Herring larvae surveys 2011-2012: Survey reports and results

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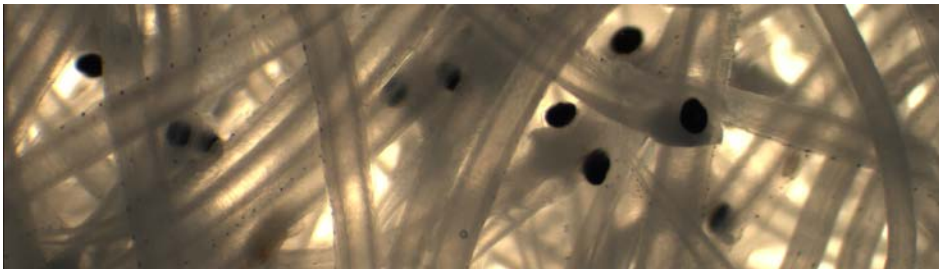
Report number C099.12



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Contents

Summary

In the period September 2011 to January 2012 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. The weather conditions during the September and December surveys were mostly good and all planned stations could be sampled. In January due to bad weather conditions and engine problems some stations could not be sampled. During all surveys good coverage of the entire sampling area was achieved.

In September high numbers of herring larvae were caught. The abundances were higher compared to September 2010. In December and January high numbers of larvae were caught, but lower compared to previous surveys in 2010-2011. In December and January the larvae were less spread over the area compared to the previous surveys. This season the Spawning-Component Abundance Index (SCAI) is the highest in the time series.

An internal larvae identification workshop was held for quality assurance. The agreement in identification of all larvae is lower compared to previous workshops. This is mainly due to lower agreement in the identification of sprat and sardine larvae, for herring larvae agreement was comparable to the previous workshop but can still be improved.

1. Introduction

Larvae of the autumn and winter spawning herring populations in the North Sea and English Channel are sampled every year during the international herring larvae surveys (IHLS). The number of larvae is the basis of an estimate of the existing spawning stock biomass. This produces a fishery-independent estimate used for ' tuning' of the herring assessment. This research is performed within the statutory research tasks within the framework of EL&I-programs (WOT).

The international herring larvae surveys are carried out together with the German fisheries institute "Johann Heinrich von Thünen Institute" in Hamburg. In the autumn larvae of herring spawning in the north western North Sea are sampled:

- 1^{e} half of September – Orkney/Shetland by Germany (2 weeks)
- **2^{e} half of September – Buchan and Central North Sea by Netherlands (2 weeks)**

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

- **2^{e} half of December – southern North Sea/Eastern Channel by Netherlands (1 week)**
- 1^{e} half of January – southern North Sea/Eastern Channel by Germany (1 week)
- **2^{e} half of January – southern North Sea/Eastern Channel by Netherlands (1 week)**

The herring larvae survey is coordinated by the ICES "Working Group for International Pelagic Surveys" (WGIPS), formerly "Planning Group for Herring Surveys" (PGHERS). The database is managed by the von Thünen institute.

In the past the numbers of herring larvae in the North Sea were presented in the so-called "MLAI-index" (Multiplicative Larval Abundance Index), based on the results of all herring larvae surveys. The MLAI index is based on the assumption that the relative proportions between the different spawning components, Shetland, Buchan and Central North Sea and the ‘Downs’, are fixed. In the past years the relative proportion of the ‘Downs’ component has increased. A new index has been developed that includes the changes in relative proportions between the different spawning components, the “SCAI”-index (Spawning-Component Abundance Index; Payne, 2010). Since 2012 the “SCAI” Spawning-Component Abundance Index” is calculated.
The MLAI and SCAI are used by the ICES “Herring Assessment Working Group” (HAWG) for the estimation of the herring spawning stock biomass.

2. Objective

The purpose of the International Herring Larvae Surveys (IHLS) is to provide an index for the spawning biomass of the autumn and winter spawning herring populations in the North Sea and English Channel. This index is used by the "Herring Assessment Working Group" (HAWG) for tuning of the assessment.

This report contains the results of the Dutch herring larvae surveys carried out in 2011-2012.

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. 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 sampler in the water column and its height off the seabed and the temperature and salinity continually throughout each deployment.

Figure 3.1. The Gulf VII plankton sampler.

3.2 Fishing method

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

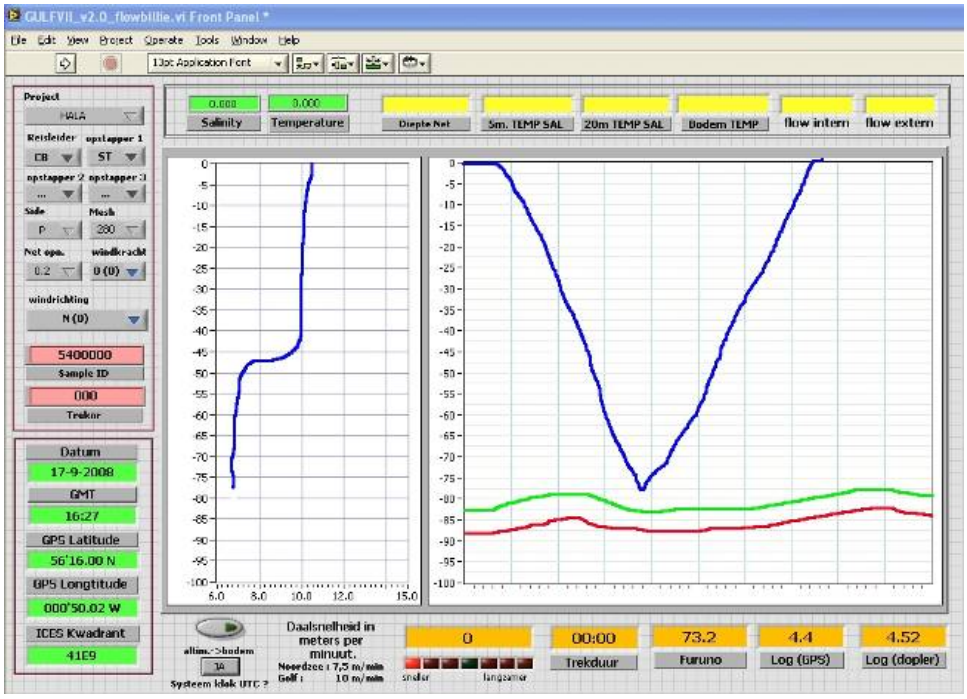

Figure 3.2. Illustration of a 'double-oblique' haul in the Labview program. In the right frame: The blue line shows the depth profile of the plankton sampler, the red line is the sea bottom depth, the green line is the 5 meter above the bottom safety line. In the left frame: The blue line shows the temperature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

The plankton sampler was lowered to 5 meter above the sea floor. To ensure that enough water was filtered, the haul duration needed to be at least 10 minutes. At shallower stations a double or triple 'double oblique' was performed without the plankton sampler 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. This to ensure a reliable estimate of the total number of larvae which is not dominated by exceptional high catches.

3.4 Workup of samples

After each deployment, as soon as the plankton sampler 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 is estimated. The fresh sample is immediately fixed in 4% buffered formaldehyde (formaldehyde solutions were buffered with sodium acetate trihydrate).
Upon return after each survey, fish larvae were sorted out from the fixed sample. If the sample contains a high number 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. At least 100 clupeid larvae were measured in each sample.
All data is entered into Billie turf and after data control uploaded to the IMARES FRISBE database.

For quality assurance an internal clupeid larvae identification workshop is held before the survey samples were analysed.

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 krigging 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	19-09-2011	09:00	Dundee	23-09-2011	16:00
Dundee	26-09-2010	08:00	Scheveningen	29-09-2010	20:00

Crew Kees Bakker (cruise leader)
Ruben Hoek
Volunteers Silja Tribuhl
Bert Storm

Deviations from the planned sampling grid

There were no deviations from the planned sampling grid. In total 144 stations were sampled during the September survey (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.

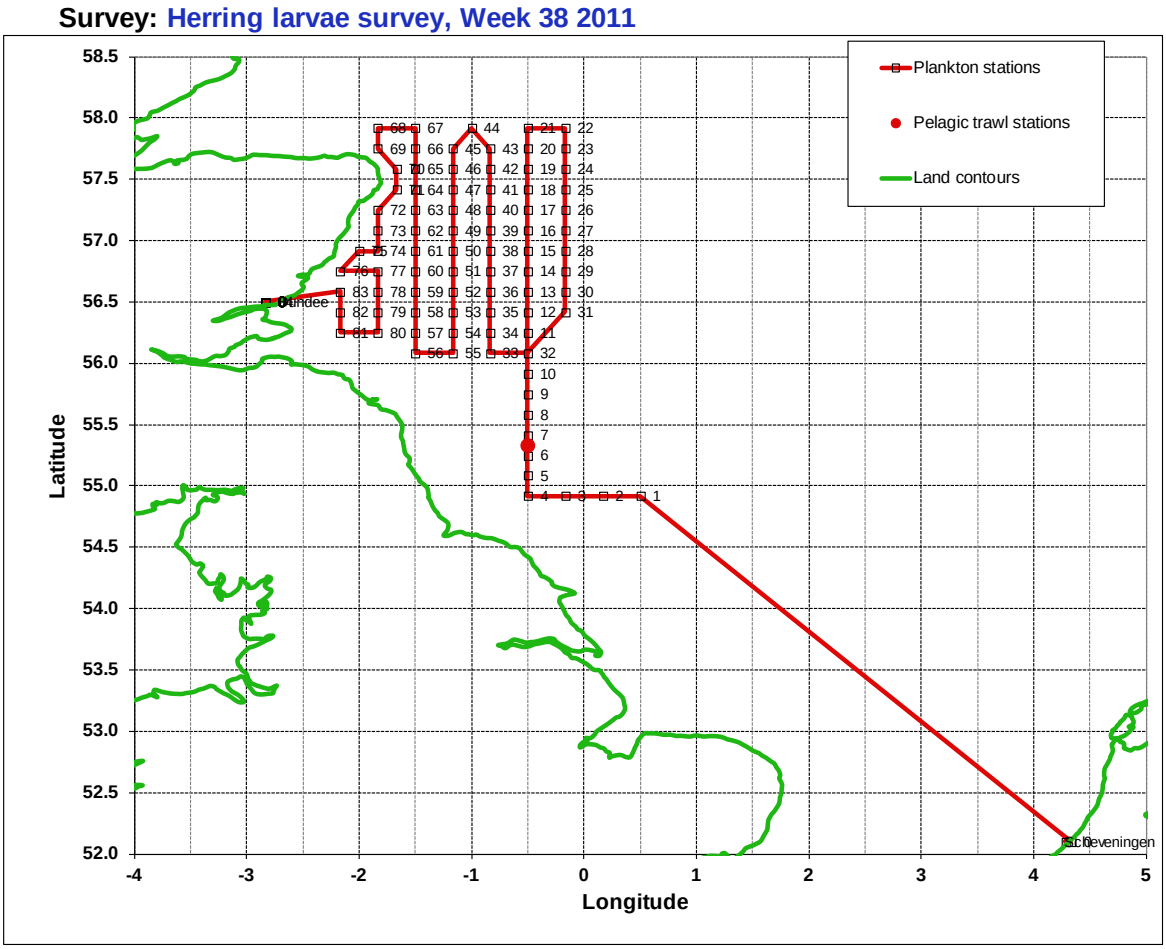

Figure 4.1a. Stations sampled in week 38 2011.

