The International Ecosystem survey in the Nordic Seas in May 2017

IESNS

R/V DANA Cruise No. 5/2017

Calibration of Echo-sounders

24/4 – 27/4 2017

International Acoustic Monitoring of Herring and Blue whiting

28/4 – 23/5 2017

Cruise participants

Calibration 24/4 – 27/4

Karl-Johan Staehr	Denmark (Cruise leader)
Torben Filt Jensen	Denmark
Eik Ehlert Britch	Denmark
Christian Petersen	Denmark
Mette Dalgaard Agersted, AU	Denmark
Lars Jøtgensen, MacArtney	Denmark
Simon Lønne Madsen, MacArtney	Denmark
Henrik Søndergård Mathiesen, MacArtney	Denmark

Acoustic monitoring 28/4 - 8/5

Karl-Johan Staehr	Denmark (Cruiseleader)
Acoustic Torben Filt Jensen	Denmark
AcousticDick de Haan	Netherlands
FishlabRickardYngwe	Sweden
Fishlab Matthew Eade	United Kingdom
FishlabMaria Jarnum	Denmark
Fishlab Peter Vingaard	Denmark
Tech. EikEhlert Britch	Denmark

Acoustic monitoring 9/5-23/5

Matthias Kloppmann	Germany (Cruiseleader)
Acoustic Benoit Berges	Netherlands
Acoustic Sven Kupschus	United Kingdom
FishlabAnne-Marie Palmén Bratt	Sweden
FishlabFrankie McDaid	Ireland
Fishlab Helle Andersen	Denmark
Fishlab Gert Holst	Denmark
Tech.Christian Petersen	Denmark

Cruise summary

Effective survey days	20(+ 3 for calibration)
Mileage	Steaming before start of transects 490 NM Monitoring 3344 NM Steaming for end port 1059 NM
Number of trawl hauls	38
Number of CTD stations	33
Number of WP2 stations	33
Number of biological samples - herring	560
Number of biological samples – blue whiting	756
Number of biological samples - mackerel	593
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 BearIsland. 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 FaeroeseIslands.

Calibration

The echo sounders were calibrated immediately before the survey at Bornö Island in the Gullmar Fjord, Sweden during the 24th April and 27th April 2017. 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.

Materials and methods

Acoustic data

Acoustic data was collected with the EK60 using a 38 kHz splitbeam transducer, mounted in a towed body (paravane). During the acoustic survey over transects, echo integration was conducted continuously and the data was scrutinized using the LSSS software. During trawling, the EK60 using the hull mounted 38 kHz transducer was used to visualize the echo traces but the data were not logged. The echosounder data during trawling were only informative for the scrutinizing process.

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 IESNS participating vessels from which a biomass index will be calculated. The final estimate methodology is presented at the post cruise meeting in Bergen 20-22 June 2017 and in the WGIPS report of January 2017.

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 was put in the water again and a new integrating section was started.

The scrutiny process on the Dana was carried out by Bram Couperus for the last 10+ years. It is important to note that this year's scrutiny was conducted by Benoit Berges and Sven Kupschusfor the first time. They have much less experience with this process.

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 32 successful 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 bowintake 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. During most of the second part of the survey, the smaller "FOTØ" trawl was used instead in order to not to overload the fragile trawl winches. Surface hauls were also carried out randomly and independent of acoustic registration. A total of 38 fishing 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 560 individual herring, 756 blue whiting and 593 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

25 April 2017, 02.00 UTC	Leave Hirtshals for calibration of acoustic equipment at Bornö
27 April 2017, 16.00 UTC	Dock Hirtshals, end of calibration.
28 April 2017, 11.23 UTC	Leave Hirtshals for start of IESNS
29 April 2017, 21,15 UTC	Start monitoring at 62°05 N, 004°34 E
7 May 2017, 17.45 UTC	Stop monitoring at 65°31 N, 010°42 E, end of 1st of the survey
8 May 2017, 11.20 UTC	Dock Bodø for staff exchange
9 May 2017,15.00 UTC	Leave Bodø for start of the second part
9 May 2017, 23.45 UTC	Start monitoring at66°22 N, 011°21 E
20 May 2017, 03.00 UTC	Stop monitoring at 70°28 N, 006°45W, end of2nd part of the survey
23 May 2017, 04.00 UTC	Dock Hirtshals, end of survey

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

30-04-2017 17.00. We arrived at our starting point at the eastern end of transect 1 stratum 1 the 29 April at 21.15 UTC and started with a CTD for setting the EK60. We had a surface haul at 62N 05.492, 004E 05.532 at 23.30 UTC with a total catch of 109 kg consisting of 71 kg KRI, 21 kg NOP and 8 kg POK. This morning we made a haul at a layer around 320 to 370 m depth at 62 N05.433, 002 E 18.6with a total catch of 181 kg mostly WHB with 158 kg, mean length 21,5 cm.
We are now at 62 N 05.14, 001 E 04.80 preforming our second CTD/WP2 station along the transect.

01-05-2017 20.30. We had a trawl haul in the surface at 62N 05.559, 001W 09.601 at 00.14 UTC with a total catch of 540 kg with 182 kg Mac, mean length31.8 cm, 88 kg HER, mean length 29.4 cm , 48 kg WHB, mean length 22.0 cm and finally 2 specimens of POR with a total weight of 220

kg. The western end of transect 1 stratum 1 were past at 06.30 UTC. This afternoon we had a trawl haul at 62N 48.083, 001W 34.921 at a depth of 300-330 m with a total catch of 126 kg. WHB 122 kg mean length 25,1 cm and 19 specimens HER, 3.5 kg mean length 30.1 cm.
We are now at 62 N 48.04, 000 W 25.625 going east at transect 2 stratum 1.

03-05-2017 20.00. Last night we started in the eastern end of transect 3 stratum 1 at 01 UTC going west. During the morning we had a trawl haul in the surface as we had a layer with some small read spots. We fished at 63N 30.5, 004E 13.3 at 10.56 UTC in the depth layer 5-30 m. The total catch was 460 kg consisting of MAC 443 kg mean length 17.0 cm and HER 15 kg mean length 29.8 cm. We have until now not seen typical herring marks in larger scale and only got quantities of herring in the catches from the surface hauls.
We are now at 63 N 30.8, 003 E 08.4, going west. At the moment we are setting the trawl for a haul on a layer at 100-150 m depth.

