

The International Ecosystem survey in the Nordic Seas in May 2016

IESNS

R/V DANA Cruise No. 5/2016

Calibration of Echo-sounders

27/4 – 29/4 2016

International Acoustic Monitoring of Herring and Blue whiting

30/4 – 26/5 2016

Cruise participants

Calibration 27/4 – 29/4

Karl-Johan Staehr	Denmark (Cruise leader)
Torben Filt Jensen	Denmark
Eik Ehlert Britch	Denmark
Christian Petersen	Denmark
Thomas Vilsted Thomsen	Denmark
Karen Edelvang	Denmark

Acoustic monitoring 30/4 - 11/5

Karl-Johan Staehr	Denmark (Cruiseleader)
Acoustic Torben Filt Jensen	Denmark
Acoustic Dick de Haan	Netherlands
Fishlab Anders Wernbo	Sweden
Fishlab Louise Cox	United Kingdom
Fishlab Helle Andersen	Denmark
Fishlab Peter Vingaard	Denmark
Tech. Christian Petersen	Denmark

Acoustic monitoring 12/5-26/5

Bram Couperus	Netherlands (cruiseleader)
Acoustic John Power	Ireland
Acoustic Sven Kupschus	United Kingdom
Fishlab Björn Fagerholm	Sweden
Fishlab Matthias Kloppmann	Germany
Fishlab Helle Andersen	Denmark
Fishlab Tom Svolgaard	Denmark
Tech. Eik Ehlert Britch	Denmark

Cruise summary

Effective survey days	21 (+ 3 for calibration)
Mileage	Steaming before start of transects 490 NM Monitoring 3470 NM Steaming for end port 1062 NM
Number of trawl hauls	33
Number of CTD stations	34
Number of WP2 stations	34
Number of biological samples - herring	453
Number of biological samples – blue whiting	806
Number of biological samples - mackerel	305
Number of biological samples – deepsea redfish (Sebastes mentella)	8
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. The blue whiting stock is currently supporting one of the largest fisheries of the Northeast Atlantic. 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 27th April and 29th April 2016. The calibration was performed according standard operation procedures as described in the 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.

During the steaming to and from the calibration the Inomar bottom profiling echosounder was tested in Danish waters.

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 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 at the post cruise meeting in Copenhagen 16-18 June 2015 and in the WGIPS report of January 2016.

Similar to last year, intertransects were skipped, i.e. the towed body was hoisted up at the end of each transect and the distance to the next transect was travelled without echo integration. On reaching the next transect, the towed body put in the water again and a new integrating section was started.

Hydrographical and zooplankton data

At fixed positions, a priory determined by ICES WGIPS, plankton samples were taken by means of vertical tows from 200 m or 5 m above the seabed to the surface with a WP2 equipped with 180 µm mesh. The biomass samples were oven-dried on board at 70 °C for 24 hours, and subsequently frozen for later weight determination at DTU Aqua.

At the same positions, 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, conductivity (salinity) and oxygen. All together Dana carried out 34 CTD and 33 WP2 stations (Table 1, Figure 1)

Each day, water samples were taken at 1000 m and in one shallower layer for calibration of the CTD's conductivity sensor. 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. Surface hauls were also carried out randomly and independent of acoustic registration. A total of 33 stations were carried out during the survey. (Table 2, Figure 1).

Catches were sorted and weighed by species. Length measurements were taken for all species. For herring, blue whiting and mackerel 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, blue whiting and mackerel otoliths were taken and will be read at Aqua DTU. In total 419 individual herring, 774 blue whiting and 138 mackerel were sampled.

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

Itinerary of the survey

27 April 2016, 04.00 UTC	Leave Hirtshals for calibration of acoustic equipment at Bornö
29 April 2016, 16.00 UTC	Dock Hirtshals, end of calibration.
30 April 2016, 09.55 UTC	Leave Hirtshals for start of IESNS
01 May 2016, 22.28 UTC	Start monitoring at 62°22 N, 004°53 E
10 May 2016, 08.45 UTC	Stop monitoring at 65°31 N, 010°42 E, end of first part of the survey
11 May 2016, 07.00 UTC	Dock Bodø for staff exchange
12 May 2016, 15.30 UTC	Leave Bodø for start of the second part
13 May 2016, 02.00 UTC	Start monitoring at 66°42 N, 011°54 E
22 May 2016, 10.45 UTC	Stop monitoring at 70°35 N, 020°01 E, end of second part of the survey
26 May 2016, 08.00 UTC	Dock Hirtshals, end of survey

Log during the first half of the survey as reported during the survey to the other participating vessels:

03-05-2016 18.30. We arrived at our starting point at the Eastern end of transect 1 stratum 1 the 1st May at 22.28 UTC and started with a CTD for setting the EK60. After the first CTD/WP2 station (station 3) at 07 UTC on the 1st May we had to stop due to the weather (27 m/s and 6-7 m waves). As the weather has improved we could continue at 17 UTC. We had a trawl haul in the surface at 001E 22 at 23 UTC with a catch of 2390 kg, 1509 kg Herring (mean length 28.8 cm), 699 kg Mackerel (mean 29.9 cm) and 92 kg Blue whiting (mean 21.3 kg). On the 2nd May we tried to fish on marks at 150 to 180 m at 000 W 02 with no success.

We are now at 62 N 22.102, 001 W 36.99. We expect to be at the western end of this transect at 19 UTC and start at the western end of transect 3 at around 03 OTC tomorrow.

