The International Ecosystem survey in the Nordic Seas in May 2015

R/V DANA Cruise No. 5/2015

Calibration of Echo-sounders

28/4 – 30/4 2015

International Acoustic Monitoring of Herring and Blue whiting

1/5 – 23/5 2015

Cruise participants

Calibration 28/4 – 30/4

Karl-Johan Staehr	Denmark (Cruise leader)
Torben Filt Jensen	Denmark
Eik Ehlert Britch	Denmark
Christian Petersen	Denmark
Henrik Søndergård Mathiesen, MacArtney	Denmark
Tommy Mikkelsen, MacArtney	Denmark
Lasse Jørgensen, MacArteney	Denmark
Rune Stockholm Pedersen, MacArtney	Denmark
Mette Glud Olsen, Dansk Metal	Denmark

Acoustic monitoring 1/5 - 11/5

Karl-Johan Staehr	Denmark (Cruiseleader)
Acoustic Torben Filt Jensen	Denmark
Acoustic Dick de Haan	Netherlands
Fishlab Ronnie Nilsson	Sweden
Fishlab Joanne Smith	United Kingdom
Fishlab Helle Andersen	Denmark
Fishlab Tom Svoldgaard	Denmark
Tech. Christian Petersen	Denmark

Acoustic monitoring 12/5-23/5

Bram Couperus	Netherlands (cruiseleader)
Acoustic Cormac Nolan	Ireland
Acoustic Sven Kupschus	United Kingdom
Fishlab Fredrik Franzen	Sweden
Fishlab Matthias Kloppmann	Germany
Fishlab Peter Vingaard	Denmark
Fishlab Frank Ivan Hansen	Denmark
Tech. Eik Ehlert Britch	Denmark

Cruise summary

Effective survey days	20 (+ 3 for calibration)
Mileage	Steaming for start of transects 490 NM Monitoring 3320 NM Steaming for end port 240 NM
Number of trawl hauls	30
Number of CTD stations	36
Number of WP2 stations	35
Number of biological samples - herring	419
Number of biological samples – blue whiting	774
Number of biological samples - mackerel	138
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 28th April and 30th April 2015. 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 a new towed platform Flexus had its first real sea test. It is a platform developed between DTU-Aqua and MacArtney were you can adjust the depth of the platform from the vessel. The test went well but adjustments to the steering program has to be made.

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.

Unlike previous years, on Dana intertransects were skipped, including the off-coast intertransects. Our procedure was now to hoist up the towed body at the end of a transect and steam to the next transect without integrating.

Hydrographical and zooplankton data

At fixed positions decided by ICES WGIPS plankton samples were taken by means of vertical tows from 200 m 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 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, conductivity (salinity) and oxygen. All together Dana carried out 36 CTD and 35 WP2 stations (Table 1, 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 30 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

Dana left Hirtshals at the 28th april at 04.00 UTC for calibration of acoustic equipment at Bornö in Sweden. All transducers were calibrated and Dana arrived in Hirtshals again at 30th April at 18.00 UTC.

Dana left Hirtshals to start the acoustic survey on the 1st May at 10.00 UTC.

Data monitoring was started at 01.19 UTC on 3rd of May at 62°11 N, 004°40 E with a CTD for preparing the Environment settings for EK60.

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

03-05-2015 21:50 Dana's current position is 62N11, 000E 39 heading west. We started at the eastern end of transect 1 in stratum 1 this morning at 02 UTC. We had a surface haul near to the coast in the early morning just at day break and got 1 lumpsucker. During the day we have had serious problems with our towed body as both of our tow cables have broken today and we have to run by the haul mounted transducer during repair of the two cables. At the moment we are fishing at 240to 260 meters.

04-05-2015 21:30 Dana's current position is 62N 52, 001W 32 heading east. We have just started on transect 2 stratum 1. Last evening did we fish at 230 m depth on transect 1 with a catch of 441 kg blue whiting. The catch consisted of two length groups with mean at 18.5 cm and 23.5 cm. Later in the night did we fish in the surface with a catch of 233 kg mackerel (mean length 15.5 cm) and 149 kg blue whiting (mean 24 cm and 18.5 cm). We have now got the one of the cables for the towed body repaired and it is up running again.

05-05-2015 21:30 Dana's current position is 62N 52, 003E 21 heading east at transect 2 stratum 1. Last night we had a haul at the western end of the transect in the surface. The catch was 3,352 kg total, 1,816 kg herring (mean 30 cm), 1453 kg mackerel (mean 32 cm) and 101 kg blue whiting (mean 18.5 cm). In the morning we had a haul at 250 m depth with 10 kg blue whiting (mean 20 cm). Finely we had a haul late afternoon at around 300 m with 8 kg, 6 kg blue whiting (mean 19 cm). The weather has been excellent al day. We expect to finalize transect 2 stratum 1 tomorrow morning and start steaming for the eastern end of transect 6 in stratum 1.

06-05-2015 22:00 Dana's current position is 65N 26, 010E 22 steaming north-east to start transect 6 stratum 1in the eastern end. Transect 2 was finalized at 03.54 UTC and we expect to start transect 6 at 21.30 UTC heading west.

07-05-2015 22:00 Dana's current position is 65N 37.8, 004E 19 heading west at transect 6 stratum 1. At the most eastern part of the transect at depth up to 400 m nearly nothing have been registered. We have fished at 270 m and got 300 kg blue whiting (mean 18 cm). We are at the moment fishing at 200 m.