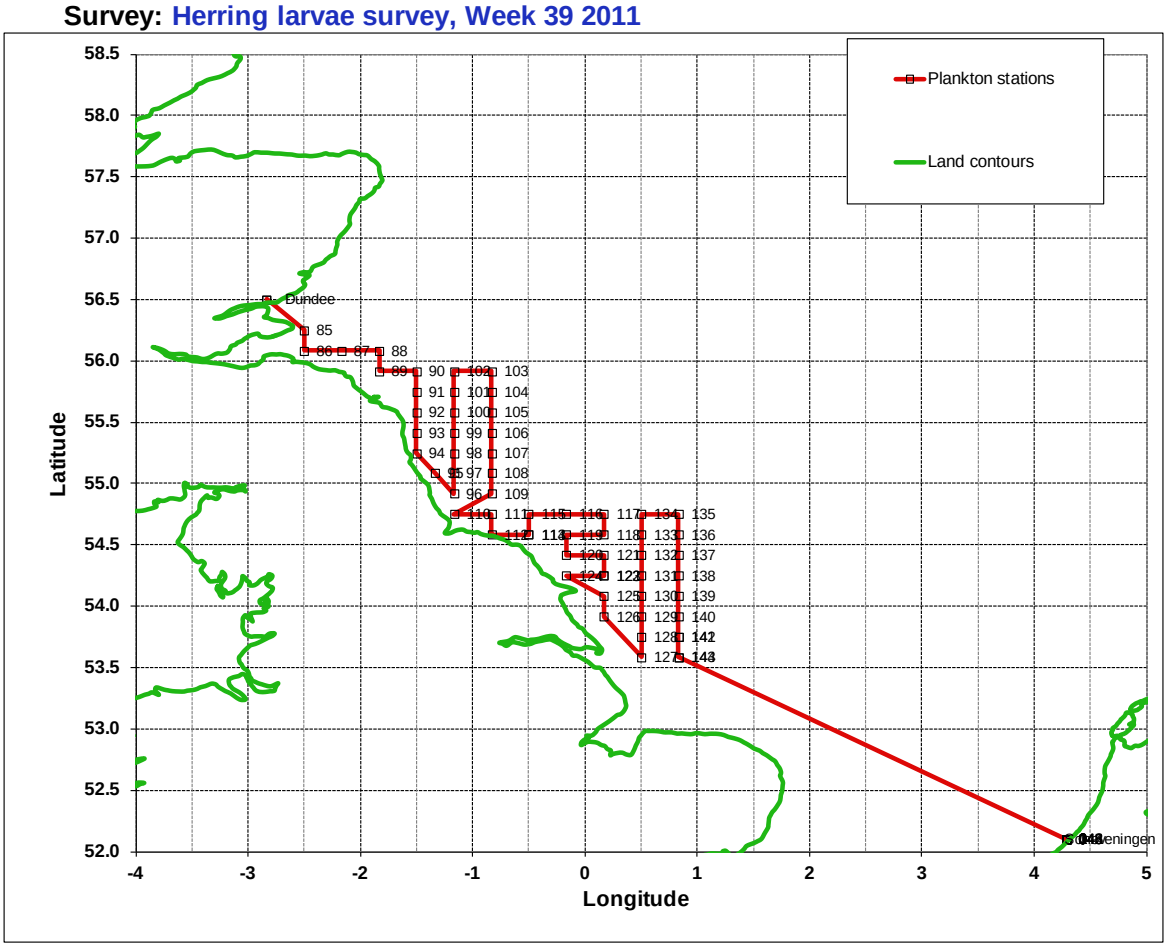

Figure 4.1b. Stations sampled in week 39 2011.

Damage to sampling equipment

No damage to the sampling equipment occurred during this survey.

Survey

On Monday 19 September 2011 at 09:00 (UTC) departed from the port of Scheveningen. The first station was reached after 17 hours steaming, on 20-09-2011 at 01:47 (UTC) be fished. A calibration of the flowmeters was carried out before the first station was sampled. On 28-09-2011 17:02 (UTC) the last station was sampled.

On 20-09-2011 around 06:00 (UTC) we collected a sample of adult spawning herring fish. After 15 minutes towing the sensors on the net showed that sufficient herring was caught.

For the weekend we planned to dock in the port of Aberdeen, but because the harbour was crowded we detoured to Dundee. On Monday 26 September 2011 at 10:18 (UTC) we resumed the survey.

On Monday 26 September 2011 around 15:30 (UTC) something remarkable happened! The communication between the computers was suddenly disconnected, and our measurements became impossible resulting in loss of sampled stations! This is intolerable! In the paragraph "Remarks for the next survey" is explained what happened exactly.

Partly due to the favourable weather, we sampled most plankton stations hassle-free.

In general higher numbers of larvae were estimated in the samples. Unlike last year. Especially in the northern part of the survey more larvae were found.

Also in the second week especially in the southern part some extra samples were collected because many more than 1000 larvae were found at the standard stations.

Sample-id's
2011.5400361 t/m 2011.5400504, 2011.5400601

Samples and data
We sampled 144 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.

Remarks for the next surveys
Aboard the 'RV Tridens' it is possible to switch network ports on and off from the shore. Given the fact that a large proportion of IMARES computers during IMARES surveys are used as measurement and control systems and mutually communicate over TCP-IP, it is unacceptable that the network ports are manually switched on and off from the shore. Our survey instruments, with a purchase price of around 100.000, - euro, are dragged to 5 meters above the bottom. When the monitoring falls away (what happened when the ports were closed!), the consequences can be disastrous! Damage to the material and, in the worst case, loss of the instruments. For this issue, it is imperative that for the next herring larvae surveys in December 2011 and January 2012 an appropriate solution is wanted!

The starboard torpedo winch is still not usable. A persistent wiring error is the cause, probably due to the inferior slip rings. At the moment we haven't got a spare winch, which makes the plankton surveys very vulnerable. It is of the utmost importance for the next larvae surveys (December 2011/January 2012) to remedy this.

Numbers of herring larvae
High numbers of herring larvae were found in the centre of the northern part of the Buchan area, but especially in the southern part of the sampling area in the Central North Sea (Figure 4.2). In general numbers of herring larvae caught were higher compared to September 2010.
Bottom temperature was not very variable in the sampling area (Figure 4.3). Temperature varied between 10.1 and 14.2°C. In 2010 the temperature range was much smaller, between 12.0 and 13.7°C (Fig. 4.3). In September 2011 temperature distribution was the same as in 2009.
Like the bottom temperature, bottom salinity was not very variable in September 2011 (Figure 4.4). The 35 ‰ isocline is at the same position as in 2010. Along the coast line salinity is lower compared to 2010.