04-05-2016 18.30 Dana´s current position is 63 N 37.5, 002 E 01.7. We started at the western end of transect 3 stratum 1 this morning at 03 UTC. We have had a trawl haul at 200-240 meters this

morning. The total catch was 157 kg with 146 kg blue whiting (mean 22.5 cm). This layer between 200 and 300 has been seen constantly throughout the day. Some sporadic marks have been seen in the upper 80 meters. If the weather permits do we plan to make a surface haul in the darkest period tonight.

05-05-2016 18:30 Dana's current position is 64 N 0.9, 008 E 17.0. We stopped at the eastern end of transect 3 stratum 1 at 14 UTC and expect to start at the eastern end of transect 5 integrating west at 23 UTC. The weather did not permit us to make a surface haul in the darkest period tonight as planned. We hope that the weather will improve from what we have had for the first two transects.

06-05-2016 18:30 Dana's current position is 64 N 52, 005 E 24. We started at the eastern end of transect 5 stratum 1 at 22 UTC and had a trawl haul in the surface at 23.35 UTC in the eastern end of the transect. The total catch was 32 kg dominated by 20 kg of krill and including 6 specimens of mackerel and 3 specimens of herring. Going west over the shallow area along the coast we haven't seen anything.

07-05-2016 18:30 Dana's current position is 64 N 53, 001 E 12 at transect 5 going west. Last evening we had a trawl haul at 300-320 m at 64 N 53, 005 E 05 with a catch of 219 kg blue whiting (mean length 21.5 cm). In the dark period we had a trawl haul in the surface at 64 N 53, 004 E 25 with a catch of 53 kg herring (mean length 29.0 cm), 530 kg mackerel (mean length 20.6 cm) and 515 kg blue whiting (mean length 23.5). In the morning we had a haul at 64 N 53, 002 E 57 on 220 m just on the top of the layer of blue whiting with a catch of 26 kg herring (mean length 31 cm). We expect to finalize transect 5 during the night and continue to the western end of transect 6 stratum 1.

08-05-2016 18:30 Dana's current position is 65 N 30, 001 E 52 at transect 6 going east. Last evening we had a trawl haul at 140-210 m at 64 N 53, 001 E 05 with a catch of 24 kg blue whiting (mean length 28.9 cm). In the dark period we had a trawl haul in the surface at 64 N 59, 000 E 01 with a catch of 244 kg herring (mean length 34.1 cm) and 62 kg blue whiting (mean length 24.3). In the morning we had a haul at 65 N 30, 000 E 46 on 180-220 m with a catch of 0.5 kg herring (mean length 32.5 cm) and 35 kg blue whiting (mean length 28.2 cm). We have just fished at 350 m at is at the moment hauling.

09-05-2016 18:15 Dana's current position is 65 N 30, 006 E 09 at transect 6 going east. Last late afternoon we fished on 350 m at 65 N 30, 002 E 05 and got 26.6 kg blue whiting (mean length 29.6 cm). Later in the evening we fished on 65 m at 65 N 31, 002 E 31 and got 101 kg herring (mean length 31.6 cm) and 2058 kg blue whiting (mean length 21.7 cm). This morning we made a haul on 70-95 m at 65 N 31, 005 E 03 with 7.3 kg mackerel (mean length 28.9 cm). Finally we have made a haul in the surface layer at 65 N 31, 005 E 31 getting 2015 kg mackerel (mean length 28.3 cm).

10-05-2016 18:20 Dana's current position is 66 N 17, 011 E 09. Early last evening we had a haul on 70-90 m on some weak signals at 65 N 31, 006 E 13 and got only krill and pearlside. Later in the dark period we had a surface haul at 65 N 31, 008 E 05 with a little blue whiting and mackerel but dominated by krill. For the last eastern part of transect 6 we did not see anything to fish at. We

finalized transect 6 at 08.45 UTC and is now on our way to Bodø for exchange of crew. Bram Couperus will then take over and is expected to start on the eastern end of transect 9 stratum 1 at the 12th May in the late afternoon.

Integration on first half on the survey was ended 10th May at 08.45 UTC at 65°31N, 10°42E. Bodø was entered at 11th May at 07.00 UTC for change of crew.

Conditions during first half of the survey:

The wind increased during the first hours after arriving at the eastern start point of transects 1, stratum 1 at 22.28 UTC on 1st of May. After taking the eastern CTD/WP2 station on the transect we had to stop integrating as the wind reached 27-30 m/s with 6-7 m waves. The stop lasted for 10 hours until the wind dropped. For the first two transects the wind only occasionally decreased 12-15 m/s with high waves coming cross to the transect resulting in constant rolling at up to 30 degrees. During the last two transects, transect 5 and 6 stratum 1 the weather has been excellent.

All CTD and WP2 stations have been taken as planned and 17 trawl hauls have been made.

Log during the second half of the survey as reported during the survey to the other participating vessels:

13 May

After change of crew, Dana left Bodo 12 May at 15:30. The weather forecast predicted bad weather, peaking at 22:00. In order to avoid the worst of it, we slowed down, heading for an ETA of 2:00 at the start position of transect 9. We started logging at 66.46.26N 11.54.28E, sailing in western direction. Due to the swell, it was not possible to carry out a surface haul. CTD station at 6:30 66.49.08N – 10.07.92E. This afternoon, 14:48 UTC we carried out a surface haul at the shelfedge (66.44.88N-7.50.68E). The catch was 20 kg, mainly mackerel, but also a herring, a lumpsucker and a grey gurnard. We fished at the same position at 330m. The catch (station 51) at 330m was a basket containing a mix of mackerel and small blue whiting, some lanternfish and 3 *Periphylla*'s).

14 May

At present (16:20) we are at 66.46N-2.52E on transect 9 heading west.

