0M       | 2012ad | 0                                  | 0.0   | 0.000               | 0.0   |
| 1I       | 2011im | 1281                               | 22.5  | 63.419              | 9.0   |
| 1M       | 2011ad | 19                                 | 0.3   | 1.422               | 0.2   |
| 2I       | 2010im | 162                                | 2.9   | 12.248              | 1.7   |
| 2M       | 2010ad | 1533                               | 27.0  | 199.371             | 28.4  |
| 3I       | 2009im | 17                                 | 0.3   | 2.146               | 0.3   |
| 3M       | 2009ad | 1583                               | 27.8  | 217.541             | 31.0  |
| 4I       | 2008im | 0                                  | 0.0   | 0.000               | 0.0   |
| 4M       | 2008ad | 285                                | 5.0   | 52.890              | 7.5   |
| 5I       | 2007im | 0                                  | 0.0   | 0.000               | 0.0   |
| 5M       | 2007ad | 523                                | 9.2   | 94.359              | 13.4  |
| 6M       | 2006   | 144                                | 2.5   | 27.172              | 3.9   |
| 7M       | 2005   | 52                                 | 0.9   | 11.022              | 1.6   |
| 8M       | 2004   | 27                                 | 0.5   | 4.876               | 0.7   |
| 9M       | 2003   | 29                                 | 0.5   | 5.005               | 0.7   |
| 10M      | 2002   | 21                                 | 0.4   | 4.027               | 0.6   |
| 11M      | 2001   | 1                                  | 0.0   | 0.150               | 0.0   |
| 12+      | <2001  | 9                                  | 0.2   | 6.645               | 0.9   |
| Total    |        | 5686                               | 100.0 | 702.294             | 100.0 |
| Immature |        | 1461                               | 25.7  | 77.813              | 11.1  |
| Mature   |        | 4225                               | 74.3  | 624.481             | 88.9  |

Table 5. Mean length, mean weight, biomass (thousands of tonnes) and numbers (millions) **sprat** breakdown by age and maturity obtained during the July 2013 North Sea herring acoustic survey on R/V Tridens.

| Age      | Year   | Total area (all strata summarized) |       |                     |       |
|----------|--------|------------------------------------|-------|---------------------|-------|
|          |        | Number (millions)                  | %     | Biomass (1000 tons) | %     |
| 0I       | 2012im | 0                                  | 0.0   | 0.000               | 0.0   |
| 0M       | 2012ad | 449                                | 36.2  | 2.255               | 13.3  |
| 1I       | 2011im | 0                                  | 0.0   | 0.000               | 0.0   |
| 1M       | 2011ad | 362                                | 29.2  | 6.261               | 37.1  |
| 2I       | 2010im | 0                                  | 0.0   | 0.000               | 0.0   |
| 2M       | 2010ad | 400                                | 32.2  | 7.776               | 46.0  |
| 3I       | 2009im | 0                                  | 0.0   | 0.000               | 0.0   |
| 3M       | 2009ad | 30                                 | 2.4   | 0.601               | 3.6   |
| 4I       | 2008im | 0                                  | 0.0   | 0.000               | 0.0   |
| 4M       | 2008ad | 0                                  | 0.0   | 0.000               | 0.0   |
| 5I       | 2007im | 0                                  | 0.0   | 0.000               | 0.0   |
| 5M       | 2007ad | 0                                  | 0.0   | 0.000               | 0.0   |
| 6M       | 2006   | 0                                  | 0.0   | 0.000               | 0.0   |
| 7M       | 2005   | 0                                  | 0.0   | 0.000               | 0.0   |
| 8M       | 2004   | 0                                  | 0.0   | 0.000               | 0.0   |
| 9M       | 2003   | 0                                  | 0.0   | 0.000               | 0.0   |
| 10M      | 2002   | 0                                  | 0.0   | 0.000               | 0.0   |
| 11M      | 2001   | 0                                  | 0.0   | 0.000               | 0.0   |
| 12+      | <2001  | 0                                  | 0.0   | 0.000               | 0.0   |
| Total    |        | 1240                               | 100.0 | 16.893              | 100.0 |
| Immature |        | 0                                  | 0.0   | 0.000               | 0.0   |
| Mature   |        | 1240                               | 100.0 | 16.893              | 100.0 |

