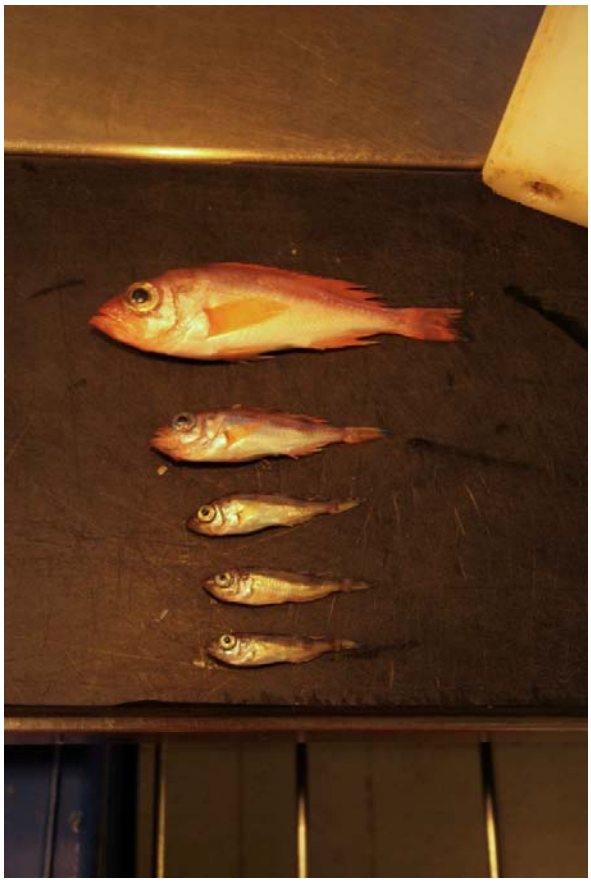

The International Ecosystem survey in the Nordic Seas in May 2011

R/V DANA Cruise No. 3/2011

Calibration of Echo-sounders

27/4 – 29/4 2011

International Acoustic Monitoring of Herring and Blue whiting

30/4 – 26/5 2011

Cruise participants

Calibration 27/4 – 29/4

Karl-Johan Staehr	Denmark (Cruise leader)
Bo Lundgren	Denmark
Torben Filt Jensen	Denmark
Peter Faber	Denmark
Thyge Dyrnesli	Denmark
Frank V. Knudsen	Denmark
Mads Larsen	Denmark

Acoustic monitoring 30/4 - 12/5

Karl-Johan Staehr (Cruise leader) (acoustic)	Denmark
Torben Filt Jensen (acoustic)	Denmark
Maria Jansson (acoustic)	Sweden
Peter Vingaard (plankton/fishlab)	Denmark
Lise Sindahl plankton/fishlab)	Denmark
Helle Rasmussen (plankton/fishlab)	Denmark
Fredrik Landfors (plankton/fishlab)	Sweden
Thyge Dyrnesli (technician)	Denmark

Acoustic monitoring 12/5-25/5

Bram Couperus (acoustic)	Netherlands (Cruise leader)
David Miller (acoustic)	Netherlands
Ryan Saunders (acoustic)	Ireland
Frank I. Hansen (plankton/fishlab)	Denmark
Joanne Smith (plankton/fishlab)	UK
Helle Andersen (plankton/fishlab)	Denmark
Matthias Kloppmann (plankton/fishlab)	Germany
Frank F. Knudsen (technician)	Denmark

Cruise summary

Effective survey days	20
Mileage	2886 (as scrutinized in BI500)
Number of trawl hauls	22
Number of CTD stations	34
Number of WP2 stations	33 (in duplo)
Number of biological samples - herring	307
Number of biological samples – blue whiting	80
Remarks	

Introduction

The Norwegian spring spawning herring is a highly migratory and straddling stock carrying out extensive migrations in the NE Atlantic. After spawning, the main spawning areas being along the Norwegian west coast from 62°N to 65°N in February – March, the herring migrates NW-wards towards the Norwegian Sea feeding grounds. In general, the main feeding has taken place along the polar front from the island of Jan Mayen and NE-wards towards Bear Island. During the latter half of the 1990's there has been a gradual shift of migration pattern with the herring migrations shifting north and eastwards. In 2002 - 2004 this development seems to have stopped and the herring had more southerly distribution at the end of the feeding season than in 2001. After feeding, the herring concentrated in August in the northern parts of the Norwegian Sea prior to the southern migration towards the Vestfjord wintering area (68°N, 15°E). Since the winter 2002-2003 most of the stock seems to winter in the Norwegian Sea off Lofoten. In January the herring start their southerly spawning migrations.

Besides herring, abundant stocks of blue whiting and mackerel exploit the Norwegian Sea as an important feeding area. In the past decade, the blue whiting stock has supported the largest fisheries of the Northeast Atlantic but at the present the fisheries have been reduced drastically as a consequence of a considerable decline of the stock due to overexploitation and poor recruitment. The main spawning areas are located along the shelf edge and banks west of the British Isles. The eggs and larvae drift both northwards and southwards, depending on location and oceanographic conditions. The northward drift spreads juvenile blue whiting to all warmer parts of the Norwegian Sea and adjacent areas from Iceland to the Barents Sea. Adult blue whiting carry out active feeding and spawning migrations in the same area. Blue whiting has consequently an important role in the pelagic ecosystems of the area, both by consuming zooplankton and small fish, and by providing a resource for larger fish and marine mammals.

Background and objective of the survey

This survey is carried out in order to investigate distribution and migrations of the Atlanto-Scandian herring, blue whiting and other pelagic fish and to produce a biomass index for herring and a recruitment index for blue whiting for the Working Group on Widely Distributed stocks (WGWIDE). Furthermore hydrographic conditions and plankton abundance in the Norwegian Sea and adjacent waters are monitored in order to investigate distribution and migration of herring and other pelagic fishes are influenced by environmental conditions.

This survey was coordinated with Norway as an international survey with participation of Norway, Iceland, Faroe Islands and EU, where the Danish R/V Dana conducted the EU survey part. The acoustic survey tracks of Dana are shown in figure 1.
With the exceptions of 2002 and 2003 the survey is carried out since 1997 with participation of EU countries together with Norway, Russia, Iceland and the Faeroese Islands.

