Annex 1: 2012 Individual Acoustic Survey Reports

ICES co-ordinated acoustic survey on Herring and Sprat in the North Sea

RV "Johan Hjort", 25 June - 23 July 2012

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1 INTRODUCTION

In 2012, the Norwegian Institute of Marine Research (IMR) carried out the Norwegian part of the ICES co-ordinated herring and sprat acoustic survey in the North Sea and adjacent areas. The acoustic survey (HERAS) is planned and co-ordinated by the Working Group for International Pelagic Surveys (WGIPS 2012). Six countries cooperate in surveying the North Sea and Div. IIIa for an acoustic abundance estimation of herring and sprat. The Norwegian herring acoustic area was defined as the area between 56°30' and 62°N and between 2° and 6°E. The Norwegian survey has since 2006 been a multi-purpose survey, covering HERAS, saithe acoustics, IBTS 3Q, hydrographical standard transects, as well as process studies for the project "Early life history dynamics of North Sea Fishes". The data from the HERAS part of the survey will be combined with the HERAS surveys of the other countries to provide a combined age disaggregated abundance index for use in the assessment carried out by the ICES Herring Assessment Working Group (HAWG) to be held in March 2013.

Objectives for the HERAS part of the survey with RV "Johan Hjort" were:

a) To conduct an acoustic survey to estimate the abundance and distribution of herring and sprat in the north-eastern part of the North Sea, between 56°30'and 62° N, and between 2° and 5°E.
b) To obtain biological samples. Herring were sampled for data on length, weight, age, sex, maturity, mesenteric fat, vertebrae count and infection by Ichthyphonus.

2. SURVEY DESCRIPTION AND METHODS

2.1 Personnel

25 June - 08 July

Else Torstensen	(Cruise leader)
Irene Huse	(Scientist)
Hege Øverbø Hansen	(Technician – demersal fish)
Inger Henriksen	(Technician – pelagic fish)
Else Holm	(Technician – demersal fish)
Jan de Lange	(Technician – pelagic fish)
Arne Storaker	(Technician – demersal fish)
Guri Nesje	(Technician - chemistry)
Richard Nash	(Scientist, 25-28 June)
Julio Erices	(Technician- plankton, 25-28 June)
Jon Rønning	(Technician- plankton, 25-28 June)
Bjarte Kvinge	(Acoustic operator)
Terje Haugland	(Acoustic operator)

08 – 23 July

Else Torstensen	(Cruise leader)
Irene Huse	(Scientist, 18-23 July)
Knut Hansen	(Technician – pelagic fish)
Inger Henriksen	(Technician – pelagic fish, until 18 July)
Else Holm	(Technician – demersal fish)
Harald Larsen	(Technician – demersal fish)
Anne-Liv Johnsen	(Technician – pelagic fish)
Rupert Wienerroither	(Technician – demersal fish)
Padmini Dalpadado	(Scientist – plankton)
Terje Jåvold	(Technician – plankton)
Jan Erik Nygaard	(Acoustic operator)
Bjarte Kvinge	(Acoustic operator)

2.2 Narrative

RV "Johan Hjort" left Bergen at 1355 UTC 25 June 2012. The vessel headed south to the start position of the transect Utsira-Start Point, 59˚17'N 05˚02' E. The weather conditions were good and we finalized the transect (59˚17'N 02˚14' W) on the 27 June. The vessel called for Lerwick 28 June at 1000 UTC to disembark the plankton technicians, and departed at 1530 UTC for the first IBTS-trawl station in ICES square 48E9. The vessel continued by IBTS-trawling in the western squares heading for square 42F2 where the acoustic NSAS-transects started on 30 June at 1150 h and continued from south to north. 8 July we called for Stavanger to change the scientific crew and 17 July to change the maritime crew. The survey concluded in Bergen on

23 July at 1020 UTC. This year the weather conditions were good, except for the last days. We managed to carry out the survey according to the plans. The present report presents the results from the HERAS part of the survey.

2.3 Survey design

The survey was mostly carried out in systematically parallel east-west transects with a spacing of 15 nm, progressing northwards from N56° 30' to N61°30' and between 2˚ and 6˚ E.

2.4 Calibration

The calibration of the echo sounders was done in Bergen, 23 June 2012. The settings used are presented in Table 1 for the 38 kHz transceiver.

2.5 Acoustic data collection

The acoustic survey was carried out using a SIMRAD ER60 38 kHz sounder and an ES38B SK transducer mounted on the drop keel. Acoustic data were collected 24 hours per day. Additional data were collected at 18, 120 and 200 kHz (ES120–7 transducer). These data were used to present the frequency responses as guidance in the scrutiny of the acoustic data for species allocations. The mean volume back scattering values (S_V) were integrated pr nm intervals from 9-13 m (depending on weather conditions and the use of the lower keel) below the surface to 0.5 m above the seabed. The speed of the vessel during the acoustic sampling was about 10 knots. The acoustic recordings were scrutinized twice per day using the Post Processing System LSSS (ver. 1.2.2) (Large Scale Survey System, Korneliussen et al. 2006).

2.6 Biological data - fishing trawl hauls

Trawling was carried out for species identification of acoustic scatters and for biological sampling. For pelagic trawling a salmon trawl was used, and the hauls were monitored by a Scanmar TE40-2 (PL) (narrow beam) and depth sensor D1200.

The total catches were sampled for species composition by number and weights. Individual biological samples (length, weight, age and maturity) of the target species were taken according to the IMR fish sampling manual (Mjanger et al 2012). Herring were examined for sex, maturity (macroscopic 8 point scale, see Annex 1), fat, stomach content, vertebrae count and macroscopic evidence of Ichthyophonus infection. Otoliths were taken for age determination (number of winter rings).

2.7 Hydrographical data

The Utsira-Start Point, a standard hydrographical transect including plankton stations, were taken twice. The first was taken as a start off on 26 June and the second out

from Stavanger on the 18 July. In addition, a CTD station was taken at each bottom trawl station, reaching a total of 101 CTD stations.