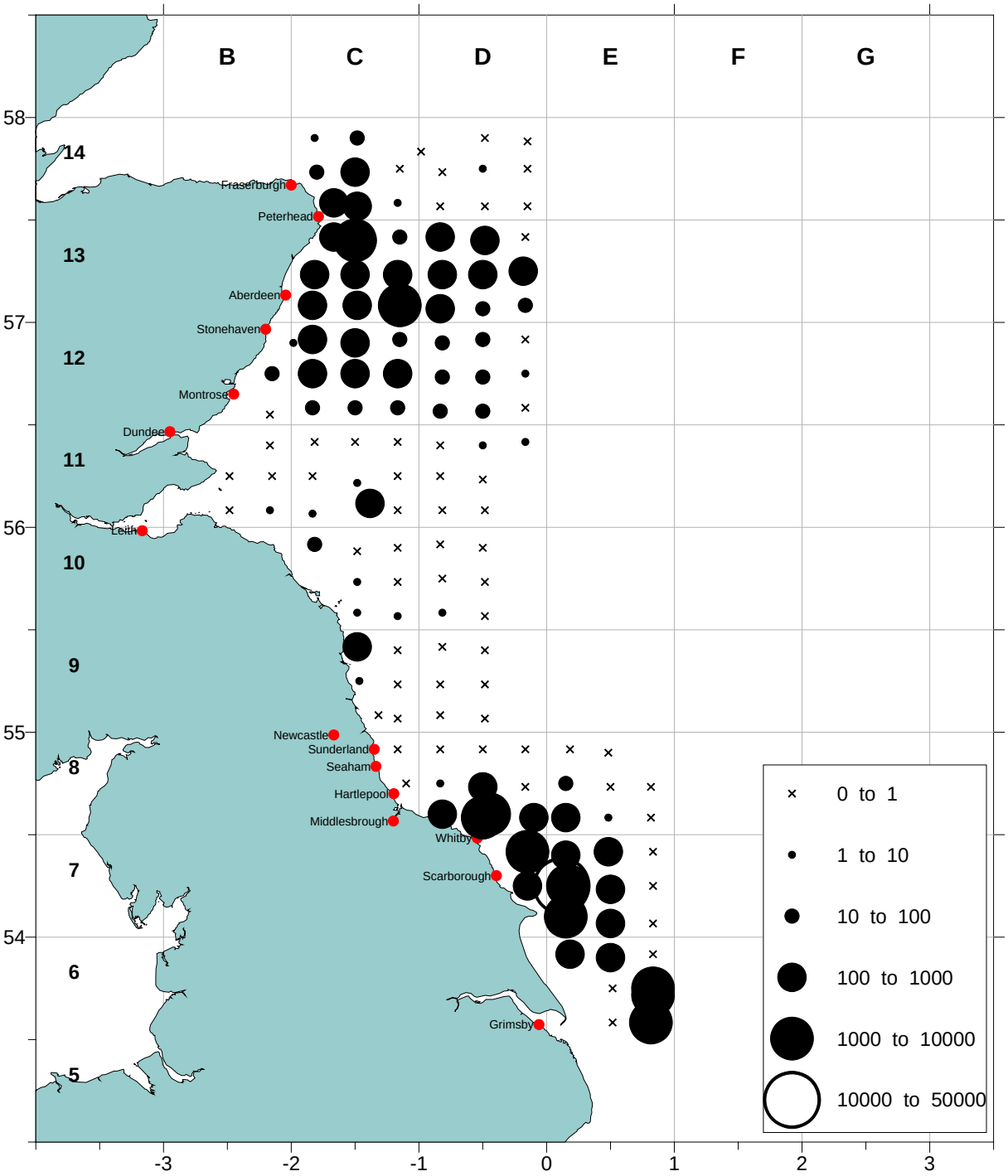

Figure 4.2. Numbers of larvae per m^2 caught during the September 2011 survey.

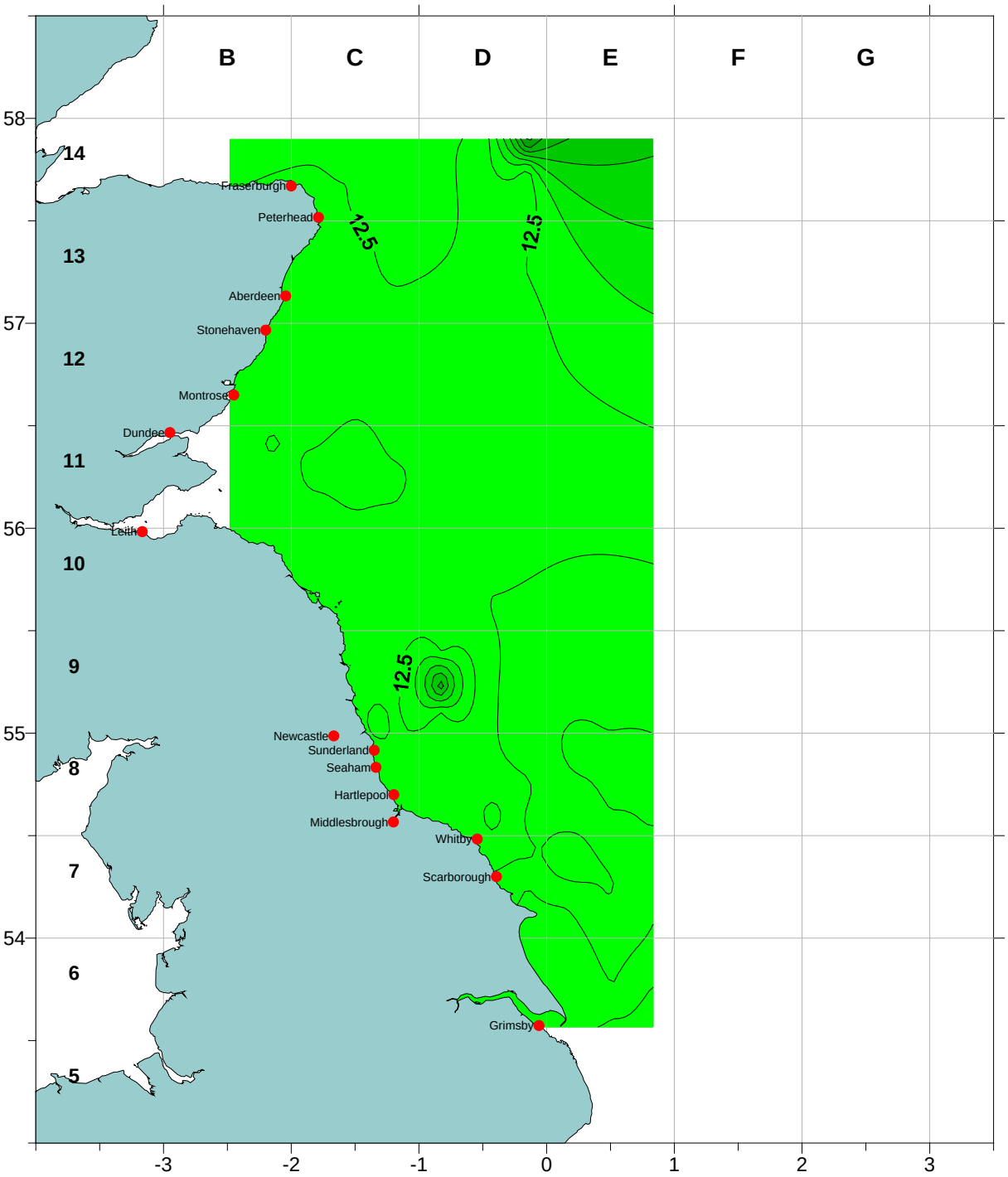

Figure 4.3. Bottom temperature during the September 2011 survey.

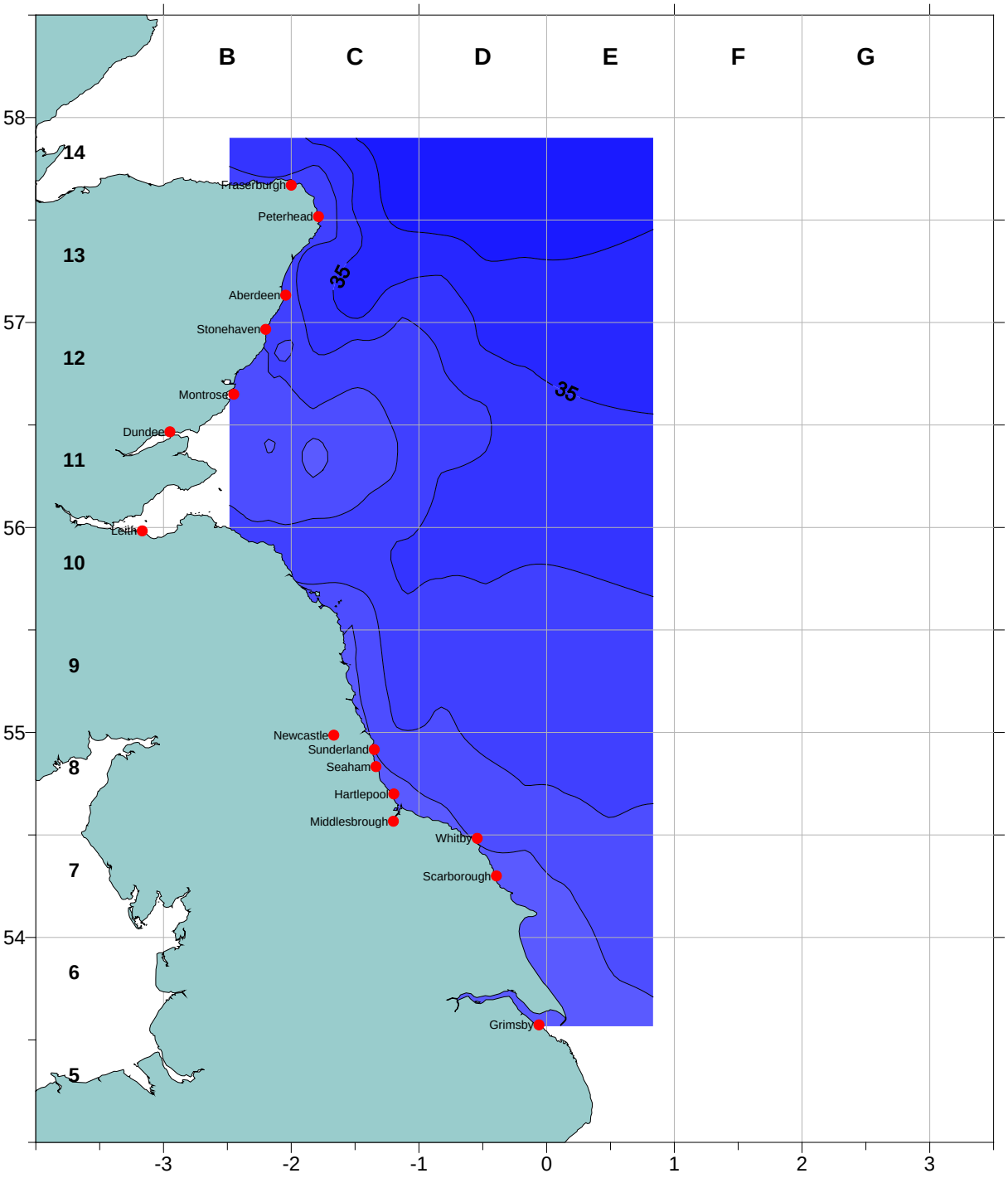

Figure 4.4. Bottom salinity during the September 2011 survey.

4.2 December survey

Date, time and harbours

From (harbour)	Date	Time (UTC)	To (harbour)	Date	Time (UTC)
Scheveningen	19-12-2011	09:30	Scheveningen	22-12-2010	19:00

Crew Kees Bakker (cruise leader)
André Dijkman-Dulkes

Guests Bjorn Illing (University Hamburg, Germany)
Jan Niemax (University Hamburg, Germany)

Deviations from the planned sampling grid

No deviations from the proposed sampling grid occurred (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.