04-05-2017 19.30. Last night we had a haul at 80-120 m at 63N 30.7, 003E 11.4 at 18.06 UTC. Total catch 55 kg consisting of 41 kg PLS and 11 kg KRZ. During the night at 23.32 UTC we fished in the surface at 63N 30.6, 002E 53.4 and got total 1990 kg consisting of MAC 1871 kg, men length 31.0 cm, WHB 118 kg, mean length 21.2 cm and 3 specimens of HER mean length 30.0 cm. This morning at 07.30 UTC we had a haul at 63N 30.6, 001E 03.8 at a depth of 300 m. The catch was WHB 89 kg, mean length 23.9 cm and MAC 2 kg, mean length 32.5 cm. Just now we have been fishing in the upper 30 m at 63N 30.6, 001W 03.5 on some tiny read spots that we hope are the herring. Catch 146 kg, Her 111kg and MAC 35 kg. We have still not found the herring!
We are now at 63 N 36.3, 000 W 50.5, steaming for the western end of transect 6 stratum 1. We expect to be there tomorrow morning at 3-4 UTC.

05-05-2017 19.30. We dis start at the western end of transect 6 stratum 1 with a CTD/WP2 station at 03.57 UTC. In the morning we had a trawl haul at some strong markings in 200-230 m depth at 65N 38.8, 000E 33.4. Even we could see something going in the trawl we only had a catch of 1.4 kg LUM and 0.5 kg PLS. This afternoon we have made a haul in the upper 5-25 m to see if the herring should hide high in the water column. We fished at 65N 39.0, 001E 45.8 at 12.54 UTC. The herring was not here! We had a catch of 376 kg MAC mean length 35.0 cm. Now it is starting to look like a mackerel survey!
We are now at 65 N 38.9, 002 E 25.5, taking a CTD/WP2 station. We will continue east on transect 6 stratum 1.

06-05-2017 19.30. Last night we had a trawl haul in the surface at 65N 38.4, 004E 13.3 at 23.32 UTC. The catch was total 260 kg consisting of WHB 113 kg mean length 23.0 cm, MAC 93 kg mean length 19.8, LUM 20 kg and KRZ 19 kg. In the morning we had a haul at 300 m at 65N 38.9, 004E 53.2 at 07.38 UTC. This time the catch was total 50 kg, WHB 31 kg mean length 22.2 cm and NRK 11 kg. in the afternoon we had a haul at 110 m depth at 65N 38.6, 004E 53.2 at 11.20 UTC. This time the catch was 30 kg PLS. Just now we are trying with a haul in the surface.
We are now at 65 N 38.2, 006 E 06.7, continuing east on transect 6 stratum 1.

07-05-2017 18.30. At 16.44 UTC we had a haul in the surface at 65N 38.9, 006E 14.0 with a catch of 23 kg total. Mainly MAC, 19.4 kg mean length 33.5 cm. During the dark period at 23.52 UTC we had a haul in the surface at 65N 38.6, 007E 19.0. The catch was 200 kg total, consisting of

MAC-small 109 kg mean length 16.3 cm, MAC-large 75 kg men length 35.7 and finally 7 specimens of HER 1.5 kg mean length 30.8 cm. This afternoon we had one more haul in the surface at 65N 39.0, 010E 07.3 at 12.48 UTC the catch was total 15 kg, with 19 spec. HER 3.8 kg mean length 29.7 cm, 2 spec MAC 1 kg mean length 39.0 cm and 9.5 kg LUM.
We are now at 65 N 38.9, 010 E 31.9, we expect to be at the eastern end of transect 6 stratum 1 at 17.00 UTC then will we go to Bodö for change of crew.

Integration on first half on the survey was ended 7thMay at 17.14 UTC at 65°39N, 10°50E. Bodø was entered at 8th May at 11.20 UTC for change of crew.

Conditions during first half of the survey:

The weather conditions were excellent through first half of the survey except for the last day where the wind throughout the day increased up to16-19 m/s

All CTD and WP2 stations were successfully completed as planned along with 18 trawl hauls.

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

09-05-2017 The scientific as well as major part of the ship's crew was exchanged on the 9th May. Following safety briefings and an introduction, and the ships crew having carried out repairs on the starboard winch drum, Dana sailed SW to the beginning of transect 7 of stratum 1 at 15:00 from Bodøinto calm seas. The position was reached at 21:47 UTC(all times hereafter given in UTC) and a CTD, WP2 as well as a surface haul was conducted with the TURBO trawl gear specified for the survey in order to test the repair on the winch drum. A 140kg catch was mostly made up of krill, with 5kg of herring and lump suckers each, but also of 400 g of 1-group mackerel (around 17 cm length).

10-05-2017 Acoustic logging of transect 7 commenced at 0:55 on the 10th of May, interrupted by CTD and WP2 data collections at 7:00 and 17:00 hours UTC. Two further trawls were completed successfully having commenced at 13:51 and 23:19. The first was a deep water (ca 300m) focusing on targets observed on the echo sounder. The catch (13.1 kg) mainly contained myctophids and blue whiting with a good portion of krill. The second was a surface haul done at the darkest time of day to catch herring dispersed in the layer at this time. One herring and one mackerel were caught along with 6.1 kg of krill and 3.5kg of myctophids.

11-05-2017 The first stop on the 11th of May was for CTD and WP2 collections at 02:53 UTC and 10:40 UTC. We were informed in the morning that the malfunction on the port winch sensor was due to a crack in the drum. Repairs would take most of the day and when repaired it would only be possible to use the smaller FOTØ trawl as it was likely the strain of the extra weight that had caused the damage in conjunction with longer warps having been fitted during a refit. Fishing commenced at 15:54 with a haul at 20m (3 lumpsuckers at 2.3kg) followed by a deep water haul to make up for the technical issues before completing the transect. The latter yielded blue whiting (10kg) and a number of myctophids and sternoptychids including a hatchet fish. Transect 7 was completed at 20:21 and Dana headed north to transect 8 of stratum 1.

12-05-2017 Operations continued on transect 8 of stratum 1 on the 12th May, commencing at 00:28 UTC with a CTD and WP2 station followed by another at 8:03. Fishing around 12:10 at a depth of 400m based on echo sounder traces 21 kg of blue whiting were retained to provide a good length sample, with a fair amount (0.6kg) of krill also taken along with some myctophids. A further CTD and WP2 station was completed at 18:44 and we conducted a midnight (23:30) surface to as there was little on the sounders. Fifty kg of blue whiting and mackerel were taken along with five salmon after hauling in the early hours of the 13th of May.

13-05-2017 Undefined echoes were recorded on the sounder at 120m around 4:00 and fishing operations began to determine the species. These turned out to be mesopelagics (caught 2.5kg of silver sides) not of interest to the survey, but important to identify for the scrutinizing. A CTD and WP2 station was completed after breakfast and a further fishing operation was conducted at 14:30 after spotting some schools rising of the bottom in comparatively shallow water (>500m). The catch (6.2kg) was mostly blue whiting (3.5kg), enough for a length sample, but was generally quite divers with pearlsides, three velvetbellies, a hatchetfish, Risso'sbarracudinas and some invertebrates. At 18:05 a CTD and WP2 station was completed and the day rounded off with a night time surface haul at 22:30. The catch comprised of 4.5kg lump sucker and salmon each plus 1.4kg of herring. After completion, we steamed 240 miles north to transect 1 of stratum 2.

