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REPORT OF THE

BALTIC INTERNATIONAL FISH SURVEY WORKING GROUP

Copenhagen, Denmark
24-28 March 2003

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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TABLE OF CONTENTS

Section **Page**

1 INTRODUCTION

1.1 Participants

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1.2 Terms of Reference

According to Annual Science Conference Resolution (C.Res 2002/2G04) in Copenhagen last year, the Baltic International Fish Survey Working Group [WGBIFS] (Chairperson: R. Oeberst, Germany) will meet at Copenhagen, Denmark from 24-28 March 2003 to:

a) combine and analyse the results of the 2002 acoustic surveys and experiments and report to WGBFAS;

b) update the hydroacoustic databases BAD1 and BAD2 for the years 1991 to 2002;

c) plan and decide on acoustic surveys and experiments to be conducted in 2003 and 2004;

d) update, if necessary, the Baltic International Acoustic Survey (BIAS) manual;

e) discuss the results from BITS surveys made in autumn 2002 and spring 2003;

f) plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2003 and spring 2004 (as well as autumn 2004);

g) update and correct the Clear Tow database;

h) continue to study the proposed model for estimating the conversion factors between new and old survey trawls under inclusion of the new inter-calibration experiments;

i) update, if necessary, the Baltic International Trawl Survey (BITS) manual;

j) develop protocols and criteria to ensure standardization of all sampling tools and survey gears;

k) investigate the TS distributions and length frequency distributions from 2001-2002 surveys.

WGBIFS will report by 25 April 2003 for attention of the Living Resources Committee and to the Baltic and Resource Management Committee.

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 includes 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).

The activities in 2001 were concentrated on the initialisation of the 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.

Last year activities were in addition to standard acoustic and dermersal surveys devoted the inter-calibration of gears used during the 1996-2001 period and the different versions of the new standard survey gear (TV3).

The most important future activities are to combine and analyse 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, 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 1996-2002

The WGBIFS activities was initiated in 1996 to promote co-ordination and standardization 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 inter-calibration 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 inter-calibration program 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 planned inter-calibration programs. 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 of inter-calibration experiments 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 new inter-calibration experiments are necessary.

2 RESULTS OF THE 2002 BALTIC ACOUSTIC SURVEYS

In 2002 the following acoustic surveys were conducted during October, November and December:

Vessel	Country	Area
ARGOS	Sweden	27 and parts of 24,25,28,29S
ATLANTNIRO	Russia	26,28
BALTICA	Poland	25,26 (parts 24)
SOLEA	Germany, Denmark	22,23,24
SOLVEIG	Estonia	28,29
ZANE	Latvia	26,28

The results from the different cruises are stored in the database BAD1. The cruise reports are presented in Annex 1 using the suggested standard format (ICES CM 2002/G:05 Ref. H, Annex 5)

The cruise reports with results from the May/June acoustic surveys for sprat are given in Annex 2.

2.1 Combined results and overlapping areas

During the international acoustic survey 2002, twenty-two 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 late November and December. For the further use of these data it was necessary to propose how these data should be used in the estimates for the ICES Sub-divisions.

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 the abundance in numbers by rectangle for herring and sprat are given. Overlapping coverage by two or more vessels is indicated by grey shadow.

2.2 Total results

The results of the international acoustic survey in 2002 are summarized in 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 Tables 2.1.2.3 and 2.1.2.4 for herring and sprat. These data are also given by ICES Subdivision and age group.

The WGBIFS recommends that the data from 2002 can be used in the estimation process of the herring and sprat stocks. For comparing acoustic estimates of different years it seems to be better to use the acoustic estimates as index values in number per NM^2.

The following estimations of the acoustic survey in the Baltic Sea area must be regarded with care:

- Estimation of the herring 2+ age group in SD 22, 23 and 24:

It is known from tagging experiments that in autumn older herring (2+ age group) is migrating from the feeding areas in the North Sea and Skagerrak through the Kattegat (SD 21) for over wintering in the Sound (SD 23) to the main spawning grounds around Rügen, reaching this area during spring time. Since the corresponding acoustic survey is not covering the whole area at the same survey time (excluding the Skagerrak and northern Kattegat area, respectively), the older herring (2+ age group) may be underestimated.

- Estimation of the young herring and young sprat in the eastern Baltic Sea (Subdivisions 25-32):

The young herring and sprat stay partly in the shallow water of the eastern Baltic Sea. These areas can not be investigated with the used vessels. Therefore the abundance of these groups is uncertain.

2.3 Possible effects of Aurelia on the result

The Sea Fisheries Institute in Gdynia has conducted hydroacoustic surveys in the southern Baltic Sea since 1982. The cruises usually take place in October and have been conducted from the r/v *Baltica* since 1994. The Baltic International Fish Survey Working Group (BIFSWG) has co-ordinated the surveys for the last seven years.

Working paper was presented (Grygiel et al. Appendix 4) that study the occurrence of jellyfish during the acoustic surveys in the Polish EEZ and to analyse possible effects of jellyfish concerning the acoustic estimates of fish. This paper presents basic results of fish species composition and the CPUE of fishes in the control catches made during the October 2002 cruise of the r/v *Baltica* which took place in the Polish EEZ. Changes in some hydrological parameters (mainly in the seawater temperature) were observed during this period in the southern Baltic Sea, and the occurrence of relatively high concentrations of the jellyfish (medusae) *Aurelia aurita* were noted. The jellyfish by-catch was estimated with regard to the mass of fish caught and to its geographical distribution. An attempt was made to statistically evaluate the dependencies between the CPUEs of jellyfish and fish and between the CPUEs and water temperature in the area where the pelagic trawl was deployed. One of the causes of distortion in the indications of the EY-500 echo sounder transducer was revealed.

Table 2.1.1.1 Treatment of data from rectangles with overlapping in October 2002.

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	2	Sum of areas
24	39G3	Solea	Whole area	4	Argos	Whole area	3	Arithm. mean
24	39G4	Solea	Whole area	4	Argos	Whole area	1	Solea data
25	39G4	Solea	Not covered	4	Argos	Whole area	1	Argos data
25	39G5	Argos	NW part storm	0	Baltica	SE part	2	Baltica data
25	40G7	Argos	Whole area	1	Baltica	Small part in S	0	Argos data
26	38G9	Baltica	SW part	5	Atlantniro	NE part	3	Sum of areas
26	39G8	Baltica	Very small part	0	Atlantniro	Whole area	?	Atlantniro data
26	39G9	Baltica	Small part in W	2	Atlantniro	Whole area	?	Atlantniro data
26	40G8	Baltica	Small part in E	0	Atlantniro	Whole area	?	Atlantniro data
26	41G9	Atlantniro	Whole area	3	Zane	NE part	1	Atlantniro data
26	41H0	Atlantniro	W part	2	Zane	NW part	0	Atlantniro data
28	42H0	Atlantniro	Whole area	3	Zane	Whole area	0	Atlantniro data
28	43H0	Atlantniro	Whole area	4	Zane	Whole area	3	Arithm. mean
28	43H1	Atlantniro	Small part in NW	0	Zane	NW part	1	Zane data
28	44H0	Atlantniro	Whole area	4	Zane	S part	2	Atlantniro data
28	44H1	Atlantniro	W part	2	Zane	SW part	1	Atlantniro data
28	45HO	Atlantniro	Whole area	?	Solveig *	NE part	1	Atlantniro data
28	45H1	Atlantniro	W part	?	Solveig *	W part	1	Atlantniro data
29	46H0	Argos	Whole area	2	Solveig *	E part	0	Argos data
29	46H1	Argos	W part	1	Solveig *	Whole area	2	Argos data
29	47H1	Argos	Whole area	2	Solveig *	S part	1	Argos data

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

Table 2.1.1.2 Estimated numbers (millions) of herring in October 2002

Ship	SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
SOL	22	37G0	169.66	166.43	3.15	0.06	0.02					
SOL	22	37G1	1110.54	819.65	238.85	20.79	19.35	10.41		1.49		
SOL	22	38G0	639.89	627.71	11.87	0.23	0.08					
SOL	22	38G1	285.91	278.96	6.95							
SOL	22	39F9	3.14	3.14								
SOL	22	39G0	42.44	42.20	0.24							
SOL	22	39G1	92.56	91.25	1.31							
SOL	22	40F9	0.26	0.24	0.02							
SOL	22	40G0	6.36	5.96	0.40							
	22 Total		2350.76	2035.54	262.79	21.08	19.45	10.41		1.49		
SOL	23	40G2	439.13	39.51	164.11	123.70	75.79	26.04	5.30	2.38	1.83	0,47
SOL	23	41G2	21.02	9.43	9.47	1.12	0.59	0.28	0.07	0.03	0.02	0,01
	23 Total		460.15	48.94	173.58	124.82	76.38	26.32	5.37	2.41	1.85	0.48
SOL	24	37G2	23.16	12.76	3.40	2.98	2.84	0.90	0.21	0.05		0,02
SOL	24	38G2	537.61	350.75	19.09	32.38	73.15	46.08	10.11	3.45	0.22	2,38
SOL	24	38G3	904.75	236.57	60.08	101.46	270.07	187.83	29.24	10.90	0.60	8,00
uBAL+SOL	24	38G4	648.35	577.95	22.23	18.27	21.39	6.54	2.13	0.63	0.87	0,31
SOL	24	39G2	161.10	64.49	2.66	16.62	36.75	28.78	7.60	2.76		1,44
uARGSOL	24	39G3	360.16	239.68	36.71	22.25	38.39	15.47	5.56	1.15	1.44	0,24
uSOL	24	39G4	156.16	64.63	37.38	22.31	21.07	8.06	1.97	0.56		0,18
	24 Total		2791.29	1546.83	181.54	216.27	463.66	293.66	56.82	19.50	3.13	12.57
BAL	25	37G5	53.00	29.53	9.69	2.93	6.94	1.14	1.87	0.48	0.26	0,16
BAL	25	38G5	195.00	67.30	36.89	20.68	36.08	12.57	12.57	4.05	2.84	2,03
BAL	25	38G6	421.00	195.38	83.07	29.52	65.87	15.29	20.76	5.55	2.76	2,79
BAL	25	38G7	50.00	7.86	12.75	7.50	13.49	2.53	3.63	1.04	0.65	0,54
ARG	25	39G4	105.54	14.86	16.50	17.11	27.15	16.08	8.20	5.12		0,51
uBAL	25	39G5	124.00	23.52	27.10	16.53	31.81	8.69	10.00	2.69	2.40	1,25
BAL	25	39G6	164.00	44.63	46.24	16.79	36.05	5.10	9.73	2.64	1.46	1,35
BAL	25	39G7	580.00	150.97	145.30	68.96	134.46	23.24	36.05	9.95	6.45	4,61
ARG	25	40G4	53.51	10.99	4.97	13.81	10.99	6.83	4.01	1.58	0.33	
ARG	25	40G5	256.87	13.54	23.64	24.66	62.18	62.53	44.62	15.20	8.79	1,70
ARG	25	40G6	401.14	4.66	16.40	39.93	157.21	107.13	55.39	16.49	3.34	0,58
uARG	25	40G7	201.74		6.22	13.07	103.67	55.50	20.88	2.39		
ARG	25	41G6	153.53		1.77	14.52	57.52	47.36	25.04	7.32		
ARG	25	41G7	153.00	0.09	6.07	14.67	45.22	48.36	31.99	3.67	2.93	
	25 Total		2912.31	563.33	436.61	300.67	788.65	412.36	284.75	78.19	32.21	15.53
BAL	26	37G8	198.00	89.84	71.12	9.02	14.86	2.97	7.29	1.53	0.46	0,92
BAL	26	37G9	181.00	82.13	65.01	8.24	13.58	2.71	6.67	1.40	0.42	0,84
BAL	26	38G8	177.00	11.76	59.94	27.85	38.96	10.44	15.29	4.97	3.12	4,66
uATL+BAL	26	38G9	187.40	60.49	57.03	18.56	24.19	6.47	11.40	3.79	2.59	2,88
uATL	26	39G8	650.70	30.36	98.15	83.39	181.41	59.15	111.98	31.87	31.99	22,40
uATL	26	39G9	194.10	2.10	19.20	14.70	54.02	23.31	25.24	15.65	25.21	14,67
ATL	26	39H0	78.80	26.96	22.28	7.13	8.36	1.48	4.43	2.86	1.54	3,76
uATL	26	40G8	396.20	0.89	8.12	28.44	125.99	61.89	96.37	38.98	17.36	18,16
ATL	26	40G9	148.20	0.32	24.33	14.98	41.56	16.39	22.53	10.10	9.05	8,94
ATL	26	40H0	397.70	145.11	41.38	9.63	30.34	23.14	38.41	36.99	45.53	27,17
ATL	26	41G8	300.80	1.32	9.42	23.09	99.81	37.42	68.76	35.09	13.71	12,18
uATL	26	41G9	897.00	1.87	39.88	63.71	217.52	128.06	191.53	99.76	120.72	33,95
uATL	26	41H0	218.60	5.53	62.77	21.83	44.39	27.30	26.44	12.39	9.46	8,49
	26 Total		4025.50	458.67	578.63	330.58	895.00	400.73	626.34	295.38	281.16	159.02
ARG	27	42G7	390.66	0.44	22.85	35.62	103.72	124.83	86.89	5.99	10.33	
ARG	27	43G7	1241.68	167.17	68.42	226.89	396.24	186.03	126.34	35.16	31.48	3,94
ARG	27	44G7	413.48	121.76	110.97	116.48	35.79	24.65	3.46	0.37		
ARG	27	44G8	351.24	4.43	37.79	111.56	124.55	41.47	25.39	6.05		
ARG	27	45G7	278.50	174.73	38.46	37.08	23.04	5.19				
ARG	27	45G8	861.10	10.22	116.63	221.65	408.21	90.42	13.97			
ARG	27	46G8	400.83	398.80	2.03							
	27 Total		3937.48	877.55	397.14	749.29	1091.55	472.58	256.05	47.57	41.80	3.94
ATL	28	42G8	173.30		2.51	9.12	53.24	27.33	41.19	20.83	15.84	3,24

ATL	28 42G9	108.00		2.41	5.80	26.49	15.83	33.83	7.07	10.01	6,56
uATL	28 42H0	556.90	27.51	29.79	37.37	124.24	77.63	120.96	60.26	41.71	37,43
ARG	28 43G8	132.61	2.35	1.41	0.47	39.03	72.79	14.48	1.60	0.47	
ATL	28 43G9	370.00	5.03	5.44	11.95	90.06	59.76	113.18	40.40	32.12	12,06
uATLZANE	28 43H0	902.71	64.88	15.49	100.88	206.43	110.39	185.89	76.44	67.04	75,27
uZANE	28 43H1										
ATL	28 44G9	107.10	8.63	2.42	6.48	33.79	13.22	25.61	10.46	5.54	0,95
uATL	28 44H0	313.90	98.72	3.96	32.83	47.78	35.09	45.02	22.13	18.08	10,29
uATL	28 44H1	488.30	212.26	81.16	140.48	29.60	8.25	9.42	5.37		1,76
ATL	28 45G9	555.70	218.17	7.00	37.12	88.52	59.57	74.41	41.01	29.90	
uATL	28 45H0	108.50	19.43	1.06	15.55	24.65	12.98	16.82	9.45	5.70	2,86
uATL	28 45H1	2547.70	584.19	55.03	551.32	465.46	199.99	316.68	124.33	136.05	114,65
	28 Total	6364.71	1241.17	207.68	949.37	1229.29	692.83	997.50	419.35	362.46	265.07
ARG	29 46G9	762.27	132.77	96.95	137.26	321.20	65.24	8.84			
uARG	29 46H0	596.76	358.17	14.38	78.30	104.00	29.67	12.24			
uARG	29 46H1	2206.03	2206.03								
EST	29 46H2	24.02	11.95	3.42	2.07	3.25	1.70	1.26	0.25	0.12	
ARG	29 47G9	2615.07	2386.37	68.60	68.58	57.94	33.57				
ARG	29 47H0	1370.86	592.48	166.79	286.20	211.91	108.46	5.01			
uARG	29 47H1	2118.25	557.82	222.98	468.34	663.80	205.33				
EST	29 47H2	2068.65	1951.34	28.84	40.87	21.80	10.03	11.41	2.67	1.70	
	29 Total	11761.92	8196.92	601.95	1081.63	1383.90	454.00	38.76	2.92	1.82	
	Grand Total	34604.12	14968.96	2839.94	3773.71	5947.87	2762.90	2265.59	866.81	724.44	456.61

Table 2.1.1.3 Estimated numbers (millions) of sprat in October 2002

Ship	2.4	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
SOL	22	37G0	21.06	11.77	5.84	1.37	0.32	0.88	0.88			
SOL	22	37G1	622.78	345.42	168.07	53.26	27.80	16.24	9.76	2.23		
SOL	22	38G0	79.45	44.39	22.04	5.18	1.22	3.31	3.31			
SOL	22	38G1	20.38	13.27	5.54	1.14	0.26	0.14	0.03			
SOL	22	39F9	106.88	105.85	0.97	0.06						
SOL	22	39G0	2.20	2.20								
SOL	22	39G1	121.24	120.69	0.44	0.08	0.03					
SOL	22	40F9	7.18	7.18								
SOL	22	40G0	178.82	178.71	0.11							
	22 Total		1159.99	829.48	203.01	61.09	29.63	20.57	13.98	2.23	0.00	0.00
SOL	23	40G2	11.84	4.26	1.21	1.67	3.02	1.12	0.41	0.15		
SOL	23	41G2	31.91		14.41	5.60	10.93	0.43	0.53	0.01		
	23 Total		43.75	4.26	15.62	7.27	13.95	1.55	0.94	0.16	0.00	0.00
SOL	24	37G2	77.66	73.45	2.74	0.44	0.49	0.20	0.22	0.11		0.01
SOL	24	38G2	138.89	94.52	27.56	4.37	6.72	2.35	2.17	0.85	0.01	0.34
SOL	24	38G3	1038.42	579.03	348.19	32.29	49.56	9.28	15.53	1.00	0.03	3.51
uBAL+SOL	24	38G4	2146.92	1803.87	133.70	83.45	51.11	44.90	15.74	11.60	1.89	1.28
SOL	24	39G2	32.82	14.54	15.08	1.40	1.05	0.27	0.26	0.22		
uARGSOL	24	39G3	778.06	48.25	476.53	64.38	87.74	32.31	43.24	14.22	3.35	8.06
uSOL	24	39G4	985.56	291.19	460.79	73.35	77.11	31.29	31.56	17.94	0.36	1.97
	24 Total		5198.33	2904.85	1464.59	259.68	273.78	120.60	108.72	45.94	5.64	15.17
BAL	25	37G5	556.00	297.49	80.45	65.04	50.60	52.36	6.51	3.55		
BAL	25	38G5	1471.00	591.14	319.97	206.98	169.36	156.11	17.82	9.62		
BAL	25	38G6	241.00	106.21	45.44	33.34	25.18	24.96	3.17	2.12	0.58	
BAL	25	38G7	95.00	8.14	33.96	19.77	15.87	14.62	1.69	0.96		
ARG	25	39G4	13.94	1.34	4.91	1.09	3.72	0.33	1.27	0.10	0.63	0.54
uBAL	25	39G5	599.00	26.68	290.53	108.61	86.95	73.20	8.60	4.42		
BAL	25	39G6	1356.00	235.40	520.06	227.24	189.49	154.73	18.55	10.53		
BAL	25	39G7	985.00	53.35	403.72	193.89	160.04	145.81	17.91	9.91	0.38	
ARG	25	40G4	163.06	1.83	40.81	7.83	49.37	10.38	28.97	0.91	9.11	13.85
ARG	25	40G5	277.96	0.00	33.96	57.05	76.07	11.11	82.80	1.46	5.85	9.65
ARG	25	40G6	157.89	0.00	22.39	16.56	40.97	9.16	35.16	8.80	16.04	8.83
uARG	25	40G7	56.45	0.00	6.97	4.40	21.94	6.95	9.17	2.24	3.90	0.88
ARG	25	41G6	19.58	0.00	4.66	0.55	3.66	0.30	3.67	1.99	2.69	2.05
ARG	25	41G7	101.10	0.17	13.73	7.99	28.01	8.22	20.82	3.66	12.45	6.05
	25 Total		6092.98	1321.75	1821.57	950.34	921.22	668.25	256.09	60.27	51.63	41.84
BAL	26	37G8	1780.00	1055.35	596.94	66.04	35.21	23.51	1.86	0.55	0.55	
BAL	26	37G9	1337.00	792.70	448.38	49.60	26.44	17.66	1.40	0.41	0.41	
BAL	26	38G8	1251.00	31.81	771.99	209.68	126.45	92.01	11.27	6.49	1.30	
uATL+BAL	26	38G9	2855.05	1104.35	1234.61	177.79	216.56	42.66	61.80	1.80	9.92	11.13
uATL	26	39G8	1149.70	41.16	151.66	90.65	344.42	55.68	318.08	25.07	87.28	35.69
uATL	26	39G9	6991.90	1115.68	3718.52	254.34	1223.77	83.95	481.55	15.54	58.56	39.99
ATL	26	39H0	4354.10	1641.18	2223.17	149.66	226.69	0.00	83.60	0.00	24.68	5.11
uATL	26	40G8	2303.50	264.44	386.24	211.26	645.27	150.17	495.15	37.16	70.33	43.49
ATL	26	40G9	3915.40	1704.06	1011.01	189.99	463.44	71.01	367.72	14.89	63.01	30.28
ATL	26	40H0	5033.80	4332.72	443.02	22.86	125.78	5.99	63.59	2.66	24.89	12.28
ATL	26	41G8	2223.00	152.60	281.55	252.79	810.06	136.93	488.53	16.71	62.04	21.79
uATL	26	41G9	2160.80	206.49	658.89	211.32	564.43	30.36	338.74	40.50	82.12	27.95
uATL	26	41H0	1990.70	1416.15	312.92	47.12	112.83	6.72	58.69	3.89	27.09	5.29
	26 Total		37345.95	13858.71	12238.90	1933.11	4921.35	716.65	2771.96	165.68	512.18	232.99
ARG	27	42G7	458.62	0.84	34.27	44.98	145.38	55.03	101.07	2.06	58.99	16.00
ARG	27	43G7	520.43	0.68	37.34	122.09	164.55	12.49	96.74	45.37	33.78	7.40
ARG	27	44G7	1340.93	16.41	125.40	304.13	616.37	14.32	114.63	48.04	28.82	72.81
ARG	27	44G8	306.92	0.00	7.04	39.30	124.71	16.98	56.29	34.94	19.41	8.25
ARG	27	45G7	1490.58	262.19	47.58	463.20	456.40	62.15	100.02	0.00	33.66	65.38
ARG	27	45G8	2253.73	0.00	119.47	482.93	668.66	378.29	330.83	29.34	185.58	58.63
ARG	27	46G8	2748.42	873.53	362.20	475.12	732.91	119.31	55.39	74.57	55.39	0.00

	27 Total	9119.64	1153.64	733.29	1931.74	2908.98	658.58	854.97	234.31	415.64	228.49
ATL	28 42G8	2949.99	2.11	480.26	223.48	1241.65	116.00	640.98	61.69	92.37	91.45
ATL	28 42G9	4542.30	163.52	1099.24	268.00	1826.00	131.73	794.90	18.17	208.95	31.80
uATL	28 42H0	1420.40	27.93	432.40		602.36	51.44	192.66	0.33	24.86	0.33
ARG	28 43G8	214.96	0.82	8.20	38.56	63.67	52.18	29.87	17.23	0.00	4.43
ATL	28 43G9	6299.20	2547.12	768.25	244.24	1498.95	141.55	812.14	0.00	257.51	29.44
uATLZANE	28 43H0	4709.96	955.84	908.61		1257.13	190.88	786.56	27.89	121.10	179.66
uZANE	28	1980.07	131.28	664.03	218.79	525.47	12.16	293.42	48.13	74.63	12.16
ATL	28 44G9	3403.50	17.02	401.61	384.60	1354.59	108.91	701.12	6.81	248.46	180.39
uATL	28 44H0	8579.30	729.24	2256.36	737.82	2951.28	154.43	1269.74	17.16	197.32	265.96
uATL	28 44H1	2395.90	129.38	773.88	146.15	747.52	40.73	301.88	19.17	158.13	79.06
ATL	28 45G9	3041.60	410.62	310.24	231.16	1161.89	118.62	520.11	6.08	179.45	103.41
uATL	28 45H0	9789.10	1566.58	1341.11	754.94	3567.15	418.28	1687.67	19.58	322.10	111.70
uATL	28 45H1	14887.88	11240.30	686.90	183.66	1399.46	103.94	767.59	55.64	297.76	152.62
	28 Total	64214.17	17921.75	10131.10	3801.79	18197.12	1640.85	8798.66	297.87	2182.63	1242.40
ARG	29 46G9	3128.15	723.82	89.05	412.22	569.17	162.34	719.43	167.04	180.69	104.38
uARG	29 46H0	9864.38	4468.09	787.67	690.54	1172.84	450.91	995.83	441.97	441.97	414.55
uARG	29 46H1	3282.87	3174.02	9.08	24.19	9.08	0.00	27.21	30.25	9.06	0.00
EST	29 46H2	13.65	7.09	1.04	0.88	1.87	0.83	0.90	0.30	0.20	0.54
ARG	29 47G9	8554.62	3525.64	813.97	979.87	1980.52	31.10	565.10	0.00	134.79	523.63
ARG	29 47H0	12630.40	10238.29	478.41	526.26	392.32	114.82	516.70	95.68	95.68	172.24
uARG	29 47H1	5123.92	1512.53	182.44	390.19	1122.71	255.61	679.57	377.69	235.63	367.55
EST	29 47H2	2683.35	2303.95	64.14	53.53	106.22	46.61	54.46	16.05	8.86	29.52
	29 Total	45281.34	25953.43	2425.79	3077.69	5354.74	1062.22	3559.20	1128.98	1106.89	1612.40
	Grand Total	168456.14	63947.87	29033.87	12022.71	32620.78	4889.27	16364.52	1935.44	4274.61	3373.28

Table 2.1.2.1 Estimated numbers (millions) of herring in October 2002

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
22	2351	2036	263	21	19	10		1		
23	460	49	174	125	76	26	5	2	2	0
24	2791	1547	182	216	464	294	57	19	3	13
25	2912	563	437	301	789	412	285	78	32	16
26	4026	459	579	331	895	401	626	295	281	159
27	3937	878	397	749	1092	473	256	48	42	4
28	6365	1241	208	949	1229	693	997	419	362	265
29	11762	8197	602	1082	1384	454	39	3	2	
Total	34604	14969	2840	3774	5948	2763	2266	867	724	457

Table 2.1.2.2 Estimated numbers (millions) of sprat in October 2002

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
22	1160	829	203	61	30	21	14	2		
23	44	4	16	7	14	2	1	0		
24	5198	2905	1465	260	274	121	109	46	6	15
25	6093	1322	1822	950	921	668	256	60	52	42
26	37346	13859	12239	1933	4921	717	2772	166	512	233
27	9120	1154	733	1932	2909	659	855	234	416	228
28	64214	17922	10131	3802	18197	1641	8799	298	2183	1242
29	45281	25953	2426	3078	5355	1062	3559	1129	1107	1612
Total	168456	63948	29034	12023	32621	4889	16365	1935	4275	3373

Table 2.1.2.3 Estimated biomass (in tonnes) of herring in October 2002

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
22	32536	19379	9704	1279	1266	768		140		
23	32684	517	8234	10044	8333	3670	997	432	359	95
24	129045	12297	6195	15026	45512	34536	7727	2744	396	1783
25	119254	6662	14608	14569	37268	23795	16056	4890	2081	1199
26	165697	4817	19727	14843	38225	17955	28958	15130	15749	10433
27	89884	4011	6119	18311	33357	18759	11190	2527	1964	185
28	168674	6214	4818	24523	37574	23103	34257	14944	13324	11048
29	133948	31905	11692	25051	37806	13442	1265	81	55	
Total	871722	85804	81097	123647	239342	136027	100450	40887	33928	24743

Table 2.1.2.4 Estimated biomass (in tonnes) sprat in October 2002

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
22	10251	4097	3378	1218	650	485	364	59		
23	675	21	240	121	237	34	18	4		
24	46283	13964	19042	3957	4452	2093	1796	784	108	270
25	76303	7266	23554	14518	14023	10707	4037	958	820	644
26	298668	42249	117091	22471	58175	9518	35332	2384	6699	3006
27	88425	3572	6649	19745	32292	7571	11094	2908	5392	3087
28	557921	53006	95669	41387	202286	19301	102805	3685	26275	14971
29	313056	69993	22185	32518	58105	12493	41651	13689	13462	19669
Total	1391582	194168	287809	135936	370221	62202	197097	24469	52757	41646

3 UPDATE OF THE HYDROACOUSTIC DATABASES BAD1 AND BAD2 FOR THE YEARS 1991-2002

3.1 Status of the BAD1 database

The revision 6 of the database BAD1 contains the results of the Baltic acoustic surveys from 1991 to 2002. Some datasets from previous years were completely re- recalculated. Therefore the revision 6 is not compatible with all older versions.

The intensity of coverage has decreased since 2000 where in total 128 statistical rectangles were covered by five ships. In 2002 six research vessels have worked during the Baltic International Acoustic Survey but only 94 rectangles were covered. The missing areas of the last two years are located mainly in the northeast Baltic, the ICES Subdivisions 30 to 32 but in 2002 also the northwest Baltic, the Kattegat was not investigated. In all other areas of the Baltic we can state an ordinary degree of coverage over the last years. The participation and coverage of all vessels by subdivision in the surveys 1991 to 2002 is depicted in table 3.1.1.

During the WGBIFS 2002 it was recommended that the variability in the results of the acoustic surveys should be analysed. A first analysis of the data from the BAD1 is given in Appendix 1 as the working document "Mean value and variance of BAD1 data for the years 1991 to 2002". Only such rectangles were considered, for which at least seven-year data records are available. Altogether still 73 rectangles remained. As simple characteristics of the time series the average and the standard deviation were used in order to show the spatial and temporal distribution of the target species.

The WG recommends that this database BAD1 should be continued for the next years and that the intensive studies of the data from BAD1 should be continued.

3.2 Status of the BAD2 database

The BAD2 database has been inoperative at least since the previous WGBIFS meeting in 2002. According to the database keeper, DIFRES, the HERSUR and BALTDAT (BAD2) projects are completed and there is no funding for maintenance or further development.

The WGBIFS pointed out that the BAD2 could be a useful tool for studying different aspects of the stock development. However, it is necessary that the field definitions are updated to reflect the actual data and most important, users must be able to access the database.

In the future the following options are possible for the BAD2:

a) Denmark (DIFRES) officially guarantees that they will host and develop the database during the next 5 to 10 years.
b) ICES will host and develop the database in the future.
c) The BAD2 will be discontinued with the consequence that detailed analyses as it was required by the assessment working group (WGBFAS) cannot be done.

The WGBIFS recommend either option a) or b) and that the yearly resources needed to maintain the database is estimated. It is necessary that the assessment working group supports the need of the BAD2.

Table 3.1.1 Baltic Acoustic Surveys in 1991 – 2002

Participation and number of ICES squares covered

		SD												
YEAR	**SHIP**	21	22	23	24	25	26	27	28	29	30	31	32	Grand 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
Grand Total		44	112	24	105	170	188	78	159	71	41	8	21	1021

4 PLAN FOR HYDRO ACOUSTIC EXPERIMENTS AND SURVEYS IN 2003 AND 2004

In 2003 all the Baltic Sea countries (except Lithuania and 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 Sub-div.)	Period of investigation
ARGOS	Sweden	27, part of 25, 28, 29S	2003-10-05 – 2003-10-24
ATLANTNIRO	Russia, Latvia	26, 28	2003-05-20 – 2003-06-10 2003-10-05 – 2003-10-30
BALTICA	Poland	Part of 24, 25, 26	2003-10-01 – 2003-10-20
SOLVEIG	Estonia	28,29,32	2003-10-?? – 2003-10-??
ZANE	Latvia, Estonia	28.5	2003-07-20 – 2003-07-30
WALTHER HERWIG III	Germany	24, 25 part of 26, 27, 28	2003-04-30 – 2003-05-26
SOLEA	Germany, Denmark	21, 22, 23 and 24	2003-09-29 – 2003-10-20

During the acoustic surveys in October 2003 on board of R/V Argos, an experiment will be carried out to compare stratified sampling strategy against random sampling strategy. The experiment will estimate the optimal number of individuals of herring and sprat to be sampled for length and age analysis. The results will be available to the next WGBIFS meeting in 2004.

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

The preliminary plan for acoustic surveys and experiments in 2004 for majority of institutes will be taken after verification of budget plans.

The WGBIFS also recommends that

1) each country conducting acoustic surveys in the Baltic sea should store TS values of herring and sprat on the frequency used for the stock assessment.

2) cage experiments should be conducted to compare TS length distribution with *in situ* measurements of herring,

3) herring and sprat should be collected for radiography from other areas and seasons to be included in the backscattering models, as they become available.

4) the suggested protocol in the Report of the Study Group of Target Strength Estimation in the Baltic Sea for TS measurements should be applied during all 2003 acoustic surveys in the Baltic Sea.

The main results of BIAS should be summarised and reported in standard report format (WD "STUCTURE OF CRUISE REPORTS FOR ACOUSTIC SURVEYS IN THE BALTIC SEA" by T. Groehsler, Appendix 8) and in BAD1 format to the acoustic surveys co-ordinator **(Nils Håkansson)** and the BAD1 keeper **(Eberhard Götze)** <u>not later than one month before the ICES WGBIFS meeting of the next year</u>. These results are intended for the information of the ICES Assessment Working Groups.

5 UPDATING OF THE MANUAL FOR THE BALTIC INTERNATIONAL ACOUSTIC SURVEY (BIAS)

5.1 General

The manual has been discussed during the meeting also considering the modifications proposed in the working document by T. Gröhsler (IOR) & E. Götze (IFH), Germany, in Appendix 2. The revised manual (version 0.80) is presented in Annex 3.

5.2 Problems still left to solved

Since a couple years the following problems are every year addressed in the report but could jet not be solved between the meetings:

- Basic aspects/requirements of survey design
- Gear specific selectivity
- Optimum sample size for length, weight and age distribution
- Calculation method for species composition and length distribution
- Lack of sample hauls

A detailed description of the problems can be found in the 2002 WGBIFS-report (ICES CM 2002/G:05 Ref. H).

The WGBIFS propose that a study group should be established to solve the above mentioned problems.

6 INVESTIGATE THE TS DISTRIBUTIONS AND LENGTH FREQUENCY DISTRIBUTIONS FROM 2001-2002 SURVEYS

6.1 General

The members of the WGBIFS have not recommended this topic during the last meeting in 2002. The WG members were informed about this task end of January 2003. Unfortunately it was not possible to solve these matters within the short notice given. The WGBIFS judges the solution of these tasks for very important. These tasks should actually be worked on by the SGTSEB. Nevertheless the WGBIFS will support this work, as far as it's possible.

6.2 Summary from the Study Group on Target Strength Estimation in the Baltic Sea (SGTSEB)

The following is a citation from the minutes of the Fisheries Technology Committee regarding Study Group on Target Strength Estimation in the Baltic Sea (SGTSEB):

“The Study Group did not produce a written report. Specific recommendations emerging from this meeting were presented orally to the Committee. These were:

1) each country conducting acoustic surveys in the Baltic sea should store TS values of herring and sprat on all available frequencies (i.e. 38, 120 kHz),

2) cage experiments be conducted to compare TS length distribution with *in situ* measurements of herring,

3) herring and sprat should be collected for radiography from other areas and seasons to be included in the backscattering models, as they become available,

4) the suggested protocol for TS measurements should be applied during all 2002 acoustic surveys in the Baltic Sea,

5) a Term of Reference should be included in the 2003 meeting of WGBIFS to investigate the TS distributions and length frequency distributions from the 2001-2002 surveys

The new chair of SGTSEB will be B. Lundgren (Denmark). In addition, members of SGTSEB will meet during the April 2003 meeting of WGBIFS to discuss target strength matters with Baltic acoustic colleagues and to prepare for the 2003 meeting of SGTSEB."

The draft report by Fredrik Arrhenius has been partly revised by Bo Lundgren and is now (end of March 2003) distributed to the study group members. Below is summary of the report from the study group meeting in Sete, June 7 – 8 2002 is given.

The Study Group evaluated the results of calculating backscatter properties of a group of herring and a group of sprat collected in October in the Baltic proper using x-rays to obtain the swimbladder shape and KRM (Kirchhoff-ray mode) modeling. Calculated target strength increases monotonically as a function of length for both the herring group (27 specimens) and the sprat group (25 specimens) at 38 kHz. Calculated mean target strengths varied from approximately –42 to –38.5 dB over a length range extending from 75 to 150 mm caudal (i.e. standard length). Mean target strengths of sprat were consistently higher than those of herring of the same size. Mean target strength-length curves differed noticeably in amplitude and pattern between the two species at 120 kHz. Mean target strengths of herring and sprat at 38 and 120 kHz both peak dorsally at approximately 85^{o} relative to the caudal extension of the fish body length axis, but vary over a broad range for both species. This corresponds well to the mean tilt angle of approximately 5° tilt (front part up) relative to the body axis of the swim bladder for both species. Target strengths decrease as tilt angles deviate from horizontal (i.e. head up or head down). Calculated mean backscattering response surfaces showing the variations of the backscattering response with fish length/sound wavelength ratio (L/λ) and tilt angle contain the same general features for both herring and sprat. They peak at an angle of 85 ^{o} across the range modeled. Target strength is not consistently greater for one species over the other over the range of frequencies examined (38 – 200 kHz). Sprat target strength exceeds that of herring at low (38 – 90 kHz) and intermediate frequencies (130 – 160 kHz) and vice versa at other frequencies, but the difference does not exceed two decibels at any frequency.

Reviews of the latest literature of TS of herring and sprat and current information on the diel cycles of stomach fullness and seasonal cycle of fat content and in different part of the Baltic area are included.

A draft version of a protocol for TS measurements on the Baltic herring and sprat is suggested. This draft protocol was presented for discussion on the WGBIFS-meeting.

7 RESULTS OF BITS IN AUTUMN 2002 AND SPRING 2003 IN SD 22 – 32

The following countries participated in surveys of 2002 and 2003 that covered all Subdivisions except 29 and 32:

Autumn: Sweden, Denmark, Germany, Latvia, Poland and Russia.

Spring: Sweden, Denmark, Germany, Poland, Latvia and Russia.

A summary of national contributions is given below. The number of hauls performed including hauls made for comparative purposes are presented in Table 7.1.

Denmark

In the period from 1-18/11-2002 R/V DANA took 46 hauls using large TW3 standard trawl (TV3#930). 29 of those were taken in Subdivision 25 and 17 hauls in Sub-division 26. In Subdivision 25 5 were double hauls and 1 haul was invalid due to gear damage. In Subdivision 26 3 were double hauls and 2 haul was invalid due to gear damage. Furthermore, 41 CTD samples were obtained. All hauls were worked up following normal BITS routine.

In the period from 4-20/3-2003 R/V DANA took 54 hauls using large TW3 standard trawl (TV3#930). All hauls were taken in Sub-division 25 and 5 were double hauls and 3 haul was invalid due to totally gear damage. Furthermore, 49 CTD samples were obtained. All hauls were worked up following normal BITS routine. Due to total damage of all available standard trawls, it was not possible to finish the 2 remaining hauls given to DANA and the survey was terminated 2 days before scheduled.

In the period from 7-17/3-2003 and 23-28/3-2003 R/V Havfisken took 41 hauls in Sub-division 21-22 and 23 using the small TW3 standard trawl (TV3#520). All hauls were worked up following normal BITS routine.

In the period from 16/10 - 11/11 - 2002 R/V Havfisken took 41 hauls in Sub-division 21-22 and 23 using the small TW3 standard trawl (TV3#520). All hauls were worked up following normal BITS routine.

Poland

In the period of 05-09/11-2002 R/V BALTICA conducted 25 hauls using large TV3#930 trawl. Ten of these hauls were double for calibration purposes (type 3) and one was not fully representative due to partly damage of the net. Eight hauls were made with standard TV-3#930 trawl and other 17 hauls using trawl equipped with bobbins. Furthermore, 22 CTD samples were obtained. The ICES Subdivisions 25 and 26 (southern part within the Polish EEZ) were covered by hauls. Part of the bottom in SD 25 (southern part) is not available to standard bottom trawl TV3#930. No significant difficulties were anticipated.

In February 2003 (during 11 days) R/V BALTICA participated in the international BITS survey, including the calibration experiment (type 3) with large TV3 trawl. In total 47 hauls were made, and from that 20 hauls were conducted with standard gear TV3#930, and 27 hauls using trawl equipped with bobbins. No difficulties related to fishing gear were anticipated. Relatively large numbers of gill nets limited the primary planed areas for trawling.

Germany

The autumn 2002 as well as the spring 2003 BITS surveys were carried out by the RV „Solea" using TV#520. The positions of the hauls were carried out according to the allocated positions of the Clear Tow Database for each stratum of the ICES Sub-division 22 (1 stratum) and 24 (4 strata). Additionally hauls were carried out for the Type 3 calibration experiment. On each trawling positions a CTD profile was made.

Periods of the surveys and number of hauls realized are given in the following text table (in brackets the number of hauls for the calibration):

Date	SD 22	SD 24
18 Nov. to 05 Dec. 2002	11 (2)	48 (8)
18 Feb. to 06 March 2003	11 (0)	47 (8)

Sweden

Autumn 2002

Totally 34 hauls were carried out in SD 25 and 27 from 18 to 29 November 2002. The randomly sampled tows were not all clear and at some stations the oxygen content was well below 2 ml/l. Such stations were, whenever possible, replaced with other or new stations nearby. The number of stations allocated was considered too high for the time available and the large area to be covered. No permission to enter the Latvian water (SD 26) was granted in time for the survey.

Subdivisions 25

In SD 25 a total of 8 assigned stations were not trawled due to oxygen deficiency (0_2 below 2 ml/l) and replaced if possible with other or new stations nearby. A total of 24 hauls (with 2 inter-calibrations hauls) were carried out in this area. In the Bornholm basin, the oxygen levels were above 2 ml/l to around 70 meters of depth and slightly below between 80 and 90 meters depth.

Subdivision 27

In SD 27 a total of 10 stations were trawled while only 1 among the assigned station had oxygen content below 2 ml/l and therefore it was not sampled. In the Gotland Basin the limit for 2 ml/l 0_2 was around 70 meters depth.

Spring 2003

The expedition was conducted on board of R/V Argos between 3 and 20 March 2003. The expedition covered the areas SD 25, 26, 27 and 28. Sweden was assigned 46 randomly selected hauls among those only 30 were sampled due to oxygen deficiency and trawl stations with bottom considered impossible to trawl. Those stations were completed with 11 replacement hauls carried out in the same area and depth strata.

The replacement hauls were added, as the clear tow database is incomplete (trawl stations impossible to trawl). A total of 42 valid stations were sampled together with 9 inter-calibrations hauls. The remaining five trawl stations had oxygen deficiency and were not trawled but included as zeros catch in the survey. In case of few station being sampled within a SD, due to oxygen deficiency or unsuitable bottom, complementary hauls were carried out nearby and in the same depth strata whenever possible. However, those hauls were used for biological sampling only and excluded from the cod biomass estimation.

Subdivision 25

A total of 20 stations were assigned in this area and 18 were trawled (including 7 replacements hauls) together with 8 inter-calibrations hauls. In the Gotland Basin, the oxygen levels were always well above the 2 ml/l threshold.

Subdivion 26

A total of 5 stations were assigned in this area and 5 were trawled together with 1 inter-calibrations haul. In this area, the limit for 2 ml/l 0_2 was around 70 meters depth.

Subdivion 27

A total of 10 stations were assigned in this area and 8 were trawled including 3 complementary hauls. In the Gotland Basin the limit for 2 ml/l 0_2 was around 70 meters depth.

Subdivisions 28

A total of 11 stations were assigned in this area and 11 were trawled including 3 replacement hauls. In the Arkona basin, the oxygen levels were well above the 2 ml/l threshold except for the deepest strata (below 85 m depth).

Latvia

LATFRI conducted demersal surveys both in autumn 2002 and in spring 2003. Both surveys were carried out using standard TV3#20 trawl onboard of Latvian commercial vessels (CLV). The chartered vessels for both surveys were of similar type – MRTK (medium size trawlers). All hauls were performed in Latvian EEZ, in Subdivision 28. However, certain deviation from the planned survey design occurred. The main reasons for that are following:

1. Some allocated stations are located outside Latvian EEZ. However the vessels could work in Latvian waters only. Therefore the stations, outside the Latvian EEZ were replaced with others from the trawl list. The survey coordinator was informed about these replacements.

2. Some stations included in the database obviously were performed with large TV3 trawl or old national gear with bigger rock-hoppers. These stations also were replaced with other stations from the list, where use of small TV3 was possible.

3. The spring survey of 2003 was partly hampered by the heavy ice conditions in Latvian coastal zone.

The manager of clear tow database will be informed on tracks where the use of small TV3 is not possible in order to exclude those from the random selection.

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

Survey	Vessel	Date	Number of hauls in SD 28
Autumn 2002	CLV AGNESE	26 – 30 of November	25
Spring 2003	CLV GRIFS	25 February – 2 March	25

Russia

The Russian chartered commercial vessel Voshod carried out a bottom trawl survey in ICES Subdivision 26 from 26.02 -12.03.2002. Totally 44 sample hauls were made with large TV3#930, equipped with standard ground rope.

The Russian R/V AtlantNIRO carried out a bottom trawl survey in ICES Subdivision 26 from 05 - 27.02.2003. Totally 50 sample hauls were made with large TV3#930, equipped with standard ground rope. From this amount 35 hauls were made in area of the Russian EEZ, 9 hauls in the Lithuanian EEZ and 6 hauls in the Latvian EEZ.

The coverage of the depth strata in both surveys was as follows:

Depth strata	R/V Voshod, 2002	R/V AtlantNIRO, 2003
0-20	-	-
21-40	1	4
41-60	7	11
61-80	11	16
81-100	23	18
>100	2	1
Total	44	50

8 PLAN OF DEMERSAL TRAWL SURVEYS AND EXPERIMENTS IN AUTUMN 2003 AND SPRING 2004

8.1 Planning of the next surveys

It was agreed during the meeting of WGBIFS in 2002 that the allocation scheme of hauls should be modified. ICES Subdivisions 22 and 24 should only be covered by vessels operating the small TV3#520. This arrangement was chosen to improve the quality of the stock indices in the ICES Subdivisions 25 - 28/32 since the studies of the conversion factors suggests that the accuracy of the stock indices increases when only the same type of TV3 is used in a Subdivision.

According to this arrangement only RV "Solea" and RV “Havfisken” cover the western Baltic Sea (SD 22, 24) using TV3#520. The larger version of the new standard gear TV3#930 is only applied in a large part of the eastern Baltic Sea (SD 25 - 28/32). As consequence the procedure of the haul allocation was modified. The agreed method which use the areas of the ICES Subdivisions and a running 5 years mean of the CPUE values is separately applied for the western Baltic Sea (SD 22, 24) and the eastern Baltic Sea (SD 25 - 28/32). In both the cases the areas are weighted with the factor 0.6, and the running means of the distribution pattern are weighted with the factor 0.4.

Furthermore, it is important that the shallow waters are covered by the adjacent countries to reduce problems with licences. Therefore, it is proposed that all counties should take part during the spring and the autumn surveys.

The aim of the surveys is to cover the total distribution area of the target species independent of the actual stock situation. Besides the different sizes of both the cod stocks the actual hydrographical conditions influence the distribution pattern of cod. However, the relationship between the hydrographical parameters and the distribution pattern cannot be described with the necessary accuracy up to now, and the hydrographical conditions during the surveys cannot be predicted. Therefore, it was agreed that an important part of the number of planned stations should be distributed dependent on the size of the areas of the ICES Subdivisions using depth from 10 to 120 m. However, the dramatic decrease of the eastern Baltic cod stock in the last years suggests that the hauls should be also allocated according to the distribution and density pattern of the cod stocks. It was agreed during the WGBIFS in 2001 that a running 5 years mean of CPUE values should be used for describing the distribution pattern of cod.

Both the factors (area of the subdivisions, distribution pattern of cod) should be used with different weight. The parameter area should be used with a weighting factor of 0.6, and the parameter mean cod distribution should be used with a weighting factor of 0.4. The same procedure is used for allocating the number of stations according to the depth layers in the different Subdivisions.

The areas of the defined depth layers are given in the BITS Manual by subdivision. The running mean of the CPUE (age group 1+) must be adapted every year using the results of the spring surveys. For allocating the hauls of the surveys in 2004 the BITS database version spring 2003 was used. For combining the CPUE-values of the different hauls the conversion factors were used that are given in the database.

8.2 Optimal size of units for allocating hauls of the Clear Tow Database

The BITS subgroup discussed the working paper by Rainer Oeberst" Optimal size for units for allocating hauls of Baltic International Trawl Survey". The results were recognized and found as a possible way to identify the optimal area size in order to overcome the first step in the problems connected to the heterogeneous distribution of hauls in the clear tow database. The next step could then be

- either to use the identified optimal area size (units) for stratifying the selection of the hauls taken in the BITS or
- to "clean up" the hauls available for selection to the BITS in order to only make a fixed number of hauls available in each area for the selection of trawls tracks for the BITS. It is recommended that it is investigated before next BIFS WG how to ensure that the selection procedure for hauls in the clear tow database actually select the hauls geographically correct.

The following procedure should be used for allocating the hauls of the surveys in November 2003 and the surveys in 2004. Units of optimal size, according to the working paper by Rainer Oeberst (10'N x 20'E), are selected step by step using a random number generator. In a subsequent step one of the hauls of the Tow Database is randomly selected that have the first position in the selected unit. This algorithm is repeated until the total number of planed stations is achieved.

Oxygen levels are well known to influence recruitment of cod (i.e. Cardinale and Arrhenius 2000) but they could also affect the vertical distribution of individuals. Acoustic observations and information from the fishermen indicate that in those areas where oxygen levels close to the bottom are below 2 ml/l, cod may move in the upper layers and therefore be not caught with bottom trawl as used in the BITS surveys. This could bias the estimate of the biomass of cod in those areas. Thus, the WG recommend that procedures for obtaining information of the distribution of fish in the pelagic water column should be worked out. Data could be used to compare biomass estimates and length structure of cod close to the bottom (i.e. oxygen deficiency) to layers above. This will increase knowledge of cod vertical distribution in areas of oxygen deficiency in the bottom to be used for planning of BITS surveys. Preferably acoustic information should be combined with the trawl data.

Tables 8.1.1 and 8.1.2 present the basic data for allocating the hauls for the planned surveys. The running means of the BITS indices of age group 1+ from 1997 to 2001 were used.

The available total number of planned stations is given by countries in **Table 8.2.1** for the spring survey in 2004 and in **Table 8.2.2** for the survey in autumn 2004.

The total number of available stations of **Tables 8.2.1 - 8.2.2** was used in combination with the results of Table 8.1.1 and 8.1.1 to allocate the number of stations by subdivision and depth layer for the different surveys. **Table 8.2.3 and 8.2.4** present the allocation of the hauls by subdivision and depth layer for the spring survey in 2004. Furthermore, the numbers of hauls that the different countries will carry out in the different subdivisions are given. **Tables 8.2.5 and 8.2.6** show the corresponding data for the survey in autumn 2004.

Table 8.1.1 Basic data for allocating the hauls of the autumn survey 2003 and the spring survey 2004 by subdivision.

	Total area of the depth layer 10-120 m	Proportion of the SD (weight=0.6)	Running mean of the BITS indices of age groups 1+ (1998 - 2002)	Proportion of the index values (weight=0.4)	Proportion of the stations	Special Decisions (additional stations)
SD	[nm²]	[%]		[%]	[%]	
22	3673	39	68	23	33	
23	0	0	0	0	0	3
24	5724	61	230	77	67	
Total 22 + 24	9397	100	298	100	100	
25	13762	43	273	55	48	
26	9879	31	194	39	34	
27	0	0	0	0	0	10
28	8516	26	29	6	18	
Total 25 - 28	32156	100	496	100	100	

Table 8.1.2 Basic data for allocating the hauls according to the depth layer for the survey by subdivision.

	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+ (1998 – 2002)	Proportion of the depth layer (0.4) [%]	Proportion of the depth layer [%]
24	10 - 39	4174	73	140	13	49
	40 - 59	1550	26	5225	48	35
	60 -	29	1	434	40	16
	Total	5733	100	1096	100	100
25	10 - 39	4532	37	28	2	23
	40 - 59	3254	26	499	43	33
	60 - 79	3037	25	488	42	32
	80 -	1461	12	142	12	12
	Total	12284	100	1157	100	100
26	10 - 39	2379	23	16	3	15
	40 - 59	1519	15	388	64	35
	60 - 79	1911	19	187	31	24
	80 - 100	2872	28	13	2	18
	100 - 120	1504	15			99
	Total	10185	100	694	100	100
27	10 - 39	1642	31			15
	40 - 59	1101	21			10
	60 - 79	996	19	24	7	12
	80 -	1596	30	318	93	52
	Total	5335	100	342	100	100
28	10 - 39	2589	39	1	1	23
	40 - 59	1598	24	27	13	20
	60 - 79	1101	16	159	79	41
	80 - 100	1389	21	15	7	15
	Total	6677	100	1380202	100	100

Table 8.2.1 Total number of the stations planned for the BITS in spring 2004.

Vessel	Country	Number of planned stations
Solea	Germany	60
Havfisken	Denmark	15
Total 22 + 24		**75**
Dana	Denmark	50
	Estonia	
	Finland	
Commercial vessel	Latvia	25
Baltica	Poland	35
Atlantida/Atlantniro	Russia	44
Argos	Sweden	45
Total 25 - 28		**199**

Table 8.2.2 Total number of the stations planned for the BITS in autumn 2004.

Vessel	Country	Number of planned stations
Solea	Germany	57
Havfisken	Denmark	15
Total 22 + 24		**72**
Dana	Denmark	50
Kootsaare	Estonia	10
	Finland	
Commercial vessel	Latvia	25
Baltica	Poland	30
	Russia	
Argos	Sweden	35
Total 25 - 28		**150**

Table 8.2.3 Allocation of the planned stations by country and subdivision in spring 2004.

Sub-division Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		44	6		
Estonia	**0**							
Finnland	**0**							
Germany	**60**	11		49				
Latvia	**25**							25
Poland	**35**				24	11		
Russia	**44**					44		
Sweden	**45**				22	3	10	10
Total	**279**	23	3	49	90	64	10	35

Table 8.2.4 Allocation of the planned stations by subdivision and depth layer in spring 2004.

Sub-division Depth layer	22	23	24	25	26	27	28
10 – 39	23	3	24	21	10	3	8
40 – 59			17	30	22	2	7
60 – 79			8	29	16	2	14
80 – 100				11	11	3	5
100 - 120					6		
Total	23	3	49	90	64	10	35

Table 8.2.5 Allocation of the planned stations by country and subdivision in autumn 2004.

Sub-division Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		30	20		
Estonia	**10**					4		6
Finnland								
Germany	**57**	10		47				
Latvia	**25**					5		20
Poland	**30**				19	11		
Russia								
Sweden	**35**				18	7	10	
Total	**222**	22	3	47	72	33	10	35

Table 8.2.6 Allocation of the planned stations by subdivision and depth layer in autumn 2004.

Sub-division Depth layer	22	23	24	25	26	27	28
10 – 39	22	3	23	15	7	3	6
40 – 59			17	22	16	2	5
60 – 79			7	21	11	2	
80 – 100				8	8	3	4
100 – 120					4		
Total	22	3	47	67	47	10	26

9 UDATE AND CORRECTION OF THE CLEAR TOW DATABASE

During the last meeting it was agreed that the participants of the BITS send the feedback from the realized stations to Germany that hosts the Tow Database as fast as possible after the surveys.

These information should contain:

- Haul number of the 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
- If the positions of the haul are changed, please add the new positions

The data of the trawl surveys in November 2002 were used to rework the Tow Database (correct or delete some hauls). Furthermore, new hauls were added to reduce the “white areas” where hauls were not available. The hauls were checked using special procedures. However it must be pointed out **that additional errors / problems exist which were not found.**

The shift of the working group into the March produced the problem that the last surveys finished immediately before the meeting starts. Therefore, it was not possible to update the Tow Database until the meeting of WGBIFS in 2003 finished. It was agreed by the working group that the feedback (performed track information) of the spring surveys will be send to Germany until 15 April 2003. The Tow Database will be updated and send to the participants by mail before the end of May.

The new version should be used for allocating the hauls of the survey in November 2003and the surveys in 2004.

During the survey it was experienced by R/S DANA that hauls in the southern part of Subdivision 25 are very difficult to fish using standard survey gear (gear tearing). The haul positions are provided by Poland to the trawl track library. During the meeting it was revealed that some Polish TV3 BITS hauls from southern part of Sub-division 25 have been performed using a bobbins ground on the TV3#930 that is not described because it was well known that the bottom conditions seldom allows the use the standard ground rope. Poland will provide information on where the bobbins gear has been used in the Polish BITS survey. This information should be included in the clear tow database.

Furthermore, the information on the ground rope of the tracks included in the Clear Tow Database is needed in the database.

It was suggested that it should be investigated if it would be useful to go through all haul tracks in areas with problematic bottom conditions are experienced using a side scan sonar in order to make detailed detection of bottom topography and in order to decide on use of bottom gear (standard or rock hopper). Furthermore, suitable areas for the use of the standard gear can be revealed.

Recommandation:

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

- The feedback from the surveys should be submitted to Germany using the above format not later than 20 December (autumn survey) and 5 April (spring survey).

- Rock hoppers ground gear should only be used when considered absolutely necessary.

- The number of hauls per stratum in the Clear Tow Database that are close together should be reduced.

- 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.

- Hauls with a total length of more than 5 nm should be split up in different hauls. The total length of each of the new hauls should not be less than 2.5 nm.

- Additional columns should be added in the Clear Tow Database. Two columns contain data concerning the TV3 version and the used ground rope type of the realized stations respectively. The third column contains a new name of the stations. The new numbers of the haul includes on the first two places the notation of the subdivision.

10 ANALYSES OF CONVERSION FACTORS BETWEEN NEW AND OLD SURVEY TRAWLS ON NATIONAL LEVEL

10.1 Gear inter-calibration on national level and gear inter-calibration analyses

Under the EU ISDBITS Study Project field tests and between gear inter-calibration experiments on a national level between the currently used trawl gears and the new standardized full scale TV3 trawls in relation to the current BITS survey have been carried out in 1st and 4th quarter of the year in 1999 and 2000 (Nielsen *et al.* 2001). Furthermore, inter-calibrations between two different sizes of the new standard TV3-trawl and, additionally, between two different types of bottom gear rigging (light and intermediate ground-gear construction) for the large TV3 trawl for soft and hard (rocky) bottom localities, respectively, have been carried under the ISDBITS project in the same period. In 2001, 2002 and 2003 additional inter-calibration experiments have been performed in order to improve the inter-calibration database and to obtain missing observations of type 3 inter-calibration experiments on national level (which is a haul performed with the new TV3-trawl followed by a haul of the new TV3-trawl) in order to improve the estimates of the inter-calibration conversion factors and the trawl disturbance effects between and by the different types of trawls used.

In general, the field tests of the trawls have followed the recommended requirements and design given in ICES 3rd and 2nd (and 1st) Workshop on Standard Trawls for Baltic International Fish Surveys (Anon., 1999a; 1998a; 1998e; 1997a, ICES 2001) as well as followed the recommendations given in Anon. (1999b, ICES 2001) and in "Report of the Baltic International Fish Survey Working Group", April 2000 (ICES CM 2000/H:2, Ref.:D).

The design of making the inter-calibrations based on repeated parallel (overlapping) hauls at the same locality as well as the selection of optimal localities for this were described in the "Report of the Baltic International Fish Survey Working Group", April 2000 (ICES CM 2000/H:2, Ref.:D). These principles have been followed during all inter-calibration experiments. More detailed descriptions and minor modifications to the above can be found in the Final ISDBITS EU Study Report (Nielsen *et al.* 2001) accepted by the EU Commission in October 2001.

An overview of the inter-calibration activities performed in 1999 and 2000 is given in the Final ISDBITS EU Study Report (Nielsen *et al.* 2001) as well as in "Report of the Baltic International Fish Survey Working Group" February 2001 (ICES CM 2001/H:02, Ref.: D) including information of country, research vessel, national trawl gear, type of TV3-trawl, area as ICES Sub-division, time (month), number of inter-calibration days (per survey / month), number of inter-calibration hauls, number of stations as well as comments on the type of inter-calibration performed. Additional inter-calibration activities in 2001-2003 are partly described in two working documents presented to the Baltic International Fish Survey Working Group in 2002 (Nielsen *et al.* 2002(a+b) in ICES CM 2002/G:05 Ref. H) and in a manuscript submitted to a peer reviewed journal in February 2003 (by Lewy, Nielsen and Hovgård, 2003) which has been presented to the Baltic International Fish Survey Working Group during this meeting.

10.2 Analysis of inter-calibration data (paired hauls) and estimation of conversion factors between the TV3 and the traditional national trawls

Under the ISDBITS project there was established a database for the analysis of the inter-calibration data (CPUE by length group by trawl for the paired hauls) and for the estimation of conversion factors between the new standard trawl and the traditionally used national trawls. This database contains all inter-calibration data for all nations with respect to these trawls as well as inter-calibration data between the small and the large TV3-trawls and the inter-calibration data between the standard ground gear and the rock-hopper ground gear for the large TV3-trawl. This database has continuously been up-dated with data from the 2001-2003 inter-calibration experiments.

Consequently, the database contains data of three types of inter-calibration experiments carried out which are classified as follows:

Type = 1: The experiment for which a haul of the old gear is followed by a haul of the new gear on national basis.

Type = 2: The experiment for which a haul of the new gear is followed by a haul of the old gear on national basis.

Type = 3: The experiment for which a haul of the new gear is followed by a haul of the new gear (data only available for Denmark which also have been used for the other countries).

In order to obtain inter-calibration estimates a major aim and task of the ISDBITS project was to make analysis of the field test inter-calibrations to link new and old data time series on national level and to provide a statistical method to calculate conversion factors between the traditional, national trawls and the new standard trawls on national basis. On that basis existing national survey data time series can be converted to the units of the new standard trawl (or the opposite way around) and can be used directly as historical research data time series in relation to the new standard with new trawl design when using the data for assessment purposes. The inter-calibration, as well as establishment of robust methods to calculate conversion factors, are necessary in order to obtain a relatively fast "up-grading" of existing national, historical survey data time series from BITS, i.e. to shorten the transition period, and to assure that the surveys and time series could be continued based on an internationally agreed standard.

Different approaches and methods have been discussed and applied for these analyses of inter-calibration data and for estimation of conversion factors during the period 1999-2003 both in EU ISDBITS and in ICES WGBIFS context. Details of methodologies developed and history of methodologies and approaches are presented in last years report of this BIFS Working Group (ICES CM 2002/G:05 Ref. H).

To the present ICES BIFS 2003 Working Group meeting additional documents were presented on the methodology to statistically evaluate the inter-calibration experiments and to calculate conversion factors. Oeberst (2003) presents a modification of Method 2 that is a false reference taking discussion points and issues of last years working group meeting into consideration. Furthermore, in a manuscript by Lewy, Nielsen and Hovgård (2003; submitted), which was presented to the BIFS working group during this meeting, a final version of Method 1 is given, which was originally described and presented in two working documents to the 2002 WGBIFS meeting (Nielsen *et al.* (2002a,b) in ICES CM 2002/G:05 Ref. H).

It was agreed that the ICES BIFS Working Group recommend that the same method as used last year (i.e. Method 1 originally presented in Nielsen *et al.* (2002a,b) and identical to Lewy, Nielsen and Hovgård (2003)) is applied to calculate conversion factors to be used by the ICES WGBFAS working group in the assessment of Baltic cod stocks.

Conversion factors using Method 1 is presented below. These conversion factors are slightly modified from last years estimates by inclusion of the new data for the additional type 3 experiments carried out in autumn 2002 and spring 2003 on national level. Additional type 3 data has been obtained from Denmark, Germany, Poland, Russia and Sweden. In accordance with the procedure used last year results are presented for conversion factors and disturbance effects from the full model on national basis.

By introduction of type 0 experiments where a haul of the old gear is followed by a haul of the old gear on national basis two independent estimates of conversion factors will be obtained which can be compared. It is recommended by the ICES BIFS working group that during its future meetings it shall evaluate the necessity of performance of further inter-calibration experiments of either type 2 and 3 or of type 0 and 1 based on the estimates of variation in inter-calibration data and the precision of estimates of the conversion factors. This has been evaluated for the Danish inter-calibration experiments in Lewy, Nielsen and Hovgård (2003). On that basis it is recommended that additional type 2 and 3 experiments are carried out on national level in the first place. This is partly based on that no type 0 experiments exist so far.

Additionally, more inter-calibration experiments between the large TV3-930 and the small TV3-520 standard trawl should be carried out, as well as between the two different types of bottom gear rigging (light and intermediate ground-gear construction) for the large TV3-930 trawl for soft and hard (rocky) bottom localities.

The working group noted that inter-calibration analyses and estimates of conversion factors for flounder applying Method 1 was not yet available and recommended that these should be provided as soon as possible.

10.3 Analysis of inter-calibration data (paired hauls) and estimation of conversion factors between the large (TV3-930) and the small (TV3-520) TV3 trawls based on German national data

In Nielsen *et al.* (2002b) in ICES CM 2002/G:05 Ref. H analysis of inter-calibration data (paired hauls) and estimation of conversion factors between the large (TV3-930) and the small (TV3-520) TV3 trawls were presented based on partly German (R/V Solea) and Danish (R/V Dana for large TV3-930 trawl and R/V Havfisken for small TV3-520 trawl) data using type 0, type1, type2, and type3 inter-calibration experiments combined from both countries. The reason for this procedure was that only Danish data were available to the 2002 BIFS Working Group meeting for experiments where a haul of the TV3 trawl was followed by a haul of the TV3 trawl both for the large and the small TV3 trawl. In Nielsen *et al. (*2002b) the following design was used:

Type 0: TV3-520 first haul and TV3-520 second haul. Denmark, R/V Havfisken.

Type 1: TV3-930 first haul and TV3-520 second haul. Germany, R/V Solea.

Type 2: TV3-520 first haul and TV3-930 second haul. Germany, R/V Solea.

Type 3: TV3-930 first haul and TV3-930 second haul. Denmark, R/V Dana.

However, it is not optimal to include data from inter-calibration experiments made by several vessels and countries in the same analyses as the data and results can be influenced by different ship effects and different national fishing procedures.

For this working group meeting national German type3 data (a haul of TV3-520 is followed by a haul of TV3-520) has been made available allowing for calculation of conversion factors between the two types of TV3-trawls using information from experiments performed by the same research vessel, i.e. on national basis (Germany). Consequently, the BIFS Working Group has in 2003 used the following design to estimate conversion factors between the two types of TV3-trawls:

Type1: TV3-930 first haul and TV3-520 second haul. Germany, Solea.

Type2: TV3-520 first haul and TV3-930 second haul. Germany, Solea.

Type3: TV3-520 first haul and TV3-520 second haul. Germany, Solea.

Beta: disturbance for TV3-520 trawl. Germany, Solea.

Alfa: disturbance for TV3-930 haul. Germany, Solea.

Gamma: Conversion factor = new/old = TV3-520/TV3-930. Germany, Solea.

Gamma is the number we shall multiply on TV3-930 to obtain TV3-520 level.

1/Gamma (inverse Gamma) is the number we shall multiply TV3-520 to obtain

TV3-930 level.

From the results (see below) it appears that the conversion factors between the two trawls do not differ much from 1 for nearly all length groups. One would have expected that the large TV3-930 trawl would be more efficient in catching cod than the smaller TV3-520 trawl which was also seen to a higher degree in last years results. However, this can maybe be an effect of that R/V Solea is a too small research vessel to handle the large TV3-930 trawl optimally and to make the trawl fish optimally.

10.4 Use of the trawl conversion factors in Baltic cod stock assessment

The trawl calibration experiments are carried out to improve the use the historical trawl survey data in the assessment for Eastern and Western Baltic cod. It is, however, up to the Baltic assessment working group (ICES WGBFAS) to decide how the conversion factor should be used in the assessment. A discussion of this is given in last years report of the ICES BIFS Working Group (ICES CM 2002/G:05 Ref. H). Please, see that discussion as it is still relevant.

There are some uncertainties on the results of the Polish type 3 trials, as the TV3#930 standard gear ocasionly has been rigged with bobbins mounted ground gear. The Polish data should be reanalyzed next year using only the standatd gear without bobbins. The magnitude of the Polish conversion factors do not exhippit any patterns, which differs from other countries, when comparing the conversion facorts for this year with the conversion factors from last year.

There are still no type 3 experiments available for converting from the Latvian LBT to TV3#520. Therefore, the results from the Germail Solea type 3 trials are used for the estimating of the converting factor convering the Latvian LBT to TV3#.

Tables

Denmark

Table 10.4.1. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Denmark.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	.	.	.	.	.	.
12,5	19	9,8	25	15,7	12	8,3
17,5	22	39,5	28	30,1	18	29,0
22,5	24	90,6	28	55,7	21	107,8
27,5	24	157,3	28	47,8	21	147,0
32,5	24	68,6	28	51,5	21	131,3
37,5	24	30,5	27	41,3	21	119,9
42,5	23	20,0	28	19,5	21	65,8
47,5	23	8,6	28	7,5	21	24,7
52,5	22	2,7	23	3,5	19	7,3

Table 10.4.2. Type 3 test results of the hypotheses $H_1 - H_4$. Denmark.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 : Over-dispersion > 1	596	2699	<0.001
$H_2 : \gamma_l = 1$	9	249.56	<0.001
$H_3 : \alpha_l = 1$	9	25.65	0.0023
$H_4 : \beta_l = 1$	9	404.57	<0.001

Over-dispersion: 2.13

Table 10.4.3. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of Granton to TV3-930 catches. Denmark.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
12,5	8,10	2,48	26,42
17,5	5,31	3,22	8,75
22,5	4,16	3,04	5,68
27,5	2,77	2,02	3,80
32,5	2,29	1,70	3,08
37,5	2,45	1,76	3,43
42,5	2,33	1,48	3,68
47,5	2,15	0,98	4,73
52,5	1,22	0,37	4,02

Table 10.4.4. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–930. Denmark.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	0,45	0,21	0,96
17,5	0,73	0,55	0,97
22,5	0,68	0,60	0,79
27,5	0,51	0,45	0,58
32,5	0,49	0,43	0,56
37,5	0,51	0,44	0,59
42,5	0,54	0,44	0,65
47,5	0,42	0,30	0,59
52,5	0,36	0,18	0,72

Table 10.4.5. Disturbance parameters, α_l, and lower and upper confidence limits by length for Granton. Denmark.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	1,28	0,27	6,12
17,5	0,84	0,46	1,53
22,5	0,53	0,37	0,75
27,5	0,63	0,45	0,88
32,5	0,77	0,55	1,09
37,5	0,80	0,52	1,23
42,5	0,81	0,46	1,42
47,5	0,59	0,24	1,46
52,5	0,79	0,19	3,25

Germany

Table 10.4.6. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Germany.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	9	3,7	17	10,2	7	3,9
12,5	12	36,2	20	31,6	14	13,1
17,5	12	92,2	20	31,8	16	18,9
22,5	12	180,2	20	45,2	16	59,6
27,5	12	192,0	20	76,0	17	126,3
32,5	12	60,1	20	57,0	17	96,2
37,5	12	16,5	20	28,0	17	77,9
42,5	12	8,2	20	13,1	17	32,5
47,5	12	3,0	19	4,9	17	7,6
52,5	8	0,4	18	2,2	16	1,9

Table 10.4.7. Type 3 test results of the hypotheses $H_1 - H_4$. Germany.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 :Over-dispersion > 1	431	3316	<0.001
$H_2 : \gamma_l = 1$	10	16.66	0.0821
$H_3 : \alpha_l = 1$	10	7.68	0.6602
$H_4 : \beta_l = 1$	10	8.87	0.5441

Over-dispersion: 2.77

Table 10.4.8. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of HG20/25 to TV3-520 catches. Germany.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
7,5	0,79	0,14	4,61
12,5	0,83	0,40	1,72
17,5	0,86	0,49	1,54
22,5	0,79	0,56	1,12
27,5	0,80	0,63	1,03
32,5	0,81	0,61	1,07
37,5	0,63	0,44	0,92
42,5	0,61	0,34	1,09
47,5	0,68	0,24	1,92
52,5	0,63	0,09	4,57

Table 10.4.9. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–520. Germany.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	0,67	0,13	3,49
12,5	0,62	0,32	1,18
17,5	0,73	0,45	1,18
22,5	0,98	0,77	1,26
27,5	0,98	0,83	1,15
32,5	1,03	0,85	1,24
37,5	0,87	0,70	1,08
42,5	0,75	0,52	1,06
47,5	0,87	0,43	1,75
52,5	0,65	0,14	3,07

Table 10.4.10. Disturbance parameters, α_l, and lower and upper confidence limits by length for HG20/25. Germany.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	0,97	0,11	8,48
12,5	0,71	0,32	1,58
17,5	0,81	0,44	1,51
22,5	1,03	0,70	1,51
27,5	1,31	0,97	1,77
32,5	1,36	0,90	2,04
37,5	1,16	0,62	2,18
42,5	1,56	0,60	4,06
47,5	1,10	0,23	5,32
52,5	0,43	0,01	25,10

Poland

Table 10.4.11. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Poland.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	6	68,3	7	12,6	4	7,8
12,5	9	178,0	11	49,3	4	10,0
17,5	9	65,4	13	36,6	5	6,0
22,5	11	69,2	13	64,6	5	52,4
27,5	11	66,5	13	59,8	5	80,2
32,5	11	24,2	15	25,8	5	60,8
37,5	11	10,9	15	7,9	5	57,0
42,5	10	4,4	15	14,7	5	27,0
47,5	9	1,6	12	17,2	5	6,8
52,5	6	0,2	12	5,8	3	2,7

Table 10.4.12. Type 3 test results of the hypotheses $H_1 - H_4$. Poland.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 : Over-dispersion > 1	235	1352	<0.001
$H_2 : \gamma_l = 1$	10	21.42	0.0183
$H_3 : \alpha_l = 1$	10	15.09	0,1287
$H_4 : \beta_l = 1$	10	13.42	0.2013

Over-dispersion: 2.40

Table 10.4.13. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of P20/25 to TV3-930 catches. Poland.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
7,5	1,38	0,35	5,43
12,5	4,82	1,60	14,52
17,5	1,46	0,36	5,87
22,5	1,04	0,61	1,75
27,5	1,69	1,04	2,73
32,5	1,83	1,00	3,36
37,5	1,28	0,55	2,99
42,5	2,28	0,92	5,64
47,5	2,27	0,51	10,03
52,5	1,09	0,02	56,15

Table 10.4.14. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–930. Poland.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	1,16	0,37	3,67
12,5	1,20	0,44	3,28
17,5	0,70	0,18	2,67
22,5	0,68	0,43	1,08
27,5	0,70	0,49	1,01
32,5	0,75	0,50	1,14
37,5	0,70	0,45	1,08
42,5	0,70	0,37	1,32
47,5	0,62	0,17	2,28
52,5	0,25	0,01	10,28

Table 10.4.15. Disturbance parameters, α_l, and lower and upper confidence limits by length for P20/25. Poland.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	1,39	0,33	5,78
12,5	0,30	0,10	0,93
17,5	1,19	0,29	4,97
22,5	1,82	1,00	3,32
27,5	1,07	0,61	1,88
32,5	0,63	0,30	1,32
37,5	0,86	0,30	2,45
42,5	0,35	0,09	1,28
47,5	0,21	0,03	1,79
52,5	0,13	0,00	77,45

Russia

Table 10.4.16. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Russia.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	1	1,0	0	.	2	7,50
12,5	1	1,0	1	2,0	4	1,75
17,5	3	1,3	2	0,5	3	1,33
22,5	4	4,5	6	3,5	6	11,17
27,5	4	49,8	6	30,2	7	39,71
32,5	4	65,5	6	36,7	7	40,57
37,5	4	11,5	6	14,2	7	32,57
42,5	4	10,3	6	13,2	6	27,83
47,5	4	5,3	6	8,7	6	11,00
52,5	4	1,0	6	2,5	6	4,33

Table 10.4.17. Type 3 test results of the hypotheses $H_1 - H_4$. Russia.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 :Over-dispersion > 1	13	942	<0.001
$H_2 : \gamma_l = 1$	9	7.08	0.6291
$H_3 : \alpha_l = 1$	9	8.76	0.4593
$H_4 : \beta_l = 1$	10	33.42	0.0002

Over-dispersion: 3.02

Table 10.4.18. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of HAKE-4M to TV3-930 catches. Russia.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
12,5	0,57	0,00010	3353,01
17,5	0,13	0,00001	2322,73
22,5	0,94	0,07	12,96
27,5	1,16	0,42	3,15
32,5	0,55	0,22	1,38
37,5	0,49	0,13	1,81
42,5	0,32	0,08	1,28
47,5	0,36	0,05	2,56
52,5	0,29	0,01	12,55

Table 10.4.19. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–930. Russia.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	0,286	0,0025	33,11
17,5	0,250	0,0003	188,87
22,5	0,448	0,12	1,65
27,5	0,511	0,28	0,94
32,5	0,377	0,19	0,74
37,5	0,320	0,14	0,71
42,5	0,281	0,11	0,75
47,5	0,288	0,06	1,35
52,5	0,192	0,01	3,48

Table 10.4.20. Disturbance parameters, α_l, and lower and upper confidence limits by length for HAKE-4M. Russia.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	1,8	0,00001	304009,74
17,5	10,7	0,00021	534737,54
22,5	0,8	0,03	20,81
27,5	0,3	0,08	0,77
32,5	0,5	0,17	1,28
37,5	0,6	0,12	3,31
42,5	1,4	0,23	8,06
47,5	1,6	0,13	21,13
52,5	1,2	0,01	188,38

Sweden

Table 10.4.21. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Sweden.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	12	28,6	18	10,6	5	8,4
12,5	12	16,7	16	16,4	5	4,8
17,5	13	16,5	16	41,3	7	69,4
22,5	13	95,7	19	71,4	11	229,3
27,5	13	158,2	19	78,2	11	221,0
32,5	13	133,1	18	54,1	11	287,5
37,5	13	48,0	18	29,4	11	121,3
42,5	13	19,9	19	15,5	11	37,6
47,5	13	9,1	18	7,5	10	19,7
52,5	13	2,7	17	2,4	10	3,6

Table 10.4.22. Type 3 test results of the hypotheses $H_1 - H_4$. Sweden.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 :Over-dispersion > 1	348	4539	<0.001
$H_2 : \gamma_l = 1$	10	97.19	<0.001
$H_3 : \alpha_l = 1$	10	43.90	<0.001
$H_4 : \beta_l = 1$	10	109.94	<0.001

Over-dispersion: 3.61

Table 10.4.23. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of GOV to TV3-930 catches. Sweden.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
7,5	0,73	0,13	4,12
12,5	0,60	0,06	6,42
17,5	0,33	0,16	0,66
22,5	0,39	0,28	0,55
27,5	0,44	0,32	0,61
32,5	0,45	0,31	0,66
37,5	0,38	0,22	0,65
42,5	0,48	0,20	1,11
47,5	0,30	0,07	1,33
52,5	0,57	0,05	6,86

Table 10.4.24. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–930. Sweden.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	0,90	0,19	4,41
12,5	0,67	0,07	6,55
17,5	0,40	0,22	0,72
22,5	0,54	0,43	0,69
27,5	0,67	0,54	0,84
32,5	0,53	0,43	0,66
37,5	0,48	0,34	0,67
42,5	0,48	0,26	0,88
47,5	0,22	0,07	0,73
52,5	0,58	0,08	4,07

Table 10.4.25. Disturbance parameters, α_l, and lower and upper confidence limits by length for GOV. Sweden.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	3,99	0,60	26,35
12,5	5,65	0,42	76,71
17,5	2,96	1,04	8,36
22,5	1,79	1,13	2,85
27,5	1,53	1,00	2,34
32,5	2,51	1,56	4,02
37,5	2,94	1,48	5,84
42,5	1,75	0,61	5,01
47,5	2,28	0,40	13,15
52,5	0,69	0,04	12,54

Latvia

Table 10.4.26. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Latvia.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
12,5	5	10,8	3	1,7	14	13,1
17,5	6	24,3	3	1,7	16	18,9
22,5	7	38,3	4	6,3	16	59,6
27,5	8	77,4	4	7,8	17	126,3
32,5	7	52,6	3	10,7	17	96,2
37,5	9	37,3	3	25,7	17	77,9
42,5	8	28,8	4	10,8	17	32,5
47,5	9	4,9	3	1,3	17	7,6
52,5	5	1,2	4	1,3	16	1,9

Table 10.4.27. Type 3 test results of the hypotheses $H_1 - H_4$. Latvia.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 : Over-dispersion > 1	215	1816	<0.001
$H_2 : \gamma_l = 1$	9	53.03	<0.001
$H_3 : \alpha_l = 1$	9	30.11	0.0004
$H_4 : \beta_l = 1$	9	8.28	0.5064

Over-dispersion: 2.83

Table 10.4.28. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of LBT to TV3-520 catches. Latvia.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
12,5	3,10	0,01	1411,60
17,5	1,82	0,02	195,13
22,5	2,46	0,30	19,96
27,5	1,59	0,31	8,11
32,5	0,63	0,18	2,24
37,5	0,18	0,09	0,38
42,5	0,09	0,04	0,25
47,5	0,03	0,00	0,56
52,5	0,10	0,00	2,26

Table 10.4.29. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–520. Latvia.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	0,62	0,32	1,20
17,5	0,73	0,45	1,19
22,5	0,98	0,76	1,27
27,5	0,98	0,82	1,16
32,5	1,03	0,85	1,25
37,5	0,87	0,69	1,09
42,5	0,75	0,52	1,07
47,5	0,87	0,42	1,78
52,5	0,65	0,13	3,17

Table 10.4.30. Disturbance parameters, α_l, and lower and upper confidence limits by length for LBT. Latvia.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
12,5	0,97	0,002	530,41
17,5	0,51	0,005	56,77
22,5	0,20	0,02	1,69
27,5	0,46	0,09	2,41
32,5	1,63	0,43	6,15
37,5	3,84	1,67	8,82
42,5	6,86	2,34	20,13
47,5	21,12	0,95	471,63
52,5	3,97	0,07	241,43

Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany

Table 10.4.31. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Length	Type 1		Type 2		Type 3	
Midpoints in cm	Number of stations	Average number of fish	Number of stations	Average number of fish	Number of stations	Average number of fish
7,5	5	20,4	4	14,5	7	3,9
12,5	9	18,0	8	18,6	14	13,1
17,5	9	28,8	9	35,9	16	18,9
22,5	9	14,3	9	16,3	16	59,6
27,5	9	15,0	9	15,6	17	126,3
32,5	9	18,4	9	20,0	17	96,2
37,5	9	16,3	9	16,2	17	77,9
42,5	9	20,3	9	15,0	17	32,5
47,5	8	14,5	8	12,1	17	7,6
52,5	8	3,6	8	6,5	16	1,9

Table 10.4.32. Type 3 test results of the hypotheses $H_1 - H_4$. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Test	df	χ^2(Type3)	$P > \chi^2$
H_1 :Over-dispersion > 1	290	1625	<0.001
$H_2 : \gamma_l = 1$	10	4.62	0.9150
$H_3 : \alpha_l = 1$	10	7.35	0.6918
$H_4 : \beta_l = 1$	10	12.19	0.2727

Over-dispersion: 2.37

Table 10.4.33. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of TV3-930 to TV3-520 catches. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
7,5	1,68	0,27	10,34
12,5	1,06	0,46	2,45
17,5	1,15	0,64	2,07
22,5	0,98	0,55	1,75
27,5	0,91	0,52	1,60
32,5	0,80	0,49	1,31
37,5	0,81	0,46	1,42
42,5	0,61	0,33	1,13
47,5	1,12	0,44	2,85
52,5	1,29	0,23	7,32

Table 10.4.34. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–520. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	0,67	0,16	2,74
12,5	0,62	0,36	1,08
17,5	0,73	0,48	1,10
22,5	0,98	0,79	1,22
27,5	0,98	0,85	1,13
32,5	1,03	0,88	1,21
37,5	0,87	0,72	1,05
42,5	0,75	0,55	1,01
47,5	0,87	0,48	1,58
52,5	0,65	0,17	2,44

Table 10.4.35. Disturbance parameters, α_l, and lower and upper confidence limits by length for TV3-930. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Length	Disturbance	Lower 95 % CL	Upper 95 % CL
7,5	2,17	0,27	17,15
12,5	1,80	0,63	5,09
17,5	0,96	0,47	1,96
22,5	0,94	0,42	2,12
27,5	0,75	0,35	1,62
32,5	0,70	0,36	1,36
37,5	0,70	0,33	1,46
42,5	1,00	0,47	2,14
47,5	0,51	0,17	1,49
52,5	0,29	0,04	2,15

Table 10.4.36. Inverse Conversion factors, $1/\gamma_l$ by length for the conversion of TV3-520 to TV3-930 catches. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

Length	Conversion factor (Gamma`	Inverse Gamma
7,5	1,68	0,59
12,5	1,06	0,94
17,5	1,15	0,87
22,5	0,98	1,02
27,5	0,91	1,10
32,5	0,80	1,25
37,5	0,81	1,24
42,5	0,61	1,64
47,5	1,12	0,89
52,5	1,29	0,77

FIGURES

Denmark

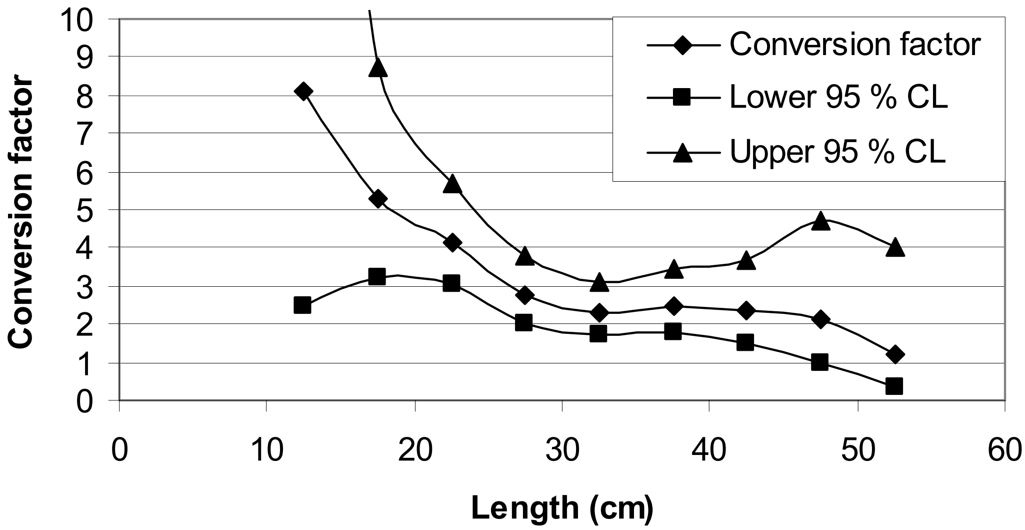

Figure 10.4.1 Conversion factors, γ_l, and 95% confidence limits by length for Granton converted to TV3-930. Denmark.

