Herring larvae surveys 2013-2014: Survey reports and results

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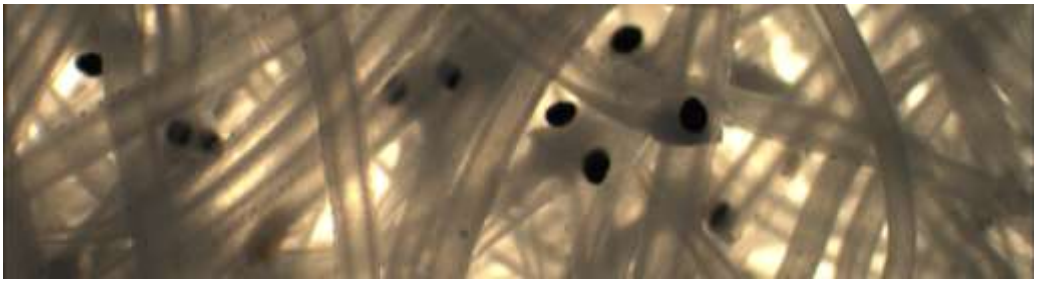
Report number C107/14



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Summary

The international herring larvae surveys (IHLS) are carried out to sample larvae of the North Sea autumn and winter spawning herring populations. The abundance of larvae is used as an index for the estimation of North Sea herring spawning stock biomass. These surveys are performed within the statutory research tasks within the framework of EZ-programs (WOT).

In the period September 2013 to January 2014 three herring larvae surveys were carried out by 'RV Tridens'. In September, the Buchan area and Central North Sea were sampled and in December and January the southern North Sea and the Eastern channel. During all three surveys bad weather circumstances occurred and not all planned stations could be sampled in the September and December surveys. In January despite bad weather all planned stations could be sampled. Although some stations could not be sampled, over all coverage of the entire sampling area was achieved during all surveys.

In September high numbers of herring larvae were caught, similar to previous September surveys. In the Buchan area larvae occurred more northerly compared to last year and in the Central North Sea abundances were back to normal levels after the low numbers found last winter. In December almost no larvae were caught. In January high abundances of larvae were found but only at the stations above 50°N. Numbers were lower in December but in January comparable to previous surveys. The minimum bottom temperature in both December and January was one degree higher compared to previous surveys.
Despite the low numbers found in the December survey, the Spawning-Component Abundance Index (SCAI) in 2014 is the highest in the time series.

An internal larvae identification workshop was held for quality assurance. The consensus in larvae identification between the experts is high.

1. Introduction

Every year the international herring larvae surveys (IHLS) are carried out to sample the larvae of the autumn and winter spawning herring populations in the North Sea and English Channel. The number of larvae is used as an index for the estimation of the existing North Sea herring spawning stock biomass. The produced fishery-independent estimate is used for ' tuning' of the herring stock assessment. These surveys are performed within the statutory research tasks within the framework of EZ-programs (WOT).

The international herring larvae surveys are carried out together with "Thünen Institute" in Hamburg, Germany. In the autumn larvae of herring spawning in the north western North Sea are sampled:

- 1st half of September – Orkney/Shetland by Germany (2 weeks)
- **2nd half of September – Buchan and Central North Sea by the Netherlands (2 weeks)**

In winter the larvae of the 'Channel' or 'Downs' herring are sampled:

- **2nd half of December – southern North Sea/Eastern Channel by the Netherlands (1 week)**
- 1st half of January – southern North Sea/Eastern Channel by Germany (1 week)
- **2nd half of January – southern North Sea/Eastern Channel by the Netherlands (1 week)**

The herring larvae surveys are coordinated by the ICES "Working Group for International Pelagic Surveys" (WGIPS). The database is managed by the Thünen institute. Since 2012 the survey data is also stored in the ICES egg and larval database http://www.ices.dk/marine-data/data-portals/Pages/Eggs-and-larvae.aspx and data are publicly available.

Until 2012 the numbers of herring larvae in the North Sea, based on all individual surveys, were only presented in the so-called "MLAI-index" (Multiplicative Larval Abundance Index). The MLAI index is based on the assumption that the relative proportions between the different spawning components, Shetland, Buchan, Central North Sea and the 'Downs', are fixed. However, the relative proportion of the 'Downs' component has increased in recent years. In order to include changes in relative proportions between the different spawning components a new index, the "SCAI"-index (Spawning-Component Abundance Index; Payne, 2010), has been developed. Since 2012 the "SCAI" Spawning-Component Abundance Index" is calculated.
Both the MLAI and SCAI indices are used by the ICES "Herring Assessment Working Group" (HAWG) for the assessment of the herring spawning stock biomass.

2. Assignment

The aim of the IHLS is to provide an index for the spawning stock biomass of the individual autumn and winter spawning herring populations in the North Sea and English Channel. This index is used by HAWG for tuning of the North Sea herring assessment.

This report contains the results of the Dutch herring larvae surveys carried out in the spawning season 2013-2014.

3. Materials and Methods

3.1 Gear

The sampling of the herring larvae was performed with a "High Speed Plankton Sampler Gulf VII" (Figure 3.1) (referred to as 'torpedo' in the remainder of the report) with a plankton net with mesh size 280 µm (Nash *et al*. 1998). A small Scripps depressor (25 kg) was attached to the plankton sampler for stabilisation of the torpedo in the water. The amount of water filtered during each haul was measured using a Valeport electronic flowmeter mounted inside the nosecone (Model 001; http://www.valeport.co.uk/Portals/0/Docs/Datasheets/Valeport_Model001&002_v2a.pdf). A similar 'external' flowmeter was mounted on the frame of the sampler. The ratio of 'internal' to 'external' flowmeter revolutions provided an index of the extent of net clogging.
A Seabird 911plus CTD with a Benthos PSI 916 altimeter were mounted on the sampler frame to provide a 'real-time' graphical display (Figure 3.2) of the depth of the torpedo in the water column, its height off the seabed as well as continues measurements of the temperature and salinity throughout each deployment.

A small PUP-net (80 µm) was attached to the torpedo and we used the SB32 water sampler to collect water samples. Both of these gears were used for the collection of microzooplankton for condition and diet studies of the herring larvae.

Figure 3.1. The Gulf VII plankton sampler.

3.2 Fishing method

The surveys were carried out on board the 'RV Tridens'. The speed during fishing with the torpedo was 5 knots through the water. At each station a 'double oblique' haul (a V-shaped haul through the water column; Figure 3.2) was performed. This way each 10 meters of the water column are sampled 1 minute going down and going up.

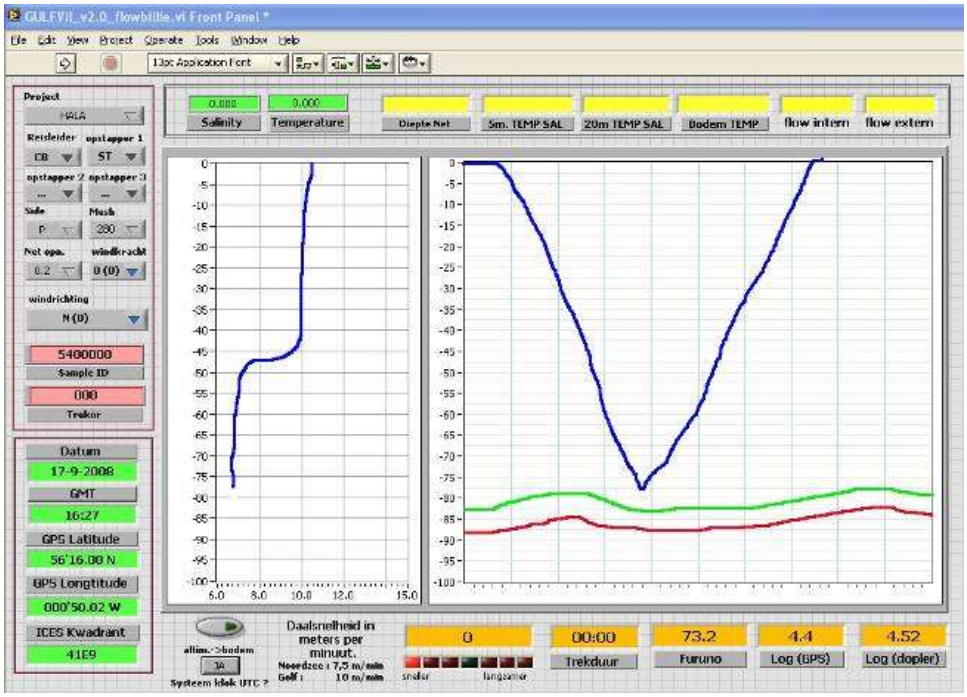

Figure 3.2. Illustration of a 'double-oblique' haul in the Labview program. In the right frame: The blue line shows the depth profile of the plankton sampler, the red line is the sea bottom depth, the green line is the 5 meter above the bottom safety line. In the left frame: The blue line shows the temperature through the water column.

The torpedo was lowered to approximately 5 meter above the sea floor. To ensure enough water was filtered, haul duration needed to be at least 10 minutes. At shallower stations a double or triple 'double oblique' was performed without the torpedo breaking the surface of the water to ensure sufficient water was filtered.

3.3 Sampling grid

During the herring larvae surveys a standard grid is sampled. In each ICES rectangle 9 stations are sampled (0°30 N x 1°E/W; ca. 30 x 30 NM). If at a station the sample contains over a thousand larvae, immediately within the 1/9 ICES rectangle another sample is taken. In this way a reliable estimate of the total number of larvae, which is not dominated by exceptional high catches, can be ensured.

3.4 Workup of samples

After each deployment, as soon as the torpedo was on board the vessel, the sample was taken to the laboratory on board of the vessel. The number of herring larvae in the sample was estimated, and the fresh sample was immediately fixed in 4% buffered formaldehyde (formaldehyde solutions were buffered with sodium acetate trihydrate). The larvae need to be fixed as soon as possible (within minutes of the torpedo coming on deck) to ensure the larvae do not shrink as a result of temperature change.
Upon return after each survey, all fish larvae were sorted out from the fixed sample. If the sample contains a high number (>100) of larvae, the larvae were sub-sampled using a 'Folsom' splitter (Griffiths *et al*. 1984). At least 50 clupeid larvae were identified in each sample. Clupeid larvae are identified to species by counting the number of myotomes, which are species and length specific (Ehrenbaum 1909, Russel 1976, Munk & Nielsen 2005). The species composition is used through the subsample factor to calculate the total number of herring larvae in the whole sample. All, or at least 100, clupeid larvae were measured in each sample.

