The International Ecosystem survey in the Nordic Seas in May 2014

R/V DANA Cruise No. 5/2014

Calibration of Echo-sounders

8/5 – 10/5 2014

International Acoustic Monitoring of Herring and Blue whiting

11/5 – 6/6 2014

Cruise participants

Calibration 8/5 – 10/5

Karl-Johan Staehr	Denmark (Cruise leader)
Torben Filt Jensen	Denmark
Thyge Dyrnesli	Denmark
Christian Petersen	Denmark
Claus Halle, Guest	

Acoustic monitoring 11/5 - 22/5

Karl-Johan Staehr	Denmark (Cruiseleader)
Acoustic Torben Filt Jensen	Denmark
Acoustic Dirk Burggraaf	Netherlands
Fishlab Baldvin Thorvaldsson	Sweden
Fishlab Joanne Smith	United Kingdom
Fiashlab Peter Vingaard	Denmark
Fishlab Tom Svoldgaard	Denmark
Tech. Christian Petersen	Denmark

Acoustic monitoring 23/5-6/6

Bram Couperus	Netherlands (cruiseleader)
Acoustic Olavi Kaljuste	Sweden
Acoustic Sven Kupschus	United Kingdom
Fishlab Robert Brunn	Ireland
Fishlab Matthias Kloppmann	Germany
Fiashlab Helle Andersen	Denmark
Fishlab Frank Ivan Hansen	Denmark
Tech. Christian Petersen	Denmark

Cruise summary

Effective survey days	19
Mileage	3159
Number of trawl hauls	32 (+1 for mackerel sampling)
Number of CTD stations	36
Number of WP2 stations	36
Number of biological samples - herring	481
Number of biological samples – blue whiting	500
Number of biological samples - mackerel	147
Remarks	Haul station 1 has been carried out outside the survey strata for the collection of fecundity samples of mackerel.

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 8th May and 11th May 2014. 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 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 19-21 June 2014 and in the WGIPS report of January 2015 (Copenhagen).

Hydrographical and zooplankton data

At approximately 60 nautical mile interval 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 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 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 481 individual herring, 500 blue whiting and 147 mackerel were sampled.

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

Itinerary of the survey

Dana left Hirtshals at the 8th May at 08.30 UTC for calibration of acoustic equipment at Bornö in Sweden. All transducers were calibrated and Dana arrived in Hirtshals again at 10th May at 17.00 UTC.

Dana left Hirtshals to start the acoustic survey on the 11th May at 11.00 UTC.

Data monitoring was started at 09.11 UTC on 13th of May at 62°46 N, 05°36 E with a CTD and a WP2.

The weather conditions during first half:
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 transects (transect 1 and 2, stratum 1) the weather was reasonable but in periods with swells from behind and thereby a lot of movement of the vessel, but survey speed could be maintained. At the start of third transect (transect 4 stratum 1) from the eastern end the wind increased to 20 m/s and survey speed had to de reduced for the first 90 NM of this transect. Due to the weather one CTD/WP2 station (CTD station 15 stratum 1) had to be cancelled.

Integration on first half on the survey was ended 21nd May at 20.13 UTC at 66°34N, 11°34E. Bodø was entered at 22nd May at 08.30 UTC for change of crew.

Dana left Bodo for the second half of the survey at 13:00 UTC on the 23th of May. Except for the first three days, the weather during the second half of the survey was extremely calm.

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

24-5-2014 21:59 - Dana‘s current position is 68.05N – 005.21E. We are heading west. The weather is calm. No herring, blue whiting or Mackerel on the echosounder since we left Bodo yesterday. We carried out a surface haul yesterday at midnight at 68.05N-11.52E for 20 kg of juvenile herring. Another surface haul today at 11:00: a basket of lumpsuckers and a salmon.