Calibration

The echo sounders were calibrated immediately before the survey at Bornö Island in the Gullmar Fjord, Sweden during the 28th and 29th April 2011. The calibration was performed according standard operation procedures as described in the WGNAPES/WGIPS manual for three frequencies (18, 38 and 120 kHz).The calibration of the towed body split-beam transducer at 38 kHz was conducted against a 60 mm copper sphere. Calibration of the three hull-mounted split-beam transducers at 18, 38, and 120 kHz were carried out against 63mm, 60 mm, and 23 mm copper spheres respectively. The resulting calibration parameters are shown in Annex 1 and were used during the subsequent survey.

Materials and methods

Acoustic data

Acoustic data was collected with EK60 using a 38 kHz splitbeam transducer, mounted in a towed body (paravane). During trawling, acoustic data was collected by the EK60 using the hull mounted 38 kHz transducer: the recordings during trawling were only used for scrutiny of the echograms. Echo integration was conducted continuously and the data was scrutinized daily during the survey utilizing SIMRAD BI500 and LSSS software.

A biomass estimate will not be carried out based on data of this cruise alone, but the data will be included in the survey's database from all participating vessels from which a biomass index will be calculated. The final estimate methodology is presented in the WGNAPES report of August 2011 (Kaliningrad).

2886 NM has been integrated and scrutinized along the cruise track.

Hydrographical and zooplankton data

For approximately every 60 nautical miles plankton samples were taken in duplo by means of vertical tows from 200 m to the surface with a WP2 equipped with 180 µm mesh. One sample was fractioned into three size groups (180 µm, 1000 µm and 2000 µm) of zooplankton for biomass estimation. The biomass samples were oven-dried on board at 70 °C for 24 hours, and subsequently frozen for later weight determination at DTU Aqua. The other sample was used for species(groups) identification later.

At the same positions as for standard plankton sampling, CTD casts were carried out to a maximum depth of 1000 m or 5 m above the seabed with a Seabird CTD and rosette water sampler. The following parameters were measured: depth (pressure), temperature,

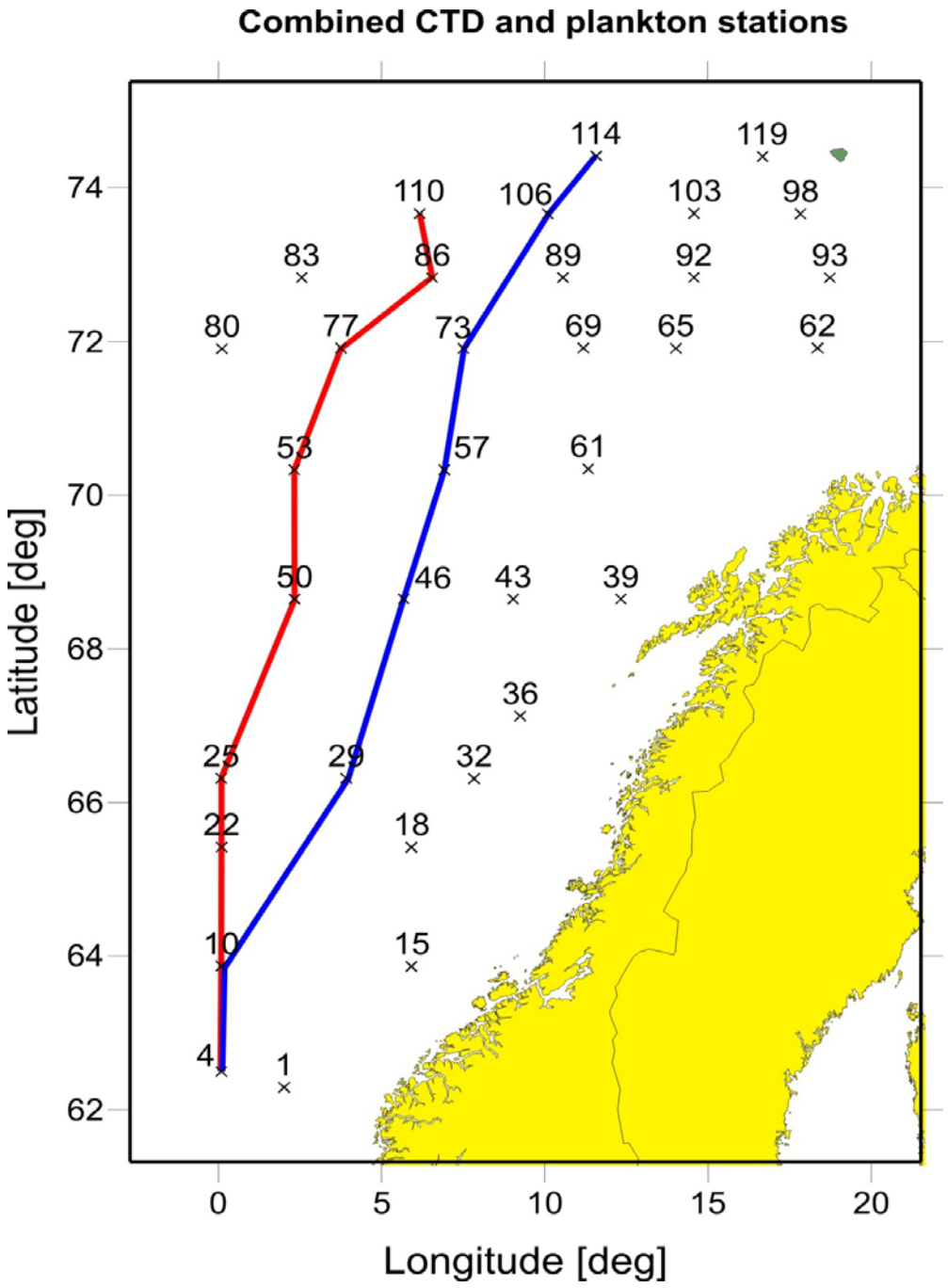

Figure 1. Combined CTD- and WP2-stations taken by R/V Dana from 2 May to 26 May 2011. The red and blue lines indicate the 2 CTD transects chosen for the characterization of the vertical hydrogaphic structure.

conductivity (salinity) and oxygen. All together Dana carried out 33 combined CTD and WP2 stations (Table 1 and 2, Figure 1).

Each day water samples were taken once close to the surface and at 1000 m depth in order to calibrate the conductivity sensor of the CTD unit. Additionally, sea surface temperature, salinity and fluorescence were continuously monitored from the ship's bow intake and were stored along with information on meteorological conditions (e.g. wind direction, wind speed etc.) utilizing R/V Dana's hydrographic and meteorological analysis system.