This morning 5:25 we carried out a hydrographic station at 66.45N-5.04E (wind N5 with a less unreasonable swell). We shoot the net at 12:30, 66.46N-2.59E (station 56) for a layer at 300m with some denser dots in it (there were also some big dense herring schools at 200m, but we did not target those). The catch was 700 kg herring with some blue whiting (enough for a sample!) and three redfish (*S. mentella*).

15 May

At present we are on transect 11, 68.01N-1.05E, heading east. Tonight we carried out a surface haul (Station 59, 23:15, 66.46N-0.53E) and caught 485 kg herring (young and old). This morning we reached the end of transect 9 (hydrographic station 60 and 61) and spent a large part of the day steaming up to the start of transect 11. We shoot the net (station 62, 15:20, 68.01N-1.03E) on a very light layer at 200m and hauled the net for 1.5 basket of blue whiting (and three redfish, some

mesopelagics, a haddock, a herring and a Periphylla). The weather is fine (4WSW) and Max Verstappen (18yrs, first Dutch winner in history) has won the Formula 1 race in Spain.

16 May

We are now (18:20 UTC) at 68.02N-7.45E on transect 11, shooting the net for a surface haul. This night we carried out a surface haul (Station 66, 68.02N-2.39E) with a disappointing catch of 1 kg herring. Otherwise it is very quiet, the screen becomes whiter and whiter. Hopefully we encounter some blue whiting/herring/haddock when we come closer to the coast.

17 May

We are now about 40 miles from the eastern end of transect 11 N68.02-10.29E, hauling the net in a surface haul (Station 76). The catch of the surface haul yesterday, 16 May, at 68.02N-7.45E (station 69) was 7kg: three small salmon, a lumpsucker and about 20 herrings. In a surface haul later (12:00; station 72; 68.02N-8.51E) we caught 2 salmon, a lumpsucker and a grey gurnard. This morning at the shelfedge we started to set the net for the Blue whiting layer at 300m, but a hydraulic oil leak forced us to interrupt the process. The leak was repaired during which we carried out a hydrographic station (planned more to the east, but shifted west for the occasion in order to save time) and shot the net again (Station 75, 67.02N-10.13E): 42 kg of greater argentine (35-40cm) and 24 kg of blue whiting.

18 May

At this moment we are at N69.17 - 14.10E, hydrographic stations (79 and 80). The catch of yesterday's haul (St 76) during which I wrote and sent the daily report was half a basket of krill, a grey gurnard and a lumpsucker.

Last night we sailed along the coast to the start of transect 13 which we reached at 6:00. We carried out a surface haul and a haul at 250m at the shelf edge: station 77 and 78 (69.17N-14.55E). The catch in the surface haul consisted of one lumpsucker and a grey gurnard (and some boiled potatoes and beetroot from last supper). The deep haul revealed a more attractive content: 1500 kg blue whiting, scattered with greater argentine, cod, saithe, haddock, golden redfish, silvery pout and whiting. One of the whittings was more than 50cm long. Wind SW6.

20 May

We are at 70.24N-4.15E, close to the western start of transect 1. Today we haven't been fishing, partly to save fishing time for the last transect and partly because of the fact we have been sailing the inter-transect today. The weather is very quiet :-)

21 May

Current position at 70.35N-12.38E, 16:44 UTC), heading east. A quiet day with no herring recordings. We carried out one surface haul at midnight (Station 92, 70.35N-6.52E), catching 17kg of lumpsuckers and 2 herrings). We will finish transect 1 tomorrow afternoon.

22 May

Dana finished transect 1 at 10:45 UTC and is now homeward bound. At 2:41 this morning we carried out a haul at the shelfedge at 250m (Station 99, 70.35N-17.17E). The catch was 1500 kg, mainly blue whiting but also including a few baskets of saithe, cod and haddock. We did see hardly any herring during this last transect.

23-26 May

Dana sailed back to Hirtshals. During the trip home the data for the PGNAPES database was prepared. A draft cruise report was produced. Time of arrival in Hirtshals 8:00 UTC.

Results

Catch composition

The catch composition of all trawl hauls are presented in Table 3, Table 2 gives further information on trawling depth, speed, wire length and weather conditions. Distribution of trawl hauls is shown in Figure 1.

Distribution and density of herring and blue whiting

Distribution and densities of herring and blue whiting along the survey track are presented in Figure 1.

Like in previous years, herring was much more abundant in the south than in the north. In comparison to last year the distribution in the south was shifted westwards. The herring found in the north was distributed in a few patches along the transects.

Blue whiting was abundant in the whole off shelf area except for the northern end of the two northern most transects (70.35 and 69.17 N). In the north, juvenile blue whiting was particularly abundant in the area close to the shelf edge.