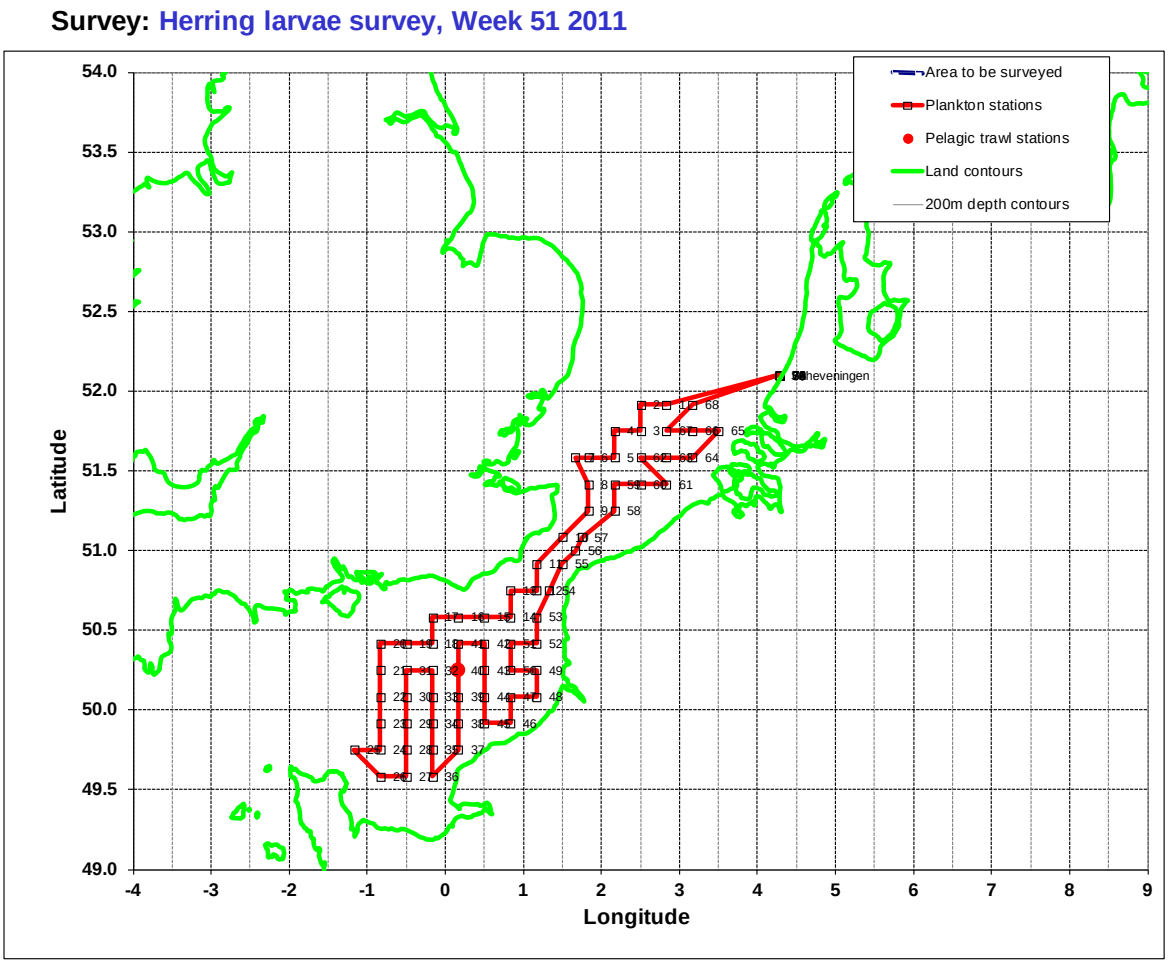

Figure 4.5. Stations sampled in December 2011.

Damage to sampling equipment

No damage to the sampling equipment occurred during this survey.

Survey

On Monday 19 December 2011 at 9:30 (UTC) RV Tridens departed from the port of Scheveningen. The first station was reached after three hours steaming and sampled at 14:25 (UTC). On 22 December, at 12:15 (UTC) we sampled the last station. On the 68 planned stations 74 samples were taken, including 5 additional samples because of high numbers of larvae found.

For the collection of data on the development of the herring larvae, a pelagic trawl haul was performed at 50.30°N and 00.30°E to collect spawning herring. The catch consisted of 250kg herring, eggs of 40 females were collected and fertilized and left to develop in the temperature control room.

Sample-id's
2011.5400511 t/m 2011.5400584

Samples and data
We sampled 74 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 in the centre of the spawning area.

Remarks for the next survey
The accurate control of the torpedo winches requires much effort from the bridge personnel. This is a task that should be carried out with extreme precision and with much concentration and thus skill of the operator is requested. Experience and exercise of the bridge personnel is very important. Wrong usage of the torpedo winches can lead to loss of the torpedo and reduces the quality of the plankton sampling. During the last years temporary workers are hired for a single survey. The temporary personnel needs to be trained while on survey. To learn the correct handling and build up expertise in handling of the torpedo winches takes a few days. Since the herring larvae survey only take one week the temporary personnel is trained at the end of the survey but the next survey a new person joins. This reduces the quality of our plankton surveys!

Due to long delivery times, the slip rings sets on the torpedo winches were not replaced before this survey. Already at the first stations problems occurred with the equipment. It soon became apparent that the problems were due to the old drag rings on the winches. For the start of the next herring larvae survey in January 2012 this problem needs to be resolved.

Numbers of herring larvae
December is the start of the spawning season of the 'Downs' herring. The numbers of larvae are high (Figure 4.6), but lower compared to December 2010. The larvae are also less spread out over the area compared to December 2010, suggesting spawning started later this year. Highest abundances of herring larvae were not found directly north of the Seine Bay, but more in the eastern Channel at the knows spawning hotspot. Many herring larvae both with and without yolk sac were caught.
The bottom temperature in the channel and the southern North Sea was much higher in December 2011 compared to December 2010 (Figure 4.7). The temperature varied from 7.9 to 12.4°C, in 2010 the temperature varied between 4.9 and 10.7°C.
The bottom salinity is higher compared to 2010 (Figure 4.8).

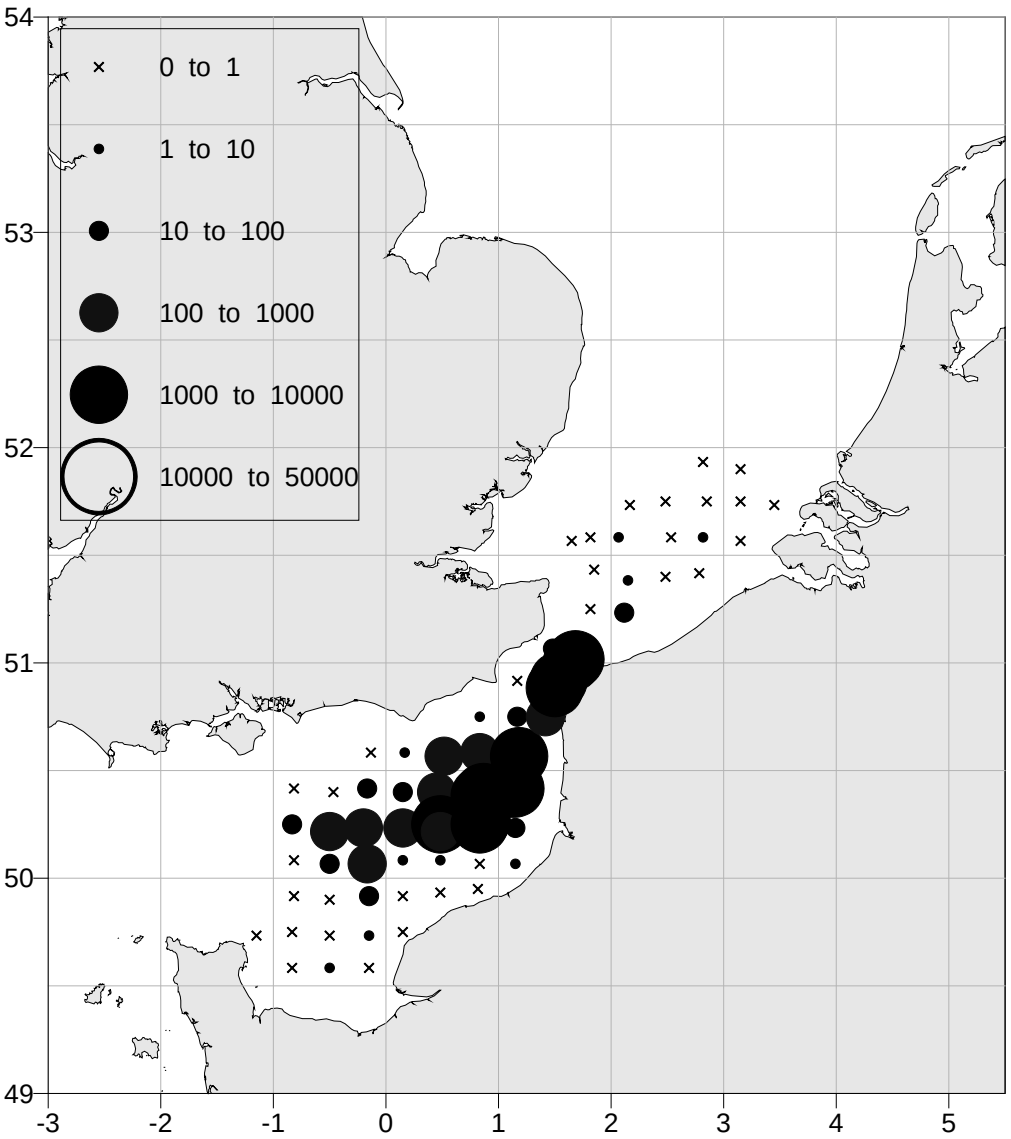

Figure 4.6. Numbers of larvae per m^2 caught during the December 2011 survey.