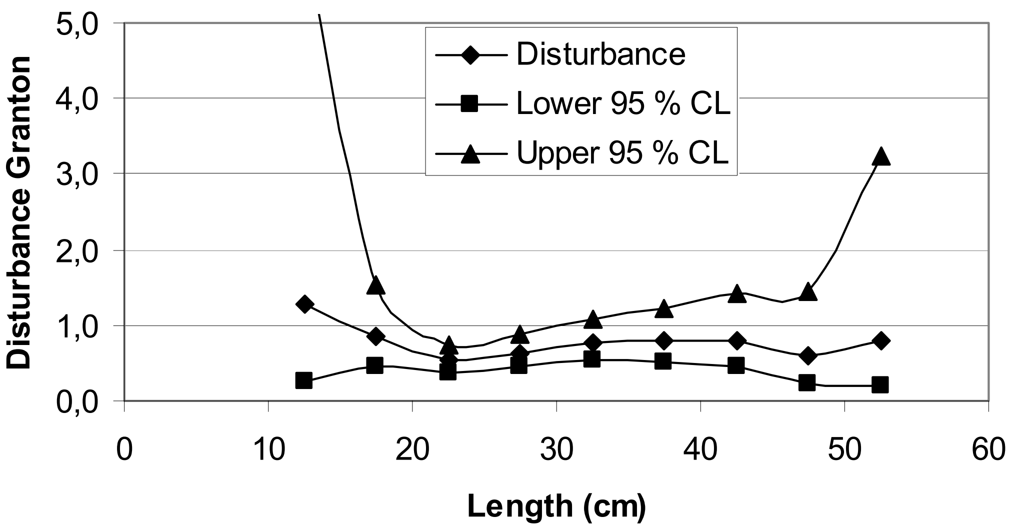

Figure 10.4.2. Disturbance parameters, α_l, and 95% confidence limits by length for Granton. Denmark

.

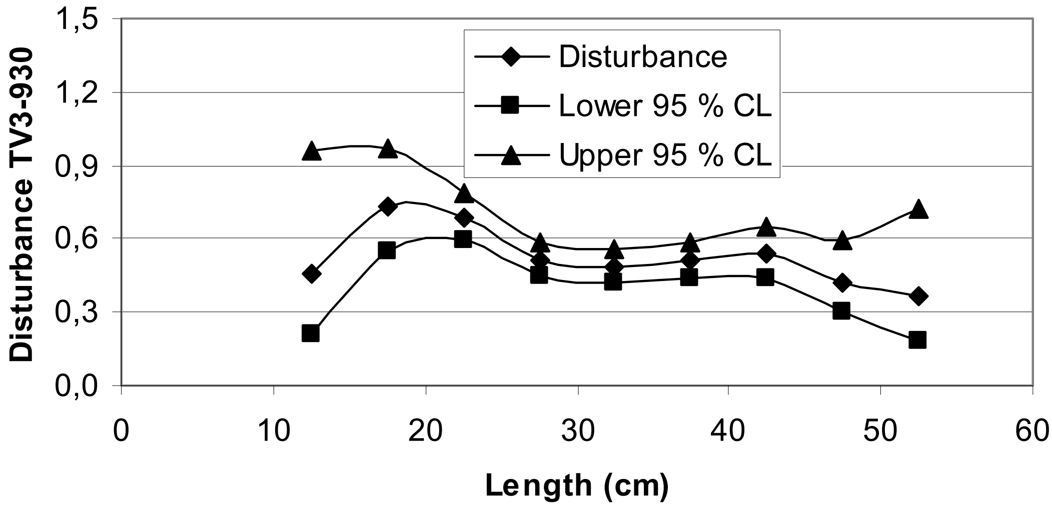

Figure 10.4.3. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Denmark.

Germany

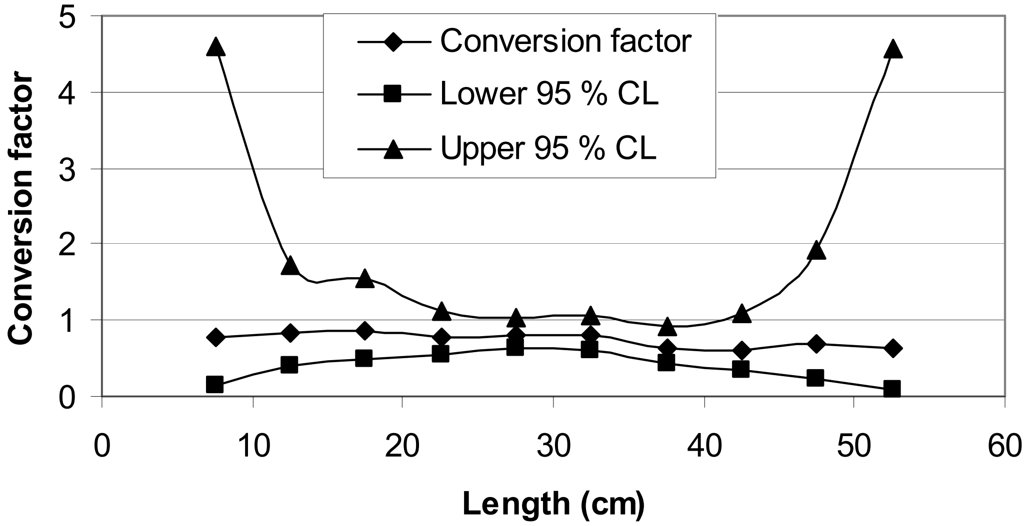

Figure 10.4.4 Conversion factors, γ_l, and 95% confidence limits by length for HG20/25 converted to TV3-520. Germany.

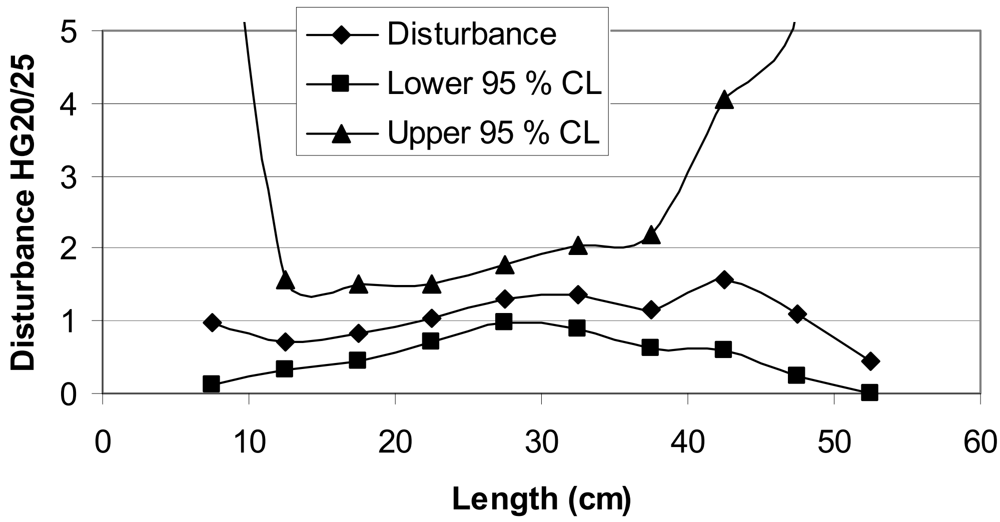

Figure 10.4.5. Disturbance parameters, α_l , and 95% confidence limits by length for HG20/25. Germany.

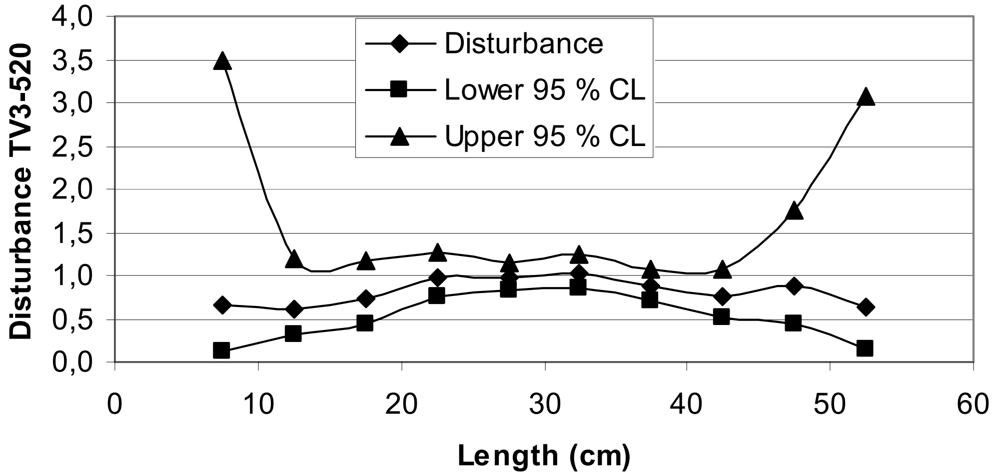

Figure 10.4.6. Disturbance parameters, β_l , and 95% confidence limits by length for TV3-520. Germany.

Poland

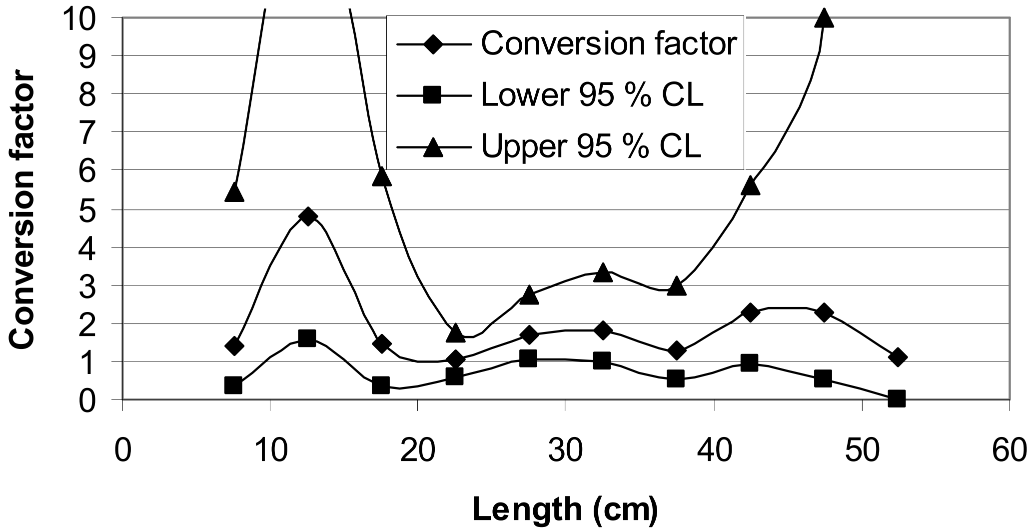

Figure 10.4.7. Conversion factors, γ_l , and 95% confidence limits by length for P20/25 converted to TV3-930. Poland.

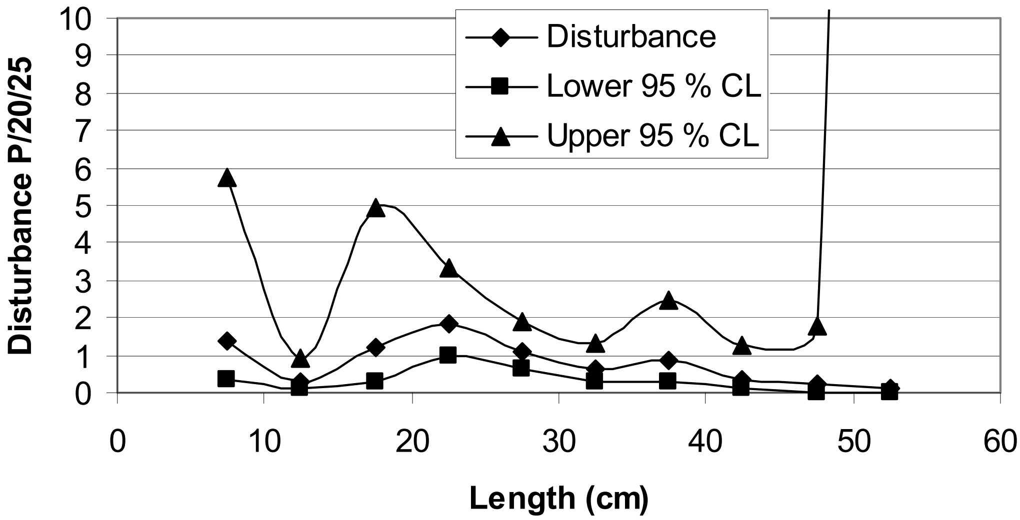

Figure 10.4.8. Disturbance parameters, α_l , and 95% confidence limits by length for P20/25. Poland.

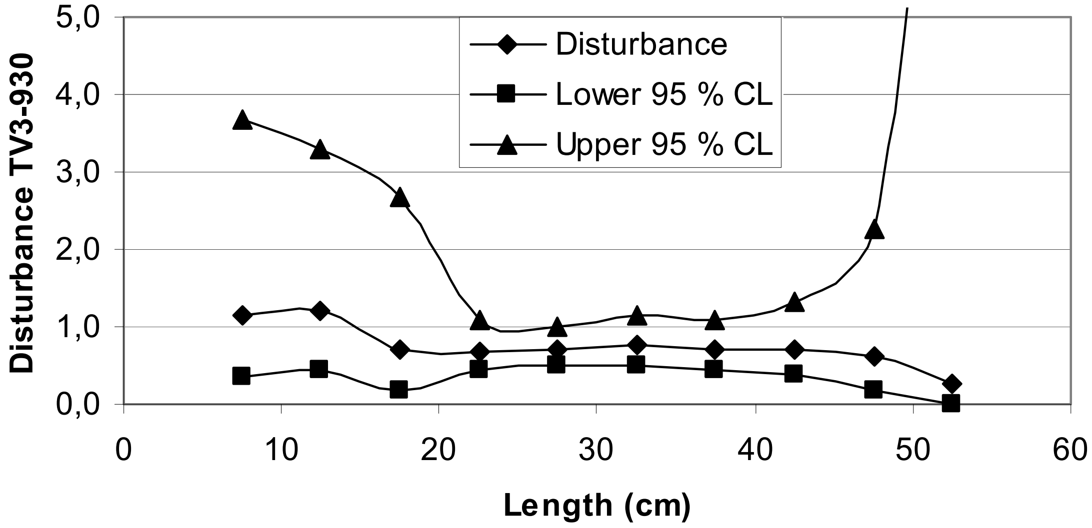

Figure 10.4.9. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Poland.

Russia

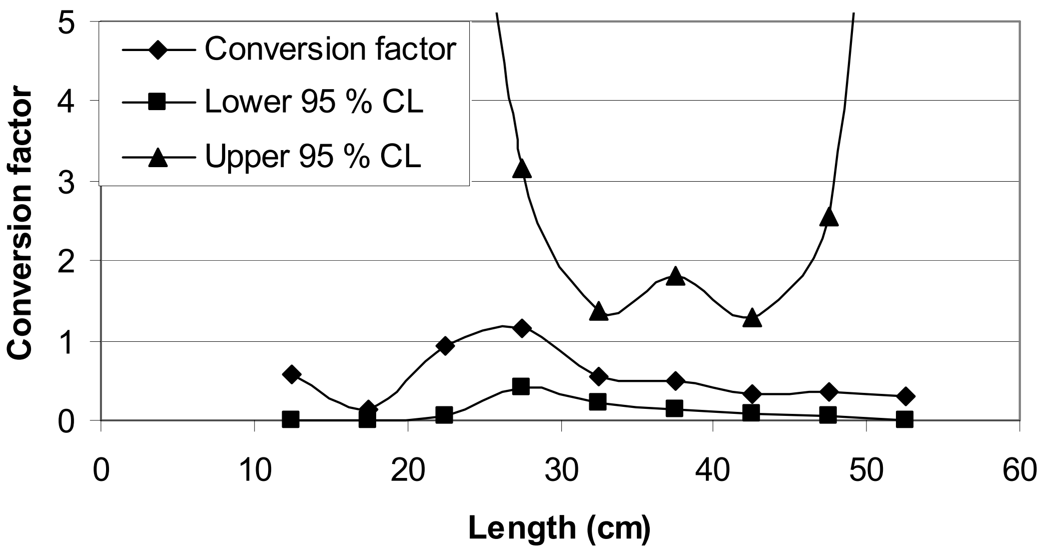

Figure 10.4.10. Conversion factors, γ_l, and 95% confidence limits by length for HAKE-4M converted to TV3-930. Russia.

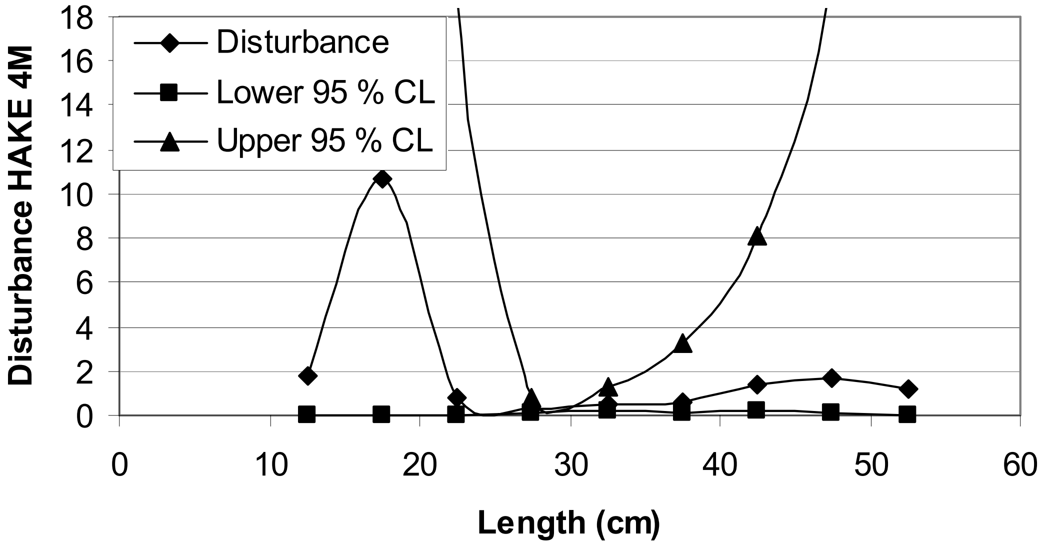

Figure 10.4.11. Disturbance parameters, α_l , and 95% confidence limits by length for HAKE-4M. Russia.

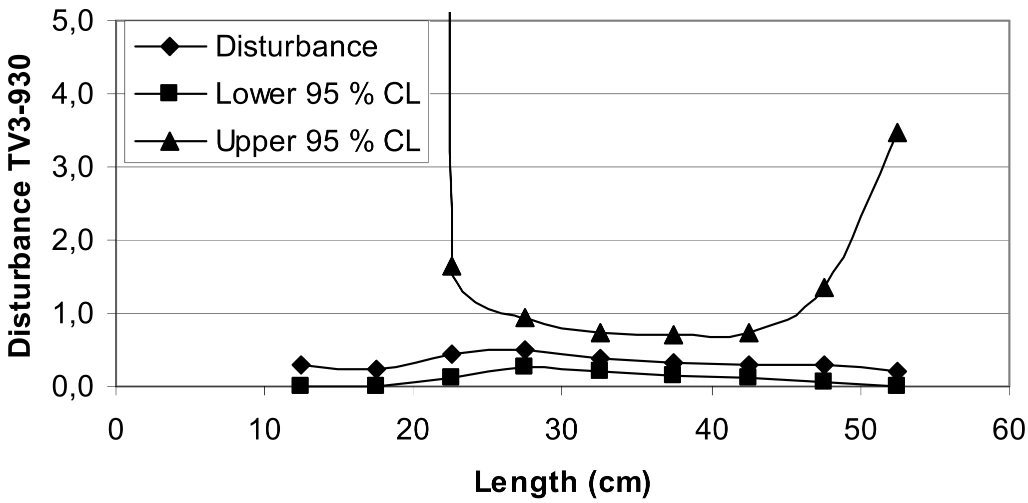

Figure 10.4.12. Disturbance parameters, β_l , and 95% confidence limits by length for TV3-930. Russia.

Sweden

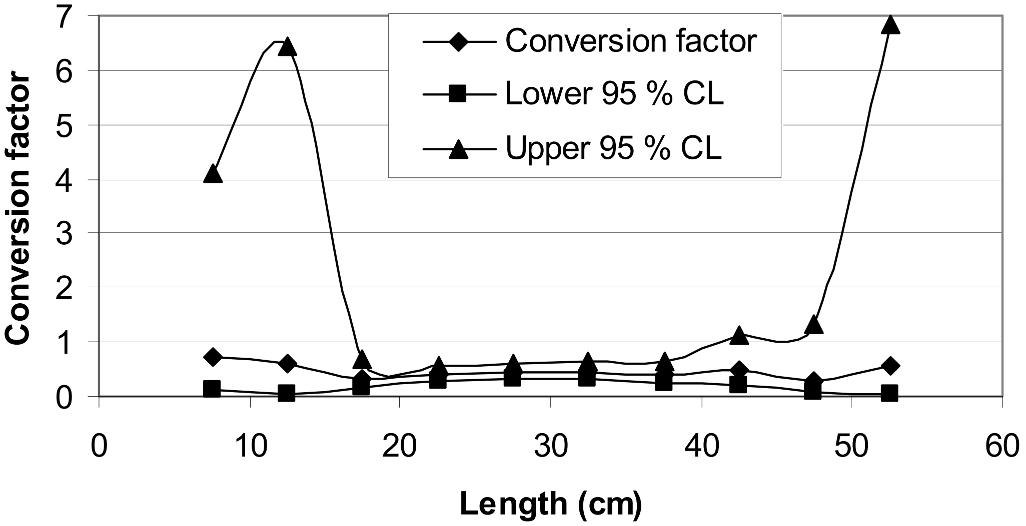

Figure 10.4.13 Conversion factors, γ_l, and 95% confidence limits by length for GOV converted to TV3-930. Sweden.

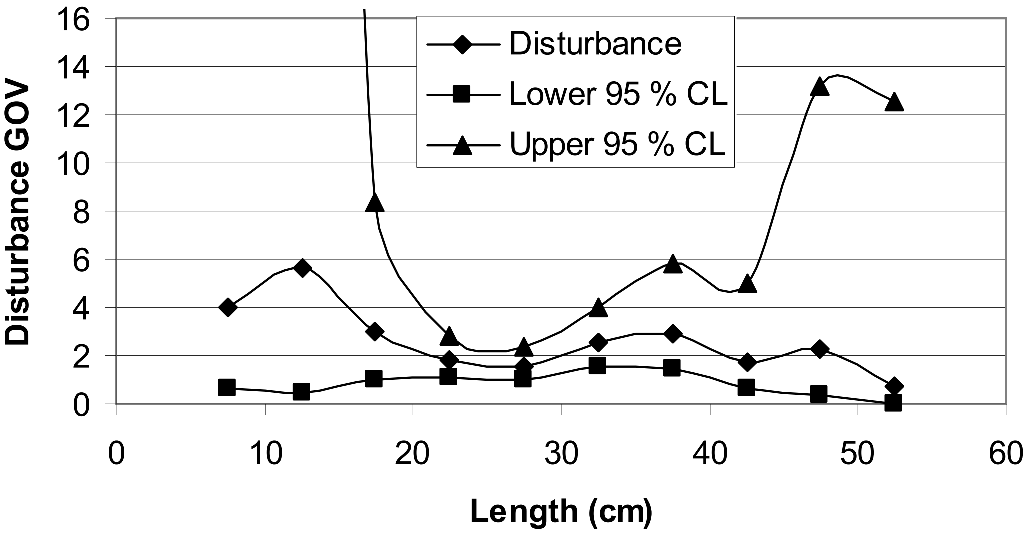

Figure 10.4.14. Disturbance parameters, α_l, and 95% confidence limits by length for GOV. Sweden.

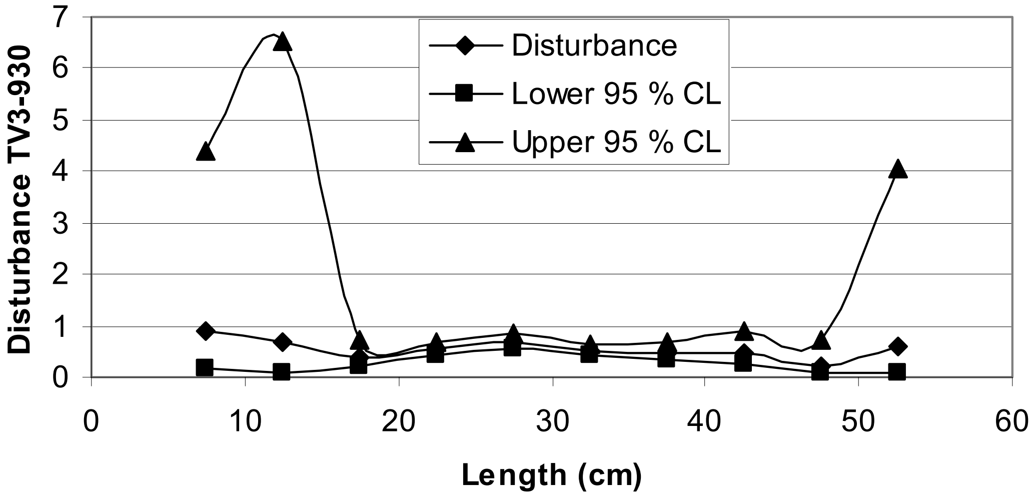

Figure 10.4.15. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Sweden.

Latvia

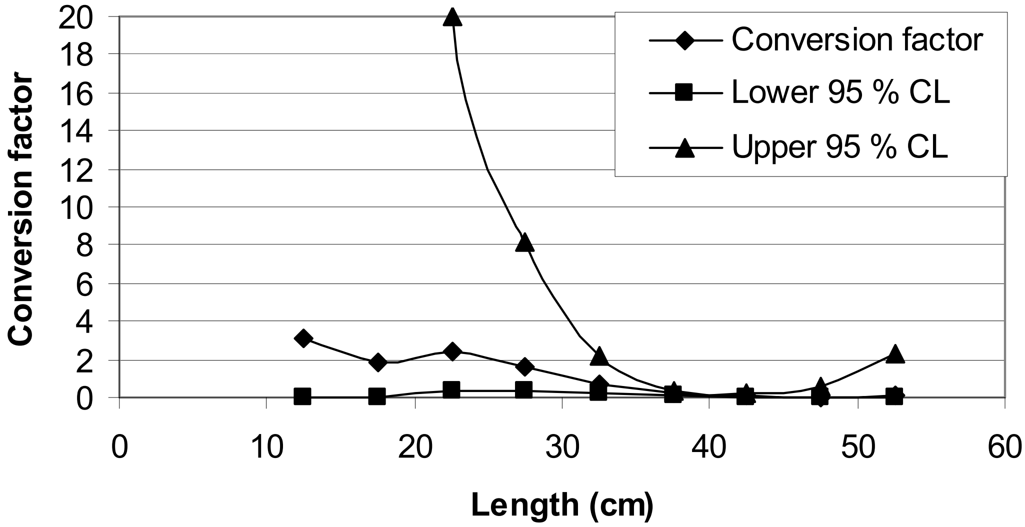

Figure 10.4.16. Conversion factors, γ_l, and 95% confidence limits by length for LBT converted to TV3-520. Latvia.

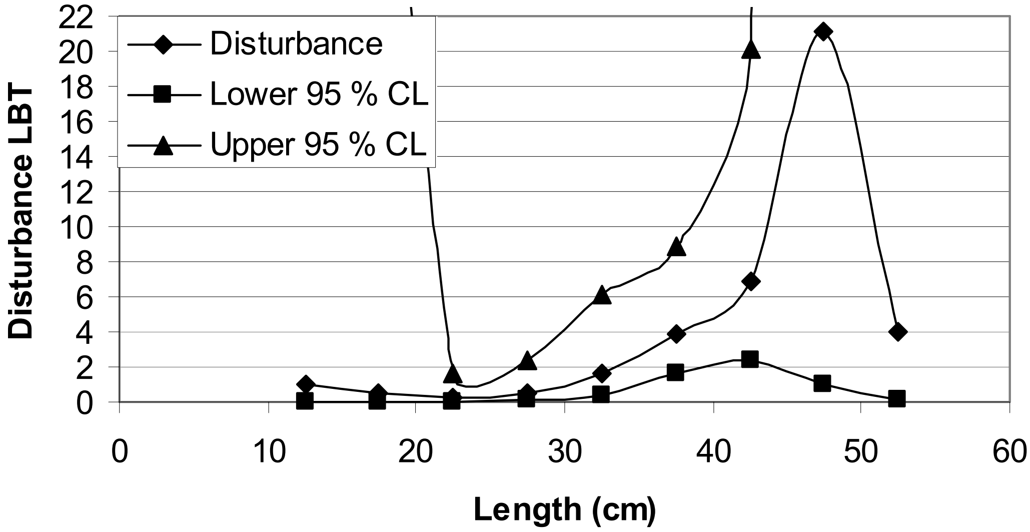

Figure 10.4.17. Disturbance parameters, α_l, and 95% confidence limits by length for LBT. Latvia.

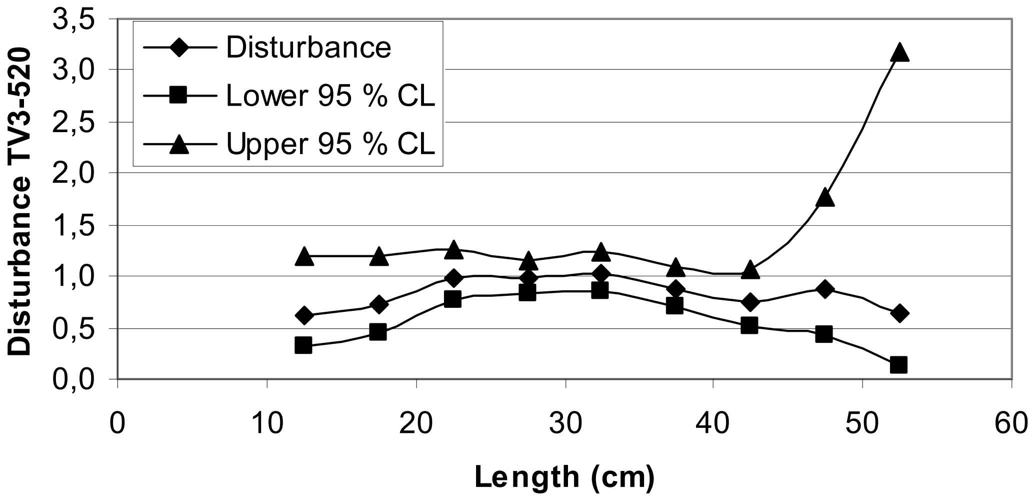

Figure 10.4.18. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-520. Latvia.

Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany

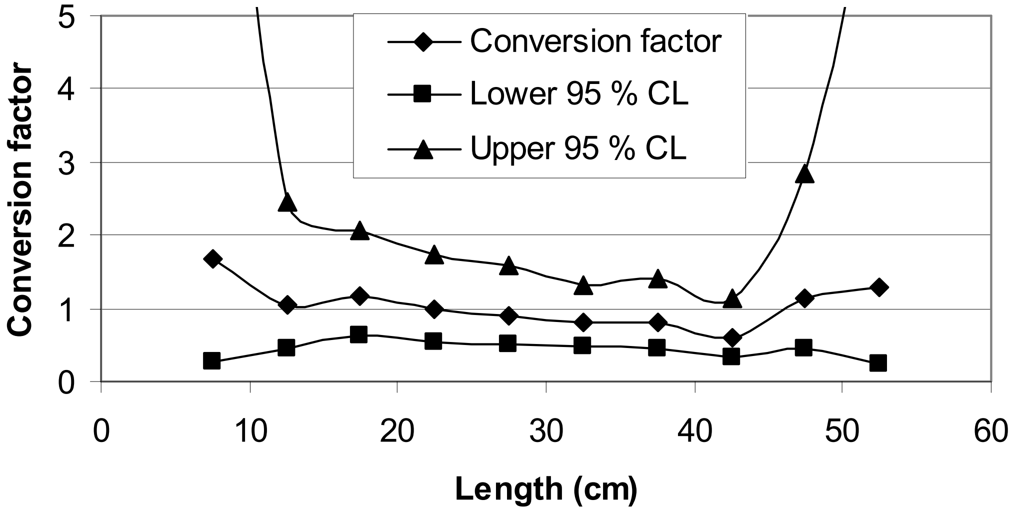

Figure 10.4.19 Conversion factors, γ_l, and 95% confidence limits by length for TV3-930 converted to TV3-520. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

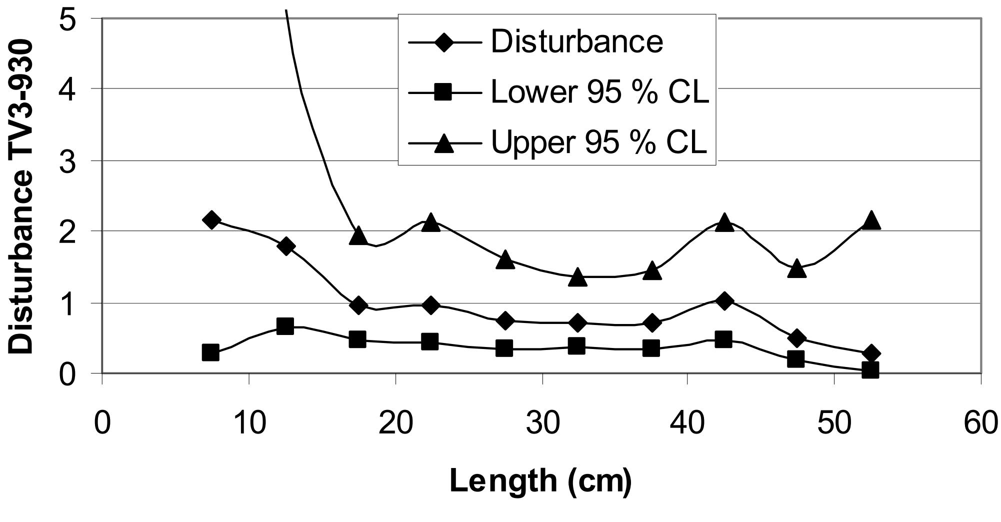

Figure 10.4.20. Disturbance parameters, α_l, and 95% confidence limits by length for TV3-930. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

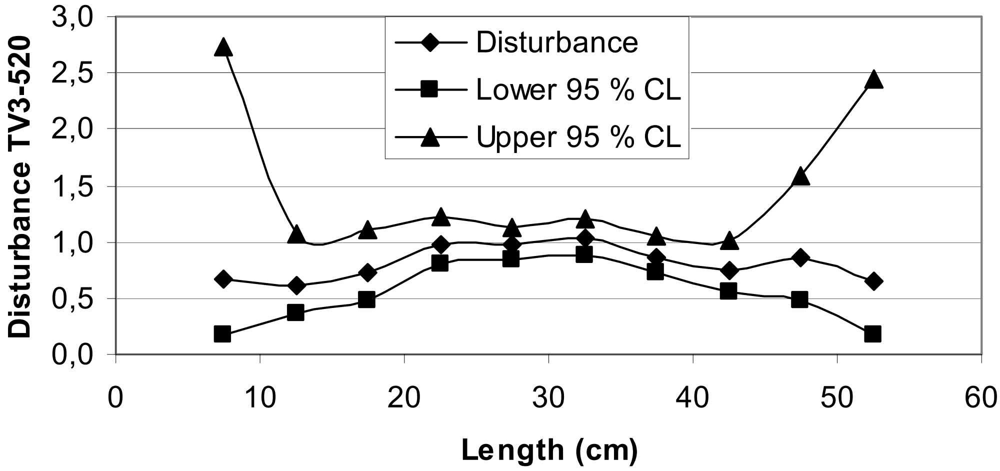

Figure 10.4.21. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-520. Large (TV3-930) – Small (TV3-520) TV3-trawl, Germany.

11 UPDATE OF THE MANUAL OF THE BALTIC INTERNATIONAL TRAWL SURVEYS

The BITS manual was discussed during the meeting and it was agreed that no changes are necessary. Therefore the version of the report in 2002 (Version April 2002) is used.

12 STATUS OF THE DATRAS DATABASE.

A presentation was made by Neil Holdsworth (ICES secretary) with 5 headings containing topics that are of interest to WGBIFS.

Proposed Exchange Format

A new exchange format was developed by the DATRAS steering group for consideration by WGBIFS and WGIBTS. It was reported that the format was well received at the WGIBTS meeting, with some modifications. A number of questions were raised by WGBIFS, which are presented below.

1. WGBIFS were interested in knowing who is on the DATRAS steering group and specifically whether anyone from the Baltic region was on it.

The steering group consists of participants from the countries whom deliver data under the DATRAS project, which means Scotland, France and Holland. The steering group coordinate the project and provide the working groups with information and suggest new things for the WG, like the exchange format where ultimately the WG has to agree on the proposals.

Efforts were made to include the Baltic region at a later stage, specifically Latvian and Polish data. WGBIFS are aware of this initiative.

2. *There was a discussion about HaulNo/HydStatNo and how these were used.*

The HydStatNo is an internal institute number between the fisheries discipline and the oceanographic discipline. It should be possible to find the related CTD's from the surveys in the Oceanographic database – this seems not to work because the HydStatNo in the fishery data and in the CTD data is not always the same.

HaulNo is used to identify the haul again in an easy way. It is supposed to be a numeric value forward number from 1 to X. Beside that there is the StNo, which is again an internal numeration – used to be only used by the countries which used fix stations – going to the same station every year instead of random sampling.

3. HH Record: There was a discussion about Warpdia field (Warp Diameter). The point was made that this piece of information is of limited use. The general opinion seemed to be that warp density (weight per metre) was the key piece of information.

Warp Diameter information must remain to satisfy requirements from historical data. However, IBTS agreed that it could be useful to include one more field for this extra information.

4. HH Record: Thermocline field. A 'definition' of what exactly is to be reported. While it was clear that this was a y/n field to indicate the presence of a thermocline – there seemed to be some confusion about the different ways of measuring/detecting a thermocline and so some clarification is necessary.

All institutes are able to deliver information on temperature from data collected by units on the gear whilst trawling or with a CTD cast at the beginning or end of the tow. However, a description explaining when a thermocline is detected has not been provided so clarification is needed before information can be included in this field.

5. AreaType/AreaCode was proposed in the exchange format to replace specific fields for Subdivision/Statistical Rectangle.

This was accepted by the participants.

6. Would WGBIFS be requiring 2 levels of data screening, a stricter set of checks and a more widely accepting level?

The point of doing this is to make a more conservative check. In the appendix with ship codes it was on purpose that only one ship per country is included– the point was to reduce the ship codes to the code actually used today and remove all the old ships not used any longer. If these ships are still used and data will be delivered with these codes in the future, they will remain active.

The recommendation is that 2 levels should be provided, as this will involve a minimum amount of additional effort and could greatly reduce errors or oversights.

7. The Russian participant noted that in Appendix III of the reporting format the Russian ship code is incorrect.

The code is printed as VSH and should in fact be VOS. The 2 other Russian ship codes were deliberately left off this appendix (see Number 6 above).

8. *Appendix IV: The 2 gear types were not properly described and there is one addition.*

The descriptions will be modified as below for the 2 existing Gear codes.

Small TV3 trawl (520)	*TVS*
Large TV3 trawl (930)	*TVL*

The 3rd new code is in fact a variation on the existing gear code and should be used in conjunction with the Gear Exception code (see appendix IV in the manual for clarification).

9. The group asked whether standard species list was still relevant/useful. Perhaps this was just for historical data?

WGBIFS are correct in this assumption however, IBTS would like to keep the code for historical reasons (if they resubmit old data they need the field) and therefore they decided to keep the field but only allowing the code 11. In addition the standard species code describes what species there should be taken otolihts from for indices calculation.

Reference Codes

Due to the growing number and complexity of the coding systems used by ICES working groups, a new database and web page has been developed to consolidate these code lists in one place. This was demonstrated to WGBIFS, the web page can be accessed at http://www.ices.dk/reco/

It is planned to modify this page so that various groups get to see only the codes that are relevant to them.

Data Screening Utility (DATSU)

The new web based test version of the data screening program was demonstrated to the meeting. In essence, a data file is uploaded through the ICES web site and the checks are carried out, in the meantime the 'user' can close the browser or remain on-line to wait for a hyperlink to the results. When the checks are finished a link appears in the browser (for example: Results) simultaneously an email with the same hyperlink is sent to the users email address. The utility is currently under limited testing by IBTS and should be available to BITS for testing by August 2003.

A list of the checks that the program currently uses was supplied to participants for feedback.

The web address is http://www.ices.dk/datsu

DATRAS: Summary of Progress

It was reported to WGBIFS that the database has been designed and is up and running on the SQL Server platform. In January and February 2003, work was undertaken on the data loading module and the indices calculation module. As of March 2003 both were operational and 30 surveys from 2000-2003 have been loaded. Output from the indices module was used by HAWG in March and was found to be acceptable compared to the old indices output.

ITIS: Raising Awareness

The Integrated Taxonomic Information System (ITIS) is been actively promoted by ICES as the primary source for species codes throughout the ICES database system. The new coding system was made necessary as the NODC codes used by the fisheries WG's are no longer maintained. ITIS was found to be the natural replacement for this system as it incorporates a lookup table for the NODC codes. ICES now holds a copy of the ITIS database on SQL Server and will provide the SQL script to any participants who may want this system.

ICES would also encourage the practice of submitting missing species information directly to the ITIS administration.

The data files, Informix script and documentation can all be downloaded from the main ITIS site at http://www.itis.usda.gov/

13 DEVELOP PROTOCOLS AND CRITERIA TO ENSURE STANDARDIZATION OF ALL SAMPLING TOOLS AND SURVEY GEARS

During the last meetings of WG BIFS manual were developed to standardize the different steps of the acoustic and bottom trawl surveys. These manuals are discussed during the WG BIFS and when it is necessary the manuals are updated. These manuals are the basis for ensuring the quality of the stock indices based on the surveys.

New standard gears for the BITS are developed. These gears have been used since 2001.

The WG recommands that the different parts of the standard gears should be checked during summer 2003 by all countries using the protocols given in the BITS manual. The protocols are presented and discussed during the WG BIFS in 2004.

Some methodical problems concerning the acoustic surveys must be solved. The WG recommends that a special study group should be establishe to solve the problems.

14 RECOMMENDATIONS

14.1 Acoustic surveys

The following important working items must be considered for the future and the WGBIFS 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 Sub-divisions 29N, 30, 31 and 32 should be covered during future surveys.

- In order to get a complete picture of herring and sprat distribution in the Western Baltic area (Skagerrak, Kattegat, Sub-divisions 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, Sub-divisions 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.

- A standarized way to publish the data from the hydroacoustic surveys (WD "STUCTURE OF CRUISE REPORTS FOR ACOUSTIC SURVEYS IN THE BALTIC SEA" by T. Groehsler, Appendix 8) has been tested and is recommended to be used for future acoustic cruise reports.

- The variability in the results of the acoustic surveys used for the assessment should be analysed.

- The results of the joint acoustic surveys in May/June 2003 should be reported to the next meeting of the WGBIFS and results presented in the same way as for the BIAS. These data should be submitted in the BIAS exchange format at least two months before the WGBIFS meeting to E. Götze. Hamburg, Germany

- The database BAD1 should be continued for the next years and that the intensive studies of the data from BAD1 should be continued.

- The data from all acoustic spring surveys should be stored in a database (eg. format like BAD1).

- A study group should be established to solve the problems described in section 5.2.

Concerning target strength estimation the WGBIFS recommends that

- each country conducting acoustic surveys in the Baltic sea should store TS values of herring and sprat on the frequency used for the stock assessment.

- cage experiments should be conducted to compare TS length distribution with *in situ* measurements of herring,

- herring and sprat should be collected for radiography from other areas and seasons to be included in the backscattering models, as they become available.

- the suggested protocol in the Report of the Study Group of Target Strength Estimation in the Baltic Sea for TS measurements should be applied during all 2003 acoustic surveys in the Baltic Sea.

The WGBIFS recommend that the problem raised by the working document by W. Grygiel (ref) is further investigated before the next WG.

Taken into account the present status of the BAD2 database the following options are possible:

a) Denmark (DIFRES) officially guarantees that they will host and develop the database during the next 5 to 10 years.

b) ICES will host and develop the database in the future.

c) The BAD2 will be discontinued with the consequence that detailed analyses as it was required by the assessment working group (WGBFAS) cannot be done.

The WGBIFS recommend either option a) or b) and that the yearly resources needed to maintain the database is estimated at either DIFRES or ICES. It is necessary that the assessment working group supports the need of the BAD2.

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.

The WGBIFS recommend that the procedure for selecting hauls for the BITS is revised taking into consideration the work made by Rainer Oeberst (Appendix 7) identifying optimal units in order to account for the heterogeneous geographical distribution of the hauls available in the Clear Tow Database.

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 5 April (spring survey).

- Rock hoppers ground gear should only be used when considered absolutely necessary.

- The number of hauls per stratum in the Clear Tow Database that are close together should be reduced.

- 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.

- Hauls with a total length of more than 5 nm should be split up in different hauls. The total length of each of the new hauls should not be less than 2.5 nm.

- Additional columns should be added in the Clear Tow Database. Two columns contain data concerning the TV3 version and the used ground rope type of the realized stations respectively. The third column contains a new name of the stations. The new numbers of the haul includes on the first two places the notation of the subdivision

14.3 Estimation of the conversion factors

Further type 2 and type 3 hauls should be made during the autumn 2003 BITS survey.

14.4 Next meeting in year 2004

14.4.1 Time and venue

The Working Group discussed its next meeting (to be decided at the Annual Science Conference in Tallinn, Estonia) and WGBIFS recommends that it will meet five days from 29 of March - 2 of April 2004 in Rostock (Chairperson: Rainer Oeberst), to assist WGBFAS and ACFM.

14.4.2 Terms of reference

According to Annual Science Conference Resolution in Copenhagen, Denmark (C.Res.2003/x:xx) The Baltic International Fish Survey Working Group [WGBIFS] (Chair: Rainer Oeberst) will meet in ICES Headquarters from 29 of March - 2 of April 2004 to:

1. combine and analyse the results of the 2003 acoustic surveys and experiments and report to WGBFAS;
2. update the hydro-acoustic databases BAD1 and BAD2 for the years 1991 to 2003;
3. plan and decide on acoustic surveys and experiments to be conducted in 2004 and 2005;
4. discuss the results from BITS surveys performed in autumn 2003 and spring 2004;

5. plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2004 and spring and autumn 2005;
6. 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.
7. update and correct the Clear Tow database and allocate the hauls for the Baltic International Trawl Survey (autumn, 2004);
8. continue to study the proposed model for estimating the conversion factors between new and old survey trawls under inclusion of the new inter-calibration experiments;
9. update, if necessary, the Baltic International Trawl Survey (BITS) manual;
10. update, if necessary, the Baltic International Acoustic Survey (BIAS) manual.
11. Agree in a procedure investigating the vertical distribution of the fish 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 2003 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.

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WGBIFS 2003
WD

Mean value and variance of BAD1 data for the years 1991 to 2002

by
E. Götze (IFF) & T. Gröhsler (IOR)
Germany

The results of the Baltic International Acoustic Surveys are collected in the database BAD1. It contains the data from the years 1991 to 2002. The data for 2002 were not supplied so far from Latvia and Sweden yet. They are therefore missing in the following presentations. This lack will cause however no large distortion of the reality.
The Baltic Sea was not covered evenly in all years. In the first years the surveys were limited to the Baltic Proper. Especially the ICES subdivisions 30 to 32 were only sporadically examined. In some years the cover is very incomplete because of technical and organizational problems. For a first analysis of the collected data only the rectangles were considered, for which at least seven-year data records are present. Altogether still 73 rectangles remained. As simple characteristics of the time series the average and the standard deviation were used in order to show the spatial distribution of the estimated results and their temporal change.
First the distribution of the acoustic measured values S_A (fig.1) is to be represented. In the central basins of the Baltic Sea these values are quite evenly distributed. In the western Baltic there are some few high values against it apart from generally quite small measured values e.g. in the Sound and the Belts (subdivision 22 and 23).

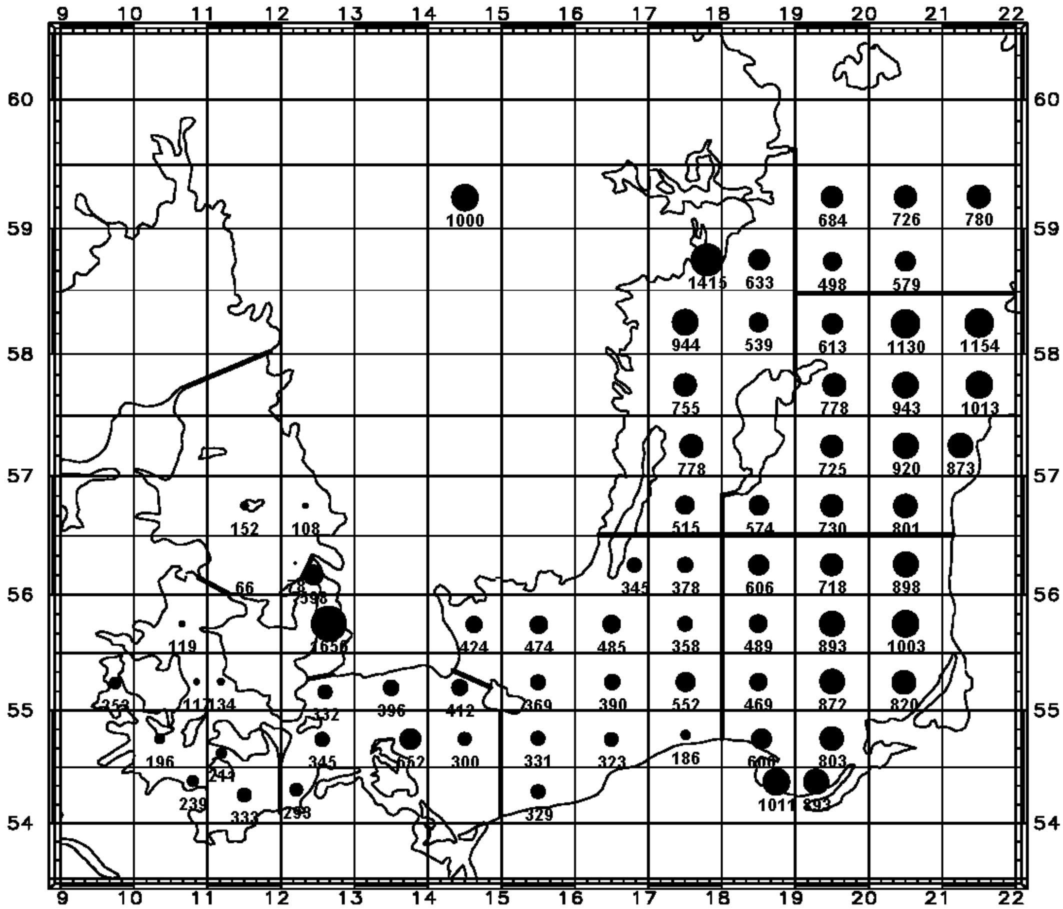

Fig. 1 Mean values of the NASC for the years 1991-2002

The standard deviation (fig. 2) shows a similar picture as the average value. This particularly clearly if we will present the quotient of these two values, the coefficient of variation C.V (fig. 3).

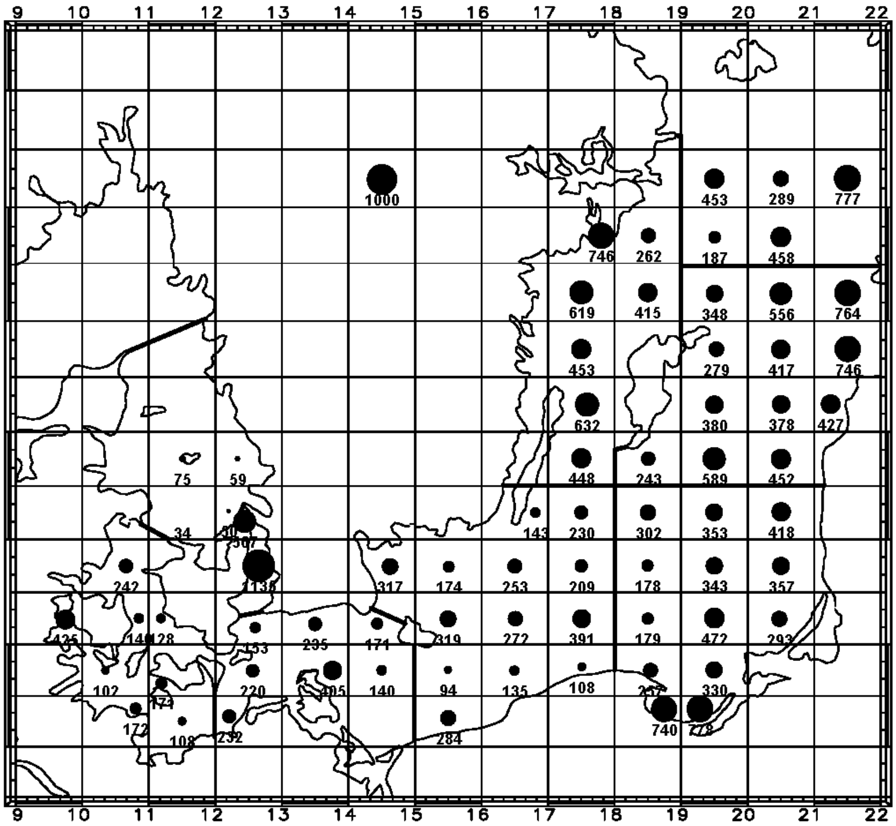

Fig. 2 Standard deviation of NASC

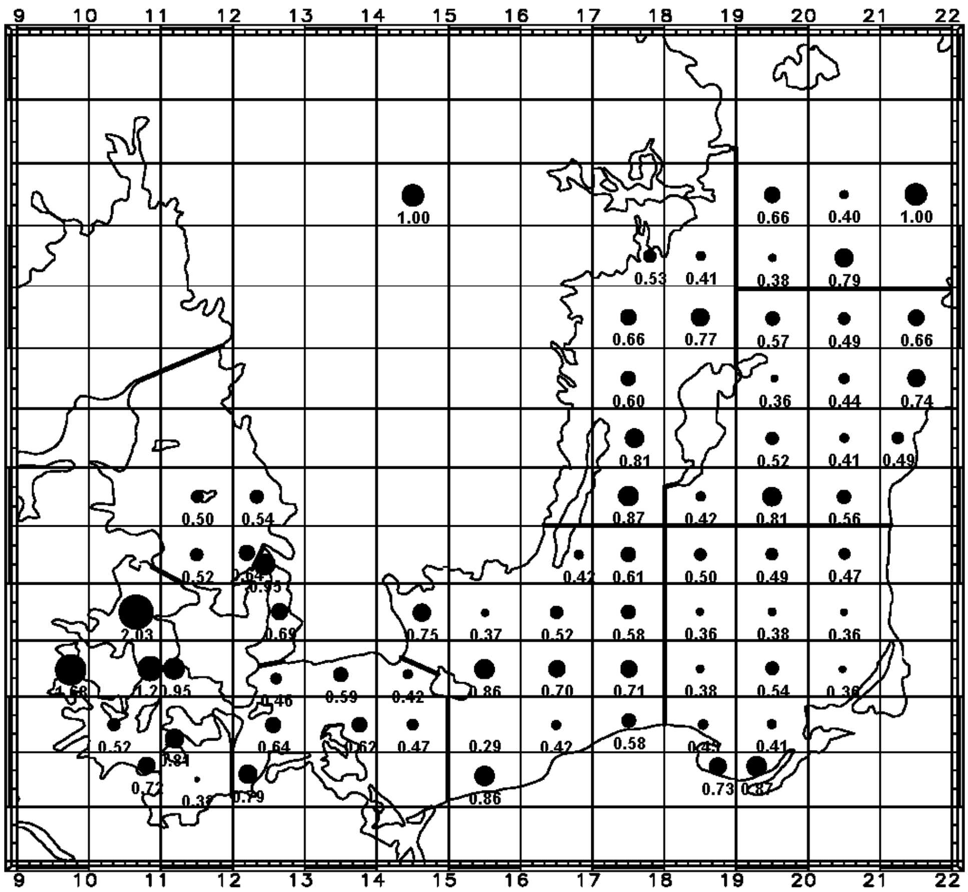

Fig. 3 Coefficient of variation (C.V.) of the NASC

For the acoustic estimations the mean scattering cross section in the stratum is an important parameter. It depends on the length of the existing fish and gives thus a picture of the length distribution of the main fish species herring and sprat. Its value varies from 0.5 cm² with small sprat up to some cm² with large herring. Values in the proximity of 1 particularly arise in the central and southeast Baltic Sea (fig. 4).

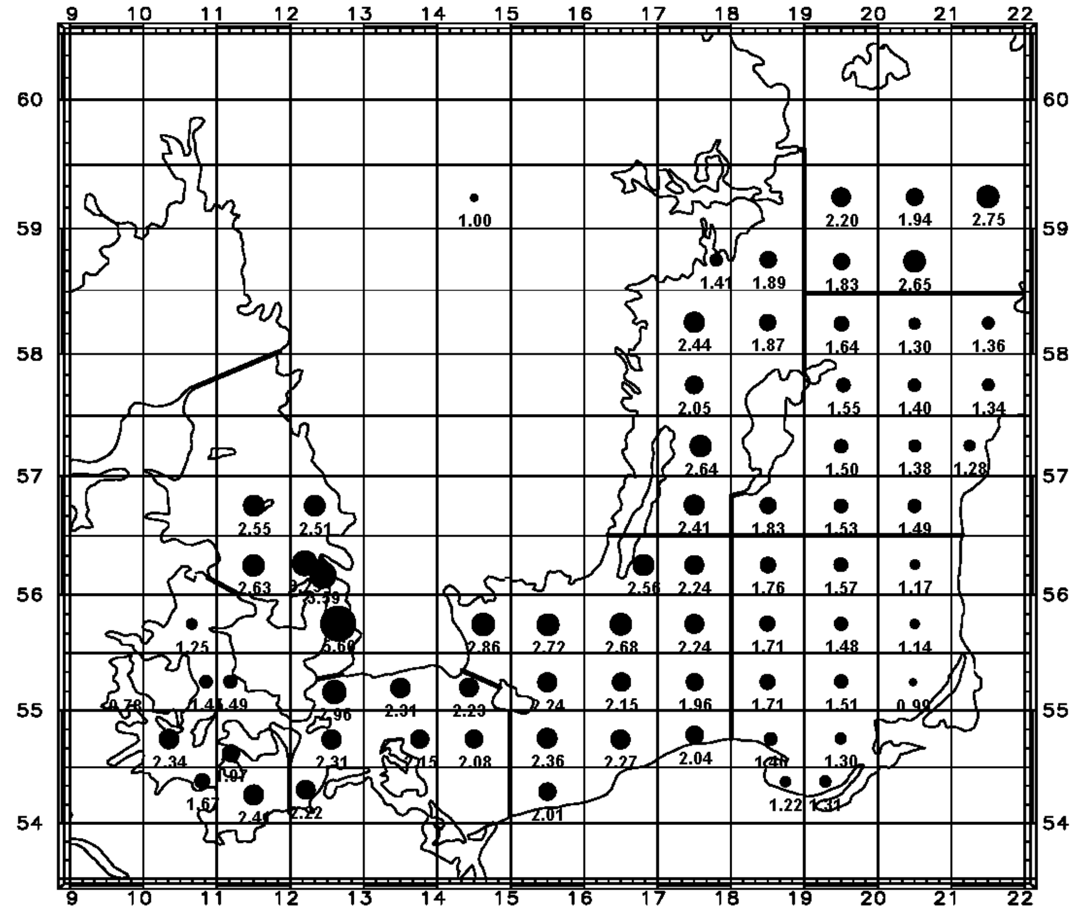

Fig 4. Mean scattering cross section σ [cm²]

These values result in the case of fish lengths from 10 to 15 cm up. It mostly concerns thereby around sprat, possibly also small herring. If the scattering cross section becomes larger than 2, also adult herring is present. This is to be observed in the western and northern Baltic Sea. The variability of the scattering cross section is quite small in most central areas. This points on the fact that the biological characteristic is quite similar in all years there. A larger variability arises in the northern and western Baltic. There the scattering cross section can change relatively strong by different admixtures of large herring.

We can find a more exact presentation of the species composition from the trawl results. In the database however only the portions of herring and sprat are indicated. A further allocation is not possible therefore. In fig. 6 we can see a confirmation of the acceptance made above. The sprat is concentrated in the central parts of the Baltic Sea. Larger portions herring are in the western Baltic and to a smaller content also in the northern areas. The partial quite high portion other species in the western part consists usually of small fish, like goby or stickleback.

The first step in acoustic estimations is the computation of the total number of fish inside the stratum. In fig. 7 the average from the investigation period of this total fish number is represented. The largest numbers arise in the central and southeast Baltic Sea. There the S_A values were high and the mean scattering cross sections small. Both trends together lead to a

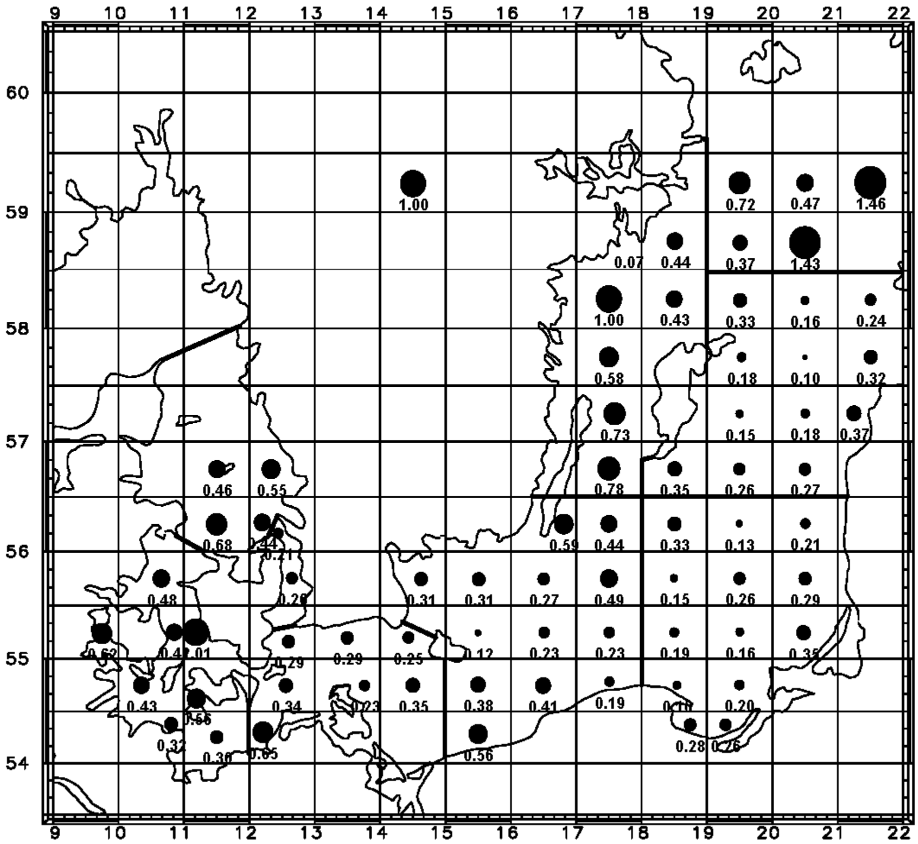

Fig. 5 Variability (C.V.) of σ for the years 1991 to 2002.

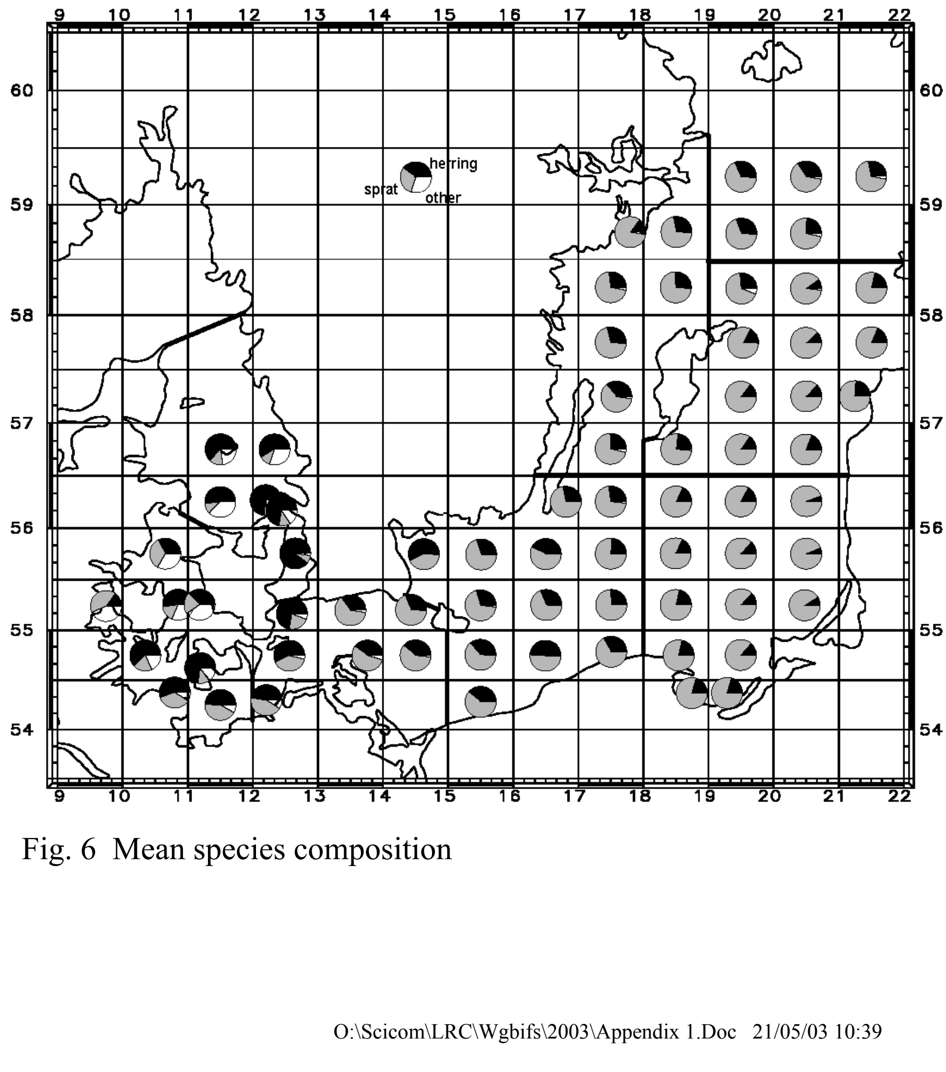

Fig. 6 Mean species composition

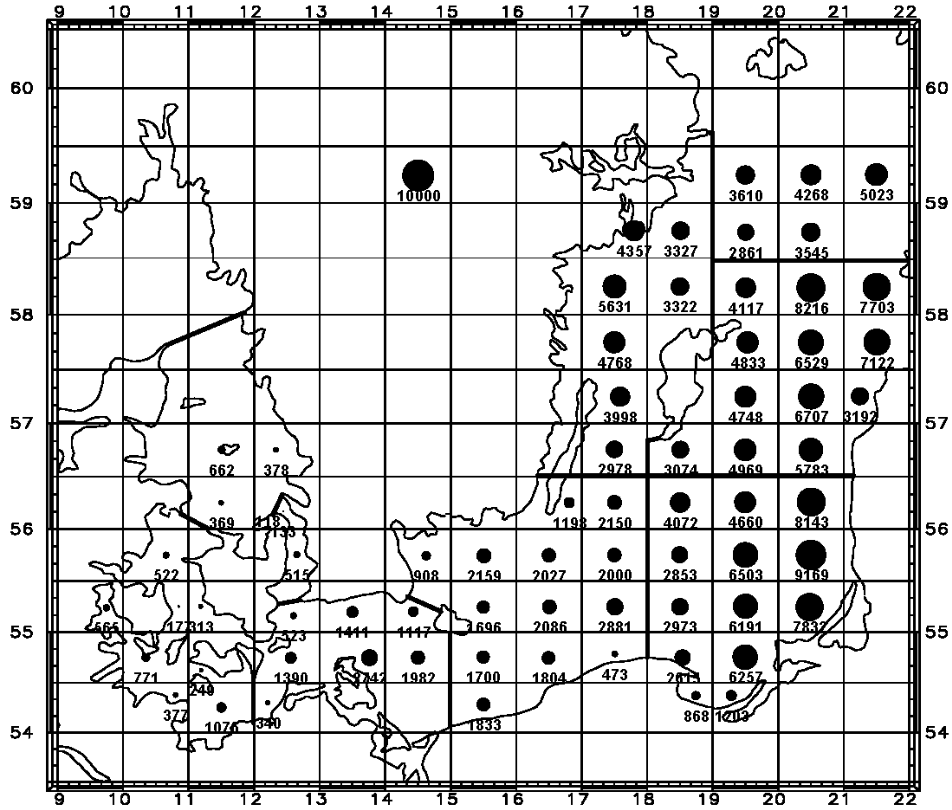

Fig. 7 Total abundance (millions)

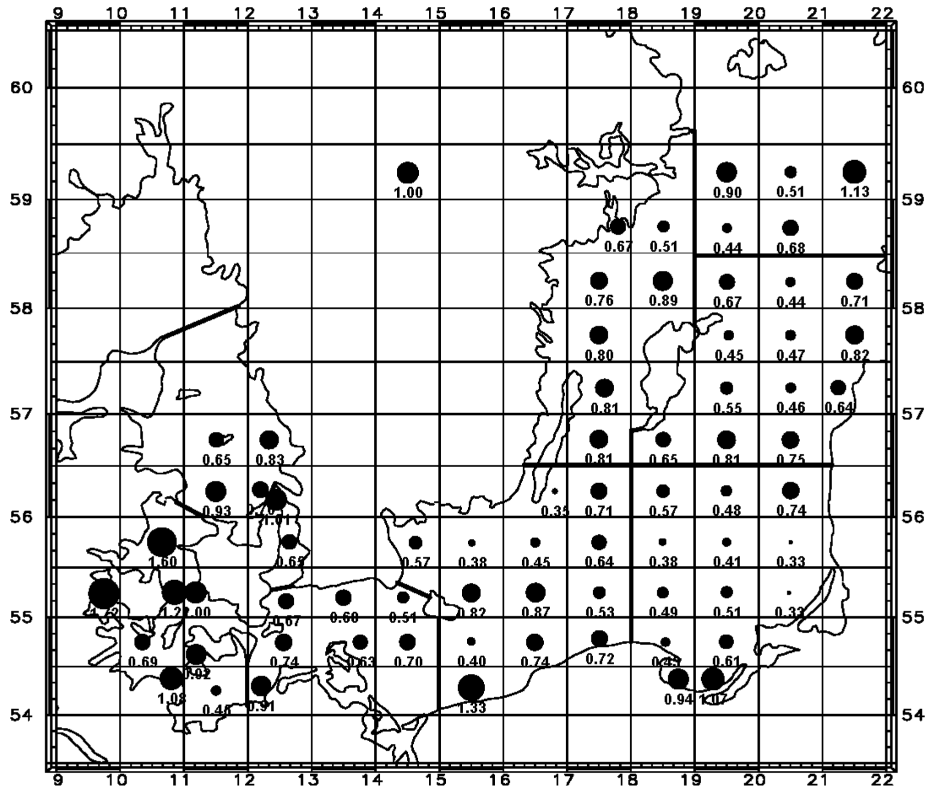

Fig. 8 Variability (C.V.) in the total abundance

high fish abundance. The small scattering cross section implies also that it consist probably of small fish. The numbers of fish in the western and southern Baltic Sea (subdivisions 21 to 25) are comparatively small against it. It should be noticed however that it concerns billions of fish per rectangle also there. The variance of the total abundance (fig. 8) is particularly high in the west. This value states however few. Therefore it is better to examine the variability of the two main species herring and sprat.
The abundance of herring (fig. 9) is quite evenly distributed over the entire Baltic Sea. The numbers mostly range between 500 million and a billion per rectangle. Only in the west these values are smaller.

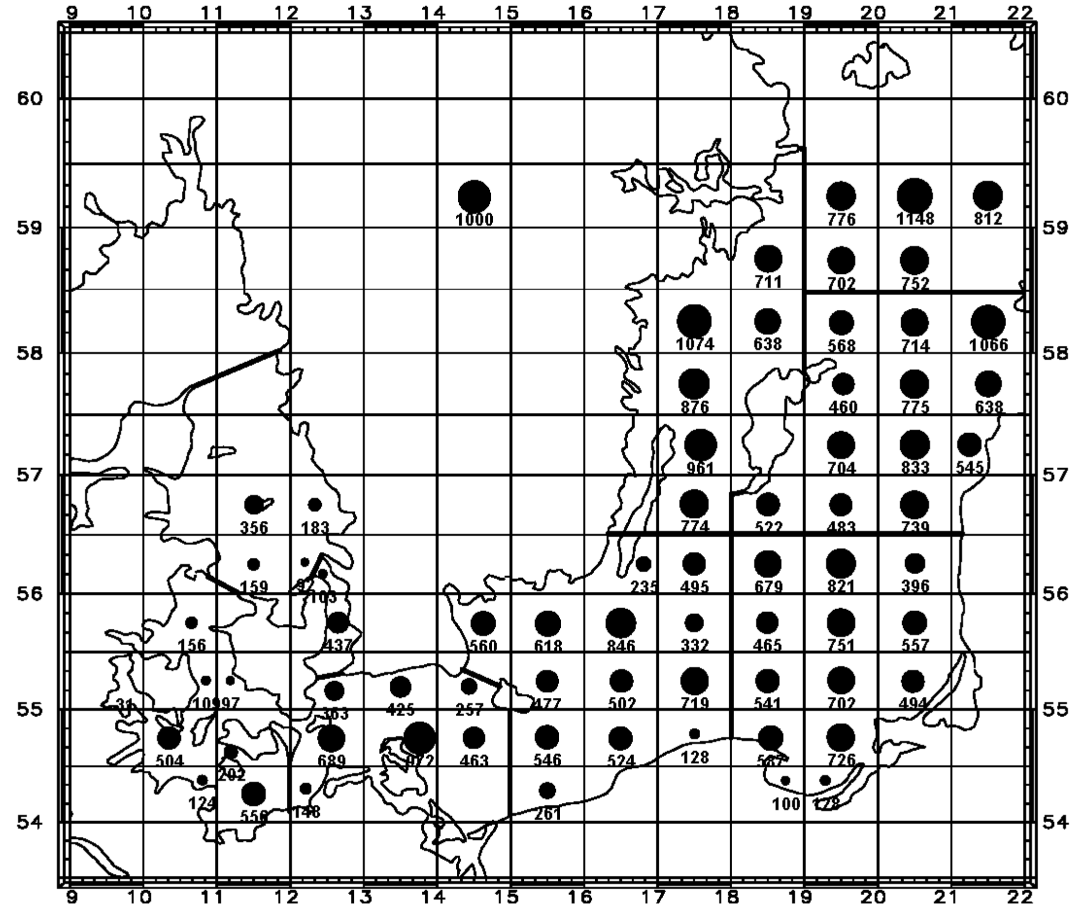

Fig. 9 Mean abundance of herring (millions)

On the other hand the sprat is mainly concentrated in the eastern and northeaster Baltic Sea (see fig. 10). The sprat numbers are higher nearly an order of magnitude than the herring values. At these high densities the abundance in the southern and western Baltic looks quite poor. It should be noted however that the abundance of sprat nevertheless reaches the herring values there.

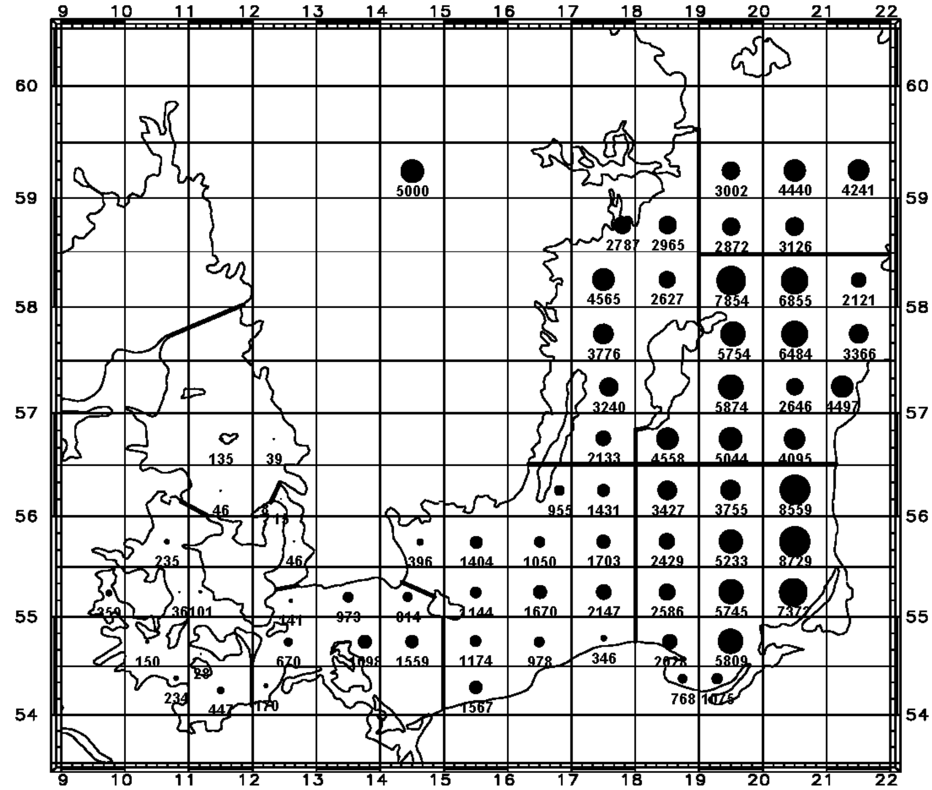

Fig. 10 Mean abundance of sprat (millions)

The quite high temporal stability of the sprat abundance is remarkable (fig 11). In the main concentration area the coefficient of variation C.V. is usually smaller 0.5. That means the standard deviation is only half as large as the average. In the areas with small sprat density this C.V. is much higher. There we have a substantial annual change of the sprat abundance.

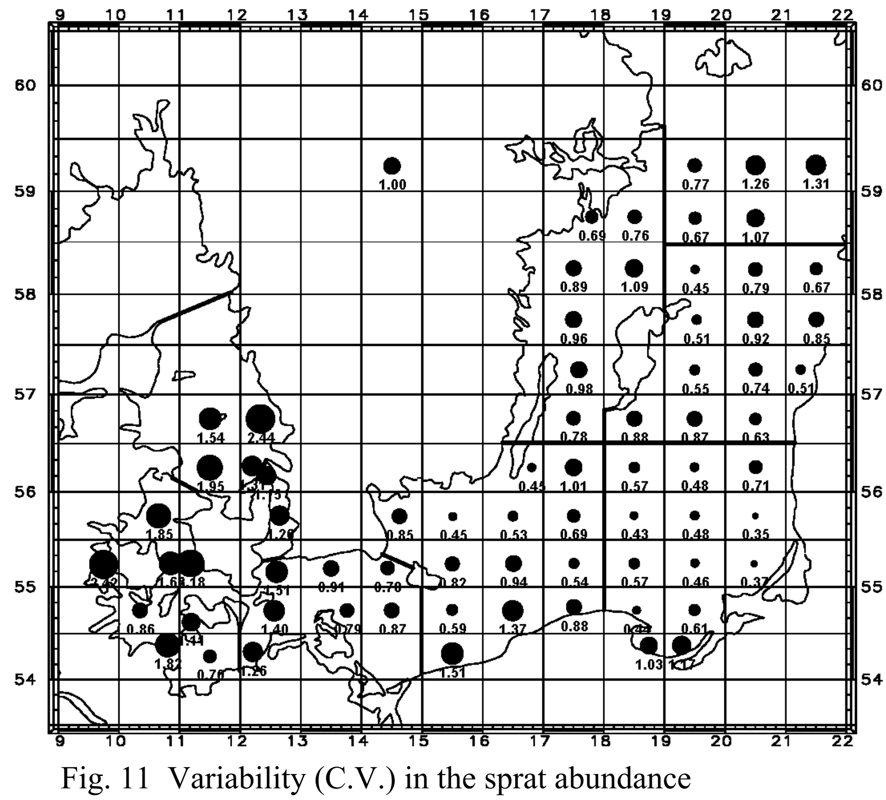

Fig. 11 Variability (C.V.) in the sprat abundance

Finally we want to examine the age distribution of herring and sprat. The herring (fig. 12) shows a regular behaviour only in the western Baltic. The abundance of the 0-group is highest and the numbers decrease with rising age. In the remaining areas young fish is strongly under represented. The missing young herring in the central Baltic cannot be supplied from the western Baltic, because it concerns to separate stocks. Obviously the young herring in the largest part of the investigation area is not sufficiently covered.
A similar picture results for sprat (fig. 13). Only in the offshore areas in the southeast are substantial quantities of young fish. This problem should be discussed in more detail.
With the stated analyses only the average value and the variance of the time series were examined. Already these simple descriptions brought quite interesting views of the stability and dynamics of important stock parameters.

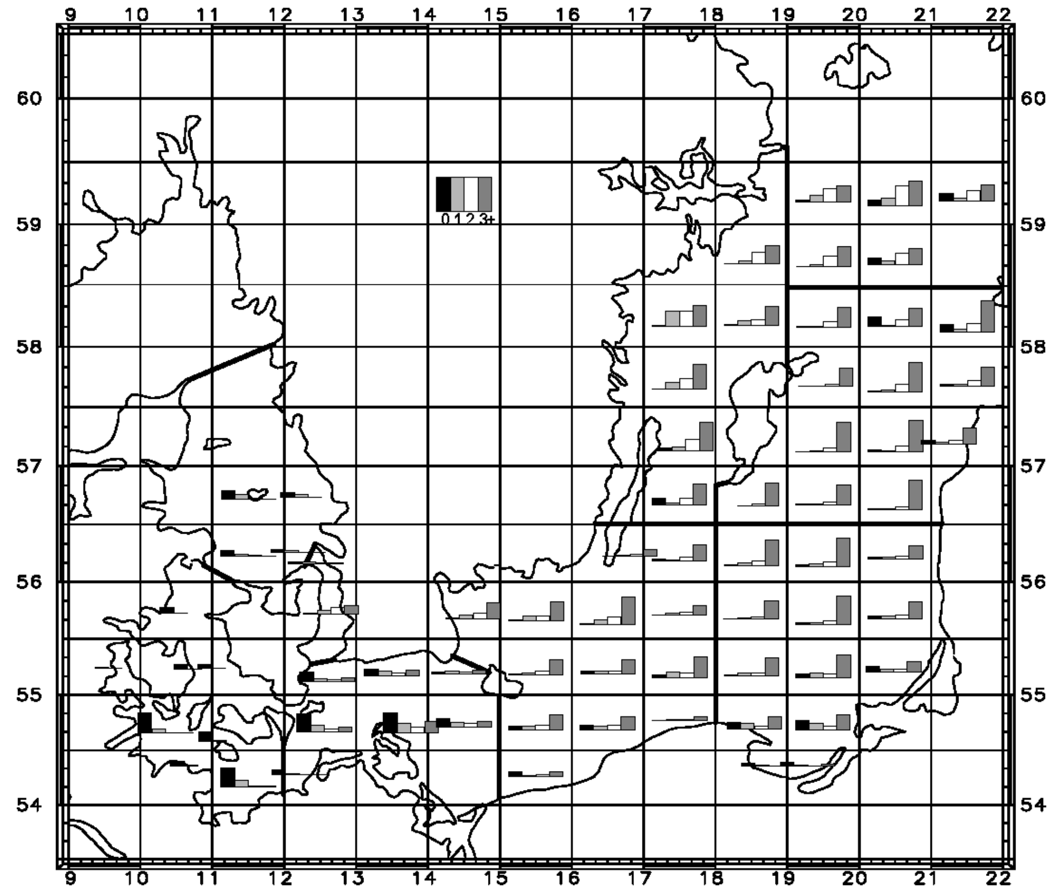

Fig. 12 Age composition (age 0, 1, 2 and 3+) for herring

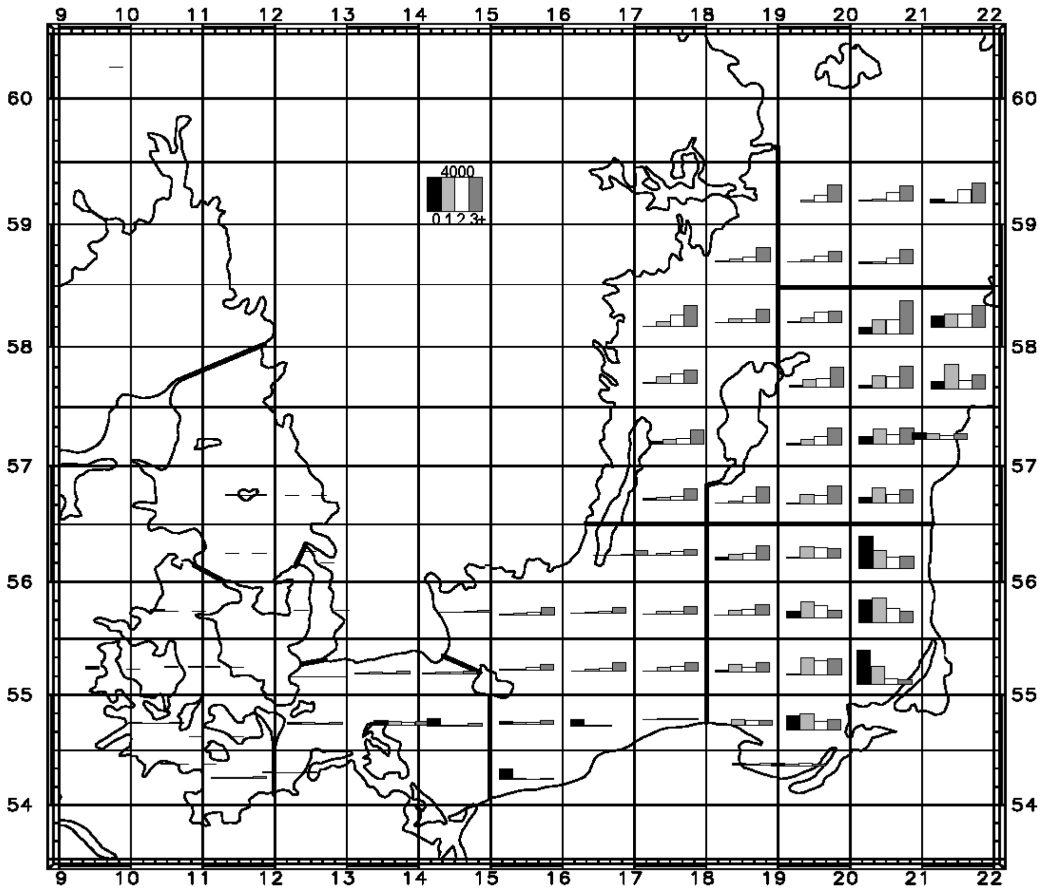

Fig. 13 Age composition (age 0, 1, 2 and 3+) for sprat

WGBIFS 2003
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Proposed modifications to the
MANUAL FOR THE BALTIC INTERNATIONAL ACOUSTIC SURVEY
(BIAS)
Version 0.72
07.04.2000

by
T. Gröhsler (IOR) & E. Götze (IFH)
Germany

I Proposed modifications

2.3 Transects

Original: … unsuiTable
New: … unsuitable

Original: The length of the survey track should be chosen proportional to the parallel case.
New: The transect density should be in the same order as for above mentioned the parallel transects.

2.4 Observation time

Original: Therefor the surveys should be carried out only during nighttime.
New: Therefore it is recommended that shallow water areas should be surveyed only during night-time.

4.2 Method

Original: It is recommended to sample a minimum of 2 hauls per stratum.
New: It is recommended to sample a minimum of 2 hauls per ICES rectangle.

Original: With two or more fish layers in an area (Figure 4.2.1), all layers should be sampled by separate hauls.
New: In the case of two or more layers in one area (Figure 4.2.1), it is recommended to sample all layers by separate hauls.

4.3 Samples

New 1: **<u>For Rectangles, which include hauls with small and large catches</u>: Hauls (kg/0.5 h) with small catches of less then 50 clupeoid specimens should in general be excluded from further analysis.**

or

New 2: **<u>For Rectangles, which include hauls with small and large catches</u>: Hauls (kg/0.5 h) with small catches, which are contributing to the overall mean catch in numbers of all survey hauls with less then 5 percent, should in general be excluded from further analysis.**

4.3.2 Length distribution

Original: In case of large catches of clupeoids with a small length spectrum, a sub-sample should be taken containing at least 200 specimens per species to get a reasonable normal length distribution. For other species at least 50 specimens should be measured.
New: In case of **small catches of clupeoids** it is recommended to measure **all herring and sprat**. In case of **large catches of clupeoids with a small length spectrum** the following sub-sample size is recommended: **200 specimens for herring**, **100 specimens for sprat** and other species 50 specimens.
In case of large **catches of clupeoids with a wide length spectrum** the following sub-sample size is recommended: **400 specimens for herring**, **200 specimens for sprat** and other species 50 specimens.