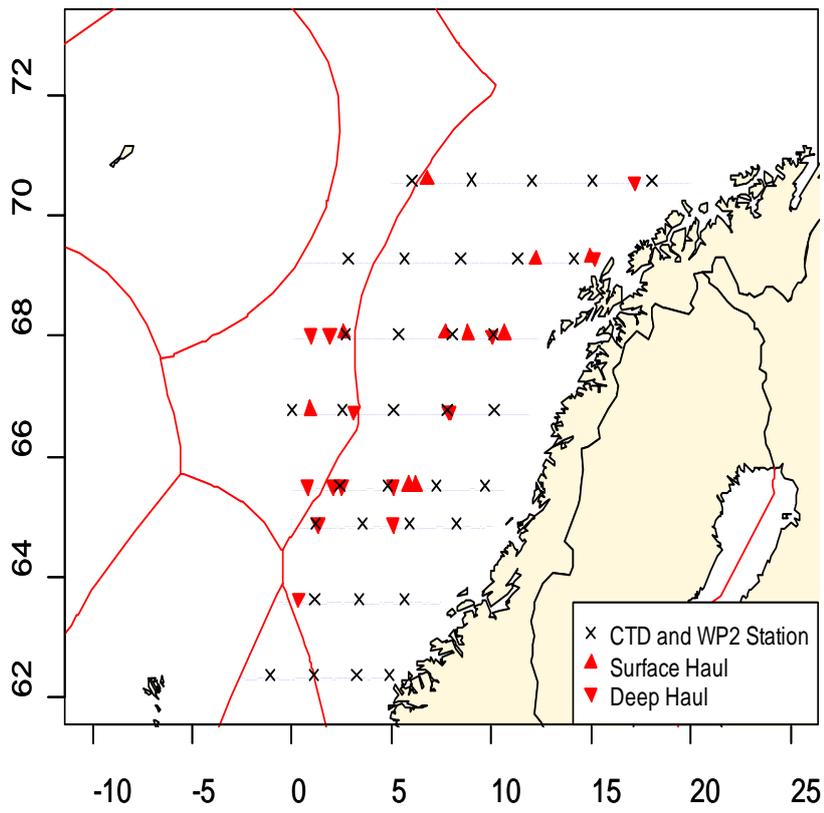


Figure 1a. Sailed transects and hydrographical stations and trawl hauls.

