ICES Living Resources Committee
ICES CM 2004/G:08, Ref. D, H

Report of the Baltic International Fish Survey Working Group (WGBIFS)

29 March – 2 April 2004
Rostock, Germany

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark
Telephone + 45 33 15 42 25 · Telefax +45 33 93 42 15
www.ices.dk · info@ices.dk

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SUMMARY OF THE MEETING OF BALTIC INTERNATIONAL FISH SURVEY WORKING GROUP IN 2004

According to the terms of reference an important aspect of the meeting of the working group was the combination of the results of the acoustic and trawl surveys carried out in the Baltic Sea in summer and autumn 2003 and spring 2004. The resulting indices are used by the Baltic Fisheries Assessment Working Group as fishery independent estimates.

The working group recommended that the acoustic estimates for herring and sprat can be used without any restrictions and that the combined estimates represents the stock size and the distribution pattern of both species.

Furthermore, the results of the trawl surveys in autumn 2003 and spring 2004 represent the stock size and the distribution pattern of the two target species cod and flatfish. The intensive checks of the used standard gears which based on the description in the manuals have shown that the data of the trawl surveys are not significantly influenced by a change quality of the gears.

Besides the discussion of the survey results the future acoustic and trawl surveys in summer and autumn 2004 and the trawl surveys in 2005 were planned, and methodical problems were discussed. It was agreed by the working group that areas with a size 10'N x 20'E should be used for reducing the influence of the heterogeneity of the available hauls in the Tow Database. Furthermore, parameters which influence the quality of the conversion factors between the standard gears and the former used national gears were studied. The presented studies suggest that it is useful the check the quality of the data on the national level. The result will be discussed during the next meeting. Additional intercalibration experiments are necessary for comparing the catchability of the large standard gear TV3#930 with and without rock hopper equipment. These experiments are planned by Denmark. For improving the conversion factors between the small and large version of the standard gear additional experiments are also necessary. Unfortunately, the vessels used during the trawl surveys are not in the position that both types of the standard gear can be used with the necessary quality (large vessel can not handle the small version and small vessels can not handle the large version without restrictions. Therefore, it was agreed that intercalibration experiments between the large and small version of TV3 should be planned in the western part of the Baltic Sea using experiments incorporating two vessels (e.g., “Dana” and “Havfisken” or “Dana” and “Solea”).

First studies were presented to quantify the proportion of cod in the pelagic waters during the trawl surveys. Two reasons are possible for the occurrence of cod in the pelagic waters, the vertical migration of cod and the oxygen deficiency close to the bottom in deeper areas of the Baltic Sea. These observations have shown that the proportion of cod in the pelagic water which is not covered by the demersal trawl is different from year to year and also different in space, and that this proportion can not be ignored. Therefore, it was agreed that Sweden will carry out special experiments during the next trawl surveys and that the available data of the acoustic surveys should be analysed.

1 INTRODUCTION

1.1 Participation

Henrik Degel	Denmark
Peter Ernst (part time)	Germany
Claus-Christian Friess	Germany
Pavel Gasjukov	Russia
Eberhard Götze	Germany
Tomas Gröhsler	Germany
Wlodzimierz Grygiel	Poland
Nils Håkansson	Sweden
Joackim Hjelm	Sweden
Igor Karpoushevski (part time)	Russia
Hildrun Müller	Germany
Rainer Oeberst (Chair)	Germany
Maris Plikshs	Latvia
Tiit Raid	Estonia
Faust Shvetsov	Latria
Ivo Sics	Latvia
Vladimir Severin	Russia
Sarunas Toliusis *(Non-member)*	Lithuania

1.2 Terms of Reference

According to Annual Science Conference Resolution (2G08) in Tallinn last year the Baltic International Fish Survey Working Group [WGBIFS] (Chair: R. Oeberst, Germany) will meet in Rostock, Germany from 29 March – 2 April 2004 to undertake the tasks as specified in (C.Res 2003/2G08):

a) combine and analyse the results of the 2003 acoustic surveys and experiments and report to WGBFAS;
b) update the hydroacoustic databases BAD1 and BAD2 for the years 1991 to 2003;
c) plan and decide on acoustic surveys and experiments to be conducted in 2004 and 2005;
d) discuss the results from BITS surveys made in autumn 2003 and spring 2004;
e) plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2004 and spring 2005;
f) revise the selecting procedures of hauls allocated to the BITS survey, taking into account the heterogeneity of the geographical distribution of the haul available in the Clear Tow database;
g) update and correct the Clear Tow database and allocate the hauls for the Baltic International Trawl Survey (autumn, 2004);
h) continue to study the proposed model for estimating the conversion factors between the new and old survey trawls under inclusion of the new intercalibration experiments;
i) update, if necessary, the Baltic International Trawl Survey manual (BITS);
j) update, if necessary, the Baltic International Acoustic Survey manual (BIAS);
k) agree on a procedure investigating the vertical distribution of fish during the BITS survey in a situation with oxygen deficiency close to the bottom.

WGBIFS will report by 16 April 2004 for the attention of the Living Resources, the Baltic, and the Resource Management Committees.

The main objective of the WGBIFS is to co-ordinate and standardise national research surveys in the Baltic for the benefit of accurate resource assessment of fish stocks. From 1996 to 2001 attention has been put on evaluations of traditional surveys, introduction of survey manuals and considerations of sampling design and standard gears as well as co-ordinated data exchange format.

The results of the different surveys produce VPA independent stock indices which are required by WGBFAS as necessary input data for the stock assessments and are used for advices of the International Baltic Sea Fishery Commission. Linkage to advisory functions in ICES include the quality assurance of basic data for stock assessments and management of Baltic herring, sprat and cod stocks. The quality assurance of the primary data will require achievements towards a fully agreed calibration of processes and internationally agreed standards (C.Res.1999/2:61).

Last year activities were devoted to install international coordinated demersal trawl surveys in spring and autumn. During the two surveys in 2001 the participating institutes used the new standard gears type TV3. Furthermore, the Clear Tow Database was reworked.

The main objective of WGBIFS is to coordinate and standardise national research surveys in the Baltic for the benefit of accurate resource assessment of Baltic fish stocks. From 1996 to 2002 attention has been put on evaluations of traditional surveys, introduction of survey manuals and consideration of sampling design and standard gears as well as coordinated data exchange format. In recent years activities have been devoted to coordinate international coordinated demersal trawl surveys using the new standard gear TV3 and to continue the analyses of the conversion factors between the new and old survey trawls.

The most important future activities are to combine and analyze acoustic survey data for the Baltic Fisheries Assessment Working Group, develop a disaggregated hydroacoustic database, plan and decide on acoustic surveys and experiments to be conducted. The quality assurance of ICES will require achievements towards a fully agreed calibration of processes and internationally agreed standards. [Action Numbers a): 1.2.1, 1.2.2 b): 1.2.2, 1.13.3 c): 1.11 d): 1.2.1, 1.2.2 e): 1.11, f): 1.11, g): 1.11, h): 1.13.4, 1.11 i): 1.13.4 j): 1.13.4 k): 1.13.4, 1.11]

The most important future activities are to combine and analyse acoustic survey data for Baltic Fisheries Assessment Working Group, develop disaggregated hydroacoustic database, plan and decide on acoustic surveys and experiments to be conducted. The quality assurance of ICES will require achievements towards a fully agreed calibration of processes and internationally agreed standards, to establish checking procedures on the data that are submitted into the BITS database and BAD1- and BAD2 databases are one important task for WGBIFS in the future, and to coordinate the international bottom trawl surveys in the Baltic Sea.

1.3 Overview of WGBIFS activities in 1996–2003

The WGBIFS activities was initiated in 1996 to promote co-ordination and standardisation of national research surveys in the Baltic (ICES CM 1995/J:1). The first Working Group meeting (ICES CM 1996/J:1) considered the design of trawl surveys for cod assessment, established a bottom trawl manual and outlined problems in hydroacoustic surveys. The second meeting (ICES CM 1997/J:4) gave advice on intercalibration between research vessels, described sampling protocols of sprat and flounder and evaluated historical data from hydroacoustic estimates on herring. Both meetings dealt with the introduction of modern standard bottom trawls for resource surveys in the Baltic.

Expertise advise on the choice of standard trawls has been provided by two workshops (ICES CM 1997/J:6; 1998/H:1). The third meeting (ICES CM 1998/H:4) adopted the recommendation on standard trawls for Baltic International Fish Surveys. They also made a plan intercalibration programs for the introduction of new standard gears. They also evaluated the continuation of existing survey practice, optimised the sampling procedures for both cod and other target species including a critical inventory of the current coding procedures for fish maturity stages and reviewed the effects of biological sampling and TS conversion formulas on the results of acoustic stock levels and biomass estimates. During the meeting also updated the Manual for Baltic International Acoustic Surveys (BIAS) based on a draft made by the Study Group on Baltic Acoustic Data (SGBAD).

The fourth meeting (ICES CM 1999/H:2) propose detailed protocols on fishing methods, sampling, report formats, etc. for trawl surveys in the Baltic in order to implement a quality assurance to the Baltic International Trawl Survey (BITS). It also preliminary compared the results from concurrent survey activities by the traditional and the new standard trawls and plannedintercalibrationprograms. WGBIFS has established an acoustic database BAD2 (including the information on Elementary Sampling Distance Unit (ESDU and biological sampling), which should replace the existing database BAD1. This process is still going on.

The fifth meeting of WGBIFS (ICES CM 2000/H:2) updated protocols on fishing methods, sampling, report formats, etc. for trawl surveys and both manuals (BITS, BIAS) and data exchange formats for the international acoustic survey database (BAD2). WGBIFS also recommended some routines to be used in the future for demersal trawl survey design.

The sixth meeting of WGBIFS (ICES CM 2001/H:2) analyzed the results ofintercalibrationexperiments between the national gears and the new standard bottom gears TV3#930 and TV3#520 and estimated conversion factors. Furthermore the Clear Tow Database was presented. It is the basis for the international coordinated trawl surveys that started in 2001. The establishment of the CTD was supported by the EU study project ISDBITS (Anon. 2001a). The coordination of the acoustic surveys and the analyses of their results, as well as the update of the manuals (BIAS, Anon. 2001b, BITS Anon. 2001c) were carried out by the working group.

The seventh meeting of WGBIFS (ICES CM 2002/G:05 Ref. H) dealt with the co-ordination of the planed surveys. Furthermore, analyses were presented and discussed which estimate the conversion factors between the national gears and the new standard gears. It was agreed that newintercalibrationexperiments are necessary.

The acoustic and trawl surveys carried out in autumn 2002 and spring 2003 were studied and recommendations were given to the Baltic assessment working group how the indices should be used (ICES CM 2002/G:05 Ref. D, H). Furthermore, the surveys to be conduct in autumn 2003 and spring 2004 were planned. The algorithm for allocating the hauls of trawl surveys was discussed and the Clear Tow Database was updated. The methods for estimating the conversion factors were discussed and new versions of conversion factors were estimated based on the total number of realizedintercalibrationexperiments.

2 COMBINE AND ANALYSE THE RESULTS OF THE 2003 ACOUSTIC SURVEYS AND EXPERIMENTS AND REPORT TO WGBFAS (TOR A)

2.1 Combined results of the Baltic International Acoustic Surveys (BIAS)

In 2003 the following acoustic surveys were conducted during October and November:

Vessel	Country	Area
"ARGOS"	Sweden	27 and parts of 25,28,29S
"ATLANTIDA"	Russia, Latvia	26, 28
"BALTICA"	Poland	24 (part), 25, 26
"SOLEA"	Germany, Denmark	21 (part), 22, 23, 24
"AMAZON"	Estonia	28, 29, 32 (part)

The results from the different cruises are stored in the database BAD1. The cruise reports are presented in Annex 2 using the suggested standard format (ICES CM 2002/G:05 Ref. H, Annex 5)

2.1.1 Overlapping areas

During the international acoustic survey 2003, fourteen rectangles were investigated by more than one vessel. The investigations were carried out within the time interval of some days to some weeks except for the Estonian survey in November. For the further use of these data it was necessary to propose how these data should be used in the estimates for the ICES Subdivisions.

For each rectangle the following data was compared between vessels

- the covered area of the rectangle and
- the number of hauls in the rectangles.

The differences between the species and length composition were being supposed as stochastic variations. If the whole rectangle was investigated by both vessels and the number of hauls was more than one the arithmetic mean of both data sets were used. If the coverage of the rectangles were quite different or the number of hauls were zero for one vessel the handling of the data were discussed. Table 2.1.1.1 presents the results of this analysis. In Tables 2.1.1.2 and 2.1.1.3 you will find the abundance in numbers by rectangle for herring and sprat. Overlapping coverage by two or more vessels is indicated by grey shadow.

2.1.2 Total results

The results of the international acoustic survey 2003 are summarized Tables 2.1.2.1 to 2.1.2.4. The overlapping areas are used as described in Table 2.1.1.1.

Tables 2.1.2.1 and 2.1.2.2 give the abundance estimates for herring and sprat for ICES subdivisions and age groups. The biomass estimates are presented in the Tables 2.1.2.3 and 2.1.2.4 for herring and sprat. These data are also given by ICES subdivisions and age groups.

2.1.3 Recommendation to WGBFAS

The WGBIFS recommends that the data from 2003 can be used in the estimation process of the herring and sprat stocks. When comparing acoustic estimates from different years it seems to be better to use the acoustic estimates as index values in number per NM².

2.2 Results of the 2003 acoustic spring surveys

2.2.1 General

In 2003 following acoustic surveys were conducted during May and June:

Vessel	Country	Area
"WALTHER HERWIG III"	Germany	24, 25, 262 (part)
"ATLANTNIRO"	Russia, Latvia	26, 28 (part)

The results from the different cruises 1999 to 2003 are stored in the database BASS (Baltic acoustic spring survey). Detailed information are presented in the cruise reports (Annex 3) using the standard format (ICES CM 2002/G:5 Ref. H, Annex 5)

2.2.2 Results

The hydroacoustic spring survey was carried out only in part of the sprat main distribution area. Germany covered Subdivisions 24, 25 and the western part of 26. This investigation was related to the project GLOBEC Germany "Trophic interaction between zooplankton and fish influenced by physical processes". The survey in 2003 was the fourth May-Survey in this area since 1999. Latvia and Russia covered mainly there own EEZ in the Subdivisions 26 and 28. This survey was carried out since 2001. The results of the spring acoustic survey in 2003 are shown in Figure 2.2.1.

The sprat abundance in 2003 was characterized by a strong decrease in numbers of individuals and biomass in Subdivision 25 compared to previous years. In 2003 distinct lower numbers than in Subdivisions 26 and 28 were found. A strong inflow of salty, oxygen rich and cold water reached the Bornholm Basin in January 2003. This inflow caused a considerable decrease of temperature in the deep-water parts of the Bornholm Basin. Sprat usually avoids cold-water layers with a temperature below 4°C and was possibly evaded by this inflow water to eastern parts of the total stock distribution area.

The subgroup discussed the possibility of an enlargement of the spring hydroacoustic survey. The main part of the Baltic sprat stock is concentrated in the winter and spring in deeper basins of the Baltic proper. Sprat is spreading during the spawning time in spring and summer over the whole central and southern Baltic. In the main feeding season in summer and early autumn sprat is mainly distributed onshore. Related to this the best time to carry out a hydroacoustic survey on sprat should be May.

There is a need to enlarge the covered area of the hydroacoustic spring survey in order to match with the main distribution area of sprat in the Baltic Sea. The hereby increased information on the distribution pattern of clupeids leads to an increase of the knowledge of the interaction between pelagic species in the Baltic Sea. The WG therefore recommends that the spring hydroacoustic survey should be extended to cover the main distribution area of sprat in the Baltic Sea.

2.3 Experiments related to target strength estimation

In situ target strength measurements were made 2003–10–14 and 2003–10–15 in ICES SD 25 by the Swedish RV "Argos", but results are not yet analysed.

Table 2.1.1.1. Treatment of data from rectangles with overlapping areas October 2003.

ICES SD	ICES rect.	Vessel A	Sa values	Number of hauls	Vessel B (and C)	Sa values	Number of hauls	Suggestion
24	38G4	Solea	W part	2	Baltica	E part	1	Sum of areas
25	39G5	Argos	Whole area	5	Baltica	SE part	0	Argos data
25	40G7	Argos	Whole area	1	Baltica	Small part in S	0	Argos data
26	38G9	Baltica	SW part	1	Atlantida	NE part	2	Sum of areas
26	39G8	Baltica	Whole area	3	Atlantida	Whole area	2	Arithm. mean
26	39G9	Baltica	Small part in W	1	Atlantida	Whole area	2	Atlantida data
26	40G8	Baltica	Whole area	2	Atlantida	Whole area	2	Arithm. mean
28	42G8	Argos	Whole area	1	Atlantida	E part	2	Arithm. mean
28	44G9	Argos	Whole area	1	Atlantida	E part	1	Arithm. mean
28	45G9	Argos	Whole area	2	Atlantida	E part	2	Arithm. mean
28	45H0	Atlantida	Whole area	2	Amazon *	NE part	0	Atlantida data
29	46H0	Argos	Whole area	2	Amazon *	E part	1	Argos data
29	46H1	Argos	W part	1	Amazon *	Whole area	2	Argos data
29	47H1	Argos	Whole area	2	Amazon *	S part	1	Argos data

* The Amazon cruise was conducted 1 month ore more after the Argos and Atlantida cruises and these data do probably not represent the situation in October.

Table 2.1.1.2. Estimated numbers (millions) of herring October 2003 by rectangle.

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	41G1	600.17	233.95	349.55	16.34	0.33					
21	41G2	29.86	21.64	7.80	0.38	0.01	0.03				
21	42G1	2.12	0.79	1.23	0.10						
21	42G2	143.04	0.06	125.55	17.14	0.29					
21 Total		775.19	256.44	484.13	33.96	0.63	0.03				
22	37G0	127.26	111.02	15.92	0.11	0.16		0.05			
22	37G1	371.68	280.47	78.06	6.42	5.04	1.37	0.32			
22	38G0	148.07	142.02	5.76	0.29						
22	38G1	315.66	305.04	10.62							
22	39F9	82.50	82.10	0.40							
22	39G0	16.29	16.09	0.20							
22	39G1	8.84	8.81	0.03							
22	40G0	45.67	45.44	0.23							
22	41G0	1.56	1.44	0.10		0.02					
22 Total		1117.53	992.43	111.32	6.82	5.22	1.37	0.37			
23	40G2	573.17	114.90	55.95	62.35	117.85	152.98	49.32	14.68	3.89	1.25
23	41G2	86.62	81.28	5.34							
23 Total		659.79	196.18	61.29	62.35	117.85	152.98	49.32	14.68	3.89	1.25
24	37G2	75.74	64.46	11.14	0.10	0.04					
24	38G2	758.93	584.16	163.67	6.57	2.85	1.08	0.30	0.30		
24	38G3	1150.70	940.59	86.85	29.86	24.39	39.66	18.09	7.46	1.84	1.96
24	38G4	708.92	454.36	39.06	60.39	22.17	69.86	25.31	31.75	1.85	5.09
24	39G2	220.33	128.51	56.06	10.94	8.79	9.30	4.34	1.50	0.18	0.71
24	39G3	648.77	357.35	163.95	38.84	34.07	31.83	12.21	7.09	1.17	2.26
24	39G4	300.75	157.51	93.65	17.27	13.67	11.82	3.71	2.37	0.45	0.30
24 Total		3864.14	2686.94	614.38	163.97	105.98	163.55	63.96	50.47	5.49	10.32
25	37G5	1523.00	942.17	90.54	133.73	93.14	133.92	49.94	66.47	5.70	7.39
25	38G5	472.00	171.04	41.33	71.38	55.70	70.22	22.90	29.70	4.62	5.10
25	38G6	864.00	71.54	96.50	208.14	145.13	178.92	54.31	76.56	14.87	18.03
25	38G7	145.00	9.34	18.41	35.35	24.16	31.35	8.83	12.85	2.10	2.62
25	39G4	874.27	571.09	97.20	51.25	54.40	86.08	7.93	3.70		2.64
25	39G5	765.43	105.96	137.73	204.94	133.50	117.72	52.94	6.32	6.32	
25	39G6	677.00	50.43	80.27	167.72	110.41	140.23	41.95	60.25	10.89	14.84
25	39G7	740.00	29.66	137.16	153.96	155.15	148.04	41.07	61.06	6.69	7.23

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
25	40G4	330.93	268.03	43.03	5.59	9.45	3.86	0.96			
25	40G5	884.94	295.58	265.78	130.59	91.61	63.64	23.98	11.27	2.48	
25	40G6	871.79	22.14	52.02	121.87	220.75	248.22	114.92	74.65	14.09	3.14
25	40G7	58.85	0.06	1.54	12.13	18.70	18.04	5.94	2.04	0.35	0.06
25	41G6	808.02	23.46	83.93	189.49	273.69	153.00	65.16	10.43	8.86	
25	41G7	145.30		9.80	36.33	51.17	32.04	7.37	5.11	2.93	0.55
25 Total		9160.53	2560.50	1155.25	1522.46	1436.97	1425.27	498.20	420.40	79.89	61.60
26	37G9	48.00	42.21	2.48	1.11	0.72	0.70	0.18	0.37	0.02	0.21
26	38G8	536.00	342.17	49.84	40.30	31.88	34.09	10.48	15.78	1.42	10.04
26	38G9	666.58	119.61	97.96	103.42	51.09	77.84	55.13	76.80	21.48	63.54
26	39G8	1012.53	31.03	133.94	200.86	156.30	218.11	75.56	103.46	32.54	59.54
26	39G9	383.09	9.21	50.36	61.36	52.29	76.86	36.63	51.31	14.85	30.34
26	39H0	67.61	17.96	11.73	8.48	6.42	5.02	5.00	3.40	2.13	7.48
26	40G8	1015.69	4.65	81.63	158.61	194.08	234.44	75.04	130.81	54.63	80.80
26	40G9	437.75	8.80	51.77	48.07	69.55	103.83	41.52	58.37	21.28	34.59
26	40H0	507.79	3.76	49.57	44.59	68.73	71.90	48.46	69.50	64.29	86.93
26	41G8	373.66		16.46	39.21	86.54	97.93	31.76	45.31	14.12	42.33
26	41G9	374.65		52.12	37.36	77.23	84.50	42.67	36.58	24.28	19.61
26	41H0	481.51	39.90	158.19	53.81	93.72	56.08	25.23	15.63	16.81	20.41
26 Total		5904.85	619.30	756.06	797.18	888.53	1061.31	447.66	607.32	267.85	455.83
27	42G6	159.08		12.88	39.00	59.67	36.64	10.27	0.62		
27	42G7	329.73		104.61	90.90	73.69	32.29	16.82	10.45		0.97
27	43G7	915.00	45.02	734.43	51.49	36.00	36.56	11.51			
27	44G7	1395.22	11.48	621.31	331.31	297.23	97.29	16.49	20.12		
27	44G8	4030.63	444.46	910.32	1060.51	931.81	606.90	45.98	30.66		
27	45G7	1416.27	148.71	442.26	334.20	316.37	140.54	25.70	8.49		
27	45G8	421.57	366.62	31.90	9.62	5.39	6.82	0.81	0.40		
27	46G8	89.93	21.88	59.41	5.82	2.52		0.30			
27 Total		8757.44	1038.18	2917.11	1922.83	1722.68	957.04	127.88	70.75		0.97
28	42G8	1171.20	1.51	100.08	180.81	270.39	299.06	155.39	75.97	38.97	49.03
28	42G9	193.29		28.94	49.14	50.06	33.39	12.17	11.08	1.97	6.55
28	42H0	493.54		220.86	76.99	111.03	43.34	14.44	13.76	2.42	10.70
28	43G8	2658.69		312.03	222.88	948.85	748.25	299.30	44.58	82.78	
28	43G9	436.76	0.79	104.74	65.52	97.90	79.82	29.83	35.38	7.76	15.03
28	43H0	761.49		148.46	103.63	229.98	129.32	52.12	47.53	20.67	29.78
28	43H1	2237.13	70.97	155.75	138.99	1015.30	151.26	154.77	129.54	133.66	286.89
28	44G9	321.82	142.04	64.93	20.33	49.95	21.23	8.84	10.70	1.29	2.51
28	44H0	948.17	1.30	224.88	151.33	227.01	162.75	46.64	68.15	23.48	42.63
28	44H1	2004.72	29.47	573.53	111.32	673.44	202.63	100.62	99.04	59.19	155.48
28	45G9	964.77	106.96	361.30	157.02	163.31	123.74	31.92	13.36	4.03	3.13
28	45H0	1083.09	33.30	371.08	175.94	226.19	159.34	73.94	24.83	8.84	9.63
28	45H1	321.39	117.89	95.61	33.03	27.21	24.92	10.73	6.37	1.60	4.02
28 Total		13596.05	504.23	2762.20	1486.93	4090.62	2179.04	990.69	580.29	386.66	615.38
29	46G9	1074.93	92.41	433.22	299.55	132.29	103.94	10.44			3.07
29	46H0	1683.16	100.52	689.90	408.59	343.65	111.68	14.41	9.60	4.81	
29	46H1	1327.00	706.23	589.27	27.00	4.50					
29	46H2	4.34	4.34								
29	47G9	641.60	112.80	185.71	156.48	124.93	32.37	29.31			
29	47H0	2581.35	916.31	1180.74	220.23	185.97	78.08				
29	47H1	4127.66	579.16	2141.83	715.88	463.57	145.92	58.37	22.93		
29	47H2	335.77	74.35	175.69	21.79	32.89	17.28	10.62	1.85	1.31	
29 Total		11775.80	2586.12	5396.36	1849.53	1287.80	489.26	123.15	34.38	6.12	3.07
32	47H3	1395.79	93.63	772.24	240.82	142.70	70.65	42.46	24.58	0.51	8.21
32 Total		1395.79	93.63	772.24	240.82	142.70	70.65	42.46	24.58	0.51	8.21
Grand Total		57007.11	11533.94	15030.34	8086.85	9798.99	6500.50	2343.69	1802.86	750.41	1156.63

Table 2.1.1.3. Estimated numbers (millions) of sprat October 2003 by rectangle.

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	41G1	40.64	6.84	3.58	17.07	11.72	0.76	0.67			
21	41G2	0.14	0.13			0.01					
21	42G1	1.70		0.19	0.72	0.58	0.18	0.03			
21	42G2	2.93	1.28	0.56	0.51	0.54	0.03	0.01			
21 Total		45.41	8.25	4.33	18.30	12.85	0.97	0.71			
22	37G0	708.84	708.84								
22	37G1	560.64	403.93	6.00	3.89	67.67	41.25	19.67	18.23		
22	38G0	1556.57	1523.59	0.94	2.89	20.85	5.01	1.88	1.41		
22	38G1	1140.51	1140.51								
22	39F9	4925.78	4925.78								
22	39G0	598.25	596.85	0.45	0.35	0.40	0.10		0.10		
22	39G1	307.43	307.43								
22	40G0	1380.74	1370.03	1.53		1.53	7.65				
22	41G0	0.18	0.18								
22 Total		11178.94	10977.14	8.92	7.13	90.45	54.01	21.55	19.74		
23	40G2	145.14	45.12	7.08	27.34	33.97	22.39	7.28	0.50	1.46	
23	41G2	1.41	1.21	0.05	0.15						
23 Total		146.55	46.33	7.13	27.49	33.97	22.39	7.28	0.50	1.46	
24	37G2	66.37	50.78	3.95	5.20	3.34	1.77	0.33	0.53	0.47	
24	38G2	409.65	280.57	26.66	48.48	31.66	16.50	2.04	1.28	2.40	0.06
24	38G3	2797.08	1919.95	390.09	281.73	154.20	42.49	1.90	1.62	5.10	
24	38G4	320.55	152.49	93.96	34.59	22.27	6.58	7.06	1.84	1.06	1.38
24	39G2	46.27	45.62	0.65							
24	39G3	356.95	214.24	39.09	53.71	30.97	14.50	1.25	0.96	2.15	0.08
24	39G4	755.41	270.18	146.06	177.93	97.01	47.61	4.16	4.14	7.07	1.25
24 Total		4752.28	2933.83	700.46	601.64	339.45	129.45	16.74	10.37	18.25	2.77
25	37G5	496.00	120.31	115.66	111.79	77.28	36.47	19.99	9.39	5.11	
25	38G5	577.00	246.86	86.30	95.00	65.60	42.23	25.29	10.05	5.67	
25	38G6	1590.00	1050.46	119.76	160.07	115.92	67.44	42.64	19.98	13.73	
25	38G7	235.00	26.41	56.65	60.73	45.11	20.81	12.69	7.53	5.06	
25	39G4	1179.14	84.24	299.01	510.38	110.33	88.44		65.69	4.22	16.84
25	39G5	1193.06	90.60	259.08	428.51	127.55	86.64	45.62	112.05	43.01	
25	39G6	662.00	262.64	69.59	128.31	91.84	50.15	31.35	16.16	11.96	
25	39G7	1632.00	140.14	348.00	460.42	335.20	155.93	93.89	56.43	41.98	
25	40G4	1255.00	920.34	133.78	59.64	36.86	38.93	19.88	33.13		12.43
25	40G5	2149.64	545.35	323.54	524.80	142.56	384.43	36.31	153.15		39.50
25	40G6	833.00	154.46	73.98	174.13	39.89	197.28	39.89	113.67		39.72
25	40G7	404.29	6.35	36.16	105.54	36.27	84.96	41.34	43.37	2.50	47.79
25	41G6	1473.73	124.03	62.75	284.53	509.24	264.10	35.02	166.34	27.72	
25	41G7	1123.62		89.31	300.08	262.28	228.96	110.71	85.49	39.93	6.85
25 Total		14803.48	3772.18	2073.57	3403.94	1995.94	1746.77	554.62	892.44	200.90	163.13
26	37G9	966.00	922.27	33.39	7.95	1.52	0.42	0.22	0.22		
26	38G8	3028.00	791.15	866.22	572.20	286.91	203.45	182.39	80.20	45.47	
26	38G9	8719.42	2785.64	4457.46	1108.62	125.09	150.02	54.66	49.99	14.20	16.34
26	39G8	1680.30	302.44	333.35	376.37	135.95	260.93	127.23	106.71	25.51	23.63
26	39G9	20806.30	13371.14	4615.43	1637.43	27.80	657.96	29.75	379.51	11.11	76.17
26	39H0	7600.51	4712.08	2775.47	58.83		36.03		18.10		
26	40G8	6747.15	141.34	1015.25	2020.15	964.34	1354.98	356.30	670.59	101.42	245.58
26	40G9	15826.80	10679.29	3426.83	611.37	85.44	634.45	19.00	300.22	4.73	65.48
26	40H0	5924.30	3408.47	2034.70	230.10	63.08	141.27	2.68	24.61		19.39
26	41G8	1348.00	21.77	170.75	133.90	105.14	308.10	54.49	268.65	34.14	251.06
26	41G9	7316.00	714.48	2479.26	1357.26	611.14	1023.39	56.16	629.84	134.37	310.10
26	41HO	4870.10	692.16	2384.85	604.31	94.66	358.19	82.74	240.12	66.29	346.78

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
26 Total		84832.88	38542.23	24592.96	8718.48	2501.07	5129.20	965.63	2768.75	437.24	1354.52
27	42G6	316.64	21.11	9.95	58.50	41.92	96.50	7.84	57.30		23.52
27	42G7	1684.01	19.90	72.92	23.87	535.04	496.57	205.53	194.92	31.83	103.42
27	43G7	4566.16		547.15	991.96	1102.16	991.95	145.65	169.27	94.48	523.54
27	44G7	6068.08	774.60	1013.92	925.53	319.27	752.00	708.94	1025.17		548.66
27	44G8	6491.92	3126.42	570.13	29.43	1206.43	1029.86	154.48	253.79	84.60	36.79
27	45G7	6469.14	1473.14	866.02	1099.71	796.63	1405.38	207.82	163.91	144.62	311.93
27	45G8	7564.99	5020.46	1291.20	300.45	421.82	120.65	62.80	169.33	1.61	176.67
27	46G8	1658.89	91.48	442.77	171.99	265.61	194.56	6.10	147.59	31.71	307.08
27 Total		34819.83	10527.11	4814.06	3601.44	4688.88	5087.46	1499.16	2181.27	388.84	2031.61
28	42G8	1705.32	13.66	269.69	199.79	276.63	393.99	103.21	260.22	30.53	157.60
28	42G9	6349.70	297.19	1888.96	1011.90	536.91	1311.49	84.57	716.06	105.45	397.17
28	42H0	14007.83	1320.73	6619.94	2376.52	907.15	1310.14	58.35	803.87	40.66	570.47
28	43G8	2471.50	10.98	109.85	241.66	732.66	254.84	682.13	208.70	21.97	208.70
28	43G9	7278.84	4994.19	734.61	313.87	132.61	604.17	34.99	219.14	53.58	191.67
28	43H0	11523.03	2568.54	5465.34	1184.79	429.96	887.46	38.04	508.94	94.73	345.24
28	43H1	2374.64	1401.04	854.87	45.51	7.92	41.56	5.94	5.94		11.87
28	44G9	3432.97	1940.63	498.23	273.37	145.66	272.11	62.72	96.39	15.90	127.95
28	44H0	4576.25	495.08	2608.29	576.00	117.12	396.73	37.17	187.75	37.17	120.95
28	44H1	14303.64	3175.90	7666.96	1018.40	229.89	754.98		724.40		733.11
28	45G9	5298.89	646.87	1415.17	791.53	576.57	873.11	229.42	357.36	88.23	320.64
28	45H0	6791.39	1588.61	1942.56	910.90	448.31	907.38	56.67	475.58	56.67	404.70
28	45H1	4736.17	4467.52	198.45	34.50	14.75	6.25	6.25			8.44
28 Total		84850.17	22920.95	30272.93	8978.74	4556.12	8014.23	1399.46	4564.35	544.88	3598.51
29	46G9	4066.32	603.34	468.29	424.40	1028.65	719.29	95.99	119.49	161.50	445.39
29	46H0	3172.28	347.89	481.57	436.37	742.64	261.14	219.10	111.45	135.37	436.73
29	46H1	26237.69	17440.26	6698.60	416.38	674.34	171.97	282.88	169.02	121.54	262.70
29	46H2	855.03	845.89	9.14							
29	47G9	3787.81	157.59	1442.67	866.74	478.94	348.75	184.00	140.18	7.84	161.09
29	47H0	7710.14	857.97	2178.96	1147.80	1827.32	111.01	588.08	588.08		410.92
29	47H1	20211.36	8021.89	9819.44	87.31	644.31	156.32	602.20	335.23	240.06	304.60
29	47H2	5639.50	4460.96	676.55	177.59	195.09		13.38	37.20	49.90	28.83
29 Total		71680.12	32735.79	21775.22	3556.57	5591.30	1768.47	1985.63	1500.66	716.22	2050.26
32	47H3	3472.77	1598.17	1260.23	249.95	112.68	68.38	144.91	10.19	17.60	10.68
32 Total		3472.77	1598.17	1260.23	249.95	112.68	68.38	144.91	10.19	17.60	10.68
Grand Total		310582.43	124061.97	85509.81	29163.67	19922.71	22021.33	6595.69	11948.27	2325.39	9211.48

Table 2.1.2.1. Estimated numbers (millions) of herring October 2003.

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	775.19	256.44	484.13	33.96	0.63	0.03				
22	1117.53	992.43	111.32	6.82	5.22	1.37	0.37			
23	659.79	196.18	61.29	62.35	117.85	152.98	49.32	14.68	3.89	1.25
24	3864.14	2686.94	614.38	163.97	105.98	163.55	63.96	50.47	5.49	10.32
25	9160.53	2560.50	1155.25	1522.46	1436.97	1425.27	498.20	420.40	79.89	61.60
26	5904.85	619.30	756.06	797.18	888.53	1061.31	447.66	607.32	267.85	455.83
27	8757.44	1038.18	2917.11	1922.83	1722.68	957.04	127.88	70.75		0.97
28	13596.05	504.23	2762.20	1486.93	4090.62	2179.04	990.69	580.29	386.66	615.38
29	11775.80	2586.12	5396.36	1849.53	1287.80	489.26	123.15	34.38	6.12	3.07
32	1395.79	93.63	772.24	240.82	142.70	70.65	42.46	24.58	0.51	8.21
Total	57007.11	11533.94	15030.34	8086.85	9798.99	6500.50	2343.69	1802.86	750.41	1156.63

Table 2.1.2.2. Estimated numbers (millions) of sprat October 2003.

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	45.41	8.25	4.33	18.30	12.85	0.97	0.71			
22	11178.94	10977.14	8.92	7.13	90.45	54.01	21.55	19.74		
23	146.55	46.33	7.13	27.49	33.97	22.39	7.28	0.50	1.46	
24	4752.28	2933.83	700.46	601.64	339.45	129.45	16.74	10.37	18.25	2.77
25	14803.48	3772.18	2073.57	3403.94	1995.94	1746.77	554.62	892.44	200.90	163.13
26	84832.88	38542.23	24592.96	8718.48	2501.07	5129.20	965.63	2768.75	437.24	1354.52
27	34819.83	10527.11	4814.06	3601.44	4688.88	5087.46	1499.16	2181.27	388.84	2031.61
28	84850.17	22920.95	30272.93	8978.74	4556.12	8014.23	1399.46	4564.35	544.88	3598.51
29	71680.12	32735.79	21775.22	3556.57	5591.30	1768.47	1985.63	1500.66	716.22	2050.26
32	3472.77	1598.17	1260.23	249.95	112.68	68.38	144.91	10.19	17.60	10.68
Total	310582.43	124061.97	85509.81	29163.67	19922.71	22021.33	6595.69	11948.27	2325.39	9211.48

Table 2.1.2.3 Estimated biomass (in tonnes) of herring October 2003.

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	26608	3568	20935	2060	42	5				
22	13986	9281	3765	419	374	121	28			
23	58141	2094	2281	6266	13296	22526	8041	2667	748	221
24	89975	22438	18875	9760	9220	16107	7764	5441	712	1426
25	334070	28649	35627	70866	61925	72876	25790	21044	5603	4136
26	223171	4721	18053	29117	32907	46000	21492	32585	14955	27683
27	158560	3855	39533	39193	43706	27258	4538	2489		62
28	361693	1552	37628	31369	111620	72700	35492	22746	14715	38574
29	117965	5821	44286	26973	25034	11222	3351	1068	197	92
32	14157	262	5595	2808	2445	1342	936	572	15	181
Total	1398326	82242	226578	218830	300568	270157	107433	88611	36945	72375

Table 2.1.2.4 Estimated biomass (in tonnes) of sprat October 2003.

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	804.1	47.7	78.0	377.3	261.9	23.4	15.6			
22	39760.4	35729.4	160.3	111.6	1690.1	1102.3	494.8	459.6		
23	2464.3	210.1	122.7	555.1	783.0	553.0	184.3	14.6	40.9	
24	36525.0	11688.5	8266.4	8620.3	4961.6	2099.6	315.8	200.5	318.2	56.9
25	161863.7	16719.1	21745.7	48408.2	28284.2	27619.0	8676.8	14460.3	3028.6	2894.7
26	554827.8	118838.6	192291.3	89034.2	28927.4	58801.8	12511.4	33164.7	5574.2	16929.0
27	302207.8	29087.9	35600.8	38135.1	53844.5	59281.0	17631.4	28049.4	4568.9	25794.8
28	597594.5	54603.5	206423.9	86224.4	49309.5	87425.0	16014.1	50245.1	6156.9	39764.5
29	415464.7	64546.3	106789.0	31860.3	57134.0	19591.3	20871.9	15806.3	7405.3	22872.1
32	18499.3	4707.0	7684.8	2387.1	1146.5	683.5	1491.3	87.9	193.6	117.7
Total	2130011.5	336178.1	579162.8	305713.5	226342.7	257180.1	78207.4	142488.3	27286.5	108429.7

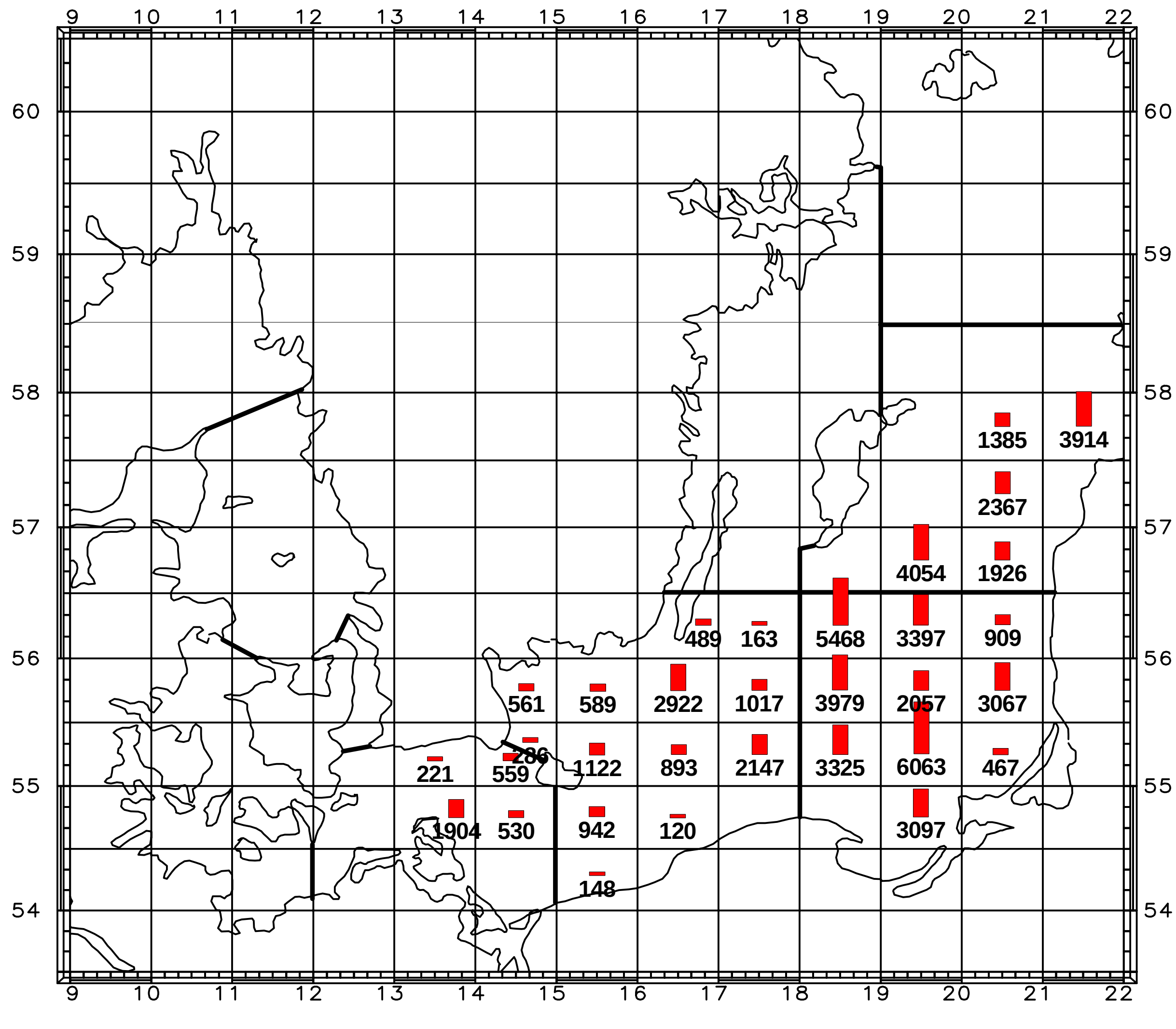

Figure 2.2.1 Distribution of sprat (millions) by rectangle in May/June 2003.

3 UPDATE OF THE HYDROACOUSTIC DATABASE BAD1 AND BAD2 FOR THE YEARS 1991 TO 2003 (TOR B)

3.1 Status of the BAD1 database

The old version of the database was extended by the results of the year 2003. Changes at the past data were not accomplished. The BAD1 revision 7 contains now the results of the hydroacoustic surveys from the years 1991 to 2003. It is to be stated that the coverage has decreased again. After the very extensive investigations in the years 1999 and 2000 the research intensity was constantly reduced. Particularly it is to be noticed that the ICES Subdivisions 30 to 32 were not more covered. In the other areas of the Baltic we can state an ordinary degree of coverage over the last years. The participation and covering of all vessels by subdivision in the surveys 1991 to 2003 is depicted in Table 3.1.1.

The analysis of the BAD1 data was continued and a working document is given in Annex 1 “Mean weights of herring and sprat in the database BAD1 for the years 1991 to 2002”. The WG recommends that further investigations of the temporal and spatial variability of the results of hydroacoustic surveys should be continued.

3.2 Status of the BAD2 database

The poor status of the BAD2 database is consistent over the last years. Only data from Latvia, Sweden and Germany are loaded into the database but also these sets are not complete. Reasons are the unclear definitions of some data fields and problems in uploading the data. These claims were addressed to the database holder (DIFRES) year by year but no solutions are implemented. It seems to be better to shift the database to the ICES to get more assistance in completing this work. The WG recommends that the ICES should examine the possibilities to hold the BAD2 data within the frame of an existing database system (DATRAS).

3.3 Collection of hydrographical data

The spatial and temporal changes of the results of hydroacoustic surveys can be better understood, if hydrographical data are included. To use hydrographical data in the analyses two conditions must be fulfilled:

- A sufficiently complete quantity of hydrographical data must be simply available.
- Suitable Tools for the treatment and representation of the data must be found.

Hydrographical data are collected as a standard during the most acoustic and other surveys. These data records fit time near the acoustically observed spatial distributions of the examined fish concentrations. Therefore these data for the intended purpose are particularly suitable. It is therefore recommended to form an experimental set from the 2003 data. The available hydrographical data from all participants should be delivered up to the 1 July 2004 to E. Götze.

The date should have the following format:

Cruise	Station	Date	UTC	Lon[°E]	Lat[°N]	Bot.Depth
	number	mon/day/yr	hh:mm	decimal	decimal	meter
SOL514	34	10/12/2003	18:44	12.34211	54.9965	25.45

Depth	Temperature	Salinity	(Oxygen)	……other
meter	°C	PSU	ml/l	
12.17	8.675	12.065	6.78	

For each depth step a similar row must be added. The depth steps can be chosen in the range of 10cm to 1m to give a sufficient precision in the vertical distribution and on the other hand to hold the file dimension small. The oxygen and other parameters are optional but it would be valuable to have at least some oxygen determinations in discrete depths (e.g., Winkler method).

For the storage, processing and representation of these data the “Ocean Data View” software seems to be optimal. This program can be loaded free of charge (only for scientific use) from the page http://www.awi-bremerhaven.de/GEO/ODV.

During the next meeting of the WGBIFS the further steps in this process will be decided.

Table 3.1.1. Participation and number of ICES squares covered.

YEAR	SHIP	21	22	23	24	25	26	27	28	29	30	31	32	total
1991	Baltijas Petnieks					10	11	6	10	7				44
	Solea		9	2	7	9								27
1991 total			9	2	7	19	11	6	10	7				71
1992	Argos			2	1	8	4	8	2	5				30
	Monokristal					2	11		9					22
	Solea		10		7	1								18
1992 total			10	2	8	11	15	8	11	5				70
1993	Baltijas Petnieks						5		7					12
	Solea	6	9	2	8									25
1993 total		6	9	2	8		5		7					37
1994	Argos					9	1	9	3	6				28
	Baltica					8	8							16
	Monokristal						8		11					19
	Solea	6	10	2	7	2								27
1994 total		6	10	2	7	19	17	9	14	6				90
1995	Baltica				1	12	7	5						25
	Monokristal						10		12					22
	Solea	3	9	2	7									21
1995 total		3	9	2	8	12	17	5	12					68
1996	Argos				2	10	2	9	2	5				30
	Atlantniro						9		11					20
	Baltica				1	12	7							20
	Solea	4	9	2	7									22
1996 total		4	9	2	10	22	18	9	13	5				92
1997	Atlantniro						9		12					21
	Baltica					6	7							13
	Solea	4	11	2	7									24
1997 total		4	11	2	7	6	16		12					58
1998	Argos				1	9	1	9	5	4				29
	Atlantniro						10		9					19
	Baltica				2	8	7							17
	Solea	4	8	2	7									21
1998 total		4	8	2	10	17	18	9	14	4				86
1999	Argos					8	1	8	2	7				26
	Atlantida						8		12					20
	Baltica				2	8	7							17
	Julanta									6	16	8	9	39
	Solea	6	8	2	7									23
1999 total		6	8	2	9	16	16	8	14	13	16	8	9	125
2000	Argos					8	1	8	3	5				25
	Atlantida						10		12					22
	Baltica				2	8	7							17
	Julanta									5	25		11	41
	Solea	4	10	2	7									23
2000 total		4	10	2	9	16	18	8	15	10	25		11	128
2001	Argos			2	4	8	1	9	3	5				32
	Atlantida						10		12					22
	Baltica				1	8	7							16
	Solea	7	10		7									24
	Solveig								2	5			1	8
2001 total		7	10	2	12	16	18	9	17	10			1	102
2002	Argos				2	8		7	1	6				24
	Atlantniro						10		12					22
	Baltica				1	8	7							16
	Solea		9	2	7									18
	Solveig								2	5				7
	Zane						2		5					7
2002 total			9	2	10	16	19	7	20	11				94
2003	Amazon								2	5			1	8
	Argos					8		8	4	6				26
	Atlantida						10		11					21
	Baltika				1	8	6							15
	Solea	4	9	2	7									22
2003 total		4	9	2	8	16	16	8	17	11			1	92
total		48	121	26	113	186	204	86	176	82	41	8	22	1113

4 PLAN AND DECIDE ON ACOUSTIC SURVEYS AND EXPERIMENTS TO BE CONDUCTED IN 2004 AND 2005 (TOR C)

In 2004 all the Baltic Sea countries (except Finland) intend to take part in acoustic surveys and experiments. The list of participating research vessels and periods are given in the following table:

Vessel	*Country*	*Area of investigation (ICES Subdivisions)*	*Preliminary period of investigations*
ARGOS	Sweden	25 (part), 27, 28 (part), 29S	27 September – 15 October (19 days)
CHARTER	Estonia	28(part), 29S, 32 (part)	October (10 days)
BALTICA	Poland	24(part), 25, 26	2 – 26.October. (19 days)
ATLANTIDA	Russia	26, 28	May-June (17 days)
		26, 28	October (17 days)
CHARTER	Latvia	26 (part), 28	May (10 days);
		26 (part), 28	October (10 days)
DARIUS	Lithuania	26 (Lithuanian EEZ)	May (2 days)
			October (2–3 days)
WALTHER HERWIG III	Germany	24, 25, 26 (part)	06–25 May (20 days)
SOLEA	Germany	21, 22, 23, 24	29 September- 19 October (21 days)

The WGBIFS recommends that the data from all acoustic spring surveys should be stored in a database (e.g., format like BAD1).

The preliminary plan for acoustic surveys and experiments in 2005 for majority of institutes is presented in the text table below. However, the final outline of plans will be available after verification of budgets.

Vessel	*Country*	*Area of investigation (ICES Subdivisions)*	*Preliminary period of investigations*
ARGOS	Sweden	Info not available	Info not available
CHARTER	Estonia	28(part), 29S, 32 (part)	October (10 days)
BALTICA	Poland	24(part), 25, 26	Sept. – Oct. (21 days)
ATLANTIDA	Russia	26, 28	October (17 days)
CHARTER	Latvia	26 (part), 28	May (10 days)
		26 (part), 28	October (10 days)
DARIUS	Lithuania	26 (Lithuanian EEZ)	May (2 days)
			October (2–3 days)
WALTHER HERWIG III	Germany	24, 25, 26 (part)	09–27 May (19 days)
SOLEA	Germany	21, 22, 23, 24	October (20 days)

The main results of both BIAS and the Acoustic Spring Surveys should be summarized and reported in standard report format (ICES CM 2002/G:05 Ref. H, Annex 5) and in BAD1 format to the acoustic surveys co-coordinator (Niklas Larson, niklas.larson@fiskeriverket.se) and the BAD1 keeper **(**Eberhard Götze, eberhard.goetze@ifh.bfa-fisch.de) not later than one month before the ICES WGBIFS meeting of the next year. These results are intended for the information of the ICES Assessment Working Groups.

5 DISCUSS THE RESULTS FROM BITS SURVEYS MADE IN AUTUMN 2003 AND SPRING 2004 (TOR D)

5.1 Reports of the trawl surveys conducted in autumn 2003 and spring 2004

The following table summarizes the period of investigations and the number of realized stations by subdivision and nation:

BITS in autumn 2003

Country	Period	21	22	23	24	25	26	27	28
Denmark-Havfisken	21/10 – 6/11/03	26	13	3					
Denmark - Dana	6/11 – 18/11/03					26			
Germany	18/11 – 5/12/03		11		48				
Latvia	21/11 – 27/11/03						11		14
Poland	12/11 – 21/11/03					12	13		
Russia	3/11 – 7/11/03						14		
Sweden	17/11 – 28/11/03					17	9	7	5

BITS in spring 2004

Country	Period	21	22	23	24	25	26	27	28
Denmark-Havfisken		26	12	3					
Denmark - Dana	11/3 – 24/3/04			3					
Germany	19/2 – 5/3/04		10		49				
Latvia	11/3 – 18/3/04						8		23
Poland	16/2 – 2/3/04					24	11		
Russia	17/2 – 12/3/04						47		2
Sweden	1/3– 19/3/04					25	6	10	10

In some cases selected positions were not carried out dependent on oxygen deficiency close to the bottom. In this cases zero catches were added to the BITS database. Furthermore, selected positions were replaced by other positions when it was not possible to carry out the hauls due to wrecks, extreme rocky bottom or other reasons. All these information were used for improving the Tow Database. In the following text details descriptions of the cruises are presented.

Denmark

The cruise was terminated before time because of a serious accident and the crew demanded that the ship return to the harbour. It was not possible to continue the cruise after the accident.

In the period from 6–18/11–2009 RV “DANA” took 26 hauls using large TW3 standard trawl (TV3#930) and 3 comparable hauls using TV3 rockhopper gear. All hauls were taken in Subdivision 25. Only insignificant damage to the trawl was experienced. 30 CTD stations were made in connection with the trawl stations. Due to the accident and the denied access to Russian zone no stations were made in subdivision 26. All hauls were worked up following normal BITS routine. Echograms were obtained on all fished stations.

In the period from 11–24/3–2004 RV “DANA” took 32 hauls using the standard TV3 trawl and 9 hauls using the TV3 rockhopper trawl. The last 7 hauls were made using TV3 rockhopper because no more standard VT3 trawl was available. 2 standard trawl stations were invalid due to total damage of the gear. All stations from subdivision 25.

In the period from 21/10–6/11 2003 RV “Havfisken” took 42 hauls in total. 26 in Subdivision 21, 13 in SD 22 and 3 in SD23. In all cases the small TW3 standard trawl (TV3#520) was used. All hauls were worked up following normal BITS routine.

In the period from x - x - 2004 RV "Havfisken" took 41 hauls in Subdivision 21–22 and 23 using the small TV3 standard trawl (TV3#520). All hauls were worked up following normal BITS routine.

Poland

In the periods of 12–21 November 2003 and 16 February – 02 March 2004 RV "Baltica" conducted the BITS surveys. In autumn 2003 - 30 and in winter 2004 - 35 randomly selected hauls were assigned to Poland, of which RV "Baltica" realized 29 and 42 hauls, respectively.

All hauls were made with standard rigging large bottom trawl TV-3#930. The duration of the hauls was 0.5 hours.

In autumn 2003 four and in winter 2004 six of these hauls were double for calibration experiment (type 3) purposes. The ICES Subdivisions 25 and 26 (within the Polish EEZ) were covered by hauls.

At each hauling position a CTD profile was taken. In total 29 and 42 hydrological samples, respectively in autumn 2003 and winter 2004, were obtained.

In autumn 2003 difficulties related to fishing gear were not anticipated. Due to low oxygen content near bottom – especially in the Gdansk Basin - for 50% of primary selected hauls trawling positions were modified. The other 50% of hauls were made at positions selected from the Clear Tow Database in four depth stratums. In winter 2004 two hauls are not fully representative due to partly damage of the net. On one trawling position in the Gdansk Deep - primary selected from CTD – new underwater construction is placed.

Germany

The autumn 2003 as well as the spring 2004 BITS surveys were carried out by the RV "Solea" using TV3/520 survey trawl. The duration of the hauls was 0.5 hours. The hauls were done at positions selected from the Clear Tow Database in one stratum in Subdivision 22 and 4 strata in Subdivision 24. At each hauling position a CTD profile was taken. The hauls incorporated in the BITS database can be used without any restrictions. Numbers of valid hauls are given in the following table.

Date	SD 22	SD 24
18 Nov. to 05 Dec. 2003	11	48
19 Feb. to 05 March 2004	10	49

In SD 24 only 19 cod where larger than 38 cm which is, the minimum landing size and only 1 cod was found larger 50 cm during the November survey. The amount of undersized cod (smaller than 38 cm) was 95 % in the Arkona Sea. The main length range was 11 to 22 cm, this length range belongs almost exclusively to Age 0. The mean length was 29.6 cm and the mean weight 100 g. In SD 22 only 22 cod per station were larger than 38 cm in the same time. The amount of undersized cod in numbers was 94.6%, the Age 0 cod (year-class 2003), dominated here. The mean length was 28.7 cm and the mean weight 102 g.

In contrast to the low densities of cod in the area covered by the BITS in November large cod were captured by recreational fishery in the shallow waters with higher densities as observed in the years before. The might be the a large body of warm water displacing the adult from the Arkona Basin into shallower and thus more rapidly cooling areas of near shore waters. This observations suggest that it is necessary to incorporate the areas of very shallow waters in the BITS since incomplete coverage of the living space of the target species my result in serious errors of the stock indices.

Sweden

Autumn 2003

The expedition was conducted on board of RV "Argos" between 17–28 November 2003. Sweden was assigned 35 randomly selected hauls of which Argos trawled 18 and 9 (replacement hauls) but also helped RV "Dana" with four hauls, which this year resulted in that Argos realised 31 valid hauls and covered area SD 25, 26, 27 and 28 during the period. The replacement hauls were added, because the clear tow database is still incomplete. There was oxygen deficiency at seven trawl stations and hence they were not trawled. The data can be used in the assessment.

Subdivisions 25

In SD 25 a total of nine assigned stations were trawled. An addition, eight replacement hauls were realised in the same depth strata.

Subdivision 26

In SD 26 we were allocated five hauls (due to that Dana had some problems) by which we realized four hauls. The last position was not trawled due to rough bottom.

Subdivision 27

In SD 27 a total of 7 stations were trawled while three among the assigned station had oxygen content below 2 ml/l and therefore it was not sampled. One calibration haul (type 3) was also made. An addition one replacement haul was realised in the same depth strata.

Subdivision 28

In SD 28 a total of five stations were trawled while two were not trawled due to low oxygen. One calibration haul (type 3) was also made.

Spring 2004

The expedition was conducted on board of RV “Argos” between 1–19 March, 2004. Sweden was assigned 45 randomly selected hauls of which Argos realized 29. 13 replacement hauls were realised because the clear tow database is still incomplete. In addition, 11 calibration, eight complementary and two hauls with a new pelagic trawl were realized during this expedition. Overall, Argos made 66 hauls and covered parts of SD 25, 26, 27 and 28 this year. The data can be used in the assessment.

Subdivision 25

A total of 25 stations were assigned to RV “Argos” in this area but 7 were not trawled but replaced with 7 replacements hauls in the same depth strata. Three hauls were invalid due to a damaged trawl. 11 intercalibrations hauls (type 3) and 2 hauls with a new pelagic trawl were also realized.

Subdivion 26

RV “Argos” was assigned a total of six stations, which were all realized.

Subdivion 27

A total of 10 stations were assigned to RV “Argos” in this area, and all were realized

Subdivisions 28.

A total of 10 stations were assigned to RV “Argos” in this area, and all were realized

Latvia

LATFRI conducted demersal surveys both in autumn 2003 and in spring 2004. Both surveys were carried out using standard TV3 520 trawl onboard of Latvian commercial vessels (CLV). The chartered vessels for both surveys were of similar type – MRTK (medium size trawlers).

In autumn survey all hauls were performed in Latvian EEZ and Lithuania EEZ, in Subdivisions 28 and Northern part of Subdivision 26.

However, certain deviation from the planned survey design occurred. The main reasons for that are following:

1) Some allocated stations are located outside Latvian and Lithuania EEZ. However the vessels could work in Latvian and Lithuania waters only. Therefore the stations, outside the Latvian and Lithuania EEZ were replaced with others from the trawl list. The survey coordinator was informed about these replacements.
2) In Lithuania EEZ 8 new tracks were made. In track database was not information about suitable tracks for small TV 3 trawl in Lithuania EEZ. Information about these tracks is added to the clear tow database.

From this year spring survey (25 tracks in SD 28, Latvian EEZ) selected stations, 3 tracks were outside Latvian waters. We planed to perform 25 trawling and selected additional tracks from the database for Latvian waters. Totally we have made 23 tracks. The last one was unlucky and we seriously damaged our trawl.

After this we stop our spring survey to keep the second trawl to be ready for the autumn survey.

Additionally, we also have made 8 tracks in Lithuania waters (SD 26). We started our survey with the work in this area. The same tracks we made in our November survey. The biological information from these additional tracks will be included in BITS database.

Dates and realized haul number during Latvian surveys in 2002 and 2003:

Survey	Vessel	Date	Subdivision	Number of hauls
Autumn 2003	CLV “PRIEDAINE”	21–27 November	26	11
			28	14
Spring 2004	CLV “HOGLANDE”	11–18 March	26	8
			28	23

Russia

Russia carried out BITS surveys in November 2003 using RV “ATLANTIDA” and in spring 2004 using RV “ATLATNIRO”. In November 2003 14 hauls were carried out in the Russian zone and spring 2004 49 hauls were realized in SD 26 and 28 (only 2 trawls). Complete descriptions of the results of both the surveys are presented in Annex 3.

Recommendation to WG BFAS:

The working group stated that the data of the BITS surveys in autumn 2003 and spring 2004 can be used without restrictions.

5.2 Presentation of BITS results

The very first draft for the presentation of survey data was demonstrated for the WG. This includes mapping facilities by statistical rectangle by species of the following variables: number of stations, number of age readings and length measurements. Furthermore, a table (and map) giving the CPUE (number and weight) by rectangle/sub-div for a specified length range or age is prepared but still not implemented. This report will be ready before the WGBFAS.

The WG suggested the following list of additional reports and analysis which will be implemented before the WBBIFS meeting in 2005.

- Map of realized stations for both survey periods
- Density distribution based on rectangles for 0, 1, 2+ of November surveys
- Density distribution based on rectangles for 1, 2, 3+ of spring surveys

Inclusion of hydrographical information in the presentation of survey results.

It is general accepted that the geographical distribution and the abundance of cod is influenced by the hydrographical conditions in the Baltic Sea. Until now it has not been standard to include hydrographical information in the presentation of survey results. Never the less, it is an expressed wish from the scientific community to have easy access to CTD information in combination with survey CPUE values in order to be able to perform combined analysis. Therefore, the possibility to include such information in the presentation of the survey results as standard has been discussed during meeting. Most countries collect CTD information in combination with the BITS but not everybody submits the data to ICES' hydrographic database. Presentation of the survey results are now an integrated part of FishFrame and it seems most convenient to investigate the possibility to upload the CTD information to FishFrame and then design new reports, which take advance of the combination of CTD data and survey results.

A CTD station establishes the profile of salinities, temperatures and oxygen contents in the whole water column. Normally the data is of relative large quantity because of the high resolution (to a high of 10 cm of depth). As a starting point, it is not necessary to keep such a high resolution and it was agreed to maintain a resolution of 1 m of depth. An exchange format for the CTD data based on the file structure known from other file exchange formats in FishFrame was suggested. The suggestion is showed in Table 5.2.1.

Table 5.2.1. Comma separated exchange format for record type HY.

Order	Name	Type	M/O	Range	Comments
1	Record type	A	M	HY	Fixes value
2	Country	A	M	See Appendix 1	ICES alpha code for countries
3	Year	N	M	1900 to 3000	
4	Journey	N	M	1 to 9999	National coding system
5	Station no	N	M	1 to 998	Sequential numbering by journey
6	month	N	M	1 to 12	
7	Day	N	M	1 to 28/29/30/31	
8	Probes instillation	N	M	1, 2	1= in cone, 2= in trawl
9	Depth	N	M	1 to 150	In meters
10	Salinity	N	M	1 to 100	In per mille (0/00)
11	Temperature	N	M	-3 to 20	In Celsius degrees
12	Oxygen	N	O	0 to 20	In ml/l

At the Working Group meeting a software capable of presenting hydrographical data together with catch data was presented. The software is named *"Ocean Data View"* and can be found on the site: http://www.awi-bremerhaven.de/GEO/ODV/

The program is developed by R. Schlitzer and Alfred Wegener, Institute for Polar and Marine Research, Bremerhaven, Germany. The software is in open source and can be downloaded by anyone and used for free for scientific studies. The program has an potential use as a tool for analyzing the combination of Survey data and CTD data. It was suggested that a report was made in FishFrame which is able to the input data file to *Ocean Data View.*

The WGBIFS recommends that FishFrame is developed in order to store the CTD data recorded in connection with BITS and make the data available for analysis.

6 PLAN AND DECIDE ON TRAWLS SURVEYS AND EXPERIMENTS TO BE CONDUCTED IN AUTUMN 2004 AND SPRING 2005 (TOR E)

6.1 Joint international surveys

Latvia and Poland intends to conduct a common BITS surveys on RV "Baltica" in autumn 2005 and 2006 in the south-eastern part of the Baltic Sea.

6.2 Trawl surveys in autumn 2004

During discussion between BIFSWG members, it was agreed that in autumn 2004 the total number of hauls will be the same as it was planned for 2003 with small modifications. Russian vessel intends to conduct 15 hauls in SD 26 (Russian EEZ). Sweden will carry out special investigation related to the combination of acoustic and trawl surveys during one week if areas exist with oxygen deficiency. In this case Sweden will carry out 15 trawl stations instead of the 30 planned stations.

6.3 Trawl surveys in spring and autumn 2005

The allocation of stations to the Subdivisions and depth layers based on the method described in Annex 3 “Method used for planning the Baltic international trawl survey”. The BITS Database (version from March 2004) was used to estimate the running means of distribution patter of both cod stocks by depth layer and ICES Subdivision. The conversion factors (version from 2003) were used for the period 2001 - 2003 and the estimates of fishing power were used for 1999 and 2000.

In spring and autumn 2005, the haul allocation scheme by country (vessels) and depth stratums will be modified according to updated results of the spatial distribution of cod in 2004. Representatives of particular countries expressed a preliminary opinion about research vessels activities in BITS surveys in 2005. The Danish vessel “Dana”, the German RV “Solea” and the Latvian chartered vessel will operating on the Baltic Sea with the same effort as in previous years. The Swedish RV “Argos” intends to conduct the same number of hauls as in 2004. The Polish RV “Baltica” will increase the number of hauls in spring and autumn surveys by five hauls. Estonia will perform 10 hauls in autumn 2005 in the ICES Subdivision 28. The Lithuanian RV “Darius” intends to conduct about 10 hauls in spring as well in autumn in the ICES Subdivision 26.

Tables 6.3.1 and 6.3.2 present the basic data for splitting up the planned total number of hauls by ICES Subdivision and by depth layers. The running means of the BITS indices of age group 1+ of cod from 1999 to 2003 were used. For the period from 2001 to 2003 the conversion factors presented in the WGBIFS 2003 report were used. For the period 1999 and 2000 the estimates of fishing power were used. The available total number of planned stations by countries is given in Table 6.3.3 for the spring and the autumn survey in 2005.

The total number of available stations was used in the combination with the results of Tables 6.3.1 and 6.3.2 to allocate the number of stations by ICES Subdivision and depth layer for the different surveys. Tables 6.3.4 and 6.3.5 present the allocation of the hauls by ICES Subdivision and depth layer for the spring survey in 2005. Furthermore, the number of hauls that the different countries have to be carried out in the different Subdivisions is given. Tables 6.3.6 and 6.3.7 show the corresponding data for the survey in autumn 2005.

Table 6.3.1. Basic data for allocating the hauls of the survey by the ICES Subdivision.

ICES Subdiv.	Total area of the depth layer 10–120 m [nm²]	Proportion of the SD (weight=0.6) [%]	Running mean of the BITS indices of age groups 1+ (1999–2003)	Proportion of the index values (weight=0.4) [%]	Proportion of the stations [%]	Special decisions (additional stations)
22	3673	39	236	41	40	
23	0	0	0	0	0	3
24	5724	61	333	59	60	
Total	9397	100	569	100	100	
25	13762	43	386	51	46	
26	9879	31	284	38	34	
27	0	0	0	0	0	10
28	8516	26	81	11	20	
Total	32156	100	751	100	100	

Table 6.3.2. Basic data for allocating the hauls according to the depth layer for the survey by the ICES Subdivision.