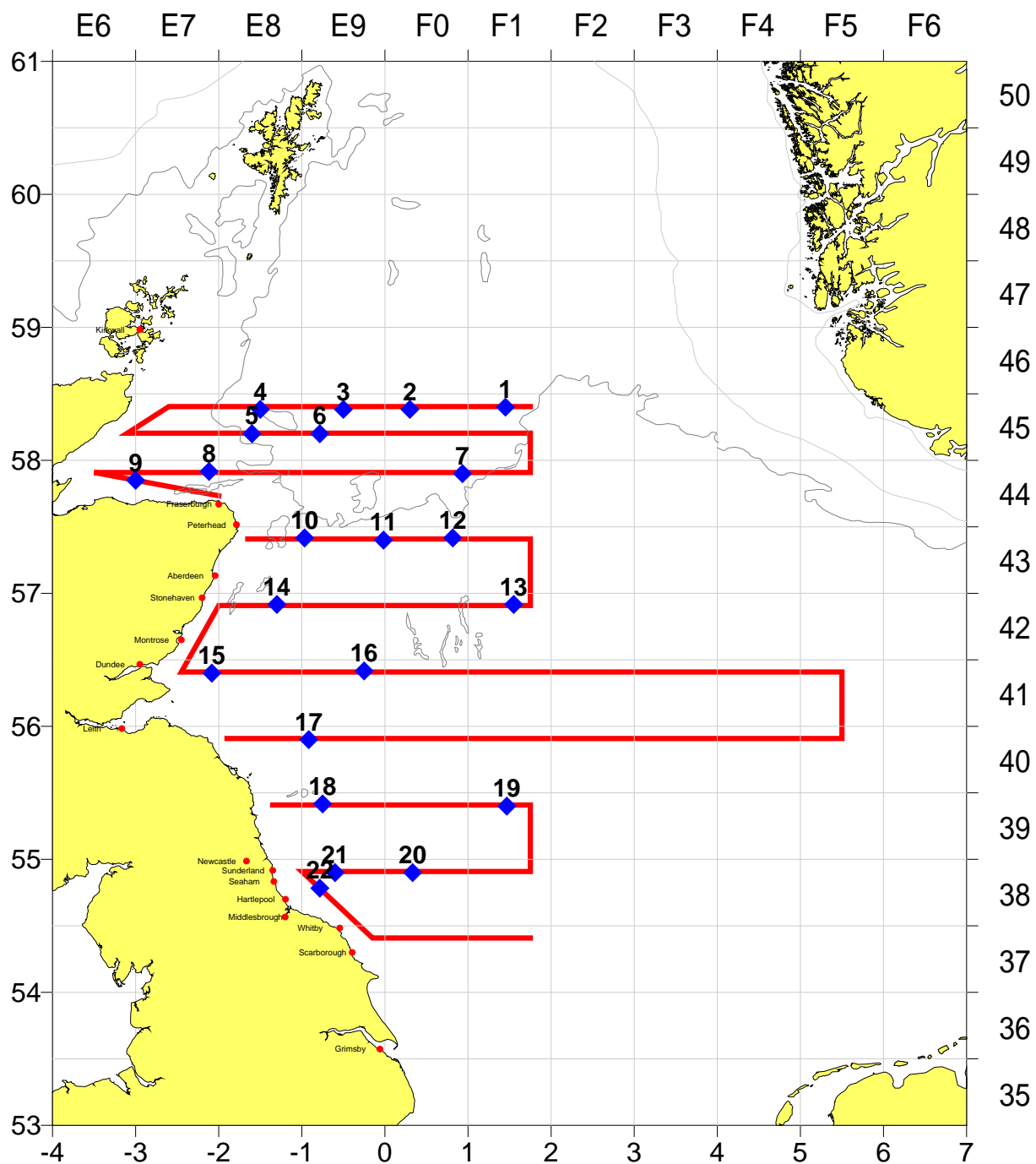


Figure 1a. Map of executed cruise track and positions of trawl stations (blue diamonds with numbers) during the July 2013 North Sea herring acoustic survey on R/V Tridens.