14-05-2017 Having steamed north for close to a day to transect 1 of stratum 2,work commenced thereclose to midnight of the 14th with a surface haul to make use of the relative darkness. We caught 260kg of herring, two salmon, a grey gurnard and 13 lump suckers.

15-05-2017 After hauling it was noted that the port winch drum required repair. We continued to the next CTD and WP2 station to allow time for further investigation. The damage was serious and later it was discovered that the previous starboard winch repair had also failed during the haul. Operations ceased for 22 hours while repairs were made.All of the day was dedicated to repairs of the two trawl winches

16-05-2017 Acoustic logging commenced again on the 16th of May at 3:30 UTC. After a short period acoustic monitoring a dense layer of pelagic fish interspersed with strong echoes was observed. The gear was set to 310m and after an hour fishing produced a good catch of blue whiting (65kg) but also three good sized haddock and two saithe. At 13:30 a number of small, but strong echoes indicative of herring were observed in the surface layer and a surface haul was conducted with the 750kg catch being made up almost entirely of herring (725kg) with a few lump suckers. At 17:30 a CTD and WP2 station was completed, followed by commencement of night time surface fishing at 23:13.

17-05-2017 We hauled the trawl in the early hours of the 17th to find a good catch of 170kg, 162kg of which was herring and the rest made up mainly of lump suckers and a few pearl sides. At the CTD and WP2 station commenced at 3:40 it was noticed that there had been an acoustic logging

error and we conducted a short detour to make up the lost data before completing another CTD WP2 station at 15:45.

18-05-2017 During the night of the 17thto the 18th, the weather had deteriorated and we completed the acoustic monitoring of transect 1 in stratum 2 before returning the 1.5 miles to the CTD and WP2 station to minimize the handling of the towed body in rough seas. After completion of the hydrographic station and a fair bit of tidying around the ship we waited for the swells to reduce before conducting a final fishing station on the transect. There were concerns that the weakened winches could fail under the additional stresses cause by the swell. Fishing commenced just below the surface (15m) at 6:20, but yielded only a solitary lump sucker. After completion of that haul, we steamed northeastwards towards the start of transect 1 in stratum 5. A thin, but persistent layer of echoes at 300m appeared to indicate the presence of blue whiting there, and a trawl conducted at 12:30 confirmed this yielding 58kg of blue whiting, but surprisingly for the depth also 50kg of herring and 2kg of lump suckers. A CTD and WP2 station was completed around 21:00 that evening, before commencing the normal night time haul at 23:00.

19-05-2017 The night time trawl was hauled at 00:30 on the 19th of May containing a further good catch of herring (53.5 kg of ca. 35cm herring). At around 2:00 a strong series of echoes at a depth of around 300m were observed on the 38kHz sounder, initially looking like deep herring schools. However, the schools also seemed to resonate at 18 and 120 kHz so it was deemed necessary to investigate. We trawled at 310m for an hour at around 12:30 and appeared to be passing through several of the aggregations. Unfortunately, we failed to capture any individuals. A further large school with the same characteristics was observed later in the day, but the chances of obtaining a sample were considered too small. Two CTD and WP2 stations were completed at 9:00 and 16:30, completing the second leg of the first transit at 22:40. The survey completed with a final night time surface haul on the transect that started at 22:30. The catch was made of 5kg of lumpsuckers and 10kg of large hyperiidamphipods of the species *Themisto libellula*.

20-05-2017 With the completion of the last surface haul on 00:30 UTC, the survey work ended and Dana started her journey home to Hirtshals

Conditions during second half of the survey:

The weather conditions continued to be excellent throughout almost all of the second half of the survey. Only on the 17th of May, a short disturbance passed the survey area with wind forces up to 8-9 Bft. Longer interruptions of the survey work were due to failures of the two trawl hauls, where cracks in either the axle of the starboard or the drum wall of the portside winch not only made major repair works necessary but also necessitated the change to a smaller trawl (the FOTØ), which may have impaired catchability of the trawl hauls.

All CTD and WP2 stations have been taken as planned and 20 trawl hauls had been made.

Results

Catch composition

Table 2 gives information on trawling depth, speed, wire length and weather conditions during all fishery hauls while the catch composition of all trawl hauls is presented in Table 3. Distribution of trawl hauls is shown in Figure 1. It appears noteworthy that particularly during the first half of the survey, mackerel appeared to dominate the shallower catches over herring. Even on the first two transect of the second half mackerel were observed in the catches unlike in recent years.

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(b).It is interesting to compare these results with those from 2016. Whilst the transect lines differ from the IESNS survey conducted by the Dana in 2016, one can observe a significant change in the herring distribution. First, the overall abundance has decreased in the survey area, especially in the southern section. Second, the area where herring occurs is now located in the north, north of 70°N, an area that did not show any large abundances of herring in 2016. The distribution of Blue Whiting is somewhat similar to 2016 though less abundant. Collating the results from all the vessels will allow one to confirm these trends.

Through the scrutinizing process, herring was found as few scattered individuals in the southern section (62°N and 63°transects) while they were more aggregated and abundant along transect 1 of stratum 2 (70°N 18° Eto 70°N 5° E).

Blue whiting was particularly abundant in the southern part of the survey though patches were found consistently along all transects. Along the three transects located between 65°N and 68°N, no Blue Whiting was found in the shallow coastal regions. Similarly, the end of the last transect (70°N 5° Eto 70°N 8°W) showed no Blue Whiting.