All data is entered into Billie turf and after standard data checking procedures uploaded to the IMARES FRISBE database.

For quality assurance an internal IMARES clupeid larvae identification workshop is held before the analyses of the survey samples.

3.4 Calculation of the larvae numbers

The total number of herring larvae in the sample were counted and abundances were calculated using the below formulae (Smith & Richardson 1977). The numbers below a square metre of sea surface at each station were calculated as:

$$n/m^2 = \frac{larvae\ per\ sample\ (n) * bottom\ depth\ (m)}{volume\ filtered\ \ (m^3)}$$

The volume filtered is obtained from the formula:

$$Volume\ \ filtered\ \ = \frac{area\ of\ \ mouth\ opening\ (m^2) * efficiency\ \ factor * flowmeter\ \ revolutions}{flowmeter\ \ calibration\ constant}$$

$$Raising\ \ Factor = \frac{total\ \ n\ caught}{total\ \ measured}$$

$$Calibration\ Factor = \frac{flowmeter\ \ calibration * bottom\ depth}{flowmeter\ \ revolutions * pi * \left(\frac{aperture}{2}\right)^2 * efficiency\ \ \ factor}$$

$$n/m^2_{Year,10*10\,rectangle} = grouped\ LFD * raising\ \ factor * calibration\ \ factor$$

The number of eggs and larvae per m^2 were plotted per station per month. Temperature and salinity were plotted per month using the kriging method in Golden Software Surfer v8.01.

4. Results

4.1 September survey

Date, time and harbours

From (harbour)	Date	Time (UTC)	To (harbour)	Date	Time (UTC)
Scheveningen	16-09-2013	13:00	Aberdeen	21-09-2013	18:00
Aberdeen	23-09-2013	06:00	Scheveningen	27-09-2013	08:00

Crew Kees Bakker (cruise leader)
Dirk Burggraaf

Volunteers Tjipken Visser

Guests Franziska Bilz (University Hamburg, Germany)
Simon Fischer (University Hamburg, Germany)

Extra sampling
For the first time we attached a small PUP-net (80 µm) to the torpedo and we used the SB32 water sampler to collect water samples. Both of these gears were used for the collection of microzooplankton for our colleagues from the University of Hamburg. These samples were collected for condition and diet studies of the herring larvae.

Deviations from the planned sampling grid
Due to bad weather circumstances at the start of the survey the order of the sampling grid has been changed. Luckily the weather improved during the survey. Some survey time was lost because the survey started with one plankton sampling winch not working and the second one broke down halfway the first week. Due to the technical and weather problems 15 planned stations could not be sampled (Figure 4.1). Positions of some stations were slightly moved for nautical reasons, thus the sampling position of these stations was off the centre of the 1/9 ICES rectangle (Figure 4.1).
Despite prior agreement to have a 24 hour break during the survey when close to a harbour, the captain decided to have a 36 hour break.

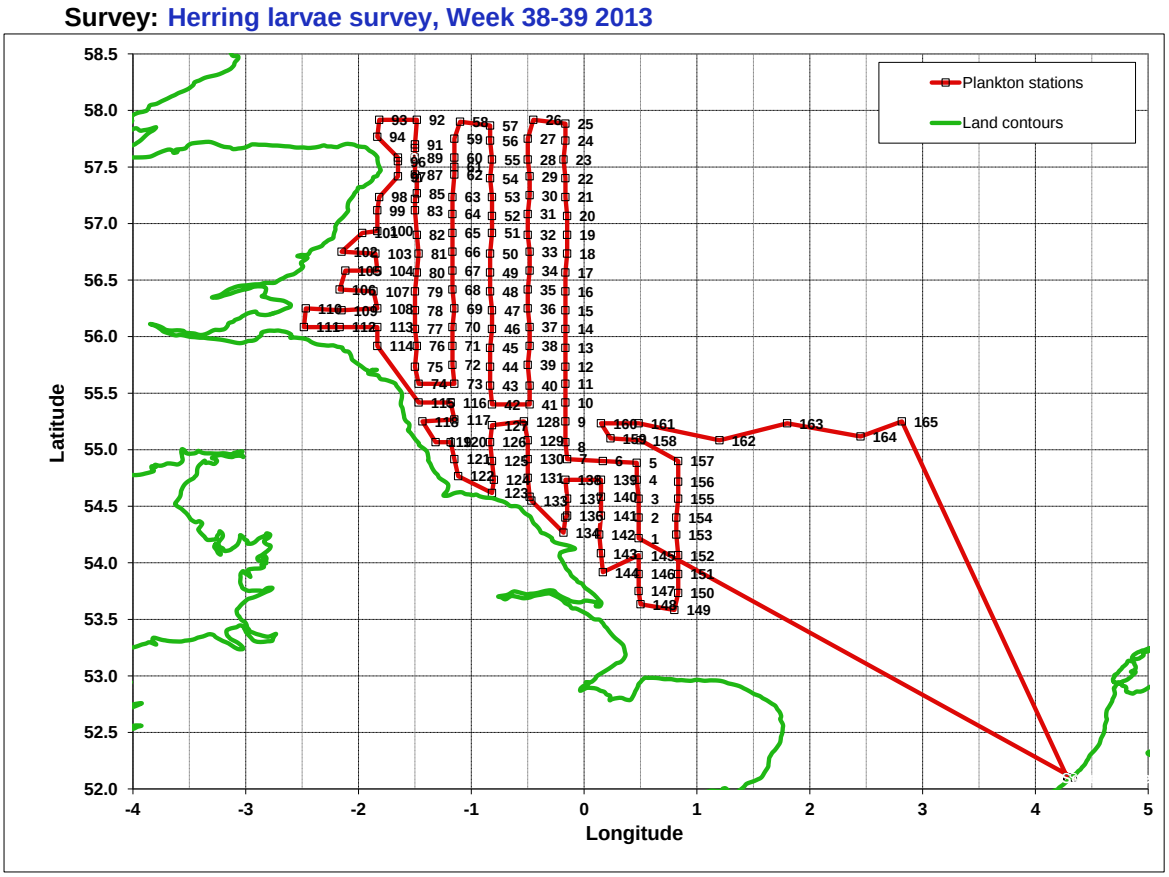

Figure 4.1. Stations sampled in September 2013.

Damage to sampling equipment

No damage to the sampling equipment occurred during this survey.

Survey

Week 38

RV Tridens left Scheveningen harbour on Monday 18th September at 13:00 (UTC). Due to bad weather circumstances it was decided to change the planning and to move towards the English coast were highest numbers of larvae were expected and sampling was possible under the circumstances. The first station was sampled on Tuesday at 08:43 (UTC). Lots of larvae were caught at the expected spawning hot spots.

At station 99 RV Tridens was close to Aberdeen harbour and it was decided to go into harbour for a 36 hour break.

Week 39

The survey was resumed on Monday 23rd September at 6:00 (UTC). The second part of the survey started with calibration tows, but these were only partly successful. Larvae were found at the usual stations in low numbers. Also some stations were sampled at the 'Doggerbank' to check for renewed spawning. On Wednesday at 3:12 the last plankton station was sampled. During the steam from the survey area to Scheveningen harbour a second successful calibration was performed.

Sample-id's

2013.5400541 t/m 2013.5400705

Samples and data

We sampled 157 stations with a Gulf VII plankton torpedo with a CTD mounted on top. At 8 stations a second haul was performed because of high numbers of larvae. At each station a double oblique haul was performed and minimum sampling time was 10 minutes.

Collection of PUP-net samples was successful at all torpedo stations and an extra 12 stations were sampled with the SB32 water sampler.

Numbers of herring larvae

High numbers of herring larvae were found in the Buchan area off Peterhead. The larvae were found more northerly and less spread out compared to the distribution in 2012 (Figure 4.2). In the central North Sea larvae were only caught at a few stations. After low numbers found in 2012, the numbers were again comparable to those found in 2011.

Bottom temperatures were the similar to those found in 2012, though the influence of colder Atlantic water from the north is less pronounced compared to 2012 (Figure 4.3). Temperature varied between 11.6 and 14.7°C, while in 2012 the temperature range was between 11.2 and 14.7°C.

Bottom salinity was not very variable in September 2013 (Figure 4.4). The weaker influence of the Atlantic inflow is clearly visible since the 35‰ isocline is much more northerly compared to previous years.