08-05-2015 21:30 Dana's current position is 66N 08, 000E 00 steaming north for transect 8 stratum 1. We expect to be at the western end of transect 8 at 00.30 UTC. Last evening we were fishing between 200 and 100 m an got a catch of 514 kg blue whiting (mean 18 cm). During the darkest period of the night we had a haul in the surface. This haul had a peculiar catch. 270 kg consisting of 257 kg blue whiting, 2 kg mackerel, 1 specimen of herring and some mesopelagic. Finally did we early afternoon have a haul at small read spots in the upper 50 meters and got 224 kg herring (mean 35 cm) and 3 kg mackerel (32 to 40 cm).

09-05-2015 21:45 Dana's current position is 67N 00.5, 003E 59 heading east at transect 8 stratum 1. In the western end of this transect we have seen bands of herring in the upper 50 to 100 m. We have tried to fish at this layer both only 2 specimens of herring even we vent right through it. In the afternoon we have had a haul at 240 m and got blue whiting at 18 cm. We have had very fine wind conditions (> 8 m/s) but due to old swell coming from a bad direction have we constantly been rolling 10 degrees to each side all day and every half an hour have been out to 25-30 degrees. It is a little difficult when you with one hand tries to keep you and your chair near to the table and with the other hand tries to catch the flying key board.

10-05-2015 21:45 Dana's current position is 67N 00.5, 009E 18 heading east at transect 8 stratum 1. Last night we had a surface haul around the middle of the transect and got 671 kg herring and 332 kg blue whiting. In the morning we had a haul at 250 m and got 208 kg blue whiting and 8 kg herring. Just now we have had a surface haul with 14 specimens of mackerel and 10 specimens of salmon. We will end this transect tomorrow morning and continue east to Bodø for change of crew. It is planned to leave Bodø 12. May at 13.00 UTC, but now with Bram Couperus as cruise leader.

Integration on first half on the survey was ended 11thMay at 05.30 UTC at 67°00N, 11°46E. Bodø was entered at 11th May at 08.30 UTC for change of crew.

Conditions during first half of the survey:

Weather conditions on the last part before the starting point were a little rough with the wind and waves just against us and we had to go by reduced speed. Therefore the arrival for the starting point was a little dilated. During the first two half of the survey the weather was god but in periods with large swells from behind and thereby a lot of movement of the vessel, but survey speed could be maintained. All CTD and WP2 stations have been taken as planned.
During the first transect we had problem with the termination on the tow cable for the towed body but this problem got fixed.

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

12 May 2015
Dana left Bodo this afternoon at 15:30. We will start approximately at 12:00 GMT with transect 10 at 68.23N-13.07E with a hydrographical station and then proceed west.

13 May 2015
We are now fishing at 68.22.64N-9.32.84E fishing at 150m for some small scattered red dots. The weather was poor this afternoon (N7-8), but its getting better. This is the third haul since we left Bodo yesterday. The catch was –again- disappointing: a few saithe and haddock, two helmet jellyfish (Periphylla) and traces of krill and glacierlanternfish. All together not even half a basket.
In our first haul at midnight above the shelf at 68.23.24N-12.37.36E at 70m for small reddish schools, well above the bottom, we caught a basket of haddock, with 5 herring and one lumpsucker.
The second haul took place today, still on the shelf (8:00 GMT; 68.23.11N-11.34.39E), on some real typical herring pillars as we are familiar with in the North Sea in July. We managed to miss them all: the catch was three haddocks and one grey gurnard.

14 may 2015
Dana is now (17:30 GMT; 14-5-2015) at 68.23.10N-4.37.00E. We have just hauled for a haul (station 72) at the blue whiting layer which showed numerous reddish kernels. The catch was 300kg blue whiting and it contained some herring as well (I do not know the exact number yet; appr. 35).
Earlier today, in the morning (3:00 GMT) we carried out another haul on the blue whiting layer (Station 69; 68.22.77N-7.52.90E) and collected 52 kg of blue whiting and 5 herrings.
The weather has much improved (NE 4).

15 may 2015
We find ourselves now on transect 12 at 69.46.05N-2.20.71E, heading west. No fishing today as we spent most of the day between transects. At midnight we will carry out a surface haul. Wind: SSE 5.

16 May 2015
Dana is proceeding in good health on the 12th transect in eastern direction. Our current position (16 May 2015; 19:00 GMT) is 69.45.90N-8.40.12E, carrying out a hydrographical station (85 and 86).
Last night we trawled at the surface (Station 81; 69.46.64N-2.50.38E) for 120 kg of herring. Today 10:50 GMT (Station 84; 69.47.50N-6.12.28E) we shot the gear for little red schools and single targets at 400m depth. The catch was a brim-full basket, consisting of a mix of blue whiting (mainly), 21 herrings, some red fish and meso pelagics and – again – helmet jellyfishes.

17 May 2015
Dana finds itself at 69.43.13N - 16.04.20E carrying out an hydrographical station (Station 92 & 93). We had to change our course slightly because of the traffic separation scheme. Also we have decided to shift the planned hydrographical station at the end of this transect (12) as it would have been in rather shallow water (50m). The depth at our present position is according to the sea charts around 1300m, but the 38 and 18 kHz echosounders seem to suggest that the bottom is at 300m: probably a strong thermocline and/or a lot of plankton?
We did one haul this morning (Station 89; 9:49 GMT 69.46.15N-14.01.01) at 200 for a layer of small red and green dots and large blue-green schools. The catch was half a basket of krill (=the blue-green schools) and Pearlsides (=the red and green dots).
After this station we will proceed to the end of the transect - three hours - followed by twelve hours steaming to the next transect. This means we will be around 11:00 GMT tomorrow at the start of transect 2 (eastern end).