25-5-2014 22:00 - Dana is currently at the western intertransect 68.13N – 0 E/W heading north to the tenth transect (stratum 1). The weather has become a bit more rough, 6-7 E. Nothing to be seen on the screen. Yesterday night we carried out a survey haul at 68.05N-5.27E for five kg of herring.

Today another survey haul at 68.05N-1.25E for two lumpsuckers. If we have time left, we will take over transect 3 in stratum 5 from the GO Sars.

27-5-2014 12:22 - We are at the tenth transect in stratum 1 69.37N-7.39E heading east.
A surface haul at midnight yesterday at 68.35N-0E/W (that is on the western inter-transect between 8 and 10 in stratum 1) gave us 160 kg herring without having seen any indication of herring on the screen. No catch in a surface haul yesterday morning at 69.37N-0.26E; This night at 69.37N-4.01E we encountered a big school of herring at 100m. We tried to catch it, but only got a basket with 160 herrings and 100 blue whitings.

28-5-2014 9:44 - We have now just finished the CTD/WP2 station at 69.37N-14.20E on the tenth transect in stratum 1 and the sea is like a mirror. This morning the crew had to move slightly away from the track in order to avoid collision with a large spermwhale. From here it is approximately 55 Nm till the end of this transect. From there we will sail towards the eastern starting point of transect 2 in the second stratum – we will keep integrating during this inter-transect. Nothing on the screen the last 24 hours. We did a survey haul at midnight at 69.37N-11.24E (station ID 78) and caught 4kg of herring.

29-5-2014 8:50 - Our current position is 71.21N – 18.44E, still on the eastern inter-transect between transect 10-stratum 1 and transect 2-stratum 2, but very close to the point where we will turn to the west again. Yesterday we fished at the shelf edge 69.35N-15.48E at 400m and caught 350kg small blue whiting (station ID 81). At midnight on the inter-transect in shallow water 70.23N-17.41E we carried out a surface haul, catching half a basket of mixed species (station ID 82). The weather is yesterday and now is unbelievable calm.

30-5-2014 9:53 - We are at CTD/WP2 station 71.44N – 2.47E, transect 2 in stratum 2, heading west, and the sea is still like a mirror.
Yesterday in the afternoon we carried out a haul at 100m on some very light recordings. The catch was a basket of haddock (ID 85). Yesterday, at about 20:00 UTC 71.45N – 16.23E we encountered a group of approximately 10 fin whales, heavenly feeding at the surface on schools that appeared blue on the 38 kHz at -70db threshold. We fished on these schools or rather an interrupted layer and caught 40 kg krill (ID 86). The catch contained also 20 kg of herring. My impression is that under the current calm weather conditions, herring tends to stay higher in the water column, above the transducer, because on the screen there is – again - no clue of herring. The densities may not be very high, but the surface hauls during the second half of this trip so far indicate that we miss some herring.

31-5-2014 10:34 - We are at 71.43N-4.06E on the 2nd transect in stratum 5, heading west. Yesterday afternoon we had a surface haul at 71.45N-10.24E, catching a basket of lumpsuckers, blue wolffish and young Gonatus (ID 91). This night we caught 79 lumpsuckers and a hand full of nothingness at the surface at 71.44N-7.08E (ID 94). The sea surface is – compared to yesterday - just a little rippled, but in fact flat.
No herring on the screen.

1-6-2014 9:37 - We are at the end of the transect 2 (str5), carrying out one more surface haul 71.43N-3.28W (a pod of killer whales in the distance). Yesterday afternoon we caught a one and a half basket of lumpsuckers and young Gonatus at 71.44N-305E (ID 99) and one more basket of lumpsuckers at the surface at 71.43N-0.06W (ID 102). No herring around. The sea is still dead

calm. After this last surface haul (ID 105) we are finished and will be sailing homewards. The catch of this last surface haul consisted of 71 lumpsuckers (2 and a half basket).

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.