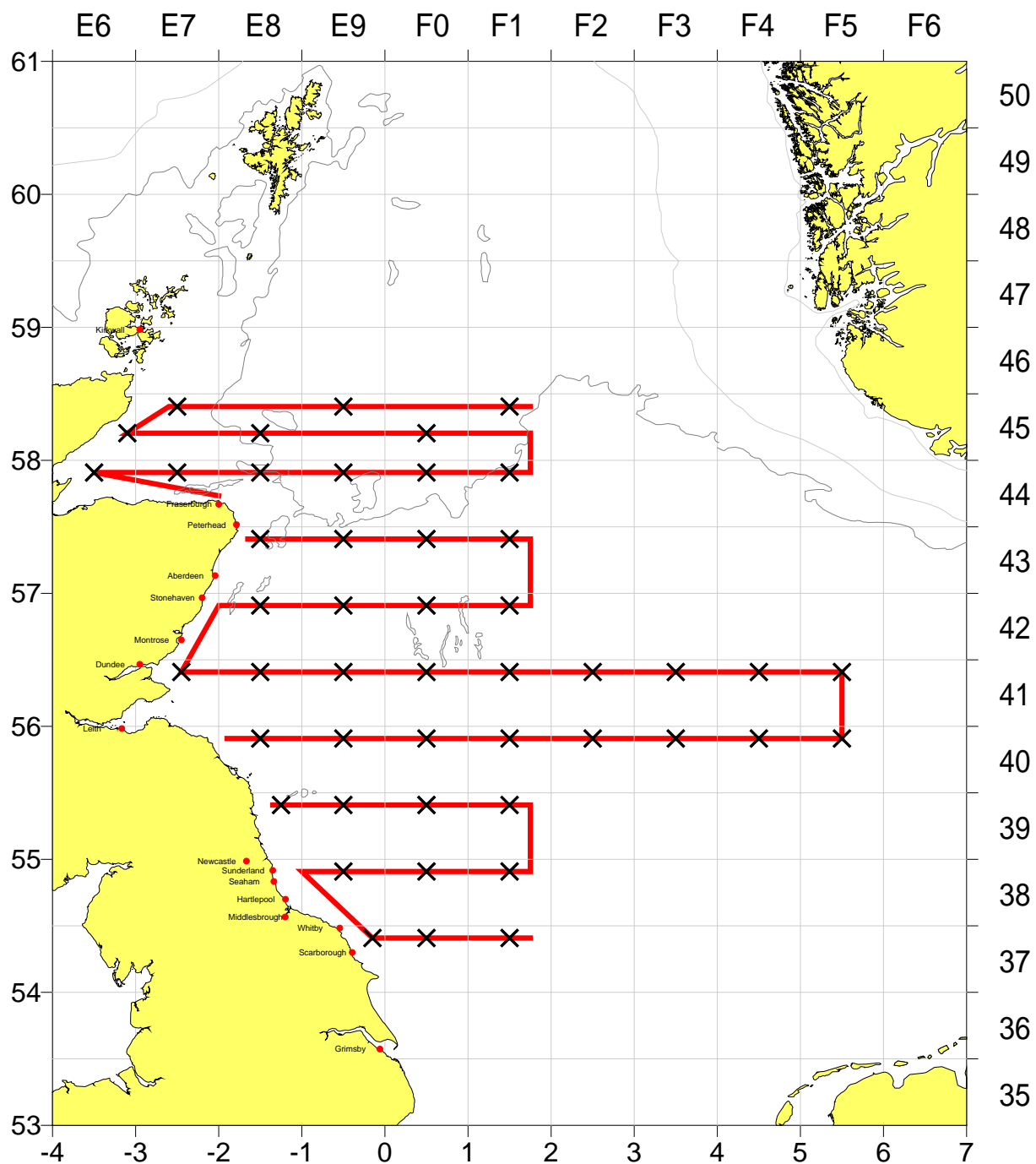


Figure 1b. Map of hydrographical stations (crosses) during the July 2013 North Sea herring acoustic survey on R/V Tridens.