18 May 2015
Dana is now (19:00 GMT) at 71.43.60N - 16.38.13E (transect 2), heading west. Yesterday evening 17 May, 22:30 GMT, shortly before we arrived at the eastern end of transect 12, we set the net in coastal water at 100m depth for numerous large en small red schools (Station 94; 69.45.36N - 17.07.44E). The catch was 400 kg haddock. After that we steamed along the intertransect towards the eastern end of transect 2, where we arrived at 12:00 GMT today. No fishing yet, but we will carry out a surface haul tonight. The weather is fine (W2).
As it looks now, we have sufficient time to finish the planned transects and do some fishing.

19 May 2015
We have almost arrived at the western end of transect 2. Our position (19:00 GMT; is 71.43.50N - 7.03.70E. Last night we carried out a surface haul (Station 99; 21:44; 71.43.97N - 15.58.97E) and caught 41 herrings and the usual lumpsuckers. Today, proceeding west and carrying out the hydrographical stations on our way, we did see some small red schools at 150-200m but did not fish on them as we considered the chance to miss them too big. The schools became even rarer towards the west.
Tomorrow we will start on our last transect. Most likely we will run into concentrations of capelin when we come near Bear Island.
We expect to end the survey on Thursday at noon and to arrive Saturday morning in Tromso.

20 May 2015
Today we started on our last transect (4) from west to east. We did one trawl on nothing very much at 370m (station 106; 9:45 GMT; 73.35.69N - 10.22.69E) and caught 5.8 kg of krill and meso pelagics, including 3 blue whitings. This haul was followed this afternoon by a surface haul in a dense plankton layer (station 107; 15:00 GMT; 73.35.99N -11.55.50E). The catch was half a basket of lumpsuckers, squid (gonatus) and 4 red fish (mentella) of which one specimen was actually running fish larvae. At current our position is 73.35N - 11.59E. We happily proceed eastwards and expect to arrive tomorrow around 13:00 GMT at the eastern end of the transect. From there we will steam to Tromso where we expect to arrive at noon.

21 may 2015
This is Dana's last report. We are on our way to Tromso. This morning (3:10 GMT) we did a haul on scattered schools at 100-200m (Station 110; 73.35.64N - 16.51.10E). The catch was 200kg of

haddock. Towards the end of transect 4 we ran into feeding fin whales and humpbacks. We reached the end of the transect at 11:30 and carried out a last haul at 400m depth. During the first attempt the starboard net ropes turned out to be twisted and we had to haul again and repeat the session. The second attempt (Station 113; 12:10 GMT; 73.35.32N - 19.47.64E) was successful: 200 kilogram of capelin, haddock, there were three or four blue whiting's included as well.

During the second half, on three occasions the acoustic data have not been recorded (minimum half an hour, maximum two and a half hour).

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.

It appears noteworthy that with the last surface tow at station 107 5 beaked redfish (*Sebastes mentella*) were caught of which 1 was extruding live larvae. This is, after the catch of a few specimens in one haul in 2011, the second time that larvae extruding females were caught at the surface. Those specimens were caught in broadly the same area above the slope of the Barents Sea plateau at almost the same date. From ichthyoplankton surveys, it is well know that the larvae extrusion area for *S. mentella* is along the Norwegian Shelf Break northwards up to the latitude of Bear Island. No information, however, is published on the spawning behavior of the species. In order to monitor that behavior more systematically, it is suggested/recommended that, if time permits, additional surface hauls should be taken above the slope area during the coming IESNS. All by-caught *S. mentella* from any haul should be sampled for sex and maturity.

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.

Both target species were more abundant in the southern survey area and became scarce towards the North. Larger herring schools could be detected, however, on almost every transects even though becoming more patchy towards the North, while in blue whiting school size declined while their distribution remained uniform almost over the entire survey area. Only on the northernmost transect, blue whiting was only found at the entrance to the Barents Sea. No herring were detected on the northernmost transect.