Herring was found in two distinct areas, in the south western part of the area and between 69 and 70 degrees North. Survey hauls in the northern half of the area which contained herring, seem to indicate that herring have been “missed” acoustically, either because they were not aggregating in schools or because they swam above the transducer. As reported above, the sea was exceptionally calm during the second half of the survey, which may have caused the herring to swim closer to the surface than usual.

Blue whiting was found in the whole area except the northwestern part. The higher concentrations were found in the south. During the second part of the survey, on the 3 northernmost transects blue whiting were much less abundant than during the first part. Overall blue whiting had a more southern distribution than in 2013.

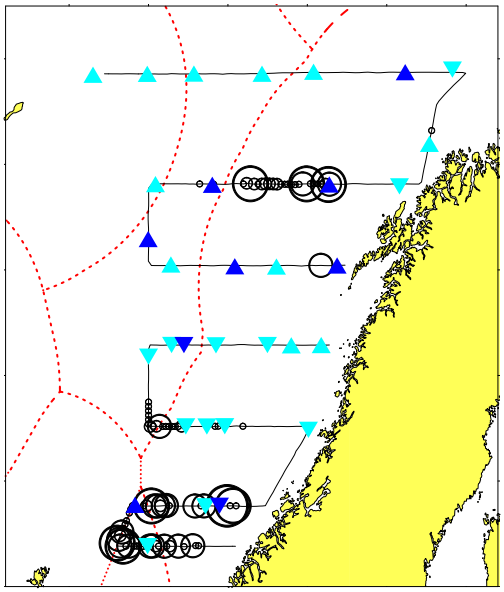

Figure 1. Sailed transects, trawl -, plankton – and hydrographical stations and Nautical Area Scattering Coefficients (NASC's) assigned to herring and blue whiting. Survey hauls in the northern half of the area which contained herring, seem to indicate that herring have been "missed" acoustically, either because they were not aggregating in schools or because they swam above the transducer.

Hydrographic conditions

The observed sea surface temperature (SST) range during the cruise was wider than last year and resembled more or less those ranges that were encountered during earlier years between < 6° C in the North and >8 °C in the South decreasing to values <1°C in the Northwest. Overall, surface temperatures were about 1°C warmer than last year over almost the entire survey area. Temperatures > 8°C were again more common than last year and were encountered up to almost 67° N.At 200 m, the arctic front could be located along the 0° Meridian. In the surface, the 7°C isothermal reached as far north as 71°N, stretching over a wider longitudinal range even north of 70° N (figure 5). The overall picture of temperature distribution apparently resembles more the warmer conditions before 2007 than that of the cooler period between 2007 and 2013. Waters in the surface layer closer to the coast were cooler than at 50 m and also of lower salinities, indicating at a discharge of cold waters from the land.

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 6). The magnitude of these layers varied only slightly with latitude. In the southern part of the survey area, Atlantic water could be detected over the entire, rather shallow water column closer to the coast and down to at least 450 m in the more oceanic area. Along the coast as well as in the oceanic section, this layer remained of almost the same magnitude with respect to depth, but became cooler towards the North. The latitudinal transect from the Barents Sea into the northern Norwegian Sea showed a stronger influence of Atlantic water in and immediately west of the Barents Sea boundary with a comparatively thick layer (down to >500 m) of warmer water there. Only on the 2 westernmost stations, Arctic water masses became dominant and increased its thickness towards the surface layers.