2.8 Acoustic data analysis

Data from the post-processing LSSS (sA) were averaged per 5 nm. The acoustic data were allocated to the following categories: herring, saithe, demersal fish, pelagic fish and plankton. To calculate integrator conversion factors, the target strengths of the target species herring and sprat were estimated using the following TS-length relationship:

$$TS = 20\log_{10}L - 71.2 \text{ dB}$$

Herring were separated from other recordings by using catch information, TS and characteristics of the recordings (e.g. frequency response – Korneliussen et al. 2006). The abundance estimation (Toresen et al. 1998) was made by ICES rectangles and summed up for the whole area.

North Sea autumn spawners and Western Baltic spring spawners (WBSS) are mixed during summer in the area covered by RV "Johan Hjort" (east of 2°E). No system for workable stock discrimination on individual herring during the survey is available. The proportions of Baltic spring spawners and North Sea autumn spawners by age were calculated by applying the formula

WBSS= ((56.5-VS (sample))/(56.5–55.8)) (p. 29, HAWG 1999)

WBSS is the proportion of WBSS and VS(sample) is the mean vertebrae count of the sample. All samples were worked up on board. The length-at-age and weight-at-age were assumed to be the same in the two stocks. The measured proportions of mature fish were applied equally to calculate the maturing part of each age group in both stocks.

3 RESULTS and DISCUSSION

The survey track, trawl hauls and the CTD stations are presented in Figure 1 and 2.

3.1 Acoustic data

3.1.1 Herring

Herring were scatterly distributed in the area in general low densities. The highest mean sA recorded by ICES rectangle was 247 (46F3) followed by 172 in 42F5 and 152 in 48F4. Pelagic trawling was based on both random positions regularly chosen for trawling at the surface, i.e. not based on echo registration (90%), and trawling on acoustic registrations (10%). In the "Norwegian survey area" herring tend to keep close to the surface and may thus be underestimated. Most of the schools were small

and occurred scattered throughout the area, either close to the surface or near bottom. Few “classical” herring schools were observed.

3.1.2 Sprat

No sprat was observed in the Norwegian area. This is the same as last years.

3.2 Biological data

A total of 41 valid pelagic trawl hauls were taken in the Norwegian survey area (Figure 1, Table 2). In general 30 min hauls were made. Catch composition per haul is given in Table 3. Herring were present in 22 pelagic hauls of sample size >20 herring. The length distributions in the trawl hauls used in the acoustic herring estimate are presented in Table 4. For estimating the abundance of herring, the pelagic trawl samples used by squares were:

Trawl haul	ICES square
211, 212	42F2-F5/43F2-F5
228, 233	44F2-F5
245-247, 253-256	45F2-F5/46F2-F4
257-259, 263-265	47F2-F4/48F2-F3
270, 275, 281, 282, 283	49F2-F4/50F2-F4/ 50F2-F3

From the pelagic hauls, 2018 herring were length measured and 1002 aged by number of winter rings in otoliths. No herring was observed to be infected by Ichthyophonus.

3.3 Abundance and Biomass estimates

3.3.1 Herring

Table 5 gives the mean length, mean weight, total numbers (millions) and biomass (thousands of tonnes) by age and maturity stage (immature/mature) for the North Sea autumn spawners and the Western Baltic spring spawners in the Norwegian target area in July 2012.

Herring was distributed over the whole area. Total number of herring was 2 332 million, an increase of 35% since last year (Torstensen 2012). The abundance of NSAS made 79% of the total abundance, a decrease of 7 % since last year

Total biomass of NSAS was estimated to 189 300 tonnes and the spawning stock biomass as 143 000 tonnes. Mature fish dominated the 2- and 3-ringers. The proportions of mature 2- and 3-ringers by numbers were estimated at 50 and 91%. The mature proportion of 2-ringers was much lower than in previous years, 72% in 2010 and 89% in 2011. The 1-ringers dominated the North Sea autumn spawners in numbers (47%). In biomass, the 2-, 3- and 9+-ringers each made 17-18%.

The total biomass of spring spawners was 81 000 tonnes, an increase since last year (54 000 tonnes). The total abundance was 640 million, an increase from 368 million last year.

Few good acoustic marks of herring schools were observed and the majority of the trawling positions were regularly chosen randomly for trawling at surface, i.e. not based on echo registration. Due to the tendency of staying near the surface during daytime, herring may have been underestimated.

3.4 Hydrography

A total of 101 CTD stations were sampled (Figure 2).The temperature and salinity at 5 m depth, 50 m depth and at bottom, are presented in Figures 3-5.

The hydrographical data are part of a general monitoring program of IMR/ICES, and will be analysed and published separately.

4. References

HAWG 1999. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES HQ, 15-24 March 1999. ICES CM 1999/ACFM:12.

Korneliussen, R.J., Ona, E., Eliassen, I.K., Heggelund, Y., Patel, R., Godø, O.R., Giertsen, C., Patel, D., Nornes, E.H., Bekkvik, T., Knudsen, H.P. and Lien, G. 2006. The Large Scale Survey System-LSSS, a new post-processing system for multi-frequency echo sounder data. ICES WGFAST Report 2006.

Mjanger, H., Hestenes, K., Svendsen, B.V., de Lange Wenneck, T. 2012. Manual for sampling of fish and crustaceans. Ver. 3.16. Institute of Marine Research. 197 s.

Toresen, R., Gjøsæter, H. and de Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34: 27–37.

Torstensen, E., 2012. ICES co-ordinated acoustic survey on Herring and Sprat in the North Sea. RV "Johan Hjort", 3 July – 2 August 2011. Annex 5c in ICES 2012, Report of the Working Group of International Pelagic Surveys (WGIPS), ICES CM 2012/SSGESST:21

WGIPS 2012. Report of the Working Group of International Pelagic Surveys (WGIPS), 16-20 January 2012, ICES Headquarters, Copenhagen, Denmark. ICES CM 2012/ SSGESST: 21

Table 1. RV "Johan Hjort", survey 2012207. International acoustic survey on herring in the North Sea, 25 June – 23 July 2012. Simrad ER60 and analysis settings used.