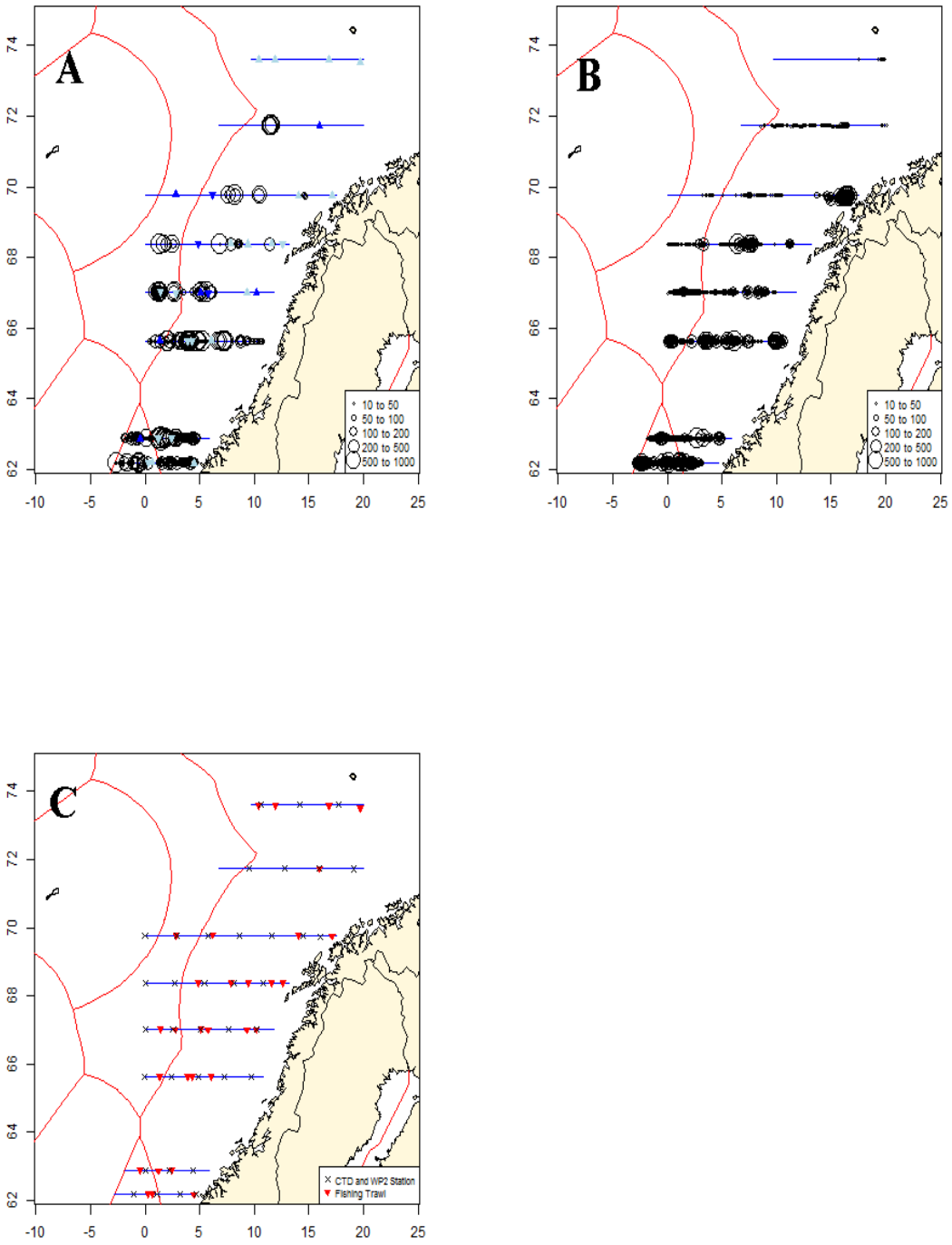

Figure 1. Sailed transects, trawl -, plankton – and hydrographical stations (C) and Nautical Area Scattering Coefficients (NASC's) assigned to herring (A) and blue whiting (B).