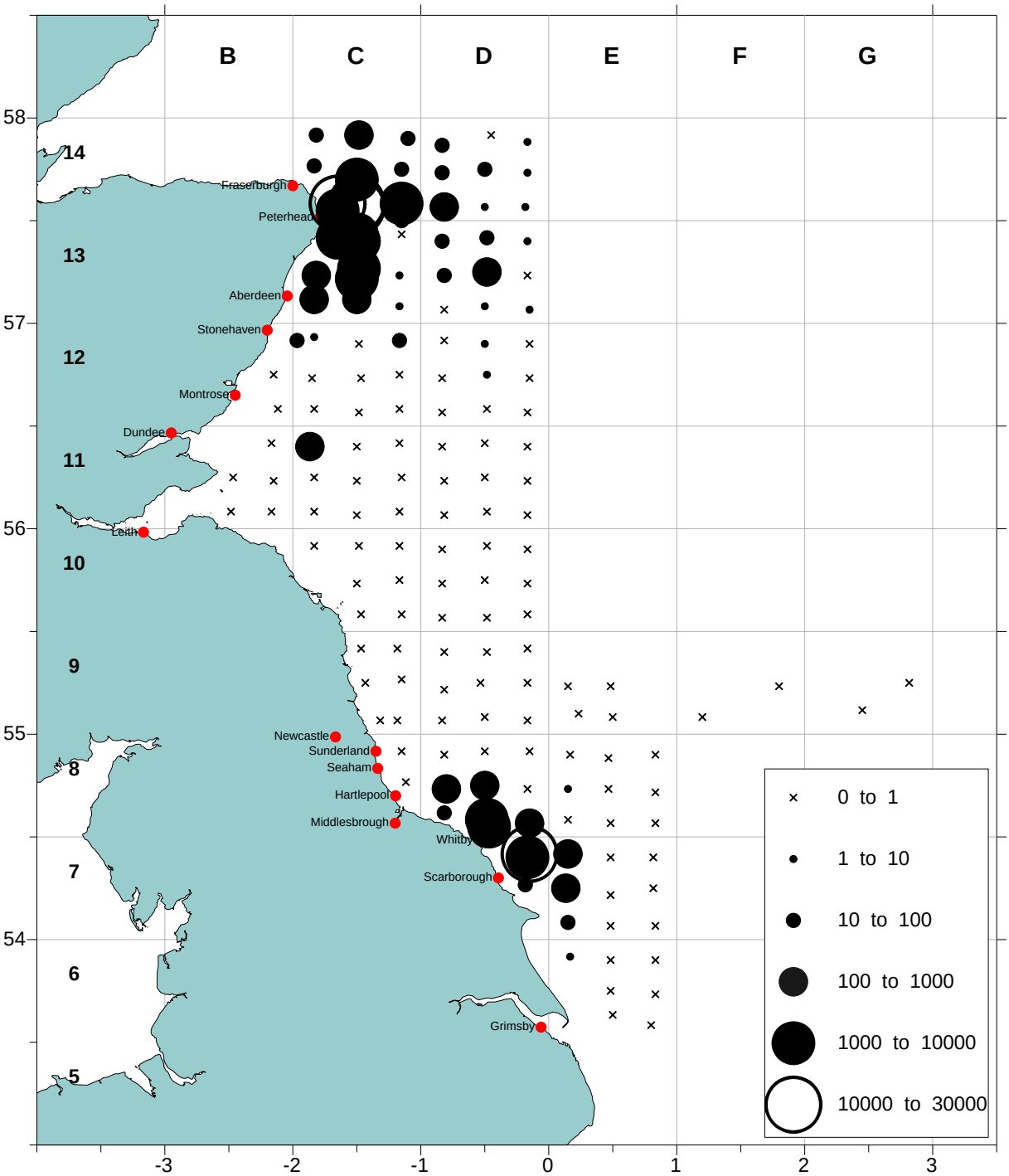

Figure 4.2. Numbers of larvae per m^2 caught during the September 2013 survey.

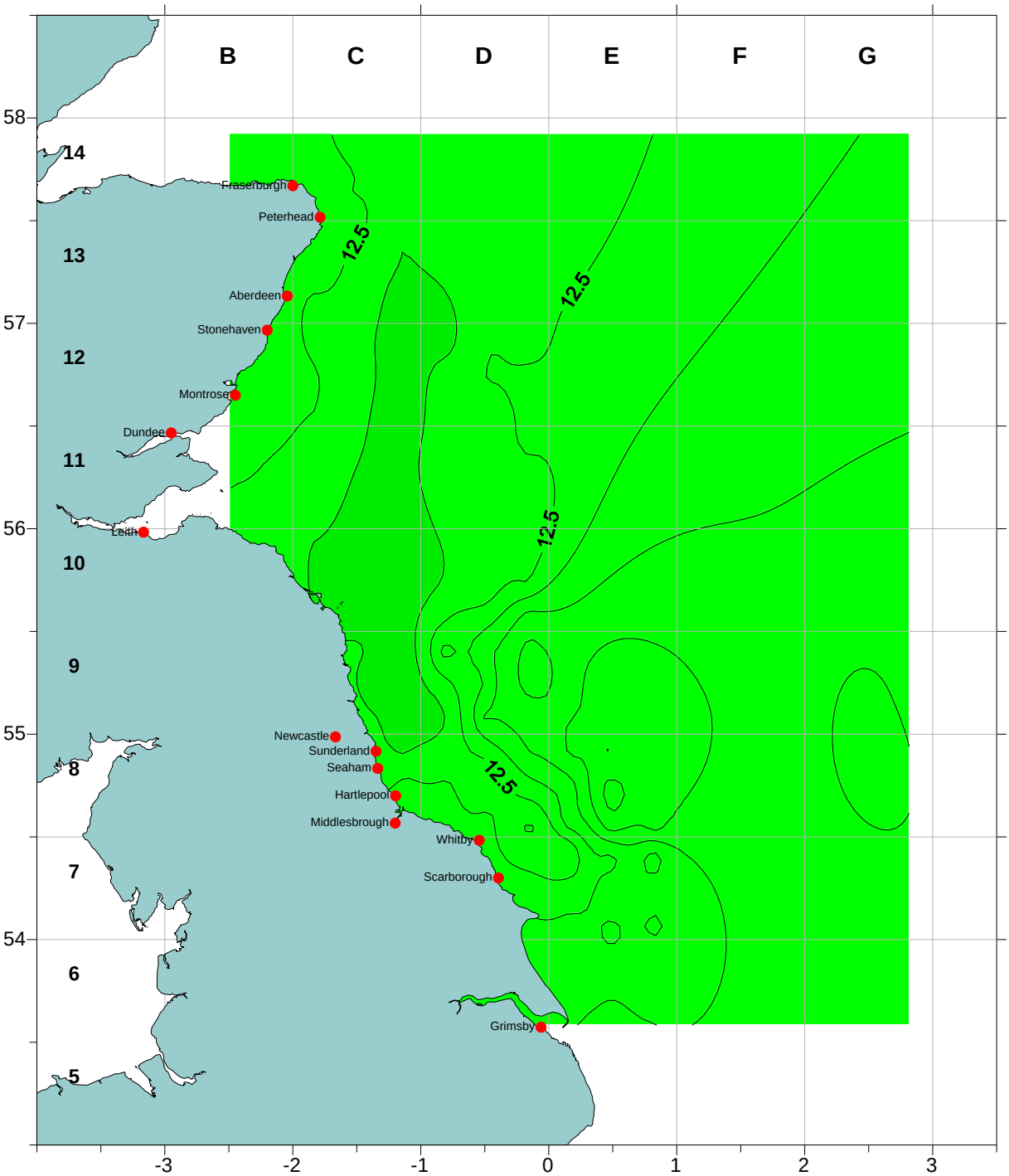

Figure 4.3. Bottom temperature during the September 2013 survey.

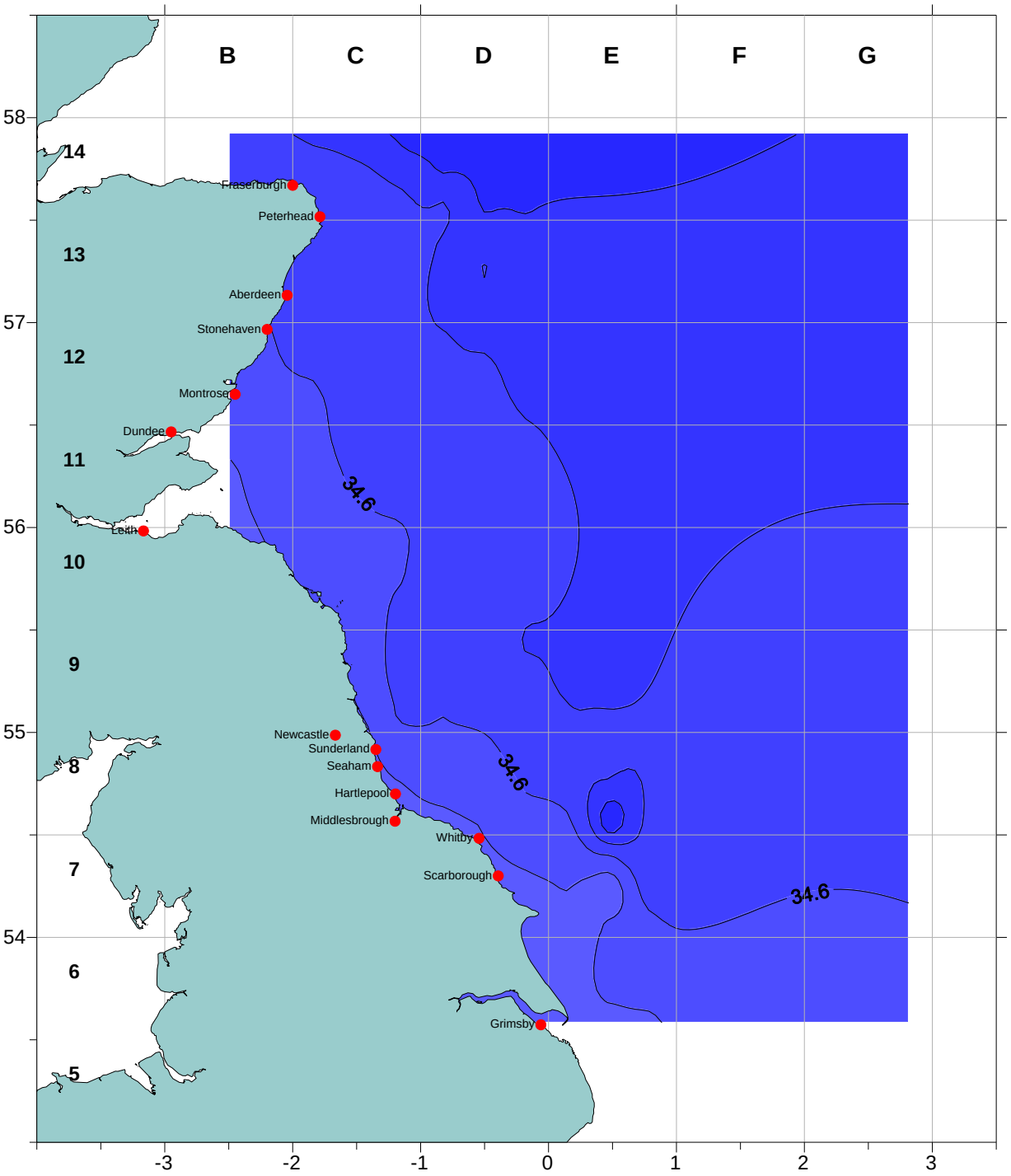

Figure 4.4. Bottom salinity during the September 2013 survey.

4.2 December survey

Date, time and harbours

From (harbour)	Date	Time (UTC)	To (harbour)	Date	Time (UTC)
Scheveningen	16-12-2013	9:00	Scheveningen	19-12-2013	20:00

Crew Kees Bakker (cruise leader)
André Dijkman-Dulkes
Ewout Blom
John Schobben

Guests Franziska Bils (University Hamburg, Germany)
Julia Rössger (University Hamburg, Germany)

Extra sampling

Ewout Blom joined the survey to collect eggs from adult herring and fertilize these for an experiment to investigate the effect of sound impulses on herring larvae. For this purpose a pelagic trawl haul was carried out.