4.3.3 Weight distribution

The sentence at the end 'Herring and sprat should be sorted into 0.5 cm length groups and weighted' should be moved to the start of the chapter 4.3.3.

4.3.4 Age distribution

Original: The following minimum sampling levels should be maintained for herring and spat per Sub-division:

- 5 otoliths per 0.5 cm length-class for l<10 cm

- 10 otoliths per 0.5 cm length-class for l>=10 cm

New: The following minimum sampling levels should be maintained for herring and spat per Sub-division and per 0.5 cm length-class:

- 5 otoliths for l<10 cm
- 10 otoliths for l>=10 cm

5.1 Species composition

Original: Each trawl catch is given equal weight, unless it is decided that a trawl is not representative for the fish concentrations sampled. In this case, the particular trawl catch is not used. The species frequency fi of species I can be estimated by …

New: Each trawl catch is given equal weight. The species frequency f_i of species I can be estimated by …

What is the meaning of M in the formula? M = total number of hauls?

Original: A species can be excluded if the percentage is lower than one percent.

New: A species can be excluded from further total species frequency calculation if the overall mean contribution to all sampled hauls is lower than one percent.

5.2 Length distribution

Original: In this case each trawl catch is given equal weight. Very small samples are considered as non representative and excluded from the calculation. We find the length frequency f_{ij} in the length class j as the mean over all M_i trawl catches containing the species i….

New: In this case each trawl catch is given equal weight. The length frequency f_{ij} in the length class j is calculated as the mean of all M_i trawl catches containing species i ….

5.3 Age distribution

Minimum and maximum effort method should be in bold letters!!

5.4 Weight distribution

Minimum and maximum effort method should be in bold letters!!

5.5 Lack of sample hauls

Eberhard??

5.6 Allocation of records

Original: … stratum.

New: … ICES rectangle.

5.7 Target strength of individual fish

Original: We get the simple formula:

New: We get the formula:

5.8 Estimation of the mean cross section in the stratum

New header?: Mean cross section

Original: … stratum.

New: … ICES rectangle.

5.9 Estimation of the mean cross section in the stratum

Original: … stratum.

New: … ICES rectangle.

II Problems still left to solved

Since a couple years the following problems are every year addressed in the report but could jet not be solved between the meetings:

- Basic aspects/requirements of survey design
- Gear specific selectivity
- Optimum sample size for length, weight and age distribution
- Calculation method for species composition and length distribution
- Lack of sample hauls

A detailed description of the problems can be found in the 2002 WGBIFS-report (ICES CM 2002/G:05 Ref. H).

It is suggested to install a Study group at least for one year to solve the above mentioned problems.

The TV-3#930 trawl calibration experiment results obtained by the Polish r.v. "Baltica" (November 2002)

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INTRODUCTION

The issue of the inter-calibration of bottom trawls used by research vessels for Baltic fish catches has been addressed few times during the Study Group on Young Fish Surveys in the Baltic and the Baltic International Fish Survey Working Group meetings. Some of the first international experiments focused on this issue were conducted in December 1983 (Schulz and Grygiel 1984, 1987) and in March 1986 (Anon. 1987) under the co-ordination of the above mentioned ICES Study Group.

In light of the need to standardise the fishing gears used in research catches of Baltic fish, the international EU Study Project No. 98/099: ISDBITS was launched in January 1999 (Nielsen et al. 2001a). In November 1999 the new standard TV-3 bottom trawl was introduced and from spring 2000 is an applied in BITS survey (ICES 1998, Nielsen 2001, Nielsen et al. 2001b). One of the tasks of the above mentioned project was to inter-calibrate the trawls, which had been used previously by various research vessels with the new TV-3 trawl. The aim of these works was to evaluate the data conversion coefficient (Oeberst et al. 2000, Nielsen 2001, Oeberst and Grygiel 2002, Nielsen et al. 2001b, Gasyukov 2002).

This report presents the results of Polish research catches conducted in November 2002 aboard the r.v. Baltica which were part of the international calibration experiment (type 3) for the TV-3 bottom trawl. The aim of these investigations was to evaluate the impact of disturbances, mainly acoustic type, caused by the working trawl and the vessel on the fish aggregations in the given area. CPUE was used as the measure of fish concentration. This research was initiated and co-ordinated by the Baltic International Fish Survey Working Group (Anon. 2002).

MATERIALS AND METHODS

The basic biological and fishery studies were conducted aboard the r.v. Baltica in the period 5-9 November 2002, within the Polish EEZ (the southern part of ICES Sub-divisions 25 and 26; Fig. 1). Of the total of 25 control hauls conducted, 20 were aimed at calibrating the TV-3#930 bottom trawl with 10 mm bar length in the codend. Ten calibration hauls were made in each of the investigated basins - Gdansk and Bornholm. The type 3 of calibration experiment was comprised of two consecutive hauls made with the same trawl at the shortest possible time interval. Each haul started from the same location, followed the same route (ship's course) at a constant depth and lasted for 30 minutes. The term prime haul, which is used in the reminder of the text, refers to the first fish catch made in a particular location.

The fish were caught during the day at vessel working speeds of 3.1-3.4 knots. The depth range for all hauls was 17-65 m and the average was 32.5 m. The results of investigations were separated according to the catch depth criterion - of shallow (20-40 m) and medium-deep (50-65 m) waters. All catches were representative and were conducted properly from a technical point of view; during one haul the front, bottom part of the trawl was damaged while it was being hauled in. A CPUE of 0.0 kg/h was not reported in any of hauls. Each catch was sorted by species and weighed and the CPUE per one hour of trawling were calculated for the various fish species.

The following materials related to the experiment on trawl calibration were collected and analysed:

- detailed biological and exploitation data for 10 prime and 10 repeated hauls, including the CPUE for various fish species and their percentage in total catch;

- total length measurements in 1-cm classes for 2,273 cod specimens, i.e. all the specimens caught in 18 calibration hauls;
- length and mass measurements in 0.5-cm classes for 3,082 herring specimens from 18 random samples;
- length and mass measurements in 0.5-cm classes for 2,841 sprat from 14 samples;
- length measurements in 1-cm classes for 2,701 flounder specimens from 20 samples;
- the share (by numbers) of young cod, herring, sprat and flounder under the protection length limit, i.e. 35, 16, 10 and 25 cm total length, respectively in each of the samples representing a particular haul (Grygiel et al. 2002).

RESULTS

CPUE of cod, herring, sprat and flounder in the prime hauls and repeated hauls

The weather conditions during the survey and the lack of significant seawater temperature gradients up to 80-90 m isobaths not determined conducting the planned control catches or the depth range of vertical fish migrations. The mean seawater temperature, salinity and oxygen contents at the catch sites were 8.65ºC, 7.48 PSU and 7.03 ml/l, respectively. The values of these hydrological parameters were stable and relatively high throughout the study area.

A total of 23 fish species were recorded in the control hauls with flounder being the most common and occurring in 100% of the hauls, followed by cod in 96%, herring in 92% and sprat in 76%. These species dominated in terms of CPUE in all the investigated areas.

The mean CPUE was higher in prime hauls than in repeated hauls by 31.3% for all fish species, 37.3% - cod, 46.4% - herring and 17.5% - flounder. The maximum differences in CPUE (in kg/h) of the individually compared pairs of hauls conducted for the first time in the same place and then repeated were as follows:

- all species – 629.2;
- cod – 152.2;
- herring – 739.7;
- flounder – 206.7 (Figures 2 and 3).

Exceptionally, the CPUE of sprat was higher (on average by 28.8 kg/h = 29.1%) in repeated hauls versus prime hauls in the 20-40 m water layer. The average percentage of sprat was also 10.5% (by weight) higher in repeated hauls (mean = 24.6%) than in prime hauls (Fig. 3). The difference in CPUE of sprat in the prime and repeated hauls might be caused by their reaction to the mechanical and acoustic stress (disturbance) which occurs in the vicinity of the working vessel and trawl and differs from that of the other species. Sprat, pelagic and shoal types of fish are more mobile than cod, flounder and adult herring. Additionally, it is a natural defence mechanism for these small fish to reassemble immediately after the disturbance ceases.

The next stage of the study was to statistically analyse the CPUEs for cod, herring, sprat, flounder and altogether species obtained in both prime and repeated calibration hauls (Fig. 2). The results of the applied regression analysis (linear model) of the CPUE in repeated hauls versus the CPUE in prime hauls show statistically significant dependence between the variables ($r = 0.957$, $\alpha = 1.90E\text{-}27$, F-ratio = 522.4; Fig. 2.D). Used statistical model in 91.6% explains the variation of the dependent variable. The CPUE in both the prime and repeated hauls exhibited similar increasing tendencies; however, in terms of absolute values, the prime hauls were almost always higher.

Length distribution of cod, herring, sprat and flounder in the TV-3 trawl calibration experiment

The length distribution of cod, herring, sprat and flounder specimens in prime and repeated hauls during the TV-3 trawl calibration experiment for the entire investigation area are presented in Figure 4. The length range of the fish in the studied samples was as follows:

- cod − 4.0-68.0 cm (plus one specimen 102.0 cm in length);
- herring − 8.0-31.5 cm (plus one specimen 34.0 cm in length);
- sprat − 6.5-16.0 cm;
- flounder − 12.0-44.0 cm.

The length distributions for cod, herring and flounder were similar in both the prime and repeated hauls. A slight shift of the frequency peaks towards higher length classes was observed in the repeated hauls (Fig. 4). The length distribution between the prime and repeated hauls differed slightly only with sprat. The distribution curve in the latter haul type was flatter, and the frequency peaks in the group of fish above 10 cm were divergent.

Two dominant groups of fish, which were nearly equal in terms of frequency, were clearly distinguishable in the length distribution of cod – classes 20-26 cm and 32-40 cm (Fig. 4). Young herring specimens from the 11-13 cm length classes clearly dominated the samples, while the percentage of those from the 17-19 cm classes were of secondary importance. In the sprat samples young specimens from the 8.0-9.5 cm classes dominated and longer, older fish from the 11.0-14.0 cm classes were of secondary importance. So-called 'undersized' flounder specimens from the 16-24 cm length classes clearly dominated.

The mean length, the mean weight and the percentage (by numbers) of undersized fish in the samples from the prime and repeated hauls were almost similar (see the following table):

		mean		percentage of undersized specimens
		weight [g]	length [cm]	
cod	prime hauls	486.30	33.76	72.1
	repeated hauls	415.33	33.30	67.4
herring	prime hauls	29.95	15.86	55.7
	repeated hauls	35.99	16.78	50.2
sprat	prime hauls	8.03	10.55	56.5
	repeated hauls	7.49	10.31	54.5
flounder	prime hauls	200.22	24.91	86.1
	repeated hauls	201.38	25.02	89.8

CONCLUSIONS:

A) The mean CPUE of fishes, caught in November 2002 in the Polish EEZ, was higher in the prime hauls than in repeated hauls (made in the same location) with the exception of sprat - to, which were lower:
- 31.3% for all fish species,
- 37.3% for cod,
- 46.4% for herring,
- 17.5% for flounder,
- 29.1% for sprat (in the 20-40 m water layer); the mean share of sprat in repeated catches was 10.5% higher than in prime hauls.

B) The results of the regression analysis (linear model) of the CPUE in repeated calibration fish catches versus the CPUE obtained for the prime catches show a statistically significant dependence between the variables ($r = 0.957$, probability level = 1.90E-27, $R^2 = 91,6\%$, $y = 37.226 + 1.211x$).

C) The length distribution of cod, herring, flounder and, to some extent, sprat were almost similar in both prime and repeated hauls. A slight shift in frequency peaks towards longer length classes was observed in repeated hauls.

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Figure 1. The geographical distribution of bottom control hauls conducted by r.v. "Baltica" during the BITS survey (5-9 November 2002) in the Polish EEZ

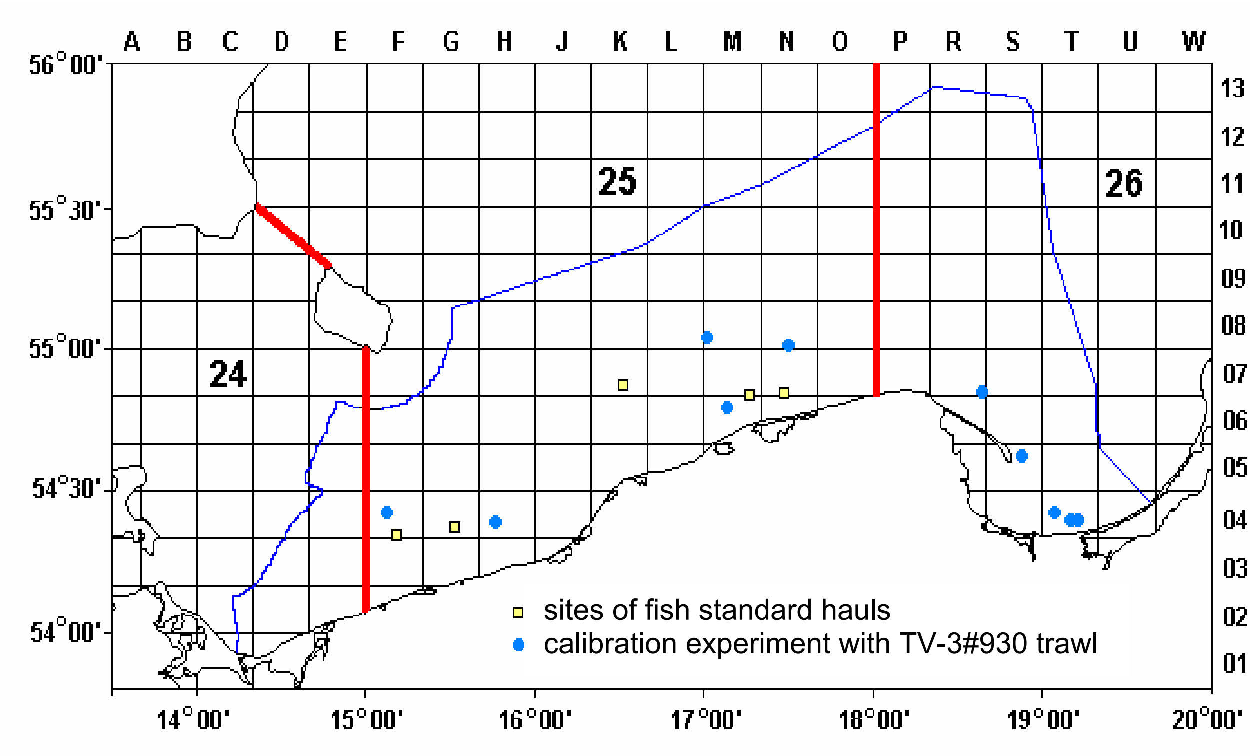


Figure 2. The mean CPUEs of fishes in the prime and repeated hauls and difference between the CPUE in two type of hauls in the TV-3#930 bottom trawl calibration experiment conducted in the Polish EEZ (05-09 Nov. 2002; parts A, B, C) and the regression analysis of the CPUE in repeated hauls vs. the CPUE in prime hauls (part D); total - all fish species including the by-catch

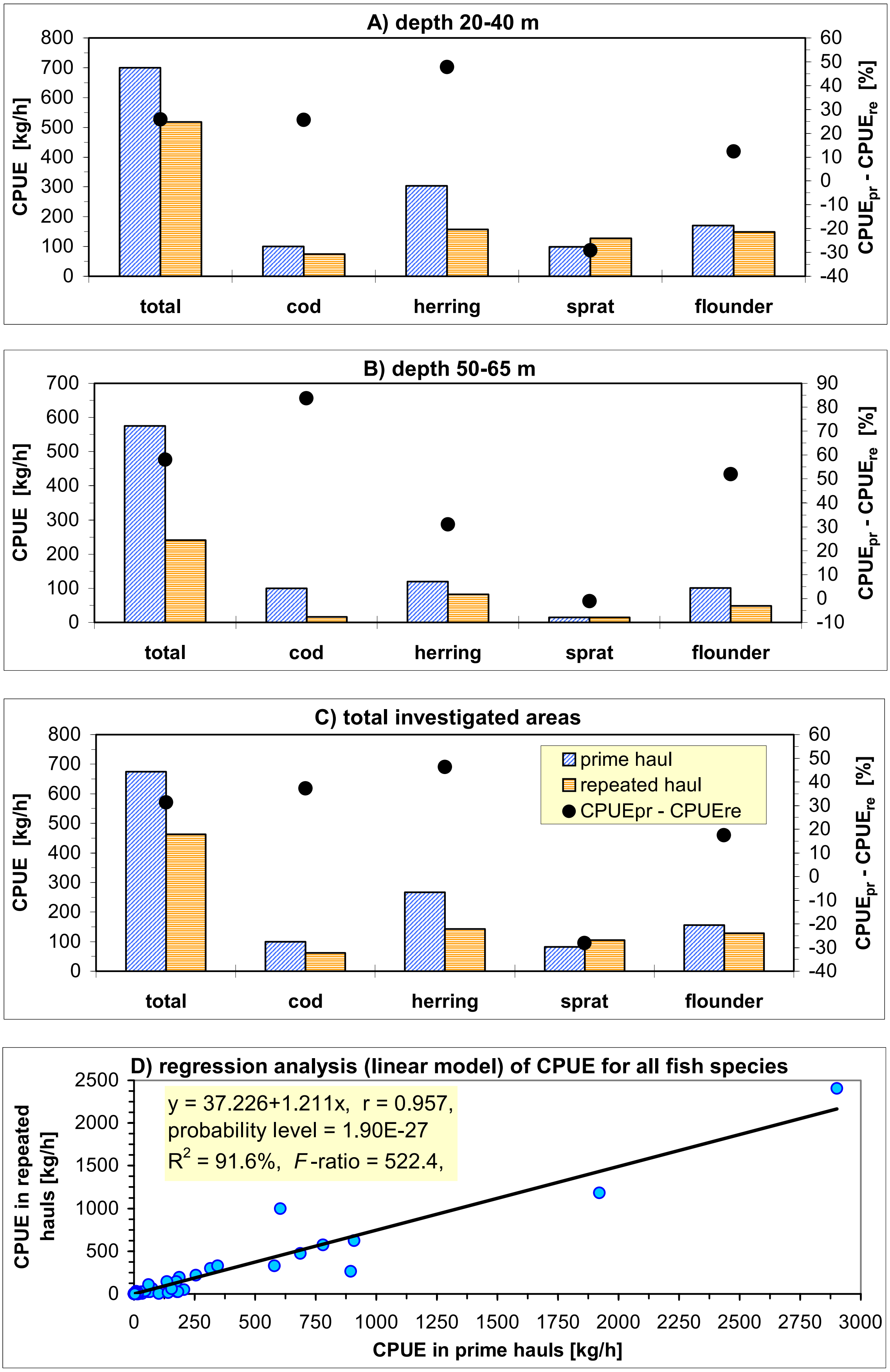


Figure 3. The share (in %) of particular fish species in the prime and repeated hauls conducted during the TV-3 bottom trawl calibration experiment on r.v. "Baltica" (05-09 Nov. 2002) in the Polish EEZ at different depth strata

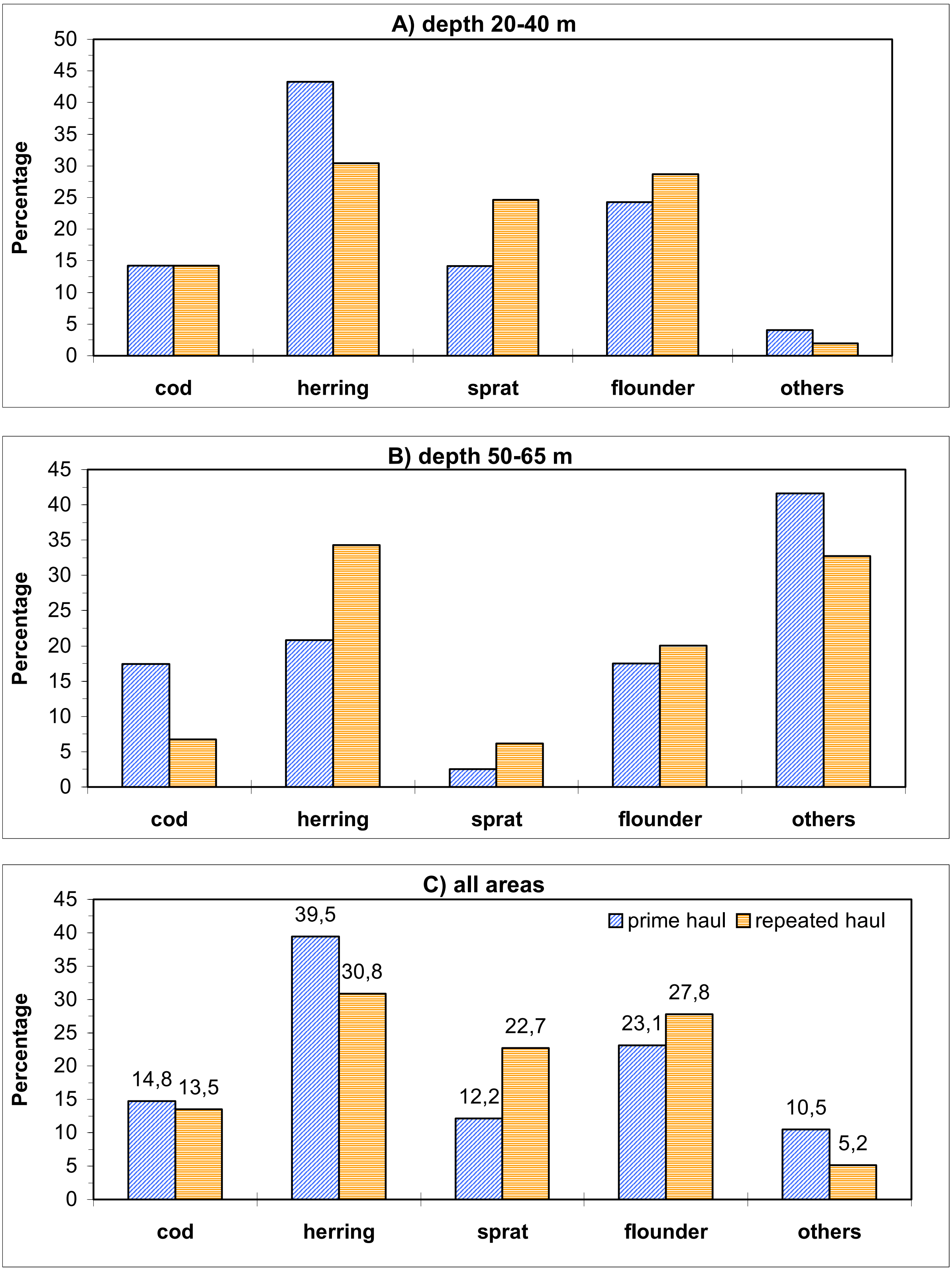
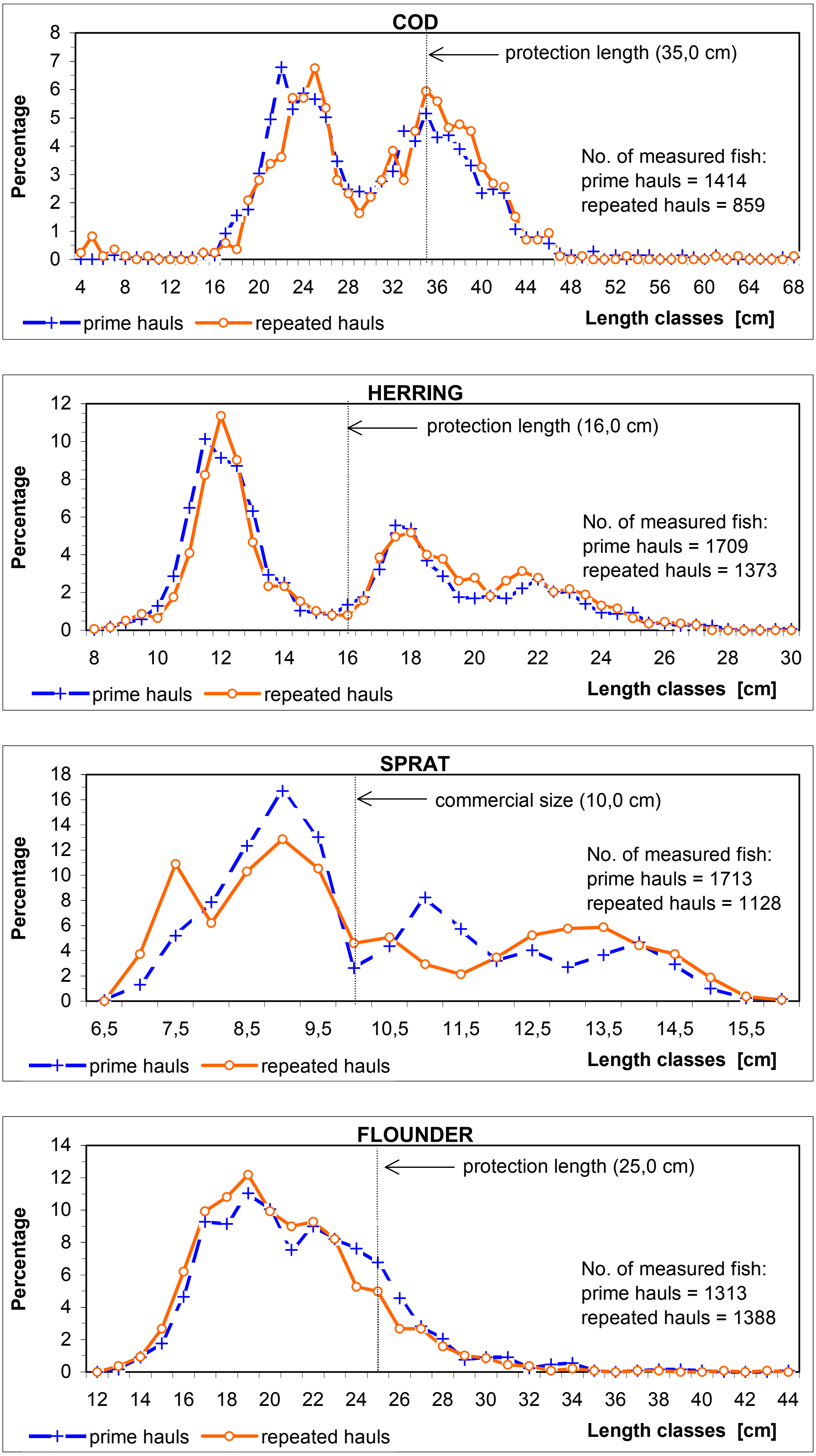


Figure 4. Length distribution of cod, herring, sprat and flounder in the prime and repeated hauls, conducted during the TV-3 bottom trawl calibration experiment on r.v. "Baltica" in November 2002 (all investigated areas)



BIFSWG meeting, Copenhagen 24-28.03. 2003
Working paper

Some peculiarities of the October 2002 hydroacoustic survey in the Polish EEZ

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INTRODUCTION

The Sea Fisheries Institute in Gdynia has conducted hydroacoustic surveys in the southern Baltic Sea since 1982. The cruises usually take place in October and have been conducted from the r/v *Baltica* since 1994. The Baltic International Fish Survey Working Group (BIFSWG) has co-ordinated the surveys for the last seven years.

This paper presents basic results of fish species composition and the CPUE of fishes in the control catches made during the October 2002 cruise of the r/v *Baltica* which took place in the Polish EEZ. Changes in some hydrological parameters (mainly in the seawater temperature) were observed during this period in the southern Baltic Sea, and the occurrence of relatively high concentrations of the jellyfish (medusae) *Aurelia aurita* were noted. The jellyfish by-catch was estimated with regard to the mass of fish caught and to its geographical distribution. An attempt was made to statistically evaluate the dependencies between the CPUEs of jellyfish and fish and between the CPUEs and water temperature in the area where the pelagic trawl was deployed. One of the causes of distortion in the indications of the EY-500 echosounder transducer was revealed.

MATERIALS AND METHODS

During the r/v *Baltica* hydroacoustic survey from 18 to 27 October 2002, a total of 23 control hauls were conducted at depths from 7 to 76 m from the sea surface. A total of 2, 13 and 8 control hauls were made in ICES Sub-divisions 24, 25 and 26, respectively (Fig. 1.A). The catches were conducted along the standard Polish hydroacoustic transects (echo integration). The study area comprised the part of the southern Baltic Sea that is within the Polish EEZ (Figures 1.A and 1.B).

A WP 53x64x4 pelagic herring trawl with an 11-mm bar length insert in the codend was used. Wesmar TCS700E sonar was used to control the trawl during deployment. The vertical trawl opening varied from 14.0 to 16.5 m (average of 15.9 m). Most of the hauls (20) were conducted during the day, but three were conducted at dusk. The unit haul time in 87% of hauls was 30 minutes, while in the remaining 13% it was 60 minutes.

A set of echograms which represent the temporary record of fish distribution in October 2002 throughout an area of 7643.7 nm^2 (calculated according to ICES Sub-divisions) was obtained. The hydroacoustic investigations were conducted on the distance of 1,089 nm.

Stratified measurements of seawater temperature, salinity and oxygen content (Winkler method) were made in the direct vicinity of the 23 trawling locations at isobath depth intervals of 2.5 m. Additional measurements of these parameters were taken at eight standard hydrographic stations, which are located in the main profile of the southern Baltic Sea (Fig. 1.B). A CTD Neil-Brown sound jointed with bathymeters rosette was used for the measurements. Wind speed and direction and the state of the sea were also recorded at the trawl release sites.

RESULTS

Hydro-meteorological conditions during fishing

Strong and very strong winds with speeds reaching 30 m/s were registered during the hydroacoustic survey. The wind force throughout the catch period was an average of 5ºB. Southerly winds prevailed for 82.6% of the hauling time (south-easterly directions dominated), while northerly winds prevailed during the remaining 17.4% of hauling time.

In October 2002 the highest average seawater temperature (12.58ºC) at catch depth was registered in the western part of the studied areas, while the lowest (8.74ºC) was noted in the eastern part. The ranges of mean salinity and oxygen content in the three studied ICES Sub-divisions were relatively narrow at 7.36-7.75 PSU and 6.42-6.91 ml/l (Grygiel et al. 2002). Water temperature in the catch areas was higher in October 2002 than in October 2000 by an average of 3.72ºC, 4.20ºC and 3.57ºC for ICES Sub-divisions 24, 25 and 26, respectively.

The exceptionally high water temperature in October 2002, which reached 14°C in the surface layers in the western and central parts of the southern Baltic Sea (Fig. 7), combined with the absence of the traditional thermal gradient in the deeper layers resulted in a decrease of fish biomass (density) in the Polish EEZ. In October 2002 the CPUEs were lower by 21.2% in comparison to those in 2001 (204.3 kg/h) and by 19.0% to those in 2000 (198.8 kg/h; Grygiel et al. 2002). The traditional fish concentrations in the Gdansk Deep and the Gulf of Gdansk were shifted to a small area located near the Vistula River mouth. The distribution of clupeid stocks in the Polish EEZ in October 2002 must be regarded as highly atypical and largely the result of climatic anomalies.

The mean CPUE of the main fish species and by-catch of jellyfish (medusae) *Aurelia aurita*

In October 2002 sprat dominated the pelagic control hauls, and their mean share to the mass of all fish caught was 67%. The second most common fish was herring with the mean share of 31% (Fig. 2). In October 2000, during an analogous survey the proportions were reversed, i.e. the mean share of herring was 63%.

The mean sprat CPUE in October 2002 in ICES Sub-divisions 24, 25 and 26 increased from 27.0 to 77.0 and to 176.4 kg/h, respectively (average for the study area - 107.2 kg/h; Fig. 2). The proportions between the mass of sprat and other fish species caught in Sub-divisions 24 and 26 were almost identical at 80.8 and 80.5%, respectively. In Sub-division 25 the sprat share in the control catches was lower at 53.2% and did not vary much from that of herring at 45.4%. It should be stressed that the mean percentage of herring in catches conducted in Sub-divisions 24 and 26 was similar at 13.8 and 17.0%, respectively, although the CPUEs varied significantly (Fig. 2). A tendency for the mean herring CPUE to increase was observed in the central part of the Polish EEZ where it was 65.8 kg/h, while decreases of 93 and 44% were observed in the western and eastern parts, respectively. The mean share of cod in the by-catch throughout the studied area was 1.5% (in 2000 – 0.8%); other species in it occurred in trace amounts.

The mean CPUE throughout the entire study area for all 12 fish species identified in the control catches was 160.9 kg/h and ranged from 6.8 to 926.9 kg/h. An increase of the mean CPUE from 33.4 to 144.8 and 219.1 kg/h and in the number of fish species from three to 11 was observed in catches which were conducted in stages from west to east of the Polish EEZ (Sub-divisions 24, 25 and 26).

As mentioned earlier, a significant by-catch of jellyfish *Aurelia aurita* was noted in pelagic control catches in October 2002, just as they had been e.g. in October 1999. The specimens were large, exhibited negligible metabolic activity and had almost entirely resorbed gonads following reproduction. The jellyfish concentrations were registered mainly at depths of 50-65 m. The results obtained by other researchers (including Margoński and Horbowa 1994, 1995), indicated that large concentrations of jellyfish *Aurelia aurita* occurred in the Bornholm Deep in summer mainly at depths of 50-60 m. Cod eggs was also present in this layer. The abundant occurrence of *Aurelia aurita* was associated with the warm-water (8-12°C) intrusion from the Arkona Basin.

Jellyfish were very common in nine hauls in October 2002, and their "CPUE" range was estimated to be from 14.0 to 78.2 kg/h. The jellyfish by-catch was insignificant or non-existent in other hauls. It should be mentioned that a large number of the jellyfish caught were entangled in trawl meshes; the jellyfish CPUE presented in this report refers only to those which were landed along with fish. A tendency for the jellyfish CPUE and by-catch to decrease was noted in hauls conducted from west to east in the southern Baltic Sea. In 2002, an average of 70 kg/h, 14 kg/h and 6 kg/h of jellyfish were caught in Sub-divisions 24, 25 and 26, respectively (Figures 3 and

4). A similar tendency was observed in October 1999, when an average of 107 kg/h, 54 kg/h and 11 kg/h of jellyfish were caught in Sub-divisions 24, 25 and 26, respectively (Fig. 3). In October 2002 the jellyfish by-catch in individual control hauls varied from 0 to 1153%, for an average of 9.9% throughout the study area, while in 1999 it was from 0 to 2950%, with an average of 22.4% (Fig. 3).

The data regarding the proportions between the mass of caught jellyfish and fish in the compared basins are more important than catch data. This is because they allow for the better understanding of, for example, the mechanisms of competition for a free ecological niche. Considerable numbers of jellyfish in a given area significantly distorts the integration of the echo reflected by the fish. In October 2002 the ratios of the mass of jellyfish and fish caught in Sub-divisions 24, 25 and 26 were 2.1:1.0, 0.1:1.0 and 0.03:1.0, respectively; the figure for the entire study area was 0.1:1.0 (in 1999 - 0.2:1.0).

Based on the distribution of parameters – fish CPUE and jellyfish by-catch in the individual hauls conducted in October 2002 (Fig. 5.A) and seawater temperature distribution at haul depth – the following theses were formulated and regression analysis was used to explain them:

a) increases in jellyfish *Aurelia aurita* CPUE were accompanied by decreases in fish CPUE;
b) increases in sea water temperatures were accompanied by increases in jellyfish CPUE;
c) increases in sea water temperature were accompanied by decreases in fish CPUE.

The multiplicative model occurred to be the best for solving the first dependence, while the statistical model based on a polynomial of the 2nd order was best for the second and third. The results of calculations indicated the diverse and statistically significant dependence of the three compared variable pairs:

- dependence "a": $r = -0.691$, $\alpha = 0.0003$, 47.8% explanation of the variance of the dependent variable (Fig. 5.B);
- dependence "b": $r = 0.57$, $\alpha < 0.01$, 32.7% explanation of the variance of the dependent variable (Fig. 5.C);
- dependence "c": $r = -0.633$, $\alpha < 0.01$, 40.1% explanation of the variance of the dependent variable (Fig. 5.D).

In October 2002 both the mean seawater temperature and the jellyfish by-catch exhibited decreasing tendencies from the west towards the east in the southern Baltic Sea, while fish CPUE increased (Fig. 5.A). The highest fish CPUEs were recorded at locations where jellyfish were not present or catches of them were insignificant.

In addition to the biological and mechanical distortions in echo integration experienced during the research cruise which were related to the occurrence of jellyfish assemblages, there were also fairly serious problems with calibrating the EY-500 echosounder. The device was calibrated by representatives of the SIMRAD Company. The same calibration method was used as in October 1998 and 2000 and it was conducted in the standard calibration location, i.e. near Bogen (Sande Bay in the Oslo Fjord). The new calibration coefficient was different from that obtained in October 2000.

After the r/v *Baltica* returned to Gdynia, the location of the echosounder transducers on the vessel bottom was inspected. Underwater pictures revealed the presence of large concentrations of the barnacle *Balanus improvisus*, which had overgrown the surface of both transducers (Fig. 6). The other areas of the vessel bottom were free of barnacles. The numerous air bubbles, which concentrated between the barnacle shells when the vessel was stationary during calibration procedures, had the greatest impact on the calibration coefficients obtained. These air bubbles distorted the acoustic signals transmitted (Grygiel et al. 2002).

CONCLUSIONS:

A) In October 2002 both the mean seawater temperature and the by-catch of jellyfish in control pelagic fish catches exhibited a tendency to decrease from the west towards the east in the southern Baltic Sea, while the fish CPUE increased.

B) The highest fish CPUEs were obtained in locations where jellyfish were not present or their catches were insignificant. The results of the studies indicate that the CPUEs of fish and jellyfish are impacted differently by seawater temperature; water temperature increases result in jellyfish aggregation (positive reaction) and fish shoals disperse (negative reaction on high gradient of temperature).

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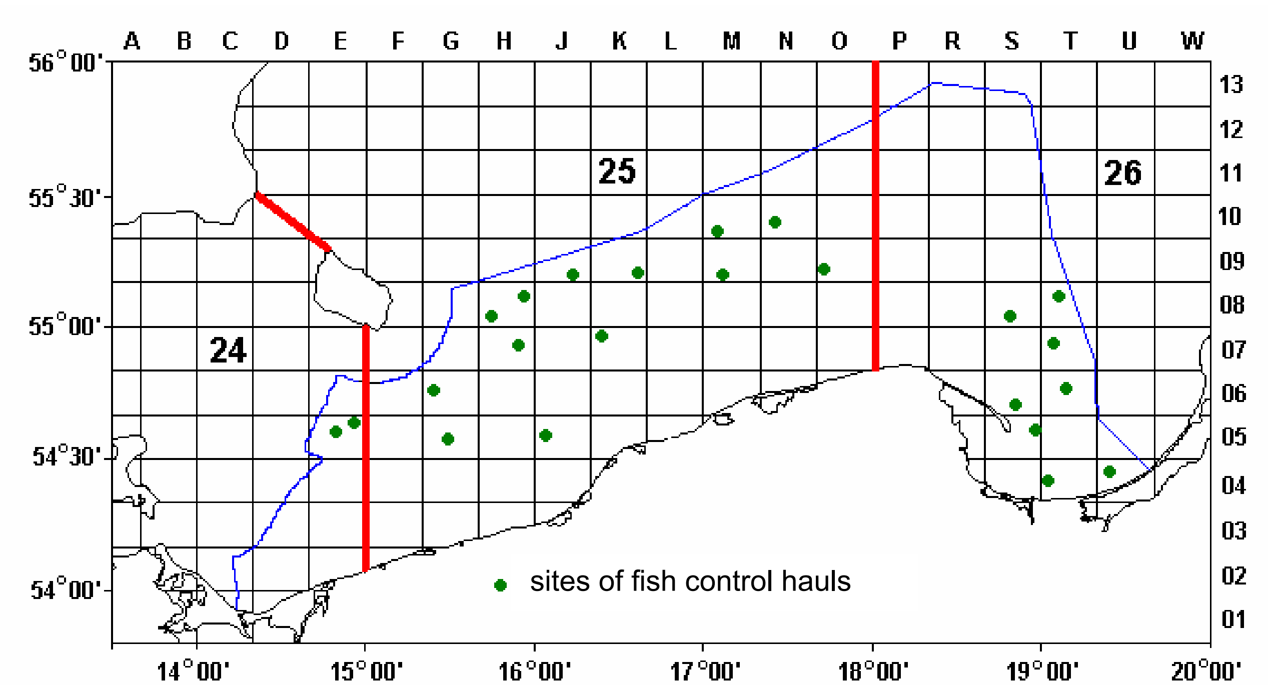


Figure 1.A. The geographical distribution of pelagic control hauls conducted during the hydroacoustic survey (11-28.10. 2002) on r.v. "Baltica" in the Polish EEZ

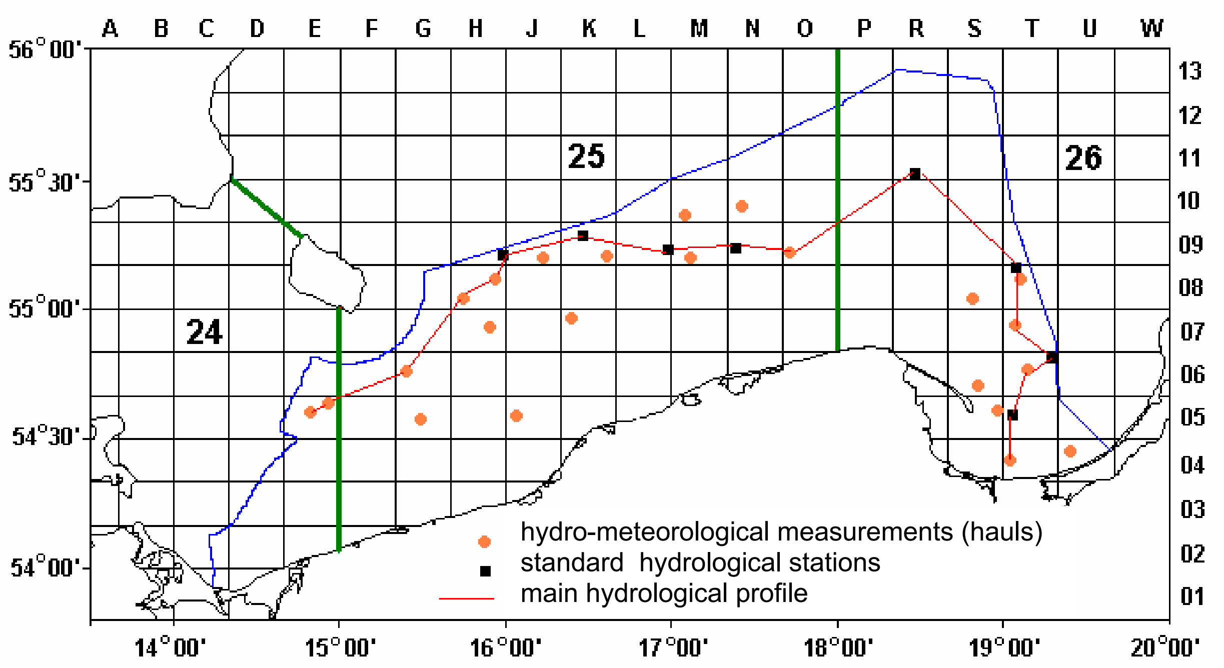


Figure 1.B. The geographical distribution of hydro-meteorological measurements conducted on the position of fish control hauls and the standard hydrological stations on the main hydrological profile of the southern Baltic (data from the hydroacoustic survey, 11-28.10. 2002, on r.v. "Baltica" in the Polish EEZ)

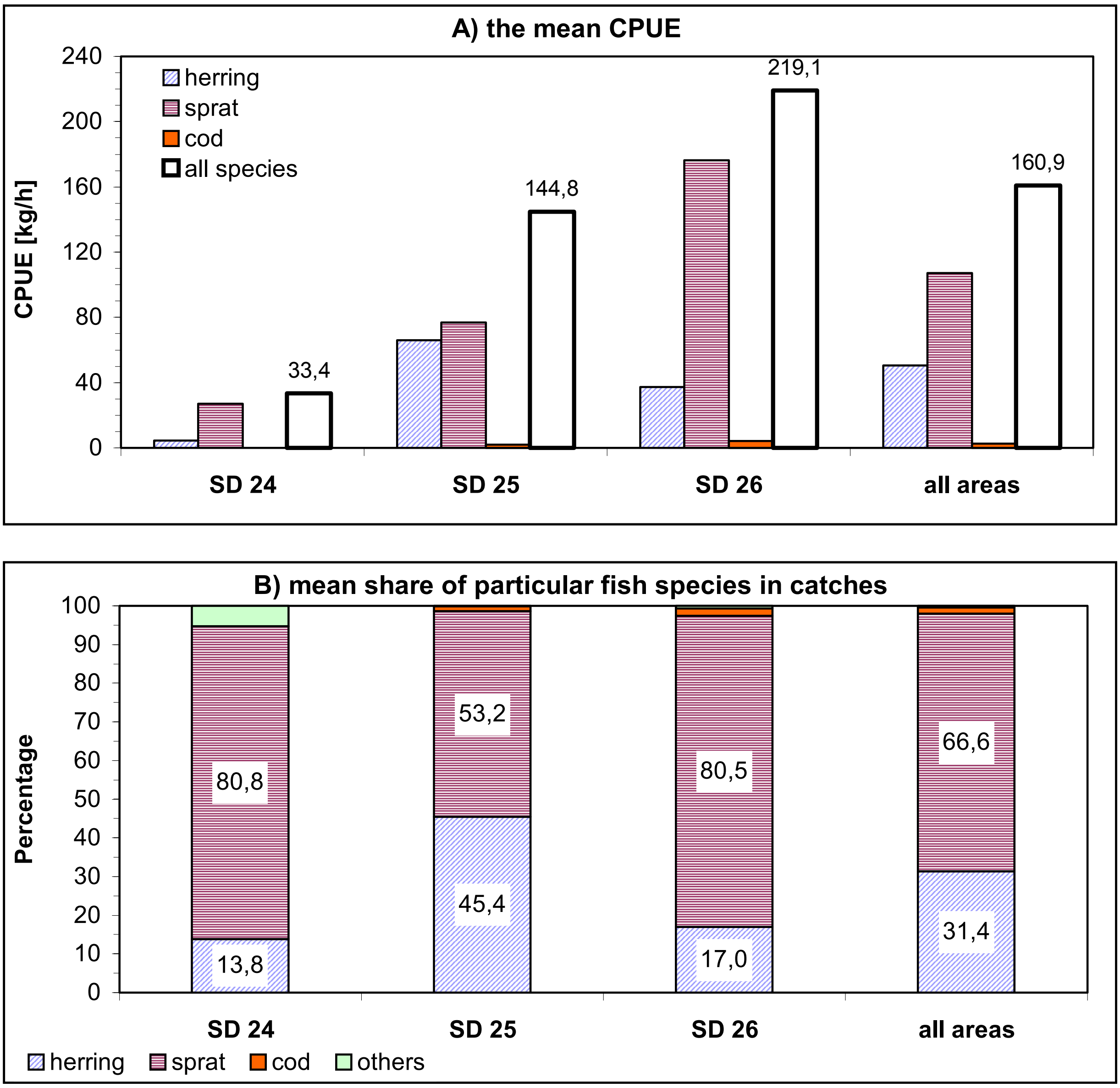
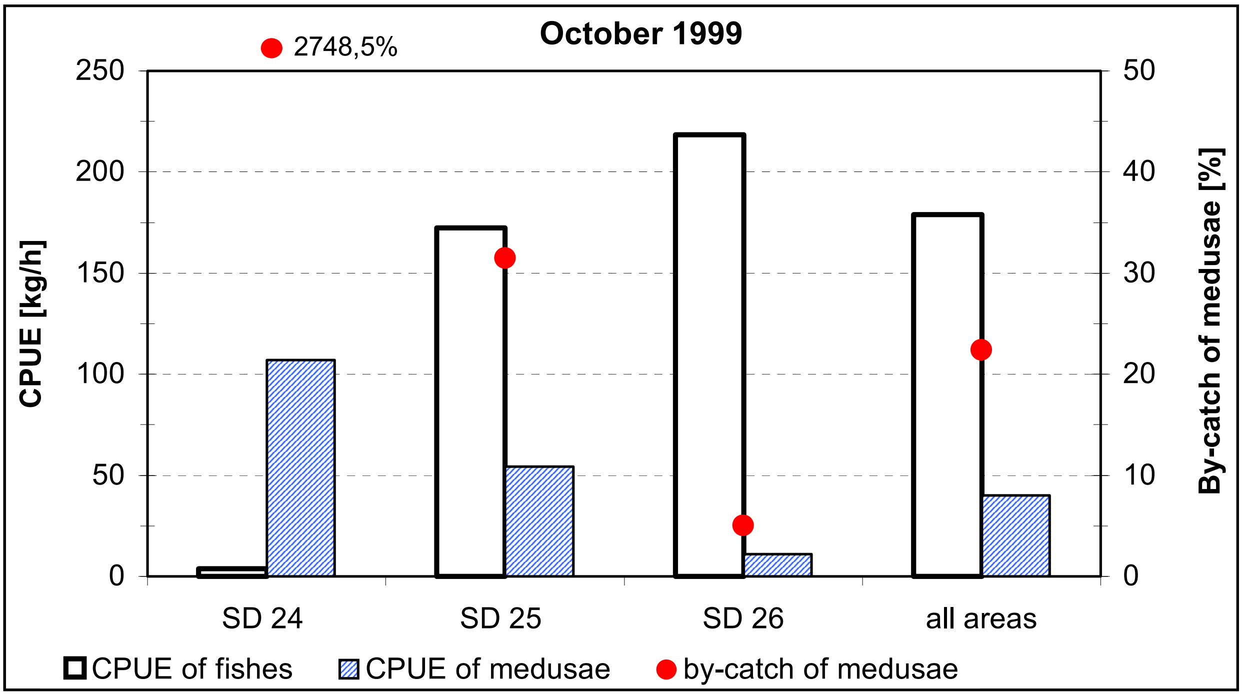


Figure 2. The mean CPUE (part A) and the mean share (part B) of dominant fish species - herring, sprat and cod - in pelagic catches conducted in the October 2002 hydroacoustic survey



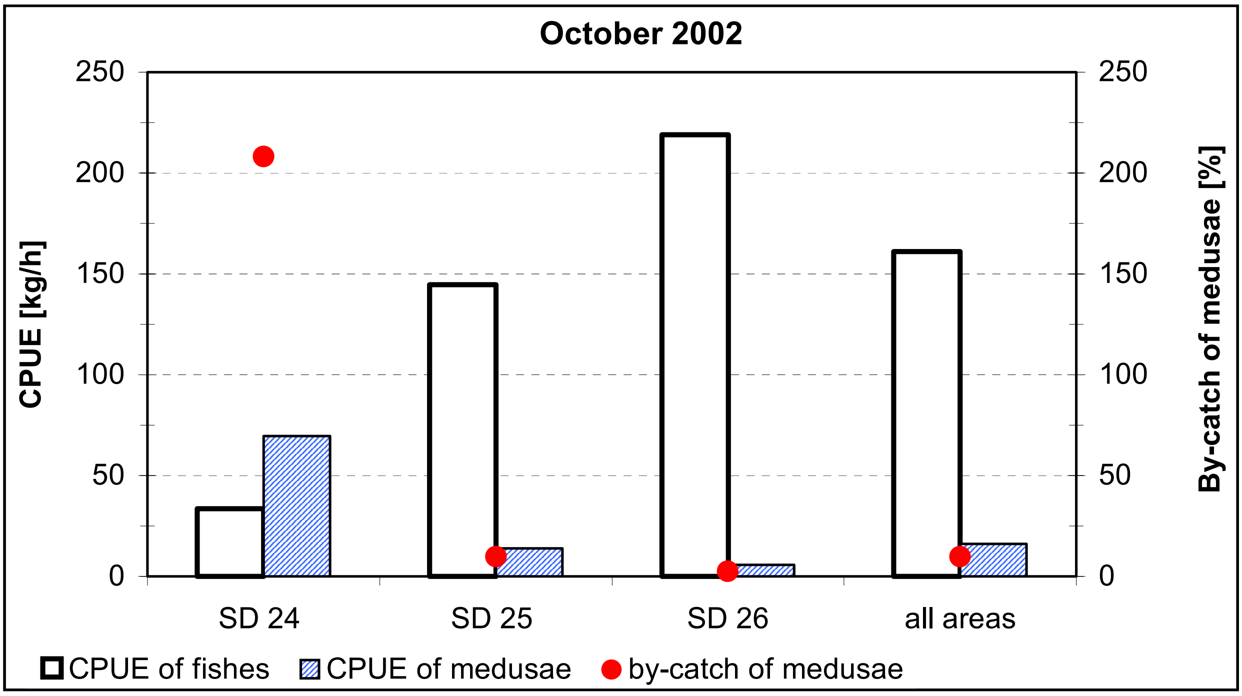


Figure 3. The mean CPUEs of fishes and jellyfish (*Aurelia aurita*), and the mean by-catch of jellyfish in pelagic catches conducted in the October 1999 and 2002 hydroacoustic surveys

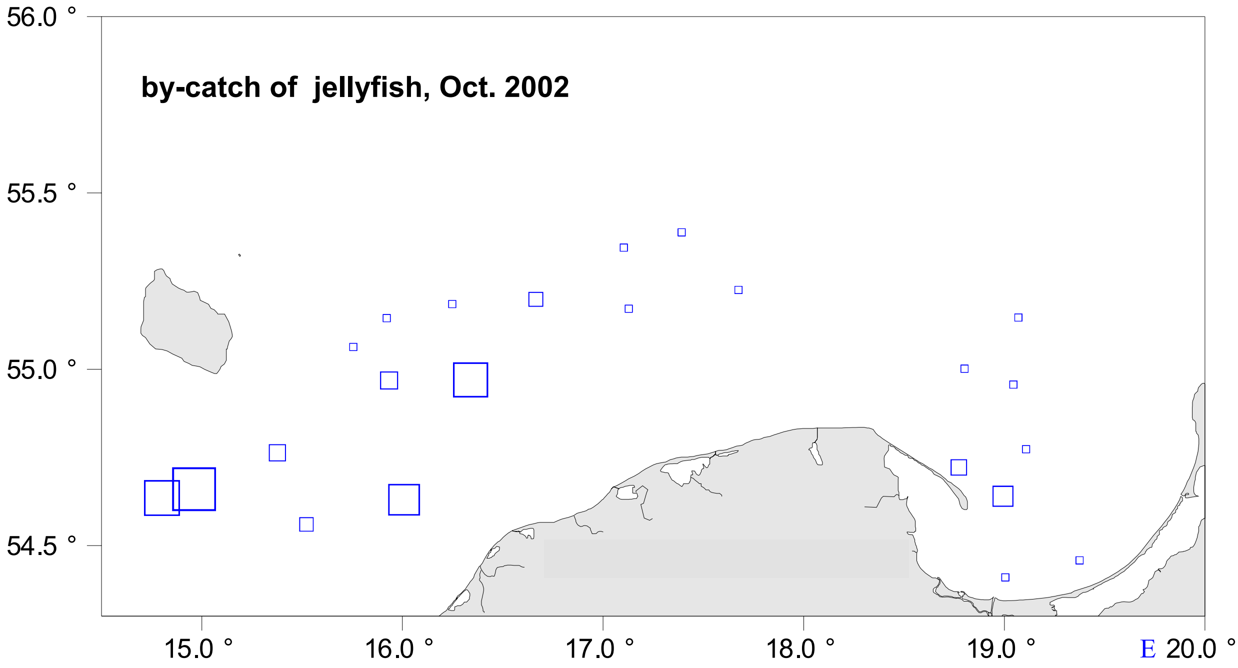


Figure 4. The geographical distribution of the by-catch of medusae (*Aurelia aurita*) in pelagic fish control hauls conducted by r.v. "Baltica" in the hydroacoustic survey (11-28 October 2002) within the Polish EEZ; the size of squares corresponds with the size of the by-catch (in kg/h)

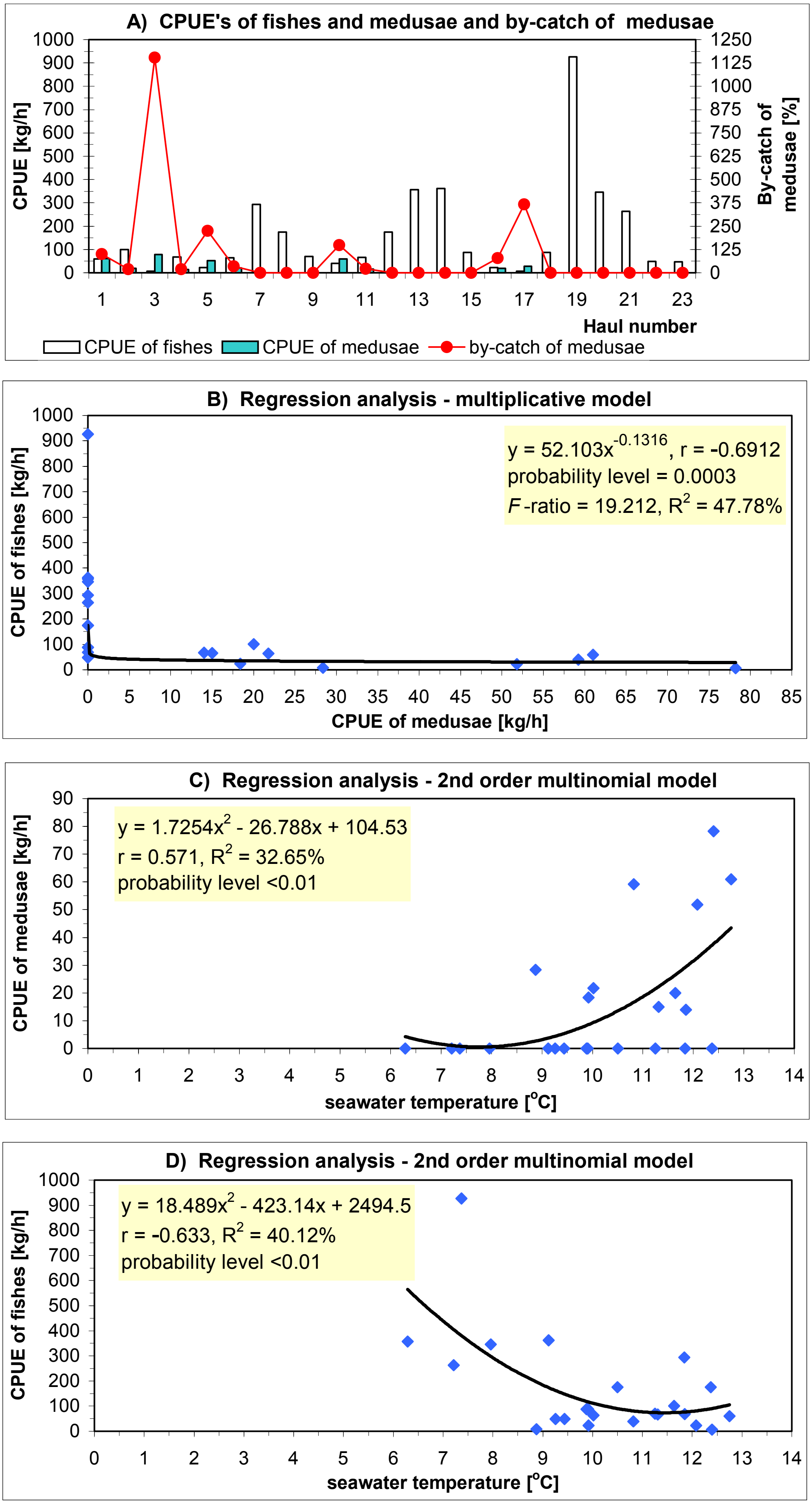


Figure 5. The relationship between the CPUE of fishes and the CPUE of jellyfish in pelagic catches and the seawater temperature at trawling depth layers in the October 2002 hydroacoustic survey

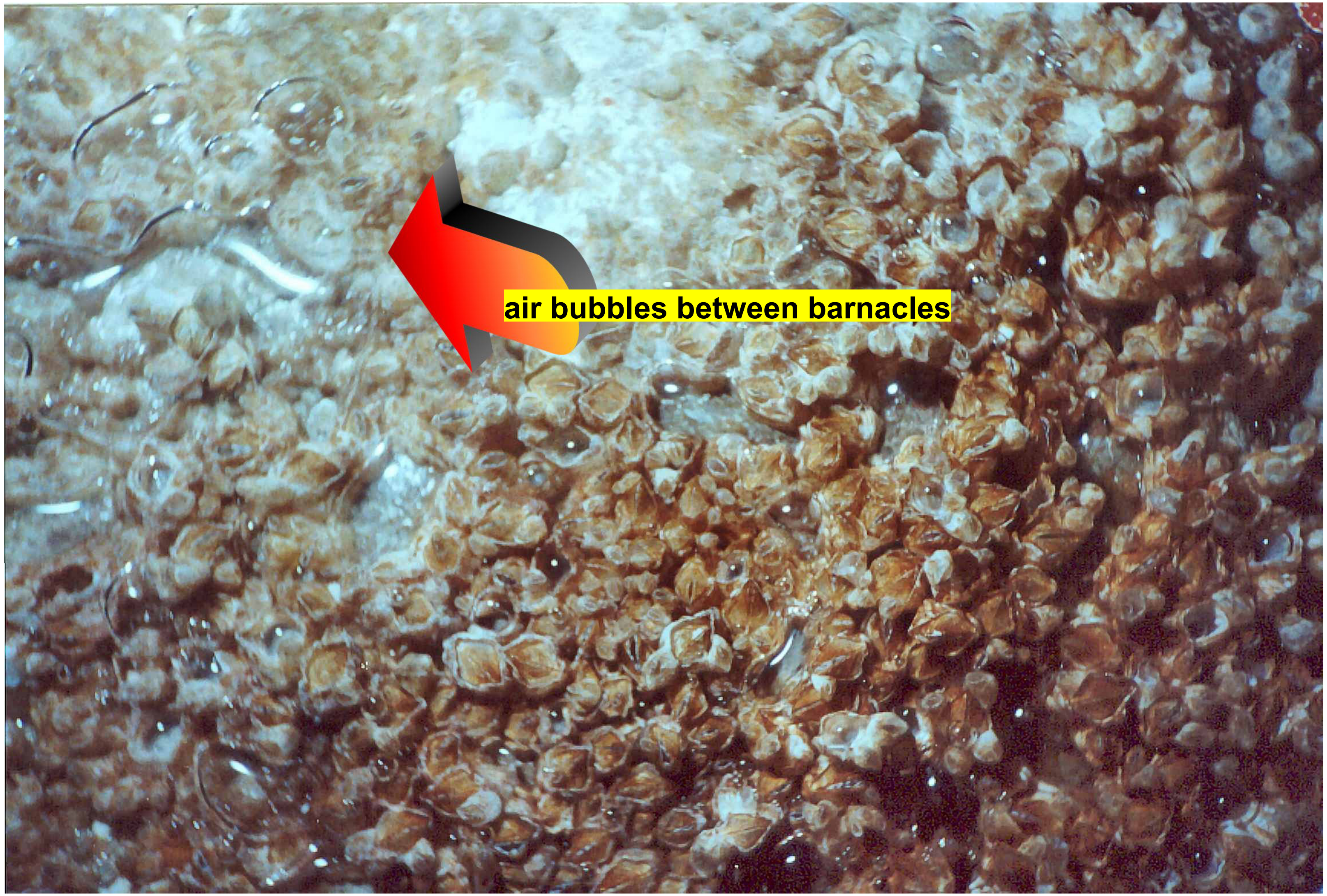


Figure 6 (part 1). One of the technical problems connected with a calibration procedure of EY-500 echo sounder - this is barnacle *Balanus improvisus*, which in October 2002 to become covered a surface of the transducer (obtained by courtesy of Dr. A. Orłowski)

Figure 6 (part 2). One of the technical problems connected with a calibration procedure of EY-500 echo sounder - this is barnacle *Balanus improvisus*, which in October 2002 to become covered a surface of the transducer (obtained by courtesy of Dr. A. Orłowski)

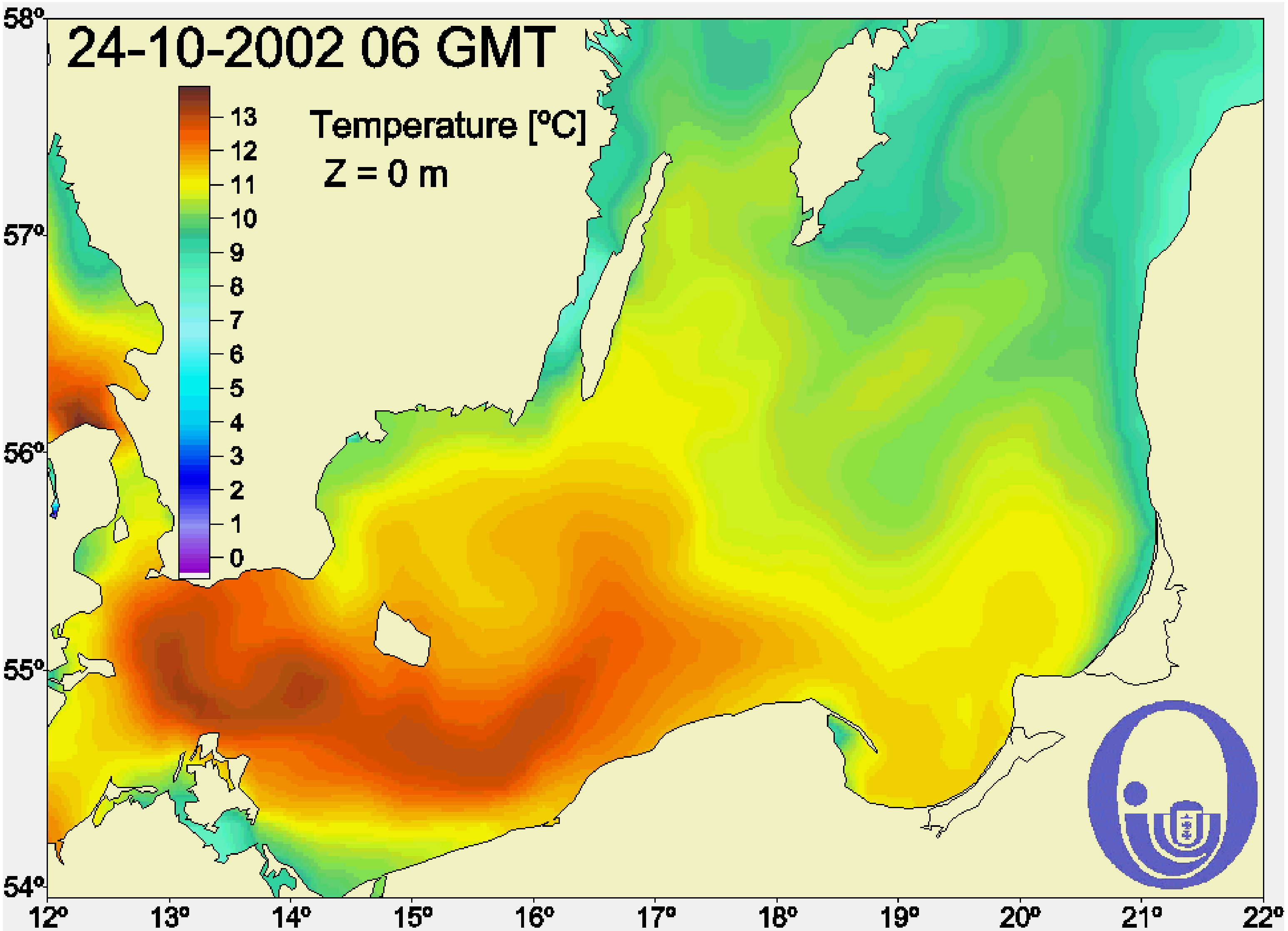


Figure 7. The surface seawater temperature distribution in the Baltic Sea on 24 Oct. 2002 (data by courtesy of the University of Gdansk, Institute of Oceanography - M. Kowalewski)

BIFSWG meeting, Copenhagen 24-28.03. 2003

Working paper

The length distribution of the southern Baltic herring, sprat, cod and flounder and the by-catch of young, undersized specimens in autumn 2002 research control hauls

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INTRODUCTION

In 1977 the Sea Fisheries Institute in Gdynia initiated systematic studies of variations in the admixture of young clupeid fish under the commercial size (protection length) in the bottom zone of the southern Baltic Sea. These ongoing studies are based on the results of total length measurements of fish from control hauls made by research vessels. The studies conducted in October and November 2002 aboard the r.v. "Baltica" constituted an integral part of international analyses regarding changes in stock size of cod, flounder, herring and sprat and their recruitment in the Baltic Sea. These annual studies focus on changes in the numerical proportions of young, undersized fish and constitute a supplementary source of data, which is independent of commercial fisheries on topics such as the abundance of recruiting fish year classes. They also indirectly indicate the reduction rate (mortality) of the older year classes in the stock.

This report presents the results of Polish length distribution studies of herring, cod, sprat and flounder and the relative number of young specimens in the by-catch. These results are based on data obtained during two surveys on board of r.v. "Baltica" in autumn 2002 and were used to the evaluation of the abundance of the recruiting year classes of fish in the southern Baltic Sea. The hydroacoustic survey (October) and the BITS survey (November) were co-ordinated by the Baltic International Fish Survey Working Group (BIFSWG; Anon. 2002).

MATERIALS AND METHODS

During the hydroacoustic survey (11-28 Oct. 2002), 23 control hauls were conducted at depths from 7 to 76 m from the sea surface, along the standard hydroacoustic transects for Polish studies (Grygiel et al. 2002). A WP 53x64x4 pelagic herring trawl was used. During the BITS survey (05-09. Nov. 2002), 25 hauls were made at depths from 17 to 65 m at stations designated by the BIFSWG (Grygiel and Grelowski 2002). A TV-3#930 bottom cod trawl was used. Small mesh size inserts were installed in both of the trawls at the end of the codends; the bar lengths of the devices employed on the first and second cruises were 11 and 10 mm, respectively. The research area covered in each of the cruises comprised the part of the southern Baltic, which lies within the Polish EEZ (Fig. 1).

The fish from each haul were sorted and weighed according to species in order to determine their share (by weight) in the control hauls and to estimate the CPUE per hour of trawling. Random samples of herring, sprat, cod and flounder (the dominant species in the hauls) were then selected for measurements of the total length and weight. The measured herring and sprat specimens were grouped into 0.5-cm length classes and the cod and flounder specimens into 1-cm length classes. The results of length measurements were used to determine the share (by numbers) of young, undersized fish in the by-catch of the control hauls. Twenty-three length measurements samples on a total of 4,020 herring and 4,508 sprat specimens were made during the hydroacoustic survey. In November 2002, total length was measured for 2,408 cod from 24 hauls, 3,762 herring from 23 hauls, 3,686 sprat from 19 hauls and 2,980 flounder from 25 hauls (Grygiel et al. 2002, Grygiel and Grelowski 2002).

The criterion for separating undersized from commercial-sized fish was the protection, or commercial, length. This was used to evaluate the share (admixture) of young specimens in research hauls. The protection lengths for cod, flounder, herring and sprat are 35, 25, 16 and 10 cm, respectively.

RESULTS

Length distribution of sprat and herring specimens and the by-catch of young, undersized fish in October 2002 (hydroacoustic survey)

The length ranges of sprat and herring specimens in the studied samples were 7.5-16.0 cm and 9.5-30.0 cm, respectively. Young fish from the 8.5-9.5 cm length classes dominated (74.3%) in the sprat caught in the ICES Sub-division 24 (Fig. 2). Adult specimens from the 12.0-14.0 cm length classes dominated (67.5%) in the ICES Sub-division 25, while those from the 11.0-12.5 cm length classes did so in the ICES Sub-division 26 (70.0%). In these two ICES Sub-divisions admixture of young sprat were also observed, but they were not as significant as that in the ICES Sub-division 24 (Fig. 2). The mean shares (by numbers) of adult sprat above the commercial size in the ICES Sub-divisions 24, 25 and 26 were 25.3, 83.8 and 74.4%, respectively.

The bimodal length distribution of herring specimens was roughly similar in samples from ICES Sub-divisions 25 and 26 with specimens from length classes 16.5-19.5 cm dominating (Fig. 2). The mean share of herring specimens from the dominant “S” assortment (17-21 cm) was 56.5% in the ICES Sub-division 25 and 70.2% in the ICES Sub-division 26; the average for the entire study area was 58.5%. Exceptionally, young herring specimens from length classes below the protection length (16-cm) dominated (78.0%) in samples from the ICES Sub-division 24. In October 2002, large herring specimens above 21 cm (“D” assortment) were present in the samples with average percentages in the ICES Sub-divisions 24, 25 and 26 of 2.8, 9.4 and 5.4%, respectively; the mean for the entire study area was 7.8%. In previous years the admixture of large herring specimens in October samples did not exceed 2-3%.

Although the ICES Sub-division 24 was characterised by a high proportion of young herring (78.0%) and young sprat (74.7%), mainly from the 2002 year class, low CPUEs (4.6 kg/h and 27.0 kg/h; Fig. 2) were recorded for these species. The by-catch of these same species was lower in the ICES Sub-division 25 at 34 and 21%, respectively, although the CPUEs were higher than in the ICES Sub-division 24 at 65.8 kg/h for herring and 76.9 kg/h for sprat from all length classes. In the Gdansk Basin the proportion of young herring (average of 24.4%) and young sprat (average of 16.2%) was the lowest of the three ICES Sub-divisions studied. However, the CPUE, especially for sprat (an average of 176.4 kg/h) was much higher in this basin than in the Bornholm Basin. The admixture of so-called undersized herring and sprat specimens throughout the entire study area was 33.8% and 25.6%, respectively. Young herring occurred in all control hauls in the range of 4.2 to 98.7% (Fig. 3). Young sprat occurred in 18 hauls (78.3% of the total number of hauls) and their share in the entire study area varied from 0.0 to 98.9% (Fig. 3). It should be mentioned that the mean water temperature at catch depth was the highest in the ICES Sub-division 24 (12.58°C) and the lowest in the ICES Sub-division 26 (8.74°C). The average salinity and oxygen content in the seawater were similar in all three studied ICES Sub-divisions.

Length distribution of cod, herring, sprat and flounder specimens and the by-catch of young, undersized fish in November 2002 (BITS survey)

The total length of main fish species ranged as follows:

- cod − 4.0-68.0 cm (one specimen 102.0 cm long);
- herring − 8.0-31.5 cm (one specimen 34.0 cm long);
- sprat − 6.5-16.0 cm;
- flounder − 12.0-44.0 cm.

In the western part of the Polish EEZ cod, which were close to the protection length (35 cm) dominated; however, in the Gdansk Basin specimens below this size dominated (mainly from the 20-26 cm length classes; Fig. 4). The share (by numbers) of cod specimens below the protection length in the Bornholm Basin varied from 16.7 to 86.7% (the mean of 51.4%), and in the Gdansk Basin from 30.0 to 95.2% (the mean of 82.7%; Fig. 5). The by-catch of young (below the protection length) cod specimens was significant throughout the entire study area at an average of 69.1% of all the specimens. Young cod specimens were present in all the hauls in which this species occurred (Fig. 6). It should be mentioned that the mean CPUE of all length classes cod in the studied basins varied only slightly from 66.4 kg/h in the Bornholm Basin to 75.9 kg/h in the Gdansk Basin (Fig. 5). Relatively high concentrations of young cod specimens near the bottom were observed at depths of 40 m near the Ustka-Łeba fishing ground and in the north-western and south-eastern parts of the Gulf of Gdansk, at depths of 65 and 30 m, respectively (Fig. 6). A few large cod specimens measuring from 45 to 65 cm were recorded in several of the control hauls.

The length distribution of herring in both the Bornholm and Gdansk basins was similar, especially in the 8.0-16.5 cm length ranges, which dominated in the samples (Fig. 4). A greater share of herring of the "S" assortment (17-21 cm) was observed in the Gdansk Basin than in the Bornholm Basin. Especially in the Ustka-Łeba fishing ground, a significant proportion of the herring were large specimens longer than 21 cm. The share (by numbers) of herring below the protection length was nearly identical in the Gdansk and the Bornholm basins at 53.4% and 53.6%, respectively (Fig. 5). Young herring specimens were noted in all the hauls in which this species occurred (Fig. 6). It should be emphasised that there was significant diversity between the herring CPUEs in the two basins; in the Gdansk Basin it was 368.4 kg/h, while in the Bornholm Basin it was 40.3 kg/h or 89% lower (Fig. 5).

Young sprat from the 9.0-10.0 cm length classes dominated in the Bornholm Basin, and the mean share of undersized fish was 71.5% (by numbers; Figures 4 and 5). Notably, the mean sprat CPUE in this basin was low at 16 kg/h. In the Gdansk Basin, young sprat mainly from the 8.0-8.5 cm length classes also dominated (with the share 47.7%). However, the sprat CPUE of 168 kg/h was 10-times higher than in the western part of the Polish EEZ. Adult sprat specimens from the 11.0-12.0 cm length classes were strongly represented in the length distribution of this species from the Gdansk Basin. As was the case with herring, significant concentrations of young sprat were registered near the bottom in a small area of the south-eastern part of the Gulf of Gdansk at a depth of 30 m (Fig. 6). The mean share of sprat above the commercial size was 52.3% in the Gdansk Basin, while that in the Bornholm Basin was only 28.5%.

The length distribution of flounder caught in the Bornholm Basin was multi-modal and the admixture of young fish under the protection length was 60.6% (by numbers), on average, and the mean CPUE was relatively low at 31.9 kg/h (Fig. 4 and 5). In the Gdansk Basin the flounder length distribution was nearly single peaked, the average admixture of young fish was 92.4% and the mean CPUE was 260.7 kg/h, or 8-times higher than that in the Bornholm Basin. Flounder from the 20-28 cm length classes dominated in the Bornholm Basin, while specimens from the 17-24 cm length classes did so in the Gdansk Basin. Significant concentrations of undersized flounder were recorded in the Gulf of Gdansk (Fig. 6).

CONCLUSIONS:

A) The mean CPUE of cod, herring, sprat and flounder as well as the by-catch of undersized cod and flounder in control hauls was higher in the Gdansk Basin than in the Bornholm Basin.

B) Based on the results of the research catches conducted aboard the r.v. "Baltica" in autumn 2002, the following predictions about recruiting year classes strength can be made:
   - the 2002 year class of herring and sprat will be abundant and the spawning stocks size of these species will increase in 2004;
   - the abundance of the 2000-2001 year classes of cod and the 1999-2000 year classes of flounder (especially in the Gdansk Basin) will improve in relation to the low recruitment level of the 1990s; this also indirectly indicates a dangerously high reduction of older year classes, which comprise the spawning stocks of these species - in the Gdansk Basin this is indicated by the 17.4% and 16.1% shares of cod and flounder, respectively, which are larger than the protection length.