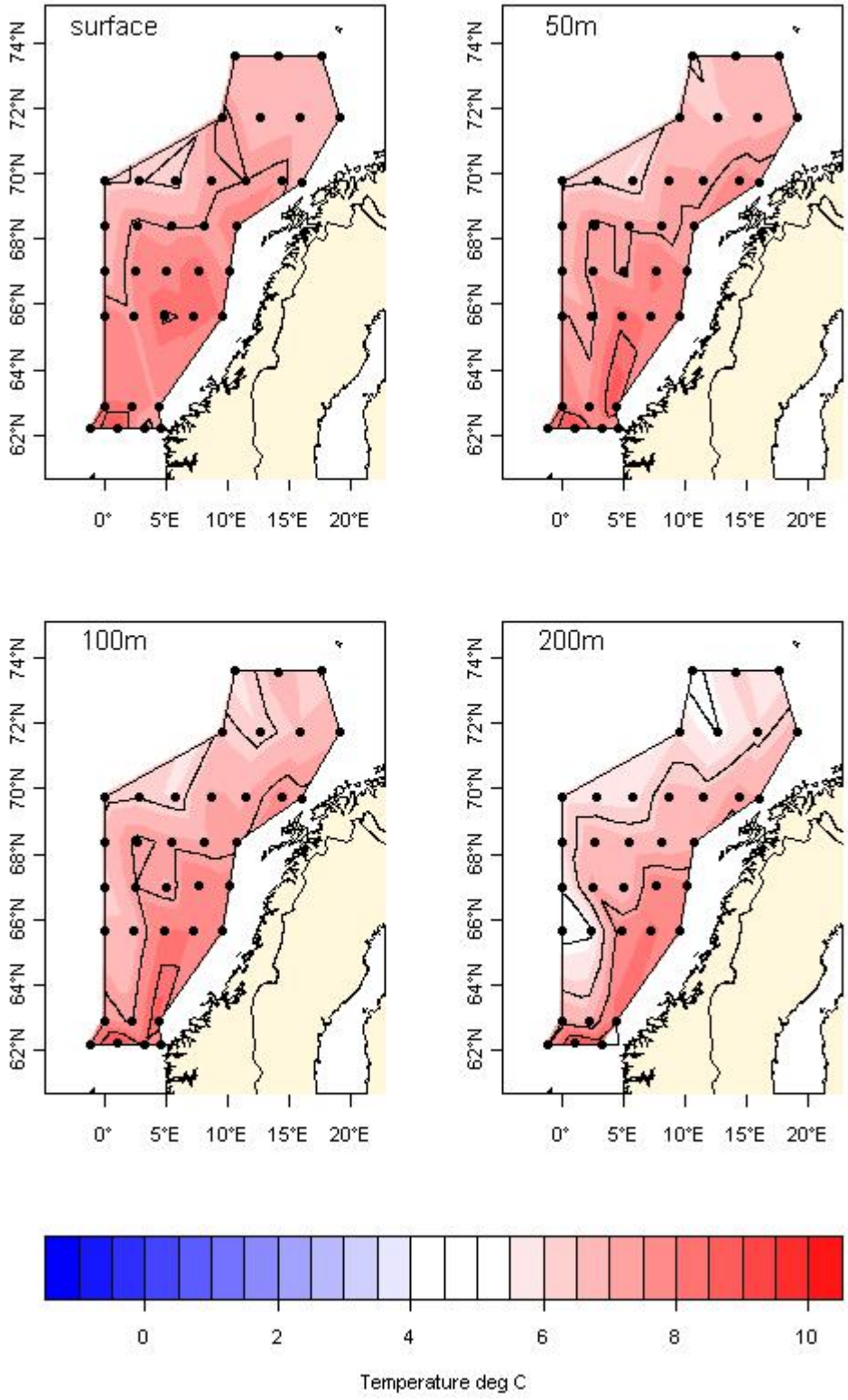

Figure 2: Horizontal temperature distribution linearly interpolated from CTD data at selected depths

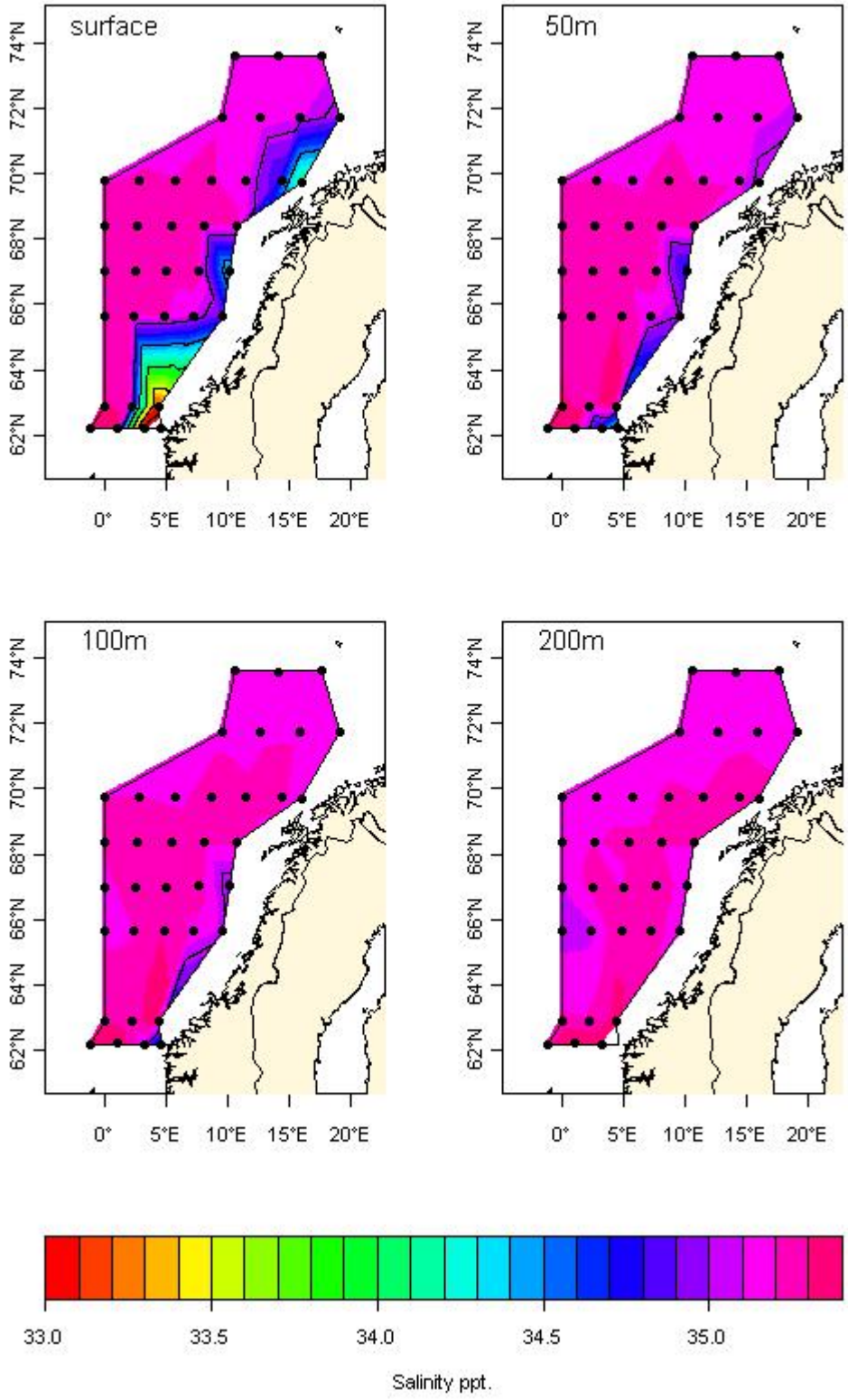

Figure 3: Horizontal salinity distribution linearly interpolated rom CTD data at selected depths