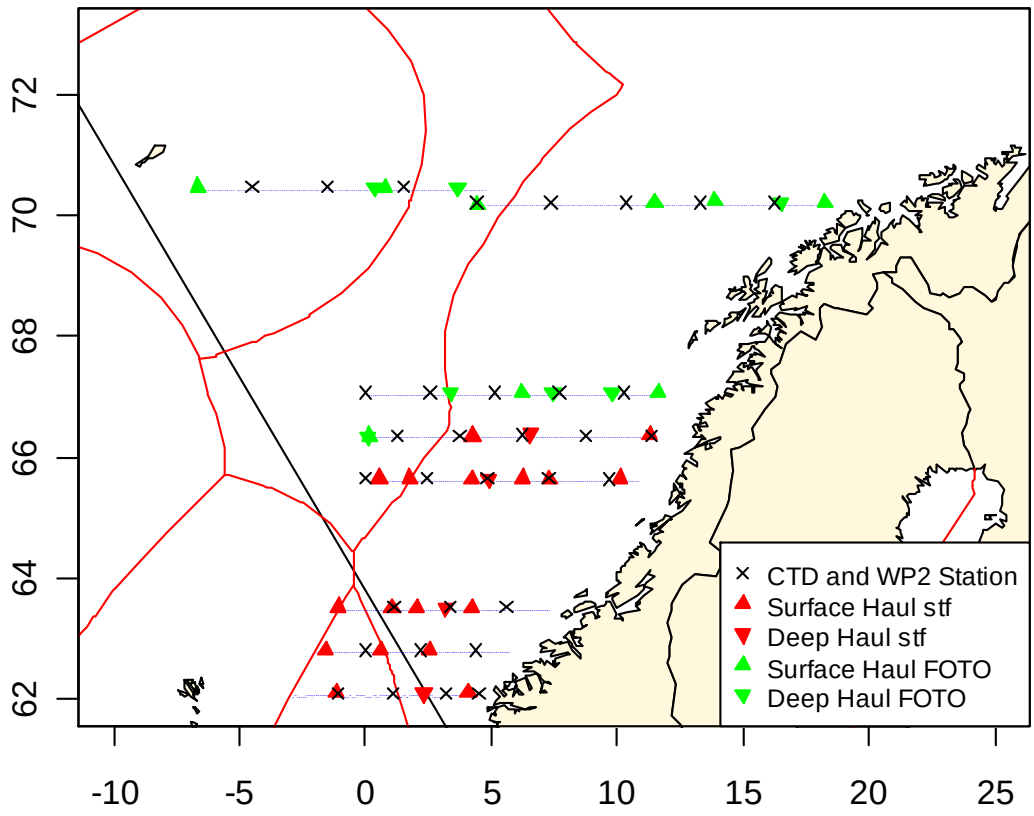

Figure 1a.Sailed transects and hydrographical stations and trawl hauls.

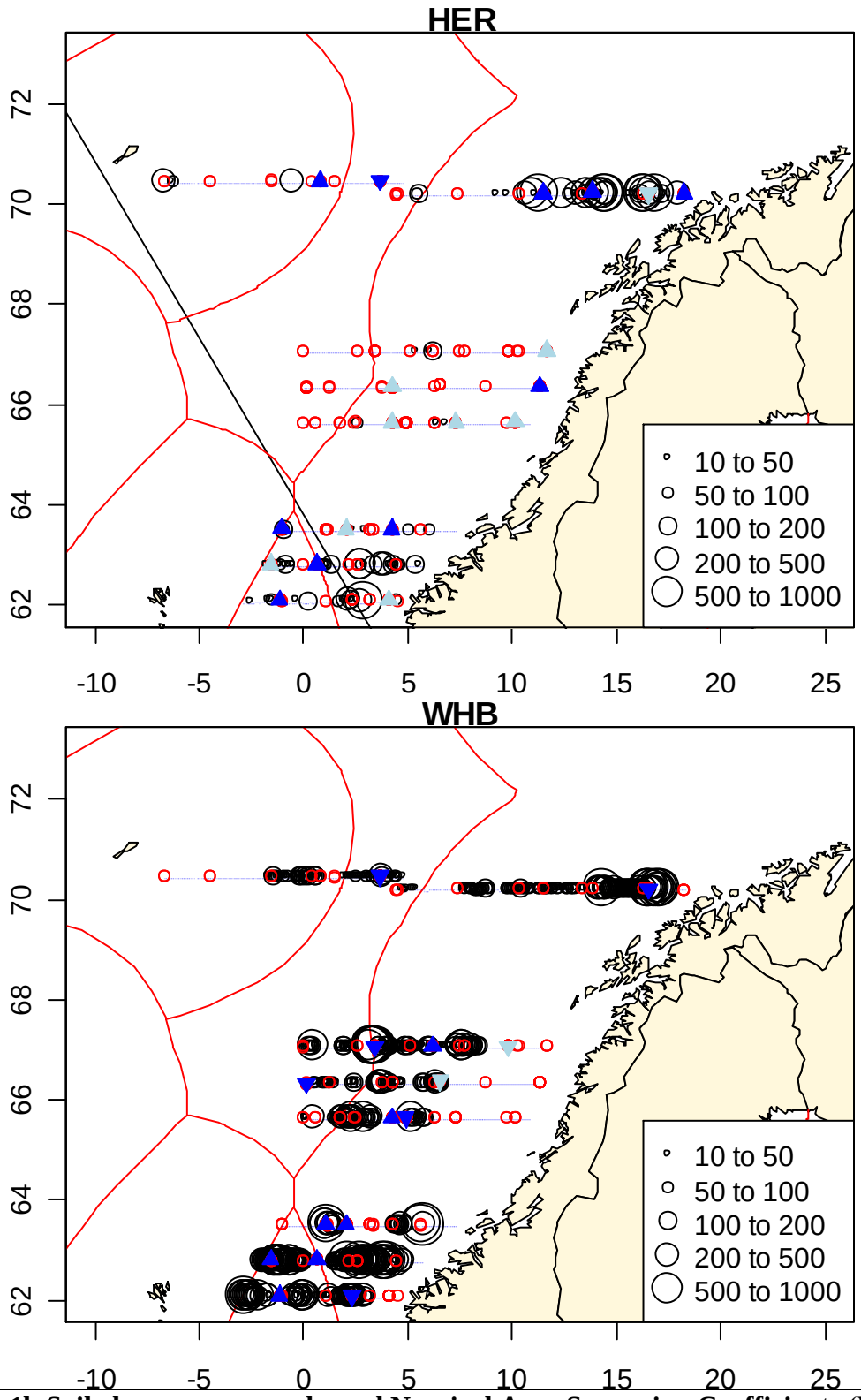

Figure 1b.Sailed transects, trawl - and Nautical Area Scattering Coefficients (NASC's) assigned to herring and blue whiting. Triangles indicate trawl catches. Light blue > 5kg, Dark blue < 5kg; red, non-filled = no catch.

Hydrographic conditions

Surface values were between 5.5°C in the Northwest and > 8°C in the South. Overall, the pattern of surface temperature distribution was comparable to those of last year in the same area: warmer waters in the South and East, colder waters North and West. However, over most of the water column, temperatures in the southern survey area were warmer than last year, while in the North they were considerable cooler (figure 2), indicating at a weakened influenceof the warmer Atlantic waters in the area.

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 the northernmost transect this warm Atlantic water layer reached deeper to > 600 m east of the 0-meridian but was much cooler than in the south.