Transceiver Menu	**38 kHz**
Absorption coefficient	9.4 dB/km
Pulse length	1.024 ms
Bandwidth	2.43 kHz
Max power	2000 W
Two-way beam angle	-20.6 dB
3 dB Beam width (deg) - along ship	6.85°
3 dB Beam width (deg) - athwart ship	6.82°
Calibration details	
TS of sphere	-33.6
Range to sphere in calibration	22.0 m
Transducer gain	26.89
sA correction	-0.33 dB
Log/Navigation Menu	
Speed	Serial from ship's GPS
Operation Menu	
Ping interval	1 s

Table 2. RV "Johan Hjort", survey 2012207, 25 June – 23 July 2012. Trawl stations for herring in the North Sea.. H: herring sample (≥ 20 herring), h: herring present (< 20 ind.). Quality: 1 = random position at surface, 2 = trawling on acoustic registration.

Date	Trawl haul #	Ser #	Lat	Long	ICES Area	TIME (UTC)	Water depth (m)	Duration (min)	Herring	Saithe	Quality
626	BT201	24302	59176	3080	47 F3	2051	139	30		x	1
627	BT202	24303	59167	2195	47 F2	255	126	30	h	x	1
627	BT203	24304	59175	1130	47 F1	907	110	31	H	x	1
627	BT204	24305	59186	310	47 E9	1325	132	23	H	x	1
628	BT205	24306	59456	246	48 E9	1940	134	31		x	1
629	BT206	24307	59439	398	48 F3	249	120	27		x	1
629	BT207	24308	58452	354	48 F3	1038	121	29	H	x	1
629	BT208	24309	58451	309	46 F3	1514	133	30	H	x	1
630	BT209	24310	57147	290	43 F2	253	83	30	h	x	1
630	BT210	24311	57127	126	43 F1	637	95	30	H		1
630	PT211	24312	56356	5102	42 F5	2144	58	32	H		2
701	PT212	24313	56392	5500	42 F5	123	54	25	H		1
701	PT213	24314	56502	4186	42 F4	803	56	29			2
701	PT214	24315	57051	3120	43 F3	2154	67	33	h		1
702	PT215	24316	57049	4040	43 F4	134	65	19			1
702	BT216	24317	57058	4225	43 F4	312	61	33			1
702	BT217	24318	57051	5186	43 F5	807	54	30		x	1
702	BT218	24319	57091	6197	43 F6	1253	67	29	H	x	1
702	PT219	24320	57189	5544	43 F5	1535	77	39			1
702	BT220	24321	57204	5068	43 F5	1926	64	34			1
702	PT221	24322	57201	4566	43 F4	2117	62	30			1
703	PT222	24323	57200	3546	43 F3	121	62	27	h		1
703	BT223	24324	57233	3319	43 F3	348	62	30			1
703	BT224	24325	57203	2286	43 F2	903	81	31			1
703	BT225	24326	57455	1298	44 F1	1528	89	26	H		1
703	BT226	24327	57371	2188	44 F2	1921	79	26		x	1
703	PT227	24328	57351	2382	43 F2	2137	71	31			1
704	PT228	24329	57351	3228	44 F3	49	68	39	H		1
704	BT229	24330	57366	3315	44 F3	245	76	39	h		1
704	BT230	24331	57383	4108	44 F4	706	66	30	h		1
704	BT231	24332	57351	5170	44 F5	1201	85				5
704	BT232	24333	57348	6090	44 F6	1740	141				5
704	PT233	24334	57502	5155	44 F5	2331	96	30	H		1
705	BT234	24335	57448	5099	44 F5	244	106	30		x	1
705	BT235	24336	57500	2311	44 F2	1248	71	32			1
705	PT236	24337	57514	2004	44 F2	1603	88	30			1
705	BT237	24338	58110	1291	45 F1	1926	103	30	h		1
705	PT238	24339	58054	2026	45 F2	2229	79	31			1
706	PT239	24340	58049	2240	45 F2	23	71	31	h		1
706	BT240	24341	58091	2203	45 F2	238	73	30			1
706	BT241	24342	58051	2303	45 F2	427	69	17			1
706	BT242	24343	58138	3267	45 F3	903	96	30	H		1
706	BT243	24344	58134	4204	45 F4	1503	140	32			1
706	PT244	24345	58049	5165	45 F5	1947	257	31			1
706	PT245	24346	58078	5318	45 F5	2251	292	34	H		1
707	PT246	24347	58206	5150	45 F5	110	320	34	H		1

Table 2. cont.

Date	Trawl haul #	Ser #	Lat	Long	ICES Area	TIME (UTC)	Water depth (m)	Duration (min)	Herring	Saithe	Quality
708	PT247	24348	58204	3562	45 F3	2249	134	32	H		1
709	PT248	24349	58203	2586	45 F2	228	95	31			1
709	BT249	24350	58453	1364	46 F1	937	108	30	H	x	1
709	BT250	24351	58349	2166	46 F2	1326	96	17	H		2
709	PT251	24352	58350	3183	46 F3	1749	108	20			2
709	BT252	24353	58418	3369	46 F3	2039	168	30		x	1
709	PT253	24354	58349	3498	46 F3	2320	235	32	H	x	1
710	PT254	24355	58353	4069	46 F4	118	287	31	H		1
710	PT255	24356	58510	4017	46 F4	735	282	30	H		1
710	BT256	24357	58482	2302	46 F2	1346	111	30	H	x	1
710	PT257	24358	59073	2320	47 F2	2054	119	30	H		1
710	PT258	24359	59049	2506	47 F2	2315	118	30	H		1
711	PT259	24360	59049	3170	47 F3	123	166	31	H		1
711	BT260	24361	59168	4134	47 F4	833	275	26			1
711	PT261	24362	59200	3104	47 F3	1348	141	31	h		1
711	PT262	24363	59208	2045	47 F2	1813	123	30	h		1
711	PT263	24364	59351	2175	47 F2	2104	123	30	H		1
711	PT264	24365	59352	2436	47 F2	2306	118	31	H		1
712	PT265	24366	59354	3049	47 F3	58	127	32	H		1
712	BT266	24367	59401	3115	48 F3	248	149	32		x	1
712	PT267	24368	59350	4218	48 F4	809	264	32	h		1
712	BT268	24369	59450	2205	48 F2	1822	115	30		x	1
712	PT269	24370	59548	2045	48 F2	2135	103	31	h		1
713	PT270	24371	60050	2213	49 F2	19	112	32	H		1
713	BT271	24372	60046	2456	49 F2	254	106	30		x	1
713	BT272	24373	60060	3093	49 F3	532	154	31			1
713	BT273	24374	60200	3339	49 F3	1348	301	24	h		1
713	PT274	24375	60350	2054	50 F2	2041	122	30		x	1
713	PT275	24376	60348	2368	50 F2	2258	110	30	H		1
714	PT276	24377	60347	3011	50 F3	101	139	31	H		1
714	BT277	24378	60359	3039	50 F3	302	162	31		x	1
714	PT278	24379	60349	4033	50 F4	736	298	30			2
714	BT279	24380	60466	2420	50 F2	1537	123	31			1
714	BT280	24381	61057	2092	51 F2	2018	138	31			1
714	PT281	24382	61053	2205	51 F2	2230	133	31	H		1
715	PT282	24383	61066	2504	51 F2	38	308	32	H		1
715	PT283	24384	61054	3101	51 F3	228	360	31	H		1
715	BT284	24385	61361	1261	52 F1	1536	173	30		x	1
715	BT285	24386	61220	404	51 F0	2102	168	25		x	1
716	BT286	24387	61027	1138	51 F1	259	148	30		x	1
716	BT287	24388	60482	310	49 F0	701	134	30		x	1
716	BT288	24389	60455	1186	50 F1						6
716	BT289	24390	60379	1346	50 F1	1824	142	31		x	1
716	BT290	24391	60232	1142	49 F1	2049	136	30		x	1