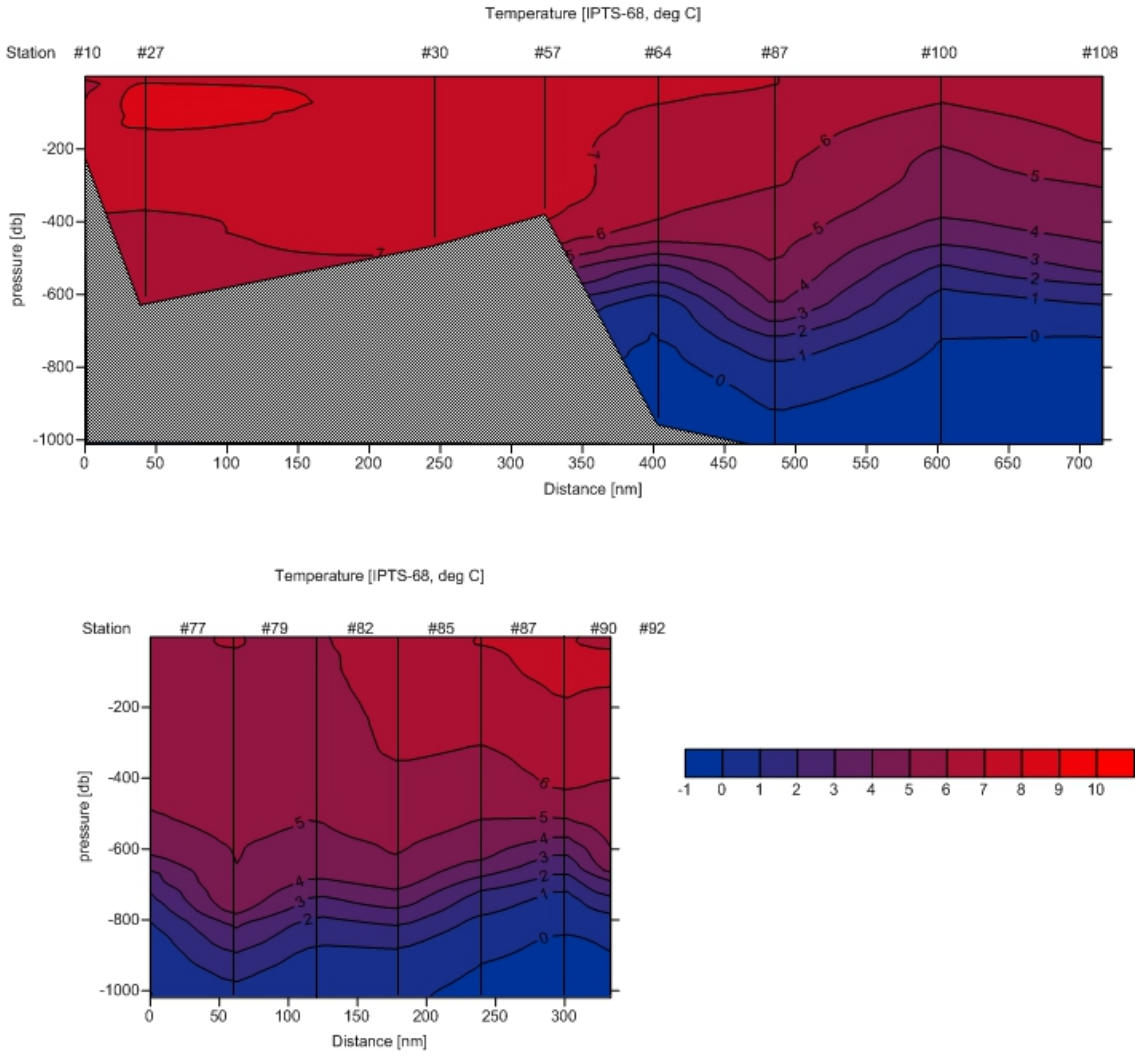

Figure 4: Vertical temperature distributions from South to North along a coastal (top), and along a latitudinal transect at 69°43'N (bottom, for position of selected stations see Figure 1).

Hydrographic conditions

The observed temperature range during the cruise was due to the restriction of the survey area mostly to east of 0°E narrower than in previous years.Surface values were between 5.5 in the Northwest and >8°C in the South. Overall, the surface temperatures were comparable to those of last year in the same area. In the surface of the western survey area (W of about 7° E), the 7°C isothermal reached only as far up north as slightly south of 70°N, while it stretched further northwards to the east of it, and as far as 72° N in a narrow tongue along the 10° E Longitude(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 4). The magnitude of these layers varied with latitude. In the southern part of the survey area, Atlantic water could be detected down to about 500 m closer to the coast and down to at least 350 m in the more oceanic area. Along the coast, this layer remained of the same magnitude with respect to depth, but became cooler towards the North.

Salinity values were between 33 at the southern coastal stations and > 35.3 in the oceanic surface and deeper layers. Particularly low salinity values at some coast near stations indicated at some increased fresh water discharge from land. In the oceanic areas, salinity decreased from south to north (Figure 3).