Biological data

During the survey fishing was carried out regularly on acoustic registrations to verify the species scrutinized and to give information about the size composition to be used in the biomass estimation. A pelagic trawl "*Turbo*", was used either at the surface or in midwater down to a maximum of 450 m depth. A total of 22 trawl stations were carried out during the survey. (Table 3, Figure 1)

Catches were sorted and weighed by species. Length measurements were taken for all species. For herring and blue whiting samples of 50 fish were also randomly taken in order to determine individual length to weight relationships as well as age, sex and maturity. For age determination in herring scales and otoliths were sampled and mounted on microscope slices whereas in blue whiting only otoliths were taken. Scales and otoliths will be read at Aqua DTU. In total 307 samples of individual herring and 80 samples of individual blue whiting were taken.

By request from vTI/SF in Hamburg has redfish in the catch been examined for stomach content, maturity, parasites and pigmentation. In total 71 specimens have been caught and sampled (as a comparison: last year 2 specimens).

All trawl data were entered into the Babelfisk database and validated. The data were also stored in the WGNAPES formats and sent by email to the WGNAPES database at the Faeroes at the end of the survey.

Itinerary of the survey

Dana left Hirtshals at the 27th April at 10.00 UTC for calibration of acoustic equipment at Bornö in Sweden. All transducers were calibrated and Dana arrived in Hirtshals again at 29th April at 17.00 UTC.

Dana left Hirtshals to start the acoustic survey on the 30th of April at 11.00 UTC. Echo integration started at 22.00 UTC on 1st of May at 62°18 N, 02°01 E.

Weather conditions during first half of the survey were excellent until the 10 May only with short periods with wind speed above 10 m/s. An integration speed of around 10 knots could be kept all the time. From the morning on the 10 May the wind increased to 15 M7s and larger swells occurred. From beginning on the afternoon on 10 May the survey speed had to be reduced to 6-8 knots and WP2 sampling had to be canceled. This continued for the rest of first half of the survey and no fishery or hydrographic were made on 11 May.

Integration on first half on the survey was ended 12th May at 17.20 UTC at 69°48N, 17°12E. Tromsø was entered at 12th May at 09.30 UTC for change of crew.

Dana left Tromsø on the 12th of may at 1600 UTC. The paravane was put in the water at 56.64N 17.44E - 20.54 UTC. Weather conditions were good during the second half of the trip except for the 16 and 17 May when the wind speed was more than 13 m/s and there was some transmission loss due to air bubbles. During the whole 2nd half of the survey no herring was encountered. In the Barents Sea, southwest of Bear Island the echograms showed relatively high concentrations of Haddock.

The survey ended on the 21 of May at 72.25N 10.30E – 00.16 UTC.

Results

Catch composition

The catch composition of all trawl hauls are presented in Table 4, Table 3 gives information on trawling position and depth. Distribution of trawl hauls is shown in Figure 2.

Distribution and density of herring and blue whiting

Distribution and densities of herring and blue whiting along the survey track are presented in Figure 2 and 3.

Most herring was found in the south western part of the survey area. Above the 70°20N transect no herring was found at all: only two small schools have been assigned to herring in the scrutiny process. During the second half of the survey, from 13 may onwards not a single herring showed up in the catches.

Blue whiting was found in very low concentrations in the whole area, except for a high concentration at the shelf edge around approximately 64.30N-7E.

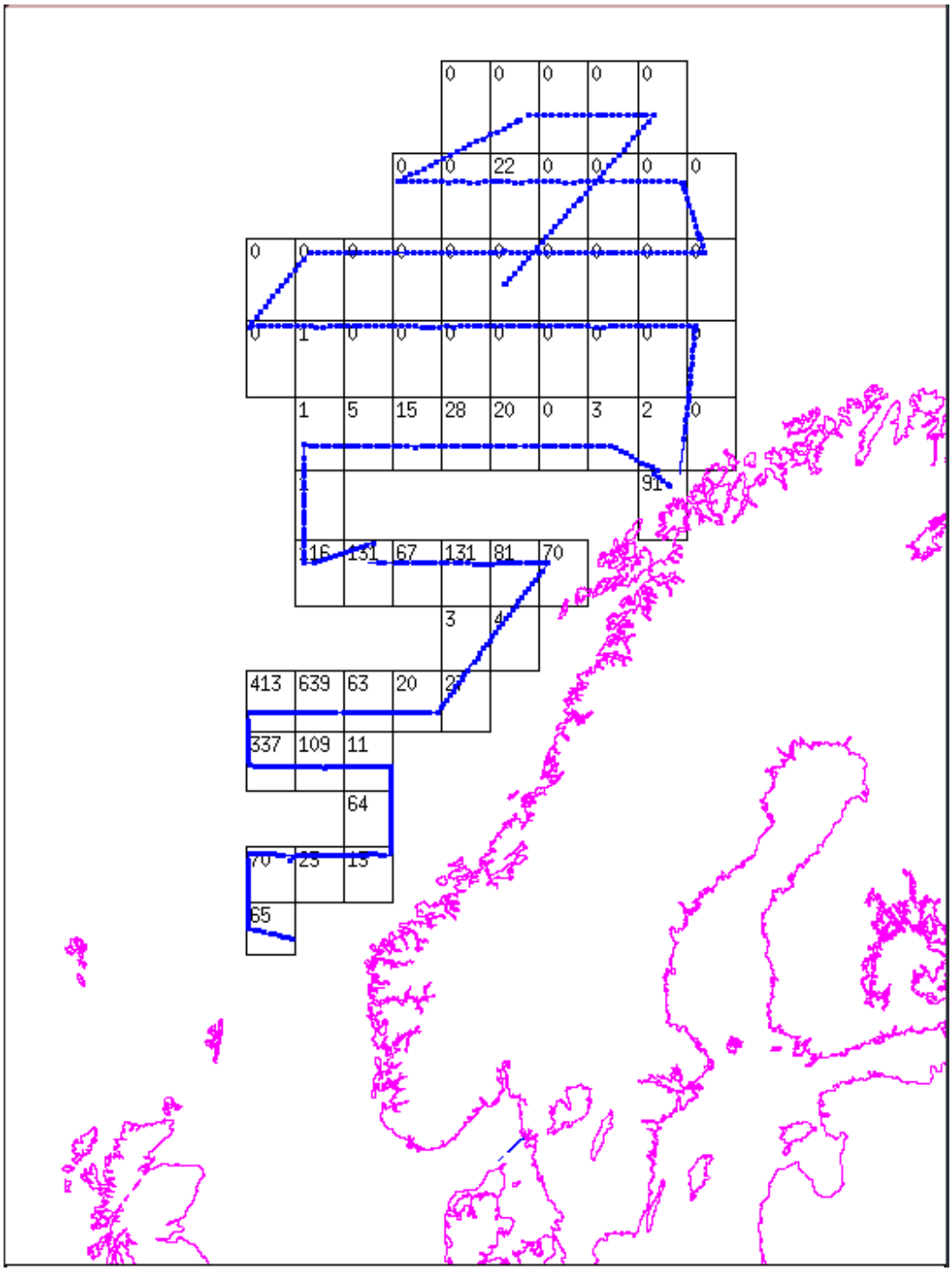

Figure 2: Distribution and densities of herring recorded by R/V Dana during 2 to 26 May 2011