Table 2. cont.

Date	Trawl haul #	Ser #	Lat	Long	ICES Area	TIME (UTC)	Water depth (m)	Duration (min)	Herring	Saithe	Quality
719	BT291	24392	59319	2551	48 F2	1221	122	25			1
720	BT292	24393	59491	304	48 F0	1941	138	33		x	2
721	BT293	24394	60205	238	49 F0	304	143	30		x	1
721	BT294	24395	60409	160	50 F0	644	89	26		x	1
721	BT295	24396	61110	156	51 F0	1029	155	32		x	1
721	BT296	24397	61394	222	52 F0	1419	208	31		x	1
721	BT297	24398	61415	318	52 F1	1800	209	28			1
721	BT298	24399	61412	357	52 F0	1919	209	22		x	1
722	BT299	24400	61527	428	52 F0	319	415	22		x	1

Table 3. RV "Johan Hjort" 25 June – 23 July 2012. Catch composition (kg) in the pelagic trawl hauls in the Norwegian survey area of the North Sea.

Trawl haul no		PT213	PT211	PT212	PT227	PT214	PT222	PT215	PT221	PT219	PT236	PT228	PT233	PT238	PT239	PT248	PT247	PT244	PT245	PT246
Serial no		24314	24312	24313	24328	24315	24323	24316	24322	24320	24337	24329	24334	24339	24340	24349	24348	24345	24346	24347
ICES area		42 F4	42 F5	42 F5	43 F2	43 F3	43 F3	43 F4	43 F4	43 F5	44 F2	44 F3	44 F5	45 F2	45 F2	45 F2	45 F3	45 F5	45 F5	45 F5
Total catch (kg)		2.378	137.124	287.764	4.870	60.924	36.512	38.842	59.493	27.096	32.871	508.895	105.365	142.955	237.951	18.203	151.344	17.109	128.305	155.782
Herring	Clupea harengus		32.200	9.740		0.459	0.061		0.104			366.125	15.190		0.181		9.306		89.350	118.740
Sprat	Sprattus sprattus																			
Mackerel	Scomber scombrus		101.510	275.900	3.578	59.140	32.160	37.810	51.280	5.230	5.031	58.100	80.695	133.445	228.370	2.405	125.065	7.504	11.825	24.400
Horse Mackerel	Trachurus trachurus																			
Blue whithing	Micromesistius poutassou																		7.790	
Saithe	Pollachius virens																			
Haddock	Melanogrammus aeglefinus	0.004					0.022			0.012	0.055					0.018	0.043		0.010	0.007
Whiting	Merlangius merlangus	0.034		0.004	0.002		0.074	0.019	0.002	0.054	0.118		4.200		2.000	0.190	0.175	0.017	0.212	0.009
Hake	Merluccius merluccius																			
Norway pout	Trisopterus esmarkii																		0.056	
Silvery pout	Gadiculus argenteus																			
Grey gurnards	Eutrigla gurnardus			0.420			0.980	0.382	0.307	0.440					0.270		0.375			
Lumpsucker	Cyclopterus lumpus				1.210					3.050	6.410			1.390	1.935	1.020		4.160		
Angler fish	Lophius piscatorius		2.180																	
Garfish	Belone belone	0.290	0.620	0.530				0.373					0.280							
Spurdog	Squalus acanthias									0.340										
Flying squid	Ommastrephes sagittatus			0.080				0.004			0.177						0.120			
Jelly fish		2.050	0.610	1.090	0.080	0.025	3.210	0.254	7.800	17.970	21.080	0.670	5.000	8.120	5.195	14.570	16.260	3.020	18.860	12.625
Other			0.004			1.300	0.005					84.000						2.408	0.202	0.001

Table 3. RV "Johan Hjort" 25 June – 23 July 2012. Cont.