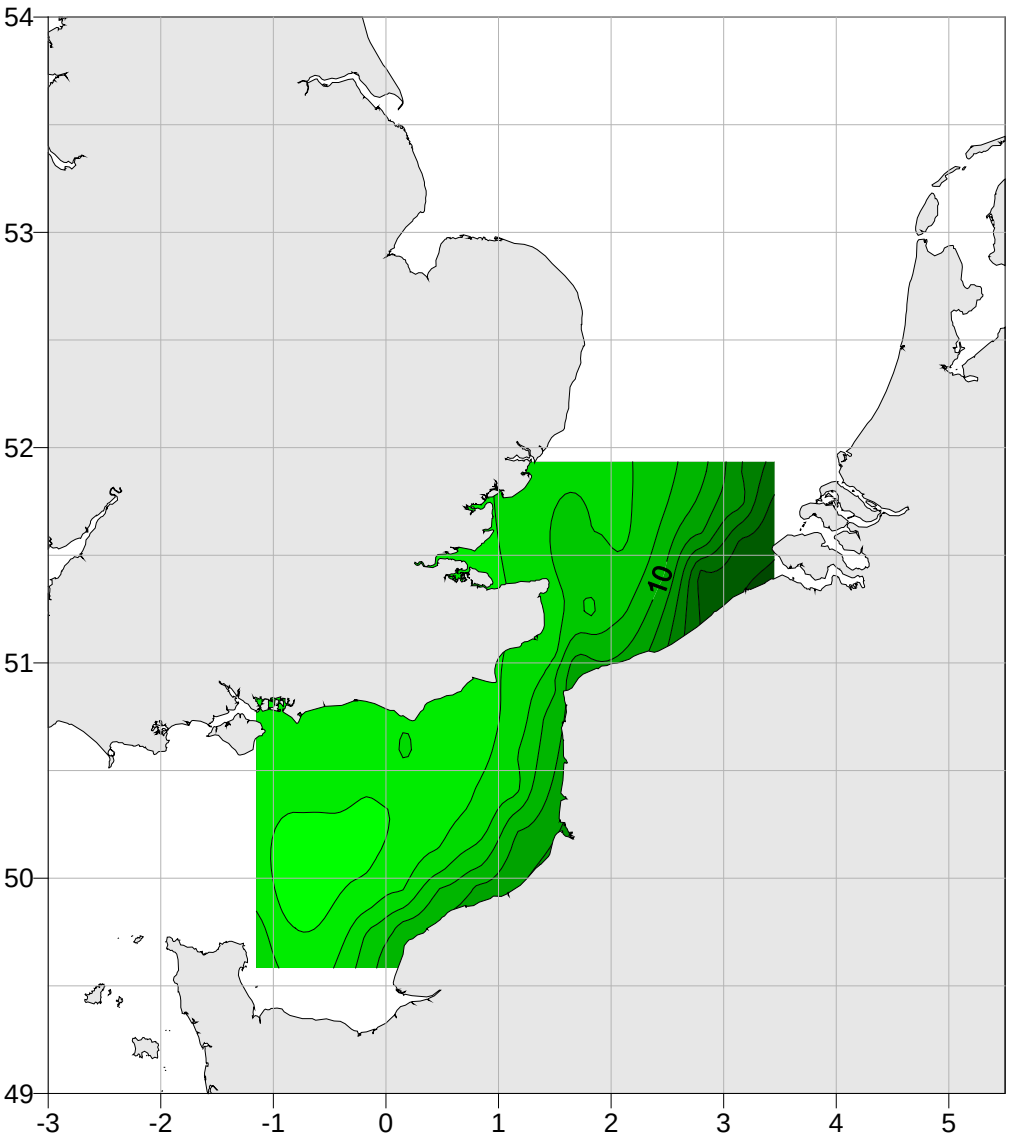

Figure 4.7. Bottom temperature during the December 2011 survey.

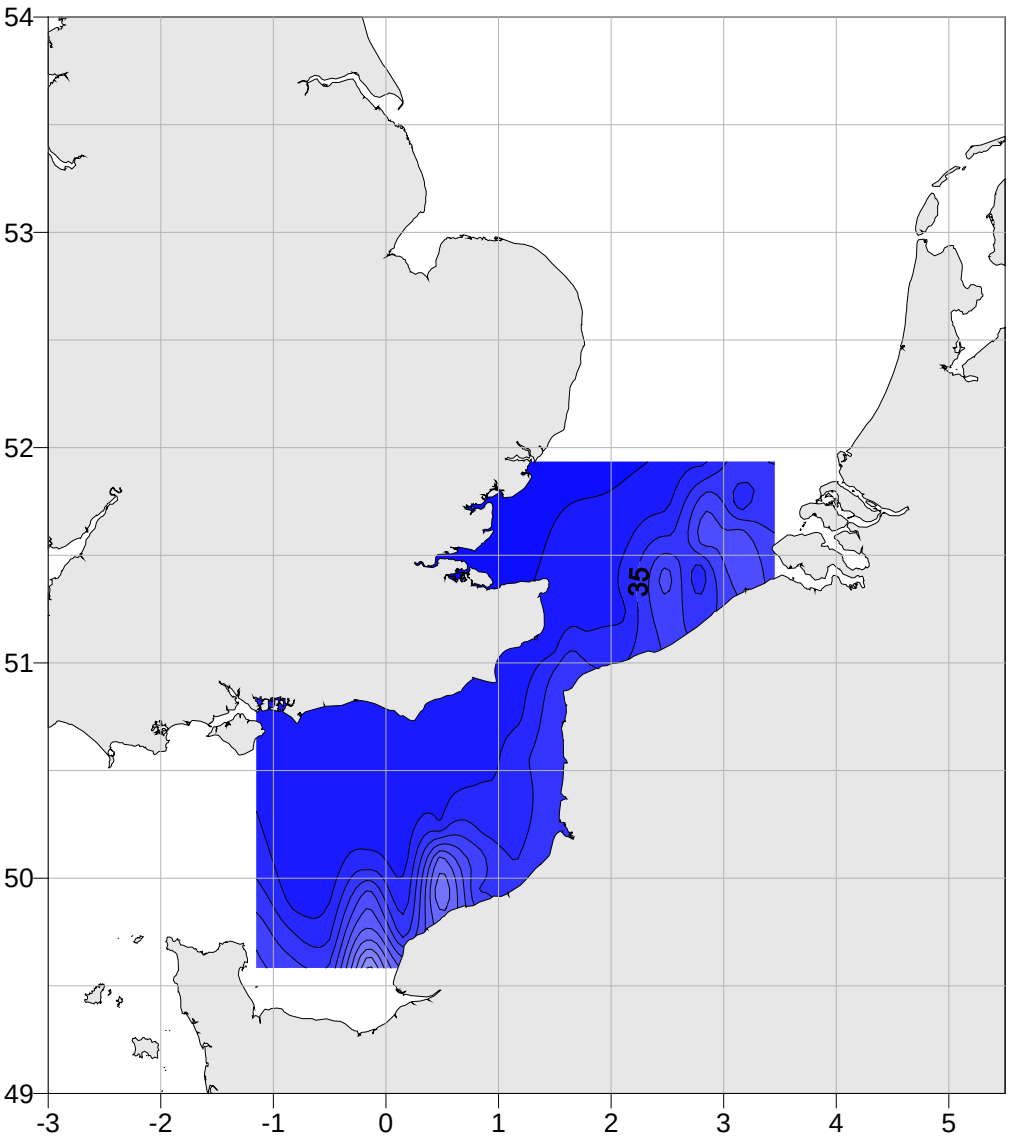

Figure 4.8. Bottom salinity during the December 2011 survey.

4.3 January survey

Date, time and harbours

From (harbour)	Date	Time (UTC)	To (harbour)	Date	Time (UTC)
Scheveningen	16-01-2011	10:00	Scheveningen	21-01-2011	13:00

Crew

Kees Bakker (cruise leader)
Cindy van Damme
Ewout Blom
Marta Valdes-Lopez

Guests Audrey Geffen (University Bergen, Norway)
Raphaela Kathöver (AWI, Bremerhaven, Germany)
Fredy Véliz Moraleda (AWI, Bremerhaven, Germany)

Volunteer Bert Storm

Deviations from the planned sampling grid

In total 85 stations were sampled during the January survey (Figure 4.9). Given the predicted adverse weather conditions later in the week, is was decided at the start of the survey to change the route. It was decided to first sample the northernmost part of the southern North Sea north of the Strait of Dover. In retrospect, this choice is not very favourable since we pass some of the northernmost stations on our way back to Scheveningen harbour. Due to this, the bad weather conditions and later on also problems with the ships engine some plankton stations could not be sampled. Because of the engine problem it was also not possible to carry out a pelagic fish haul to collect spawning herring. Later on in the week is was decided to sample longer on the last day of the survey and thanks to this flexible attitude of the captain the reduction of the number of stations has remained limited.
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.