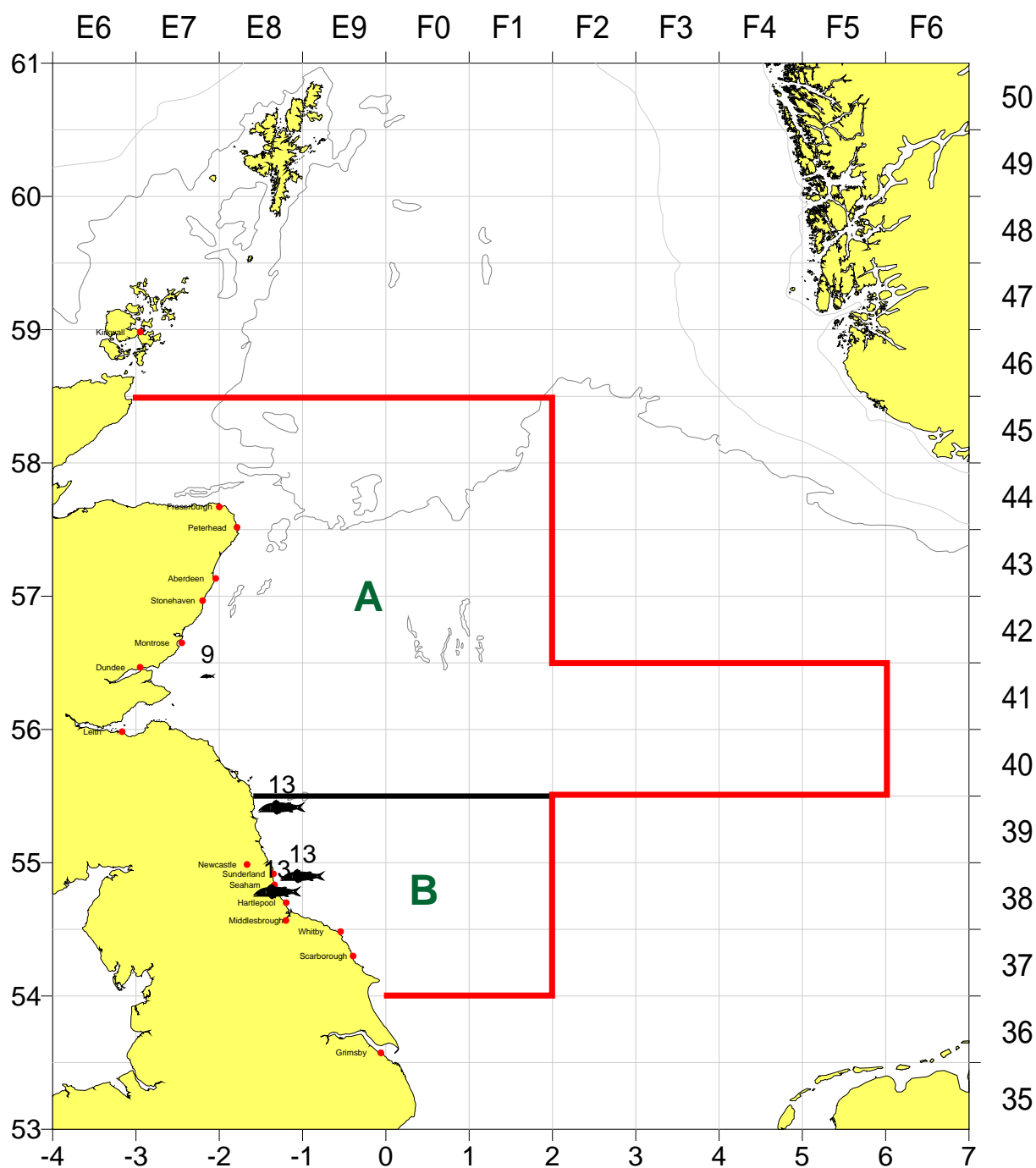


Figure 2b. Survey strata used to pool length frequency distributions of **sprat** and to raise NASC's by rectangle to numbers and biomass during the July 2013 North Sea herring acoustic survey on R/V *Tridens*. Size of fish symbols represent relative mean lengths of **sprat** caught in the hauls.

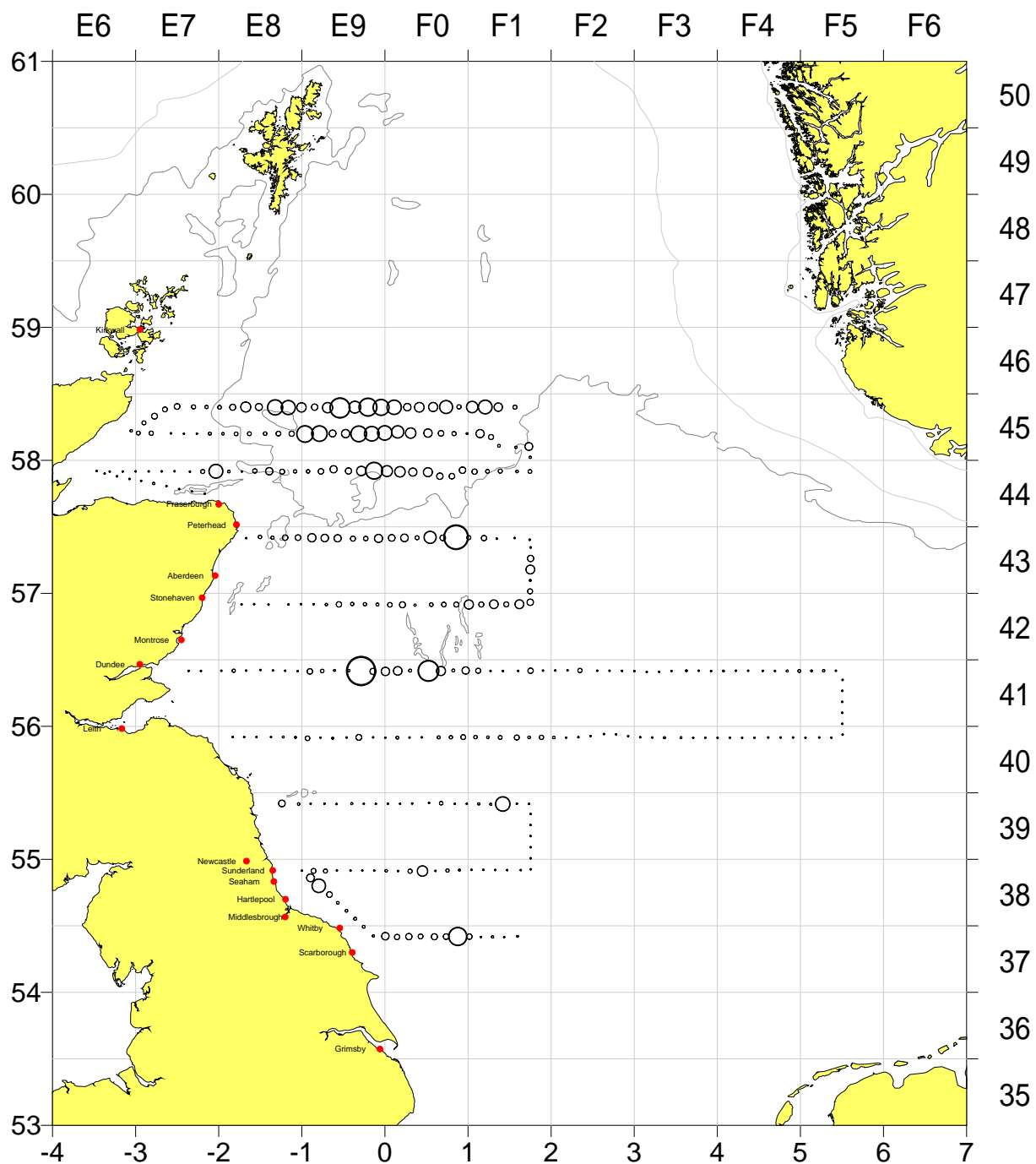


Figure 3a. Post plot showing the distribution of **total herring** NASC's of 5 nm intervals (on a proportional square root scale relative to the maximum value of 5514.46) obtained during the July 2013 North Sea herring acoustic survey on R/V *Tridens*.