Concluding remarks

Overall, the survey was successful in that all scheduled tasks were completed to the standards required by WGNAPES. The increased amount of available ship's time in conjunction with a slightly reduced survey programme comparison to last year, allowed for more fishing operations improving scrutinizing and greater certainty in results. As noted in previous years the state of the vessels old trawling winches risks jeopardized the success of this survey. It is only thanks to the skills, willingness and tireless work of captain, chief engineer and crew of RV Dana, that the success of the survey aims could be completed. However, despite the repairs we were forced to change the trawl net from the Turbo Trawl to the less efficient FOTØ; cut the trawl wires to 1800 m, which limited the maximum depth of trawling and reduced winding speeds; and limit trawling speed to < 4 knots at greater depth. These were necessary precautionary measures to avoid further winch failure, but they also result in less flexibility and lower catchability of trawls so can negatively impact the survey results.
Scientific participants of this survey have repeatedly expressed concerns over the poor performance of the trawl winches and suggested the ship's administrators should consider equipping Dana with new winches, winches of a newer build, or at a minimum completely overhaul of the current ones to restore their original performance and safety. The more than 35-year-old winches have in many occasions proven to be too slow, particularly when deep trawls at depths >200 m, and take a considerable amount of time to adjust gear depth when reacting to changes in the depth of the target layer. In addition shooting and hauling of the net consumes a considerable amount of ship time, and may lead cruise leaders to relinquish deep hauls potentially biasing the results.

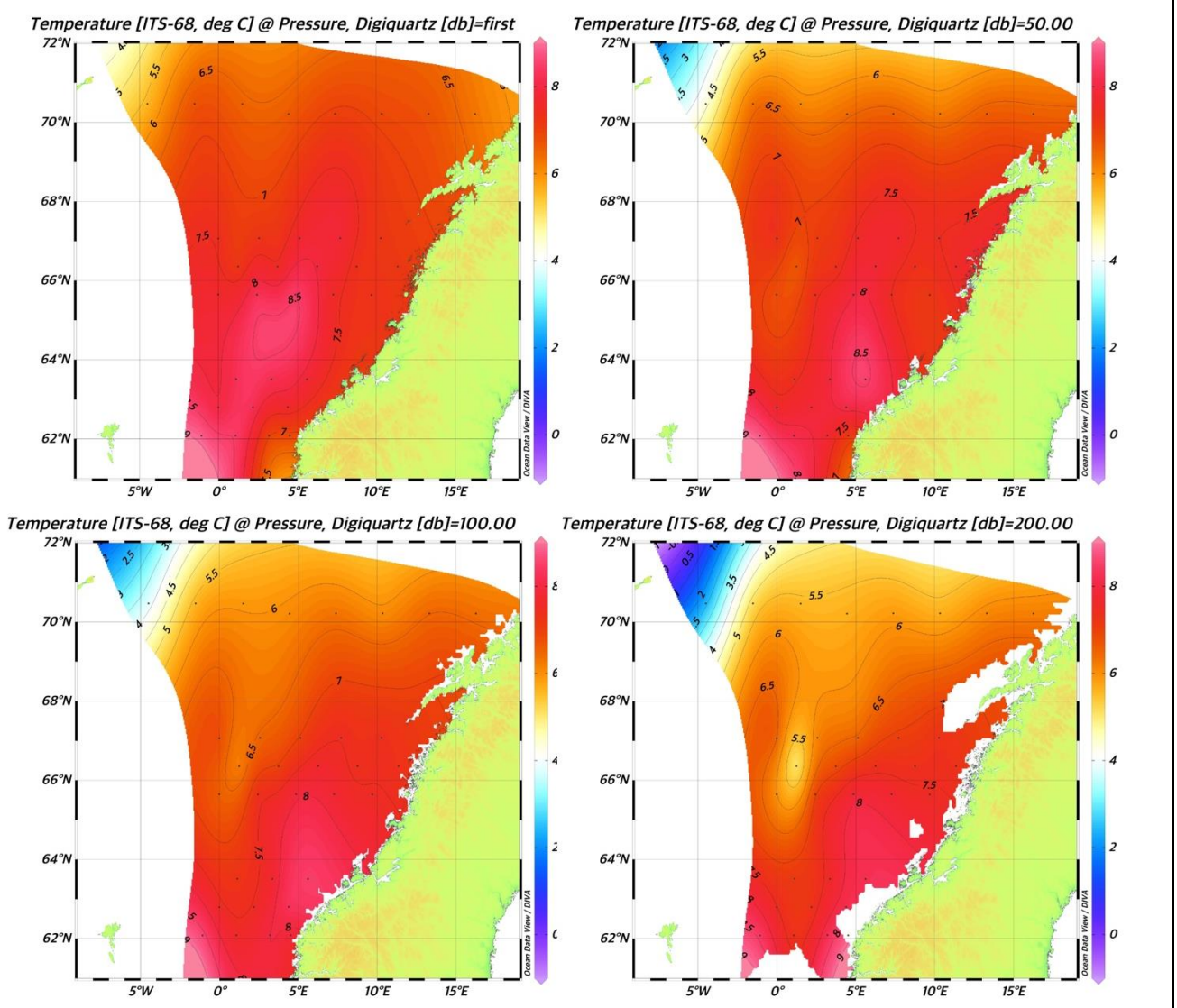

Figure 2: Horizontal temperature distribution interpolated from CTD data at selected depths: surface (top left), 50 m (top right), 100 m (bottom left), and 200 m (bottom right)