Suggestions for improvement of the survey

1. The winches of Dana are too slow for proper pelagic fishery and should be replaced by a more powerful type. In coastal areas, currently fast swimming fish – herring! – tends to escape under the bottom rope as it is considered to risky to fish close to the bottom. In case of an unexpected object on the bottom or a steep rise, it is not possible to haul the net fast enough. The second reason advantage of faster winches is that one is thus better able to respond to the vertical position of new schools appearing on the echogram during fishing.
2. It is recommended to add a column “bottom depth” in the acoustic logsheet and make the recording of bottom depth and “tow depth” the responsibility of the acoustic operator. The fields should be recorded at each station (not during changes of course etc.). At the current situation, many stations have no correct bottom - and/or gear depth due to incorrect acoustically obtained bottom depths or otherwise incorrect entries. These wrong data end up in the Ship Information System while there is no way for people on board to correct these values in the system. It is very time consuming (sometimes impossible) to look up the depths at a later stage. If bottom – and tow depth is manually recorded at every station by the acoustic operator, one can quickly replace the missing data values in the logbook file for the PGNAPES database.
3. Care should be taken during the execution of the CTD, in order to collect temperature and salinity at the surface. After lowering the CTD in the water, well below the surface, it should stay there until the system starts pumping. **Then the CTD is hoisted up to the surface**, after which it is lowered at the appropriate speed (0.2m/s the first 100m, 0.5m/s from 100m onwards). In two cases (station 18 and 21) the lowest recorded depth value was 6m instead of the required 3m.

Table 1: CTD and WP2 stations taken by R/V Dana during 3 to 22 May 2015. *Geographical position belonging to the CTD station. The position of the WP2 is slightly different, due to drift.

Station CTD	Station WP2	Year	Month	Day	Hour	Min	Latitude decimal*	Longitude decimal*	WinDir	WinSpeed
10	No WP2 station									
12	13	2015	5	3	8	52	62.1805	3.2182	355.6	9.9
14	15	2015	5	3	17	8	62.1946	1.0830	107.6	13.5
18	19	2015	5	4	7	32	62.1850	-1.0726	93.5	10.8
21	22	2015	5	5	3	4	62.8762	0.0023	247.8	10.1
24	25	2015	5	5	13	22	62.8756	2.1879	126.3	2.8
27	29	2015	5	6	0	3	62.8776	4.3930	92.5	5.1
30	31	2015	5	7	0	37	65.6262	9.6883	217.4	4.5
32	33	2015	5	7	7	27	65.6287	7.2534	112.6	7.3
35	36	2015	5	7	17	34	65.6284	4.8478	161.5	4.3
39	40	2015	5	8	6	7	65.6342	2.4125	135.6	7.6
42	43	2015	5	8	16	3	65.6259	-0.0130	39.1	8.0
44	45	2015	5	9	2	16	67.0066	0.0024	43.2	11.8
47	48	2015	5	9	12	52	67.0062	2.5620	164.3	4.7
51	52	2015	5	10	2	14	67.0067	5.1136	0.9	6.5
54	55	2015	5	10	12	41	67.0118	7.6743	327.2	6.1
59	60	2015	5	10	22	51	67.0195	10.2361	286.9	3.2
64	65	2015	5	13	13	4	68.3826	10.8523	347.1	12.1
67	68	2015	5	14	0	47	68.3771	8.1477	341.9	14.5
70	71	2015	5	14	12	8	68.3806	5.4274	343.2	13.3
73	74	2015	5	14	22	54	68.3822	2.7235	3.2	0.9
75	76	2015	5	15	6	23	68.3804	0.0107	114.9	1.7
77	78	2015	5	15	15	13	69.7622	-0.0037	190.2	10.6
79	80	2015	5	15	22	45	69.7693	2.8841	134.5	12.3
82	83	2015	5	16	8	35	69.7729	5.7756	137.5	13.0
85	86	2015	5	16	20	10	69.7651	8.6669	123.5	10.4
87	88	2015	5	17	3	46	69.7669	11.5638	110.5	5.1
90	91	2015	5	17	13	53	69.7666	14.4435	115.8	4.7
92	93	2015	5	17	19	2	69.7180	16.0725	59.2	1.0
95	96	2015	5	18	14	18	71.7262	19.1277	148.2	9.0
97	98	2015	5	18	21	11	71.7269	15.9326	260.5	0.1
100	101	2015	5	19	6	28	71.7292	12.7444	206.2	3.2
102	103	2015	5	19	14	4	71.7279	9.5663	87.6	0.2
104	105	2015	5	20	8	48	73.5981	10.6170	67.9	3.0
108	109	2015	5	20	21	51	73.5960	14.1740	353.2	5.0
111	112	2015	5	21	7	20	73.5984	17.6966	353.5	8.3