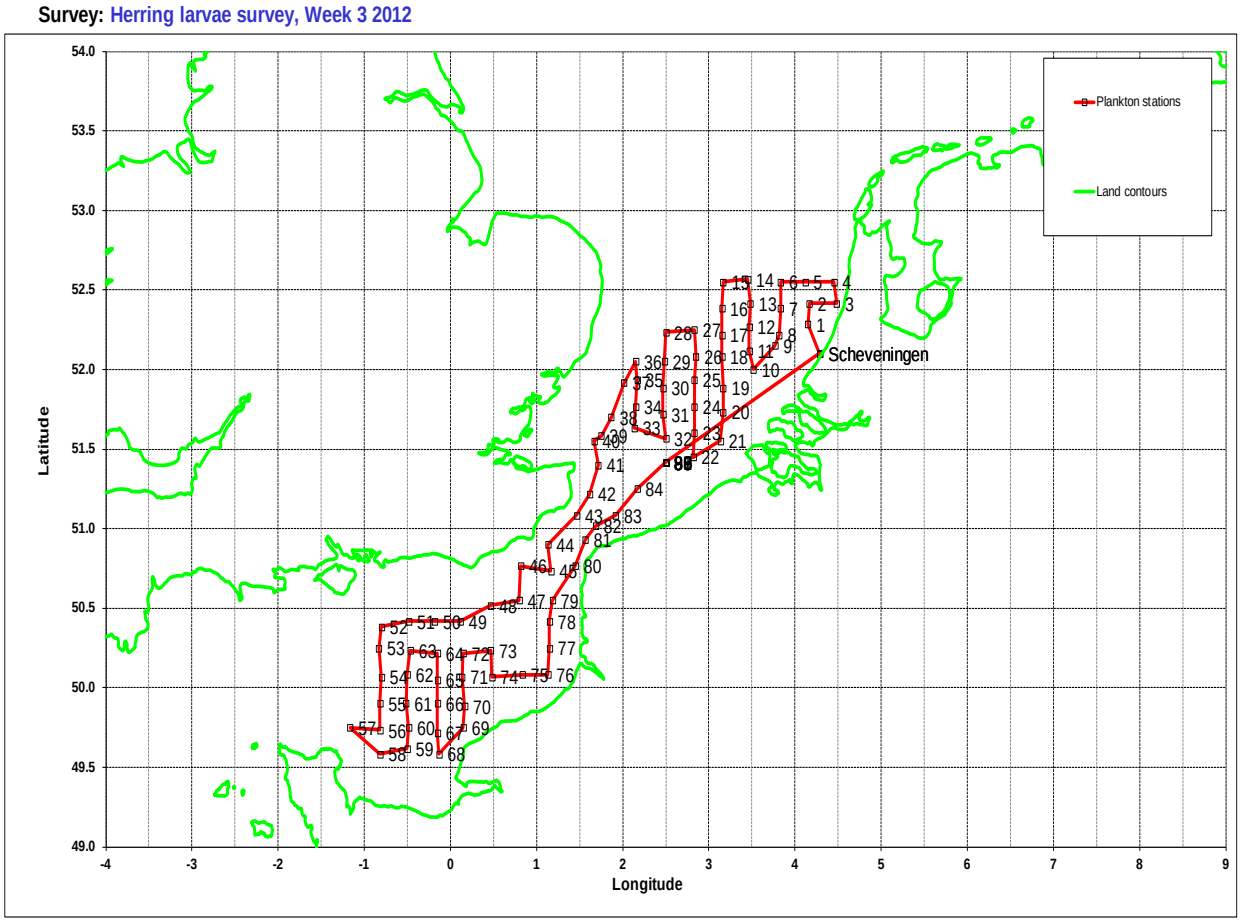

Figure 4.9. Stations sampled in January 2012.

Damage to sampling equipment

No damage to the sampling equipment occurred during this survey. However, there has been a small incident with the torpedo winch due to an error of the operator. The torpedo winch was not stopped by the operator and kept running the cable and hence the cable was no longer tight on the winch drum. This incident fortunately had a happy ending with retention of the material. In this case, the operator was a temporary worker who had to be trained on handling the torpedo winch during the survey. This issue was also raised previously in chapter 4.2 reporting on the December 2011 survey.

Survey

On Monday 16 January 2012 10:00 (UTC) RV Tridens departed from the port of Scheveningen. After one hour steaming the first station was sampled at 10:49 (UTC). On 21 January at 13:04 (UTC) we sampled the last station. During the survey it was intended to do a pelagic trawl haul for the benefit of herring population research. During the first half of the survey week we did not find herring schools on the acoustics and later on in the week we were faced with bad weather and engine failure and hence we decided not to do a pelagic trawl haul. During the survey most of the samples were sorted for larvae on board the vessel.

Sample-id's

2012.5400001 t/m 2012.5400085

Samples and data

We sampled 85 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.

Remarks

Before the start of the survey the slip rings sets of both torpedo winches were replaced. The quality of these new slip rings will be proven in subsequent surveys but despite of the bad weather conditions during this trip no malfunctions occurred.

Numbers of herring larvae

In January 2011 high abundances of herring larvae were found throughout the sampling area (Figure 4.10). However, the numbers of herring larvae is lower compared to 2011. No larvae were found in the Seine Bay and the northern part of the survey area. Larvae both with and without yolk sac were caught in January.

The bottom temperature in January 2012 was higher compared to 2011 (Figure 4.11) Salinity was generally comparable to 2011, but was higher this year along the French, Belgium and Dutch coast (Figure 4.12). The bottom temperature varied from 6.0 to 11.0°C in January 2012 and from 4.8 to 9.5°C in 2011.

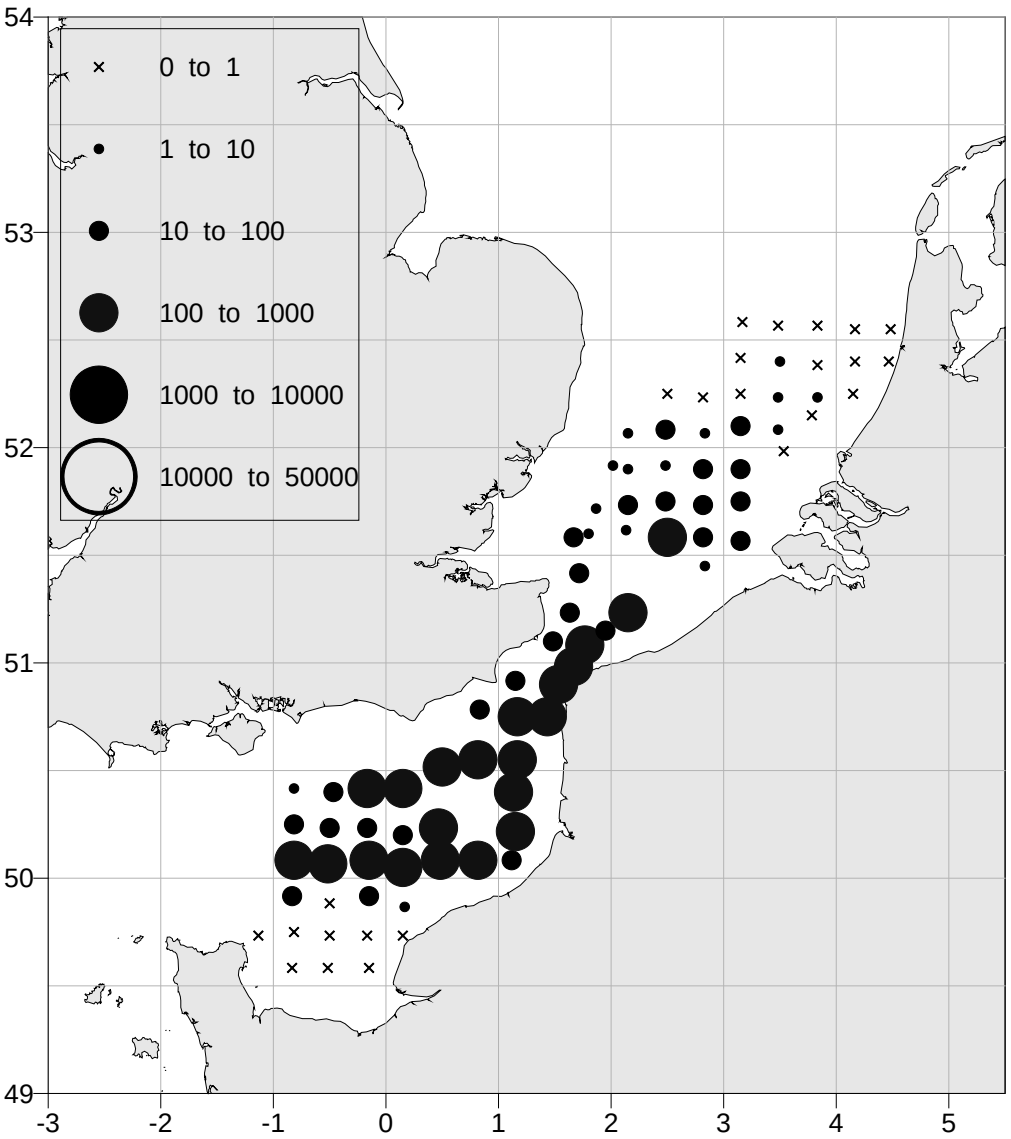

Figure 4.10. Numbers of larvae per m^2 caught during the January 2012 survey.