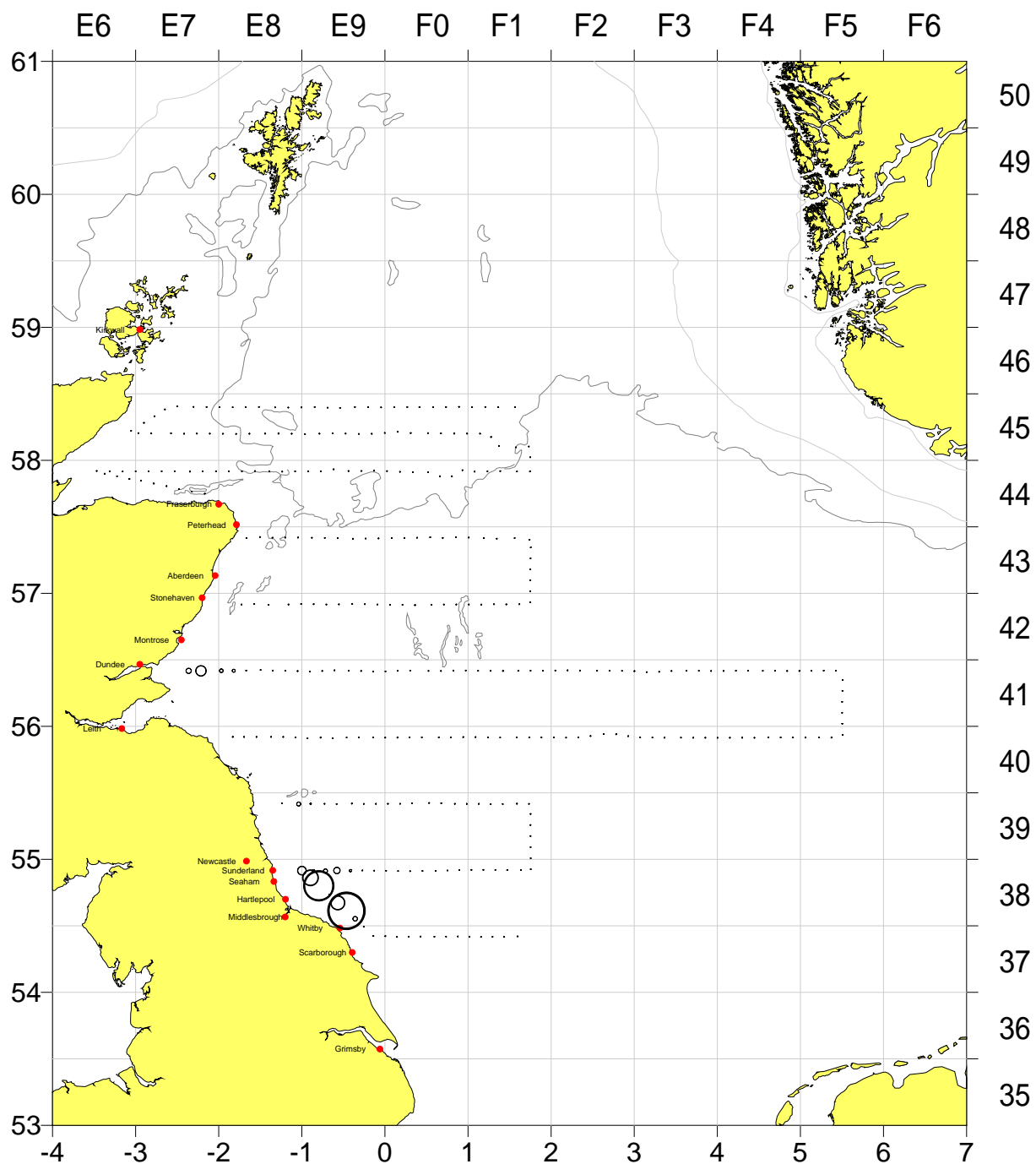


Figure 3b. Post plot showing the distribution of **total sprat** NASC's by 5 nm intervals (on a proportional square root scale relative to the largest value of 1327.88). Obtained during the July 2013 North Sea herring acoustic survey on R/V Tridens.