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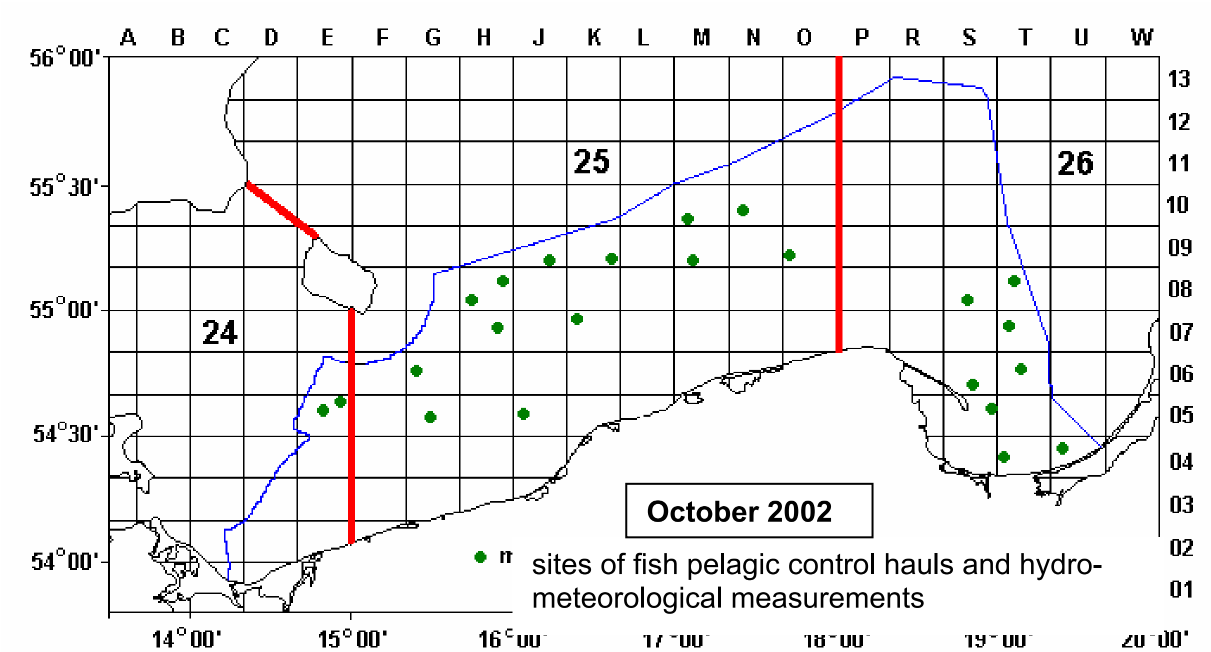
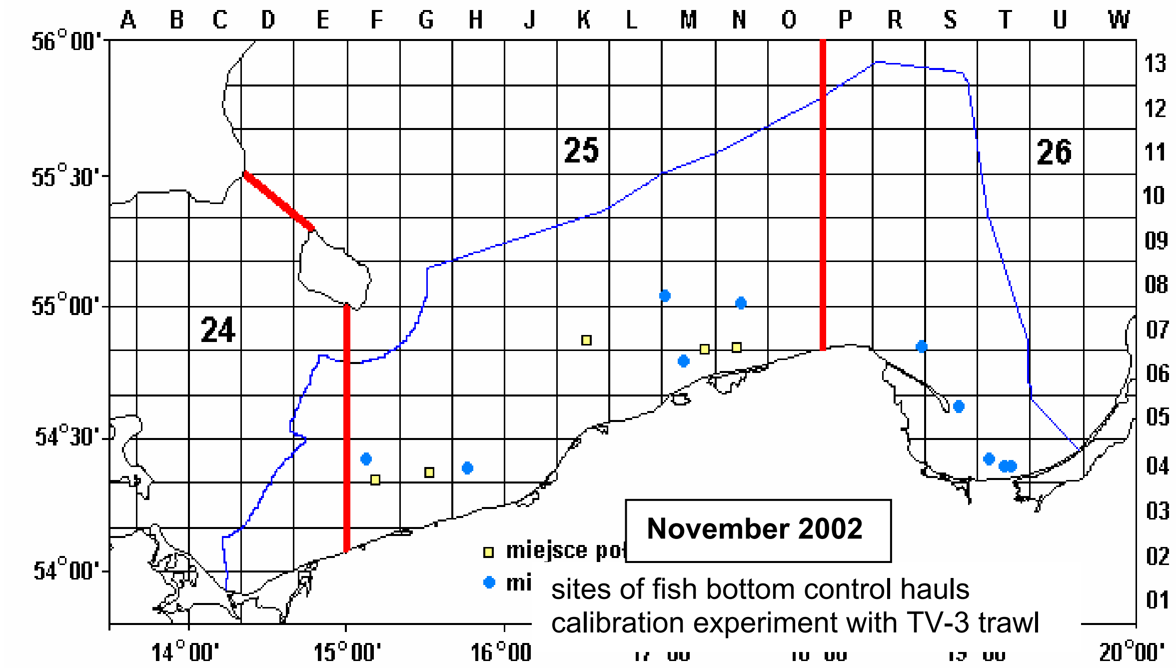


Figure 1. The geographical distribution of fish control hauls conducted by r.v. "Baltica" during the



hydroacoustic (11-28.10. 2002, upper part) and BITS (05-09.11. 2002, lower part) surveys in the Polish EEZ

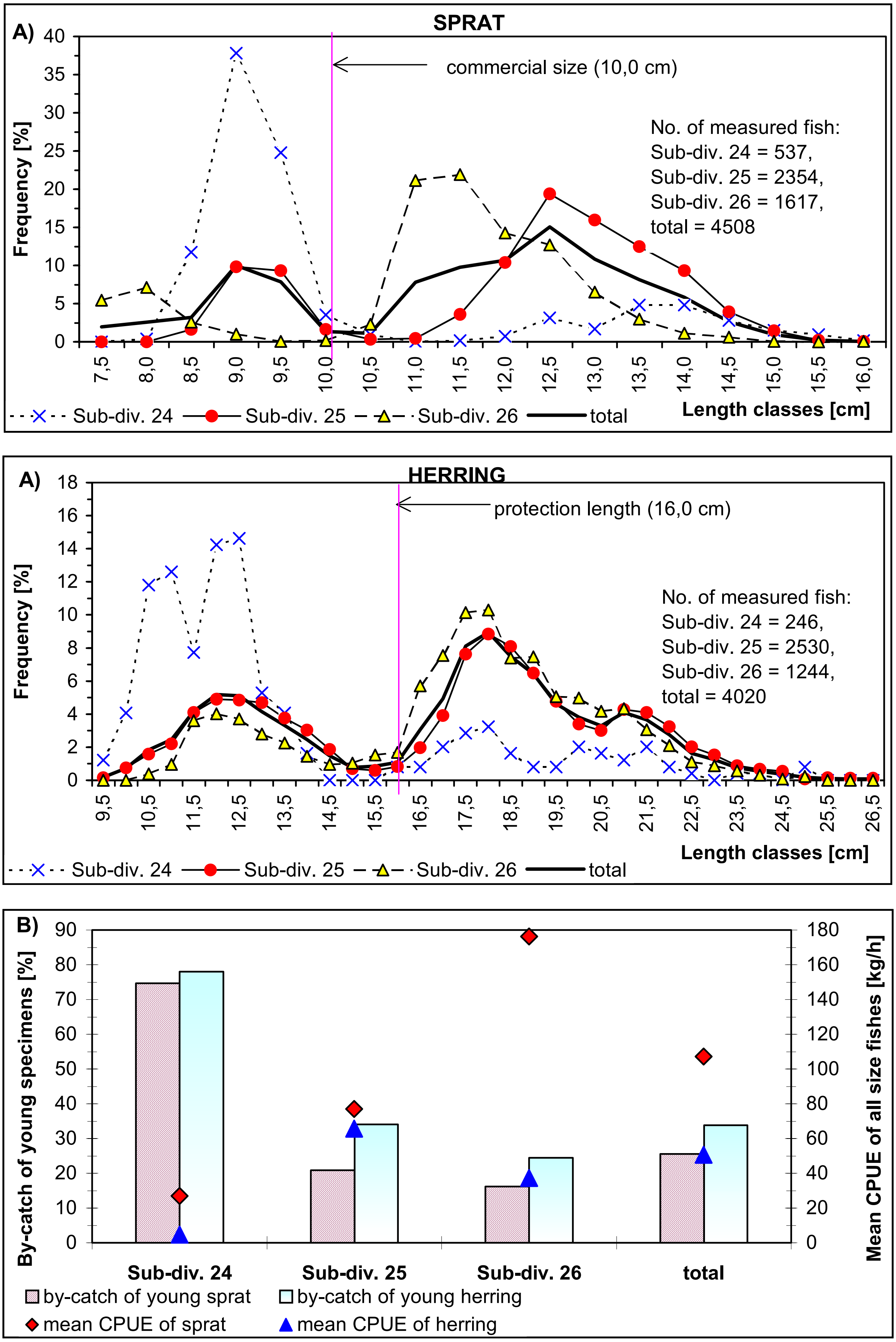


Figure 2. Length distribution of sprat and herring (A) and the mean percentage (by numbers) of undersized specimens and the mean CPUE of all size fishes (B) in the pelagic control hauls, conducted in the hydroacoustic survey of r.v. "Baltica" (October 2002)

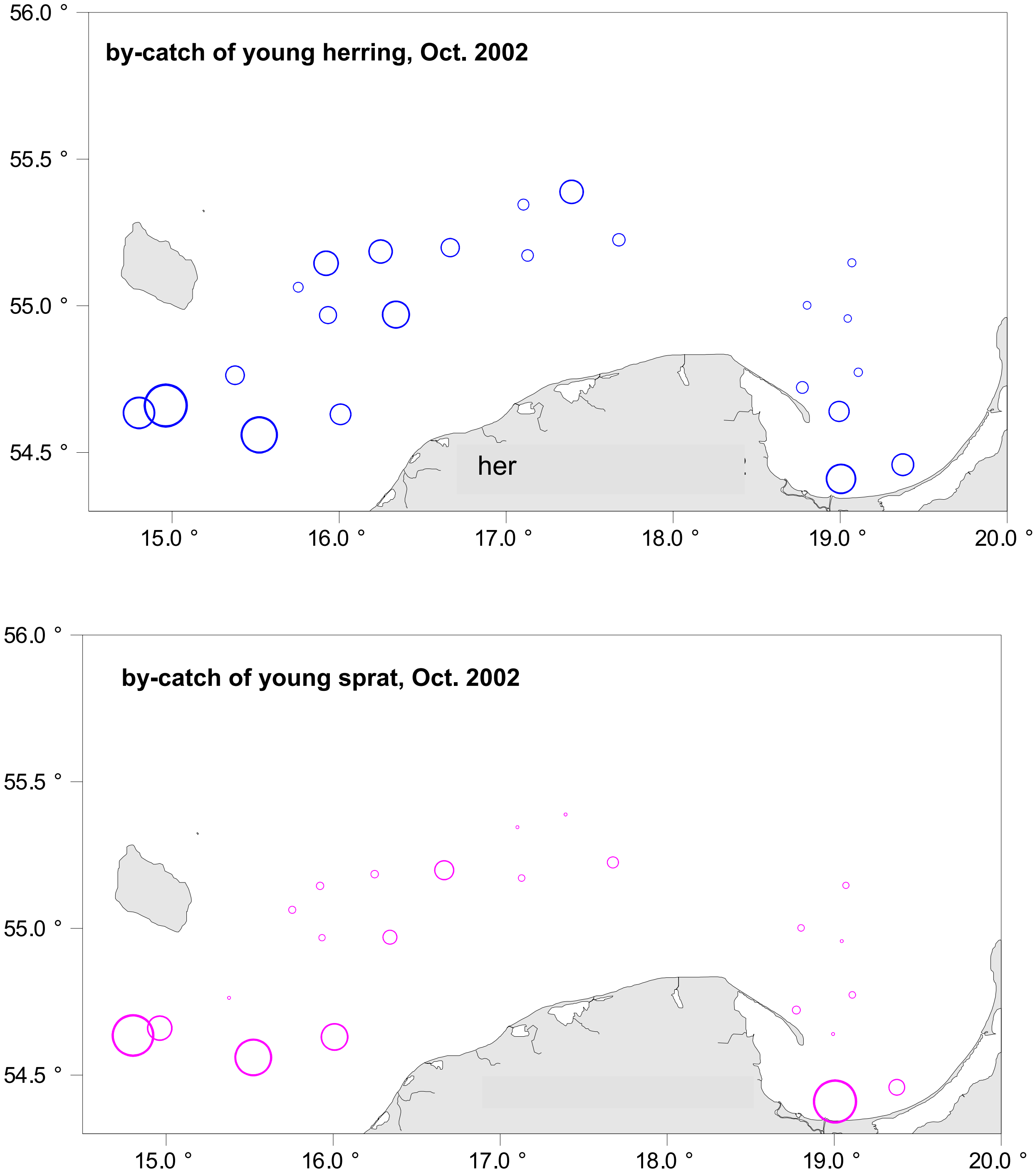


Figure 3. The geographical distribution of the by-catch (in % of numbers) of young, undersized herring and sprat in the pelagic control hauls, conducted by r.v. "Baltica" in the hydroacoustic survey (11-28 October 2002); the diameter of rings corresponds with the size of the by-catch

Figure 4. Length distribution of cod, herring, sprat and flounder in the bottom control hauls, conducted during BITS survey of r.v. "Baltica" in November 2002

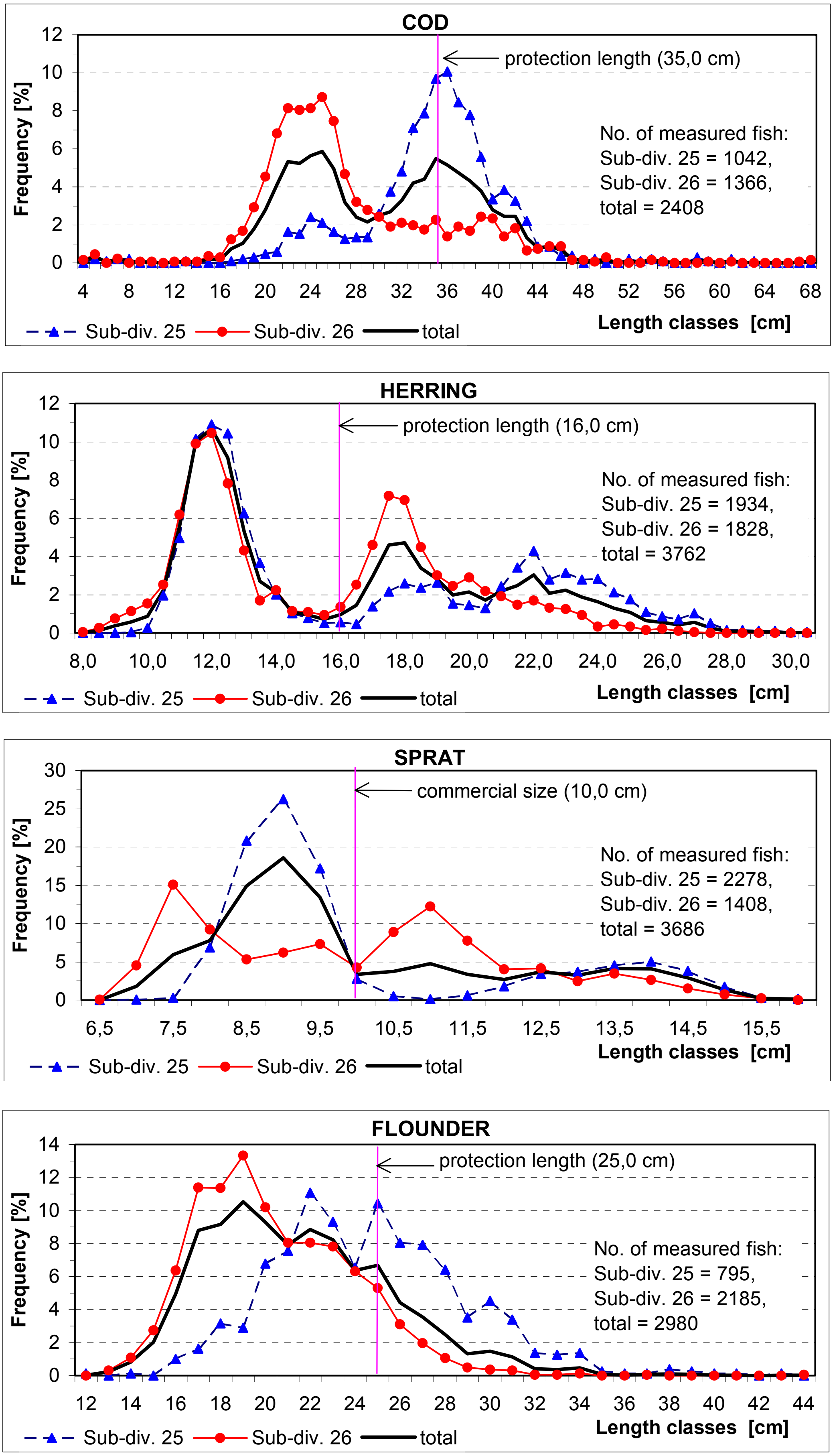
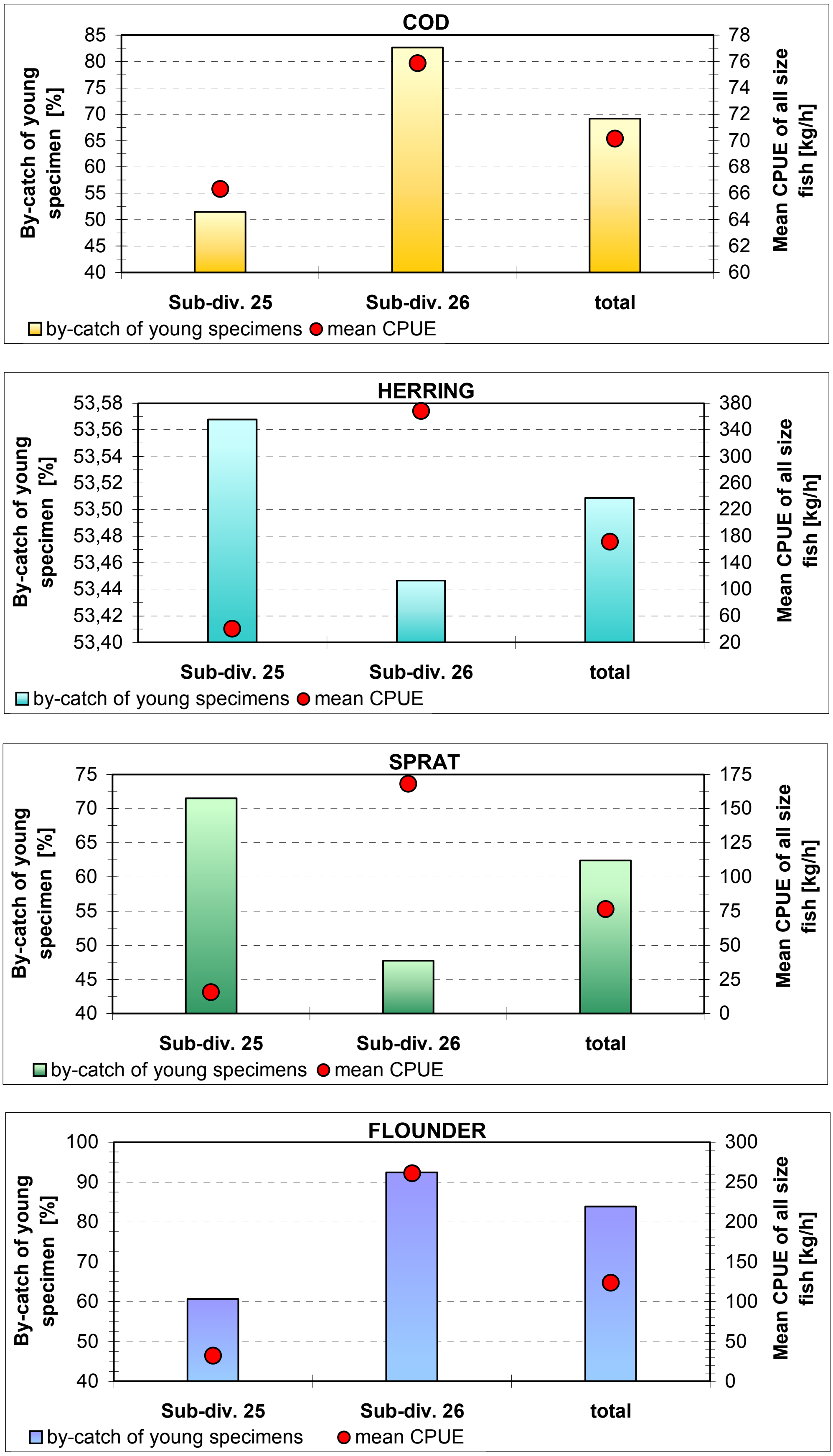


Figure 5. The mean percentage (by numbers) of undersized cod, herring, sprat and flounder and the mean CPUE of all size fishes in the bottom control hauls, conducted during BITS survey of r.v. "Baltica" in November 2002



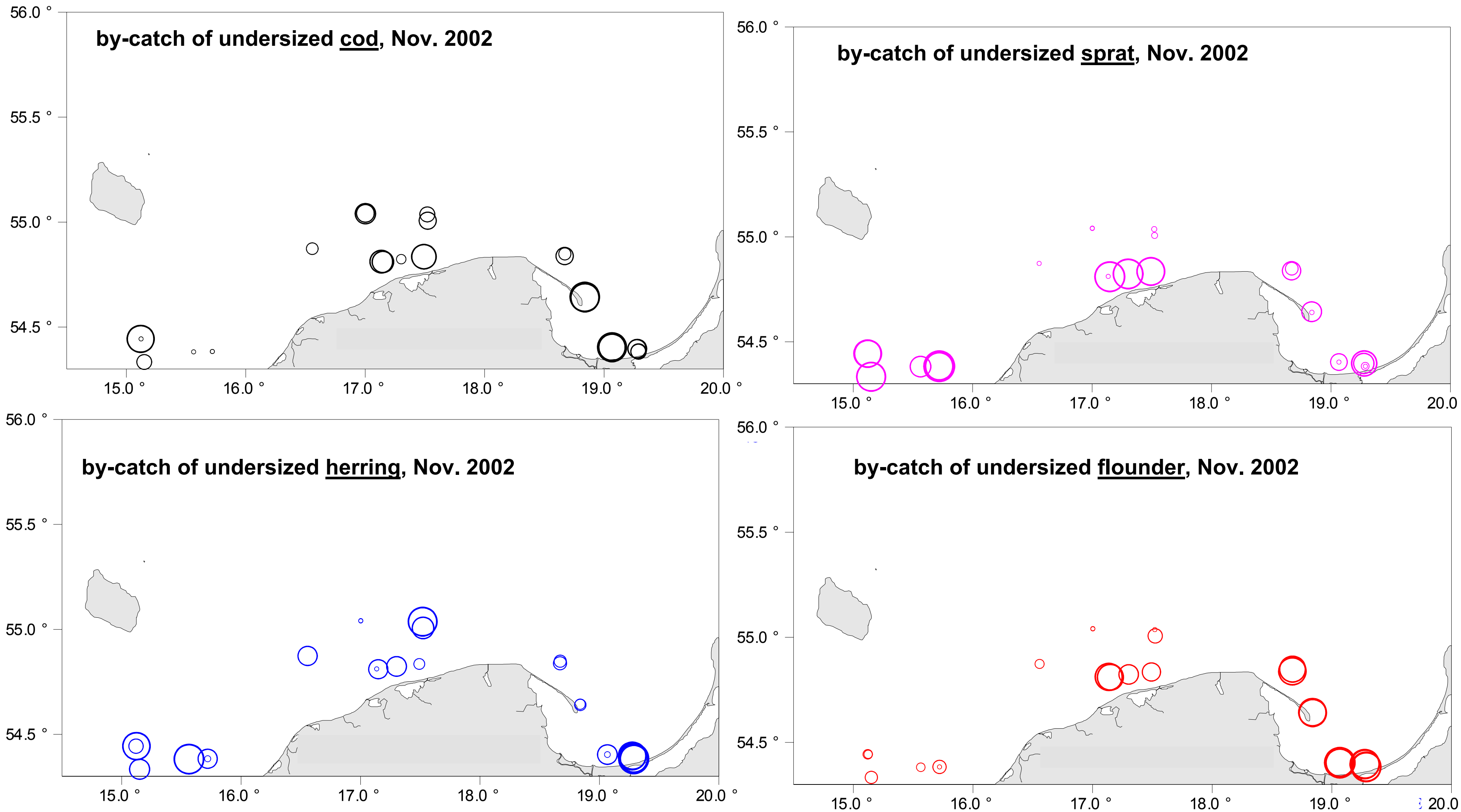


Figure 6. The geographical distribution of the by-catch (in % of numbers) of undersized cod, herring, sprat and flounder in bottom control hauls, conducted by r.v. "Baltica" in BITS survey (05-09 November 2002); the diameter of rings corresponds with the size of the by-catch

CORRECTED CONVERSION FACTORS OF COD AND FLOUNDER BASED ON THE GERMAN MODEL

by

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Introduction

During the WG BIFS in 2002 different estimates of conversion factors were presented and intensively discussed. New model to estimate the conversion factors were presented by Nielsen et al. (2003). The model included a new type of inter-calibration experiments. Gaskukov (2003) use the Δ-distribution to describe distribution pattern of the conversion factors. Oeberst and Grygiel (2003) compared the catchability of the Polish gear type P 20/25 and the German gear type HG 20/25 using the conversion factors that are based on the Germen model (Oeberst et al. 2001) and hauls which were carried out by Poland and Germany in Subdivision 25 during the different Baltic international trawl surveys (BITS).
Unfortunately, the results of the different studies were presented in different formats. This fact made it difficult to compare them. Nielsen et al. (2003) estimated the conversion factors
CPUE(national gear) = conversion factor * CPUE(TV3#930) for 5 cm length intervals.
Gasjukov (2003) estimated
CPUE(TV3#930) = conversion factors * CPUE(national gear)
for 5 cm length intervals and Oeberst et al. (2001) estimated the same conversion factors for 2 cm length intervals. Furthermore, the studies of Gasjukov suggest that small errors are possible in the realization of the German model (ICES 2001, Oeberst et al. 2001).
To get a more clear picture the conversion factors based on the German model were estimated for 5 cm length intervals. Furthermore, additional studies were carried out to improve the interpretation of the estimates.

Material

The realization of the German model (Oeberst et al. 2001) were checked and conversion factors were estimated for 5 cm length intervals for cod and flounder since estimates of both the species are required for the stock assessment. The evaluation of the used procedures for realizing the German model have shown that an error exists that produce biased estimates. The corrected procedures were used during the studies presented in this paper.
Additional analyses were realized. Mean CPUE values of the new standard gears (TV) were compared with the estimates (TV') that are based on the mean CPUE values of the national gears in combination with the estimates of the mean conversion factors and the influence of the sequence of the gears to assess the quality of the estimates using the equations:
Sequence 1: TV' = CPUE(national gear) / C(t) * CF(t)) (1)
Sequence 2: TV' = CPUE(national gear) * C(t) * CF(t)) (2)

with

C(t) mean influence of the sequence of the gears
CF(t) mean conversion factor.

Furthermore, the mean conversion factors and the standard deviation of the means were estimated using the jackknife or the crossvalidation method.
In many cases the estimated conversion factors are significantly influenced by the low number of available data set and the high variability of the conversion factors of the single inter-calibration experiments CF(t,i) using t as index of the length interval and i as index of the inter-calibration experiment. To reduce the high variability limits of CPUE values were defined in some studies. Only those inter-calibration experiments were used during the presented studies where the CPUE value of both the gears compared were larger than the required limit of 3 individuals.
The minimum and maximum values of CF(t,i) were summarized for different limits of the CPUE value to study the influence of the minimum and maximum CF(t,i).

Results

The corrected procedures were used to estimate conversion factors for all national gears by 5 cm length intervals. **Table 1.1 to 1.7** present the mean conversion factors CF(t)

CPUE(TV3#) = CF(t) * CPUE(national gear)

for cod. The estimates are given for the length range from 5 cm to 54 cm. Beside the ln-transformed estimates of both the gears, the mean influence of the sequence of the gear, C(t), the mean ln-transformed and the back-transformed conversion factors are presented. Furthermore, the standard deviations and the confidence intervals are given as well as the necessary number of available data sets if a required accuracy is given. These estimates depend on two parameters, the error of first kind α and the required level of accuracy. For the analyses presented it was chosen that $\alpha = 0.05$ and that the half of the confidence intervals of the ln-transformed conversion factors should be less or equal than 0.20. For comparing the data with the estimates of Nielsen et al. (2002) the quotient 1/CF(t) must be used.
Tables 2.1 to 2.7 present the mean conversion factors for flounder by 5 cm length intervals for the length range from 15 cm to 49 cm.
To evaluate the used model and the quality of the estimated conversion factors the mean CPUE value of the new standard gear (TV) were compared with the estimates that are based on the Equations 1 and 2 (TV') by sequence of the gears.
Figures 1.1 to 1.7 present the estimates TV and TV' by 5 cm length intervals and the different national gears for both the sequences of the gears. The mean CPUE value of the new standard gear and the recalculated CPUE values (TV') were different when both the sequences of the gear are taken into account. The CPUE values of TV and TV' correspond well for the gear types HG 20/25, TV3#930-TV3#520 and GOV. Large differences were found for at least one length interval for the other gears. One possible reason for these differences is probably the partly high changes of C(t) from one length interval to the neighbouring length interval. As examples the length range from 30 cm to 40 cm in **Table 1.5** as well as from 35 cm to 50 cm in **Table 1.7** can be used. When the selection characteristics

of the different gears that describes the continuous change of the catchability of the gear in relation to the total length is taken into account it can be expected that the changes of C(t) as well as CF(t) are also continuous processes dependent on the length.

Estimates of conversion factors were presented by Nielsen et al. (2002) for all national gears. Gasjukov (2002) presented conversion factors for the gear type HG 20/25 and GOV. Both the different methods were used to estimate CF(TV3#930,TV3#520). Furthermore, estimates of the German model are available. **Figure 2.1 to 2.3** show the different estimates by 5 cm length intervals and gear. Estimates of Gasjukov (2002) and the corrected estimates (Table 1.1 to 1.7) are relative close together. In contrast to this the estimates of Nielsen et al. (2002) are different, spatially the estimates of CF(TV3#930,TV3#520) and CF(TV3#930, GOV).

As second independent check of the estimated conversion factors the jackknife method was used to estimate mean conversion factors and their standard deviation by national gears. **Tables 4.1 to 4.7** show the results using the German model as background. The comparisons of both the estimates of conversion factors are significantly dependent on the national gear. Both the estimates, the mean and the standard deviation are comparable for the national gear types HG 20/25 and GOV as well as for the conversion factor CF(TV3#930,TV3#520). For these gears the difference between both the means is less than 0.04. The mean conversion factors and the standard deviation of both the methods also correspond for the Polish gear type P 20/25. However, in some cases the limit as mentioned above is crossed. Strong differences were observed for the gear types Granton, LBT and Hake 4M. However, it must be taken into the account that the number of available data sets of the gear types LBT and Hake 4M are very low for most of the length intervals (Tables 1.4, 1.6).

To get a more detailed and clear picture of the variability of the available data sets two additional tables were prepared. **Table 5.1** presents the total minimum and maximum of all CF(t,i) by gear types. The conversion factors of each individual inter-calibration experiment and each length interval were only used when the CPUE values of both the compared gears were larger than 3 (as used for the results in Tables 1.1 to 1.7). The minimum and maximum values were separately estimated using 2 cm and 5 cm length intervals.

A decreasing range between the minimum and the maximum of CF(t,i) if length intervals of 5 cm were used instead of 2 cm suggests that the length range from 5 cm to 54 cm is relative uniform covered by the paired hauls and that the stochastic variability of the CPUE values of neighbouring intervals will be balanced as it can be expected. Furthermore, the influence of individual extreme data sets is reduced.

Maximum values of 30.5 and 22.6 as well as minimum values of 0.01 suggest that different populations were sampled by the paired stations and that it seems to be useful that these data sets should be handled as outlier. **Table 5.2** presents the total minimum and maximum of all CF(t,i) by gear types. In this case only those data sets were used where the CPUE values of both the compared gears were larger than 30. That means that experiments with low catches were excluded. Unfortunately, the number of data sets with high catches is low. The studies illustrate that the conversion factors are strongly influenced by the high variability of the CPUE values with low catches.

Table 1.1: Estimates of the inter-calibration experiment between the gears TV3 520 and HG 20/25 for cod
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	12	0.45	0.47	2	0.36	1.45	-0.04	14	0.40	0.58	0.07	0.74	1.77	1.33	1.07	2.09	35
10	18	0.41	0.62	12	-0.30	0.75	-0.35	30	0.05	0.66	-0.19	0.30	1.31	1.19	0.83	1.35	44
15	15	0.16	0.56	12	-0.23	0.54	-0.19	27	-0.03	0.53	-0.25	0.18	1.11	0.74	0.78	1.19	30
20	19	0.12	0.72	12	-0.32	0.57	-0.22	31	-0.10	0.64	-0.34	0.13	1.11	0.98	0.71	1.14	42
25	19	-0.01	0.66	12	-0.15	0.43	-0.07	31	-0.08	0.57	-0.28	0.13	1.09	0.78	0.75	1.14	33
30	20	-0.17	0.71	12	-0.02	0.52	0.08	32	-0.09	0.63	-0.32	0.13	1.11	0.94	0.73	1.14	40
35	20	-0.27	0.83	12	-0.30	0.57	-0.02	32	-0.28	0.72	-0.54	-0.02	0.98	1.04	0.58	0.98	52
40	18	-0.13	0.53	10	-0.25	0.63	-0.06	28	-0.19	0.55	-0.40	0.02	0.96	0.66	0.67	1.02	31
45	12	-0.15	0.65	7	-0.10	0.90	0.03	19	-0.12	0.71	-0.47	0.22	1.14	1.19	0.63	1.24	51
50	2	0.06	0.44	0	0.00			2									

Table 1.2: Estimates of the inter-calibration experiment between the gears TV3 930 and TV3 520 for cod
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	3	-0.66	1.61	2	-1.42	1.26	-0.38	5	-1.04	1.19	-2.41	0.33	0.72	2.61	0.09	1.39	139
10	7	-0.27	0.85	5	-0.67	1.17	-0.20	12	-0.47	0.90	-1.04	0.10	0.94	1.59	0.35	1.10	81
15	10	-0.27	1.00	9	-0.64	0.63	-0.19	19	-0.46	0.80	-0.84	-0.07	0.87	1.15	0.43	0.93	64
20	7	0.01	0.70	8	-0.18	0.66	-0.10	15	-0.09	0.64	-0.44	0.26	1.12	0.97	0.64	1.30	41
25	8	0.34	0.75	9	-0.30	0.66	-0.32	17	0.02	0.66	-0.32	0.36	1.27	1.18	0.73	1.44	45
30	10	0.21	1.05	10	0.09	0.89	-0.06	20	0.15	0.93	-0.28	0.58	1.79	3.20	0.75	1.79	85
35	10	0.53	0.77	9	-0.05	0.37	-0.29	19	0.24	0.59	-0.04	0.52	1.51	1.17	0.96	1.69	36
40	8	0.56	0.47	8	0.30	0.47	-0.13	16	0.43	0.46	0.19	0.67	1.71	0.91	1.21	1.96	22
45	6	0.51	0.72	6	-0.15	0.42	-0.33	12	0.18	0.56	-0.17	0.53	1.40	0.98	0.85	1.70	32
50	6	0.72	0.51	5	-0.60	0.66	-0.66	11	0.06	0.56	-0.31	0.43	1.25	0.89	0.73	1.54	33

N number of stations. Std standard deviation

Table 1.3: Estimates of the inter-calibration experiment between the gears TV3 930 and Granton for cod
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors Sequence 1			Sequence 2				Ln-transformed corrected conversion factors					Back-transformed conversion factors				
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	0	0.00		0	0.00			0									
10	3	1.98	1.31	3	1.60	0.44	-0.19	6	1.79	1.09	0.70	2.88	10.90	30.07	2.01	17.87	117
15	6	1.81	0.84	7	0.96	0.71	-0.42	13	1.38	0.86	0.87	1.90	5.77	8.75	2.38	6.68	73
20	10	1.82	0.49	11	0.70	1.36	-0.56	21	1.26	1.07	0.78	1.74	6.21	15.90	2.17	5.71	111
25	11	2.14	0.56	13	0.45	1.56	-0.84	24	1.29	1.24	0.77	1.81	7.81	31.84	2.16	6.13	149
30	8	1.58	0.70	13	0.26	1.40	-0.66	21	0.92	1.18	0.38	1.46	5.06	17.84	1.47	4.30	137
35	7	1.14	1.61	11	0.64	0.96	-0.25	18	0.89	1.20	0.30	1.49	5.01	18.37	1.35	4.42	140
40	6	1.22	0.58	11	0.61	1.00	-0.30	17	0.92	0.87	0.47	1.36	3.66	5.76	1.60	3.91	76
45	2	0.90	0.12	9	0.24	0.84	-0.33	11	0.57	0.76	0.06	1.07	2.36	2.80	1.06	2.92	58
50	1	0.66		3	0.31	0.48	-0.18	4	0.48	0.45	-0.14	1.11	1.80	0.95	0.87	3.04	22

Table 1.4: Estimates of the inter-calibration experiment between the gears TV3 520 and LBT for cod
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors Sequence 1			Sequence 2				Ln-transformed corrected conversion factors					Back-transformed conversion factors				
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	1	-0.41		0	0.00			1									
10	0	0.00		3	-0.13	1.45		3									
15	0	0.00		3	0.69	1.23		3									
20	3	-0.04	0.46	6	0.56	1.04	0.30	9	0.26	0.81	-0.35	0.87	1.80	2.40	0.71	2.39	65
25	4	0.47	0.61	6	0.28	1.08	-0.10	10	0.37	0.85	-0.22	0.97	2.08	3.04	0.80	2.64	71
30	2	-1.13	1.02	5	-0.15	1.01	0.49	7	-0.64	0.94	-1.48	0.20	0.82	1.53	0.23	1.22	87
35	3	-0.98	0.78	6	0.40	0.95	0.69	9	-0.29	0.85	-0.94	0.35	1.08	1.61	0.39	1.43	73
40	2	-1.83	0.84	6	0.75	1.17	1.29	8	-0.54	1.15	-1.48	0.39	1.12	3.59	0.23	1.48	129
45	1	-3.43		4	-0.05	1.05	1.69	5	-1.74	1.62	-3.61	0.12	0.65	8.76	0.03	1.13	255
50	1	0.00		1	0.69		0.35	2	0.35	0.00			1.41	0.00			

N number of stations. Std standard deviation

Table 1.5: Estimates of the inter-calibration experiment between the gears TV3 930 and P 20/25 for cod (ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	7	0.17	0.14	4	-0.63	0.92	-0.40	11	-0.23	0.49	-0.56	0.09	0.90	0.53	0.57	1.10	26
10	10	0.60	0.87	6	-0.21	0.97	-0.40	16	0.20	0.86	-0.26	0.65	1.76	2.69	0.77	1.92	74
15	6	0.65	1.00	9	-0.29	0.39	-0.47	15	0.18	0.66	-0.18	0.55	1.49	1.38	0.83	1.73	44
20	11	0.61	0.83	8	-0.46	0.64	-0.54	19	0.07	0.73	-0.28	0.42	1.40	1.53	0.76	1.53	54
25	9	0.80	0.72	8	-0.52	0.69	-0.66	17	0.14	0.69	-0.21	0.49	1.46	1.45	0.81	1.64	48
30	12	0.74	0.91	7	-0.13	0.36	-0.43	19	0.30	0.74	-0.05	0.66	1.79	2.02	0.95	1.94	55
35	7	0.07	1.31	10	-0.06	0.48	-0.06	17	0.01	0.85	-0.43	0.44	1.45	2.15	0.65	1.56	72
40	9	1.04	0.67	9	0.18	0.40	-0.43	18	0.61	0.57	0.33	0.90	2.18	1.60	1.39	2.45	34
45	6	1.09	0.35	5	0.47	0.46	-0.31	11	0.78	0.48	0.46	1.10	2.45	1.40	1.59	3.00	24
50	2	1.10	0.00	0	0.00			2									

Table 1.6: Estimates of the inter-calibration experiment between the gears TV3 930 and Hake 4M for cod (ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	0	0.00		0	0.00			0									
10	0	0.00		0	0.00			0									
15	0	0.00		0	0.00			0									
20	3	0.52	0.44	2	0.45	0.96	-0.04	5	0.49	0.55	-0.15	1.12	1.90	1.32	0.86	3.08	32
25	5	0.71	0.77	4	0.30	1.11	-0.20	9	0.50	0.85	-0.14	1.15	2.38	3.53	0.87	3.14	72
30	6	0.56	0.83	4	0.42	1.37	-0.07	10	0.49	0.97	-0.19	1.17	2.62	5.25	0.82	3.24	93
35	6	0.51	0.90	4	0.87	1.55	0.18	10	0.69	1.07	-0.06	1.45	3.55	9.22	0.94	4.25	112
40	6	0.23	0.88	3	0.26	0.51	0.01	9	0.24	0.70	-0.29	0.77	1.63	1.66	0.75	2.16	50
45	3	0.00	0.28	3	0.28	0.40	0.14	6	0.14	0.28	-0.15	0.42	1.19	0.36	0.86	1.52	10
50	1	0.75		1	0.79		0.02	2	0.77	0.43			2.37	1.17			20

N number of stations. Std standard deviation

Table 1.7: Estimates of the inter-calibration experiment between the gears TV3 930 and GOV for cod (ln-transformed conversion factors. back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
5	8	-0.43	1.02	9	-0.46	0.94	-0.01	17	-0.44	0.92	-0.92	0.03	0.98	1.75	0.40	1.03	84
10	12	-0.02	0.76	7	-0.69	0.82	-0.34	19	-0.36	0.73	-0.71	-0.01	0.91	1.01	0.49	0.99	54
15	11	-0.45	0.74	11	0.06	1.27	0.26	22	-0.19	1.00	-0.64	0.25	1.35	2.90	0.53	1.28	98
20	13	-0.17	0.74	14	0.22	1.20	0.19	27	0.03	0.97	-0.36	0.41	1.64	3.27	0.70	1.51	93
25	13	-0.29	0.67	14	0.06	0.91	0.17	27	-0.12	0.78	-0.42	0.19	1.20	1.48	0.66	1.21	60
30	12	-0.34	0.86	15	0.01	0.95	0.17	27	-0.17	0.88	-0.51	0.18	1.24	1.97	0.60	1.20	77
35	10	-0.51	1.11	14	0.20	0.84	0.35	24	-0.15	0.92	-0.54	0.23	1.31	2.32	0.58	1.26	84
40	12	-0.12	0.68	13	-0.08	0.75	0.02	25	-0.10	0.69	-0.38	0.18	1.15	1.14	0.68	1.20	48
45	11	0.03	0.87	12	-0.10	0.90	-0.06	23	-0.03	0.85	-0.40	0.33	1.38	2.02	0.67	1.39	71
50	4	-0.35	0.95	5	0.17	1.10	0.26	9	-0.09	0.92	-0.78	0.61	1.40	2.48	0.46	1.83	84

N number of stations. Std standard deviation

Table 2.1: Estimates of the inter-calibration experiment between the gears TV3 520 and HG 20/25 for flounder
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	1	-0.51		7	-0.33	0.36	0.09	8	-0.42	0.36	-0.71	-0.13	0.70	0.28	0.49	0.88	15
20	4	0.10	0.69	7	-0.52	0.24	-0.31	11	-0.21	0.40	-0.48	0.05	0.88	0.40	0.62	1.06	18
25	17	0.05	0.52	11	-0.32	0.48	-0.18	28	-0.14	0.48	-0.32	0.05	0.98	0.57	0.72	1.05	25
30	18	-0.14	0.71	12	-0.12	0.51	0.01	30	-0.13	0.62	-0.36	0.10	1.06	0.88	0.70	1.10	39
35	12	-0.01	0.74	12	-0.23	0.59	-0.11	24	-0.12	0.64	-0.39	0.15	1.09	0.95	0.68	1.16	42
40	2	-0.31	0.44	7	-0.19	0.63	0.06	9	-0.25	0.55	-0.67	0.16	0.90	0.62	0.51	1.17	31
45	0	0.00		5	0.08	1.02		5									

N number of stations, Std standard deviation

Table 2.2: Estimates of the inter-calibration experiment between the gears TV3 930 and TV3 520 for flounder
(ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	1	-1.53		4	-1.01	0.73	0.26	5	-1.27	0.84	-2.24	-0.30	0.40	0.58	0.11	0.74	71
20	4	-0.08	0.41	8	-0.21	0.76	-0.06	12	-0.15	0.61	-0.53	0.24	1.04	0.85	0.59	1.27	38
25	9	0.87	0.70	9	-0.40	0.55	-0.63	18	0.24	0.63	-0.07	0.55	1.54	1.29	0.93	1.73	40
30	9	0.92	0.42	10	-0.33	1.10	-0.63	19	0.29	0.83	-0.11	0.69	1.90	2.69	0.90	2.00	69
35	5	1.32	0.34	6	-0.04	0.66	-0.68	11	0.64	0.62	0.23	1.06	2.31	1.93	1.26	2.88	40
40	0	0.00		3	0.27	0.41		3									
45	0	0.00		1	0.00			1									

N number of stations, Std standard deviation

Table 2.3: Estimates of the inter-calibration experiment between the gears TV3 930 and Granton for flounder (ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	0	0.00		0	0.00			0									
20	6	1.68	0.91	6	1.48	0.42	-0.10	12	1.58	0.80	1.08	2.08	6.66	8.57	2.94	8.00	63
25	9	1.65	0.58	7	1.53	0.72	-0.06	16	1.59	0.72	1.21	1.97	6.37	6.86	3.34	7.19	53
30	5	1.14	0.70	5	1.61	0.36	0.24	10	1.38	0.60	0.95	1.80	4.75	3.79	2.59	6.06	37
35	3	1.14	1.03	4	1.36	0.71	0.11	7	1.25	0.83	0.51	1.99	4.90	6.85	1.66	7.29	68
40	0	0.00		1	2.85			1									
45	0	0.00		0	0.00			0									

N number of stations, Std standard deviation

Table 2.4: Estimates of the inter-calibration experiment between the gears TV3 520 and LBT for flounder (ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	9	0.80	1.79	13	-0.76	0.90	-0.78	22	0.02	1.28	-0.55	0.58	2.30	10.50	0.58	1.79	159
20	14	0.49	1.01	20	-0.30	0.74	-0.39	34	0.10	0.84	-0.20	0.39	1.56	2.24	0.82	1.47	70
25	14	0.37	0.75	21	0.16	1.37	-0.11	35	0.26	1.13	-0.12	0.65	2.48	7.64	0.88	1.92	126
30	12	0.43	0.63	20	-0.06	0.87	-0.24	32	0.18	0.77	-0.09	0.46	1.61	1.94	0.91	1.59	59
35	8	-0.22	0.79	10	0.12	0.93	0.17	18	-0.05	0.82	-0.46	0.36	1.33	1.84	0.63	1.43	67
40	0	0.00		1	-0.69			1									
45	0	0.00		0	0.00			0									

N number of stations, Std standard deviation

Table 2.5: Estimates of the inter-calibration experiment between the gears TV3 930 and P 20/25 for flounder (ln-transformed conversion factors, back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	7	0.17	0.56	3	-0.30	0.47	-0.24	10	-0.06	0.49	-0.41	0.28	1.06	0.61	0.67	1.32	25
20	11	-0.07	0.93	8	-0.34	0.97	-0.14	19	-0.21	0.89	-0.64	0.22	1.21	1.99	0.53	1.25	79
25	11	0.05	0.74	8	-0.15	0.87	-0.10	19	-0.05	0.75	-0.41	0.31	1.26	1.46	0.66	1.37	57
30	9	-0.16	0.91	5	-0.16	0.18	0.00	14	-0.16	0.70	-0.56	0.24	1.09	1.10	0.57	1.27	49
35	7	-0.10	0.24	3	-0.84	0.55	-0.37	10	-0.47	0.31	-0.69	-0.25	0.66	0.22	0.50	0.78	11
40	0	0.00		0	0.00			0									
45	0	0.00		0	0.00			0									

N number of stations, Std standard deviation

Table 2.6: Estimates of the inter-calibration experiment between the gears TV3 930 and Hake 4M for flounder (ln-transformed conversion factors. back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors							Ln-transformed corrected conversion factors					Back-transformed conversion factors				
	Sequence 1			Sequence 2													
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	2	0.46	0.56	1	-1.70		-1.08	3	-0.62	0.40	-1.35	0.11	0.58	0.26	0.26	1.12	18
20	6	0.15	0.43	4	-0.97	0.70	-0.56	10	-0.41	0.49	-0.76	-0.06	0.75	0.44	0.47	0.94	26
25	6	-0.17	0.43	4	-0.70	0.50	-0.26	10	-0.44	0.41	-0.73	-0.14	0.70	0.33	0.48	0.87	19
30	6	-0.19	0.39	4	-0.87	0.54	-0.34	10	-0.53	0.41	-0.82	-0.24	0.64	0.30	0.44	0.79	18
35	6	-0.07	0.57	4	-0.77	0.49	-0.35	10	-0.42	0.49	-0.76	-0.08	0.74	0.43	0.47	0.93	25
40	3	0.75	0.16	1	0.49		-0.13	4	0.62	0.36	0.13	1.12	1.99	0.78	1.14	3.06	14
45	0	0.00		0	0.00			0									

N number of stations. Std standard deviation

Table 2.7: Estimates of the inter-calibration experiment between the gears TV3 930 and GOV for flounder
(ln-transformed conversion factors. back-transformed estimates and the necessary number of paired Stations N*)

	Ln-transformed conversion factors Sequence 1			Ln-transformed conversion factors Sequence 2				Ln-transformed corrected conversion factors					Back-transformed conversion factors				
Length	N	Mean	Std	N	Mean	Std	C(t)	N	Mean	Std	Confidence limits		Mean	Std	Confidence limits		N*
15	0	0.00		1	-0.69			1									
20	3	-0.22	0.39	3	-0.20	0.37	0.01	6	-0.21	0.32	-0.53	0.11	0.85	0.29	0.59	1.11	12
25	6	0.10	0.81	2	-0.17	0.59	-0.13	8	-0.04	0.67	-0.59	0.51	1.21	1.15	0.56	1.67	46
30	7	-0.24	0.68	3	-0.27	0.26	-0.02	10	-0.25	0.54	-0.64	0.13	0.90	0.61	0.53	1.14	31
35	1	1.25		2	-0.55	0.53	-0.90	3	0.35	0.70	-0.93	1.63	1.82	1.83	0.40	5.12	49
40	0	0.00		1	-0.62			1									
45	0	0.00		0	0.00			0									

N number of stations. Std standard deviation

Table 4.1: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#520 and HG 20/25 for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5	1.77	0.24	1.48	1.18
10	1.31	0.13	1.31	0.22
15	1.11	0.10	1.12	0.11
20	1.11	0.11	1.11	0.15
25	1.09	0.10	1.09	0.12
30	1.11	0.10	1.11	0.13
35	0.98	0.10	0.98	0.13
40	0.96	0.09	0.96	0.11
45	1.14	0.15	1.15	0.22
50				

Table 4.2: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#930 and TV3#520 for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5	0.72	0.27	0.69	0.49
10	0.94	0.18	0.97	0.25
15	0.87	0.12	0.89	0.12
20	1.12	0.16	1.12	0.23
25	1.27	0.17	1.28	0.26
30	1.79	0.25	1.79	0.48
35	1.51	0.18	1.51	0.25
40	1.71	0.18	1.70	0.21
45	1.40	0.20	1.37	0.32
50	1.25	0.19	1.23	0.23

Table 4.3: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#930 and Granton for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5				
10	10.90	3.43	7.46	6.23
15	5.77	1.02	5.22	1.36
20	6.21	0.88	5.91	1.37
25	7.81	0.99	7.06	2.54
30	5.06	0.71	4.84	1.46
35	5.01	0.76	4.79	2.00
40	3.66	0.56	3.54	0.89
45	2.36	0.43	2.33	0.35
50	1.80	0.39	1.80	0.24

Table 4.4: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#520 and LBT for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5				
10				
15				
20	1.80	0.38	2.08	0.46
25	2.08	0.43	2.12	0.58
30	0.82	0.22	0.74	0.36
35	1.08	0.24	1.05	0.32
40	1.12	0.29	1.02	0.47
45	0.65	0.25	0.65	0.00
50	1.41	0.00		

Table 4.5: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#930 and P 20/25 for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5	0.90	0.12	0.90	0.22
10	1.76	0.28	1.82	0.48
15	1.49	0.21	1.47	0.36
20	1.40	0.19	1.16	0.20
25	1.46	0.20	1.45	0.24
30	1.79	0.24	1.84	0.24
35	1.45	0.22	1.46	0.38
40	2.18	0.26	2.13	0.30
45	2.45	0.32	2.37	0.28
50				

Table 4.6: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#930 and Hake 4M for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5				
10				
15				
20	1.90	0.44	1.86	0.75
25	2.38	0.52	2.28	0.98
30	2.62	0.56	2.47	1.27
35	3.55	0.78	3.27	1.93
40	1.63	0.32	1.61	0.49
45	1.19	0.13	1.20	0.17
50	2.37	0.74		

Table 4.7: Mean conversion factors and standard deviations of the means based on the direct method (German model) and the Jackknife method of the inter-calibration experiment between the gears TV3#930 and GOV for cod

Length	Direct estimates		Jackknife	
interval	Mean	Std	Mean	Std
5	0.98	0.15	1.00	0.22
10	0.91	0.12	0.93	0.17
15	1.35	0.19	1.32	0.45
20	1.64	0.20	1.61	0.49
25	1.20	0.14	1.21	0.21
30	1.24	0.15	1.24	0.28
35	1.31	0.17	1.30	0.36
40	1.15	0.13	1.16	0.18
45	1.38	0.18	1.39	0.30
50	1.40	0.32	1.38	0.58

Table 5.1: Minimum and maximum values of conversion factors of all inter-calibration experiments where the CPUE values of each gear were larger than 3

	2 cm		5 cm	
Gear	Min	Max	Min	Max
HG 20/25	0.01	8.00	0.14	5.07
TV3#520	0.17	12.75	0.21	8.00
Granton	0.01	14.33	0.01	30.50
LBT	0.05	4.50	0.03	3.00
P 20/25	0.14	9.00	0.19	6.75
Hake 4M	0.25	17.93	0.41	22.63
GOV	0.08	7.33	0.09	12.50

Table 5.2: Minimum and maximum values of conversion factors of all inter-calibration experiments where the CPUE values of each gear were larger than 30

	2 cm		5 cm	
Gear	Min	Max	Min	Max
HG 20/25	0.24	3.59	0.28	3.07
TV3#520	0.54	2.40	0.43	6.00
Granton	0.84	5.40	0.84	6.18
LBT	0.10	0.92	0.09	1.17
P 20/25	0.33	4.17	0.37	3.68
Hake 4M	0.55	11.26	0.52	10.59
GOV	0.18	6.54	0.20	5.49

FIGURES

Figure 1: Comparison of mean CPUE values of the new standard gear and the back-calculated mean CPUE values (TV') using the mean CPUE values of the national gears in combination with the conversion factors, CF(t), and the mean influence of the sequence of the gears, C(t), by sequence of the gear (see Equation 1 and 2)

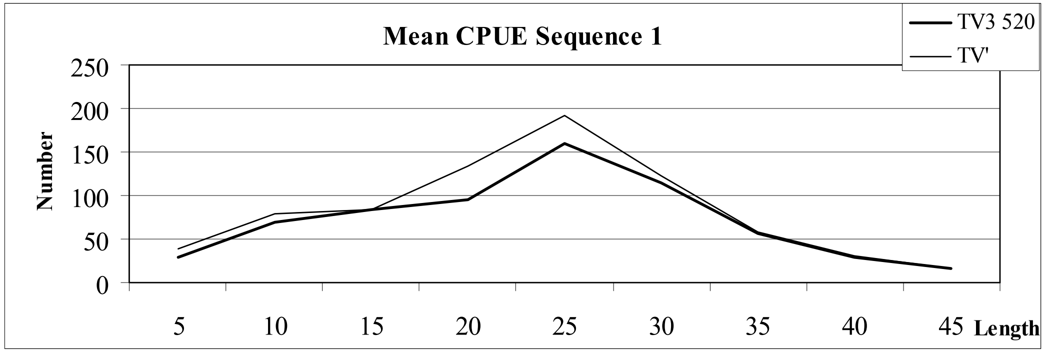
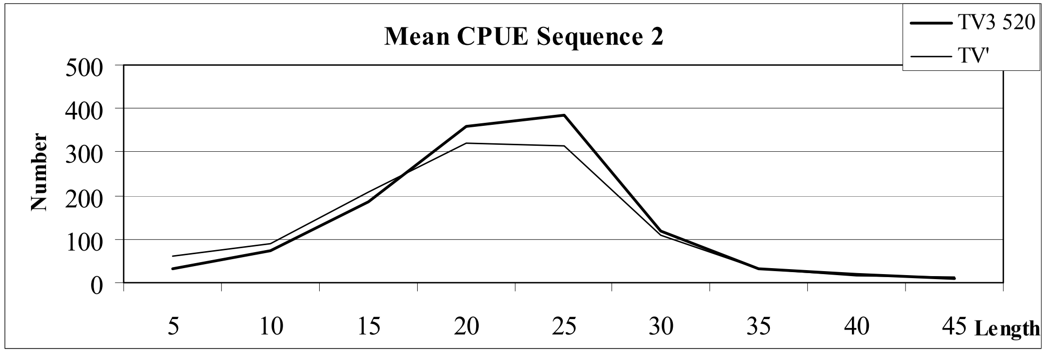


Figure 1.1: Inter-calibration TV3#520 – HG 20/25 – Sequence 1



Inter-calibration TV3#520 – HG 20/25 – Sequence 2

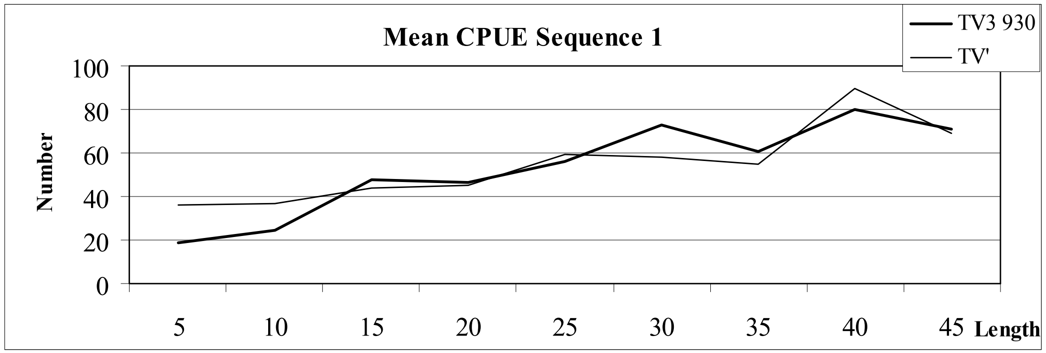
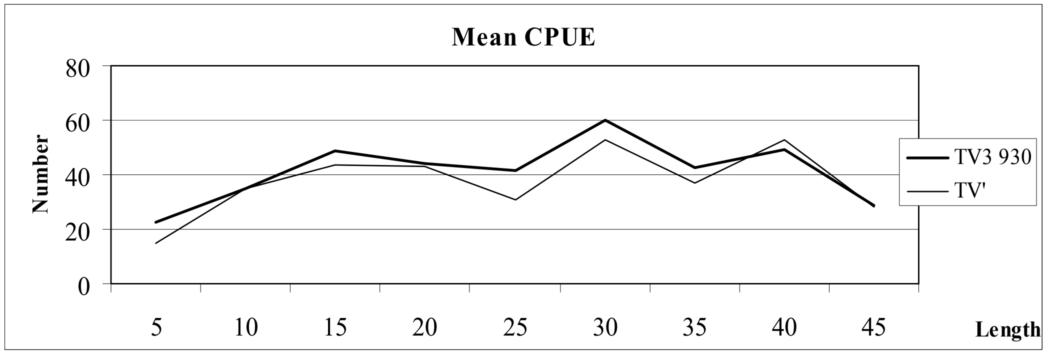


Figure 1.2: Inter-calibration TV3#930 – TV3#520 – Sequence 1



Inter-calibration TV3#930 – TV3#520 – Sequence 2

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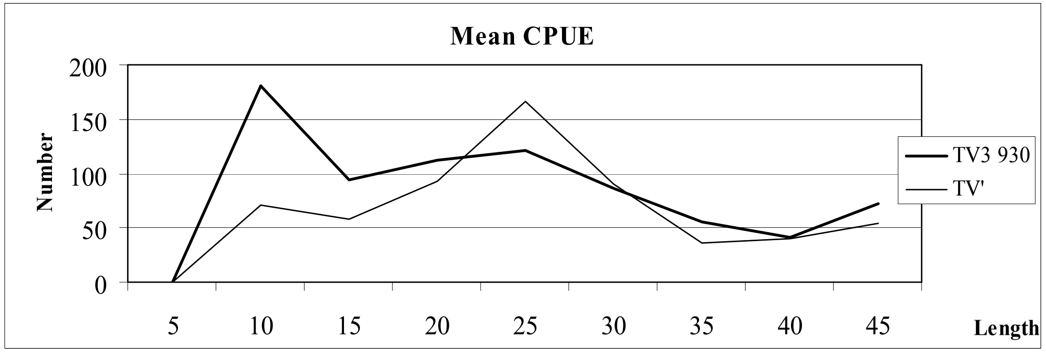
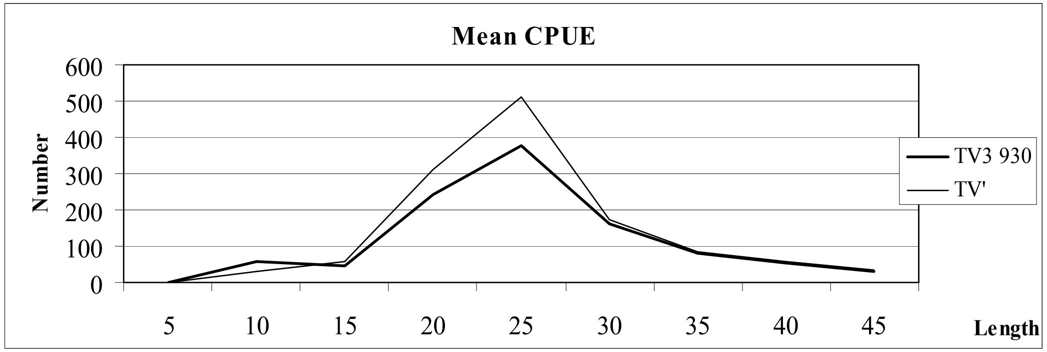


Figure 1.3: Inter-calibration TV3#930 – Granton – Sequence 1



Inter-calibration TV3#930 – Granton – Sequence 2

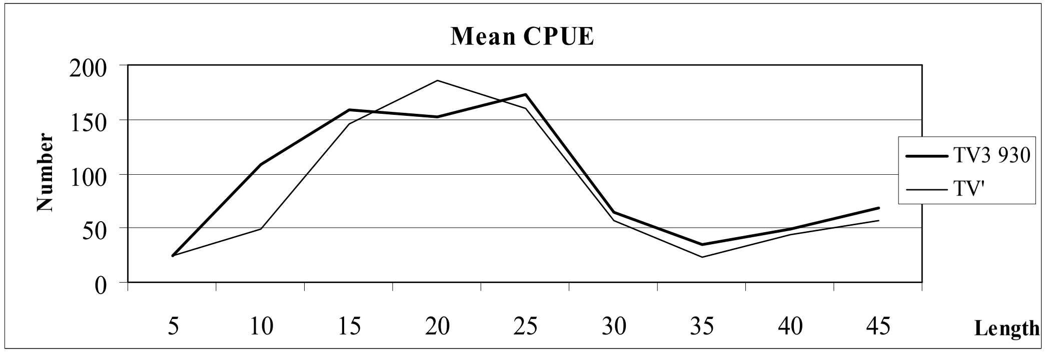
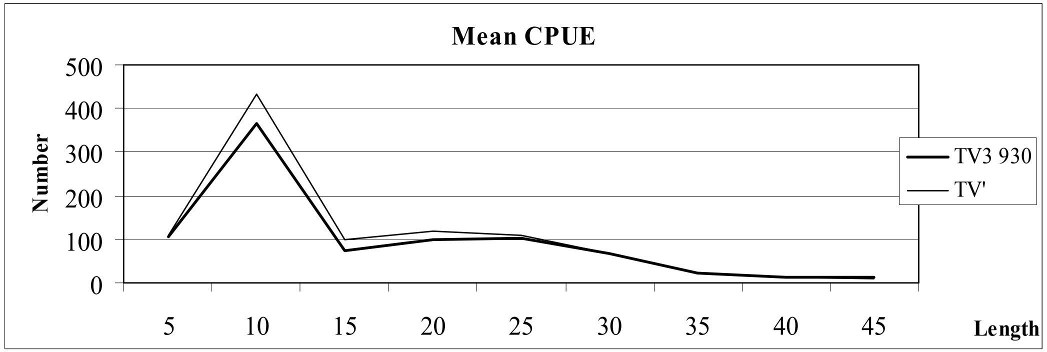


Figure 1.4: Inter-calibration TV3#930 – P 20/25 – Sequence 1



Inter-calibration TV3#930 – P 20/25 – Sequence 2

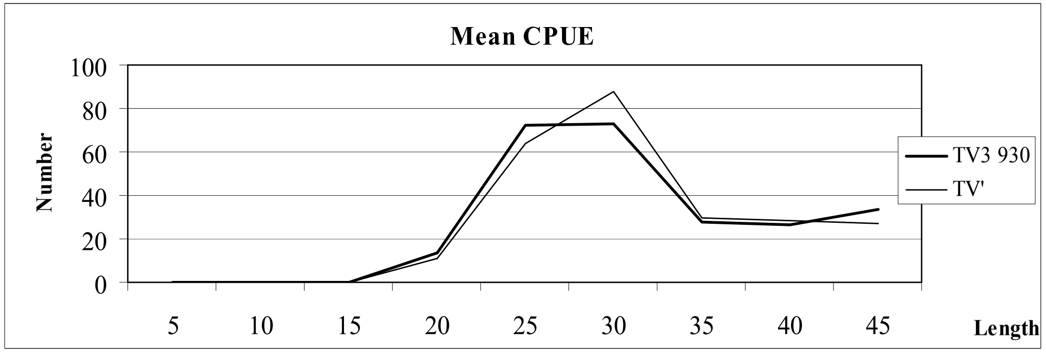
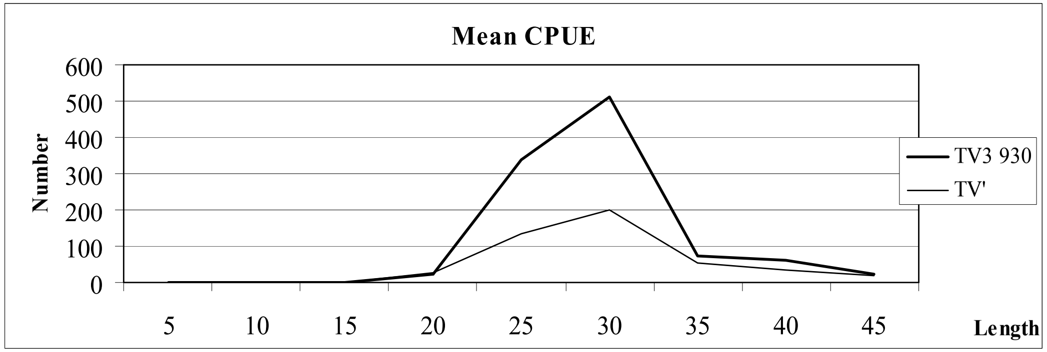


Figure 1.5: Inter-calibration TV3#930 – Hake 4M – Sequence 1



Inter-calibration TV3#930 – Hake 4M – Sequence 2

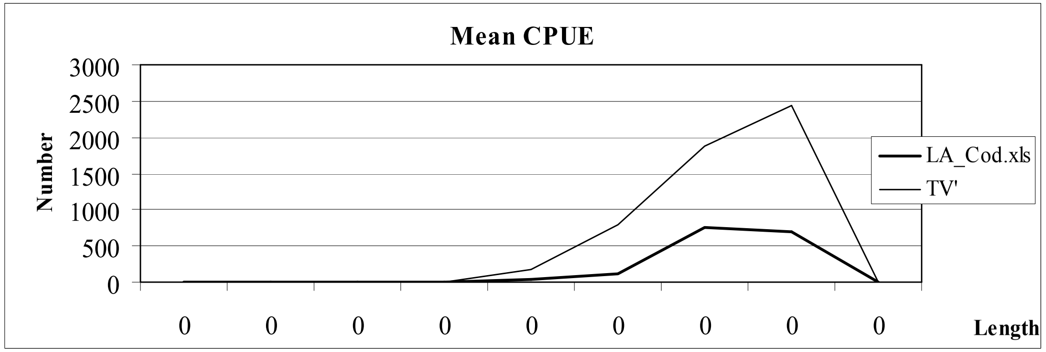
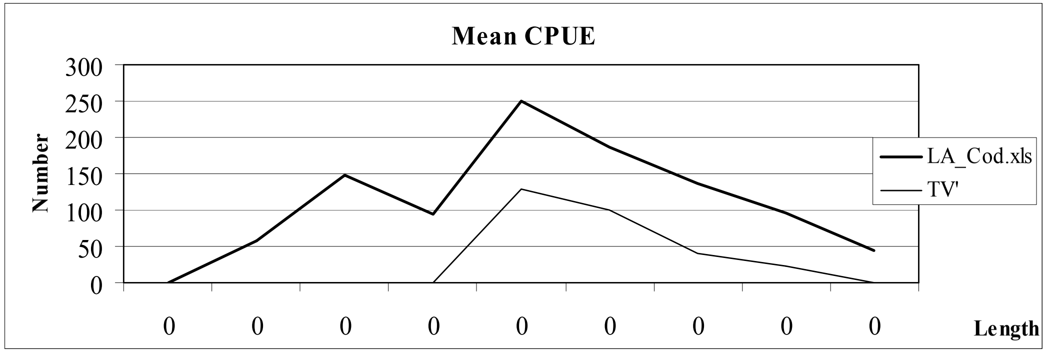


Figure 1.6: Inter-calibration TV3#930 – LBT – Sequence 1



Inter-calibration TV3#930 – LBT – Sequence 2

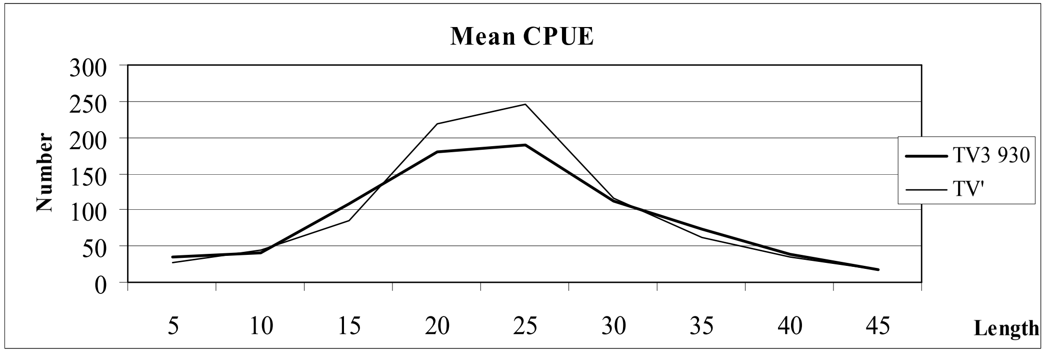
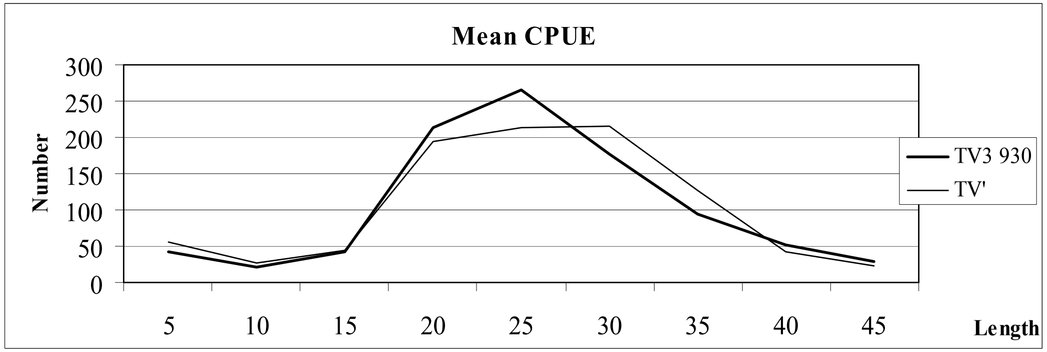


Figure 1.7: Inter-calibration TV3#930 – GOV – Sequence 1



Inter-calibration TV3#930 – GOV – Sequence 2

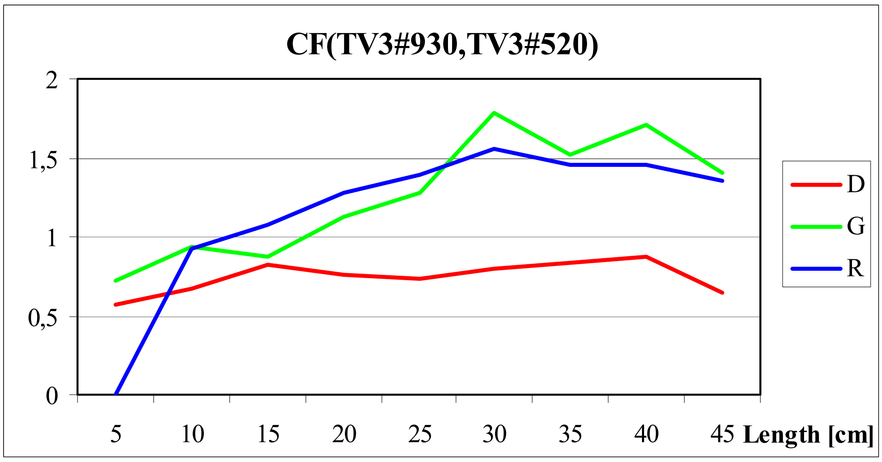


Figure 2.1: Conversion factors between TV3#930 and TV3#520 of cod by the Danish, German and Russian model by length intervals

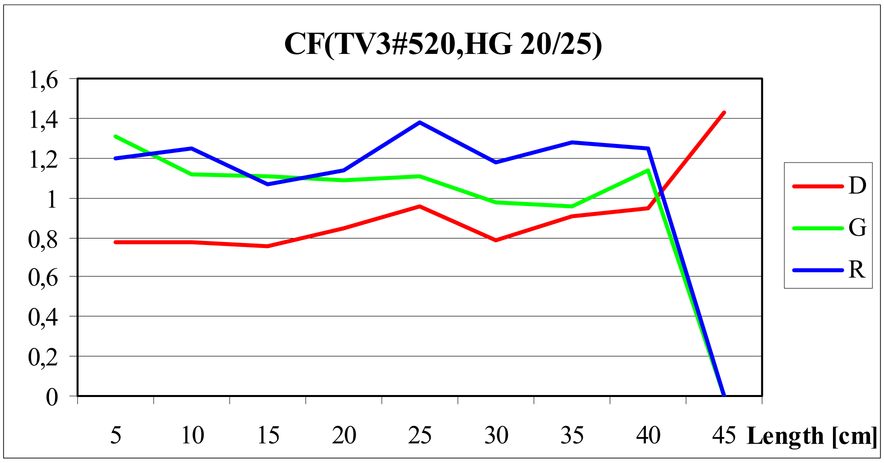


Figure 2.2: Conversion factors between TV3#520 and HG 20/25 of cod by the Danish, German and Russian model by length intervals

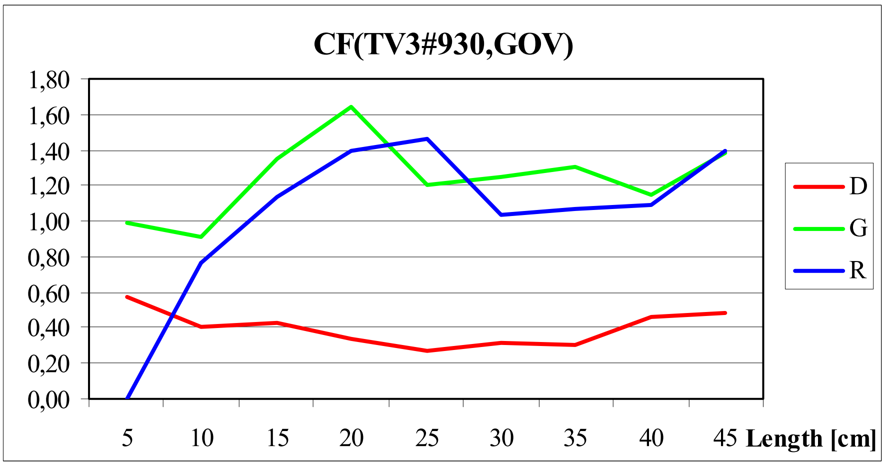


Figure 2.3: Conversion factors between TV3#930 and GOV of cod by the Danish, German and Russian model by length intervals

OPTIMAL SIZE OF UNITS FOR ALLOCATING HAULS OF BALTIC INTERNATIONAL TRAWL SURVEY

by

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Introduction

New standard gears have been used during the **B**altic **I**nternational **T**rawl **S**urveys (BITS) since 2001, and international co-ordinated surveys have been started to reach a coverage of the total distribution area of the target species within a relative short period. Therefore, the planned total number of all stations are allocated to subdivisions and depth layers according to the defined algorithm (ICES 2002). Subsamples of the available haul positions that are stored in the Tow Database are selected dependent on the proposed number of stations for a given depth layer of subdivision.
Unfortunately, the available haul positions are very heterogeneously distributed in many depth layers (ICES 2002). Therefore, it must be assumed that the use of a generator of equally distributed random numbers can not be used to select hauls from the Tow Database since such algorithm produces a biased selection due to the different probability (number of hauls within small units, see Table 10.4, ICES 2002) of areas to come into the selected pool of hauls.
During the last meeting of WGBIFS this problem was intensively discussed. It was pointed out that the use of too small or too large units during the selection process can produce a biased coverage of the total area. However, since additional studies were not possible during the meeting it was agreed that the units of 5'Nx10'E should be used for selecting the stations of the surveys in autumn 2002, spring 2003 and autumn 2003. It was also pointed out that further studies are necessary to find the optimum size of units.

The aim of this paper is to study whether the use of units can reduce the influence of the heterogeneously distributed available positions and whether an optimal units size exists.

Material and Methods

The aim of the random selection process is to cover the total distribution area of the target species and to make sure that all parts of the depth layer have the same probability to come into the sample as it is required by the theory of probability. Therefore, a criterion must be used that is only influenced by the coverage of the total area of investigation by the selected haul positions for comparing the different proposed algorithm.
The relative distribution of the distances (RD) between all selected positions can be used as such a criterion. That means that after the allocation of n sampling positions the distances between all selected positions are calculated and the relative distribution of these n + (n-1) / 2 values is calculated. This relative distribution is only dependent on the coverage of the total area by the selected positions.

A common and universal unit size that is optimal for all depth layers in the Baltic Sea is not possible due to different coverage of the different depth layers by the available haul positions. Furthermore, the number and spatial distribution of the available positions change from year to year since new positions are added to the Clear Tow Database and positions are deleted where gears were damaged. Therefore, simulation were used to check the effects of different unit sizes concerning the representative coverage of the total area.

For the simulations an one-dimensional sampling area is used. It is assumed that this area can be separated into 50 units of the same size 1 and that in every unit more than one position exist were data can be sampled. This situation is comparable with a depth layer of the Baltic Sea if the total area is separated in very small parts of 1'Nx1'E.

The used restriction that an one dimensional population is used instead of a two dimensional area is not important for the interpretation since the results are comparable. The advantage of the use of this model is the easier and better presentation of the results.

Furthermore, it is assumed that two options exist for selecting positions. The first option is that no restrictions exist concerning the use of a position during sampling. That means that the probability for each position to come into the sample is the same as required by the probability theory. The second option is comparable to the BITS. Only a subsample of all positions can be used during the sample. Furthermore, the distribution of the available positions is heterogeneously distributed. Figure 1 illustrates the simulation. It presents the 50 units and the used example of the 50 heterogeneously distributed positions.

In a first step it is necessary to determine the control distribution (CD) of RD if restrictions concerning the availability of positions where samples can be taken do not exist. It is assumed that 50 positions with equidistant distance are sampled. That means that 49 differences between the used position exist with a distance of one unit, 48 differences exist with a distance of two units etc. The relative distribution is a straight line with a negative slope.

An other way is that 50 positions are selected using a generator of equal distributed random numbers. This procedure is repeated more times and the mean RD is calculated. Both the ways produce the same relative distribution as presented in **Figure 2**. The control distribution (CD) presents the RD that can be expected if restrictions concerning the availability of positions do not exist.

Furthermore, the RD of the available 50 heterogeneous distributed position is calculated (CD') and presented in **Figure 2**.

Both the distributions are significantly different. However, the differences between CD and CD' is dependent on the distribution pattern of the available positions. The aim of the defined allocation schemes is to produce mean RD that corresponds as well as possible with the CD.

The described method can be used all possible areas, e.g. depth layer of the ICES subdivision. For each area a control distribution can be calculated. In this case the distances of all positions or the distance of all possible very small units must be determined The structure of the CD is not necessary a straight line. It is dependent of the structure of the studied region. Furthermore, the RD of the available positions can be estimated. Dependent on the difference of between CD and CD' decided whether a random selection of the positions can be used or whether it is necessary to use special methods.

For studying the effects of different allocation algorithm the following procedures were used. A number of M positions was chosen. Then 4 times a sample of M positions were selected using each of the proposed algorithm of allocation. For each sample the RD was calculated and then the mean RD of the four samples was estimated.

The correspondence of the mean RD and the control distribution was used to assess the quality of the different allocation algorithm.

The following allocation schemes were analysed.

1. The total area was not separated in different parts
2. The total area was separated in two parts of the same size

3. The total area was separated in five parts of the same size
4. The total area was separated in ten parts of the same size
5. The total area was separated in 25 parts of the same size
6. The total area was separated in 50 parts of the same size

If the number of planned stations was larger than the number of separated parts the different parts were selected using a generator of equal distributed random numbers. Then again the generator was used to select a position within the selected part. If the number of planned positions is higher than the separated parts the same number of positions was planned for each part (proportional distribution) and the position within a part was selected using a generator of equal distributed random numbers.

Results

The simulations were carried out using the total number of 20 positions and of 10 positions. A high number of total positions results in relative stable figures of the mean RD if only 4 simulations are carried out. To illustrate that the conclusions are not only true for a high number of planned positions the simulations were again carried out using a total number of 10 positions. Furthermore, control distribution CD and / or CD' were presented in the different figure to give an impression concerning the agreement / disagreement of the mean RD with the control distribution.

<u>Allocation scheme 1</u>
The following results are based on the use of 20 positions (planned positions). **Figure 3** presents the RD of four simulated allocations and the mean distribution when all positions are possible without restrictions as well as CD. **Figure 4** shows the RD of the 4 simulated allocations and the mean distribution when only the limited number of 50 positions (Figure 1) are available as well as CD'. **Figure 5** summarizes the results that are presented in Figure 3 and 4. However, without the RD of the single simulations.
The graphs illustrate that the mean RD's correspond with the control distributions, and that the random selection of positions produce a RD that is significantly different from the expected control distribution (CD) when a limited number of heterogeneously distributed positions are available. **Figure 6** presents the mean RD if only a total of 10 positions were used instead of 20 positions. The graphs present the same trends as **Figure** 5. The mean distributions correspond with the expected distributions CD and CD', but the variability of the mean distribution is higher. Similar results are obtained when the total area was separated in 50 parts of the same size (allocation scheme 6)

<u>Allocation scheme 2</u>
The results of the simulations are presented in **Figures 7 to 9**. **Figure 7** shows the four RD, the mean RD and the CD'. These simulations are based on the use of 20 positions. The total area was separated into two parts of the same size and in each part the half of the planned positions were selected as mentioned above. **Figure 8** presents the expected CD, the CD' and the mean RD. It is easy to see that the mean RD is close to CD'. That means that the separation of the total area in two parts of the same size did not produce a significant better coverage of the total area by the selected positions if only the heterogeneous distributed positions are available. **Figure 9** shows the mean RD if only 10 positions can be used in the sample. The disagreement between the mean RD and CD corresponds with the case of 20 positions (**Figure 8**). However, the variability of the mean RD is higher. The correspondence between the mean RD and CD' is determined by the heterogeneous distribution of the available positions in the used large parts used.

Allocation scheme 3

This allocation scheme separates the total area in 5 parts of the same size. The other steps of simulation are comparable to the other allocations schemes. In this and the next cases the graphs of the single RD are not presented since the mean RD is used to assess the effects of the allocation schemes. **Figure 10** shows the mean RD, CD and CD' if 20 positions could be used. Figure 11 presents the same distributions when only 10 positions were available. In contrast to the allocation scheme 2 the correspondence between the mean RD and CD increased. This trend can be observed for both the cases, 20 and 10 positions

Allocation scheme 4

In this case the total area is separated in 10 parts. **Figure 12** illustrates that the mean RD corresponds with CD. This effect is independent of the used number of stations as **Figure 13** illustrates. The used allocation scheme produces a balance between the relative regular selection of the different parts in the sample and the remaining heterogeneity of the available positions within the parts.

Allocation scheme 5

The separation of the total area in more parts with smaller size, in this case the use of 25 parts, produce a mean RD that also corresponds with CD independent of the used number of available positions used. (**Figures 14 and 15**)

Allocation scheme 6

A further decrease of the size of the separated parts as used in the allocation scheme results in a worse correspondence between the mean RD and CD as shown in **Figures 16 and 17**. In this case the allocation process is significantly influenced by the parts which do not contain any position. The units that can be selected are partly close together dependent on the structure of the available positions.

It must be pointed out that the results presented are dependent on the structure of the available positions. However, the results can be used to show general relations. The separation of the total area into a low number of parts with the same size as well as the separation into a lot of very small parts is not suitable to reduce the effects of the heterogeneously distributed positions. When the total area is separated into parts that are not to small and not to large the mean RD is relative close to the control distribution (CD). **Figure 12** illustrates the situation

The allocation scheme 3, 4 and 5 produce mean RD's that are relative close together. However, the number of 4 simulations as basis of the analyses is to low to detect significant differences between the different allocation schemes. That was not the aim of the studies since the optimal scheme is dependent on the structure of the positions available.

It is not possible and also not useful to select the optimal allocation scheme for each possible variation of possible positions.

In the case of BITS the following options are possible:

- Optimal allocation schemes are estimated and are adopted if the distribution of the available hauls changes for each depth layer.
- The same allocation scheme is used for all depth layers independent whether the selected scheme is optimal or not optimal.

The results suggest that unit sizes of 5'N x 10'E or 10'N x 20'E are suitable to reduce the effects of the available heterogeneously distributed hauls in the Clear Tow Database.

Discussion

The aims of the studies was

- to develop a method that describes the effects of different allocation schemes,
- to analyse and illustrate the effects of different separations of the total area into parts of the same size,
- to derive generalized recommendations.

The studies have illustrated that two factors influence the allocation scheme chosen, the number and their spatial distribution of parts without available positions and the heterogeneity of the available positions within the parts. When the total area is separated into a small number of large parts the number of parts without positions is low, but the influence of the heterogeneity of the available positions within the parts increase. The opposite option uses many parts of small size. In this case the number of parts without positions increases and the influence of the heterogeneity of the parts with available positions also increases. In contrast to this the effects of the heterogeneity of the positions within the parts decreases.
Since it is useful to take the same allocation scheme in all depth layers of the Baltic Sea it seems to be not necessary to estimate the most optimal allocation scheme. It is more important to use an allocation scheme that is close to this optimum.