ICES Sub-div.	Depth layer [m]	Total area of the depth layer [nm²]	Proportion of the depth layer (0.6) [%]	Running mean of the BITS indices of age group 1+ (1999 – 2003)	Proportion of the depth layer (0.4) [%]	Proportion of the depth layer [%]
24	10 - 39	4174	73	224	12	48
	40 - 59	1550	27	763	39	32
	60 - 79	29	0.50	955	49	20
	Total	5724	100	1942	100	100
25	10 - 39	4532	37	38	2	23
	40 - 59	3254	26	751	45	34
	60 - 79	3037	25	600	36	29
	80 -	1461	12	291	17	14
	Total	12284	100	1680	100	100
26	10 - 39	2379	23	12	1	14
	40 - 59	1519	15	155	14	15
	60 - 79	1911	19	451	41	28
	80 - 100	2872	28	292	26	27
	100 - 120	1504	15	198	18	16
	Total	10185	101	1108	100	100
27	10 - 39	1642	31			18
	40 - 59	1101	21			12
	60 - 79	996	19	24	7	14
	80 -	1596	30	317	93	55
	Total	5335	100	341	100	100
28	10 - 39	2589	39	14	4	25
	40 - 59	1598	24	21	7	17
	60 - 79	1101	16	33	10	14
	80 - 100	1389	21	250	79	44
	Total	6677	100	318	100	100

Table 6.3.3. Total number of the stations planned for the BITS in spring and autumn 2005.

Vessel	Country	Number of planned stations in spring 2005	Number of planned stations in autumn 2005
Solea	Germany	60	57
Havfisken	Denmark	15	15
Total 22 + 24		**75**	**72**
Dana	Denmark	50	50
Commercial vessel	Estonia		10
	Finland		
Chartered vessel	Latvia	25	25
Baltica	Poland	40	35
Atlantniro	Russia	44	15
Argos	Sweden	45	30
Total 25 - 28		**204**	**165**

Table 6.3.4. Allocation of the planned stations by country and the ICES Subdivision in spring 2005.

		ICES Subdivision						
Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		45	5		
Estonia	**0**							
Finland	**0**							
Germany	**60**	17		43				
Latvia	**25**							25
Poland	**40**				24	16		
Russia	**44**					44		
Sweden	**45**				21		10	14
Total	**279**	29	3	43	90	65	10	39

Table 6.3.5. Allocation of the planned stations by ICES Subdivision and depth layer in spring 2005.

ICES Sub-div. Depth layer [m]	22	23	24	25	26	27	28
10 – 39	29	3	21	21	9	3	10
40 – 59			13	30	10	2	7
60 – 79			9	26	18	2	5
80 – 100				13	18	3	17
100 – 120					10		
Total	29	3	43	90	65	10	39

Table 6.3.6. Allocation of the planned stations by country and ICES Subdivision in autumn 2005.

Subdivision Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		33	17		
Estonia	**10**							10
Finland								
Germany	**57**	16		41				
Latvia	**25**					4		21
Poland	**35**				24	11		
Russia	**15**					15		
Sweden	**30**				15	5	10	
Total	**237**	28	3	41	72	52	10	31

Table 6.3.7. Allocation of the planned stations by ICES Subdivision and depth layer in autumn 2005.

ICES Subdiv. Depth layer [m]	22	23	24	25	26	27	28
10 – 39	28	3	20	17	8	3	8
40 – 59			13	24	8	2	5
60 – 79			8	21	16	2	4
80 – 100				10	15	3	14
100 – 120					5		
Total	28	3	41	72	52	10	31

7 REVISE THE SELECTING PROCEDURES OF HAULS ALLOCATED TO THE BITS SURVEY, TAKING INTO ACCOUNT THE HETEROGENEITY AND GEOGRAPHICAL DISTRIBUTION OF THE HAUL AVAILABLE IN THE CLEAT TOW DATABASE (TOR F)

Based on the method for estimating the optimal unit size presented during the last meeting (ICES 2002) and the proposed method was again evaluated. The working group stated that the method is a suitable to for solving the problems of heterogeneity of the hauls which are available in the Clear Tow Database. The analyses have shown again that the use of a unit with 10’N x 20’E as it was proposed during the last meeting is the best compromise if it is taken into account that the same unit size should be used for selecting hauls in all depth layers of all Subdivisions.

The group agreed that the unit size of 10’N x 20’N should be used in the future.

8 UPDATE AND CORRECT THE TOW DATABASE AND ALLOCATE THE HAULS FOR THE BALTIC INTERNATIONAL SURVEY (AUTUMN 2004) (TOR G)

8.1 Reworking of the Tow Database

The feedback from the surveys carried out in 2002 and 2003 was used to improve the quality of the Tow Database, including correction of depth and/or positions, deleting of hauls where gears were damaged and adding new hauls in “white areas”.

The allocation of stations to different countries is a problem especially, in SD 25, 26 and 28 because the territorial waters must be taken into account. Therefore, the column “TV” was included to characterize the used gear and to add information which country was successfully used this station. The following notations were used:

D TV3#930 – Denmark
E TV3#520 – Estonia
G TV3#520 - Germany
L TV3#520 – Latvia
P TV3#930 - Poland
R TV3#930 – Russia
S TV3#930 – Sweden

The advantage of this extension in the data base is that these data support the assignment of the selected hauls to the different nations. For example, if a haul with TV = R is selected for BITS it is known that Russia already used this haul position successfully. Consequently, this haul will be assigned to Russia.

According to the recommendation made during the meeting in 2003, long distance hauls were split up in separate parts with a distance of 2.5 nm. This procedure resulted in some additional necessary changes of the database.

Two different numbers were used in the past, and before the hauls were split up. The first version of haul numbers that were used did not include the ICES SD, and the newer version with the format 2jxxx; where 2j represents the Subdivision and xxx represents the new number of the haul within the SD. The splitting up of long distance hauls produced new hauls. However, all parts have the same old and new number to assure the relation to the source hauls and that the sequence of the different parts of the haul is not lost.

Therefore, the new haul number was extended and resulted in the following structure:

Haul number: 2jxxx.yy

with

2j represents the subdivision,
xxx represents the haul number and
yy represents the number of the separated part.
Two digits are necessary because of the longest hauls were separated in more than 10 parts.

The consequences of the splitting up of the long distance hauls are:

- the number of hauls dramatically increased, especially in SD 24, and 25,
- the distance of subsequent parts of single haul is very small in the most cases,
- the separated parts of haul have the first position in the same unit of 5'N x 10'E in many cases (unique increase of hauls by unit) and
- some separated part of the haul have the first position in a unit where already hauls exist

The following table summarizes the number of available hauls.

Subdivision	SD22	SD24	SD25	SD26	SD28
Number of available hauls before the splitting was carried out	100	337	277	140	90
Number of hauls after the splitting	214	614	598	142	95
maximum number of parts of a single haul	17	12	12	2	2

During the meeting of WGBIFS in 2003 it was discussed how to improve the Tow Database and how to allocate hauls in future surveys. It was stressed that a reduction of the hauls is necessary in areas where the number of hauls is extremely high. Furthermore, proposal regarding the optimal unit size for allocating hauls of planned surveys was discussed. It was agreed that for the surveys in autumn 2003 and spring 2004, the unit size of 10'N x 20'E should be used when allocating the hauls (see report of 2003). However, it was also pointed out that further discussions are necessary during the next year and that a change of the defined unit size of 10'N x 20'E should be possible.

Taken this into the account, the Tow Database was modified after agreement by the working group by correspondence between the meetings in 2003 and 2004.

The reduction of the number of hauls based on a unit size of 5'N x 10'E. These smaller areas was used so that the reduction of available hauls was not to strong and allow a later decrease of the unit size for the allocation of hauls.

Deleting of parts of split up hauls:

- All subsequent parts of a split up haul (2jxx.02, 2jxx.03,..) were deleted if they had their first position in the same unit and if the new split up haul had not been used successfully
- All subsequent parts of a split up haul (2jxx.02, 2jxx.03,..) were deleted when they had the first position in a unit where already hauls exists with 2jxx.01 – first part of haul

Further reduction of the total number of hauls:

- Hauls were deleted when more than 3 hauls have the first position in the same unit of 5'N x 10'E or if the distance between the hauls was small. In this case those hauls were preferred that were already used, successfully.

8.2 Actual version of Tow Database CTV_2004V1.XLS used for planning the BITS in November 2004 and spring 2005

The actual version of the Tow Database is based on the feedback submitted until 26.3.2004. The presented table below summaries the available hauls by subdivision. Besides the total number of hauls, the number and proportion of hauls that were not be used during the last surveys. These data show that experience exist for more than 60 % of the available hauls in most subdivisions. Furthermore, the maximum number of hauls by unit size of 5'N x 10'E and 10'N x 20'E are presented. These data show that the maximum number of hauls is two for unit size of 5'N x 10'E and four hauls for unit size of 10'N x 20'E. In these cases only one haul is located in each of the four subunits of 5'N x 10'E.

The following table summarizes the result of this working step.

SD	Total number of hauls	Hauls without experience		Maximum number of hauls per unit	
		in number	in %	5'N x 10'E	10'N x 20'E
22	111	69	62	2	2
24	114	29	33	2	3
25	218	92	41	1	4
26	134	38	28	2	4
27					
28	74	17	23	2	3

The available hauls are presented in Figure 8.1 (SD 22 and 24) and Figure 8.2 (SD 25 – 28). The figures show "white areas" where additional hauls are necessary. Especially, the depth layer from 10 to 20 meters is covered by a very low number of available hauls. Since additional feedback is expected due to the late finish of one BITS survey in spring 2004 the updating of the Tow Database will be finalized in the middle of April, and the new version of the Tow Database will be submitted to all countries.

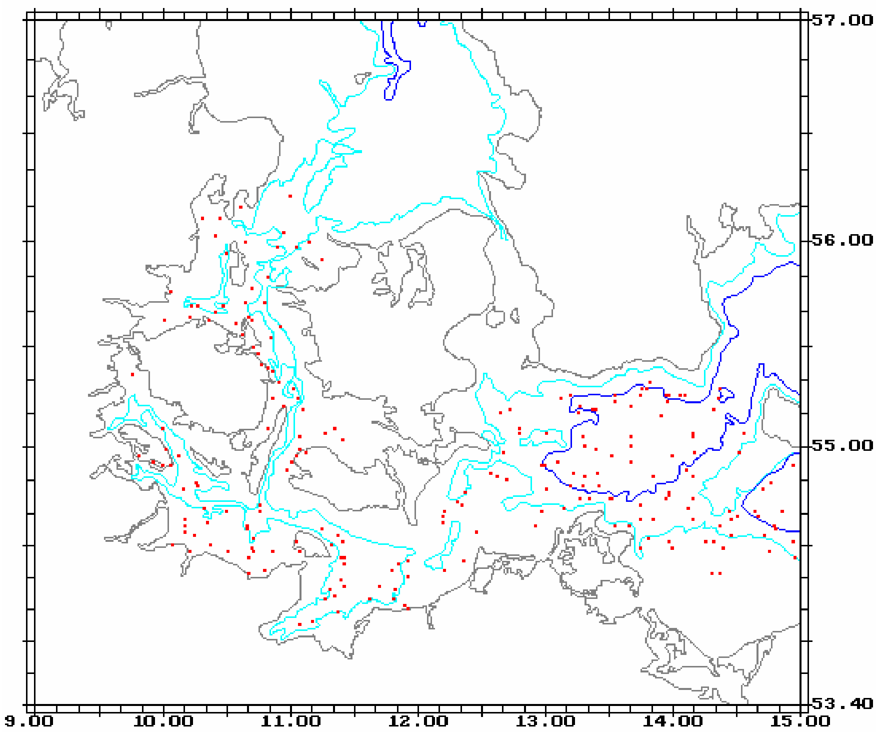

Figure 8.1 Available hauls in Subdivision 22 and 24.

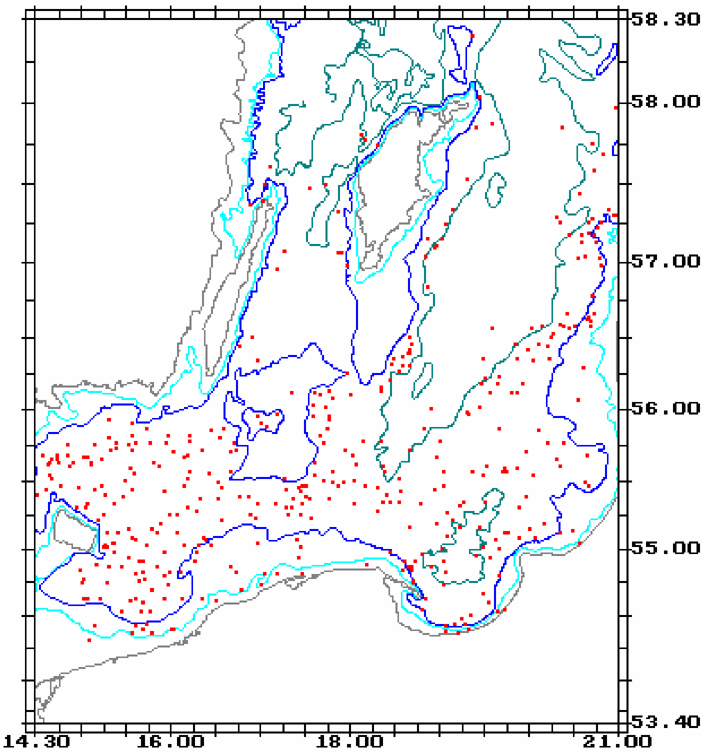

Figure 8.2 Available hauls in Subdivision 25 to 28.

8.3 Feedback from BITS

The feedback from the BITS surveys is the most important factor for improving the Tow database. An updated Tow database is essential to reduce the probability of damage gears, the use of hauls in the wrong depth layer and a optimal assignment of the hauls to the different nations. However, it is necessary that the feedback is available as soon as possible because of the period between the surveys is very short and due to the problems with the vessels permission which are necessary to work within the 12 nm zones of other nations. It is also important that the feedback has standard structure and the standard structure should be used by all nations involved in the BITS.Furthermore, a set of codes (see table below) for separating the different cases of realization of hauls was defined.

Code		Case
a		The position and the mean depth are suitable. Small changes of the positions are possible due to weather condition,...
b	1	The position is suitable, depth must be corrected
b	2	Depth is ok, position must be corrected (reason)
c		The position is not suitable and it should be deleted (reason)
d		New haul for the database

The following data of all realized stations of BITS should be submitted to Germany.

- New version of haul number of Tow Database
- Subdivision
- Start position (latitude, longitude)
- Mean depth
- Depth range
- TV3 version 1 – TV3#520, 2 – TV3#930
- Used ground rope 1 – standard ground rope, 2 – rock hopper ground rope
- Code of the haul
- Reason for deleting the haul

Position of new hauls should be submitted using the standard structure of the Tow Database.

Recommendations:

The described changes of the database were discussed during the working group meeting and it was agreed that:

- The feedback from the realized surveys should be submitted to Germany using the proposed standard format not later than 20 December (autumn survey) and immediately after the spring survey.
- It is not allowed to use the rock hopper ground rope in the following areas:
  - Southern part of SD24
  - SD25
  - South western part of SD26
- The standard ground rope must be used when the station was successfully carried out during earlier surveys by standard ground rope (see the columns TV3 and ground rope in the TD).
- Additional hauls should be submitted to Germany as soon as possible. Especially, hauls in the "white areas" are necessary to cover the total distribution area of the target species. It was proposed that time should be allocated during surveys to find new hauls in the "white areas".

8.4 Allocation of the hauls for the Baltic International Trawl Survey (autumn 2004)

The selection of hauls for the trawl survey in autumn 2004 will be carried out after the finalization of updating of the Tow Database. Then the selected stations will be submitted to the countries.

9 CONTINUE TO STUDY THE PROPOSED MODEL FOR ESTIMATING THE CONVERSOION FACTORS BETWEEN THE NEW AND OLD SURVEY TRAWLS UNDER INCLUSION OF THE NEWINTERCALIBRATIONEXPERIMENTS (TOR H)

In the intercessional period there was a short discussion on the necessity to continue the studies related to the model for estimating the conversion factors between the new and old survey trawls. Some members asserted that the decision depends on the fact that the new experiments would be carried out. Some other members continue the investigations of the property of the obtained estimates of conversion factors.

Sweden and Poland carried out additional Type 3intercalibrationexperiments during the last two surveys for improving the quality of the conversion factors. The summary of the observations are presented in the next table.

Country	Gear	Type of experiment	Number of paired trawls
Sweden	TV3#930	3	11
Poland	TV3#930	3	12

The Working Group recommended that these observations should be added to the database and update of the conversion factors should be carried out.

Some studies were presented during the meeting which investigate the factors that influence the quality of the conversion factors.

Assuming that the speed of the vessel depends on the weather condition the distance between the start and end points of the hauls was estimated. Data of following intercalibration experiments carried out by Germany were used for the analyses:

- Type 1 and 2 between the standard gear type TV3#520 and the German gear type HG 20/25 and between TV3#930 and TV3#520
- Type 3 experiments with TV3#520.

The table presents the total number of intercalibration experiments, the range of the absolute and relative difference of the trawled distances of the paired hauls.

Intercalibration experiment	Number of intercalibration experiments	Range of difference between the distances of paired stations in nm	
		absolute	relative
TV3#520 – HG 20/25	32	-0.63 to 0.68	-51% to 31%
TV3#930 – TV3#520	18	-0.84 to 0.14	-154% to 9%
TV3#520 – TV3#520	9	-0.52 to 0.26	-43% to 13%

The data show that large differences of the covered track lines occurred. These large differences between the paired hauls can significantly influence the used CPUE values of catch per half hour.

The start and end positions of the paired stations were used for calculating the distances between start and end pointes as well as the middle pointes of the paired stations. These estimates were compared with the expected mean door spread of the small and large new standard gear. The mean door spread of the gear type TV3#520 is about 55 m and of the gear type TV3#930 is about 110 m. The results are summarized in the following table.

Intercalibration experiment	Number of intercalibration experiments	Number of experiments with a distance larger than the mean expected door spread		
		First or end position	First and end position	Middle position
TV3#520 – HG 20/25	32	29	14	25
TV3#930 – TV3#520	18	14	7	10
TV3#520 – TV3#520	9	4	4	4

The results illustrates that in many cases of the intercalibration experiments the areas covered by the first and second haul of the paired stations significantly differed. That means that the disturbance effect of the first hauls related to the second haul of the paired station was also very different during the intercalibration experiments

The results suggest that estimates of the distance between the start and end position of both the hauls of the intercalibration experiments should be carried out for assessing the possible effects of the realisation of the experiments concerning the conversion factors.

For the estimation of the conversion factors presented during the meeting in 2003 all paired hauls were used where the CPUE values of the total cod catch was larger than 20 cod independently of the catch in the used 5 cm length intervals. For the estimation of the conversion factors based on the model presented by Oeberst *et al.* (2002) those CPUE values of 5 cm length intervals were used where at least more than 3 cod were captured by each haul of the paired stations. For evaluating the effects of different limits for the CPUE values the parameter

Bi = CPUE(gear1) / [CPUE(gear1) + CPUE(gear2)]

of the paired station was used (Lewy *et al.* in press), Nielsen *et al.* 2002, ICES, 2003).

The following limits were used:

a) CPUE values of 5 cm intervals of each hauls were larger than 0
b) CPUE values of 5 cm intervals of each hauls were larger than 3
c) CPUE values of 5 cm intervals of each hauls were larger than 10.

The requirement c) exclude the intercalibration experiments with very low catches which can be significantly influenced by stochastic factors as haul duration, speed, weather condition, etc. The studies have shown that the number of usable data sets decreased in some cases, dramatically, when the limit was changed from version a) to c) (TV3#930 – Granton, TV3#930 – GOV). The mean estimates of Bi did not change significantly in the most cases. If the different limits were used for estimating the conversion factors based on the model presented by Oeberst *et al.* (2002) in some cases the conversion factors significantly changed (TV3#930 – Granton, TV3#930 – GOV).

The estimates of fishing power, FP, (Sparholt and Tomkiewicz 2000) can be used for estimating independent conversion factors for the different intercalibration experiments.

Based on the equations 3 and 2 (Oeberst and Grygiel 2002, 2004, ICES 2002) values can be estimated that are comparable to the fishing power

$$F_{p2}(\text{national gear}) = 1 / CF(\text{TV3\#930, national gear}) / CF(\text{TV3\#930, GOV}) \quad (3)$$

$$C_f(\text{TV3\#930, national gear}) = C_f(\text{TV3\#930, TV3\#520}) \times C_f(\text{TV3\#520, national gear}) \quad (2)$$

The following table presents the fishing power based on the Sparholt and Tomkiewicz (2000), the models presented by ICES (2003) and by Oeberst *et al.* (2002).

Intercalibration experiment	FP	Nielsen *et al.*	Oeberst *et al.*
TV3#930 – Granton	0.57	6.28	0.24
TV3#930 – P 20/25	0.34	3.55	0.79
TV3#930 – GOV	1	1	1
TV3#520 – HG 20/25	0.87	1.35	0.82
TV3#520 – LBT	0.44	0.49	0.39

As it can be expected the different estimates of GOV are equal. For the intercalibration experiments between TV3#930 and Granton as well as P 20/25 all three estimates are different. For the experiment between TV3#520 and HG 20/25 the estimates of FP and Oeberst *et al.* correspond and for the experiments between TV3#520 and LBT all three estimates are close together. A further aspect is that the estimates by Oeberst *et al.* for TV3#930 – P 20/25 and TV3#520 – HG 20/25 are comparable as it can be expected due to the comparable construction of both the gear types (Oeberst and Grygiel 2002, 2004, ICES 2002).

It was discussed during the meeting whether additional intercalibration experiments are necessary. The group pointed out that the importance of the conversion factors concerning their use for tuning procedures by the stock assessment will decrease based on the increasing time series of surveys carried out with the new standard gears. Therefore, it is agreed that additional intercalibration experiments of Type 3 are not necessary on national level. However, it was also pointed out that additional experiments are necessary between the large version of the new standard gear TV3#930 with and without rock hopper equipment. Therefore, Denmark plans special intercalibration experiments during the next surveys for comparing the catchability of the gear TV3#930 with and without rock hopper equipment.

Furthermore, additional experiments are necessary between the two versions of the new standard gear TV3#930 and TV3#520. Since research vessel does not exist that can handle both versions without any restrictions it was agreed that intercalibration experiments between the large and small version of TV3 should be planned in the western part of the Baltic Sea using experiments incorporating two vessels (e.g., Dana and Havisken or Dana and Solea)

The Working group recommends that:

- The countries should undertake certain effort to investigate the parameters which influence the quality of the estimates of conversion factors.
- Additional intercalibration experiments of type 3 on national level are not necessary due to the decreasing importance of the conversion factors related to the stock assessment.
- Comparisons of conversion factors based on 5 cm length intervals and the total length range should be carried and presented during the next meeting.

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10 UPDATE, IF NECESSARY, THE BALTIC INTERNATIONAL TRAWL SURVEY MANUAL (BITS) (TOR I)

10.1 Update of the BITS manual

The BITS manual was discussed during the meeting, and it was agreed that no changes are necessary. Therefore the Version April 2002 (Addendum to ICES CM 2002/G:05) is still valid.

10.2 Check of the new standard gears

In 2003 WGBIFS recommended that all countries should check the measurements of the standard gears (Appendices XIII and XIV, ICES 2002). Germany, Latvia and Sweden carried out the check. The results are given in Tables 10.2.1 to 10.2.3. For Denmark it was not necessary to carry out the check because the old standard gear has to be replaced by new ones several times.

The measured distances and mesh size do not significantly differ from the values given in the manual. These observations suggest that CPUE values presented in the BITS database are not significantly influenced by changes of the gear parameters.

WGBIFS recommended that the other countries should check their gears according to the parameters listed in the tables below up to the next WG BIFS.

Table 10.2.1. Results of the German gear check.

Type of fishing gear	TV3#520
Nation	Germany
Date of measurements	21.10.2003
Name of operators	Rehme, Mieske, Oeberst
Number of realized hauls	360
Comments concerning the use	Lower panel destroyed, small cuts in the side panels

Manual TV3#520 page 10 - Parameter	Measured distance	Mesh size
Section 1 - 1B1	8.20	122
Section 1 - 1A1	7.99	196
Section 1 - 1A2	7.85	198
Section 1 - 1B2	8.23	120
Section 1 – 1C1	8.11	119
Section 1 – 1C2	8.01	119
Section 2 – 2B1	2.02	81
Section 2 - 2A	2.05	117
Section 2 – 2B2	2.03	81
Section 2 – 2C1	2.03	81
Section 2 – 2C2	2.05	81
Section 3 – 3B1	1.94	82
Section 3 – 3A	1.88	80
Section 3 – 3B2	1.88	81
Section 3 – 3C	1.83	80
Section 4 – 4B1	7.89	80.5
Section 4 – 4A	7.97	80.5
Section 4 – 4B2	7.92	80.5
Section 4 – 4C	8.06	79.5
Section 5 – 5B1	7.94 (Section 5 + 6)	80.5
Section 5 – 5A	7.96 (Section 5 + 6)	80.5
Section 5 – 5B2	7.92 (Section 5 + 6)	80.5
Section 5 – 5C	7.94 (Section 5 + 6)	79.5
Section 6 – 6B1		80.5
Section 6 – 6A		80.5
Section 6 – 6B2		80.5
Section 6 – 6C		79.5
Section 7		39.4
Section 8		18

Manual TV3#520 page 11 – Parameter	Measured distance	
Head line extension Port.	3.00	
Head line wing section Port.	12.58	
Head line bossom section	2.77	
Head line wing section Stbd.	12.73	
Head line extension Stbd.	2.94	
Fishing line extension Port.	0.86	
Fishing line wing section Port.	14.50	
Fishing line bossom section	2.71	
Fishing line wing section Stbd.	14.56	
Fishing line extension Stbd.	0.87	
Lower wing line Port.	3.67	
Lower wing line Stbd.	3.7	
Upper wing line Port.	3.67	
Upper wing line Stbd.	3.8	

Table 10.2.2. Results of the Latvian gear checks.

	Gear 1	Gear 2
Type of fishing gear	TV3 # 520	TV3 # 520
Nation	Latvia	Latvia
Date of measurements	2004. March – (measured after the survey)	2004. March – (measured after the survey)
Name of operators	Fishery company “GRIFS”	Fishery company “GRIFS”
Number of realized hauls	2	2
Comments concerning the use		

	Gear 1		Gear 2	
Manual TV3#520 page 10 - Parameter	Measured distance	Mesh size	Measured distance	Mesh size
Section 1 - 1B1	8.22	120	8.24	120.3
Section 1 - 1A1	8.10	200	8.10	200
Section 1 - 1A2	8.10	200	8.10	200
Section 1 - 1B2	8.22	120	8.23	120.2
Section 1 – 1C1	8.30	120.2	8.31	120.4
Section 1 – 1C2	8.29	120.1	8.32	120.5
Section 2 – 2B1	2.04	80	2.04	80
Section 2 - 2A	2.04	120	2.04	120
Section 2 – 2B2	2.04	80	2.04	80
Section 2 – 2C1	2.13	80.3	2.13	80.3
Section 2 – 2C2	2.12	80	2.12	80
Section 3 – 3B1	1.96	80	1.96	80
Section 3 – 3A	1.96	80	1.96	80
Section 3 – 3B2	1.96	80	1.96	80
Section 3 – 3C	2.13	80.3	2.14	80.7
Section 4 – 4B1	7.94	80.2	7.94	80.2
Section 4 – 4A	7.92	80	7.92	80
Section 4 – 4B2	7.93	80.1	7.95	80.3
Section 4 – 4C	8.05	80.5	8.06	80.6
Section 5 – 5B1	3.97	80.2	3.98	80.4
Section 5 – 5A	3.96	80	3.96	80
Section 5 – 5B2	3.98	80.4	3.99	80.6
Section 5 – 5C	4.03	80.6	4.04	80.8
Section 6 – 6B1	3.93	80.2	3.94	80.4

	Gear 1		Gear 2	
Manual TV3#520 page 10 - Parameter	Measured distance	Mesh size	Measured distance	Mesh size
Section 6 – 6A	3.92	80	3.93	80.2
Section 6 – 6B2	3.93	80.2	3.94	80.4
Section 6 – 6C	3.99	80.6	4.00	80.8
Section 7		40		40
Section 8		20		20

	Gear 1	Gear 2
Manual TV3#520 page 11 – Parameter	Measured distance	Measured distance
Head line extension Port.	3.0	3.01
Head line wing section Port.	12.69	12.70
Head line bossom section	2.8	2.8
Head line wing section Stbd.	12.69	12.7
Head line extension Stbd.	3.0	3.01
Fishing line extension Port.	0.81	0.8
Fishing line wing section Port.	14.44	14.45
Fishing line bossom section	2.9	2.9
Fishing line wing section Stbd.	14.43	14.44
Fishing line extension Stbd.	0.8	0.81
Lower wing line Port.	3.73	3.74
Lower wing line Stbd.	3.73	3.73
Upper wing line Port.	3.83	3.84
Upper wing line Stbd.	3.83	3.83

	Gear 1		Gear 2	
Manual TV3#520 page 12 – Parameter	Port	Stbd	Port	Stbd
Backstrop	8.0	8.0	8.0	8.0
Sweep	75.05	75.08	75.05	75.08
Chain sweep	2.1	2.1	2.1	2.1
Lower bridle	9.14	9.13	9.12	9.13
Lower extension	3.14	3.14	3.14	3.15
Chain for adjustment of upper bridle	0.15	0.15	0.15	0.15
Upper bridle	9.11	9.12	9.12	9.13
Headline extension	3.0	3.0	3.0	3.01
Floats			11 * 200	
Chain for adjustment of foot rope				

Table 10.2.3. Results of the Swedish gear checks.

	Gear 1	Gear 2
Type of fishing gear	TV3 # 930	TV3 # 930
Nation	Sweden	Sweden
Date of measurements	February 2004	February 2004
Name of operators	DFS-Fiskebäck	DFS-Fiskebäck
Number of realized hauls		2
Comments concerning the use		

	Gear 1		Gear 2	
Manual TV3#930 page 11 - Parameter	Measured distance	Bar length	Measured distance	Bar length
Section 1 – 1B1	22.22	100	22.22	100
Section 1 – 1A1	22.22	100	22.22	100
Section 1 – 1A2	22.30	100	22.27	100
Section 1 – 1B2	22.30	100	22.27	100
Section 1 – 1C1	22.22	60	22.22	60
Section 1 – 1C2	22.30	60	22.27	60
Section 2 – 2B1	2.97	80	2.93	80
Section 2 - 2A	2.85	80	2.86	80
Section 2 – 2B2	2.98	80	2.95	80
Section 2 – 2C1	2.96	60	2.95	60
Section 2 – 2C2	2.95	60	2.95	60
Section 3 – 3B1	2.94	60	2.95	60
Section 3 – 3A	2.89	60	2.83	60
Section 3 – 3B2	2.92	60	2.90	60
Section 3 – 3C	2.95	60	2.94	60
Section 4 – 4B1	7.91	40	7.88	40
Section 4 – 4A	7.83	40	7.79	40
Section 4 – 4B2	7.95	40	7.89	40
Section 4 – 4C	7.93	40	8.00	40
Section 5 – 5B1	5.90	30	5.86	30
Section 5 – 5A	5.90	30	5.82	30
Section 5 – 5B2	5.92	30	5.87	30
Section 5 – 5C	5.94	30	5.89	30
Section 6 – 6B1	11.99	20	11.71	20
Section 6 – 6A	11.91	20	11.71	20
Section 6 – 6B2	11.95	20	11.70	20
Section 6 – 6C	12.07	20	11.73	20
Section 7				
Section 8				

11 UPDATE, IF NECESSARY, THE BALTIC INTERNATIONAL ACOUSTIC SURVEY MANUAL (BIAS) (TOR J)

Since two years the BIAS manual is used without any greater change and with success. Up to now we have no serious reasons to change the methods from the manual in basic parts.

In June an ICES Workshop on Survey Design and Data Analysis [WKSAD] in Aberdeen will be held. During this workshop the general methods of fish surveys also of acoustic surveys will be discussed. It seems to be possible that some new ideas can influence the methodology described in the manual and provide solutions to problems pointed out in previous WGBIFS meetings. The WG therefore recommends that we should address our problems to this workshop and revise the manual in the light of the findings at the next meeting of the WGBIFS.

12 AGREE ON A PROCEDURE INVESTIGATING THE VERTICAL DISTRIBUTION OF FISH DURING THE BITS SURVEY IN A SITUATION WITH OXYGEN DEFICIENCY CLOSE TO BOTTOM (TOR K)

In certain years, the distribution of cod in specific areas in the Baltic Sea is influenced by a pronounced lack of oxygen near the bottom. It is generally accepted that cod may avoid oxygen content below 1, 5–2 ml/l. This has been verified several years at different depth strata, and areas. Two behavioural responses are possible related to low oxygen content in the water close bottom: horizontal or vertical migration. A significant amount of fish biomass has been observed by in the water column by acoustic people for some time. By interpreting the echograms, it is likely to assume that part of the biomass observed in the water column is cod (Figure 12.1). That cod are abundant in the pelagic under poor oxygen conditions at the bottom is supported by the practice by the fishermen, who do have significant catches of cod using mid water trawls in areas where poor oxygen conditions near the bottom. There are no scientific reports that suggest that cod migrate horizontal at a large extent except that in same areas fishermen trawl closer to the shore when poor oxygen conditions at the bottom have been observed.

The variation in migratory pattern is probably strongly related to season and the magnitude is probably area dependent. In general, it is assumed that during feeding period cod is distributed above the halocline but during the pre-spawning or spawning period – below the halocline. It can thus be hypothesized that when insufficient oxygen conditions occur on depths below the halocline during pre-spawning and spawning period, cod may need to migrate to a larger extent compared to that during feeding period. However quantitative analyses on the vertical and horizontal distribution of cod in different basins have not been performed.

At present very oxygen content are interpreted as so-called zero hauls after initially verification in each stratum, which suggest that a fictive catch of zero cod is included in the database (but see the manual). However, the ability for a demersal survey to describe the stock abundance situation is dependent of the assumption that the a relative constant proportion of the total biomass of cod in the water column are reachable for the bottom trawl.

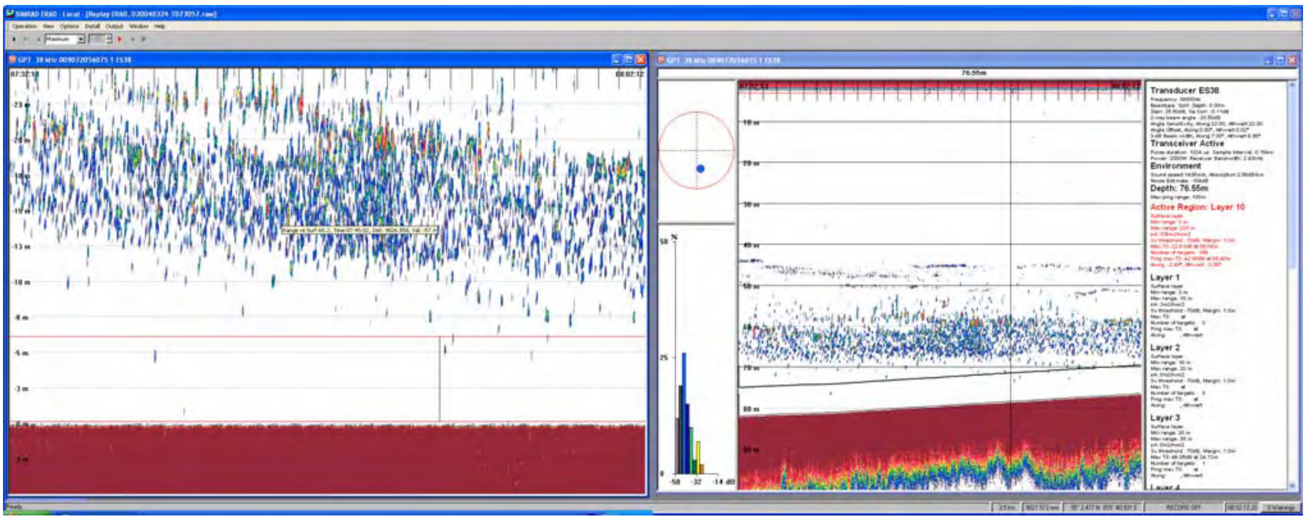

Figure 12.1. Echogram showing a typical situation when low oxygen contents are experienced near the bottom. The picture to the left is a magnification of the near bottom area indicated by the solid line parallel to the seafloor on the right picture (75m to 82 m).

This assumption is clearly violated in the case where no cod is seen at the bottom due to poor oxygen conditions. The two behavioural responses have very different implication for the interpretation of the zero hauls. If cod seeks other areas near the bottom (horizontal migration) with better oxygen conditions this suggest that the zero stations should be kept as zero catches in order to counter balance the increased abundance of cod in adjacent areas i.e., cod are accounted for in hauls made on locations with sufficient oxygen at the bottom. On the other hand, if the cod is migrating vertical into the pelagic, this means the migrating cod should be included in the calculations of indices. At present, no agreed method is available to estimate the fraction of cod in the pelagic compared to the bottom. As no information is available the best guess will probably be to apply the strata average concentration of cod to the zero station.

A preliminary analysis of the distribution of pelagic cod in SD 25 and 27 (N=8 years for both areas) in relation to the abundance of demersal cod suggests that there is no correlation between demersal and pelagic abundance indices. That is, the proportion cod in the pelagic is not constant. However, it was suggested that the acoustic measure of cod was not reliable because it also include night time data when cod migrate into the pelagic and only daytime acoustic data should be used i.e., an overestimation of the cod abundance in the pelagic. This analysis is based on the acoustic survey in October and the BITS in November each year.

When correlating the demersal cod index for SD 25 and 27 with the oxygen concentration close to the bottom (average of the 10 m closest to the bottom; SMHI station By5 SD 25 and By38 in SD27) the relationship was positive in SD 25 suggesting that an increased oxygen concentration at the bottom will allow an increase in the abundance of cod at the bottom. In contrast this relationship was hump-shaped in area SD 27. This suggest that at low oxygen concentrations influences the efficiency to catch cod possibly because the cod are situated close to the coast where trawling is not possible or in cod has vertically migrated into the pelagic. In contrast, at high oxygen concentrations, cod are dispersed over a larger area, which results in low density and low catch efficiency. The reason why the catch efficiency is higher in intermediate concentrations of oxygen can be explained by the fact that we use haul positions given to us from fishermen that target cod, i.e., high cod density areas.

Another preliminary analysis was presented for the group. The analysis was based on the interpretation of echograms using the software: *Sonar Data Echoview.* The result suggests that it is possible to convert SA values into TS values using a filter and identify differences in the length distribution of the fish biomass in the different depth layers. This will allow us to explore the fraction of pelagic fish in different areas and in different environmental conditions (for example variable oxygen concentrations).

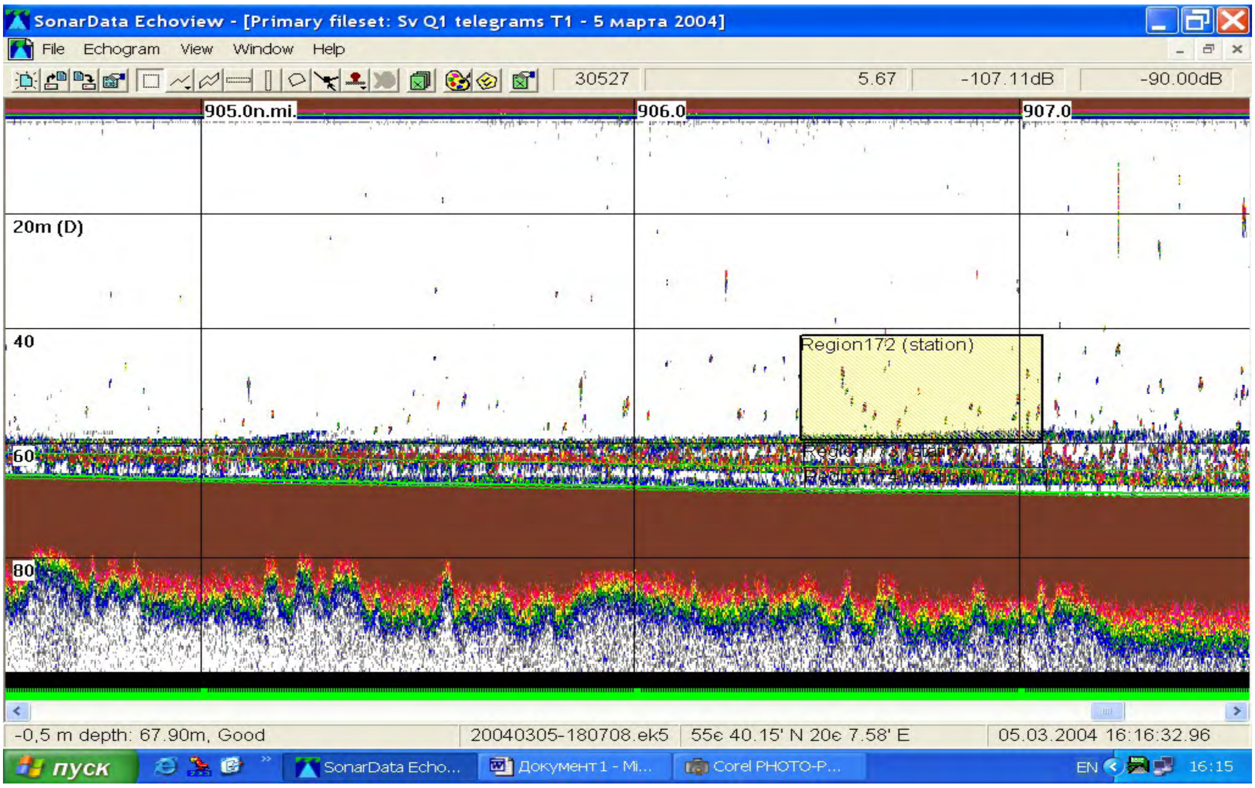

Figure 12.2. Regular echogram showing the areas selected for TS analysis. The thermo cline and the vertical high is seen at the echogram.

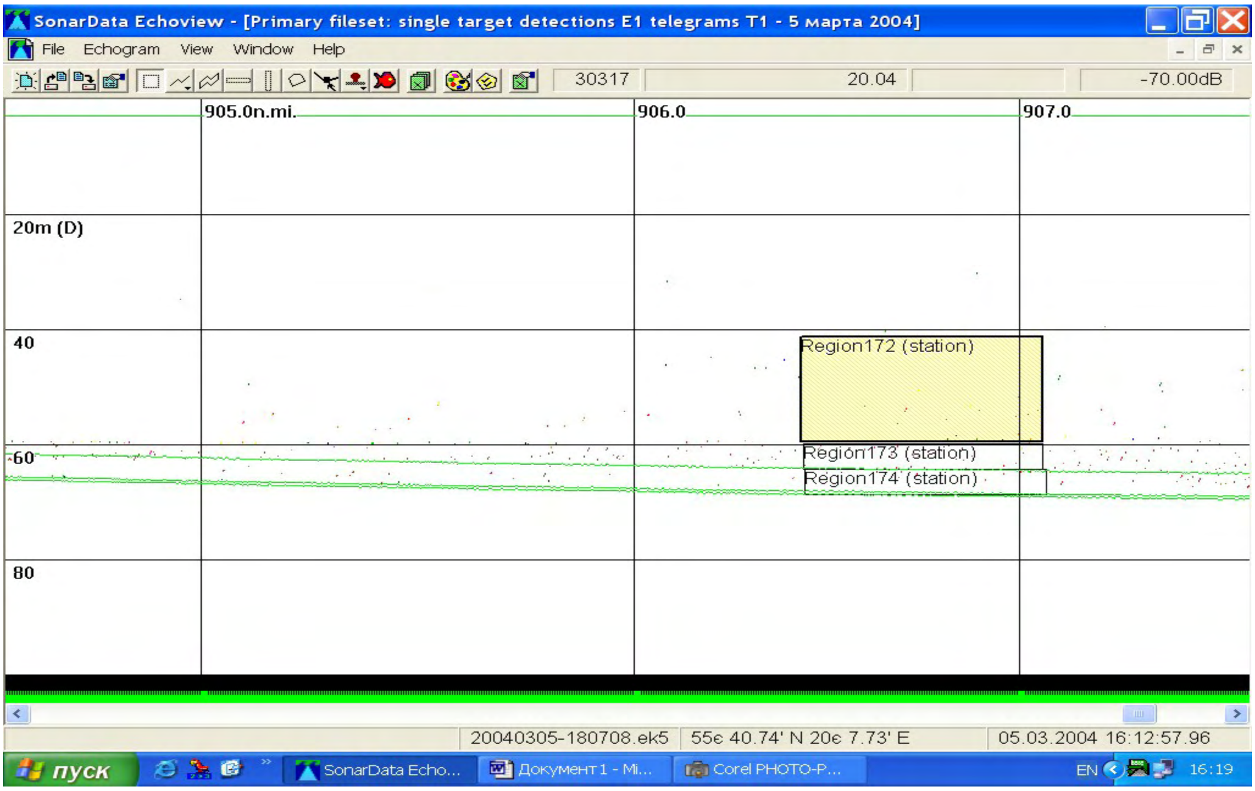

Figure 12.3.The same echogram as shown in Figure 12.2 but after filtering with Sonar Data Echoview software (TS-modul).

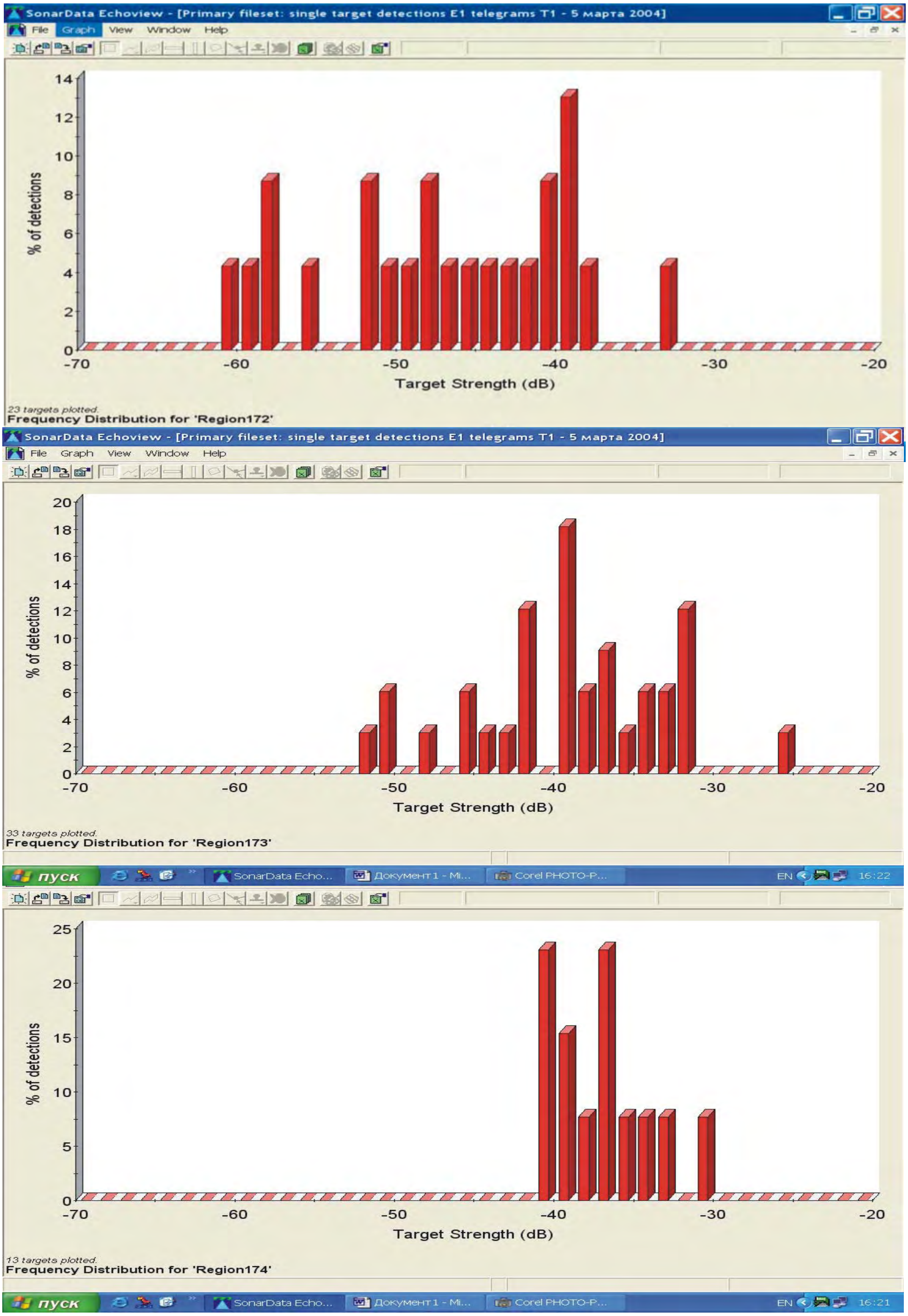

Figure 12.4 Target strength histogram for the selected areas (region 172, 173, 174 in fig x) a.

Examples of Target Strength distributions of fish obtained in the three strata selected areas as shown in Figure 12.2. On Figure 12.4 the differences between histograms from the selected areas representing different layers can be seen. On a bottom layer, larger TS can be observed and in the upper pelagic layers the big values of TS is absent. From the practice experience situations where the big values TS have been defined in pelagic layers has been experienced. This indicates that TS may be a good indicator for the vertical distribution of cod in the water column.

The method can be summarized in the following steps:

1) Detect the echo trace of single fishes from echo signals with Sonar Data (Echoview software)
2) Define the layers subject for analyses
3) Build the histogram for fish trace distribution in every layer
4) By experience the histogram can be converted to length distribution

It might be possible, based on the experience, to define all fish longer that e.g., 20 cm as cod. The preliminary analysis presented here has all been used during night time hydro acoustic surveys. It should be further investigated if this method is applicable when analysing daytime echogram as well, at least for the fish biomass in the pelagic. The method may be suitable to investigate how the zero-catches should be handled in the future.

It was agreed that further analysis are needed concerning cod migration as a function of oxygen near the bottom and these analyses should be made before the next WGBIFS. The WG recognises two alternative strategies; use already available data such as echogram and CPUE data in relation to CTD data or do a survey where both echogram data and CPUE measures of cod in both in the pelagic and demersal could be collected. The disadvantage with the first method is that the actual abundance of pelagic cod can not be verified. The disadvantage with the second alternative is finance and allocated survey time.

Hence, the WG suggest that Sweden, during the autumn survey, will be allocated a lower number of standard BITS hauls and instead use their new pelagic/demersal trawl in combination with hydro acoustic sampling in low oxygen concentration areas. Furthermore, the WG suggest that analyses are made on available hydro acoustic data in order to reveal the spread of the areas suffering from poor oxygen conditions. In order to learn about how the vertical cod distribution is affected by poor bottom oxygen conditions, analysis should be made on the available matching hydro acoustic, the demersal catch data and the CTD data.

13 ICES POLICY ON ACCESS TO DATRAS (TOR L)

The protocol on access to the DATRAS database that was presented in last year's report was discussed and some minor alterations were suggested.

To structure data access, five survey/area combinations were distinguished, the countries participating in these combinations and whether data were submitted to the database (table).

Country	North Sea IBTS	Western IBTS	Southern IBTS	BITS	BTS	Data in database
Denmark	X			X		X
England	X	X			X	X
France	X	X	X			X
Germany (Hamburg)	X					X
Ireland		X			X	
Netherlands	X				X	X
Norway	X					X
Portugal			X			
Scotland	X	X				X
Spain		X	X			
Sweden	X			X		X
Latvia				X		X
Russia				X		X
Germany (Rostock)				X		X

Country	North Sea IBTS	Western IBTS	Southern IBTS	BITS	BTS	Data in database
Estonia				X		X
Poland				X		X

Within each of these survey/area combinations there was agreement on the data access policy. This is exemplified in the table below, which distinguishes three user categories:

1) Public and other parties that request data, typically for research purposes.
2) ICES working groups
3) Institutes that have supplied data to the database.

and three data types:

1) Standard maps and graphs: Per survey/area combination for all relevant ages of species for which assessments are conducted. Maps will show bubble plots indicating abundance per ICES rectangle or per haul. Time series of the indices and a graph showing the proportion of the age-groups will be generated.
2) Aggregated data. A query of the database using pivot tables. Based on these tables, plots and graphs can be made on an interactive basis. The minimum level of aggregation differs between survey/area combinations.
    - ICES rectangle: IBTS in the North Sea, Skagerrak, Kattegat and the BTS in the North Sea, Channel and Irish Sea
    - Stratum: IBTS western and southern divisions, BITS Baltic Sea
3) Un-aggregated (raw) data. These are catch (numbers at length and/or numbers at age) data on a haul-by-haul basis and SMALK (Sex, Maturity, Age-Length-Keys) data per individual.

Data access per “User category” and per “Data type” can be organized according to the following matrix. F is the abbreviation for “free access”, P for “password protected access” and R for “access to extracted data after granted request”.

Data type	User categories		
	ICES WG[1]	Data supplier[2]	Public and other parties
Standard maps and graphs	F	F	F
Aggregated data	P	P	P/R[3]
Non-aggregated (raw) data	R	P	R[4]

Notes:

[1]ICES WGs will have access to data from only those survey/area combinations that are relevant for their recommendations and as such should be specified in those recommendations.

[2]Data suppliers will only have access to data of those survey/area combinations to which the institute has provided data.

[3]Per survey/area combination the members can decide whether individuals will have free access to aggregated data or only after request. If a request is granted, an extraction of the data will be made available

[4]Access can be requested and if granted, an extraction of the data will be made available

All data (aggregated or non-aggregated) are protected by passwords. Each institute delivering data to the database can suggest a username and password to ICES which will give them access to the data in those survey/area combinations they are (for a sufficiently long period) members of. ICES WGs will have a password that allows them access to aggregated data, raw data will be issued to the Chair of the WG after request. Other parties can request access to the (both aggregated or non-aggregated) data through the ICES website. A standard form must be filled in to inform the institutes involved in the survey(s) on:

- Who is requesting data, including partners in the research project
- The purpose of the data request
- Which data (at what aggregation level) are requested
- Confirmation that the ICES rules for acknowledging the data source will be observed

Completing the form will result in a request to the relevant survey contact person of each institute involved with that survey/area combination and this person will be requested to reply to ICES within 14 days. For the IBTS the contact person has to reply within this time limit, if not it will be taken as acceptance of the request for data access. When after 14 days no relevant data supplier has objected, ICES will extract the requested data from the database and make them available.

For BITS the contact person have to reply positive before the data can be provided. This is to ensure that if the contact person is not reading his/her email within the time period data will not be given out.

As only France has submitted data for the southern division the above agreement has no consequences yet for this division. If more countries in this survey/area combination submit data a comparable agreement on data access may be drafted.

14 RECOMMENDATIONS

14.1 Acoustic surveys

The following important working items must be considered for the future and the WG BIFS therefore recommends that:

- The coverage of the autumn hydroacoustic survey by different nations in the Baltic Sea should be maintained at the actual high level. Additionally Subdivisions 29N, 30, 31 and 32 should be covered during future surveys.
- Additional acoustic investigations should be carried out by Lithuania in the shallow waters of SD26 and 28 in October.
- In order to get a complete picture of herring and sprat distribution in the Western Baltic area (Skagerrak, Kattegat, Subdivisions 22–24) the whole area should be covered at the same time. At present the Western Baltic area is covered by two separate surveys in different time of the year. One is carried out in July (Skagerrak, northern Kattegat) and the other in September/October (southern Kattegat, Subdivisions 22 to 24). The July survey is connected to the North Sea acoustic summer surveys whereas the October survey is linked to the Baltic Sea acoustic surveys.
- The results of the acoustic surveys in May/June should be submitted in the BIAS exchange format at least one month before the WGBIFS meeting to Eberhard Götze, Germany and Niklas Larson, Sweden
- The database BAD1 should be updated and the intensive studies of the data from this database should be continued.
- ICES should examine the possibilities to hold the BAD2 data within the frame of an existing database system (DATRAS).
- The spring hydroacoustic survey should be extended to cover the main distribution area of sprat in the Baltic Sea (Subdivisions 25, 26, 28 and 29S)

14.2 BITS

The WGBIFS recommends that a procedure for obtaining information of the vertical distribution of the fish are developed on those assigned positions where oxygen levels are below 2 ml/l.

Clear Tow Database

- The feedback from the surveys should be submitted to Germany using the above format not later than 20 December (autumn survey) and immediately after the spring survey.
- Additional hauls should be submitted to Germany. Especially hauls in the "white areas" are necessary to cover the total distribution area of the target species. It is proposed to use short periods of the future surveys to detect regions in the "white areas" where hauls are possible.
- From 2004 4th quarter all institutes should deliver data to ICES in the new exchange format and screen the data with the new data screening program.
- The WGBIFS recommends that FishFrame is developed so it can store the CTD data recorded in connection with BITS and make the data available for analysis.

14.3 Estimation of the conversion factors

- The countries should undertake certain effort to investigate the parameters which influence the quality of the estimates of conversion factors.
- Additional intercalibration experiments of type 3 on national level are not necessary due to the decreasing importance of the conversion factors related to the stock assessment
- Comparisons of conversion factors based on 5 cm length intervals and the total length range should be carried and presented during the next meeting.

14.4 Next meeting in 2005

14.4.1 Election of Chair

The Working Group agreed that Rainer Oeberst should continue to Chair the Working Group for the next three years.

14.4.2 Time and venue

The Working Group discussed its next meeting (to be decided at the Annual Science Conference in Vigo, Spain) and WGBIFS recommends that it will meet five days from 4–8 of April 2005 in the ICES headquarter in Copenhagen (Chair: Rainer Oeberst), to assist WGBFAS and ACFM.

14.4.3 Terms of reference

According to Annual Science Conference Resolution in Vigo, Spain (C.Res.2004/x:xx) The Baltic International Fish Survey Working Group [WGBIFS] (Chair: Rainer Oeberst) will meet in ICES Headquarters from 4 -8 of April 2005 to:

a) combine and analyse the results of the 2004 acoustic surveys and experiments and report to WGBFAS;
b) update the hydro-acoustic databases BAD1 and BAD2 for the years 1991 to 2004;
c) plan and decide on acoustic surveys and experiments to be conducted in 2005 and 2006;
d) discuss the results from BITS surveys performed in autumn 2004 and spring 2005;
e) plan and decide on demersal trawl surveys and experiments to be conducted in spring and autumn 2006;
f) update and correct the Tow database
g) continue to study the proposed model for estimating the conversion factors between new and old survey trawls under inclusion of the new intercalibration experiments;
h) update, if necessary, the Baltic International Trawl Survey (BITS) manual;
i) update, if necessary, the Baltic International Acoustic Survey (BIAS) manual.
j) study the vertical distribution of the cod during the BITS survey in a situation with oxygen deficiency close to the bottom.

The above Terms of Reference are set up to provide ACFM with information required to respond to requests for advice/information from the International Baltic Sea Fishery Commission and Science Committees. WGBIFS will report to the Baltic Committee and Resource Management Committees at the 2004 Annual Science Conference in Copenhagen.

Justifications:

The main objectives of the WGBIFS is to co-ordinate and standardize national research surveys in the Baltic for the benefit of accurate resource assessment of Baltic fish stocks. From 1996 to 2002 attention has been put on evaluations of traditional surveys, introduction of survey manuals and considerations of sampling design and standard gears as well as coordinated data exchange format. In recent years activities has been devoted to establish international coordinated demersal trawl surveys using new standard gear types TV3.

The most important future activities are to combine and analyze acoustic survey data for Baltic Fisheries Assessment Working Group, develop disaggregated hydro acoustic database, plan and decide on acoustic surveys and experiments to be conducted. The quality assurance of ICES will require achievements towards a fully agreed calibration of processes and internationally agreed standards Furthermore, the Clear Tow Database should be improved and updated so it is capable of dealing with the heterogeneous geographical distribution of the haul tracks in the haul library.

ANNEX 1: WORKING PAPER - MEAN WEIGHTS OF HERRING AND SPRAT IN THE DATABASE BAD1 FOR THE YEARS 1991 TO 2002

Working Paper | Baltic International Fish Survey WG
29.03. – 02.04.2004

Mean weights of herring and sprat in the database BAD1
for the years 1991 to 2002

E. Götze (IFF Hamburg) and T. Gröhsler (IOR Rostock)

The mean weights of herring and sprat by individual age groups are stored in the database BAD1. The present document gives an overview of the temporal and spatial variability of the mean weights by age for the years1991 to 2002.

Mean weight of herring

The mean weights by age group depend strongly on the residential area in the Baltic Sea. The largest weights are generally found in the western Baltic Sea. The weights decrease toward the northern Baltic Sea area (Figures 1, 3 and 4).

The spatial variability of 0-group herring mean weights is presented in Figure 1. Beside the decreasing trend in weights from southwest toward the northeast, some low mean weights can be found locally. I.e. the weights are substantially smaller near Ruegen Island with 9.6 g than in the surrounding areas. The area around Rügen Island belongs to the main spawning ground of the herring stock of the Western Baltic spring spawners (Division IIIa and Subdivisions 22–24). The distribution of the mean weights may be an indication of a migration of the 0-group of herring into the northern and western parts of the Western Baltic Sea. A similar picture can be found in the shallow water areas south of Gotland. The corresponding mean weight of 6.3 g may reflect a main spawning site. The overall temporal variability of 0-group herring weights is rather small (Figure 1).

The temporal change of the 0-group herring mean weights in Subdivision 24 are represented in Figure 2. Pronounced yearly variation can be observed. The lowest weights were determined in 1991, in the mid 90's and again in 2002. A similar picture can be found in all other regions of the Baltic Sea. The low mean weights during this period may be explained by a shortage in food supply or/and changes in other environmental conditions.

Growth of herring

The mean weights of herring by age groups show an almost linear relationship in time. In the same time intervals the herring increases by the same weight. Some arbitrary chosen growth curves from Subdivisions 24 and 32 are represented as examples in Figure 5 and Figure 6. The linearity is not always exactly achieved. Some deviations from an evenly distributed growth pattern may be explained by changed environmental conditions in time. As an approximation, a constant growth rate was assumed. This constant rate was calculated as the average value of all mean weight at age estimates.

To calculate this factor, the mean weight of each age group was divided by the age in months. An age of 5 months was assumed for the 0-group herring. 17 months was used for age group 1 (Age group 0 = 5 month + Age group 1 = 12 month), 29 moths for age group 2 etc. The quotients by age groups represent the age specific growth rates. The average value of these quotients over all nine age groups 0 to 8+ was then taken as the average growth rate GF. This rate is not representing the regular growth of cohorts, but this rate is representing the actual level of the measured weights. The result depends strongly on the origin of the fish. It amounts to approximately 3 g/month in the Kattegat and reaches only 0,5 g/month in the northern Gotland Sea. The average growth factor and corresponding standard deviation is presented by rectangle for the years 1991 to 2002 in Figure 7. The standard deviations are in all cases relatively small. The average of the CVs of all squares amounts to 17%.

Mean weight of sprat

Compared to herring the mean weights of sprat show a similar variability in time. Figure 8 and Figure 9 are shown as an example for the change of sprat mean weights of age groups 1 and 3 in Subdivision 24. The mean weights for age group 1 decreased constantly since the beginning of the time series in 1991. The lowest values could be found in the years 1998/1999. Since than the mean weights increased year by year. This trend can also to be seen in other age groups. A larger variability can be observed in relation to the spatial distributions. As for herring the largest weights arise in the northwest part of the Baltic Sea. The weights are than decreasing towards the eastern Baltic areas. Figure 10 describes the spatial distribution of the mean weights of 0-group sprat. In the southern Baltic Sea the averages reach around 5 g. The averages than decrease towards the eastern areas to 3 g and increase again towards the western areas to more than 7 g. The same trend can be found for all other age groups (Figures 11 for age 1 and Figure 12 for age 2). The small standard deviations indicate that the mean weights are quite stable from year to year in the period 1991 to 2002.

Growth of sprat

The growth function of sprat doesn't show the same linear trend in all areas as for herring. This linearity can only be found in the western Baltic Sea (Figure 13). This area differs from other parts of the Baltic Sea (Figure 14). After a fast growth for young ages the weight raises only moderately for older sprat. The growth curve of the sprat cannot be simplified as a simply straight line as for herring. Young sprat gains about 10 g per year, whereas the growth rate of older sprat is only less than 5 g per year. The sprat growth curve is characterised by two parameters:

- Parameter 1 (Growth factor 1 = GF 1), which can be derived from differences in weights of the age groups 0 and 1.
- Parameter 2 (Growth factor 2 = GF 2+), which can be taken as a mean growth rate of all other remaining age groups (ages 2–8+).

Figure 15 shows the spatial distribution of these two parameters. As for herring a decrease of the growth rates arise towards the northeast in the Baltic Sea. GF 1 is about equal in all Baltic areas. For older age the changes strongly depend on the area of residence. In the Kattegat the growth rate remains almost linear; the GF1 and GF 2+ values are very similar (Figure 15). GF2+ shows a decreasing trend towards the north-eastern Baltic areas.

CONCLUSION

The analyses were performed using only the average of mean weights for sprat and herring. Information about the individual variability in weight is not included in the database BAD 1. The analysis of individual changes in weight could lead to a more comprehensive picture. Further work on individual data should be done to investigate the presented growth differences of sprat and herring in the Baltic Sea. Nevertheless even using no raw data and simplifying the method resulted in the following results.

- The mean weights of herring and sprat have a strong spatial variability. The temporal variability from 1991 to 2002 is rather small.
- In all age groups the weights decrease continuously from the Kattegat towards the area in the northern Baltic Sea.
- The growth of herring is to a large extent linear in time. It can be described by only one coefficient (= growth factor (GF)). The growth factor shows the same spatial pattern as the weights. GF shows a decreasing trend from the western to north-eastern areas in the Baltic Sea.
- The sprat grows faster during younger ages than older sprat. The overall growth factor can therefore be described by two the coefficients GF1 and GF2+.
- The growth factor of young sprat is to a large extent equal in the whole Baltic Sea. As for all herring, the growth of older sprat shows a decreasing trend from the western to north-eastern areas in the Baltic Sea.

Further results could be derived by using the existing database BAD1. The change of weights in time was only represented very briefly. The comparison of the presented data with environmental factors could enhance the knowledge of causes for differences in growth.

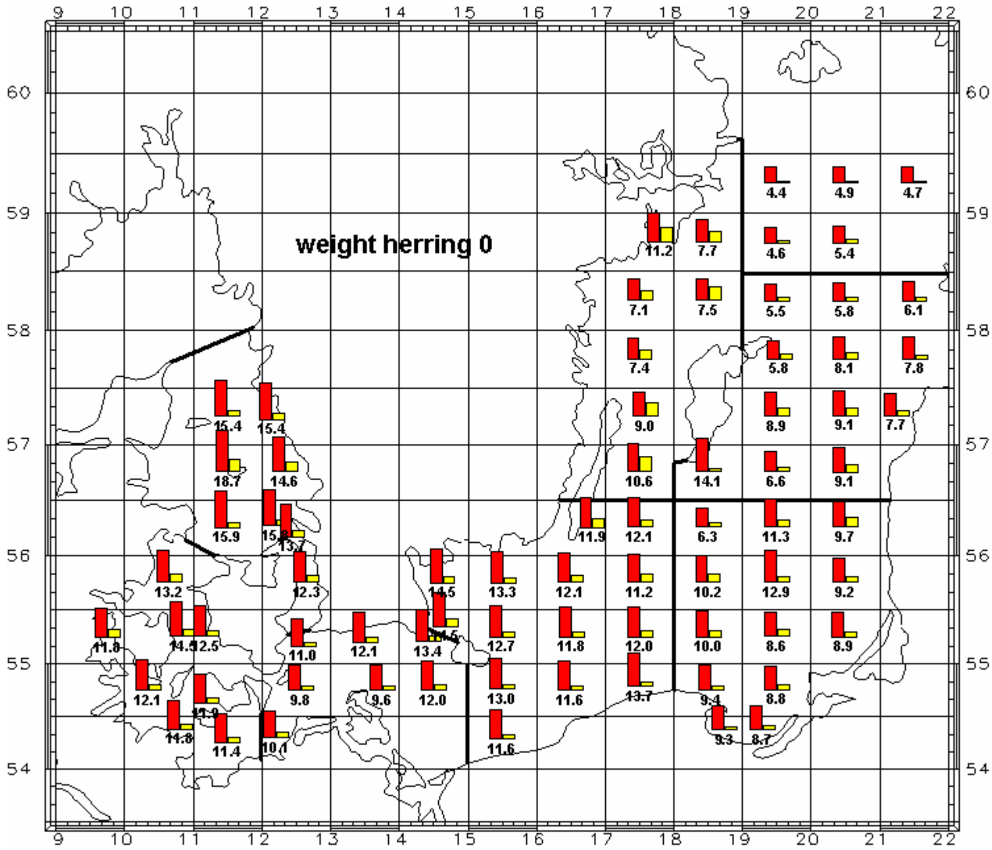

Figure 1. Mean weight (left bar in gram) over the years 1991 to 2002 and standard deviation (right bar, same scale) of 0-group herring.