Trawl haul no		PT251	PT253	PT254	PT255	PT257	PT258	PT262	PT263	PT264	PT259	PT261	PT265	PT269	PT267	PT270	PT274	PT275	PT276	PT278
Serial no		24352	24354	24355	24356	24358	24359	24363	24364	24365	24360	24362	24366	24370	24368	24371	24375	24376	24377	24379
ICES area		46 F3	46 F3	46 F4	46 F4	47 F2	47 F2	47 F2	47 F2	47 F2	47 F3	47 F3	47 F3	48 F2	48 F4	49 F2	50 F2	50 F2	50 F3	50 F4
Total catch (kg)		10.400	47.574	543.998	1498.723	279.150	67.825	15.942	96.183	204.782	772.000	5.983	278.183	127.268	133.881	403.948	16.083	1998.790	186.080	5.754
Herring	Clupea harengus		7.007	390.000	635.470	108.000	14.947	0.308	19.168	9.964	550.000	1.592	142.600	4.379	1.437	14.808		1300.000	93.300	
Sprat	Sprattus sprattus																			
Mackerel	Scomber scombrus	0.153	2.116	67.380	838.210	165.760	42.370	2.859	72.710	177.410	213.000	3.390	115.240	109.580	111.315	375.000	3.444	665.000	68.390	0.192
Horse Mackerel	Trachurus trachurus				0.300		0.268													
Blue whithing	Micromesistius poutassou		30.400																	
Saithe	Pollachius virens		4.920																0.131	
Haddock	Melanogrammus aeglefinus	0.015	0.019	0.138			0.007	0.009		0.002		0.002	0.004		0.025		0.006		0.027	
Whiting	Merlangius merlangus	0.098	0.025	0.480			0.072	0.073	0.005	0.034		0.009	0.009	0.025	0.138		0.083		0.017	0.027
Hake	Merluccius merluccius		0.590				5.620			8.520			12.910			2.700		3.790		
Norway pout	Trisopterus esmarkii							0.003											0.075	
Silvery pout	Gadiculus argenteus		0.026												0.006					
Grey gurnards	Eutrigla gurnardus	0.133					0.221			0.302				0.484		0.130				0.585
Lumpsucker	Cyclopterus lumpus	0.091										0.135	1.515		1.560				1.740	
Angler fish	Lophius piscatorius																			
Garfish	Belone belone														0.310					
Silvery lightfish	Maurolicus muelleri		0.028																	
Spurdog	Squalus acanthias																			
Flying squid	Ommastrephes sagittatus																		0.400	
Jelly fish		9.910	2.160	86.000	24.743	5.390	4.320	12.690	4.300	8.550	9.000	0.855	5.905	12.800	19.090	11.310	12.550	30.000	22.000	4.950
Other			0.283																	

Table 3. RV "Johan Hjort" 25 June – 23 July 2012. Cont.

Trawl haul no		PT281	PT282	PT283
Serial no		24382	24383	24384
ICES area		51 F2	51 F2	51 F3
Total catch (kg)		158.605	647.385	41.316
Herring	Clupea harengus	88.000	250.000	24.890
Sprat	Sprattus sprattus			
Mackerel	Scomber scombrus	54.060	385.000	3.168
Horse Mackerel	Trachurus trachurus			
Blue whithing	Micromesistius poutassou			
Saithe	Pollachius virens			
Haddock	Melanogrammus aeglefinus			0.039
Whiting	Merlangius merlangus	0.045		0.149
Hake	Merluccius merluccius			
Norway pout	Trisopterus esmarkii			
Silvery pout	Gadiculus argenteus			
Grey gurnards	Eutrigla gurnardus			
Lumpsucker	Cyclopterus lumpus			1.570
Angler fish	Lophius piscatorius			
Garfish	Belone belone		0.385	
Silvery lightfish	Maurolicus muelleri			
Spurdog	Squalus acanthias			
Flying squid	Ommastrephes sagittatus			
Jelly fish		16.500	12.000	11.500
Other				

Table 4. RV "Johan Hjort" 25 June – 23 July 2012**.** Herring length (cm) distribution, mean length and weight in pelagic trawl hauls.

L cm	PT211	PT212	PT228	PT233	PT247	PT245	PT246	PT253	PT254	PT255	PT257	PT258	PT263	PT264	PT259	PT265	PT270	PT275	PT276	PT281	PT282	PT283
	42 F5	42 F5	44 F3	44 F5	45 F3	45 F5	45 F5	46 F3	46 F4	46 F4	47 F2	47 F2	47 F2	47 F2	47 F3	47 F3	49 F2	50 F2	50 F3	51 F2	51 F2	51 F3
16	3	22																				
16.5	12	24																				
17	28	39				1	1															
17.5	31	8	2	1		1	1															
18	18	6	1	8			1															
18.5	5		3	9		2																
19	1		12	12		1																
19.5	2		17	13		6	1															
20			25	9		7	1			4	1											
20.5			18	1	3	11	5	1		6												
21			5	2	1	6	5	3	3	1					1							1
21.5			8	8	4	10	15	5	12	12	2				1							
22			4	5	3	5	18	2	15	10	3		1		2	1						
22.5		1	5	4	3	5	21	4	14	18		2			2	2			1			4
23				12	4	13	12	3	18	16	6	1			6	1			2			2
23.5				7	8	7	8	5	6	10	7	4	1	1	13	2			5		3	4
24				2	5	8	4	2	9	6	3	2	1	1	8	3			3		2	2
24.5				4	3	7	1	2	7	5	5	3	6		16	1			8		7	19
25					3	2	2	1	5	2	7	5	6		8	1			4		4	3
25.5					5	1	1	2	1	2	8	3	4		2	2			4	1	3	8
26				1	2	1	1	2	2	2	4		2		5	2		1	6		1	4
26.5				1	7	1			2		6	9	2		3	7	1		4		8	4
27					3		1	1	1	2	3	4	4	3	1	15	3	1	6	2	9	6
27.5					2	1		2	1	1	8	3	10	4	3	15	5	2	8	4	8	4
28				1	1	2			2		13	7	21	8	7	19	5	9	9	4	15	12
28.5					3	1		5	1	1	4	11	15	13	7	5	11	16	9	13	11	12
29					1		1	5			5	7	9	12	6	6	15	20	8	16	9	4
29.5					2			3		1	7	6	6	3	4	9	13	13	9	17	7	6
30					3			1			5	4	4	3	3	4	4	13	6	15	8	2
30.5					2			1	1		3	3	4	1	1	3	6	11	6	14	2	1
31					1							2	2			1	2	3	2	3	2	1
31.5								1		1		1					2	4		2		1
32												1	1		1	1	2	3		3		
32.5														1				1		3		
33												1						2		1		
33.5																				2		
34						1																
34.5																					1	
35																						
35.5																						
36																	1					
36.5																		1				
N	100	100	100	100	69	100	100	51	100	100	100	79	99	50	100	100	70	100	100	100	100	100
L cm	17.64	17.07	20.4	21.16	25.39	22.62	22.58	25.48	23.59	23.26	26.65	27.76	27.99	28.7	25.94	27.78	29.46	29.8	27.56	29.9	27.9	26.75
W gr	38.61	35.43	69.38	77.85	134.9	103.3	91.33	137.4	114.6	110.6	174	189.2	193.6	199.3	168.8	204.2	211.5	244.8	193.42	234	206	174.6