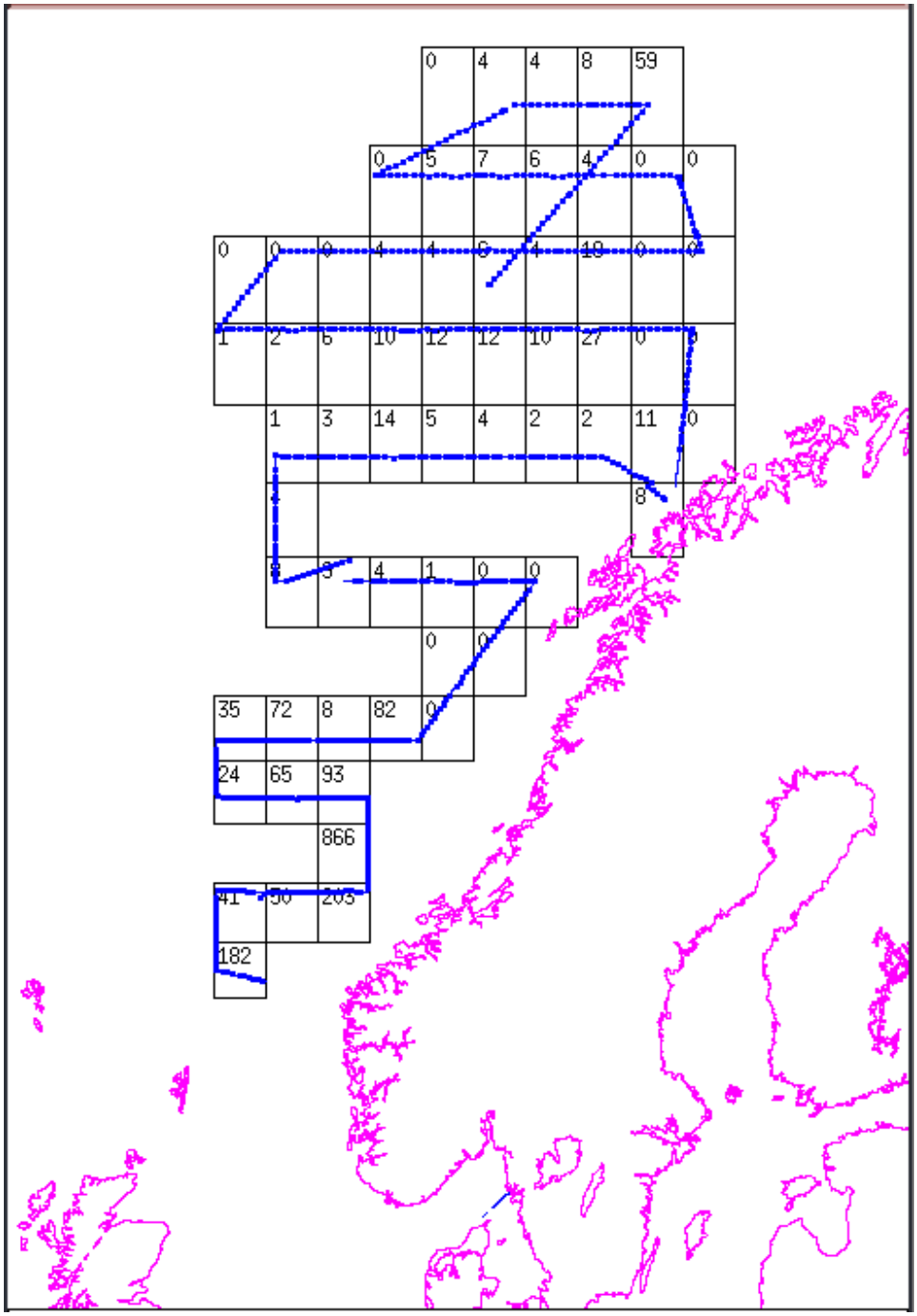

Figure 3: Distribution and densities of blue whiting recorded by R/V Dana during 2 to 24 May 2010

Hydrographic conditions

The observed temperature range during the cruise was again similar to that of previous cruises with surface values between 5 and > 9°C in the eastern part of the survey area decreasing to values < 2°C in the Northwest. However and despite the similar range, temperatures in the North were still cooler than before 2010. In the surface, the 7°C isothermal reached only up to approximately 70°N in a comparatively narrow tongue (figure 6) while in the past it could be encountered over a wider longitudinal range and in earlier years (before 2007) also far beyond the 70° latitude. In the top 200 m the warmer Atlantic waters appeared to be closer to the Norwegian coast.

Over most of the survey area, the water column was clearly vertically structured into warmer water masses of Atlantic origin in the upper layers and cold Arctic waters at depth (figure 7). The magnitude of these layers varied with latitude. In the southern part of the survey area, Atlantic water could be detected down to about 300 m. At first this layer became shallower but deepened towards > 600 m at about 70°20’ N. North of that latitude the layer of Atlantic water quickly became shallower and the influence of Arctic water became more prominent throughout the water column (figure 7). The frontal area between cold arctic water and warmer Atlantic water was only apparent at all depths from the surface and down to 200 m only in the northwest of the survey area.