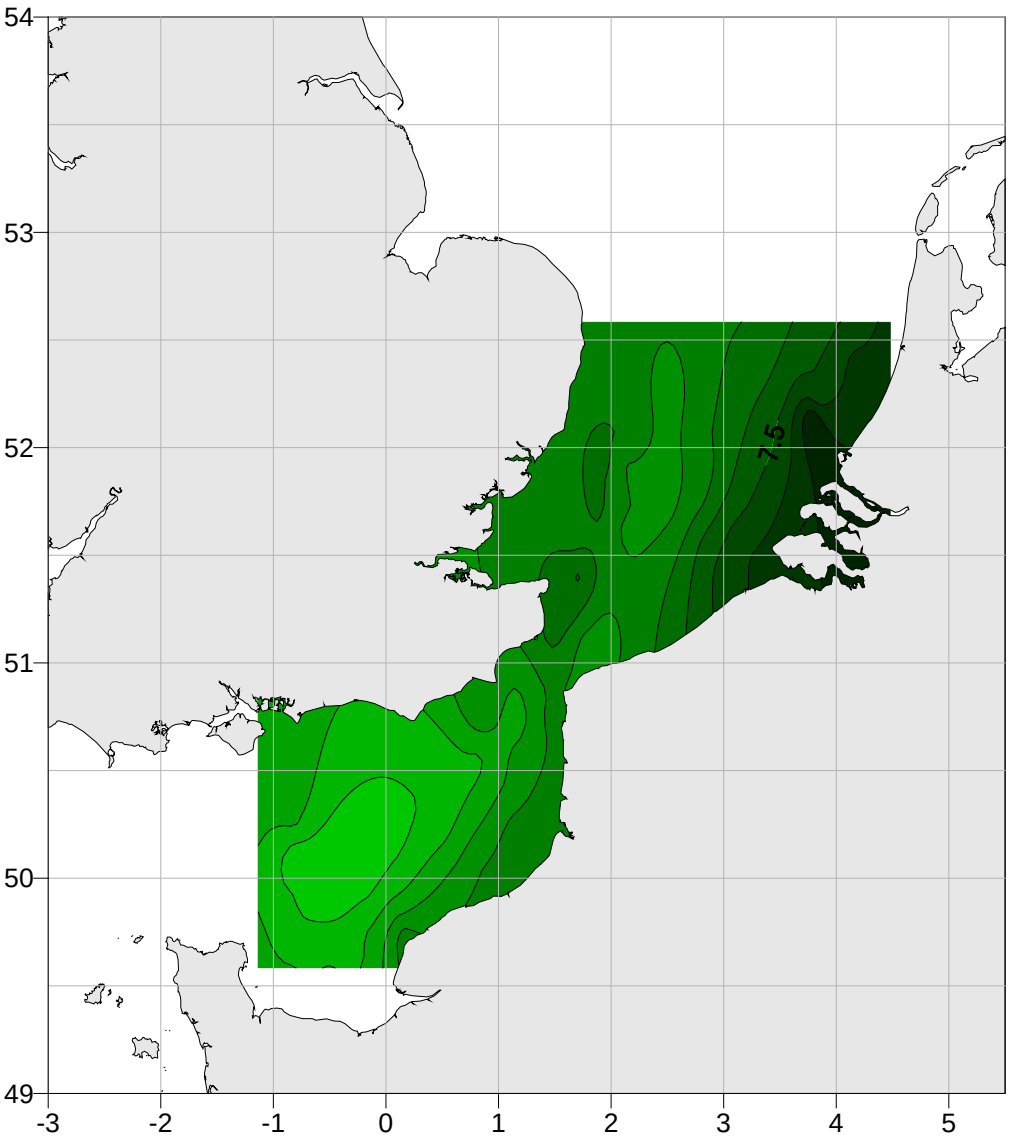

Figure 4.11. Bottom temperature during the January 2012 survey.

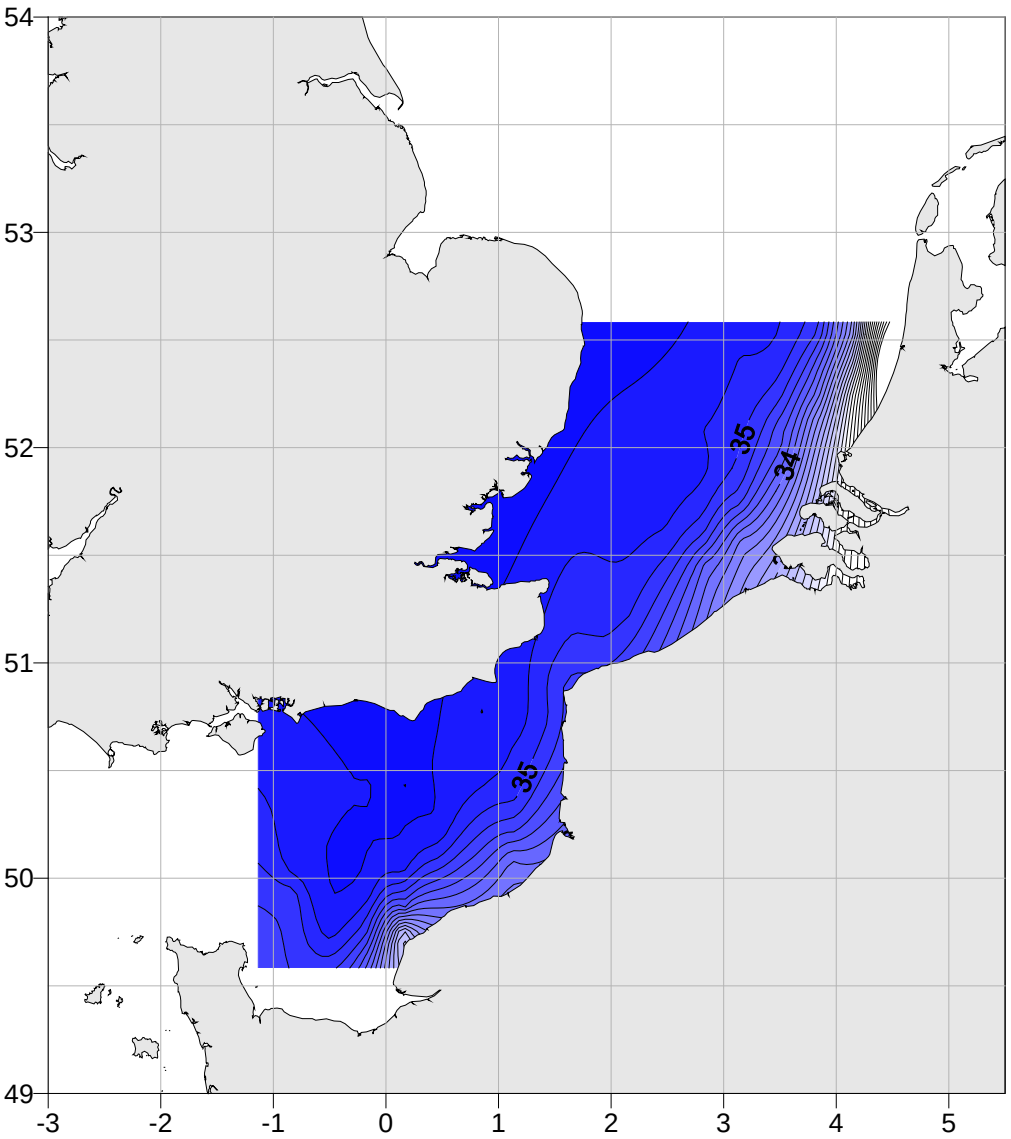

Figure 4.12. Bottom salinity during the January 2012 survey.

5. Conclusions

The abundances of herring larvae caught by ‘RV Tridens’ in the Buchan area and Central North Sea in September 2011 are higher compared to the abundances found in 2010. In addition to many larvae in the Buchan area there were especially many larvae in the southwest on the Central North Sea of the coast of Whitby caught. In September 2011 the bottom temperature was more variable compared to 2010. The inflow of the salter Atlantic water is the same as in 2010, but along the coast salinity was lower compared to 2010.
The state of the winter spawning 'Downs' herring is still good. However, the abundances of herring larvae were lower in winter 2011-2012 compared to 2010-2011. In both December 2011 and January 2012 the herring larvae were less abundant and less spread over the sampling area compared to 2010-2011. The bottom temperature in December 2011 (average bottom temperature of 11.0°C) was 3 degrees higher in comparison with 2010 (8.4°C). In January 2012 (9.05°C) bottom temperature was 1.5 degrees higher compared to 2011.

The 2011 SCAI index is the highest in the time series (Figure 5.1; ICES 2012)

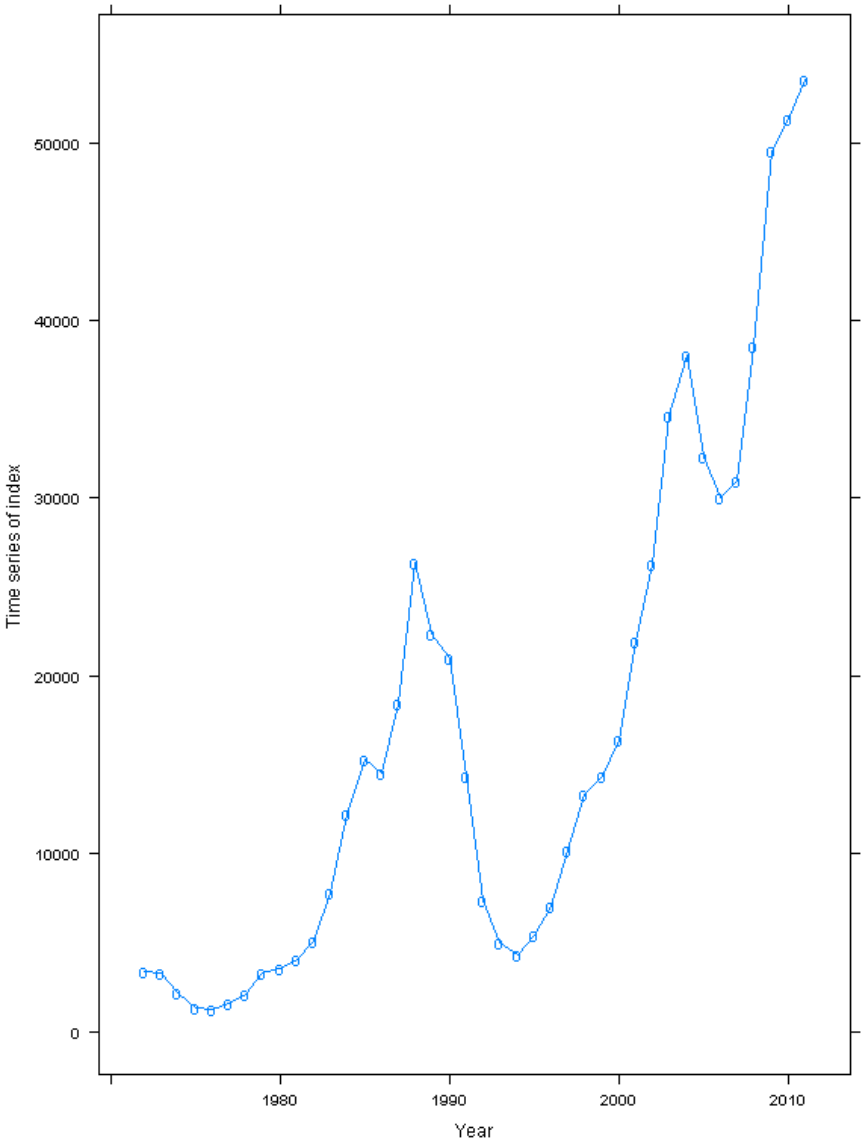

Figure 5.1. Time series of the SCAI-index.

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 4 October 2011 an internal workshop was organized for the quality control of the determination of the clupeid larvae. During the workshop 35 larvae were identified by all participants. The larvae were taken from the various herring larvae surveys in 2010 and 2011 and the MIK samples from 2011. 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
Cindy van Damme	Intermediate
Ineke Pennock	Expert
Ruben Hoek	Beginner
Marco Lohman	Beginner

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). On the basis of the determination of all participants and the original determination, a modal species 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 determined is shown. Table C shows the over-or underestimation for each participant and finally table D shows the agreement in identification by species.