Table 5. RV "Johan Hjort" 25 June – 23 July 2012**.** Herring mean length, mean weight, numbers (millions) and biomass (thousands of tonnes) by age and maturity stages in the herring stocks in the Norwegian survey area.

	mean values		North Sea Autumn Spawner				Western Baltic Spring Spawner			
Age/ Maturity	Length	Weight	N (mill)	%	Biom (10^3)	%	N (mill)	%	Biom (10^3)	%
1i	17.26	37.71	794.6	47.0	30.0	15.8	92.4	14.4	4.2	5.2
1m										
2i	22.62	94.38	147.9	8.7	14.0	7.4	121.2	18.9	11.6	14.3
2m	24.32	129.52	150.7	8.9	19.5	10.3	110.7	17.3	13.4	16.5
3i	24.51	125.04	15.4	0.9	1.9	1.0	56.9	8.9	5.4	6.7
3m	25.51	189.01	158.2	9.4	29.9	15.8	64.2	10.0	9.1	11.2
4i	28.02	128.00	1.4	0.1	0.2	0.1	15.5	2.4	1.8	2.2
4m	28.54	200.73	82.7	4.9	16.6	8.8	38.3	6.0	6.7	8.3
5i										
5m	28.81	210.06	109.0	6.4	22.9	12.1	53.3	8.3	9.6	11.9
6i										
6m	29.40	226.08	32.7	1.9	7.4	3.9	22.5	3.5	4.4	5.4
7i										
7m	29.58	212.18	26.8	1.6	5.7	3.0	10.3	1.6	2.1	2.5
8i										
8m	29.83	231.49	32.9	1.9	7.6	4.0	17.2	2.7	3.6	4.4
9+i										
9+m	30.14	240.08	139.5	8.2	33.5	17.7	38.1	5.9	9.2	11.3
Total	22.23	111.81	1691.8	100.0	189.1	100.0	640.4	100.0	80.9	100.0
Immature	18.22	48.01	959.3	55.7	46.0	23.2	285.9	33.3	23.0	19.5
Mature	27.5	195.36	732.5	44.3	143.1	76.8	354.5	66.7	57.9	80.5

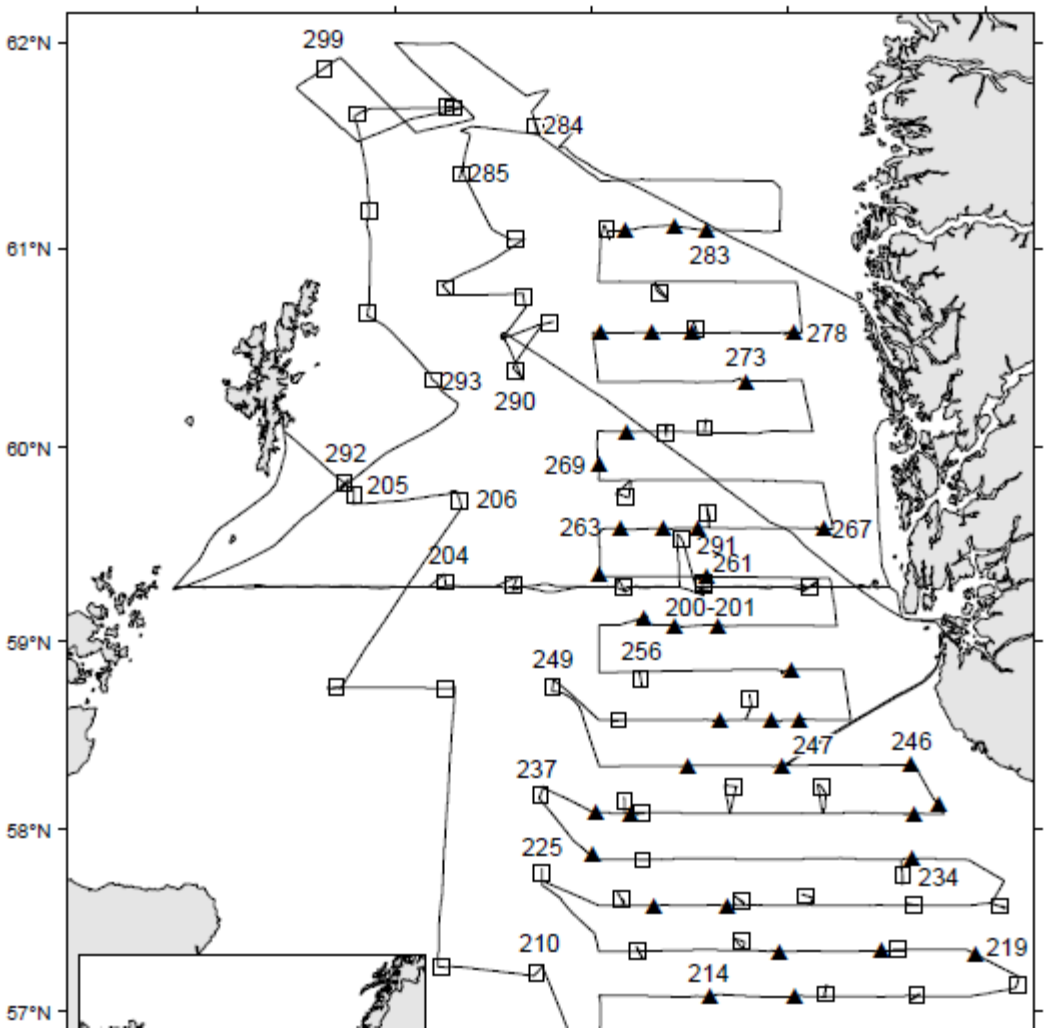

Figure 1. RV "Johan Hjort" 25 June – 23 July 2012. Cruise track and fishing trawl hauls in the combined NSAS and IBTS-3rd quarter. The Norwegian NSAS area between 2° and 6° E.