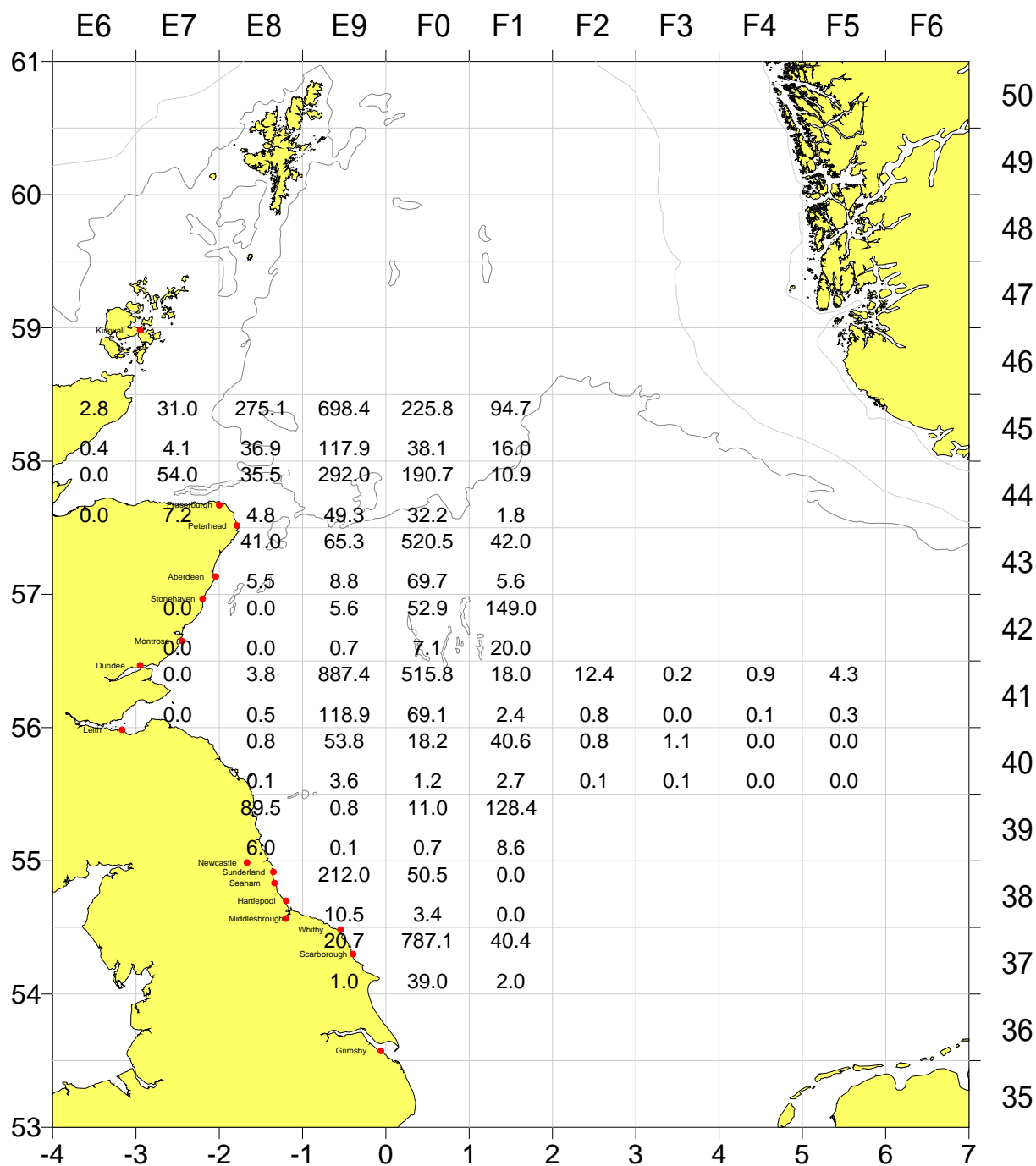


Figure 4. Estimated numbers of **herring** in millions (upper half square) and biomass in thousands of tonnes (lower half of square) by ICES rectangle. Results from the July 2013 North Sea herring acoustic survey on R/V *Tridens*.