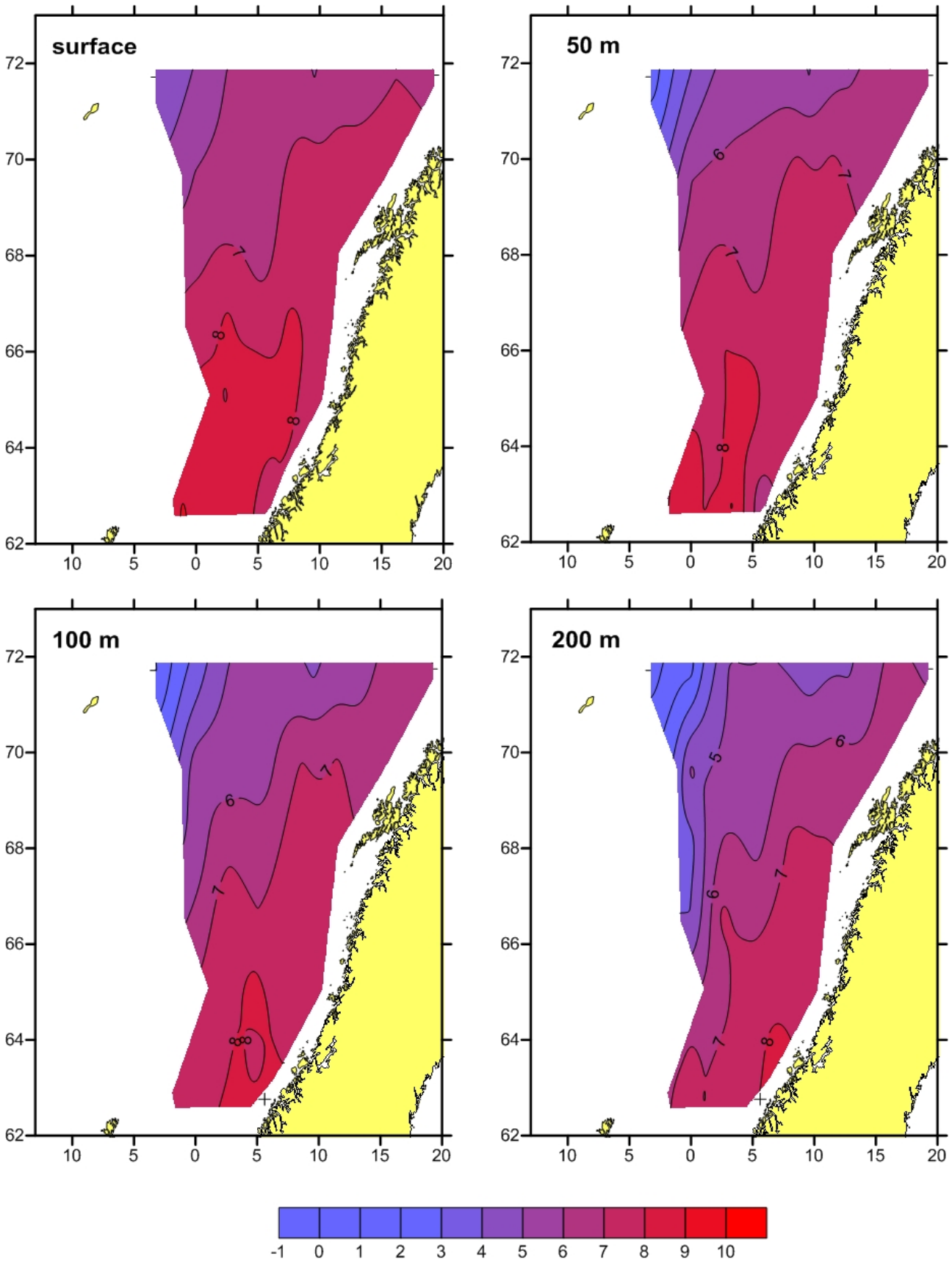

Figure 2: Horizontal temperature distribution in the survey area at the surface, and at 50m, 100m and 200m depth.