For our colleagues from Hamburg University again the PUP-net was mounted onto the torpedo and also the SB32 water sampler was used at some stations to collect microzooplankton samples. These samples were collected for condition and diet studies of the herring larvae.

Deviations from the planned sampling grid

Due to bad weather circumstances that were predicted to become worse, the planned sampling grid was amended to allow for the sampling of the known spawning grounds. Due to this 9 planned stations could not be sampled (Figure 4.5). Positions of some stations were slightly moved for nautical reasons, thus the sampling position of these stations was off the centre of the 1/9 ICES rectangle.

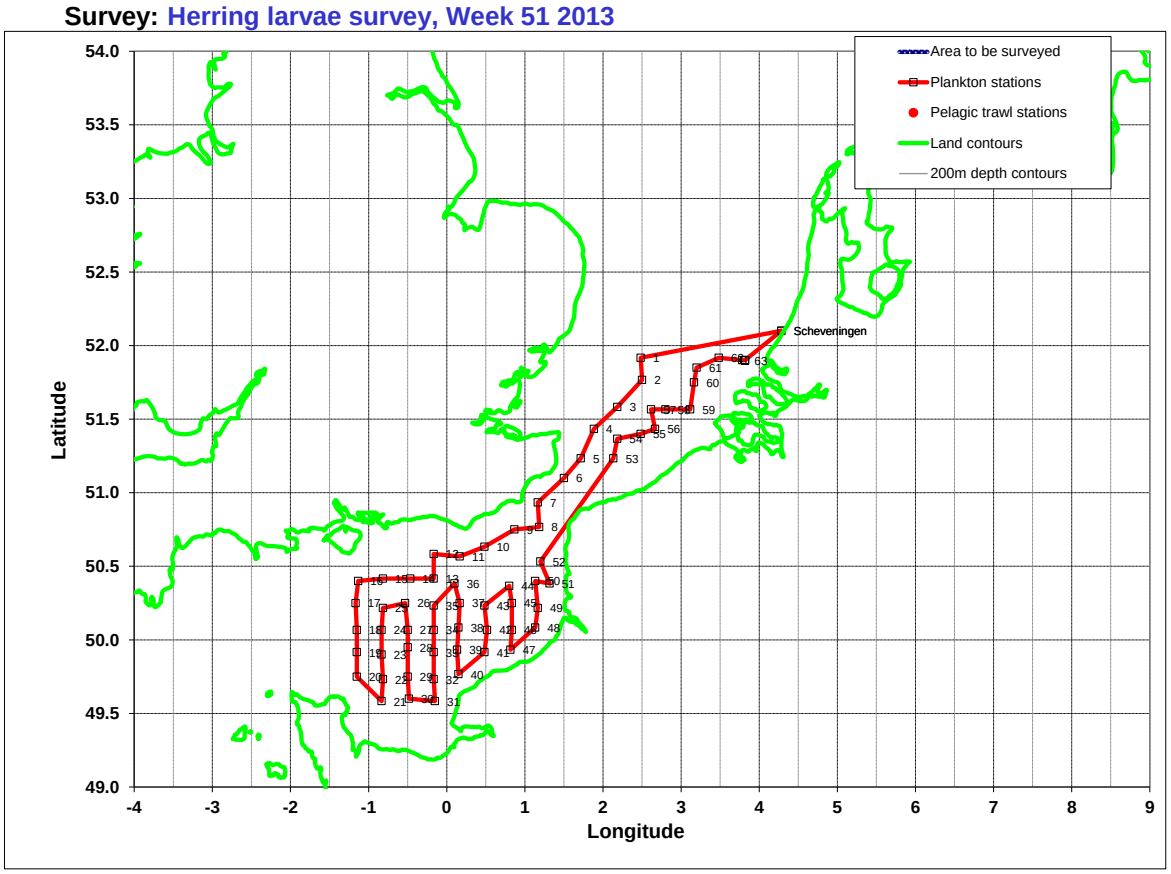

Figure 4.5. Stations sampled in December 2013.

Damage to sampling equipment
No damage occurred to the torpedo during this survey.

Survey
On Monday 16th December RV Tridens left Scheveningen harbour at 9:00 (UTC). The first plankton station was sampled at 17:04 (UTC). The last station was sampled on 19th December at 15:32 (UTC).

Sample-id's
2013.5400741 t/m 2013.5400803

Samples and data
We sampled 63 stations with a Gulf VII plankton torpedo with a CTD mounted on top. At each station a double oblique haul was performed and minimum sampling time was 10 minutes. One pelagic trawl haul was performed to collect adult herring and fertilization of herring eggs was successful.

Numbers of herring larvae
December is the start of the spawning season of the 'Downs' herring. Larvae were found at just a few surveys and the numbers caught were very low (Figure 4.6), much lower compared to previous surveys. In contrast to last year when results of the herring larvae suggested spawning started earlier, this year it looks like spawning in the English Channel has started later than other years. Of the little number of larvae caught only one larva still had a yolk-sac.
The bottom temperature in the channel and the southern North Sea were higher compared to previous years (Figure 4.7). The temperature varied from 8.4 to 12.3°C in December 2013, while in previous years it varied between 7.5 and 12.5°C. The minimum temperature was one degree higher compared to earlier. The bottom salinity clearly showed the influence of the fresh water along the Dutch southern coast (Figure 4.8). In this area salinity was lower compared to previous, but overall the pattern was the same.

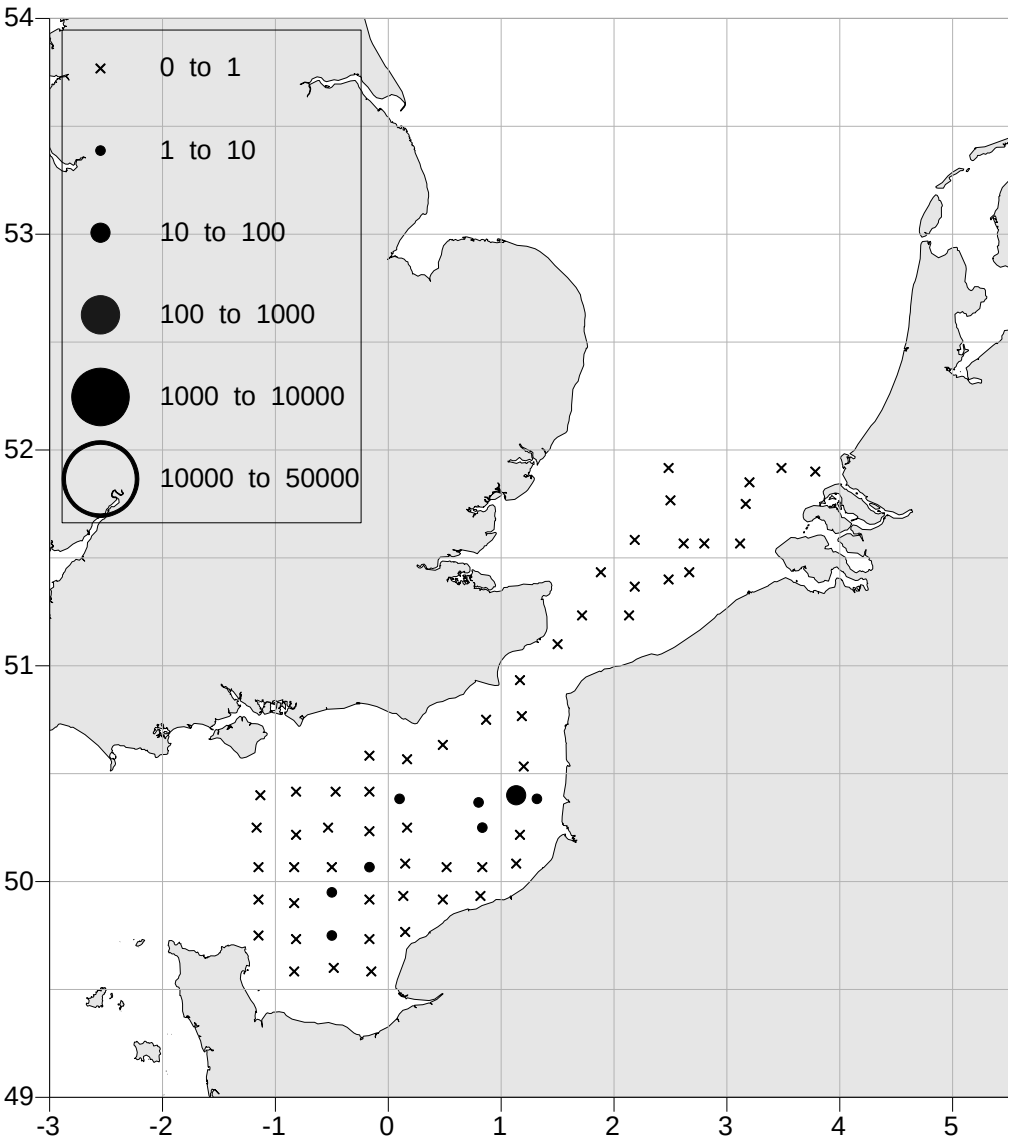

Figure 4.6. Numbers of larvae per m^2 caught during the December 2013 survey.