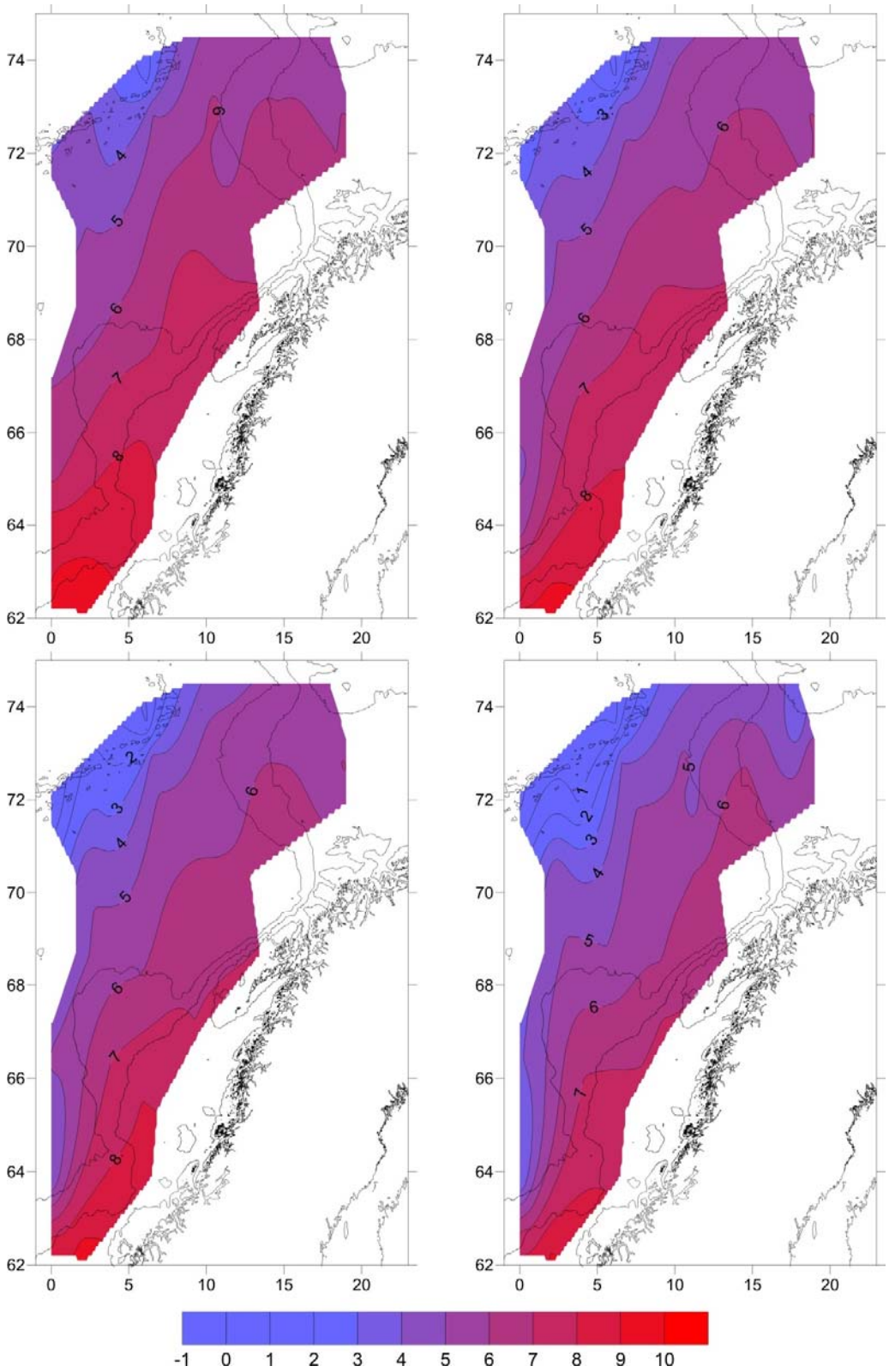

Figure 4: Horizontal temperature distribution in the survey area at the surface, and at 50m, 100m and 200m depth.

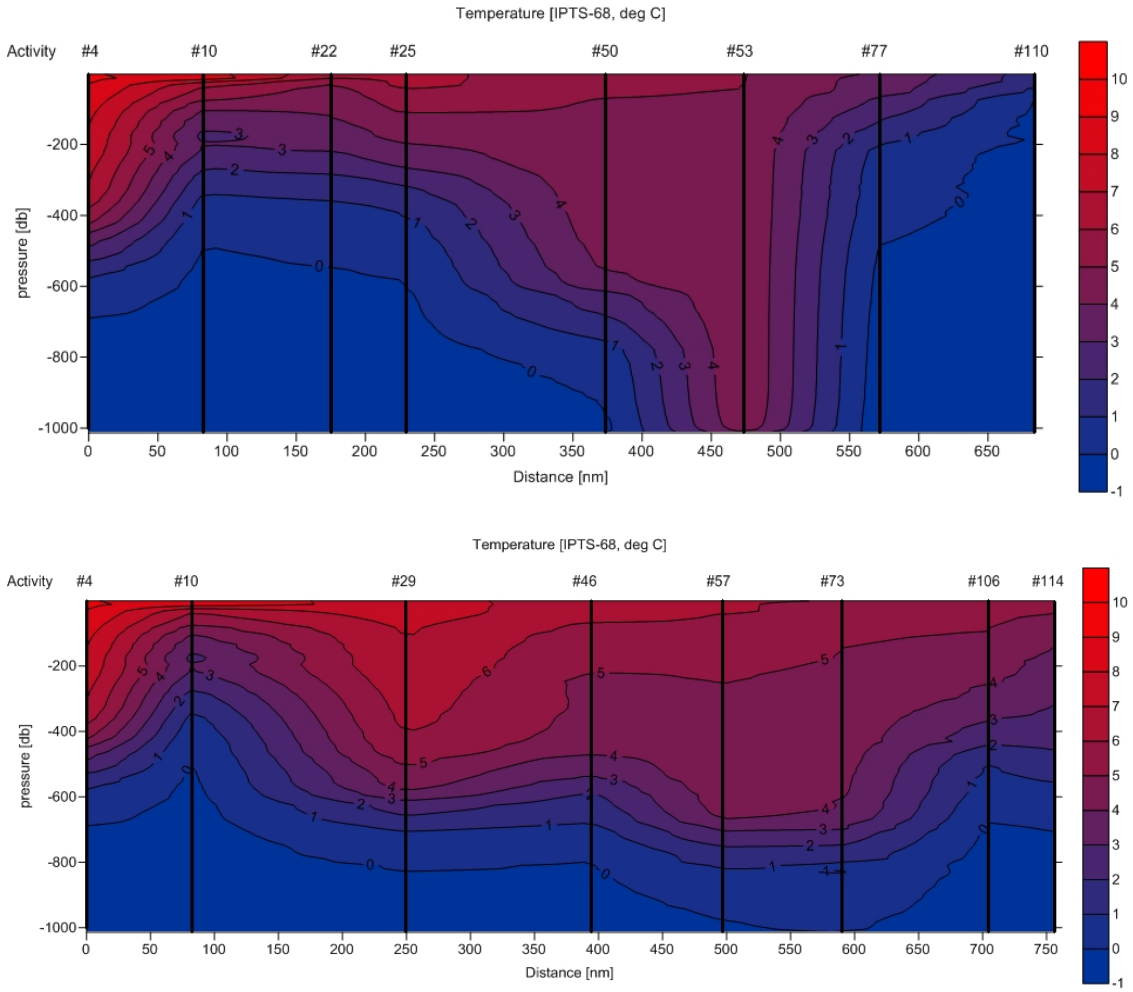

Figure 5: Vertical temperature distribution from South to North along approximately 2 - 5º (top) and 2 - 10Eº (bottom).