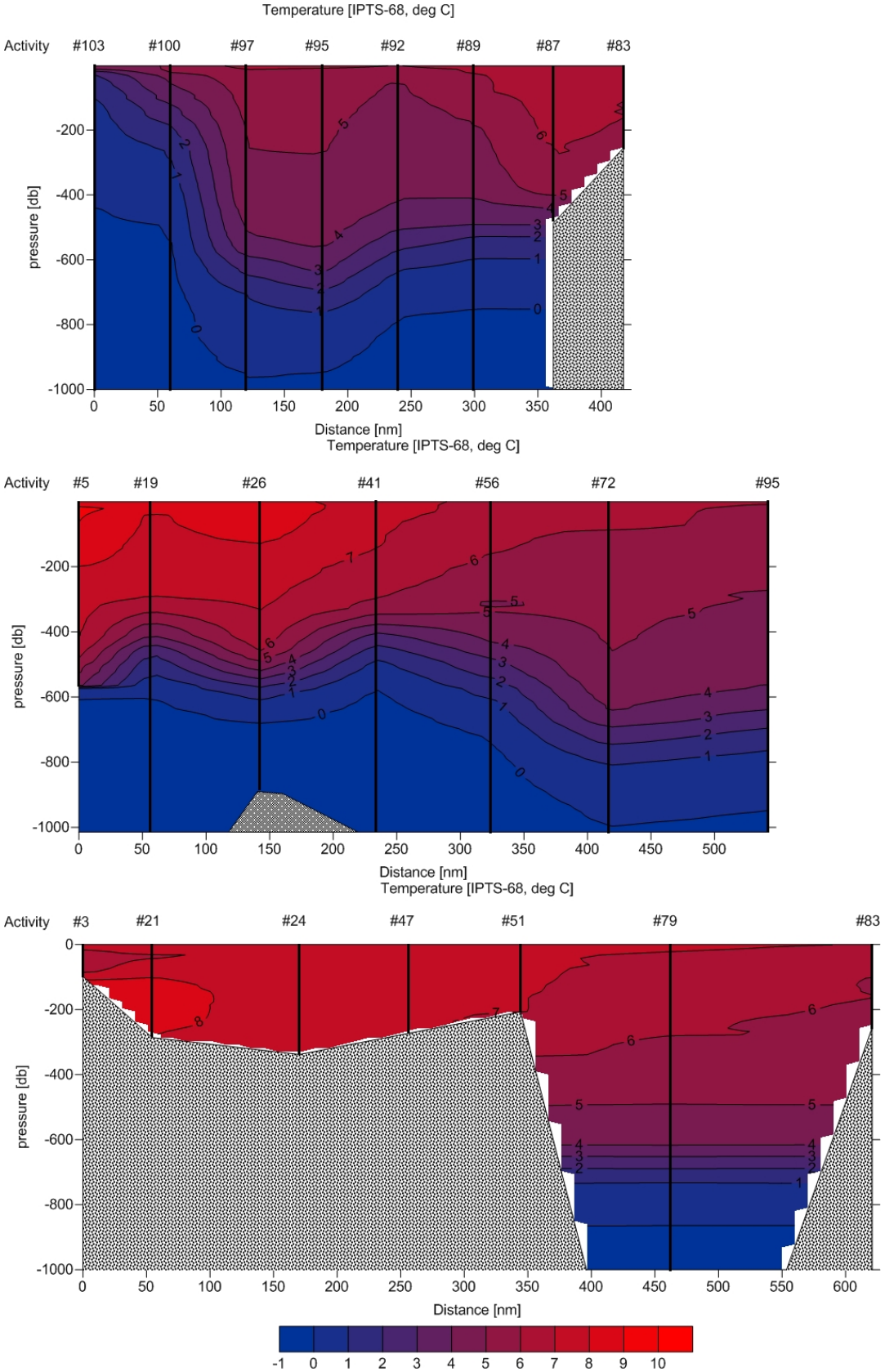

Figure 3: Vertical temperature distributions along a latitudinal transect at 71°44'N West to East, along an oceanic (middle), and along a coastal transect from South to North (bottom, for position of selected stations see Figure 1).