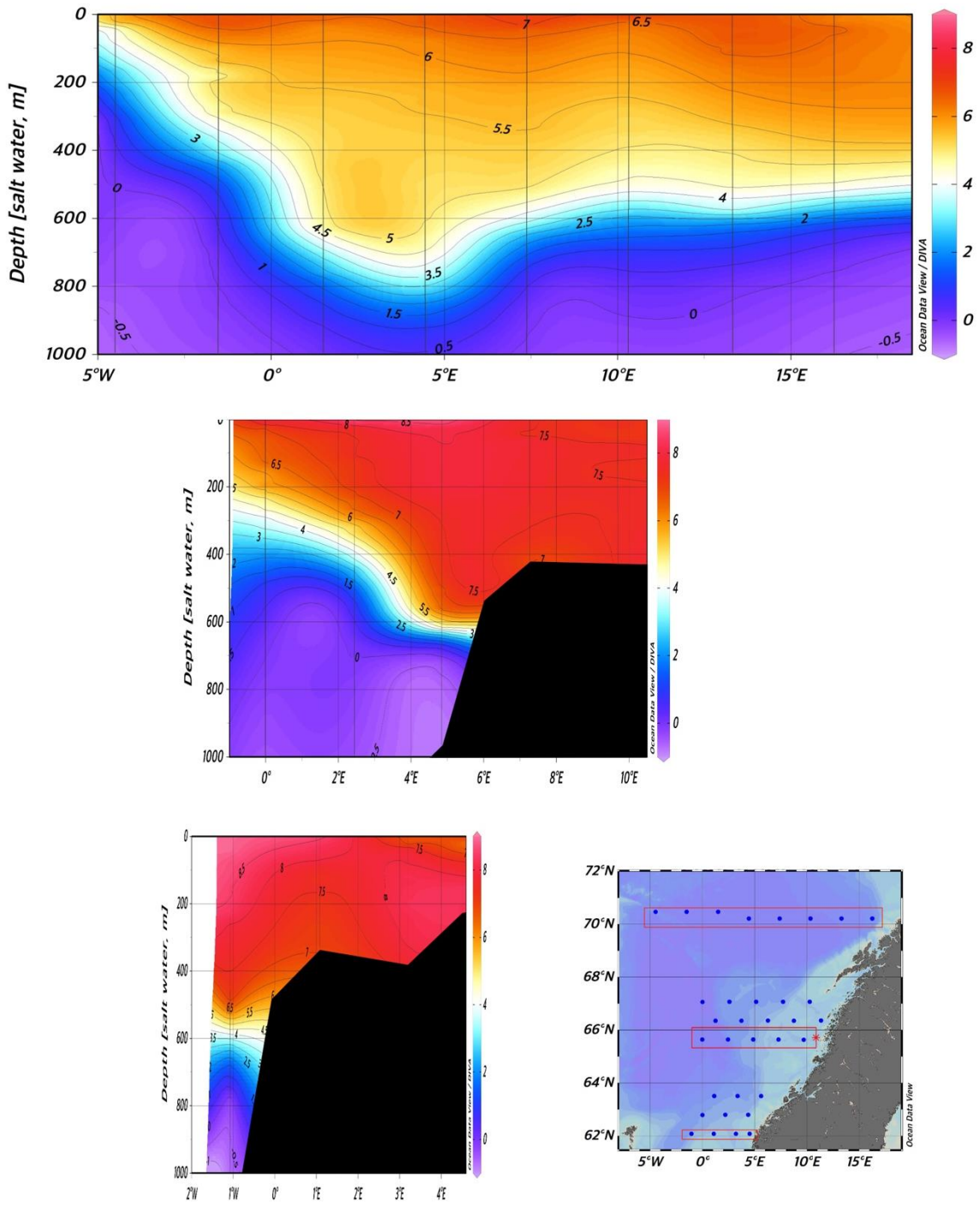

Figure 3: Vertical temperature distributions from South (bottom) to North (top) along 3 transects perpendicular to the coast. The latitudinal position of the transect can be seen in the map at the bottom.

Table 1: CTD and WP2 stations taken by R/V Dana during 28 April to 24 May 2017

Station	Station type	Year	status	Month	Day	Hour	Min	Latitude decimal	Longitude decimal	Bottom depth (m)	Wind direction	Wind speed
1	SEA	2017	Successful	4	29	21	21	62.0858	4.5090	225.4	41.2	1.82
3	SEA	2017	Successful	4	30	3	18	62.0885	3.1963	378.4	139.2	3.62
4	WP2	2017	Fail	4	30	4	1	62.0901	3.1952	377.7	122.1	3.83
5	WP2	2017	Successful	4	30	4	31	62.0922	3.1924	378	124.7	5.07
7	SEA	2017	Successful	4	30	14	51	62.0869	1.0782	331.7	130.7	9.24
8	WP2	2017	Successful	4	30	15	25	62.0843	1.0813	331.5	135.4	10.58
9	SEA	2017	Successful	4	30	21	57	62.0815	-1.0698	1053.1	150.5	7.68
10	WP2	2017	Successful	4	30	23	15	62.0856	-1.0853	1081.2	154.2	7.72
13	SEA	2017	Successful	5	1	19	58	62.7980	-0.0005	1243.3	126.6	6.14
14	WP2	2017	Successful	5	1	21	11	62.7922	-0.0057	1244.2	127.1	7.16
16	SEA	2017	Successful	5	2	5	25	62.7997	2.1860	754.5	86.2	6.3
17	WP2	2017	Successful	5	2	6	25	62.7967	2.1769	754.2	90.8	6.63
19	SEA	2017	Successful	5	2	15	9	62.8017	4.3807	372.4	43.1	6.62
20	WP2	2017	Successful	5	2	15	49	62.7999	4.3987	364.8	55.3	7.4
21	SEA	2017	Successful	5	3	5	27	63.5110	5.6098	605.9	70.1	9.07
22	WP2	2017	Successful	5	3	6	20	63.5032	5.5979	635.3	59.4	9.44
24	SEA	2017	Successful	5	3	15	12	63.5113	3.3550	1229.7	63.3	10.7
25	WP2	2017	Successful	5	3	16	31	63.4909	3.3281	1212.9	57.1	9.26
28	SEA	2017	Successful	5	4	4	43	63.5124	1.1294	1742.1	48.5	6.56
29	WP2	2017	Successful	5	4	5	53	63.5016	1.1340	1726.5	65.9	5.67
32	SEA	2017	Successful	5	5	3	57	65.6494	-0.0142	2295.3	303.1	6.32
33	WP2	2017	Successful	5	5	5	9	65.6455	-0.0030	2902.5	290.2	6.89
36	SEA	2017	Successful	5	5	16	53	65.6458	2.4349	2378.3	301.3	6.54
37	WP2	2017	Successful	5	5	18	9	65.6540	2.4503	2195.3	296.5	8.08
39	SEA	2017	Successful	5	6	4	6	65.6476	4.8512	967.3	35.2	9.64
40	WP2	2017	Successful	5	6	5	20	65.6425	4.8453	971.8	33.7	9.17
45	SEA	2017	Successful	5	7	1	51	65.6494	7.2667	414.6	31.7	12.78
46	WP2	2017	Successful	5	7	2	30	65.6406	7.2719	422.9	31.9	11.38
47	WP2	2017	Successful	5	7	2	42	65.6372	7.2745	426.9	22.7	8.93
48	SEA	2017	Successful	5	7	9	28	65.6404	9.6872	427.2	29.4	12.04
49	WP2	2017	Successful	5	7	10	9	65.6379	9.7014	426.5	7.2	13.33
51	SEA	2017	Successful	5	9	21	47	66.3598	11.3478	267.6	58.6	7.06
52	WP2	2017	Successful	5	9	22	14	66.3582	11.3516	255.5	49	9.22
54	SEA	2017	Successful	5	10	7	4	66.3597	8.7455	281.4	68.2	8.55
55	WP2	2017	Successful	5	10	7	39	66.3561	8.7516	281.1	86.1	9.63
57	SEA	2017	Successful	5	10	17	5	66.3630	6.2518	610.5	53.5	8.55
58	WP2	2017	Successful	5	10	17	58	66.3605	6.2551	609	70.9	9.06
60	SEA	2017	Successful	5	11	2	59	66.3544	3.7340	1434.6	53.6	9.98
61	WP2	2017	Successful	5	11	4	12	66.3381	3.7432	1430.3	69.7	8.08
62	SEA	2017	Successful	5	11	10	46	66.3569	1.2445	1388.3	71.5	4.78
63	WP2	2017	Successful	5	11	12	6	66.3506	1.2436	1383.6	44.6	5.21
66	SEA	2017	Successful	5	12	0	24	67.0652	-0.0033	422.4	69.6	9.21
67	WP2	2017	Successful	5	12	1	41	67.0693	-0.0117	3609.4	55.2	7.26
68	SEA	2017	Successful	5	12	7	56	67.0746	2.5681	1340.8	30.8	4.23
69	WP2	2017	Successful	5	12	9	13	67.0789	2.5887	1341.5	29.5	6.44
71	SEA	2017	Successful	5	12	18	42	67.0747	5.1301	1386.2	315.5	5.13
72	WP2	2017	Successful	5	12	19	58	67.0767	5.1316	1388	291.3	5.25
75	SEA	2017	Successful	5	13	7	22	67.0747	7.7065	1070.9	80.1	2.73
76	WP2	2017	Successful	5	13	8	37	67.0729	7.7255	1051.5	44.3	3.67
78	SEA	2017	Successful	5	13	18	5	67.0738	10.2679	323.9	38.6	6.64
79	WP2	2017	Successful	5	13	18	37	67.0706	10.2634	316.1	35.1	7.51
82	SEA	2017	Successful	5	15	5	3	70.2150	16.2514	1963.1	183.8	2.88
83	WP2	2017	Successful	5	15	6	21	70.2141	16.2489	1963.3	184.5	1.83
86	SEA	2017	Successful	5	16	17	32	70.2174	13.3006	904.5	211.2	8.08
87	WP2	2017	Successful	5	16	18	47	70.2208	13.3315	2676.2	208.6	8.08
89	SEA	2017	Successful	5	17	3	38	70.2177	10.3348	223.1	134.5	7.78
90	WP2	2017	Successful	5	17	4	57	70.2208	10.2823	2858.6	134.8	7.87
91	SEA	2017	Successful	5	17	15	52	70.2188	7.3806	3064.1	212.7	12.65
92	WP2	2017	Successful	5	17	17	8	70.2301	7.3791	3060.6	218.3	20.37
93	SEA	2017	Successful	5	18	2	58	70.2137	4.4324	3221.5	238.7	11.94
94	WP2	2017	Successful	5	18	4	17	70.2051	4.4695	3221.7	249.8	12.4
97	SEA	2017	Successful	5	18	19	40	70.4682	1.5047	358.4	49.8	8.45
98	WP2	2017	Successful	5	18	20	57	70.4564	1.5095	3195.7	48.2	8.65
101	SEA	2017	Successful	5	19	8	42	70.4697	-1.5086	3114.7	311	1.75
102	WP2	2017	Successful	5	19	9	53	70.4797	-1.5433	3056.7	331.6	1.07
103	SEA	2017	Successful	5	19	16	23	70.4682	-4.4962	2206.6	250.7	7.77
104	WP2	2017	Successful	5	19	17	35	70.4716	-4.5054	2157.7	251.5	8.28