Table 1: CTD stations taken by R/V Dana during 2 to 26 May 2011

Cruise	Station	year	Month	Day	Hour	Min	Latitude	Longitude	WinDir	WinSpeed
201103	1	2011	5	1	21	58	62.17.471 N	002.00.611 E	39.7	9,04
201103	4	2011	5	2	4	57	62.29.937 N	000.05.190 E	51.7	6,95
201103	10	2011	5	2	17	56	63.52.433 N	000.05.084 E	54.9	5,96
201103	15	2011	5	3	17	16	63.52.025 N	005.54.786 E	356.3	4,53
201103	18	2011	5	4	3	11	65.24.998 N	005.54.884 E	287	6,65
201103	22	2011	5	4	22	22	65.25.169 N	000.05.802 E	351.8	7,68
201103	25	2011	5	5	5	32	66.18.949 N	000.05.045 E	9.4	6,09
201103	29	2011	5	5	19	12	66.18.892 N	003.54.859 E	4.9	6,3
201103	32	2011	5	6	6	15	66.18.682 N	007.49.893 E	10.1	5,81
201103	36	2011	5	6	17	2	67.07.508 N	009.15.022 E	8.2	4,67
201103	39	2011	5	7	5	5	68.39.057 N	012.19.952 E	272.1	5,79
201103	43	2011	5	7	16	28	68.38.990 N	009.01.868 E	142	0,36
201103	46	2011	5	8	4	14	68.39.070 N	005.40.823 E	119.9	7,89
201103	50	2011	5	8	20	30	68.38.924 N	002.19.894 E	168.8	5,43
201103	53	2011	5	9	8	18	70.19.966 N	002.19.560 E	43.5	9,59
201103	57	2011	5	9	22	17	70.19.930 N	006.55.255 E	106.9	8,48
201103	61	2011	5	10	18	2	70.20.601 N	011.19.922 E	73.3	14,78
201103	62	2011	5	13	10	0	71.55.130 N	018.21.479 E	93.1	16,81
201103	65	2011	5	13	19	31	71.54.825 N	014.01.285 E	99.9	8,69
201103	69	2011	5	14	4	39	71.55.123 N	011.10.899 E	79.7	3,67
201103	73	2011	5	14	17	20	71.54.814 N	007.30.388 E	62.4	3,17
201103	77	2011	5	15	4	47	71.54.985 N	003.45.362 E	83.8	9,13
201103	80	2011	5	15	13	55	71.54.530 N	000.06.246 E	79.8	11,98
201103	83	2011	5	15	23	17	72.50.115 N	002.33.113 E	64.3	12,12
201103	86	2011	5	16	8	23	72.50.017 N	006.32.874 E	67.9	3,89
201103	89	2011	5	16	17	49	72.50.167 N	010.33.505 E	83.1	13,93
201103	92	2011	5	17	6	13	72.50.261 N	014.34.344 E	57.3	12
201103	93	2011	5	17	19	32	72.50.022 N	018.44.186 E	53.4	12,16
201103	98	2011	5	18	10	8	73.39.954 N	017.50.227 E	73.3	1,58
201103	103	2011	5	18	23	15	73.40.206 N	014.34.539 E	332.3	0,99
201103	106	2011	5	19	8	23	73.40.002 N	010.05.392 E	349.9	1,36
201103	110	2011	5	19	19	27	73.40.040 N	006.10.035 E	334.6	5,9
201103	114	2011	5	20	10	51	74.25.118 N	011.34.955 E	313.7	4,49
201103	119	2011	5	21	3	49	74.24.678 N	016.40.530 E	141.5	9,81