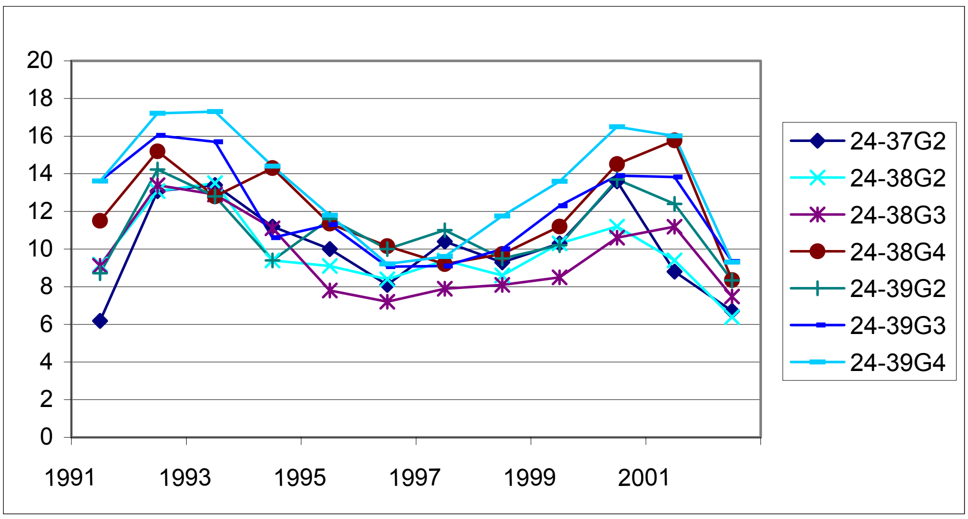

Figure 2. Temporal change of the mean weights of 0-group herring in the Arkona Sea.

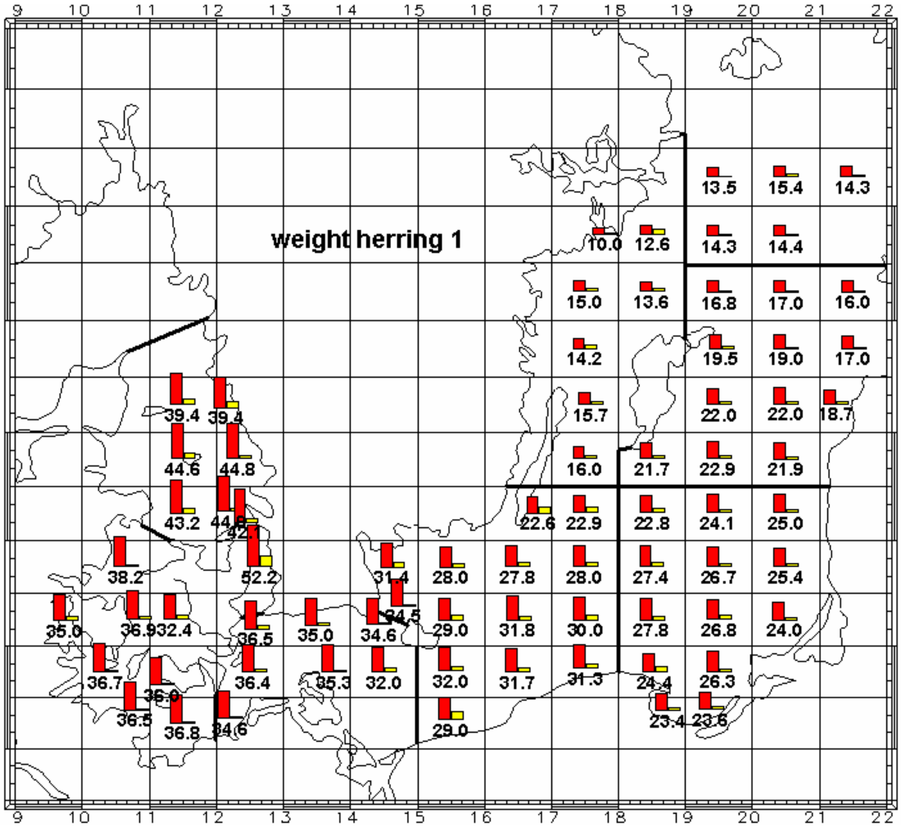

Figure 3. Mean weight (left bar in gram) over the years 1991 to 2002 and standard deviation (right bar, same scale) of 1-group herring.

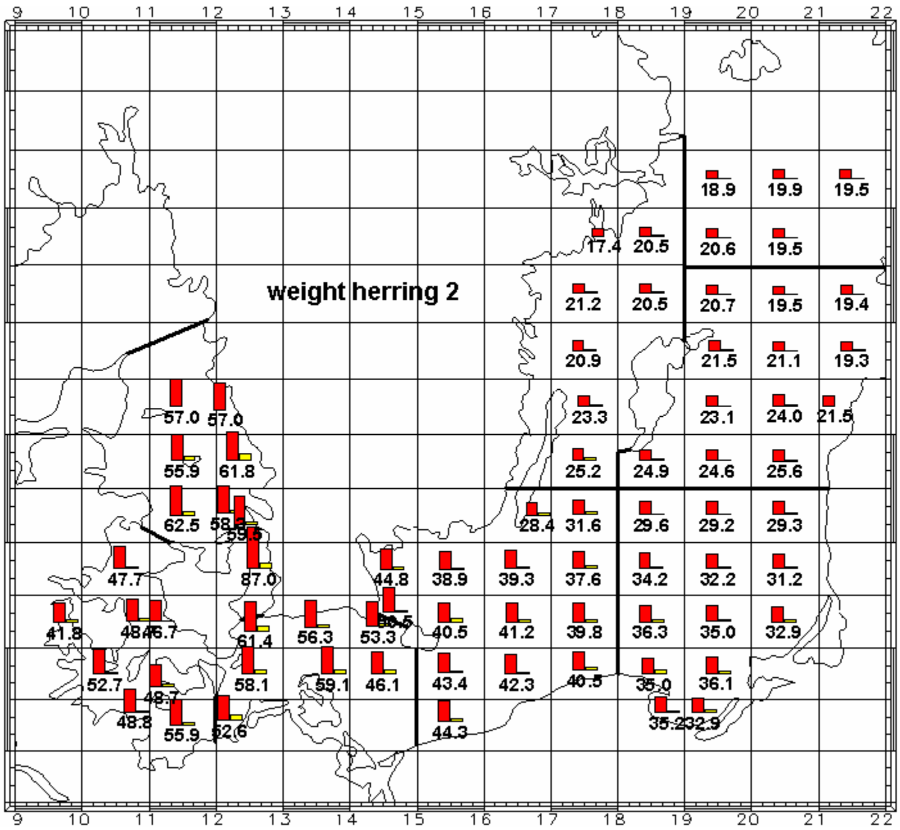

Figure 4. Mean weight (left bar in gram) over the years 1991 to 2002 and standard deviation (right bar, same scale) of 2-group herring.

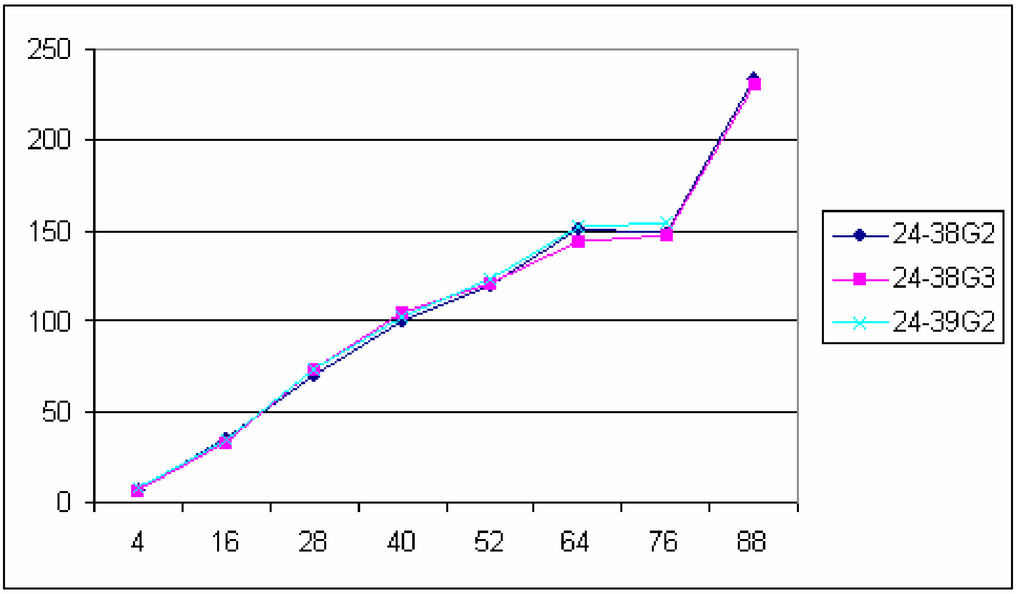

Figure 5. Change of the mean weight (in gram) with the time (months) in SD 24.

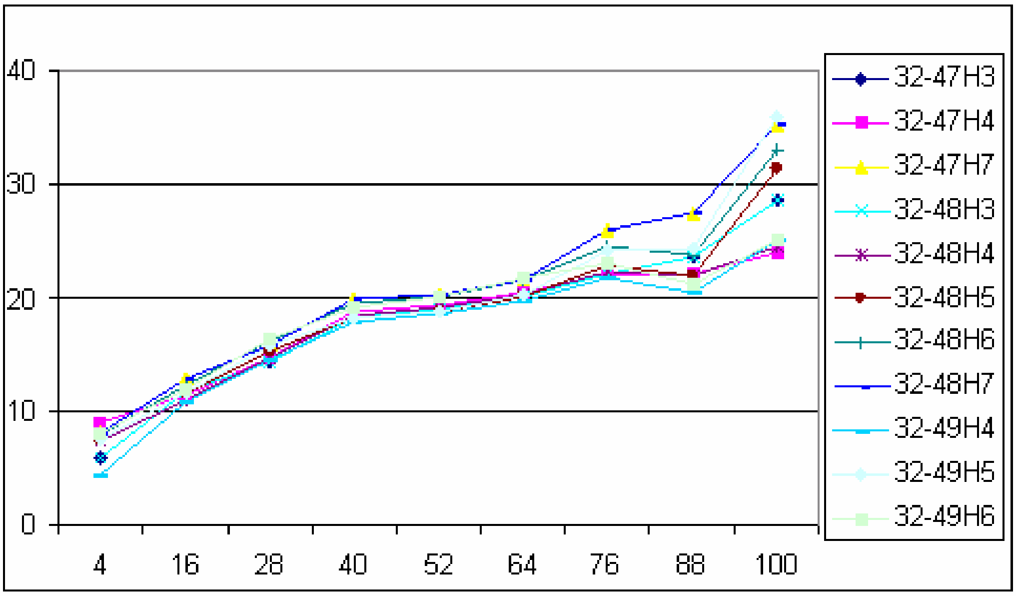

Figure 6. Change of the mean weight (in gram) with the time (months) in SD 32.

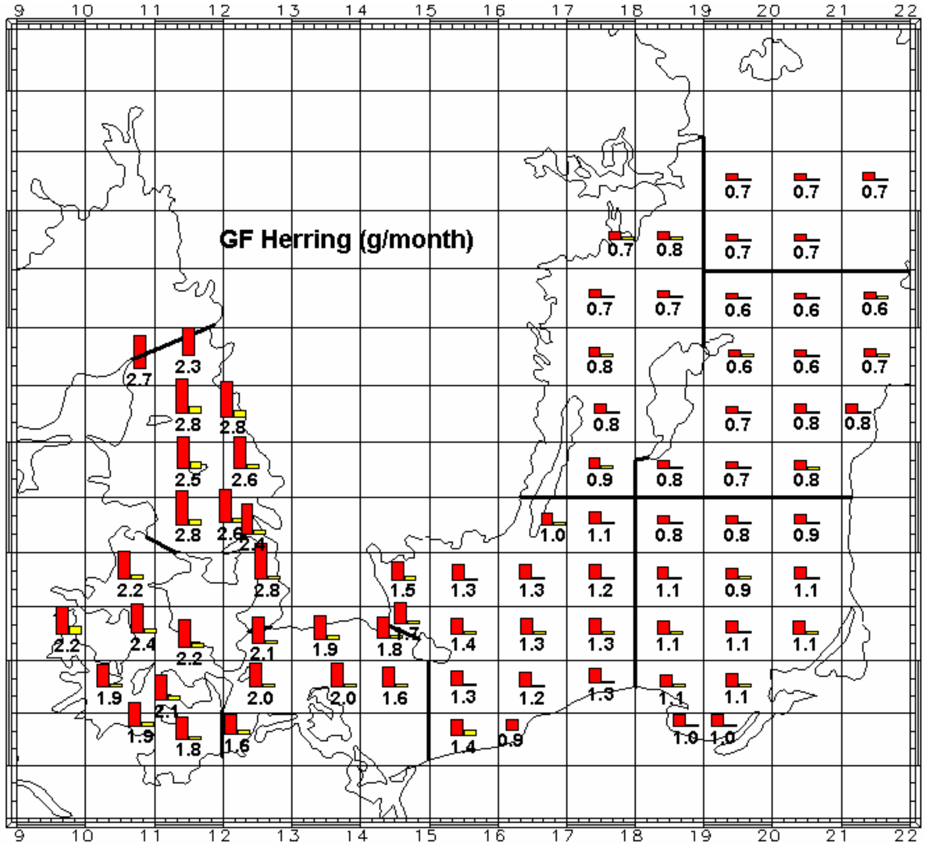

Figure 7. Growth factor (gram/month, left bar) and standard deviation (right bar, same scale) for herring in the Baltic Sea.

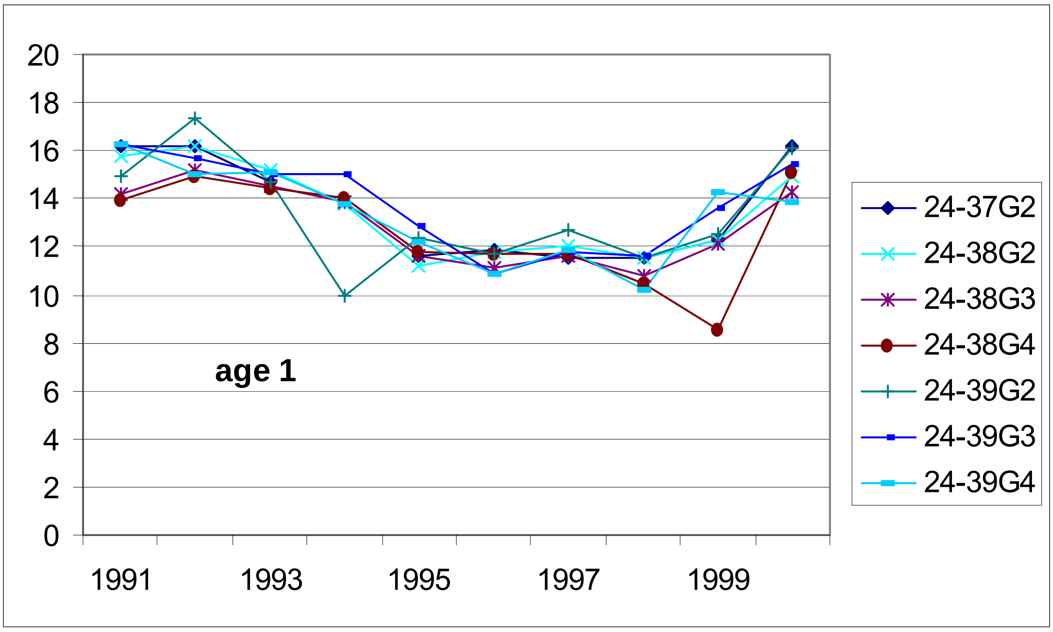

Figure 8. Temporal change of the mean weights of 1-group herring in the Arkona Sea.

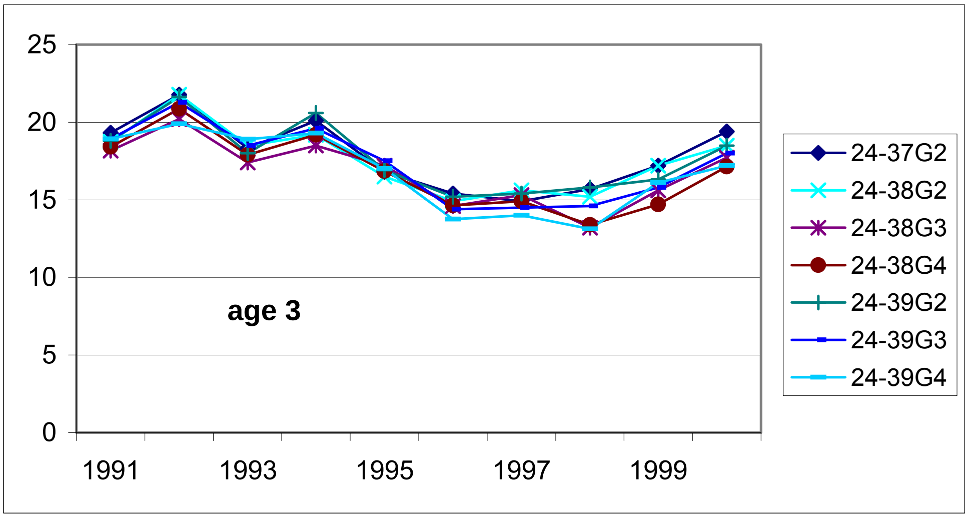

Figure 9. Temporal change of the mean weights of 3-group herring in the Arkona Sea.

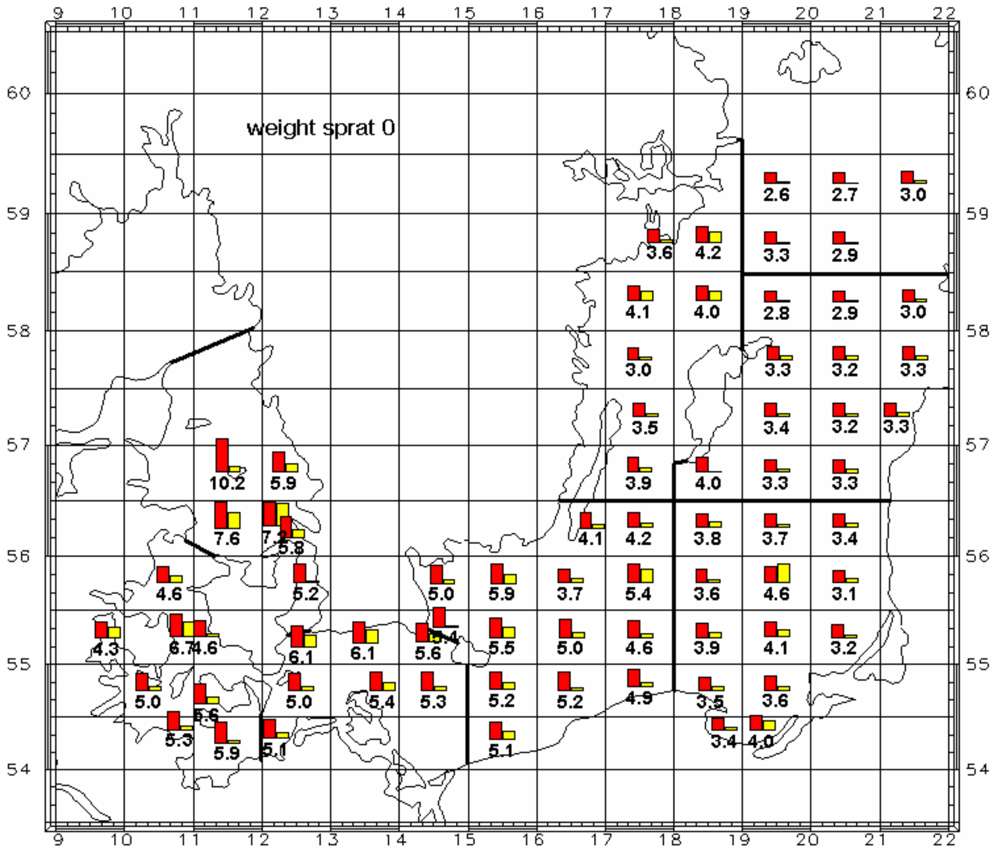

Figure 10. Mean weight (left bar in gram) and standard deviation (right bar, same scale) of 1-group sprat.

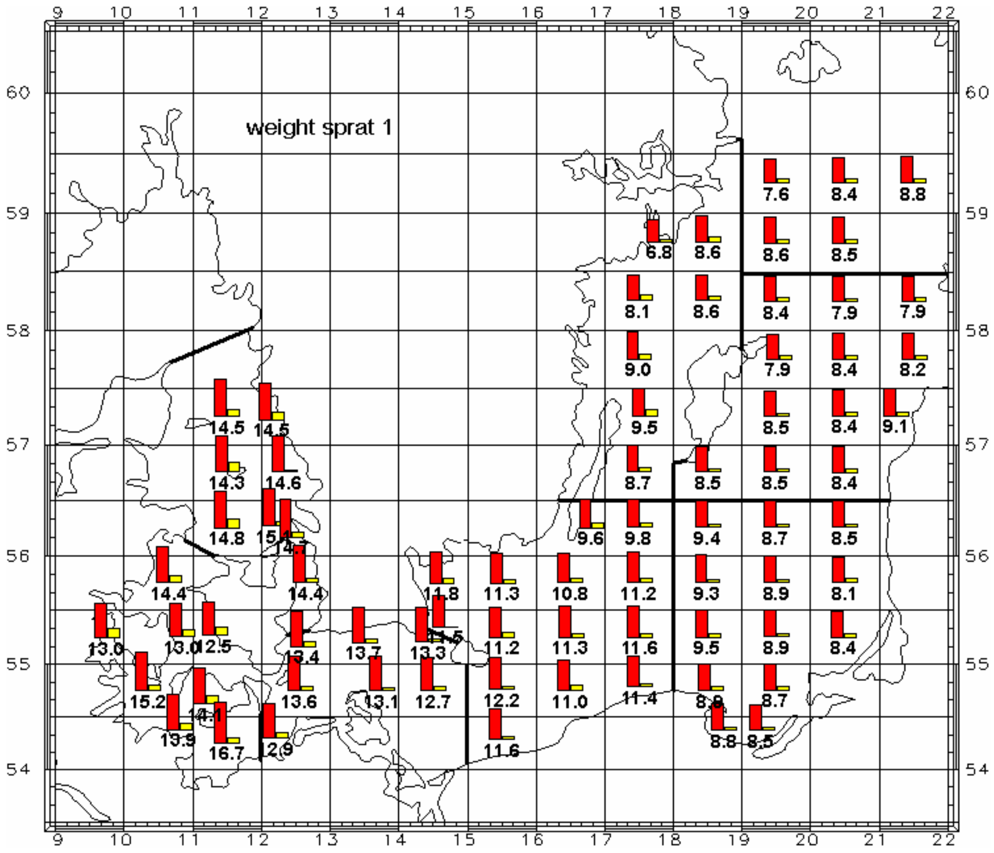

Figure 11. Mean weight (left bar in gram) and standard deviation (right bar, same scale) of 1-group sprat.

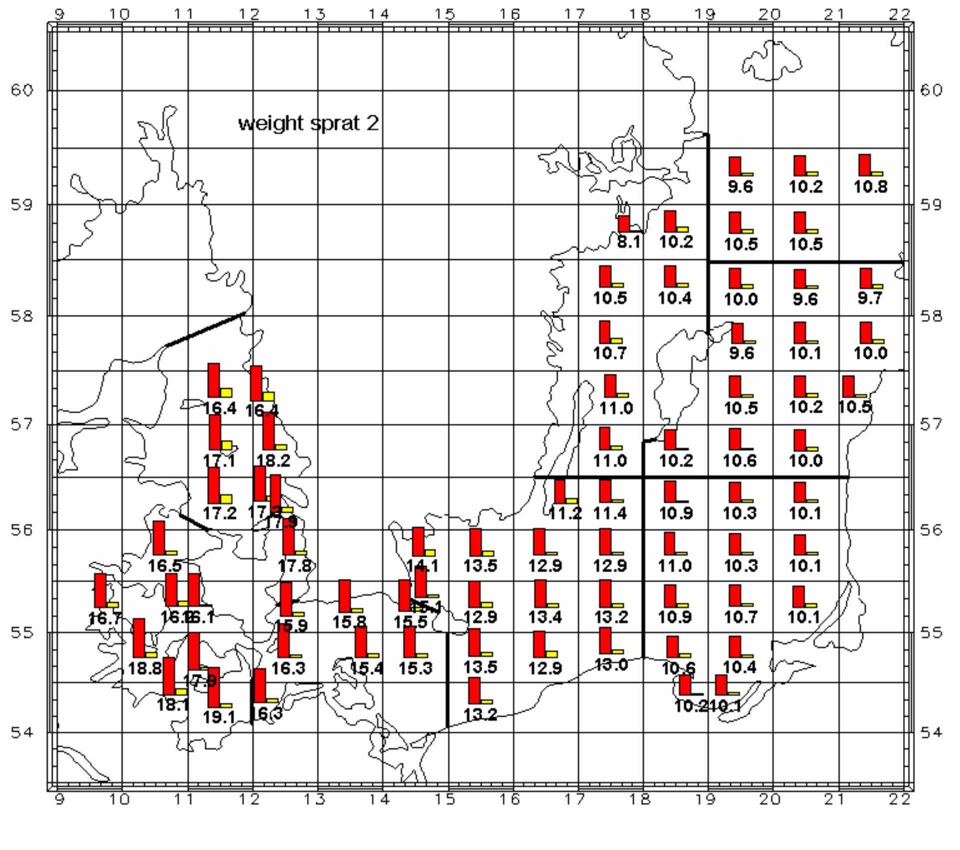

Figure 12. Mean weight (left bar in gram) and standard deviation (right bar, same scale) of 2-group sprat.

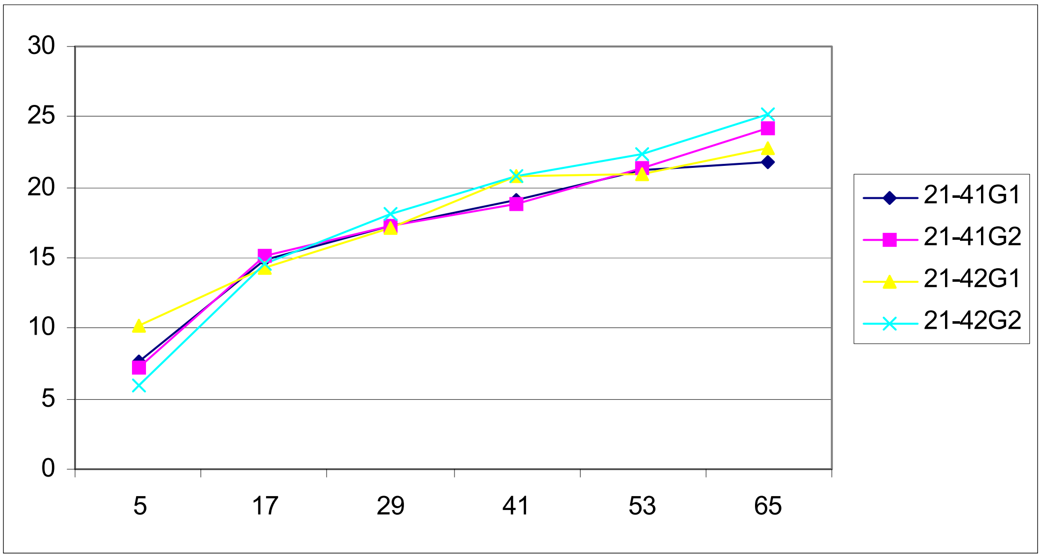

Figure 13. Change of the mean weight (in gram) of sprat with the time (months) in SD 21.

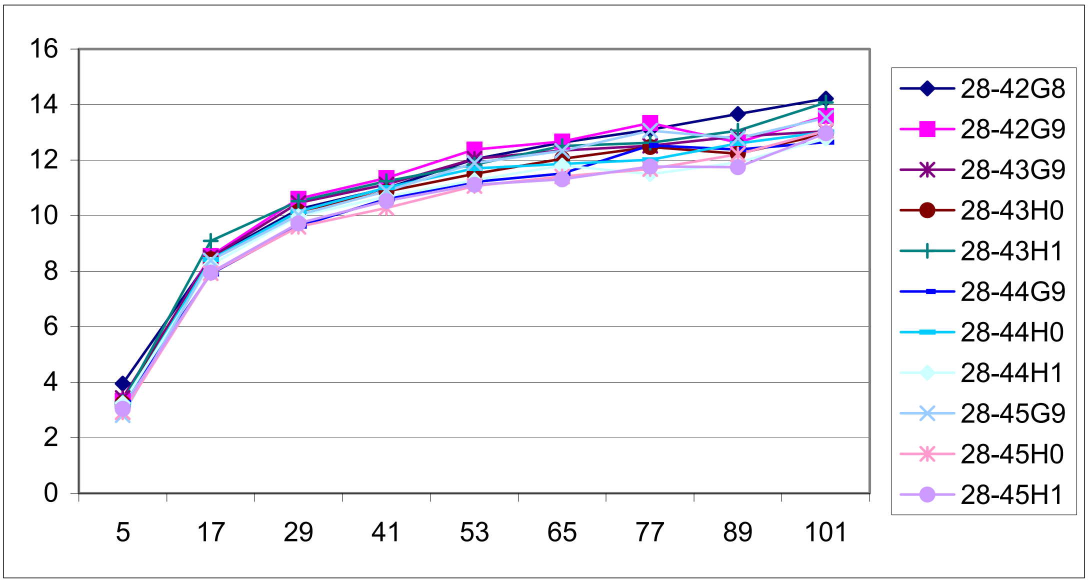

Figure 14. Change of the mean weight (in gram) of sprat with the time (months) in SD 28.

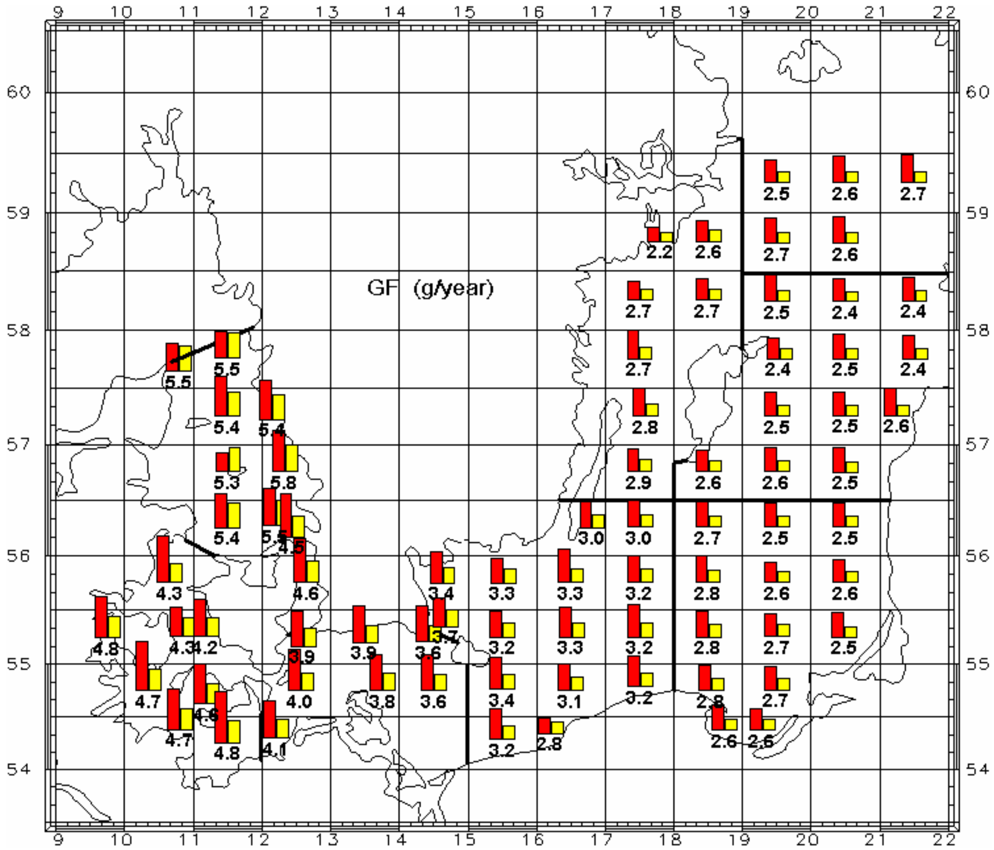

Figure 15. Growth factor GF1 (left bar) and GF2+ (right bar, numbers in gram/year) for sprat.

ANNEX 2: METHOD USED FOR PLANNING THE BALTIC INTERNATIONAL TRAWLS SURVEYS

The aim of the surveys is to cover the main distribution area (ICES Subdivisions 22 – 28) of the target species - cod and flounder. Besides the size of both Baltic cod stocks, the actual hydrographical conditions may influence the distribution. However, the relationship between the hydrographical parameters and the cod distribution cannot be accurately described at this date. Furthermore, the hydrographical conditions during the surveys cannot be predicted. Therefore, it was agreed that the number of planned stations should be distributed dependent on the size of the areas of ICES Subdivisions and using depth range from 10 to 120 m. The significant decrease of the eastern Baltic cod stock in the last years suggests that the control hauls should be also allocated according to the distribution and density pattern of the cod stocks. It was agreed during the WGBIFS meeting in February 2001 that a running 5 year mean of the CPUE derived from the BITS survey in spring should be used for describing the distribution of cod.

The factors - area of ICES Subdivision, and distribution pattern of cod - are used with different weights. A weighting factor of 0.6 was defined for area, and a weighting factor of 0.4 was defined for mean cod distribution (running 5 year mean). The same weights were used for the parameters - area and running mean of the distribution patter - for allocating the number of stations in all the depth layers for the different ICES Subdivisions. The areas of the defined depth layers are given in the BITS Manual by a ICES Subdivision. The running mean of the cod (age group 1+) CPUE should be adapted every year based on the results of the spring surveys.

When allocating hauls for BITS surveys, the total number of planned stations are allocated to the ICES Subdivisions based on the area and running mean. Secondly, the allocated number of stations by Subdivision, are split up by depth layer of the specific Subdivision.

It was agreed during the WG BIFS meeting in 2002 that this scheme of the allocation of hauls should be modified. During future surveys, RV “Solea” should only cover the ICES Subdivisions 22 and 24 and the RV “Dana” should work in the ICES Subdivision 25–28. This arrangement was chosen to improve the stock indices in the ICES Subdivisions 25–28 and 32. In the previous years, RV “Dana” and RV “Solea” covered ICES Subdivision 25 and RV “Baltica”, RV “Dana”, RV “Solea” and RV “Argos” covered the ICES Subdivision 25. The vessels “Baltica”, “Dana” and “Argos” use the large version of the new standard gear (trawl type TV3#930) and RV “Solea” use the small version of standard trawl (TV3#520). However, the studies of the conversion factors between the small and large version of the new standard gear suggest that the accuracy of the stock indices is improving when only one type of TV3 trawl is used per ICES Subdivision. As consequence the algorithm of the haul allocation was modified. The above described method, which use the areas of the ICES Subdivisions and a running 5 years mean of the CPUE values, is separately used in the western Baltic Sea (SD 22, 24) and in the eastern Baltic Sea (SD 25 – 28 and 32). In both the cases the areas are weighted with the factor 0.6 and the running mean of the distribution pattern is weighted with the factor 0.4.

ANNEX 3: CRUISE REPORTS OF ACOUSTIC SURVEYS CARRIED OUT IN THE BALTIC SEA IN OCTOBER 2003

Survey Report for RV "ARGOS"
29 September 2003 – 16 October 2003

Institute of Marine Research, Lysekil, Sweden
Niklas Larson and Nils Håkansson

1 INTRODUCTION

International hydroacoustic surveys have been conducted in the Baltic Sea since 1978. The starting point was the cooperation between Sweden and the German Democratic Republic in October 1978, which produced the first acoustic estimates of total biomass of herring and sprat in the Baltic Main basin (Håkansson *et al.*, 1979). Since then there has been at least one annual hydroacoustic survey for herring and sprat stocks and results have been reported to ICES. The main objective is to assess clupeoid resources in the Baltic Sea. The surveys in September/October are co-ordinated within the frame of the **Baltic International Acoustic Surveys (BIAS).** The present survey will provide data to the ICES Baltic Fisheries Assessment Working Group (WGBFAS).

2 METHODS

2.1 Personnel

K. Frohlund	Institute of Marine Research, Lysekil, Sweden – fish sampling
N. Håkansson	Institute of Marine Research, Lysekil, Sweden – cruise leader
L. Ilic	Institute of Marine Research, Lysekil, Sweden – fish sampling
N. Larson	Institute of Marine Research, Lysekil, Sweden – scientific leader
A-M Palmén-Bratt	Institute of Marine Research, Lysekil, Sweden – fish sampling
J-O. Pettersson	Institute of Marine Research, Lysekil, Sweden – fish and acoustics
R. Sjöberg	Institute of Marine Research, Lysekil, Sweden – fish sampling

2.2 Narrative

The RV "Argos" cruise number 15, 2003, started 2003–09–29 from Västervik and ended 2003–10–16 in Karlskrona. Västervik was also visited 2003–10–03 – 2003–10–05 and 2003–10–10 – 2003–10–13 for exchange of crew and scientific staff. Högön was visited 2003–09–29 for calibration of the SIMRAD EK500 echo sounder and 2003–10–13 for calibration of the new SIMRAD EK60 sounder, which was installed 2003–10–12. The cruise covered ICES subdivision (SD) 27 and parts of ICES subdivisions 25, 28 and 29S. In situ target strength measurements were made 2003–10–14 and 2003–10–15 in ICES SD 25 but results are not yet analysed.

2.3 Survey design

The stratification is based on ICES statistical rectangles with a range of 0.5 degrees in latitude and 1 degree in longitude. The areas of all strata are limited by the 10 m depth line (ICES CM 2003/G:05 Ref: D, H; Appendix 9, Annex 3). The aim is to use parallel transects spaced on regular rectangle basis at a maximum distance of 15 nautical miles and with a transect density of about 60 NM per 1000 NM². The irregular shape of the survey area allocated to the RV "Argos" and the weather conditions makes it difficult to fulfil this aim. The area covered by the survey was 21620 NM² and the distance used for acoustic estimates was 1602 NM. The entire cruise track and positions of trawl hauls is shown in Figure 2.3.1.

2.4 Calibration

The SIMRAD EK500 echo sounder with the transducers ES38B and ES120–7 (not used during this cruise) were calibrated at Högön 2003–09–29 according to the BIAS manual (ICES CM 2003/G:05 Ref.: D, H; Appendix 9, Annex 3). Calibrated TS and Sv gain for 38 kHz the last 6 years is shown below.

Date	1998–09–28	1999–10–04	2000–10–09	2001–10–08	2002–10–14	2003–09–29
Place	Högön	Högön	Högön	Högön	Högön	Högön
Calibr. TS transd. gain	27,65	27,85	27,63	27,75	27,75	27,80
Calibr. Sv transd. gain	27,75	27,74	27,56	27,56	27,53	27,62

The new EK60 echo sounder was calibrated 2003–10–13 at Högön.

2.5 Acoustic data collection

The acoustic sampling was performed around the clock. The SIMRAD EK500 echo sounder with the hull mounted 38 kHz transducer ES38B was used during the cruise. The settings of the hydroacoustic equipment were as described in the BIAS manual (ICES CM 2003/G:05 Ref.: D, H; Appendix 9, Annex 3). The post processing of the stored echo signals was made using the Bergen integrator BI500. The mean volume back scattering values (Sv) were integrated over 1 NM ESDUs from 10 m below the surface to the bottom. Contributions from air bubbles, bottom structures and scattering layers were removed from the echogram by using the BI500.

2.6 Biological data – fishing stations

All trawl hauls were made with the Macro 4 midwater trawl. The stretched mesh size in the codend was 22 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the net opening were controlled by a depth sensor and an ATLAS net sond. The trawling depth was chosen in accordance to the indications on the echogram. A net opening of 24–30 m was achieved with the Macro 4 trawl. The distance between trawl doors was also monitored. The standard trawling time was 30 minutes, but variation occurred. From each haul subsamples were taken to determine length and weight of fish. Samples of herring and sprat were frozen for further investigations in the lab (i.e., sex, maturity, and age).

2.7 Data analysis

The pelagic target species sprat and herring are usually distributed in mixed layers in combination with other species so that it is impossible to allocate the integrator readings to a single species. Therefore the species composition was based on the trawl catch results. For each rectangle the species composition and length distribution were determined as the unweighted mean of all trawl results in this rectangle. In the case of lack of sample hauls within an individual ICES rectangle (due to gear problems, bad weather conditions or other limitations) a mean from hauls from neighbouring rectangles was used. From these distributions the mean acoustic cross-section σ was calculated according to the following target strength-length (TS) relationships:

Clupeoids TS = 20 log L (cm) - 71.2 (ICES 1983/H:12)

Gadoids TS = 20 log L (cm) - 67.5 (Foote *et al.* 1986)
Fish without swimbladder TS = 20 log L (cm) – 84,9

Salmonids and 3-spined stickleback were assumed to have the same acoustic properties as herring.

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (S_a) and the rectangle area, divided by the corresponding mean cross section. The total number was separated into different fish species according to the mean catch composition in the rectangle.

2.8 Hydrographic data

Two CTD casts were made with a General Oceanics MKIII CTD when calibrating the acoustic instruments.

3 RESULTS

3.1 Biological data

In total 52 trawl hauls were carried out, 20 in SD 25 (of which 1 was excluded), 15 in SD 27 (of which 3 were excluded), 6 in SD 28 (of which 1 was excluded) and 11 hauls in SD 29S. The reason for excluding hauls was catch less than 50 kg per half hour. 3484 herrings and 1644 sprats were analysed at the institute. Catch compositions by trawl haul is presented in Table 3.1.1. Length distributions for herring and sprat by ICES subdivision are shown in Figures 3.1.1 and 3.1.2.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean scattering cross section σ, the estimated total number of fish, the percentages of herring and sprat per Subdivision/rectangle are shown in Table 3.2.1.

3.3 Abundance estimates

The total abundances of herring and sprat are presented in Table 3.2.1. The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Tables 3.3.1 and 3.3.3. The corresponding mean weights by age group and Subdivision/rectangle are shown in Tables 3.3.2 and 3.3.4. The estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarised in Tables 3.3.5 and 3.3.6.

4 DISCUSSION

The data collected during the survey should be considered as representative for the abundance of the pelagic species during the BIAS in 2003.

5 REFERENCES

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Foote, K.G., Aglen, A., and Nakken, O. 1986. Measurement of fish target strength with a split-beam echosounder. J.Acoust.Soc.Am. 80(2):612–621.

Håkansson, N., Kollberg, S., Falk, U., Götze, E., and Rechlin, O. 1979. A hydroacoustic and trawl survey of herring and sprat stocks of the Baltic proper in October 1978. Fischerei-Forschung, Wissenschaftliche Schriftenreihe 17(2):7–2.

Table 3.1.1. Catch composition (kg/0.5 hour) per haul by ICES subdivision.

ICES subdivision 25							
Haul No.	**596**	**597**	**598**	**599**	**600**	**601**	**602**
Date	**20031007**	**20031007**	**20031007**	**20031007**	**20031008**	**20031008**	**20031008**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**41G7**	**40G7**	**40G7**	**40G6**	**39G5**	**39G5**	**39G4**
AURELIA SPP					30,260	5,554	4,644
CLUPEA HARENGUS	96.961	26.951	36.611	397.602	68.175	123.429	107.230
GADUS MORHUA	0.890	2.400		30.060		14.100	1.550
GASTEROSTEUS ACULEATUS	0.377						
HYPEROPLUS LANCEOLATUS							
MERLANGIUS MERLANGUS				0.376			1.385
PLATICHTHYS FLESUS							
PLEURONECTES PLATESSA							
SPRATTUS SPRATTUS	172.905	205.724	109.037	99.621	16.732	853.202	89.500
Total	**271.133**	**235.075**	**145.648**	**527.659**	**115.167**	**996.285**	**204.309**

ICES subdivision 25							
Haul No.	**603**	**604**	**605**	**606**	**607**	**615**	**616**
Date	**20031008**	**20031008**	**20031008**	**20031009**	**20031009**	**20031014**	**20031014**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**40G4**	**40G5**	**40G5**	**40G6**	**41G6**	**41G7**	**40G6**
AURELIA SPP	5.986	30.738	20.691				
CLUPEA HARENGUS	140.683	92.213	52.202	102.387	297.875	35.395	318.402
GADUS MORHUA	1.910	0.063	6.297	5.700	13.200	0.754	12.712
GASTEROSTEUS ACULEATUS		0.015					
HYPEROPLUS LANCEOLATUS							
MERLANGIUS MERLANGUS	0.260						
PLATICHTHYS FLESUS					0.557		
PLEURONECTES PLATESSA							
SPRATTUS SPRATTUS	270.140	84.065	31.321	28.649	224.581	332.880	196.095
Total	**418.979**	**207.094**	**110.511**	**136.736**	**536.213**	**369.029**	**527.209**

ICES subdivision 25						
Haul No.	**617**	**618**	**619**	**620**	**621**	**622**
Date	**20031014**	**20031014**	**20031015**	**20031015**	**20031015**	**20031015**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Invalid**
Species/ICES rectangle	**40G6**	**40G6**	**39G5**	**39G5**	**39G5**	**39G5**
AURELIA SPP						
CLUPEA HARENGUS	249.102	223.976	37.123	83.353	125.469	14.226
GADUS MORHUA	2.818	2.671	5.397	0.195	6.019	6.798
GASTEROSTEUS ACULEATUS						
HYPEROPLUS LANCEOLATUS				0.042		
MERLANGIUS MERLANGUS	0.064					
PLATICHTHYS FLESUS						
PLEURONECTES PLATESSA	0.480		0.193			
SPRATTUS SPRATTUS	48.452	42.055	39.316	18.724	40.728	5.323
Total	**300.916**	**268.702**	**82.029**	**102.314**	**172.216**	**26.347**

ICES subdivision 28						
Haul No.	**590**	**591**	**592**	**593**	**594**	**595**
Date	**20031006**	**20031006**	**20031006**	**20031006**	**20031006**	**20031006**
Validity	**Valid**	**Valid**	**Valid**	**Invalid**	**Valid**	**Valid**
Species/ICES rectangle	**45G9**	**45G9**	**44G9**	**44G9**	**43G8**	**42G8**
AMMODYTIDAE						0,205
CLUPEA HARENGUS	247.490	96.462	4.727	1.697	633.188	345.080
CYCLOPTERUS LUMPUS	1.438		0.655		1.636	0.158
GASTEROSTEUS ACULEATUS	9.401	0.802	35.597	33.649	8.245	5.377
PLATICHTHYS FLESUS	0.353				2.206	
PUNGITIUS PUNGITIUS			0.019	0.008		
SCOPHTHALMUS MAXIMUS	0.319					
SPRATTUS SPRATTUS	667.758	269.834	25.155	2.463	229.201	134.435
Total	**926.760**	**367.098**	**66.153**	**37.817**	**874.476**	**485.255**

Table 3.1.1.(continued). Catch composition (kg/0.5 hour) per haul by ICES subdivision.

ICES subdivision 27								
Haul No.	**570**	**571**	**572**	**584**	**585**	**586**	**587**	**588**
Date	**20030929**	**20030929**	**20030930**	**20031002**	**20031002**	**20031002**	**20031002**	**20031002**
Validity	**Valid**	**Valid**	**Valid**	**Invalid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**44G7**	**45G7**	**46G8**	**46G8**	**45G8**	**45G8**	**45G7**	**44G8**
CLUPEA HARENGUS	142.079	45.758	10.588	16.852	2.300	4.839	246.101	199.940
CYCLOPTERUS LUMPUS	1.000	2.472	0.324		0.450	0.155	0.747	2.176
GADUS MORHUA								
GASTEROSTEUS ACULEATUS	2.282	0.844	2.856	1.296	17.700	4.036	12.405	10.330
HYPEROPLUS LANCEOLATUS								0.133
MYOXOCEPHALUS SCORPIUS		0.079						
PLATICHTHYS FLESUS	0.265	0.354	0.337		0.118			
PUNGITIUS PUNGITIUS					0.002			
SPRATTUS SPRATTUS	181.378	173.084	195.146	26.574	37.600	74.203	370.407	119.964
Total	**327.004**	**222.591**	**209.251**	**44.722**	**58.170**	**83.233**	**629.660**	**332.543**

ICES subdivision 27							
Haul No.	**589**	**608**	**609**	**610**	**611**	**612**	**614**
Date	**20031003**	**20031009**	**20031009**	**20031009**	**20031009**	**20031010**	**20031014**
Validity	**Valid**	**Valid**	**Valid**	**Invalid**	**Invalid**	**Valid**	**Valid**
Species/ICES rectangle	**44G7**	**42G6**	**42G7**	**42G7**	**43G7**	**44G7**	**43G7**
CLUPEA HARENGUS	114.480	234.497	28.620	26.700	25.220	45.535	34.818
CYCLOPTERUS LUMPUS	0.195					0.809	
GADUS MORHUA		13.200			0.003		0.003
GASTEROSTEUS ACULEATUS	0.649			0.349	0.520	1.235	0.039
HYPEROPLUS LANCEOLATUS							
MYOXOCEPHALUS SCORPIUS							
PLATICHTHYS FLESUS	0.320					0.213	
PUNGITIUS PUNGITIUS				0.005	0.009		
SPRATTUS SPRATTUS	648.520	217.068	72.411	11.900	6.600	105.733	143.140
Total	**764.164**	**464.765**	**101.031**	**38.954**	**32.352**	**153.525**	**178.000**

ICES subdivision 29S								
Haul No.	**573**	**574**	**575**	**576**	**577**	**578**	**579**	**580**
Date	**20030930**	**20030930**	**20030930**	**20030930**	**20030930**	**20031001**	**20031001**	**20031001**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**46G9**	**47G9**	**47H0**	**47H1**	**47H1**	**46H1**	**46H0**	**46H0**
CLUPEA HARENGUS	144.733	25.821	82.263	74.383	41.440	49.239	165.390	2.085
CYCLOPTERUS LUMPUS		0.185		0.245		0.533		0.520
GADUS MORHUA							1.799	
GASTEROSTEUS ACULEATUS	0.166	4.106	1.762	5.200	6.506	10.902		21.580
PUNGITIUS PUNGITIUS					0.418			0.018
RHINONEMUS CIMBRIUS	0.072							
SPRATTUS SPRATTUS	224.371	481.752	391.136	197.332	76.296	569.385	138.301	38.038
Total	**369.342**	**511.864**	**475.161**	**277.160**	**124.660**	**630.059**	**305.490**	**62.240**

ICES subdivision 29S				
Haul No.	**580**	**581**	**582**	**583**
Date	**20031001**	**20031001**	**20031001**	**20031002**
Validity	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**46H0**	**47H0**	**47G9**	**46G9**
CLUPEA HARENGUS	2.085	55.410	90.189	88.234
CYCLOPTERUS LUMPUS	0.520	0.330	0.645	1.888
GADUS MORHUA				
GASTEROSTEUS ACULEATUS	21.580	6.969	9.416	74.561
PUNGITIUS PUNGITIUS	0.018			
RHINONEMUS CIMBRIUS				
SPRATTUS SPRATTUS	38.038	127.808	180.971	618.064
Total	**62.240**	**190.517**	**281.221**	**782.747**

Table 3.2.1. RV “Argos” survey statistics, October 2003.

Sub-division	ICES Rectangle	Area (NM²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)	NCod (million)
25	39G4	287.3	448.98	0.63	2057	42.5	57.3	874	1179	1.9
25	39G5	979.0	469.17	2.33	1968	38.9	60.6	765	1193	9.3
25	40G4	677.2	393.76	1.68	1586	20.9	79.1	331	1255	0.1
25	40G5	1012.9	548.04	1.81	3070	28.8	70.0	885	2150	34.4
25	40G6	1013.0	440.93	2.60	1721	50.6	48.4	872	833	16.3
25	40G7	1013.0	83.48	1.83	463	12.7	87.3	59	404	0.0
25	41G6	764.4	578.32	1.94	2283	35.4	64.5	808	1474	1.5
25	41G7	1000.0	219.83	1.72	1278	11.4	87.9	145	1124	0.1
25 Total		6746.8			14427			4740	9611	63.4
27	42G6	266.0	351.94	1.97	476	33.4	66.5	159	317	0.3
27	42G7	986.9	344.25	1.69	2014	16.4	83.6	330	1684	
27	43G7	913.8	923.95	1.54	5491	16.7	83.2	915	4566	1.2
27	44G7	960.5	1155.36	1.44	7684	18.2	79.0	1395	6068	
27	44G8	456.6	3016.77	1.09	12629	31.9	51.4	4031	6492	
27	45G7	908.7	1215.63	1.32	8381	16.9	77.2	1416	6469	
27	45G8	947.2	850.17	0.60	13331	3.2	56.7	422	7565	
27	46G8	884.8	674.31	3.18	1873	4.8	88.6	90	1659	
27 Total		6324.5			51880			8757	34820	1.6
28	42G8	945.4	824.73	3.90	2002	42.6	46.1	853	923	
28	43G8	296.2	2749.60	1.42	5717	46.5	43.2	2659	2472	
28	44G9	876.6	1078.89	0.40	23859	1.8	21.0	437	5007	
28	45G9	924.5	915.62	1.32	6396	16.8	79.7	1072	5097	
28 Total		3042.7			37974			5020	13498	
29S	46G9	933.8	825.41	1.24	6200	17.3	65.6	1075	4066	
29S	46H0	933.8	844.92	1.08	7322	23.0	43.3	1683	3172	0.1
29S	46H1	921.5	1887.43	0.61	28727	4.6	91.3	1327	26238	
29S	47G9	876.2	692.44	1.20	5056	12.7	74.9	642	3788	
29S	47H0	920.3	1391.86	1.11	11505	22.4	67.0	2581	7710	
29S	47H1	920.3	2335.97	0.76	28130	14.7	71.8	4128	20211	
29S Total		5505.9			86940			11436	65186	0.1
Grand Total		21619.9			191221			29953	123115	65.1

Table 3.3.1. RV “Argos” estimated number (millions) of herring, October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	874.27	571.09	97.20	51.25	54.40	86.08	7.93	3.70		2.64
25	**39G5**	765.43	105.96	137.73	204.94	133.50	117.72	52.94	6.32	6.32	
25	**40G4**	330.93	268.03	43.03	5.59	9.45	3.86	0.96			
25	**40G5**	884.94	295.58	265.78	130.59	91.61	63.64	23.98	11.27	2.48	
25	**40G6**	871.79	22.14	52.02	121.87	220.75	248.22	114.92	74.65	14.09	3.14
25	**40G7**	58.85	0.06	1.54	12.13	18.70	18.04	5.94	2.04	0.35	0.06
25	**41G6**	808.02	23.46	83.93	189.49	273.69	153.00	65.16	10.43	8.86	
25	**41G7**	145.30		9.80	36.33	51.17	32.04	7.37	5.11	2.93	0.55
	Sum	4739.53	1286.31	691.03	752.20	853.28	722.59	279.20	113.51	35.02	6.39
27	**42G6**	159.08		12.88	39.00	59.67	36.64	10.27	0.62		
27	**42G7**	329.73		104.61	90.90	73.69	32.29	16.82	10.45		0.97
27	**43G7**	915.00	45.02	734.43	51.49	36.00	36.56	11.51			
27	**44G7**	1395.22	11.48	621.31	331.31	297.23	97.29	16.49	20.12		
27	**44G8**	4030.63	444.46	910.32	1060.51	931.81	606.90	45.98	30.66		
27	**45G7**	1416.27	148.71	442.26	334.20	316.37	140.54	25.70	8.49		
27	**45G8**	421.57	366.62	31.90	9.62	5.39	6.82	0.81	0.40		
27	**46G8**	89.93	21.88	59.41	5.82	2.52		0.30			
	Sum	8757.44	1038.18	2917.11	1922.83	1722.68	957.04	127.88	70.75		0.97
28	**42G8**	852.69		26.78	77.44	186.77	306.18	178.98	42.78	30.96	2.81
28	**43G8**	2658.69		312.03	222.88	948.85	748.25	299.30	44.58	82.78	
28	**44G9**	437.03	284.08	54.59	22.56	53.21	15.30	3.63	3.65		
28	**45G9**	1071.64	182.41	420.61	164.50	144.07	134.53	21.87	3.64		
	Sum	5020.05	466.50	814.01	487.38	1332.91	1204.27	503.79	94.64	113.74	2.81
29S	**46G9**	1074.93	92.41	433.22	299.55	132.29	103.94	10.44			3.07
29S	**46H0**	1683.16	100.52	689.90	408.59	343.65	111.68	14.41	9.60	4.81	
29S	**46H1**	1327.00	706.23	589.27	27.00	4.50					
29S	**47G9**	641.60	112.80	185.71	156.48	124.93	32.37	29.31			
29S	**47H0**	2581.35	916.31	1180.74	220.23	185.97	78.08				
29S	**47H1**	4127.66	579.16	2141.83	715.88	463.57	145.92	58.37	22.93		
	Sum	11435.69	2507.43	5220.67	1827.74	1254.91	471.99	112.53	32.54	4.81	3.07
Total		29952.72	5298.42	9642.82	4990.15	5163.78	3355.90	1023.40	311.43	153.57	13.24

Table 3.3.2. RV “Argos” estimated mean weights (g) of herring. October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	34.1	9.6	32.1	45.3	56.1	65.3	77.7	48.0		68.0
25	**39G5**	36.2	13.0	29.8	54.0	56.1	51.9	52.4	69.0	69.0	
25	**40G4**	22.4	10.6	28.4	37.0	47.4	51.5	46.0			
25	**40G5**	35.6	12.3	30.7	48.4	59.8	62.2	60.5	70.5	131.0	
25	**40G6**	48.4	13.1	28.7	37.3	42.5	53.1	66.0	60.9	80.8	79.0
25	**40G7**	42.9	9.0	28.7	34.2	41.1	49.0	46.2	64.7	49.0	79.0
25	**41G6**	32.5	12.7	16.3	25.9	32.4	41.8	39.0	56.0	53.0	
25	**41G7**	34.2		16.1	28.5	33.9	42.6	48.5	56.2	38.5	43.0
27	**42G6**	27.7		15.6	22.7	29.6	36.3	35.0	46.0		
27	**42G7**	27.7		15.8	26.4	28.1	35.9	54.3	41.0		64.0
27	**43G7**	17.6	4.9	13.6	21.1	26.4	31.0	33.3			
27	**44G7**	20.2	4.4	13.1	20.3	26.7	29.1	30.9	30.4		
27	**44G8**	17.0	3.6	14.0	19.7	24.7	27.3	33.3	38.0		
27	**45G7**	18.8	4.4	13.3	20.9	24.8	28.9	31.6	29.0		
27	**45G8**	11.1	3.4	12.2	18.2	24.4	25.5	29.0	22.0		
27	**46G8**	8.7	3.0	9.9	14.8	17.0		23.0			
28	**42G8**	37.7		14.7	19.0	51.3	36.9	39.9	40.8	50.3	72.0
28	**43G8**	28.2		14.2	20.0	28.2	37.3	39.8	46.0	46.4	
28	**44G9**	10.9	2.6	10.1	19.2	21.6	25.0	27.0	28.0		
28	**45G9**	17.7	3.4	12.3	18.5	22.3	29.5	34.1	28.0		
29S	**46G9**	13.0	3.1	11.4	17.3	20.3	25.3	33.0			30.0
29S	**46H0**	11.9	2.3	8.7	14.3	20.7	23.4	24.5	34.0	35.0	
29S	**46H1**	6.7	1.9	8.5	15.7	18.0					
29S	**47G9**	12.0	3.0	9.9	17.3	20.6	26.5	26.8			
29S	**47H0**	9.1	2.6	8.2	14.0	18.8	19.7				
29S	**47H1**	9.8	1.7	7.2	13.2	18.2	21.8	27.6	30.0		

Table 3.3.3. RV “Argos” estimated number (millions) of sprat. October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	1179.14	84.24	299.01	510.38	110.33	88.44		65.69	4.22	16.84
25	**39G5**	1193.06	90.60	259.08	428.51	127.55	86.64	45.62	112.05	43.01	
25	**40G4**	1255.00	920.34	133.78	59.64	36.86	38.93	19.88	33.13		12.43
25	**40G5**	2149.64	545.35	323.54	524.80	142.56	384.43	36.31	153.15		39.50
25	**40G6**	833.00	154.46	73.98	174.13	39.89	197.28	39.89	113.67		39.72
25	**40G7**	404.29	6.35	36.16	105.54	36.27	84.96	41.34	43.37	2.50	47.79
25	**41G6**	1473.73	124.03	62.75	284.53	509.24	264.10	35.02	166.34	27.72	
25	**41G7**	1123.62		89.31	300.08	262.28	228.96	110.71	85.49	39.93	6.85
	Sum	9611.48	1925.37	1277.60	2387.61	1264.98	1373.74	328.77	772.91	117.38	163.13
27	**42G6**	316.64	21.11	9.95	58.50	41.92	96.50	7.84	57.30		23.52
27	**42G7**	1684.01	19.90	72.92	23.87	535.04	496.57	205.53	194.92	31.83	103.42
27	**43G7**	4566.16		547.15	991.96	1102.16	991.95	145.65	169.27	94.48	523.54
27	**44G7**	6068.08	774.60	1013.92	925.53	319.27	752.00	708.94	1025.17		548.66
27	**44G8**	6491.92	3126.42	570.13	29.43	1206.43	1029.86	154.48	253.79	84.60	36.79
27	**45G7**	6469.14	1473.14	866.02	1099.71	796.63	1405.38	207.82	163.91	144.62	311.93
27	**45G8**	7564.99	5020.46	1291.20	300.45	421.82	120.65	62.80	169.33	1.61	176.67
27	**46G8**	1658.89	91.48	442.77	171.99	265.61	194.56	6.10	147.59	31.71	307.08
	Sum	34819.83	10527.11	4814.06	3601.44	4688.88	5087.46	1499.16	2181.27	388.84	2031.61
28	**42G8**	922.58	3.45	98.13	64.27	251.55	209.74	194.02	39.39		62.02
28	**43G8**	2471.50	10.98	109.85	241.66	732.66	254.84	682.13	208.70	21.97	208.70
28	**44G9**	5007.25	3787.85	691.46	153.28	156.69	74.94	68.11	17.02		57.90
28	**45G9**	5096.77	273.02	1364.50	758.04	697.93	833.48	419.81	374.11	119.58	256.30
	Sum	13498.11	4075.31	2263.94	1217.25	1838.83	1373.00	1364.07	639.22	141.55	584.92
29S	**46G9**	4066.32	603.34	468.29	424.40	1028.65	719.29	95.99	119.49	161.50	445.39
29S	**46H0**	3172.28	347.89	481.57	436.37	742.64	261.14	219.10	111.45	135.37	436.73
29S	**46H1**	26237.69	17440.26	6698.60	416.38	674.34	171.97	282.88	169.02	121.54	262.70
29S	**47G9**	3787.81	157.59	1442.67	866.74	478.94	348.75	184.00	140.18	7.84	161.09
29S	**47H0**	7710.14	857.97	2178.96	1147.80	1827.32	111.01	588.08	588.08		410.92
29S	**47H1**	20211.36	8021.89	9819.44	87.31	644.31	156.32	602.20	335.23	240.06	304.60
	Sum	65185.59	27428.94	21089.52	3378.99	5396.21	1768.47	1972.25	1463.45	666.32	2021.43
Total		123115.00	43956.73	29445.13	10585.28	13188.91	9602.67	5164.25	5056.85	1314.09	4801.10

Table 3.3.4. RV “Argos” estimated mean weights (g) of sprat. October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	11.22	3.92	9.81	15.00	17.40	18.25		14.50	18.00	18.00
25	**39G5**	12.45	4.57	10.41	14.82	17.67	17.86	19.33	17.60	16.00	
25	**40G4**	10.43	4.25	11.50	14.60	17.33	18.40	19.00	17.00		18.50
25	**40G5**	11.30	3.89	11.25	15.80	17.57	17.13	18.33	19.36		18.00
25	**40G6**	11.12	4.33	9.81	13.88	16.00	15.56	16.00	16.80		18.67
25	**40G7**	12.77	4.14	9.65	13.00	13.83	15.18	16.50	15.86	17.00	16.44
25	**41G6**	10.00	3.92	9.00	12.38	13.17	14.33	12.00	14.00	15.00	
25	**41G7**	12.21		8.85	12.71	12.50	13.88	13.50	16.00	15.00	18.00
27	**42G6**	11.98	3.91	9.80	13.33	15.33	15.11	18.50	16.83		15.67
27	**42G7**	11.17	4.00	7.91	14.50	12.00	13.40	12.00	13.80	17.00	14.00
27	**43G7**	10.08		7.69	11.17	11.50	11.20	12.00	12.00	13.00	12.33
27	**44G7**	11.05	4.00	8.45	10.60	13.33	11.33	11.00	13.20		13.86
27	**44G8**	7.54	2.62	7.40	10.00	10.86	11.50	13.00	13.00	11.50	14.00
27	**45G7**	8.14	2.88	7.61	10.50	12.00	11.83	13.00	13.00	10.00	13.33
27	**45G8**	7.00	2.63	6.58	9.67	10.50	10.33	11.00	10.50		11.00
27	**46G8**	7.23	2.46	6.42	8.00	10.40	9.33	12.00	11.00	12.00	10.75
28	**42G8**	9.71	3.00	7.40	9.67	11.29	12.00	11.80	9.50		12.00
28	**43G8**	9.95	3.00	7.50	9.25	11.25	12.00	11.57	11.00	14.00	11.00
28	**44G9**	6.03	2.60	5.76	9.80	10.00	11.00	11.00	13.00		11.67
28	**45G9**	7.73	2.94	6.41	9.10	10.25	11.18	11.33	11.20	10.50	11.60
29S	**46G9**	7.55	2.50	6.36	9.29	10.77	10.85	11.00	12.50	11.80	11.33
29S	**46H0**	6.93	2.15	5.25	8.92	10.21	11.00	11.60	11.67	11.50	11.60
29S	**46H1**	6.28	1.97	5.04	8.75	10.04	11.13	10.82	10.86	10.43	11.44
29S	**47G9**	6.70	2.23	5.88	9.33	11.00	11.33	11.00	10.00		10.00
29S	**47H0**	6.21	2.06	5.32	8.57	10.00	12.00	10.00	10.00		12.00
29S	**47H1**	5.10	1.63	4.42	8.00	9.60	11.00	10.25	10.50	9.00	9.50

Table 3.3.5. Estimated biomass (in tonnes) of herring October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	29806	5502	3124	2323	3050	5624	616	177		180
25	**39G5**	27727	1378	4104	11067	7495	6106	2774	436	436	
25	**40G4**	7427	2836	1223	207	448	199	44			
25	**40G5**	31523	3637	8159	6315	5477	3956	1451	794	325	
25	**40G6**	42227	290	1493	4550	9385	13181	7589	4543	1138	248
25	**40G7**	2527	1	44	415	768	883	274	132	17	5
25	**41G6**	26271	297	1371	4901	8859	6397	2541	584	470	
25	**41G7**	4965		158	1035	1737	1363	358	287	113	24
	Sum	172472	13940	19677	30813	37219	37710	15647	6955	2499	456
27	**42G6**	4413		201	884	1765	1328	360	28		
27	**42G7**	9123		1654	2396	2069	1160	913	428		62
27	**43G7**	16084	222	9974	1086	952	1133	383			
27	**44G7**	28147	51	8137	6716	7922	2833	509	612		
27	**44G8**	68676	1614	12699	20857	22985	16568	1533	1165		
27	**45G7**	26665	659	5890	6993	7839	4062	811	246		
27	**45G8**	4672	1243	390	175	132	174	23	9		
27	**46G8**	780	66	588	86	43		7			
	Sum	158560	3855	39533	39193	43706	27258	4538	2489		62
28	**42G8**	32111		394	1471	9584	11290	7147	1743	1556	202
28	**43G8**	75006		4433	4458	26794	27872	11906	2051	3841	
28	**44G9**	4756	748	550	433	1148	383	98	102		
28	**45G9**	18934	620	5185	3036	3220	3967	746	102		
	Sum	130807	1368	10562	9399	40746	43512	19896	3998	5397	202
29S	**46G9**	14025	288	4932	5185	2682	2633	345			92
29S	**46H0**	20079	228	5970	5843	7112	2615	353	327	168	
29S	**46H1**	8912	1342	5022	423	81					
29S	**47G9**	7685	335	1836	2706	2579	858	784			
29S	**47H0**	23592	2373	9685	3073	3501	1536				
29S	**47H1**	40392	1010	15503	9419	8445	3181	1611	688		
	Sum	114685	5577	42947	26650	24400	10823	3093	1014	168	92
Total		576525	24741	112719	106054	146071	119303	43174	14456	8064	813

Table 3.3.6. Estimated biomass (in tonnes) of sprat October 2003.