Table 2: Fishing stations taken by R/V Dana during 28 April to 23 May 2017

Country	Vessel	Cruise	Station	Gear	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)
DK	OXBH	201705	2	stf	4	29	23	38	62.091533	4.092200	87.7	2.06	NA	60	8.35	2
DK	OXBH	201705	6	stf	4	30	8	40	62.090550	2.310000	165.7	9.39	NA	60	18.04	300
DK	OXBH	201705	11	stf	5	1	0	14	62.092650	-1.160017	133.3	6.66	NA	60	60.00	5
DK	OXBH	201705	12	stf	5	1	13	7	62.801383	-1.582017	139.7	7.07	NA	60	24.99	5
DK	OXBH	201705	15	stf	5	1	23	55	62.807467	0.614300	138.6	7.83	NA	60	439.72	5
DK	OXBH	201705	18	stf	5	2	8	45	62.798500	2.552083	103.7	6.94	NA	60	0.74	5
DK	OXBH	201705	23	stf	5	3	10	56	63.507767	4.222183	64.4	13.07	NA	60	115.00	5
DK	OXBH	201705	26	stf	5	3	18	6	63.512417	3.189167	57.4	10.54	4	58	9.22	90
DK	OXBH	201705	27	stf	5	3	23	32	63.510000	2.036683	57.4	7.98	NA	60	497.50	2
DK	OXBH	201705	30	stf	5	4	7	29	63.510050	1.061967	55.8	6.1	NA	60	30.38	2
DK	OXBH	201705	31	stf	5	4	15	35	63.518300	-1.060217	46.2	2.82	NA	70	36.89	2
DK	OXBH	201705	34	stf	5	5	7	49	65.646217	0.557183	295.5	6.5	NA	60	0.53	2
DK	OXBH	201705	35	stf	5	5	12	54	65.649567	1.762983	282.2	7.98	NA	60	128.32	2
DK	OXBH	201705	38	stf	5	5	23	32	65.639400	4.222167	21.3	7.26	NA	60	17.33	2
DK	OXBH	201705	41	stf	5	6	7	38	65.647533	4.885967	45.1	8.04	NA	95	5.61	300
DK	OXBH	201705	42	stf	5	6	11	20	65.644050	4.886183	54.5	8.78	NA	60	7.98	110
DK	OXBH	201705	43	stf	5	6	16	44	65.647733	6.233183	18.7	7.26	NA	60	7.72	5
DK	OXBH	201705	44	stf	5	6	23	52	65.643833	7.317267	20.3	9.68	NA	60	40.00	2
DK	OXBH	201705	50	stf	5	7	12	48	65.650100	10.121283	356.7	11.54	NA	60	3.74	2
DK	OXBH	201705	53	stf	5	9	22	52	66.359200	11.300050	59.5	7.02	NA	61	14.03	5
DK	OXBH	201705	56	stf	5	10	13	49	66.387967	6.559817	65	9.55	NA	60	1.46	300
DK	OXBH	201705	59	stf	5	10	23	18	66.350200	4.254617	67.4	6.13	NA	60	1.55	5
DK	OXBH	201705	64	FOTØ	5	11	15	22	66.354267	0.144617	57.9	6.87	NA	60	2.31	20
DK	OXBH	201705	65	FOTØ	5	11	17	26	66.325083	0.106933	68	7.54	NA	87	1.60	300
DK	OXBH	201705	70	FOTØ	5	12	12	9	67.070250	3.394400	13.6	7.22	NA	60	3.49	400
DK	OXBH	201705	73	FOTØ	5	12	23	16	67.078117	6.211333	349.6	1.13	NA	60	28.31	5
DK	OXBH	201705	74	FOTØ	5	13	4	31	67.070017	7.447917	345	1.98	NA	60	1.16	120
DK	OXBH	201705	77	FOTØ	5	13	14	29	67.069900	9.794850	42	6.38	NA	60	0.56	420
DK	OXBH	201705	80	FOTØ	5	13	22	43	67.073817	11.633650	33.5	8.54	NA	60	3.49	5
DK	OXBH	201705	81	FOTØ	5	14	22	42	70.213000	18.257267	149.1	3.8	NA	60	71.25	5
DK	OXBH	201705	84	FOTØ	5	16	5	26	70.214617	16.506050	201.5	4.27	NA	60	7.41	310
DK	OXBH	201705	85	FOTØ	5	16	13	50	70.248167	13.859467	205.1	9.3	NA	59	374.99	15
DK	OXBH	201705	88	FOTØ	5	16	23	18	70.216433	11.487400	147.5	5.08	NA	60	42.50	5
DK	OXBH	201705	95	FOTØ	5	18	6	23	70.180850	4.462583	238.6	13.48	NA	60	0.52	17
DK	OXBH	201705	96	FOTØ	5	18	12	45	70.470117	3.659767	352.9	3.1	NA	60	3.18	300
DK	OXBH	201705	99	FOTØ	5	18	23	16	70.465850	0.772283	26.9	9.67	NA	60	19.79	5
DK	OXBH	201705	100	FOTØ	5	19	2	44	70.470533	0.366883	355.3	7.62	NA	60	0.00	310
DK	OXBH	201705	105	FOTØ	5	19	23	0	70.471767	-6.648883	230.1	14.09	NA	60	7.58	5