Figures

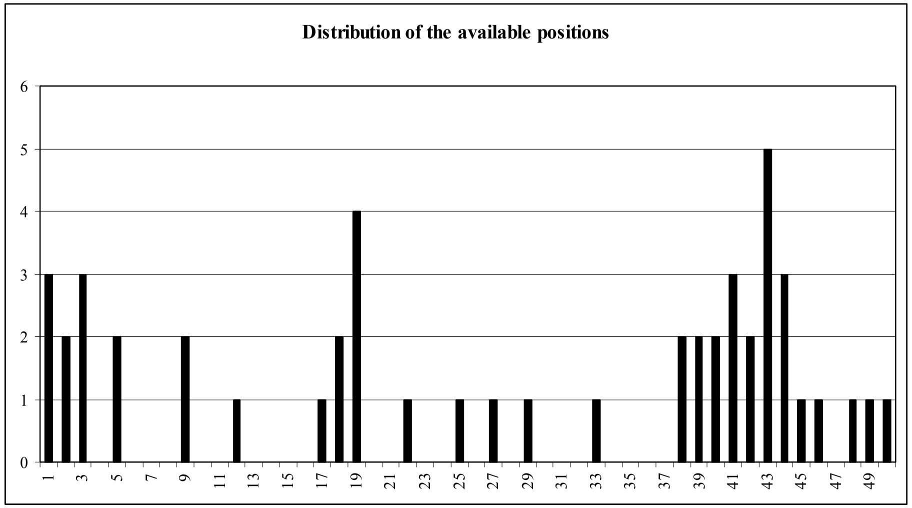

Figure 1: Distribution of the simulated positions

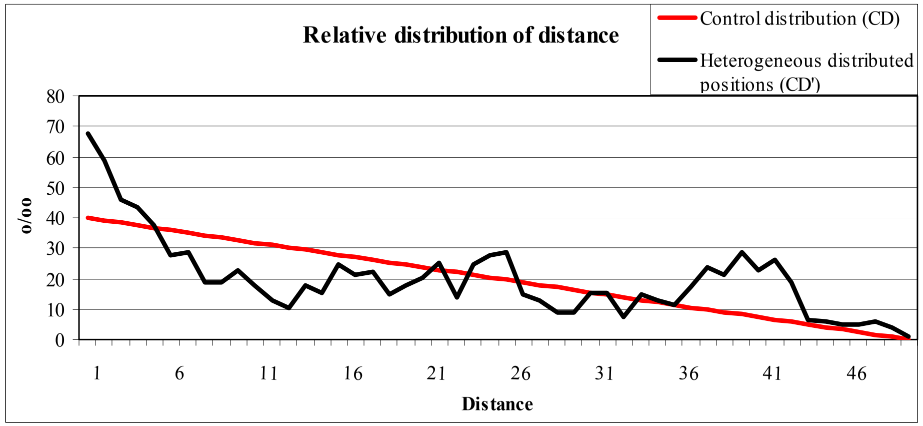

Figure 2: Relative distribution of distance of the control distribution and the 50 heterogeneous distributed positions

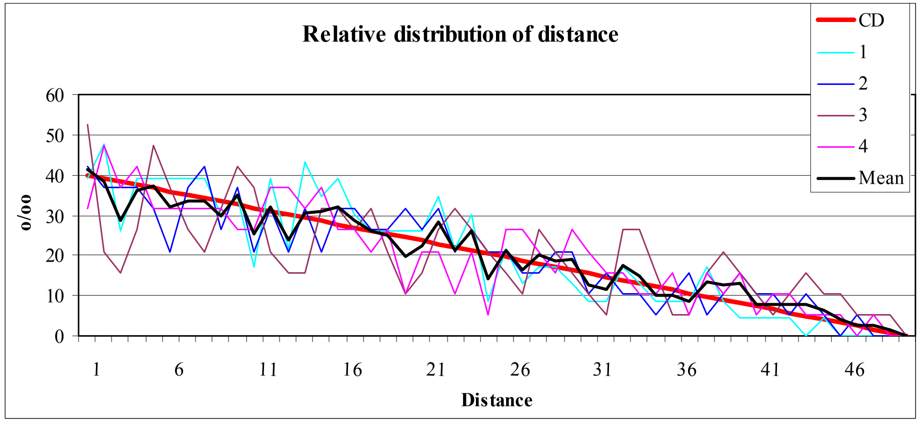	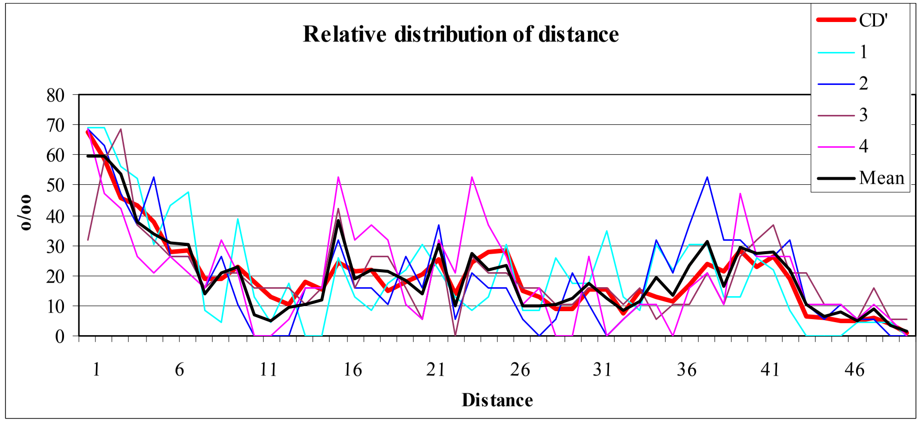
Figure 3: Relative distribution (RD) of the distances of 4 simulations and the mean RD using 20 positions without restrictions	Figure 4: Relative distribution (RD) of the distances of 4 simulations and the mean RD using 20 of the possible positions
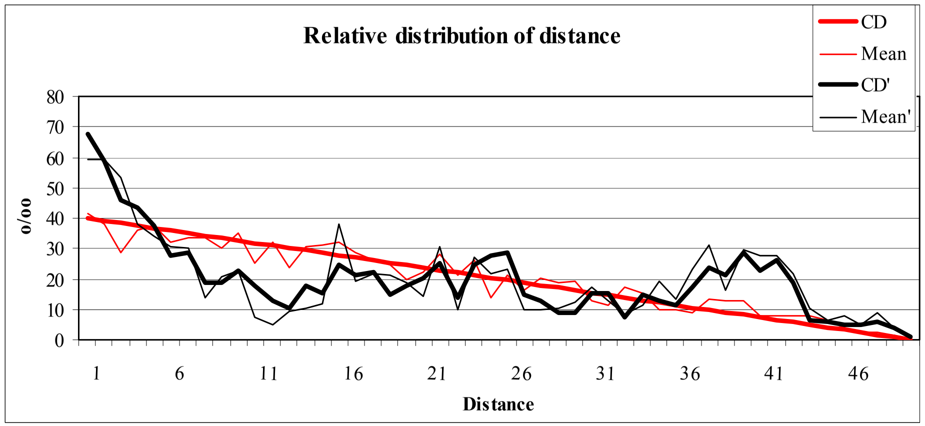	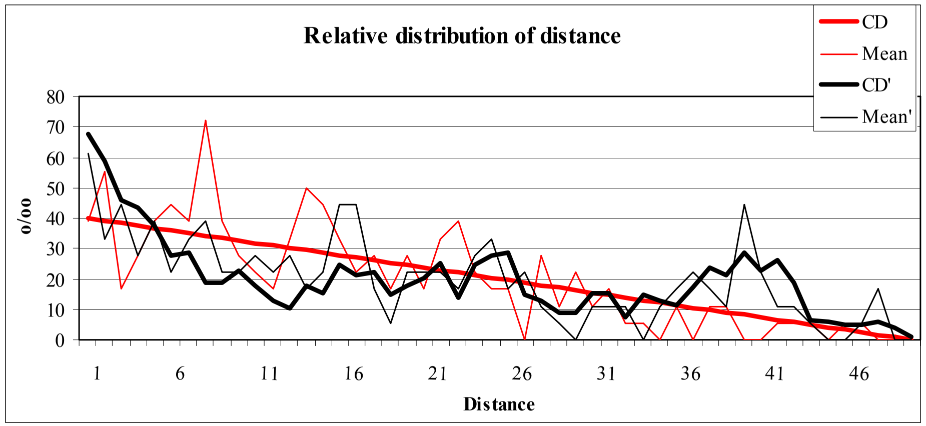
Figure 5: Comparison of the mean relative distribution of distances, Mean, Mean’, and the expected distributions, CD, CD’, of both options of the selection of positions using 20 positions	Figure 6: Comparison of the mean relative distribution of distances, Mean, Mean’, and the expected distributions, CD, CD’, of both options of the selection of positions using 10 positions

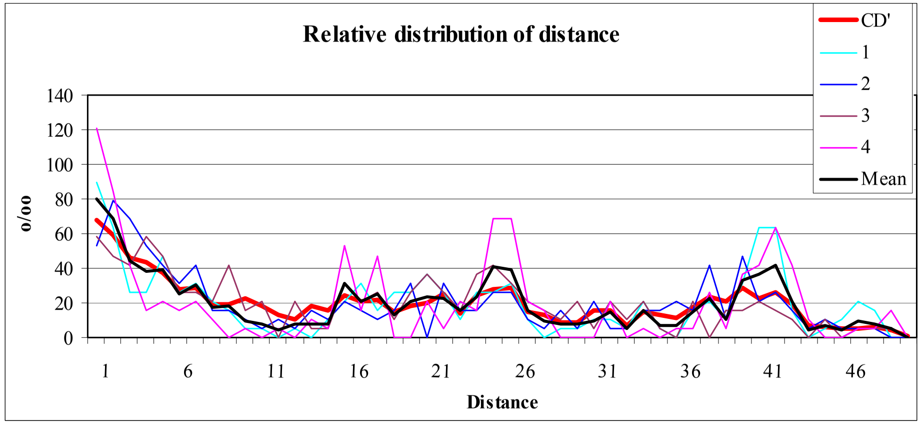

Figure 7: N=20, scheme = 2

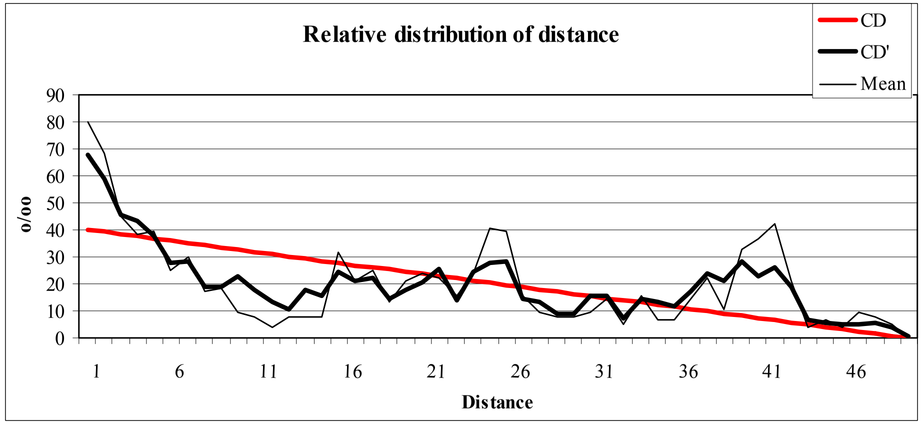

Figure 8: N=20, scheme = 2

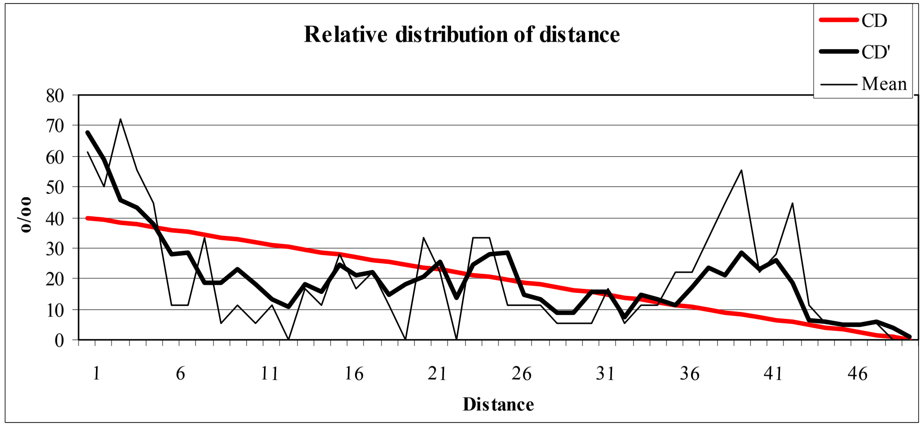

Figure 9: N=10, scheme = 2

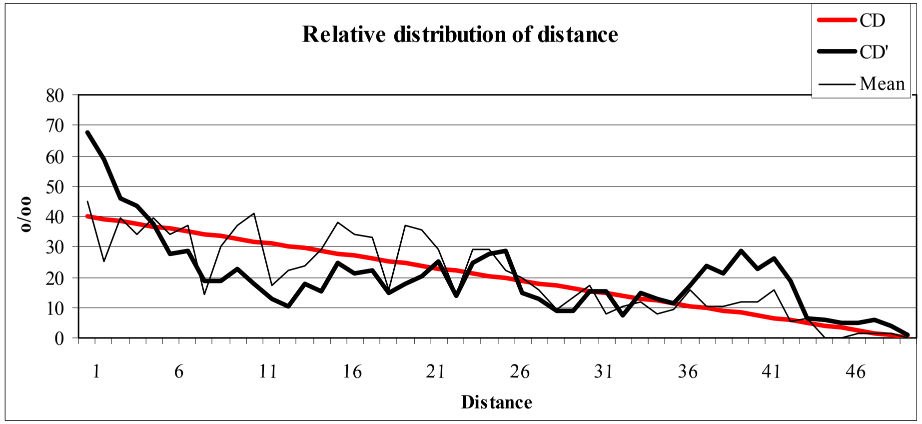

Figure 10: N=20, scheme = 3

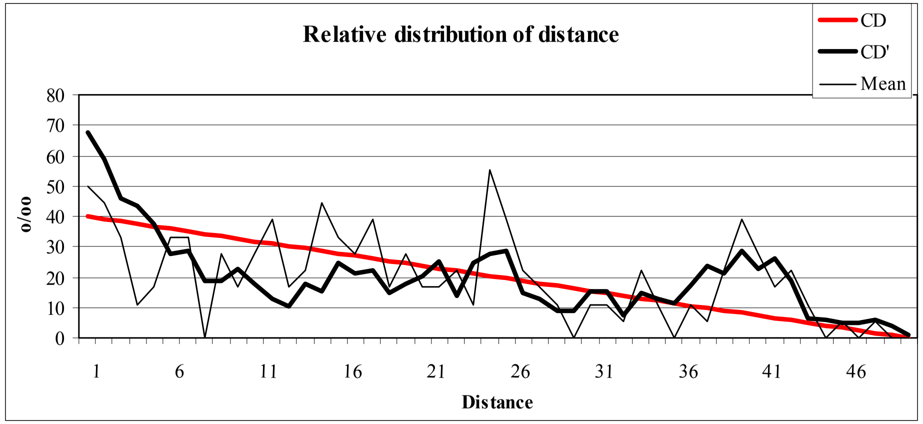

Figure 11: N=10, scheme = 3

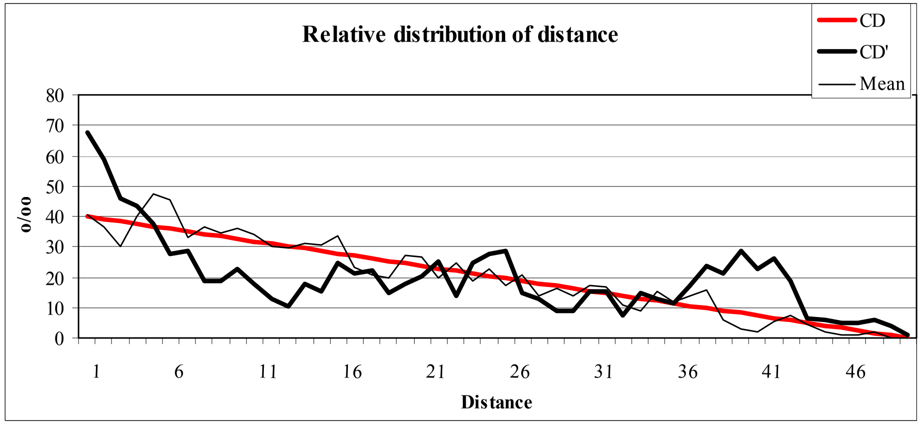

Figure 12: N=20, scheme = 4

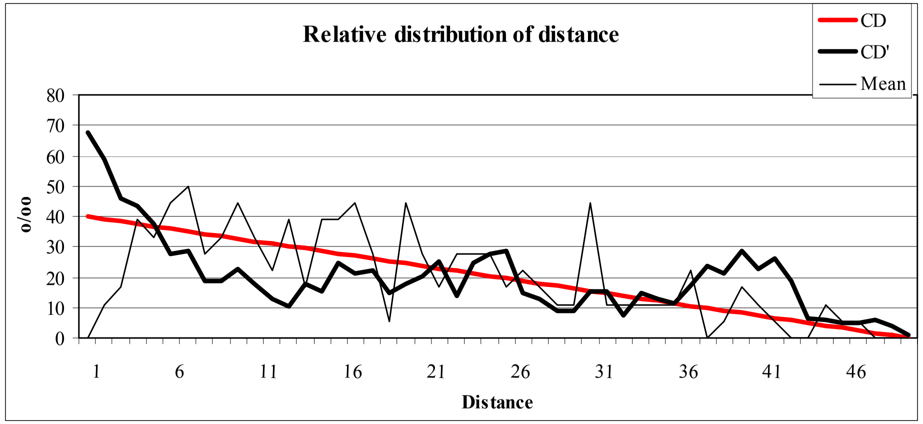

Figure 13: N=10, scheme = 4

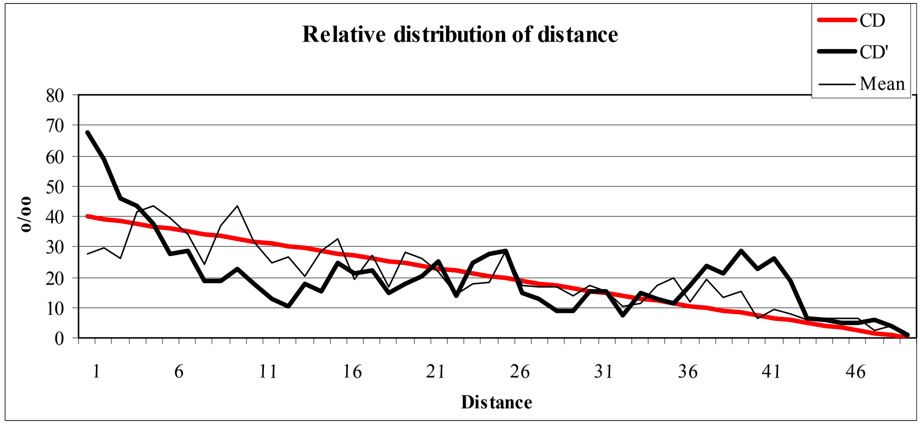	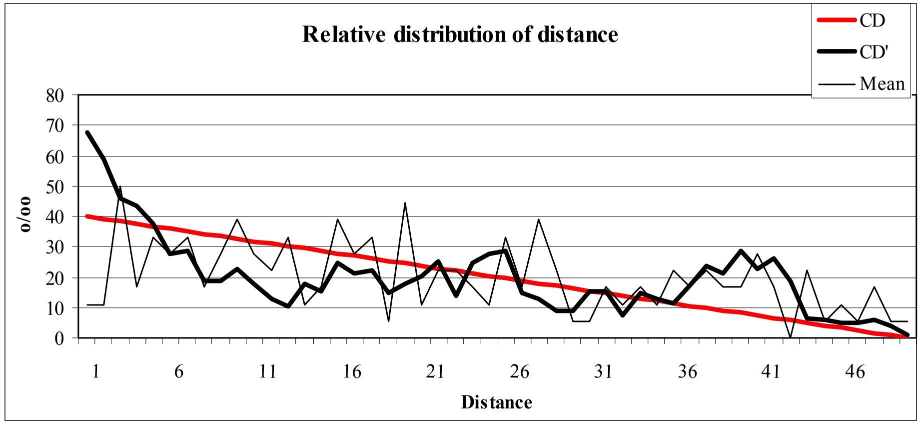
Figure 14: N=20, scheme = 5	Figure 15: N=10, scheme = 5
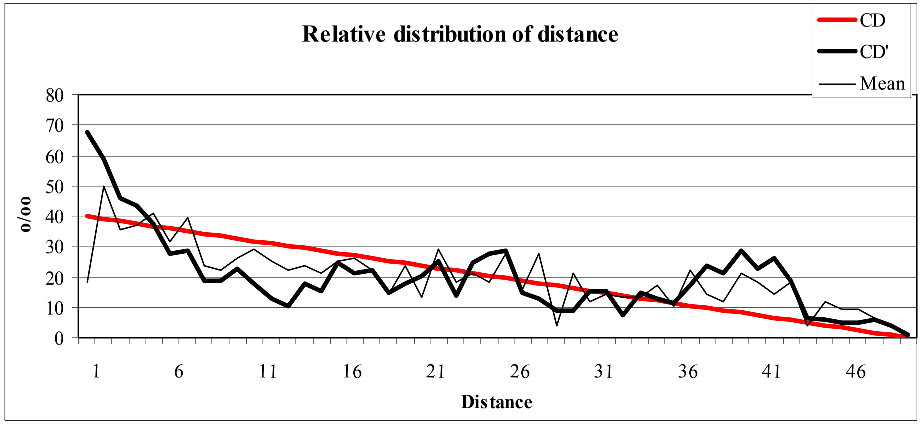	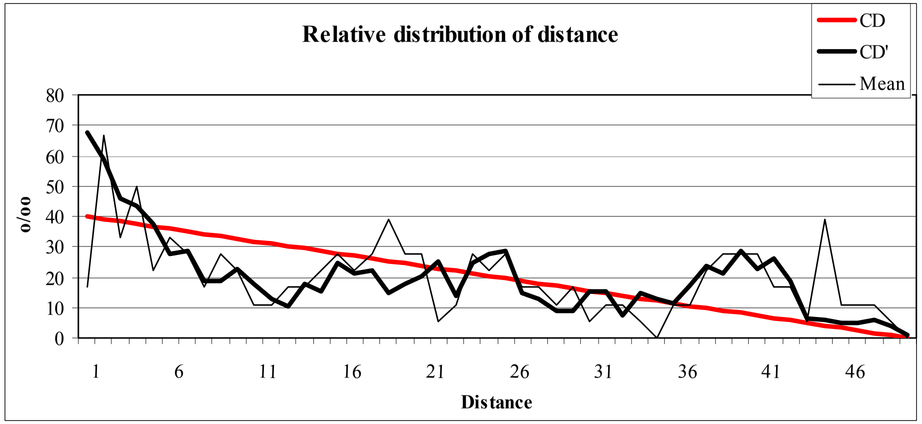
Figure 16: N=20, scheme = 6	Figure 16: N=20, scheme = 6

WGBIFS 2003
WD

Proposal for structuring

CRUISE REPORTS FOR ACOUSTIC SURVEYS IN THE BALTIC SEA

by

T. Gröhsler (IOR)

Germany

Survey report for RV "Baltic Peace"

Date start of survey – date end of survey

Country, Author, Institute

1 INTRODUCTION

Brief background.
Objectives.

2 METHODS

2.1 Personnel

List of scientific staff (role of each person, affiliation).
Visitors should be included.

2.2 Narrative

Brief narrative, listing start and end points / dates and any mid cruise landings. Any alterations to the schedule due to malfunctions, mishaps or bad weather.

2.3 Survey design

Rationale for survey design (intertransect distance, placement, survey area, total mileage covered) and limits of area. Refer to cruise track Figure.

2.4 Calibration

Dates and location of calibration(s). Quality of calibration, comparison to previous values. Refer to manual.

2.5 Acoustic data collection

Description of acoustic equipment, reference to table of echosounder settings. Times data collected. Description of data archive, amount and type of data collected (echogram / sample phase).

2.6 Biological data - fishing stations

Rationale for fishing, standard tow periods. General methods. Description of gear (name of trawl, mesh size in cod end). Sampling procedure.

2.7 Data analysis

Description of echogram scrutiny. Software used and methods employed. TS/length relationships used. Splitting procedure.

2.8 Hydrographic data (optional)

Instruments used, no. of samples, reference to Figure.

3 RESULTS

3.1 Biological data

No. of trawl hauls. No of herring and sprat investigated.
Reference to Tables of catch composition by haul (kg/0.5 h) and to Figures of length distribution of clupeoids by Sub-division. Highlight the major results.

3.1 Acoustic data

Reference to table of survey statistics concerning survey area, mean Sa, mean scattering cross section σ, estimated total number of fish, percentages of clupeoids and estimated total number of clupeoids by Sub-division/rectangle.
Reference to Figure of geographical distribution of NASC values.
Highlight the major results.

3.3 Abundance estimates

Total abundance, mean weight and resulting biomass estimates by age and by Sub-division/rectangle for clupeoids. Refer to tables. Highlight the major results.

3.4 Hydrographic data (optional)

Hydrographic results. Highlight the major results. Refer to Figure.

4 DISCUSSION

Comparison to previous years**.** Classify the results. Highlight major deficits.

5. REFERENCES

Figures
1. Cruise track, trawl stations, hydrographic (CTD) stations (optional).
2. Length frequency distribution of clupeoids.
3. Distribution of NASC values
4. Hydrographic data (optional)

Tables
1. Catch composition (kg/0.5 h) per haul and Sub-division.
2. Survey statistics (area, Sa, sigma, N total, % herring, % sprat, N herring, N sprat) per rectangle/Sub-division.
3. Estimated numbers by age (millions) of clupeoids per rectangle/Sub-division.
4. Estimated mean weight (g) by age of clupeoids per rectangle/Sub-division.
5. Estimated biomass (t) by age of clupeoids per rectangle/Sub-division.

TEXT EXAMPLE
Survey Report for RV "SOLEA"
14.-25.10.2002

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

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 (Sub-divisions 22, 23 and 24).

2 METHODS

2.1 Personnel

E. Götze	Inst. for Fishery Technology and Fish Quality, Hamburg, in charge
Dr. T. Gröhsler	Institute for Baltic Sea Fisheries Rostock
U. Nielsen	DIFRES, Charlottenlund, Denmark
R. Oeberst	Institute for Baltic Sea Fisheries Rostock
G. Ulrich	Institute for Baltic Sea Fisheries Rostock

2.2 Narrative

The 498th cruise of RV 'Solea' represents the 15th subsequent survey and took place from 14th to 25th October in 2002. Due to technical problems with the winch on board of the research vessel, the survey started with a delay of more than two weeks. RV "SOLEA" left the port of Rostock/Warnemünde on 14th October 2002. The joint German-Danish acoustic survey was intended to cover the whole sub-divisions 21, 22, 23 and 24. Since the survey time has to be shortened the Kattegat area (Sub-division 21) could not be covered in 2002. The survey ended on 25th October 2002 in Kiel.

2.3 Survey design

For all Sub-divisions 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 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 7,900 NM^2. The cruise track (Figure 1) reached in total a length of 666 nautical miles.

2.4 Calibration

The transducer 38-26 was calibrated during the survey in Rostock/seaport. The calibration procedure was carried out 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 Ref.D).

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)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02). 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 netsonde. The trawl depth was chosen in accordance to the 'characteristic indications' by the echogram. Normally a net opening of about 8-10 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 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. 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. The total number were separated into herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 37 trawl hauls were carried out (16 hauls in sub-division 22, 3 hauls in sub-division 23 and 18 hauls in sub-division 24). 1274 herring and 588 sprat were frosted for further investigations in the lab. The results of the catch composition by Sub-division are presented in Table 1-3. As in former years the catch composition was dominated by herring and to a lower extend by sprat.
The length distributions of herring and sprat of the years 2001 and 2002 are presented by Sub-division 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 Sub-division/rectangle are shown in Table 4.
The horizontal distribution of Sa values (Figure 4 and Table 4) was similar to the years before. High fish concentrations were found in the Sound (Sub-division 23), in the Arkona Basin (Sub-division 24) and in the southern part of Sub-division 22. In the Belt Sea (northern part of Sub-division 22) the fish density was as low as in former years.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 4. The estimated number of herring and sprat by age group and Sub-division/rectangle are given in Table 5 and Table 8. The corresponding mean weights by age group and Sub-division/rectangle are shown in Table 6 and Table 9. The estimates of herring and sprat biomass by age group and Sub-division/rectangle are summarised in Table 7 and Table 10. It should be noted that the results in the Sound cannot be compared to last years results as this area could not be covered in 2001.

The herring stock was estimated to be 6.0 x 10^9 fish or about 195.2 x 10^3 tonnes in Sub-divisions 22-24. The abundance estimates were dominated by young herring. Adult herring, which was concentrated in former years only in the Sound, could this year also be found in the deeper areas of the Arkona sea.

The estimated sprat stock was 6.7 x 10^9 fish or 58.1 x 10^3 tonnes in Sub-divisions 22-24.
As for herring, the abundance estimates of sprat were dominated by young fish (Figure 3 and Table 8). The contribution of the age-groups 0 and 1 was 86% in numbers and 74% in biomass.

4 DISCUSSION

Caused by technical problems with the research vessel the Kattegat area could not be monitored this year. Last year the Sound (Sub-division 23) could not be surveyed due to the missing Swedish permission. Therefore last years results are only comparable with this years results of Sub-divisions 22 and 24.
The total number of herring increased slightly by 24% compared to 2001. The present level is dominated by a high fraction of 0-group herring (Figure 2 and Table 5). The abundance of young herring was about 2 times higher compared to estimates of the last two years. The 2002 year class attained about the level of the big 1999 year class. Caused by the high fraction of young herring the total biomass reached only 84% of the estimated biomass in 2001.
The relatively high fraction of adult fish in the Arkona sea could be explained by the late survey time. Some adult herring could have been already migrated from the Sound into the Arkona sea on the way to the spring spawning areas around Rügen island.

The abundance of sprat in the Western Baltic was slightly lower than that of the last year. The last two years abundance estimates were about 3 times higher than in 2000. In 2000 the sprat abundance was on the lowest level for the last ten years. It should be noted that the whole time series of the sprat abundance estimates is characterised by strong fluctuations from year to year.

5 REFERENCES

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STUDIES CONCERNING THE DISTURBANCE EFFECTS OF TV3#930 AND TV3#520 BASED ON THE INTER-CALIBRATION EXPERIMENTS OF TYPE 3

by

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Introduction

New model was developed by Nielsen et al. (2002) to estimate conversion factors between the new standard gears and the national gears. This models require inter-calibration experiments of a new type to estimate the disturbance effects of the new standard gears. It was agreed that at least ten inter-calibration experiment of type tree should be carried out by all countries during the BITS in November 2002 and spring 2003. These data should be used to detect possible vessel effects.

Material and Methods

Inter-calibration experiments of type 3 were carried out by Denmark, Poland and Sweden using TV3#930 and by Germany using TV3#520. Different estimates of the disturbance effects were carried out to study the different effects that influence the mean disturbance effects.

1. ∑ CPUE(first haul) / ∑ CPUE(second haul) using all data
2. Mean and standard deviation of the single conversion factors, CF(t,i) based on the assumption that the CF(t,i) are normally distributed. Furthermore, only those data sets where the CPUE values of each of both the hauls was larger than 3.
3. Mean and standard deviation of the single conversion factors, CF(t,i) based on the assumption that the CF(t,i) are ln normally distributed. Furthermore, only those data sets where the CPUE values of each of both the hauls was larger than 3.
4. Mean and standard deviation of the single conversion factors, CF(t,i) based on the assumption that the CF(t,i) are normally distributed. Furthermore, only those data sets where the CPUE values of each of both the hauls was larger than 10.
5. Mean and standard deviation of the single conversion factors, CF(t,i) based on the assumption that the CF(t,i) are ln normally distributed. Furthermore, only those data sets where the CPUE values of each of both the hauls was larger than 10.

The different limits of 3 and 10 were used to illustrate the effects of low catches concerning the disturbance effects.

Results

The results are presented by the national experiments The tables contain the following data:

- Estimates of methods 1
- Estimates of methods 2 and 3 including the number of datasets
- Estimates of methods 4 and 3 including the number of datasets.

Table 1 presents the estimates based on the Danish experiments, Table 2 shows results of Polish experiments (not all data are included) and Table 3 gives the estimates of Sweden. The disturbance effects of the small TV3 are presented in Table 4 based on the German data. Figures 1 to 4 present the mean disturbance effects of the different methods by countries (Figure 1 – Method 2, Figure 2 – Method 3, Figure 3 – Method 4, Figure 4 – Method 5). Figures1 and 2 show that the mean disturbance effects of Methods 2 and 3 are comparable. That means that the basic assumptions of both the models result in the comparable means when the same limit for the CPUE-values is used. The tables illustrate that the standard deviations differ.
Figures 3 and 4 illustrate the mean disturbance effects of Methods 4 and 5 when the limit of 10 was used for the CPUE-values of the used data sets. The increase of the limit for the CPUE-values results in an partly significant change of the mean disturbance effects, especially the disturbance effects of the large TV3. Furthermore, the standard deviation of the CF(t,i) decreased. That means that the data sets with a CPUE-values of less than 10 have a high variability and can produce a significant changes of the means. Furthermore, the mean disturbance effects of Models 4 and 5 are comparable.
Figures 3 and 4 also show that the mean disturbance effects of the different vessels are close together. A vessel effect is possible, but the standard deviations suggest that the differences are not significant.
A further important result is that the disturbance effect of TV3#520 is very close to the effects of the large TV3. Especially, if the standard deviation of the disturbance effects is taken into the account. This result supports the German model that assumes that the disturbance effects of both the gears compared is comparable. That means that the estimated conversion factors between both the new standard gears of the German model can be used. These results also support the analyses by Oeberst and Grygiel (2002). The comparison of the conversion factors between the new standard gears and the national gears used the conversion factors between the small and large TV3.

Discussion

The studies show that a vessel effect is possible concerning the large TV3#930.

The disturbance effects of the small and large TV3 are comparable as it is assumed by the German model. This result corresponds with the analyses by Oeberst and Grygiel (2002) which compared the catchability of the Polish and German national gears based on the conversion factors.

Table 1: Different estimates of the disturbance effects of TV3#930 based on Danish data

	Method 1	Method 2			Method 3		Method 4			Method 5	
Length	Mean	Number	Mean	Std	Mean	Std	Number	Mean	Std	Mean	Std
5	5.83	1	12.00				0	0		0.00	0.00
10	1.74	9	1.86	1.10	1.91	1.46	9	1.86	1.10	1.91	1.46
15	1.54	11	1.94	1.53	1.98	2.26	9	1.63	1.15	1.67	1.66
20	1.06	11	1.20	0.83	1.32	2.18	9	1.42	0.75	1.46	1.12
25	0.98	10	1.35	1.05	1.47	2.42	7	1.30	0.66	1.45	1.76
30	0.82	11	1.18	0.73	1.20	0.93	10	1.05	0.61	1.06	0.71
35	0.93	11	1.11	0.54	1.13	0.68	10	1.11	0.57	1.12	0.72
40	0.90	11	1.07	0.66	1.16	1.37	8	0.94	0.30	0.95	0.38
45	0.83	9	1.08	0.50	1.13	0.83	2	0.80	0.03	0.80	0.03
50	0.75	9	0.95	0.52	1.01	1.06	1	0.89		0.00	0.00

Table 2: Different estimates of the disturbance effects of TV3#930 based on Polish data

	Method1	Method 2			Method 3		Method 4			Method 5	
Length	Mean	Number	Mean	Std	Mean	Std	Number	Mean	Std	Mean	Std
5	0.25	1	0.25								
10	3.00										
15	4.33	2	0.94	0.55	1.04	0.86					
20	2.31	4	2.36	2.66	2.49	4.66	3	1.03	0.28	1.04	0.29
25	1.88	4	1.89	1.27	2.07	2.49	4	1.89	1.27	2.07	2.49
30	1.77	6	1.55	0.50	1.56	0.48	5	1.37	0.21	1.37	0.22
35	1.40	8	1.47	0.82	1.48	0.81	6	1.69	0.85	1.69	0.77
40	1.38	6	1.52	1.00	1.54	1.10	4	1.78	1.18	1.89	1.80
45	1.67	3	1.14	0.25	1.15	0.24	1	1.43			
50	8.00										

Table 3: Different estimates of the disturbance effects of TV3#930 based on Swedish data

	Method 1	Method 2			Method 3		Method 4			Method 5	
Length	Mean	Number	Mean	Std	Mean	Std	Number	Mean	Std	Mean	Std
5	1.11	2	1.17	0.02	1.17	0.02	2	1.17	0.02	1.17	0.02
10	1.51	3	2.59	3.06	3.62	19.70					
15	2.53	5	1.82	0.92	1.88	1.26	4	2.03	0.91	2.13	1.41
20	1.84	10	1.60	1.07	1.65	1.63	8	1.37	0.95	1.41	1.31
25	1.49	10	2.42	3.24	2.29	3.74	8	1.26	0.65	1.29	0.84
30	1.88	11	4.18	7.84	3.47	7.59	10	1.83	0.88	1.88	1.32
35	2.08	11	3.45	5.35	3.03	4.47	10	1.85	0.80	1.87	0.98
40	2.16	10	2.52	1.52	2.58	2.05	8	2.12	1.12	2.17	1.49
45	4.47	9	3.97	1.77	4.14	2.82	3	5.51	1.98	5.60	2.06
50	1.72	3	2.40	1.28	2.63	2.42	1	2.70			

Table 4: Different estimates of the disturbance effects of TV3#520 based on German data

	Method 1	Method 2			Method 3		Method 4			Method 5	
Length	Mean	Number	Mean	Std	Mean	Std	Number	Mean	Std	Mean	Std
5	1.57	1	0.90				1	0.90			
10	1.61	5	1.39	0.65	1.49	1.28	5	1.39	0.65	1.49	1.28
15	1.37	14	1.84	1.00	1.90	1.50	10	1.33	0.56	1.36	0.77
20	1.02	16	1.33	0.76	1.37	1.23	15	1.25	0.72	1.29	1.11
25	1.02	17	1.39	0.91	1.41	1.09	16	1.43	0.93	1.45	1.16
30	0.97	17	1.29	0.70	1.30	0.86	17	1.29	0.70	1.30	0.86
35	1.15	17	1.37	0.67	1.41	1.02	17	1.37	0.67	1.41	1.02
40	1.35	16	1.52	0.98	1.51	1.03	16	1.52	0.98	1.51	1.03
45	1.15	17	1.55	1.01	1.69	2.37	4	1.57	1.20	1.95	4.66
50	1.53	3	1.56	1.26	1.71	2.11					

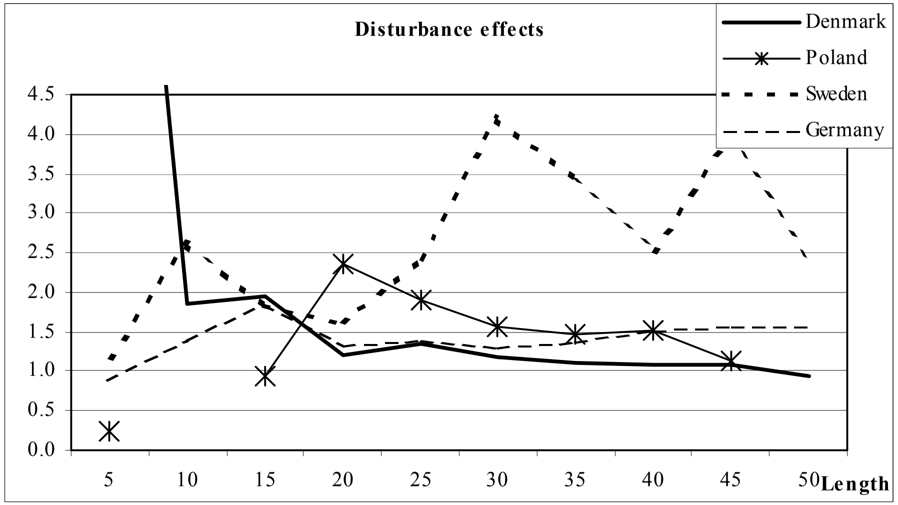	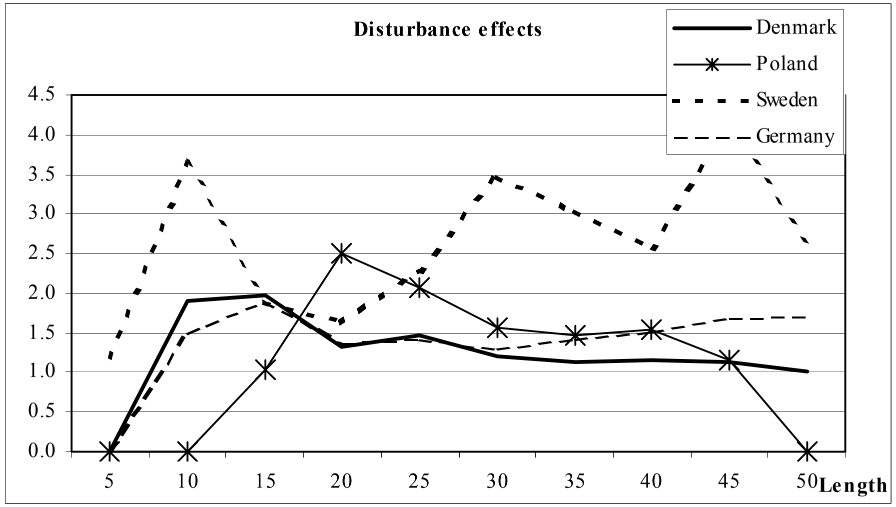
Figure 1: Disturbance effects based on Method 2 by countries (normally distributed, CPUE-values > 3)	Figure 2: Disturbance effects based on Method 3 by countries (ln-normally distributed, CPUE-values > 3)
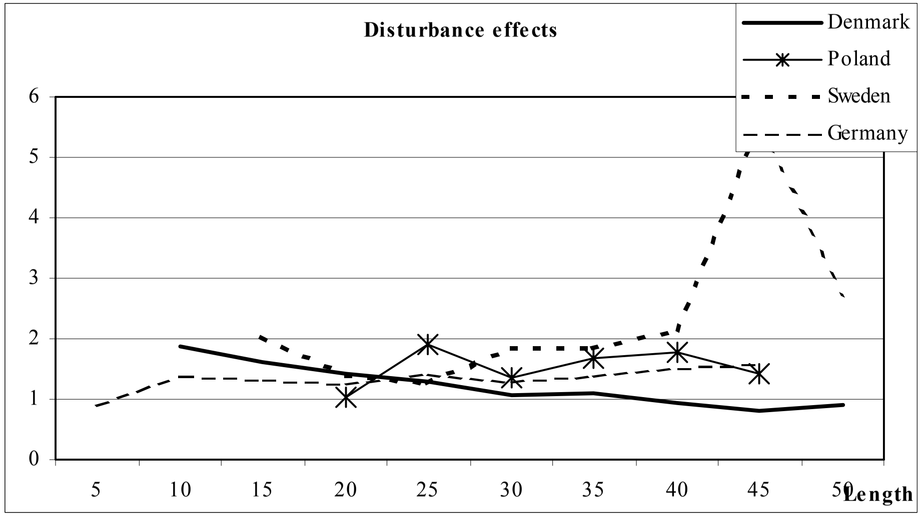	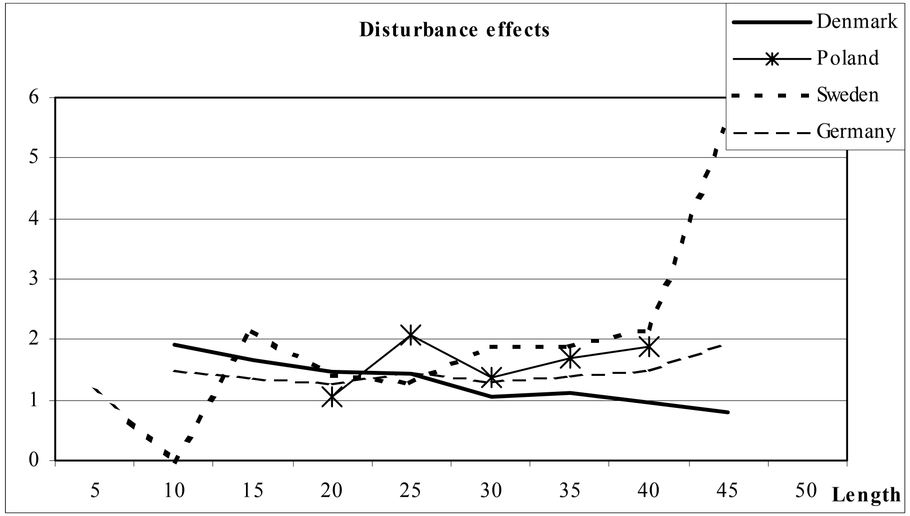
Figure 3: Disturbance effects based on Method 4 by countries (normally distributed, CPUE-values > 10)	Figure 4: Disturbance effects based on Method 5 by countries (ln-normally distributed, CPUE-values > 10)

Annex 1

Report of Estonian acoustic survey 2002

Estonian acoustic survey was carried out on C\V "Solveig" (vessel with length 28 m and 423 kW engine) from 28 November to 04 December 2002 in the North-eastern Baltic. The survey covered parts of ICES Sub-divisions 28 and 29S.

The acoustic equipment used was the SIMRAD EY500 portable sounder system. A 38 kHz split beam SIMRAD transducer ES38-12 was employed in a towed wing. The hydro-acoustic equipment was calibrated directly before the survey against the standard 60 mm copper sphere in the Tagalaht Bay, Veere (Sub-division 28).

Investigations were performed during both day- and nighttime. The integration interval was 1 nautical mile. The length of survey track was 293 nm and integrations covered 5602 square nautical miles. Vessel speed was 7-8 knots during the acoustic integration. The fish samples were taken using a commercial mid-water trawl with a 10 mm mesh size (bar length) in the cod-end and ca. 23 m vertical opening. Totally 8 trawl hauls were made during the survey. The trawling speed was 2.6 - 3.2 knots, and haul duration 30-34 minutes.

Fish numbers were estimated using the TS-LENGTH regression for clupeoids:

TS = 20logL-71.2, where L is the fish length in cm. For ALKs totally 4071herrings and 2288 sprats were measured and 290 herrings and 204 sprats were aged.

The estimated numbers and mean weights of herring and sprat are presented in Tables 1-4. The survey statistics is shown in Table 5. and survey track in Figure 1.

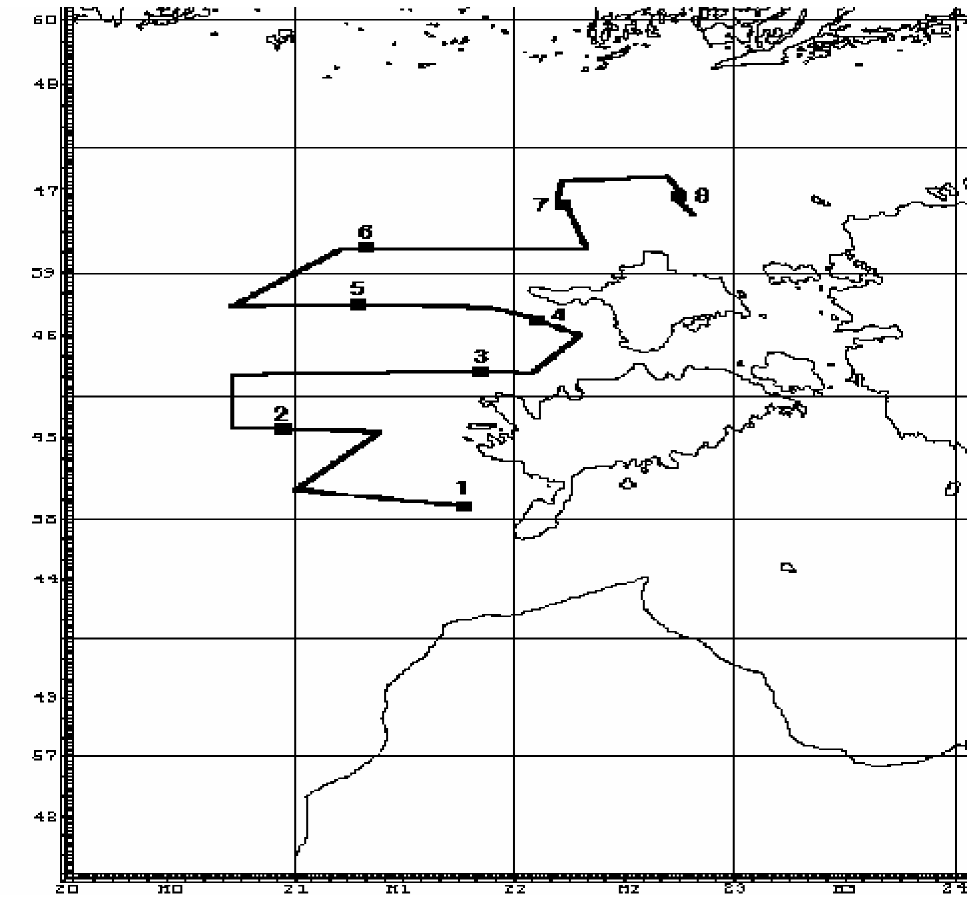

Figure 1 Cruise track of C/V "SOLVEIG" in November-December 2002.

Table1 Estimated numbers (millions) of herring r/v "Solveig" November

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
28	45H0	2345.31	2112.81	15.35	19.11	80.90	53.17	38.66	12.78	7.57	4.96
28	45H1	1373.27	1185.90	33.03	47.44	49.43	23.60	22.29	6.60	3.31	1.66
29	46H0	1274.76	1037.35	23.91	36.69	75.17	48.26	35.34	12.68	3.68	1.69
29	46H1	1022.75	626.37	87.80	70.89	115.80	59.25	45.86	11.23	4.19	1.35
29	46H2	24.02	11.95	3.42	2.07	3.25	1.70	1.26	0.25	0.12	0.00
29	47H1	853.06	778.16	13.33	17.72	18.31	9.96	10.41	3.38	1.78	0.00
29	47H2	2068.65	1951.34	28.84	40.87	21.80	10.03	11.41	2.67	1.70	0.00

Table 2 Estimated mean weight (gram) of herring r/v "Solveig" November

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
28	45H0	7.39	4.90	16.52	23.20	29.34	33.28	31.28	38.24	36.53	34.34
28	45H1	8.40	5.60	15.41	22.83	28.08	32.91	31.63	39.11	37.51	34.34
29	46H0	9.08	4.94	17.48	22.44	26.95	31.51	28.59	33.29	32.45	61.50
29	46H1	12.95	5.84	15.09	22.35	26.30	30.00	28.37	29.78	31.49	61.50
29	46H2	15.12	7.03	14.59	22.31	26.27	30.04	28.41	28.44	31.24	
29	47H1	6.24	4.46	17.06	21.45	26.72	29.44	28.95	29.98	31.75	
29	47H2	5.25	4.19	17.85	21.25	25.30	28.37	29.10	27.65	30.13	

Table 3 Estimated numbers (millions) of sprat c/v "Solveig" November

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
28	45H0	3333.06	2901.94	84.50	62.82	104.51	52.54	60.04	20.85	10.84	35.02
28	45H1	1947.99	1165.63	157.83	115.99	179.80	104.11	105.84	37.63	19.29	61.86
29	46H0	2260.24	1932.08	68.91	46.13	78.54	39.81	44.84	15.23	8.46	26.24
29	46H1	1139.52	774.25	63.72	49.24	99.88	45.58	50.04	16.41	10.70	29.70
29	46H2	13.65	7.09	1.04	0.88	1.87	0.83	0.90	0.30	0.20	0.54
29	47H1	1214.65	823.01	64.10	59.09	93.01	56.62	56.22	20.31	10.75	31.53
29	47H2	2683.35	2303.95	64.14	53.53	106.22	46.61	54.46	16.05	8.86	29.52

Table 4 Estimated mean weight (gram) of sprat r/v "Solveig" November

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
28	45H0	3.68	2.88	9.09	10.96	10.72	11.07	11.41	11.32	11.50	11.82
28	45H1	4.06	3.01	9.35	10.95	10.75	10.92	11.43	11.32	11.48	11.84
29	46H0	4.44	2.98	8.92	10.95	10.72	11.01	11.43	11.34	11.60	11.83
29	46H1	5.87	2.93	9.04	10.90	10.64	10.98	11.37	11.34	11.74	11.79
29	46H2	6.56	2.67	9.15	10.89	10.62	10.98	11.34	11.34	11.76	11.77
29	47H1	3.36	2.65	9.51	10.96	10.72	10.94	11.59	11.28	11.45	11.82
29	47H2	3.03	2.57	9.62	10.90	10.63	10.90	11.59	11.33	11.58	11.72

Table 5 Survey statistics c/v "Solveig" November

ICES SD	ICES Rect.	Area (nm²)	Sa (m²/nm²)	□ (m²/nm²)	N total (million)	herring (%)	sprat (%)
28	45H0	947.2	498.0	0.830	5680.87	41.284	58.716
28	45H1	827.1	401.1	0.997	3325.49	41.295	58.705
29	46H0	933.8	339.6	0.896	3537.45	36.036	63.964
29	46H1	921.5	258.6	1.100	2166.28	47.212	52.788
29	46H2	258.0	18.1	1.237	37.74	63.636	36.364
29	47H1	920.3	197.3	0.877	2071.45	41.182	58.818
29	47H2	793.9	451.3	0.753	4759.41	43.532	56.468

Survey Report for RV "SOLEA"
14.-25.10.2002

Federal Research Centre for Fisheries, Germany
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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 (Sub-divisions 22, 23 and 24).

2 METHODS

2.1 Personnel

E. Götze	Inst. for Fishery Technology and Fish Quality, Hamburg, in charge
Dr. T. Gröhsler	Institute for Baltic Sea Fisheries Rostock
U. Nielsen	DIFRES, Charlottenlund, Denmark
R. Oeberst	Institute for Baltic Sea Fisheries Rostock
G. Ulrich	Institute for Baltic Sea Fisheries Rostock

2.2 Narrative

The 498th cruise of RV 'Solea' represents the 15th subsequent survey and took place from 14th to 25th October in 2002. Due to technical problems with the winch on board of the research vessel, the survey started with a delay of more than two weeks. RV "SOLEA" left the port of Rostock/Warnemünde on 14th October 2002. The joint German-Danish acoustic survey was intended to cover the whole sub-divisions 21, 22, 23 and 24. Since the survey time has to be shortened the Kattegat area (Sub-division 21) could not be covered in 2002. The survey ended on 25th October 2002 in Kiel.

2.3 Survey design

For all Sub-divisions 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 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 7,900 NM^2. The cruise track (Figure 1) reached in total a length of 666 nautical miles.

2.4 Calibration

The transducer 38-26 was calibrated during the survey in Rostock/seaport. The calibration procedure was carried out 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 Ref.D).

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)' (Annex 2 in the 'Report of the Baltic International Fish Survey Working Group', ICES CM 2001/H:02). 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 netsonde. The trawl depth was chosen in accordance to the 'characteristic indications' by the echogram. Normally a net opening of about 8-10 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 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. 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. The total number were separated into herring and sprat according to the mean catch composition.

3 RESULTS

3.1 Biological data

In total 37 trawl hauls were carried out (16 hauls in sub-division 22, 3 hauls in sub-division 23 and 18 hauls in sub-division 24). 1274 herring and 588 sprat were frosted for further investigations in the lab.

The results of the catch composition by Sub-division are presented in Table 1-3. As in former years the catch composition was dominated by herring and to a lower extend by sprat.

The length distributions of herring and sprat of the years 2001 and 2002 are presented by Sub-division 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 Sub-division/rectangle are shown in Table 4.

The horizontal distribution of Sa values (Figure 4 and Table 4) was similar to the years before. High fish concentrations were found in the Sound (Sub-division 23), in the Arkona Basin (Sub-division 24) and in the southern part of Sub-division 22. In the Belt Sea (northern part of Sub-division 22) the fish density was as low as in former years.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 4. The estimated number of herring and sprat by age group and Sub-division/rectangle are given in Table 5 and Table 8. The corresponding mean weights by age group and Sub-division/rectangle are shown in Table 6 and Table 9. The estimates of herring and sprat biomass by age group and Sub-division/rectangle are summarised in Table 7 and Table 10. It should be noted that the results in the Sound cannot be compared to last years results as this area could not be covered in 2001.

The herring stock was estimated to be 6.0 x 10^9 fish or about 195.2 x 10^3 tonnes in Sub-divisions 22-24. The abundance estimates were dominated by young herring. Adult herring, which was concentrated in former years only in the Sound, could this year also be found in the deeper areas of the Arkona sea.

The estimated sprat stock was 6.7 x 10^9 fish or 58.1 x 10^3 tonnes in Sub-divisions 22-24.

As for herring, the abundance estimates of sprat were dominated by young fish (Figure 3 and Table 8). The contribution of the age-groups 0 and 1 was 86% in numbers and 74% in biomass.

4 DISCUSSION

Caused by technical problems with the research vessel the Kattegat area could not be monitored this year. Last year the Sound (Sub-division 23) could not be surveyed due to the missing Swedish permission. Therefore last years results are only comparable with this years results of Sub-divisions 22 and 24.

The total number of herring increased slightly by 24% compared to 2001. The present level is dominated by a high fraction of 0-group herring (Figure 2 and Table 5). The abundance of young herring was about 2 times higher compared to estimates of the last two years. The 2002 year class attained about the level of the big 1999 year class. Caused by the high fraction of young herring the total biomass reached only 84% of the estimated biomass in 2001.

The relatively high fraction of adult fish in the Arkona sea could be explained by the late survey time. Some adult herring could have been already migrated from the Sound into the Arkona sea on the way to the spring spawning areas around Rügen island.

The abundance of sprat in the Western Baltic was slightly lower than that of the last year. The last two years abundance estimates were about 3 times higher than in 2000. In 2000 the sprat abundance was on the lowest level for the last ten years. It should be noted that the whole time series of the sprat abundance estimates is characterised by strong fluctuations from year to year.

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:02 Ref.: D.

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

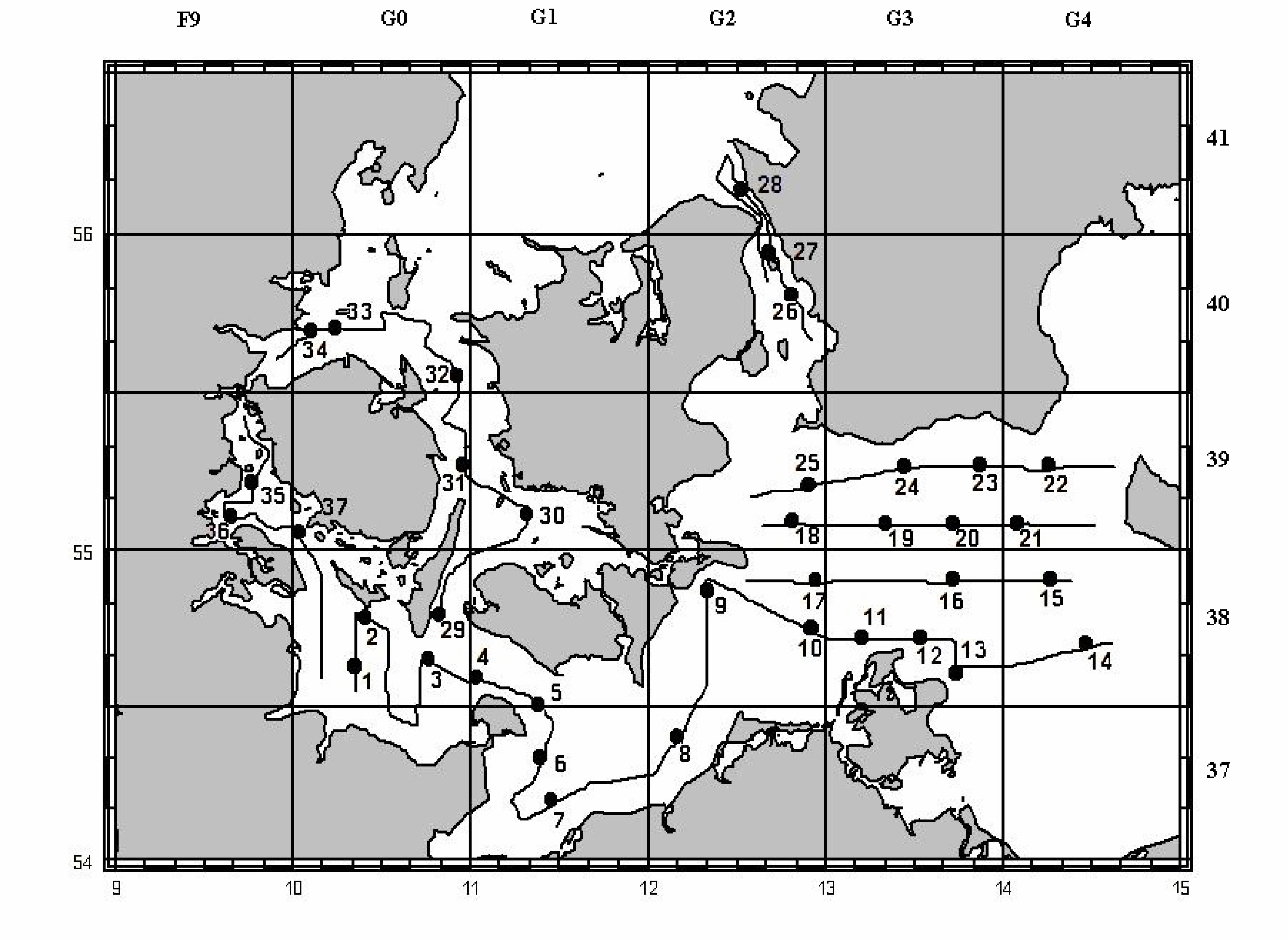


Figure 1. Cruise track for RV Solea 14-25/10 – 2002.

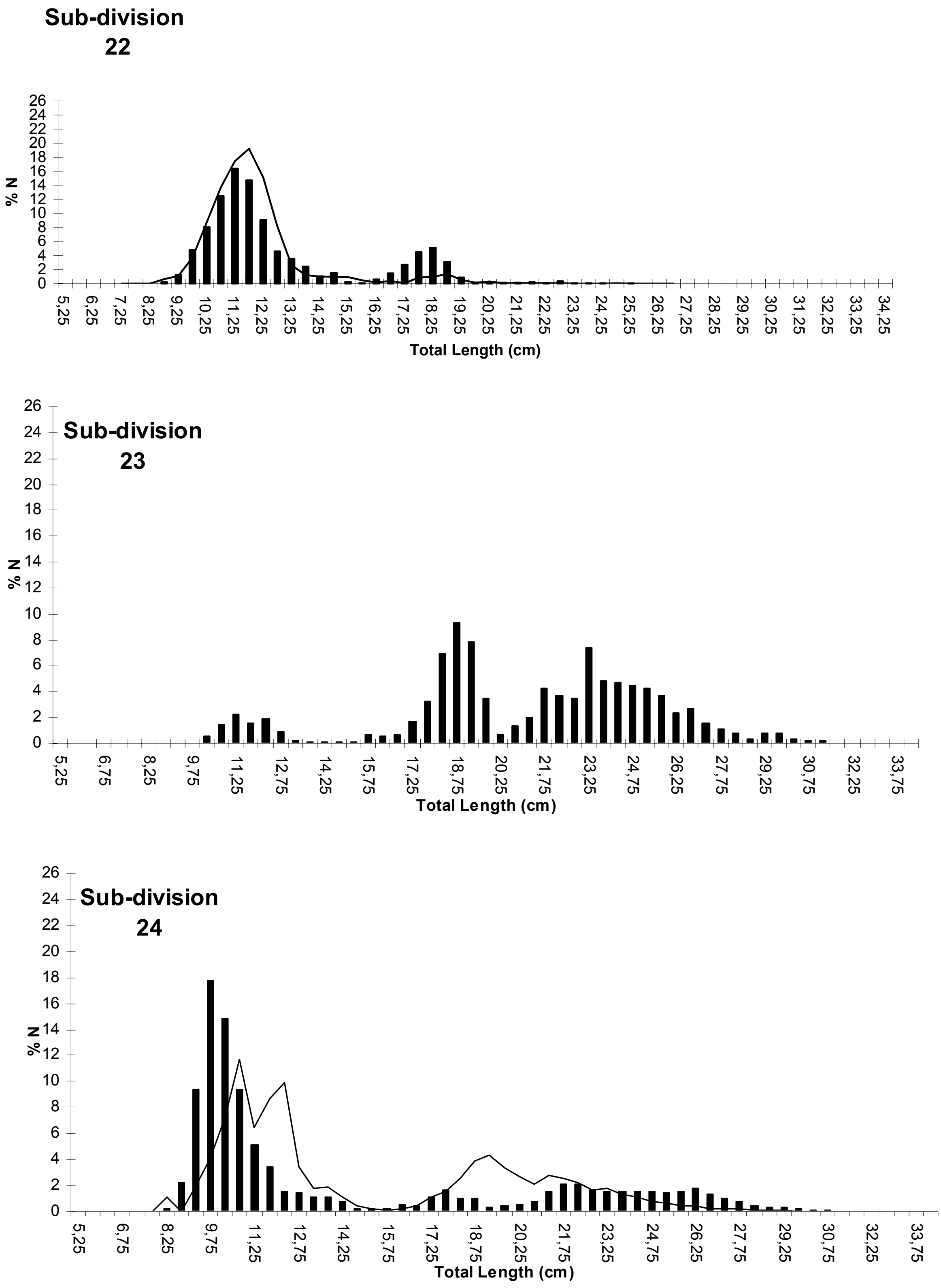
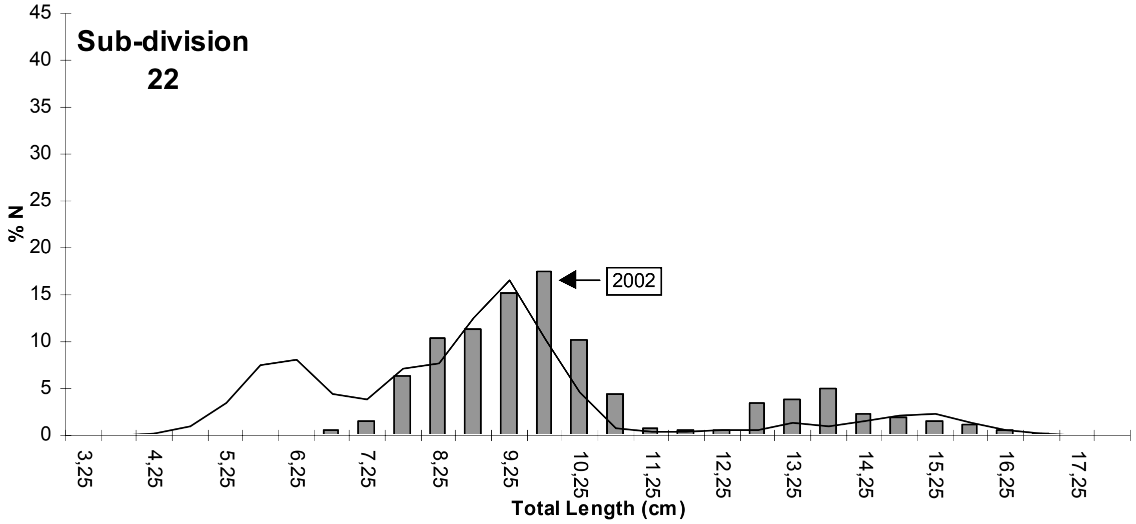
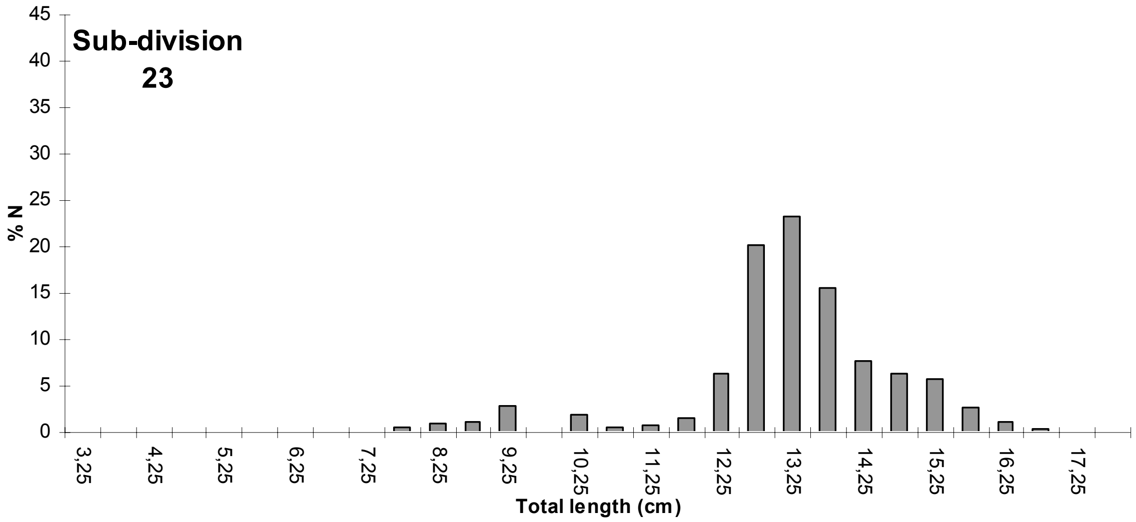


Figure 2 Length distribution of herring in Sub-divisions 22, 23 and 24 in 2001 (=line) and in 2002 (=bar)





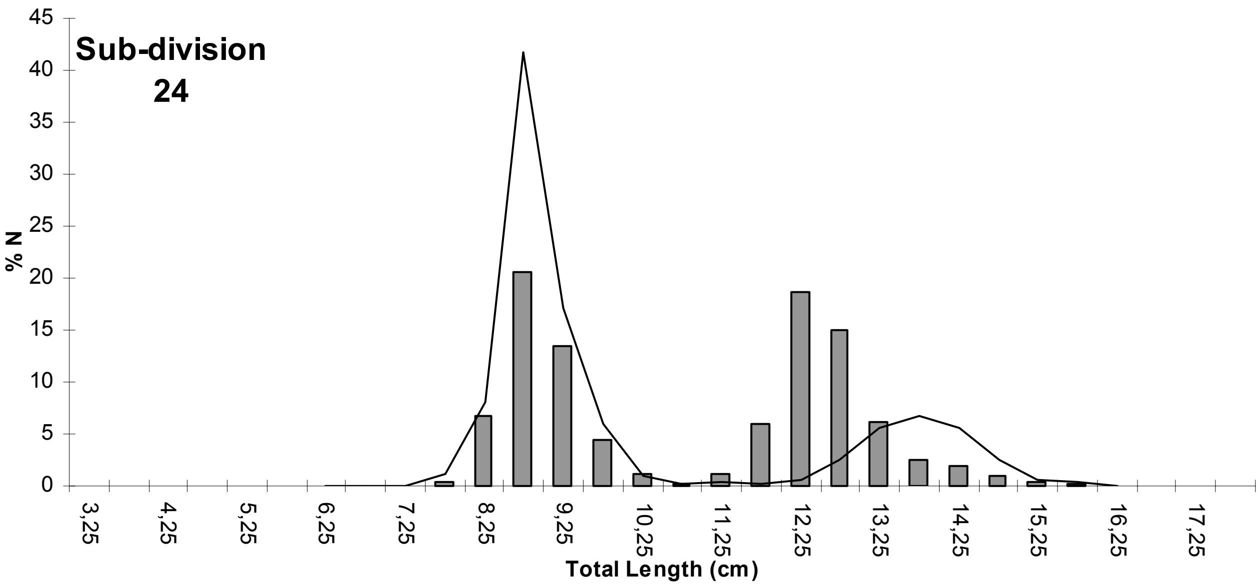


Figure 3 Length distribution of sprat in Sub-divisions 22, 23 and 24 in 2001 (=line) and in 2002 (=bar)

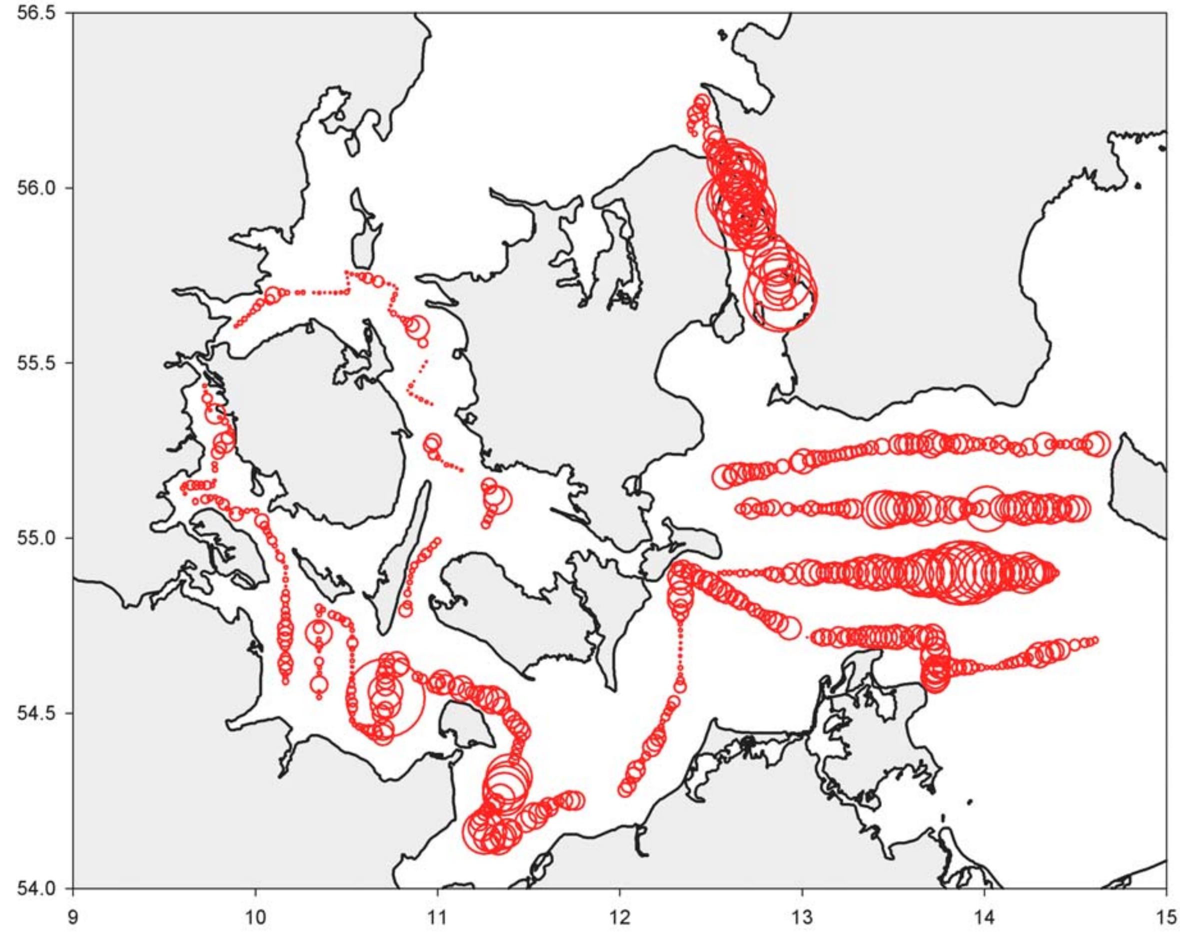


Figure 4: Distribution of Sa-values for RV “SOLEA” in October 2002

Table 1: Catch composition (kg/0.5 h) per haul No. in Sub-division 22

Species/Haul No.	1	2	3	4	5	6	7	29	30	31
APHIA MINUTA									0.08	+
BELONE BELONE		0.04		0.11	0.05					
CLUPEA HARENGUS	0.36	0.29	16.23	6.44	10.34	130.76	22.24	4.26	3.59	1.04
CRANGON									+	
CTENOLABRUS RUPESTRIS										
ENGRAULIS ENCRASICOLUS				0.01	+			0.02	0.03	0.05
EUTRIGLA GURNARDUS				0.01						
GADUS MORHUA		0.65		7.02	2.12		2.41			
GASTEROSTEUS ACULEATUS			0.02	0.05	0.02	0.03	0.01	0.02	0.01	0.01
GOBIUS NIGER									+	
HYPEROPLUS LANCEOLATUS										0.01
LIMANDA LIMANDA		0.23	0.13	0.53	0.07			0.15	+	
LOLIGO									+	
MERLANGIUS MERLANGUS	0.19		+	0.02	+	0.75	0.31		+	
MYOXOCEPHALUS SCORPIUS										
POMATOSCHISTUS MINUTUS		+		0.01	+			+		
SOLEA VULGARIS		0.02								
SPINACHIA SPINACHIA										
SPRATTUS SPRATTUS	0.28	0.03	0.20	0.44	12.34	12.76	4.41	0.04	2.26	
TRACHURUS TRACHURUS	0.04		+	+	0.14	0.95	0.08		0.01	0.01
Total	**0.87**	**1.26**	**16.58**	**14.64**	**25.08**	**145.25**	**29.46**	**4.49**	**5.98**	**1.12**
Medusae	50.00	103.45	73.70	28.70	5.28	103.97	186.51	21.10	5.40	12.50

Species/Haul No.	32	33	34	35	36	37	Total
APHIA MINUTA	0.17	+	+				**0.25**
BELONE BELONE							**0.20**
CLUPEA HARENGUS		0.01	0.11	0.04	0.09	0.03	**195.83**
CRANGON							**+**
CTENOLABRUS RUPESTRIS			0.01				**0.01**
ENGRAULIS ENCRASICOLUS	0.31	+	+				**0.42**
EUTRIGLA GURNARDUS							**0.01**
GADUS MORHUA		0.11		13.02			**25.33**
GASTEROSTEUS ACULEATUS		0.19	0.31	0.03	0.37	0.14	**1.21**
GOBIUS NIGER	+		+	0.01	+		**0.01**
HYPEROPLUS LANCEOLATUS							**0.01**
LIMANDA LIMANDA	0.24	0.07		0.01		0.33	**1.76**
LOLIGO	0.34	0.02					**0.36**
MERLANGIUS MERLANGUS			0.01	0.11		0.01	**1.40**
MYOXOCEPHALUS SCORPIUS			0.06				**0.06**
POMATOSCHISTUS MINUTUS				+			**0.01**
SOLEA VULGARIS				0.02			**0.04**
SPINACHIA SPINACHIA	+						**+**
SPRATTUS SPRATTUS	+	0.17	1.02	0.69	0.74	0.02	**35.40**
TRACHURUS TRACHURUS	0.01			+			**1.24**
Total	**1.07**	**0.57**	**1.52**	**13.93**	**1.20**	**0.53**	**263.55**
Medusae	1.90	96.77	22.10	85.50	29.00		**825.87**

+ = < 0.01 kg

Table 2: Catch composition (kg/0.5 h) per haul No. in Sub-division 23

Species/Haul No.	26	27	28	Total
ANGUILLA ANGUILLA			0.68	**0.68**
CLUPEA HARENGUS	777.58	494.28	19.00	**1290.86**
ENGRAULIS ENCRASICOLUS			0.07	**0.07**
GADUS MORHUA	36.90	4.77	1.11	**42.78**
LIMANDA LIMANDA			0.02	**0.02**
LOLIGO			0.32	**0.32**
MELANOGRAMMUS AEGLEFINUS	0.86	0.92		**1.78**
MERLANGIUS MERLANGUS	39.04	11.73	49.30	**100.07**
MERLUCCIUS MERLUCCIUS		0.21		**0.21**
MULLUS SURMULETUS			0.03	**0.03**
SOLEA VULGARIS	0.45			**0.45**
SPRATTUS SPRATTUS	0.16	8.18	14.34	**22.68**
TRACHINUS DRACO		0.04		**0.04**
TRACHURUS TRACHURUS			0.04	**0.04**
Total	**854.99**	**520.13**	**84.91**	**1460.03**
Medusae			1.36	**1.36**

Table 3: Catch composition (kg/0.5 h) per haul No. in Sub-division 24

Species/Haul No.	8	9	10	11	12	13	14	15	16	17
ANGUILLA ANGUILLA					1,11			0,19	1,86	
BELONE BELONE				0,09		0,10				0,10
CLUPEA HARENGUS	11,25	40,44	37,11	99,40	42,97	68,75	1,52	9,36	8,57	10,00
ENGRAULIS ENCRASICOLUS	0,05			0,02	0,01				0,05	0,01
GADUS MORHUA	7,06	7,90	0,24	1,09	0,99	0,44		4,51	1,83	2,07
GASTEROSTEUS ACULEATUS	0,06			0,01	0,02	0,04	+			
LIMANDA LIMANDA	1,77									
MERLANGIUS MERLANGUS	26,23	0,15	0,03	0,03	3,14	0,30		1,26	3,96	
OSMERUS EPERLANUS						0,07				
PLATICHTHYS FLESUS							0,19			
PLEURONECTES PLATESSA								0,22		
POMATOSCHISTUS MINUTUS				0,03	0,50	0,01	+		0,08	0,19
SALMO TRUTTA		0,22								
SOLEA VULGARIS	0,02									
SPRATTUS SPRATTUS	7,05	2,68	0,22	0,07	1,62	9,75	0,68	79,39	200,82	5,39
TRACHURUS TRACHURUS				0,03	0,04				0,10	0,02
Total	**53,49**	**51,39**	**37,60**	**100,77**	**50,40**	**79,46**	**2,39**	**94,93**	**217,27**	**17,78**
Medusae	2,55	9,29	150,00	13,07	11,06	34,13	6,35	31,93	37,70	17,49

Species/Haul No.	18	19	20	21	22	23	24	25	Total
ANGUILLA ANGUILLA				0,10					**3,26**
BELONE BELONE				0,05			0,17		**0,51**
CLUPEA HARENGUS	1,26	13,41	8,57	4,77	23,84	5,05	11,43	4,29	**401,99**
ENGRAULIS ENCRASICOLUS			0,01	0,01					**0,16**
GADUS MORHUA		4,74	1,22	2,87			0,44	0,20	**35,60**
GASTEROSTEUS ACULEATUS									**0,13**
LIMANDA LIMANDA									**1,77**
MERLANGIUS MERLANGUS	0,47	0,20	0,37	0,46				0,01	**36,61**
OSMERUS EPERLANUS									**0,07**
PLATICHTHYS FLESUS									**0,19**
PLEURONECTES PLATESSA									**0,22**
POMATOSCHISTUS MINUTUS	0,06			+					**0,87**
SALMO TRUTTA									**0,22**
SOLEA VULGARIS									**0,02**
SPRATTUS SPRATTUS	0,17	34,14	31,50	91,35	25,36	18,89	2,99	0,02	**512,09**
TRACHURUS TRACHURUS				0,06		0,03			**0,28**
Total	**1,96**	**52,49**	**41,67**	**99,67**	**49,20**	**23,97**	**15,03**	**4,52**	**993,99**
Medusae	19,90	28,59	12,00	8,88	53,73	87,00	17,90	43,60	**573,16**

Table 4 Survey statistics RV "Solea" October 2002

Sub-division	ICES Rectangle	Area (nm²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
22	37G0	209,9	122,6	1,303	197,45	85,92	10,67	169,66	21,07
22	37G1	723,3	390,5	1,619	1744,21	63,67	35,71	1110,53	622,78
22	38G0	735,3	132,0	1,303	744,72	85,92	10,67	639,89	79,45
22	38G1	173,2	240,5	1,279	325,76	87,77	6,26	285,91	20,39
22	39F9	159,3	70,4	0,675	166,21	1,89	64,31	3,14	106,89
22	39G0	201,7	41,2	0,932	89,18	47,59	2,47	42,44	2,20
22	39G1	250,0	89,2	0,780	285,75	32,39	42,43	92,56	121,23
22	40F9	51,3	18,0	0,368	25,07	1,02	28,67	0,26	7,19
22	40G0	538,1	42,7	0,368	623,83	1,02	28,67	6,36	178,82
	Total	3042,1			4202,2			2350,75	1160,02
23	40G2	164,0	1295,1	4,639	457,81	95,92	2,59	439,14	11,84
23	41G2	72,3	452,1	4,525	72,23	29,09	44,18	21,01	31,91
	Total	236,3			530,04			460,15	43,75
24	37G2	192,4	148,0	2,468	115,37	20,07	67,31	23,16	77,66
24	38G2	832,9	184,9	2,188	703,69	76,40	19,74	537,60	138,88
24	38G3	865,7	616,1	2,466	2163,02	41,83	48,01	904,76	1038,44
24	38G4	1034,8	351,9	1,046	3481,63	31,13	67,72	1083,68	2357,84
24	39G2	406,1	186,2	2,739	276,09	58,35	11,89	161,10	32,82
24	39G3	765,0	266,4	1,831	1112,99	26,29	73,70	292,60	820,22
24	39G4	524,8	343,9	1,580	1142,04	13,67	86,30	156,16	985,56
	Total	4621,7			8994,83			3159,06	5451,42
22-24	Total	7900,1			13727,05			5969,96	6655,19

Table 5 Estimated numbers (millions) of herring RV "Solea" October 2002

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	37G0	166,43	3,15	0,06	0,02						169,66
22	37G1	819,65	238,85	20,79	19,35	10,41		1,49			1110,54
22	38G0	627,71	11,87	0,23	0,08						639,89
22	38G1	278,96	6,95								285,91
22	39F9	3,14	0,00								3,14
22	39G0	42,20	0,24								42,44
22	39G1	91,25	1,31								92,56
22	40F9	0,24	0,02								0,26
22	40G0	5,96	0,40								6,36
	Total	2035,54	262,79	21,08	19,45	10,41	0,00	1,49	0,00	0,00	2350,76
23	40G2	39,51	164,11	123,70	75,79	26,04	5,30	2,38	1,83	0,47	439,13
23	41G2	9,43	9,47	1,12	0,59	0,28	0,07	0,03	0,02	0,01	21,02
	Total	48,94	173,58	124,82	76,38	26,32	5,37	2,41	1,85	0,48	460,15
24	37G2	12,76	3,40	2,98	2,84	0,90	0,21	0,05		0,02	23,16
24	38G2	350,75	19,09	32,38	73,15	46,08	10,11	3,45	0,22	2,38	537,61
24	38G3	236,57	60,08	101,46	270,07	187,83	29,24	10,90	0,60	8,00	904,75
24	38G4	989,66	22,81	25,50	31,31	11,34	2,13	0,63		0,31	1083,69
24	39G2	64,49	2,66	16,62	36,75	28,78	7,60	2,76		1,44	161,10
24	39G3	181,14	29,14	25,13	34,58	17,08	3,94	1,13		0,47	292,61
24	39G4	64,63	37,38	22,31	21,07	8,06	1,97	0,56		0,18	156,16
	Total	1900,00	174,56	226,38	469,77	300,07	55,20	19,48	0,82	12,80	3159,08
22-24	Total	3984,48	610,93	372,28	565,60	336,80	60,57	23,38	2,67	13,28	5969,99

Table 6 Herring mean weight (g) per age group RV "Solea" October 2002

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	**37G0**	9,39	32,49	56,60	56,60						9,84
22	**37G1**	9,34	37,27	60,73	65,14	73,73		94,00			18,00
22	**38G0**	9,39	32,49	56,60	56,60						9,84
22	**38G1**	9,84	35,78								10,47
22	**39F9**	12,85									12,83
22	**39G0**	12,48	35,23								12,61
22	**39G1**	9,86	32,42								10,18
22	**40F9**	8,90	35,23								10,77
22	**40G0**	8,90	35,23								10,55
	Total	9,52	36,93	60,67	65,10	73,73		94,03			13,84
23	**40G2**	10,70	47,98	80,59	109,06	139,20	185,83	179,20	193,81	197,82	72,91
23	**41G2**	10,04	38,04	67,34	114,96	161,25	173,81	173,10	194,51	197,82	31,71
	Total	10,57	47,44	80,47	109,11	139,44	185,68	179,13	193,84	197,92	71,02
24	**37G2**	6,71	36,01	61,67	67,59	72,06	59,64	75,89		43,10	28,75
24	**38G2**	6,39	35,38	70,23	100,30	120,31	150,47	148,24	233,95	163,67	38,22
24	**38G3**	7,48	33,91	74,12	104,79	121,20	144,52	147,80	230,94	139,31	76,80
24	**38G4**	7,26	35,54	63,28	77,34	92,70	73,32	82,76		100,48	12,29
24	**39G2**	8,34	34,01	73,33	102,27	123,57	151,55	154,51		141,61	67,93
24	**39G3**	8,69	33,08	64,48	86,02	101,94	113,51	109,58		118,71	32,47
24	**39G4**	9,25	34,09	60,32	71,93	81,47	64,64	70,14		83,74	35,68
	Total	7,36	34,23	69,69	98,98	117,90	138,44	142,08	231,83	141,47	41,16
22-24	**Total**	8,50	39,14	72,79	99,19	118,22	142,63	142,84	205,51	143,51	32,71

Table 7 **Herring total biomass (t) per age group RV "Solea" October 2002**

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	**37G0**	1562,8	102,3	3,4	1,1						1669,6
22	**37G1**	7655,5	8901,9	1262,6	1260,5	767,5		140,1			19988,1
22	**38G0**	5894,2	385,7	13,0	4,5						6297,4
22	**38G1**	2745,0	248,7								2993,7
22	**39F9**	40,3									40,3
22	**39G0**	526,7	8,5								535,2
22	**39G1**	899,7	42,5								942,2
22	**40F9**	2,1	0,7								2,8
22	**40G0**	53,0	14,1								67,1
	Total	19379,3	9704,4	1279,0	1266,1	767,5	0,0	140,1	0,0	0,0	32536,4
23	**40G2**	422,8	7874,0	9969,0	8265,7	3624,8	984,9	426,5	354,7	93,0	32015,4
23	**41G2**	94,7	360,2	75,4	67,8	45,2	12,2	5,2	3,9	2,0	666,6
	Total	517,5	8234,2	10044,4	8333,5	3670,0	997,1	431,7	358,6	95,0	32682,0
24	**37G2**	85,6	122,4	183,8	192,0	64,9	12,5	3,8		0,9	665,9
24	**38G2**	2241,3	675,4	2274,0	7336,9	5543,9	1521,3	511,4	51,5	389,5	20545,2
24	**38G3**	1769,5	2037,3	7520,2	28300,6	22765,0	4225,8	1611,0	138,6	1114,5	69482,5
24	**38G4**	7184,9	810,7	1613,6	2421,5	1051,2	156,2	52,1		31,1	13321,3
24	**39G2**	537,8	90,5	1218,7	3758,4	3556,3	1151,8	426,4		203,9	10943,8
24	**39G3**	1574,1	964,0	1620,4	2974,6	1741,1	447,2	123,8		55,8	9501,0
24	**39G4**	597,8	1274,3	1345,7	1515,6	656,6	127,3	39,3		15,1	5571,7
	Total	13991,0	5974,6	15776,4	46499,6	35379,0	7642,1	2767,8	190,1	1810,8	130031,4
22-24	**Total**	33887,8	23913,2	27099,8	56099,2	39816,5	8639,2	3339,6	548,7	1905,8	195249,8

Table 8 Estimated numbers (millions) of sprat RV "Solea" October 2002

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	**37G0**	11,77	5,84	1,37	0,32	0,88	0,88				21,06
22	**37G1**	345,42	168,07	53,26	27,80	16,24	9,76	2,23			622,78
22	**38G0**	44,39	22,04	5,18	1,22	3,31	3,31				79,45
22	**38G1**	13,27	5,54	1,14	0,26	0,14	0,03				20,38
22	**39F9**	105,85	0,97	0,06							106,88
22	**39G0**	2,20									2,20
22	**39G1**	120,69	0,44	0,08	0,03						121,24
22	**40F9**	7,18									7,18
22	**40G0**	178,71	0,11								178,82
	Total	829,48	203,01	61,09	29,63	20,57	13,98	2,23	0,00	0,00	1159,99
23	**40G2**	4,26	1,21	1,67	3,02	1,12	0,41	0,15			11,84
23	**41G2**		14,41	5,60	10,93	0,43	0,53	0,01			31,91
	Total	4,26	15,62	7,27	13,95	1,55	0,94	0,16	0,00	0,00	43,75
24	**37G2**	73,45	2,74	0,44	0,49	0,20	0,22	0,11		0,01	77,66
24	**38G2**	94,52	27,56	4,37	6,72	2,35	2,17	0,85	0,01	0,34	138,89
24	**38G3**	579,03	348,19	32,29	49,56	9,28	15,53	1,00	0,03	3,51	1038,42
24	**38G4**	2075,53	177,27	29,90	36,25	15,90	11,30	10,23	0,18	1,28	2357,84
24	**39G2**	14,54	15,08	1,40	1,05	0,27	0,26	0,22			32,82
24	**39G3**	51,85	502,10	79,29	91,64	37,60	35,44	18,50	0,81	2,99	820,22
24	**39G4**	291,19	460,79	73,35	77,11	31,29	31,56	17,94	0,36	1,97	985,56
	Total	3180,11	1533,73	221,04	262,82	96,89	96,48	48,85	1,39	10,10	5451,41
22-24	**Total**	4013,85	1752,36	289,40	306,40	119,01	111,40	51,24	1,39	10,10	6655,15

Table 9 Sprat mean weight (g) per age group RV "Solea" October 2002

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	37G0	6,26	14,82	24,15	14,33	28,67	28,67				11,79
22	37G1	5,54	17,00	19,46	22,38	22,32	24,94	26,28			11,39
22	38G0	6,26	14,82	24,15	14,33	28,67	28,67				11,79
22	38G1	6,97	15,77	18,17	18,57	19,98	20,53				10,25
22	39F9	4,86	12,85	18,52							4,94
22	39G0	4,64									4,64
22	39G1	4,66	16,06	16,82	16,82						4,71
22	40F9	3,51	9,22								3,51
22	40G0	3,51	9,22								3,51
	Total	4,94	16,64	19,93	21,92	23,60	26,04	26,28			8,84
23	40G2	4,97	16,02	18,39	19,20	22,76	20,98	23,39			14,10
23	41G2		15,30	16,14	16,36	19,83	17,95	21,95			15,92
	Total	4,98	15,36	16,66	16,97	21,94	19,26	23,13			15,42
24	37G2	4,76	11,99	14,99	16,13	16,41	15,61	16,55		17,93	5,22
24	38G2	4,82	13,38	15,23	16,62	16,73	16,35	16,55	19,38	17,93	7,90
24	38G3	4,28	13,20	14,12	16,55	17,72	16,44	16,97	19,38	17,93	8,52
24	38G4	4,83	12,26	15,44	16,56	17,17	16,91	16,76	19,38	17,93	5,90
24	39G2	5,28	12,48	13,78	14,22	16,23	15,31	16,55			9,48
24	39G3	4,94	13,40	15,18	16,37	17,15	16,47	16,65	19,38	17,93	13,77
24	39G4	4,78	13,30	15,09	16,10	16,91	16,13	16,69	19,38	17,93	11,41
	Total	4,73	13,18	15,02	16,35	17,12	16,40	16,69	19,38	17,93	8,65
22-24	Total	4,77	13,60	16,10	16,92	18,30	17,63	17,13	19,38	17,93	8,72

Table 10 Sprat total biomass (t) per age group RV "Solea" October 2002

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
22	37G0	73,7	86,5	33,1	4,6	25,2	25,2				248,3
22	37G1	1913,6	2857,2	1036,4	622,2	362,5	243,4	58,6			7093,9
22	38G0	277,9	326,6	125,1	17,5	94,9	94,9				936,9
22	38G1	92,5	87,4	20,7	4,8	2,8	0,6				208,8
22	39F9	514,4	12,5	1,1							528,0
22	39G0	10,2									10,2
22	39G1	562,4	7,1	1,3	0,5						571,3
22	40F9	25,2									25,2
22	40G0	627,3	1,0								628,3
	Total	4097,2	3378,3	1217,7	649,6	485,4	364,1	58,6	0,0	0,0	10250,9
23	40G2	21,2	19,4	30,7	58,0	25,5	8,6	3,5			166,9
23	41G2		220,5	90,4	178,8	8,5	9,5	0,2			507,9
	Total	21,2	239,9	121,1	236,8	34,0	18,1	3,7	0,0	0,0	674,8
24	37G2	349,6	32,9	6,6	7,9	3,3	3,4	1,8		0,2	405,7
24	38G2	455,6	368,8	66,6	111,7	39,3	35,5	14,1	0,2	6,1	1097,9
24	38G3	2478,2	4596,1	455,9	820,2	164,4	255,3	17,0	0,6	62,9	8850,6
24	38G4	10024,8	2173,3	461,7	600,3	273,0	191,1	171,5	3,5	23,0	13922,2
24	39G2	76,8	188,2	19,3	14,9	4,4	4,0	3,6			311,2
24	39G3	256,1	6728,1	1203,6	1500,1	644,8	583,7	308,0	15,7	53,6	11293,7
24	39G4	1391,9	6128,5	1106,9	1241,5	529,1	509,1	299,4	7,0	35,3	11248,7
	Total	15033,0	20215,9	3320,6	4296,6	1658,3	1582,1	815,4	27,0	181,1	47130,0
22-24	Total	19151,4	23834,1	4659,4	5183,0	2177,7	1964,3	877,7	27,0	181,1	58055,7

Survey Report for FV "ZANE"
16.-20.10.2002

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1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The 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:

- '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 Central-Eastern Baltic area (Sub-divisions 26 and 28).