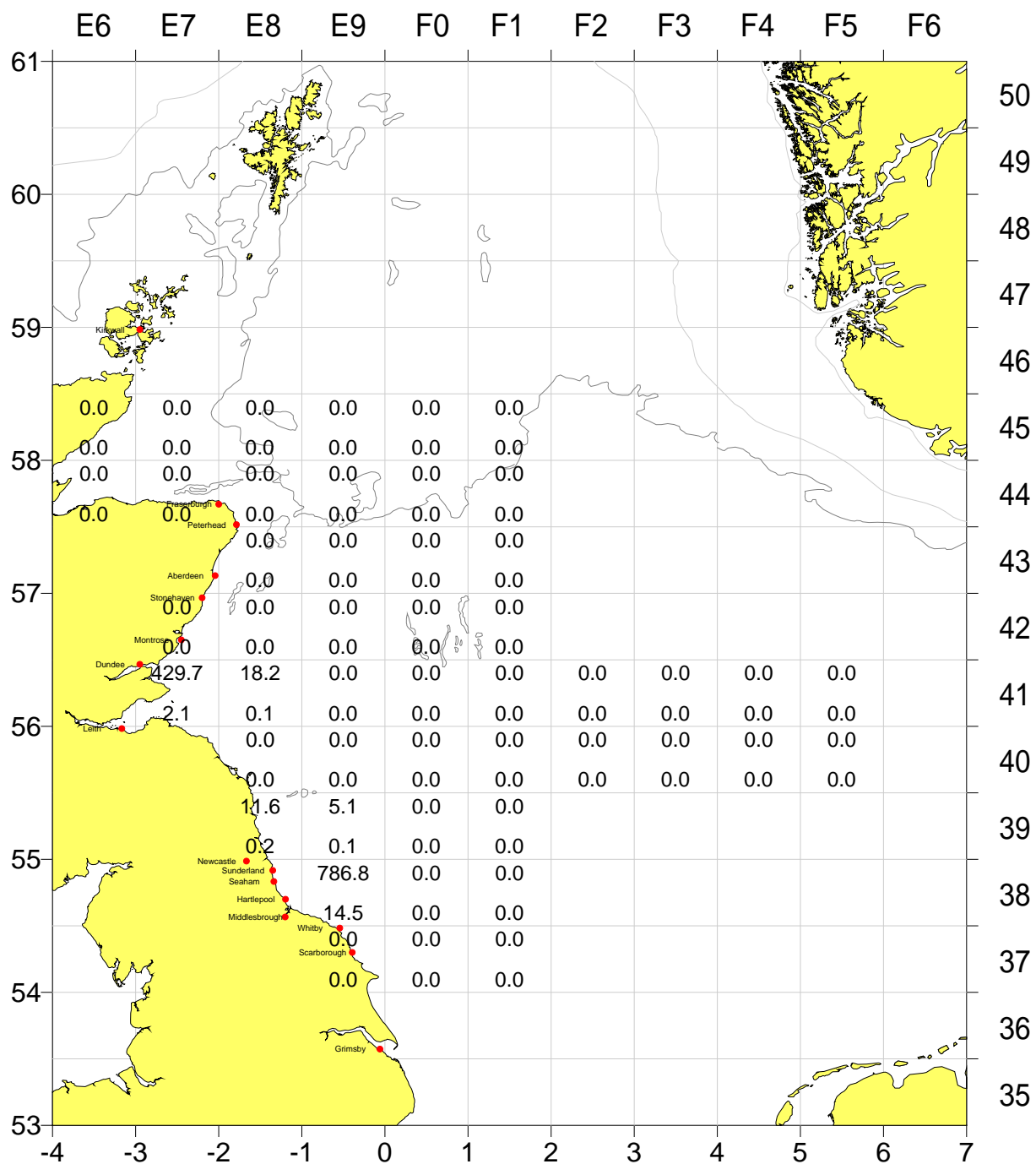


Figure 5. Estimated numbers of **sprat** in millions (upper half square) and biomass in thousands of tonnes (lower half of square) by ICES rectangle. Results from the July 2013 North Sea herring acoustic survey on R/V *Tridens*.

|   |   |     |       |      |    |   |                          |      |  |
|---|---|-----|-------|------|----|---|--------------------------|------|--|
| <b>CRUISE SUMMARY REPORT</b>  |   |     |       |      |    | FOR COLLATING CENTRE<br>USE                       |                          |      |  |
|   |   |     |       |      |    | Centre:   | Ref.                     |      |  |
|   |   |     |       |      |    | no:   |                          |      |  |
|   |   |     |       |      |    | Is data exchange restricted?                      | <input type="checkbox"/> |      |  |
|   |   |     |       |      |    | <input type="checkbox"/> <input type="checkbox"/> | Yes                      |      |  |
|   |   |     |       |      |    | In part   | No                       |      |  |
| SHIP enter the full name and international radio call sign of the ship from which the data were collected, and indicate the type of ship, for example, research ship; ship of opportunity, naval survey vessel; etc.  |   |     |       |      |    |   |                          |      |  |
| Name: TRIDENS   |   |     |       |      |    | Call Sign: PBVO                                   |                          |      |  |
| Type of ship: FISHERIES RESEARCH VESSEL   |   |     |       |      |    |   |                          |      |  |
| CRUISE NO./NAME      2013 week 26-29 HERAS (North Sea Herring Acoustic Survey)  |   |     |       |      |    |   |                          |      |  |
| CRUISE PERIOD   | start   | 24  | 06    | 2012 | to | 19  | 07                       | 2012 |  |
|   | (set sail)  | day | month | year |    | day   | month                    | year |  |
| PORT OF DEPARTURE (enter name and country) SCHEVENINGEN, THE NETHERLANDS  |   |     |       |      |    |   |                          |      |  |
| PORT OF RETURN (enter name and country) SCHEVENINGEN, THE NETHERLANDS   |   |     |       |      |    |   |                          |      |  |
| RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruise.   |   |     |       |      |    |   |                          |      |  |
| Name:   | IMARES, Institute for Marine research and Ecosystem studies |     |       |      |    |   |                          |      |  |
| Address:  | P.O. BOX 68   |     |       |      |    |   |                          |      |  |
|   | 1970 AB IJMUIDEN  |     |       |      |    |   |                          |      |  |
|   | HARINGKADE 1  |     |       |      |    |   |                          |      |  |
| Country: THE NETHERLANDS  |   |     |       |      |    |   |                          |      |  |
| CHIEF SCIENTIST(S) enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruise.  |   |     |       |      |    |   |                          |      |  |
| Bram Couperus and Sascha Fässler, IMARES  |   |     |       |      |    |   |                          |      |  |
| OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the reported data were collected.  |   |     |       |      |    |   |                          |      |  |
| To carry out a hydro acoustic survey defining the abundance of herring and sprat in the North Sea, in co-operation with the institutes of Norway, Scotland, Denmark, Ireland and Germany. Calibration of the echosounder in a sheltered area, preferably at Scapa Flow, Orkneys 58°56'71 N - 003°00'57 W, Loch Eriboll 58°30N - 4°41W (second choice), Stavanger fjord 59°05N - 005°36 (third choice) or Kristiansand harbour 58°08N - 007°59E (fourth choice). |   |     |       |      |    |   |                          |      |  |

| Centre:   | Ref.                     |
|---|--------------------------|
| no:   |                          |
| Is data exchange restricted?                      | <input type="checkbox"/> |
| <input type="checkbox"/> <input type="checkbox"/> | Yes                      |
| In part No  |                          |