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
25	**39G4**	13230	330	2933	7656	1920	1614		953	76	303
25	**39G5**	14857	414	2697	6350	2253	1547	882	1972	688	
25	**40G4**	13091	3911	1538	871	639	716	378	563		230
25	**40G5**	24294	2119	3640	8292	2505	6583	666	2966		711
25	**40G6**	9264	669	726	2416	638	3069	638	1910		741
25	**40G7**	5164	26	349	1372	502	1290	682	688	43	786
25	**41G6**	14737	486	565	3521	6705	3785	420	2329	416	
25	**41G7**	13724		790	3815	3279	3177	1495	1368	599	123
	Sum	108362	7957	13239	34292	18441	21782	5161	12748	1821	2895
27	**42G6**	3793	83	98	780	643	1458	145	964		369
27	**42G7**	18812	80	577	346	6420	6654	2466	2690	541	1448
27	**43G7**	46004		4206	11077	12675	11110	1748	2031	1228	6457
27	**44G7**	67068	3098	8572	9811	4257	8523	7798	13532		7603
27	**44G8**	48955	8188	4219	294	13098	11843	2008	3299	973	515
27	**45G7**	52630	4235	6591	11547	9560	16630	2702	2131	1446	4159
27	**45G8**	52955	13179	8495	2904	4429	1247	691	1778		1943
27	**46G8**	11991	225	2843	1376	2762	1816	73	1624	381	3301
	Sum	302208	29088	35601	38135	53844	59281	17631	28049	4569	25795
28	**42G8**	8962	10	726	621	2839	2517	2289	374		744
28	**43G8**	24581	33	824	2235	8242	3058	7893	2296	308	2296
28	**44G9**	30195	9848	3984	1502	1567	824	749	221		675
28	**45G9**	39415	803	8753	6898	7154	9320	4758	4190	1256	2973
	Sum	103154	10695	14287	11257	19802	15719	15690	7081	1563	6689
29S	**46G9**	30710	1508	2979	3941	11078	7802	1056	1494	1906	5048
29S	**46H0**	21996	747	2528	3891	7586	2873	2542	1300	1557	5066
29S	**46H1**	164714	34318	33778	3643	6768	1913	3060	1835	1268	3005
29S	**47G9**	25378	352	8483	8090	5268	3953	2024	1402		1611
29S	**47H0**	47848	1770	11595	9838	18273	1332	5881	5881		4931
29S	**47H1**	102982	13088	43432	698	6185	1719	6173	3520	2161	2894
	Sum	393629	51783	102795	30101	55159	19591	20735	15431	6891	22554
Total		907353	99523	165922	113786	147246	116373	59217	63310	14844	57932

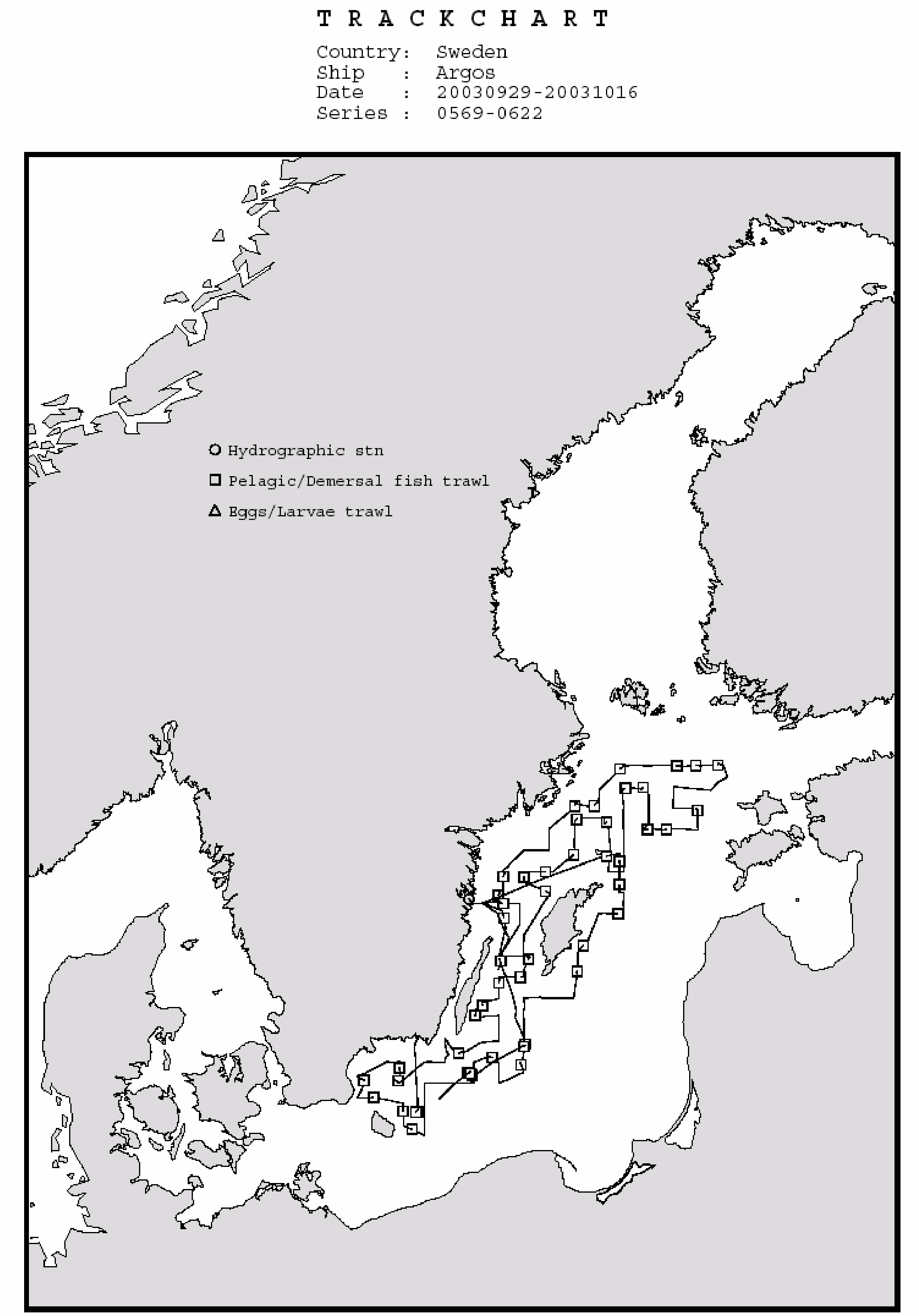
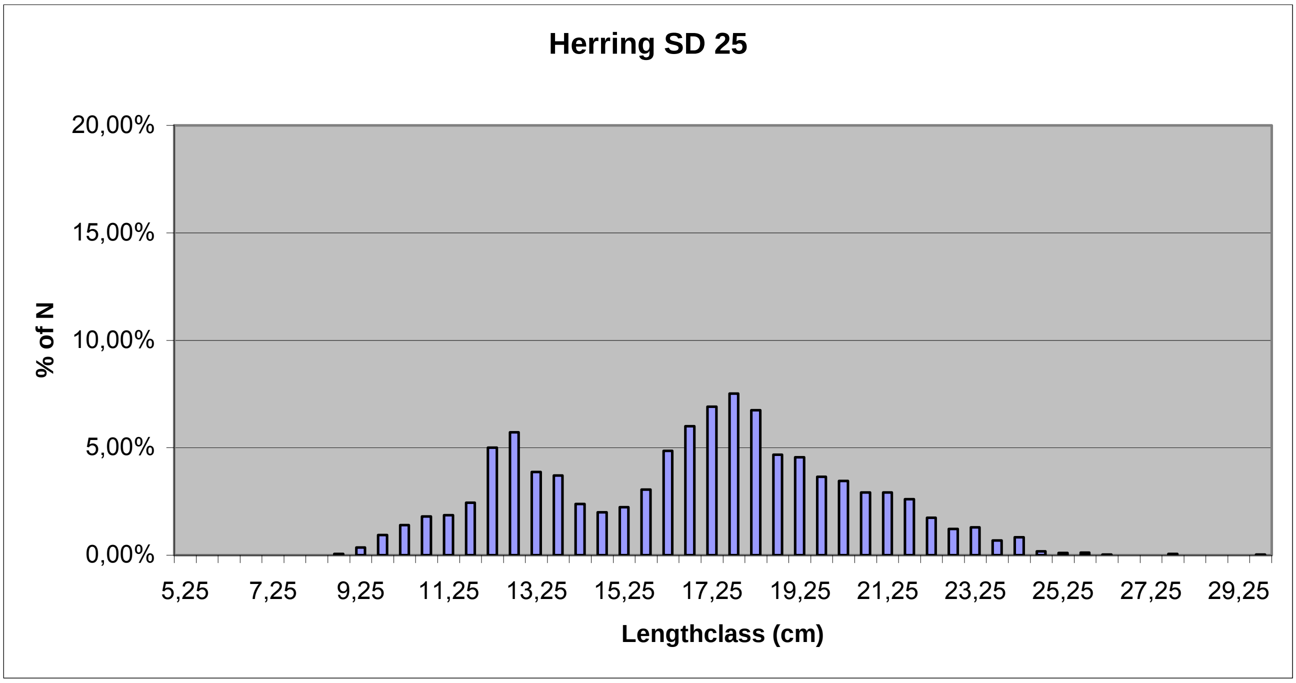


Figure 2.3.1. Survey grid and trawl positions of RV "Argos".



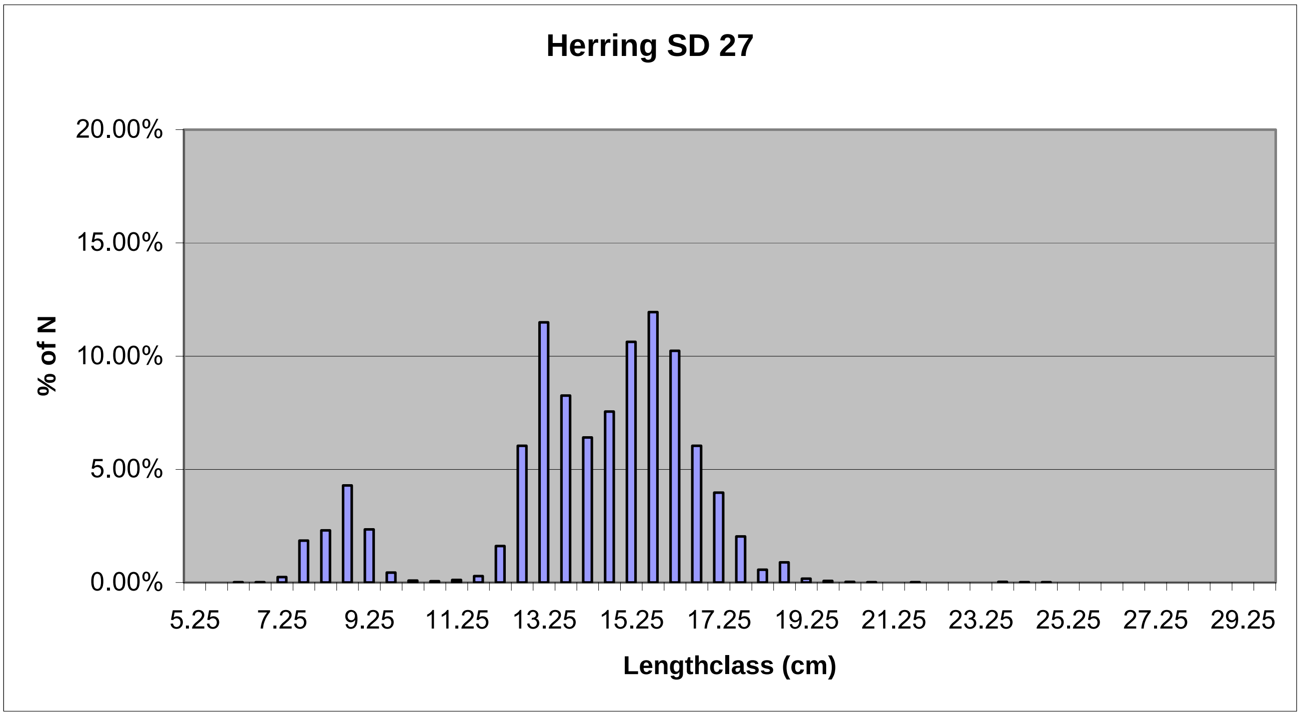
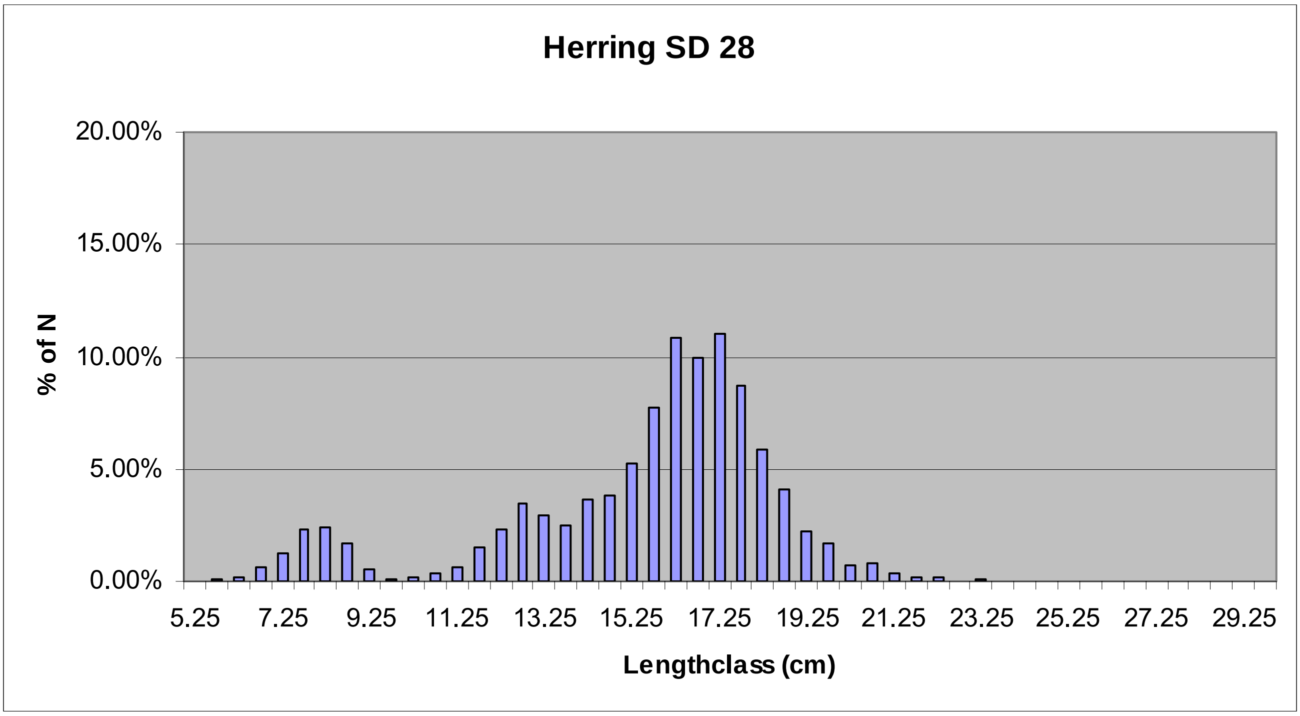


Figure 3.1.1. Length distribution of herring, October 2003.



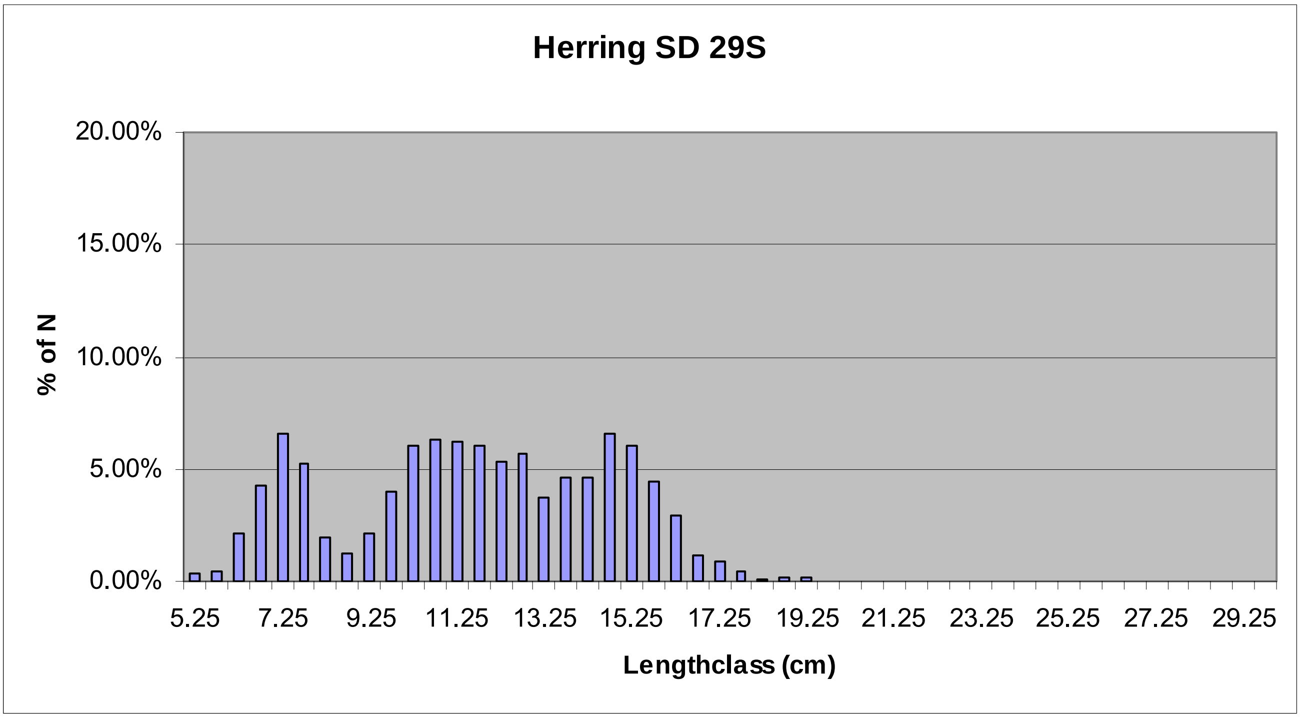


Figure 3.1.1. (continued). Length distribution of herring, October 2003

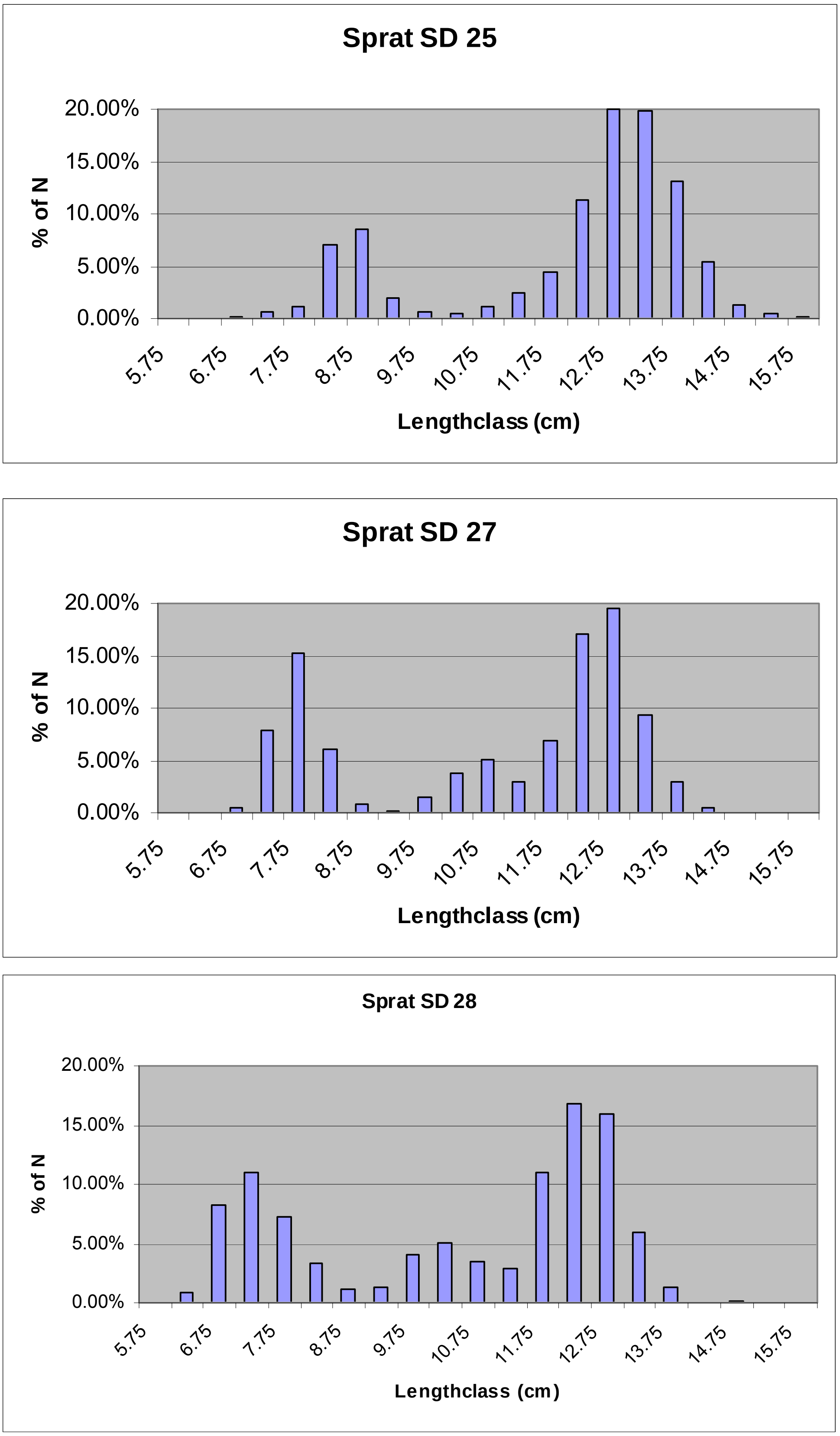


Figure 3.1.2. Length distribution of sprat, October 2003.

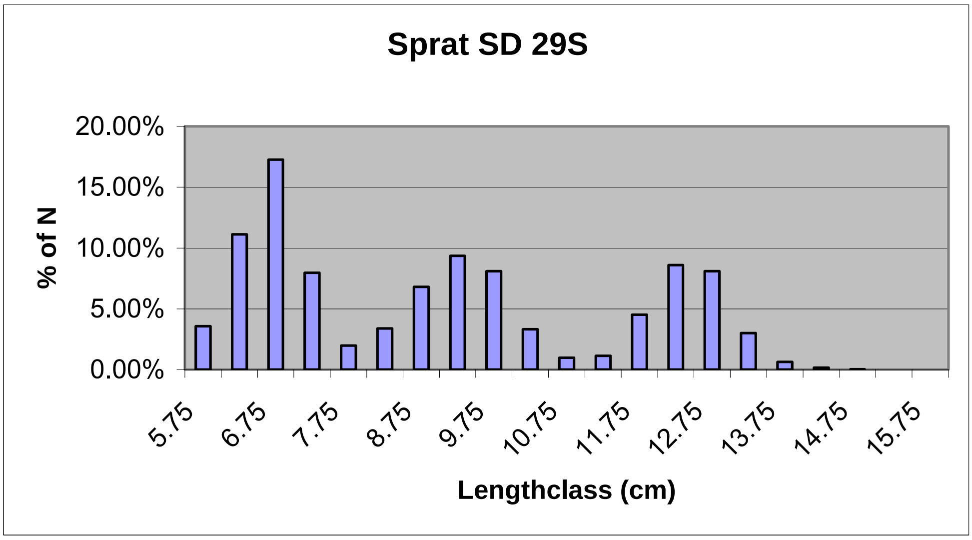


Figure 3.1.2. (continued) Length distribution of sprat, October 2003.

Survey Report for CV "AMAZON"

5–10 November 2003

Olavi Kaljuste
Estonian Marine Institute, University of Tartu, Tallinn, Estonia

1. INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea and in the Estonian economic zone. The Estonian survey is co-ordinated within the frame of Baltic International Acoustic survey. The reported survey is conducted every year to supply:

- the ICES 'Herring Assessment Working Group for the Area South of 62ºN (HAWG)',
- the ICES 'Baltic Fisheries Assessment Working Group for the Area South of 62ºN (WGBFAS)' and
- the Department of Fish Resources of Estonian Ministry of the Environment

with a index value for the stock size of herring and sprat, respectively, in the northeastern Baltic Sea (in Estonian economic zone).

2 METHODS

2.1 Personnel

M. Kaljuste	Estonian Marine Institute – fish sampling
MSc. O. Kaljuste	Estonian Marine Institute – in charge
PhD. A. Lankov	Estonian Marine Institute – fish sampling
PhD. T. Raid	Estonian Marine Institute – fish sampling

2.2 Narrative

The 3rd Estonian acoustic survey took place in the northeastern Baltic Sea with a CV "Amazon". CV "Amazon" has the same vessel type and technical parameters as CV "Solveig" which was used in two previous years for acoustic survey. The survey was carried out from 5 to 10 November 2003. CV "Amazon" left the port of Mõntu on 5 November 2003. Estonian acoustic survey was intended to follow the same cruise track as in two previous years and cover the parts of ICES Subdivisions 28, 29 and 32. Due to mishap with a crane the transducer cable broke on 5 November and the vessel returned to the port of Mõntu. Cable was repaired and survey continued on 7 November. The survey ended on 10th November 2003 in Veere.

2.3 Survey design

For all Subdivisions the statistical rectangles were used as strata (ICES CM 2001/H:02 Ref. D: Annex 2). The area is limited by the 10 m depth line. The survey area in the northeastern Baltic Sea is characterized by large islands, sounds and shoals. Therefore parallel transects were combined with zig-zag track to cover all the depth strata regularly. The survey area was 6140 NM². The cruise track (Figure 1) reached in total a length of 353 NM.

2.4 Calibration

The transducer ES38–12 was calibrated against the standard 60 mm copper sphere directly before the survey on 5 November and after cable repairmen on 6 November. The calibrations were performed close to the port of Mõntu accordingly to the methodology described in the BIAS manual (ICES CM 2001/H:2 Ref. D: Annex 2).

2.5 Acoustic data collection

The acoustic investigations were performed around the clock. During the acoustic integration the vessel speed was 6–7 knots. The main pelagic species of interest were herring and sprat. The acoustic equipment was an SIMRAD EY500 portable sounder system. A 38 kHz split beam SIMRAD transducer ES38–12 was employed in a towed wing on the left board of vessel and 2 m below the water surface. The specific settings of the hydroacoustic equipment were used as described in the BIAS manual (ICES CM 2001/H:2 Ref. D: Annex 2). The mean area scattering cross section (Sa) values were integrated over 1 nautical mile intervals from 6 m below the surface to the bottom.

2.6 Biological data – fishing stations

The fish samples were taken using a commercial mid-water trawl. The mesh size in the cod-end was 10 mm (bar length). The intension was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the vertical net opening were controlled by a net sound. The trawl depth was chosen in accordance to the indications on the echogram. The speed 2.3 – 2.7 knots and the vertical net opening of about 20–24 m was achieved during the trawling. The trawling time lasted 30–34 minutes. From each haul sub-samples were taken to determine the length composition, mean weight at length-class, sex and maturity stage of fish. Otolith samples of herring and sprat were taken for age determination in the lab.

2.7 Data analysis

The pelagic target species herring and sprat are usually distributed in mixed layers in combinations with other species, so that it is impossible to allocate the integrator readings to a single species. Therefore the species composition was based on the trawl catch results. For each ICES statistical rectangle the species composition and length distribution were determined as the unweighted mean of all trawl results in this rectangle. From these distributions the mean acoustic cross section (sigma) was calculated according to the following target strength-length (TS) relationships:

Clupeoids	$TS = 20 \log L\ (cm) - 71.2$	(ICES 1983/H:12)

3-spined stickleback was assumed to have the same target TS relationship as herring and sprat.

The total number of fish (total N) in one ICES statistical rectangle was estimated as the product of the mean area scattering cross section (Sa) and the rectangle area, divided by the corresponding mean cross section (sigma). The total number were separated to herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 12 trawl hauls were made during the survey (2 hauls in Subdivision 28, 8 hauls in Subdivision 29 and 2 hauls in Subdivision 32). Catch compositions by trawl hauls are presented in Table 1. Sprat, 3-spined stickleback and herring formed about 99.9% of all catches. 1015 herrings and 3410 sprats were measured on board the vessel for length and weight investigations. From 503 herrings and 292 sprats were taken otoliths for age determination in the lab. Length distributions for herring and sprat by ICES Subdivisions are shown in Figures 2 and 3.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean sigma, the estimated total number of fish, the percentages of herring and sprat per Subdivision and ICES statistical rectangle are presented in Table 2. The horizontal distribution of Sa values is shown in Figure 4. High fish concentrations were found in the rectangles 46H0, 46H1 and 47H3.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 2. The estimated number of herring and sprat by age group and Subdivision/ICES statistical rectangle are given in Table 3 and Table 6. The corresponding mean weights by age group and Subdivision/ICES statistical rectangle are shown in Table 4 and Table 7. The estimates of herring and sprat biomass by age group and Subdivision/ICES statistical rectangle are summarized in Table 5 and Table 8.

The abundance and biomass estimates were dominated by young fish (0 and 1 year old sprat and 1 year old herring).

4 DISCUSSION

In 2002 the survey was performed in hard weather conditions one month later than last year. Therefore last year results could be compared only for rectangles 46H0, 46H1 and 47H1 with the results of RV "Argos" from 2002.

The total number of fish has decreased only by 3% compared to 2002. The number of herring has decreased about 2 times and biomass by 27%. At the same time sprat abundance has increased by 60% and biomass by 24% due to the abundant year-class in 2003.

5 REFERENCES

ICES. 1983. Report of the Planning Group on ICES co-ordinated herring and sprat acoustic surveys. ICES CM 1983/H:12.

ICES. 2001. Report of the Baltic International Fish Survey Working Group. ICES CM 2001/H:2 Ref. D: Annex 2.

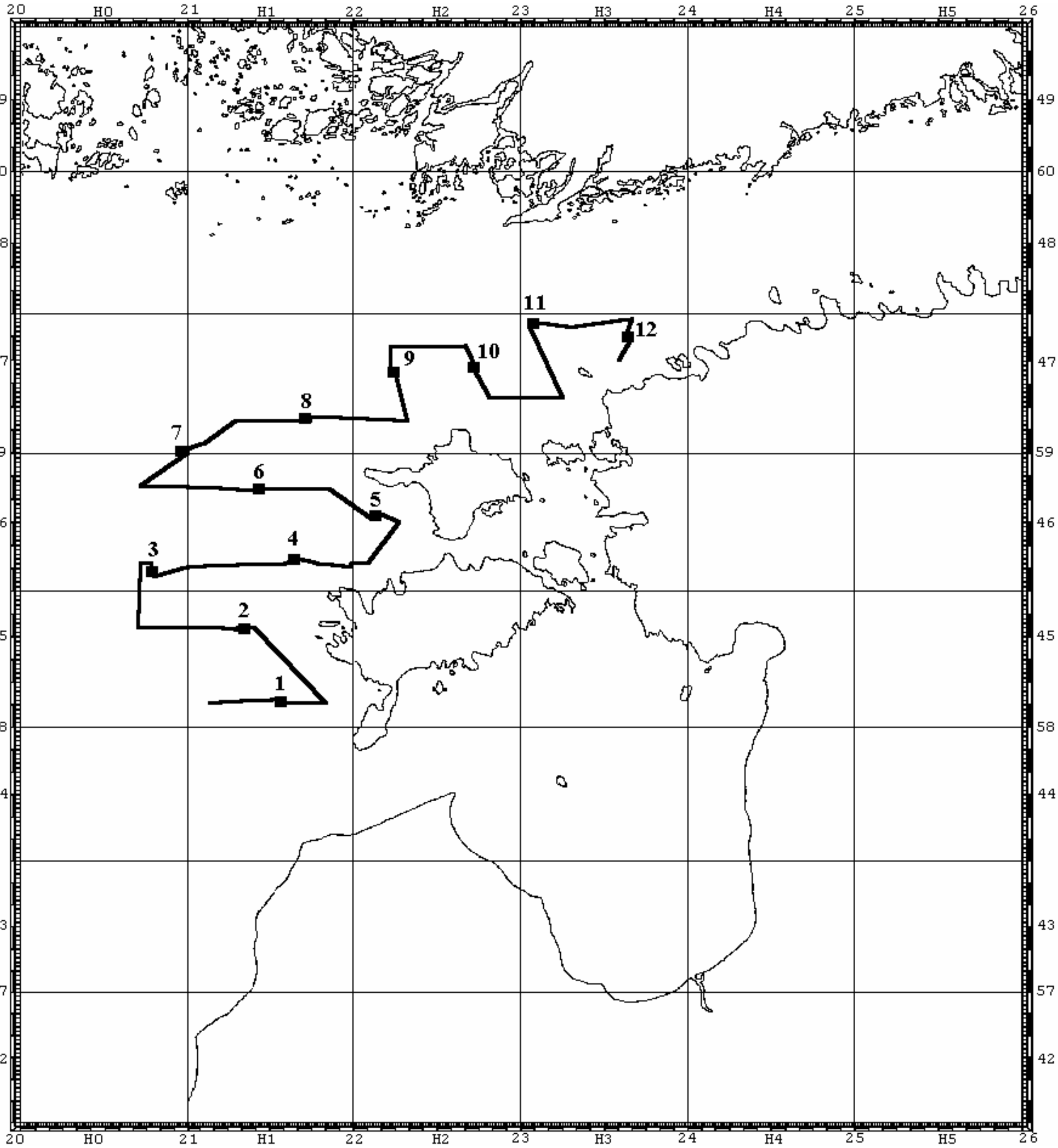
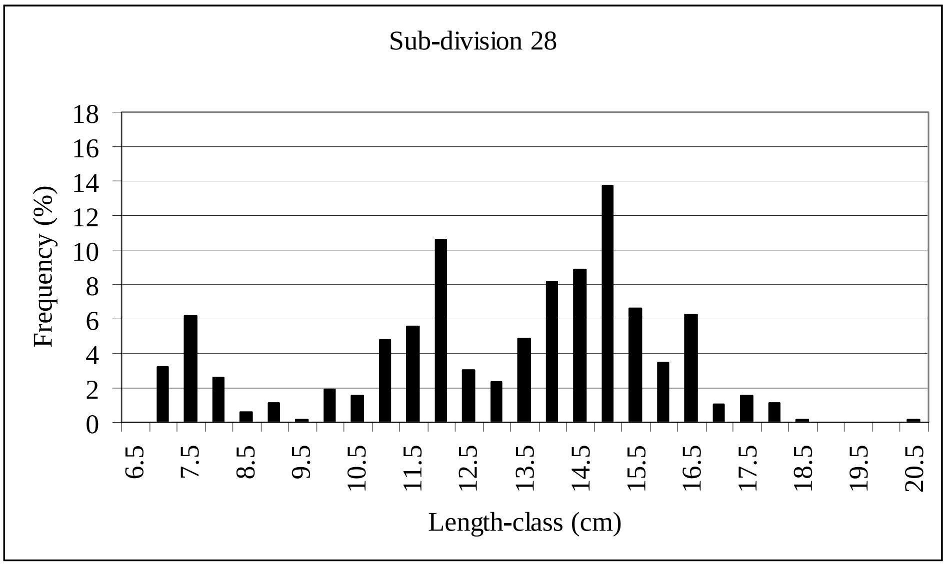
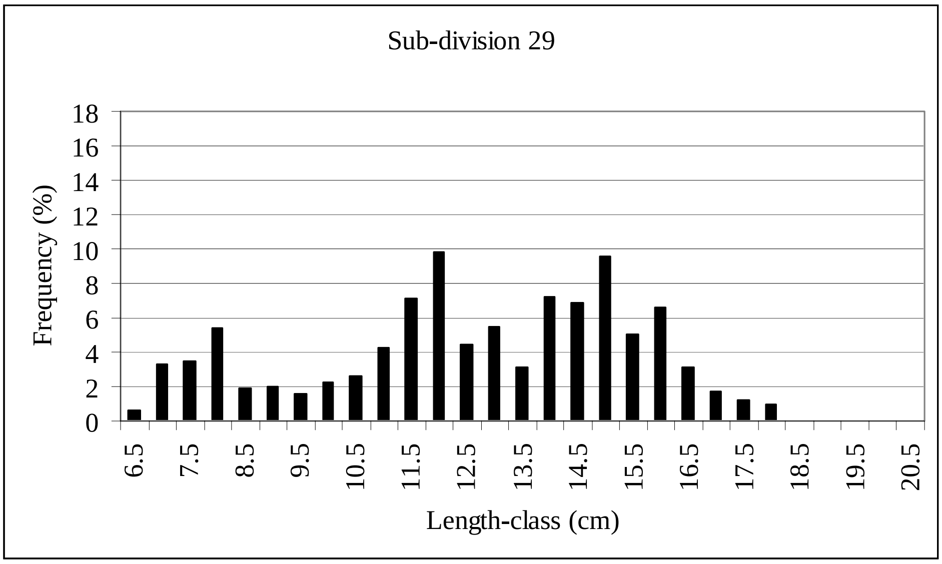


Figure 1. Cruise track and trawl positions of CV "Amazon", November 2003.





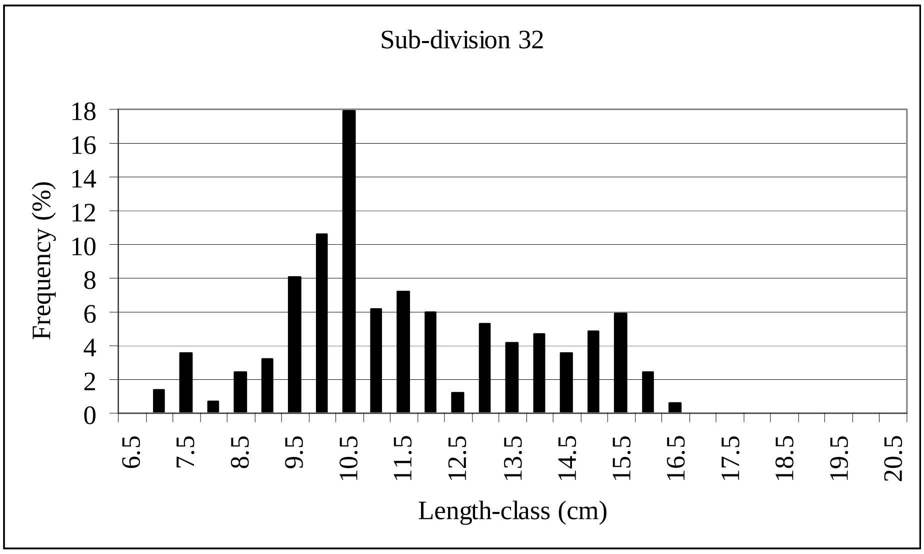


Figure 2. Length frequency distribution of herring in Subdivisions 28, 29 and 32.

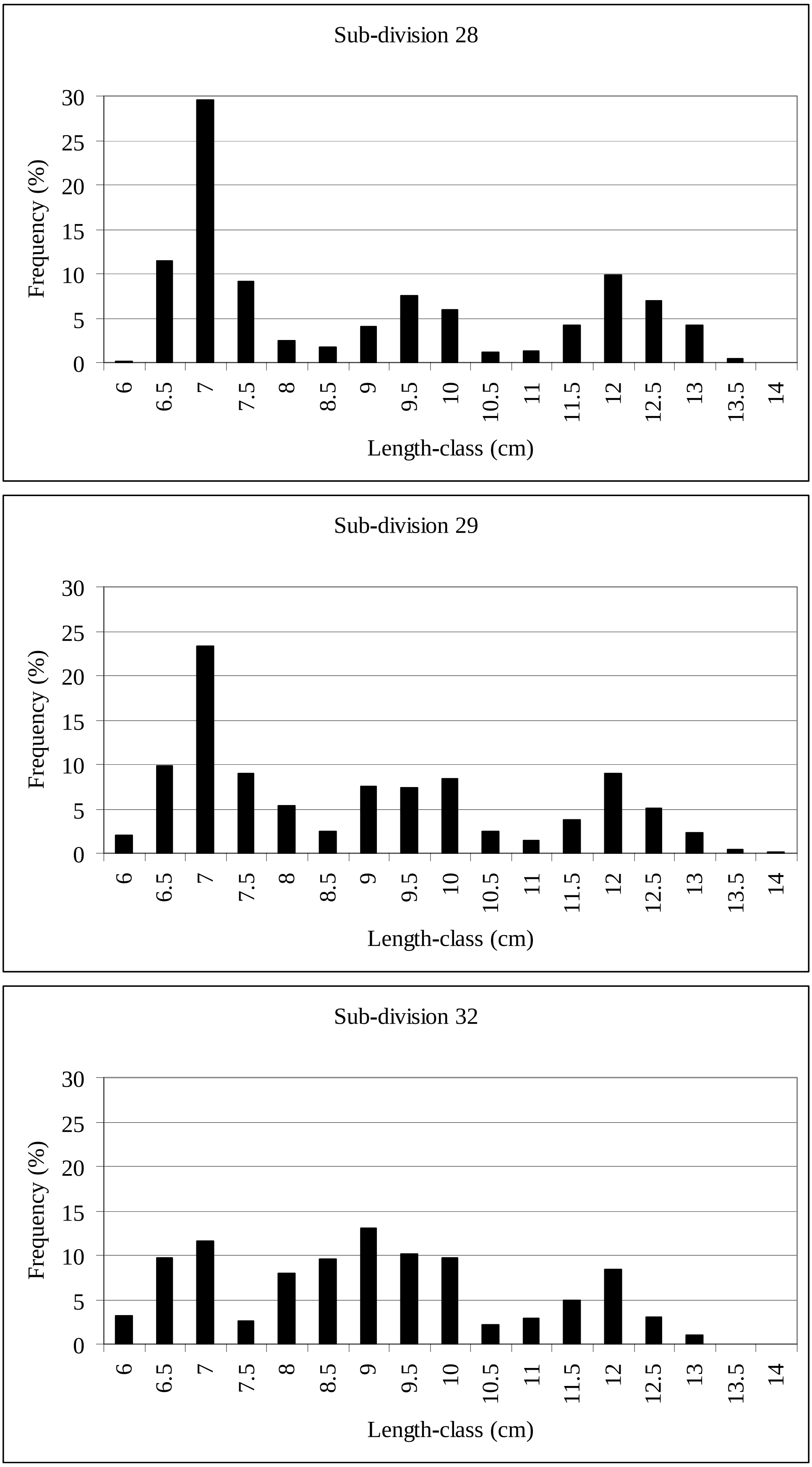


Figure 3. Length frequency distribution of sprat in Subdivisions 28, 29 and 32.

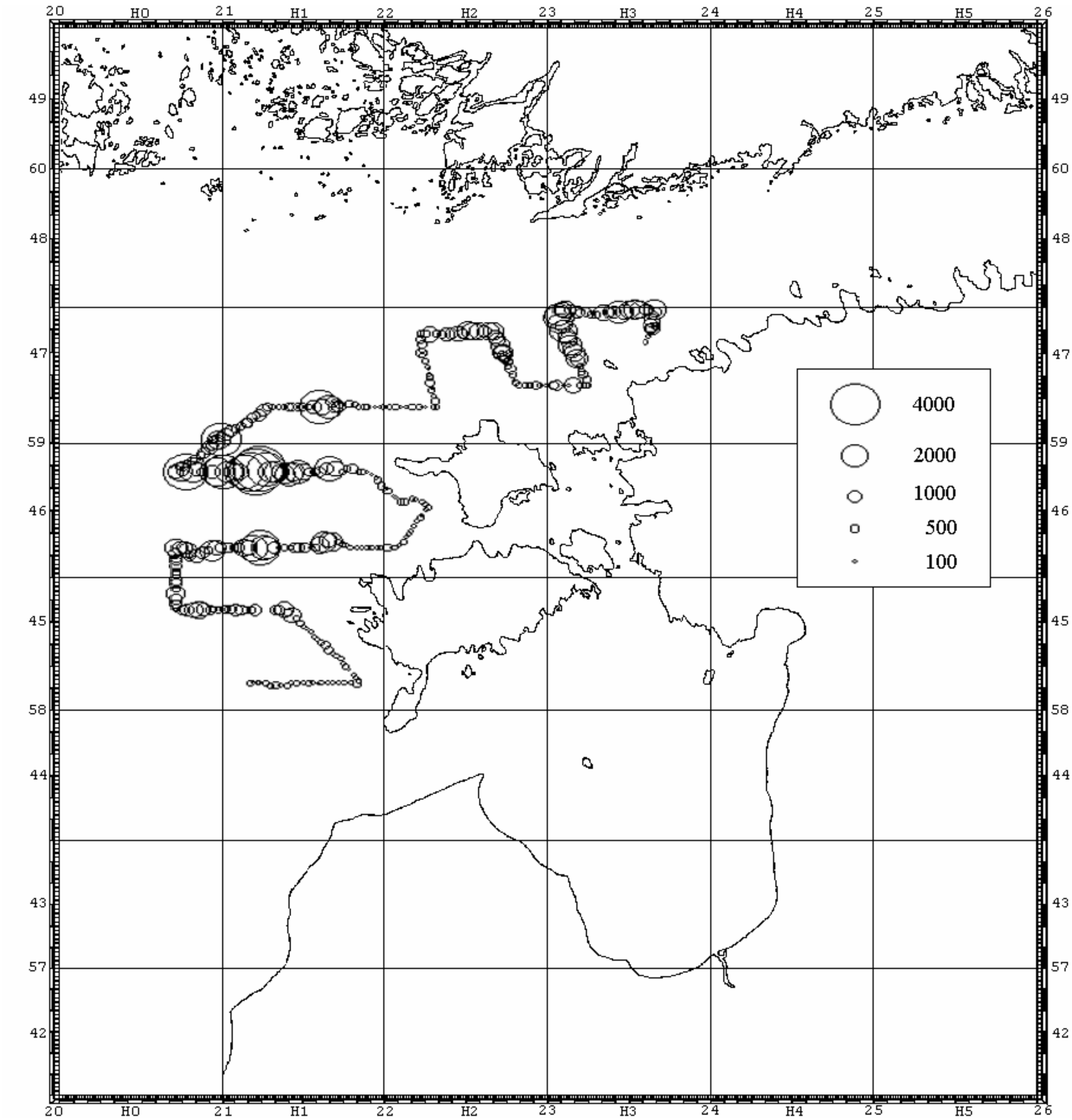


Figure 4. Distribution of Sa-values estimated by C/V “Amazon”, November 2003.

Table 1. CV "Amazon" catch composition (kg/0.5 h) per haul and Subdivision, November 2003.

Subdivision	28		29								32		Total
ICES rectangle	45H1	45H1	46H0	46H1	46H2	46H1	47H0	47H1	47H2	47H2	47H3	47H3	
Species \ Haul No.	1	2	3	4	5	6	7	8	9	10	11	12	
Clupea harengus	20.02	16.96	29.01	8.16	0.08	21.21	10.32	22.73	78.76	2.30	16.76	135.69	362.01
Sprattus sprattus	35.07	110.02	100.27	51.61	13.35	75.36	61.96	243.54	219.48	15.56	20.30	336.02	1282.53
Gasterosteus aculeatus	44.91	3.02	20.72	20.23	26.57	53.43	27.72	33.73	51.76	12.14	12.94	228.29	535.46
Total	100	130	150	80	40	150	100	300	350	30	50	700	2180

Table 2. Survey statistics of CV "Amazon", November 2003.

Subdivision	ICES Rectangle	Area (NM²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	N Herring (million)	N Sprat (million)
28	45H0	947.2	745.7	1.131	6245	10.71	77.14	669	4818
	45H1	827.1	371.1	0.561	5469	5.88	86.61	321	4736
	Total	1774.3			11714			991	9554
29	46H0	933.8	1449.0	0.933	14507	8.04	83.51	1166	12115
	46H1	921.5	1219.9	0.927	12130	8.40	81.20	1019	9850
	46H2	258.0	243.0	0.373	1680	0.26	50.90	4	855
	47H1	920.3	673.3	0.767	8081	5.66	89.83	457	7259
	47H2	793.9	605.5	0.556	8652	3.88	65.18	336	5640
	Total	3827.5			45051			2982	35719
32	47H3	536.2	961.7	0.879	5867	23.79	59.19	1396	3473
Grand	Total	6137.9			62632			5368	48745

Table 3. CV "Amazon" estimated number of herring (millions) per age group, November 2003.

Sub-division	ICES Rectangle	Total	Age 0	1	2	3	4	5	6	7	8+
28	45H0	669.11	24.53	163.93	176.57	146.77	106.38	17.35	17.97	4.46	11.15
	45H1	321.39	117.89	95.61	33.03	27.21	24.92	10.73	6.37	1.60	4.02
	Sum	990.50	142.42	259.55	209.60	173.98	131.29	28.08	24.34	6.06	15.18
29	46H0	1165.88	190.83	287.60	240.92	242.20	83.65	82.71	19.25	18.73	0.00
	46H1	1018.68	52.10	452.16	229.16	122.54	69.48	53.23	29.55	10.46	0.00
	46H2	4.34	4.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	47H1	457.36	162.73	121.11	52.94	63.89	27.26	25.23	0.00	4.20	0.00
	47H2	335.77	74.35	175.69	21.79	32.89	17.28	10.62	1.85	1.31	0.00
	Sum	2982.03	484.35	1036.56	544.81	461.51	197.66	171.78	50.66	34.70	0.00
32	47H3	1395.79	93.63	772.24	240.82	142.70	70.65	42.46	24.58	0.51	8.21
Total		5368.32	720.40	2068.34	995.24	778.19	399.60	242.32	99.57	41.27	23.39

Table 4. Herring mean weight (g) per age group estimated by CV "Amazon", November 2003.

Sub-division	ICES Rectangle	Total	Age 0	1	2	3	4	5	6	7	8+
28	45H0	16.12	3.75	9.69	14.70	19.15	21.61	24.02	24.61	32.33	35.50
	45H1	10.69	2.79	9.15	14.49	19.36	22.19	25.51	27.33	32.33	42.93
29	46H0	14.23	2.93	9.64	15.02	19.23	21.38	26.10	29.65	24.83	
	46H1	14.34	3.80	9.87	14.63	18.84	24.19	26.02	30.76	29.30	
	46H2	2.50	2.50								
	47H1	10.85	2.90	9.33	14.85	19.35	21.57	25.98		22.07	
	47H2	9.73	3.13	7.62	14.82	19.29	23.13	24.34	28.84	22.07	
32	47H3	10.14	2.80	7.25	11.66	17.13	18.99	22.05	23.29	29.17	22.07

Table 5. Herring total biomass (t) per age group estimated by CV "Amazon", November 2003.

Sub-division	ICES Rectangle	Total	Age								
			0	1	2	3	4	5	6	7	8+
28	45H0	10784.9	92.0	1588.0	2596.2	2810.9	2298.9	416.6	442.1	144.2	395.9
	45H1	3434.4	328.6	874.8	478.7	526.7	553.0	273.8	174.1	51.9	172.8
	Sum	14219.3	420.6	2462.9	3074.9	3337.6	2851.9	690.4	616.3	196.1	568.7
29	46H0	16589.4	559.0	2772.2	3617.7	4657.1	1788.6	2159.0	570.9	465.0	0.0
	46H1	14603.5	198.1	4463.5	3352.2	2308.9	1680.3	1385.1	909.1	306.3	0.0
	46H2	10.9	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	47H1	4960.4	472.0	1129.7	786.0	1236.6	588.0	655.5	0.0	92.8	0.0
	47H2	3268.6	232.6	1338.4	322.9	634.3	399.6	258.5	53.3	29.0	0.0
	Sum	39432.8	1472.5	9703.8	8078.7	8836.9	4456.5	4458.1	1533.2	893.2	0.0
32	47H3	14156.6	262.4	5595.1	2808.5	2444.5	1341.6	936.0	572.4	14.8	181.3
Total		67808.7	2155.5	17761.8	13962.1	14619.0	8650.0	6084.5	2721.9	1104.1	749.9

Table 6. CV "Amazon" estimated number of sprat (millions) per age group, November 2003.

Sub-division	ICES Rectangle	Total	Age								
			0	1	2	3	4	5	6	7	8+
28	45H0	4817.62	736.94	1638.87	705.52	436.04	347.26	427.92	109.99	146.65	268.43
	45H1	4736.17	4467.52	198.45	34.50	14.75	6.25	6.25	0.00	0.00	8.44
	Sum	9553.79	5204.46	1837.32	740.01	450.78	353.51	434.17	109.99	146.65	276.87
29	46H0	12115.10	5155.87	3403.86	1154.05	1246.41	0.00	172.35	171.83	370.65	440.09
	46H1	9849.86	3735.48	3427.83	968.78	944.30	0.00	129.61	124.66	255.00	264.20
	46H2	855.03	845.89	9.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	47H1	7259.10	4425.21	1936.38	324.26	322.77	0.00	32.28	49.90	83.95	84.35
	47H2	5639.50	4460.96	676.55	177.59	195.09	0.00	13.38	37.20	49.90	28.83
	Sum	35718.59	18623.41	9453.76	2624.67	2708.57	0.00	347.62	383.60	759.50	817.47
32	47H3	3472.77	1598.17	1260.23	249.95	112.68	68.38	144.91	10.19	17.60	10.68
Total		48745.15	25426.04	12551.31	3614.63	3272.03	421.89	926.70	503.78	923.75	1105.02

Table 7. Sprat mean weight (g) per age group estimated by CV "Amazon", November 2003.

Sub-division	ICES Rectangle	Total	Age								
			0	1	2	3	4	5	6	7	8+
28	45H0	7.74	2.78	6.09	9.68	10.30	10.66	10.75	11.00	11.10	10.38
	45H1	2.70	2.45	5.83	9.54	9.84	10.06	10.06			9.89
29	46H0	5.87	2.65	6.10	9.99	10.29		10.49	10.21	10.67	11.05
	46H1	5.88	2.62	6.03	9.86	10.23		10.29	10.24	10.67	11.00
	46H2	2.12	2.09	4.89							
	47H1	4.51	2.66	6.08	9.86	10.21		10.25	10.19	10.56	11.21
	47H2	3.55	2.47	5.84	9.90	10.13		10.22	10.07	10.32	11.03
32	47H3	5.33	2.95	6.10	9.55	10.18	10.00	10.29	8.63	11.00	11.02

Table 8. Sprat total biomass (t) per age group estimated by C/V "Amazon", November 2003.

Sub-division	ICES Rectangle	Total	Age								
			0	1	2	3	4	5	6	7	8+
28	45H0	37272.6	2045.8	9981.4	6828.1	4491.5	3700.0	4602.0	1209.9	1627.9	2786.0
	45H1	12773.3	10933.7	1156.2	329.1	145.1	62.9	62.9	0.0	0.0	83.5
	Sum	50046.0	12979.5	11137.6	7157.1	4636.7	3763.0	4664.9	1209.9	1627.9	2869.5
29	46H0	71164.3	13673.0	20765.2	11524.4	12822.0	0.0	1807.3	1754.5	3955.1	4862.8
	46H1	57937.3	9794.0	20684.6	9555.6	9664.2	0.0	1334.3	1276.6	2721.9	2906.2
	46H2	1810.4	1765.7	44.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	47H1	32729.0	11790.6	11771.4	3198.8	3296.5	0.0	330.9	508.7	886.8	945.3
	47H2	20025.1	10997.6	3949.0	1758.9	1975.3	0.0	136.8	374.8	514.7	318.0
	Sum	183666.1	48020.9	57214.8	26037.7	27758.0	0.0	3609.4	3914.6	8078.5	9032.3
32	47H3	18499.3	4707.0	7684.8	2387.1	1146.5	683.5	1491.3	87.9	193.6	117.7
Total		252211.3	65707.3	76037.2	35581.9	33541.1	4446.4	9765.5	5212.4	9900.0	12019.5

Survey Report for RV "ATLANTIDA"

8 October – 3 November 2003

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography

(AtlantNIRO), Kaliningrad, Russia. and Latvian Fisheries Research Institute, Riga, Latvia

1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The joint Russian/Latvian survey in October is traditionally co-ordinated within the frame of the **Baltic International Acoustic Survey.** The reported acoustic survey is conducted every year to supply the ICES:

- 'Baltic Fisheries Assessment Working Group (WGBFAS)' with an index value for the stock size of herring and sprat, respectively, in the Baltic area (Subdivisions 26 and 28).

2 METHODS

2.1 Personnel

Zezera A.	AtlantNIRO, Kaliningrad, RUSSIA, - cruise leader
Konstantinov V.	AtlantNIRO, Kaliningrad, RUSSIA, - scientific leader
Severin V.	AtlantNIRO, Kaliningrad, RUSSIA, - hydroacoustic
Shalaginov V.	AtlantNIRO, Kaliningrad, RUSSIA, - hydroacoustic
Vasilieva T.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Shopov V.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Gribov E.	AtlantNIRO, Kaliningrad, RUSSIA, - okeanologist
Kalinina N.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Lapushkin A.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Ivanovich V.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Shvetsov F.	Latvian Fisheries Research Institute, Riga, Latvia – fish and acoustic
Chervoncev B.	Latvian Fisheries Research Institute, Riga, Latvia - fish sampling

2.2 Narrative

The 34th cruise of RV "ATLANTIDA" took place from 14th to 8th October to 3 November in 2003. The cruise was intended to cover ICES subdivisions (SD) 26 and 28, included Russian and Latvian economic zones and some parts of economic zones of Poland, Sweden and Lithuania.

2.3 Survey design

For both Subdivisions nr.26 and 28, the statistical rectangles were used as strata (ICES CM 2001/H:02 Ref. D: Annex 2). The area is limited by the 10 m depth line. The scheme of transects is defined as the regular, of rectangular form, with the distance between transects of 15 NM. The average speed of a vessel for the period of acoustic survey was 8 knots. The average speed of the vessel with a trawl was 4 knots. Duration of trawling was 30 minutes. The survey was conducted in the daytime from 7.45 up to 19.30. The survey area was 19637.4 NM^2 and the distance used for acoustic estimates was 1159 NM. The entire cruise track with positions of the trawling is shown in Figure 1.

2.4 Calibration

Both transducers with split-beam and the working frequency 38 and 120 kHz, was calibrated in the Baltic Sea shore area, near the port Baltiysk (Russia), just before echosurvey in October, 2003. The ship was fixed on the two anchors and one trawl door on the depth nearly 25 meters. The calibration procedure was carried out with a standard calibrated copper sphere, in accordance with the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02 Ref. D).

Date: 10.10.2003	Place: Baltiysk (Russia)
Type of transducer	ES38 B, (38kHz)
SV transducer Gain (ВАРУ 20 log R)	27.37 дБ
TS transducer Gain (ВАРУ 40 log R)	27.53 дБ

2.5 Acoustic data collection

The acoustic investigations were performed during only daytime. The main pelagic species of interest were herring and sprat. The acoustic equipment was an echosounder EK500 on 38 and 120 kHz. Both transducers is stationary installed in the bottom of the ship, in special blister, for air bubbles noise level decreasing. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02). The post-processing of the stored echo signals, was done with the Sonar Data Echoview ver. 2.25, Surfer and Excel software. The mean volume back scattering values Sv, were integrated over 1 NM intervals, from 10 m below the surface to the bottom. Contributions from air bubbles, trawl and oceanologic sampling manoeuvres, bottom structures and scattering layers were removed from the echogram by using the Sonar Data Echoview software. The maps of Sa-distribution, was made on base filtered Sv-data with Surfer 8 software.

2.6 Biological data – fishing stations

All trawling was done with the pelagic gear „RT/TM 70/300“ in the midwater as well as near the bottom. The mesh size in the codend was 6.5 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the trawl opening were defined with a netzonde CI-110, or trawl sonar monitoring system FS-925. The trawling depth was chosen by the echogram, in accordance to the characteristic of echo records from the fish. Normally, the trawl had vertical opening of about 34 m. The trawling time lasted usually 30 minutes, but in dense concentrations the trawling time duration was reduced. From each haul sub-samples were taken to determine length and weight composition of fish. Samples of herring and sprat were analyzed for further investigations on the board of vessel (i.e., sex, maturity, age). After each trawl haul, ocean logic samples with a CTD-probe was executed, for the hydrographic condition investigations.

2.7 Data analysis

The pelagic target species sprat and herring are usually distributed in mixed layers in combination with other species, so that it is impossible to allocate the integrator readings to a single species. Therefore the species composition was based on the trawl catch results. For each rectangle the species composition and length distribution were determined as the mean- weighted of all trawl results in this rectangle. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relationships:

Clupeoids $TS = 20 \log L (cm) - 71.2$ (ICES 1983/H:12)

Gadoids $TS = 20 \log L (cm) - 67.5$ (Foote *et al.* 1986)

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (Sa) and the rectangle area, divided by the corresponding mean cross section (σ). The total number were separated into herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 53 trawl hauls were carried out (28 hauls in Subdivision 26 and 25 hauls in Subdivision 28). 12721 herring and 10452 sprat were measured and 5166 herring and 4731 sprat were aged.

The results of the catch composition by Subdivision are presented in Table 1. As in former years the catch composition was dominated by sprat and to a lower extent by herring.

The length distributions of herring and sprat of the years 2001 and 2002 are presented by Subdivision in Figures 2 and 3.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean scattering cross-section σ, the estimated total number of fish, the percentages of herring and sprat per Subdivision/rectangle are shown in Table 2.

The horizontal distribution of density (mln/nm^2) values of herring and sprat are shown in Figure 4, 5.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 2. The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Table 3 and Table 6. The corresponding mean weights by age group and Subdivision/rectangle are shown in Table 4 and Table 7. The estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarised in Table 5 and Table 8.

The herring stock was estimated to be 16.6 x 10^9 fish or about 534.2 x 10^3 tonnes in Subdivisions 26+28. The abundance estimates were dominated by 1–4ages herring (Figure 2 and Table 3).

The estimated sprat stock was 155.4 x 10^9 fish or 1061.1 x 10^3 tonnes in Subdivisions 26+28.

The abundance estimates of sprat were dominated by young fish (Figure 3 and Table 6). The contribution of the age-groups 0 and 1 was near 70% in numbers and 50% in biomass.

4 DISCUSSION

Total number and biomass of herring in 2003 in SD 26+28 has increased for 60% and 57% accordingly than in 2002. Increasing of herring stock size has noted in both of SD 26 (for 44% number; for 50% biomass) and 28 (for 68% number; for 64% biomass). Number of herring at age 0 (generation of 2003) was low – 416 mln inversely 2002 – 1700 mln. For that reason have not yet said about further gain of herring number.

Total number and biomass of sprat in 2003 in SD 26+28 has increased for 59% and 24% accordingly than in 2002. This process is caused from high number of generations 2002 and 2003. The abundance of young sprat the 2003 year class was the highest for all years of observations. Further increasing of sprat stock has oncoming.

5 REFERENCES

ICES. 1983. Report of the Planning Group on ICES co-ordinated herring and sprat acoustic surveys. ICES CM 1983/H:12.

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Foote, K.G., Aglen, A., and Nakken, O. 1986. Measurement of fish target strength with a split-beam echosounder. J.Acoust.Soc.Am. 80(2):612–621.

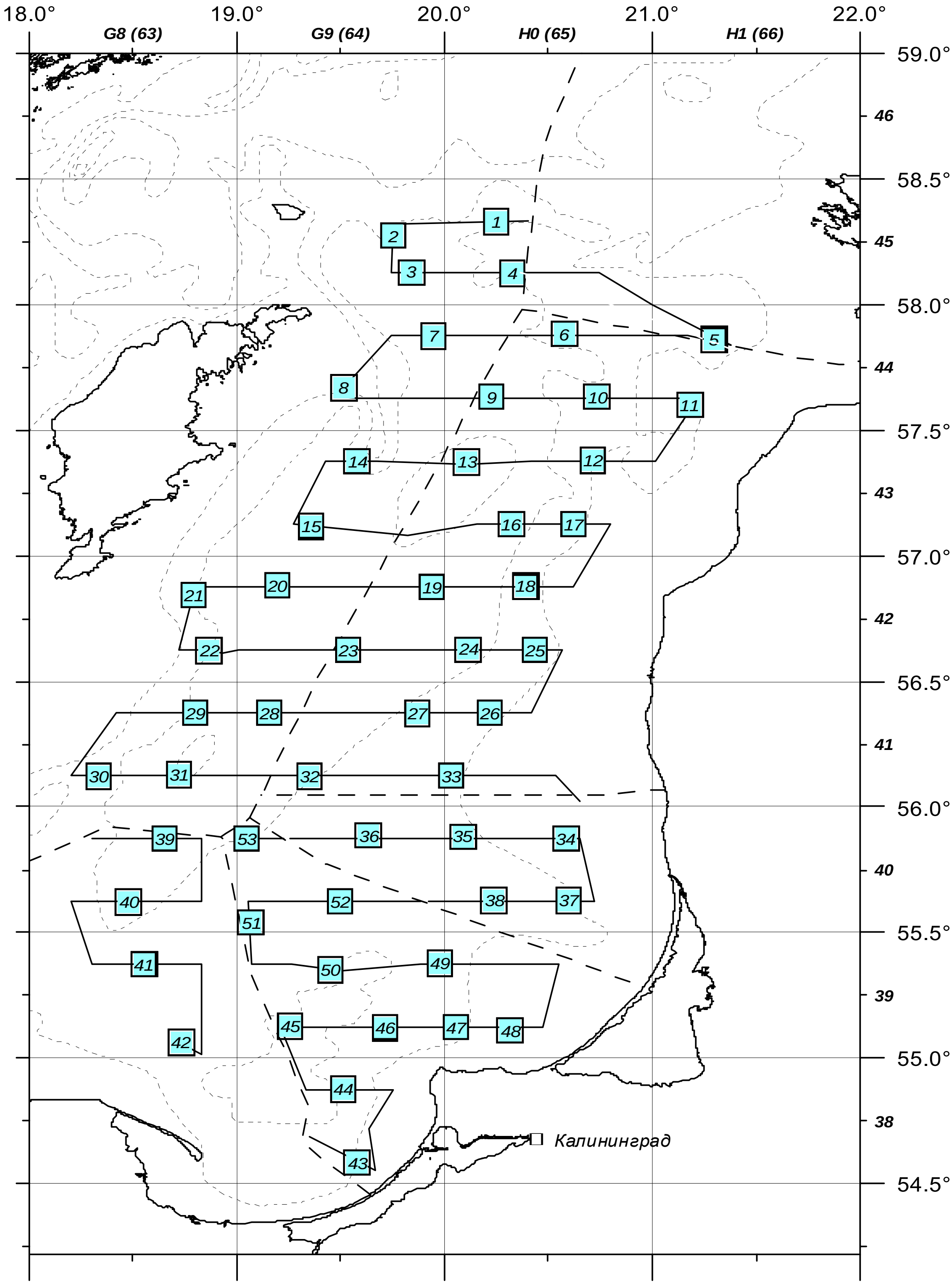

Figure 1. The scheme of cruise track and trawl stations for joint Russian-Latvian survey (RV “Atlantida”, 08.10–03.11.2003)

Table 1. Catch composition (kg/1hour) per haul by ICES subdivision (RV "Atlantida", October 2003)

ICES subdivision 26							
Haul No	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Date	**20031020**	**20031020**	**20031021**	**20031021**	**20031021**	**20031022**	**20031022**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**41H0**	**41G9**	**41G9**	**41G8**	**41G8**	**41G8**	**41G9**
CLUPEA HARENGUS	240.0	1400.0	96.9	340.0	1220.0	270.0	171.0
SPRATTUS SPRATTUS	1540.0	7600.0	765.0	1240.0	160.0	140.0	980.0
GADUS MORHUA						1.5	
ANOTHER			2.1			0.5	1.0
Total	1780.0	9000.0	864.0	1580.0	1380.0	412.0	1152.0

ICES subdivision 26							
Haul No	**33**	**34**	**35**	**36**	**37**	**38**	**39**
Date	**20031023**	**20031023**	**20031024**	**20031024**	**20031025**	**20031026**	**20031027**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**41H0**	**40H0**	**40H0**	**40G9**	**40H0**	**40H0**	**40G8**
CLUPEA HARENGUS	455.4	7.5	252.0	276.0	670.0	940.0	542.0
SPRATTUS SPRATTUS	216.0	20.0	240.0	160.0	1460.0	320.0	1650.0
GADUS MORHUA	1.8		0.9			6.0	7.0
ANOTHER	0.8	2.5	0.0	8.0	0.1		
Total	674.0	30.0	492.9	444.0	2130.1	1266.0	2199.0

ICES subdivision 26							
Haul No	**40**	**41**	**42**	**43**	**44**	**45**	**46**
Date	**20031027**	**20031028**	**20031028**	**20031030**	**20031030**	**20031031**	**20031031**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**40G8**	**39G8**	**39G8**	**38G9**	**38G9**	**39G9**	**39G9**
CLUPEA HARENGUS	820.0	328.0	400.0	1215.0	376.0	154.0	540.0
SPRATTUS SPRATTUS	260.0	120.0	34.0	1200.0	550.0	1200.0	3060.0
GADUS MORHUA	9.2	10.6	3.3	3.9	5.6		15.0
ANOTHER		19.4	1.5		14.4	0.2	
Total	1089.2	478.0	438.8	2418.9	946.0	1354.2	3615.0

ICES subdivision 26							
Haul No	**47**	**48**	**49**	**50**	**51**	**52**	**53**
Date	**20031031**	**20031031**	**20031101**	**20031101**	**20031102**	**20031102**	**20031103**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**39H0**	**39H0**	**39G9**	**39G9**	**40G9**	**40G9**	**40G9**
CLUPEA HARENGUS	96.0	140.1	374.0	42.0	224.0	144.0	340.0
SPRATTUS SPRATTUS	3100.0	570.0	1670.0	570.0	1020.0	2610.0	440.0
GADUS MORHUA			10.8		4.6	9.0	
ANOTHER	0.0	10.3	11.6	0.2	0.5		0.4
Total	3196.0	720.4	2066.4	612.2	1249.1	2763.0	780.4

ICES subdivision 28							
Haul No	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Date	**20031010**	**20031010**	**20031011**	**20031011**	**20031012**	**20031012**	**20031013**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**45H0**	**45G9**	**45G9**	**45H0**	**44H1**	**44H0**	**44G9**
CLUPEA HARENGUS	74.6	132.8	228.0	188.0	339.0	191.8	178.0
SPRATTUS SPRATTUS	294.0	680.0	312.0	328.0	1640.0	1008.0	692.0
GADUS MORHUA				0.9		5.5	0.9
ANOTHER	4.4	1.2	2.0	1.1	1.0	0.7	3.1
Total	373.0	814.0	542.0	518.0	1980.0	1206.0	874.0

ICES subdivision 28							
Haul No	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Date	**20031013**	**20031014**	**20031014**	**20031014**	**20031015**	**20031015**	**20031016**
Validity	**Invalid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**44G9**	**44H0**	**44H0**	**44H1**	**43H0**	**43H0**	**43G9**
CLUPEA HARENGUS		117.7	880.0	660.0	60.4	130.6	97.0
SPRATTUS SPRATTUS		232.0	428.0	90.0	308.0	380.0	432.0
GADUS MORHUA		8.8		0.1			
ANOTHER	20.0	1.5	4.0	13.8	1.6	1.4	1.0
Total	20.0	360.0	1312.0	763.9	370.0	512.0	530.0

ICES subdivision 28							
Haul No	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Date	**20031016**	**20031017**	**20031017**	**20031017**	**20031018**	**20031018**	**20031018**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**43G9**	**43H0**	**43H0**	**42H0**	**42G9**	**42G9**	**42G8**
CLUPEA HARENGUS	196.0	29.6	100.0	178.0	147.6	211.0	17.0
SPRATTUS SPRATTUS	420.0	144.0	552.0	1740.0	4680.0	360.0	52.0
GADUS MORHUA	1.4	4.0				0.8	
ANOTHER	4.6	0.4	2.0	2.0	2.4	2.2	1.0
Total	622.0	178.0	654.0	1920.0	4830.0	574.0	70.0

ICES subdivision 28				
Haul No	**22**	**23**	**24**	**25**
Date	**20031016**	**20031017**	**20031017**	**20031017**
Validity	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**43G9**	**43H0**	**43H0**	**42H0**
CLUPEA HARENGUS	196.0	29.6	100.0	178.0
SPRATTUS SPRATTUS	420.0	144.0	552.0	1740.0
GADUS MORHUA	1.4	4.0		
ANOTHER	4.6	0.4	2.0	2.0
Total	622.0	178.0	654.0	1920.0

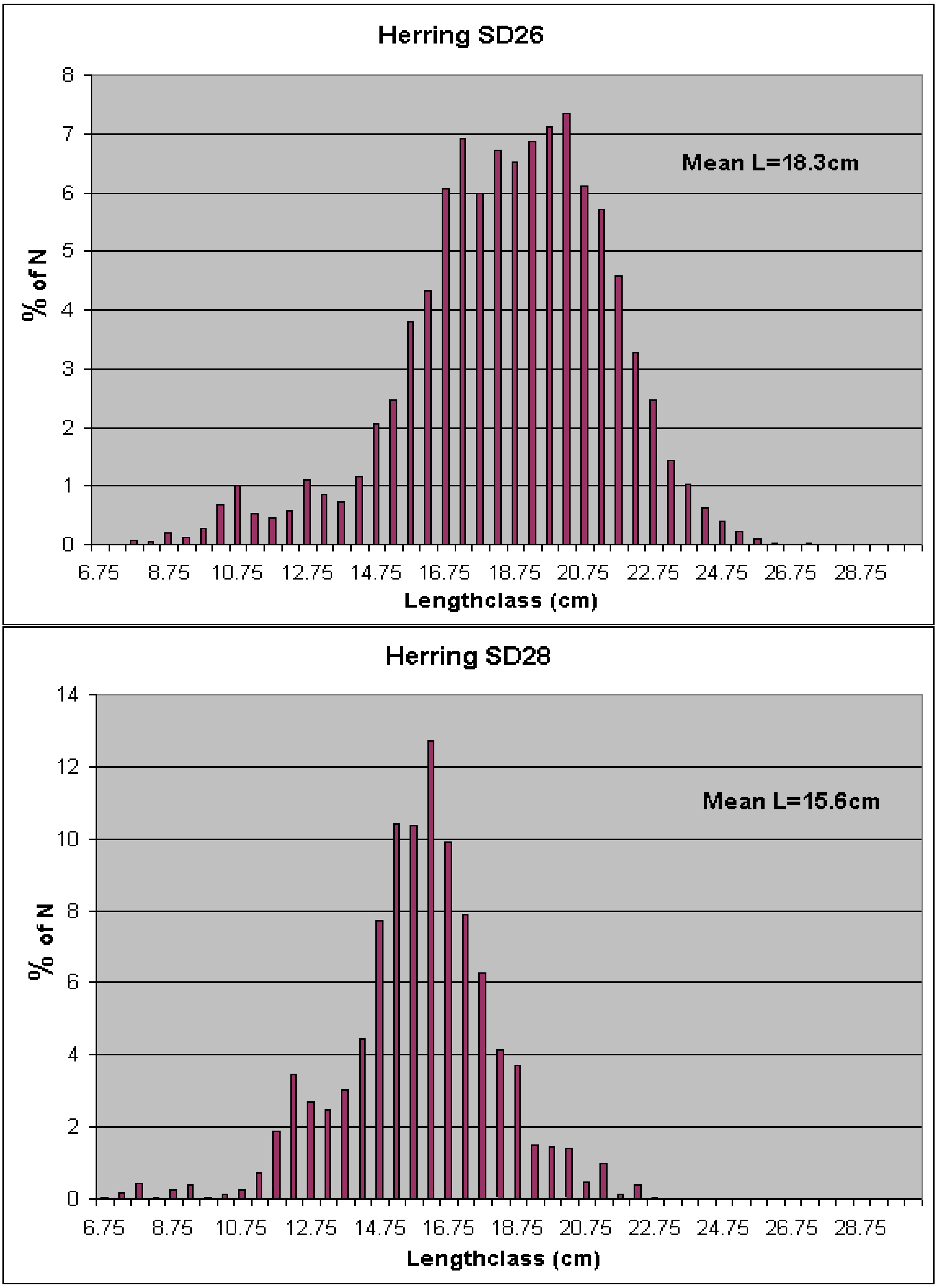

Figure 2. Length distribution of herring (RV "Atlantida", October 2003).