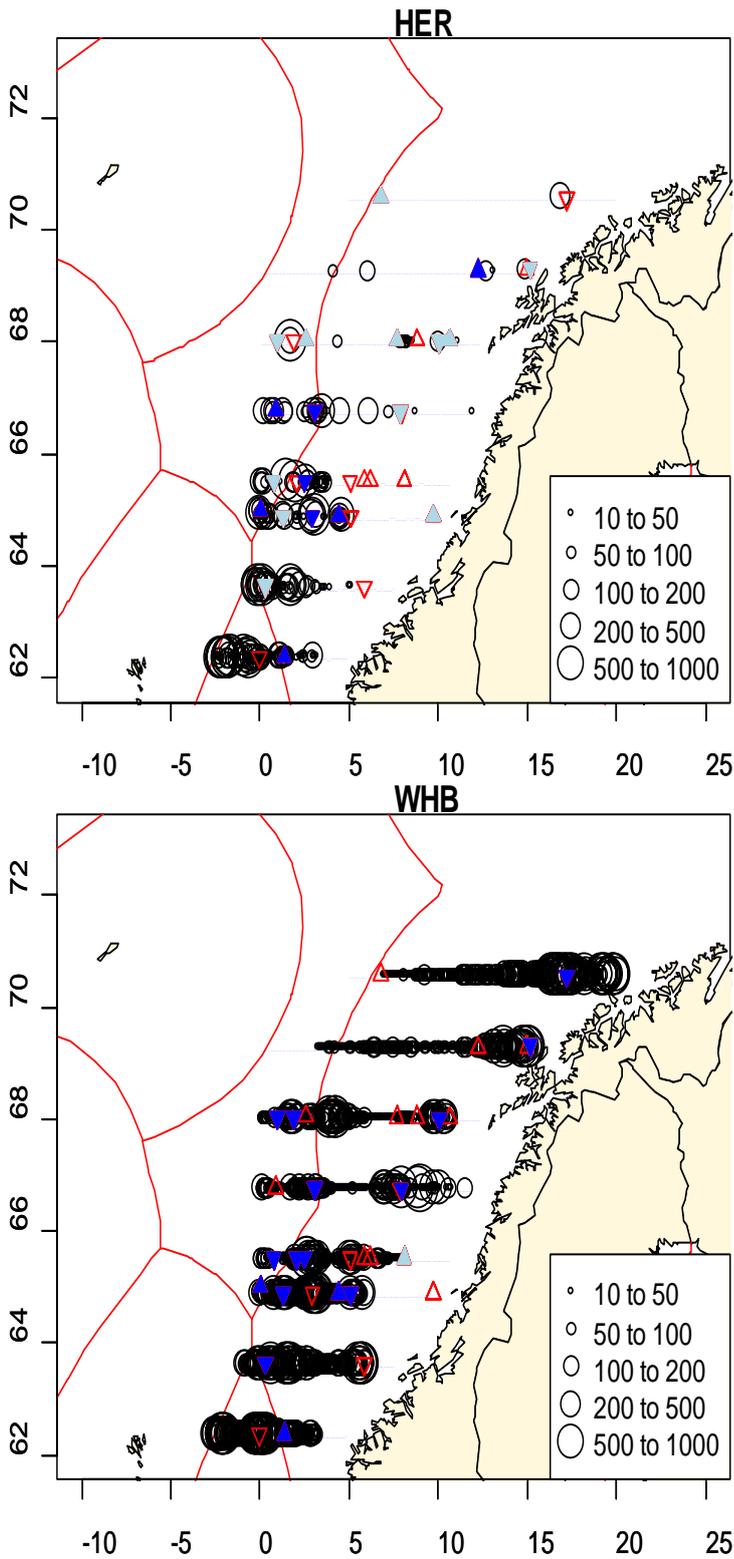


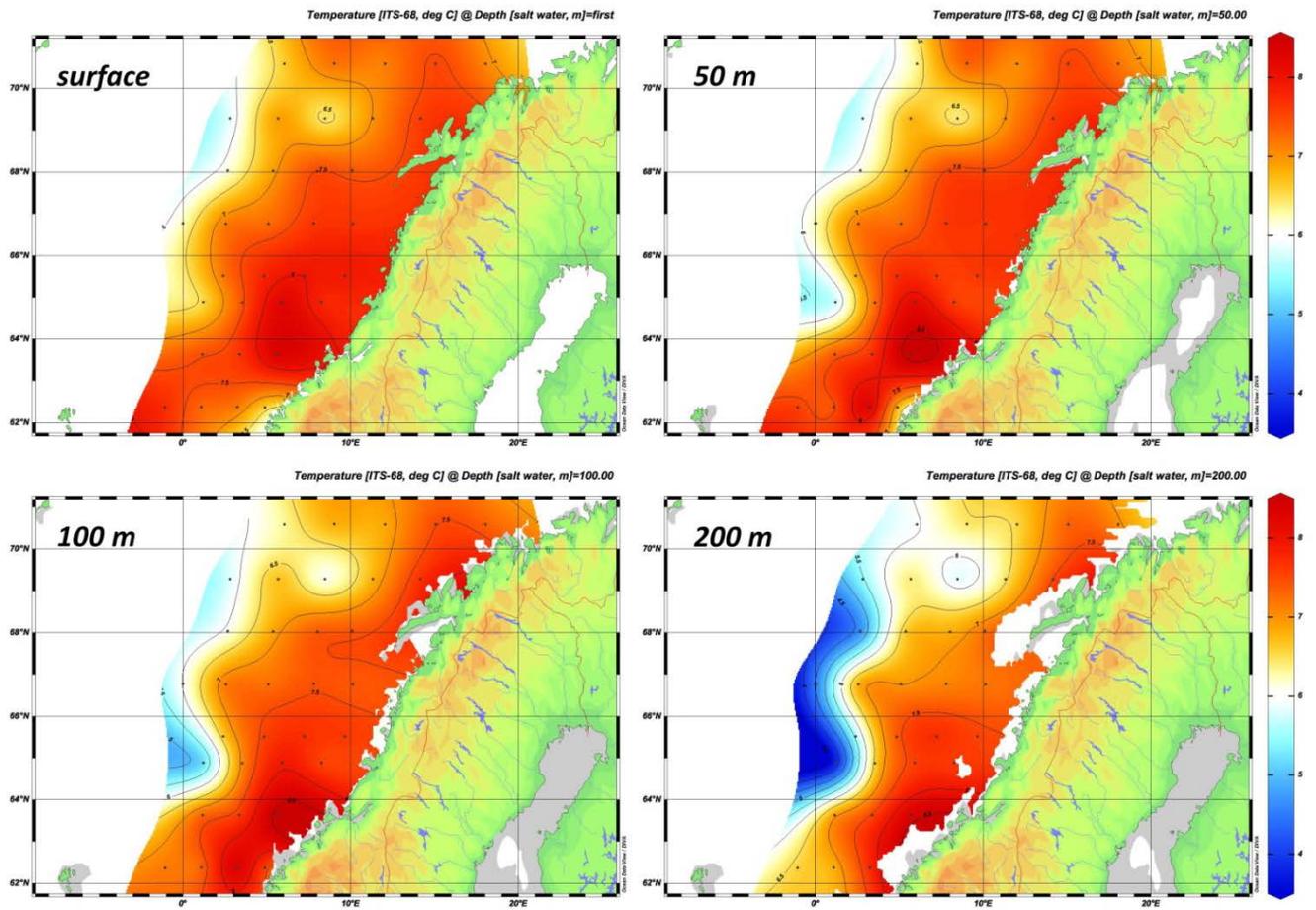
Figure 1b. Sailed transects, trawl - and Nautical Area Scattering Coefficients (NASC's) assigned to herring and blue whiting. Triangles indicate trawl catches. Light blue > 5kg, Dark blue < 5kg; red, non-filled = no catch.

Hydrographic conditions

Surface values were between 5.5 in the Northwest and $> 8^{\circ}\text{C}$ in the South. Overall, the pattern of surface temperature distribution was comparable to those of last year in the same area. However, over most of the water column, temperatures were roughly 0.5°C higher than in previous years. In the surface of almost the entire survey area, the 7°C isothermal reached well beyond the 70°N latitude. Only at the western margin of the survey area, lower surface temperatures were encountered. (figure 2)

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 3). The magnitude of these layers varied only slightly with latitude. In the southern part of the survey area, the layer of warmer Atlantic water could be detected down to about 500 m only close to the coast. In the oceanic area, this layer was only 400 – 450 m of magnitude decreasing to 200 m at the westernmost station. On both northernmost transect this warm Atlantic water layer reached deeper to > 600 m.

Figure 2: Horizontal temperature distribution interpolated from CTD data at selected depths