Table 2: WP2 stations taken by R/V Dana during 2 to 26 May 2011

Cruise	Station	year	Month	Day	Hour	Min	Latitude	Longitude	WinDir	WinSpeed
201103	2	2011	5	1	22	36	62.17.087 N	002.00.796 E	39.2	9,42
201103	3	2011	5	1	22	58	62.16.843 N	002.00.835 E	55.1	7,98
201103	5	2011	5	2	6	3	62.29.240 N	000.04.328 E	54.5	6,9
201103	6	2011	5	2	6	4	62.29.233 N	000.04.313 E	59.1	6,5
201103	7	2011	5	2	6	6	62.29.203 N	000.04.250 E	65	5,75
201103	8	2011	5	2	6	34	62.28.985 N	000.04.239 E	47.7	7,09
201103	11	2011	5	2	19	4	63.52.565 N	000.05.191 E	63.8	5,8
201103	12	2011	5	2	19	18	63.52.624 N	000.05.411 E	50.2	5,69
201103	16	2011	5	3	17	39	63.51.954 N	005.55.132 E	0.3	4,6
201103	17	2011	5	3	17	53	63.51.885 N	005.55.398 E	357.5	5,47
201103	19	2011	5	4	3	46	65.25.201 N	005.55.151 E	292.8	7,69
201103	20	2011	5	4	4	1	65.25.247 N	005.55.282 E	297.3	6,54
201103	23	2011	5	4	23	26	65.25.420 N	000.06.249 E	345.3	7,64
201103	24	2011	5	4	23	39	65.25.476 N	000.06.433 E	348.3	6,88
201103	26	2011	5	5	6	48	66.18.868 N	000.06.732 E	2	6,2
201103	27	2011	5	5	7	2	66.18.870 N	000.07.056 E	21.2	5,88
201103	30	2011	5	5	20	21	66.18.581 N	003.55.434 E	32	7,04
201103	31	2011	5	5	20	34	66.18.542 N	003.55.460 E	30	7,01
201103	33	2011	5	6	6	46	66.18.424 N	007.50.173 E	14	5,87
201103	34	2011	5	6	7	0	66.18.343 N	007.50.207 E	358.2	5,18
201103	37	2011	5	6	17	37	67.07.514 N	009.15.636 E	0	4,91
201103	38	2011	5	6	17	51	67.07.541 N	009.15.910 E	344.9	5,83
201103	40	2011	5	7	5	33	68.39.338 N	012.21.344 E	260.9	5,73
201103	41	2011	5	7	5	48	68.39.539 N	012.22.027 E	262.5	5,67
201103	44	2011	5	7	17	33	68.38.945 N	009.02.839 E	56.8	0,89
201103	45	2011	5	7	17	46	68.38.976 N	009.03.115 E	109	1,48
201103	47	2011	5	8	5	24	68.39.364 N	005.41.013 E	137	8,39
201103	48	2011	5	8	5	36	68.39.414 N	005.41.112 E	134.4	9,61
201103	51	2011	5	8	21	38	68.39.021 N	002.19.618 E	177.9	6,28
201103	52	2011	5	8	21	52	68.39.053 N	002.19.523 E	187.9	5,68
201103	54	2011	5	9	9	27	70.20.748 N	002.19.488 E	38.7	8,31
201103	55	2011	5	9	9	41	70.20.907 N	002.19.635 E	47	9,34
201103	58	2011	5	9	23	24	70.19.405 N	006.54.590 E	97.2	10,01
201103	59	2011	5	9	23	40	70.19.271 N	006.54.455 E	91.6	9,4
201103	63	2011	5	13	10	29	71.55.139 N	018.22.184 E	90.3	14,62
201103	64	2011	5	13	10	45	71.55.177 N	018.22.397 E	97.1	14,14
201103	66	2011	5	13	20	41	71.55.221 N	013.59.563 E	93.9	9,78
201103	67	2011	5	13	20	58	71.55.344 N	013.59.281 E	97.5	9,08
201103	70	2011	5	14	5	49	71.55.607 N	011.11.299 E	91.6	3,49
201103	71	2011	5	14	6	3	71.55.692 N	011.11.606 E	83.2	3,82
201103	74	2011	5	14	18	26	71.54.369 N	007.27.407 E	58.8	3,84
201103	75	2011	5	14	18	38	71.54.248 N	007.26.859 E	66	3,46
201103	78	2011	5	15	5	59	71.55.182 N	003.43.443 E	78.8	9,08
201103	79	2011	5	15	6	12	71.55.199 N	003.43.154 E	84.9	8,97
201103	81	2011	5	15	15	0	71.53.654 N	000.07.918 E	78.4	11,32
201103	82	2011	5	15	15	14	71.53.491 N	000.08.151 E	81.4	11,63
201103	84	2011	5	16	0	22	72.50.318 N	002.36.398 E	59.7	11,93
201103	85	2011	5	16	0	36	72.50.342 N	002.37.046 E	68.1	10,41
201103	87	2011	5	16	9	34	72.49.828 N	006.31.414 E	68.9	3,12
201103	88	2011	5	16	9	48	72.49.814 N	006.31.236 E	80.5	3,51
201103	90	2011	5	16	19	5	72.50.322 N	010.31.724 E	80.6	14,67
201103	91	2011	5	16	19	19	72.50.370 N	010.31.479 E	75.3	13,31
201103	94	2011	5	17	20	3	72.49.763 N	018.43.799 E	44.4	8,22
201103	95	2011	5	17	20	18	72.49.659 N	018.43.593 E	62.8	13,13
201103	99	2011	5	18	10	39	73.39.565 N	017.50.230 E	83.3	2,44
201103	100	2011	5	18	10	51	73.39.393 N	017.50.192 E	61.2	1,66
201103	104	2011	5	19	0	15	73.40.502 N	014.34.399 E	321.6	1,64
201103	105	2011	5	19	0	28	73.40.550 N	014.34.634 E	10.2	1,49
201103	107	2011	5	19	9	31	73.40.149 N	010.05.721 E	6.1	2,64
201103	108	2011	5	19	9	45	73.40.171 N	010.05.876 E	1.3	1,1
201103	111	2011	5	19	20	38	73.39.786 N	006.10.896 E	342.5	5
201103	112	2011	5	19	20	53	73.39.737 N	006.11.152 E	334.5	6,43
201103	115	2011	5	20	11	56	74.25.380 N	011.32.845 E	318.4	3,28
201103	116	2011	5	20	12	10	74.25.520 N	011.32.664 E	294	1,99
201103	120	2011	5	21	4	11	74.24.792 N	016.40.369 E	143.8	12,01
201103	121	2011	5	21	4	23	74.24.843 N	016.40.488 E	143.5	10,28