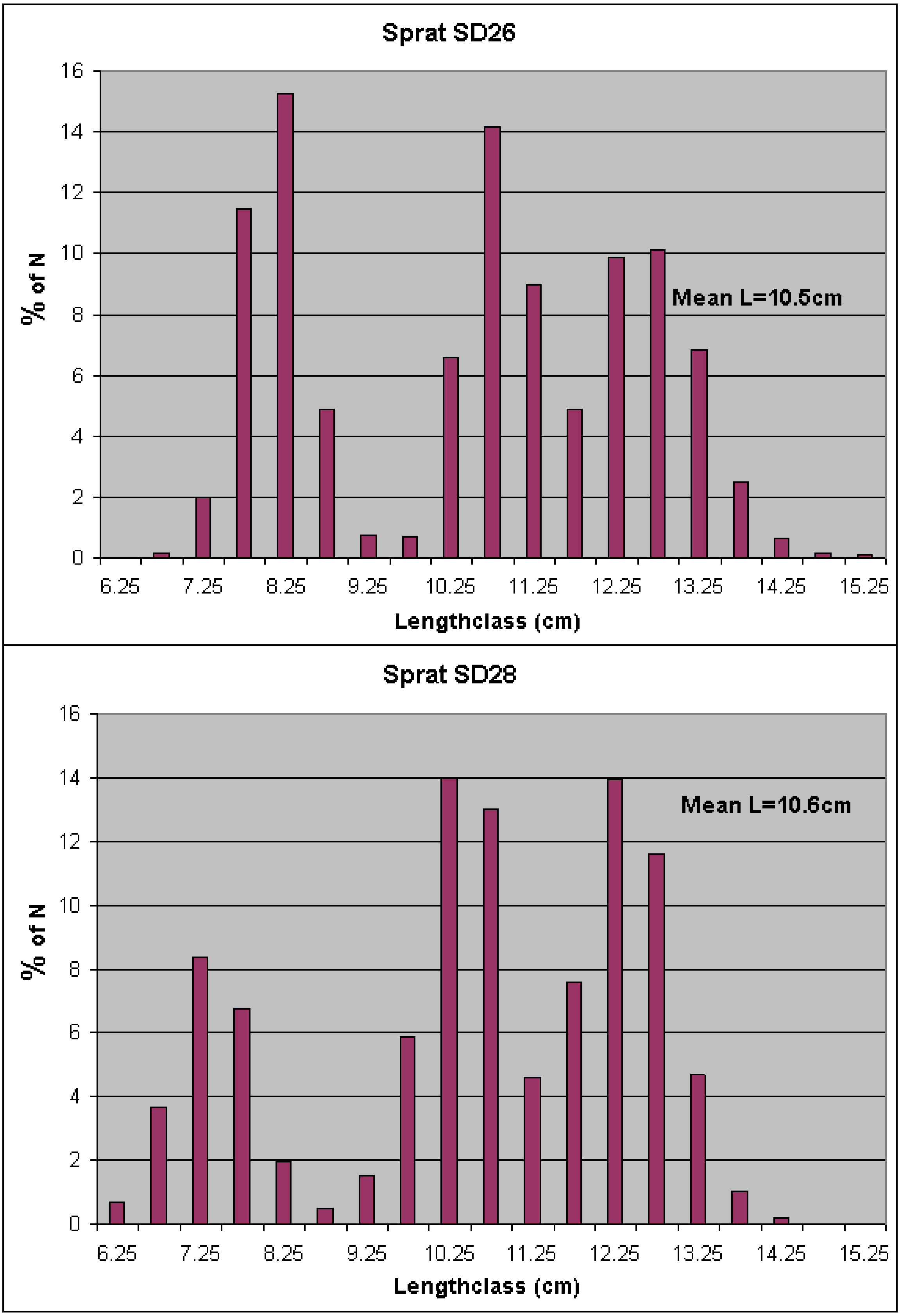

Figure 3 Length distribution of sprat (RV "Atlantida", October 2003)

Table 2. RV “Atlantida” survey statistics, October 2003.

CCODE	SD	RECT	AREA	SA	SIGMA	NTOT	HH	HS
ATLD03	26	41H0	953.3	694.9	1.24	5349.2	9.0	91.0
ATLD03	26	41G9	1000.0	1038.2	1.35	7689.9	4.9	95.1
ATLD03	26	41G8	1000.0	311.0	1.80	1723.7	21.8	78.2
ATLD03	26	40H0	1012.1	663.1	1.04	6430.8	7.9	92.1
ATLD03	26	40G9	1013.0	1434.0	0.89	16263.3	2.7	97.3
ATLD03	26	40G8	1013.0	1071.7	1.76	6170.0	14.9	85.1
ATLD03	26	39H0	881.6	715.4	0.82	7668.0	0.9	99.1
ATLD03	26	39G9	1026.0	1879.5	0.91	21188.3	1.8	98.2
ATLD03	26	39G8	1026.0	529.5	2.60	2087.1	50.5	49.5
ATLD03	26	38G9	918.2	1365.8	1.31	9598.2	12.7	87.3
ATLD03	28	45H0	947.2	1030.4	1.24	7874.5	13.8	86.2
ATLD03	28	45G9	924.5	908.9	1.32	6358.9	13.5	86.5
ATLD03	28	44H1	824.6	2297.4	1.16	16308.4	12.3	87.7
ATLD03	28	44H0	960.5	778.4	1.35	5524.4	17.2	82.8
ATLD03	28	44G9	876.6	346.7	1.47	2065.3	10.0	90.0
ATLD03	28	43H1	412.7	1843.0	1.65	4611.8	48.5	51.5
ATLD03	28	43H0	973.7	1455.5	1.15	12284.5	6.2	93.8
ATLD03	28	43G9	973.7	707.8	0.89	7715.6	5.7	94.3
ATLD03	28	42H0	968.5	1855.9	1.24	14501.4	3.4	96.6
ATLD03	28	42G9	986.9	909.7	1.37	6543.0	3.0	97.0
ATLD03	28	42G8	945.4	833.5	1.98	3977.8	37.5	62.5

Table 3. RV “Atlantida” estimated number (millions) of herring, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	481.5	40.0	158.8	54.0	94.1	56.3	25.3	15.7	16.9	20.5
26	41G9	374.7	0.0	52.2	37.4	77.3	84.6	42.7	36.6	24.3	19.6
26	41G8	373.7	0.0	16.5	39.2	86.5	97.9	31.8	45.3	14.1	42.3
26	40H0	507.8	3.8	49.6	44.6	68.7	71.9	48.5	69.5	64.3	86.9
26	40G9	437.8	8.8	51.8	48.1	69.5	103.8	41.5	58.4	21.3	34.6
26	40G8	925.4	0.0	19.0	60.3	196.5	239.7	78.5	148.8	99.3	83.3
26	39H0	67.6	18.0	11.7	8.5	6.4	5.0	5.0	3.4	2.1	7.5
26	39G9	383.1	9.2	50.3	61.3	52.3	76.8	36.6	51.3	14.8	30.3
26	39G8	1098.1	0.0	109.2	211.9	166.0	266.3	99.1	123.4	58.6	63.4
26	38G9	1223.2	166.6	181.7	201.1	97.2	149.5	108.9	149.3	42.7	126.0
	Sum	5872.6	246.4	700.8	766.3	914.6	1151.8	518.0	701.7	358.5	514.5
28	45H0	1083.1	33.3	371.1	175.9	226.2	159.3	73.9	24.8	8.8	9.6
28	45G9	857.9	31.5	302.0	149.5	182.5	112.9	42.0	23.1	8.1	6.3
28	44H1	2004.7	29.5	573.5	111.3	673.4	202.6	100.6	99.0	59.2	155.5
28	44H0	948.2	1.3	224.9	151.3	227.0	162.8	46.6	68.2	23.5	42.6
28	44G9	206.6		75.3	18.1	46.7	27.1	14.0	17.8	2.6	5.0
28	43H1	2237.1	71.0	155.8	139.0	1015.3	151.3	154.8	129.5	133.7	286.9
28	43H0	761.5		148.5	103.6	230.0	129.3	52.1	47.5	20.7	29.8
28	43G9	436.8	0.8	104.7	65.5	97.9	79.8	29.8	35.4	7.8	15.0
28	42H0	493.5		220.9	77.0	111.0	43.3	14.4	13.8	2.4	10.7
28	42G9	193.3		28.9	49.1	50.1	33.4	12.2	11.1	2.0	6.6
28	42G8	1489.7	3.0	173.4	284.2	354.0	291.9	131.8	109.2	47.0	95.2
	Sum	10712.4	170.3	2378.9	1324.7	3214.2	1393.9	672.3	579.3	315.6	663.2
Total		16585.0	416.7	3079.7	2091.0	4128.8	2545.7	1190.3	1281.0	674.1	1177.7

Table 4. RV "Atlantida" estimated mean weights (g) of herring, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	29.7	5.6	21.8	30.9	32.0	36.8	56.3	45.9	43.9	47.7
26	41G9	31.0	0.0	15.7	21.4	27.0	33.4	35.5	40.3	44.8	51.0
26	41G8	36.5	0.0	15.2	21.5	30.1	36.7	43.1	47.2	49.3	51.1
26	40H0	50.7	9.6	23.9	30.9	36.1	42.5	46.7	65.1	65.2	76.2
26	40G9	41.5	11.7	22.1	32.3	37.7	42.9	47.3	51.1	55.1	63.2
26	40G8	43.2	0.0	29.7	31.5	32.7	42.4	47.1	48.9	53.0	56.1
26	39H0	36.2	8.1	22.8	39.1	43.9	49.2	52.1	55.9	69.4	76.8
26	39G9	48.0	12.1	24.7	42.8	49.2	51.8	57.0	55.7	64.6	64.5
26	39G8	49.3	0.0	32.3	39.3	41.0	52.6	60.4	59.3	62.5	71.2
26	38G9	41.4	9.0	24.8	33.8	44.4	50.2	51.9	64.0	66.1	63.8
28	45H0	18.4	2.0	12.1	18.1	24.3	23.0	24.9	26.4	24.0	30.4
28	45G9	19.5	3.9	14.5	20.6	23.2	25.6	24.8	26.7	24.8	24.5
28	44H1	27.4	3.8	12.4	24.6	26.2	35.0	37.2	41.6	37.9	65.2
28	44H0	23.0	3.0	13.9	21.2	25.4	25.3	28.6	30.4	32.1	33.6
28	44G9	21.4		14.9	22.4	24.1	26.3	24.3	28.3	26.5	27.7
28	43H1	35.6	3.8	16.0	27.8	27.2	43.7	40.4	50.4	35.0	74.0
28	43H0	24.9		15.8	21.4	25.7	28.8	30.4	28.8	32.2	37.1
28	43G9	23.9	4.0	13.3	22.4	25.2	28.3	30.3	31.1	30.0	40.2
28	42H0	22.1		16.1	20.8	24.8	31.6	39.1	37.8	42.0	40.3
28	42G9	25.4		16.3	21.7	26.4	29.6	31.3	35.2	32.8	35.7
28	42G8	28.6	5.0	18.3	21.0	26.2	33.4	31.4	40.6	38.9	42.3

Table 5. RV "Atlantida" estimated biomass (in tonnes) of herring, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	14299.1	224.2	3461.0	1668.7	3009.8	2071.2	1425.6	720.0	740.6	977.9
26	41G9	11611.7	0.0	818.9	800.1	2086.9	2824.6	1516.0	1475.4	1088.6	1001.2
26	41G8	13656.7	0.0	250.2	843.0	2604.9	3594.0	1368.9	2138.6	696.1	2161.0
26	40H0	25739.2	36.1	1184.9	1378.0	2481.4	3056.1	2263.3	4525.0	4192.2	6622.1
26	40G9	18178.4	103.0	1144.0	1552.6	2621.9	4454.0	1963.8	2982.5	1172.4	2184.2
26	40G8	39959.5	0.0	564.6	1898.5	6426.6	10163.0	3697.3	7276.7	5260.9	4671.9
26	39H0	2445.8	145.5	267.4	331.5	281.8	246.9	260.5	190.0	147.8	574.4
26	39G9	18392.1	111.4	1243.5	2625.4	2571.9	3980.1	2087.3	2857.1	959.0	1956.5
26	39G8	54157.1	0.0	3528.7	8328.9	6805.2	14007.9	5987.8	7317.5	3664.9	4516.2
26	38G9	50693.4	1499.7	4507.0	6795.6	4317.6	7503.3	5654.4	9557.6	2825.7	8032.5
	Sum	249132.8	2119.8	16970.2	26222.3	33207.9	51901.1	26224.7	39040.5	20748.3	32698.0
28	45H0	19889.8	68.1	4473.1	3184.5	5489.8	3669.7	1843.1	656.2	212.1	293.0
28	45G9	16725.7	122.8	4385.0	3074.7	4241.7	2892.0	1040.7	615.4	199.7	153.6
28	44H1	54914.9	110.5	7134.7	2733.4	17615.9	7083.3	3738.3	4124.3	2241.7	10132.8
28	44H0	21811.6	3.9	3127.5	3202.1	5760.7	4121.1	1334.3	2073.4	754.3	1434.3
28	44G9	4416.2	0.0	1119.5	405.5	1125.8	714.4	341.9	501.7	68.3	139.2
28	43H1	79547.2	266.2	2492.0	3864.0	27632.6	6604.9	6259.4	6532.6	4678.1	21217.4
28	43H0	18926.1	0.0	2350.2	2213.1	5918.7	3720.3	1582.6	1369.3	665.7	1106.1
28	43G9	10431.2	3.2	1396.6	1470.4	2462.4	2256.5	904.8	1100.7	232.7	604.0
28	42H0	10901.3	0.0	3561.1	1598.6	2753.0	1371.0	564.2	520.5	101.8	431.2
28	42G9	4916.1	0.0	471.0	1066.4	1322.8	987.1	380.4	389.9	64.7	233.7
28	42G8	42592.8	15.1	3178.7	5959.2	9276.3	9749.5	4131.6	4427.0	1826.6	4028.8
	Sum	285072.7	589.7	33689.5	28772.1	83599.7	43169.7	22121.3	22311.0	11045.6	39774.0
Total		534205.5	2709.6	50659.7	54994.4	116807.6	95070.8	48346.0	61351.5	31793.9	72472.0

Table 6 RV “Atlantida” estimated number (millions) of sprat, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41HO	4870.1	692.2	2384.9	604.3	94.7	358.2	82.7	240.1	66.3	346.8
26	41G9	7316.0	714.5	2479.3	1357.3	611.1	1023.4	56.2	629.8	134.4	310.1
26	41G8	1348.0	21.8	170.7	133.9	105.1	308.1	54.5	268.6	34.1	251.1
26	40H0	5924.3	3408.5	2034.7	230.1	63.1	141.3	2.7	24.6		19.4
26	40G9	15826.8	10679.3	3426.8	611.4	85.4	634.4	19.0	300.2	4.7	65.5
26	40G8	5248.3	241.0	585.8	948.1	380.4	1783.8	117.6	931.1	15.0	245.6
26	39H0	7600.5	4712.1	2775.5	58.8		36.0		18.1		
26	39G9	20806.3	13371.1	4615.4	1637.4	27.8	658.0	29.8	379.5	11.1	76.2
26	39G8	1032.6	32.1	166.3	250.3	33.0	333.7	44.5	145.3	3.8	23.6
26	38G9	8379.8	2726.4	4157.5	1174.2	45.5	198.3		61.5		16.3
	Sum	78352.7	36598.9	22796.9	7005.8	1446.2	5475.2	407.0	2999.0	269.3	1354.5
28	45H0	6791.4	1588.6	1942.6	910.9	448.3	907.4	56.7	475.6	56.7	404.7
28	45G9	5501.0	1020.7	1465.8	825.0	455.2	912.7	39.0	340.6	56.9	385.0
28	44H1	14303.6	3175.9	7667.0	1018.4	229.9	755.0	0.0	724.4	0.0	733.1
28	44H0	4576.3	495.1	2608.3	576.0	117.1	396.7	37.2	187.8	37.2	120.9
28	44G9	1858.7	93.4	305.0	393.5	134.6	469.3	57.3	175.8	31.8	198.0
28	43H1	2374.6	1401.0	854.9	45.5	7.9	41.6	5.9	5.9	0.0	11.9
28	43H0	11523.0	2568.5	5465.3	1184.8	430.0	887.5	38.0	508.9	94.7	345.2
28	43G9	7278.8	4994.2	734.6	313.9	132.6	604.2	35.0	219.1	53.6	191.7
28	42H0	14007.8	1320.7	6619.9	2376.5	907.1	1310.1	58.3	803.9	40.7	570.5
28	42G9	6349.7	297.2	1889.0	1011.9	536.9	1311.5	84.6	716.1	105.4	397.2
28	42G8	2488.0	23.9	441.3	335.3	301.7	578.2	12.4	481.0	61.1	253.2
	Sum	77053.1	16979.3	29993.6	8991.7	3701.4	8174.2	424.5	4639.1	538.0	3611.3
Total		155405.8	53578.1	52790.5	15997.4	5147.6	13649.4	831.4	7638.1	807.3	4965.8

Table 7. RV “Atlantida” estimated mean weights (g) of sprat, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41HO	8.1	2.5	8.0	8.9	10.6	9.5	11.8	12.6	11.0	12.2
26	41G9	9.0	2.5	7.6	10.2	11.0	11.3	10.8	11.3	12.3	12.0
26	41G8	11.7	3.7	7.8	10.9	12.2	12.3	12.0	12.3	13.4	13.3
26	40H0	4.7	2.7	7.0	9.0	9.5	10.8	12.1	10.6		12.1
26	40G9	5.0	3.1	7.8	9.9	12.0	11.2	13.7	11.7	14.0	11.4
26	40G8	11.0	3.6	8.1	10.5	11.6	11.7	13.4	12.6	15.1	12.7
26	39H0	4.8	3.1	7.4	10.0		11.9		10.8		
26	39G9	5.2	3.2	7.7	10.0	10.3	11.0	14.3	12.1	16.2	13.0
26	39G8	11.1	4.0	8.3	10.6	13.0	12.2	13.0	12.9	14.3	13.1
26	38G9	6.8	3.4	7.9	9.5	12.5	11.5		12.0		15.2
28	45H0	7.2	2.1	6.1	9.6	10.2	10.7	11.3	10.5	11.1	10.3
28	45G9	8.0	2.4	6.9	9.2	10.5	10.8	12.1	11.1	10.9	10.9
28	44H1	6.3	2.1	6.4	8.6	9.7	9.9		10.1		10.8
28	44H0	7.3	2.4	6.6	9.4	9.8	10.8	11.8	10.7	10.6	10.9
28	44G9	9.3	2.2	6.3	9.4	10.1	10.5	10.1	10.9	9.8	11.7
28	43H1	3.9	2.1	6.1	9.2	10.0	10.2	8.9	10.6		11.4
28	43H0	7.1	2.4	7.1	9.8	10.8	10.8	11.4	11.6	11.0	11.1
28	43G9	4.7	2.4	7.1	9.9	10.6	10.8	12.2	11.1	11.7	11.6
28	42H0	8.3	3.0	7.3	9.9	11.1	11.0	12.4	11.2	11.4	10.8
28	42G9	9.7	2.5	7.5	10.2	11.5	11.3	11.2	11.6	11.8	11.7
28	42G8	10.6	3.1	7.7	10.0	11.3	11.3	8.8	11.9	11.3	11.8

Table 8. RV “Atlantida” estimated biomass (in tonnes) of sprat, October 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	39574.7	1716.4	19156.0	5357.4	1007.9	3392.2	978.6	3027.0	725.9	4213.3
26	41G9	65923.0	1763.1	18910.9	13834.1	6712.1	11613.9	608.3	7095.3	1654.7	3730.5
26	41G8	15711.4	80.7	1332.2	1462.8	1283.1	3788.0	654.7	3317.6	457.6	3334.8
26	40H0	28123.1	9089.0	14297.6	2081.3	599.1	1527.3	32.5	261.9	0.0	234.4
26	40G9	78572.8	33252.9	26574.7	6023.4	1023.3	7117.9	259.6	3508.3	66.2	746.5
26	40G8	57590.4	860.2	4719.1	9984.4	4404.5	20946.5	1580.7	11750.3	225.8	3118.9
26	39H0	36247.7	14552.1	20480.3	590.3	0.0	429.7	0.0	195.4	0.0	0.0
26	39G9	108395.5	42643.1	35709.5	16334.8	286.3	7241.5	424.2	4582.5	180.0	993.7
26	39G8	11491.2	128.4	1380.1	2661.1	427.4	4071.2	578.8	1881.8	53.7	308.6
26	38G9	57008.8	9143.1	32858.5	11159.3	568.4	2289.8	0.0	741.4	0.0	248.3
	Sum	498638.6	113228.9	175419.0	69488.8	16312.1	62418.1	5117.4	36361.5	3363.8	16929.0
28	45H0	48676.4	3302.0	11911.4	8734.5	4586.5	9721.1	637.6	4976.8	629.1	4177.4
28	45G9	43858.5	2404.8	10111.6	7611.4	4794.8	9895.8	470.3	3765.4	617.1	4187.3
28	44H1	89766.9	6782.8	49344.6	8707.3	2218.4	7442.0	0.0	7340.5	0.0	7931.2
28	44H0	33460.7	1181.7	17267.2	5438.1	1141.9	4282.1	437.3	2002.3	395.2	1314.9
28	44G9	17233.0	203.3	1920.4	3689.6	1362.8	4933.8	579.0	1917.5	311.7	2314.9
28	43H1	9335.9	2986.9	5175.3	419.6	79.2	423.9	52.8	62.9	0.0	135.4
28	43H0	81857.8	6212.5	38617.2	11560.1	4645.7	9623.6	433.7	5878.3	1042.0	3844.8
28	43G9	34091.9	12137.1	5200.5	3112.3	1410.6	6532.2	425.2	2421.5	626.9	2225.6
28	42H0	116569.4	3911.4	48284.2	23541.2	10069.3	14386.2	720.6	9041.4	463.5	6151.5
28	42G9	61314.5	732.2	14182.7	10303.9	6190.8	14769.1	943.8	8308.0	1248.8	4635.4
28	42G8	26277.4	74.6	3400.1	3367.4	3406.0	6511.6	109.2	5741.2	692.4	2974.8
	Sum	562442.4	39929.4	205415.2	86485.6	39906.1	88521.3	4809.4	51455.8	6026.7	39893.0
Total		1061081.0	153158.3	380834.1	155974.4	56218.2	150939.4	9926.8	87817.3	9390.5	56822.0

Distribution of herring density in the Baltic Sea

(Latvian - Russian hydroacoustic survey, R/V "Atlantida", 10.10 - 03.11.2003)

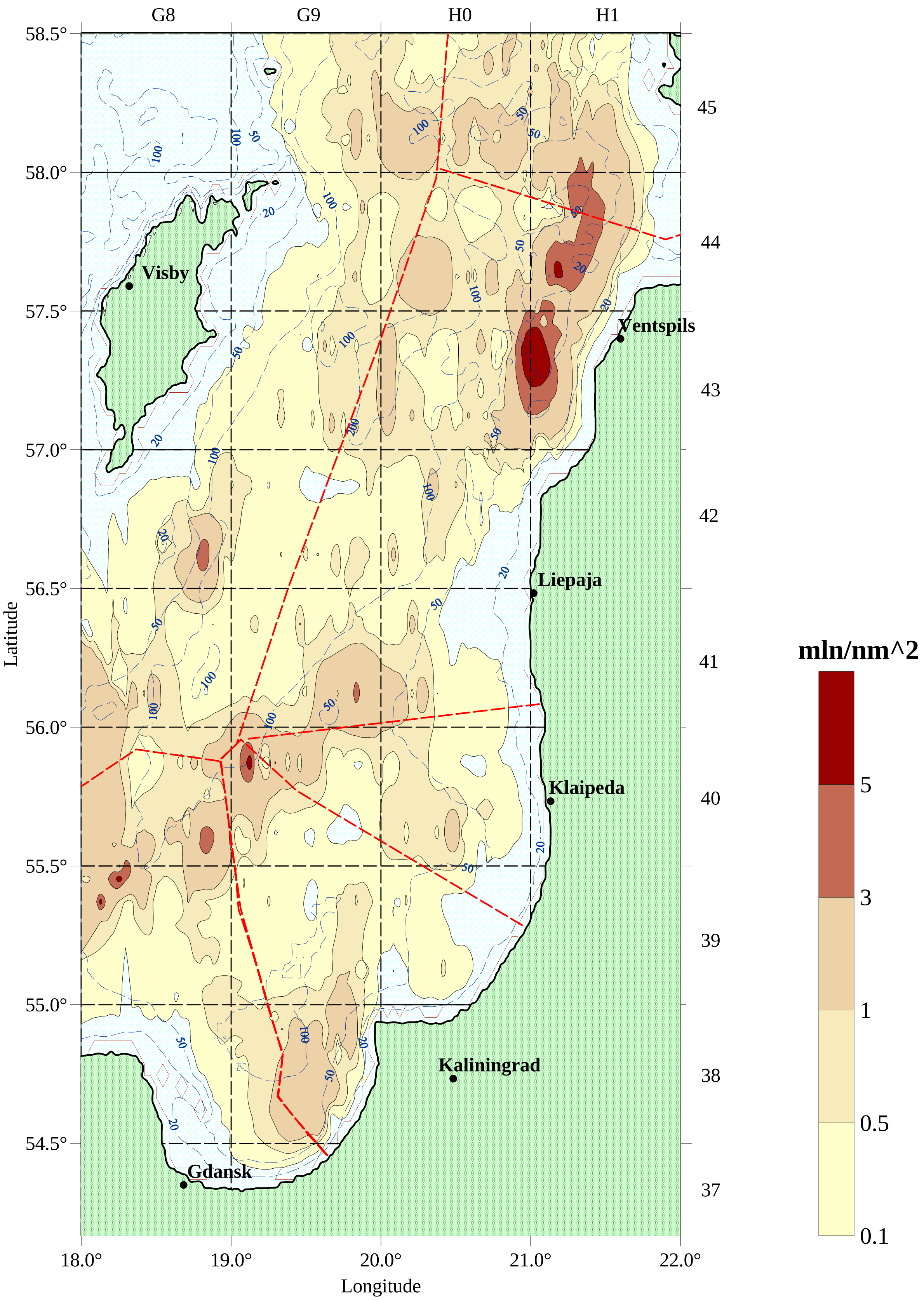

Figure 4

Distribution of sprat density in the Baltic Sea

(Latvian - Russian hydroacoustic survey, R/V "Atlantida", 10.10 - 03.11.2003)

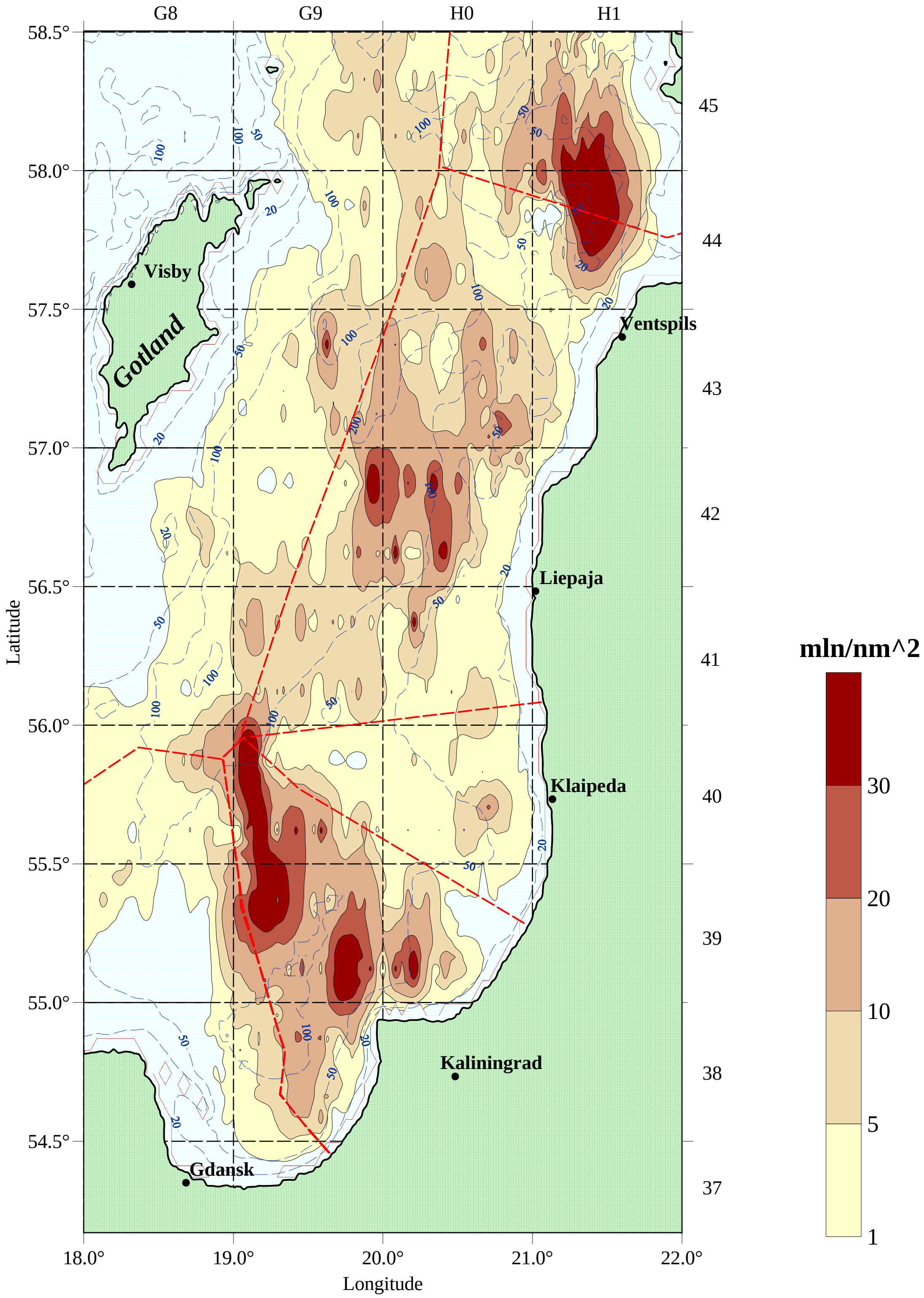

Figure 5

Survey Report for RV "BALTICA"
1 October 2003 – 24 October 2003

Sea Fisheries Institute, Gdynia, Poland
Miroslaw Wyszynski, Andrzej Orlowski and Magdalena Podolska

1. INTRODUCTION

Acoustic surveys in September/October has been carried out in the Baltic proper since 1978. Polish participation in these surveys was started in 1982 with a commercial trawler HEL 100 chartered by the Sea Fisheries Institute in Gdynia. Only control catches in Polish and partly in Swedish EEZ has been carried out. Since 1994 the permanent participation of RV "BALTICA" has took place in international hydroacoustic estimations of clupeoids biomass in the Baltic. However, sporadically RV"PROFESOR SIEDLECKI" participated in these estimations earlier (1989, 1990). The autumn (September/October) surveys are co-ordinated within the frame of the Baltic International Acoustic Surveys (BIAS). The present survey data will provide to the ICES Baltic Fisheries Assessment Working Group (WGBFAS).

2. METHODS

2.1. Personnel

M. Wyszynski, Sea Fisheries Institute, Poland – cruise leader
M. Kaczmarek, Sea Fisheries Institute, Poland – acoustic team leader
A. Kujawa, Sea Fisheries Institute, Poland - acoustics
R. Nowakowski, Sea Fisheries Institute, Poland – acoustics
B. Grabowska, Sea Fisheries Institute, Poland – fish sampling
R.Pactwa Sea Fisheries Institute, Poland – fish sampling
H. Dabrowski Sea Fisheries Institute, Poland – fish sampling
L. Barcz Sea Fisheries Institute, Poland – fish sampling
A. Grelowski Sea Fisheries Institute, Poland – hydrology parameters

2.2. Narrative

The RV "BALTICA" cruise number 12/2003, started 2003–10–01 from Gdynia and ended 2003–10–24 in Gdynia. Västervik - Sweden (including Högön Island) was visited 2003–10–02 – 2003–10–04 for calibration of the SIMRAD EY 500 echo sounder. The cruise covered parts of ICES Subdivisions 24, 25 and 26 in Polish EEZ.

2.3. Survey design

The stratification is based on ICES statistical rectangles with range of 0.5 degrees in latitude and 1 degree in longitude. The areas of all strata are limited by the 10 m depth line (ICES CM 2003/G:05 Ref.: D, H; Appendix 9, Annex 3).Due to historical comparability of data the survey track is planned each year in a similar pattern. Final pattern of transects is mostly limited by the weather conditions, what had a place in 2003. The area covered was 12927.1 NM^2 and 876 ESDU were used for acoustic estimates. Acoustic survey track and trawl stations are shown in Figure2.3.1.

2.4. Calibration

Calibration of acoustic system was performed at Högön near Västervik by SIMRAD specialist on the beginning of the cruise (4 October 2003) according to BIAS manual (ICES CM 2003/G:05 Ref.: D,H:, Appendix 9, Annex 3). Calibrated Sv gain was 24.72 dB.

2.5. Acoustic data collection

Acoustic data were collected with EY500 scientific system 24 hours a day for each nautical mile distance unit (ESDU), in a slice-structured database. The hull-mounted transducer of 7.2˚x8.0˚ was applied for sounding.

The settings of the acoustic equipment were as described in the BIAS Manual (ICES CM 2003/G:05 Ref.: D,H:, Appendix 9, Annex 3).The values of Sa for each ESDU were collected in layers of 10m depth. Due to the draught of the vessel, hull reverberations and aeriation zone integration started at 15 m depth. Contribution of echoes from jellyfish, hydrologic gradients, and air bubbles were removed by analyses of echograms from the survey.

2.6. Biological data – fishing stations

All trawl hauls were made with WP 53/64x4 midwater trawl. The stretched mesh size in the codend was 22 mm.

The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the net opening were controlled by a trawl sonar WESMAR TCS 700E. The standard trawling time was 30 minutes. From each haul subsamples were taken to determine the species composition, fish length and weight measurements as well as for the biological analysis (i.e., sex, maturity, and age).

2.7. Data analysis

Species composition and fish length distributions were based on trawl catch results. For each rectangle the species and length distribution were determined as unweighted mean. of all trawls in that area. In the case of luck of samples a mean from neighbouring rectangles was applied.

Mean target strength was calculated according to the following formulas:

Clupeoids: TS = 20logL-71.2 (ICES 1983/H:12)
gadoids: TS = 20logL-67.5 (Foote *et al.* 1986)

The total number of fish (total N) in each rectangle was estimated as a product of mean area scattering cross section (Sa) and the rectangle area, divided by corresponding mean acoustic cross-section. Number was separated into different species according to the mean catch composition in the rectangle.

2.8. Hydrographic data

56 CTD casts were made for the temperature and salinity measurements (including the station of the acoustic instruments calibration) as well as the rosette sampler casts for oxygen contents.

3. RESULTS

3.1. Biological data

In total 21 trawl hauls were carried out, 2 in SD 24 (of which 1 was excluded as no representative), 8 in SD 25 (of which 1 was excluded), and 11 in SD 26. 3345 herrings and 4887 sprats were measured, 941 and 480 fish were aged respectively.

Catch compositions by trawl haul are presented in Table 3.1.1. Length distributions for herring and sprat by ICES subdivision are shown in Figures 3.1.1. and 3.1.2.

3.2. Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean scattering cross-section, the total no of fish, and percentages of herring and sprat per ICES rectangles are shown in Table 3.2.1.

3.3. Abundance estimates

The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Table 3.3.1. and 3.3.2. The corresponding mean weights by age group and Subdivision/rectangle are shown in Table 3.3.3. and 3.3.4. The estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarised in Table 3.3.5. and 3.3.6.

4. DISCUSSION

The data collected during the survey should be considered as representative. Limitation of survey tracks was traditionally caused by bad weather conditions.

5. REFERENCES

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ICES 2003. Report of the Baltic International Fish Survey Working Group. ICES CM 2003/G05 Ref D,H.

T R A C K C H A R T
Country: Poland
Ship: BALTICA
Date 200310–1-20031024

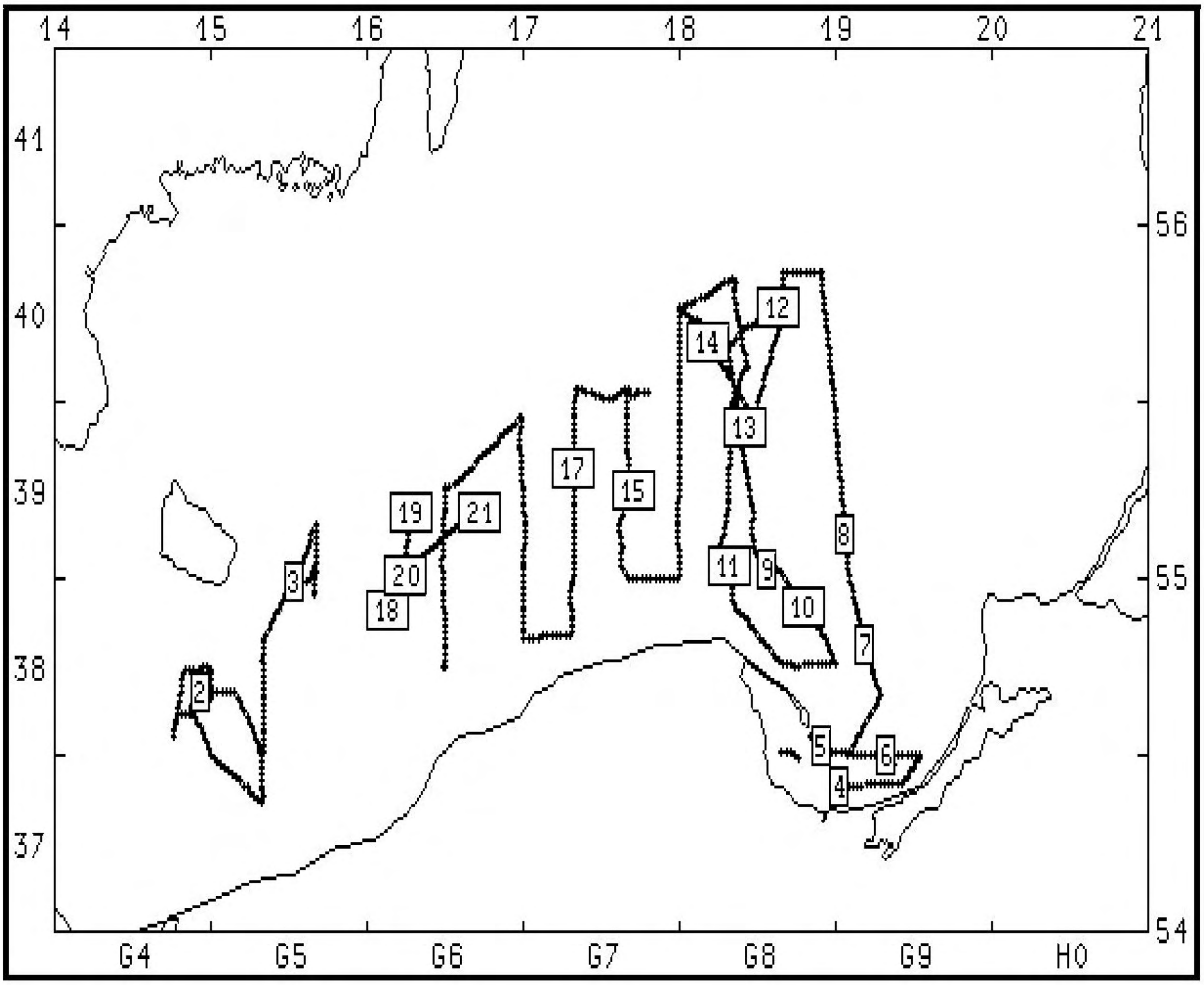

Figure 2.3.1. Survey grid and trawl positions of RV “BALTICA”.

Table 3.1.1. Catch data from the Polish acoustic survey conducted by the r/v BALTICA in October 2003, with trawl type WP 53/64x4 .

Haul number	Date of catch	ICES rectangle	ICES Sudivision	Headrope depth from the surface (m)	Vertical net opening (m)	Geographical position of haul: start latitude 00°00'N	start longitude 00°00'E	end latitude 00°00'N	end longitude 00°00'E	Fishing time start	Fishing time end	Duration of trawling [min]	Catch per unit effort [kg/h] herring	sprat	cod	others	total
1	6-10-03	38G4	24	46	18	54°37'0	14°49'5	54°36'7	14°52'1	8.05	8.35	30	6.480	0.480	1.520		8.480
2	6-10-03	38G4	24	54	18	54°40'9	14°54'6	54°40'9	14°57'5	9.50	10.20	30	53.980	8.120		0.002	62.102
3	6-10-03	38G5	25	77	18	54°59'2	15°31'8	55°00'4	15°33'5	17.35	18.05	30	13.060	3.680			16.740
4	13-10-03	37G8	26	41	18	54°25'9	18°59'6	54°24'9	19°02'1	14.40	15.10	30	1.268	35.840		0.032	37.140
5	14-10-03	38G8	26	63	18	54°32'5	18°54'3	54°30'0	18°54'0	11.30	12.00	30	32.760	205.960			238.720
6	14-10-03	37G9	26	64	18	54°29'8	19°19'9	54°28'2	19°22'0	14.55	15.25	30	6.140	92.000			98.140
7	16-10-03	38G9	26	105	18	54°49'8	19°11'2	54°48'2	19°11'9	12.00	12.30	30	3.160	183.060	4.040		190.260
8	16-10-03	39G9	26	92	17	55°07'4	19°04'5	55°08'0	19°02'0	16.20	16.50	30	1.570	24.720		0.594	26.884
9	17-10-03	39G8	26	88	18/17	55°01'7	18°32'6	55°01'9	18°36'0	9.45	10.15	30	28.180	49.320	2.430	0.222	80.152
10	17-10-03	38G8	26	96	19	54°56'5	18°46'0	54°54'4	18°49'3	12.15	12.45	30	70.600	71.100		0.024	141.724
11	17-10-03	39G8	26	58	18	55°01'7	18°19'8	55°02'3	18°21'7	19.15	19.45	30	195.660	43.780	0.170	0.048	239.658
12	18-10-03	40G8	26	100	18	55°45'0	18°37'6	55°47'0	18°39'8	8.20	8.50	30	176.520	217.380		0.514	394.414
13	18-10-03	39G8	26	86	18	55°25'1	18°25'3	55°26'9	18°27'1	12.45	13.15	30	65.140	33.680		0.234	99.054
14	18-10-03	40G8	26	85	17	55°39'9	18°10'9	55°40'1	18°13'5	16.10	16.40	30	335.840	810.500		0.420	1146.760
15	19-10-03	39G7	25	68	18	55°15'0	17°41'0	55°15'1	17°45'1	8.00	8.30	30	48.540	33.000			81.540
16	19-10-03	40G7	25	66	18	55°31'3	17°44'0	55°32'0	17°47'1	12.00	12.30	30	3.050	0.380		0.004	3.434
17	19-10-03	39G7	25	76	18	55°19'4	17°19'4	55°17'9	17°18'9	16.50	17.20	30	12.000	7.270		0.008	19.278
18	21-10-03	38G6	25	60	18	54°54'7	16°08'0	54°54'3	16°05'6	8.25	8.55	30	15.660	12.440			28.100
19	23-10-03	39G6	25	72	17	55°12'6	16°17'2	55°10'5	16°16'8	8.30	9.00	30	177.660	59.840	2.994	0.062	240.556
20	23-10-03	39G6	25	65	17	55°01'6	16°15'5	55°00'2	16°13'1	10.40	11.10	30	65.740	3.520			69.260
21	23-10-03	39G6	25	80	16	55°12'8	16°45'0	55°11'2	16°42'9	14.45	15.15	30	430.3	135.1			565.400

Fig.3.1.1. Length distributions of herring by ICES Sub-division - r.v."Baltica", October 2003

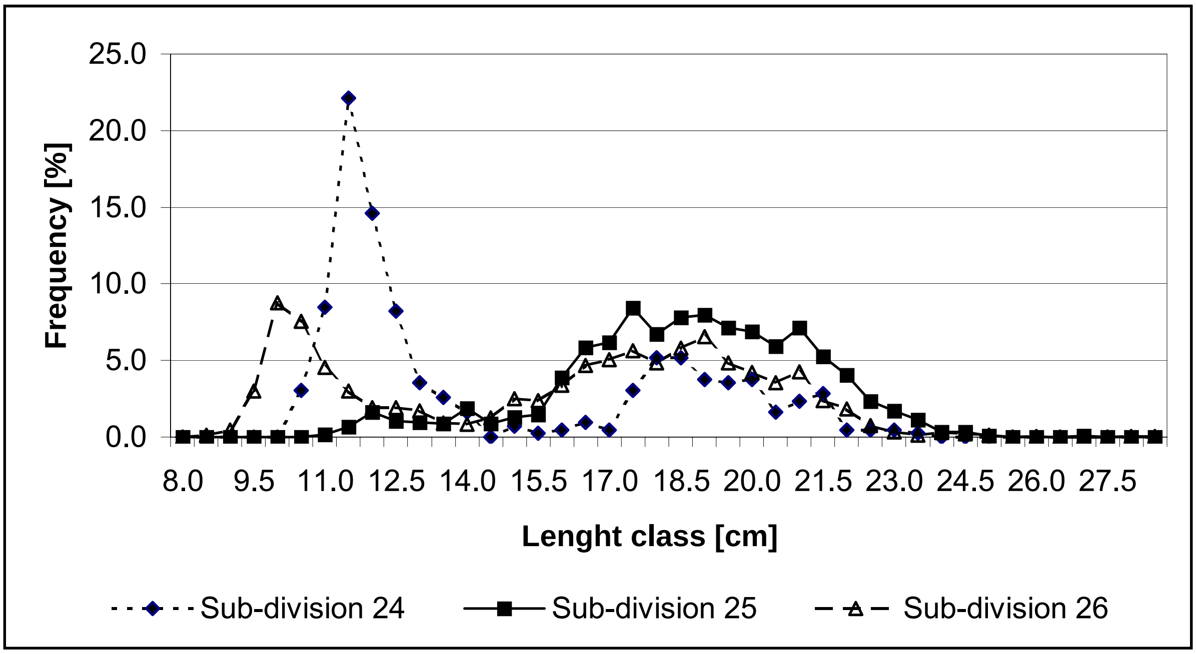

Fig.3.1.2. Length distributions of sprat by ICES Sub-division - r.v."Baltica", October 2003

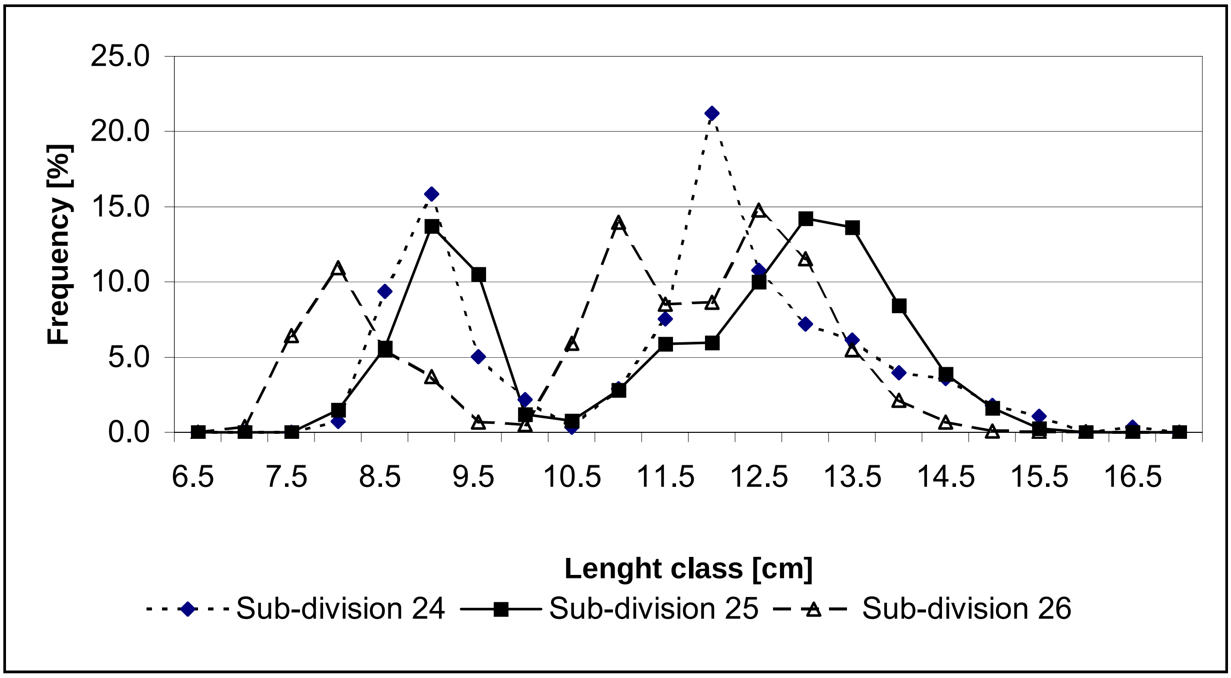

Table 3.2.1. Survey statistics. RV “BALTICA”, October 2003.

SD	Rectangle	Area	Mean Sa	ESDU	Sigma	Total	Species composition (%)		Abundance [mln]	
		[nm^2]	[m^2/nm^2]		cm^2	abundance [mln]	herring	sprat	herring	sprat
24	38G4	1034.8	246	48	1.925	1322	75.42	24.58	997	325
	Total:	**1034.8**				**1322**			**997**	**325**
25	37G5	642.2	605	22	1.925	2019	75.42	24.58	1523	496
	38G5	1035.7	205	56	2.029	1049	44.99	55.01	472	577
	38G6	940.2	508	23	1.947	2454	35.22	64.78	864	1590
	38G7	471.7	184	43	2.274	381	38.14	61.75	145	235
	39G5	979.0	195	23	2.584	740	55.24	44.76	409	331
	39G6	1026.0	319	97	2.442	1339	50.54	49.44	677	662
	39G7	1026.0	485	93	2.096	2373	31.21	68.79	740	1632
	40G7	1013.0	541	38	1.738	3153	9.37	90.63	296	2857
	Total:	**7133.8**				**13508**			**5126**	**8380**
26	37G9	151.6	784	34	1.173	1014	4.76	95.24	48	966
	38G8	624.6	767	63	1.344	3563	15.03	84.97	536	3028
	38G9	918.2	1064	52	1.065	9170	1.20	98.79	110	9059
	39G8	1026.0	588	104	1.851	3257	28.45	71.48	927	2328
	39G9	1026.0	827	34	0.841	10086	0.74	99.26	74	10011
	40G8	1013.0	1662	144	1.800	9352	11.82	88.18	1106	8246
	Total:	**4759.4**				**36442**			**2801**	**33638**

Table 3.3.1. Estimated number (millions) of herring according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	997	628.66	45.35	93.12	21.46	111.47	35.66	55.74		5.54
	SUM	**997**	**628.66**	**45.35**	**93.12**	**21.46**	**111.47**	**35.66**	**55.74**		**5.54**
25	37G5	1523	942.17	90.54	133.73	93.14	133.92	49.94	66.47	5.70	7.39
	38G5	472	171.04	41.33	71.38	55.70	70.22	22.90	29.70	4.62	5.10
	38G6	864	71.54	96.50	208.14	145.13	178.92	54.31	76.56	14.87	18.03
	38G7	145	9.34	18.41	35.35	24.16	31.35	8.83	12.85	2.10	2.62
	39G5	409	37.34	43.87	100.03	64.11	86.73	25.31	36.67	6.70	8.24
	39G6	677	50.43	80.27	167.72	110.41	140.23	41.95	60.25	10.89	14.84
	39G7	740	29.66	137.16	153.96	155.15	148.04	41.07	61.06	6.69	7.23
	40G7	296	6.88	38.03	76.99	45.77	66.61	20.17	33.30	3.96	4.29
	SUM	**5126**	**1318**	**546**	**947**	**694**	**856**	**264**	**377**	**56**	**67.73**
26	37G9	48	42.21	2.48	1.11	0.72	0.70	0.18	0.37	0.02	0.21
	38G8	536	342.17	49.84	40.30	31.88	34.09	10.48	15.78	1.42	10.04
	38G9	110	72.52	14.10	5.69	4.88	6.15	1.26	4.18	0.19	1.02
	39G8	927	62.06	158.86	190.25	146.97	170.48	52.19	83.79	6.58	55.82
	39G9	74	6.62	14.72	13.76	11.55	13.10	3.94	6.16	0.55	3.60
	40G8	1106	9.30	144.30	257.07	192.05	229.71	71.75	113.13	10.22	78.48
	SUM	**2801**	**534.87**	**384.30**	**508.19**	**388.05**	**454.24**	**139.81**	**223.41**	**18.97**	**149.17**

Table 3.3.2. Estimated number (millions) of sprat according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	325	77.12	150.11	41.18	30.57	6.47	13.77	3.03	1.38	1.38
	SUM	**325**	**77.12**	**150.11**	**41.18**	**30.57**	**6.47**	**13.77**	**3.03**	**1.38**	**1.38**
25	37G5	496	120.31	115.66	111.79	77.28	36.47	19.99	9.39	5.11	
	38G5	577	246.86	86.30	95.00	65.60	42.23	25.29	10.05	5.67	
	38G6	1590	1050.46	119.76	160.07	115.92	67.44	42.64	19.98	13.73	
	38G7	235	26.41	56.65	60.73	45.11	20.81	12.69	7.53	5.06	
	39G5	331	94.48	42.33	72.75	50.64	34.58	20.47	9.22	6.54	
	39G6	662	262.64	69.59	128.31	91.84	50.15	31.35	16.16	11.96	
	39G7	1632	140.14	348.00	460.42	335.20	155.93	93.89	56.43	41.98	
	40G7	2857	19.77	814.59	884.46	734.34	134.06	117.58	101.60	50.60	
	SUM	**8380**	**1961.06**	**1652.89**	**1973.54**	**1515.95**	**541.67**	**363.89**	**230.35**	**140.65**	
26	37G9	966	922.27	33.39	7.95	1.52	0.42	0.22	0.22		
	38G8	3028	791.15	866.22	572.20	286.91	203.45	182.39	80.20	45.47	
	38G9	9059	2844.88	4757.40	1043.07	204.65	101.71	54.66	38.43	14.20	
	39G8	2328	572.83	500.39	502.41	238.89	188.14	209.97	68.11	47.27	
	39G9	10011	6921.67	2525.56	423.88	84.67	27.18	12.25	12.25	3.56	
	40G8	8246	41.65	1444.75	3092.23	1548.26	926.19	594.97	410.08	187.88	
	SUM	**33638**	**12094.45**	**10127.71**	**5641.73**	**2364.91**	**1447.09**	**1054.45**	**609.29**	**298.37**	

Table 3.3.3. Mean weight (gramme) of herring according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Average	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	24.4	11.9	30.1	44.9	61.3	50.0	46.9	42.0		68.0
25	37G5	24.0	11.1	35.3	51.1	41.9	46.1	43.7	43.9	69.4	66.0
	38G5	34.1	11.4	35.5	52.2	43.4	49.6	45.5	46.1	70.0	67.1
	38G6	46.3	13.5	35.5	53.8	45.0	53.1	47.3	46.9	69.2	66.8
	38G7	46.2	13.0	34.7	52.9	44.2	52.9	47.5	47.4	69.4	66.1
	39G5	47.0	13.6	36.4	54.5	46.5	53.9	47.7	48.7	69.3	67.1
	39G6	47.1	15.8	34.8	54.1	45.6	53.1	49.8	48.1	68.9	67.0
	39G7	41.0	13.9	32.3	47.7	37.1	46.7	44.8	44.3	68.8	66.2
	40G7	47.2	16.3	38.4	53.2	43.7	49.7	46.3	45.7	65.3	65.7
26	37G9	10.8	7.5	18.9	37.9	36.0	62.7	67.4	45.5	56.8	67.4
	38G8	18.5	7.4	23.3	40.8	39.7	44.3	49.0	43.5	52.0	55.0
	38G9	18.6	8.8	20.2	36.1	36.2	50.2	40.9	77.5	51.7	45.6
	39G8	39.2	11.0	26.0	44.7	42.1	42.3	46.7	45.1	47.5	54.7
	39G9	36.1	10.3	24.9	41.4	40.3	39.8	45.2	47.4	50.7	51.1
	40G8	42.9	12.8	28.5	46.5	43.7	42.7	45.7	45.3	50.6	53.4

Table 3.3.4. Mean weight (gramme) of sprat according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Average	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	11.2	4.7	11.5	15.0	15.6	16.9	16.9	17.0	18.3	19.9
25	37G5	10.9	4.7	11.0	13.1	12.7	15.8	15.8	14.3	14.5	
	38G5	9.8	4.8	10.9	13.8	13.3	16.1	16.3	14.8	14.9	
	38G6	7.8	4.8	10.6	14.1	13.7	15.8	15.9	14.5	14.5	
	38G7	12.1	4.4	10.5	13.9	13.4	15.5	15.3	14.2	14.5	
	39G5	11.4	4.7	10.8	14.4	13.9	16.0	16.1	14.7	14.7	
	39G6	10.3	4.7	10.9	14.2	13.8	15.8	15.7	14.4	14.4	
	39G7	12.5	4.4	10.6	13.9	13.5	15.4	15.2	14.2	14.4	
	40G7	12.4	5.7	11.4	12.9	12.6	13.1	13.5	13.3	13.6	
26	37G9	3.0	2.7	8.3	9.9	10.8	10.8	11.5	11.1		
	38G8	8.7	3.0	8.5	11.1	12.1	12.5	13.6	12.2	12.7	
	38G9	7.1	3.1	8.4	10.0	10.8	11.8	12.6	12.0	12.2	
	39G8	9.5	4.0	9.1	11.2	12.2	12.6	14.1	12.2	13.0	
	39G9	4.8	3.1	8.4	9.8	10.3	11.3	11.7	11.4	12.2	
	40G8	11.3	4.3	9.5	11.2	12.0	12.1	12.7	12.0	12.3	

Table 3.3.5. Estimated biomass (tonnes) of herring according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	24305	7477	1367	4185	1316	5569	1672	2341	0	377
	SUM	24305	7477	1367	4185	1316	5569	1672	2341	0	377
25	37G5	36565	10471	3201	6838	3900	6173	2183	2916	395	488
	38G5	16119	1945	1467	3728	2419	3481	1043	1369	324	342
	38G6	39995	963	3423	11189	6527	9497	2570	3594	1029	1204
	38G7	6703	122	639	1870	1067	1659	419	609	146	173
	39G5	19219	507	1599	5451	2978	4676	1207	1785	464	553
	39G6	31877	796	2793	9080	5032	7446	2090	2896	750	994
	39G7	30339	413	4428	7346	5760	6909	1839	2706	460	478
	40G7	13972	112	1460	4093	2000	3311	934	1523	258	282
	SUM	**194790**	**15328**	**19008**	**49597**	**29684**	**43152**	**12284**	**17397**	**3827**	**4514**
26	37G9	520	317	47	42	26	44	12	17	1	14
	38G8	9927	2517	1163	1645	1266	1512	513	686	74	552
	38G9	2049	641	285	205	177	309	52	324	10	47
	39G8	36304	680	4136	8509	6190	7203	2439	3782	313	3051
	39G9	2672	68	366	570	465	521	178	292	28	184
	40G8	47483	119	4110	11945	8394	9803	3280	5127	517	4189
	SUM	**98956**	**4343**	**10107**	**22916**	**16517**	**19391**	**6474**	**10228**	**942**	**8036**

Table 3.3.6. Estimated biomass (tonnes) of sprat according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2003.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	3628	365	1723	619	476	109	233	51	25	27
	SUM	3628	365	1723	619	476	109	233	51	25	27
25	37G5	5382	563	1277	1463	980	576	316	135	74	0
	38G5	5631	1186	940	1307	872	682	411	149	84	0
	38G6	12382	5042	1266	2253	1588	1067	677	289	199	0
	38G7	2854	116	592	843	605	322	194	107	74	0
	39G5	3773	448	458	1047	706	554	329	136	96	0
	39G6	6789	1244	759	1827	1267	795	492	233	173	0
	39G7	20464	611	3673	6422	4532	2396	1426	800	604	0
	40G7	35482	114	9284	11408	9287	1757	1586	1356	689	0
	SUM	**92757**	**9324**	**18249**	**26571**	**19836**	**8149**	**5431**	**3204**	**1993**	**0**
26	37G9	2913	2529	278	79	17	5	3	2	0	0
	38G8	26202	2397	7392	6373	3461	2540	2480	982	578	0
	38G9	64100	8949	39981	10448	2202	1196	689	462	173	0
	39G8	22158	2269	4545	5652	2913	2377	2956	829	617	0
	39G9	48281	21399	21237	4140	871	308	143	140	43	0
	40G8	93196	180	13744	34664	18601	11214	7565	4916	2314	0
	SUM	**256850**	**37724**	**87176**	**61356**	**28064**	**17640**	**13835**	**7331**	**3725**	**0**

Survey Report for RV "SOLEA"

30.09–18.10.2003

Federal Research Centre for Fisheries, Germany
Tomas Gröhsler [1] and Eberhard Götze [2]
[1] Inst. for Baltic Sea Fisheries Rostock, [2] Inst. for Fishery Technology and Fish Quality, Hamburg

1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The joint German/Danish survey in September/October is traditionally co-ordinated within the frame of the **Baltic International Acoustic Survey.** The reported acoustic survey is conducted every year to supply the ICES:

- 'Herring Assessment Working Group for the Area South of 62°N (HAWG)' and
- 'Baltic Fisheries Assessment Working Group (WGBFAS)'

with an index value for the stock size of herring and sprat, respectively, in the Western Baltic area (Subdivisions 22, 23 and 24).

2 METHODS

2.1 Personnel

M. Drenkow	Institute for Fishery Technology and Fish Quality, Hamburg
Dr T. Gröhsler	Institute for Baltic Sea Fisheries, Rostock, in charge
M. Koth	Institute for Baltic Sea Fisheries, Rostock
S.-E. Levinsky	DIFRES, Charlottenlund, Denmark
R. Oeberst	Institute for Baltic Sea Fisheries, Rostock

2.2 Narrative

The 514th cruise of RV "Solea" represents the 16th subsequent survey and took place from 30th September to 18th October in 2003. RV "SOLEA" left the port of Rostock/Warnemünde on 30th October 2003. The joint German-Danish acoustic survey was intended to cover the whole Subdivisions 21, 22, 23 and 24. Due to bad weather conditions only the southern part of the Kattegat area (Subdivision 21) could be covered in 2003. The survey ended on 18th October 2003 in Rostock/Marienehe.

2.3 Survey design

For all Subdivisions the statistical rectangles were used as strata (ICES 2003). The area is limited by the 10 m depth line. The survey area in the Western Baltic Sea is characterised by a number of islands and sounds. Parallel transects would lead in consequence to an unsuitable coverage of the survey area. Therefore a zig-zag track was used to cover all depth strata regularly. The survey area was 10,892 NM^2. The cruise track (Figure 1) totally reached a length of 864 nautical miles.

2.4 Calibration

The transducer 38–26 was calibrated during the survey time in Rostock/seaport. The calibration procedure was carried out as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (ICES 2003).

2.5 Acoustic data collection

The acoustic investigations were performed during night time. The main pelagic species of interest were herring and sprat. The acoustic equipment was an echosounder EK500 on 38 kHz. The transducer 38–26 was installed in a towed body, which had a lateral distance of about 30 m to reduce escape reactions of fish. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (ICES 2003). The postprocessing of the stored echosignals was done by the Bergen integrator BI500. The mean volume back scattering values (Sv) were integrated over 1 nm intervals from 8 m below the surface to the bottom. Contributions from air bubbles, bottom structures and scattering layers were removed from the echogram by using the BI500.