Table 3: Catch composition in trawl stations takenby R/V Dana during 28 April to 23 May 2017

Station	Latitude	Longitude	average Depth (m)	Total catch (kg)	*Anarhichas lupus*	*Arctozenus risso*	*Argentina silus*	*Argentina sphyraena*	*Argyropelecus olfersi*	*Benthosema glaciale*	Cephalopoda	*Clupea harengus*	*Cyclopterus lumpus*	*Etmopterus spinax*	Euphausiidae sp.	*Eutrigla gurnardus*	*Gadiculus argenteus*	Invertebrata	*Lamna nasus*	*Maurolicus muelleri*	*Melanogrammus aeglefinus*	*Merluccius merluccius*	*Micromesistius poutassou*	*Notoscopelus elongatus*	*Pollachius virens*	*Salmo salar*	*Scomber scombrus*	Scyphozoa sp.	*Sebastes mentella*	*Sprattus sprattus*	*Trachipterus arcticus*	*Trisopterus esmarkii*
2	62°05,492'N	004°05,532'E	2	108.5	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.2	6.5	0.0	70.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.7	0.0	0.0	0.0	0.0	20.7
6	62°05,433'N	002°18,600'E	300	180.4	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	1.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	157.3	3.7	2.7	0.0	0.0	0.2	1.8	0.0	0.0	0.0
11	62°05,559'N	001°09,601'W	5	540.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	88.2	0.0	0.9	0.0	0.0	0.0	0.0	220.0	0.0	0.0	0.0	48.1	0.0	0.0	0.0	182.2	0.0	0.0	0.0	0.0	0.0
12	62°48,083'N	001°34,921'W	5	125.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.8	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0
15	62°48,448'N	000°36,858'E	5	3078.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1529.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	1386.0	0.0	0.0	0.0	0.0	0.0
18	62°47,910'N	002°33,125'E	5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.7	0.0	0.3	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	63°30,466'N	004°13,331'E	5	460.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6	1.6	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	443.3	0.0	0.0	0.0	0.0	0.0
27	63°30,600'N	002°02,201'E	90	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.0	0.0	0.0	0.0	1871.4	0.0	0.0	0.0	0.0	0.0
30	63°30,603'N	001°03,718'E	2	1990.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	88.7	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
31	63°31,098'N	001°03,613'W	2	91.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	35.4	0.0	0.0	0.0	0.0	0.0
26	63°30,745'N	003°11,350'E	2	147.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	11.0	0.0	0.0	0.0	0.0	40.8	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	0.0	0.0	0.0	0.0
34	65°38,773'N	000°33,431'E	2	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	65°38,974'N	001°45,779'E	2	385.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	376.2	0.0	0.0	0.0	0.0	0.0
38	65°38,364'N	004°13,330'E	2	260.0	0.0	0.3	0.0	0.0	0.0	1.9	0.1	0.6	20.5	0.0	18.5	0.0	0.0	0.0	0.0	1.4	0.0	0.0	112.9	0.2	0.0	8.0	92.9	0.0	0.0	0.0	1.6	0.0
41	65°38,852'N	004°53,158'E	300	50.4	0.0	11.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.7	0.0	0.0	31.1	0.4	0.0	0.0	2.4	3.0	0.0	0.0	0.0	0.0
42	65°38,643'N	004°53,171'E	110	31.9	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.2	0.0
43	65°38,864'N	006°13,991'E	5	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	19.5	0.0	0.0	0.0	0.0	0.0
44	65°38,630'N	007°19,036'E	2	200.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	1.5	0.0	0.0	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	184.5	0.0	0.0	0.0	0.0	0.0
50	65°39,006'N	010°07,277'E	2	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0	0.0
56	66°23,278'N	006°33,589'E	5	140.3	0.0	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	1.5	0.0	0.0	3.8	2.4	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0
64	66°21,256'N	000°08,677'E	300	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	66°19,505'N	000°06,416'E	5	10.9	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
70	67°04,215'N	003°23,664'E	20	2.3	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.1	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0
73	67°04,687'N	006°12,680'E	300	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.2	0.0	0.0	3.5	52.8	0.0	0.0	0.0	0.0	0.0
74	67°04,201'N	007°26,875'E	400	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	67°04,194'N	009°47,691'E	5	113.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	67°04,429'N	011°38,019'E	120	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0
59	66°21,012'N	004°15,277'E	420	6.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	3.7	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
53	66°21,552'N	011°18,003'E	5	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.7	0.0	127.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3	0.9	0.4	0.0	0.0	0.0	0.0	0.0
81	70°12,780'N	018°15,436'E	5	285.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	262.2	20.8	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
84	70°12,877'N	016°30,363'E	310	74.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	65.5	0.0	3.4	0.0	0.0	1.0	0.0	0.0
85	70°14,890'N	013°51,568'E	15	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	725.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	70°12,986'N	011°29,244'E	5	170.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.7	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
95	70°10,851'N	004°27,755'E	17	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96	70°28,207'N	003°39,586'E	300	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0
99	70°27,951'N	000°46,337'E	5	59.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.5	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	70°28,232'N	000°22,013'E	310	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
105	70°28,306'N	006°38,933'W	5	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Annex 1 - Calibration report.

Annex 1 - Calibration report for the towed body mounted transducer used for abundance estimation.

Transceiver Menu	
Frequency	38 kHz
Sound speed	1469.2m.s^{-1}
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	25.32 dB
3 dB Beamwidth	6.8°
TS of sphere	-33.6 dB
Range to sphere in calibration	11.1 m
Measured NASCvalue for calibration	22100 m^2/nmi^2
Calibration factor for NASCs	1.00
Absorption coeff	8.197 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	-85 dB