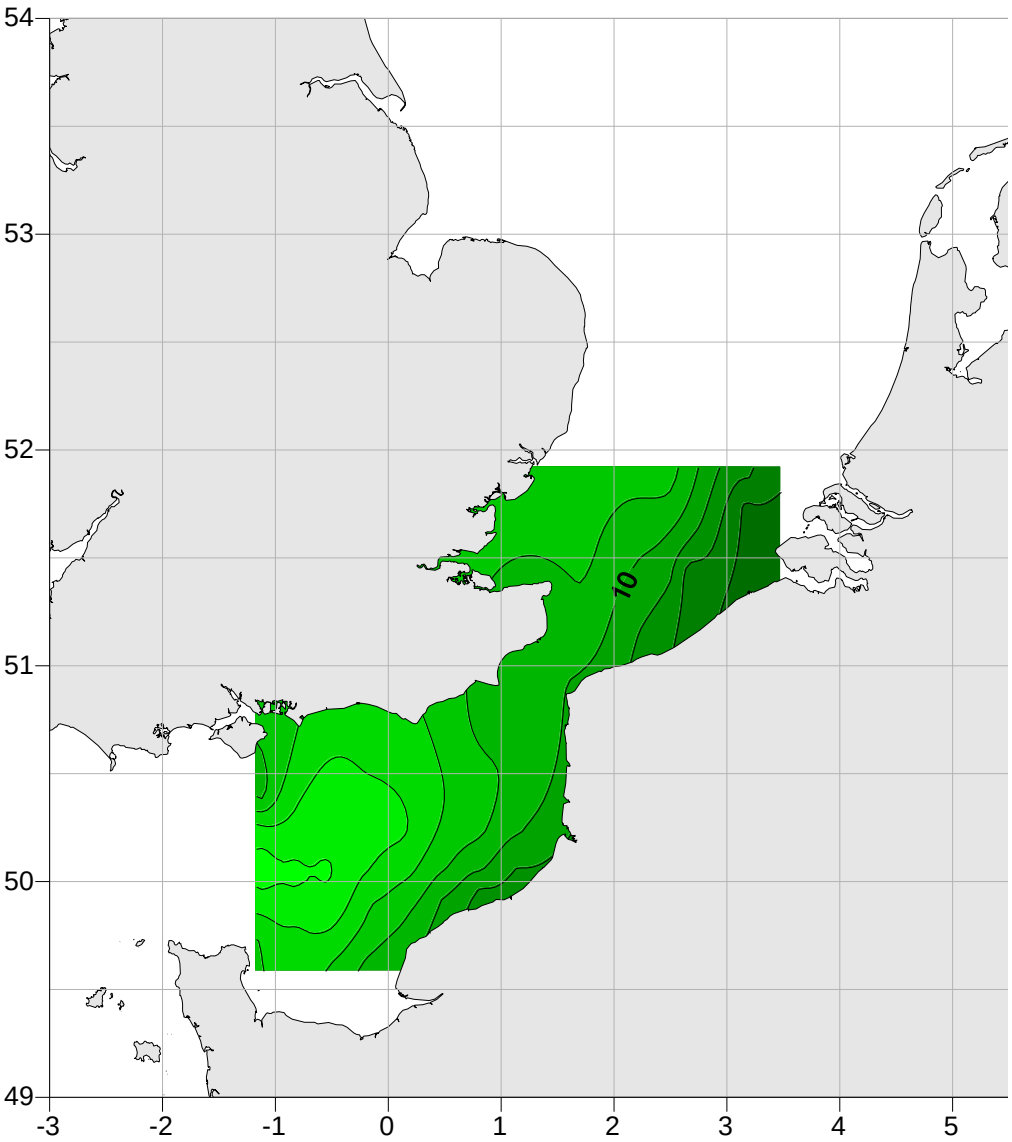

Figure 4.7. Bottom temperature during the December 2013 survey.

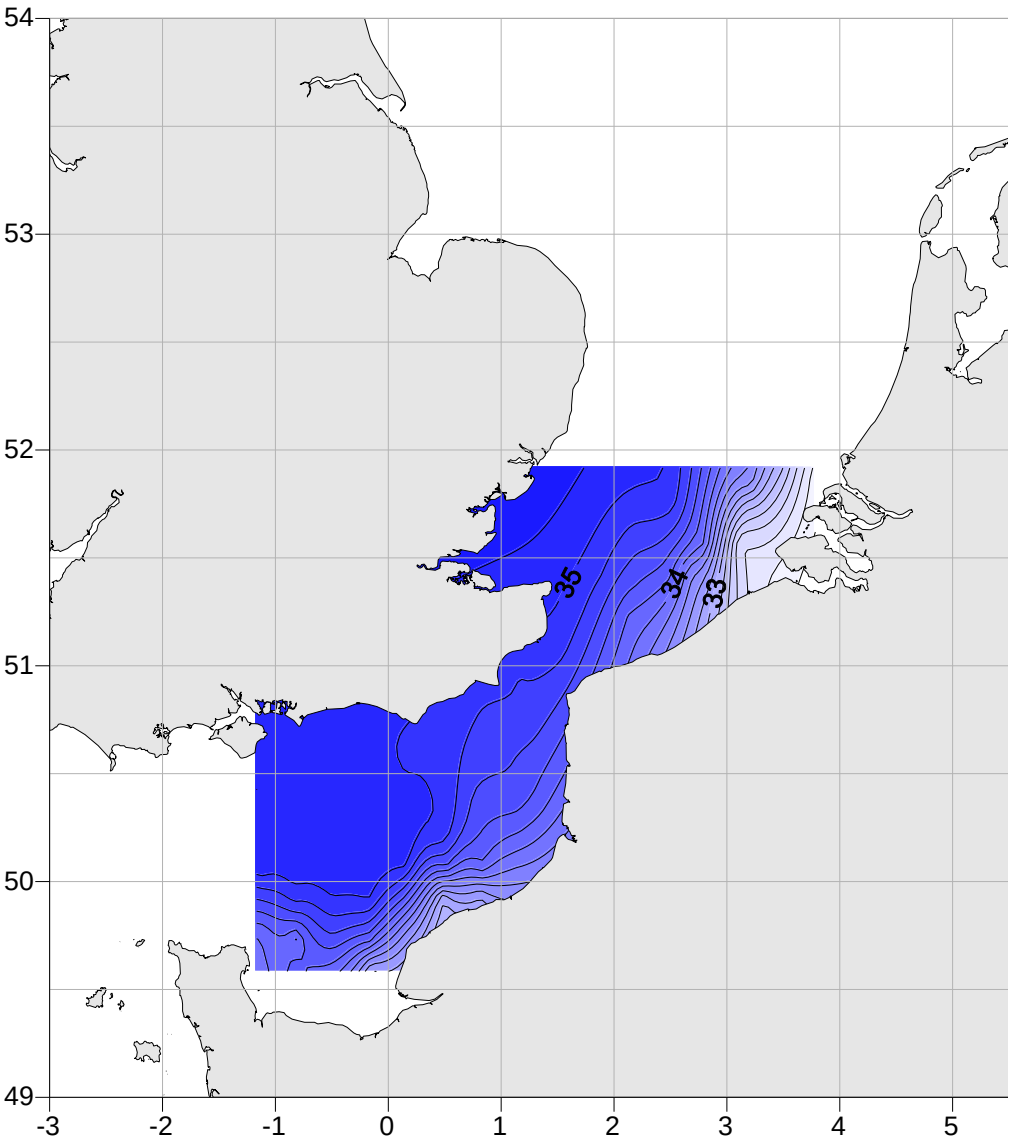

Figure 4.8. Bottom salinity during the December 2013 survey.

4.3 January survey

Date, time and harbours

From (harbour)	Date	Time (UTC)	To (harbour)	Date	Time (UTC)
Scheveningen	19-01-2014	9:00	Scheveningen	24-01-2013	13:00

Crew Kees Bakker (cruise leader)
Andre Dijkman-Dulkes

Guests Franziska Bils (University Hamburg)
Carlos Palacio Borres (University Hamburg)
Johanna Thoms (University Hamburg)
Kees Verbogt (Ministry EZ)

Extra sampling

For our colleagues from Hamburg University again the PUP-net was mounted onto the torpedo and also the SB32 water sampler was used at some stations to collect microzooplankton samples. These samples were collected for condition and diet studies of the herring larvae.

A Multisampler was also taken on board to try and collect fish larvae samples at known depth. However, due to time constraints it was not possible to do a trial haul with this sampler.

Deviations from the planned sampling grid

Due to predicted bad weather circumstances the order of sampling of the stations was turned around (Figure 4.9). However, it was possible to sample all of the planned plankton stations, except for 2 stations which are impossible to samples due to the changed ship routes in the southern North Sea. Positions of some stations were slightly moved for nautical reasons, thus the sampling position of these stations was off the centre of the 1/9 ICES rectangle.

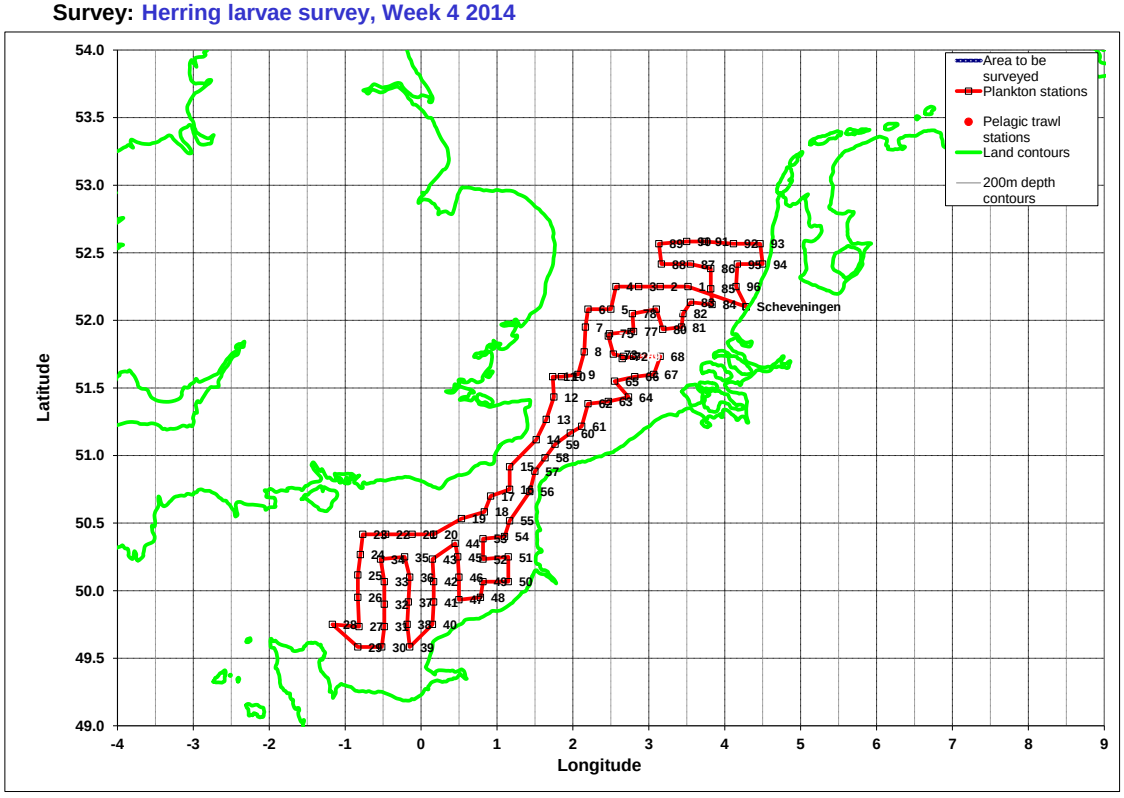

Figure 4.9. Stations sampled in January 2014.