2 METHODS

2.1 Personnel

Dr. F. Shvetsov	Latvian Fisheries Research Institute, Riga
G. Strods	Latvian Fisheries Research Institute, Riga
V. Chervontsev	Latvian Fisheries Research Institute, Riga
A. Novikov	Latvian Fisheries Research Institute, Riga

2.2 Narrative

The 7th acoustic survey and 5th acoustic survey of FV 'ZANE' took place from 16th to 20th October in 2002. FV "ZANE" left the port of Ventspils on 16th October 2002. The Latvian acoustic survey was intended to cover the whole Latvian economic zone (part of SD 26 and 28). The survey ended on 20th October 2002 in Ventspils.

2.3 Survey design

For all Sub-divisions 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 Latvian economic zone in The Baltic Sea is characterised by a slanting seabed in South and The Gotland Deap in North. Our acoustic survey tracks normally is made of parallel transects, but due to weather conditions they can be as zig-zag. The cruise track (Figure 1) reached in total a length of 243 nautical miles.

2.4 Calibration

The transducer ES38-12 was calibrated on 16th July in The Gulf of Riga. The calibration procedure was carried out 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 Ref.D).

2.5 Acoustic data collection

The acoustic investigations were performed during day time. The main pelagic species of interest were sprat and herring. The acoustic equipment was an echosounder EY500 on 38 kHz. The transducer 38-12 was installed on the left board of vessel and 2m below the water surface. 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 mean area scattering cross section (Sa) were integrated over 1 nm intervals from 6-7 m below the surface to the bottom.

2.6 Biological data – fishing stations

Trawling was done with the pelagic gear in the midwater (60-80 m deep). The mesh size in the codend was 10 mm. The intention was to carry out at eight hauls per whole Latvian economic zone. The trawling depth and the net opening were controlled by a netsonde. The trawl depth was chosen in accordance to the 'characteristic indications' by the echogram. Normally a net opening of about 15-20 m was achieved. The trawling time lasted usually 30-45 minutes, but in dense concentrations the duration was reduced. From each haul sub-samples were taken to determine length and weight of fish, but age was determine in the lab. (Tab.1 and Tab.2)

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. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relationships:

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

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 8 trawl hauls were carried out (7 hauls in sub-division 28, 1 haul in sub-division 26). 1416 herring and 1368 sprat were taken for length (Fig.2 and Fig.3) and weight investigations and 1416 herring and 680 sprat for age investigations in the lab.

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 Sub-division/rectangle are shown in Table 3.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table The estimated number of herring and sprat by age group and Sub-division/rectangle are given in Table 4 and Table 7. The corresponding mean weights by age group and Sub-division/rectangle are shown in Table 5 and Table 8. The estimates of herring and sprat biomass by age group and Sub-division/rectangle are summarised in Table 6 and Table 9.

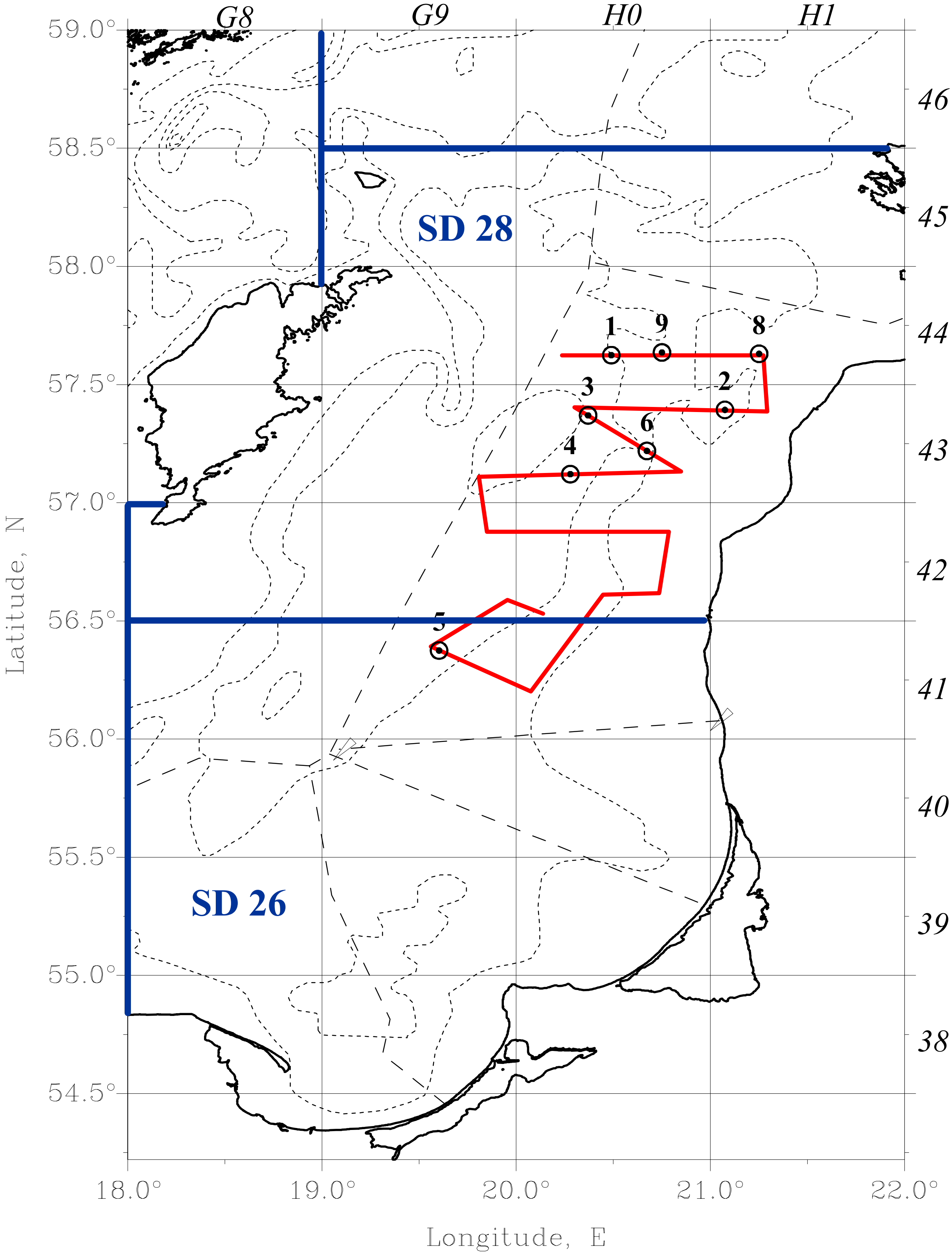


Figure 1. Cruise track design and hauls of Latvian acoustic surveys F/V "ZANE", 16 - 20.10.2002.

Figure 2. Length distribution of sprat in SD 28 (October 2002)

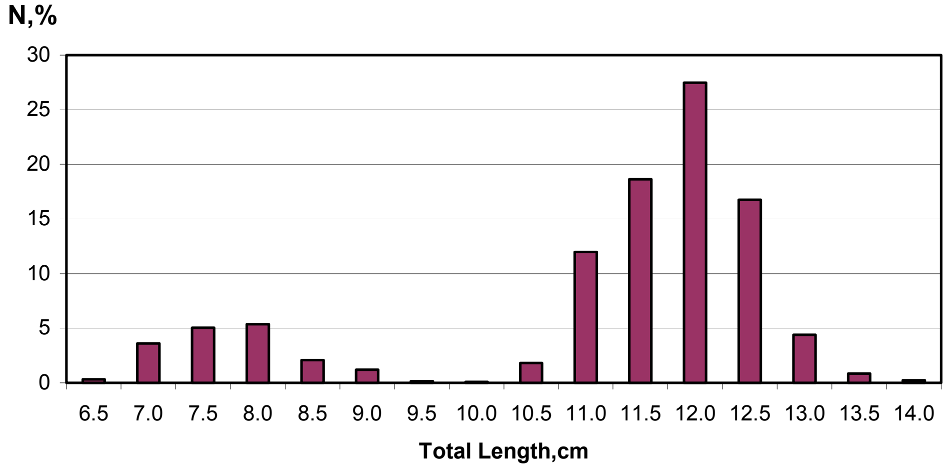
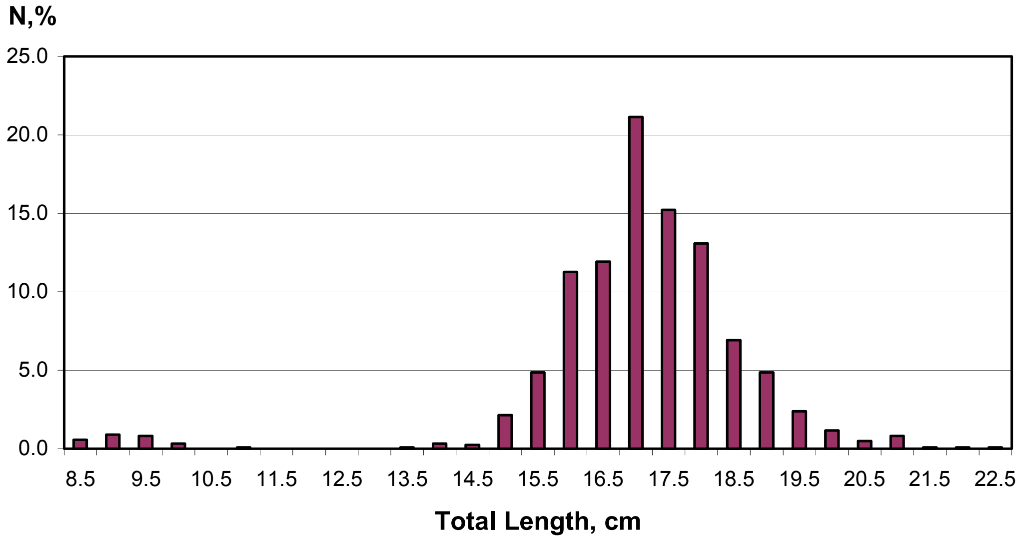


Figure 3. Length distribution of herring in SD 28 (October 2002)



Haul No. Species/ICES Rectangle	1
	44H0
Clupea Harengus	9.4
Sprattus Sprattus	43.1
Total	52.5

Haul No. Species/ICES Rectangle	1	2	3	4	6	8	9	Total
	44H0	43H1	43H0	43H0	43H0	44H1	44H0	
Clupea Harengus	9.4		42.4	45.0	625.0	820.0		1541.8
Sprattus Sprattus	43.1	400.0	385.7	405.0	125.0	1000.0	1100.0	3458.8
Total	52.5	400.0	428.1	450.0	750.0	1820.0	1100.0	5000.6

Table 3 Survey statistics FV "ZANE" 2002, October

SD	ICES rect.	Area in nm^2	Mean Sa m^2/ nm^2	Sigma in m^2*10^-4	Total Abundance In million	Species composition, %		Quantity in million	
						herring	sprat	herring	sprat
28	44H1	824.6	162.1	1.45	925	10.1	89.9	93	832
	44H0	960.5	962.0	1.22	7575	3.1	96.9	236	7339
	43H1	412.7	633.0	1.32	1980	0.0	100.0	0	1980
	43H0	973.7	1013.1	1.57	6280	21.6	78.4	1358	4923
	42H0	968.5	595.8	1.57	3674	21.6	78.4	794	2880
26	41H0	953.3	445.1	1.52	2799	6.3	93.7	175	2624
	41G9	1000	460.3	1.52	3036	6.3	93.7	190	2846

Table 4 Estimated number (millions) of herring FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	93	2	17	50	9	7	3	1	2	2
	44H0	236	0	0	16	61	22	82	14	20	22
	43H1	0	0	0	0	0	0	0	0	0	0
	43H0	1358	58	27	161	316	161	273	113	113	135
	42H0	794	34	16	94	185	94	160	66	66	79
26	41H0	175	0	23	26	33	20	41	12	7	13
	41G9	190	0	25	28	36	22	45	13	7	14

Table 5 Herring mean weight (g) per age group FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	23.5	12.5	19.5	23.4	21.9	30.0	32.0	36.0	29.5	30.0
	44H0	33.0			21.4	32.0	32.6	34.3	34.8	34.7	37.0
	43H1										
	43H0	33.7	5.0	30.7	29.9	32.4	35.8	35.6	38.1	38.3	40.0
	42H0	33.7	5.0	30.7	29.9	32.4	35.8	35.6	38.1	38.3	40.0
26	41H0	39.1		34.2	36.4	37.5	41.4	39.1	42.8	42.8	48.2
	41G9	39.1		34.2	36.4	37.5	41.4	39.1	42.8	42.8	48.2

Table 6 Herring total biomass (t) per age group FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	2198	23	327	1183	205	224	90	34	55	56
	44H0	7784	0	0	339	1959	703	2802	474	709	798
	43H1	0	0	0	0	0	0	0	0	0	0
	43H0	45731	286	817	4810	10249	5780	9734	4316	4326	5413
	42H0	26752	167	478	2814	5995	3381	5694	2525	2531	3166
26	41H0	6854	0	796	954	1229	843	1621	499	281	631
	41G9	7435	0	863	1035	1334	915	1758	541	304	685

Table 7 Estimated number (millions) of sprat FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	832	28	277	79	264	7	124	10	32	11
	44H0	7339	2324	782	361	2357	73	854	147	257	183
	43H1	1980	131	664	219	525	12	293	48	75	12
	43H0	4923	776	567	312	1565	200	1069	56	78	300
	42H0	2880	454	332	183	915	117	625	33	45	175
26	41H0	2624	119	653	407	574	77	380	0	272	142
	41G9	2846	129	709	441	622	83	413	0	295	154

Table 8 Sprat mean weight (gram) per age group FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	10.2	4.0	9.4	10.8	10.9	11.8	10.8	10.6	11.4	12.8
	44H0	8.9	3.3	10.3	11.6	11.7	12.5	12.0	12.5	11.3	11.8
	43H1	9.7	4.0	9.3	10.5	10.6	11.6	10.5	10.6	11.3	11.6
	43H0	10.3	3.3	9.7	10.5	11.6	12.4	12.4	12.3	11.5	12.7
	42H0	10.3	3.3	9.7	10.5	11.6	12.4	12.4	12.3	11.5	12.7
26	41H0	11.2	5.0	9.4	11.5	12.1	13.0	12.8		12.6	13.3
	41G9	11.2	5.0	9.4	11.5	12.1	13.0	12.8		12.6	13.3

Table 9 Sprat total biomass (t) per age group FV "Zane" October 2002

ICES SD	ICES Rect.	Total	Age								
			0	1	2	3	4	5	6	7	8
28	44H1	8487	110	2610	856	2874	79	1342	107	368	139
	44H0	65364	7566	8097	4193	27490	917	10210	1835	2899	2156
	43H1	19273	525	6172	2297	5556	141	3087	510	843	141
	43H0	50602	2580	5513	3286	18143	2492	13200	686	888	3814
	42H0	29601	1509	3225	1923	10613	1458	7722	401	520	2231
26	41H0	29477	594	6141	4674	6924	999	4851	0	3414	1881
	41G9	31976	644	6661	5070	7510	1084	5262	0	3703	2040

Report on the Polish acoustic survey in ICES Sub-divisions 24, 25 and 26; October 2002

by
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The Polish acoustic survey was carried out by r.v. BALTICA within the Polish EEZ in ICES Sub-divisions 24, 25 and 26, from 11 to 28 October, 2002. The acoustic measurements were conducted both during day and night with EY500 sounder and stored on HDD for time intervals corresponding to a distance of 1 nm (ESDU=1 nm). The working speed of the vessel was 4-8 knots. Bad weather conditions caused significant limitation of ESDU in ICES rectangles 39G8 and 40G8. Due to problems with performing the hydroacoustic system calibration in Bogen (Norway) in 2002 the results of the last measurements conducted by SIMRAD at 10th October 2000 (Bogen) were applied into calculations.

Herring pelagic trawl type WP53/64x4 with 11 mm bar length in the codend was used to collect biological samples. The trawling speed was 3.0-4.0 knots, and single haul duration amounted 30 minutes (60 minutes in three cases only).

Fish numbers were estimated using the TS-LENGTH regressions:

clupeoids: TS = 20logL-71.2

gadoids: TS = 20logL-67.5

Total number of fish was divided into species and age groups according to the species and age composition in samples taken randomly from catches. ALKs were prepared for sprat and herring for each Sub-division.

Data: 1089 ESDU; 23 fish pelagic hauls; herring - length measurements for 23 samples (4020 indiv.), age - 20 samples (927 indiv.); sprat - length measurements for 23 samples (4508 indiv.), age - 19 samples (450 indiv.). Quality of data was reserved due to bad weather conditions and calibration problems.

The estimated stocks size and mean weight of herring and sprat per age group are given in Tables 1-4. Survey statistics and catch data are given in Tables 5-6. Acoustic data for ESDU are given in Table 7. Acoustic track and trawl stations are presented in Figure 1.

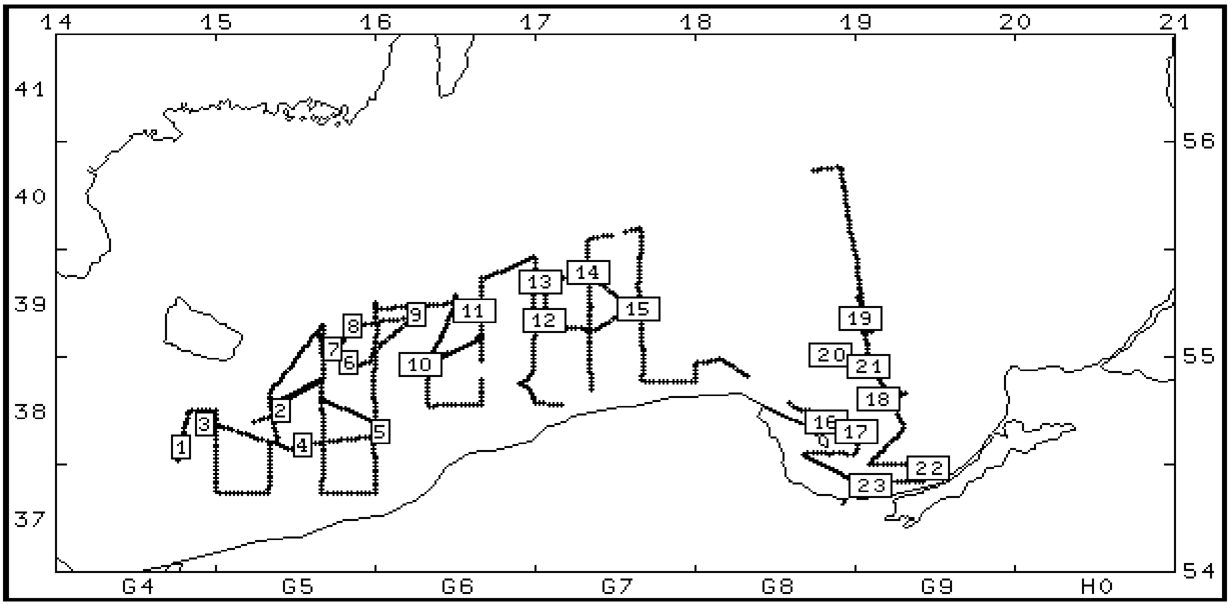

Figure 1. Cruise track and trawl stations of r. v. "Baltica" in October 2002.

Table 1. Estimated number (millions) of herring according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2002.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	213	166,24	21,65	11,04	11,47	1,73			0,87	
	SUM	**213**	**166,24**	**21,65**	**11,04**	**11,47**	**1,73**			**0,87**	
25	37G5	53	29,53	9,69	2,93	6,94	1,14	1,87	0,48	0,26	0,16
	38G5	195	67,30	36,89	20,68	36,08	12,57	12,57	4,05	2,84	2,03
	38G6	421	195,38	83,07	29,52	65,87	15,29	20,76	5,55	2,76	2,79
	38G7	50	7,86	12,75	7,50	13,49	2,53	3,63	1,04	0,65	0,54
	39G5	124	23,52	27,10	16,53	31,81	8,69	10,00	2,69	2,40	1,25
	39G6	164	44,63	46,24	16,79	36,05	5,10	9,73	2,64	1,46	1,35
	39G7	580	150,97	145,30	68,96	134,46	23,24	36,05	9,95	6,45	4,61
	40G7	258	77,17	72,08	23,40	54,80	8,09	14,60	3,96	2,21	1,68
	SUM	**1845**	**596,36**	**433,12**	**186,32**	**379,51**	**76,64**	**109,23**	**30,37**	**19,02**	**14,42**
26	37G8	198	89,84	71,12	9,02	14,86	2,97	7,29	1,53	0,46	0,92
	37G9	181	82,13	65,01	8,24	13,58	2,71	6,67	1,40	0,42	0,84
	38G8	177	11,76	59,94	27,85	38,96	10,44	15,29	4,97	3,12	4,66
	38G9	214	45,60	78,03	24,64	33,56	7,96	13,99	4,10	2,37	3,75
	39G8	105	4,19	34,29	17,15	24,11	6,59	9,32	3,53	2,41	3,42
	39G9	273	9,80	85,58	47,77	63,90	17,42	24,69	9,04	5,92	8,88
	40G8	176	7,02	57,48	28,74	40,41	11,04	15,63	5,91	4,05	5,73
	SUM	**1324**	**250,33**	**451,45**	**163,41**	**229,38**	**59,12**	**92,87**	**30,48**	**18,76**	**28,19**

Table 2. Mean weight (gramme) of herring according to ICES rectangles and Sub-divisions; r/v BALTICA, October 2002.

SD	Rectangle	Average	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	18,0	9,4	36,7	55,1	60,4	60,4			92,0	
25	37G5	25,2	11,6	34,4	52,0	43,3	64,9	45,7	49,3	57,4	54,1
	38G5	38,7	12,6	33,7	54,2	54,0	77,9	63,1	69,6	76,2	63,9
	38G6	29,6	11,0	34,9	51,9	47,6	65,7	52,9	57,5	55,5	62,2
	38G7	42,0	13,2	35,8	53,2	49,3	65,2	51,7	52,8	55,9	56,9
	39G5	44,2	12,4	35,7	54,3	53,1	73,7	58,7	59,9	75,8	55,0
	39G6	34,7	11,9	34,9	50,9	45,6	56,6	48,4	49,1	55,9	54,4
	39G7	37,1	12,5	35,2	52,7	47,8	63,4	49,5	51,1	64,4	55,6
	40G7	33,8	12,5	34,6	50,9	45,1	58,6	46,6	48,8	70,3	54,7
26	37G8	24,7	11,8	30,8	42,9	40,6	49,7	44,3	46,5	59,3	72,3
	37G9	24,7	11,8	30,8	42,9	40,6	49,7	44,3	46,5	59,3	72,3
	38G8	44,1	13,3	35,2	52,6	49,1	52,6	50,8	54,0	59,6	81,7
	38G9	36,0	13,4	32,9	51,0	47,0	52,5	48,1	52,5	58,5	68,9
	39G8	46,9	15,1	35,2	53,1	50,8	54,5	53,2	58,2	63,3	88,7
	39G9	46,9	14,7	35,5	53,4	50,7	54,4	52,1	57,1	61,3	81,1
	40G8	33,8	15,1	35,2	53,1	50,8	54,5	53,2	58,2	63,3	88,7

Table 3. Estimated number (millions) of sprat according to ICES rectangles and Sub-divisions;
r/v BALTICA, October 2002.

SD	Rectangle	Total	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	1936	1532,22	90,13	137,00	65,98	73,91	20,19	12,98	3,61	
	SUM	**1936**	**1532,22**	**90,13**	**137,00**	**65,98**	**73,91**	**20,19**	**12,98**	**3,61**	
25	37G5	556	297,49	80,45	65,04	50,60	52,36	6,51	3,55		
	38G5	1471	591,14	319,97	206,98	169,36	156,11	17,82	9,62		
	38G6	241	106,21	45,44	33,34	25,18	24,96	3,17	2,12	0,58	
	38G7	95	8,14	33,96	19,77	15,87	14,62	1,69	0,96		
	39G5	599	26,68	290,53	108,61	86,95	73,20	8,60	4,42		
	39G6	1356	235,40	520,06	227,24	189,49	154,73	18,55	10,53		
	39G7	985	53,35	403,72	193,89	160,04	145,81	17,91	9,91	0,38	
	40G7	525	2,10	229,94	106,67	91,01	79,74	9,84	5,39	0,30	
	SUM	**5828**	**1320,52**	**1924,08**	**961,53**	**788,49**	**701,54**	**84,09**	**46,50**	**1,26**	
26	37G8	1780	1055,35	596,94	66,04	35,21	23,51	1,86	0,55	0,55	
	37G9	1337	792,70	448,38	49,60	26,44	17,66	1,40	0,41	0,41	
	38G8	1251	31,81	771,99	209,68	126,45	92,01	11,27	6,49	1,30	
	38G9	1648	135,16	1169,87	165,62	97,32	68,62	7,10	2,78	1,54	
	39G8	1664	23,55	1163,00	234,89	138,80	94,18	7,76	1,31	0,50	
	39G9	4712	45,31	3225,55	708,33	415,36	283,41	26,39	5,74	1,91	
	40G8	2067	14,49	1254,22	364,53	223,76	172,21	28,38	7,51	1,91	
	SUM	**14459**	**2098,37**	**8629,96**	**1798,69**	**1063,33**	**751,58**	**84,16**	**24,78**	**8,12**	

Table 4. Mean weight (gramme) of sprat according to ICES rectangles and Sub-divisions; r/v BALTICA, . October 2002

SD	Rectangle	Average	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
24	38G4	7,5	5,1	13,2	17,0	17,9	18,3	17,9	16,9	20,9	
25	37G5	9,9	5,4	13,5	15,8	15,7	16,3	16,0	16,3		
	38G5	11,1	5,4	13,3	15,6	15,5	16,1	16,0	16,2		
	38G6	11,0	5,6	12,7	16,4	16,4	16,7	17,0	17,5	21,1	
	38G7	14,0	5,5	13,0	15,8	15,7	16,1	16,2	16,6		
	39G5	13,7	5,9	12,9	15,1	15,1	15,7	15,8	15,9		
	39G6	12,8	5,8	13,0	15,2	15,2	15,8	16,2	16,5		
	39G7	14,0	5,5	13,1	15,5	15,4	16,0	16,1	16,4	21,1	
	40G7	14,5	8,0	13,2	15,3	15,2	15,9	16,0	16,3	21,1	
26	37G8	6,5	3,5	10,3	12,6	13,1	13,6	15,3	16,4	18,3	
	37G9	6,5	3,5	10,3	12,6	13,1	13,6	15,3	16,4	18,3	
	38G8	11,4	4,3	10,6	13,0	13,4	13,8	15,4	18,7	18,3	
	38G9	10,4	4,1	10,3	12,8	13,3	13,8	15,4	16,3	18,3	
	39G8	11,1	4,9	10,4	12,8	13,2	13,4	15,1	16,3	18,3	
	39G9	11,2	5,0	10,4	12,9	13,2	13,5	15,2	16,3	18,3	
	40G8	11,6	5,6	10,4	13,4	13,6	14,0	15,2	16,3	18,3	

Table 5. Survey statistics. r/v BALTICA, October 2002.

SD	Rectangle	Area	Mean Sa	ESDU	Sigma	Total	Species composition (%)		Abundance [mln]	
		[nm^2]	[m^2/nm^2]		m^2x10-4	abundance [mln]	herring	sprat	herring	sprat
24	38G4	1034.8	233	36	1.121	2149	9.91	90.09	213	1936
	Sum:	**1034.8**				**2149**			**213**	**1936**
25	37G5	642.1	133	49	1.403	609	8.64	91.36	53	556
	38G5	1035.6	252	200	1.568	1667	11.68	88.25	195	1471
	38G6	940.2	146	75	2.071	661	63.58	36.42	421	241
	38G7	471.7	69	41	2.229	145	34.56	65.44	50	95
	39G5	978.9	136	58	1.836	723	17.08	82.80	124	599
	39G6	1025.9	247	164	1.665	1521	10.81	89.14	164	1356
	39G7	1025.9	330	140	2.166	1565	37.08	62.91	580	985
	40G7	1013.0	159	19	2.054	782	32.95	67.03	258	525
	Sum:	**7133,3**				**7673**			**1845**	**5828**
26	37G8	85.9	1775	9	0.771	1978	10.00	90.00	198	1780
	37G9	151.5	1232	44	1.229	1518	11.91	88.06	181	1337
	38G8	624.6	393	56	1.719	1428	12.39	87.55	177	1251
	38G9	918.1	326	71	1.606	1862	11.47	88.42	214	1648
	39G8	1025.9	266	6	1.543	1769	5.92	94.06	105	1664
	39G9	1025.9	754	49	1.551	4985	5.47	94.50	273	4712
	40G8	1013.0	354	30	1.600	2243	7.85	92.13	176	2067
	Sum:	**4844.9**				**15783**			**1324**	**14459**

Table 6. Catch data from the Polish acoustic survey conducted by the r/v BALTICA in October 2002, with trawl type WP 53/64x4 .

Haul number	Date of catch	ICES rectangle	ICES Sudivision	Headrope depth from	Vertical net opening (m)	Geographical position of haul				Fishing time		Duration of trawling	Catch per unit effor		
						start		end							
						latitude 00°00'N	longitude 00°00'E	latitude 00°00'N	longitude 00°00'E	start	end	[min]	herring	sprat	cod
1	18-10-02	38G4	24	23	16	54°38'1	14°48'1	54°34'7	14°47'5	15,25	16,25	60	7,670	48,800	0,000
2	20-10-02	38G5	25	26	17	54°45'8	15°22'6	54°44'8	15°24'5	8,30	9,00	30	27,660	72,760	0,000
3	20-10-02	38G4	24	15	12	54°39'6	14°57'7	54°41'1	14°56'0	11,25	11,55	30	1,580	5,200	0,000
4	20-10-02	38G5	25	16	16	54°33'6	15°31'3	54°35'8	15°33'8	14,55	15,25	30	5,260	62,380	0,000
5	20-10-02	38G6	25	18	15	54°37'8	16°00'5	54°40'0	16°03'0	17,30	18,00	30	17,100	5,880	0,000
6	21-10-02	38G5	25	35	16	54°58'1	15°56'0	54°57'4	15°53'4	8,40	9,10	30	23,520	36,120	4,340
7	21-10-02	39G5	25	34	16	55°03'8	15°45'3	55°01'6	15°44'7	10,50	11,20	30	185,920	106,000	1,980
8	21-10-02	39G5	25	24	15	55°08'7	15°55'3	55°08'0	15°52'6	13,05	13,35	30	7,280	152,080	15,580
9	21-10-02	39G6	25	31	16	55°11'1	16°14'9	55°12'9	16°16'5	15,40	16,10	30	7,640	58,720	1,900
10	22-10-02	38G6	25	8	15	54°58'2	16°20'4	54°57'4	16°16'8	10,35	11,05	30	35,580	4,000	0,000
11	22-10-02	39G6	25	20	17	55°11'9	16°39'9	55°12'6	16°37'1	14,40	15,10	30	8,790	57,080	0,000
12	23-10-02	39G7	25	21	14	55°10'3	17°07'7	55°10'2	17°04'9	8,15	8,45	30	82,180	92,960	0,000
13	23-10-02	39G7	25	33	16	55°20'7	17°06'2	55°20'9	17°01'7	10,40	11,10	30	268,720	88,620	0,000
14	23-10-02	39G7	25	32	17	55°23'3	17°23'5	55°23'4	17°20'3	13,30	14,00	30	118,200	243,520	0,548
15	23-10-02	39G7	25	19	15	55°13'5	17°40'5	55°13'6	17°37'6	16,35	17,05	30	67,440	20,730	0,000
16	24-10-02	38G8	26	37	16	54°43'3	18°46'4	54°42'2	18°48'8	14,40	15,10	30	11,960	9,700	1,814
17	24-10-02	38G8	26	33	16	54°38'4	18°59'6	54°39'1	19°01'1	17,10	17,40	30	1,680	3,196	2,314
18	25-10-02	38G9	26	42	14	54°46'4	19°06'5	54°47'9	19°08'6	8,35	9,05	30	6,380	71,280	10,180
19	25-10-02	39G9	26	51	16	55°08'8	19°04'2	55°10'9	19°02'3	14,20	14,50	30	75,940	847,920	3,018
20	26-10-02	39G8	26	60	16	55°00'1	18°48'1	55°00'5	18°51'1	13,10	13,40	30	112,580	228,640	5,014
21	26-10-02	38G9	26	55	16	54°57'4	19°02'7	54°57'4	19°05'4	15,10	15,40	30	42,560	211,180	10,024
22	27-10-02	37G9	26	28	15	54°27'5	19°22'5	54°28'8	19°27'7	8,05	9,05	60	27,630	11,570	0,000
23	27-10-02	37G9	26	7	23	54°24'6	19°00'3	54°24'3	19°05'9	12,00	13,00	60	18,61	27,34	0

Table 7. The acoustic tracks and Sa-value. r/v BALTICA, October 2002.

Log C	Date	End time	End Lat.	End Long.	Bottom	Sa	Species Cod.	Layer top
1	1018	1252	5431.1	1445.4	23	317.15		11
2	1018	1301	5432.1	1445.8	27	151.70		11
3	1018	1309	5433.0	1446.2	32	25.11		14
4	1018	1318	5434.0	1446.5	35	991.80		20
5	1018	1326	5435.0	1446.8	41	2410.08		13
6	1018	1334	5436.0	1447.1	45	358.90		17
7	1018	1342	5437.0	1447.4	47	54.86		23
8	1018	1351	5438.1	1447.8	49	31.56		29
9	1018	1410	5438.7	1448.2	49	31.56		29
10	1018	1428	5437.8	1448.0	50	57.34		28
11	1018	1445	5436.8	1447.9	47	14.20		25
12	1018	1502	5435.9	1447.7	45	49.32		27
13	1018	1518	5435.0	1447.4	42	238.57		17
14	1018	1542	5434.4	1447.5	41	563.07		15
15	1018	1550	5435.3	1447.7	43	67.71		20
16	1018	1557	5436.3	1447.8	45	270.85		23
17	1018	1604	5437.3	1447.9	49	73.71		27
18	1018	1611	5438.2	1448.0	50	24.10		12
19	1018	1618	5439.2	1448.1	50	54.59		33
20	1018	1625	5440.1	1448.3	52	187.32		28
21	1018	1634	5441.0	1448.6	52	138.85		24
22	1018	1642	5441.9	1448.8	54	191.15		25
23	1018	1651	5442.8	1449.2	55	224.06		13
24	1018	1700	5443.8	1449.5	55	68.98		22
25	1018	1709	5444.7	1449.8	56	68.07		13
26	1018	1717	5445.0	1451.2	56	67.17		13
27	1018	1726	5445.0	1452.9	60	58.16		12
28	1018	1734	5445.0	1454.6	58	97.38		11
29	1018	1743	5445.0	1456.4	60	65.82		12
30	1018	1752	5445.0	1458.1	60	161.84		13
31	1018	1801	5445.0	1459.8	61	421.92		11
32	1018	1809	5444.1	1500.1	60	444.73		10
33	1018	1818	5443.1	1500.1	60	488.24		12
34	1018	1827	5442.1	1500.2	60	573.89		13
35	1018	1836	5441.0	1500.2	58	408.98		11
36	1018	1845	5440.0	1500.2	56	535.57		12
37	1018	1855	5438.9	1500.2	55	1273.57		12
38	1018	1904	5437.8	1500.1	53	1710.86		11
39	1018	1913	5436.7	1500.1	50	836.72		12
40	1018	1922	5435.6	1500.1	50	1145.53		13
41	1018	1930	5434.6	1500.1	47	746.11		14
42	1018	1939	5433.5	1500.1	45	418.05		12
43	1018	1947	5432.5	1500.1	41	586.52		11
44	1018	1956	5431.4	1500.1	38	600.94		10
45	1018	2004	5430.4	1500.1	36	649.18		10
46	1018	2013	5429.4	1500.1	33	222.61		10
47	1018	2021	5428.3	1500.1	28	135.20		10
48	1018	2029	5427.4	1500.1	26	110.36		11
49	1018	2037	5426.4	1500.1	24	99.81		10
50	1018	2045	5425.4	1500.1	22	76.23		10
51	1018	2054	5424.4	1500.1	22	80.65		10
52	1018	2102	5423.5	1500.1	22	36.90		11
53	1018	2111	5422.5	1500.1	21	56.85		10
54	1018	2120	5422.2	1501.6	22	144.67		11
55	1018	2128	5422.1	1503.4	24	170.41		10
56	1018	2137	5422.1	1505.1	25	251.42		10
57	1018	2145	5422.0	1506.8	25	145.71		10
58	1018	2154	5421.9	1508.5	25	107.66		11
59	1018	2202	5421.9	1510.1	25	156.71		11
60	1018	2210	5421.9	1511.8	26	133.58		11
61	1018	2219	5421.8	1513.4	27	117.93		11
62	1018	2227	5421.8	1515.0	28	68.66		11
63	1018	2235	5421.8	1516.6	27	124.56		10
64	1018	2244	5421.8	1518.2	26	150.17		10
65	1018	2252	5422.1	1519.6	29	165.00		11
66	1019	2302	5423.1	1519.7	30	98.59		10
67	1018	2316	5424.1	1519.9	30	123.30		10
68	1018	2325	5425.1	1520.0	30	186.96		10
69	1018	2333	5426.0	1520.1	30	221.85		11
70	1018	2342	5427.0	1520.1	32	209.54		13

Survey Report for RV "ATLANTNIRO"
05.10. - 03.11. 2002

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

1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The reported acoustic survey is conducted every year in October 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 South-Eastern and Central Baltic Sea (Sub-divisions 26 and 28).

2 METHODS

2.1 Personnel

A. Zezera	AtlantNIRO, Kaliningrad, Russia, in charge
V. Konstantinov	AtlantNIRO, Kaliningrad, Russia
V. Sunkovich	AtlantNIRO, Kaliningrad, Russia
A. Oleynik	AtlantNIRO, Kaliningrad, Russia
T. Vasileva	AtlantNIRO, Kaliningrad, Russia
E. Gribov	AtlantNIRO, Kaliningrad, Russia
S. Burykin	AtlantNIRO, Kaliningrad, Russia
V. Shopov	AtlantNIRO, Kaliningrad, Russia
F. Patokina	AtlantNIRO, Kaliningrad, Russia
N. Krasovskaya	AtlantNIRO, Kaliningrad, Russia
T. Golubkova	AtlantNIRO, Kaliningrad, Russia

2.2 Narrative

The 35th cruise of RV 'Atlantniro' took place from 05th October to 03th November in 2002. RV "Atlantniro" left the port of Kaliningrad on 08th October 2002. Russian acoustic survey was intended to cover the whole sub-divisions 26 and 28. The survey was finished on 02th November 2002 in Kaliningrad.

2.3 Survey design

For both Sub-divisions 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 of a vessel speed 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 20473,1 NM^2. The cruise track is submitted in Figure 1..

2.4 Calibration

Both transducers, the 38 and 120 kHz was calibrated in the Baltic Sea shore area, near the port Baltiysk (Russia) , the 18th-19th May, 2002. The ship was fixed on the two anchors and one trawl desk on depth nearly 30 meters. The calibration procedure was carried out with a standard calibrated copper sphere, 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 Ref.D).

2.5 Acoustic data collection

The acoustic investigations were performed during 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 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 postprocessing of the stored echosignals was done with the SonarData EchoView ver. 2.25, Surfer and Excel. 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.

2.6 Biological data – fishing stations

All trawling was done with the pelagic gear „PT/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 trawl depth was chosen by the echogram, in accordance to the characteristic of echo - records from the fish. Normally, the trawl had 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 frosted for further investigations in the lab (i.e. sex, maturity, age). After each trawl haul, it was executed oceanologic samples with a CTD-probe, 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. The total number, were separated into herring and sprat according to mean - weighted catch composition in rectangle.

3 RESULTS

3.1 Biological data

From total 58 trawl hauls were carried out (29 hauls in every sub-division 26, 28.), 5 hauls from them, was carried out in Estonian area, 17 hauls in Latvian area, 15 in Sweden, 5 in Lithuania, 4 in Poland and 12 in Russian areas.

13213 herring, 11607 sprat and 318 cod were measured.

5411 herring, 5085 sprat and 318 cod was analysed and took for age investigation.

The results of the catch composition by Sub-division are presented in Table 1-3.

The length distributions of herring and sprat of the 2002 year, are presented by Sub-division 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 Sub-division/rectangle are shown in Table 4.

The horizontal distribution of Sa values (Figure 4 and Table 4) was differ to the years before. More higher values of Sa was distributed at the north part of 28 sub-division, in Estonian and Latvian areas.

In comparison with 2001 year acoustic survey, Sa values in 28 sub-division are varies in range 15-1500m2/nm2. On the all other parts of acoustic survey area Sa values lays in range 10-100 m2/nm2.

In the 26 sub-division the fish density has small differences as in former years.

3.3 Abundance estimates

The total abundance of herring and sprat are presented in Table 4. The estimated number of herring and sprat by age group and Sub-division/rectangle are given in Table 5 and Table 8. The corresponding mean weights by age group and Sub-division/rectangle are shown in Table 6 and Table 9. The estimates of herring and sprat biomass by age group and Sub-division/rectangle are summarised in Table 7 and Table 10.

4 DISCUSSION

Control catches of pelagic fish are shown, the indexes of number young a sprat of generation of 2002 were much higher than last year's parameters (17 thousand numbers per one trawl against 4.7 thousand numbers per one trawl in 2001) and as a whole were close to a level of very abundance generations of a sprat 1994, 1995 and 1997.

Also the increase in a young part of herring is marked, especially in 28 subdivision ICES, where she has more than 16 % of herring catches, that is much higher, than the last years during same period.

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:02 Ref.: D.

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

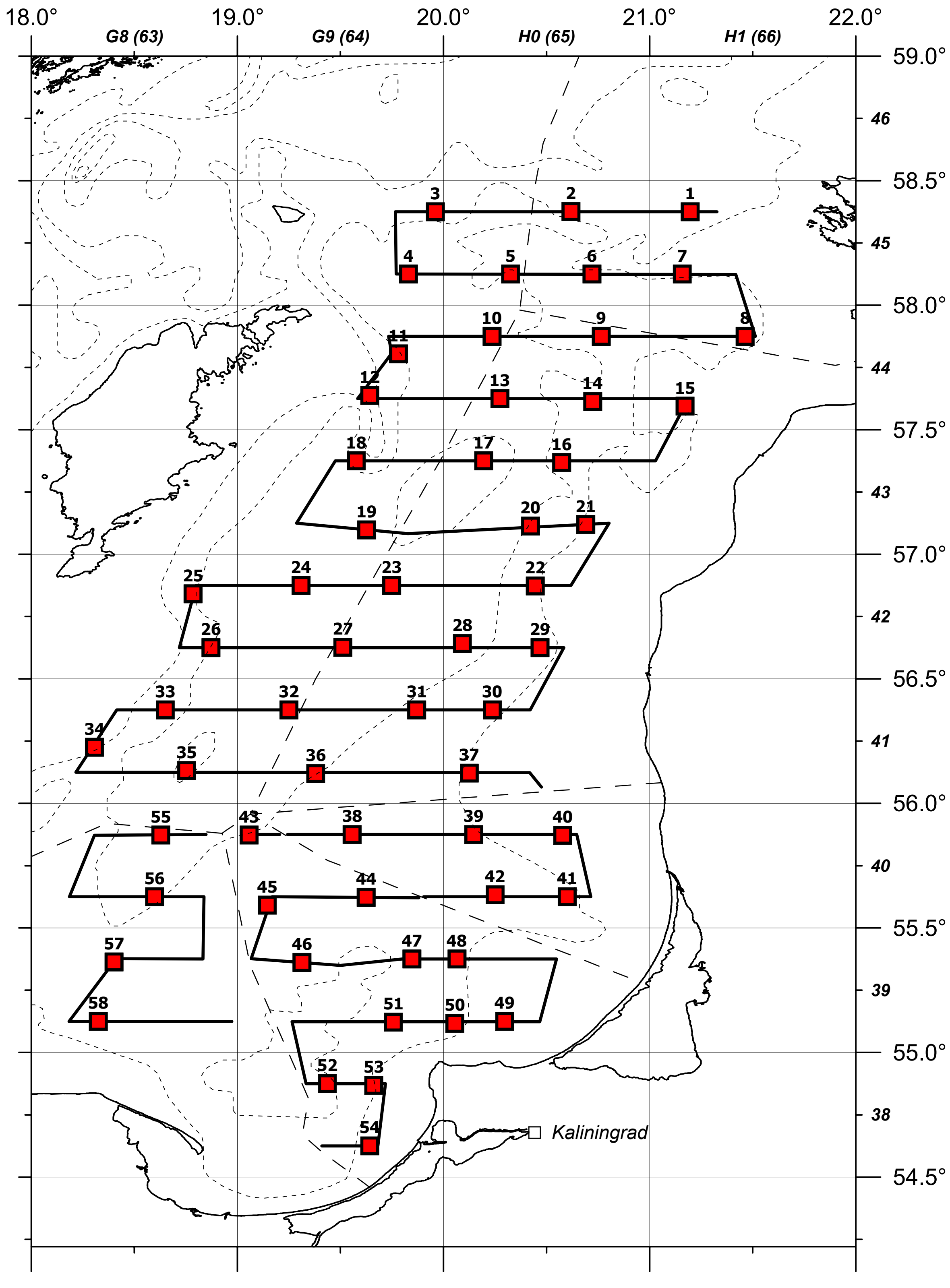

Figure 1. Cruise track and trawl positions for RV „ATLANTNIRO“ in October 2002

Survey Report for RV "ATLANTNIRO"
05.-27.02.2003

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. The ground 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 (Sub-divisions 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
N. Kalinina	AtlantNIRO, Kaliningrad, Russia - engineer
V. Shopov	AtlantNIRO, Kaliningrad, Russia - engineer
E. Timohin	AtlantNIRO, Kaliningrad, Russia - hydrologist
V. Konstantinov	AtlantNIRO, Kaliningrad, Russia - engineer
T. Golubkova	AtlantNIRO, Kaliningrad, Russia - engineer

2.2 Narrative

The 36th cruise of RV STM-K-1711 «ATLANTNIRO» took place from 5th to 27th February in 2003. RV «ATLANTNINO» left the port of Kaliningrad on 5th February in 2003. The ground trawl survey was intended to cover the Sub-division 26 (areas of the Russia, Lithuania and southern part of the Latvia). The survey ended on 27th February in 2003 on road of port Baltijsk.

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 21 up to 104 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 and southern part of the Latvia.

2.4 Calibration

Calibration passed in the beginning of flight on road of port Baltijsk. 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 netsonde. 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 50 trawl hauls were carried out (35 hauls in area of the Russia, 9 hauls in area of the Lithuania and 6 hauls in area southern part of the Latvia). 1677 cod, 1881 flounder, 1768 herring and 735 sprat were investigated in lab onboard a vessel. In February 2003, total length was measured for 7266 cod from 47 hauls, 8897 flounder from 50 hauls, 7271 herring from 39 hauls, and 3855 sprat from 21 hauls.
The length distributions of cod and flounder year 2003 presented in Figures 2 - 9.
The results of the catch composition on the countries Sub-division 26 are presented in Table 1-3 and Figure 10.

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 schoals 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

In February 2003 on the basic part of Gdansk Basin the high temperature of the deep waters was kept. The positive water temperature anomalies in the bottom-near layer in Gdansk Deep exceeded 1.5 ° at absolute values more then 8°C, at the same time anomalies of salinity as in the surface (0-50 m), and in the bottom (80-100 m) layers were characterized by negative values, accordingly 0.46‰ and 1.13‰.

In comparison with autumn 2002 the area with the oxygen concentrations less than 1 ml/l has considerably extended in the near bottom layers. For a winter hydrological season the sea area, with an oxygen deficiency was close to maximal for the last decade. The locations of stations, temperature, salinity distribution and the oxygen concentration at a bottom is shown on fig. 11-14.

4 DISCUSSION

The total number of cod and flounder in catches decreased importantly compared to 2002. Catch of herring increased and reached 37% from of the total catch. The catch of herring in 2002 consists 18% from of the total. Catch of sprat also increased and reached 6 %.

The total length of main fish species ranged as follows:

- cod – 5.0 – 97.0 cm

- flounder – 10.0 – 48.0 cm

In 2002 marked large numbers of young cod in hauls length before 30 cm -54%. Young cod occurred in control 2003 in hauls in the range of 0.0 to 100% (the mean of 31%). The abundance of 2 age group cod in the Sub-division 26 was lower than that of the last year – 25% (in 2002 of 2 age group cod prepared 42%).

5 REFERENCES

Report of the Baltic International Fish Survey Working Group. ICES CM 2002/G:05 Ref. H.
Manual for the Baltic International Acoustic Surveys (BIAS)

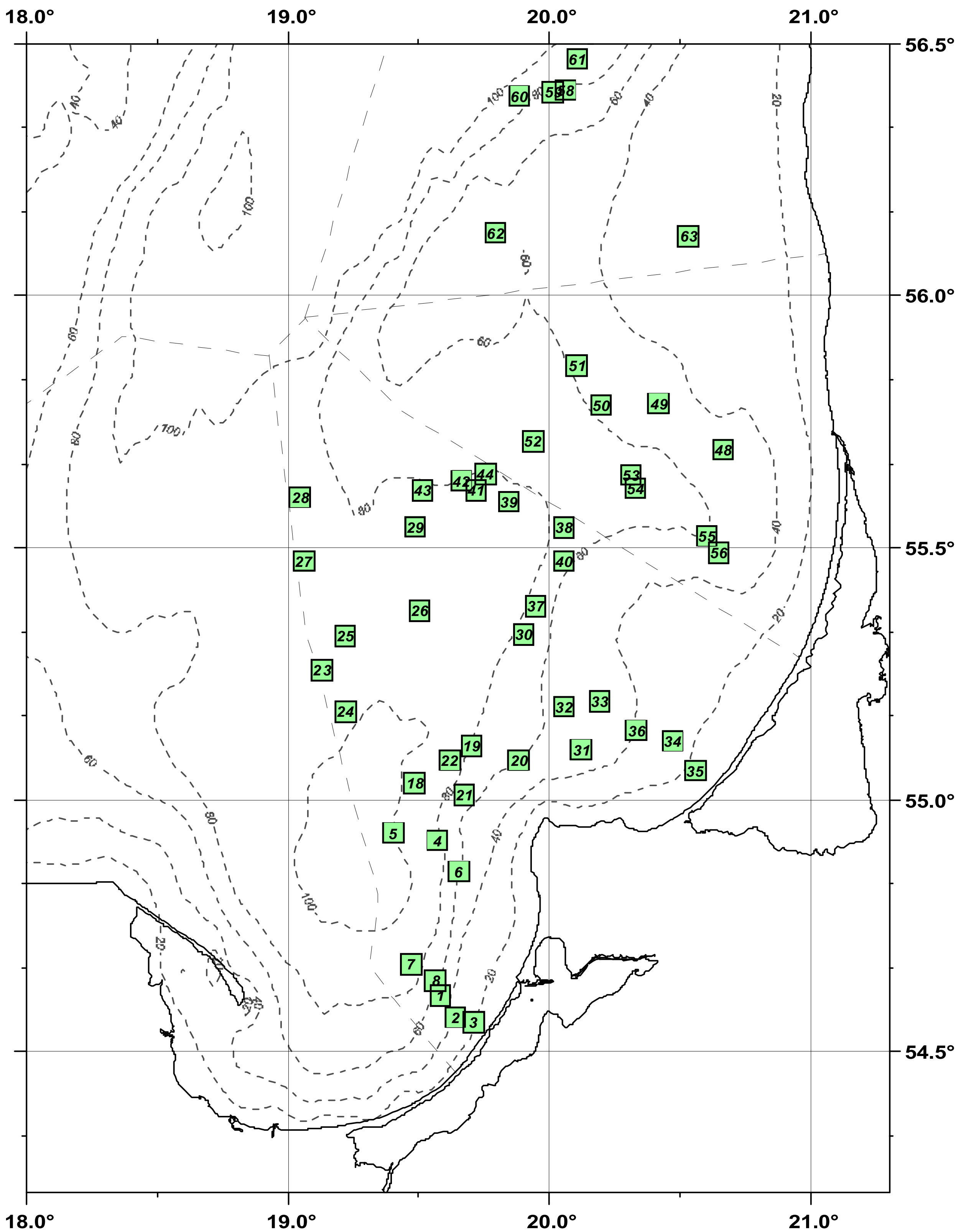

Fig 1. Trawl positions for RV "ATLANTNIRO" in February 2003

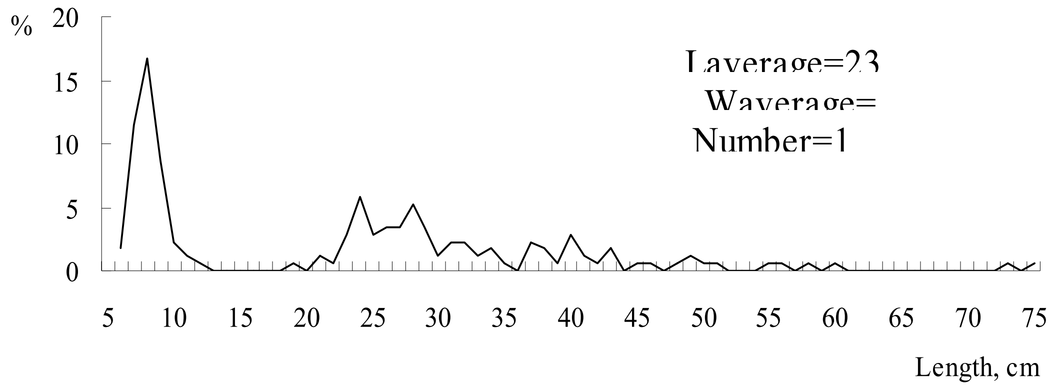

Fig 2. Length distribution of cod in area of the Russia (Sub-division 26) in 2003.

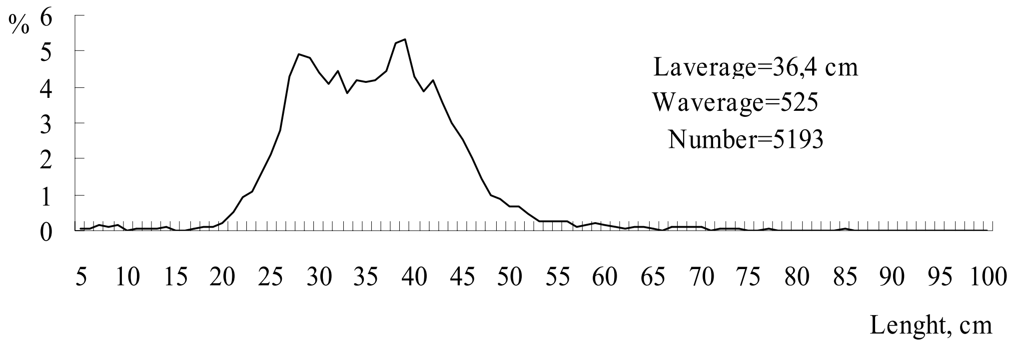

Fig 3. Length distribution of cod in area of the Lithuania (Sub-division 26) in 2003.

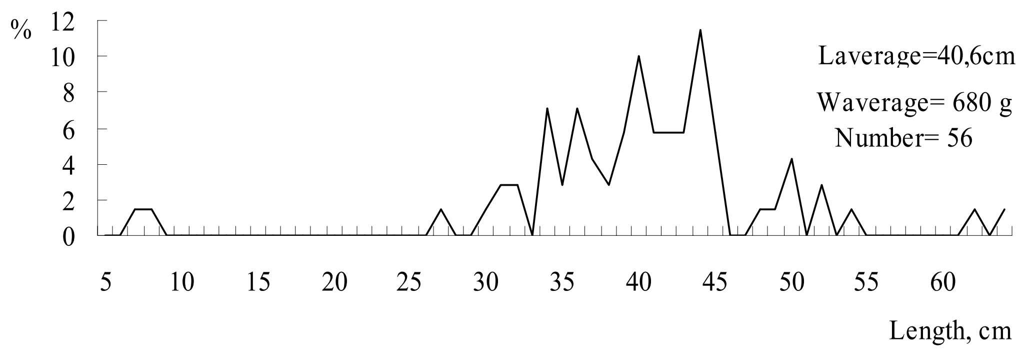

Fig 4. Length distribution of cod in area of the Latvia (Sub-division 26) in 2003.

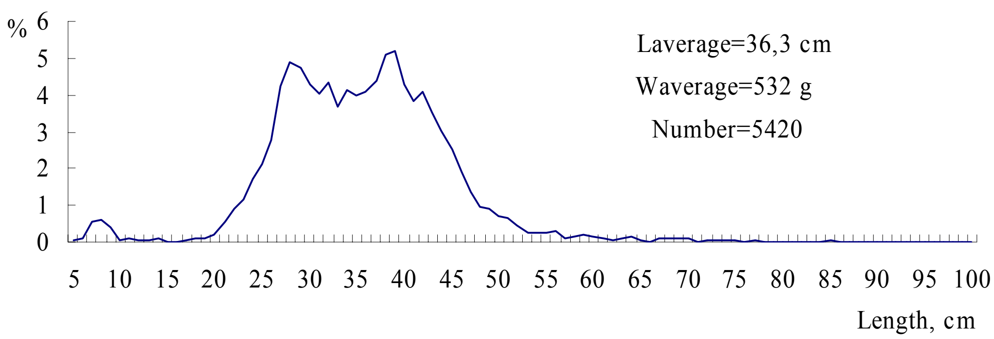

Fig 5. Length distribution of cod in Sub-division 26 in 2003.

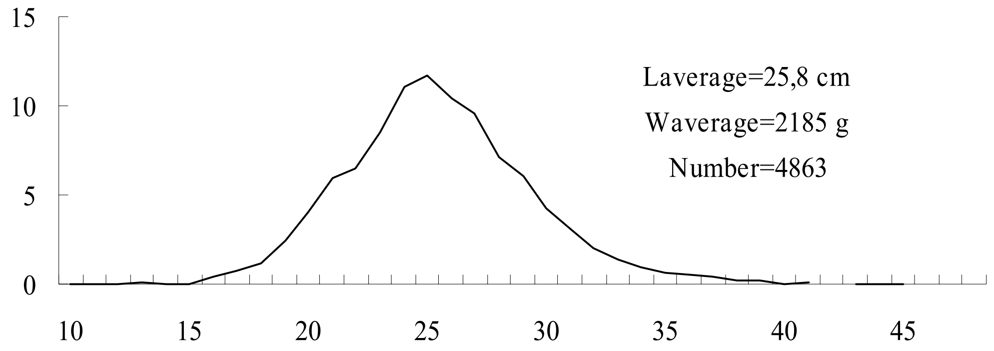

Fig 6. Length distribution of flounder in area of the Russia (Sub-division 26) in 2003.

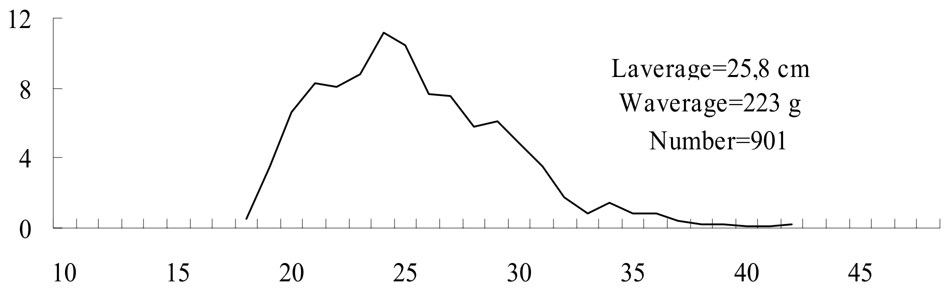

Fig 7. Length distribution of flounder in area of the Lithuania (Sub-division 26) in 2003.

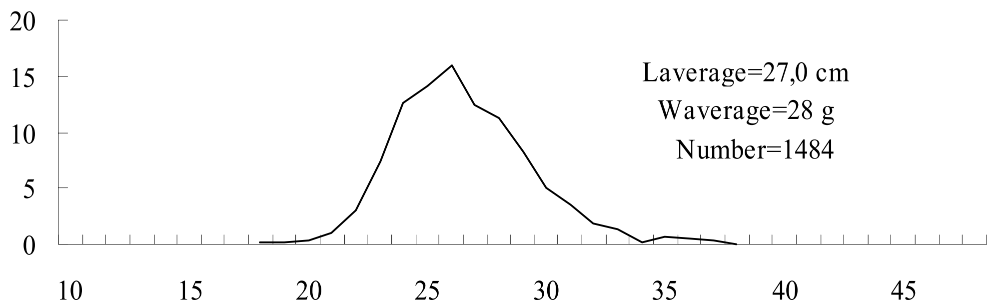

Fig 8. Length distribution of flounder in area of the Latvia (Sub-division 26) in 2003.

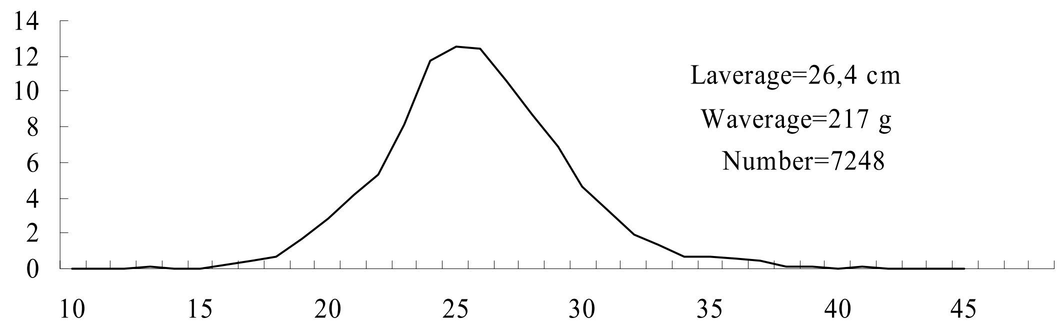

Fig 9. Length distribution of flounder in Sub-division 26 in 2003.

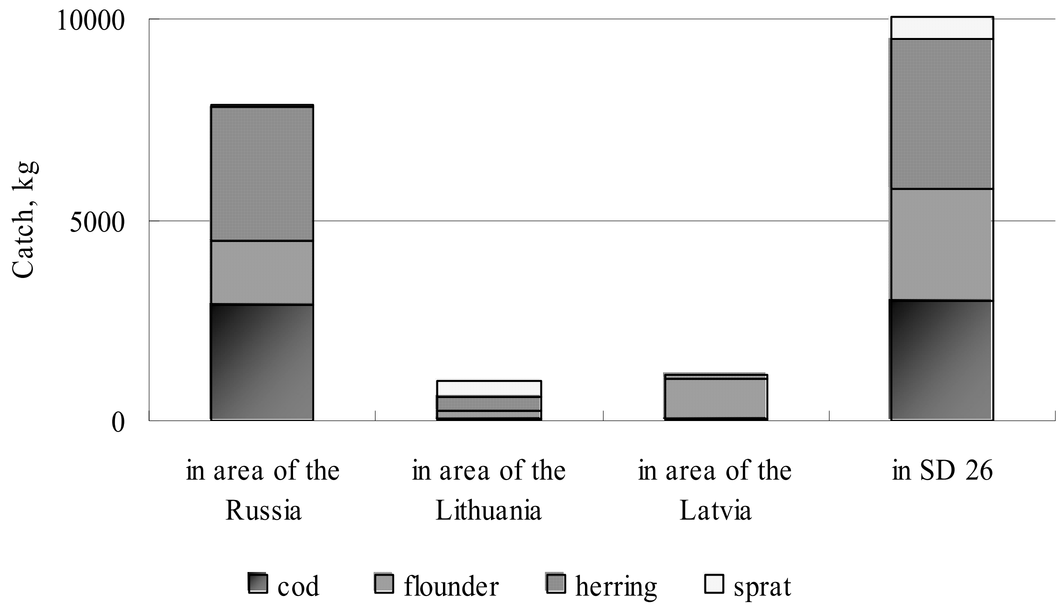

Fig. 10. Catch composition (kg/ 0.5 h) in areas and Sub-division 26

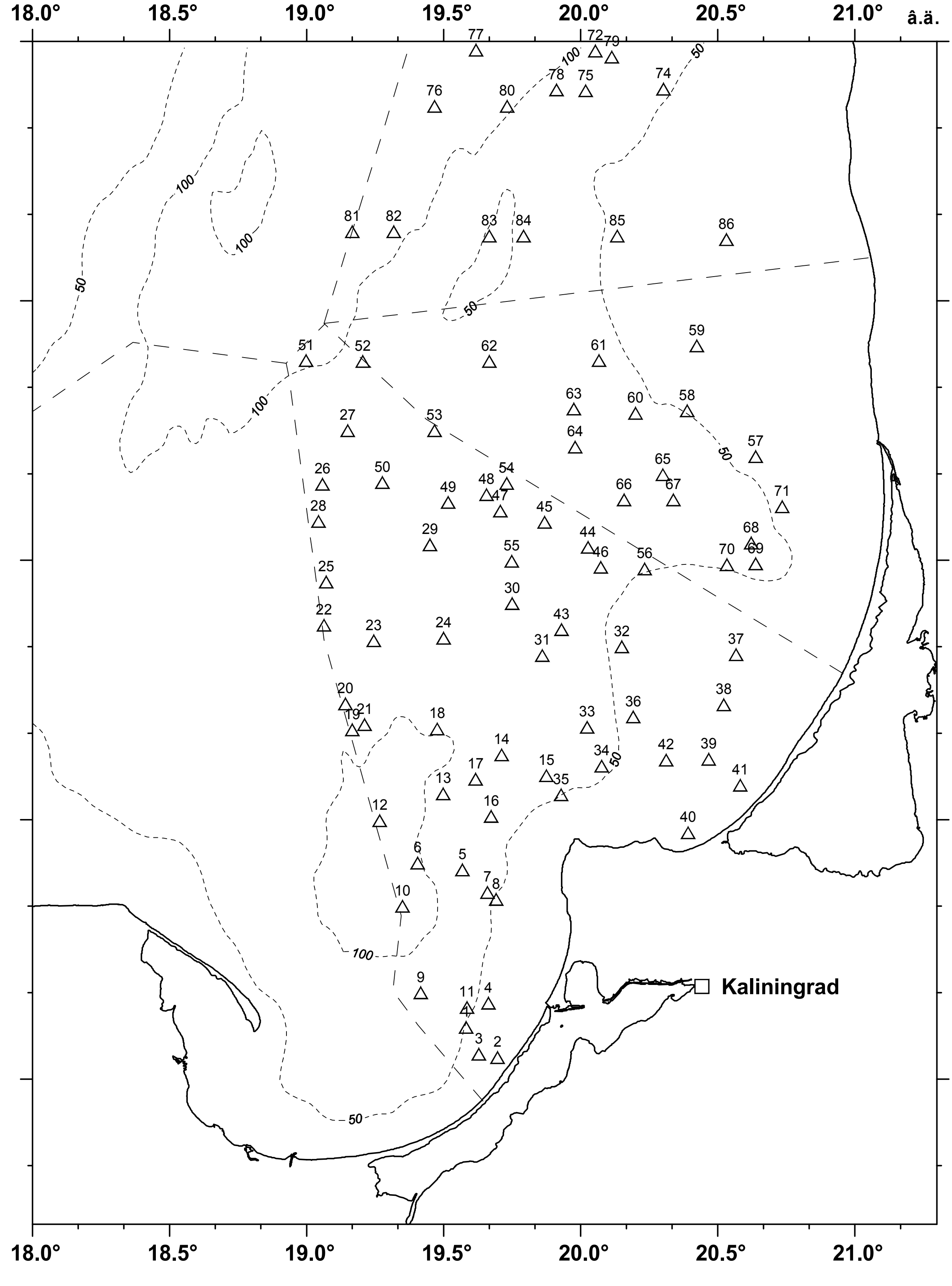

Fig. 11. Location of hydrographic stations in February 2003, RV “ATLANTNIRO”

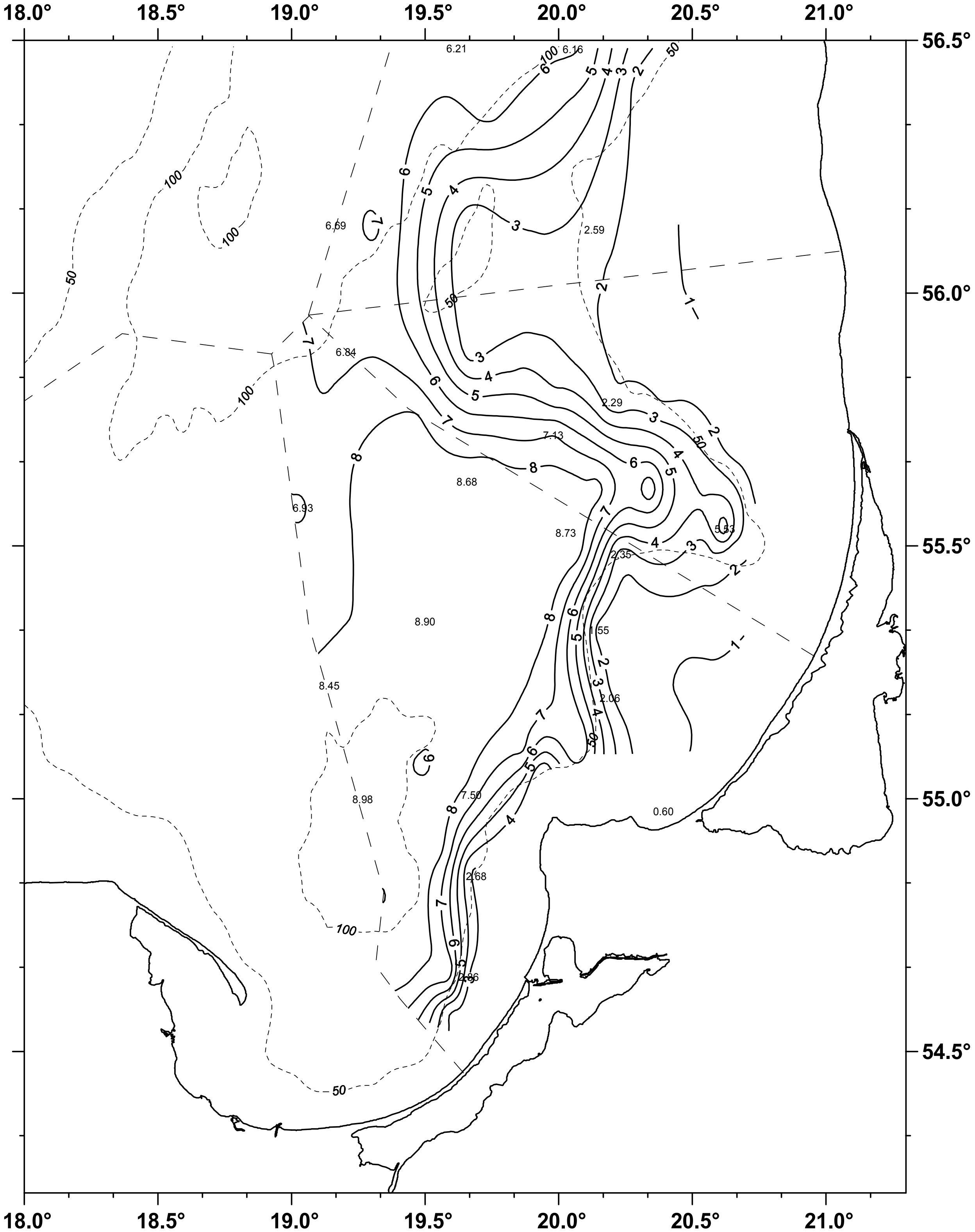

Fig . 12. Bottom water temperature distribution (°C) in February 2003, RV "ATLANTNIRO"

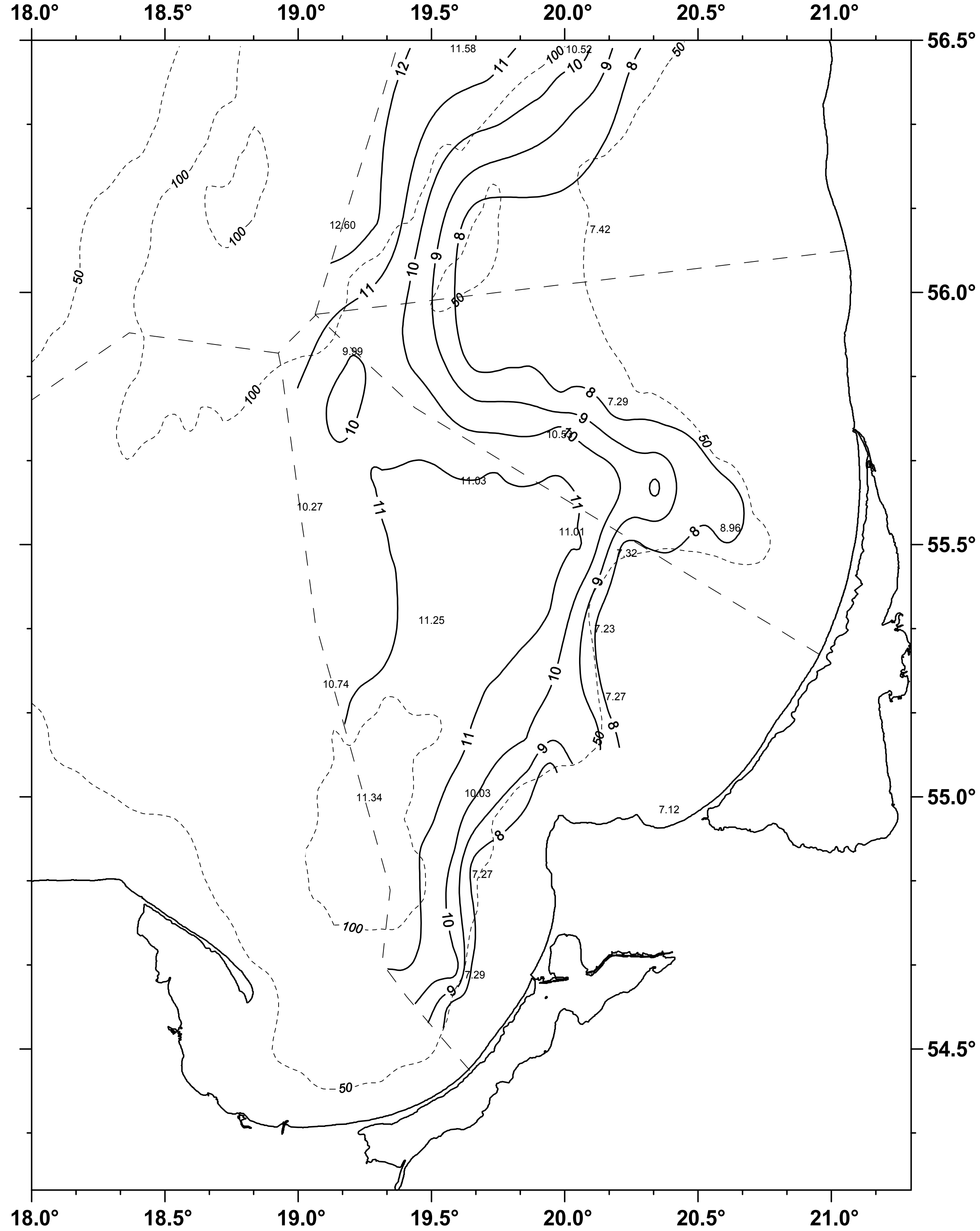

Fig. 13. Bottom water salinity distribution (‰) in February 2003, RV "ATLANTNIRO"

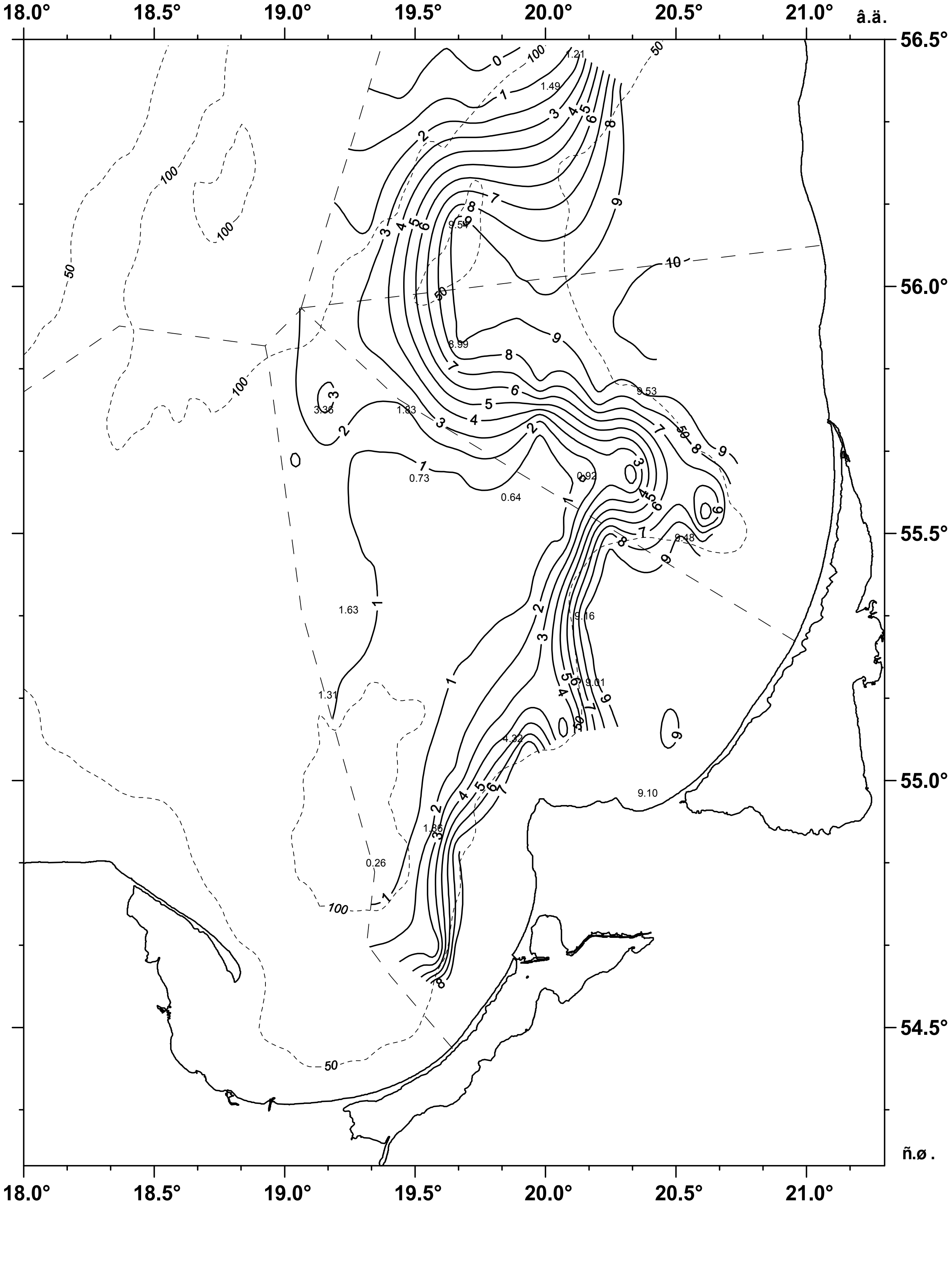

Fig. 14. Bottom water oxygen concentration (ml/l) in February 2003, RV "ATLANTNIRO"

Survey Report for R/V ARGOS
2002-10-06 – 2002-10-19

Institute of Marine Research, Lysekil, Sweden
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

Dr. M. Cardinale	Institute of Marine Research, Lysekil, Sweden – acoustic
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
H. Jonasson	Institute of Marine Research, Karlskrona, Sweden – fish sampling
M. Leiditz	Institute of Marine Research, Lysekil, Sweden – fish sampling
J-O. Pettersson	Institute of Marine Research, Lysekil, Sweden – acoustic & fish
R. Sjöberg	Institute of Marine Research, Lysekil, Sweden – fish sampling
D. Stepputis	Institut für Meereskunde-FB Marine Ökologie-Abt. Fischereibiologie, Kiel, Germany – special 0-group sprat sampling

2.2 Narrative

The R/V Argos' cruise number 14, 2002, started 2002-10-06 from Copenhagen and ended 2002-10-19 in Gothenburg. Västervik and Högön was visited 2002-10-11 – 2002-10-14 for exchange of crew and scientific staff and calibration of acoustic equipment. The cruise was intended to cover ICES subdivision (SD) 27 and parts of ICES subdivisions 25, 28 and 29S. However, due to technical problems on the German R/V Solea, also the northern part of ICES SD 24 was covered. Due to the shallow water in SD 24 the Fotö one boat pelagic trawl was used in the beginning of the cruise. The Atlas net sond worked only intermittently during the first 10 hauls which made the fishing hazardous and 3 hauls were excluded due to small or irrelevant catch. Finally it ceased to work completely during the eleventh trawl haul and the Fotö trawl was torn during this haul. After that the Macro 4 midwater trawl without net sond was used and fishing close to bottom was no longer possible.

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 2001/H:02 Ref.D: Annex 2). 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 R/V Argos and the weather conditions makes it difficult to fullfill this aim. The area covered by the survey was 19897 NM² and the distance used for acoustic estimates was 1480 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 2002-10-14 according to the BIAS manual (ICES CM 2001/H:02 Ref.D: Annex 2). Calibrated TS and Sv gain for 38 kHz the last 5 years is shown below.

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

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 2001/H:02 Ref.D: Annex 2). 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

As mentioned above the first 11 hauls were made with the Fotö one boat pelagic trawl and the rest of the hauls with the Macro 4 midwater trawl. The stretched mesh size in the codend of both trawls 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 a net sond during the first 11 hauls. After that only headrope depth could be monitored. The trawling depth was chosen in accordance to the indications on the echogram. A net opening of 16-20 m was achieved with the Fotö trawl and 24-30 m with the Macro 4 trawl. The distance between trawl doors was also monitored. The standard trawling 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 frosen 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 (Sa) 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

One CTD cast was made with a General Oceanics MKIII CTD when calibrating the acoustic instruments.

3 RESULTS

3.1 Biological data

In total 32 trawl hauls were carried out (4 hauls in SD 24, 7 in SD 25 (of which 3 were excluded), 11 in SD 27, 1 in SD 28 and 9 hauls in SD 29S). 2468 herrings and 1316 sprats were analyzed 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 Sub-division/rectangle are shown in Table 3.2.1.

3.3 Abundance estimates

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

4 DISCUSSION

The accomplishment of the survey was greatly influenced by the malfunction or lack of net sond as well as unsuitable weather. The fishing ability was restricted and the most significant echo traces could often not be fished. Therefore the quality of the catch and length compositions is less than during previous years.

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. & 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., 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):7–23.