Table 6.1. Species identification of all larvae.

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

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	1	17	17	17	17	17	17	17	119
Pilchard	2	6	6	6	6	6	6	6	42
Sprat	3	5	5	5	5	5	5	5	35
Sandeel	4	1	1	1	1	1	1	1	7
Goby	5	1	1	1	1	1	1	1	7
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	4	4	4	4	4	4	4	28
Total	1-9	35	35	35	35	35	35	35	245

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

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	1	16	20	15	13	17	12	18	111
Pilchard	2	8	2	6	4	9	7	6	42
Sprat	3	8	4	5	8	4	0	4	33
Sandeel	4	1	1	1	1	1	2	1	8
Goby	5	1	2	0	1	0	4	3	11
Roundfish	6	1	0	0	0	2	0	0	3
Unknown	9	0	4	5	7	1	9	2	28
Total	1-9	35	33	32	34	34	34	34	236

C **Percentage overestimation / underestimation**

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	1	-6%	18%	-12%	-24%	0%	-29%	6%	-7%
Pilchard	2	33%	-67%	0%	-33%	50%	17%	0%	0%
Sprat	3	60%	-20%	0%	60%	-20%	-100%	-20%	-6%
Sandeel	4	0%	0%	0%	0%	0%	100%	0%	14%
Goby	5	0%	100%	-100%	0%	-100%	300%	200%	57%
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	-100%	0%	25%	75%	-75%	125%	-50%	0%

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

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	1	82%	100%	71%	76%	88%	71%	82%	82%
Pilchard	2	100%	17%	33%	50%	67%	83%	50%	57%
Sprat	3	100%	20%	60%	80%	40%	0%	40%	49%
Sandeel	4	100%	100%	100%	100%	100%	100%	100%	100%
Goby	5	100%	0%	0%	100%	0%	0%	100%	43%
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	0%	75%	100%	100%	25%	100%	50%	64%
Weighted mean	1-9	77.1%	65.7%	62.9%	74.3%	65.7%	62.9%	65.7%	67.8%
		1	3	6	2	3	6	3	

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

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

	Modal or actual species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	**1**	13	13	13	13	13	13	13	**91**
Pilchard	**2**	5	5	5	5	5	5	5	**35**
Sprat	**3**	5	5	5	5	5	5	5	**35**
Sandeel	**4**	1	1	1	1	1	1	1	**7**
Goby	**5**	1	1	1	1	1	1	1	**7**
Roundfish	**6**	-	-	-	-	-	-	-	**-**
Unknown	**9**	3	3	3	3	3	3	3	**21**
Total	**1-9**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**203**

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

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	**1**	13	15	15	11	12	8	15	**89**
Pilchard	**2**	6	1	1	3	8	6	5	**30**
Sprat	**3**	7	4	5	6	4	0	3	**29**
Sandeel	**4**	1	1	1	1	1	2	1	**8**
Goby	**5**	1	2	0	1	0	4	3	**11**
Roundfish	**6**	1	0	0	0	2	0	0	**3**
Unknown	**9**	0	4	4	6	1	8	1	**24**
Total	**1-9**	**29**	**27**	**26**	**28**	**28**	**28**	**28**	**194**

C **Percentage overestimation / underestimation**

	Modal or actual species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	**1**	0%	15%	15%	-15%	-8%	-38%	15%	**-2%**
Pilchard	**2**	20%	-80%	-80%	-40%	60%	20%	0%	**-14%**
Sprat	**3**	40%	-20%	0%	20%	-20%	-100%	-40%	**-17%**
Sandeel	**4**	0%	0%	0%	0%	0%	100%	0%	**14%**
Goby	**5**	0%	100%	-100%	0%	-100%	300%	200%	**57%**
Roundfish	**6**	-	-	-	-	-	-	-	**-**
Unknown	**9**	-100%	33%	33%	100%	-67%	167%	-67%	**14%**

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

	Modal or actual species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	**1**	85%	100%	92%	85%	85%	62%	85%	**85%**
Pilchard	**2**	100%	20%	20%	60%	80%	80%	60%	**60%**
Sprat	**3**	100%	20%	60%	80%	40%	0%	40%	**49%**
Sandeel	**4**	100%	100%	100%	100%	100%	100%	100%	**100%**
Goby	**5**	100%	0%	0%	100%	0%	0%	100%	**43%**
Roundfish	**6**	-	-	-	-	-	-	-	**-**
Unknown	**9**	0%	100%	100%	100%	33%	100%	33%	**67%**
Weighted mean	**1-9**	**79.3%**	**65.5%**	**69.0%**	**79.3%**	**65.5%**	**55.2%**	**65.5%**	**68.5%**
		1	**4**	**3**	**1**	**4**	**7**	**4**	

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

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

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	1	4	4	4	4	4	4	4	28
Pilchard	2	1	1	1	1	1	1	1	7
Sprat	3	-	-	-	-	-	-	-	-
Sandeel	4	-	-	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	1	1	1	1	1	1	1	7
Total	1-9	6	6	6	6	6	6	6	42

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

	Species	Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	TOTAL
Herring	1	3	5	0	2	5	4	3	22
Pilchard	2	2	1	5	1	1	1	1	12
Sprat	3	1	0	0	2	0	0	1	4
Sandeel	4	0	0	0	0	0	0	0	-
Goby	5	0	0	0	0	0	0	0	-
Roundfish	6	0	0	0	0	0	0	0	-
Unknown	9	0	0	1	1	0	1	1	4
Total	1-9	6	6	6	6	6	6	6	42

C **Percentage overestimation / underestimation**

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	1	-25%	25%	-100%	-50%	25%	0%	-25%	-21%
Pilchard	2	100%	0%	400%	0%	0%	0%	0%	71%
Sprat	3	-	-	-	-	-	-	-	-
Sandeel	4	-	-	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	-100%	-100%	0%	0%	-100%	0%	0%	-43%

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

Modal or actual species		Original	Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6	ALL
Herring	1	75%	100%	0%	50%	100%	100%	75%	71%
Pilchard	2	100%	0%	100%	0%	0%	100%	0%	43%
Sprat	3	-	-	-	-	-	-	-	-
Sandeel	4	-	-	-	-	-	-	-	-
Goby	5	-	-	-	-	-	-	-	-
Roundfish	6	-	-	-	-	-	-	-	-
Unknown	9	0%	0%	100%	100%	0%	100%	100%	57%
Weighted mean	1-9	66.7%	66.7%	33.3%	50.0%	66.7%	100.0%	66.7%	64.3%
		2	2	7	6	2	1	2	

For all larvae there is an agreement in species determination of 68.0%, lower compared to 2010 (78.0%), with an agreement of 82, 49 and 59% for herring, sprat, sardine, respectively. For herring, agreement is the same as the previous workshop. For sprat and sardine this is a much lower outcome of the workshop of previous year, 71 and 69%, respectively, agreement was reached in 2010. During the workshop in 2010 one beginner participated, this workshop two beginners participated. However, when comparing the experts only, overall agreement is still lower, 71%, compared to the previous workshop. Agreement in herring for experts only was the same as previous, but with 63%, agreement in sprat and sardine was for the experts only also lower compared to the last workshop.
Yolk sac identification of all participants was correct during this workshop.

For the larvae of the herring larvae survey samples, there is an agreement of 85% for herring, 49% for sardine and for sprat 60%. Compared to 2010 this is the same for herring, but for sprat and sardine a

decline in improvement. For the MIK-samples the agreement for herring was lower compared to the herring larvae survey samples, only 71% and much higher compared to 43% in 2010, for sardine 43% and no sprat larvae was available from the MIK samples during this workshop. Compared to 2010, this is a deterioration in agreement for sardine.
This year the quality of the larvae to identify during the workshop was good. These results suggest that there is a reasonable consensus in the identification of the herring, but that agreement between the identifiers has dropped and improvement is possible and 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 other larvae. The MIK sample larvae are larger and less transparent than the smaller larvae from the herring larvae survey samples; 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 2010.

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 5	Reader 6		Reader 1	Reader 2	Reader 3	Reader 4	Reader 5	Reader 6
Mean overall	0	-1	-1	0	-1	-1		0	0	1	1	1	1
STDEV overall	1.13	2.68	1.73	2.87	2.49	1.59		2.85	3.44	2.42	3.64	1.89	3.37
Mean HELA	-1	-1	-1	0	-1	-1		1	0	0	1	1	1
STDEV HELA	1.17	1.83	1.85	3.02	2.63	1.76		3.19	3.70	1.50	3.44	2.10	3.69
Mean MIK	0	6	0	4	-1	0		-1	2	4	0	0	0
STDEV MIK								1.00	1.73	2.58	4.50	0.00	2.16

Table 6.5 shows the over/underestimation of the length relative to the average length. Results are comparable with 2010.

Table 6.5. Over/underestimation the larvae length measurements.

	Length					
	Reader 1	**Reader 2**	**Reader 3**	**Reader 4**	**Reader 5**	**Reader 6**
Mean overall	0	-1	0	0	0	0
STDEV overall	0.88	1.44	0.67	1.14	1.66	2.22
Mean HELA	0	-1	0	0	1	-1
STDEV HELA	0.77	1.40	0.54	0.67	1.70	2.22
Mean MIK	-1	-2	0	-2	-1	-1
STDEV MIK	1.00	1.73	1.26	2.65	1.73	1.00

Finally, no validated larvae were available for this workshop so the results only show the agreement and differences among the participants.

6.2 ISO

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

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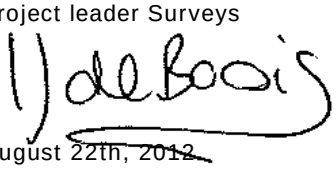
Justification

Report: C099.12
Project Number: 4301211028

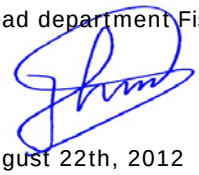
The scientific quality of this report has been peer reviewed by a colleague scientist and the head of the department of IMARES.

Approved: Ingeborg de Boois
Project leader Surveys

Signature: 

Date: August 22th, 2012

Approved: John Schobben
Head department Fish

Signature: 

Date: August 22th, 2012