Damage to sampling equipment

During the survey no damage was sustained to the sampling equipment.

Survey

On Monday 19th January RV Tridens left Scheveningen harbour at 9:00 (UTC). After 2 hours steaming two calibration hauls were carried out, since this was not possible during the last December 2013 survey. At 13:51 the first plankton station was sampled. The last stations was sampled on 24th December at 9:44 (UTC).

Sample-id's

2014.5400001 t/m 2014.540096

Samples and data

We sampled 96 stations, including 4 extra hauls at stations with high numbers of larvae, with a Gulf VII plankton torpedo with a CTD mounted on top. At each station a double oblique haul was performed and minimum sampling time was 10 minutes.

Numbers of herring larvae

Herring larvae were found at almost all stations above 50°N. High abundances of herring larvae were found comparable to January 2013 (Figure 4.10). In contrast to January 2013, only larvae without yolk sac were caught this survey.

The bottom temperature in January 2014 were the higher to 2013 (Figure 4.11). Like in December survey the minimum bottom temperature was one degree higher compared to last year. The bottom temperature varied from 7.8 to 10.9°C in January 2014 and from 6.7 to 10.8°C in 2013. Bottom salinity was very similar compared to January 2013 (Figure 4.12).

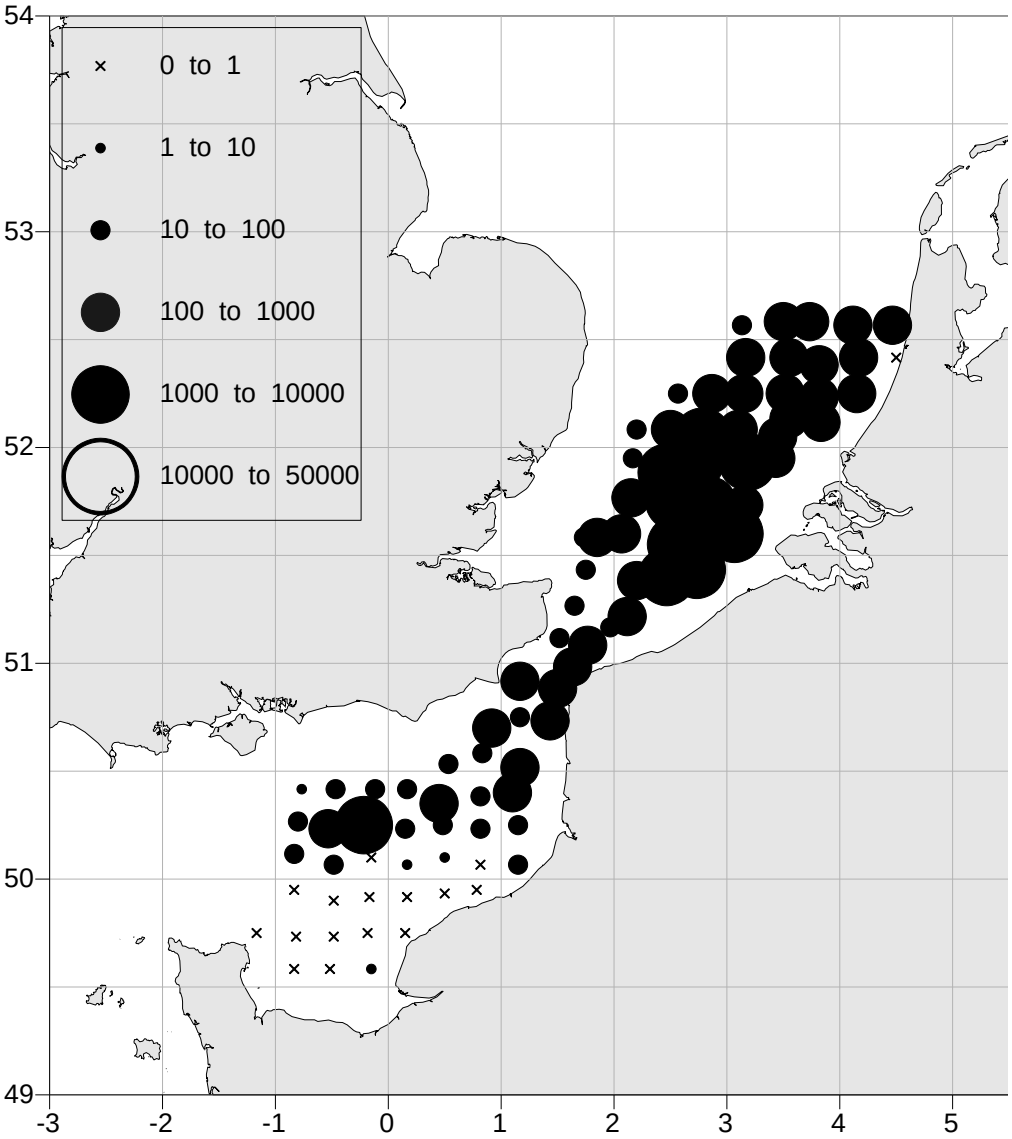

Figure 4.10. Numbers of larvae per m^2 caught during the January 2014 survey.

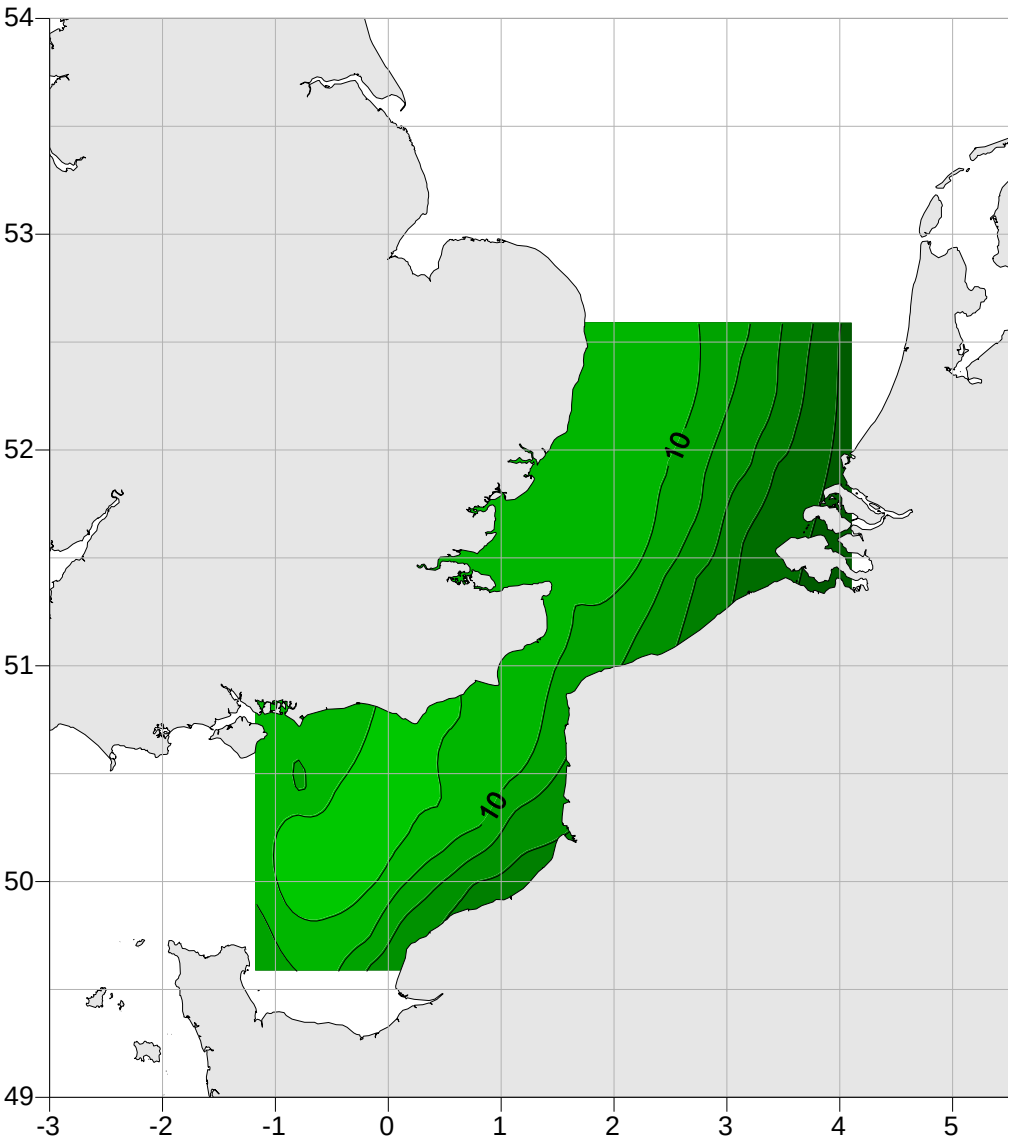

Figure 4.11. Bottom temperature during the January 2014 survey.