2.6 Biological data – fishing stations

Trawling was done with the pelagic gear "PSN388" in the midwater as well as near the bottom. The mesh size in the codend was 10 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the net opening were controlled by a net sonde. The trawl depth was chosen in accordance to the 'characteristic indications' by the echogram. Normally a net opening of about 9–10 m was achieved. The trawling time lasted usually 30 minutes, but in dense concentrations the duration was reduced. From each haul sub-samples were taken to determine length and weight of fish. Samples of herring and sprat were frosted for further investigations in the lab (i.e., sex, maturity, age). After each trawl haul it was intended to investigate the hydrographic condition by a CTD-probe.

2.7 Data analysis

The pelagic target species sprat and herring are usually distributed in mixed layers in combination with other species so that the integrator readings cannot be allocated to a single species. Therefore the species composition was based on the trawl catch results. For each rectangle the species composition and length distribution were determined as the unweighted mean of all trawl results in this rectangle. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relation:

Clupeoids	TS = 20 log L (cm) - 71.2	(ICES 1983)
Gadoids	TS = 20 log L (cm) - 67.5	(Foote *et al.* 1986)

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (Sa) and the rectangle area, divided by the corresponding mean cross section. The total number were separated into herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 50 trawl hauls were carried out (9 hauls in Subdivision 21, 21 hauls in Subdivision 22, 3 hauls in Subdivision 23 and 17 hauls in Subdivision 24). 2175 herring and 806 sprat were frozen for further investigations in the lab.

The results of the catch composition by Subdivision are presented in Table 1–4. The contribution of anchovy and sprat in 2003 was remarkable higher then in 2002. The catch in the northern part of Subdivision 22 and in the southern part of Subdivision 21 contained for the first time shad. On sea lamprey was caught in the Hohwachter bight (Subdivision 22).

The length distributions of herring and sprat of the years 2002 and 2003 are presented by Subdivision in Figures 2 and 3.

For herring the major differences can be seen in Subdivisions 22 and 23 (Figure 2). In this area the one year old herring (16–20 cm = year class 2002) is occurring to a lesser degree compared to 2002. The 2002 year class is only dominating in Subdivision 21, which could not be surveyed last year. Remarkable higher proportions of older herring (> 20 cm) are found this year in the Sound (Subdivision 23). In the last two years the new incoming year class is dominating in Subdivision 22 and 24. The amount of older herring (> 20 cm) decreased compared to last year. The actual new incoming year class 2003 (<= 15 cm) is characterised by two maxima. Further analysis may show whether this two peaks are referring to different growth pattern or whether they are caused by spring and autumn spawned herring.

The length distributions of sprat in 2002 and 2003 show a different picture in all Subdivisions (Figure 4). Compared to last year the contribution of older sprat (>10 cm) decreased both in Subdivision 22 and 24. In contrast to 2002 and beside the results in Subdivision 21 the new incoming year class is now dominating in Subdivisions 22–24. Remarkable numbers of large sprat are occurring in 2003 in Subdivision 21 and 23.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean S_a, the mean scattering cross section σ, the estimated total number of fish, the percentages of herring and sprat per Subdivision/rectangle are shown in Table 4.

The horizontal distribution of S_a values (Figure 4 and Table 4) was quite different compared to the results in previous years. Remarkably high values were now found in the Belt Sea (Subdivision 22). Very high concentrations were observed particularly in the Kiel Bay and in the Lille Belt. In the entire Arkona Sea (Subdivision 24) the S_a values reached only about 50% of the mean of the period 1991–2002. In the area of the Kattegat (Subdivision 21) and the Sound (Subdivision 23) the highest fish concentrations were detected in the southern parts as in former years.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 5. The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Table 6 and Table 9. The corresponding mean weights by age group and Subdivision/rectangle are shown in Table 7 and Table 10. The estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarised in Table 8 and Table 11.

The herring stock was estimated to be 6.1 x 10^9 fish or about 182.4 x 10^3 tonnes in Subdivisions 21–24. For the included area of Subdivisions 22–24 the number of herring was calculated to be 5.4 x 10^9 fish or about 155.8 x 10^3. As in former years the abundance estimates were dominated by young herring. Adult herring, which was concentrated in former years only in the Sound, could be found the last two years in deeper areas of the Arkona Sea.

The estimated sprat stock was 16.12 x 10^9 fish or 78.8 x 10^3 tonnes in Subdivisions 21–24. For the included area of Subdivisions 22–24 the number of sprat was calculated to be 16.07 x 10^9 fish or 78.0 x 10^3 tonnes. As for herring, the abundance estimates of sprat were dominated by young sprat (Figure 3 and Table 9). The year class strength 2003 was estimated on a record high level.

4 DISCUSSION

Last year the Kattegat area (Subdivision 21) could not be surveyed at all because of a lack of survey time caused by technical problems with the research vessel. Therefore this years results are only compared to last year's results in Subdivisions 22, 23 and 24.

The total number of herring in Subdivisions 22–24 decreased slightly by 10 % compared to the results in 2002. This overall small decrease is characterised by a strong decrease in numbers in Subdivisions 22 (- 53 %), which was mostly compensated by higher numbers in Subdivision 23 (+ 43 %) and in Subdivision 24 (+ 13 %). The slight increase in Subdivision 24 was based either by decreased numbers of age groups 2–4 (2002: 32 % and 2003: 10 %) or by increased numbers of age-groups 0–1 (2002: 66 % and 2003: 87 %), which are on a high level in 2003. The smaller numbers of age groups 2–4 could be explained by a changed migration pattern compared to last year. A lower proportion of adult herring may have been migrated at the survey time from the Sound into the Arkona Sea on the way to the spring spawning areas around Rügen Island.

In 2002 the entire level in numbers is dominated by a high fraction of 0-group herring (Figure 2 and Table 5: 67 % in 2002 and 69 % in 2003). In the last two years the total abundance of young herring was about 2 times higher compared to the estimates of the last two years before. The year class 2002 and 2003 attained about the level of the big 1999 year class.

The total biomass reached only 80 % of the estimate in 2002 of 195.3 x 10^3 t.

The abundance of sprat in the Western Baltic increased and was now in Subdivisions 22–24 estimated about 142 % higher than that of the last year. The years 2002 and 2001 abundance estimates were already about 3 times higher than in 2000, which represented the lowest level of the time series since 1991. The increase in numbers was mainly caused by the high 0-group estimate in Subdivision 22, which is about 13 times higher than in 2002 (2002: 0.8 x 10^9 fish and 2003: 11.0 x 10^9 fish). The actual high contribution of the age-group 0 in Subdivisions 22–24 was 87 % in numbers and 61 % in biomass (2002: 60 % in numbers and 33 % in biomass).

5 REFERENCES

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Table 1: Catch composition (kg/0.5 h) per haul No. in Sub-division 21

Haul No.	42	43	44	45	46	47	48	49	50	Total
Species/ICES Rectangle	**41G2**	**41G1**	**41G1**	**41G1**	**41G2**	**42G1**	**42G1**	**42G2**	**41G2**	
AGONUS CATAPHRACTUS		0,01								**0,01**
ALOSA FALLAX	0,20	0,01	1,18		0,78	10,82	0,17		0,32	**13,48**
APHIA MINUTA	+		+		+		+	0,01		**0,01**
CLUPEA HARENGUS	0,47	106,74	1,35	1236,71	2,78	2,40	0,06	337,71	9,13	**1697,35**
CYCLOPTERUS LUMPUS		0,94								**0,94**
ELEDONE			0,01							**0,01**
ENGRAULIS ENCRASICOLUS	0,22	0,57	39,32	19,83	19,88	138,26	4,14	0,49	12,34	**235,05**
GADUS MORHUA		0,69			+			4,20	0,01	**4,90**
LIMANDA LIMANDA		5,13			0,05	0,11		6,07	0,04	**11,40**
LOLIGO FORBESI			0,07		0,13	0,40	0,03	0,02		**0,65**
MERLANGIUS MERLANGUS		0,95	0,04		7,57	1,38	0,13	7,92	0,54	**18,53**
MULLUS SURMULETUS		0,01	0,11		0,22				0,07	**0,41**
MYOXOCEPHALUS SCORPIUS		0,15								**0,15**
NEPHROPS NORVEGICUS									0,10	**0,10**
PLEURONECTES PLATESSA								0,34		**0,34**
POMATOSCHISTUS MINUTUS					+	+				**+**
SCOMBER SCOMBRUS				2,09	0,11	0,57				**2,77**
SPRATTUS SPRATTUS		0,02	0,07	89,00	0,07	0,13	0,07	1,86	0,01	**91,23**
TRACHINUS DRACO		0,35	0,10		0,86	0,50	0,04	0,20	0,05	**2,10**
TRACHURUS TRACHURUS	0,01	0,16	0,65		0,10	1,71	+	0,02	0,02	**2,67**
TRIGLA LUCERNA								0,03		**0,03**
TRISOPTERUS MINUTUS								0,08	0,00	**0,08**
Total	**0,90**	**115,73**	**42,90**	**1347,63**	**32,55**	**156,28**	**4,64**	**358,95**	**22,63**	**2082,21**
Medusae	0,94	0,54	3,16		1,14		1,25	0,57	0,43	8,01

+' = < 0.01 Kg

Table 2: Catch composition (kg/0.5 h) per haul No. in Sub-division 22

Haul No.	18	19	20	21	22	23	24	25	26	27	28	29
Species/ICES Rectangle	**37G1**	**37G1**	**37G1**	**37G1**	**38G1**	**38G0**	**37G0**	**38G0**	**38G0**	**38G0**	**39G0**	**39F9**
ALOSA FALLAX												
APHIA MINUTA							+		0,01	+		
CLUPEA HARENGUS	4,92	4,79	13,12	21,03	1,35	2,54	5,47	2,52	5,02	6,21	0,79	6,39
CRANGON CRANGON												
CTENOLABRUS RUPESTRIS												
ENGRAULIS ENCRASICOLUS	0,39	8,16	0,47	0,77	0,51	8,12	4,75	12,57	1,12	52,36	36,88	0,68
GADUS MORHUA	0,01		11,88	0,03				0,94	0,47	0,01		
GASTEROSTEUS ACULEATUS	+	7,25	+			+	+	0,03	+	0,16	0,10	4,67
GOBIUS NIGER						0,01						0,01
LEANDER SQUILLA												
LIMANDA LIMANDA	0,09				0,12	1,54					0,21	
LOLIGO FORBESI						0,01						
MERLANGIUS MERLANGUS	0,81	0,40	0,15	0,58	0,94		0,21	2,12	0,31	0,01	0,01	0,08
MULLUS SURMULETUS		0,07				0,05	0,04		0,14			
PETROMYZON MARINUS							0,42					
POMATOSCHISTUS MINUTUS	+					+			+	+		
SCOMBER SCOMBRUS		2,90		0,36								
SPRATTUS SPRATTUS	3,59	47,62	0,09	92,65	75,76	12,30	7,28	1,70	56,92	2,55	12,02	101,59
SYNGNATHUS ROSTELLATUS												
TRACHINUS DRACO												
TRACHURUS TRACHURUS	1,40	17,05	2,89	0,47	0,12	1,00	10,83	288,54	1,00	0,62		0,30
TRISOPTERUS MINUTUS						+						
Total	**11,21**	**88,24**	**28,60**	**115,89**	**78,80**	**25,57**	**29,00**	**308,42**	**64,99**	**61,92**	**50,01**	**113,72**
Medusae	21,9	299,3	118,5	32,6	3,1	55,3	114,8	20,5	63,2	70,5	48,3	21,5

Haul No.	30	31	32	33	34	35	36	37	38	Total
Species/ICES Rectangle	**39F9**	**40G0**	**40G0**	**41G0**	**40G0**	**39G0**	**39G0**	**39G1**	**38G1**	
ALOSA FALLAX		0,05	0,03	0,13	0,49					**0,70**
APHIA MINUTA	0,02	0,01	0,03			+	+	0,03	+	**0,10**
CLUPEA HARENGUS	1,14	0,64	0,20	1,04	2,68	1,80	4,49	0,49	1,10	**87,73**
CRANGON CRANGON					+					**+**
CTENOLABRUS RUPESTRIS							+			**+**
ENGRAULIS ENCRASICOLUS	0,29	3,43	3,01	84,94	34,48	6,05	2,33	0,23	0,09	**261,63**
GADUS MORHUA	0,01	0,02	0,03				0,05	0,10	0,04	**13,59**
GASTEROSTEUS ACULEATUS	0,09	0,01						0,08	+	**12,39**
GOBIUS NIGER										**0,02**
LEANDER SQUILLA								+		**+**
LIMANDA LIMANDA			+		0,01	0,04			0,02	**2,03**
LOLIGO FORBESI		0,01	0,59			0,01	0,01	0,02	+	**0,65**
MERLANGIUS MERLANGUS	0,45	0,08	0,05	0,11	0,01	0,16	0,17	0,03	0,05	**6,73**
MULLUS SURMULETUS		0,01	0,02	0,00	0,01		0,03	0,02	0,03	**0,42**
PETROMYZON MARINUS										**0,42**
POMATOSCHISTUS MINUTUS			0,01			+	+	+	0,01	**0,02**
SCOMBER SCOMBRUS		0,03								**3,29**
SPRATTUS SPRATTUS	102,32	22,62	28,42	0,04	0,19	32,60	46,32	6,04	0,56	**653,18**
SYNGNATHUS ROSTELLATUS		+						+		**+**
TRACHINUS DRACO					0,24					**0,24**
TRACHURUS TRACHURUS	0,10	0,02	0,04	0,05	0,16	0,22	0,04	0,02	0,02	**324,89**
TRISOPTERUS MINUTUS			0,01							**0,01**
Total	**104,42**	**26,93**	**32,44**	**86,31**	**38,27**	**40,88**	**53,44**	**7,06**	**1,92**	**1368,04**
Medusae	19,8	2,6	2,2	3,8	2,4	3,9	1,3	2,1	20,2	927,8

+' = < 0.01 Kg

Table 3: Catch composition (kg/0.5 h) per haul No. in Sub-division 23

Haul No.	39	40	41	Total
Species/ICES Rectangle	**40G2**	**40G2**	**41G2**	
APHIA MINUTA			+	+
CLUPEA HARENGUS	1703,55	402,24	5,07	**2110,86**
ENGRAULIS ENCRASICOLUS	0,47	0,78	5,64	**6,89**
GADUS MORHUA	61,16	33,26	+	**94,42**
LIMANDA LIMANDA			0,02	**0,02**
MERLANGIUS MERLANGUS	3,09	12,11	0,16	**15,36**
SCOMBER SCOMBRUS			0,05	**0,05**
SPRATTUS SPRATTUS	29,30	42,00	0,03	**71,33**
TRACHINUS DRACO			0,01	**0,01**
TRACHURUS TRACHURUS			0,04	**0,04**
Total	**1797,57**	**490,39**	**11,02**	**2298,98**
Medusae		5,32	0,7	6,0

+' = < 0.01 Kg

Table 4: Catch composition (kg/0.5 h) per haul No. in Sub-division 24

Haul No.	1	2	3	4	5	6	7	8	9	10	11	12
Species/ICES Rectangle	**37G2**	**38G2**	**38G2**	**38G2**	**38G3**	**38G3**	**38G4**	**38G4**	**38G4**	**38G3**	**39G3**	**39G3**
AMMODYTES MARINUS	0,05											
ANGUILLA ANGUILLA								0,11				
CLUPEA HARENGUS	7,13	34,08	23,85	5,80	28,09	3,60	3,12	18,67	11,23	35,96	22,70	97,67
CRANGON CRANGON			+		0,02							
CYCLOPTERUS LUMPUS												0,26
ENGRAULIS ENCRASICOLUS	2,60	1,35	0,23	0,04	1,30	0,06	0,10	0,01	0,03	0,05		0,01
GADUS MORHUA	3,66			0,22	0,78	0,49	1,65	42,26		0,85	2,44	2,32
GASTEROSTEUS ACULEATUS		0,01			+	0,01	0,19		0,01	0,01		
GOBIUS NIGER	+	0,01										
HYPEROPLUS LANCEOLATUS					0,08							
LIMANDA LIMANDA	3,10	0,12			0,97							
MERLANGIUS MERLANGUS	0,75	1,14		0,37	4,81	1,46		0,75	0,55	0,26		3,42
MYOXOCEPHALUS SCORPIUS							+	+				
PLATICHTHYS FLESUS						0,43						
PLEURONECTES PLATESSA										0,19		
POMATOSCHISTUS MINUTUS	0,02	0,07	0,09		0,04	0,06	+	0,12	+			
POMATOSCHISTUS PICTUS		+										
SCOMBER SCOMBRUS	0,01											
SPRATTUS SPRATTUS	3,78	4,82	25,28	0,25	70,03	24,43	0,05	19,06	0,86	7,11	1,27	48,51
SYNGNATHUS ROSTELLATUS												+
TRACHURUS TRACHURUS	0,15	2,21		0,10							0,09	
Total	**21,25**	**43,81**	**49,45**	**6,78**	**106,12**	**30,54**	**5,11**	**80,98**	**12,68**	**44,43**	**26,50**	**152,19**
Medusae	21,0	19,7	16,0	233,1	41,8	87,5	25,1	6,8	82,4	22,8	71,5	3,7

Haul No.	13	14	15	16	17	Total
Species/ICES Rectangle	**39G4**	**39G4**	**39G3**	**39G3**	**39G2**	
AMMODYTES MARINUS						**0,05**
ANGUILLA ANGUILLA					0,03	**0,14**
CLUPEA HARENGUS	34,92	20,70	115,18	157,92	20,78	**641,40**
CRANGON CRANGON						**0,02**
CYCLOPTERUS LUMPUS						**0,26**
ENGRAULIS ENCRASICOLUS	0,05				0,02	**5,85**
GADUS MORHUA		0,77	9,02	11,30	1,53	**77,29**
GASTEROSTEUS ACULEATUS						**0,23**
GOBIUS NIGER						**0,01**
HYPEROPLUS LANCEOLATUS						**0,08**
LIMANDA LIMANDA						**4,19**
MERLANGIUS MERLANGUS		0,96	2,89	1,57	0,03	**18,96**
MYOXOCEPHALUS SCORPIUS						**+**
PLATICHTHYS FLESUS						**0,43**
PLEURONECTES PLATESSA				0,54		**0,73**
POMATOSCHISTUS MINUTUS		+		0,01	0,09	**0,50**
POMATOSCHISTUS PICTUS						**+**
SCOMBER SCOMBRUS						**0,01**
SPRATTUS SPRATTUS	70,19	11,54	85,09	2,40	0,52	**375,19**
SYNGNATHUS ROSTELLATUS						**+**
TRACHURUS TRACHURUS					+	**2,55**
Total	**105,16**	**33,97**	**212,18**	**173,74**	**23,00**	**1127,89**
Medusae	72,8	2,5	26,3	4,9	5,2	743,0

+' = < 0.01 Kg

Table 5 Survey statistics RV "Solea" September/October 2003

Sub-division	ICES Rectangle	Area (nm²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
21	41G1	946,8	220,8	2,068	1010,88	59,37	4,02	600,16	40,65
21	41G2	432,3	39,9	1,154	149,49	19,98	0,10	29,86	0,14
21	42G1	884,2	62,5	1,678	329,25	0,65	0,51	2,13	1,69
21	42G2	606,8	86,1	3,555	146,96	97,34	1,99	143,05	2,93
	Total	**2870,1**			**1636,58**			**775,20**	**45,41**
22	37G0	209,9	570,2	0,901	1327,84	9,58	53,38	127,25	708,84
22	37G1	723,3	211,1	1,223	1248,37	29,77	44,91	371,67	560,65
22	38G0	735,3	466,8	0,988	3474,05	4,26	44,81	148,07	1556,56
22	38G1	173,2	724,6	0,828	1515,09	20,83	75,28	315,66	1140,51
22	39F9	159,3	1726,3	0,526	5224,51	1,58	94,28	82,50	4925,78
22	39G0	201,7	283,0	0,758	753,52	2,16	79,39	16,28	598,24
22	39G1	250,0	91,7	0,663	345,88	2,56	88,88	8,84	307,43
22	40G0	538,1	349,5	0,853	2205,03	2,07	62,62	45,67	1380,73
22	41G0	173,1	169,4	1,134	258,64	0,60	0,07	1,56	0,18
	Total	**3163,9**			**16352,93**			**1117,50**	**11178,92**
23	40G2	164,0	1938,7	4,357	729,80	78,54	19,89	573,16	145,14
23	41G2	72,3	517,4	1,001	373,54	23,19	0,38	86,62	1,41
	Total	**236,3**			**1103,34**			**659,78**	**146,55**
24	37G2	192,4	103,5	1,032	193,02	39,24	34,39	75,75	66,38
24	38G2	832,9	189,2	1,282	1229,69	61,72	33,31	758,93	409,66
24	38G3	865,7	517,9	1,126	3982,89	28,89	70,23	1150,72	2797,06
24	38G4	1034,8	134,0	1,434	966,64	43,54	32,70	420,84	316,08
24	39G2	406,1	138,9	2,103	268,19	82,16	17,25	220,34	46,27
24	39G3	765,0	256,1	1,944	1007,84	64,37	35,42	648,78	356,95
24	39G4	524,8	323,5	1,607	1056,50	28,47	71,50	300,75	755,41
	Total	**4621,7**			**8704,77**			**3576,11**	**4747,81**
22-24	**Total**	**8021,9**			**26161,04**			**5353,39**	**16073,28**
21-24	**Total**	**10892,0**			**27797,62**			**6128,59**	**16118,69**

Table 6 Estimated numbers (millions) of herring RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G1	233,95	349,55	16,34	0,33						600,17
21	41G2	21,64	7,80	0,38	0,01	0,03					29,86
21	42G1	0,79	1,23	0,10							2,12
21	42G2	0,06	125,55	17,14	0,29						143,04
	Total	256,44	484,13	33,96	0,63	0,03	0,00	0,00	0,00	0,00	775,19
22	37G0	111,02	15,92	0,11	0,16		0,05				127,26
22	37G1	280,47	78,06	6,42	5,04	1,37	0,32				371,68
22	38G0	142,02	5,76	0,29							148,07
22	38G1	305,04	10,62								315,66
22	39F9	82,10	0,40								82,50
22	39G0	16,09	0,20								16,29
22	39G1	8,81	0,03								8,84
22	40G0	45,44	0,23								45,67
22	41G0	1,44	0,10		0,02						1,56
	Total	992,43	111,32	6,82	5,22	1,37	0,37	0,00	0,00	0,00	1117,53
23	40G2	114,90	55,95	62,35	117,85	152,98	49,32	14,68	3,89	1,25	573,17
23	41G2	81,28	5,34								86,62
	Total	196,18	61,29	62,35	117,85	152,98	49,32	14,68	3,89	1,25	659,79
24	37G2	64,46	11,14	0,10	0,04						75,74
24	38G2	584,16	163,67	6,57	2,85	1,08	0,30	0,30			758,93
24	38G3	940,59	86,85	29,86	24,39	39,66	18,09	7,46	1,84	1,96	1150,70
24	38G4	280,05	32,8	27,65	22,88	28,25	14,97	7,76	1,85	4,64	420,83
24	39G2	128,51	56,06	10,94	8,79	9,30	4,34	1,50	0,18	0,71	220,33
24	39G3	357,35	163,95	38,84	34,07	31,83	12,21	7,09	1,17	2,26	648,77
24	39G4	157,51	93,65	17,27	13,67	11,82	3,71	2,37	0,45	0,30	300,75
	Total	2512,63	608,10	131,23	106,69	121,94	53,62	26,48	5,49	9,87	3576,05
22-24	Total	3701,24	780,71	200,40	229,76	276,29	103,31	41,16	9,38	11,12	5353,37
21-24	Total	3957,68	1264,84	234,36	230,39	276,32	103,31	41,16	9,38	11,12	6128,56

Table 7 Herring mean weight (g) per age group RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G1	14,15	41,89	58,87	66,27						31,55
21	41G2	11,21	39,52	62,16	66,27	161,00					19,43
21	42G1	16,91	44,41	50,77							34,46
21	42G2	26,29	47,23	62,38	66,27						49,07
	Total	13,91	43,24	60,65	66,27	161,00					34,32
22	37G0	10,56	33,45	76,83	76,83		76,83				13,59
22	37G1	9,07	34,56	61,78	71,38	88,24	76,83				16,53
22	38G0	10,08	32,35	46,50							11,01
22	38G1	9,63	30,33								10,32
22	39F9	5,94	30,42								6,06
22	39G0	10,26	28,76								10,48
22	39G1	10,89	17,00								10,91
22	40G0	9,42	23,85								9,49
22	41G0	13,22	28,13		109,00						15,58
	Total	9,35	33,83	61,37	71,69	88,24	76,83				12,52
23	40G2	10,83	37,85	100,50	112,82	147,25	163,04	181,66	192,28	176,64	99,67
23	41G2	10,45	30,66								11,70
	Total	10,67	37,22	100,50	112,82	147,25	163,04	181,66	192,28	176,64	88,12
24	37G2	7,45	26,63	43,62	38,40						10,34
24	38G2	7,88	28,24	52,45	60,57	95,73	90,98	97,78			13,05
24	38G3	6,56	31,86	62,48	93,04	124,92	145,46	145,56	138,59	162,50	19,39
24	38G4	7,64	28,79	65,92	88,67	112,24	155,99	151,44	135,57	175,58	34,89
24	39G2	11,99	30,84	62,35	92,71	106,31	123,97	116,35	146,50	137,04	29,92
24	39G3	9,76	32,07	62,84	90,79	102,51	127,70	114,75	118,58	157,21	31,46
24	39G4	10,91	32,58	62,27	88,17	95,81	118,73	112,52	92,00	116,89	29,81
	Total	8,02	30,70	62,76	89,85	111,63	140,46	133,88	129,75	164,22	23,39
22-24	Total	8,51	31,66	74,45	101,22	131,24	151,01	150,92	155,68	165,62	29,10
21-24	Total	8,86	36,09	72,45	101,12	131,24	151,01	150,92	155,68	165,62	29,76

Table 8 Herring total biomass (t) per age group RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G1	3310,4	14642,6	961,9	21,9						18936,8
21	41G2	242,6	308,3	23,6	0,7	4,8					580,0
21	42G1	13,4	54,6	5,1							73,1
21	42G2	1,6	5929,7	1069,2	19,2						7019,7
	Total	3568,0	20935,2	2059,8	41,8	4,8	0,0	0,0	0,0	0,0	26609,6
22	37G0	1172,4	532,5	8,5	12,3		3,8				1729,5
22	37G1	2543,9	2697,8	396,6	359,8	120,9	24,6				6143,6
22	38G0	1431,6	186,3	13,5							1631,4
22	38G1	2937,5	322,1								3259,6
22	39F9	487,7	12,2								499,9
22	39G0	165,1	5,8								170,9
22	39G1	95,9	0,5								96,4
22	40G0	428,0	5,5								433,5
22	41G0	19,0	2,8		2,2						24,0
	Total	9281,1	3765,5	418,6	374,3	120,9	28,4	0,0	0,0	0,0	13988,8
23	40G2	1244,4	2117,7	6266,2	13295,8	22526,3	8041,1	2666,8	748,0	220,8	57127,1
23	41G2	849,4	163,7								1013,1
	Total	2093,8	2281,4	6266,2	13295,8	22526,3	8041,1	2666,8	748,0	220,8	58140,2
24	37G2	480,2	296,7	4,4	1,5						782,8
24	38G2	4603,2	4622,0	344,6	172,6	103,4	27,3	29,3			9902,4
24	38G3	6170,3	2767,0	1865,7	2269,2	4954,3	2631,4	1085,9	255,0	318,5	22317,3
24	38G4	2139,6	943,7	1822,7	2028,8	3170,8	2335,2	1175,2	250,8	814,7	14681,5
24	39G2	1540,8	1728,9	682,1	814,9	988,7	538,0	174,5	26,4	97,3	6591,6
24	39G3	3487,7	5257,9	2440,7	3093,2	3262,9	1559,2	813,6	138,7	355,3	20409,2
24	39G4	1718,4	3051,1	1075,4	1205,3	1132,5	440,5	266,7	41,4	35,1	8966,4
	Total	20140,2	18667,3	8235,6	9585,5	13612,6	7531,6	3545,2	712,3	1620,9	83651,2
22-24	Total	31515,1	24714,2	14920,4	23255,6	36259,8	15601,1	6212,0	1460,3	1841,7	155780,2
21-24	Total	35083,1	45649,4	16980,2	23297,4	36264,6	15601,1	6212,0	1460,3	1841,7	182389,8

Table 9 Estimated numbers (millions) of sprat RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G1	6,84	3,58	17,07	11,72	0,76	0,67				40,64
21	41G2	0,13			0,01						0,14
21	42G1		0,19	0,72	0,58	0,18	0,03				1,70
21	42G2	1,28	0,56	0,51	0,54	0,03	0,01				2,93
	Total	8,25	4,33	18,30	12,85	0,97	0,71	0,00	0,00	0,00	45,41
22	37G0	708,84									708,84
22	37G1	403,93	6,00	3,89	67,67	41,25	19,67	18,23			560,64
22	38G0	1523,59	0,94	2,89	20,85	5,01	1,88	1,41			1556,57
22	38G1	1140,51									1140,51
22	39F9	4925,78									4925,78
22	39G0	596,85	0,45	0,35	0,40	0,10		0,10			598,25
22	39G1	307,43									307,43
22	40G0	1370,03	1,53	0,00	1,53	7,65					1380,74
22	41G0	0,18									0,18
	Total	10977,14	8,92	7,13	90,45	54,01	21,55	19,74	0,00	0,00	11178,94
23	40G2	45,12	7,08	27,34	33,97	22,39	7,28	0,50	1,46		145,14
23	41G2	1,21	0,05	0,15							1,41
	Total	46,33	7,13	27,49	33,97	22,39	7,28	0,50	1,46	0,00	146,55
24	37G2	50,78	3,95	5,20	3,34	1,77	0,33	0,53	0,47		66,37
24	38G2	280,57	26,66	48,48	31,66	16,50	2,04	1,28	2,40	0,06	409,65
24	38G3	1919,95	390,09	281,73	154,20	42,49	1,90	1,62	5,10		2797,08
24	38G4	227,87	37,82	28,01	13,96	6,69	0,34	0,65	0,75		316,09
24	39G2	45,62	0,65								46,27
24	39G3	214,24	39,09	53,71	30,97	14,50	1,25	0,96	2,15	0,08	356,95
24	39G4	270,18	146,06	177,93	97,01	47,61	4,16	4,14	7,07	1,25	755,41
	Total	3009,21	644,32	595,06	331,14	129,56	10,02	9,18	17,94	1,39	4747,82
22-24	Total	14032,68	660,37	629,68	455,56	205,96	38,85	29,42	19,40	1,39	16073,31
21-24	Total	14040,93	664,70	647,98	468,41	206,93	39,56	29,42	19,40	1,39	16118,72

Table 10 Sprat mean weight (g) per age group RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G1	5,51	18,37	20,62	20,38	23,43	22,00				17,89
21	41G2	7,86			25,80	25,80					9,14
21	42G1		17,74	21,00	21,35	27,44	21,53				21,43
21	42G2	7,04	15,80	19,95	19,25	23,15	22,58				13,43
	Total	5,78	18,01	20,62	20,38	24,17	21,99				17,71
22	37G0	3,43									3,43
22	37G1	3,97	18,26	16,20	19,30	21,13	22,94	23,43			8,62
22	38G0	3,61	18,26	15,22	16,76	18,59	23,15	21,70			3,91
22	38G1	3,99									3,99
22	39F9	2,65									2,65
22	39G0	3,65	14,29	13,00	18,79	18,79		18,79			3,68
22	39G1	3,83									3,83
22	40G0	3,82	17,74		17,74	17,74					3,93
22	41G0	4,78									4,78
	Total	3,25	17,97	15,65	18,69	20,41	22,96	23,28			3,56
23	40G2	4,57	17,22	20,22	23,05	24,70	25,31	29,11	27,99		16,93
23	41G2	3,23	15,50	15,50							4,99
	Total	4,54	17,21	20,19	23,05	24,70	25,31	29,11	27,99		16,82
24	37G2	3,11	12,20	15,33	16,47	17,51	19,77	20,90	19,52		6,01
24	38G2	3,52	13,87	15,60	15,87	15,90	19,81	19,54	17,78	21,20	7,30
24	38G3	4,03	11,50	13,50	13,71	15,49	19,02	18,80	16,72		6,78
24	38G4	4,31	10,4	14,61	14,84	16,67	19,56	20,88	18,51		6,76
24	39G2	3,59	6,00								3,62
24	39G3	3,78	12,90	15,18	15,34	16,30	19,32	19,03	17,21	21,20	8,18
24	39G4	4,23	12,52	14,91	15,22	16,83	19,23	19,54	17,61	21,20	10,87
	Total	3,98	11,85	14,31	14,59	16,21	19,35	19,53	17,42	21,20	7,54
22-24	Total	3,41	11,99	14,58	16,03	18,24	22,47	22,22	18,22	21,22	4,85
21-24	Total	3,42	12,03	14,75	16,15	18,26	22,45	22,22	18,22	21,22	4,89

Table 11 Sprat total biomass (t) per age group RV "Solea" Sept./Oct. 2003

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G1	37,7	65,8	352,0	238,9	17,8	14,7				726,9
21	41G2	1,0			0,3						1,3
21	42G1	0,0	3,4	15,1	12,4	4,9	0,6				36,4
21	42G2	9,0	8,8	10,2	10,4	0,7	0,2				39,3
	Total	47,7	78,0	377,3	262,0	23,4	15,5	0,0	0,0	0,0	803,9
22	37G0	2431,3									2431,3
22	37G1	1603,6	109,6	63,0	1306,0	871,6	451,2	427,1			4832,1
22	38G0	5500,2	17,2	44,0	349,4	93,1	43,5	30,6			6078,0
22	38G1	4550,6									4550,6
22	39F9	13053,3									13053,3
22	39G0	2178,5	6,4	4,5	7,5	1,9		1,9			2200,7
22	39G1	1177,5									1177,5
22	40G0	5233,5	27,1		27,1	135,7					5423,4
22	41G0	0,9									0,9
	Total	35729,4	160,3	111,5	1690,0	1102,3	494,7	459,6	0,0	0,0	39747,8
23	40G2	206,2	121,9	552,8	783,0	553,0	184,3	14,6	40,9		2456,7
23	41G2	3,9	0,8	2,3							7,0
	Total	210,1	122,7	555,1	783,0	553,0	184,3	14,6	40,9	0,0	2463,7
24	37G2	157,9	48,2	79,7	55,0	31,0	6,5	11,1	9,2		398,6
24	38G2	987,6	369,8	756,3	502,4	262,4	40,4	25,0	42,7	1,3	2987,9
24	38G3	7737,4	4486,0	3803,4	2114,1	658,2	36,1	30,5	85,3		18951,0
24	38G4	982,1	391,4	409,2	207,2	111,5	6,7	13,6	13,9		2135,6
24	39G2	163,8	3,9								167,7
24	39G3	809,8	504,3	815,3	475,1	236,4	24,1	18,3	37,0	1,7	2922,0
24	39G4	1142,9	1828,7	2652,9	1476,5	801,3	80,0	80,9	124,5	26,5	8214,2
	Total	11981,5	7632,3	8516,8	4830,3	2100,8	193,8	179,4	312,6	29,5	35777,0
22-24	Total	47921,0	7915,3	9183,4	7303,3	3756,1	872,8	653,6	353,5	29,5	77988,5
21-24	Total	47968,7	7993,3	9560,7	7565,3	3779,5	888,3	653,6	353,5	29,5	78792,4

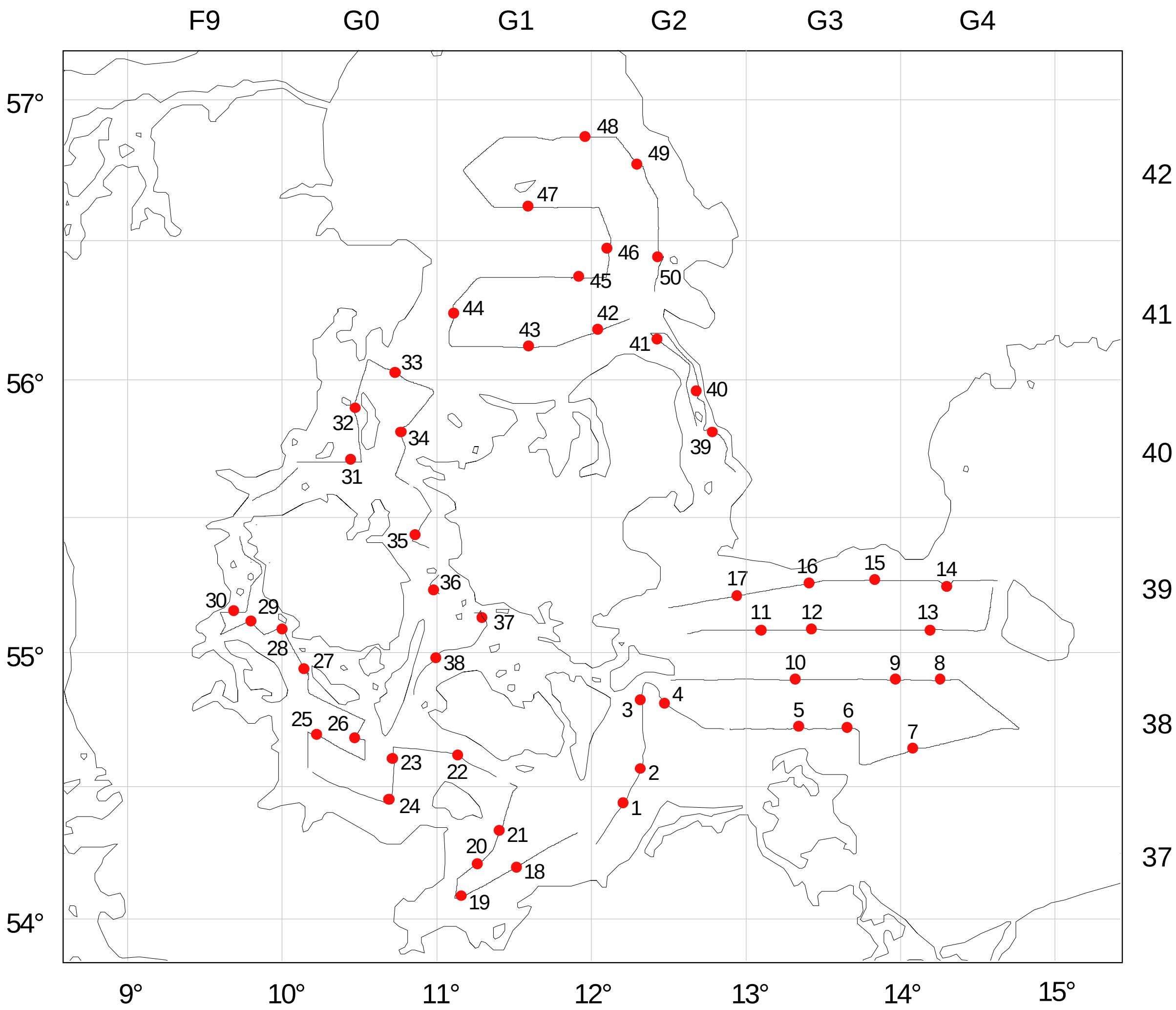

Figure 1. Cruise track and trawl positions for RV "SOLEA" in Sept./Oct. 2003.

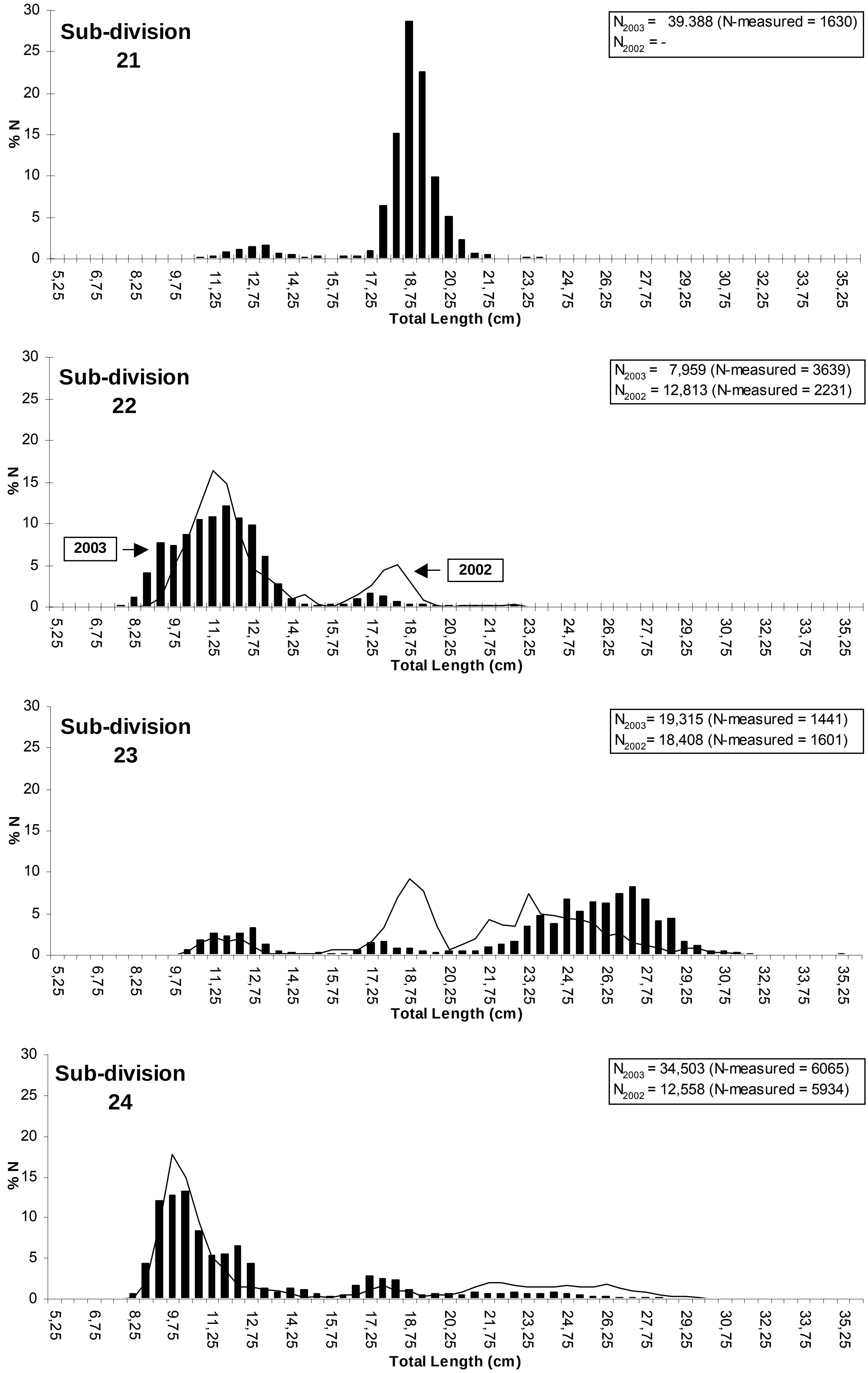

Figure 2 **Length distribution of herring in Sub-divisions 21, 22, 23 and 24 in 2002 (=line) and in 2003 (=bar)**

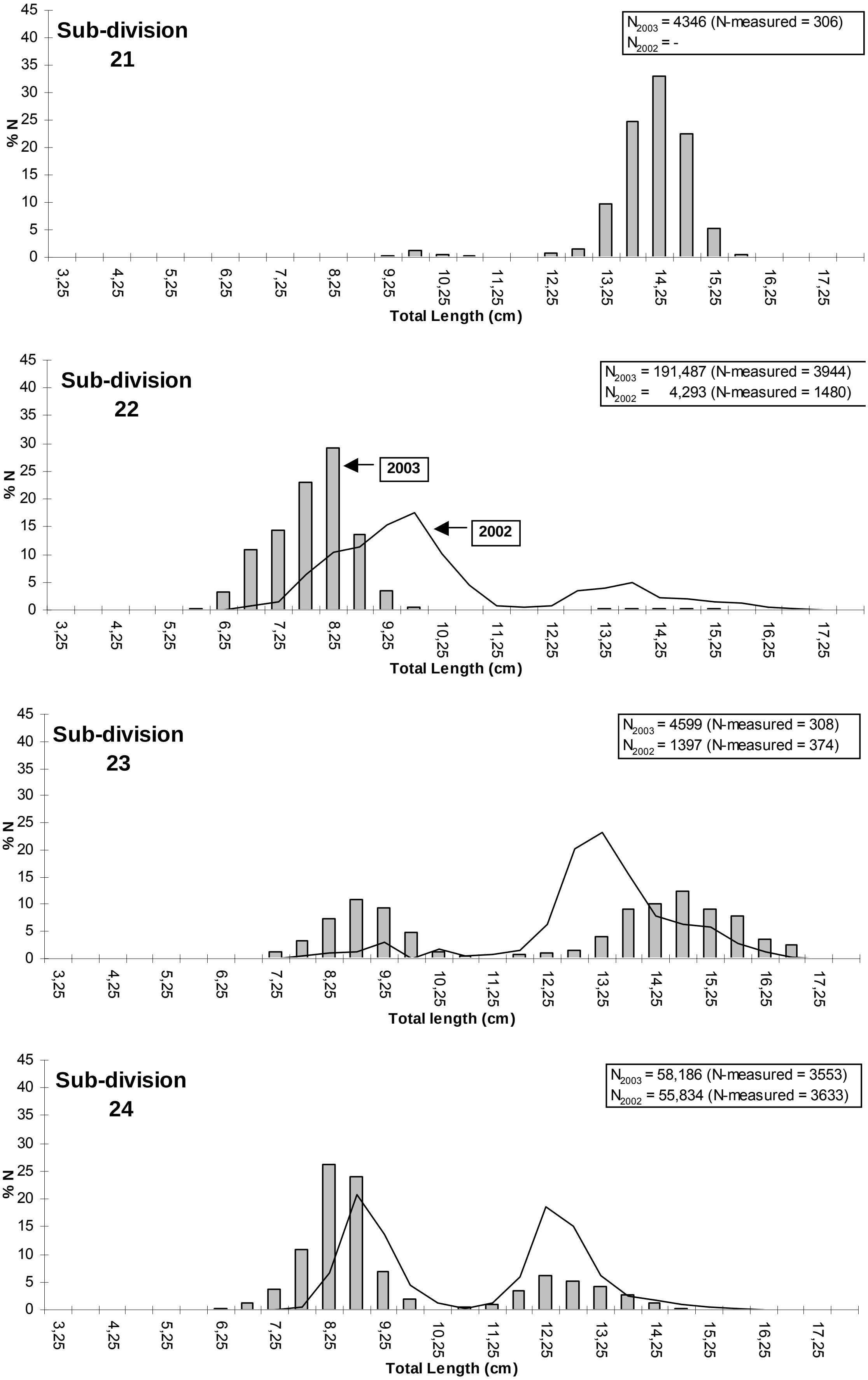

Figure 3 **Length distribution of sprat in Sub-divisions 21, 22, 23 and 24 in 2002 (=line) and in 2003 (=bar)**

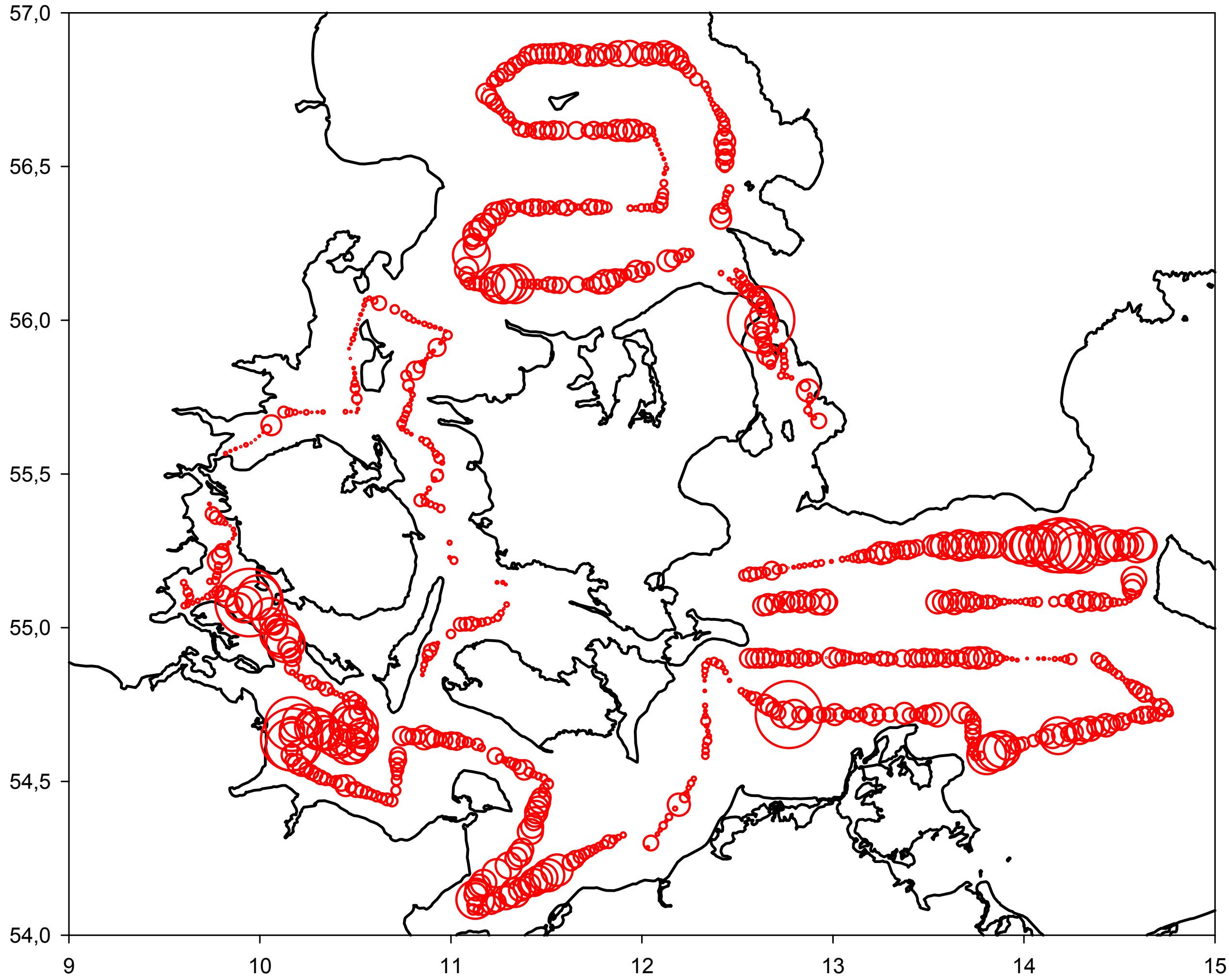

Figure 4. Distribution of Sa-values for RV "SOLEA" in Sept./Oct. 2003.

ANNEX 4: CRUISE REPORTS OF ACOUSTIC SURVEYS CARRIED OUT IN THE BALTIC SEA IN MAY/JUNE 2003

Survey Report for RV "ATLANTNIRO"
25.05–09.06.2003

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia. and Latvian Fisheries Research Institute, Riga, Latvia

1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The joint Russian/Latvian survey in October is traditionally co-ordinated within the frame of the **Baltic International Acoustic Survey.** The reported acoustic survey is conducted every year to supply the ICES:

- 'Baltic Fisheries Assessment Working Group (WGBFAS)' with an index value for the stock size of sprat, in the Baltic area (Subdivisions 26 and 28).

2 METHODS

2.1 Personnel

Zezera A.	AtlantNIRO, Kaliningrad, RUSSIA, - cruise leader
Konstantinov V.	AtlantNIRO, Kaliningrad, RUSSIA, - scientific leader
Sunkovich V.	AtlantNIRO, Kaliningrad, RUSSIA, - hydroacoustic
Sokolov M.	AtlantNIRO, Kaliningrad, RUSSIA, - hydroacoustic
Vasilieva T.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Shopov V.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Gribov E.	AtlantNIRO, Kaliningrad, RUSSIA, - oceanologist
Kalinina N.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Lapushkin A.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Krasovskaya N.	AtlantNIRO, Kaliningrad, RUSSIA, - fish sampling
Shvetsov F.	Latvian Fisheries Research Institute, Riga, Latvia – fish and acoustic
Strods G.	Latvian Fisheries Research Institute, Riga, Latvia - fish sampling

2.2 Narrative

The 37th cruise of RV "ATLANTNIRO" took place from 25th of May to 9 June in 2003. The cruise was intended to cover ICES subdivisions SD 26, SD28 and included economic zones of Russia, Latvia and Lithuania.

2.3 Survey design

For both Subdivisions nr.26 and 28, the statistical rectangles were used as strata (ICES CM 2001/H:02 Ref. D: Annex 2). The strata areas is limited by the 10 m depth line. The scheme of transects is defined as the regular, of rectangular form, with the distance between transects of 15 NM. The average speed of a vessel for the period of acoustic survey was 8 knots. The average speed of the vessel with a trawl was 4 knots. Duration of trawling time was 30 minutes. The survey was conducted in the daytime from 7.45 up to 19.30. The survey area was 11518,4 NM^2. The entire cruise track with positions of the trawling is shown in Figure 1.

2.4 Calibration

Both transducers with split-beam and the working frequencies 38 and 120 kHz, was calibrated in the Baltic Sea shore area, near the port Baltiysk (Russia), form the 8 to 9 of February 2003. The ship was fixed on the two anchors and one trawl door on the depth nearly 45 meters. The calibration procedure was carried out with a standard calibrated copper sphere, in accordance with the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02 Ref. D).

Date: 09.02.2003	Place: Baltiysk (Russia)	
Type of transducer	ES38 B, (38kHz)	ES120–7 / 120кГц
SV transducer Gain (ВАРУ 20 log R)	26.65 дБ	24.16 дБ
TS transducer Gain (ВАРУ 40 log R)	27.37 дБ	24.44 дБ

2.5 Acoustic data collection

The acoustic investigations were performed during only daytime. The main pelagic species of interest were only sprat. In a spring season, the sprat stocks usually located separately from herring and very usable for stock assessment. The acoustic equipment was an echosounder EK500 with working frequencies 38 and 120 kHz. Both transducers is stationary installed in the bottom of the ship, in special blister, for air bubbles noise level decreasing. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02). The post-processing of the stored echosignals, was done with the Sonar Data Echoview ver. 2.25, Surfer and Excel software. The mean volume back scattering values Sv, were integrated over 1 NM intervals, from 10 m below the surface to the bottom. Contributions from air bubbles, trawl and oceanologic sampling manoeuvres, bottom structures and scattering layers were removed from the echogram by using the Sonar Data Echoview software. The maps of Sa-distribution, was made on base filtered Sv-data with Surfer 8 software.

2.6 Biological data – fishing stations

All trawling was done with the pelagic gear “RT/TM 70/3002” in the midwater as well as near the bottom. The mesh size in the codend was 6.5 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the trawl opening were defined with a netzonde CI-110, or trawl sonar monitoring system FS-925. The trawling depth was chosen by the echogram, in accordance to the characteristic of echorecords from the fish. Normally, the trawl had vertical opening of about 34 m. The trawling time lasted usually 30 minutes, but in dense concentrations the trawling time duration was reduced. From each haul sub-samples were taken to determine length and weight composition of fish. Samples of herring and sprat were analyzed for further investigations on the board of vessel (i.e., sex, maturity, age). After each trawl haul, oceanologic samples was executed, for the hydrographic condition investigations.

2.7 Data analysis

The pelagic target species sprat and herring are usually distributed in mixed layers in combination with other species, so that it is impossible to allocate the integrator readings to a single species. In the May time, sprat has clear distribution with small percent of herring, around 2–7 percents. For each rectangle the species composition and length distribution were determined as the mean- weighted of all trawl results in this rectangle. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relationships:

Clupeoids	TS = 20 log L (cm) - 71.2	(ICES 1983/H:12)
Gadoids	TS = 20 log L (cm) - 67.5	(Foote *et al.* 1986)

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (Sa) and the rectangle area, divided by the corresponding mean cross section (σ). The total number were separated into herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 34 trawl hauls were carried out (16 hauls in Subdivision 26 and 18 hauls in Subdivision 28). 6060 herring and 6660 sprat were measured and 3040 herring and 3300 sprat were aged.

The results of the catch composition by Subdivision are presented in Table 1. As in former years the catch composition was dominated by sprat and to a lower extend by herring.

The length distributions of herring and sprat of the are presented by Subdivision in Figures 2 and 3.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean scattering cross section σ, the estimated total number of fish, the percentages of herring and sprat per Subdivision/rectangle are shown in Table 2.

The map of surface density distribution in SA - values are shown in Figure 4

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 2. The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Table 3 and Table 6. The corresponding mean weights by age group and Subdivision/rectangle are shown in Table 4 and Table 7. The estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarised in Table 5 and Table 8.

The herring stock was estimated to be 793.7 x 10^6 fish or about 29.4 x 10^3 tonnes in Subdivisions 26+28. The abundance estimates were dominated by 1–4ages herring (Figure 2 and Table 3).

The estimated sprat stock was 32.7 x 10^9 fish or 268.8 x 10^3 tonnes in Subdivisions 26+28.

The abundance estimates of sprat were dominated by young fish (Figure 3 and Table 6). The contribution of the age-groups 1 was near 40% in numbers.

4 DISCUSSION

The total abundance of May sprat survey has shown more less value then in October 2002. In our opinion it is explains not a full covering of an area of survey in compare with traditional autumn surveys. In the future it is necessary to carry out all surveys on the identical areas, for maintenance of the comparable data for stock assessment group.

5 REFERENCES

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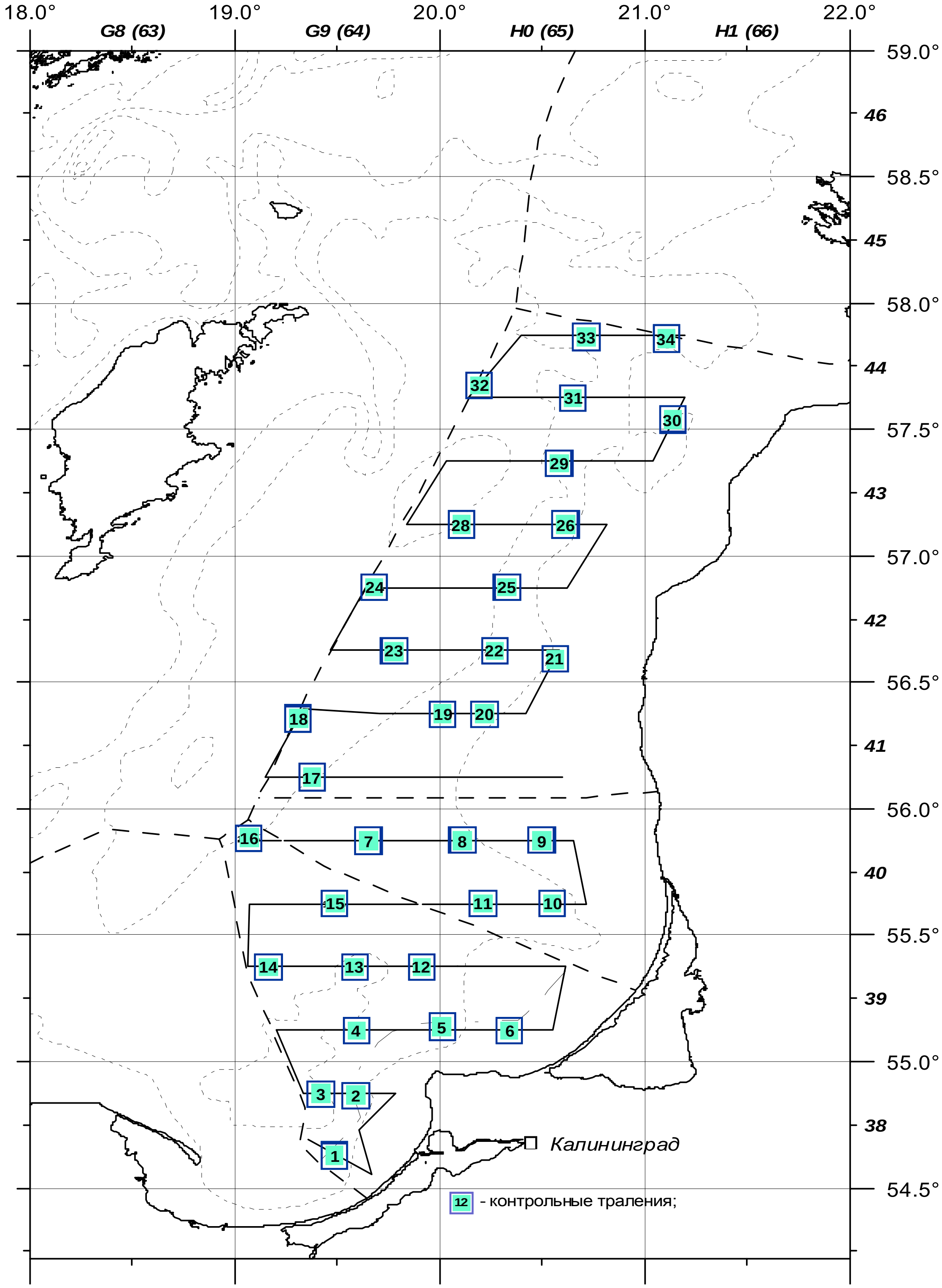


Figure 1. The scheme of cruise track and trawl stations for joint Russian-Latvian survey (RV “Atlantniro”, 25.05–09.06.2003)

Table 1. Catch composition (kg/1hour) per haul by ICES subdivision (RV "Atlantniro", May 2003).

ICES subdivision 26							
Haul No	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Date	**20030525**	**20030525**	**20030526**	**20030526**	**20030527**	**20030527**	**20030530**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**38G9**	**38G9**	**38G9**	**39G9**	**39H0**	**39H0**	**40G9**
CLUPEA HARENGUS	1.1	81.0	1.5	20.8	125.4	8.4	0.5
SPRATTUS SPRATTUS	448.0	1477.0	900.0	836.0	330.6	8.8	755.5
GADUS MORHUA	2.9	0.5		21.6			
ANOTHER			0.6			0.1	
Total	452.0	1558.5	902.1	878.4	456.0	17.3	756.0

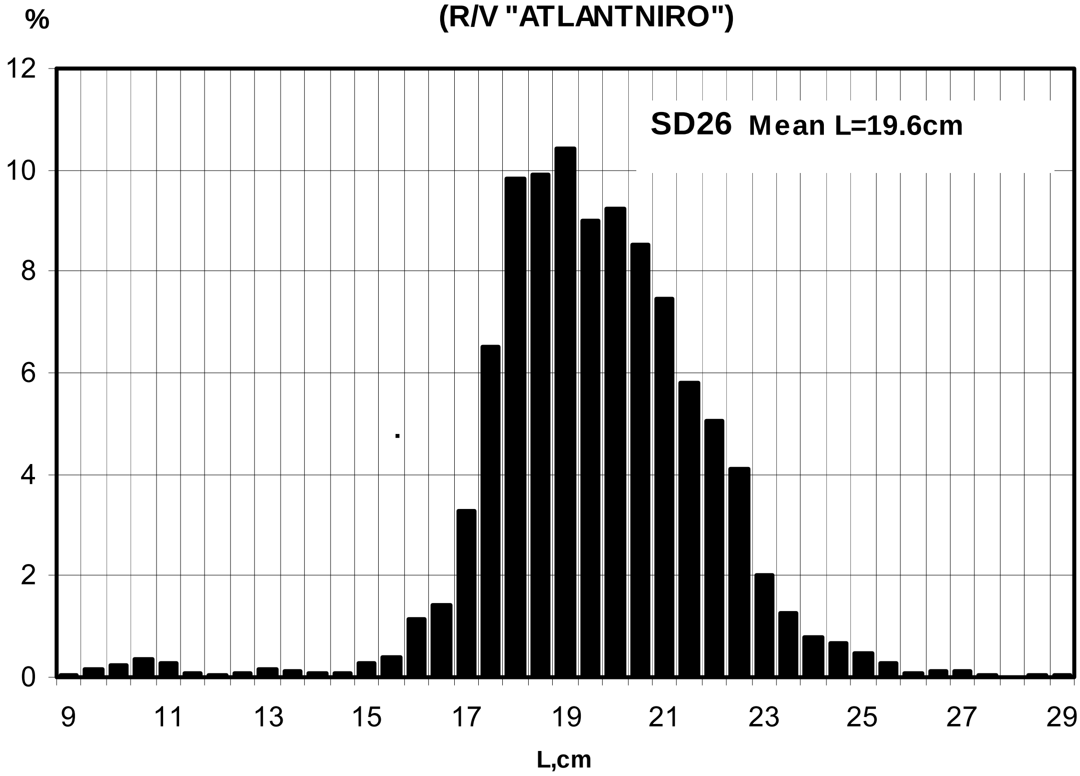
ICES subdivision 26							
Haul No	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Date	**20030530**	**20030530**	**20030531**	**20030531**	**20030601**	**20030601**	**20030602**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**40H0**	**40H0**	**40H0**	**40H0**	**39G9**	**39G9**	**39G9**
CLUPEA HARENGUS	30.0	142.8	35.0	246.0	12.0	11.0	0.9
SPRATTUS SPRATTUS	690.0	95.2	768.0	902.0	684.0	380.0	1600.0
GADUS MORHUA				43.4	22.1		
ANOTHER		0.8	1.0				
Total	720.0	238.8	804.0	1191.4	718.1	391.0	1601.0

ICES subdivision 26						
Haul No	**15**	**16**	**17**	**18**	**19**	**20**
Date	**20030602**	**20030602**	**20030603**	**20030604**	**20030604**	**20030604**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**40G9**	**40G9**	**41G9**	**41G9**	**41G9**	**41H0**
CLUPEA HARENGUS	76.6	2.3	146.0	22.0	90.0	11.0
SPRATTUS SPRATTUS	1663.4	1100.0	852.0	542.0	522.0	1612.0
GADUS MORHUA	15.7			16.0		
ANOTHER	0.9	0.4				
Total	1756.6	1102.7	998.0	580.0	612.0	1623.0

ICES subdivision 28							
Haul No	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Date	**20030605**	**20030605**	**20030605**	**20030606**	**20030606**	**20030606**	**20030606**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**42H0**	**42H0**	**42G9**	**42G9**	**42H0**	**43H0**	**43G9**
CLUPEA HARENGUS	85.1	28.3	17.9	62.0	16.0	17.6	16.8
SPRATTUS SPRATTUS	1350.0	936.0	1960.0	676.0	284.0	372.0	16.7
GADUS MORHUA		17.0	29.4	14.0		5.2	
ANOTHER	0.9	0.7	0.7	0.2	0.5	1.2	1.0
Total	1436.0	982.0	2008.0	752.2	300.5	396.0	34.5

ICES subdivision 28							
Haul No	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Date	**20030607**	**20030607**	**20030608**	**20030608**	**20030608**	**20030609**	**20030609**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**43H0**	**43H0**	**44H1**	**44H0**	**44H0**	**44H0**	**44H1**
CLUPEA HARENGUS	44.0	336.0	260.0	18.60	45.4	61.8	90.0
SPRATTUS SPRATTUS	826.0	60.0	580.0	110.0	86.0	175.0	444.0
GADUS MORHUA	4.6	5.8	4.6	9.0	6.0	0.9	1.0
ANOTHER	1.4	1.0	0.8	0.4	0.6	0.3	0.4
Total	876.0	402.8	845.4	138.0	138.0	238.0	535.5

Figure2 Length composition of herring (%) in May 2003 (R/V "ATLANTNIRO")



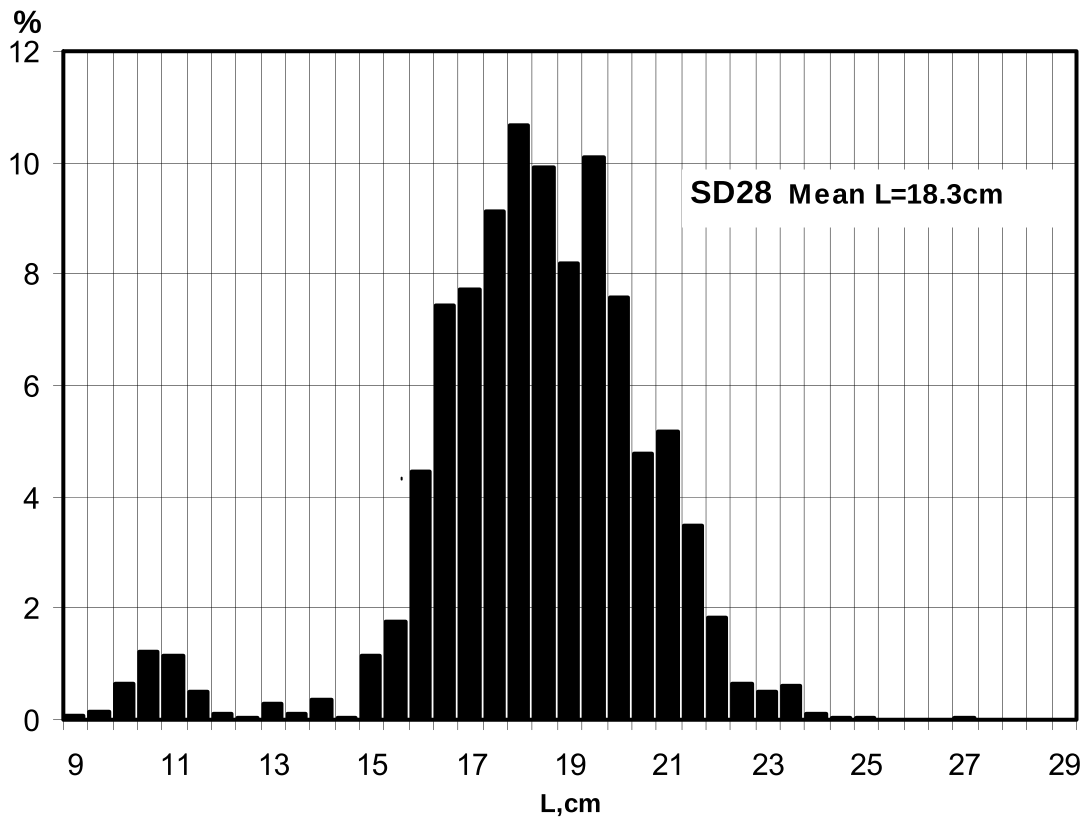
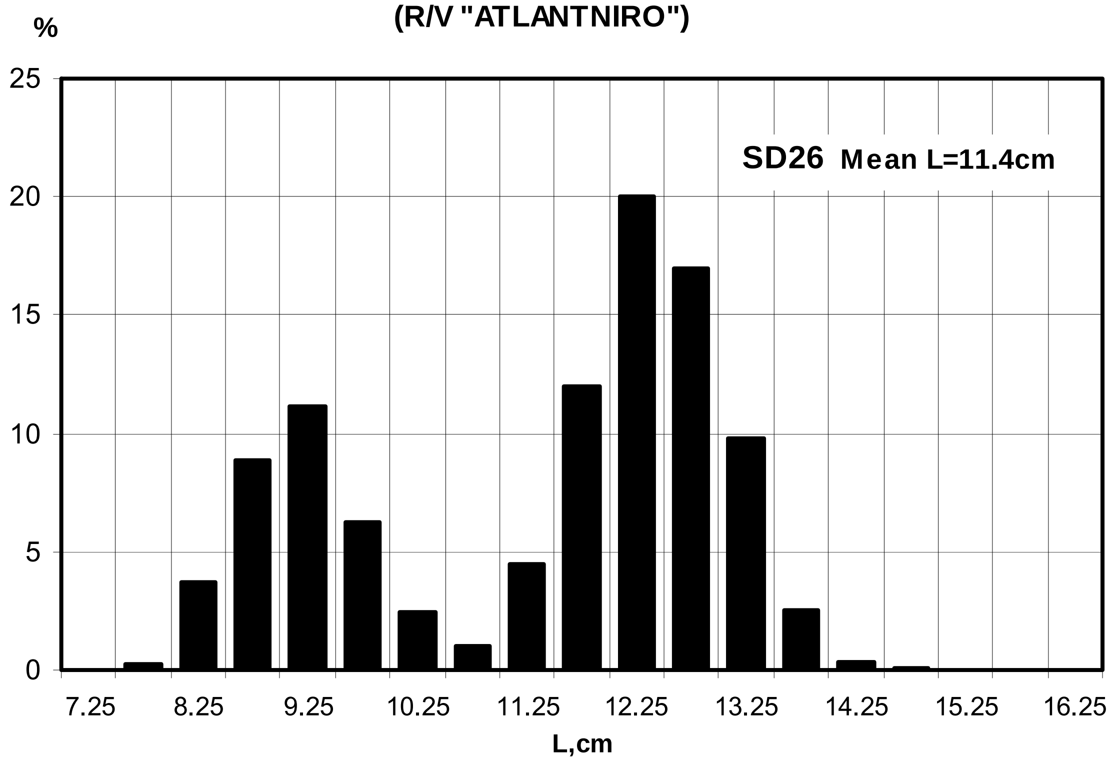


Figure3 Length composition of sprat (%) in May 2003
(R/V "ATLANTNIRO")



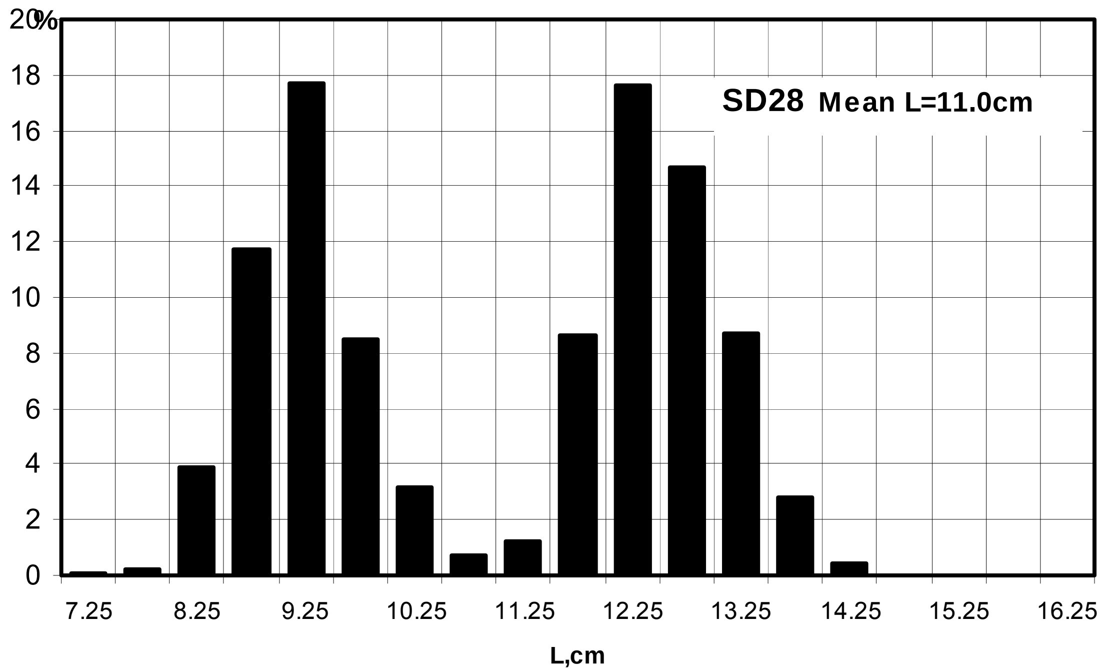


Table 2. RV "Atlantniro" survey statistics, May 2003.