Table 1: CTD and WP2 stations taken by R/V Dana during 13 May to 1 June 2014. *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
2		2014	5	12	8	28	59,30773	4,24091667	333,7	6,13
3	4	2014	5	13	9	11	62,76183	5,60758333	47,5	12,57
5	6	2014	5	13	16	50	62,76315	3,28626667	46	8,34
7	8	2014	5	14	0	16	62,76177	1,0831	26,4	3,23
10	11	2014	5	14	11	18	62,7623	-1,06943333	218,1	7,31
13	14	2014	5	15	2	45	63,52907	0,01098333	339,8	10,12
15	16	2014	5	15	10	31	63,51875	2,22695	242,5	14,83
19	20	2014	5	16	0	38	63,52652	4,48183333	240,2	9,26
21	22	2014	5	16	8	50	63,51868	6,71615	234	10,04
24	25	2014	5	17	2	34	65,03023	9,48483333	222,1	13,18
26	27	2014	5	17	21	23	65,03507	4,75026667	172,6	5,54
30	31	2014	5	18	11	38	65,03262	2,36746667	217,1	4,38
34	35	2014	5	19	12	12	66,56047	0,02093333	127	2,1
38	39	2014	5	20	1	31	66,58298	2,52453333	298,1	7,61
41	42	2014	5	20	13	28	66,57782	5,04626667	272,5	7,73
44	45	2014	5	21	1	49	66,58417	7,55593333	268,4	2,43
47	48	2014	5	21	11	53	66,57568	10,0638167	60,6	9,58
51	52	2014	5	24	3	48	68,08745	10,74445	296,4	7,23
53	54	2014	5	24	11	5	68,08127	8,04551667	348,5	9,14
56	57	2014	5	24	20	52	68,08493	5,35908333	43,6	12,41
59	60	2014	5	25	7	17	68,08542	2,68118333	34,4	10,85
62	64	2014	5	25	17	18	68,08543	0,00248333	54,3	9,09
66	67	2014	5	26	6	57	69,63258	0,00131667	76,2	10,45
69	70	2014	5	26	17	2	69,62728	2,86058333	92,5	9,79
72	73	2014	5	27	4	16	69,62782	5,73818333	116,3	7,49
74	75	2014	5	27	12	15	69,62093	8,62736667	151	5,15
76	77	2014	5	27	20	6	69,62562	11,4696333	198,1	1,77
79	80	2014	5	28	6	7	69,62525	14,3391167	278,1	0,23
83	84	2014	5	29	11	17	71,74642	19,1321333	195,5	1,13
87	88	2014	5	29	23	2	71,7446	16,14515	48,3	2,44
89	90	2014	5	30	6	16	71,74285	12,7725667	318,2	0,42
92	93	2014	5	30	16	23	71,74175	9,5662	350,5	2,07
95	96	2014	5	31	2	16	71,71808	6,37441667	244,5	5,15
97	98	2014	5	31	10	3	71,71407	3,18178333	235,5	6,69
100	101	2014	5	31	19	48	71,71443	-0,01161667	297,6	7,95
103	104	2014	6	1	4	20	71,71393	-3,1783	146,2	1,73