Table 3: Fishing stations taken by R/V Dana during 2 to 26 May 2011

Cruise	Station	Year	Month	Day	Hour	Min	Latitude	Longitude	Wind direction (deg)	Wind speed (m/s)	Ground speed (knots)	Wire length (m)	Net opening (m)	Door spread (m)	Fishing Time (min)	Gear depth (ave, m)	Catch weight (kg)
201103	9	2011	5	02	15	15	63.48.488 N	000.03.794 E	66	5	2,3	500	21	113	60	25	202,6
201103	13	2011	5	03	00	22	63.49.711 N	001.47.751 E	38	7	3,9	290	28	95	61	5	47,7
201103	14	2011	5	03	12	49	63.52.393 N	005.09.789 E	7	6	3,4	1250	28	95	60	260	22,1
201103	21	2011	5	04	12	38	65.24.767 N	003.01.771 E	5	8	3,4	300	25	105	61	25	1143,9
201103	28	2011	5	05	08	55	66.18.212 N	000.26.853 E	359	7	3,7	400	27	106	60	25	931,4
201103	35	2011	5	06	12	42	66.56.683 N	008.55.607 E	10	6	3,6	1000	25	115	95	110	102,1
201103	42	2011	5	07	12	56	68.39.050 N	009.19.873 E	302	4	3	300	27	97	90	2	3753
201103	49	2011	5	08	11	22	68.47.659 N	005.10.260 E	173	12	3,6	1500	13	115	104	300	72,7
201103	56	2011	5	09	18	06	70.20.638 N	005.58.423 E	87	10	4,2	300	25,7	100	60	5	1,2
201103	60	2011	5	10	07	10	70.20.060 N	009.31.747 E	92	13	3,6	1900	25,7	109	204	450	18,3
201103	68	2011	5	13	22	32	71.55.830 N	013.33.778 E	102	8	3,8	300	25	98	60	8	4,1
201103	72	2011	5	14	15	49	71.54.550 N	008.36.269 E	111	3	3,5	1550	25	98	59	350	9,4
201103	76	2011	5	15	00	08	71.55.154 N	004.50.026 E	66	7	3,7	300	25	98	59	10	13,4
201103	96	2011	5	17	23	01	73.03.469 N	018.21.888 E	59	7	3,1	1250			60	300	98
201103	97	2011	5	18	06	39	73.34.315 N	017.56.516 E	89	3	4,4	1300	25,2	129	61	260	1921
201103	101	2011	5	18	17	08	73.40.234 N	015.07.995 E	21	2	3,4	1360	24,8	131	60	270	330,4
201103	102	2011	5	18	20	43	73.40.114 N	015.19.484 E	10	3	4,2	320	28,7	97	60	8	478,9
201103	109	2011	5	19	10	44	73.40.014 N	010.05.067 E	6	2	3,7	325	25	100	76	8	5,3
201103	113	2011	5	20	07	23	74.20.837 N	011.04.165 E	290	5	3,3	1700	27	133	60	400	26
201103	117	2011	5	20	18	02	74.25.432 N	014.33.987 E	165	6	2,8	325	25	98	101	10	17,7
201103	118	2011	5	21	00	11	74.28.761 N	016.16.030 E	157	8	4,1	1425	25	98	60	300	37
201103	122	2011	5	21	13	51	73.26.900 N	013.31.598 E	77	9	4,3	385	26	105	59	25	12,5

Table 4: Catch composition in trawl stations taken by R/V Dana during 2 to 26 May 2011

Station	Latitude	Longitude	Fishing depth (m)	Anarhichas denticulatus	Arctozenus risso	Argentina silus	Argentina sphyraena	Benthosema glaciale	Caridea sp.	Cephalopoda sp.	Clupea harengus	Cyclopterus lumpus	Euphausiidae sp.	Gadus morhua	Mallotus villosus	Maurolicus muelleri	Melanogrammus aeglefinus	Micromesistius poutassou	Notoscopelus elongatus	Pandalus borealis	Pollachius pollachius	Salmo salar	Scomber scombrus	Scyphozoa sp.	Sebastes mentella	Trisopterus esmarkii	Grand Total
9	63.48.488 N	000.03.794 E	25								98,3												104				202,6
13	63.49.711 N	001.47.751 E	5								22,1												25,6				47,7
14	63.52.393 N	005.09.789 E	260		0,31								0,38			0,29		20,5	0,30				0,31	0,03			22,1
21	65.24.767 N	003.01.771 E	25								715	2,14											427				1143,9
28	66.18.212 N	000.26.853 E	25								926												5,00				931,4
35	66.56.683 N	008.55.607 E	110				98,39						2,02			0,32					1,31					0,03	102,1
42	68.39.050 N	009.19.873 E	2								3752	0,60										0,41	0,11				3753,2
49	68.47.659 N	005.10.260 E	300		0,63						66,7								2,07	0,02				0,16	3,15		72,7
56	70.20.638 N	005.58.423 E	5							0,42	0,19														0,57		1,2
60	70.20.060 N	009.31.747 E	450		0,59					0,60			0,92				0,99	2,49	1,95					0,11	10,7		18,3
68	71.55.830 N	013.33.778 E	8							1,55		2,56			0,02												4,1
72	71.54.550 N	008.36.269 E	350		1,86	0,01		0,91		2,25								0,82							3,52		9,4
76	71.55.154 N	004.50.026 E	10		0,21			0,01		9,00		2,83													1,38		13,4
96	73.03.469 N	018.21.888 E	300		0,80			0,06		0,49			0,94	0,01	27,6	0,00	60,5	0,45		6,38					0,78	0,03	98,0
97	73.34.315 N	017.56.516 E	260		0,06									26,1	42,4		1852								0,63		1920,7
101	73.40.234 N	015.07.995 E	270		0,95			0,003						1,73	21,5		304,8	0,82							0,64		330,5
102	73.40.114 N	015.19.484 E	8	0,08						4,40		11,9			463												478,9
109	73.40.014 N	010.05.067 E	8							1,26		3,47													0,53		5,3
113	74.20.837 N	011.04.165 E	400	1,13	9,92			5,04	1,01	0,96		3,53	1,35											1,89	1,18		26,0
117	74.25.432 N	014.33.987 E	10	0,002						14,3		2,25			0,45										0,74		17,7
118	74.28.761 N	016.16.030 E	300	0,01	0,05			0,004		4,57		1,29	0,91	12,3	10,4	0,00	7,30			0,01					0,00	0,15	37,0
122	73.26.900 N	013.31.598 E	25		0,01					2,28		3,61													6,59		12,5
Grand Total				1,2	15,4	0,01	98,4	6,0	1,0	42,1	5580,8	34,2	6,5	40,1	564,8	0,6	2225,1	27,2	2,3	6,4	1,3	0,4	562,1	2,2	30,4	0,2	9248,8

Annex 1 - Calibration report.

Transceiver Menu	
Frequency	38 kHz
Sound speed	1470 $m.s^{-1}$
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	25.05 dB
3 dB Beamwidth	6.9°
TS of sphere	-33.6 dB
Range to sphere in calibration	12.6 m
Measured NASC value for calibration	13500 m^2/nmi^2
Calibration factor for NASCs	1.00
Absorption coeff	7,727 dB/km
Log Menu	
Distance	1,0 n.mi. using GPS-speed
Operation Menu	
Ping interval	1 s
Analysis settings	
Bottom margin (backstep)	1.0 m
Integration start (absolute) depth	7 - 9 m
Range of thresholds used	-70 dB

Annex 2 -

Comparison exercise of post-processing software: BI500 and LSSS

Acoustic data were analysed for herring and blue whiting using both BI500 and LSSS software during the survey. Herring NASC values (at 5 nmi) were then compared to assess the level of variation between the two systems such that the suitability of LSSS for future surveys could be determined. Although two different people scrutinized echograms over the two legs of the survey, there was a relatively close match in herring NASC values between the two systems. Therefore, LSSS software seems highly suitable for future acoustic surveys and results are directly comparable to those collected onboard RV *Dana* using BI500 throughout the ASH time-series.