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PROJECT (IF APPLICABLE) if the cruise is designated as part of a larger scale cooperative project (or expedition or programme), then enter the name of the project, and of the organisation responsible for coordinating the project.  
Project name: North Sea Herring Acoustic Survey (HERAS)

Coordinating body: IMARES, Institute for Marine research and Ecosystem studies

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data collected on the cruise, and who may be contacted for further information about the data (The letter assigned below against each Principal Investigator is used on pages 2 and 3, under the column heading 'PI', to identify the data sets for which he/she is responsible)

Bram Couperus and Sascha Fassler

#### MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

| PI      | APPROXIMATE POSITION |                     | DATA TYPE                     | DESCRIPTION  |
|---------|----------------------|---------------------|-------------------------------|--|
| see top | LATITUDE             | LONGITUDE           | enter code(s)<br>from list on | identify, as appropriate, the nature of the instrumentation, the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, dates of deployment and/or recovery, and any identifiers given to the site. |
| of page | deg      min<br>N/S  | deg      min<br>E/W | cover page                    |  |

#### MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

| PI | APPROXIMATE POSITION |                | DESCRIPTION  |
|----|----------------------|----------------|--|
|    | Station-id           | ICES-rectangle | latitude      longitude  |
|    |                      |                | their depths, whether deployed and/or recovered, dates of deployment and/or recovery, and any identifiers given to the site. |

#### SUMMARY OF MEASURED AND SAMPLES TAKEN

| PI | NO   | UNITS                              | DATA TYPE | DESCRIPTION   |
|----|------|------------------------------------|-----------|---|
|    | 2037 | nautical miles                     | EK60 Raw  | Hydro Acoustic Data                                     |
|    | 47   | downcasts                          | CTD       | Hydrographical data                                     |
|    | 22   | 500m<br>pelagic trawls<br>stations | fish data | biological data (number, weight, length, maturity, age) |

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data were collected during the cruise - please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas')

NORTH SEA

**SPECIFIC AREAS:** If the cruise activities were concentrated in a specific area(s) of an ocean or sea, then enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.

**GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED**

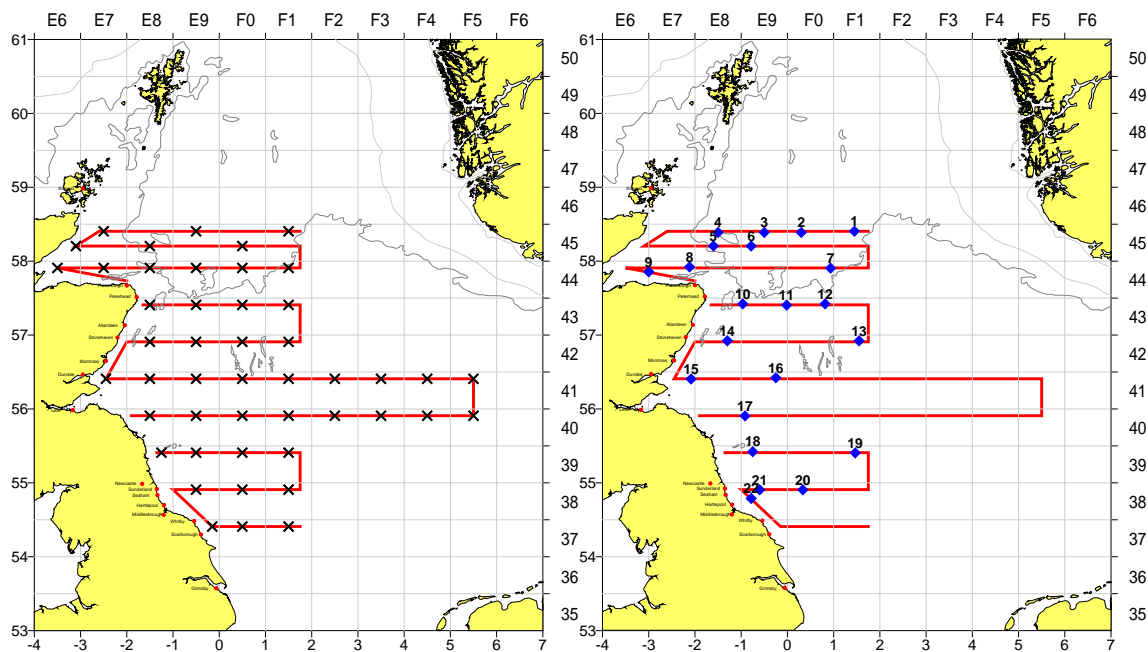


Figure 1b. Map of hydrographical stations (crosses) during the July 2013 North Sea herring acoustic survey on R/V Tridens. Figure 1a. Map of executed cruise track and positions of trawl stations (blue diamonds with numbers) during the July 2013 North Sea herring acoustic survey on R/V Tridens.