Table 2: Fishing stations taken by R/V Dana during 13 May to 1 June 2014

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	201405	1	5	12	6	54	59,242200	4,213833	340,7	8,2					
DK	OXBH	201405	9	5	14	6	54	62,766067	-0,056100	259,6	4,11	2,8	66	123,2561	125	1350
DK	OXBH	201405	12	5	14	22	4	63,548417	-0,852717	182,3	16,77	3,1	59	2989,268	0	
DK	OXBH	201405	17	5	15	17	9	63,520433	3,588583	262,2	11,51	3,5	60	16,42565	240	1500
DK	OXBH	201405	18	5	15	22	29	63,530533	4,465917	245,8	14,09	3,7	59	1133,846	240	
DK	OXBH	201405	23	5	16	22	26	64,969533	10,068800	182,4	9,52	3,7	60	114,2741	240	
DK	OXBH	201405	28	5	17	23	21	65,037383	4,802167	175,8	8,68	3,9	60	0,552	240	
DK	OXBH	201405	29	5	18	5	18	65,032533	3,673717	148,2	18,19	3,9	60	395,0014	150	850
DK	OXBH	201405	32	5	18	15	34	65,034700	2,347983	178,7	6,33	3,7	60	589,9968	185	1050
DK	OXBH	201405	33	5	19	8	19	66,355283	0,000000	167,3	1,52	3,9	60	67,17087	220	1270
DK	OXBH	201405	36	5	19	18	23	66,577150	1,451467	17,7	2,64	3,4	60	525,0035	220	930
DK	OXBH	201405	37	5	19	22	48	66,575350	2,230017	322,9	6,05	3,6	60	56,728	220	
DK	OXBH	201405	40	5	20	8	51	66,570500	4,247417	287,1	10,34	4	60	29,59781	360	1550
DK	OXBH	201405	43	5	20	23	32	66,575967	7,487300	299,7	6,55	3,3	60	4007,365	360	
DK	OXBH	201405	46	5	21	7	6	66,571200	8,988667	120,9	2,63	3,5	60	27,3	0	350
DK	OXBH	201405	49	5	21	16	19	66,576100	10,873317	36,7	12,68	3,7	61	15,825	0	370
DK	OXBH	201405	50	5	23	23	8	68,083617	11,874867	300,3	8,48	3,9	60	44,91	0	
DK	OXBH	201405	55	5	24	13	2	68,064100	8,055083	7,7	8,32	3,8	60	11,718	0	350
DK	OXBH	201405	58	5	24	22	41	68,069317	5,432100	39,1	8,04	4,1	61	17,51	0	
DK	OXBH	201405	61	5	25	12	21	68,102633	1,409400	51,4	8,9	3,7	60	1,08	0	
DK	OXBH	201405	65	5	25	22	23	68,584933	-0,022167	76,9	13,45	4,2	60	168,9976	0	
DK	OXBH	201405	68	5	26	9	41	69,625350	0,436817	89,3	8,46	3,8	61	5,136	0	354
DK	OXBH	201405	71	5	26	22	13	69,613000	4,015767	122,9	9,25	4	60	47,76734	0	800
DK	OXBH	201405	78	5	27	21	48	69,618817	11,381300	196,2	2,84	4,3	61	8,434	0	310
DK	OXBH	201405	81	5	28	11	38	69,582767	15,800667	14,2	2,91	3,9	89	373,7084	315	1690
DK	OXBH	201405	82	5	28	22	22	70,389067	17,685183	270	2,82	3,3	60	15,843	0	420
DK	OXBH	201405	85	5	29	12	40	71,795433	19,133917	323,5	1,4	3,8	60	27,44	200	1300
DK	OXBH	201405	86	5	29	21	4	71,746700	16,161667	68	2,79	4,2	60	64,50367	0	300
DK	OXBH	201405	91	5	30	12	47	71,754400	10,391383	15,6	3,37	4,3	60	27,144	0	400
DK	OXBH	201405	94	5	30	22	27	71,717350	7,145550	276,2	4,37	4	60	37,2	0	450
DK	OXBH	201405	99	5	31	12	34	71,720467	2,858300	218,3	9,7	4,3	61	27,376	0	320
DK	OXBH	201405	102	5	31	21	34	71,715583	-0,078967	260,5	5,92	3,7	60	52,556	0	315
DK	OXBH	201405	105	6	1	6	35	71,698250	-3,495383	103,4	4,74	3,8	60	60,661	0	320

Table 3: Catch composition in trawl stations taken by R/V Dana during 13 May to 1 June 2014