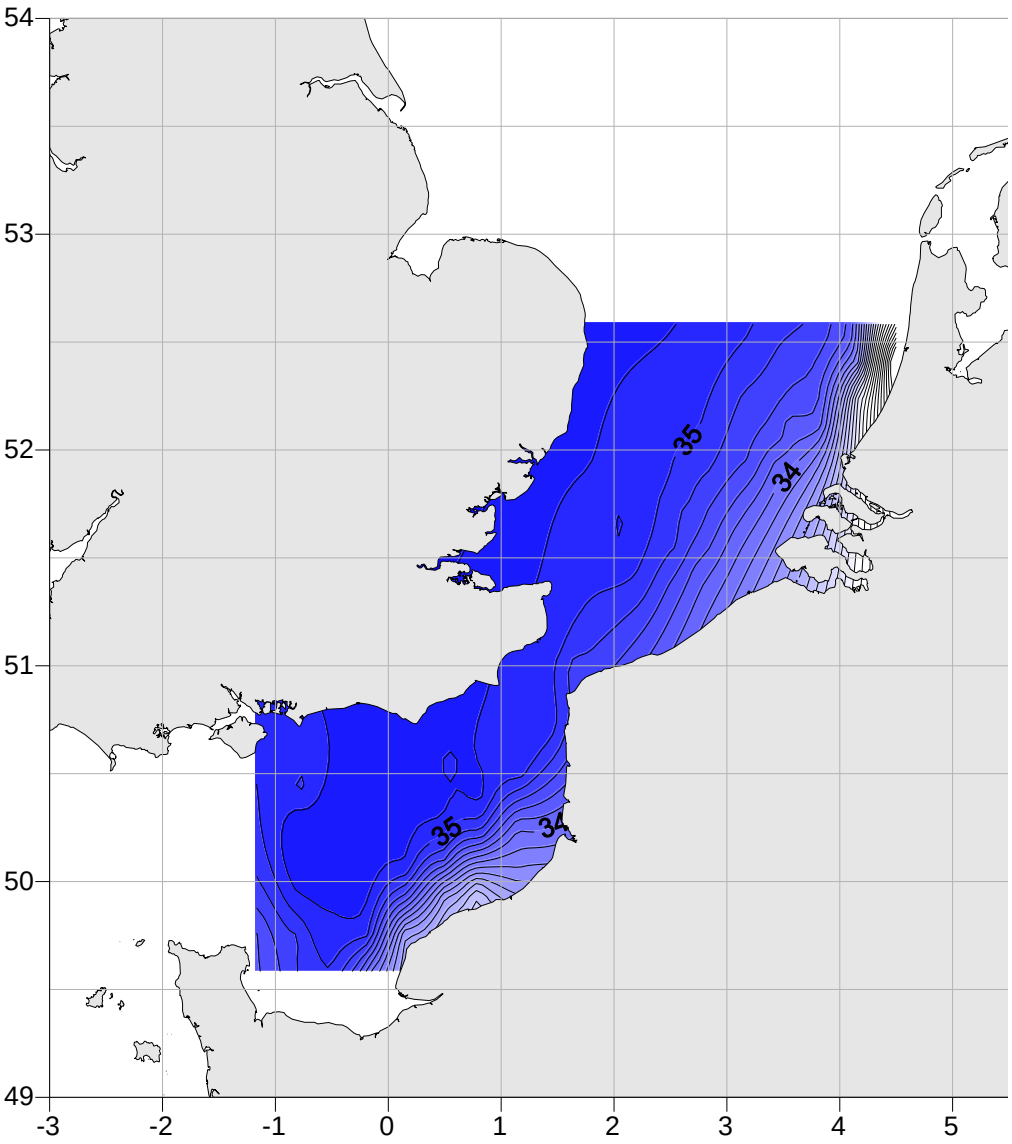

Figure 4.12. Bottom salinity during the January 2014 survey.

4.4 Remarks for next survey

Remarks from the September survey

A good communication between the bridge, deck and scientist in the laboratory is of vital importance for the execution of this survey. During the September survey the communication still needed to be done through hand-held VHF receivers and as has been stated before these do not work properly from the plankton laboratory on board. This problem could be solved with a VHF sender/receiver in the lab with an antenna outside on the roof.

Monday 16th September the survey started with only one winch working, hence no spare winch for the plankton sampling. The second one broke down during the survey. These winches are not used every survey but they are outside during every survey in all circumstances. It is therefore very important that both plankton sampling winches are checked and if needed repaired regularly, even when not used, to avoid survey time loss on plankton surveys.

Remarks from the December survey

Due to the bad weather no calibration hauls could be carried out this survey, so this needs to be done during the January survey.

Like the September survey, during the December survey the second plankton winch was not operational. Luckily the winch did not break down, but the September survey has shown how vulnerable the plankton surveys are with just one operational plankton winch.

Remarks from the January survey

Both plankton winches were repaired before this surveys and both worked well.

From the start of 2014 the international ship routes have been changed in the southern North Sea, for future surveys the station grid needs to be amended according to this.

Currently in the PUP-net a mechanic flowmeter is attached which is difficult to read. For the September 2014 survey it will be tried to attached an electronic flowmeter in the PUP-net as well.

5. Conclusions

In 2013 the abundances of herring larvae caught in the Buchan area were similar in number but at less stations and the larvae were found more northerly compared to September 2012. In the Central North Sea on the other hand, larvae were only found at a few stations and numbers in this area were higher than in 2012 and at the same level as September 2011. Variation in bottom temperature and salinity was low and the inflow of the Atlantic water was lower compared to 2012. This probably explains the more northerly distribution of the larvae this year.
In contrast to the high numbers of larvae in the English Channel and southern North Sea in winter 2012-2013, almost no larvae were found in December 2013 and in January no larvae were caught below 50°N. These results suggest that the spawning season started later than in previous years. The results of the January survey indicate that this year there was probably no prolongation of spawning. Temperature was higher this winter compared to previous years, the minimum bottom water temperature was 1 degree higher compared to the previous winter. Winter spawning herring larvae prefer colder water for spawning, the higher minimum temperature of the water is most likely the reason for the later start of the spawning this winter. In December salinity showed a strong fresh water inflow along the Dutch coast, but in January the salinity pattern was the same as in January 2013.

Despite the low number of herring larvae caught in the December and January survey, the 2014 SCAI index is the highest in the time series (Figure 5.1; ICES 2014).

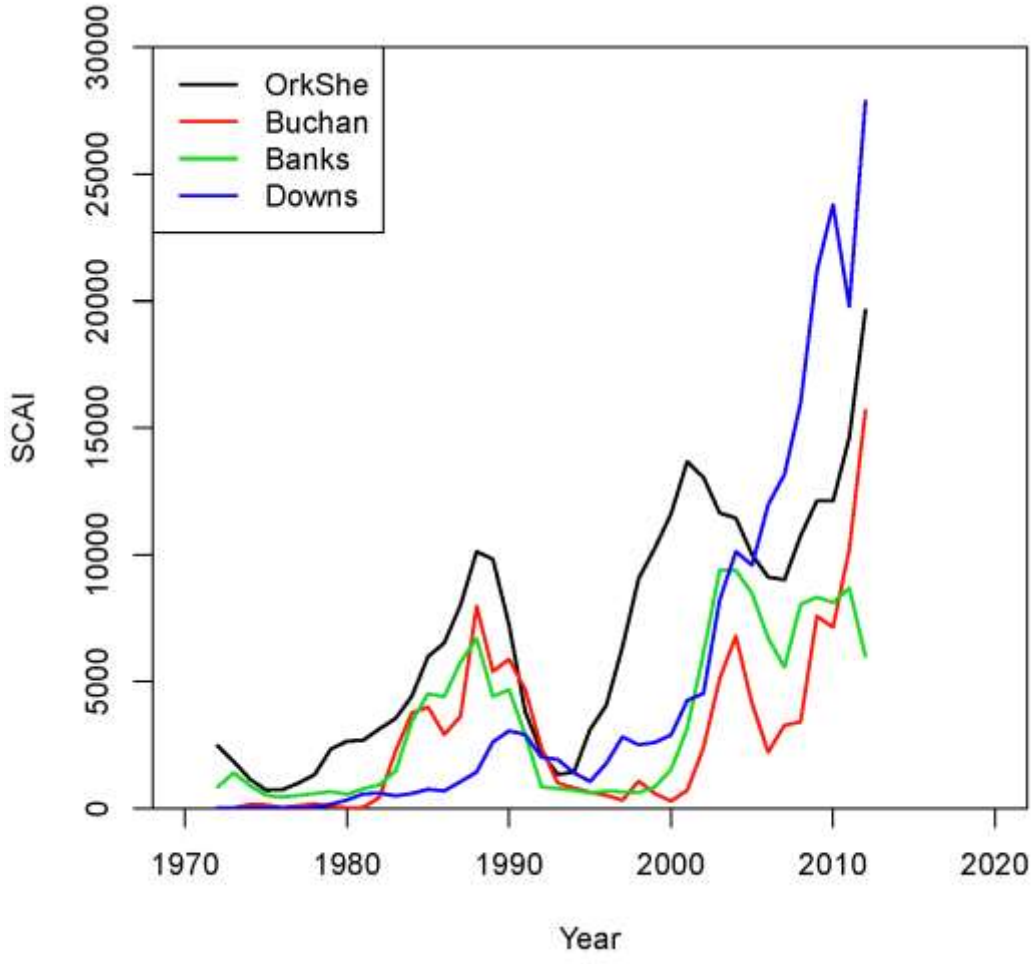

Figure 5.1. The time series of the SCAI index.

6. Quality Assurance

6.1 Check on the identification of the larvae

Following the protocols for the IMARES standard plankton surveys identification was checked (Damme *et al*. 2012).
On 1 October 2013 an internal workshop was organized for the quality control of the determination of the clupeid larvae. During the workshop 30 larvae were identified by all participants. The larvae were taken from the various herring larvae surveys in 2012 and 2013 and the MIK samples from 2013. The larvae were divided among the three plankton dissecting microscopes and every participant changed from one microscope to the other, thus possible differences between the microscopes did not influence the results of the workshop. Of each larva myotomes from the head to the anus and myotomes from the head to the tail are counted. On the basis of the number of myotomes the species of the larvae is determined and finally is the length of all the larvae measured. It is also considered whether a yolk sac was present or not.

Participants	**Expertise**
André Dijkman-Dulkes	Expert
Betty van Os-Koomen	Expert
Ineke Pennock	Expert
Ruben Hoek	Expert

Results
Tables 6.1 to 6.3 give the overview of the results of the species identification of all larvae (Table 6.1), the larvae from the herring larvae survey samples (Table 6.2) and the larvae from the MIK-samples (Table 6.3). The original identification is the identification in the sample, hence not a validated identification. On the basis of the determination of all participants and the original determination, a modal species is determined, shown in table A is the numbers per species which each participant based on the modal species should have determined. In table B is the quantity per species which actually was identified is shown. Numbers in table A and B are not always the same, because larvae are damaged during the workshop and not every participant is able to identify each larvae. The total columns at the end of table A and B are shown for information for the overall estimations of over-/underestimation and agreement. Table C shows the over-or underestimation for each participant and finally table D shows the agreement in identification by species. No validated larvae were available for this workshop so the results only show the agreement and differences among the participants, including the original identification. The original identification is taken into account as comparison since this was the identification of the larvae is the most 'fresh' state after fixation, which should be the easiest to identify and can be used as an extra check. Since the identification was done under the same circumstances it should not have a big influence on the results of the workshop.