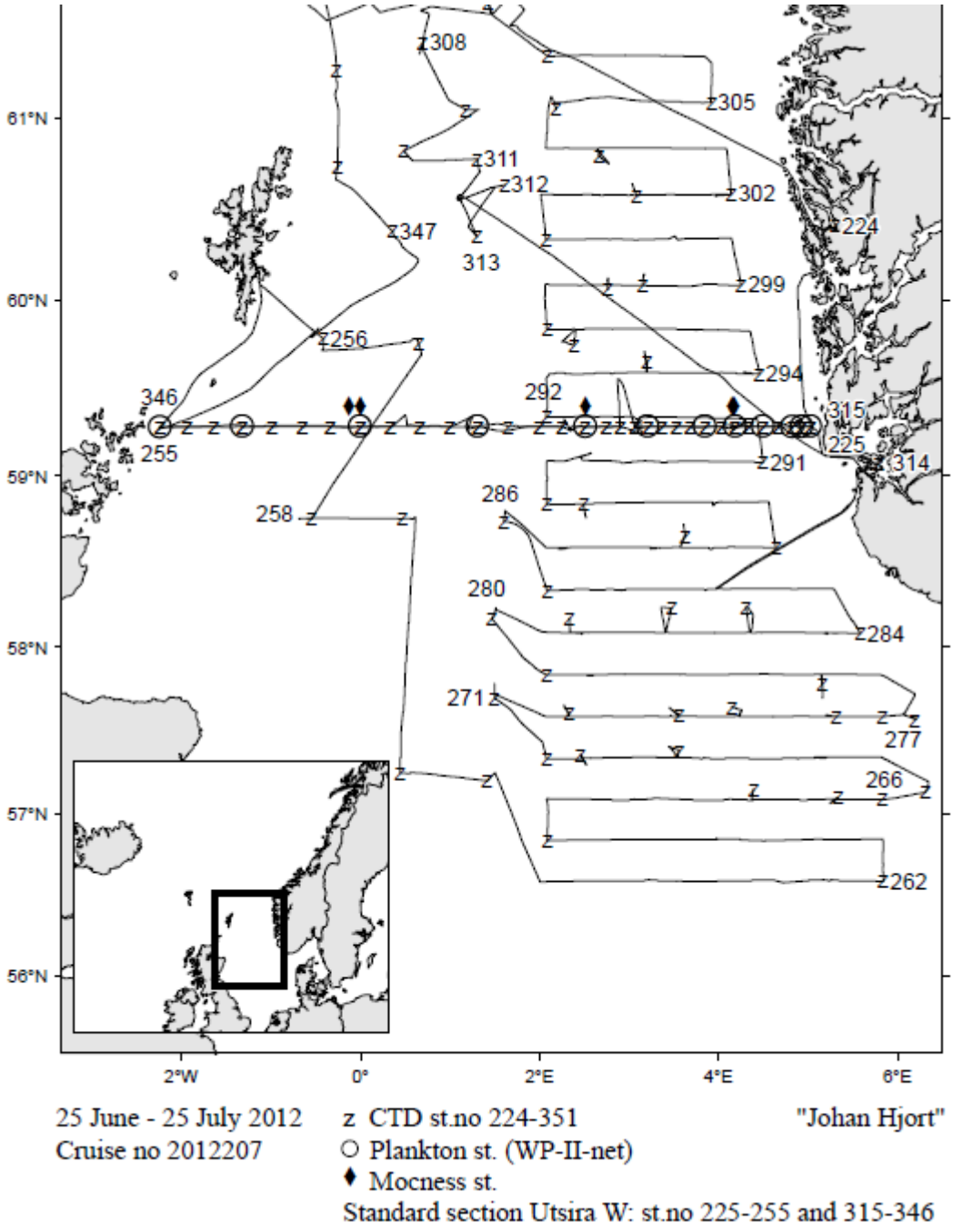

Figure 2. RV "Johan Hjort" 25 June – 23 July 2012. Cruise track and CTD-stations (Z) in the combined NSAS and IBTS-3rd quarter. The Norwegian NSAS area between 2˚ and 6˚ E.