Station	Latitude	Longitude	depthAveGear	Total Of WeightTotal	*Ammodytes marinus*	*Anarhichas denticulatus*	*Anarhichas lupus*	*Arctozenus risso*	*Argentina silus*	*Benthosema glaciale*	*Cephalopoda sp_*	*Clupea harengus*	*Cyclopterus lumpus*	*Euphausiidae sp_*	*Eutrigla gurnardus*	*Gadus morhua*	*Mallotus villosus*	*Maurolicus muelleri*	*Melanogrammus aeglefinus*	*Merlangius merlangus*	*Micromesistius poutassou*	*Notoscopelus kroeyeri*	*Pollachius virens*	*Salmo salar*	*Scomber scombrus*	*Scyphozoa sp_*	*Sebastes marinus*	*Sebastes mentella*	*Trisopterus esmarkii*
9	62°45.96' N	000°03.37' W	125	123.3						0.1			5.6					0.0			115.9	0.2				1.5			
12	63°32.91' N	000°51.16' W	0	2989.3								1507.8									1.9				1479.5				
17	63°31.23' N	003°35.31' E	240	16.4				1.6		4.5				5.4				0.0			1.7	1.3				1.1		0.8	0.0
18	63°31.83' N	004°27.96' E	240	1133.8								27.6	4.9		0.8						24.5				1076.0				
23	64°58.17' N	010°04.13' E	240	114.3	0.0				0.0					113.3				0.9		0.0									0.0
28	65°02.24' N	004°48.13' E	240	0.6				0.4			0.0							0.0			0.1					0.0			
29	65°01.95' N	003°40.42' E	150	395.0									2.0								393.0								
32	65°02.08' N	002°20.88' E	185	590.0								0.7	0.8								588.5								
33	66°21.32' N	000°00.00' E	220	67.2				0.5				0.9	0.9								63.6			0.9		0.3			
36	66°34.63' N	001°27.09' E	220	525.0								1.9	4.2								518.9								
37	66°34.52' N	002°13.80' E	220	56.7								45.6	5.8											4.5	0.8				
40	66°34.23' N	004°14.85' E	360	29.6				0.4		2.0	0.1			0.5				0.0			17.7	0.1				5.1		3.8	
43	66°34.56' N	007°29.24' E	360	4007.4								1.0	2.3												4004.0				
46	66°34.27' N	008°59.32' E	0	27.3								0.4	16.1											7.6	3.3				
49	66°34.57' N	010°52.40' E	0	15.8	0.0							0.4	10.9							0.0				4.5					
50	68°05.02' N	011°52.49' E	0	44.9			0.0					18.0	22.9						1.2				0.0	2.8					
55	68°03.85' N	008°03.30' E	0	11.7									11.0											0.7					
58	68°04.16' N	005°25.93' E	0	17.5							0.3	13.8	3.4																
61	68°06.16' N	001°24.56' E	0	1.1									1.1																
65	68°35.10' N	000°01.33' W	0	169.0							0.7	160.2	8.1				0.0												
68	69°37.52' N	000°26.21' E	0	5.1							0.2		5.0																
71	69°36.78' N	004°00.95' E	0	47.8				1.1		3.9	0.4	24.9		2.7				0.0			11.9					1.3		1.4	
78	69°37.13' N	011°22.88' E	0	8.4								4.3	4.1																
81	69°34.97' N	015°48.04' E	315	373.7				0.9		0.2				0.7		2.5		0.1	1.2		340.0	0.1	12.3			14.5	1.3		
82	70°23.34' N	017°41.11' E	0	15.8								0.3	9.0	0.1	1.0		0.0		5.4										
85	71°47.73' N	019°08.04' E	200	27.4									2.2	0.9		0.5		0.1	23.6							0.1			
86	71°44.80' N	016°09.70' E	0	64.5		0.0					2.5	17.4	11.0	33.1	0.6														
91	71°45.26' N	010°23.48' E	0	27.1		2.6	0.0				4.5		20.1																
94	71°43.04' N	007°08.73' E	0	37.2				0.2		0.0	25.4		10.8				0.0	0.0										0.7	
99	71°43.23' N	002°51.50' E	0	27.4		0.9					3.6		22.9																
102	71°42.93' N	000°04.74' W	0	52.6							1.6		51.0																
105	71°41.90' N	003°29.73' W	0	60.7							1.5		59.0													0.2			

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