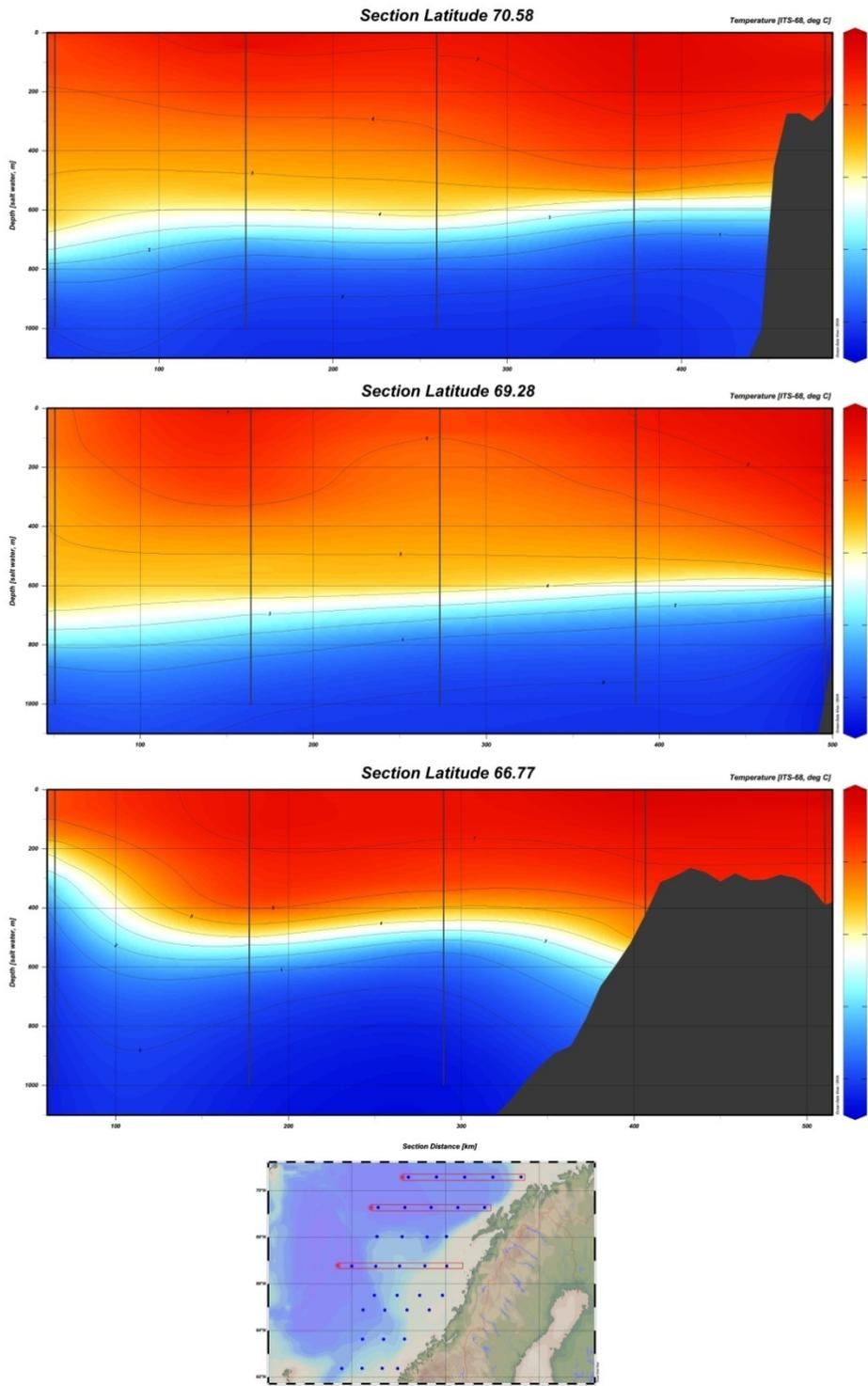


Figure 3: Vertical temperature distributions from South (bottom) to North (top) along 3 transects perpendicular to the coast. The latitudinal position of the transect can be seen in the map at the bottom.

Table 1: CTD and WP2 stations taken by R/V Dana during 1 to 26 May 2016. Geographical position belonging to the CTD station. The position of the WP2 is slightly different, due to drift.

Station CTD	Station WP2	year	Log	Month	Day	Hour	Min	Latitude decimal	Longitude decimal	Bottom depth	Wind direction	Wind speed
1		2016	0	5	1	22	34	62.3696	4.8802	154.9	197.1	14.96
2	3	2016	0	5	2	4	30	62.3728	3.2358	363.6	171	22.09
5	6	2016	0	5	3	1	25	62.3772	1.0776	624.5	206.4	7.82
8	9	2016	0	5	3	13	15	62.3702	-1.0790	1554.2	220.4	8.59
11	12	2016	0	5	4	12	13	63.6293	1.1361	1902.3	195	13.8
13	14	2016	0	5	4	19	51	63.6281	3.3783	1339.8	202	11.13
15	16	2016	0	5	5	3	58	63.6349	5.6305	680.3	202.3	8.31
19	20	2016	0	5	6	5	42	64.8842	8.2647	204.7	239.1	14.09
21	22	2016	0	5	6	13	40	64.8845	5.8925	371	199.7	9.19
25	26	2016	0	5	7	4	11	64.8777	3.5202	1445.8	226.8	7.53
28	29	2016	0	5	7	14	48	64.8827	1.1901	2747.5	243.5	10.2
34	36	2016	0	5	8	17	47	65.5137	2.4045	2724.2	51.7	3.19
38	39	2016	0	5	9	4	10	65.5109	4.8235	840.8	57.9	3.43
43	44	2016	0	5	9	20	19	65.5136	7.2407	391.3	65.5	4.21
46	47	2016	0	5	10	5	15	65.5116	9.6535	352.9	357.8	6.93
48	49	2016	0	5	13	6	54	66.7651	10.1322	398.8	282.3	7.92
52	53	2016	0	5	13	21	13	66.7750	7.7879	599.7	337.3	9.72
54	55	2016	0	5	14	5	28	66.7650	5.0788	1148.8	4.7	11.51
57	58	2016	0	5	14	17	12	66.7648	2.5510	1464.1	3.2	8.76
60	61	2016	0	5	15	4	14	66.7675	-0.0075	3377.1	299.9	4.57
64	65	2016	0	5	16	0	4	68.0313	2.6825	277.5	262.9	11.38
67	68	2016	0	5	16	11	15	68.0248	5.3586	1457.2	292	7.63
70	71	2016	0	5	16	21	9	68.0211	8.0256	2299.8	300.3	12.59
73	74	2016	0	5	17	7	33	68.0307	10.0835	748.3	298.9	7.78
79	80	2016	0	5	18	15	32	69.2795	14.1596	1410.2	262.4	14.99
82	83	2016	0	5	19	2	38	69.2785	11.3027	2936.2	315.1	4.54
84	85	2016	0	5	19	10	16	69.2801	8.4671	3044.5	327.8	3.57
86	87	2016	0	5	19	17	37	69.2801	5.6641	346.1	16.9	1.67
88	89	2016	0	5	20	0	55	69.2844	2.8163	3214.7	269.6	3.21
90	91	2016	0	5	20	19	58	70.5856	6.0346	3122.3	82.9	4.29
93	94	2016	0	5	21	5	57	70.5918	9.0258	332	77.5	12.04
95	96	2016	0	5	21	13	59	70.5862	12.0291	441.5	91.3	9.04
97	98	2016	0	5	21	21	10	70.5856	15.0567	2317.7	199.2	4.46
100	101	2016	0	5	22	6	19	70.5878	18.0573	296.3	349.8	3.1