For all larvae there is an agreement in species determination of 85%, higher compared to 2012 (79%), with an agreement of 94, 73 and 68% for herring and sprat, sardine, respectively. For herring, agreement is higher compared to the previous workshop (87%). For sprat this is a much lower outcome of the workshop of previous year, 100% agreement was reached in 2012. For sardine the agreement is lower, was 77% in 2012.
There were 4 larvae with a yolk sac still present, But there was disagreement in yolk sac identification in two herring larvae, were 50% sad no yolk sac and the others did see a yolk sac. When larvae are damaged it is difficult to note the presence of a yolk sac, this remains an issue of concern.

Table 6.1. Species identification of all larvae.

Table 6.1 Larvae identification Workshop, IJmuiden, 01 October 2013

Results of all larvae

A Species compositions using modal/actual species

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	14	14	14	14	14	70
Pilchard	2	5	5	5	5	5	25
Sprat	3	8	8	8	8	8	40
Sandeel	4	1	1	1	1	1	5
Goby	5	1	1	1	1	1	5
Roundfish	6	-	-	-	-	-	-
Flatfish	7	1	1	1	1	1	5
Unknown	8	-	-	-	-	-	-
Total	1-8	30	30	30	30	30	150

B Species compositions as estimated per participant and whole group

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	13	14	14	14	13	68
Pilchard	2	6	5	4	5	4	24
Sprat	3	8	5	7	7	8	35
Sandeel	4	1	1	1	1	1	5
Goby	5	1	2	1	1	1	6
Roundfish	6	0	0	0	0	0	-
Flatfish	7	1	1	1	1	1	5
Unknown	8	0	2	2	1	2	7
Total	1-8	30	30	30	30	30	150

C Percentage overestimation / underestimation

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	-7%	0%	0%	0%	-7%	-3%
Pilchard	2	20%	0%	-20%	0%	-20%	-4%
Sprat	3	0%	-38%	-13%	-13%	0%	-13%
Sandeel	4	0%	0%	0%	0%	0%	0%
Goby	5	0%	100%	0%	0%	0%	20%
Roundfish	6	-	-	-	-	-	-
Flatfish	7	0%	0%	0%	0%	0%	0%
Unknown	8	-	-	-	-	-	-

D Percentage agreement in species identification per species

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	93%	100%	100%	93%	86%	94%
Pilchard	2	80%	80%	80%	40%	60%	68%
Sprat	3	88%	50%	75%	63%	88%	73%
Sandeel	4	100%	100%	100%	100%	100%	100%
Goby	5	100%	100%	100%	100%	100%	100%
Roundfish	6	-	-	-	-	-	-
Flatfish	7	100%	100%	100%	100%	100%	100%
Unknown	8	-	-	-	-	-	-
Weighted mean	1-8	90.0%	83.3%	90.0%	76.7%	83.3%	84.7%
		1	3	1	5	3	

Table 6.2. Species identification of larvae from the herring larvae surveys.

Table 6.2 Larvae identification Workshop, IJmuiden, 01 October 2013

Results of HELA larvae

A Species compositions using modal/actual species

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	12	12	12	12	12	60
Pilchard	2	3	3	3	3	3	15
Sprat	3	7	7	7	7	7	35
Sandeel	4	1	1	1	1	1	5
Goby	5	1	1	1	1	1	5
Roundfish	6	-	-	-	-	-	-
Flatfish	7	1	1	1	1	1	5
Unknown	8	-	-	-	-	-	-
Total	1-8	25	25	25	25	25	125

B Species compositions as estimated per participant and whole group

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	12	12	12	11	10	57
Pilchard	2	4	4	2	3	4	17
Sprat	3	6	4	6	7	6	29
Sandeel	4	1	1	1	1	1	5
Goby	5	1	1	1	1	1	5
Roundfish	6	0	0	0	0	0	-
Flatfish	7	1	1	1	1	1	5
Unknown	8	0	2	2	1	2	7
Total	1-8	25	25	25	25	25	125

C Percentage overestimation / underestimation

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	0%	0%	0%	-8%	-17%	-5%
Pilchard	2	33%	33%	-33%	0%	33%	13%
Sprat	3	-14%	-43%	-14%	0%	-14%	-17%
Sandeel	4	0%	0%	0%	0%	0%	0%
Goby	5	0%	0%	0%	0%	0%	0%
Roundfish	6	-	-	-	-	-	-
Flatfish	7	0%	0%	0%	0%	0%	0%
Unknown	8	-	-	-	-	-	-

D Percentage agreement in species identification per species

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	100%	100%	100%	92%	83%	95%
Pilchard	2	100%	100%	67%	33%	100%	80%
Sprat	3	86%	57%	71%	71%	86%	74%
Sandeel	4	100%	100%	100%	100%	100%	100%
Goby	5	100%	100%	100%	100%	100%	100%
Roundfish	6	-	-	-	-	-	-
Flatfish	7	100%	100%	100%	100%	100%	100%
Unknown	8	-	-	-	-	-	-
Weighted mean	1-8	96.0%	88.0%	88.0%	80.0%	88.0%	88.0%
		1	2	2	5	2	

Table 6.3. Species identification of larvae from the MIK samples.

Table 6.3 Larvae identification Workshop, IJmuiden, 01 October 2013

Results of MIK larvae

A **Species compositions using modal/actual species**

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	2	2	2	2	2	10
Pilchard	2	2	2	2	2	2	10
Sprat	3	1	1	1	1	1	5
Sandeel	4	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-
Flatfish	7	-	-	-	-	-	-
Unknown	8	-	-	-	-	-	-
Total	1-8	5	5	5	5	5	25

B **Species compositions as estimated per participant and whole group**

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	TOTAL
Herring	1	1	2	2	3	3	11
Pilchard	2	2	1	2	2	0	7
Sprat	3	2	1	1	0	2	6
Sandeel	4	0	0	0	0	0	-
Goby	5	0	1	0	0	0	1
Roundfish	6	0	0	0	0	0	-
Flatfish	7	0	0	0	0	0	-
Unknown	8	0	0	0	0	0	-
Total	1-8	5	5	5	5	5	25

C **Percentage overestimation / underestimation**

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	-50%	0%	0%	50%	50%	10%
Pilchard	2	0%	-50%	0%	0%	-100%	-30%
Sprat	3	100%	0%	0%	-100%	100%	20%
Sandeel	4	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-
Flatfish	7	-	-	-	-	-	-
Unknown	8	-	-	-	-	-	-

D **Percentage agreement in species identification per species**

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	ALL
Herring	1	50%	100%	100%	100%	100%	90%
Pilchard	2	50%	50%	100%	50%	0%	50%
Sprat	3	100%	0%	100%	0%	100%	60%
Sandeel	4	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-
Flatfish	7	-	-	-	-	-	-
Unknown	8	-	-	-	-	-	-
Weighted mean	1-8	60.0%	60.0%	100.0%	60.0%	60.0%	68.0%
		2	2	1	2	2	

For the larvae of the herring larvae survey samples, there is an agreement of 95% for herring, 80% for sardine and for sprat 74%. Compared to 2012 this is an improvement for herring, but for sprat and sardine percentage agreement decreased. For the MIK-samples the agreement for herring was a bit lower compared to the herring larvae survey samples, 90% and much higher compared to 75% in 2012. For sardine 50% and sprat 60% from the MIK samples during this workshop. Compared to 2012, this is a deterioration in agreement of 25% in sardine. No sprat larvae from the MIK samples were available in the 2012 workshop.

This year the quality of the larvae to identify during the workshop was good. These results suggest that there is a good consensus in the identification of the herring, and that agreement between the identifiers has improved. The identification of sardine and sprat is still problematic. Like previous workshop, this workshop showed that the identification of the larger larvae from the MIK samples is more difficult, in comparison to the smaller larvae. The MIK sample larvae are larger and less transparent than the

smaller larvae from the herring larvae survey samples and it is therefore more difficult to count the myotomes.

Table 6.4 shows the relative difference in the number of counted myotomes. First the modal number of myotomes per larva is determined and then the difference per participant in myotomes relative to this mode is estimated. The average values of the participants are low, but the STDEV is high. The values are comparable to 2012.

Table 6.4. Over/underestimation of the number of myotomes.

	Myotomes from head to anus					Myotomes from head to tail			
	Reader 1	Reader 2	Reader 3	Reader 4		Reader 1	Reader 2	Reader 3	Reader 4
Mean overall	0	-2	-1	1		-1	0	1	0
STDEV overall	3.04	10.55	1.52	1.33		2.22	1.41	3.62	1.67
Mean HELA	0	0	-1	0		-1	0	1	0
STDEV HELA	3.25	2.97	1.44	1.11		2.24	1.49	3.83	1.23
Mean MIK	0	1	-2	1		1	1	0	1
STDEV MIK	3	3	2	2		2.00	1.11	3.15	3.14

Table 6.5 shows the over/underestimation of the length relative to the average length. The means are low and comparable to 2012. However, the standard deviation for all readers is considerably larger compared to 2012.

Table 6.5. Over/underestimation the larvae length measurements.

	Length			
	Reader 1	Reader 2	Reader 3	Reader 4
Mean overall	-1	0	0	0
STDEV overall	0.90	0.61	1.19	0.59
Mean HELA	0	0	0	0
STDEV HELA	0.73	0.62	1.25	0.50
Mean MIK	-1	0	0	0
STDEV MIK	1.46	0.86	1.27	0.78

Finally, no validated larvae were available for this workshop so the results only show the agreement and differences among the participants. Because no validated larvae are available it is difficult to interpret what the effect of the identification will be on the survey results. There is no mistake in the identification of other larvae from clupeids. Since the agreement in herring larvae identification is high and with the assumption that the numbers of sprat and sardine larvae in the field are much lower compared to herring it is assumed that these results confirm the numbers of herring larvae found in the field samples are correct.
In September 2014 an international clupeid identification workshop will be held in which IMARES will participate. This workshop will have validated larvae available and will supply more information on the accurateness of the identification and why agreement in sprat and sardine identification is lower compared to herring.

6.2 ISO

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 124296-2012-AQ-NLD-RvA). This certificate is valid until 15 December 2015. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Fish Division has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2017 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

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Justification

Report number: C107/14
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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Ingeborg de Boois
Project leader surveys

Signature: 

Date: 11th July 2014

Approved: John Schobben
Head department Fish

Signature: 

Date: 11th July 2014