Table 2: Fishing stations taken by R/V Dana during 3 to 22 May 2015

Station	Log	Month	Day	Hour	Min	Lat	Lon	BottDepth	WinDir	WinSpeed	GroundSp	Towing tir	Gear dept	WireLength
11	0	5	3	2	41	62.17207	4.471083	212	48.6	6.77	4.04	30	0	
16	0	5	3	19	40	62.18863	0.6816	550	101.8	12.63	3.95	52	230	1070
17	0	5	3	23	39	62.19662	0.289417	620	93.6	15.32	3.78	60	0	300
20	0	5	4	22	48	62.8733	-0.4789	1480	214.6	7.56	3.47	60	0	300
23	0	5	5	7	35	62.86842	1.21605	970	208.9	3.45	4.23	45	250	1200
26	0	5	5	15	25	62.88577	2.44745	808	47.5	7.02	3.09	45	300	
34	0	5	7	11	34	65.63335	6.038217	448	88.1	9.1	3.45	60	270	1000
37	0	5	7	19	54	65.62912	4.327767	1300	127.1	7.21	3.52	60	100-200	
38	0	5	7	23	30	65.63278	3.8951	1300	139.5	9.33	3.51	60	0	290
41	0	5	8	9	45	65.63703	1.324367	290	130.2	9.76	3.59	60	15	320
46	0	5	9	6	34	67.02273	1.3803	2000	147.5	4.43	3.82	60	10-25	500
49	0	5	9	14	45	67.00375	2.780317	1303	106.6	4.25	3.97	60	240	1150
50	0	5	9	22	51	67.01368	5.1075	1350	335.2	2.65	3.95	61	0	320
53	0	5	10	4	48	67.00618	5.756633	1400	351.7	8.74	4.23	60	250	
56	0	5	10	17	34	67.00363	9.3322	381	280.1	8.32	3.83	60	0	300
61	0	5	10	23	39	67.01218	10.17058	402	223.2	1.59	3.98	60	0	
62	0	5	13	1	12	68.3874	12.62272	122	202.2	2.1	4.2	60	70	350
63	0	5	13	8	0	68.3851	11.57318	131	327.5	9.69	3.99	60	100	800
66	0	5	13	17	59	68.37758	9.45105	2500	335.3	12.26	3.68	60	160	910
69	0	5	14	2	54	68.3795	7.881583	2800	2.7	12.08	3.48	60	265	1100
72	0	5	14	14	52	68.38267	4.83575	2400	21.3	8.15	3.9	60	300	1150
81	0	5	15	23	22	69.77738	2.839733	3300	123.7	11.03	3.5	60		300
84	0	5	16	10	49	69.79173	6.204667	3200	126.6	12.28	3.16	60	400	1600
89	0	5	17	9	49	69.76917	14.01685	2500	136.3	4.53	3.62	60		1020
94	0	5	17	22	26	69.75605	17.124	107	161.9	0.54	3.77	60	50-90	370
99	0	5	18	21	44	71.7328	15.98283	306	194.5	2.77	3.44	60	0	310
106	0	5	20	9	45	73.59482	10.37818	2200	31.5	4.33	3.29	60	375	1400
107	0	5	20	14	59	73.59975	11.92502	1700	1.8	7.29	4.1	60	0	
110	0	5	21	3	10	73.59395	16.8517	425	13.8	7.81	2.9	60	135	950
114	0	5	21	14	22	73.52225	19.70963	455	342.9	6.77	3.56	60	350	1350

Table 3: Catch composition in trawl stations taken by R/V Dana during 3 to 22 May 2015

Station	*Alosa alosa*	*Anarhichas denticulatus*	*Anarhichas lupus*	*Arctozenus risso*	*Benthosema glaciale*	*Cephalopoda*	*Clupea harengus*	*Cyclopterus lumpus*	*Euphausiidae sp.*	*Eutrigala gurnardus*	*Gadus morhua*	*Mallotus villostus*	*Maurolicus muelleri*	*Melanogrammus aeglefinus*	*Micromesistus poutassou*	*Notoscopelus elogatus*	*Salmo salar*	*Scomber scomrus*	*Scyphozoa sp.*	*Sebastes mentella*	*Trachipterus arcticus*	Grand Total
11								0.437														0.437
16				0.042	0.023			2.574		0.398					441.809	1.160						446.006
17	0.542			0.106		0.017	0.715	2.602	0.406	2.708			0.005		148.996	0.952		232.944				389.993
20							1816.465								101.405			1432.540			1.610	3352.020
23							0.355								9.995							10.350
26					0.059		0.334			1.132					5.722			1.062	0.105			8.414
34				0.553	0.192										229.823	1.092			0.340			231.999
37				0.672	0.064		1.534	0.984							514.090	0.119		0.340	2.194			519.997
38				0.086	2.067	0.032	0.216		11.227				0.119		252.755			2.158			1.342	270.001
41						0.103	224.239	6.245									5.098	2.450				238.135
46							0.374	0.673														1.047
49				0.011			2.060	1.844							1244.003							1247.918
50				0.353			671.112	0.528							332.103		6.395	1.376	7.165			1019.032
53				0.663	0.030		7.926							3.112	208.198	0.364			1.464		0.490	222.247
56								9.400									4.698	6.704				20.802
61							5.239	5.602	0.180									0.841				11.862
62							0.275	3.300	6.025					24.300								33.900
63										0.350				5.200								5.550
66	1.532				0.056				0.168				0.078	6.800					1.272			9.906
69	5.000			0.122	0.256		0.759		0.080				0.001	4.400	52.698	0.116			5.800			69.232
72				0.178	0.002		9.656	2.500							299.405				1.096	2.162		314.999
81						0.500	108.271	8.330									3.012					120.113
84				0.068	0.430	0.307	6.444		0.455				0.001	3.534	29.594				7.120	10.824		58.777
89	5.600								7.636				1.364						0.146			14.746
94	5.994							2.794						383.872								392.660
99			0.001			0.546	5.547	5.122														11.216
106				0.266	0.392	0.023			0.584						0.680				3.890			5.835
107		0.002	0.005			1.394		10.000												3.284		14.685
110						0.112			3.364				0.004	211.300					0.336			215.116
114				1.626	0.020	0.060					5.600	160.000		42.600	2.290				4.002	0.106		216.304
Grand Tot	18.668	0.002	0.006	4.746	3.590	3.109	2861.520	62.935	30.125	4.588	5.600	163.500	1.571	688.118	3873.566	3.803	19.203	1680.415	36.930	16.376	3.442	9481.814

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