CCODE	SD	RECT	AREA	SA	SIGMA	NTOT	HH	HS
ATL03	26	41H0	953.3	97.4	1.01	915	0.6	99.4
ATL03	26	41G9	1000.0	506.9	1.45	3490	2.7	97.3
ATL03	26	40H0	1012.1	320.5	1.04	3126	1.9	98.1
ATL03	26	40G9	1013.0	296.2	1.45	2065	0.4	99.6
ATL03	26	39H0	881.6	95.6	1.64	512	9.0	91.0
ATL03	26	39G9	1026.0	715.7	1.21	6081	0.3	99.7
ATL03	26	38G9	918.2	481.0	1.42	3113	0.5	99.5
ATL03	28	44H1	824.6	473	0.95	4100	4.5	95.5
ATL03	28	44H0	960.5	255	1.59	1533	9.7	90.3
ATL03	28	43H0	973.7	363	1.40	2531	6.5	93.5
ATL03	28	42H0	968.5	230	1.15	1944	0.9	99.1
ATL03	28	42G9	986.9	583	1.41	4083	0.7	99.3

Table 3. RV “Atlantniro” estimated number (millions) of herring, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	5.4	0.0	1.8	0.2	0.4	0.3	0.8	0.6	0.2	1.1
26	41G9	92.8	0.0	1.7	6.5	10.3	17.1	11.5	15.9	6.3	23.4
	Sum	98.2	0.0	3.5	6.7	10.7	17.4	12.4	16.6	6.4	24.5
28	44H1	185.6	0.0	7.6	11.4	48.9	18.8	17.6	24.6	9.1	47.6
28	44H0	148.5	0.0	3.1	11.8	18.5	20.7	23.8	27.8	12.2	30.7
28	43H0	164.9	0.0	4.6	7.5	18.9	20.6	19.7	22.9	18.5	52.3
28	42H0	17.9	0.0	3.1	0.8	1.9	2.1	3.0	2.0	1.5	3.5
28	42G9	29.6	0.0	1.3	2.9	4.0	3.2	3.6	2.2	2.8	9.5
	Sum	546.5	0.0	19.7	34.5	92.1	65.3	67.7	79.5	44.1	143.5
Total		644.6	0.0	23.2	41.1	102.8	82.8	80.1	96.1	50.5	168.0

Table 4. RV “Atlantniro”" estimated mean weights (g) of herring, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	4165	37.8		7.4	39.0	49.3	48.5	51.9	50.2	53.0	60.3
26	4164	44.9		6.7	30.7	36.6	37.5	41.9	45.6	50.1	60.2
28	4466	34.7		7.0	21.5	26.0	33.1	35.1	39.7	41.8	47.9
28	4465	33.2		11.0	20.4	24.4	30.0	33.8	36.4	41.3	41.1
28	4365	38.1		8.7	26.1	30.7	35.6	36.6	38.4	41.2	45.5
28	4265	36.6		8.5	26.8	31.5	34.8	43.3	44.7	42.7	54.8
28	4264	41.2		9.4	28.2	34.0	39.0	41.2	40.2	47.1	51.8

Table 5 RV “Atlantniro” estimated biomass (in tonnes) of herring, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	41H0	204.6	0.0	13.1	6.5	22.0	16.2	43.4	30.8	8.9	63.8
26	41G9	4162.6	0.0	11.4	199.6	375.6	641.2	483.5	726.6	313.8	1410.9
	Sum	4367.2	0.0	24.5	206.1	397.5	657.4	526.9	757.4	322.7	1474.7
28	44H1	6447.8	0.0	53.0	245.7	1272.3	621.7	616.5	978.0	380.4	2280.3
28	44H0	4926.4	0.0	34.6	239.4	451.0	619.7	805.9	1012.8	502.3	1260.7
28	43H0	6287.2	0.0	40.1	196.3	580.1	732.8	719.2	880.8	760.7	2377.1
28	42H0	654.7	0.0	26.4	22.2	58.5	72.3	131.9	87.9	63.6	191.8
28	42G9	1217.8	0.0	12.3	82.6	136.0	125.3	147.4	87.8	134.0	492.4
	Sum	19533.7	0.0	166.4	786.2	2497.8	2171.8	2420.9	3047.4	1841.0	6602.3
Total		23900.9	0.0	190.9	992.4	2895.3	2829.2	2947.7	3804.7	2163.6	8077.0

Table 6 RV “Atlantniro” estimated number (millions) of sprat, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	38G9	3097.0	0	362.1	1283.5	365.4	877.4	31.3	167.1		10.3
26	39G9	6063.0	0	2575.3	1454.9	312.6	1239.4	62.1	290.6	33.4	94.7
26	39H0	467.0	0	36.8	99.3	36.9	208.3		57.5		28.1
26	40G9	2057.0	0	176.6	682.4	303.5	591.0	40.0	204.3	4.4	54.7
26	40H0	3067.0	0	2230.5	372.4	83.9	240.2	33.5	79.2	6.7	20.7
26	41G9	3397.0	0	345.4	625.7	287.9	793.6	144.3	828.1	65.8	306.1
26	41HO	909.0	0	648.1	110.9	8.7	77.4	2.4	22.7	9.1	29.7
	Sum	19057.0	0	6374.9	4629.1	1399.1	4027.2	313.5	1649.4	119.4	544.4
28	44H1	3914.4	0	3535.3	135.7	15.8	92.6	1.5	41.2	20.3	71.9
28	44H0	1384.9	0	97.2	152.5	138.1	350.5	55.3	218.1	101.4	271.7
28	43H0	2366.5	0	776.7	221.3	123.0	588.1	0.5	265.9	74.6	316.4
28	42H0	1925.6	0	1041.8	231.1	82.6	241.7	21.4	169.9	43.0	94.1
28	42G9	4053.7	0	682.1	640.3	299.3	1071.4	24.8	718.8	194.3	422.9
	Sum	13645.1	0	6133.0	1380.9	658.9	2344.3	103.4	1413.9	433.5	1177.0
Total		32702.0	0	12507.9	6010.0	2058.0	6371.5	416.9	3063.4	552.9	1721.4

Table 7. RV “Atlantniro” estimated mean weights (g) of sprat, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	38G9	9.7		4.7	9.7	10.6	11.1	12.1	11.5		11.3
26	39G9	7.8		4.4	9.3	10.5	10.9	12.7	11.2	14.0	12.5
26	39H0	10.5		4.2	9.0	11.1	11.4		12.9		12.4
26	40G9	10.5		5.1	9.9	11.8	11.3	13.8	11.9	15.4	12.5
26	40H0	5.7		3.7	9.7	12.0	11.4	12.9	12.0	15.0	14.6
26	41G9	10.4		4.5	10.0	10.3	11.2	12.8	11.9	10.8	11.3
26	41HO	6.2		4.3	9.8	10.3	11.8	10.7	11.4	12.9	13.1
28	44H1	4.6		4.0	8.5	9.2	10.8	8.6	10.2	12.1	10.8
28	44H0	10.1		4.4	9.2	10.8	10.6	11.3	10.7	10.5	10.8
28	43H0	8.6		4.4	9.3	10.4	10.7	10.0	11.2	11.0	10.8
28	42H0	7.2		4.3	9.4	10.9	11.0	12.5	11.1	10.5	11.9
28	42G9	9.9		4.1	9.2	11.5	11.6	9.4	11.3	10.1	11.9

Table 8 RV “Atlantniro” estimated biomass (in tonnes) of sprat, May 2003.

SD	Rect.	Total	0	1	2	3	4	5	6	7	8+
26	38G9	30102.8	0	1690.8	12414.9	3880.9	9716.7	377.9	1919.1	0.0	116.2
26	39G9	47473.3	0	11361.5	13589.6	3286.2	13535.2	786.6	3262.8	467.4	1186.9
26	39H0	4903.1	0	154.9	892.0	410.8	2365.0	0.0	744.2	0.0	348.3
26	40G9	21660.2	0	896.2	6768.2	3575.9	6676.5	552.7	2439.4	68.2	683.5
26	40H0	17512.6	0	8357.8	3627.6	1005.8	2736.0	432.7	953.6	99.7	302.9
26	41G9	35464.7	0	1570.5	6234.8	2976.1	8853.3	1842.8	9822.1	707.5	3464.4
26	41HO	5644.9	0	2768.2	1082.3	90.1	912.6	25.6	258.7	117.2	388.7
	Sum	162761.6		26799.8	44609.5	15225.8	44795.3	4018.4	19399.9	1459.9	6490.9
28	4466	17947.5	0	14181.7	1159.3	145.9	1003.3	13.0	419.5	245.3	779.5
28	4465	13969.9	0	431.6	1397.2	1485.3	3698.7	626.4	2330.0	1065.8	2934.8
28	4365	20283.1	0	3444.0	2055.7	1284.4	6271.1	4.6	2988.5	819.8	3415.0
28	4265	13953.9	0	4500.9	2166.6	897.5	2666.6	266.1	1883.6	451.5	1121.1
28	4264	39932.0	0	2820.4	5888.6	3445.0	12448.8	232.8	8089.6	1957.9	5049.0
	Sum	106086.5	0	25378.6	12667.5	7258.2	26088.5	1143.0	15711.1	4540.4	13299.3
Total		268848.1	0	52178.4	57277.0	22483.9	70883.8	5161.4	35111.0	6000.4	19790.2

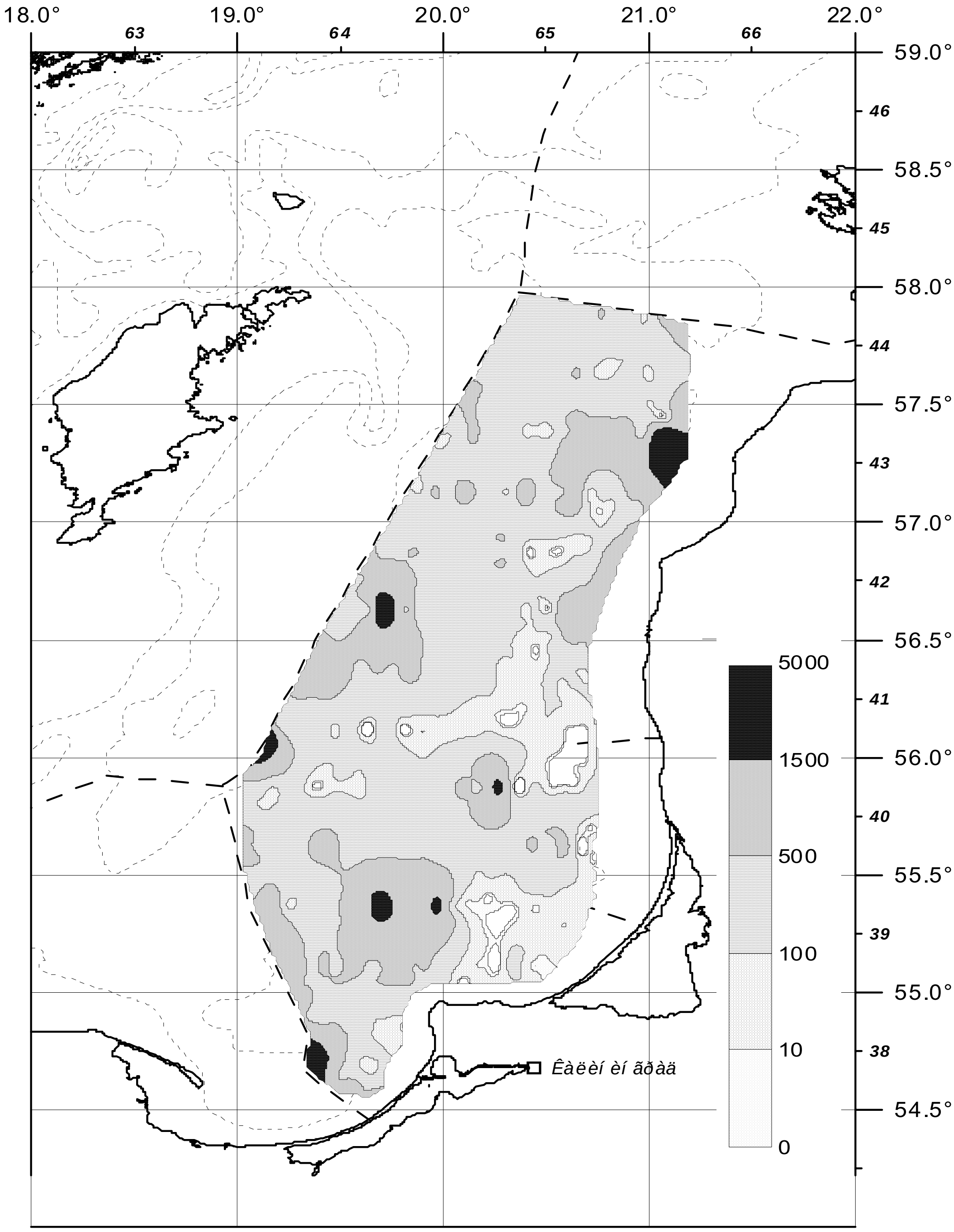


Figure 3 The map of area backscattering values distributions SA, in the May-June acoustic survey. The Baltic Sea. (RV "ATLANTNIRO", 25.05–9.06 2003)

Survey Report for RV “Walther Herwig III”

07.05.-20.05.2003
Federal Research Centre for Fisheries, Germany

U. Böttcher[1], E. Götze[2]
[1]Inst. for Baltic Sea Fisheries Rostock, [2]Inst. for Fishery Technology and Fishery Economy Hamburg

1 INTRODUCTION

The main objective of the survey was to assess the sprat stock in the south-western part of the Baltic Sea. Related to the project “Trophic interactions between zooplankton and fish influenced by physical processes“ (GLOBEC Germany), the following objectives have been covered during the cruise:

- Investigation of the horizontal distribution and abundance of sprat and herring
- Investigation of vertical distribution patterns of sprat related to the small-scale distribution of oceanographic parameters
- Sampling of sprat, herring and cod for biological investigations (i.e., diet, maturity, fecundity, age)
- Investigation of the actual hydrographic situation in the total survey area
- In situ experiments on egg production rates of copepods
- In situ experiments on development of eggs of sprat

2 METHODS

2.1 Personnel

Dr Uwe Böttcher (Chief Scientist)	Institute for Baltic Sea Fisheries Rostock
Eberhard Götze	Institute for Fishery Technology
Michael Sasse	Institute for Fishery Technology
Rosi Hinrichs	Baltic Sea Research Institute Warnemünde
Dagmar Stephan	Institute for Baltic Sea Fisheries Rostock
Christel Walther	Institute for Baltic Sea Fisheries Rostock
Vroni Schildhauer	Institute for Baltic Sea Fisheries Rostock
Daniel Stepputtis	Institute of Marine Science Kiel
Christoph Petereit	Institute of Marine Science Kiel
Mario Koth	Institute for Baltic Sea Fisheries Rostock
Kristina Bethke	Institute for Baltic Sea Fisheries Rostock
Juliane Jessel	Institute for Baltic Sea Fisheries Rostock

2.2 Narrative

The 251st cruise of RV “Walther Herwig” took place from 7th until 20th May 2003 and represents the fourth May-Survey since 1999. This hydroacoustic survey included the entire Subdivision 25, the central and eastern part of Subdivision 24 and the western part of Subdivision 26 (Figure 1). The main pelagic species of interest were sprat and herring. The hydroacoustic investigations started at 9th May in the Gdansk Bay on the eastern transect. The survey ended in the Arkona Basin on 19 May.

2.3 Survey design

For all Subdivisions the statistical rectangles were used as strata (ICES 2003). The area was limited by the 10 m depth line. In the area east of Bornholm hydroacoustic measurements were conducted on north-south transects with 17.5 nm spacing. In general each ICES rectangle was surveyed with two transects. Due to special topographical characteristics of the Arkona Basin and short time of the cruise the area was covered by modified transects. The cruise track (Figure 1) totally reached a distance of 1.119 nautical miles.

2.4 Calibration

The hull mounted 38 kHz transducer was calibrated on the first day of the cruise at calm sea on a protected site at a depth of about 20 m east of Cape Arkona. The ship was anchored to bow and stern to reduce ship movement. The calibration procedure was carried out as described in the ‘Manual for the Baltic International Acoustic Surveys (BIAS)’ (ICES 2003).

2.5 Acoustic data collection

The acoustic investigations took place from 4:00 to 18:00 UTC (6:00 and 20:00 local time). The acoustic equipment was an echosounder EK500 on 38 kHz. The specific settings of the hydroacoustic equipment were used as described in the ‘Manual for the Baltic International Acoustic Surveys (BIAS)’ (ICES 2003). The echo telegrams were continuously recorded with the Bergen Integrator BI500. The mean volume back scattering values (s_V) were integrated over 1 nm intervals from 9 m below the surface to the bottom. Contributions from air bubbles, bottom structures and scattering layers were removed from the echogram by using the BI500.

2.6 Biological data – fishing stations

Trawling was done with the pelagic gear “PSN205” in the midwater as well as near the bottom. The stretched mesh size in the codend was 20 mm. The intention was to make at least two hauls per ICES statistical rectangle. The trawling depth and the net opening were controlled by a net sonde. Normally a net opening of about 14 m was achieved. The trawl depth was chosen in accordance to ‘characteristic indications’ of the echogram. The trawling time was usually 30 minutes. Samples were taken from each haul in order to determine length and weight of fish. Sub-samples of herring and sprat were investigated on board the vessel concerning sex, maturity and age. The position of trawl hauls are shown in Figure 1.

2.7 Data analysis

The pelagic target species sprat and herring are distributed in mixed layers in combination with other species that the integrator readings cannot be allocated to a single species. The species composition was based on trawl catch results accordingly. For each rectangle the species composition and length distribution were determined as the unweighted mean of all trawl results in this rectangle. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relations:

Clupeoids	TS = 20 log L (cm) - 71.2	(ICES 1983)
Gadoids	TS = 20 log L (cm) - 67.5	(Foote *et al.* 1986)

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (s_A) and the rectangle area (nm²), divided by the corresponding mean cross section. The total number was separated into herring and sprat in relation to the mean catch composition.

2.8 Hydrographic data

Vertical profiles of hydrographical parameters were taken with a CTD-probe after every fishing station or at least every 15 miles on the hydroacoustic transects. An additional sensor on oxygen supplemented the probe. The profiles covered the entire water column up to about 2 m above the sea bottom. Additional water samples from different depths were taken once per day to measure the oxygen contents by Winkler titration. The oxygen profiles have been corrected on the basis of these data.

The hydrographical investigations were influenced by technical problems. One probe was damaged by a malfunction of electrical systems of the ship. A second probe (Seabird) proved to be unsuitable for the brackish water conditions in the Baltic Sea. Due to these problems hydrological measurements were not possible in parts of the Subdivision 25 and the Subdivision 24. The positions of valid hydographic stations are shown in Figure 2.

3 RESULTS

3.1 Biological data

In total 35 valid hauls were carried out with the pelagic trawl “PSN205”. 649 herring and 401 sprat were collected for further investigations in the lab (i.e., sex, maturity, age). The results of the catch composition in the pelagic trawls by Subdivision are presented in Table 2.

The results of the catch composition in the pelagic trawls by Subdivision are presented in Table 2. In general sprat dominated the catch composition. Sprat comprised about 86 % of the total caught biomass on the cruise. Hauls with a fraction of herring occurred at the middle bank, the northern and southern fringe ranges of the Bornholm Basin as well in the Arkona Sea. Only small numbers of herring were caught in Subdivisions 26. In general the amount of herring increased in the catch from Subdivision 26 in the east to Subdivision 24 in the west of the investigated area. The biomass of all other species including cod was negligible.

The length distributions of sprat and herring by Subdivision are presented in Figure 3. For both herring and sprat, the maximum of the length distributions are characterised by a shift to minor size from the western (Subdivision 25) to the eastern part (Subdivisions 26) of the survey area.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean s_A, the mean scattering cross section σ, the estimated total number of fish and the percentage of herring and sprat per rectangle are shown in Table 1.

Continuously distributed values were found in the deeper part of the western Gotland Sea (Figure 7). In contrast, on long distances continuous low s_A were detected in the Bornholm Basin. Only in the north-east of this region the s_A values were in the same size as in the western Gotland Sea. In the Hanö Bay and in the Arkona Basin the s_A values are more patchy distributed on the tracks. The shallow areas between the basins (Middle Bank, Rönne Bank) were characterized by long distances with zero s_A values.

16.7% of all intervals were characterised by zero s_A values and also 16.7 % reached more than 1000. The mean s_A value was 263 m²/nm². The main scatter objects were small shoals with a diameter of few meters. In the western Gotland Basin dense layers were found at about 80 to 95 m depth. In the Bornholm Basin the scatter objects predominantly stayed near the bottom and follow the ground profile up to a depth of about 80 m (Figure 6).

In the Arkona Sea and in the western Gotland Sea the s_A values ranged in the same order compared to the results in previous years (Figure 7 and Table 1). Remarkably low values were however found in the Bornholm Basin (Subdivision 25). The s_A -value reached in this area only a third of last year’s mean

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 1. The estimated number of herring and sprat by age group and Subdivision/rectangle are given in Table 3 and 6. The corresponding mean weights are shown in Table 4 and 7. The estimates of herring and sprat biomass are summarized in Table 5 and 8.

The sprat stock of the area was estimated to be 27.4 x 10^9 fish or about 290,5 x10^3 tons. The estimated number of herring was 1.0 x 10^9 fish or 46,2 x 10^3 tonnes.

3.4 Hydrographic data

The surface temperature varied between 4.0°C in the east and 7.8°C in the west of the investigated area. Only in the Bornholm Sea a weak thermocline was found at about 10 to 20 m caused by the spring warming. Below the surface layer up to the permanent halocline temperatures of about 3 – 4°C were found in the Bornholm Basin, and 2 – 4°C in the western Gotland Sea. The temperature minimum was found mostly just above the permanent halocline.

Cold water with about 3°C was prevailing below the thermocline in the Bornholm Basin. In the western Gotland Sea the temperature increased again below the permanent halocline up to 5–6°C.

The depth of the permanent halocline ranged between 40 – 50 m in the Bornholm Basin and 65–75 m in the western Gotland See. The maximum salinity was determined to be:

20.5 psu at 3.5 °C (water depth 90 m) in the Bornholm Basin,
12.9 psu at 4.8 °C (water depth 114 m) in the western Gotland Sea.

The oxygen content in the surface layer ranged from 8.7 ml/l to 9.7 ml/l. In the Bornholm Basin the oxygen content decreased to about 4 ml/l in the cold layer near the bottom. In the western Gotland Sea the oxygen content was lower then 2 ml/l in the warm water layer deeper than 75 m. The hydrographical situation was changed in relation to the May-survey in 2002.

The inflow events in January 2003 caused a decrease of the temperature and an increase of the salinity and oxygen content in the deep-water body. Due to this fact the halocline was lifted up for about 10 meter in the Bornholm Sea.

4 DISCUSSION

Acoustic surveys were performed in the southern Baltic in May/June 1999, 2001, 2002and2003. The estimated mean s_A for these cruises per Subdivision are listed below:

Year	**Mean s_A per Subdivision**		
	24	**25**	**26**
1999	285.6	471.5	546.1
2001	249.1	406.5	672.6
2002	237.5	672.9	483.2
2003	208.1	183.8	591.9
average	245.0	433.7	573.4

The mean s_A ranged in the same order in the Arkona Basin (Subdivision 24) and in the western Gotland Sea (Subdivision 26) during the last years. Whereas the s_A reached about 50 percent in the Bornholm Sea (Subdivision 25) in 2003 compared to the results in the years before.

High sprat concentrations were found in the investigated part of Subdivision 26, in the Slupsk Furrow and the north-east part of the Bornholm Basin (Subdivision 25) in 2003. The remaining part of Subdivision 25 sprat was characterised by lower numbers and biomass estimates.

In the western part of the Gotland Sea sprat was predominantly distributed in the warmer water layer below the halocline. The temperature was between 4 and 6 °C. This warm layer is missing below the halocline in the Bornholm Basin. Sprat was found in this area in a thin layer near the bottom, characterised at a temperature of about 3 - 4 °C.

A strong inflow of salty oxygen rich and cold water reached the Bornholm Basin in January 2003. This inflow caused a considerable decrease of temperature in the deep-water parts of the Bornholm Basin. Sprat usually avoids cold water layers with a temperature below 4 °C and was possibly evaded this inflow water to eastern parts of the total stock distribution area. Therefore, the low number and biomass estimates of sprat in 2003 in the Bornholm Basin could be lead back of the inflow occurred in January 2003.

The age structure of sprat in 2003 shows regional differences (Figure 4). Subdivision 24 and the south-west part of the Gotland Sea was characterised by a high fraction of young sprat (age groups 1–2: 75 % of the total number), whereas in Subdivision 25 and in the western part of Subdivision 26 the older age groups were more dominant (age group 3+: 65 % of the total number).

The results on herring do not represent the total stock size. During the present survey time most of the herring is still distributed close to the spawning area in the shallow coastal waters.

5 REFERENCES

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ICES. 1983. Report of the Planning Group on ICES co-ordinated herring and sprat acoustic surveys. ICES CM 1983/H:12.

ICES. 2003. Report of the Baltic International Fish Survey Working Group. ICES CM 2003/G:05 Ref.: D.,H.:Annex3

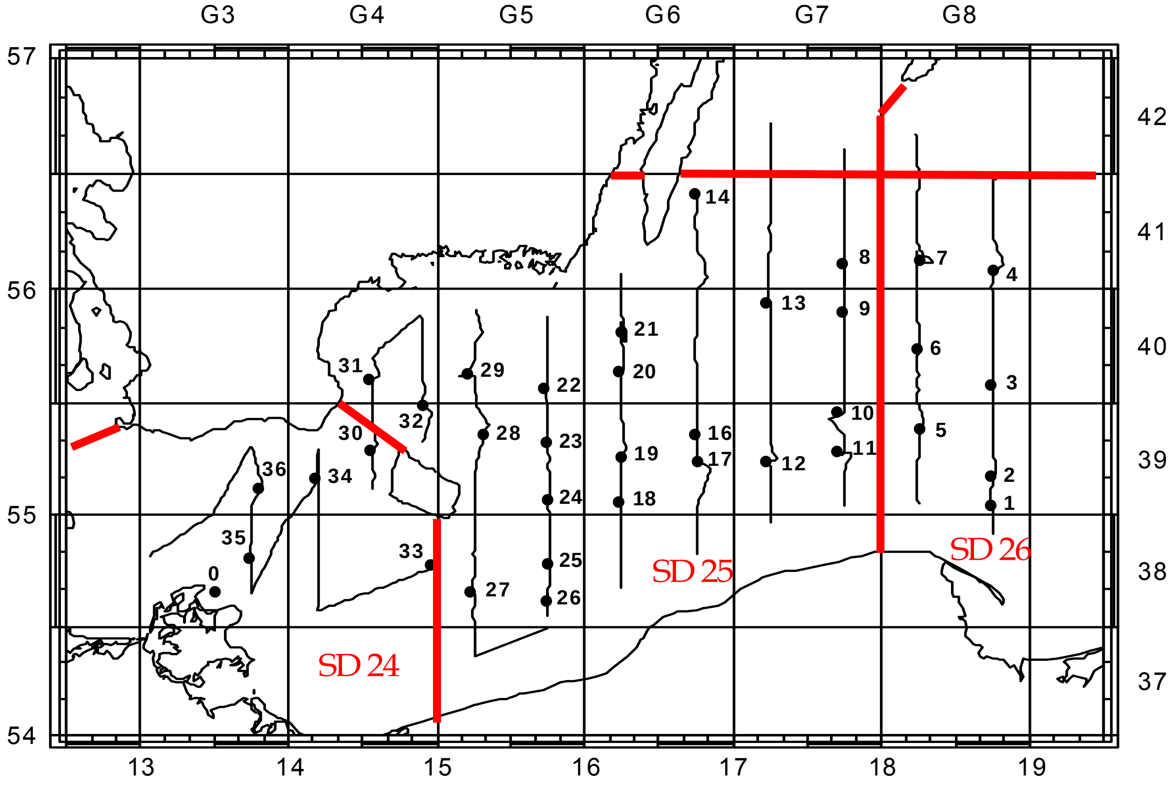

Figure 1. Hydroacoustic tracks and trawl positions, Cruise No. 251 of RV "Walter Herwig III" in May 2003.

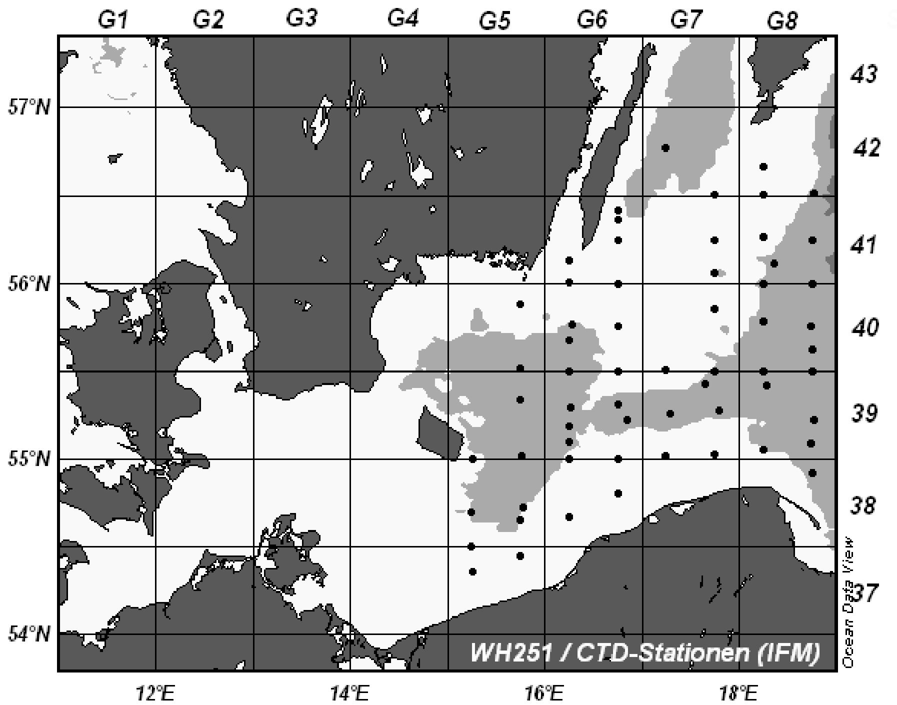

Figure 2. CTD-stations, Cruise No. 251 of RV "W. Herwig III" in May 2003.

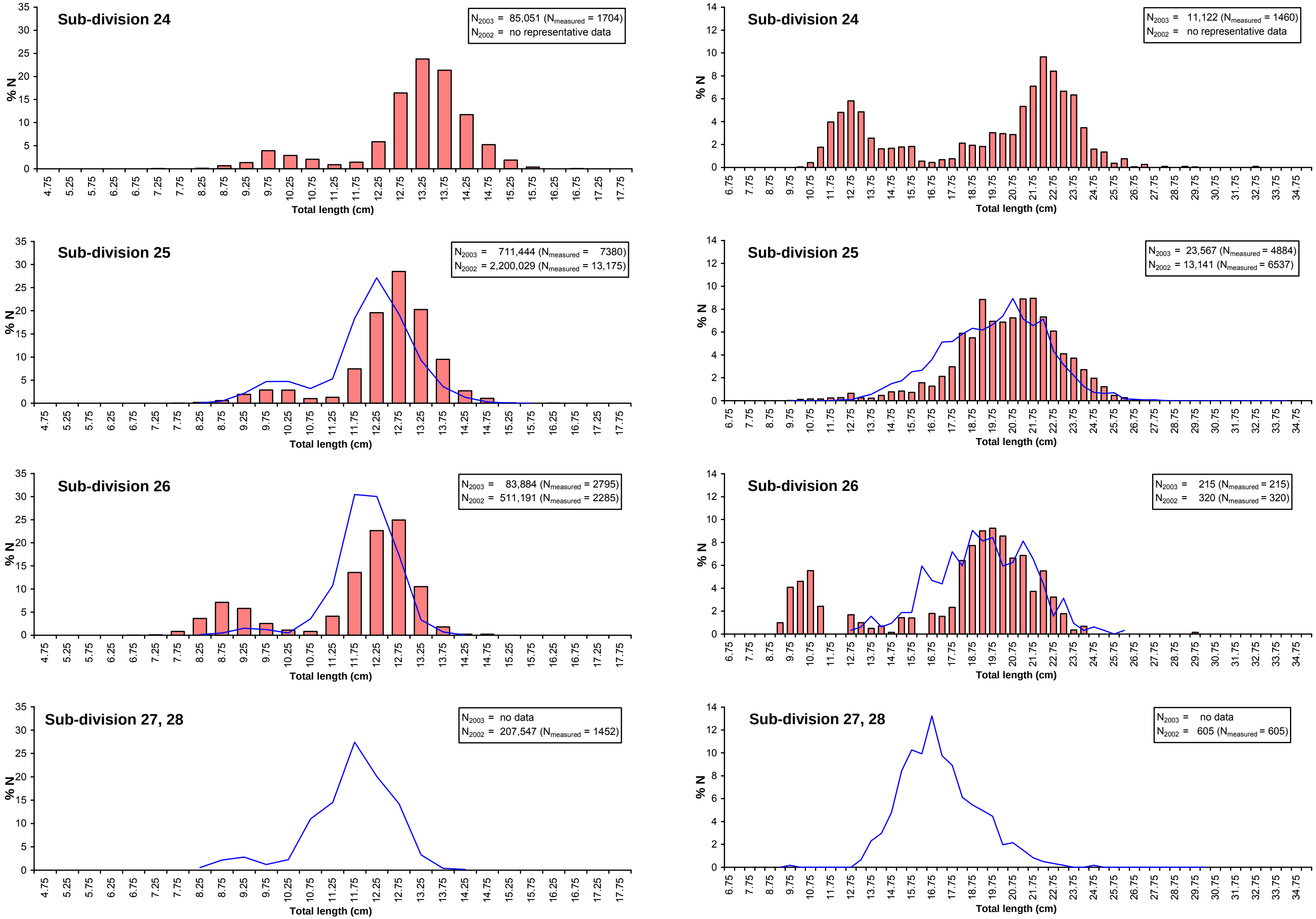

Figure 3. Length distribution of herring (right) and sprat (left) in Subdivisions 24, 25, 26, 27/28 in May 2002 (lines) and May 2003 (bars).

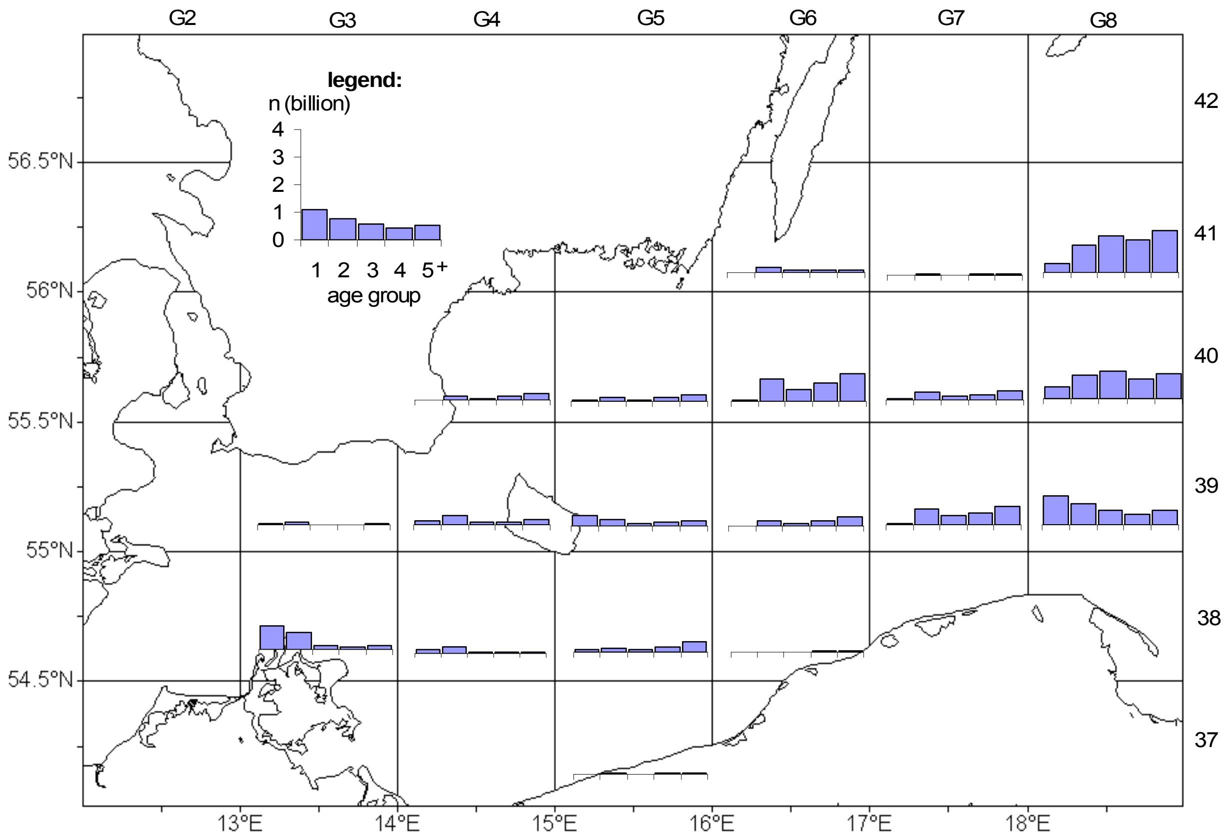

Figure 4. Sprat number per age group (billion), Cruise No. 251 of RV "W. Herwig III" in May 2003.

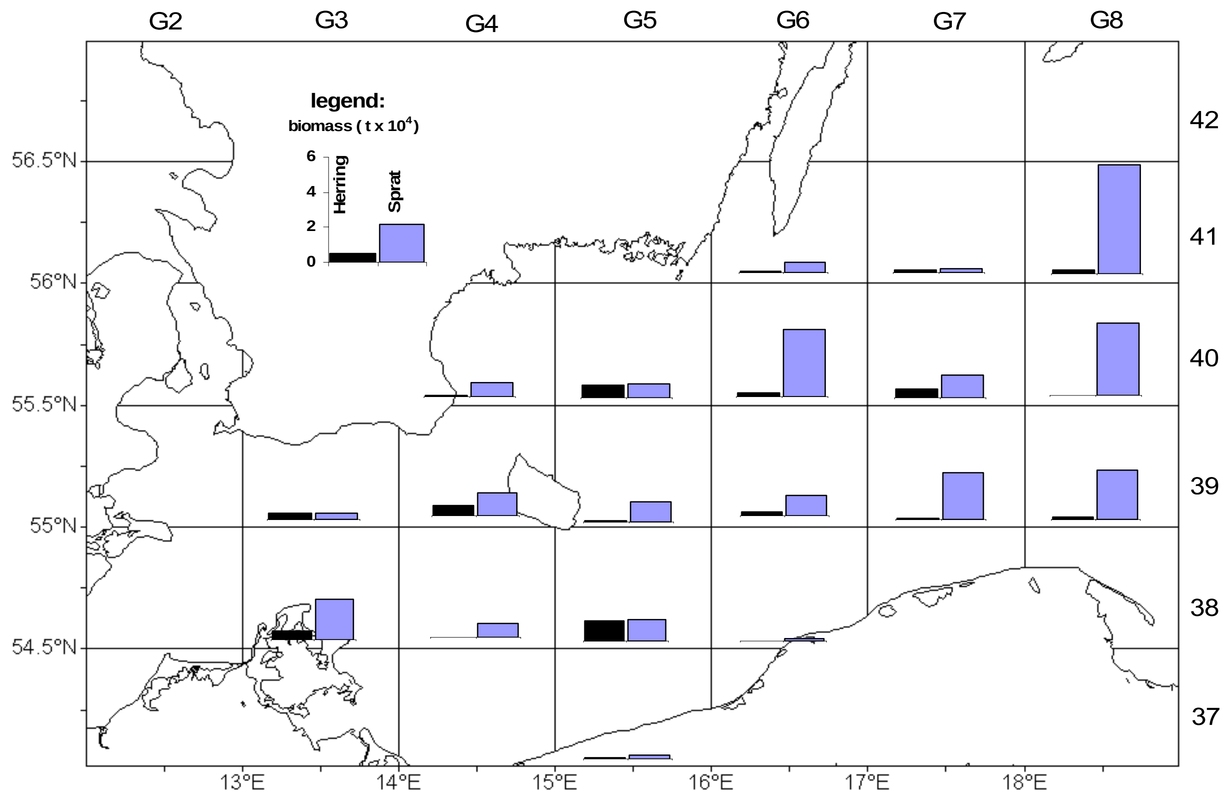

Figure 5. Herring and sprat biomass ('0000 t) per rectangle (Cruise No. 251 of RV "W. Herwig III" in May 2003.

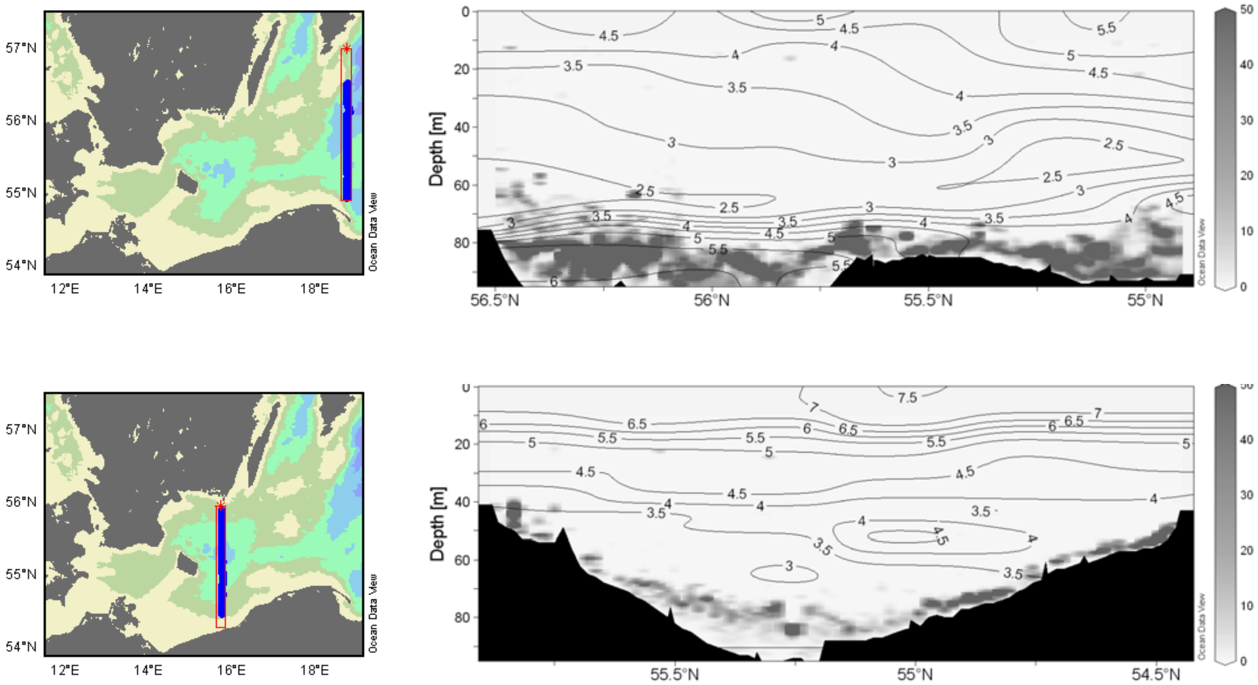

Figure 6. Vertical echo distribution in relation to the temperature on a track in the western Gotland Sea (top) and in the Bornholm Basin (below), Cruise No. 251 of RV "W. Herwig III" in May 2003.

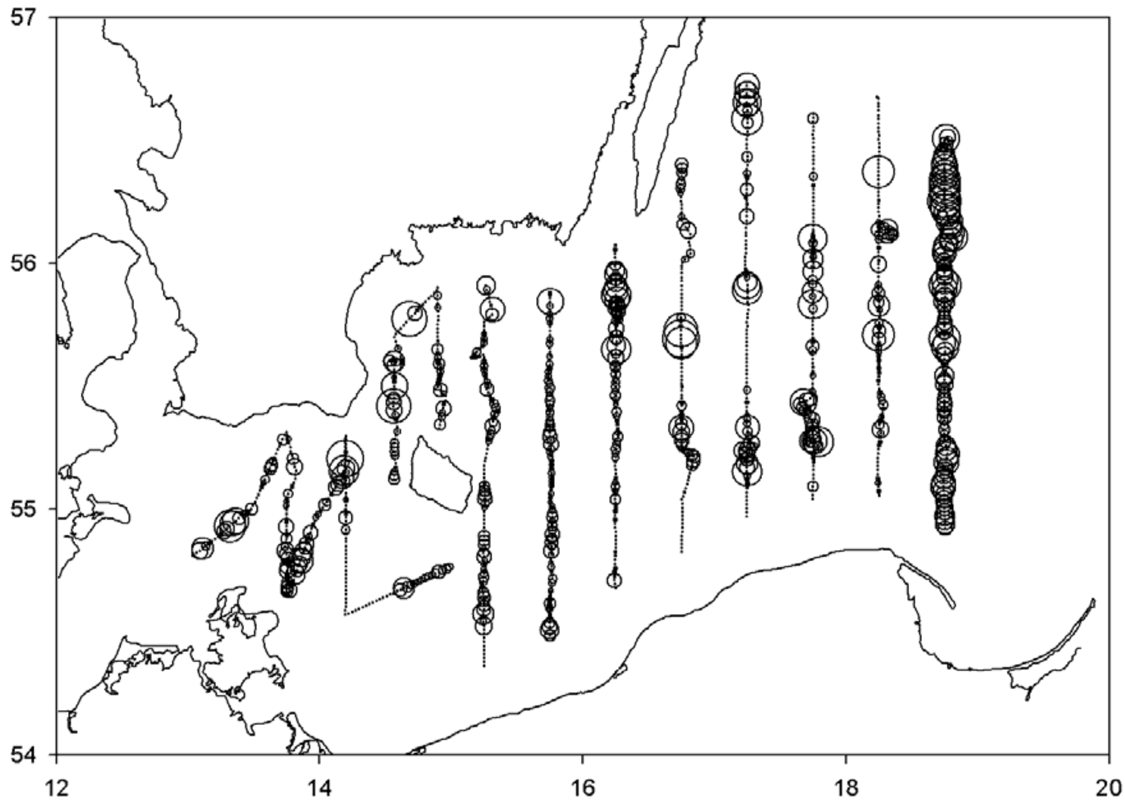

Figure 7. Relative echo distribution on the hydroacaustic track, Cruise No. 251 of RV "W. Herwig III" in May 2003.

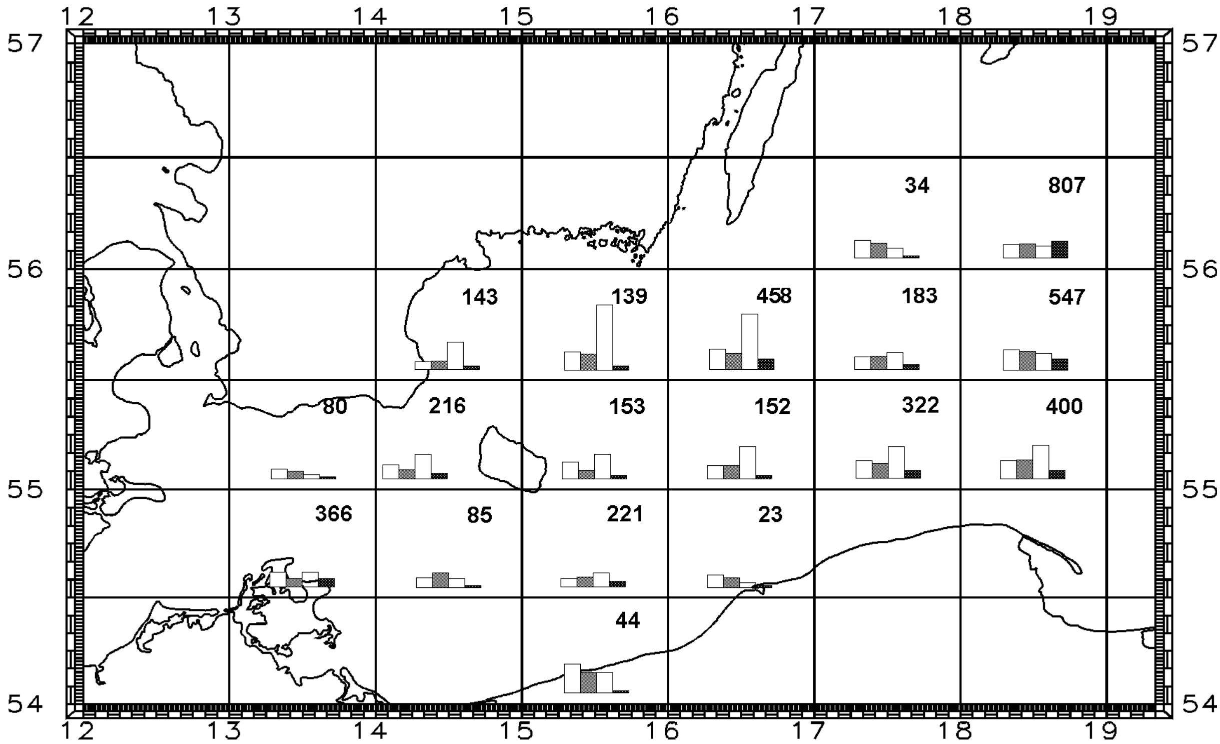

Figure 8. s_A-values per rectangle in May of 1999, 2001, 2002 and 2003. The numbers represent the s_A-values of 2003.

Table 1. Survey statistics, Cruise No. 251 of RV "W. Herwig III" in May 2003.

Subdivision	Rectangle	Area (nm²)	s_A (m²/nm²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
24	38G3	865.7	366.3	1.5	2177.0	12.5	87.5	272.7	1904.3
24	38G4	1034.8	85.3	1.7	532.9	0.6	99.4	3.4	529.5
24	39G3	765.0	79.5	2.2	274.7	19.4	80.6	53.4	221.3
24	39G4	524.8	251.5	2.1	642.8	13.0	87.0	83.8	558.9
25	37G5	642.2	44.2	1.8	155.4	5.0	95.1	7.7	147.7
25	38G5	1035.7	221.4	2.0	1119.4	15.9	84.1	177.5	941.9
25	38G6	940.2	23.2	1.7	125.7	4.9	95.1	6.1	119.6
25	39G4	287.3	180.5	1.7	305.1	6.2	93.8	18.9	286.2
25	39G5	979.0	153.0	1.3	1134.7	1.1	98.9	12.3	1122.4
25	39G6	1026.0	151.5	1.7	929.2	3.9	96.1	36.4	892.8
25	39G7	1026.0	321.9	1.5	2162.4	0.7	99.3	15.1	2147.3
25	40G4	677.2	142.8	1.7	580.6	3.4	96.7	19.5	561.2
25	40G5	1012.9	139.4	2.0	706.3	16.6	83.4	117.3	589.0
25	40G6	1013.0	458.1	1.6	2952.6	1.1	99.0	31.0	2921.6
25	40G7	1013.0	183.0	1.7	1106.0	8.1	91.9	89.5	1016.5
25	41G6	764.4	96.9	1.5	497.8	1.8	98.2	8.9	488.9
25	41G7	1000.0	33.6	1.8	187.1	13.0	87.0	24.3	162.9
26	39G8	1026.0	399.5	1.2	3360.7	1.1	98.9	35.8	3324.9
26	40G8	1013.0	547.1	1.4	3984.8	0.1	99.9	5.3	3979.4
26	41G8	1000.0	807.4	1.5	5501.3	0.6	99.4	33.2	5468.1

Table 2. Catch composition (kg/0,5 h) per fishery station, Cruise No. 251 of RV "W. Herwig III" in May 2003.

	Sub-division 24					
rectangle	39G4	38G4	39G4	38G3	39G3	
Fish species/Station	**30**	**33**	**34**	**35**	**36**	**Total**
AMMODYTES TOBIANUS			0.01	0.01		**0.02**
CLUPEA HARENGUS	29.22	5.61	212.58	93.42	13.64	**354.47**
GADUS MORHUA	10.44	2.57	23.2	7.59	2.40	**46.20**
MERLANGIUS MERLANGUS		2.30	0.06	0.70	0.29	**3.35**
PLATICHTHYS FLESUS	0.26					**0.26**
PLEURONECTES PLATESSA	0.18					**0.18**
SALMO SALAR			0.96			**0.96**
SPRATTUS SPRATTUS	61.67	219.56	399.88	428.50	14.04	**1123.65**
Total	**101.77**	**230.04**	**636.70**	**530.22**	**30.38**	**1529.11**

	Sub-division 25											
rectangle	41G7	40G7	39G7	39G7	39G7	40G7	41G6	39G6	39G6	39G6	39G6	40G6
Fish species/Station	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**16**	**17**	**18**	**19**	**20**
CLUPEA HARENGUS	408.40	76.00	34.5	5.90	0.20	190.78	32.56	5.18	1.83	2.04	74.04	9.02
GADUS MORHUA	1.17	0.56	0.7		1.88	2.55		0.57	1.54		0.47	1.37
MERLANGIUS MERLANGUS												
SPRATTUS SPRATTUS	685.89	384.07	359.8	1212.03	771.30	324.78	480.56	366.02	95.40	10.00	180.68	1356.73
SUMME	**1095.46**	**460.63**	**395.01**	**1217.93**	**773.38**	**518.10**	**513.12**	**371.77**	**98.77**	**12.04**	**255.19**	**1367.12**

	Sub-division 25											
rectangle	40G6	40G5	39G5	39G5	38G5	38G5	38G5	39G5	40G5	40G4	39G4	
Fish species/Station	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**Total**
CLUPEA HARENGUS	15.48	2.27	4.31	0.44	17.44	3.71	15.68	20.96	111.32	61.80	64.00	**1157.86**
GADUS MORHUA		1.53	11.64	0.82	2.09	2.61	2.11	1.71	2.05	18.93	8.92	**63.22**
MERLANGIUS MERLANGUS						0.24	0.57	0.38		0.31		**1.50**
SPRATTUS SPRATTUS	153.82	142.30	316.2	24.68	5.00	9.10	380.20	147.20	48.72	496.80	207.20	**8158.48**
SUMME	**169.30**	**146.10**	**332.15**	**25.94**	**24.53**	**15.66**	**398.56**	**170.25**	**162.08**	**577.86**	**280.12**	**9381.07**

	Sub-division 26							
rectangle	39G8	39G8	40G8	41G8	39G8	40G8	41G8	
Fish species/Station	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
AMMODYTES TOBIANUS								
CLUPEA HARENGUS	0.54	0.53	0.43	3.31	0.40	0.35	3.94	**9.50**
GADUS MORHUA		2.89						**2.89**
GASTEROSTEUS ACULEATUS	0.03				0.01			**0.04**
PLATICHTHYS FLESUS	0.21							**0.21**
SPRATTUS SPRATTUS	8.38	67.60	46.42	440.86	12.00	126.40	76.15	**777.81**
SUMME	**9.16**	**71.02**	**46.85**	**444.17**	**12.41**	**126.75**	**80.09**	**790.45**

Table 3 Estimated numbers (millions) of Herring (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups 0	1	2	3	4	5	6	7	8+	Total
24	38G3		245.32	6.62	3.85	7.18	3.92	1.99	2.41	1.42	272.71
24	38G4		0.54	0.41	0.43	0.76	0.45	0.40	0.30	0.09	3.38
24	39G3		4.24	4.50	7.02	13.73	10.31	5.61	5.96	1.99	53.36
24	39G4		18.42	10.27	9.05	17.27	12.35	6.58	7.18	2.52	83.64
24	**Total**		**268.52**	**21.80**	**20.35**	**38.94**	**27.03**	**14.58**	**15.85**	**6.02**	**413.09**
25	37G5		0.43	0.15	0.16	1.15	1.08	0.84	0.94	2.93	7.68
25	38G5		6.69	2.58	4.50	30.01	25.57	20.70	21.11	66.34	177.50
25	38G6		0.64	0.14	0.28	1.15	0.65	0.70	0.64	1.92	6.12
25	39G4		0.20	0.40	0.92	4.73	2.98	2.71	1.80	5.11	18.85
25	39G5		0.24	0.46	0.35	2.87	1.92	1.45	1.31	3.66	12.26
25	39G6		2.14	1.49	1.87	9.02	4.81	4.67	3.44	8.96	36.40
25	39G7		0.28	0.23	0.96	4.29	2.42	2.46	1.04	3.37	15.05
25	40G4		3.02	1.70	0.92	3.69	2.11	2.06	1.77	4.18	19.45
25	40G5		1.26	4.94	5.77	27.27	14.67	14.35	12.80	36.28	117.34
25	40G6		0.05	0.33	1.03	7.80	5.07	4.55	3.01	9.15	30.99
25	40G7		0.36	1.68	6.96	33.43	12.90	14.81	5.21	14.14	89.49
25	41G6		0.37	1.17	1.36	2.59	1.12	1.15	0.29	0.81	8.86
25	41G7		0.03	0.74	2.55	9.33	3.51	4.13	1.05	2.90	24.24
25	**Total**		**15.71**	**16.01**	**27.63**	**137.33**	**78.81**	**74.58**	**54.41**	**159.75**	**564.23**
26	39G8		15.88	2.44	2.70	5.63	2.73	2.65	0.78	2.98	35.79
26	40G8		0.53	0.48	0.99	1.75	0.36	0.38	0.41	0.42	5.32
26	41G8		0.37	3.84	4.20	10.09	3.12	4.25	2.56	4.76	33.19
26	**Total**		**16.78**	**6.76**	**7.89**	**17.47**	**6.21**	**7.28**	**3.75**	**8.16**	**74.30**

Table 4 Herring mean weight (g) per age group (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups 0	1	2	3	4	5	6	7	8+	Total
24	38G3		12.6	37.3	55.6	59.5	67.2	73.2	70.9	111.4	17.3
24	38G4		13.3	42.3	55.0	61.1	70.3	71.4	69.0	84.7	54.2
24	39G3		16.8	44.4	58.3	62.7	70.0	69.4	69.4	85.4	60.7
24	39G4		16.6	40.2	56.4	62.5	70.3	71.1	69.4	92.7	52.8
24	**Total**		**12.9**	**40.2**	**56.9**	**62.0**	**69.7**	**70.7**	**69.6**	**94.6**	**30.4**
25	37G5		11.2	23.1	37.1	51.2	60.4	60.1	70.3	71.6	60.5
25	38G5		11.2	23.3	38.5	50.4	59.7	58.3	69.2	70.7	60.3
25	38G6		10.7	21.7	38.2	47.1	56.5	51.3	66.3	68.9	52.6
25	39G4		9.2	29.0	37.4	48.0	53.6	52.5	64.5	63.7	54.0
25	39G5		10.6	26.4	37.2	46.6	55.9	51.5	66.6	69.8	56.0
25	39G6		12.7	21.9	36.7	47.2	54.1	50.4	64.3	64.7	50.8
25	39G7		13.6	25.6	37.8	45.9	52.0	49.0	57.2	59.4	49.8
25	40G4		13.4	20.3	29.9	48.4	55.7	52.4	65.0	64.9	45.9
25	40G5		16.3	24.1	36.9	46.5	55.1	51.1	66.4	67.3	55.0
25	40G6		21.0	27.7	38.8	49.4	55.2	53.6	64.4	63.7	56.0
25	40G7		15.9	28.4	38.5	45.2	48.5	46.3	57.9	58.6	47.8
25	41G6		19.1	25.9	31.9	38.9	41.2	41.4	54.7	62.1	38.5
25	41G7		20.6	29.1	38.0	43.5	45.0	43.5	54.0	56.8	44.7
25	**Total**		**12.6**	**24.4**	**37.3**	**47.0**	**54.8**	**51.8**	**65.9**	**67.2**	**54.2**
26	39G8		7.4	43.5	44.2	50.5	55.6	54.7	59.0	63.6	32.4
26	40G8		6.6	42.2	35.5	43.0	45.2	50.7	43.6	49.4	39.1
26	41G8		19.0	39.9	45.6	47.8	53.5	54.8	53.0	67.3	50.9
26	**Total**		**7.2**	**41.7**	**45.8**	**48.7**	**54.1**	**54.1**	**55.3**	**65.1**	**37.2**

Table 5 Herring total biomass (t) per age group (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups 0	1	2	3	4	5	6	7	8+	Total
24	38G3		3081.2	246.9	214.1	427.0	263.3	145.6	170.8	158.3	4707.2
24	38G4		7.2	17.4	23.6	46.4	31.6	28.6	20.7	7.6	183.1
24	39G3		71.2	199.8	408.9	861.3	721.8	389.5	413.7	170.0	3236.2
24	39G4		305.6	413.2	510.7	1079.2	868.1	467.5	498.1	283.1	4425.5
24	**Total**		**3465.2**	**877.2**	**1157.4**	**2413.9**	**1884.9**	**1031.2**	**1103.3**	**618.8**	**12551.9**
25	37G5		4.8	3.5	5.9	58.9	65.3	50.5	66.0	209.7	464.6
25	38G5		74.9	60.2	173.2	1512.8	1526.8	1206.0	1461.7	4688.8	10704.4
25	38G6		6.8	3.0	10.7	54.1	36.7	35.9	42.4	132.3	321.9
25	39G4		1.8	11.6	34.4	227.2	159.7	142.3	116.2	325.3	1018.5
25	39G5		2.5	12.1	13.0	133.7	107.3	74.7	87.3	255.4	686.0
25	39G6		27.2	32.6	68.6	425.4	260.3	235.2	221.0	579.3	1849.6
25	39G7		3.8	5.9	36.3	197.0	125.7	120.4	59.4	200.0	748.5
25	40G4		40.5	34.5	27.5	178.5	117.6	108.0	115.1	271.2	892.9
25	40G5		20.5	118.8	212.8	1267.0	807.9	733.6	849.5	2442.3	6452.4
25	40G6		1.1	9.1	40.0	385.3	280.0	243.7	193.8	582.9	1735.9
25	40G7		5.7	47.8	268.2	1511.0	625.0	685.6	301.6	828.9	4273.8
25	41G6		7.0	30.3	43.4	100.9	46.2	47.6	15.9	50.4	341.7
25	41G7		0.6	21.5	96.8	406.2	157.9	179.4	56.7	164.8	1083.9
25	**Total**		**197.2**	**390.9**	**1030.8**	**6458.0**	**4316.4**	**3862.9**	**3586.6**	**10731.3**	**30574.1**
26	39G8		117.0	106.0	119.2	284.4	151.8	144.9	46.0	189.4	1158.7
26	40G8		3.5	20.3	35.1	75.3	16.3	19.3	17.9	20.8	208.5
26	41G8		7.0	153.2	191.5	482.2	167.0	232.7	135.8	320.4	1689.8
26	**Total**		**127.5**	**279.5**	**345.8**	**841.9**	**335.1**	**396.9**	**199.7**	**530.6**	**3057.0**

Table 6 Estimated numbers (millions) of sprat (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups									
		0	1	2	3	4	5	6	7	8+	Total
24	38G3		909.73	620.63	134.65	107.47	115.01	16.81			1904.30
24	38G4		145.53	222.64	54.59	52.71	46.34	7.69			529.50
24	39G3		60.37	92.32	22.01	20.80	21.95	3.85			221.30
24	39G4		113.58	253.97	56.47	57.81	63.15	13.96			558.94
24	**Total**		**1229.21**	**1189.56**	**267.72**	**238.79**	**246.45**	**42.31**			**3214.04**
25	37G5		3.72	24.65	13.79	36.88	37.25	18.82	6.71	5.83	147.65
25	38G5		113.45	165.24	87.35	204.91	199.59	103.29	39.06	28.98	941.87
25	38G6		2.52	24.44	12.60	27.57	27.15	14.88	6.69	3.77	119.62
25	39G4		14.24	71.06	37.79	60.92	57.41	25.05	12.81	6.95	286.23
25	39G5		408.33	241.19	114.40	140.38	123.90	51.43	30.12	12.67	1122.42
25	39G6		21.78	208.72	104.43	208.57	192.56	92.39	38.99	25.38	892.82
25	39G7		73.13	606.52	324.66	449.67	413.59	154.12	80.70	44.91	2147.30
25	40G4		9.58	126.84	64.42	137.61	124.57	57.91	23.46	16.76	561.15
25	40G5		27.91	137.42	65.27	138.42	124.17	57.27	22.34	16.19	588.99
25	40G6		24.80	786.00	427.87	666.46	608.75	226.29	114.24	67.13	2921.54
25	40G7		46.60	302.49	163.79	193.55	181.74	68.92	40.33	19.11	1016.53
25	41G6		3.92	177.22	107.30	86.29	69.28	19.92	22.53	2.45	488.91
25	41G7		5.11	42.66	22.06	38.05	33.51	12.28	5.41	3.78	162.86
25	**Total**		**755.09**	**2914.45**	**1545.73**	**2389.28**	**2193.47**	**902.57**	**443.39**	**253.91**	**11397.89**
26	39G8		1096.43	756.14	547.69	411.33	318.53	175.42	5.67	13.64	3324.85
26	40G8		445.06	861.54	1008.42	736.93	620.85	301.27	5.35		3979.42
26	41G8		341.96	1013.62	1354.27	1224.37	1067.28	454.99	10.35	1.25	5468.09
26	**Total**		**1883.45**	**2631.30**	**2910.38**	**2372.63**	**2006.66**	**931.68**	**21.37**	**14.89**	**12772.36**

Table 7 Sprat mean weight (g) per age group (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups									
		0	1	2	3	4	5	6	7	8+	Total
24	38G3		8.4	13.3	14.2	14.6	15.8	18.4			11.3
24	38G4		11.9	14.4	13.9	14.4	15.7	18.3			13.8
24	39G3		11.8	14.6	14.5	15.0	15.8	18.2			14.1
24	39G4		13.9	15.5	14.8	15.9	16.3	18.5			15.3
24	**Total**		**9.5**	**14.1**	**14.3**	**14.9**	**15.9**	**18.4**			**12.6**
25	37G5		5.8	12.1	12.9	13.8	13.7	14.3	14.1	14.0	13.3
25	38G5		5.1	11.4	12.4	13.6	13.6	14.2	13.9	14.0	12.2
25	38G6		5.3	11.7	11.8	12.9	13.0	13.7	13.7	13.4	12.6
25	39G4		5.4	11.1	11.2	12.4	12.6	13.3	12.7	13.3	11.7
25	39G5		5.0	9.9	10.8	12.3	12.4	13.2	12.3	13.4	9.1
25	39G6		4.9	11.4	11.4	12.6	12.8	13.4	13.2	13.3	12.2
25	39G7		4.8	11.0	10.9	12.2	12.3	12.9	12.0	13.1	11.5
25	40G4		5.3	11.6	11.6	12.7	12.9	13.4	13.1	13.5	12.3
25	40G5		5.5	11.3	11.4	12.4	12.7	13.2	13.1	13.2	11.9
25	40G6		5.6	11.2	11.0	12.2	12.4	12.9	12.0	13.2	11.8
25	40G7		4.4	10.8	10.7	12.2	12.3	13.1	12.1	13.2	11.3
25	41G6		6.2	10.6	10.6	11.7	11.5	12.3	11.1	13.0	11.0
25	41G7		4.3	11.2	11.0	12.1	12.3	12.7	11.8	13.1	11.6
25	**Total**		**5.0**	**11.0**	**11.1**	**12.4**	**12.6**	**13.2**	**12.5**	**13.3**	**11.5**
26	39G8		3.5	8.1	10.0	10.9	11.4	10.5	15.1	14.5	7.7
26	40G8		3.5	8.8	10.2	11.1	11.3	10.6	14.0		9.5
26	41G8		3.4	9.2	10.3	11.3	11.5	10.8	14.2	16.0	10.1
26	**Total**		**3.5**	**8.4**	**10.2**	**11.1**	**11.4**	**10.6**	**14.4**	**14.5**	**8.6**

Table 8 Sprat total biomass (t) per age group (RV "W. Herwig III" in May 2003).