Table 3.1.1 Catch composition per haul by ICES subdivision

ICES subdivision 24				
Haul No.	**496**	**497**	**498**	**499**
Validity	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**39G3**	**39G3**	**39G3**	**39G4**
ANGUILLA ANGUILLA	0,629			
AURELIA SPP	8,056	67,367	503,932	27,355
BELONE BELONE	0,375			
CLUPEA HARENGUS	4,070	102,429	94,667	233,640
CYCLOPTERUS LUMPUS			0,172	
GADUS MORHUA	5,604	19,000	1,604	13,400
LIMANDA LIMANDA	0,111			
MERLANGIUS MERLANGUS	0,242	4,626		3,216
SALMO SALAR				0,703
SCOMBER SCOMBRUS	0,843			
SPRATTUS SPRATTUS	320,470	40,971	58,330	8,341
Total	**340,400**	**234,393**	**658,705**	**286,655**

ICES subdivision 25							
Haul No.	**500**	**501**	**502**	**503**	**504**	**505**	**506**
Validity	**Valid**	**Invalid**	**Valid**	**Valid**	**Invalid**	**Invalid**	**Valid**
Species/ICES rectangle	**40G4**	**40G5**	**40G5**	**40G7**	**40G7**	**40G6**	**41G6**
AURELIA SPP	25,111	32,400	32,226	3,387	16,400	23,000	6,000
CLUPEA HARENGUS	47,209	9,500	36,194	20,323		1,170	123,000
CYCLOPTERUS LUMPUS							0,028
GADUS MORHUA	142,200	0,509	12,484	1,742		0,270	9,800
GASTEROSTEUS ACULEATUS			0,025				0,002
MERLANGIUS MERLANGUS	0,495						
PLATICHTHYS FLESUS							0,661
SPRATTUS SPRATTUS	41,384	10,700	11,613	2,129		16,900	4,660
Total	**256,399**	**53,109**	**92,541**	**27,581**	**16,400**	**41,340**	**144,151**

ICES subdivision 27											
Haul No.	**507**	**508**	**509**	**510**	**511**	**512**	**514**	**515**	**516**	**517**	**518**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**42G7**	**42G7**	**43G7**	**43G7**	**44G8**	**44G7**	**44G7**	**45G7**	**45G8**	**45G8**	**46G8**
AURELIA SPP		2,945	1,199								
CLUPEA HARENGUS	84,500	88,984	180,370	347,956	58,391	45,118	80,360	78,768	153,063	92,734	38,553
CYCLOPTERUS LUMPUS			0,289	0,309	5,116	0,517	0,494	1,019			0,676
GADUS MORHUA	15,200	0,536									
GASTEROSTEUS ACULEATUS	0,001			0,249	12,000	0,348	0,969	4,696		0,088	8,139
PLATICHTHYS FLESUS									0,300	0,266	
PLEURONECTES PLATESSA								0,513			
SPRATTUS SPRATTUS	7,500	165,071	84,047	15,795	24,000	146,048	123,712	408,609	73,204	602,768	408,380
Total	**107,201**	**257,536**	**265,905**	**364,309**	**99,507**	**192,031**	**205,535**	**493,605**	**226,567**	**695,856**	**455,748**

ICES subdivision 28	
Haul No.	**528**
Validity	**Valid**
Species/ICES rectangle	**43G8**
CLUPEA HARENGUS	331,122
CYCLOPTERUS LUMPUS	0,186
GADUS MORHUA	0,928
SPRATTUS SPRATTUS	203,917
Total	**536,153**

ICES subdivision 29S									
Haul No.	**519**	**520**	**521**	**522**	**523**	**524**	**525**	**526**	**527**
Validity	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**	**Valid**
Species/ICES rectangle	**46G9**	**47G9**	**47H1**	**47H1**	**46H1**	**46H0**	**46H0**	**47H0**	**46G9**
CLUPEA HARENGUS	60,433	22,342	40,535	268,981	15,457	18,349	40,892	30,068	37,540
CYCLOPTERUS LUMPUS	0,576	1,665	0,320	0,300	0,236	0,406		1,430	0,410
GASTEROSTEUS ACULEATUS	13,113	9,543	16,116	4,611	31,813	7,560	3,363	19,392	4,750
LIPARIS LIPARIS			0,001						
PLATICHTHYS FLESUS		0,305							
PUNGITIUS PUNGITIUS					0,069	0,040		0,007	
SPRATTUS SPRATTUS	107,182	101,392	46,744	301,000	17,220	286,767	372,115	73,355	65,887
Total	**181,304**	**135,247**	**103,716**	**574,892**	**64,795**	**313,122**	**416,370**	**124,252**	**108,587**

Table 3.2.1. R/V Argos survey statistics, October 2002

Sub-division	ICES Rectangle	Area (nm²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
24	**39G3**	765,0	267,96	1,76	1168	36,63	63,02	428	736
24	**39G4**	524,8	149,79	3,56	221	87,34	11,53	193	25
24 Total		1289,8			1389			620	761
25	**39G4**	287,3	149,79	3,56	121	87,34	11,53	106	14
25	**39G5**	979,0	65,44	3,62	177	52,28	43,72	93	77
25	**40G4**	677,2	147,89	4,23	237	22,61	68,89	54	163
25	**40G5**	1012,9	165,14	3,05	548	46,88	50,73	257	278
25	**40G6**	1013,0	181,67	3,25	566	70,90	27,91	401	158
25	**40G7**	1013,0	80,07	3,13	259	77,77	21,76	202	56
25	**41G6**	764,4	81,63	3,58	174	88,04	11,23	154	20
25	**41G7**	1000,0	74,86	2,93	256	59,84	39,54	153	101
25 Total		6746,8			2338			1418	867
27	**42G7**	986,9	225,22	2,60	854	45,74	53,70	391	459
27	**43G7**	913,8	421,78	2,18	1771	70,11	29,39	1242	520
27	**44G7**	960,5	271,61	1,46	1787	23,13	75,02	413	1341
27	**44G8**	456,6	371,25	0,93	1815	19,35	16,91	351	307
27	**45G7**	908,7	249,76	1,22	1866	14,92	79,86	278	1491
27	**45G8**	947,2	566,79	1,72	3116	27,63	72,32	861	2254
27	**46G8**	884,8	397,04	1,05	3358	11,94	81,86	401	2748
27 Total		6058,5			14568			3937	9120
28	**43G8**	296,2	251,47	2,14	348	38,15	61,84	133	215
28 Total		296,2			348			133	215
29S	**46G9**	933,8	642,87	1,13	5302	14,38	58,99	762	3128
29S	**46H0**	933,8	1220,51	1,03	11055	5,40	89,23	597	9864
29S	**46H1**	921,5	745,40	0,47	14519	15,19	22,61	2206	3283
29S	**47G9**	876,2	1392,60	0,87	14044	18,62	60,91	2615	8555
29S	**47H0**	920,3	1502,86	0,62	22196	6,18	56,90	1371	12630
29S	**47H1**	920,3	1199,93	1,08	10213	20,74	50,17	2118	5124
29S Total		5505,9			77330			9669	42584
Grand Total		19897,2			95972			15778	53548

Table 3.3.1 R/V Argos estimated number (millions) of herring, October 2002

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	**39G3**	427,71	298,22	44,27	19,37	42,20	13,86	7,18	1,16	1,44	
24	**39G4**	192,78	27,15	30,14	31,25	49,59	29,38	14,97	9,36		0,94
	Sum	620,49	325,37	74,41	50,62	91,80	43,24	22,15	10,52	1,44	0,94
25	**39G4**	105,54	14,86	16,50	17,11	27,15	16,08	8,20	5,12		0,51
25	**39G5**	92,64	11,56	11,83	16,36	22,26	16,08	9,36	3,62	1,23	0,34
25	**40G4**	53,51	10,99	4,97	13,81	10,99	6,83	4,01	1,58	0,33	
25	**40G5**	256,87	13,54	23,64	24,66	62,18	62,53	44,62	15,20	8,79	1,70
25	**40G6**	401,14	4,66	16,40	39,93	157,21	107,13	55,39	16,49	3,34	0,58
25	**40G7**	201,74		6,22	13,07	103,67	55,50	20,88	2,39		
25	**41G6**	153,53		1,77	14,52	57,52	47,36	25,04	7,32		
25	**41G7**	153,00	0,09	6,07	14,67	45,22	48,36	31,99	3,67	2,93	
	Sum	1417,95	55,70	87,40	154,12	486,19	359,88	199,48	55,40	16,63	3,14
27	**42G7**	390,66	0,44	22,85	35,62	103,72	124,83	86,89	5,99	10,33	
27	**43G7**	1241,68	167,17	68,42	226,89	396,24	186,03	126,34	35,16	31,48	3,94
27	**44G7**	413,48	121,76	110,97	116,48	35,79	24,65	3,46	0,37		
27	**44G8**	351,24	4,43	37,79	111,56	124,55	41,47	25,39	6,05		
27	**45G7**	278,50	174,73	38,46	37,08	23,04	5,19				
27	**45G8**	861,10	10,22	116,63	221,65	408,21	90,42	13,97			
27	**46G8**	400,83	398,80	2,03							
	Sum	3937,48	877,55	397,14	749,29	1091,55	472,58	256,05	47,57	41,80	3,94
28	**43G8**	132,61	2,35	1,41	0,47	39,03	72,79	14,48	1,60	0,47	
	Sum	132,61	2,35	1,41	0,47	39,03	72,79	14,48	1,60	0,47	
29S	**46G9**	762,27	132,77	96,95	137,26	321,20	65,24	8,84			
29S	**46H0**	596,76	358,17	14,38	78,30	104,00	29,67	12,24			
29S	**46H1**	2206,03	2206,03								
29S	**47G9**	2615,07	2386,37	68,60	68,58	57,94	33,57				
29S	**47H0**	1370,86	592,48	166,79	286,20	211,91	108,46	5,01			
29S	**47H1**	2118,25	557,82	222,98	468,34	663,80	205,33				
	Sum	9669,24	6233,64	569,70	1038,69	1358,85	442,27	26,09			
Total		15777,77	7494,61	1130,06	1993,19	3067,42	1390,77	518,26	115,09	60,35	8,02

Table 3.3.2 R/V Argos estimated mean weights (g) of herring, October 2002

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	39G3	34,2	10,0	31,9	61,6	66,9	85,4	77,8	64,0	87,5	
24	39G4	45,2	9,4	32,8	54,9	69,1	60,6	55,9	81,6		99,0
25	39G4	45,2	9,4	32,8	54,9	69,1	60,6	55,9	81,6		99,0
25	39G5	48,2	10,6	30,0	51,4	62,3	64,3	67,5	82,7	62,3	138,5
25	40G4	48,8	10,7	31,4	52,9	67,5	67,9	83,0	102,4	48,0	
25	40G5	51,1	14,5	22,9	39,3	47,9	63,8	64,8	64,2	67,0	178,0
25	40G6	48,5	14,5	23,6	41,5	45,1	56,2	58,9	62,6	67,0	178,0
25	40G7	44,4		30,0	48,4	41,2	47,3	44,0	60,5		
25	41G6	48,9		21,7	37,9	46,8	55,2	58,5	61,8		
25	41G7	43,9	15,0	22,6	34,0	39,7	51,2	53,8	61,3	52,0	
27	42G7	41,3	15,0	22,8	31,6	34,5	49,3	52,0	60,7	52,0	
27	43G7	25,5	4,5	15,3	28,1	31,7	39,2	40,6	54,7	45,3	47,0
27	44G7	17,7	4,9	14,2	22,0	31,5	31,9	42,7	64,0		
27	44G8	24,9	5,0	16,0	20,8	28,6	32,9	35,6	36,0		
27	45G7	15,0	4,7	13,5	21,7	25,9	29,0				
27	45G8	23,2	3,9	15,8	23,2	29,2	33,4	34,8			
27	46G8	4,5	4,4	6,0							
28	43G8	38,1	4,6	13,3	21,0	38,7	42,4	42,1	61,5	69,0	
29S	46G9	18,2	3,9	15,8	23,7	27,5	32,3	37,7			
29S	46H0	12,4	4,1	16,5	22,8	25,9	31,0	31,3			
29S	46H1	3,5	3,5								
29S	47G9	13,0	3,7	16,9	22,6	29,6	28,3				
29S	47H0	18,3	4,8	28,4	23,1	27,4	29,0	36,0			
29S	47H1	16,4	4,2	15,5	23,4	27,3	29,2				

Table 3.3.3 R/V Argos estimated number (millions) of sprat, October 2002

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	**39G3**	735,91	44,64	450,96	49,47	83,84	27,02	51,04	9,93	5,89	13,12
24	**39G4**	25,46	2,45	8,98	2,00	6,79	0,60	2,32	0,19	1,15	0,98
	Sum	761,37	47,09	459,93	51,47	90,63	27,62	53,36	10,12	7,04	14,10
25	**39G4**	13,94	1,34	4,91	1,09	3,72	0,33	1,27	0,10	0,63	0,54
25	**39G5**	77,47	1,11	17,00	10,00	22,03	2,98	15,64	0,35	2,84	5,52
25	**40G4**	163,06	1,83	40,81	7,83	49,37	10,38	28,97	0,91	9,11	13,85
25	**40G5**	277,96		33,96	57,05	76,07	11,11	82,80	1,46	5,85	9,65
25	**40G6**	157,89		22,39	16,56	40,97	9,16	35,16	8,80	16,04	8,83
25	**40G7**	56,45		6,97	4,40	21,94	6,95	9,17	2,24	3,90	0,88
25	**41G6**	19,58		4,66	0,55	3,66	0,30	3,67	1,99	2,69	2,05
25	**41G7**	101,10	0,17	13,73	7,99	28,01	8,22	20,82	3,66	12,45	6,05
	Sum	867,45	4,44	144,44	105,49	245,77	49,44	197,49	19,51	53,52	47,36
27	**42G7**	458,62	0,84	34,27	44,98	145,38	55,03	101,07	2,06	58,99	16,00
27	**43G7**	520,43	0,68	37,34	122,09	164,55	12,49	96,74	45,37	33,78	7,40
27	**44G7**	1340,93	16,41	125,40	304,13	616,37	14,32	114,63	48,04	28,82	72,81
27	**44G8**	306,92		7,04	39,30	124,71	16,98	56,29	34,94	19,41	8,25
27	**45G7**	1490,58	262,19	47,58	463,20	456,40	62,15	100,02		33,66	65,38
27	**45G8**	2253,73		119,47	482,93	668,66	378,29	330,83	29,34	185,58	58,63
27	**46G8**	2748,42	873,53	362,20	475,12	732,91	119,31	55,39	74,57	55,39	
	Sum	9119,64	1153,64	733,29	1931,74	2908,98	658,58	854,97	234,31	415,64	228,49
28	**43G8**	214,96	0,82	8,20	38,56	63,67	52,18	29,87	17,23		4,43
	Sum	214,96	0,82	8,20	38,56	63,67	52,18	29,87	17,23		4,43
29S	**46G9**	3128,15	723,82	89,05	412,22	569,17	162,34	719,43	167,04	180,69	104,38
29S	**46H0**	9864,38	4468,09	787,67	690,54	1172,84	450,91	995,83	441,97	441,97	414,55
29S	**46H1**	3282,87	3174,02	9,08	24,19	9,08		27,21	30,25	9,06	
29S	**47G9**	8554,62	3525,64	813,97	979,87	1980,52	31,10	565,10		134,79	523,63
29S	**47H0**	12630,40	10238,29	478,41	526,26	392,32	114,82	516,70	95,68	95,68	172,24
29S	**47H1**	5123,92	1512,53	182,44	390,19	1122,71	255,61	679,57	377,69	235,63	367,55
	Sum	42584,34	23642,39	2360,61	3023,28	5246,64	1014,78	3503,84	1112,63	1097,83	1582,34
Total		53547,76	24848,38	3706,48	5150,54	8555,69	1802,60	4639,52	1393,80	1574,03	1876,72

Table 3.3.4 R/V Argos estimated mean weights (g) of sprat, October 2001

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	39G3	11,8	5,0	11,9	14,3	15,0	17,3	16,6	18,8	18,0	17,3
24	39G4	12,9	5,7	11,5	14,0	17,1	19,0	16,8	21,0	17,0	14,5
25	39G4	12,9	5,7	11,5	14,0	17,1	19,0	16,8	21,0	17,0	14,5
25	39G5	13,5	5,5	11,1	14,0	15,9	17,0	15,9	19,0	16,6	15,7
25	40G4	13,5	4,5	10,9	13,0	14,6	15,0	15,8	18,0	16,5	16,3
25	40G5	14,3		10,8	14,2	15,4	17,0	15,5	18,0	16,0	16,0
25	40G6	14,5		11,3	13,3	14,8	17,1	16,0	14,4	15,9	14,3
25	40G7	14,7		11,7	13,0	14,4	16,3	16,9	14,0	16,3	13,0
25	41G6	14,5		11,8	11,0	14,3	19,0	15,9	13,3	15,7	14,0
25	41G7	13,3	5,5	11,0	10,6	12,7	15,2	14,6	15,3	14,8	14,8
27	42G7	12,7	5,5	10,2	10,5	12,2	13,3	13,9	17,3	13,9	15,3
27	43G7	11,3	4,0	8,7	10,5	11,1	13,8	12,1	11,0	11,9	15,0
27	44G7	10,4	4,0	8,5	10,7	11,0	12,3	12,9	12,0	11,7	13,3
27	44G8	11,5		8,3	10,0	10,8	12,0	12,6	13,0	13,0	14,0
27	45G7	7,8	3,4	8,3	9,9	11,0	10,0	11,5		12,3	12,5
27	45G8	12,2		10,0	10,4	11,1	11,8	13,7	14,0	13,5	14,2
27	46G8	7,3	3,0	9,0	10,0	11,1	10,0	12,0	12,5	12,0	
28	43G8	11,3	3,0	8,8	10,4	10,9	12,5	13,0	12,0		14,3
29S	46G9	8,5	2,9	8,6	10,5	11,0	10,8	12,0	12,2	12,5	12,8
29S	46H0	7,9	2,9	9,3	10,6	11,6	12,5	11,6	12,0	11,7	13,2
29S	46H1	4,9	2,4	10,0	10,0	10,0		12,7	10,7	14,0	
29S	47G9	7,1	2,8	9,0	10,3	10,2	13,0	12,2		12,5	12,0
29S	47H0	6,9	2,7	9,1	11,2	11,7	12,0	11,8	13,0	13,0	11,0
29S	47H1	7,2	2,5	9,2	10,5	10,8	11,0	11,1	12,2	12,3	11,8

Table 3.3.5 Estimated biomass (in tonnes) of herring October 2002

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	**39G3**	14635	2975	1412	1192	2822	1183	558	74	126	
24	**39G4**	8705	254	987	1714	3428	1782	836	764		93
	Sum	23341	3229	2400	2907	6250	2965	1395	838	126	93
25	**39G4**	4766	139	540	939	1877	975	458	418		51
25	**39G5**	4465	123	355	842	1387	1033	631	300	77	48
25	**40G4**	2610	118	156	730	742	464	333	161	16	
25	**40G5**	13114	196	542	969	2979	3988	2892	976	589	302
25	**40G6**	19467	68	386	1656	7094	6026	3261	1033	224	104
25	**40G7**	8953		187	632	4276	2625	919	145		
25	**41G6**	7507		38	550	2694	2616	1464	452		
25	**41G7**	6715	1	137	499	1794	2475	1722	225	152	
	Sum	67595	645	2341	6816	22841	20203	11680	3710	1058	505
27	**42G7**	16145	7	521	1127	3583	6150	4521	363	537	
27	**43G7**	31681	752	1047	6366	12548	7289	5134	1922	1427	185
27	**44G7**	7330	601	1571	2559	1128	787	148	24		
27	**44G8**	8753	22	605	2315	3568	1363	903	218		
27	**45G7**	4171	825	520	804	598	150				
27	**45G8**	20012	40	1843	5140	11933	3020	485			
27	**46G8**	1792	1764	12							
	Sum	89884	4011	6119	18311	33357	18759	11190	2527	1964	185
28	**43G8**	5054	11	19	10	1511	3089	610	98	32	
	Sum	5054	11	19	10	1511	3089	610	98	32	
29S	**46G9**	13859	523	1529	3256	8837	2104	333			
29S	**46H0**	7419	1462	237	1787	2697	920	383			
29S	**46H1**	7644	7644								
29S	**47G9**	33996	8800	1159	1547	1714	948				
29S	**47H0**	25121	2864	4742	6605	5810	3145	180			
29S	**47H1**	34685	2343	3461	10942	18112	5989				
	Sum	122723	23636	11127	24137	37169	13106	897			
Total		308597	31531	22006	52181	101130	58122	25772	7173	3181	783

Table 3.3.6 Estimated biomass (in tonnes) of sprat October 2002

Subd.	Rect.	Total	0	1	2	3	4	5	6	7	8+
24	**39G3**	8720	221	5367	707	1258	466	846	187	106	227
24	**39G4**	327	14	104	28	116	11	39	4	20	14
	Sum	9047	235	5471	735	1374	478	885	191	126	242
25	**39G4**	179	8	57	15	63	6	21	2	11	8
25	**39G5**	1043	6	189	140	349	51	249	7	47	86
25	**40G4**	2201	8	445	102	721	156	459	16	150	226
25	**40G5**	3974		366	808	1174	189	1283	26	94	154
25	**40G6**	2288		254	220	604	157	562	127	255	126
25	**40G7**	830		81	57	317	113	155	31	64	11
25	**41G6**	284		55	6	52	6	58	26	42	29
25	**41G7**	1349	1	151	85	356	125	303	56	184	89
	Sum	12148	23	1598	1434	3637	802	3091	292	847	730
27	**42G7**	5832	5	348	472	1775	729	1409	36	817	245
27	**43G7**	5903	3	325	1282	1820	172	1167	499	401	111
27	**44G7**	13949	66	1066	3244	6809	175	1474	576	336	967
27	**44G8**	3530		59	393	1344	204	708	454	252	115
27	**45G7**	11691	878	397	4581	5020	621	1150		415	817
27	**45G8**	27383		1195	5022	7400	4476	4521	411	2505	831
27	**46G8**	20137	2621	3260	4751	8123	1193	665	932	665	
	Sum	88425	3572	6649	19745	32292	7571	11094	2908	5392	3087
28	**43G8**	2422	2	72	401	692	652	388	207		64
	Sum	2422	2	72	401	692	652	388	207		64
29S	**46G9**	26435	2072	769	4328	6261	1745	8633	2038	2259	1331
29S	**46H0**	77600	12766	7321	7320	13605	5636	11523	5304	5156	5458
29S	**46H1**	16162	7708	91	242	91		345	323	127	
29S	**47G9**	60674	9872	7326	10044	20245	404	6894		1685	6284
29S	**47H0**	87150	27848	4374	5894	4577	1378	6071	1244	1244	1895
29S	**47H1**	36818	3781	1678	4097	12177	2812	7543	4595	2887	4349
	Sum	304839	64047	21559	31925	56956	11975	41010	13503	13357	19317
Total		416880	67879	35349	54240	94952	21478	56467	17101	19722	23439

Figure 2.3.1. Survey grid and trawl positions of R/V Argos

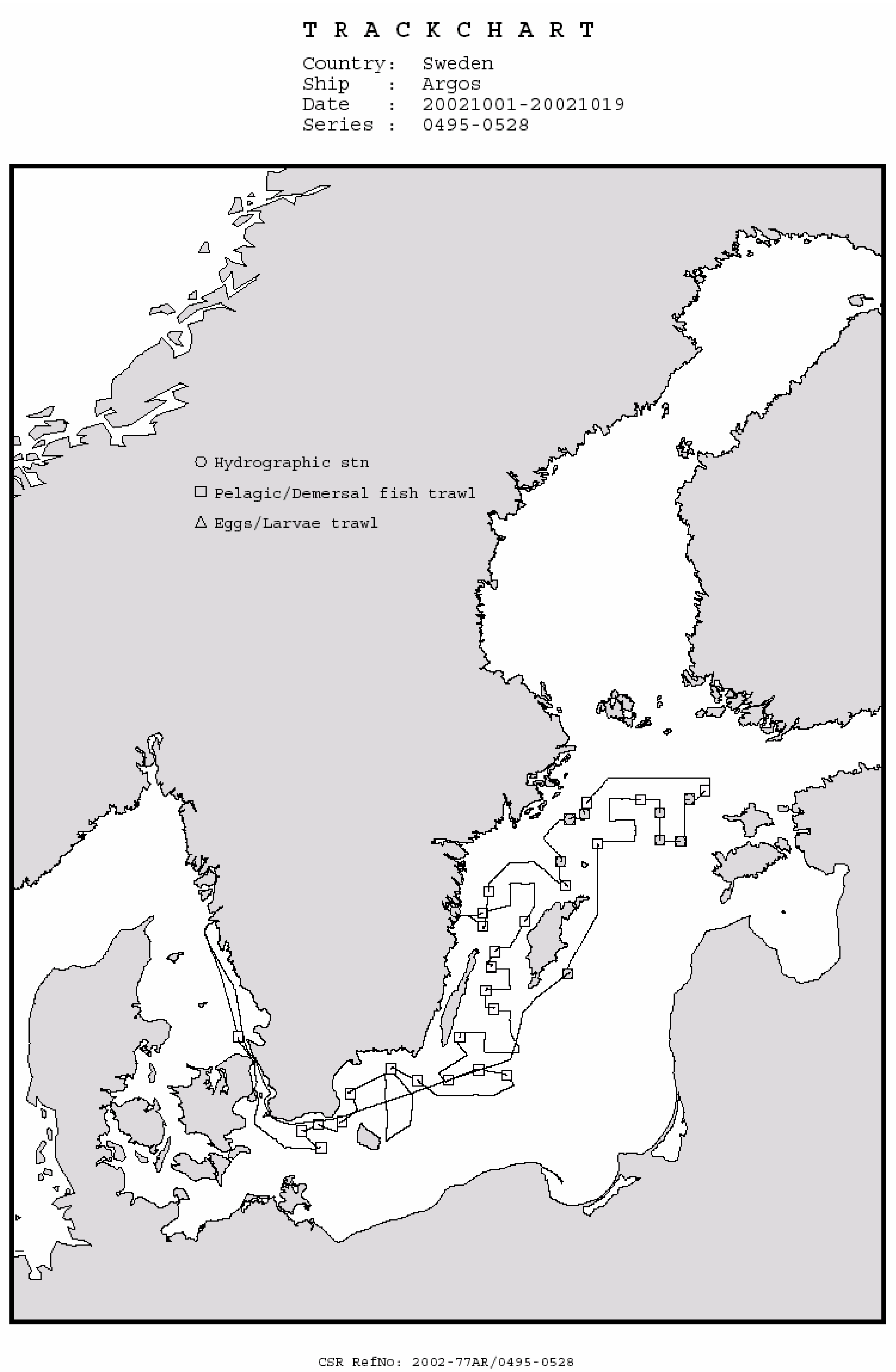
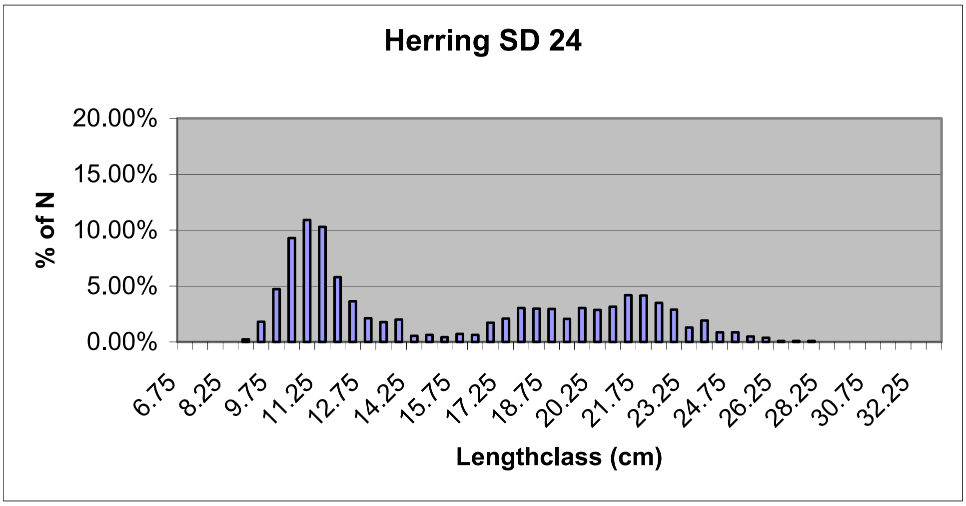
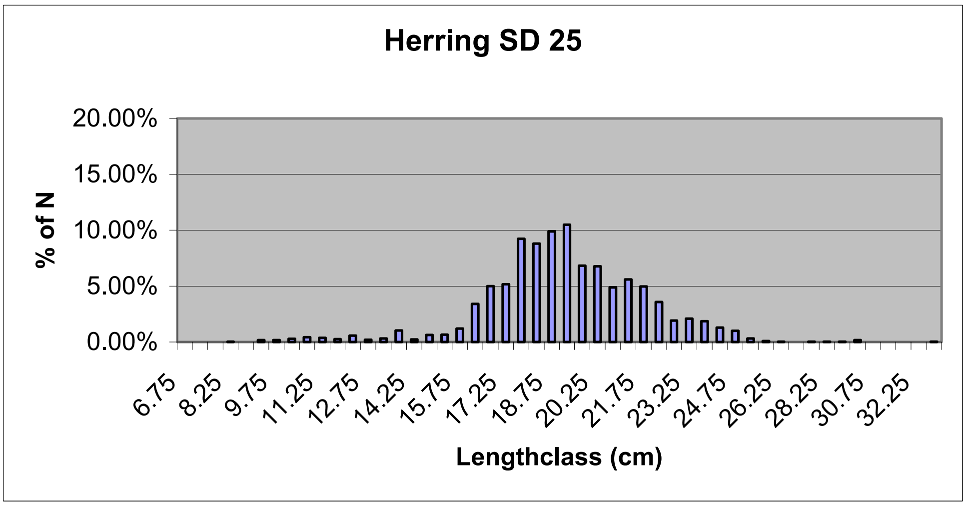


Figure 3.1.1 Length distribution of herring, October 2002





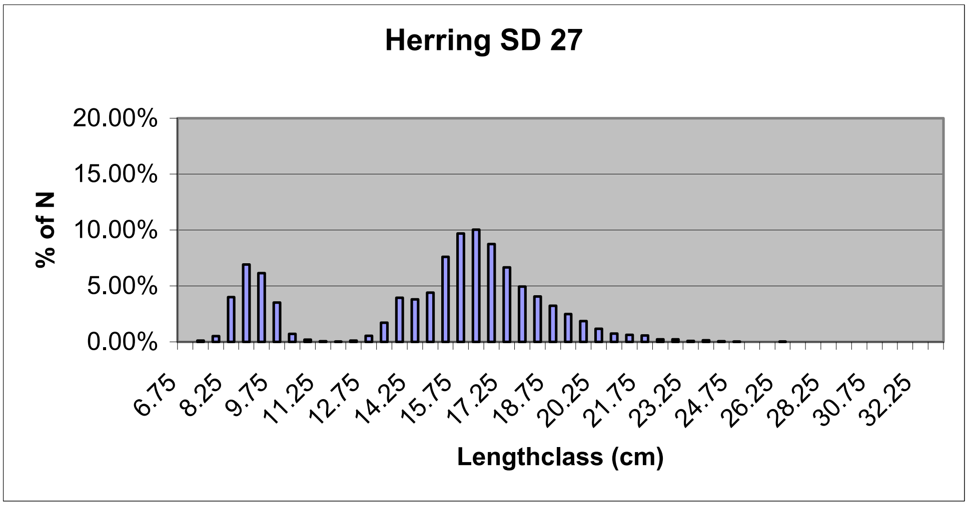
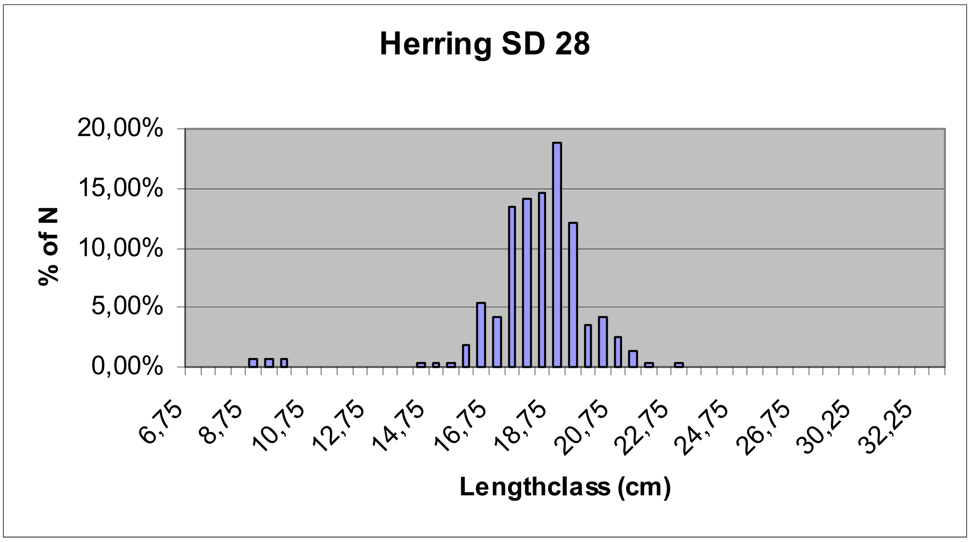


Figure 3.1.1 Length distribution of herring, October 2002 (continued)



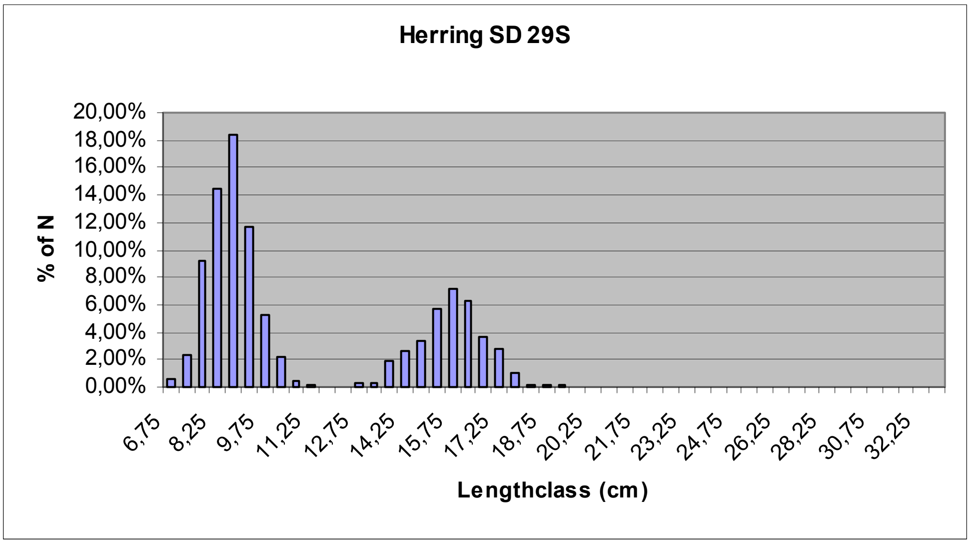


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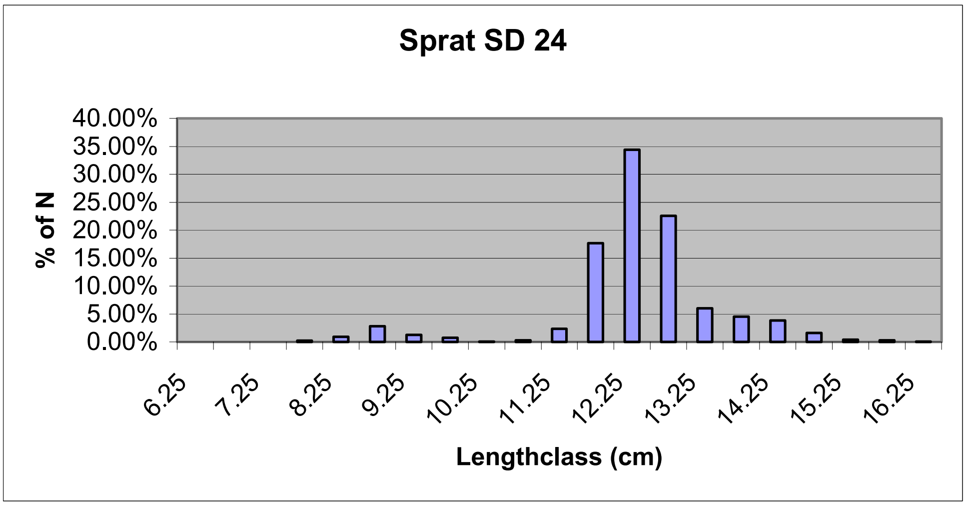
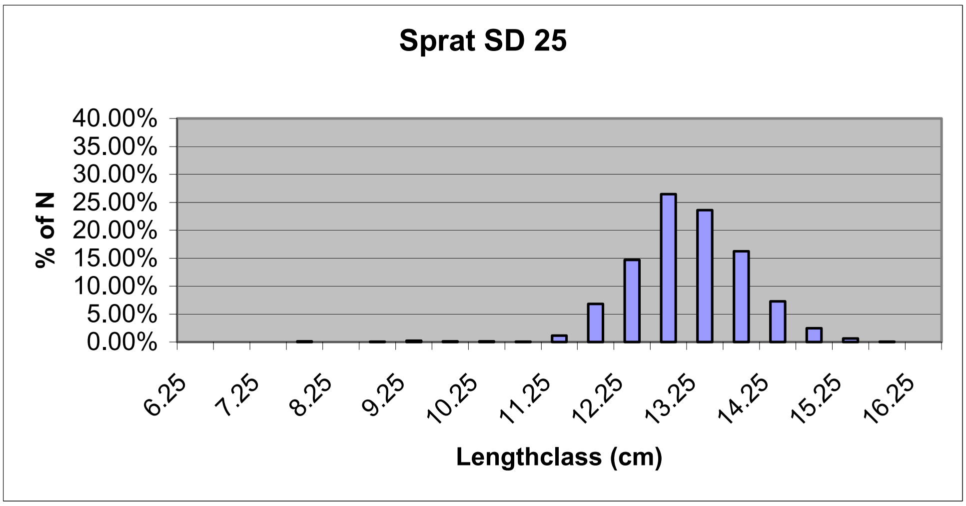
Figure 3.1.2 Length distribution of sprat, October 2002





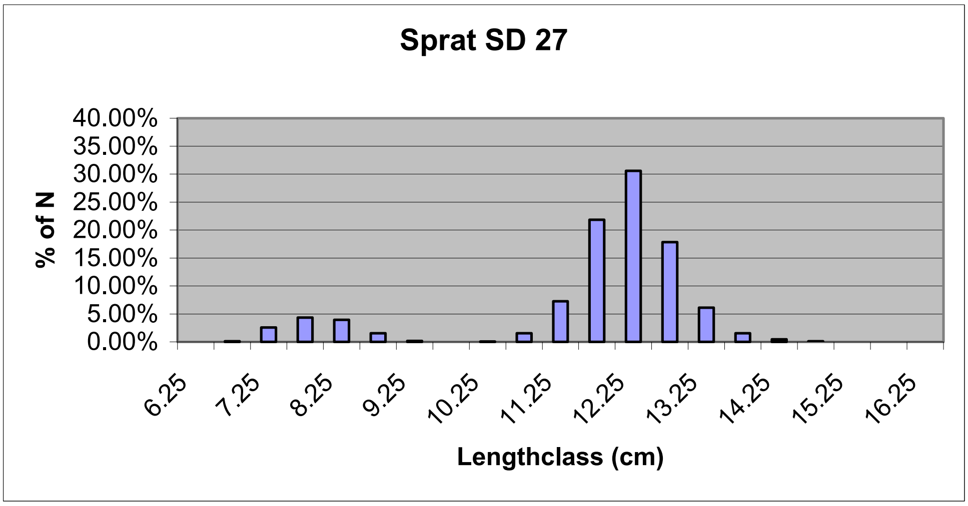
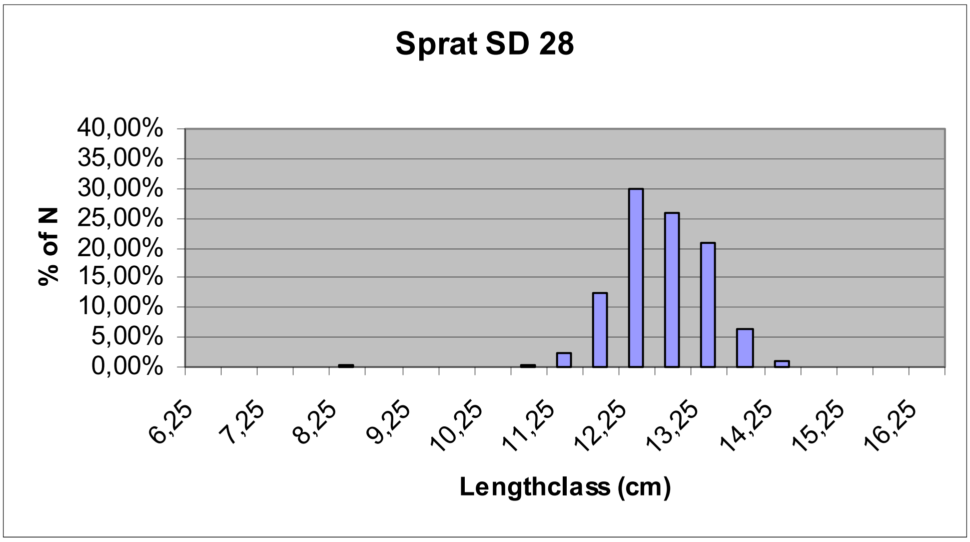
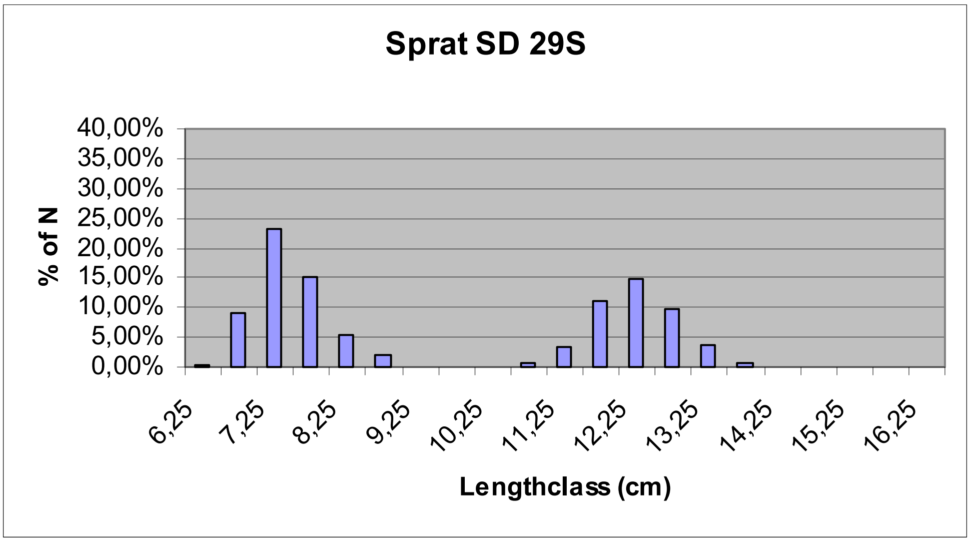


Figure 3.1.2 Length distribution of sprat, October 2002 (continued)





Annex 2

Survey Report for RV "Walther Herwig III" 03.05.-21.05.2002

Federal Research Centre for Fisheries, Germany
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1 INTRODUCTION

The main objective of the survey was to assess the pelagic fish stocks in the south-western part of the central Baltic Sea. Related to the project "Trophic interactions between zooplankton and fish under the influence of physical processes" (GLOBEC Germany), the following further 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 as well as of zoo- and ichthyoplankton (this investigations were carried out together with the RV "Heincke" on one track in the Bornholm basin)
- 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
- Zooplancton sampling in the shallow fringe area of the Bornholm basin
- In situ experiments on egg production rates of copepods

2 METHODS

2.1 Personnel

Dr. Uwe Böttcher (Chief Scientist)	Institute for Baltic Sea Fishery Rostock
Eberhard Götze	Institute for Fishery Technology
Michael Drenkow	Institute for Fishery Technology
Rosi Hinrichs	Baltic Sea Research Institute Warnemünde
Dagmar Stephan	Institute for Baltic Sea Fishery Rostock
Christel Walther	Institute for Baltic Sea Fishery Rostock
Vroni Schildhauer	Institute for Baltic Sea Fishery Rostock
Daniel Stepputtis	Institute of Marine Science Kiel
Hans-Harald Hinrichsen	Institute of Marine Science Kiel
Cornelia Albrecht	Institute for Baltic Sea Fishery Rostock
Heike Pieper	Universität Rostock
Christine Henschel	Universität Rostock

2.2 Narrative

The 239th cruise of RV “Walther Herwig” took place from the 5th to the 21th of May in 2002 and represents the third May-Survey since 1999. This hydroacoustic survey covered the whole Sub-divisions 24, 25, the western part of Sub-division 26 and small parts of Sub-divisions 27 and 28 (Figure 1). The standard hydroacoustic investigations took place between 4:00 and 18:00 UTC (6:00 and 20:00 local time). The main pelagic species of interest were sprat and herring.

Three nights were used for further small-scale oceanographic investigations. The daily vertical migration of sprat in relation to small scale distribution patterns of hydrographical parameters was further on investigatad during three days. This program was carried out in the central part of the Bornholm Basin. RV "Heinke” complemented the program by an intensive plankton sampling along the hydroacoustic track of the RV “Walther Herwig” during one day (Figure 2).

Due to problems with the net sonde during the last two days, a proper fishing was not possible in the Sub-division 24.

2.3 Survey design

ICES statistical rectangles were used as strata (ICES 2001/H:02 Ref.: D: Annex 2). 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 the special topographical characteristics of the Arkoan Basin this area was covered by modified transects. The cruise track and the position of trawl hauls are shown in Figure 1 and 2.

2.4 Calibration

The hull mounted transducer ES38B was calibrated on the first day of the cruise near Bornholm. The calibration procedure was carried out as described in the ‘Manual for the Baltic International Acoustic Surveys (BIAS)’ (ICES 2001/H:02 Ref.: D: Annex 2).

2.5 Acoustic data collection

The acoustic equipment was an echosounder EK500 on 38 kHz. The echo telegrams were continuously recorded with the Bergen Integrator BI500. The specific settings of the hydroacoustic equipment were used as described in the ‘Manual for the Baltic International Acoustic Surveys (BIAS)’ (ICES 2001/H:02 Ref.: D: Annex 2).

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 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’ 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 frosted for further investigations in the lab (i.e. sex, maturity, age).

Further investigations were undertaken in the central part of the Bornholm Basin to estimate the vertical day/night migration of fish in connection with the small-scale distribution of hydrographic parameters. Fishing hauls as well as hydroacoustic and oceanographic measurements were carried out in different depths within a box of about 5 x 5 miles. Two days were used for this program (15th and 17th May).

A further day (16th May) was used for joint investigations with the RV “Heincke”. During this day RV “W. Herwig” measured the hydroacostic parameters in fourfold sequence along a transect of 24 miles. In the same time RV "Heinke” complemented this program by an intensive plankton sampling along this hydroacoustic track.

2.7 Hydrographie

Vertical profiles of hydrographic parameters were measured with a CTD-probe about every 15 miles on the hydroacoustic transects. The measurements were carried out at least after every fishing station. The probe was supplemented by additional sensors on oxygen, fluorescence and light. The profiles covered the entire water column up to about 2 m above the sea bottom.

The small-scale hydrographic measurements were carried out with a CTD-probe towed at 4 knots. Thereby the water column was sampled continuously by heaving and loosing the probe from the surface to about 5 m of the sea bottom.

2.8 Data analysis

The echo integration, i.e. the allocation of the area backscattering strength (Sa) to the fish species level was done by a 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.

The pelagic target species sprat and herring are usually distributed in mixed layers in combination with other species so that it was impossible to allocate the integrator readings to a single species. Therefore the species composition was based on 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 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 (nm^2), 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 Acoustic data

The cruise track of the standard survey reached in total a distance of 1124 nautical miles. Additional hydroacoustic investigations together with small-scale hydrographic measurements were carried out on a track of 190 nm.

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 Sub-division/rectangle are shown in Table 1.

The Sa-values were unequal distributed over the investigated area. Elevated values were found in the Gdansker deep, the southern middle bank and in the northern and central Bornholm basin (Figure 7).

5% of all ESDU (**E**lementary **S**ampling **D**istance **U**nit) were characterised by zero Sa-values and about 16% reached more then 1000. The mean Sa-value was 541 m^2/nm^2. The main scatter objects were small shoals with a diameter of few meters. In deeper basins these shoals were found in a narrow layer at about a depth of 50 to 80 m.

3.2 Biological data

In total 57 hauls were taken with a pelagic trawl, 38 hauls were related to the standard survey, 19 hauls to day/night investigations. Samples of 666 herring and 473 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 Sub-division are presented in Table 2. In general the catch composition was dominated by sprat. Only in two rectangles the share of herring exceeded 2 percent. Most of the herring was caught in the deep between the northern and southern part of the middle bank, around Bornholm and near the polish coast. The share of cod numbers in the total catch amounted to 341.

The length distributions of herring and sprat by Sub-division are presented in Figure 3. For both herring and sprat, the mean length decreased from the western (Sub-division 25) to the eastern part of the survey area (Sub-divisions 26, 27 and 28). The survey statistics are summarised in Table 1 including information about the abundance estimates of the pelagic fish species by rectangle.

Sprat was predominantly distributed in the deeper parts of the area in a thin layer below the cold intermediate water. The lower distribution border of sprat was determined by oxygen deficit in the deep water. The nocturnal upward migration of sprat was obviously more extensive in areas without an intermediate cold water layer, which is characterised by temperatures < 4 °C.

3.3 Abundance estimates

The sprat stock was estimated to be 69.1 x 10^9 fish or about 680,500 tonnes (excluding Sub-division 24). The highest sprat concentration was found in the northern part of Sub-division 25. About 31 percent of the estimated sprat biomass was found in two rectangles in this area (Tables 6 - 8, Figures 4, 5, 7).

The age composition was dominated by age group 3 (30 %) followed by age groups 4 and 2 (25 % and 17 %, respectively). The area with the highest sprat biomass in the northern Bornholm basin was characterised by a distinct higher fraction of age group 1.

The estimated number of herring was 0.5 x 10^9 fish or 21,200 tonnes (Tables 3 - 5).

3.4 Hydrographic data

The hydrographical situation was characterised by a typical spring situation with surface temperatures between 5.0 – 8.2 °C. In the southern part of the area a distinct thermocline occurred between 15 and 20 m separating the surface layer from the cold winter water. North of the Latitude 55° 30’ N this thermocline was weaker developed or even missing.

A temperature minimum of about 3 to 5 °C was found in the vertical profiles just above the permanent halocline. The depth of the permanent halocline ranged between 20 – 40 m in the Arkona Basin, 50 – 60 m in the Bornholm Basin and 65 – 80 m in the western Gotland See. The maximum salinity was determined to be:

12.5 psu at 7.9 °C (water depth 40 m) in the Arkona Basin,

15.6 psu at 8.8 °C (water depth 85 m) in the Bornholm Basin,

11.0 psu at 5.9°C (water depth 114 m) in the western Gotland Sea.

Below the halocline the oxygen content decreased rapidly. In the Bornholm Basin the oxygen content was lower then 2 ml/l in water layers deeper then 70 - 75 m. In the western Gotland Sea this border was situated at a depth of about 80 m. A deepwater layer with more than 2 ml/l was found in the western Gotland Sea below 85 m.

4 DISCUSSION

Comparable acoustic surveys were performed in May/June 1999 and 2001 in the southern Baltic.

In all years the overall results reached about the same level. A mean Sa of 522 m²/nm² was observed in Sub-division 24 -28 in 1999. In 2001 and 2002 the according mean Sa was 464 m²/nm² and 587 m²/nm², respectively. The estimated abundance of sprat was 61.7 billion in 1999, 51.8 billion in 2001 and 69.1 billion in 2002.

A similar horizontal distribution of sprat was found in 1999 and 2001. This distribution was characterised by increasing numbers of sprat from west to east. In 2002 34 % of the individuals were concentrated in two rectangles of the northern Bornholm basin.

The main fraction in 2002 were 3 year old sprat (20.1 billion in numbers). In most rectangles the fraction of 1 year old sprat does not exceed 5 %. Only in two rectangles, one in the northern and one central Bornholm basin, 1 year old sprat reached more then 20 %.

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

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:02 Ref.: D.

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

Table 1: Survey statistics RV "W. Herwig III" in May 2002.

Sub-division	Rectangle	Area (nm²)	Sa (m²/nm²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
24	38G2	832.9	401.0						
24	38G3	865.7	333.0						
24	38G4	1034.8	214.0	1.686	1313.4	3.8	96.3	49.3	1264.1
24	39G2	406.1	317.0						
24	39G3	765.0	90.0						
24	39G4	524.8	195.0						
24	**Total**	**4429.3**	**258.2**						
25	37G5	642.2	475.0	1.624	1878.2	0.1	99.9	2.7	1875.5
25	38G5	1035.7	323.0	1.565	2137.7	1.5	98.5	32.8	2104.9
25	38G6	940.2	88.0	1.834	451.2	16.4	83.6	73.9	377.3
25	39G4	287.3	982.0	1.497	1884.0	1.2	98.8	21.9	1862.1
25	39G5	979.0	595.0	1.436	4056.7	1.1	98.9	45.9	4010.8
25	39G6	1026.0	792.0	1.320	6156.7	0.2	99.8	9.8	6147.0
25	39G7	1026.0	767.0	1.371	5738.5	0.3	99.8	14.6	5723.8
25	40G4	677.2	658.0	1.449	3075.2	1.6	98.4	48.6	3026.6
25	40G5	1012.9	1614.0	1.321	12373.2	0.1	99.9	16.4	12356.9
25	40G6	1013.0	1351.0	1.245	10993.2	0.2	99.8	21.3	10971.9
25	40G7	1013.0	382.0	1.477	2620.5	6.0	94.0	156.9	2463.6
25	41G6	764.4	102.0	1.377	566.3	0.5	99.5	3.0	563.4
25	41G7	1000.0	210.0	1.464	1434.6	0.3	99.7	4.7	1429.9
25	**Total**	**11416.9**	**640.3**		**53366.0**	**0.9**	**99.2**	**452.5**	**52913.5**
26	39G8	1026.0	824.0	1.393	6070.0	0.1	99.9	6.2	6063.7
26	40G8	1013.0	395.0	1.388	2882.8	0.0	100.0	1.0	2881.8
26	41G8	1000.0	260.0	1.343	1936.0	0.1	100.0	1.0	1935.0
27	42G7	986.9	425.0	1.358	3087.5	0.4	99.6	11.4	3076.1
28	42G8	945.4	324.0	1.396	2194.4	0.4	99.6	8.0	2186.4
all rect.	**Total**	**17423.0**	**3082.3**		**70850.0**	**5.5**	**694.5**	**529.5**	**70320.6**

Table 2: Catch composition (kg/0,5 h) per fishery station.

Sub-division 24							
rectangle	38G4	38G4	39G3	38G3	38G3	39G3	
Fish species/Station	**127**	**128**	**135**	**138**	**141**	**144**	**Total**
CLUPEA HARENGUS	4.69	8.06	0.26	0.35	49.57	8.91	**71.83**
CYCLOPTERUS LUMPUS							**0.00**
GADUS MORHUA	9.78				3.50	4.39	**17.67**
MERLANGIUS MERLANGUS					1.80		**1.80**
PLATICHTHYS FLESUS	0.17	0.17			0.96		**1.29**
SPRATTUS SPRATTUS	62.30	92.00	2.57	2.04	174.05	4.95	**337.91**
SCOMBER SCOMBRUS							**0.00**
Total	**76.93**	**100.23**	**2.83**	**2.39**	**229.88**	**18.25**	**430.49**

Sub-division 25																							
rectangle	39G7	40G7	41G7	41G7	40G7	39G7	39G6	40G6	41G6	40G6	39G6	38G6	37G5	38G5	39G5	40G5	38G5	39G5	40G5	40G4	40G4	40G4	
Fish species/Station	**25**	**27**	**29**	**36**	**38**	**40**	**44**	**46**	**49**	**51**	**53**	**56**	**60**	**61**	**63**	**65**	**69**	**71**	**73**	**78**	**81**	**82**	**Total**
CLUPEA HARENGUS	1.60	1.19		0.25	94.88	16.08	2.19	20.02	10.09	2.84	13.63	4.02	6.80	4.94	7.27	11.03	20.32	33.13	13.24	47.66	40.00	33.30	**384.43**
GADUS MORHUA						6.54	0.49	0.12			44.50		2.40	6.08	36.56	36.10	1.36	0.92	2.44	12.36	5.97	15.73	**171.56**
GASTEROSTEUS ACULEATUS			0.001																				**0.00**
LAMPETRA FLUVIATILIS																					0.02		**0.02**
MERLANGIUS MERLANGUS																				0.06			**0.06**
SPRATTUS SPRATTUS	339.60	1264.40	0.001	27.80	176.60	793.10	424.48	1510.30	265.10	706.30	1313.20	1.73	1869.35	459.10	756.60	1612.30	133.00	298.00	1675.40	959.00	418.00	456.00	**15459.36**
SCOMBER SCOMBRUS											0.21												**0.21**
ZOARCES VIVIPARUS															0.11								**0.11**
Total	**341.20**	**1265.59**	**0.002**	**28.05**	**271.48**	**815.72**	**427.16**	**1530.44**	**275.19**	**709.14**	**1371.54**	**5.75**	**1878.55**	**470.12**	**800.54**	**1659.43**	**154.68**	**332.05**	**1691.08**	**1019.08**	**463.99**	**505.03**	**16015.74**

Sub-division 26							
rectangle	39G8	40G8	41G8	41G8	40G8	39G8	
Fish species/Station	**4**	**6**	**8**	**18**	**20**	**22**	**Total**
CLUPEA HARENGUS	8.31	1.06	1.95	0.45	1.31	0.08	**13.15**
CYCLOPTERUS LUMPUS							**0.00**
GADUS MORHUA		0.24	0.17		0.38		**0.41**
GASTEROSTEUS ACULEATUS			0.00				**0.00**
PLATICHTHYS FLESUS			0.44				**0.44**
SPRATTUS SPRATTUS	945.67	805.30	603.50	878.20	865.90	840.30	**4938.87**
Total	**953.98**	**806.60**	**606.06**	**878.65**	**867.59**	**840.38**	**4953.25**

Sub-division 27/28					
rectangle	42G8	42G8	42G7	42G7	
Fish species/Station	**10**	**16**	**31**	**34**	**Total**
CLUPEA HARENGUS	0.74	4.89	1.59	10.94	**18.15**
CYCLOPTERUS LUMPUS	0.11				**0.11**
GADUS MORHUA					**0.00**
GASTEROSTEUS ACULEATUS	0.01	0.00	0.06		**0**
PLATICHTHYS FLESUS	0.09				**0.09**
SPRATTUS SPRATTUS	515.72	295.90	83.00	1016.50	**1911.12**
Total	**516.65**	**300.79**	**84.65**	**1027.44**	**1929.52**

Sub-division 25 (day/night investigations)																			
rectangle	39G6	40G6	40G6	39G6	40G6	39G6	39G6	39G6	40G6	40G6	40G6	40G6	39G6	39G6	39G6	39G6	40G6	40G6	39G6	
Fish species/Station	**86**	**88**	**90**	**92**	**94**	**96**	**98**	**100**	**102**	**103**	**105**	**106**	**108**	**110**	**112**	**114**	**116**	**118**	**120**	**Total**
BELONE BELONE												0.39								**0.39**
CLUPEA HARENGUS	20.61	19.45	3.87	10.23	7.72	24.35	8.58	28.85	3.41	3.81	2.82	3.84	2.815	13.88	28.70	7.30	15.00	21.33	11.13	**237.69**
CYCLOPTERUS LUMPUS												0.32								**0.32**
GADUS MORHUA	5.50	4.38	3.04	7.90	10.00	7.09	62.50	28.30					0.76	5.82	13.24	6.54	2.44	10.66	0.98	**169.14**
GASTEROSTEUS ACULEATUS											0.002	0.01	0.005							**0.02**
MERLANGIUS MERLANGUS			0.15		0.11															**0.26**
PLATICHTHYS FLESUS																	0.185			**0.19**
POMATOSCHISTUS MINUTUS												0.005								**0.01**
SALMO SALAR												3.90								**3.90**
SCOMBER SCOMBRUS				0.10														0.082	0.096	**0.28**
SPRATTUS SPRATTUS	1052.95	1574.68	1542.43	209.00	933.39	526.74	119.90	115.00	21.30	46.50	8.80	6.10	7.20	102.60	102.50	61.30	123.00	228.00	156.00	**6937.39**
Total	**1079.06**	**1598.51**	**1549.48**	**227.23**	**951.22**	**558.18**	**190.98**	**172.15**	**24.71**	**50.31**	**11.622**	**14.565**	**10.78**	**122.30**	**144.44**	**75.14**	**140.63**	**260.07**	**168.21**	**7349.56**

Table 3 **Estimated numbers (millions) of herring (RV "W. Herwig III" May 2002).**

Sub-division	Rectangle	Age groups 1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	23.41	10.98	7.86	4.27	2.52	0.25			49.29
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	0.57	0.78	0.51	0.32	0.13	0.11	0.20	0.10	2.71
25	38G5	0.50	2.66	6.69	5.17	4.14	3.25	7.01	3.40	32.82
25	38G6	7.78	12.51	15.18	10.22	7.03	6.43	10.36	4.40	73.92
25	39G4	0.33	3.56	5.67	2.23	2.27	2.64	3.58	1.60	21.89
25	39G5	0.83	5.41	10.63	6.01	5.30	5.08	9.11	3.53	45.90
25	39G6	0.04	1.19	2.41	1.09	1.19	1.37	1.89	0.60	9.77
25	39G7	0.04	1.82	3.56	1.64	1.81	1.77	2.88	1.11	14.62
25	40G4	0.82	7.11	12.60	5.46	5.29	5.89	8.07	3.34	48.59
25	40G5	0.02	1.28	3.62	2.36	2.09	1.95	3.55	1.48	16.35
25	40G6	1.33	4.03	6.68	1.95	1.71	2.22	2.67	0.71	21.29
25	40G7	2.98	28.16	50.60	16.53	13.89	17.77	20.73	6.27	156.92
25	41G6	0.14	0.59	0.94	0.25	0.25	0.33	0.37	0.10	2.98
25	41G7		0.77	1.45	0.45	0.57	0.67	0.55	0.25	4.72
25	Total	**15.38**	**69.87**	**120.54**	**53.68**	**45.67**	**49.48**	**70.97**	**26.89**	**452.48**
26	39G8	0.13	1.38	2.41	0.25	0.87	0.19	0.60	0.41	6.22
26	40G8	0.05	0.16	0.44	0.10	0.09	0.05	0.06	0.07	1.01
26	41G8	0.05	0.17	0.40	0.09	0.15	0.04	0.09	0.04	1.02
26	Total	**0.23**	**1.71**	**3.25**	**0.44**	**1.11**	**0.28**	**0.75**	**0.52**	**8.25**
27	42G7	0.06	0.13	0.97		5.35	1.23	1.99	1.69	11.43
28	42G8	0.15	1.42	4.23		1.16	0.51	0.46	0.11	8.03
25-28	Total	**15.82**	**73.13**	**128.99**	**54.12**	**53.29**	**51.50**	**74.17**	**29.21**	**480.19**

Table 4 **Herring mean weight (g) per age group (RV "W. Herwig III" in June 2002)**

Sub-division	Rectangle	Age groups 1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	19.5	33.2	52.9	62.9	69.6	85.4			34.5
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	16.4	19.2	31.2	38.4	55.6	50.9	56.3	124.3	30.4
25	38G5	19.1	33.1	43.6	56.9	58.9	62.2	58.9	229.7	53.5
25	38G6	16.4	22.9	41.0	47.9	54.9	54.1	56.8	122.6	42.2
25	39G4	20.4	34.8	37.4	52.0	51.5	50.6	55.7	362.0	46.2
25	39G5	19.1	34.3	41.6	55.1	54.0	53.6	56.1	228.3	49.3
25	39G6	21.9	36.0	42.7	54.3	50.0	47.9	53.7	224.3	47.9
25	39G7	20.2	36.6	43.0	52.7	50.2	46.7	54.5	113.2	47.8
25	40G4	19.7	34.2	38.6	53.4	52.0	49.4	54.8	358.1	46.4
25	40G5	20.7	37.5	45.1	56.2	54.2	51.1	56.2	229.2	52.0
25	40G6	16.8	28.4	35.7	44.5	48.3	43.5	49.4	246.7	38.2
25	40G7	19.5	31.5	35.6	46.7	45.2	44.1	52.2	510.0	41.2
25	41G6	15.8	29.8	35.7	46.1	47.2	42.8	49.1	245.2	38.7
25	41G7		33.8	37.3	51.8	48.6	45.9	54.0	120.3	43.9
25	Total	**17.6**	**30.7**	**38.3**	**50.4**	**51.0**	**49.0**	**54.8**	**467.1**	**44.4**
26	39G8	17.2	34.0	38.7	39.0	47.1	56.7	54.6	216.8	41.6
26	40G8	17.2	31.5	35.6	37.7	44.2	51.0	57.4	152.8	39.3
26	41G8	19.6	22.5	35.7	39.4	43.9	55.5	54.9	55.1	37.4
26	Total	**17.7**	**32.6**	**37.9**	**38.8**	**46.5**	**55.5**	**54.9**	**219.0**	**40.8**
27	42G7	5.0	12.5	51.5		42.1	57.0	56.1	257.8	50.1
28	42G8	19.7	18.9	26.6		32.2	30.6	36.3	42.9	27.0

Table 5 **Herring total biomass (t) per age group (RV "W. Herwig III" in May 2002).**

Sub-division	Rectangle	Age groups 1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	457.0	364.4	415.7	268.4	175.3	21.4			1702
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	9.3	15.0	15.9	12.3	7.2	5.6	11.3	6.2	82.5
25	38G5	9.5	88.0	291.5	294.2	243.9	202.2	413.2	213.7	1755.9
25	38G6	127.4	286.4	622.2	489.3	386.2	347.6	588.7	268.3	3116.5
25	39G4	6.7	123.8	211.9	116.0	116.8	133.7	199.4	102.4	1011.1
25	39G5	15.9	185.7	442.5	331.2	286.1	272.5	511.1	218.7	2263.8
25	39G6	0.9	42.8	102.8	59.2	59.4	65.6	101.6	36.0	467.8
25	39G7	0.8	66.6	153.2	86.5	90.8	82.7	157.0	61.7	698.8
25	40G4	16.1	243.4	485.9	291.5	274.9	290.8	442.4	206.4	2252.1
25	40G5	0.4	48.0	163.2	132.5	113.2	99.6	199.5	93.2	849.7
25	40G6	22.3	114.5	238.7	86.9	82.6	96.6	131.9	41.6	814.1
25	40G7	58.2	885.6	1800.3	771.6	627.3	783.1	1082.9	461.8	6469.8
25	41G6	2.2	17.6	33.6	11.5	11.8	14.1	18.2	5.7	115.3
25	41G7		26.0	54.1	23.3	27.7	30.8	29.7	14.9	207.0
25	Total	**269.9**	**2143.4**	**4615.8**	**2706.0**	**2328.0**	**2424.9**	**3886.7**	**1730.4**	**20104.4**
26	39G8	2.2	46.9	93.3	9.8	41.0	10.8	32.8	23.0	259.0
26	40G8	0.9	5.0	15.7	3.8	4.0	2.6	3.4	5.0	39.7
26	41G8	1.0	3.8	14.3	3.5	6.6	2.2	4.9	2.2	38.2
26	Total	**4.1**	**55.8**	**123.3**	**17.1**	**51.6**	**15.5**	**41.1**	**30.3**	**336.8**
27	42G7	0.3	1.6	50.0		225.0	70.1	111.6	113.0	572.3
28	42G8	3.0	26.8	112.6		37.4	15.6	16.7	4.7	216.5
25-28	Total	**277.3**	**2227.6**	**4901.7**	**2723.1**	**2642.0**	**2526.1**	**4056.1**	**1878.4**	**21230.0**

Table 6 Estimated numbers (millions) of sprat (RV "W. Herwig III" in May 2002).

Sub-division	Rectangle	Age groups								
		1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	114.90	108.82	349.78	429.66	182.59	50.26	28.06		1264.07
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	47.13	121.20	267.93	602.23	577.04	133.29	126.71		1875.52
25	38G5	269.72	183.82	309.08	569.77	517.35	123.29	131.82		2104.86
25	38G6	11.71	63.06	92.55	99.44	73.97	17.25	19.33		377.32
25	39G4	97.38	248.57	518.06	529.15	306.90	64.49	97.57		1862.11
25	39G5	813.23	553.47	789.85	887.58	627.54	149.48	189.63		4010.77
25	39G6	1205.60	1179.86	1800.80	1187.18	444.78	101.47	227.26		6146.95
25	39G7	569.77	1207.58	1902.33	1272.94	460.40	101.82	209.00		5723.84
25	40G4	288.67	546.19	888.93	717.80	361.99	84.90	138.17		3026.64
25	40G5	3012.35	2189.92	3102.73	2380.84	1023.85	197.39	449.78		12356.86
25	40G6	3672.76	2125.36	2513.71	1604.63	619.05	151.16	285.19		10971.86
25	40G7	295.11	510.13	783.45	533.68	202.94	48.45	89.84		2463.59
25	41G6	103.16	99.70	135.32	103.07	72.73	23.01	26.38		563.35
25	41G7	42.17	246.25	442.64	393.32	197.31	39.79	68.37		1429.85
25	**Total**	**10428.76**	**9275.11**	**13547.38**	**10881.63**	**5485.85**	**1235.79**	**2059.05**		**52913.52**
26	39G8	107.65	1095.65	2525.17	1856.78	440.91	37.56			6063.72
26	40G8	99.91	474.97	1200.86	876.46	213.87	15.70			2881.77
26	41G8	105.57	433.13	750.01	526.41	112.18	7.69			1934.99
26	**Total**	**313.13**	**2003.75**	**4476.04**	**3259.65**	**766.96**	**60.95**			**10880.48**
27	42G7	90.28	1012.67	1162.60	690.99	113.30	6.23			3076.09
28	42G8	76.25	451.17	928.18	417.93	309.39	3.47			2186.39
25-28	**Total**	**10908.42**	**12742.70**	**20114.20**	**15250.20**	**6675.50**	**1306.44**	**2059.05**		**69056.48**

Table 7 Sprat mean weight (g) per age group (RV "W. Herwig III" in May 2002).

Sub-division	Rectangle	Age groups								
		1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	7.8	13.5	14.2	15.5	15.7	17.3	14.7		14.3
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	6.8	9.9	11.2	13.1	14.0	14.7	13.7		12.9
25	38G5	5.9	9.3	10.9	13.0	14.1	14.7	13.5		11.8
25	38G6	6.5	9.6	10.4	12.3	13.7	14.1	12.9		11.6
25	39G4	5.6	9.9	10.6	11.7	13.0	13.5	12.0		11.1
25	39G5	5.9	9.2	10.5	12.3	13.8	14.4	12.7		10.5
25	39G6	5.1	9.5	10.2	11.1	12.6	11.8	11.3		9.5
25	39G7	5.3	9.6	10.2	11.0	12.2	11.3	11.1		10.0
25	40G4	6.0	9.5	10.3	11.5	13.0	13.2	11.7		10.5
25	40G5	5.7	9.3	10.3	11.4	12.9	12.7	11.6		9.5
25	40G6	5.5	9.1	10.1	11.1	12.4	12.0	11.2		8.7
25	40G7	5.3	9.5	10.1	11.0	12.2	11.2	11.3		9.9
25	41G6	5.6	9.3	10.2	11.7	13.4	13.5	12.2		10.1
25	41G7	6.3	9.7	10.4	11.5	12.9	13.1	11.8		11.0
25	**Total**	**5.6**	**9.4**	**10.3**	**11.5**	**13.1**	**13.1**	**11.9**		**9.9**
26	39G8	4.5	9.1	9.9	10.3	10.9	12.3			9.9
26	40G8	4.6	8.9	10.0	10.4	11.1	12.3			9.8
26	41G8	4.6	8.6	9.8	10.1	10.9	12.3			9.4
26	**Total**	**4.6**	**8.9**	**9.9**	**10.3**	**11.0**	**12.3**			**9.8**
27	42G7	4.1	8.3	10.5	11.1	9.1	13.5			9.6
28	42G8	19.7	18.9	26.6		32.2	30.6	36.3	42.9	27.0

Table 8 Sprat total biomass (t) per age group (RV "W. Herwig III" in May 2002).

Sub-division	Rectangle	Age groups								
		1	2	3	4	5	6	7	8+	Total
24	38G2									
24	38G3									
24	38G4	890.5	1465.8	4959.9	6668.3	2864.8	870.5	412.2		18126.8
24	39G2									
24	39G3									
24	39G4									
24	Total									
25	37G5	322.4	1204.7	3011.5	7871.1	8101.6	1960.7	1737.2		24213.0
25	38G5	1588.7	1702.2	3375.2	7384.2	7284.3	1814.8	1775.6		24921.5
25	38G6	76.2	605.4	963.4	1222.1	1011.9	243.1	249.0		4373.1
25	39G4	544.4	2470.8	5475.9	6180.5	3995.8	870.6	1172.8		20706.7
25	39G5	4814.3	5064.3	8301.3	10890.6	8653.8	2146.5	2408.3		42273.5
25	39G6	6172.7	11232.3	18332.1	13213.3	5582.0	1200.4	2570.3		58273.1
25	39G7	2997.0	11616.9	19346.7	14027.8	5603.1	1149.5	2324.1		57066.7
25	40G4	1726.2	5199.7	9191.5	8226.0	4709.5	1118.1	1615.2		31779.7
25	40G5	17110.1	20256.8	31989.1	27189.2	13228.1	2506.9	5213.0		117513.7
25	40G6	20310.4	19362.0	25463.9	17763.3	7676.2	1806.4	3205.5		95564.9
25	40G7	1549.3	4866.6	7928.5	5891.8	2484.0	543.6	1017.9		24266.4
25	41G6	574.6	930.2	1378.9	1201.8	975.3	309.5	321.3		5689.8
25	41G7	264.0	2396.0	4616.7	4527.1	2535.4	520.5	804.7		15656.9
25	**Total**	**58050.3**	**86907.9**	**139374.9**	**125588.8**	**71841.1**	**16190.6**	**24414.9**		**522299.0**
26	39G8	487.7	9915.6	25074.9	19032.0	4819.1	462.4			59788.3
26	40G8	458.6	4227.2	11996.6	9088.9	2363.3	193.3			28327.8
26	41G8	487.7	3729.2	7357.6	5322.0	1225.0	94.7			18208.3
26	**Total**	**1434.0**	**17872.1**	**44429.1**	**33442.9**	**8407.4**	**750.3**			**106324.3**
27	42G7	372.0	8354.5	12172.4	7635.4	1027.6	83.9			29653.5
28	42G8	334.7	4286.1	9430.3	4572.2	3545.6	52.1			22213.7
25-28	**Total**	**60191.0**	**117420.6**	**205406.7**	**171239.3**	**84821.7**	**17076.9**	**24414.9**		**680490.5**

Latvian spring acoustic surveys (Baltic sea, May 2001 and 2002)

A spring acoustic surveys was carried out on board of commercial fishing vessel "Zemgale" in the Sub-divisions 28,26 from 12 to 19 of May 2001, and from 23 to 28 of May 2002. The length of the cruise track was 274 NM in 2001 and 318 NM in 2002.

The equipment used consisted of SIMRAD EY 500 echosounder working with transducer ES38-12 at 38 kHz. Prior to the survey, the calibration was caried on against the standard 60 mm copper sphere. The vessel speed during the measurements was 6-8 knots and the integrating interval was 1 NM.

The backscattered energy was allocated to species on the basis of the catch and its length distribution, using the target strength equation for clupeids

$$TS = 20\log L - 71.2 \text{ [dB]},$$

where L = total length in cm.

Altogether 8 30-minutes trawl hauls were performed during the light time with midwater trawl with vertical opening of 20m and bar length in the trawl codend 10 mm in 2001 and 7 trawls hauls in 2002.

Sprat sampling data: 2001 – length samples 1654sp., age samples 513sp.; 2002 - length samples 1355sp., age samples 560sp.

Acoustic track and trawl stations are presented in Figure 2.4.1.

Results of surveys are presented in Tables 1 – 8.

Table 1 Survey statistics FV "ZANE" 2002, May

SD	ICES rect.	Area in nm^2	Mean Sa m^2/ nm^2	Sigma in m^2*10^-4	Total Abundance In million	Species composition, %		Quantity in million	
						herring	sprat	herring	sprat
28	44H1	824.6	359.1	1.43	2067.5	0.8	99.2	17	2051
	44H0	960.5	244.8	1.52	1543.6	3.4	96.6	52	1491
	43H1	412.7	84.1	1.34	258.9	0.0	100.0	0	259
	43H0	973.7	206.3	1.39	1444.1	0.0	100.0	0	1444
	42H0	968.5	136.1	1.44	915.5	1.1	98.9	10	905
	42G9	986.9	130.6	1.46	879.8	1.4	98.6	12	867
26	41H0	953.3	291.7	1.16	2399.3	0.0	100.0	0	2399
	41G9	1000	772.0	1.32	5829.0	0.0	100.0	0	5829

Table 2 Estimated number (millions) of sprat FV "Zane" May 2002

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	2068	25	345	772	38	469	75	102	243
	44H0	1544	2	125	527	32	428	69	98	262
	43H1	259	6	65	105	4	46	7	9	17
	43H0	1444	87	228	473	25	316	54	78	183
	42H0	915	37	106	337	18	224	35	45	114
	42G9	880	22	88	324	18	225	36	49	118
26	41H0	2399	1150	314	419	23	267	39	54	133
	41G9	5829	1428	626	1580	88	1106	173	246	582

Table 3 Sprat mean weight (gram) per age group FV "Zane" May 2002

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	9.5	4.7	8.0	10.8	11.5	11.9	11.5	12.1	13.3
	44H0	8.2	4.8	7.8	11.6	12.7	13.4	12.6	13.2	13.9
	43H1	10.2	4.6	8.2	9.9	10.3	10.4	10.5	11.0	12.6
	43H0	11.0	4.9	8.5	10.7	11.5	12.1	11.5	12.8	13.3
	42H0	10.6	5.2	7.8	10.7	11.2	12.1	12.3	12.3	13.0
	42G9	10.6	4.8	8.8	10.9	10.9	11.7	12.6	12.6	13.4
26	41H0	11.2	5.2	9.3	10.5	10.7	11.3	11.8	12.5	12.8
	41G9	10.9	5.2	8.6	10.6	11.0	11.7	12.1	12.4	12.9

Table 4 Sprat total biomass (t) per age group FV "Zane" May 2002

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	56014	7403	5349	16729	965	12927	2087	3045	7509
	44H0	19412	5979	2924	4410	246	3013	465	674	1702
	43H1	9888	109	774	3536	191	2635	448	615	1579
	43H0	9977	190	829	3593	199	2701	429	552	1482
	42H0	15568	430	1938	5057	285	3816	614	997	2431
	42G9	2503	27	533	1039	43	475	75	99	212
26	41H0	19071	12	978	6131	406	5744	862	1293	3646
	41G9	22510	118	2751	8311	440	5587	859	1230	3215

Table 5 Survey statistics FV "ZANE" 2001, May

SD	ICES rect.	Area in nm^2	Mean Sa m^2/ nm^2	Sigma in m^2*10^-4	Total Abundance In million	Species composition, %		Quantity in million	
						herring	sprat	herring	sprat
28	44H1	824.6	300.8	1.38	1798.2	0.8	99.2	14	1784
	44H0	960.5	317.3	1.38	2214.2	1.3	98.7	29	2185
	43H1	412.7	82.0	1.33	255.2	0.0	100	0	255
	43H0	973.7	510.7	1.31	3806.6	0.0	100	0	3807
	43G9	973.7	494.2	1.32	3648.7	0.0	100	0	3649
	42H0	968.5	190.5	1.36	1361.6	0.9	99.1	12	1349
	42G9	986.9	510.4	1.36	3714.0	1.1	98.9	41	3673
26	41H0	953.3	288.8	1.35	2044.3	0.0	100	0	2044
	41G9	1000.0	687.5	1.36	5072.7	0.0	100	0	5073

Table 6 Estimated number (millions) of sprat FV "Zane" May 2001

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	1798	62	436	0	689	23	314	265	9
	44H0	2214	74	569	0	832	26	374	322	17
	43H1	255	4	126	0	65	0	20	29	12
	43H0	3807	153	1866	0	952	14	200	426	196
	43G9	3649	158	1473	0	1056	54	431	438	40
	42H0	1362	27	596	0	446	11	106	162	13
	42G9	3714	67	1615	0	1193	26	339	428	46
26	41H0	2044	38	748	0	792	63	122	278	3
	41G9	5073	85	2010	0	2044	106	194	582	53

Table 7 Sprat mean weight (gram) per age group FV "Zane" May 2001

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	9.2	3.5	8.0		9.1	11.0	10.8	10.7	12.1
	44H0	9.2	3.4	7.9		9.2	11.0	10.8	10.7	12.1
	43H1	9.2	2.3	7.0		11.6		12.1	11.4	11.8
	43H0	9.1	3.6	7.6		10.7	10.8	11.8	11.2	12.4
	43G9	9.5	4.9	8.0		10.7	11.7	10.9	11.3	14.0
	42H0	10.2	5.0	8.5		11.3	15.2	12.2	11.9	15.3
	42G9	10.2	5.0	8.5		11.3	15.2	12.2	11.9	15.3
26	41H0	10.4	5.3	8.8		11.0	10.7	12.6	12.5	13.7
	41G9	10.3	5.1	8.8		11.0	11.0	12.7	12.6	13.7

Table 8 Sprat total biomass (t) per age group FV "Zane" May 2001

ICES SD	ICES Rect.	Total	Age							
			1	2	3	4	5	6	7	8
28	44H1	16561	216	3468	0	6301	249	3388	2830	109
	44H0	20446	254	4507	0	7693	288	4055	3447	201
	43H1	2360	9	883	0	758	0	237	329	144
	43H0	34522	554	14095	0	10189	150	2359	4752	2422
	43G9	34732	773	11797	0	11344	630	4699	4931	558
	42H0	13826	136	5056	0	5042	172	1294	1927	198
	42G9	37862	335	13711	0	13511	401	4125	5079	699
26	41H0	21178	199	6560	0	8701	677	1530	3476	35
	41G9	52336	432	17683	0	22505	1163	2469	7354	730

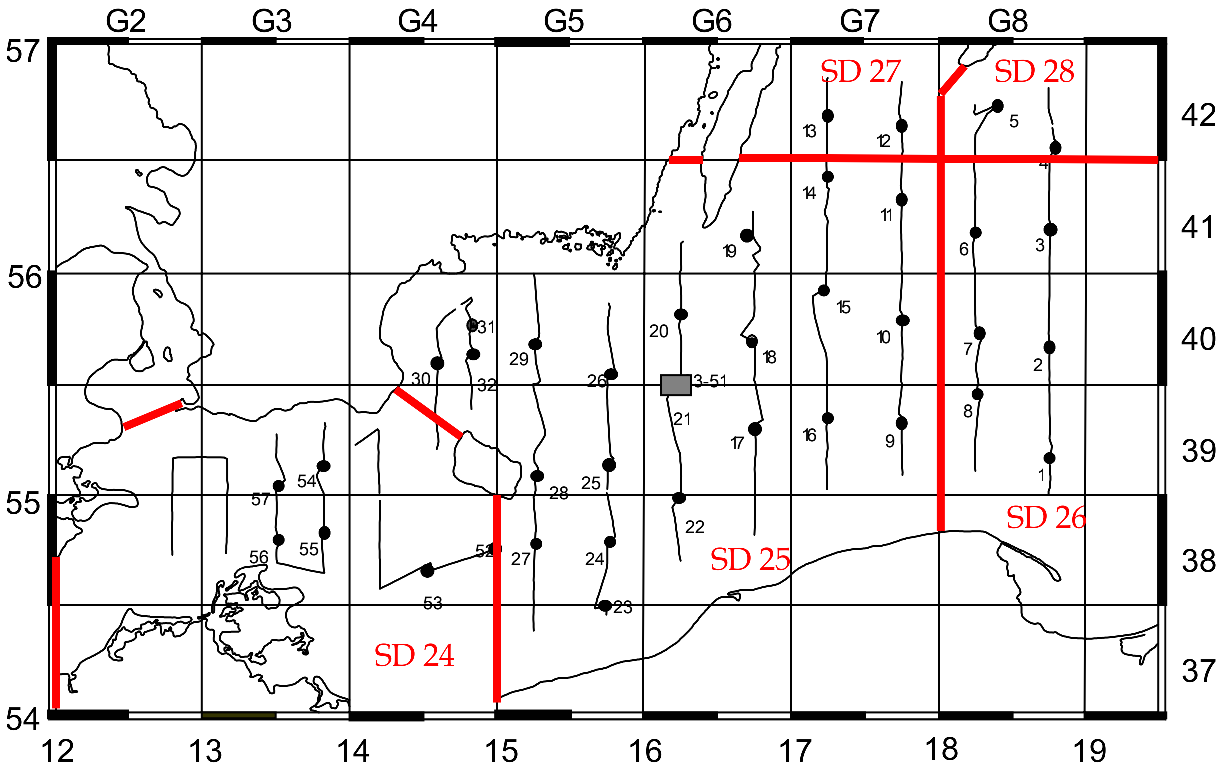

Figure 1: Hydroacoustic tracks, trawl positions and the box of the day/night investigations (RV „Walther Herwig III“, May 2002).

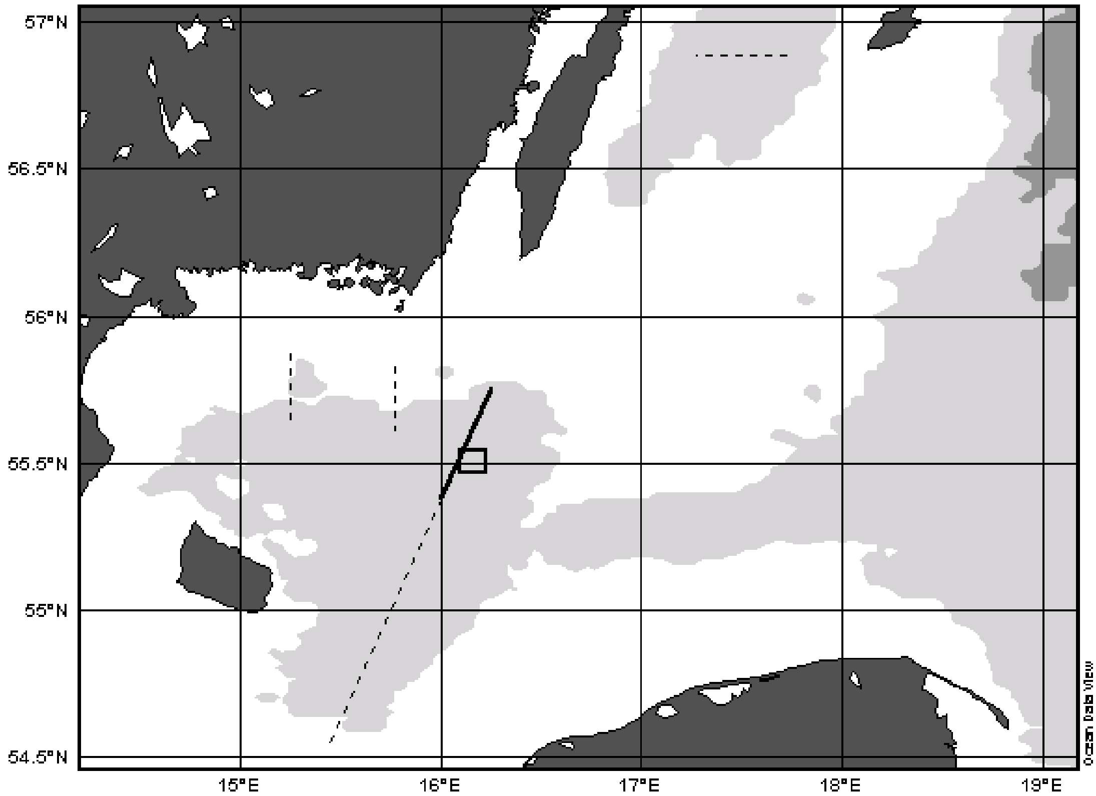

Figure 2: Box of the day/night fishing, transects with small-scale hydrographic as well as hydroacoustic investigations (dotted) and supplementary plankton samples by the RV „Heincke“ (solid) (RV „Walther Herwig III“, May 2002).

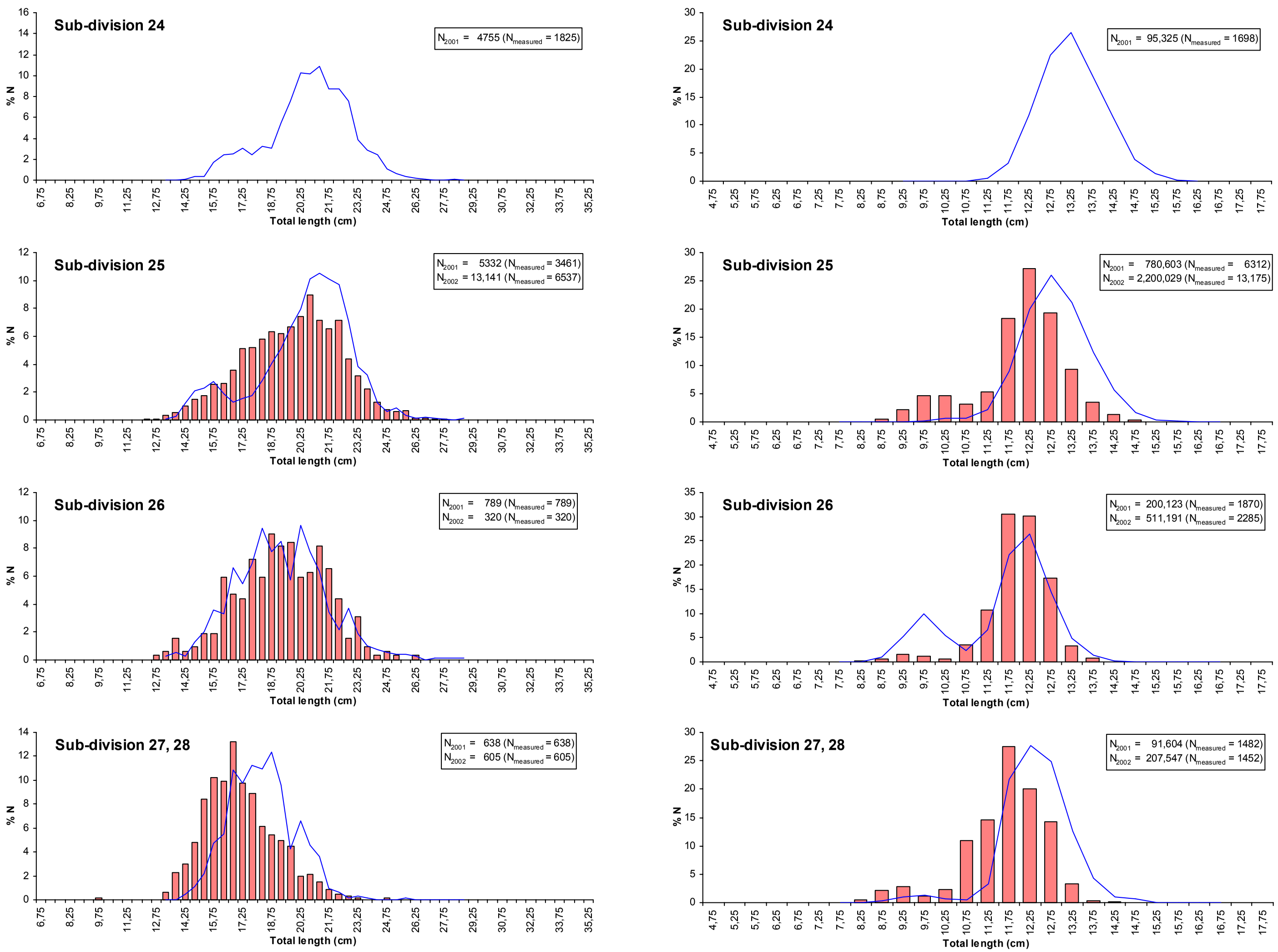

Figure 3: Length distribution of herring and sprat in Sub-divisions 24, 25, 26, 27/28 in May 2001 (=line) and May 2002 (=bar).