Table 2: Fishing stations taken by R/V Dana during 1 to 26 May 2016

Country	Vessel	Cruise	Station	Month	Day	Hour	Min	Lat_decimal	Lon_decimal	WinDir (deg)	Wind speed (m/s)	Towing speed (knots)	Towing time (min)	Catch weight (kg)	Gear depth (m)	Wire length (m)
DK	OXBH	201605	4	5	2	23	12	62.371983	1.363117	227.9	5.9	3.7	60	1834.984538	0	
DK	OXBH	201605	7	5	3	7	16	62.362433	-0.031783	203.0	8.1	3.000000001	48	0.202	0	300
DK	OXBH	201605	10	5	4	6	51	63.635750	0.323967	206.4	12.1	3.9	68	156.53495	220	1300
DK	OXBH	201605	17	5	5	6	58	63.627567	5.848533	202.0	7.6	3.4	60	3.494016	0	
DK	OXBH	201605	18	5	5	23	35	64.885000	9.724583	305.8	5.7	4	60	31.928972	0	300
DK	OXBH	201605	23	5	6	18	9	64.883583	5.075667	187.0	7.6	3.999999999	60	227.096307	300	1500
DK	OXBH	201605	24	5	6	23	34	64.888483	4.426850	221.7	6.6	4	40	1097.97975	0	1250
DK	OXBH	201605	27	5	7	8	12	64.887133	2.948383	233.7	7.2	4	60	25.779	0	300
DK	OXBH	201605	30	5	7	17	1	64.883017	1.313033	232.7	10.8	3.8	61	28.053	150	890
DK	OXBH	201605	31	5	7	23	34	64.999400	0.014433	297.1	5.0	3.8	60	310.03968	0	300
DK	OXBH	201605	32	5	8	7	10	65.510567	0.771217	315.5	7.3	3.6	60	36.213	210	1150
DK	OXBH	201605	33	5	8	13	44	65.511783	2.076033	356.6	6.9	3.8	89	45.128398	350	1650
DK	OXBH	201605	37	5	8	20	56	65.518167	2.523983	47.5	3.2	4.3	46	2159.3074	65	500
DK	OXBH	201605	40	5	9	7	23	65.509600	5.053183	64.4	4.0	3.899999999	60	9.27	80	700
DK	OXBH	201605	41	5	9	12	12	65.515850	5.850650	39.4	7.5	3.9	64	2014.9772	20	350
DK	OXBH	201605	42	5	9	15	46	65.509933	6.209983	66.8	5.6	4.2	62	6.2999475	20	
DK	OXBH	201605	45	5	9	23	34	65.511383	8.081550	14.2	5.4	3.4	60	70.435	0	315
DK	OXBH	201605	50	5	13	14	47	66.748483	7.846317	297.5	8.7	3.9	90	19.038	25	300
DK	OXBH	201605	51	5	13	18	27	66.745417	7.912683	315.7	13.9	4.300000001	60	32.433	300	1530
DK	OXBH	201605	56	5	14	13	15	66.767500	3.100683	325.9	8.1	3.5	84	699.9672	300	1500
DK	OXBH	201605	59	5	14	23	17	66.770017	0.903400	310.3	7.6	4	60	474.0212	8	285
DK	OXBH	201605	62	5	15	16	12	68.026167	0.956383	269.0	13.3	3.6	60	47.604062	240	1300
DK	OXBH	201605	63	5	15	21	1	68.028017	1.904883	253.0	11.8	3.099999999	30	140.00332	170	1000
DK	OXBH	201605	66	5	16	1	57	68.041950	2.600033	254.7	12.4	4	60	1.018	10	295
DK	OXBH	201605	69	5	16	18	46	68.035300	7.666183	296.3	12.7	4	44	10.162	0	310
DK	OXBH	201605	72	5	17	1	21	68.030100	8.836550	299.1	13.9	4.3	60	9.486	0	386
DK	OXBH	201605	75	5	17	10	28	68.007067	10.032383	293.1	9.6	3.8	97	72.469188	350	1650
DK	OXBH	201605	76	5	17	15	23	68.022567	10.656250	282.1	8.9	3.7	60	10.867998	12	315
DK	OXBH	201605	77	5	18	8	7	69.293083	14.971117	256.5	7.7	5.1	60	2.554	12	300
DK	OXBH	201605	78	5	18	11	9	69.317400	15.146483	224.8	15.8	3.200000001	30	1362.003462	250	920
DK	OXBH	201605	81	5	18	22	32	69.276133	12.221517	242.3	10.7	4.2	60	27.436	0	300
DK	OXBH	201605	92	5	20	23	20	70.590600	6.785500	66.3	10.7	2.9	60	19.196	0	300
DK	OXBH	201605	99	5	22	3	20	70.554467	17.181500	247.1	3.0	4.099999999	15	1576.997472	250	1000