Sub-division	Rectangle	Age groups									
		0	1	2	3	4	5	6	7	8+	Total
24	38G3		7596.2	8254.4	1909.3	1563.7	1820.6	309.6			21453.8
24	38G4		1736.2	3194.9	756.1	759.0	729.4	140.7			7316.3
24	39G3		714.8	1349.7	318.3	312.2	345.9	70.0			3110.9
24	39G4		1579.9	3928.9	836.3	917.4	1031.2	258.4			8552.1
24	**Total**		**11627.1**	**16727.9**	**3820.0**	**3552.4**	**3927.2**	**778.8**			**40433.4**
25	37G5		21.6	297.5	177.9	508.6	511.4	268.4	94.9	81.9	1962.2
25	38G5		583.1	1882.1	1085.8	2792.9	2720.4	1464.7	543.7	404.9	11477.6
25	38G6		13.4	285.2	148.3	355.7	352.7	204.2	91.8	50.4	1501.7
25	39G4		77.3	790.2	421.7	757.8	721.1	333.4	162.9	92.7	3357.1
25	39G5		2053.9	2392.6	1232.1	1726.7	1532.6	678.9	369.6	169.8	10156.2
25	39G6		106.5	2379.4	1191.5	2628.0	2464.8	1238.9	515.4	338.6	10863.1
25	39G7		348.1	6641.4	3522.6	5468.0	5103.7	1992.8	970.0	590.1	24636.7
25	40G4		51.1	1470.1	746.6	1744.9	1603.2	776.6	307.3	226.8	6926.6
25	40G5		152.4	1558.3	740.8	1720.6	1575.7	756.5	292.2	214.2	7010.7
25	40G6		137.6	8787.5	4719.4	8124.1	7536.3	2925.9	1370.9	885.4	34487.1
25	40G7		203.6	3260.8	1759.1	2359.4	2237.2	899.4	488.4	252.1	11460.0
25	41G6		24.3	1873.2	1135.2	1007.9	793.3	245.4	249.9	31.9	5361.1
25	41G7		21.8	479.5	243.1	459.6	413.5	156.1	64.1	49.5	1887.2
25	**Total**		**3794.7**	**32097.8**	**17124.1**	**29654.2**	**27565.9**	**11941.2**	**5521.1**	**3388.3**	**131087.3**
26	39G8		3804.6	6094.5	5498.8	4475.3	3637.6	1834.9	85.6	197.2	25628.5
26	40G8		1557.7	7607.4	10285.9	8150.4	7003.2	3187.4	74.9		37866.9
26	41G8		1155.8	9284.8	13935.4	13786.4	12220.4	4909.3	147.4	20.0	55459.5
26	**Total**		**6518.1**	**22986.7**	**29720.1**	**26412.1**	**22861.2**	**9931.6**	**307.9**	**217.2**	**118954.9**

ANNEX 5: CRUISE REPORTS OF BITS SURVEYS CARRIED OUT IN THE BALTIC SEA IN NOVEMBER 2003 AND SPRING 2004

Survey Report for RV "ATLANTIDA"
3 November –7 November 2003

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia
Igor Karpushevskiy

1 INTRODUCTION

The main objective is to assess recruits resources of cod in the Baltic Sea. Autumn demersal trawl survey was carried out for the first time. These data are necessary for Baltic Fisheries Assessment Working Group (WGBFAS). These data are necessary for group to estimate the stock size of cod, respectively, in the East Baltic area.

2 METHODS

2.1 Narrative

The demersal trawl survey of RV STM-K-1704 "ATLANTIDA" took place from 3 to 7 November in 2003. The ground trawl survey was intended to cover area of the Russia.

2.2 Survey design

The international trawl survey are carried out in from of a stratified random survey. The depth of ground trawls from 23 up to 107 m. The number of trawl stations to the depth strata according to recommendations ICES. The survey zone to cover area of the Russia (Figure 1).

2.3. Calibration

Calibration passed is carried out during of survey in October 2003. The calibration procedure was carried out with a calibrated copper sphere as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' ('Report of the Baltic International Fish Survey Working Group', ICES CM 2002/G:05 Ref. H).

2.4. Acoustic data collection

The acoustic investigations were performed during day and night time. The acoustic equipment was an echosounder EK500 on 38 kHz. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02).

2.5. Biological data – fishing stations

Trawling was done with the standard ground trawl –TV3 in a bottom. The mesh size in the codend was 10 mm. The trawling depth and the net opening were controlled by a net sonde. Normally a net opening was achieved of about 5 m. The trawling time lasted usually 30 minutes. From each haul sub-samples were taken to determine length and weight of fish. Samples of cod, flounder, herring and sprat were investigated onboard a vessel (i.e., sex, maturity, age). After each trawl haul it was intended to investigate the hydrographic condition by a CTD-probe.

3 RESULTS

3.1 Biological data

In total 14 trawl hauls were carried out. 982 cod, 63 flounder, 222 herring and 118 sprat were investigated in lab onboard a vessel. Total length was measured for 2816 cod, 63 flounder, 3576 herring and 632 sprat.

The results of the catch composition are presented in Figure 2.

The length distributions of cod and flounder year 2004 are presented in Figure 3.

4 DISCUSSION

Catch of cod for trawl made from 2.9 up to 375 kg or from 3 up to 520 pieces. The maximum quantity cod was marked on depth of 58–86 m, a minimum quantity on depth of 23–52 m.

The total length of main fish species ranged as follows:

- cod – 5.0 – 105.0 cm (average 40.5 cm)
- flounder – 6.0 – 43.0 cm

The average weight of cod – 755 g.

The numbers of young cod with length lesser then 30 cm in November was in the range of 1.4 to 74.3%, the mean 14.3%.

5 REFERENCES

ICES. 2003. Report of the Baltic International Fish Survey Working Group. ICES CM 2003/H: Ref.: D.

Manual for the Baltic International Acoustic Surveys (BIAS)

Figure captions:

Figure 1: Trawl positions for RV “ATLANTIDA” in November 2003
Figure 2: Catch composition (kg/0.5 h) per haul No. in area of the Russia
Figure 3: Length distribution of cod in area of the Russia (Subdivision 26) in November 2003

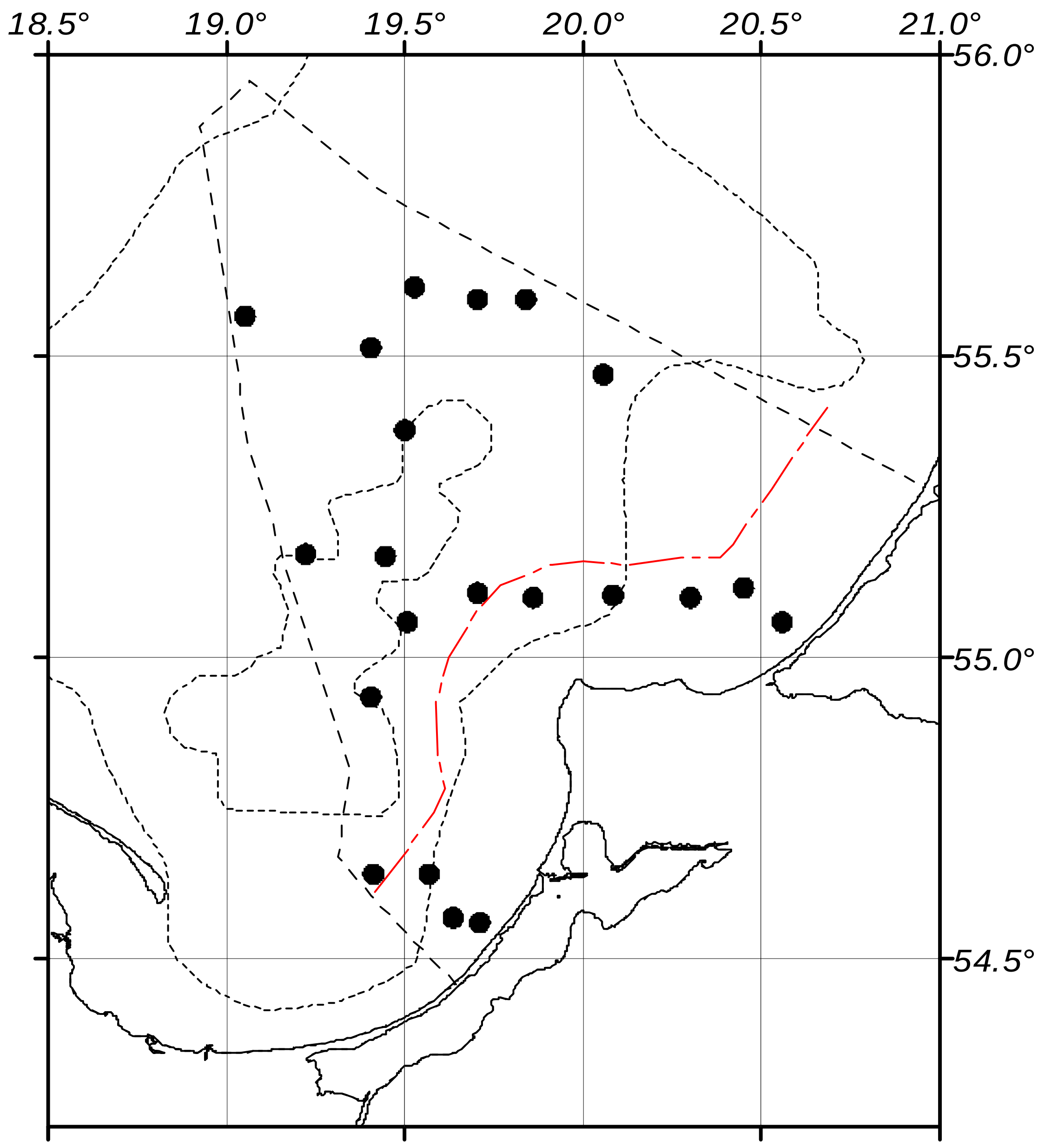

Рис. 2. Схема станций донной траловой съемки СТМ К-1704 "Атлантида".

Figure 1. Trawl positions for RV "ATLANTIDA" in November 2003.

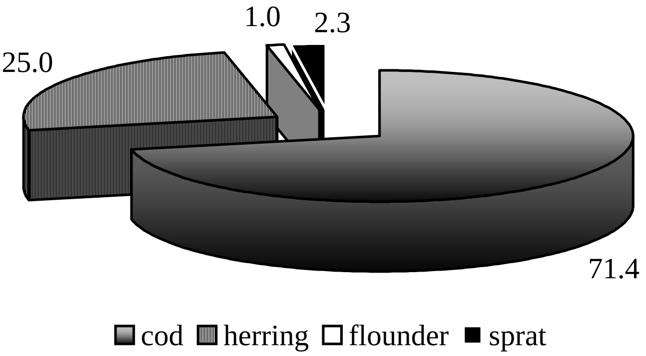

Figure 2. Catch composition (kg/0.5 h) per haul No. in area of the Russia.

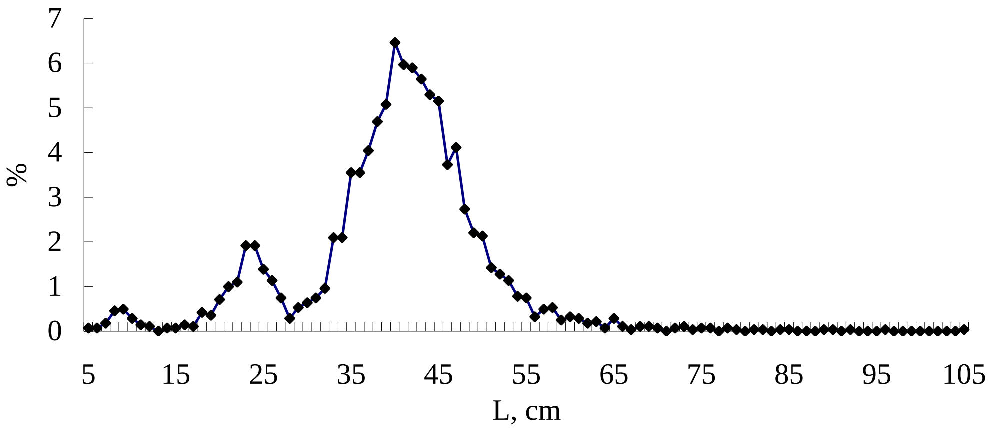

Figure 3. Length distribution of cod in area of the Russia (Subdivision 26) in November 2003.

Survey Report for RV "ATLANTNIRO"

17.02.2004–12.03.2004

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia

Igor Karpushevskiy

1 INTRODUCTION

The main objective is to assess recruits resources of cod in the Baltic Sea. The demersal trawl survey is conducted every year to supply the ICES with the data on amount young cod and cod of advanced ages. These data are necessary for Baltic Fisheries Assessment Working Group (WGBFAS). These data are necessary for group to estimate the stock size of cod, respectively, in the East Baltic area (Subdivisions 26).

2 METHODS

2.1 Personnel

A. Zezera	AtlantNIRO, Kaliningrad, Russia - cruise leader
I. Karpushevskiy	AtlantNIRO, Kaliningrad, Russia - assistant of cruise leader
V. Severin	AtlantNIRO, Kaliningrad, Russia - acoustic
J. Priemko	AtlantNIRO, Kaliningrad, Russia - engineer
S. Ivanov	AtlantNIRO, Kaliningrad, Russia - engineer
E. Gribov	AtlantNIRO, Kaliningrad, Russia - hydrologist
F. Patokina	AtlantNIRO, Kaliningrad, Russia - engineer
V. Shopov	AtlantNIRO, Kaliningrad, Russia - engineer
A. Sirota	AtlantNIRO, Kaliningrad, Russia - hydrologist
V. Konstantinov	AtlantNIRO, Kaliningrad, Russia - engineer
T. Golubkova	AtlantNIRO, Kaliningrad, Russia - engineer

2.2 Narrative

The 39th cruise of RV STM-K-1711 "ATLANTNIRO" took place from 17th March to 12th February in 2004. RV "ATLANTNINO" left the port of Kaliningrad on 17th February in 2004. The ground trawl survey was intended to cover the Subdivision 26 (areas of the Russia, Lithuania, southern part of the Latvia, southern part of the Sweden and eastern part of the Poland). The survey ended on 12th March in 2004 in Kaliningrad.

2.3 Survey design

The international trawl survey are carried out in from of a stratified random survey, however character of a ground is taken into account. The depth of ground trawls from 20 up to 136 m. The number of trawl stations to the depth strata according to recommendations ICES (ICES CM 2002/G:05 Ref. H). The survey zone to cover areas of the Russia, Lithuania, southern part of the Latvia, southern part of the Sweden and eastern part of the Poland (Figure 1).

2.4 Calibration

Calibration passed prior to the beginning of survey. The calibration procedure was carried out with a calibrated copper sphere as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' ('Report of the Baltic International Fish Survey Working Group', ICES CM 2002/G:05 Ref. H).

2.5 Acoustic data collection

The acoustic investigations were performed during day and night time. The acoustic equipment was an echosounder EK500 on 38 kHz. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for the Baltic International Acoustic Surveys (BIAS)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02).

2.6 Biological data – fishing stations

Trawling was done with the standard ground trawl –TV3 in a bottom. The mesh size in the codend was 10 mm. The trawling depth and the net opening were controlled by a net sonde. Normally a net opening was achieved of about 5–7 m. The trawling time lasted usually 30 minutes, but sometimes for the different reasons duration was reduced. From each haul sub-samples were taken to determine length and weight of fish. Samples of cod, flounder, herring and sprat were investigated onboard a vessel (i.e., sex, maturity, age). After each trawl haul it was intended to investigate the hydrographic condition by a CTD-probe.

3 RESULTS

3.1 Biological data

In total 49 trawl hauls were carried out (20 hauls in area of the Russia, 9 hauls in area of the Lithuania, 10 hauls in area southern part of the Latvia, 5 hauls in area southern part of the Sweden, 5 hauls in area eastern part of the Poland). 2143 cod, 1764 flounder, 2391 herring and 650 sprat were investigated in lab onboard a vessel. In February-March 2004, total length was measured for 4903 cod from 43 hauls, 4529 flounder from 47 hauls, 13420 herring from 45 hauls, and 3142 sprat from 30 hauls.

The length distributions of cod and flounder year 2004 presented in Figures 2–13. The results of the catch composition on the countries Subdivision 26 are presented in Table 1–5.

3.2 Acoustic data

For studying an opportunity of an estimation of a stock demersal fishes the acoustical method, during all survey, along trawling traces, on transitions between trawling and in drift, carried out gathering the acoustic data. For the analysis the bottom layer determined by opening of a trawl and the common layer, accordingly 0.5 - 7.5 meters and 10м - to bottom.

The collected information on distribution of density Sa of the mixed schools on water area echosurvey, has confirmed presence characteristic for cod echorecords in pelagic layers at night, in places with high density echorecords of a sprat and a herring. It is marked, that at low density of schools of cod on the ground in the afternoon, the echorecords practically are absent, while in control catches are confirmed presence of several pieces. The collected material is intended for postprocessing in conditions of laboratory.

3.3 Hydrographic data

The temperature of water on a surface changed from 1.4°C up to 2.9°C. Salinity of water on a surface changed in limits 6.8–7.3%.

Growth of temperature and salinity of water was observed in a layer below 55–65 m. In the central part of the Gdansk Deep up to 7.92–8.52°C and 13.03–13.13% accordingly. In Gotland Deep of value of temperature and salinity at a bottom changed in limits 6.26–7.52°C and 12.3–12.6%.

T Decrease of values of concentration of the oxygen dissolved of water up to 2 ml/l and at saturation of 15–20 % in benthonic layers 50–65 m were observed in a layer of water below.

Thus, in February - March 2004 it was marked:

- substantial growth of volume of warm deep waters practically all Gdansk Basin, and also benthonic horizons of southern part Gotland Deep on 2–3°C.
- preservation of high values of concentration of the oxygen of water in benthonic and deep layers of water area 26 SD, and also absence of hydrosulphuric zones.

The locations of stations, temperature, salinity distribution and the oxygen concentration at a he minimal values of temperature and salinity of water (1.6–2.6°C and 7.0–7.2% accordingly) were observed in a benthonic layer on the most shallow coastal sites.

The gas mode of a deep-water part was characterized by the following features: the top homogeneous thickness differed high values of the contents of oxygen – 8.0–8.9 ml/l at saturation of 90–98 %.

Bottom is shown on Figures 14–17.

4 DISCUSSION

Structure of catch of demersal trawl survey is shown on Tables 1–5.

The total length of main fish species ranged as follows:

- cod – 5.0–85.0 cm
- flounder – 6.0–43.0 cm

In 2004 marked large numbers of young cod in hauls length before 30 cm (in the range of 0.0 to 100%, the mean 67.5%). The abundance of 2 age group cod in the Subdivision 26 was above than that of the last year.

5 REFERENCES

ICES. 2003. Report of the Baltic International Fish Survey Working Group. ICES CM 2003/H: Ref.: D.

Manual for the Baltic International Acoustic Surveys (BIAS)

Figure and Table Captions

Figure 1: Trawl positions for RV "ATLANTNIRO" in February-March 2004
Figure 2: Length distribution of cod in area of the Russia (Subdivision 26) in 2004
Figure 3: Length distribution of cod in area of the Lithuania (Subdivision 26) in 2004
Figure 4: Length distribution of cod in area of the Latvia (Subdivision 26) in 2004
Figure 5: Length distribution of cod in area of the Sweden (Subdivision 26) in 2004
Figure 6: Length distribution of cod in area of the Poland (Subdivision 26) in 2004
Figure 7: Length distribution of cod in Subdivision 26 in 2004
Figure 8: Length distribution of flounder in area of the Russia (Subdivision 26) in 2004
Figure 9: Length distribution of flounder in area of the Lithuania (Subdivision 26) in 2004
Figure 10: Length distribution of flounder in area of the Latvia (Subdivision 26) in 2004
Figure 11: Length distribution of flounder in area of the Sweden (Subdivision 26) in 2004
Figure 12: Length distribution of flounder in area of the Poland (Subdivision 26) in 2004
Figure 13: Length distribution of flounder in Subdivision 26 in 2004
Figure 14: Location of hydrographic stations in February- March 2004, RV “ATLANTNIRO”
Figure 15: Bottom water temperature distribution (°C) in February- March 2004, RV “ATLANTNIRO”
Figure 16: Bottom water salinity distribution (‰) in February- March 2004, RV “ATLANTNIRO”
Figure 17: Bottom water oxygen concentration (ml/l) in February-March 2004, RV “ATLANTNIRO”

Table 1: Catch composition (kg/0.5 h) per haul No. in area of the Russia
Table 2: Catch composition (kg/0.5 h) per haul No. in area of the Lithuania

Table 3: Catch composition (kg/0.5 h) per haul No. in area of the Latvia
Table 4: Catch composition (kg/0.5 h) per haul No. in area of the Sweden
Table 5: Catch composition (kg/0.5 h) per haul No. in area of the Poland

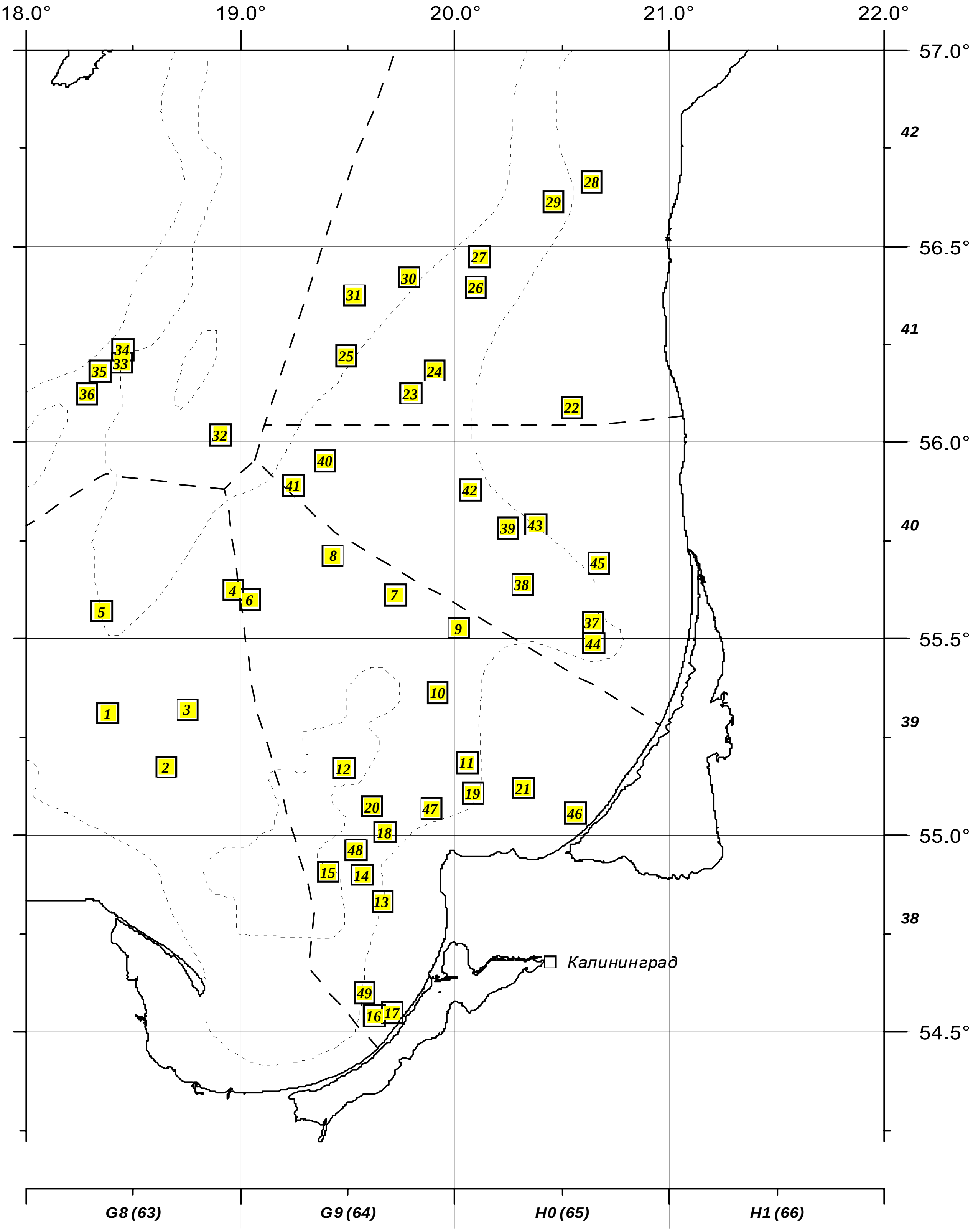

Figure 1. Trawl positions for RV "ATLANTNIRO" in February-March 2004.

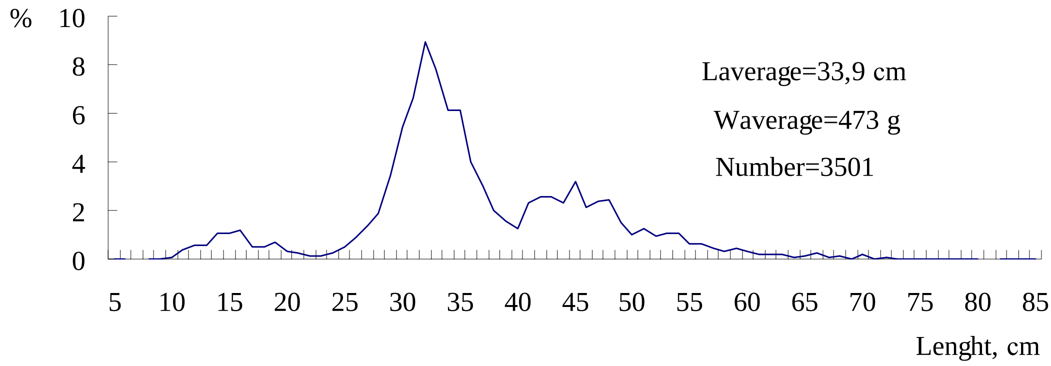

Fig 2. Length distribution of cod in area of the Russia (Sub-division 26) in 2004.

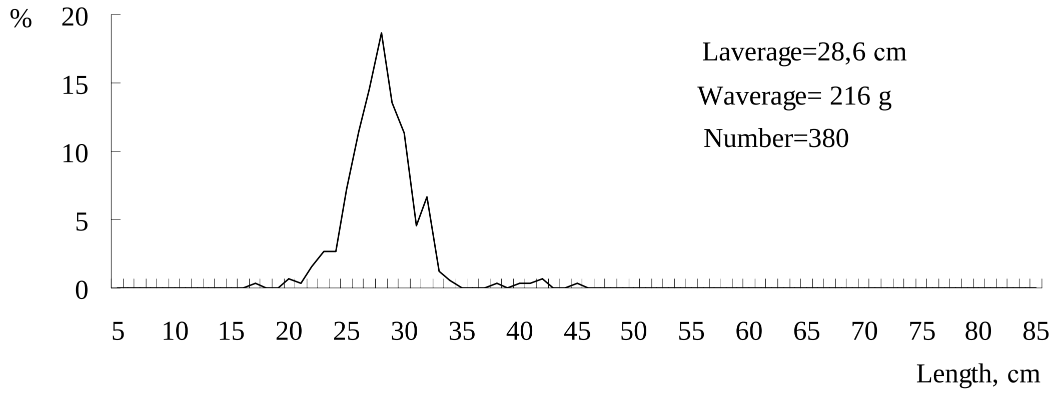

Fig 3. Length distribution of cod in area of the Lithuania (Sub-division 26) in 2004.

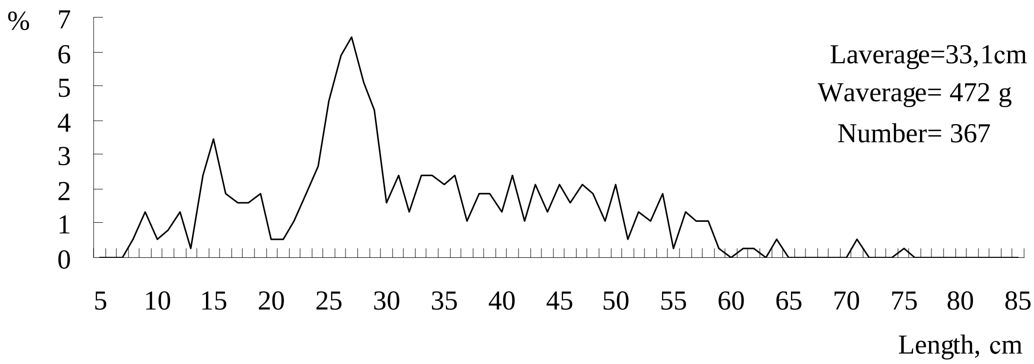

Fig 4. Length distribution of cod in area of the Latvia (Sub-division 26) in 2004.

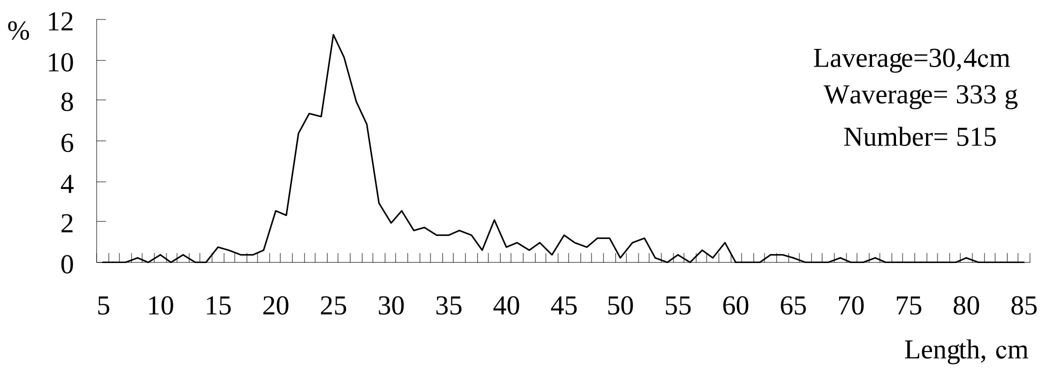

Fig 5. Length distribution of cod in area of the Sweden (Sub-division 26) in 2004.

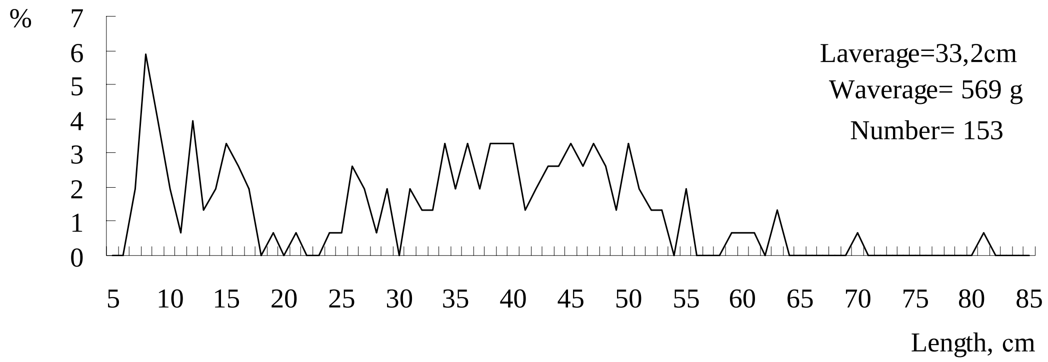

Fig 6. Length distribution of cod in area of the Poland (Sub-division 26) in 2004.

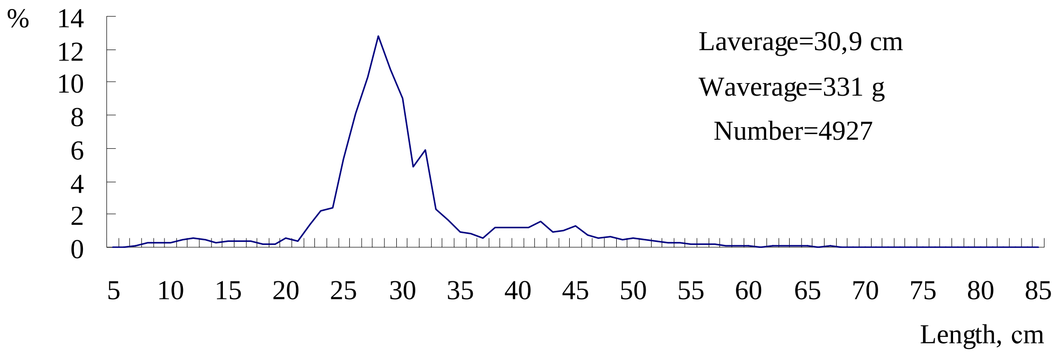

Fig 7. Length distribution of cod in Sub-division 26 in 2004.

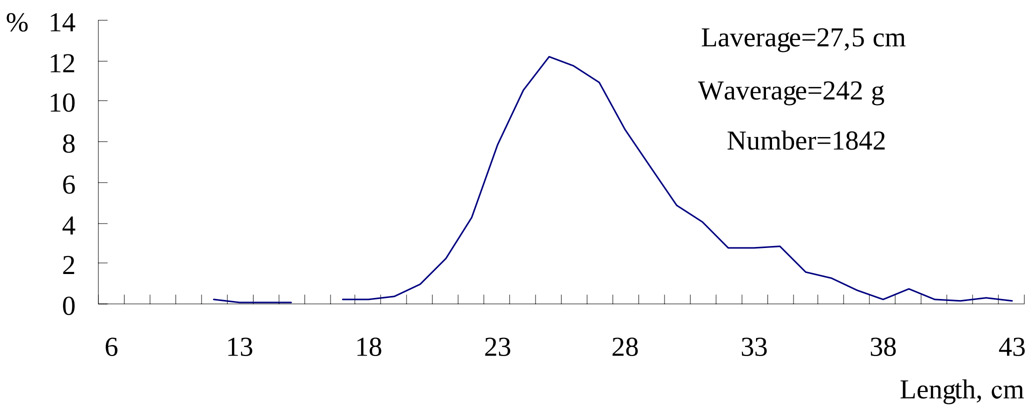

Fig 8. Length distribution of flounder in area of the Russia (Sub-division 26) in 2004.

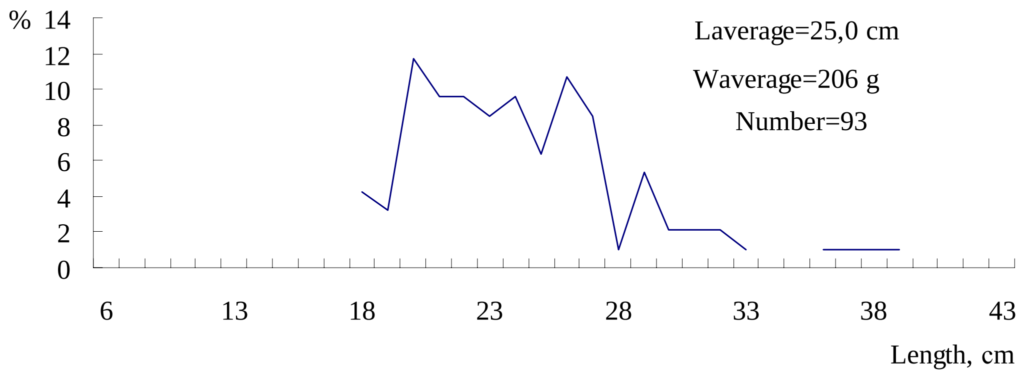

Fig 9. Length distribution of flounder in area of the Lithuania (Sub-division 26) in 2004.

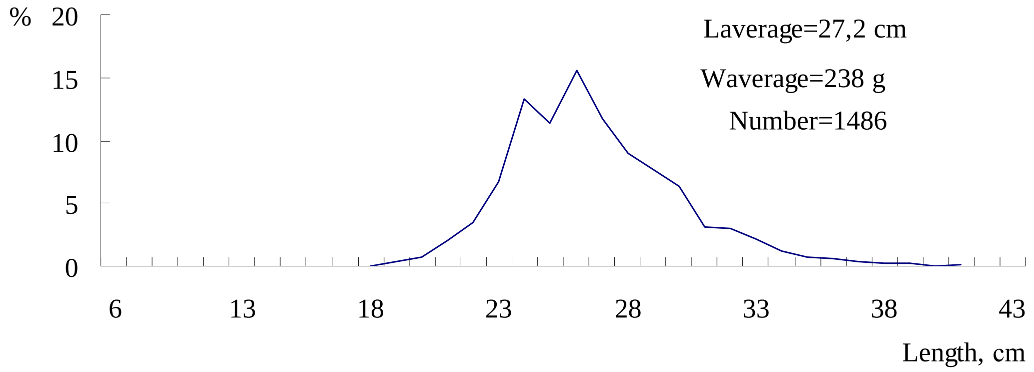

Fig 10. Length distribution of flounder in area of the Latvia (Sub-division 26) in 2004.

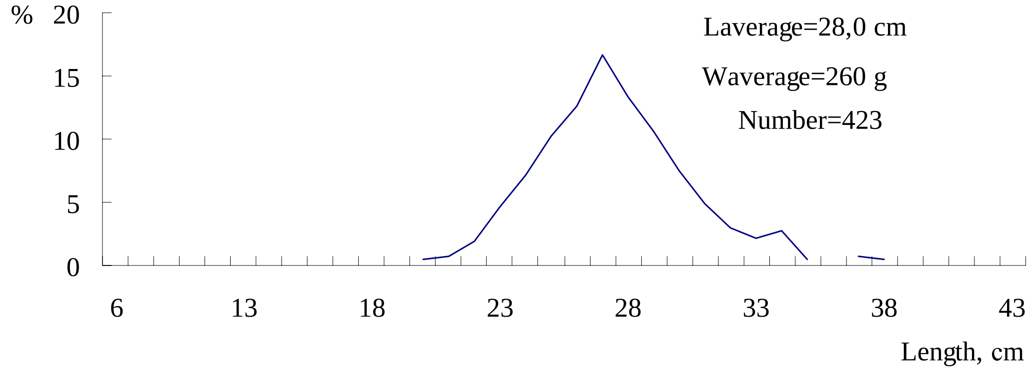

Fig 11. Length distribution of flounder in area of the Sweden (Sub-division 26) in 2004.

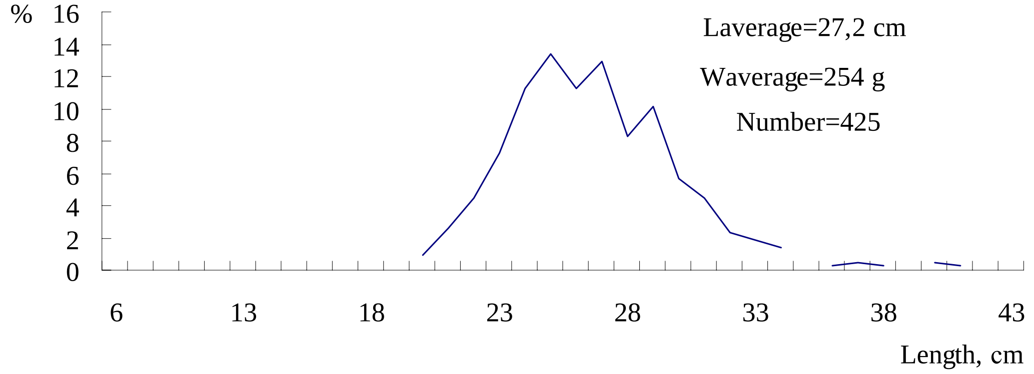

Fig 12. Length distribution of flounder in area of the Poland (Sub-division 26) in 2004.

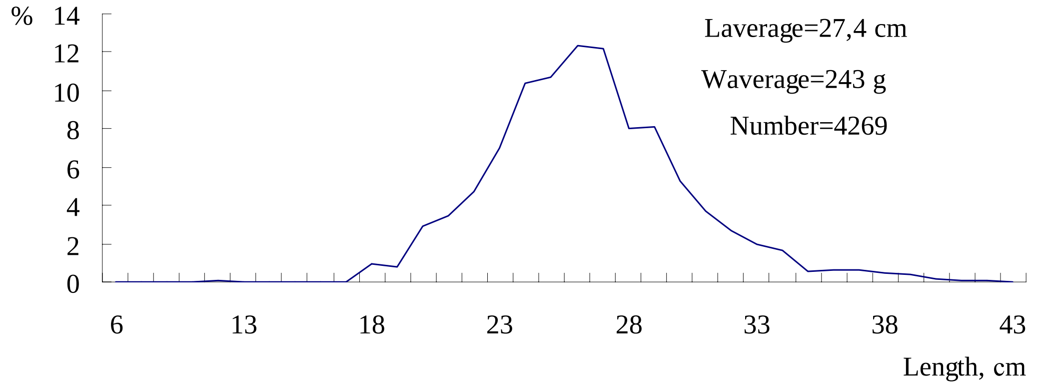

Fig 13. Length distribution of flounder in Sub-division 26 in 2004.

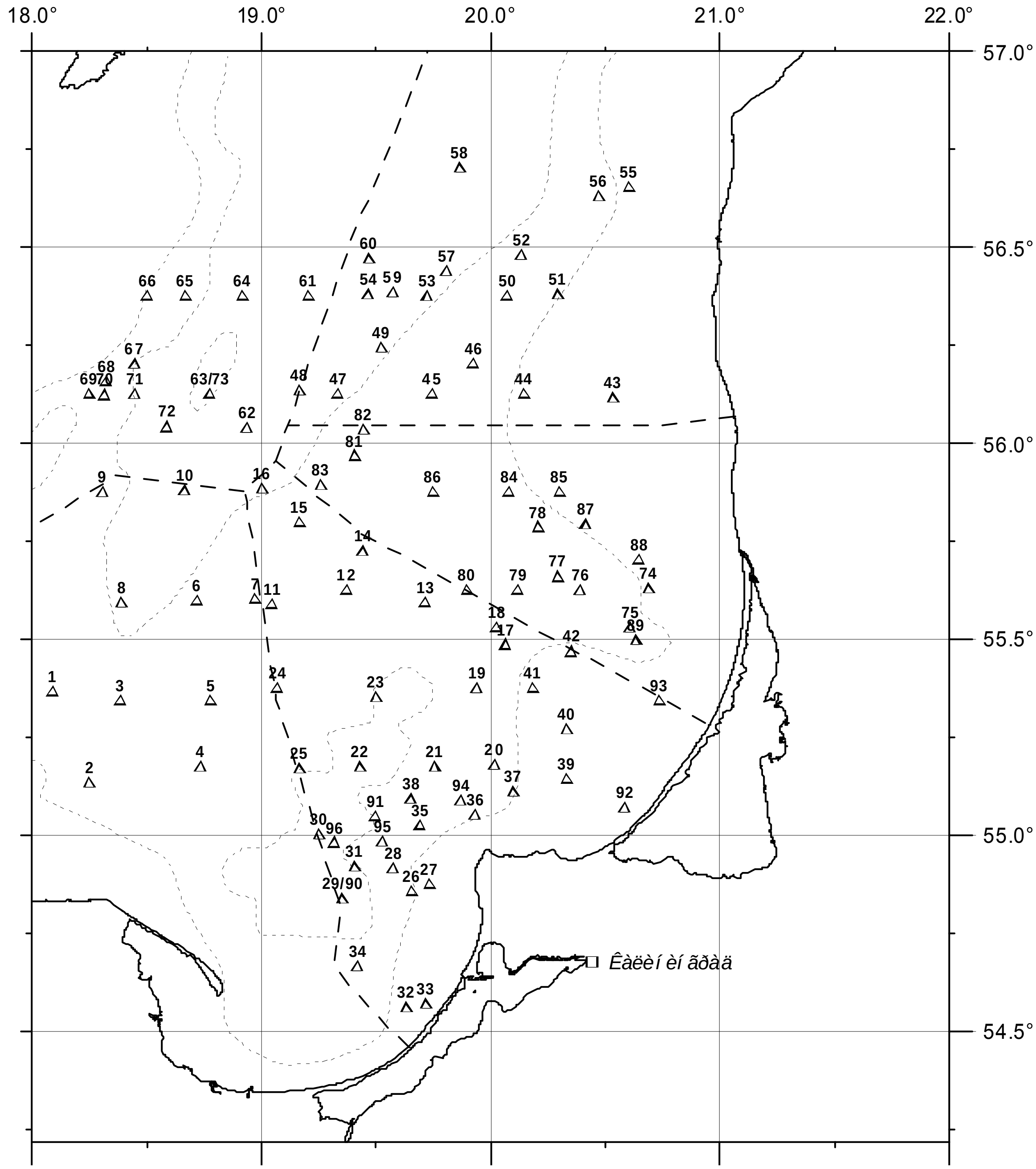

Figure 14. Location of hydrographic stations in February- March 2004, RV "ATLANTNIRO".

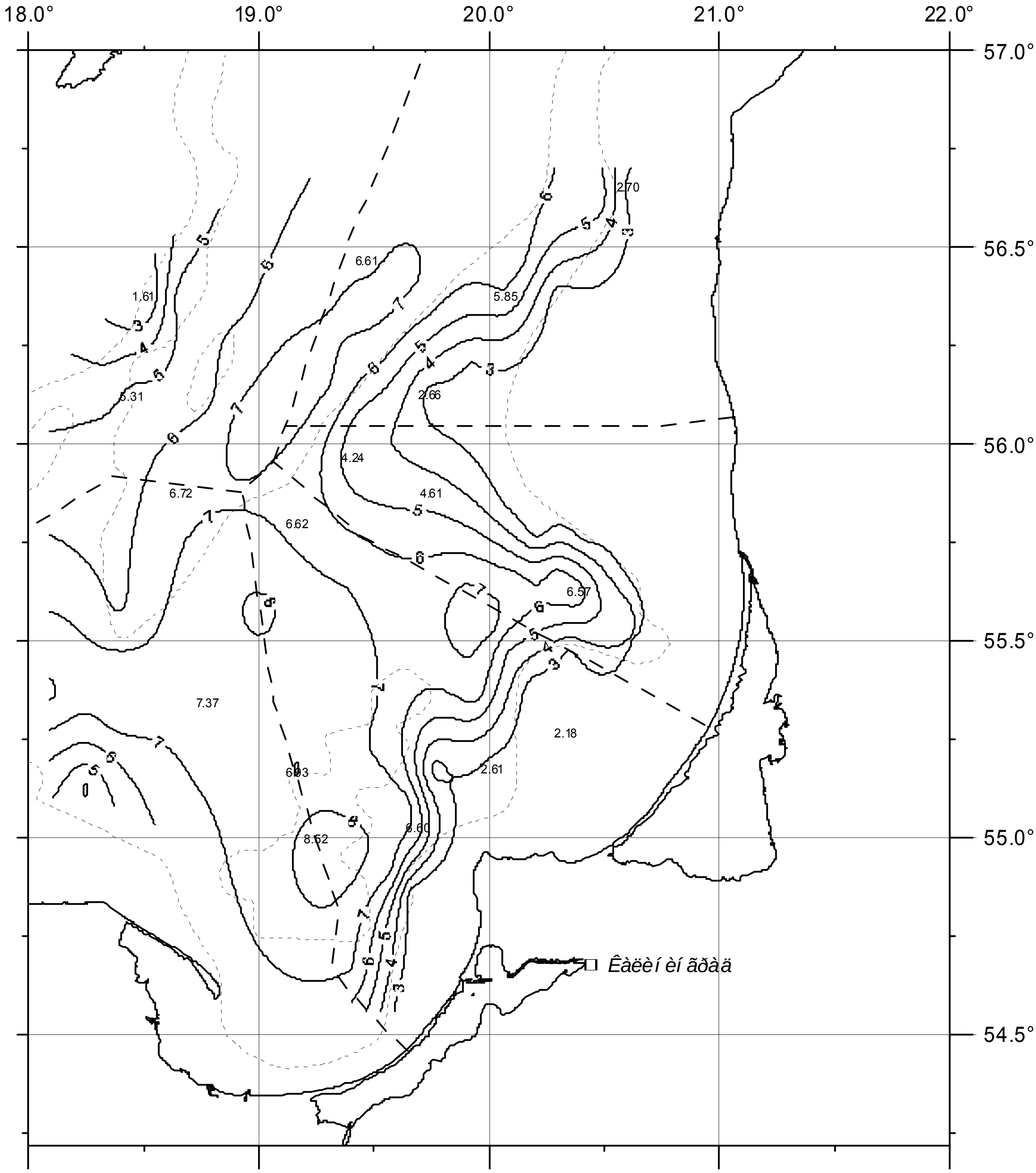

Figure 15. Bottom water temperature distribution (°C) in February- March 2004, RV "ATLANTNIRO".

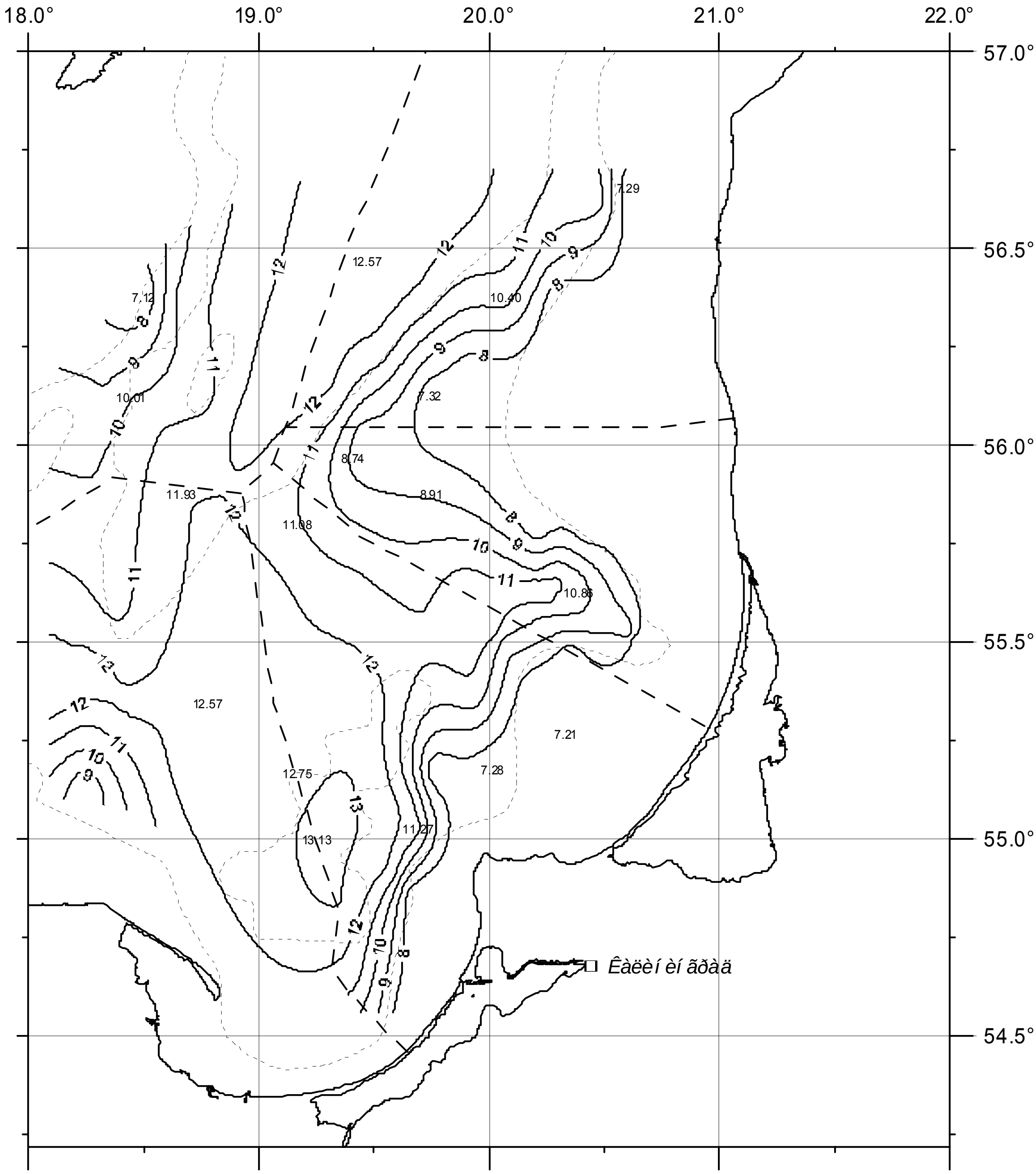

Figure 16. Bottom water salinity distribution (‰) in February- March 2004, RV "ATLANTNIRO"

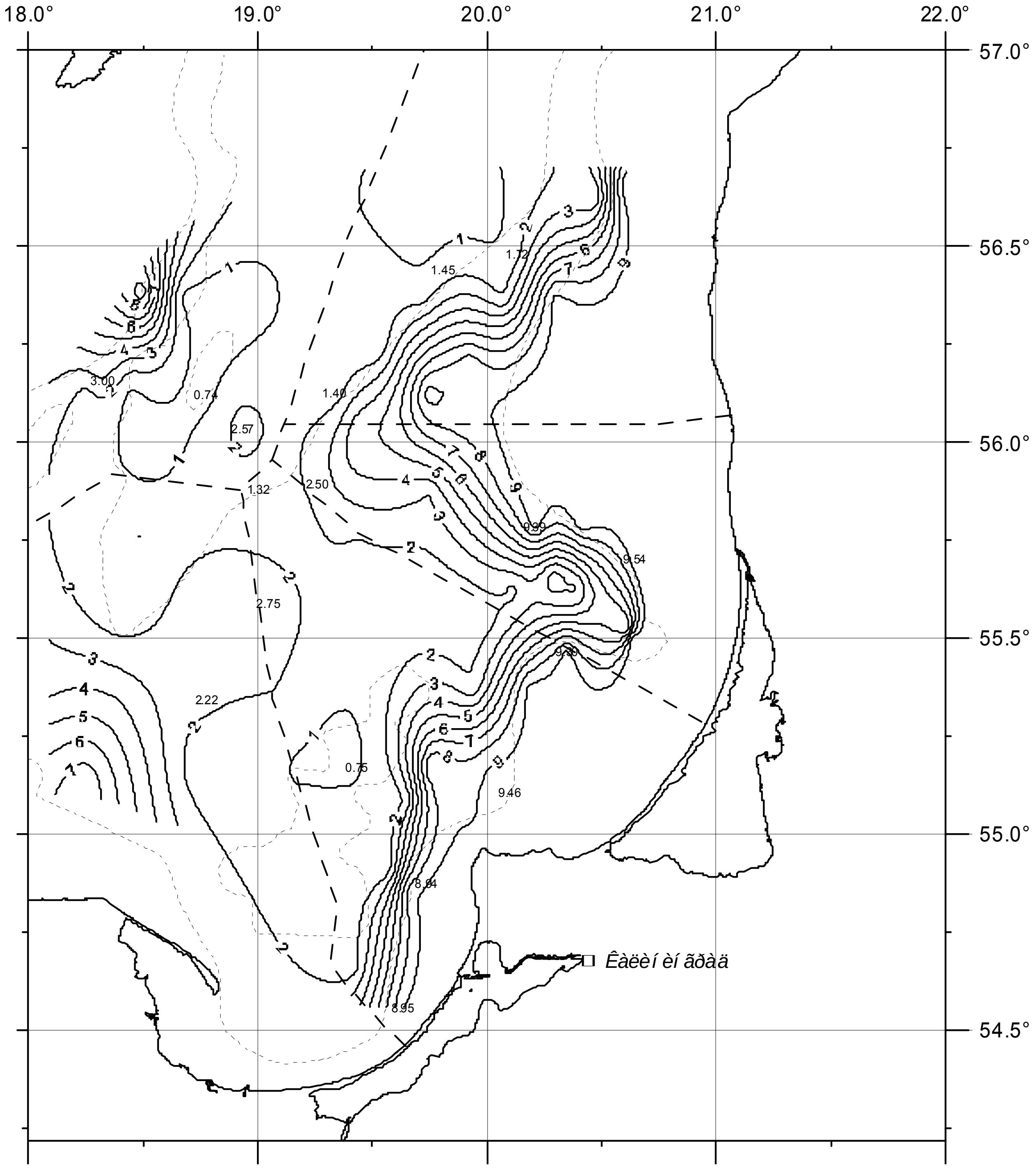

Figure 17. Bottom water oxygen concentration (ml/l) in February-March 2004, RV “ATLANTNIRO”.

Month/Year: Febr.-March 2004

Table 1.

Catch composition (kg/0.5 h) per haul No. in area of the Russia.

haul	rectangle	latitude	longitude	depth	haul	t o t a l	cod		flounder		herring		sprat		others	
nr		??" ??' N	??" ??' E	meter	duration	catch, kg	kg	%	kg	%	kg	%	kg	%	kg	%
6	4064	55360	19027	87	30	240.71	164.58	68.37	15.55	6.46	53.80	22.35	6.20	2.58	0.58	0.24
7	4064	55367	19433	82	30	111.36	15.67	14.07	25.69	23.07	37.00	33.23	33.00	29.63	0.00	0.00
8	4064	55427	19258	75	30	65.43	32.57	49.77	3.20	4.88	28.80	44.01	0.87	1.33	0.00	0.00
9	4065	55317	20010	81	30	249.66	78.63	31.49	16.03	6.42	155.00	62.09	0.00	0.00	0.00	0.00
10	3964	55218	19551	83	30	625.22	550.19	88.00	23.53	3.76	51.50	8.24	0.00	0.00	0.00	0.00
11	3965	55111	20034	59	30	178.67	81.98	45.88	17.69	9.90	75.00	41.98	4.00	2.24	0.00	0.00
12	3964	55103	19289	97	30	15.88	8.60	54.16	6.38	40.17	0.51	3.21	0.39	2.46	0.00	0.00
13	3864	54499	19397	61	30	744.51	93.85	12.61	413.00	55.47	235.00	31.56	0.00	0.00	2.66	0.36
14	3864	54540	19341	86	30	65.73	2.68	4.08	17.05	25.94	46.00	69.98	0.00	0.00	0.00	0.00
15	3864	54545	19245	105	30	276.34	150.21	54.36	123.00	44.51	0.00	0.00	0.98	0.35	2.15	0.78
16	3864	54325	19375	46	30	386.60	19.43	5.03	1.46	0.38	364.00	94.15	0.20	0.05	1.51	0.39
17	3864	54330	19424	20	30	111.78	1.45	1.30	10.32	9.23	60.00	53.68	0.00	0.00	40.01	35.80
18	3964	550057	194038	73	30	495.82	46.29	9.34	9.53	1.92	440.00	88.74	0.00	0.00	0.00	0.00
19	3965	55065	20050	58	30	334.25	99.21	29.68	1.04	0.31	225.00	67.32	9.00	2.69	0.00	0.00
20	3964	55045	19368	87	30	533.31	185.58	34.80	267.00	50.07	80.00	15.00	0.00	0.00	0.73	0.14
21	3965	55073	20191	43	30	37.91	0.81	2.12	2.02	5.33	30.60	80.73	2.55	6.73	1.93	5.09
46	3965	55034	20336	24	30	0.96	0.00	0.00	0.12	12.50	0.00	0.00	0.00	0.00	0.84	87.50
47	3964	55041	19533	65	30	243.66	71.53	29.36	1.83	0.75	168.00	68.95	2.00	0.82	0.30	0.12
48	3864	54578	19322	89	30	95.47	43.30	45.36	37.02	38.77	15.12	15.84	0.00	0.00	0.03	0.03
49	3864	54360	19347	68	30	209.97	8.76	4.17	6.21	2.96	132.00	62.87	63.00	30.01	0.00	0.00
sum						5023.24	1655.31	32.95	997.67	19.86	2197.33	43.74	122.19	2.43	50.74	1.01

Table 2.

Catch composition (kg/0.5 h) per haul No. in area of the Lithuania.

haul	rectangle	latitude	longitude	depth	haul	t o t a l	cod		flounder		herring		sprat		others	
nr		??" ??' N	??" ??' E	meter	duration	catch, kg	kg	%	kg	%	kg	%	kg	%	kg	%
37	4065	55326	20386	64	30	1516.87	1088.7	71.77	11.95	0.79	415.33	27.38	0	0.00	0.92	0.06
38	4065	55384	20189	72	30	483.556	3.541	0.73	2.29	0.47	475	98.23	2.7	0.56	0.02	0.01
39	4065	55470	20147	57	30	385.52	2.61	0.68	2.21	0.57	323	83.78	57	14.79	0.70	0.18
40	4064	55572	19236	66	30	65.579	2.534	3.86	0	0.00	57.63	87.88	5.415	8.26	0.00	0.00
41	4064	55535	19149	75	30	52.124	4.704	9.02	0.42	0.81	47	90.17	0	0.00	0.00	0.00
42	4065	55528	20043	60	30	4004.82	0	0.00	0.62	0.02	4000	99.88	0	0.00	4.20	0.10
43	4065	55475	20227	51	30	781.963	1.523	0.19	1.39	0.18	199	25.45	575.4	73.58	4.65	0.59
44	3965	55294	20387	59	30	306.048	0.822	0.27	0.57	0.19	270	88.22	34	11.11	0.66	0.21
45	4065	55416	20402	46	30	140.573	0	0.00	0	0.00	31	22.05	109	77.54	0.57	0.41
sum						7737.053	1104.4	14.27	19.45	0.25	5818	75.20	783.52	10.13	11.72	0.15

Table 3.

Catch composition (kg/0.5 h) per haul No. in area of the Latvia.

haul	rectangle	latitude	longitude	depth	haul	t o t a l	cod		flounder		herring		sprat		others	
nr		??" ??' N	??" ??' E	meter	duration	catch, kg	kg	%	kg	%	kg	%	kg	%	kg	%
22	4165	56054	20326	34	30	124.91	1.79	1.43	43.5	34.83	70	56.04	1.48	1.18	8.14	6.52
23	4164	56075	19477	57	30	297.437	0.452	0.15	0.69	0.23	65	21.85	230	77.33	1.30	0.44
24	4164	56110	19543	61	30	168.204	0.411	0.24	0.98	0.58	98	58.26	67	39.83	1.81	1.08
25	4164	56132	19295	103	30	93.619	32.674	34.90	58.5	62.49	1.105	1.18		0.00	1.34	1.43
26	4165	56237	20058	75	30	513.129	7.429	1.45	30.7	5.98	430	83.80	45	8.77	0.00	0.00
27	4165	56284	20069	87	30	150.98	6.9	4.57	68	45.04	76	50.34		0.00	0.08	0.05
28	**4265**	56398	20382	57	30	473.857	1.027	0.22	7.8	1.65	14.5	3.06	445	93.91	5.53	1.17
29	**4265**	56367	20275	73	30	1442.98	0.578	0.04	42	2.91	130	9.01	1270	88.01	0.40	0.03
30	4164	56252	19471	107	30	160.537	22.537	14.04	136	84.72	0.78	0.49		0.00	1.22	0.76
31	4164	56225	19318	136	30	242.939	105.1	43.27	136.5	56.19		0.00		0.00	1.32	0.54
sum						3668.59	178.92	4.88	524.67	14.30	885.39	24.13	2058.5	56.11	21.14	0.58

Table 4.

Catch composition (kg/0.5 h) per haul No. in area of the Sweden.

haul nr	rectangle	latitude ??" ??' N	longitude ??" ??' E	depth meter	haul duration	t o t a l catch, kg	cod		flounder		herring		sprat		others	
							kg	%	kg	%	kg	%	kg	%	kg	%
32	4163	56012	18544	120	30	210.03	82.5	39.28	125	59.52	0	0.00	0	0.00	2.53	1.20
33	4163	56122	18268	77	30	164.14	0	0.00	4.14	2.52	160	97.48	0	0.00	0.00	0.00
34	4163	56142	18271	73	30	51.007	15.597	30.58	8.77	17.19	19	37.25	7.25	14.21	0.39	0.76
35	4163	56109	18206	70	30	747.312	73.512	9.84	17.36	2.32	632	84.57	24	3.21	0.44	0.06
36	4163	56074	18171	71	30	800.36	0	0.00	0.36	0.04	308	38.48	492	61.47	0.00	0.00
sum						1972.85	171.61	8.70	155.63	7.89	1119	56.72	523.25	26.52	3.36	0.17

Table 5.

Catch composition (kg/0.5 h) per haul No. in area of the Poland.

haul nr	rectangle	latitude ??" ??' N	longitude ??" ??' E	depth meter	haul duration	t o t a l catch, kg	cod		flounder		herring		sprat		others	
							kg	%	kg	%	kg	%	kg	%	kg	%
1	3963	55187	18229	80	30	38.58	13.72	35.56	2.72	7.05	10.57	27.40	11.2	29.03	0.37	0.96
2	3963	55105	18393	88	30	215.564	5.495	2.55	30.02	13.93	29.8	13.82	144.2	66.89	6.05	2.81
3	3963	55192	18451	88	30	134.51	11.033	8.20	55.96	41.60	10.625	7.90	21.52	16.00	35.37	26.30
4	4063	55375	18580	86	30	164.753	56.748	34.44	18.36	11.14	63.8	38.72	25.7	15.60	0.15	0.09
5	4063	55343	18212	90	30	45.78	0	0.00	0.78	1.70	45	98.30	0	0.00	0.00	0.00
sum						599.187	86.996	14.52	107.84	18.00	159.8	26.67	202.62	33.82	41.94	7.00