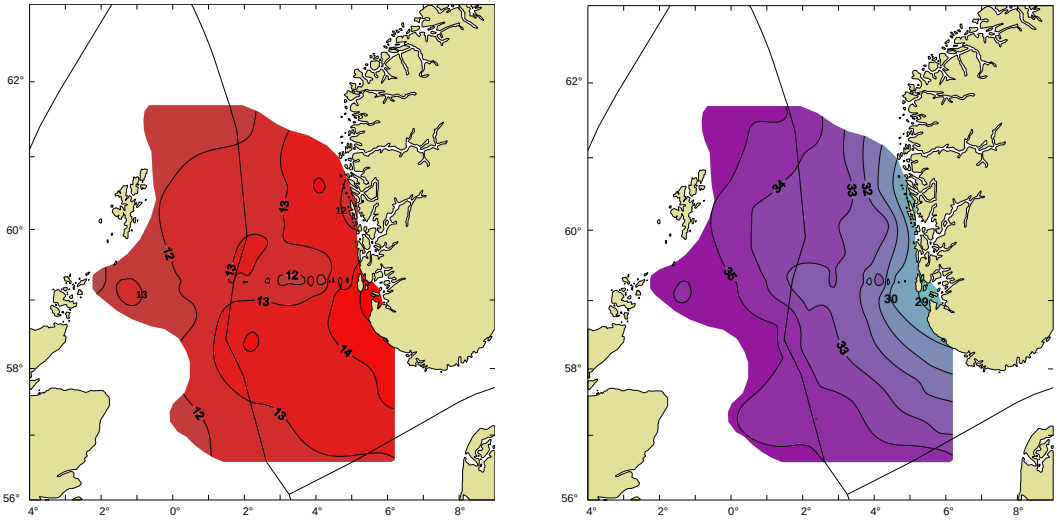

Fig. 3. Temperature (left) and salinity (right) at 5 m depth

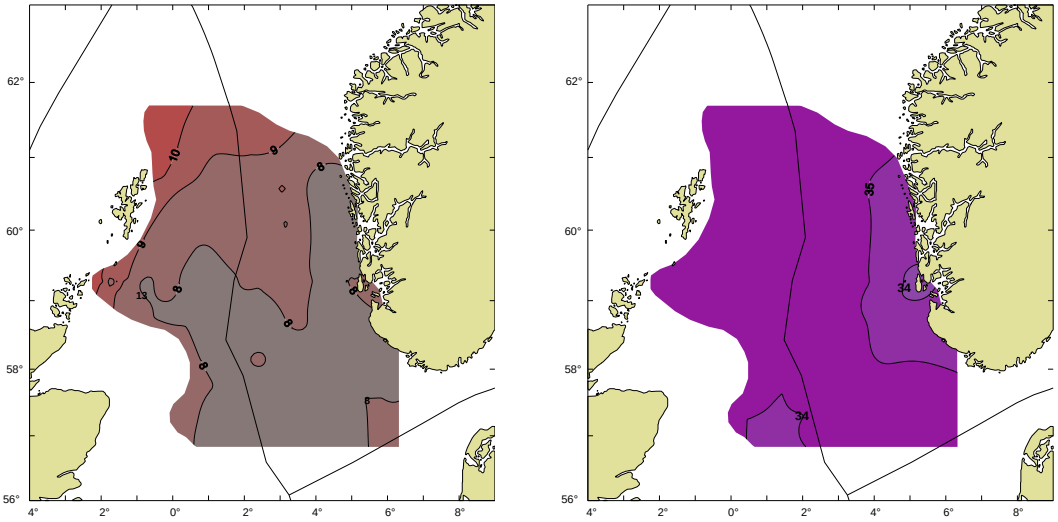

Fig. 4. Temperature (left) and salinity (right) at 50 m depth

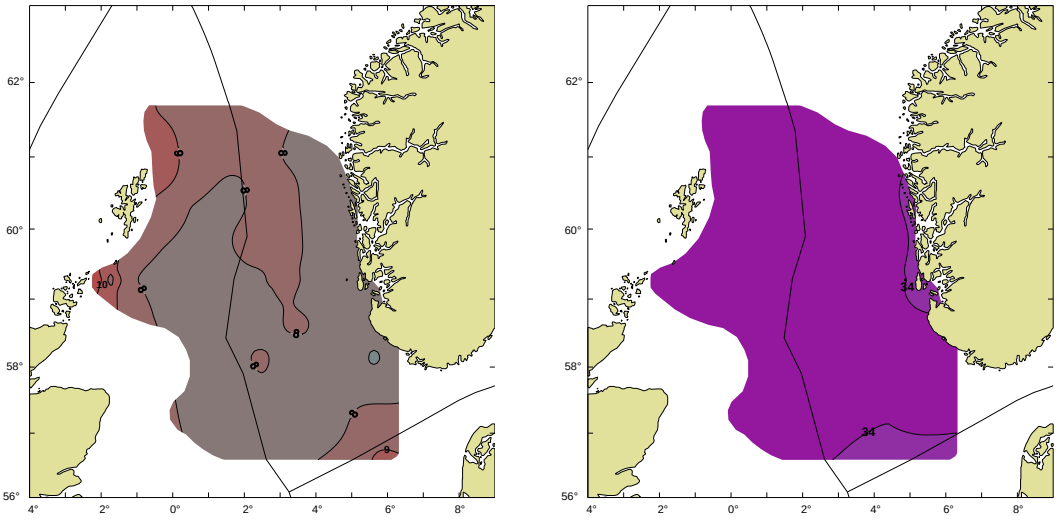

Fig. 5. Temperature (left) and salinity (right) at bottom.

Annex 1. From the English version of the IMR fish sampling manual (Mjanger et al 2006).

5.1.6 Table 6. Maturity stages used for capelin, herring, sprat, mackerel and horse mackerel

Stage	Females	Males
blank	**Undecided/not checked**	**Undecided/not checked**
1	**Immature a)** Juvenile phase. Gonads thread-like, thin and completely transparent and colourless. Difficult to determine sex.	**Immature a)** Juvenile phase. Gonads thread-like, thin and completely transparent and colourless. Difficult to determine sex.
2	**Immature b)** Gonads are somewhat larger in volume, sex is easier to determine. The gonads continue to be transparent and colourless with a hint of colour.	**Immature b)** Gonads are somewhat larger in volume, sex is easier to determine. The gonads continue to be transparent and colourless with a hint of colour.
3	**Maturing a)** Gonads opaque but developed in volume. Distinct veins. Ovaries have yellow/white eggs in lamellae and can occupy half of the body cavity or more.	**Maturing a)** Gonads opaque but developed in volume. Distinct veins. Testes white or with white spots. Firm consistency.
4	**Maturing b)** Gonads larger in volume Distinct veins. Ovaries yellowish or white, can occupy 2/3 or more of the body cavity depending on the condition of the fish. The eggs can be seen distinctly and feel like grain. The eggs in the front part of the gonad are beginning to become transparent.	**Maturing b)** Gonads larger in volume. Distinct veins. Testes light grey or white, milt thick and slow-flowing.
5	**Maturing c)** Ovaries fill the entire body cavity. Most of the eggs are transparent.	**Maturing c)** Testes are grey or white. The milt runs easily. Gonads are not yet running, however, a light pressure on the abdomen causes the milt to run.
6	**Spawning** Running gonads. A light pressure on the abdomen causes the eggs to run.	**Spawning** Running gonads. A light pressure on the abdomen causes the milt to run.
7	**Spent** Gonads loose, contain remaining eggs.	**Spent** Gonads loose, contain remaining milt.
8	**Resting** Gonads are small. Eggs are not visible. Difficult to distinguish from stages 2/ 3.	**Resting** Gonads are small. Eggs are not visible. Difficult to distinguish from stages 2/ 3.