Table 3: Catch composition in trawl stations taken by R/V Dana during 1 to 26 May 2016

Station	Latitude	Longitude	Average Depth	Total catch (kg)	<i>Arctozenus risso</i>	<i>Argentina silus</i>	<i>Argyropelecus olfersi</i>	<i>Benthosema glaciale</i>	<i>Cephalopoda</i>	<i>Clupea harengus</i>	<i>Cyclopterus lumpus</i>	<i>Euphausiidae sp.</i>	<i>Eutrigla gurnardus</i>	<i>Gadicus argenteus</i>	<i>Gadus morhua</i>	<i>Maurolicus muelleri</i>	<i>Melanogrammus aeglefinus</i>	<i>Merlangius merlangus</i>	<i>Micromesistius poutassou</i>	<i>Notoscopelus elongatus</i>	<i>Octopus vulgaris</i>	<i>Pollachius virens</i>	<i>Salmo salar</i>	<i>Scomber scombrus</i>	<i>Scyphozoa sp.</i>	<i>Sebastes marinus</i>	<i>Sebastes mentella</i>	<i>Trisopterus esmarkii</i>	
7	62°21.746' N	000°01.907' W	0	1835.0																				0.2					
4	62°22.319' N	001°21.787' E	0	0.2						1191.5									91.6					551.9					
10	63°38.145' N	000°19.438' E	220	156.5	0.1					1.8	5.4								146.1			0.8				2.4			
17	63°37.654' N	005°50.912' E	0	3.5							2.0	0.1	0.5			0.3								0.4	0.3				
18	64°53.100' N	009°43.475' E	0	31.9						0.4	9.4	19.7				0.2								2.0	0.2			0.2	
23	64°53.015' N	005°04.540' E	300	227.1	6.1		0.0	0.0								0.1			219.2	0.4				1.1	0.2				
27	64°53.228' N	002°56.903' E	0	1098.0	0.1					25.7																			
24	64°53.309' N	004°25.611' E	0	25.8	0.2				0.0	52.9			0.4						514.8					529.6					
30	64°52.981' N	001°18.782' E	150	28.1						0.2	3.6								24.3										
31	64°59.964' N	000°00.866' E	0	310.0	0.1				0.1	243.9	1.9								61.6					1.1	1.4				
32	65°30.634' N	000°46.273' E	210	36.2	0.8					0.5									34.7						0.1				
33	65°30.707' N	002°04.562' E	350	45.1	3.2			1.3				0.2				0.0			32.7	0.0	0.1					7.6			
37	65°31.090' N	002°31.439' E	65	2159.3						100.7									2058.4							0.2			
40	65°30.576' N	005°03.191' E	80	9.3							1.5					0.1								7.4	0.3				
41	65°30.951' N	005°51.039' E	20	2015.0							4.9													2010.0					
42	65°30.596' N	006°12.599' E	20	6.3								2.9				3.3										0.1			
45	65°30.683' N	008°04.893' E	0	70.4					0.4		7.4	60.0				0.1			0.3					1.6	0.7				
50	66°44.909' N	007°50.779' E	25	19.0						0.3	3.4		0.5											14.8					
56	66°46.050' N	003°06.041' E	300	32.4	1.1					687.8						0.0			6.3	0.1		1.7			1.0		2.0		
51	66°44.725' N	007°54.761' E	300	700.0	0.1			0.0				0.2							7.8	0.2				21.6	2.6				
59	66°46.201' N	000°54.204' E	8	474.0						472.7	0.9													0.4					
62	68°01.570' N	000°57.383' E	240	47.6	1.6			0.2		0.5		0.1					2.7		38.3							1.4	2.9		
63	68°01.681' N	001°54.293' E	170	140.0	0.6														135.8						3.0		0.7		
66	68°02.517' N	002°36.002' E	10	1.0						0.7	0.3																		
69	68°02.118' N	007°39.971' E	0	10.2					0.0	4.0	3.1																		
72	68°01.806' N	008°50.193' E	0	9.5					0.0		6.3		0.3											2.9					
75	68°00.424' N	010°01.943' E	350	72.5	1.6	42.2			0.0	0.3						0.0			23.8	0.6					4.0				
76	68°01.354' N	010°39.375' E	12	10.9						0.6	3.2	6.6										0.2				0.3			
77	69°17.585' N	014°58.267' E	12	2.6							2.0		0.6																
78	69°19.044' N	015°08.789' E	250	1362.0						0.6				0.1	30.2	0.0	10.3	3.4	1233.7			34.7				4.8			
81	69°16.568' N	012°13.291' E	0	27.4						2.2	14.7	10.1	0.5																
92	70°35.436' N	006°47.130' E	0	19.2					1.9	0.7	16.6																		
99	70°33.268' N	017°10.890' E	250	1577.0	0.0										19.6	0.0	12.0		1517.0			26.8			1.6				

Annex 1 - Calibration report.

Transceiver Menu	
Frequency	38 kHz
Sound speed	1462 m.s ⁻¹
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	25.17 dB
3 dB Beamwidth	6.8°
TS of sphere	-33.6 dB
Range to sphere in calibration	9.0 m
Measured NASCvalue for calibration	22100 m ² /nmi ²
Calibration factor for NASCs	1.00
Absorption coeff	6.862 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