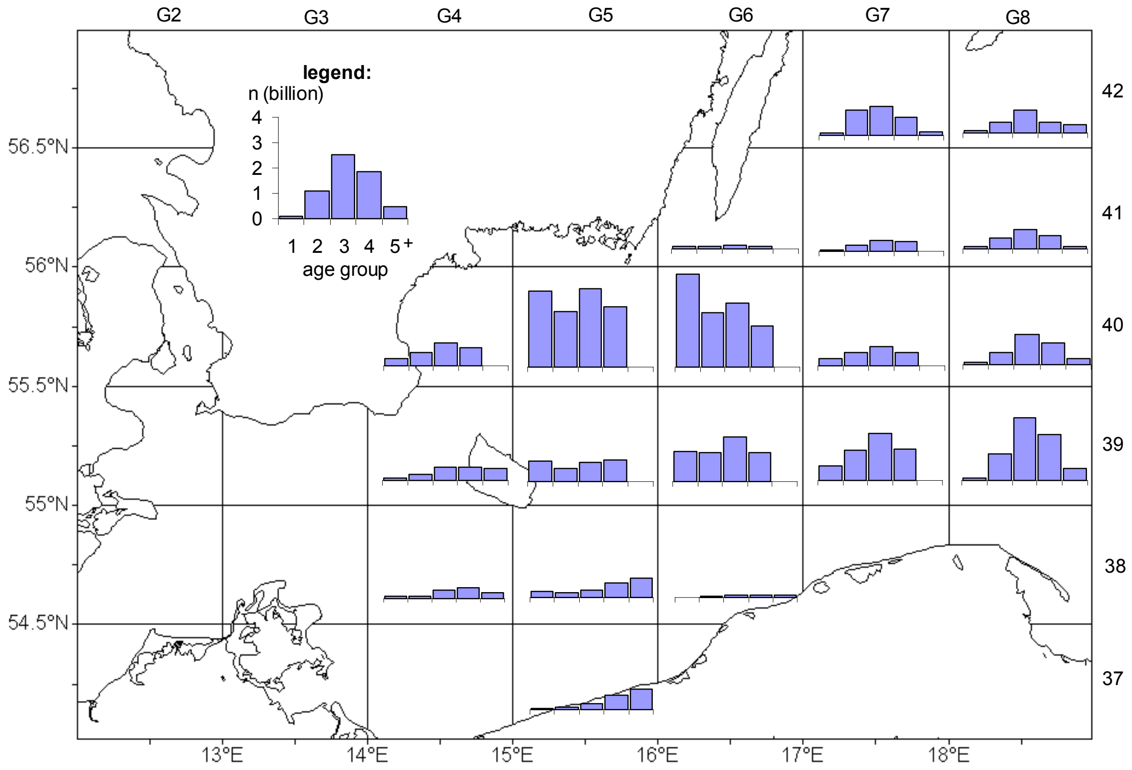

Figure 4: Sprat number per age group (billion), Cruise No. 239 of RV "W. Herwig III" in May 2002.

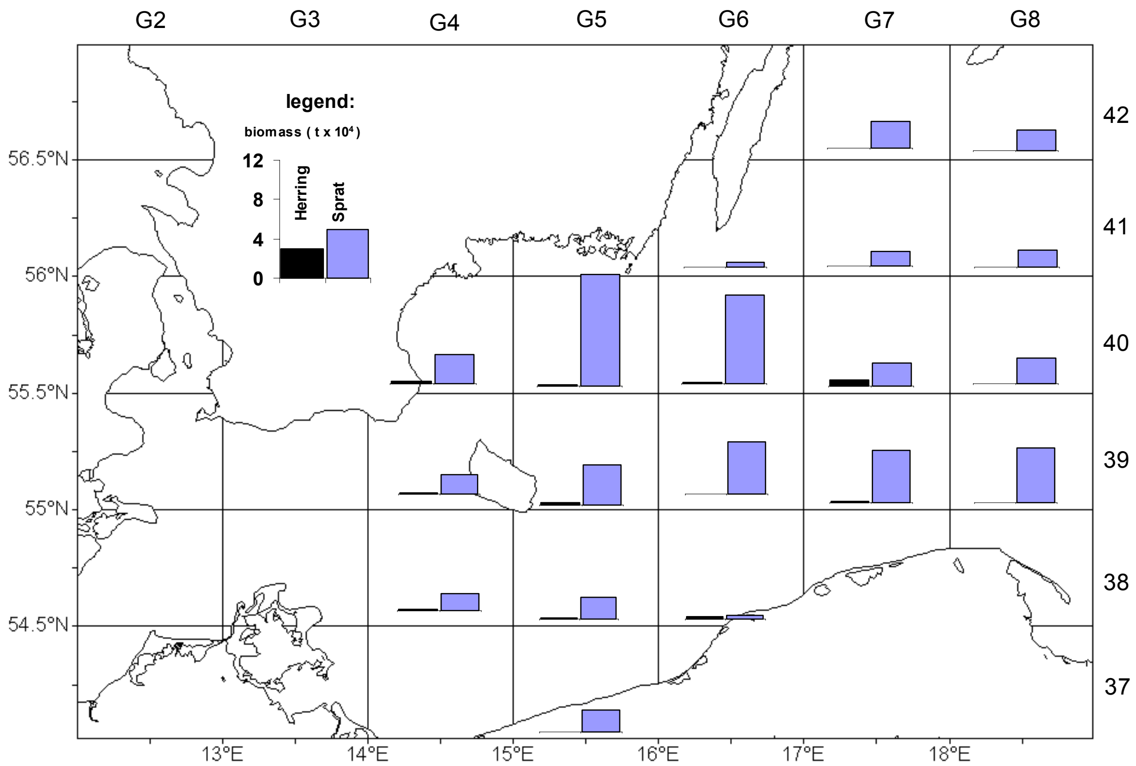

Figure 5: Hering and sprat biomass ('0000 t) per rectangle (Cruise No. 239 of RV "W. Herwig III" in May 2002.

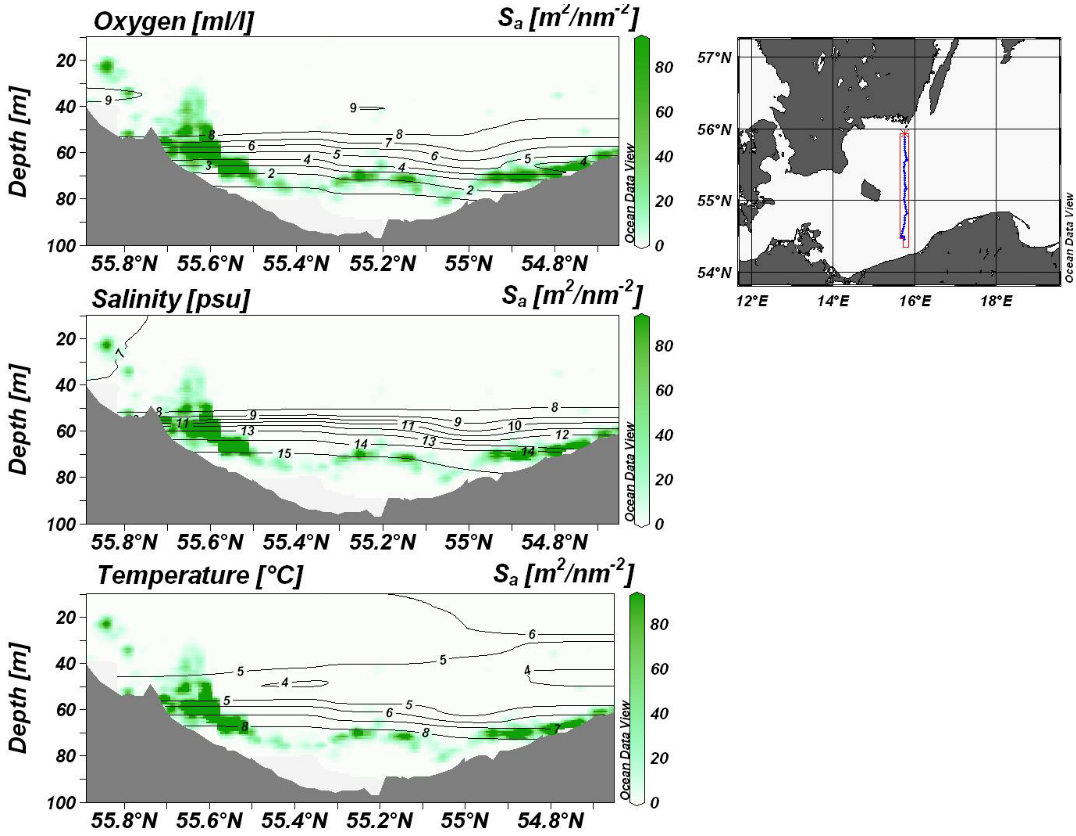

Figure 6: Vertical echo distribution in relation to oxygen, salinity and temperature in the Bornholm Basin.

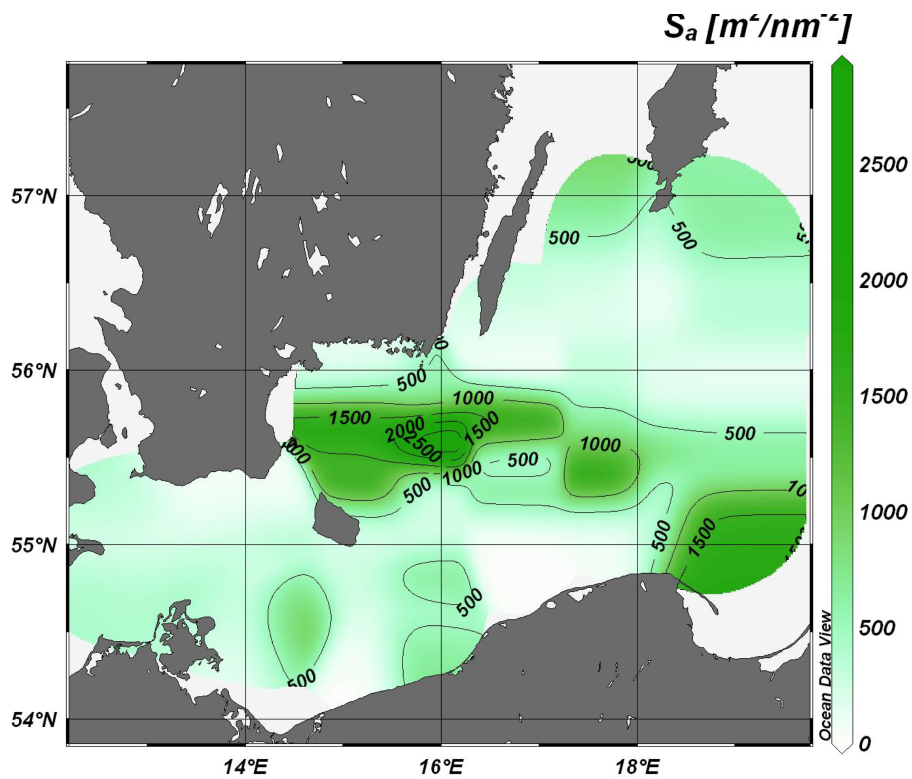

Figure 7: Horizontal echo distribution (Sa-values).

Annex 3

MANUAL

FOR THE BALTIC INTERNATIONAL ACOUSTIC SURVEY

(BIAS)

Version 0.80

2003-03-28

TABLE OF CONTENTS

Section **Page**

1 INTRODUCTION

Hydroacoustic surveys have been conducted in the Baltic Sea internationally 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 mainly for assessment purposes and results have been reported to ICES to be used for stock assessment (ICES. 1994a, 1995a, 1995b, Hagström *et al.*, 1991).

At the ICES Annual Science Conference in September 1997, the Baltic Fish Committee decided, that a manual for the International Acoustic Trawl Surveys in the Baltic area should be elaborated. The structure of the manual follows that of the Baltic International Trawl Surveys (BITS). In order to obtain a standardization for all ICES acoustic surveys some demands from the Manual for Herring Acoustic Surveys in ICES Divisions III, IV and VI (ICES, 1994b) are adopted.

The objective of the Baltic International Acoustic Surveys (BIAS) program is to standardize survey design, acoustic measurements, fishing method and data analysis throughout all national surveys where data are used as indices for assessment purposes.

2 SURVEY DESIGN

2.1 Area of observation

The acoustic surveys should cover the total area of ICES Division III. The border by subdivision is given in figure 2.1 and table 2.1. The area is limited by the 10 m depth line.

2.2 Stratification

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 limited by the 10 m depth line are given in table 2.2

2.3 Transects

Parallel transects are spaced on regular rectangle basis at a maximum distance of 15 nautical miles.
The transect density should be about 60 nm per 1000 NM².
In the vicinity of islands and in sounds the strategy of parallel transects leads to an unsuitable coverage of the survey area. In this case a zig-zag course should be used to achieve a regular covering. The length of the survey track per 1000 NM² track should be the same as when using parallel transects.

2.4 Observation time

The International Acoustic Survey is carried out in September/October. It is assumed that during this time of the year there is little or no emigration or immigration in the main part of the Baltic Sea so that the estimates are representing a good ‘snapshot’ of the herring and sprat resources.

In the shallow water areas of the Western Baltic a great part of the fish concentrations are close to the bottom during daytime and therefore not visible for the echosounder. This leads to an underestimation of fish Therefore it is recommended that shallow water areas in the western Baltic should be surveyed only during night-time

3 ACOUSTIC MEASUREMENTS

3.1 Equipment

The standard equipment used for the survey are the echosounder SIMRAD EK/EY-500 or SIMRAD EK-400.

The standard frequency used for the survey is 38 kHz.

3.2 Instrument settings

Some instrument settings will influence the acoustic measurements to a high degree. Particularly the following calibration settings in the ***Transceiver Menu*** are essential for the correct function of the acoustic device:

Max. Power
2-Way Beam Angle
Sv Transd. Gain
TS Transd. Gain

Additional in the split-beam case:

Angle Sens.Along
Angle Sens.Athw.
3dB Beamw.Along
3dB Beamw.Athw.
Alongship Offset
Athw.ship Offset

The following settings are recommended:

Pulse rate	1 sec.
Absorption coef.	3 dBkm
Pulse Length	Medium
Bandwidth	Wide

and in the ***Layer Menu***:

Threshold	-60 dB
Bottom margin	0.5 m

It is recommended to record this settings regularly to have a log about the main function of the acoustic measuring system.

It is also recommended that each year the same settings (Min Sv = -60dB) are used for the printer in order to facilitate comparison of echograms.

3.3 Sampling unit

The Elementary Sampling Distance Unit (ESDU) is the length of cruise track, where acoustic measurements are averaged to give one sample. It is recommended to use as averaging unit 1 nautical mile.

3.4 Calibration

A calibration of the transducer must be conducted at least once during the survey. If possible, the transducer should be calibrated both at the beginning and the end of the survey. Calibration procedures are described in appendix 2.

3.5 Intercalibration

When more than one ship is engaged in the same area the performance of the equipment should be compared by means of an intercalibration. Preferably the vessels should start and finish the intercalibration with fisheries hauls. A survey track should be chosen in areas with high density scattering layers. The settings of the acoustic equipment should be kept constant during the whole survey.

During the intercalibration one leading vessel should steam 0.5 nautical miles ahead of the other. The lateral distance between the survey tracks should be 0.3 nautical miles. The intercalibration track should be at least 40 nautical miles. It is stressed that the vessels have to change their position at least once during the operation.

4 FISHERY

4.1 Gear

Trawling is done with different pelagic gear in the midwater as well as in the near bottom. The collection of the trawl gears used in surveys is given in table 4.1.

The stretched mesh size in the codend of the trawl should be 20 mm.

4.2 Method

The collection of biological samples is done to determine the species composition and length, age and weight distributions of target species detected by the echosounder system.

It is recommended to sample a minimum of 2 hauls per ICES rectangle.

Standard fishing speed is 3 - 4.5 knots.

The standard trawling time is 30 minutes.

It has to be secured that all type of fish concentration is sampled for species recognition. In situations with fish vertically distributed over the whole water column, specifically in shallow waters, the whole depth range should be sampled by the trawl haul. In the case of two or more layers in one area (Figure 4.2.1), it is recommended to sample all layers by separate hauls. If shoals and scattering layers are present (Fig. 4.2.2), both should be sampled by separate trawl hauls.

4.3 Samples

4.3.1 Species composition

It should be achieved to sort the total catch into **all species** (table 4.3.1). The corresponding weight per species should be registered.

In case of homogenous large catches of clupeoids a subsample of at least 50 kg should be taken and sorted for the identification of the species. The weight of the subsample, and the total weight per species in the subsample should be registered.

In case of heterogeneous large catches consisting of a mixture of clupeoids and few larger species the total catch should be partitioned into the part of larger species and that of the mixture of clupeoids. From the mixture of clupeoids a subsample of at least 50 kg should be taken. The total weight per species for the part of the larger species and the total weight of the subsample of mixed clupeoids should be registered.

Certain related species that are hard to identify down to species level may be grouped by genus levels or larger taxonomic units.

4.3.2 Length distribution

Length distributions are recorded for all fish species caught. Length is defined as total length (measured from tip of snout to tip of caudal fin). Length is measured to 0.5 cm below for herring and sprat, and to 1 cm below for all other species.

In case of large catches of clupeoids with a narrow length spectrum, a sub-sample should be taken containing at least 200 specimen per species to get a reasonable length distribution. For other species at least 50 specimen should be measured, if possible.

In case of large herring catches with a wide length spectrum, the subsamples should contain at least 400 specimen.

4.3.3 Weight distribution

Herring and sprat should be sorted into 0.5 cm length groups and weighed. Taking into account the available manpower two methods are possible:

Maximum effort method. The mean weight per length group for herring and sprat is to be measured for each trawl haul**.**

Minimum effort method. The mean weight per length group for herring and sprat is to be measured for each ICES Sub-division**.** It is recommended to cover the whole Sub-division homogeneously.

The maximum effort method should be preferred.

4.3.4 Age distribution

Taking into account the available manpower two methods are possible:

Maximum effort method: The otolith samples are collected for herring and sprat per each trawl haul**.**

Minimum effort method: The otolith samples are collected for herring and sprat per each ICES Sub-division**.** It is recommended to cover the whole Sub-division homogeneously.

The maximum effort method should be preferred.

If otolith samples are to be taken of the 2 target species herring and sprat the number of otoliths per length-class are not fixed by a constant figure. The following minimum sampling levels should be maintained for herring and spat per Sub-division and per 0.5 cm length-class:

- 5 otoliths for l<10cm
- 10 otoliths for l>=10cm.

For the smallest size groups, that presumably contain only one age group, the number of otoliths per length class may be reduced.

Environmental data

Temperature and salinity should be taken by a CTD probe after each haul, and recorded at least in 1 m intervals.

5 DATA ANALYSIS

5.1 Species composition

Trawl catches within each ICES rectangle are combined to give an average species composition of the catch. Each trawl catch is given equal weight, unless it is decided that a trawl catch is not representative for the fish concentrations sampled. In this case, the particular trawl catch is not used. The species frequency f_i of species i can be estimated by

$$f_i = \frac{1}{M}\sum_{k=1}^{M}\frac{n_{ik}}{N_k} \quad (5.1)$$

where n_{ik} the fish number of species i in the haul, N_k the total fish number in this haul and M is the number of hauls in the ICES rectangle.

It is allowed to exclude a species from further total species frequency calculation if the overall mean contribution to all sampled hauls is lower than one percent.

5.2 Length distribution

It is assumed that catch rates are poorly related to abundance. In this case each trawl catch is given equal weight. The length frequency f_{ij} in the length class j is calculated as the mean of all M_i trawl catches containing species i

$$f_{ij} = \frac{1}{M_i}\sum_{k=1}^{M_i}\frac{n_{ijk}}{N_{ik}} \quad (5.2)$$

where n_{ijk} the number of fish within the length class j and N_{ik} the total number of species i in the haul k.

5.3 Age distribution

Minimum effort method: All sampled otoliths within each Sub-division are assumed to be representative for the species age distribution within this area. The age-length-key in this Sub-division can be expressed as frequencies f_{aj} or as relative quantities (fractions) q_{aj} associated with age a in length class j. The combination of the age length key q_{aj} for the whole Sub-division with the length distribution f_j from a specific ICES rectangle results in the age distribution f_a for this ICES rectangle, i.e.

$$f_a = \sum_j q_{aj} \cdot f_j \qquad (5.3.1)$$

Maximum effort method: The age distribution for each rectangle is estimated as unweighted mean of all samples, i.e.

$$f_a = \frac{1}{M} \sum_k f_{ak} \qquad (5.3.2)$$

5.4 Weight distribution

Minimum effort method: For the calculation of the weight distribution per age group W_a we use also the normalized age-length-key q_{aj} (see 5.3) and the mean weight per length group W_j.

$$W_a = \sum_j q_{aj} \cdot f_j \cdot W_j \qquad (5.4.1)$$

Maximum effort method: The weight distribution for each rectangle is estimated as unweighted mean of all samples.

$$w_a = \frac{1}{M} \sum_k w_{ak} \qquad (5.4.2)$$

5.5 Lack of sample hauls

In the case of lack of sample hauls within an individual ICES rectangle (due to small bottom depth, bad weather conditions or other limitations) a mean of all available neighbouring rectangles should be taken.

5.6 Allocation of records

During the survey herring and sprat normally cannot be distinguished from other species by visual inspection of the echogram. Both herring and sprat tend to be distributed in scattering layers or in pelagic layers of small schools, and it is not possible to ascribe values to typical herring schools.

Species allocation is then based entirely upon trawl catch composition. The estimates of total fish density are then allocated to species and age groups according to the trawl catch composition in the corresponding ICES rectangle.

5.7 Target strength of an individual fish

The mean cross section σ of an individual fish of species i should be derived from a function which describes the length-dependence of the target-strength.

$$TS = a_i + b_i \cdot \log L \qquad (5.7.1)$$

a_i and b_i are constants for the i'th species and L is the length of the individual fish in cm.

The equivalent formula for the cross-section is:

$$\sigma_{ij} = 4\pi \cdot 10^{a_i/10} \cdot L_j^{b_i/10} \qquad (5.7.2)$$

Normally we assume a quadratic relationship, that means b_i is 20. We get the formula:

$$\sigma_{ij} = d_i \cdot L_j^{\;2} \qquad (5.7.3)$$

The parameters a, b and d are listed in table 5.7 for different species.

5.8 Estimation of the mean cross section in the ICES rectangle

The basis for the estimation of total fish density F from the measured area scattering cross section S_a is the conversion factor c.

$$F = S_a \cdot c = \frac{S_a}{<\sigma>} \qquad (5.8.1)$$

The mean cross section <σ> in the ICES rectangle is dependent from the species composition and the length distributions of all species. From formula 5.7.3 we get the corresponding cross section $<\sigma_i>$

$$<\sigma_i> = \sum_j f_{ij} \cdot d_i \cdot L_j^2 \quad (5.8.2)$$

where L_j is the mid point of the j-th length class and f_{ij} the respective frequency.

It follows that the mean cross section in the ICES rectangle can be estimated as the weighted mean of all species related cross sections $<\sigma_i>$:

$$<\sigma> = \sum f_i \sigma_i = \sum_i f_i \sum_j f_{ij} d_i L_j^2 \qquad (5.8.3)$$

5.9 Abundance estimation

The total number of fish in the ICES rectangle has to be estimated as:

$$N = F \cdot A = \frac{S_a}{<\sigma>} \cdot A \qquad (5.9.1)$$

This total abundance is split into species classes N_i by

$$N_i = N \cdot f_i \qquad (5.9.2)$$

especially in abundance of herring N_h and sprat N_s.

The abundance of the species i is divided into age-classes, $N_{a,j}$ according to the age distribution $f_{i,a}$ in each ICES rectangle

$$N_{ia} = N_i \cdot f_{ia} \qquad (5.9.3)$$

5.10 Biomass estimation

The biomass Q_{ia} for the species i and the age group a is calculated from the abundance N_{ia} and the mean weight per age group

$$Q_{ai} = N_{ai} \cdot W_a \qquad (5.10.1)$$

6 DATA EXCHANGE AND DATABASE

6.1 Exchange of survey results

The main results of BIAS should be summarized and reported to the Acoustic Survey coordinator (F. Arrhenius, Sweden) not later than January of the next year. These results are intended for the information of the Assessment Groups and should contain the following documents :

- the map of the cruise track and the fishery stations
- a short description of the survey
- the table of the basic values for the abundance estimation (survey statistics)
- tables of the abundance of herring and sprat per age group
- tables of the mean weights of herring and sprat per age group

The standard exchange format for the documents is described in table 6.1.

6.2 BAD1

The database BAD1 is the collection of results from the Baltic International Acoustic Surveys (BIAS). The sampling unit is the ICES rectangle (see 2.2). The contents of the database are similar to the standard data exchange format (6.1) for the BIAS. The database BAD1 consists of the following six tables:

- AH Abundance (in millions) of herring per age group
- AS Abundance (in millions) of sprat per age group
- ST Basic values for the computation of the abundance
- SU Description of the different surveys
- WH Mean weights of herring per age group
- WS Mean weights of sprat per age group

The inner structure of the tables is summarised in table 6.2.

7 REFERENCES

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Håkansson, N.; Kollberg, S.; Falk, U.; Götze, E., 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):7–23.

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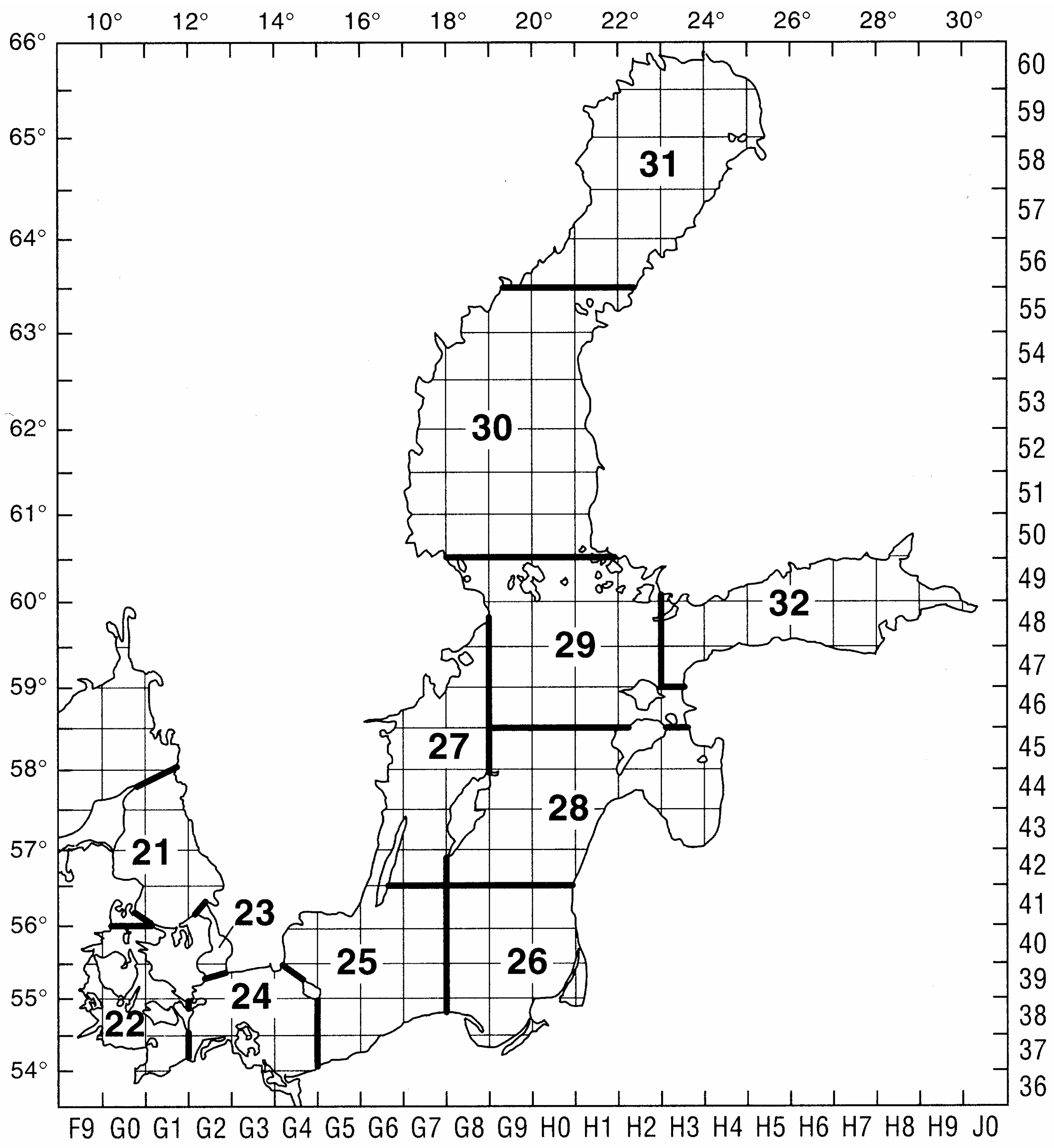

Figure 2.1. ICES Sub-division borders and rectangles codes.

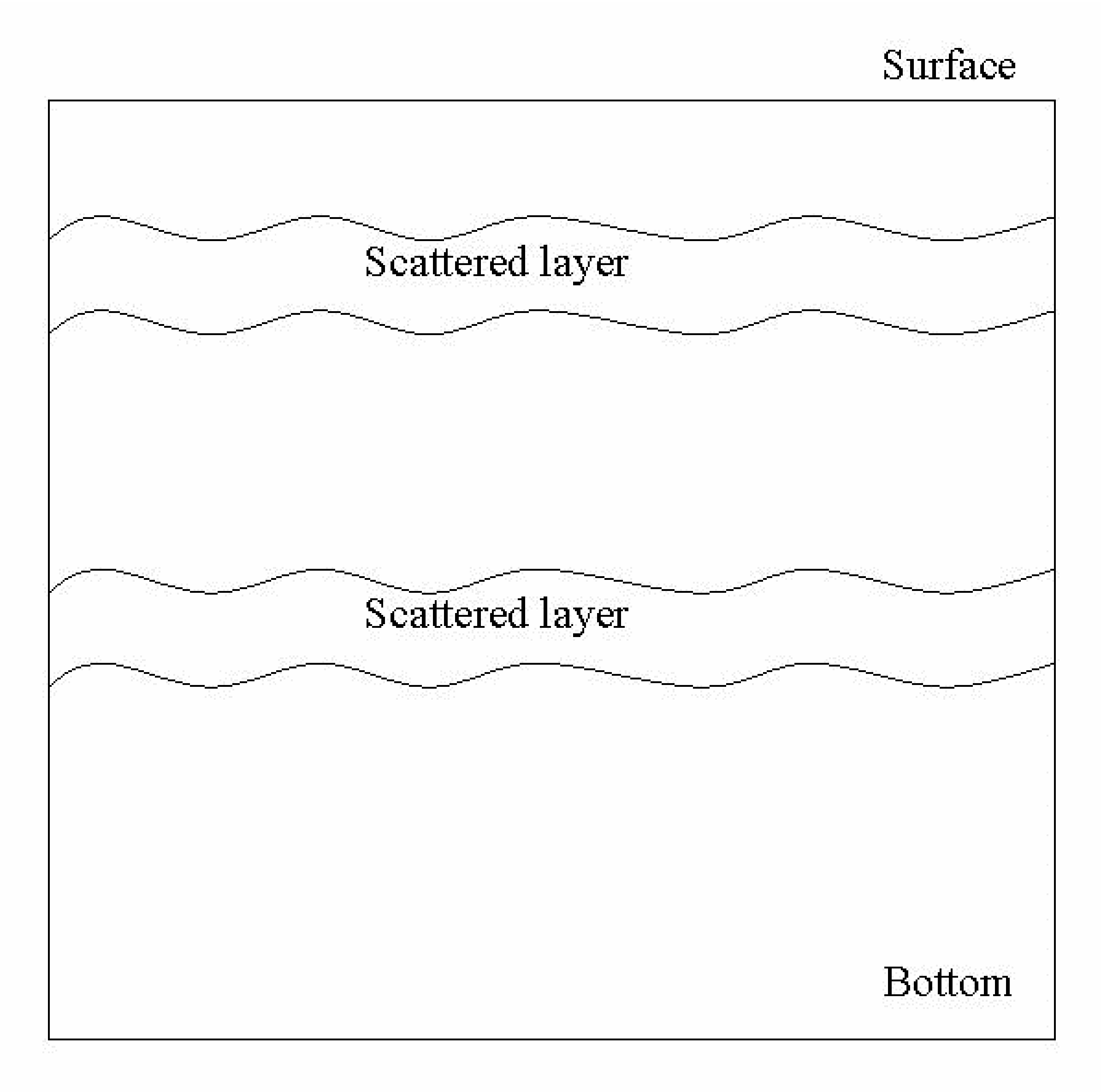

Figure 4.2.1. Multiple scattering fish layers.

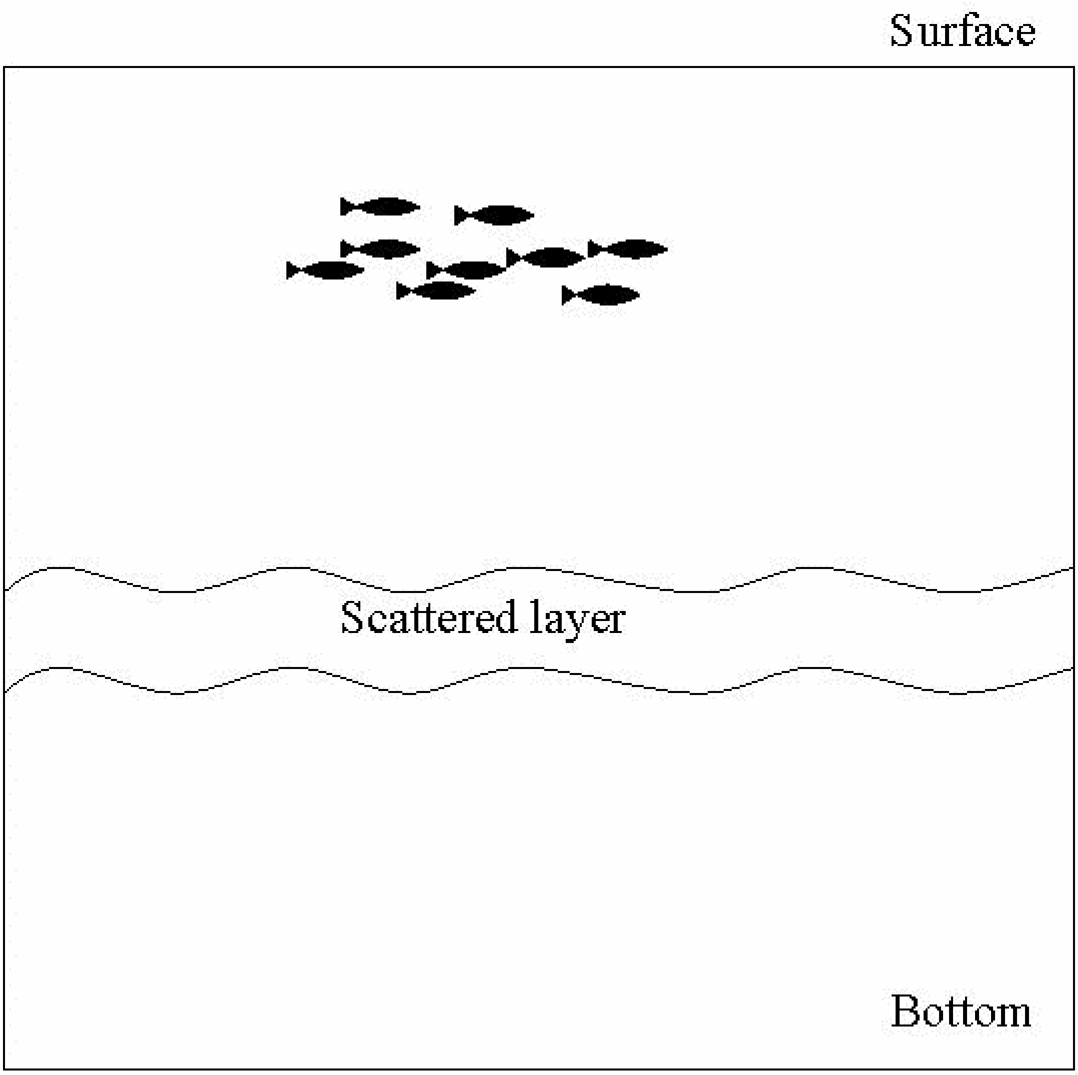

Figure 4.2.2. Shoals and scattering fish layers.

Table 2.1. The boundaries of the Sub-divisions of the Baltic Sea and the Belts.

(IBSFC Fishery Rules)

Sub-division 22

Northern boundary:	a line from Hasenore head to Gniben Point
Eastern boundary:	a line at longitude 12° East due South from Zealand to Falster, then along the East coast of the Island of Falster to Gedser Odde (54°34'N, 11°58'E), then due South to the coast of the Federal Republic of Germany.

Sub-division 23

Northern boundary:	a line from Gilbjerg Head to the Kullen.
Southern boundary:	a line from Falsterbo Light on the Swedish coast to Stevns Light on the Danish coast.

Sub-division 24

The western boundaries coincide with the eastern boundary of Sub-division 22 and the southern boundary of Sub-division 23. The eastern boundary runs along the line from Sandhammeren Light to Hammerode Light and south of Bornholm further along 15°E.

Sub-division 25

Northern boundary:	the latitude 56°30'N.
Eastern boundary:	the longitude 18°E.
Western boundary:	coincides with the eastern boundary of Sub-division 24

Sub-division 26

Northern boundary:	the latitude 56° 30'N.
Eastern boundary:	the longitude 18° E.

Sub-division 27

Eastern boundary:	the longitude 19° E from 59° 41'N to the Isle of Gotland and from the Isle of Gotland along 57° N to 18° E and further to the South along the longitude 18° E.
Western boundary:	the latitude 56°30'N.

Sub-division 28

Northern boundary:	the latitude 58° 30'N.
	the latitude 56° 30'N.
Western boundary:	north of Gotland, the latitude 19° E and south of Gotland along 57° N to the longitude 18° E, and further south along the longitude 18° E.

Sub-division 29

Northern boundary:	the latitude 60° 30'N.
Eastern boundary:	the longitude 23° E to 59° N and further along 59° N to the east Southern boundary: the latitude 58° 30'N.
Western boundary:	from 59° 41'N, along the longitude 19° E to the south.

Sub-division 30

Northern boundary:	the latitude 63° 30'N.
Southern boundary:	the latitude 60° 30'N.

Sub-division 31

Southern boundary:	the latitude 63° 30'N.

Sub-division 32

Western boundary:	coincides with the eastern boundary of Sub-division 29

Table 2.2. Area of strata (values of the areas of standard rectangles in nautical square miles below 10 m depth).

Estimated with a dataset from Seifert & Kayser (Seifert. T.; Kayser. B.: 1995. A high resolution spherical grid topography of the Baltic Sea. Meereswiss. Berichte (Marine Science Reports) Inst. Ostseeforschung Warnemünde. Nr. 9. 1995. S. 72 - 88.).

SD21	41G0	41G1	41G2	42G1	42G2	43G1	43G2
	108.1	946.8	432.3	884.2	606.8	699.0	107.0

SD22	37G0	37G1	38F9	38G0	38G1	39F9	39G0	39G1	40F9	40G0	40G1	41G0	41G1
	209.9	723.3	51.9	735.3	173.2	159.3	201.7	250.0	51.3	538.1	174.5	173.1	18.0

SD23	39G2	40G2	41G2
	130.9	164.0	72.3

SD24	37G2	37G3	37G4	38G2	38G3	38G4	39G2	39G3	39G4
	192.4	167.7	875.1	832.9	865.7	1034.8	406.1	765.0	524.8

SD25	37G5	37G6	38G5	38G6	38G7	39G4	39G5	39G6	39G7	40G4	40G5	40G6	40G7	41G4	41G5	41G6	41G7
	642.2	130.7	1035.7	940.2	471.7	287.3	979.0	1026.0	1026.0	677.2	1012.9	1013.0	1013.0	59.4	190.2	764.4	1000.0

SD26	37G8	37G9	38G8	38G9	38H0	39G8	39G9	39H0	39H1	40G8	40G9	40H0	40H1	41G8	41G9	41H0	41H1
	86.0	151.6	624.6	918.2	37.8	1026.0	1026.0	881.6	12.8	1013.0	1013.0	1012.1	56.3	1000.0	1000.0	953.3	16.6

SD27	42G6	42G7	43G6	43G7	43G8	44G6	44G7	44G8	45G6	45G7	45G8	46G6	46G7	46G8	47G8	48G8
	266.0	986.9	269.8	913.8	106.1	200.9	960.5	456.6	72.9	908.7	947.2	38.9	452.6	884.8	264.3	53.8

SD28	42g8	42g9	42h0	42h1	43g8	43g9	43h0	43h1	43h3	43h4	44g8	44g9	44h0	44h1	44h2	44h3	44h4	45g9	45h0	45h1	45h2	45h3	45h4
	945.4	986.9	968.5	75.0	296.2	973.7	973.7	412.7	744.3	261.9	68.1	876.6	960.5	824.6	627.3	936.1	290.6	924.5	947.2	827.1	209.9	638.2	96.5

SD29	46g9	46h0	46h1	46h2	46h3	47g9	47h0	47h1	47h2	48g9	48h0	48h1	48h2	49g8	49g9	49h0	49h1	49h2
	933.8	933.8	921.5	258.0	13.2	876.2	920.3	920.3	793.9	772.8	730.3	544.0	597.0	196.0	564.2	85.3	65.2	28.4

SD30	50G7	50G8	50G9	50H0	50H1	51G7	51G8	51G9	51H0	51H1	52G7	52G8	52G9	52H0	52H1	53G7	53G8	59G9
	403.1	833.4	879.5	795.1	41.6	614.5	863.7	865.8	865.7	237.3	482.6	852.0	852.0	852.0	263.9	354.5	838.1	838.1

SD30	53H0	53H1	54G7	54G8	54G9	54H0	55G8	55G9	55H0	55H1
cont.	838.1	126.6	13.2	642.2	824.2	727.9	103.6	625.6	688.6	86.7

SD31	56G9	56H0	56H1	56H2	56H3	57H1	57H2	57H3	57H4	58H1	58H2	58H3	58H4	59H1	59H2	59H3	59H4	60H2	60H3	60H4
	8.1	269.2	789.7	414.3	13.2	558.1	782.0	518.9	9.0	486.0	767.8	766.1	256.6	105.8	603.1	752.5	409.0	49.2	181.2	58.0

SD32	47H3	47H4	47H7	48H3	48H4	48H5	48H6	48H7	48H8	49H4	49H5	49H6	49H7	49H8	49H9	50H8
	536.2	90.9	90.0	615.7	835.1	767.2	776.1	851.4	308.5	64.8	306.9	586.5	754.6	665.1	205.2	43.0

Table 4.1. Trawl gear specification.

A	B	C	D	E	F	G	H	J	K	L	M	N2/N3												O	P
Country	Vessel	Power	Code	Name	Type	Panels	Headl	Groundr	Sweeps	Length	Circum	Mesh size												Height	Spread
		kW			B/P	2/4	m	m	m	m	m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	m	m
GFR	WAH3	2900	GOV	GOV	B	2	36.0	52.8	110.0	51.7	76.0	200	160	120	80	50								4	23
GFR	WAH3	2900	PS205	PSN205	P	4	50.4	55.4	99.5	84.3	205.0	400	200	160	80	50								12	28
GFR	WAH3	2900	1600#	1600# Engelnetz	P	4	70.0	78.0	69.5	118.5	315.0	200	100	50										19	36
GFR	SOL	588	BLACK	Blacksprutte 854#	P	4	39.2	39.2	105.0	60.4	156.0	8/200	4/200	200	160	120								11	22
GFR	SOL	588	PS388	Krake	P	4	42.0	42.0	63.5	59.8	142.4	400	200	80										9	21
GFR	SOL	588	H20	HG20/25	B	2	25.7	39.8	63.5	41.9	51.0	120	80	40										3	15
GFR	SOL	588	AAL	Aalhopser	B	2	31.0	29.7	63.5	57.5	119.0	160	120	80	40									6	19
GFR	SOL	588	KAB	Kabeljaubomber	P	2	53.2	53.2	63.5	73.5	129.6	200	160	120										11	30
POL	BAL	1030	P20	P20/25	B	2	28.0	42.4	100.0	53.4		120	40											4	11
POL	BAL	1030	TV3	TV-3 930#	B	4	71.7	78.8			74.4	200	40											6.5	
POL	BAL	1030	WP53	WP53/64x4	P	4	53.0	53.0	88.0	86.0	217.6	800	100											22	32
RUS	MON		RTM	RTM33S	P																				
RUS	ATL	1764	RTA	70/300 project0495	P	4	70.0	70.0	75.0	101.3	300.0	7000	5000	4000	2000	800	400	200	100	80	60	45	37	28	41
FIN	JUL	750	1600'	Finflyder combi	P	4	86.0	86.0	60.0	160.3	467.2	3200	1600	800	290	120	80	40						23	38
SWE	ARG	1324	FOTOE	Fotö 3.2	P	4	60.2	60.2	108.0	98.0	260.0	6400	3200	1600	800	400	200	100	40					16	90
SWE	ARG	1324	MACRO	Macro 5A:1	P	4	86.0	86.0	108.0	98.0	205.0	6400	3200	1600	800	400	200	100	40					19	105

Table 4.3. Species list.

NODC	Scientific name	English name
3734030201	AURELIA AURITA	COMMON JELLYFISH
5704020401	SEPIETTA OWENIANA	
5706010401	ALLOTEUTHIS SUBULATA	
6188030110	CANCER PAGURUS	EDIBLE CRAB
8603010000	PETROMYZINIDAE	LAMPREYS
8603010217	LAMPETRA FLUVIATILIS	RIVER LAMPREY
8603010301	PETROMYZON MARINUS	SEA LAMPREY
8606010201	MYXINE GLUTINOSA	HAGFISH
8710010201	SQUALUS ACANTHIAS	SPURDOG / SPINY DOGFISH
8713040134	RAJA RADIATA	STARRY RAY
8741010102	ANGUILLA ANGUILLA	EEL
8747010000	CLUPEIDAE	HERRINGS
8747010109	ALOSA FALLAX	TWAITE SHAD
8747010201	CLUPEA HARENGUS	HERRING
8747011701	SPRATTUS SPRATTUS	SPRAT
8747012201	SARDINA PILCHARDUS	PILCHARD, SARDINE
8747020104	ENGRAULIS ENCRASICOLUS	ANCHOVY
8755010115	COREGONUS OXYRINCHUS / C. LAVARETUS	WHITEFISH / HOUTING / POWAN
8755010305	SALMO SALAR	SALMON
8755010306	SALMO TRUTTA	TROUT
8755030301	OSMERUS EPELANUS	SMELT
8756010237	ARGENTINA SPYRAENA	LESSER SILVERSMELT
8759010501	MAUROLICUS MUELLERI	PEARLSIDE
8776014401	RUTILUS RUTILUS	ROACH
8791030402	GADUS MORRHUA	COD
8791030901	POLLACHIUS VIRENS	SAITHE
8791031301	MELANOGRAMMUS AEGLEFINUS	HADDOCK
8791031501	RHINONEMUS CIMBRIUS	FOUR BEARDED ROCKLING
8791031701	TRISOPTERUS MINUTUS	POOR COD
8791031703	TRISOPTERUS ESMARKI	NORWAY POUT
8791031801	MERLANGIUS MERLANGIUS	WHITING
8791032201	MICROMESTISTIUS POTASSOU	BLUE WHITING
8791040105	MERLUCCIUS MERLUCCIUS	HAKE
8793010000	ZOARCIDAE	EEL-POUTS
8793010724	LYCODES VAHLII	VAHL'S EELPOUT
8793012001	ZOARCES VIVIPARUS	EELPOUT
8803020502	BELONE BELONE	GARFISH
8818010101	GASTEROSTEUS ACULEATUS	THREE-SPINED STICKLEBACK
8818010201	SPINACHIA SPINACHIA	SEA STICKLEBACK
8820020000	SYNGNATHIDAE	PIPE FISHES
8820020119	SYNGNATUS ROSTELLATUS	NILSSON'S PIPEFISH
8820020120	SYNGNATUS ACUS	GREAT PIPEFISH
8820020123	SYNGNATUS TYPHLE	DEEP-SNOUTED PIPEFISH
8820022101	ENTELURUS AEQUOREUS	SNAKE PIPEFISH
8826020601	EUTRIGLA GURNARDUS	GREY GURNARD
8831020825	COTTUS GOBIO	BULLHEAD
8831022205	MYOXOCEPHALUS QUADRICORNIS	FOUR SPINED SCULPIN
8831022207	MYOXOCEPHALUS SCORPIUS	BULL ROUT
8831024601	TAURULUS BUBALIS	SEA SCORPION
8831080803	AGONUS CATAPHRACTUS	POGGE
8831090828	LIPARIS LIPARIS	SEA SNAIL
8831091501	CYCLOPTERUS LUMPUS	LUMPFISH
8835020101	DICETRARCHUS LABRAX	BASS
8835200202	PERCA FLUVIATILIS	PERCH

Table 4.3 continued

NODC	Scientific name	English name
8835200403	STIZOSTEDION LUCIOPERCA	ZANDER (PIKEPERCH)
8835280103	TRACHURUS TRACHURUS	HORSE MACKEREL
8835450202	MULLUS SURMULETUS	RED MULLET
8839013501	CTENOLABRUS RUPESTRIS	GOLD SINNY
8840060102	TRACHINUS DRACO	GREATER WEEVER
8842120905	LUMPENUS LAMPRETAEFORMIS	SNAKE BLENNY
8842130209	PHOLIS GUNELLUS	BUTTERFISH
8845010000	AMMODYTIDAE	SANDEELS
8845010105	AMMODYTES TOBIANUS (LANCEA)	SAND EEL
8845010301	HYPEROPLUS LANCEOLATUS	GREATER SANDEEL
8846010106	CALLIONYMUS LYRA	SPOTTED DRAGONET
8846010107	CALLIONYMUS MACULATUS	DRAGONET
8847010000	GOBIIDAE	GOBIES
8847015101	POMATOSCHISTUS MINUTUS	SAND GOBY
8847015103	POMATOSCHISTUS MICROPS	COMMON GOBY
8847016701	LESUEURIGOBIUS FRIESSII	FRIESES' GOBY
8850030302	SCOMBER SCOMBRUS	MACKEREL
8857030402	SCOPHTHALMUS MAXIMUS	TURBOT
8857030403	SCOPHTHALMUS RHOMBUS	BRILL
8857031702	ARNOGLOSSUS LATERNA	SCALDFISH
8857040603	HIPPOGLOSSOIDES PLATESSOIDES	LONG ROUGH DAB
8857040904	LIMANDA LIMANDA	DAB
8857041202	MICROSTOMUS KITT	LEMON SOLE
8857041402	PLATICHTHYS FLESUS	FLOUNDER
8857041502	PLEURONECTES PLATESSA	PLAICE
8858010601	SOLEA SOLEA	SOLE
8858010801	BUGLOSSIDIUM LUTEUM	SOLENETTE

Table 5.7 Target strength parameters

Species	a	b	d
Clupea harengus	-71.2	20	9.533E-07
Sprattus sprattus	-71.2	20	9.533E-07
Gadus morhua	-67.5	20	2.235E-06
Trachurus trachurus	-71.2	20	9.533E-07
Scomber scombrus	-84.9	20	4.066E-08

Table 6.1. Data exchange format.

Table 3.x.1 Estimated numbers (millions) of herring r/v "XXXX" October

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+

Table 3.x.2 Estimated mean weight (gram) of herring r/v "XXXX" October

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+

Table 3.x.3 Estimated numbers (millions) of sprat r/v "XXXX" October

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+

Table 3.x.4 Estimated mean weight (gram) of sprat r/v "XXXX" October

SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+

Table 3.x.5 Survey statistics r/v "XXXX" October

ICES SD	ICES Rect.	Area (nm^2)	Sa (m^2/nm^2)	σ cm^2	N total (million)	herring (%)	sprat (%)

Table 6.2. Structure of BAD1.

Structure of table AH

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SD	C	4		ICES Sub-division
RECT	C	5		ICES rectangle
NHTOT	N	8	2	Total herring abundance (millions)
NH0	N	8	2	Abundance of herring age group 0 (millions)
NH1	N	8	2	Abundance of herring age group 1 (millions)
NH2	N	8	2	Abundance of herring age group 2 (millions)
NH3	N	8	2	Abundance of herring age group 3 (millions)
NH4	N	8	2	Abundance of herring age group 4 (millions)
NH5	N	8	2	Abundance of herring age group 5 (millions)
NH6	N	8	2	Abundance of herring age group 6 (millions)
NH7	N	8	2	Abundance of herring age group 7 (millions)
NH8	N	8	2	Abundance of herring age group 8+ (millions)

Structure of table AS

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SD	C	4		ICES Sub-division
RECT	C	5		ICES rectangle
NSTOT	N	8	2	Total sprat abundance (millions)
NS0	N	8	2	Abundance of sprat age group 0 (millions)
NS1	N	8	2	Abundance of sprat age group 1 (millions)
NS2	N	8	2	Abundance of sprat age group 2 (millions)
NS3	N	8	2	Abundance of sprat age group 3 (millions)
NS4	N	8	2	Abundance of sprat age group 4 (millions)
NS5	N	8	2	Abundance of sprat age group 5 (millions)
NS6	N	8	2	Abundance of sprat age group 6 (millions)
NS7	N	8	2	Abundance of sprat age group 7 (millions)
NS8	N	8	2	Abundance of sprat age group 8+ (millions)

Structure of table WH

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SD	C	4		ICES Sub-division
RECT	C	5		ICES rectangle
WHTOT	N	7	2	Total mean weight of herring (gram)
WH0	N	7	2	Mean weight of herring age group 0 (gram)
WH1	N	7	2	Mean weight of herring age group 1 (gram)
WH2	N	7	2	Mean weight of herring age group 2 (gram)
WH3	N	7	2	Mean weight of herring age group 3 (gram)
WH4	N	7	2	Mean weight of herring age group 4 (gram)
WH5	N	7	2	Mean weight of herring age group 5 (gram)
WH6	N	7	2	Mean weight of herring age group 6 (gram)
WH7	N	7	2	Mean weight of herring age group 7 (gram)
WH8	N	7	2	Mean weight of herring age group 8+ (gram)

Table 6.2 continued

Structure of table WS

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SD	C	4		ICES Sub-division
RECT	C	5		ICES rectangle
WSTOT	N	7	2	Total mean weight of sprat (gram)
WS0	N	7	2	Abundance of sprat age group 0 (gram)
WS1	N	7	2	Abundance of sprat age group 1 (gram)
WS2	N	7	2	Abundance of sprat age group 2 (gram)
WS3	N	7	2	Abundance of sprat age group 3 (gram)
WS4	N	7	2	Abundance of sprat age group 4 (gram)
WS5	N	7	2	Abundance of sprat age group 5 (gram)
WS6	N	7	2	Abundance of sprat age group 6 (gram)
WS7	N	7	2	Abundance of sprat age group 7 (gram)
WS8	N	7	2	Abundance of sprat age group 8+ (gram)

Structure of table ST

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SD	C	4		ICES Sub-division
RECT	C	5		ICES rectangle
AREA	N	7	1	Area [NM²] see
SA	N	7	1	Mean Sa [m²/NM²]
SIGMA	N	7	3	Mean σ [m²/NM²] see formula (5.8.3)
NTOT	N	8	2	Total number of fish (millions) see formula (5.9.1)
HH	N	7	3	Percentage of herring
HS	N	7	3	Percentage of sprat

Struture of table SU

Field	Type	Length	Decimals	Description
CCODE	C	7		Survey code
SHIP	C	20		Name of the vessel
YEAR	C	5		Survey year

APPENDIX 1 – LIST OF SYMBOLS

a	age group
i	species
j	length class
k	haul
a_i, b_i, d_i	parameter of the TS-length relation for species i
f_i	frequency of species i
f_a	frequency of age group a
f_j	frequency of length j
f_{ij}	frequency of length class j for species i
f_{ia}	frequency of age group a for species i
n_{ik}	fish number of species i in haul k
n_{ijk}	fish number of species i and length class j in haul k
q_{ai}	normalised age-length-key
A	Area of the ICES rectangle
F	fish density
L_j	length in class j
M	number of hauls in the ICES rectangle
M_i	number of hauls containing species i
N_k	total fish number in haul k
N_{ik}	fish number of species i in haul k
N_i	abundance of species i
N_{ia}	abundance of age group a for species i
N	total abundance
S_a	area scattering cross section
W_j	mean weight in length class j
W_a	mean weight of age group a
Q_{ai}	biomass of age group a for species i
$\langle\sigma\rangle$	mean cross section
$\langle\sigma_i\rangle$	mean cross section of species i

APPENDIX 2 – CALIBRATION PROCEDURES

Centering of split beam

The purpose of this operation is to move the immersed, suspended sphere onto the acoustic axis of the transducer. First the echo sounder should be set so that the echo from sphere is visible on the display.

Select the Transceiver menu and set:

Mode: Active
Pulse length: Medium
Bandwidth: Wide
Transducer depth: 0.0 m

Select the Operation menu and set:

Ping mode: Normal
Ping interval: 1.0 sec.
Noise margin: 0 dB

Select the Display/Echogram menu and set

Range: Select a range from the sea surface well below the sphere
Range start: 0.0 m
Auto range: Off
Bot. Range Pres.: Off
Presentation: Normal
Layer lines: On
Integration lines: 10 000
TVG: 40 log R
TS colour min.: -50 dB

Select the Log menu and set

Mode: Ping
Ping interval: 100

Select the Layer menu and set

Super layer: 1

Select the Layer menu/Layer-1 menu and set

Type: Surface
Range:
and Range start: The range must be wide enough to cover the sphere echo during the movements in the centering operation. Otherwise it should be as narrow as possible, in order to exclude disturbing fish echoes. Be sure that also the bottom echo as well as the trailing edge of the transmitter pulse and the echo from the additional weight are outside the layer.

Margin: 0.0 m
Sv Threshold: -80 dB
No. of sublayers: 1

The rest of the sub-layers should be turned off.

Select the TS-detection menu and set

Min. value:	-50 dB
Min. echo length:	0.8
Max. echo length:	1.8
Max. gain comp.:	6.0 dB
Max. phase dev.:	2.0

The best value for the sound velocity should be set in the sound velocity menu in order to keep the accuracy as high as possible for the calibration exercise.

If the sphere is in the beam an echo will now be seen as a steady line in the echogram. If the sphere furthermore is inside the -6 dB limit of the beam, the echo will show up as a dot on the TS-detection window on the left side of the screen. The horizontal projection makes it easy to see which way the sphere must be moved to reach the beam center. Movement of the sphere occurs by turning various winches, always one winch at a time and on specific command by the director of this procedure, who is guided by constant observation of the echo on the screen.

s_A - measurement

A test and if necessary, a calibration of the s_A -calculation may be carried out according to the following procedure.

Check the cable connections to colour printer-1.
Switch on colour printer-1.

Select the printer menu and set

Integration tables:	Number of the transceiver in use (if EK 500)
Echogram:	Slave

The echogram recording will then be similar to the one on display. Read the measured s_A - value, the red number in the integrator table after each log interval. Calculate the theoretical s_A - value as follows:

TS sphere = target strength of the sphere
σ_{bs} = backscattering cross section of the sphere
$\sigma_{bs} = 10^{\text{TS sphere}/10}$
r = distance between the transducer and the sphere
(read from display screen, underneath the horizontal projection window).

If the recommended minimum of 15 m between the transducer and the calibration sphere for 38 kHz frequency cannot be attained, the absolute minimum distance to attain the theoretical accuracy of $\pm$0.1 dB for the s_A -calibration is 10 m (transducer type ES38B, max. TX power 2000 W).

The measured distance to the calibration sphere in the TS Detection menu will always be larger than the correct distance. The measured distance has to be reduced by the distance given in the table below and used when calculating the theoretical s_A - value. The given data is based on medium TX pulse with Wide Bandwidth and long TX pulse with Narrow Bandwidth (frequency 38 kHz).

Reduce distance r by 0.30 m when using Wide Bandwidth and 0.9 m when using Narrow Bandwidth.
ψ = equivalent 2-way beam angle (from the measurement data delivered with the transducer).
$\psi = 10^{\text{dB–value}/10}$
$s_A \text{ (theory)} = (4\Pi r_0^2)\ \sigma_{bs}\ (1852\text{m/nm})^2 / \psi\ r^2$
where r_0 = 1 meter is the standard reference distance for backscattering

If the measured s_A -value differs from the theoretical value, this can be corrected by changing the S_V Transducer Gain in the Transceiver menu. Calculate a new transducer gain:
New trans. gain = Old trans. gain + 10 log(s_A(measured)/ s_A(theory))/2
Enter the S_V Transducer Gain in the Transducer menu, and the measured s_A -value will be correct.
The calibration conditions and results are recorder in a calibration report.

New exchange format and appendixes

Table 1. Field name, field description, field type and requirement

RECORD TYPE 1 (Haul information - HH)			M/O**			
Field name	**Field description**	**TYPE**	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Standard station number	6AN	M	M	M	M
HaulNo	Haul number	3N	M	M	M	M
Year	Year	4N	M	M	M	M
Month	Month	2N	M	M	M	M
Day	Day	2N	M	M	M	M
TimeShot	Time shot	4N	M	M	M	M
Stratum	Stratum	4A	Not	Not	M	O
HaulDur	Haul duration	3N	M	M	M	M
DayNight	Day/night code	2A	M	M	M	M
ShootLat	Shooting latitude decimal	3N. 4D	M	M	M	M
ShootLong	Shooting longitude decimal	+/-3N. 4D	M	M	M	M
HaulLat	Hauling latitude decimal	3N. 4D	M	M	M	M
HaulLong	Hauling longitude decimal	+/-3N. 4D	M	M	M	M
StatRec	ICES statistical rectangles	4AN	M	M	O	M
Depth	Depth	4N	M	M	M	M
HaulVal	Haul validity	1A	M	M	M	M
HydroStNo	Hydrographic station number	8AN	M	M	M	M
StdSpecRecCode	Standard Species Recording Code	1N	M	M	M	M
BycSpecRecCode	By Catch Species Recording Code	1N	M	M	M	M
DataTypes	Data type	1A	M	M	M	M
Netopening	Netopening (bottom trawl) / Beam width(beam trawl)	2N. 1D	O	O	O	M
Rigging	Rigging	2A	Not	Not	Not	O
Tickler	Number of tickler chains	1N	Not	Not	Not	M
Distance	Distance	4N	O	O	O	O
Warplngt	Warp length	4N	O	O	O	O
Warpdia	Warp diameter	2N	O	O	O	O
WarpDen	Warp density	2N	O	O	O	O
DoorSurface	Door surface	2N. 1D	O	O	O	Not
DoorWgt	Door weight	4N	O	O	O	Not
DoorSpread	Door spread	3N.1D	O	O	O	Not
WingSpread	Wing spread	2N.1D	O	O	O	Not
Buoyancy	Buoyancy	4N	O	O	O	Not
KiteDim	Kite dimensions	1N. 1D	O	O	O	Not
WgtGroundRope	Weight ground rope	4N	O	O	O	Not
TowDir	Towing direction	3N	O	O	O	O
GroundSpeed	Ground speed	1N.1D	O	O	O	O
SpeedWater	Speed through water	1N.1D	O	O	O	O
SurCurDir	Surface current direction	3N	O	O	O	O

SurCurSpeed	Surface current speed	2N.1D	O	O	O	O
BotCurDir	Bottom current direction	3N	O	O	O	O
BotCurSpeed	Bottom current speed	2N.1D	O	O	O	O
WindDir	Wind direction	3N	O	O	O	O
WindSpeed	Wind speed	3N	O	O	O	O
SwellDir	Swell direction	3N	O	O	O	O
SwellHight	Swell height	2N.1D	O	O	O	O
SurTemp	Surface temperature	2N.1D	O	O	O	O
BotTemp	Bottom temperature	2N.1D	O	O	O	O
SurSal	Surface salinity	2N.2D	O	O	O	O
BotSal	Bottom salinity	2N.2D	O	O	O	O
ThermoCline	Thermo cline	1A	O	O	O	O
ThClineDepth	Depth of thermo	4N	O	O	O	O

RECORD TYPE 2 (Length frequency distribution - HL)			M/O**			
Field name	**Field description**	**TYPE***	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Standard station number	6AN	M	M	M	M
HaulNo	Haul no	3N	M	M	M	M
Year	Year	4N	M	M	M	M
SpecCodeType	Species code type	1A	M	M	M	M
SpecCode	Species code	10A	M	M	M	M
SpecVal	Validity code	2N	M	M	M	M
Sex	Sex	2A	O	O	O	O
TotalNo	Total number	7N	M	M	M	M
CatIdentifier	Category identifier	1N	M	M	M	M
NoMeas	Number measured	3N	M	M	M	M
SubFactor	Subsampling factor	3N.3D	M	M	M	M
SubWgt	Sub sampling catch weight	5N	M	M	M	M
CatCatchWgt	Category catch weight	5N.3D	M	M	M	M
LngtCode	Length class code	1N	O	O	O	O
LngtClass	Min. length class	3N.1D	M	M	M	M
HLNoAtLngt	No at length	3N	M	M	M	M

RECORD TYPE 3 (SMALK's - CA)			M/O**			
Field name	**Field description**	**TYPE***	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Station number	6AN	M	M	M	M
HaulNo	Haul no	3N	M	M	M	M
Year	Year	4N	M	M	M	M
SpecCodeType	Species code type	1A	M	M	M	M
SpecCode	Species code	10A	M	M	M	M
AreaType	Area type	2N	M	M	M	M
AreaCode	Area code	4 AN	M	M	M	M
LngtCode	Length class code	1AN	M	M	M	M
LngtClass	Min. length class	3N.1D	M	M	M	M
Sex	Sex	1A	M	M	M	M
Maturity	Maturity	2AN	M	M	O	M
PlusGr	Plus group identifier	2A	O	O	O	O
age	Age	2N	M	M	M	M
CANoAtLngt	Number	3N	M	M	M	M
IndWgt	Individual weight (g)	5N	O	O	O	O

Table 2. Legal values

RECORD TYPE 1 (Haul information - HH)

Field name	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	HH	HH	HH	HH
Quarter	1 to 4	1 to 4	1 to 4	1 to 4
Country	See Appendix III	See Appendix III	See Appendix III	See Appendix III
Ship	See Appendix III	See Appendix III	See Appendix III	See Appendix III
Gear	See Appendix IV	See Appendix IV	See Appendix IV	See Appendix IV
SweepLngt	000-999, -9	000-999, -9	000-999, -9	-9
GearExp	B, D, -9	B, D, -9	B, D, -9	B, D, -9
DoorType	P, V, F, K, -9	P, V, F, K, -9	P, V, F, K, -9	-9
StNo	-9	-9	-9	-9
HaulNo	1 to 999	1 to 999	1 to 999	1 to 999
Year	1900-2099	1900-2099	1900-2099	1900-2099
Month	1 to 12	1 to 12	1 to 12	1 to 12
Day	1 to 28/29/30/31	1 to 28/29/30/31	1 to 28/29/30/31	1 to 28/29/30/31
TimeShot	1 to 2400, 9999	1 to 2400, 9999	1 to 2400, 9999	1 to 2400, 9999
Stratum	See Appendix (to be created)	See Appendix (to be created)	See Appendix (to be created)	See Appendix (to be created)
HaulDur	5 to 150	5 to 90	5 to 90	5 to 90
DayNight	D, N, space	D, N	D, N	D, N
ShootLat	53.0000 to 66.0000	50.0000 to 64.0000	50.0000 to 64.0000	50.0000 to 64.0000
ShootLong	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000
HaulLat	53.0000 to 66.0000	50.0000 to 64.0000	50.0000 to 64.0000	50.0000 to 64.0000
HaulLong	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000
StatRec	Appendix	Appendix	Appendix	Appendix
Depth	10 to 150, space5 to 150 in Sub-div. 22 + 24, -9	10 to 300, -9	10 to 600	5 to 150, -9
HaulVal	I, V, N	I, V	I, V	I, V
HydroStNo				
StdSpecRecCode	See Appendix V	See Appendix V	See Appendix V	See Appendix V
BycSpecRecCode	See Appendix V	See Appendix V	See Appendix V	See Appendix V
DataTypes	R, C, S	R, C, S	R, C, S	R, C, S
Netopening	1.5 to 10.0, -9	2.5 to 10.0, -9	2.5 to 10.0, -9	2.5 to 10.0, -9
Tickler	-9	-9	-9	0 – 8
Rigging	-9	-9	-9	S, M, FM
Distance	1850 to 9999, -9	1850 to 9999, -9	1850 to 9999, -9	1850 to 9999, -9
Warplngt	100 to 999, -9	100 to 999, -9	100 to 999, -9	10 to 500
Warpdia	10 to 60, -9	10 to 60, -9	10 to 60, -9	10 to 60, -9
WarpDen				
DoorSurface	1.0 to 10.0, -9	3.0 to 10.0, -9	3.0 to 10.0, -9	-9
DoorWgt	50 to 2000, -9	500 to 2000, -9	500 to 2000, -9	-9
DoorSpread	25 to 200, -9	48 to 180, -9	48 to 180, -9	-9
WingSpread	12 to 30, -9	12 to 30, -9	12 to 30, -9	12 to 30, -9
Buoyancy	50 to 200, -9	50 to 200, -9	50 to 200, -9	-9
KiteDim	0.5 to 2.0, -9	0.5 to 2.0, -9	0.5 to 2.0, -9	-9
WgtGroundRope	0 to 800, -9	0 to 300, -9	0 to 300, -9	-9
TowDir	1 to 360, -9	1 to 360, -9	1 to 360, -9	1 to 360, -9
GroundSpeed	2.0 to 6.0, -9	2.0 to 6.0, -9	2.0 to 6.0, -9	2.0 to 6.0, -9
SpeedWater	1.0 to 9.9, -9	1.0 to 9.9, -9	1.0 to 9.9, -9	1.0 to 9.9, -9
SurCurDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
SurCurSpeed	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9
BotCurDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
ButCurSpeed	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9

WindDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
WindSpeed	0 to 100, -9	0 to 100, -9	0 to 100, -9	-9
SwellDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
SwellHight	0 to 25.0, -9	0 to 25.0, -9	0 to 25.0, -9	0 to 25.0, -9
SurTemp	-1.0 to 30.0, -9	-1.0 to 30.0, -9	-1.0 to 30.0, -9	-1.0 to 30.0, -9
BotTemp	1.0 to 20.0, -9	1.0 to 20.0, -9	1.0 to 20.0, -9	1.0 to 20.0, -9
SurSal	10.00-38.00, -9	10.00-38.00, -9	10.00-38.00, -9	10.00-38.00, -9
BotSal	20.00-38.00, -9	20.00-38.00, -9	20.00-38.00, -9	20.00-38.00, -9
ThermoCline	y=yes, n=no, -9	y=yes, n=no, -9	y=yes, n=no, -9	y=yes, n=no, -9
ThClineDepth	5 to 100, -9	5 to 100, -9	5 to 100, -9	5 to 100, -9

RECORD TYPE 2 (Length frequency distribution - HL)

Field name	BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	HL	HL	HL	HL
SpecCodeType	N, T	N, T	N, T	N, T
SpecCode	See Appendix VII	See Appendix VII	See Appendix VII	See Appendix VII
SpecVal	See Appendix VIII	See Appendix VIII	See Appendix VIII	See Appendix VIII
Sex	M, F, U, -9	M, F, U	M, F, U	M, F, U
TotalNo	0 to 9999999, -9	., 0, 1, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9
CatIdentifier	1 to 5	1 to 999, -9	1 to 999, -9	1 to 999, -9
NoMeas	0 to 999, -9	0 to 9999999, -9	0 to 9999999, -9	0 to 9999999, -9
SubFactor	1 - 999.999	1 to 5	1 to 5	1 to 5
SubWgt	0 to 40000, -9	0 to 999, -9	0 to 999, -9	0 to 999, -9
CatCatchWgt	0 to 10000000, -9	1 - 999.999	1 - 999.999	1 - 999.999
LngtCode	., 0, 1, 2, 5, 9	0 to 40000, -9	0 to 40000, -9	0 to 40000, -9
LngtClass	1 to 999, -9	0 to 10000000, -9	0 to 10000000, -9	0 to 10000000, -9
HLNoAtLngt	1 to 999999, -9	1 to 999999, -9	1 to 999999, -9	1 to 999999, -9

RECORD TYPE 3 (SMALK's - CA)

Field name	BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	CA	CA	CA	CA
AreaType	22 to 32, see Appendix IX	0 to 3	0 to 3	0 or 4
AreaCode	See Appendix IX	See Appendix IX	See Appendix IX	See Appendix IX
LngtCode	., 0, 1, 2, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9
LngtClass	1 to 999, -9	1 to 999, -9	1 to 999, -9	1 to 999, -9
Sex	M, F, U, -9	M, F, U	M, F, U	M, F, U
Maturity	1 to 5, -9	1 to 4, space	1 to 4, space	1 to 4, space, UK; I, M, H, R, S
PlusGr	+, -9	+, -9	+, -9	+, -9
age	0 to 99, -9	0 to 99, -9	0 to 99, -9	0 to 99, -9
CANoAtLngt	1 to 999	1 to 999	1 to 999	1 to 999
IndWgt	0 to 99999, -9	0 to 99999, -9	0 to 99999, -9	0 to 99999, -9

Table 3. Comments to fields

RECORD TYPE 1 (Haul information - HH)

Field Name	COMMENTS
RecordType	Fixed value: HH
Quarter	
Country	ICES alpha codes for countries
Ship	
Gear	Preliminary code 1)
SweepLngt	
GearExp	S = Bobbins, D = Double sweeps, -9 = unknown
DoorType	P = Polyvalent, V = Vee, F = Flat, K = Kram Waco, -9 = unknown
StNo	National coding system
HaulNo	Sequential numbering by cruise
Year	
Month	
Day	
TimeShot	In UTC
Stratum	
HaulDur	In minutes 2)
DayNight	Not known = -9
ShootLat	Shooting position: latitude decimals
ShootLong	Shooting position: longitude decimals
HaulLat	Hauling position: latitude decimals
HaulLong	Hauling position: longitude decimals
StatRec	
Depth	Depth from surface in metres, Unknown = -9
HaulVal	Invalid =I, Valid =V or no oxygen = N, C = calibrated
HydroStNo	Station no as reported to the ICES hydrographer
StdSpecRecCode	Standard species recording code
BycSpecRecCode	Bycatch species recording code
DataTypes	R = raw data by haul, C = calculated no/hour, S = Sub sample
Netopening	In metres.
Rigging	Only applying to BTS survey; F = Flip-up rope , M = Chain mat
Tickler	Only applying to BTS survey; number of tickler chains
Distance	Distance towed over ground (m)
Warplngt	in metres
Warpdia	In millimetres
WarpDen	Kg/linear meter.
DoorSurface	In squaremetres
DoorWgt	In kilogrammes
DoorSpread	In metres
WingSpread	In metres
Buoyancy	In kilogrammes
KiteDim	In squaremetres
WgtGroundRope	In kilogrammes
TowDir	
GroundSpeed	Ground speed of trawl. Knots
SpeedWater	Trawl speed through. Knots
SurCurDir	Slack water =0
SurCurSpeed	Metres per sec
BotCurDir	Slack water =0
ButCurSpeed	Metres per sec

WindDir	**0 = calm or 360=north, 0=variable**
WindSpeed	Metres per sec
SwellDir	**360=north, 0=variable**
SwellHight	Metres
SurTemp	Degree Celsius
BotTemp	Degree Celsius
SurSal	
BotSal	
ThermoCline	Defined as 2 degrees change in temperature over 10 meters
ThClineDepth	Depth from surface in metres

RECORD TYPE 2 (Length frequency distribution - HL)

Field Name	COMMENTS
RecordType	Fixed value: HL
SpecCodeType	N = NODC or T = TSN
SpecCode	Official NODC code or TSN code
SpecVal	
Sex	Male = M, Female =F, measured but unknown = U, -9 not measured
TotalNo	Not known = -9, total number catch per species and sex. If Data type C then = total number per haul per hour
CatIdentifier	If DataType = C then category number = 1, else 1 to 5, per species and sex
NoMeas	No specimen measured per sub sample if data type = S or haul if data type = C or R. If Sex is measured NoMeas have to be per sex.
SubFactor	If data type=R or C then sub sampling factor = 1
SubWgt	In g. Not known = -9
CatCatchWgt	Catch weight per category or weight per haul per hour (if data type = C). If Sex is measured CatCatchWgt have to be per sex. In g. Not known = -9
LngtCode	0.5 cm length class = 0, 1 cm length class = 1
LngtClass	Identifier of lower bound of length distribution, eg. 65-70 cm=65 For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
HLNoAtLngt	No at length is either by category or by haul and hour. Length classes with zero catch should be excluded from the record (Category catch number equals the sum of no at length).

RECORD TYPE 3 (SMALK's - CA)

Field Name	COMMENTS
RecordType	Fixed value: CA
AreaType	APPENDIX VI
AreaCode	APPENDIX VII
LngtCode	0.5 cm length class = 0, 1 cm length class = 1
LngtClass	Identifier of lower bound of length distribution, eg. 65-70 cm=65, For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
Sex	Male = M, Female = F, measured but unknown = U, -9 not measured
Maturity	See Appendix I
PlusGr	Plus group = +, else space 4)
age	Unknown age/rings= -9 5)
CANoAtLngt	6)
IndWgt	The individual weight of the fish in the record (in gram).

APPENDIX I – Maturity key

IBTS NS, IBTS Atl. And BTS

1. Virgin
   a. Male — Testes very thin translucent ribbon along an unbranched blood vessel. No sign of development.
   b. Female — Ovaries small, elongated, whitish, translucent. No sign of development.
2. Maturing
   a. Male — Development has obviously started, colour is progressing towards creamy white and testes are filling more and more of the body cavity but sperm cannot be extruded with only moderate pressure.
   b. Female — Development has obviously started, eggs are becoming larger and the ovaries are filling more and more of the body cavity but eggs cannot be extruded with only moderated pressure.
3. Spawning
   a. Male — Will extrude sperm under moderate pressure to advanced stage of extruding sperm freely with some sperm still in the gonad.
   b. Female — Will extrude eggs under moderate pressure to advanced stage of extruding eggs freely with some eggs still in the gonad.
4. Spent
   a. Male — Testes shrunken with little sperm in the gonads but often some in the gonoducts which can be extruded under light pressure. Resting condition firm, not translucent, showing no development.
   b. Female — Ovaries shrunken with few residual eggs and much slime. Resting condition, firm, not translucent, showing no development.

BITS

1. Virgin (Immature) — As IBTS
2. Maturing (Mature) — As IBTS
3. Spawning (Mature) — As IBTS
4. Spent (Mature) — As IBTS
5. Resting (Mature/immature) 1)
   a. Male — Testes firm, not translucent, showing no development.
   b. Female — Ovaries firm, not translucent, showing no development.

   1) Should be used when the investigation was during the prespawning and early spawning time (still no spent individuals). Individuals will not contribute stock in the present year.

BTS UK

I Immature
M Maturing
H Hyaline
R Running
S Spent

APPENDIX II – Country and ship codes

IBTS NS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Sweden	SWE	Argos	ARG
United Kingdom (England and Wales)	ENG	Cirolana	CIR
Denmark	DEN	Dana (new)	DAN2
Norway	NOR	Haakon Vasby	HAV
United Kingdom (Scotland)	SCO	Scotia (new)	SCO3
France	FRA	Thalassa (new)	THA2
Netherlands	NED	Tridens (new)	TRI2
Germany	GFR	Walther Herwig III	WAH3

BITS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Sweden	SWE	Argos	ARG
Denmark	DEN	Dana (new)	DAN2
		Havfisken	HAF
Germany	GFR	Solea	SOL
		Clupea	CLP
Estonia	EST		KOOT
Latvia	LAT	Commercial vessel	CLV
Poland	POL	Baltica	BAL
Russia	RUS		VSH

BTS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Belgium	BEL		
Germany	GFR		
United Kingdom (England and Wales)	ENG	Corystes	COR
		CEFAS Endeavour	CEN

IBTS Atl.

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Ireland	IRL		
France	FRA	Thalassa (new)	THA2
United Kingdom (England and Wales)	ENG	Cirolana	CIR
United Kingdom (Scotland)	SCO	Scotia (new)	SCO3

APPENDIX III – Gear codes

IBTS NS

Grand Ouverture Verticale	GOV

BITS

Small TV trawl	TVS
Large TV trawl	TVL

BTS

Beam Trawl	BT

IBTS Atl.

Grand Ouverture Verticale	GOV

APPENDIX IV – Recorded species codes used in record type 1

Recorded standard species list codes
1 = All standard species recorded

Recorded bycatch species list codes
1 = Open ended by-catch list (all species recorded)

IBTS NS standard species

Species	NODC	TSN
Herring	8747010201	161722
Sprat	8747011701	161789
Mackerel	8850030302	172414
Cod	8791030402	164712
Haddock	8791031301	164744
Whiting	8791031801	164758
Norway pout	8791031703	164756
Saithe	8791030901	164727

BITS standard species

Species	NODC	TSN
Herring	8747010201	161722
Sprat	8747011701	161789
Cod	8791030402	164712
Flounder	8857041402	172894

BTS

Plaice
Sole

IBTS Atl.

Cod	8791030402	164712
Whiting	8791031801	164758
Megrim		
Hake		
Mackerel	8850030302	172414
Lophius spp		

APPENDIX V – Species validity code

0 = Invalid information	Information lost
1 = Valid information	Length composition recorded; applies also when no per haul is zero.
4 = Total no per hour only	Catch sampled for No per hour only; no length measurements.

APPENDIX VI – Area types and sampling areas

0 = ICES Statistical Rectangles
2 = Standard Roundfish Areas
4 = Baltic Sub-division
5 = BTS Otoliths Areas

APPENDIX VII – Indices areas

IBTS NS
- Herring - *MAP*
- Sprat - *MAP*
- Mackerel - *MAP*
- Cod - *MAP*
- Haddock - *MAP*
- Whiting - *MAP*
- Norway pout - *MAP*
- Saithe - *MAP*

BITS
- Cod - *MAP*

BTS
- Plaice - *MAP*
- Sole - *MAP*

IBTS Atl.
- Cod - *MAP*
- Whiting - *MAP*
- Megrim - *MAP*
- Hake - *MAP*
- Mackerel - *MAP*
- Lophius spp - *MAP*

Annex 4
New exchange format and appendixes

Table 1. Field name, field description, field type and requirement

RECORD TYPE 1 (Haul information - HH)			M/O**			
Field name	**Field description**	**TYPE**	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Standard station number	6AN	M	M	M	M
HaulNo	Haul number	3N	M	M	M	M
Year	Year	4N	M	M	M	M
Month	Month	2N	M	M	M	M
Day	Day	2N	M	M	M	M
TimeShot	Time shot	4N	M	M	M	M
Stratum	Stratum	4A	Not	Not	M	O
HaulDur	Haul duration	3N	M	M	M	M
DayNight	Day/night code	2A	M	M	M	M
ShootLat	Shooting latitude decimal	3N. 4D	M	M	M	M
ShootLong	Shooting longitude decimal	+/-3N. 4D	M	M	M	M
HaulLat	Hauling latitude decimal	3N. 4D	M	M	M	M
HaulLong	Hauling longitude decimal	+/-3N. 4D	M	M	M	M
StatRec	ICES statistical rectangles	4AN	M	M	O	M
Depth	Depth	4N	M	M	M	M
HaulVal	Haul validity	1A	M	M	M	M
HydroStNo	Hydrographic station number	8AN	M	M	M	M
StdSpecRecCode	Standard Species Recording Code	1N	M	M	M	M
BycSpecRecCode	By Catch Species Recording Code	1N	M	M	M	M
DataTypes	Data type	1A	M	M	M	M
Netopening	Netopening (bottom trawl) / Beam width(beam trawl)	2N. 1D	O	O	O	M
Rigging	Rigging	2A	Not	Not	Not	O
Tickler	Number of tickler chains	1N	Not	Not	Not	M
Distance	Distance	4N	O	O	O	O
Warplngt	Warp length	4N	O	O	O	O
Warpdia	Warp diameter	2N	O	O	O	O
WarpDen	Warp density	2N	O	O	O	O
DoorSurface	Door surface	2N. 1D	O	O	O	Not
DoorWgt	Door weight	4N	O	O	O	Not
DoorSpread	Door spread	3N.1D	O	O	O	Not
WingSpread	Wing spread	2N.1D	O	O	O	Not
Buoyancy	Buoyancy	4N	O	O	O	Not
KiteDim	Kite dimensions	1N. 1D	O	O	O	Not
WgtGroundRope	Weight ground rope	4N	O	O	O	Not
TowDir	Towing direction	3N	O	O	O	O
GroundSpeed	Ground speed	1N.1D	O	O	O	O
SpeedWater	Speed through water	1N.1D	O	O	O	O
SurCurDir	Surface current direction	3N	O	O	O	O

SurCurSpeed	Surface current speed	2N.1D	O	O	O	O
BotCurDir	Bottom current direction	3N	O	O	O	O
BotCurSpeed	Bottom current speed	2N.1D	O	O	O	O
WindDir	Wind direction	3N	O	O	O	O
WindSpeed	Wind speed	3N	O	O	O	O
SwellDir	Swell direction	3N	O	O	O	O
SwellHight	Swell height	2N.1D	O	O	O	O
SurTemp	Surface temperature	2N.1D	O	O	O	O
BotTemp	Bottom temperature	2N.1D	O	O	O	O
SurSal	Surface salinity	2N.2D	O	O	O	O
BotSal	Bottom salinity	2N.2D	O	O	O	O
ThermoCline	Thermo cline	1A	O	O	O	O
ThClineDepth	Depth of thermo	4N	O	O	O	O

RECORD TYPE 2 (Length frequency distribution - HL)

			M/O**			
Field name	**Field description**	**TYPE***	**BITS**	**IBTS NS**	**IBTS Atlantic**	**BTS**
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Standard station number	6AN	M	M	M	M
HaulNo	Haul no	3N	M	M	M	M
Year	Year	4N	M	M	M	M
SpecCodeType	Species code type	1A	M	M	M	M
SpecCode	Species code	10A	M	M	M	M
SpecVal	Validity code	2N	M	M	M	M
Sex	Sex	2A	O	O	O	O
TotalNo	Total number	7N	M	M	M	M
CatIdentifier	Category identifier	1N	M	M	M	M
NoMeas	Number measured	3N	M	M	M	M
SubFactor	Subsampling factor	3N.3D	M	M	M	M
SubWgt	Sub sampling catch weight	5N	M	M	M	M
CatCatchWgt	Category catch weight	5N.3D	M	M	M	M
LngtCode	Length class code	1N	O	O	O	O
LngtClass	Min. length class	3N.1D	M	M	M	M
HLNoAtLngt	No at length	3N	M	M	M	M

RECORD TYPE 3 (SMALK's - CA)

Field name	Field description	TYPE*	M/O** BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	Record type	2A	M	M	M	M
Quarter	Quarter	1N	M	M	M	M
Country	Country	3A	M	M	M	M
Ship	Ship	4AN	M	M	M	M
Gear	Gear	10AN	M	M	M	M
SweepLngt	Sweep length	3N	O	O	O	Not
GearExp	Exceptions	2A	O	O	O	O
DoorType	Door type	2A	O	O	O	Not
StNo	Station number	6AN	M	M	M	M
HaulNo	Haul no	3N	M	M	M	M
Year	Year	4N	M	M	M	M
SpecCodeType	Species code type	1A	M	M	M	M
SpecCode	Species code	10A	M	M	M	M
AreaType	Area type	2N	M	M	M	M
AreaCode	Area code	4 AN	M	M	M	M
LngtCode	Length class code	1AN	M	M	M	M
LngtClass	Min. length class	3N.1D	M	M	M	M
Sex	Sex	1A	M	M	M	M
Maturity	Maturity	2AN	M	M	O	M
PlusGr	Plus group identifier	2A	O	O	O	O
age	Age	2N	M	M	M	M
CANoAtLngt	Number	3N	M	M	M	M
IndWgt	Individual weight (g)	5N	O	O	O	O

Table 2. Legal values

RECORD TYPE 1 (Haul information - HH)

Field name	BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	HH	HH	HH	HH
Quarter	1 to 4	1 to 4	1 to 4	1 to 4
Country	See Appendix III	See Appendix III	See Appendix III	See Appendix III
Ship	See Appendix III	See Appendix III	See Appendix III	See Appendix III
Gear	See Appendix IV	See Appendix IV	See Appendix IV	See Appendix IV
SweepLngt	000-999, -9	000-999, -9	000-999, -9	-9
GearExp	B, D, -9	B, D, -9	B, D, -9	B, D, -9
DoorType	P, V, F, K, -9	P, V, F, K, -9	P, V, F, K, -9	-9
StNo	-9	-9	-9	-9
HaulNo	1 to 999	1 to 999	1 to 999	1 to 999
Year	1900-2099	1900-2099	1900-2099	1900-2099
Month	1 to 12	1 to 12	1 to 12	1 to 12
Day	1 to 28/29/30/31	1 to 28/29/30/31	1 to 28/29/30/31	1 to 28/29/30/31
TimeShot	1 to 2400, 9999	1 to 2400, 9999	1 to 2400, 9999	1 to 2400, 9999
Stratum	See Appendix (to be created)	See Appendix (to be created)	See Appendix (to be created)	See Appendix (to be created)
HaulDur	5 to 150	5 to 90	5 to 90	5 to 90
DayNight	D, N, space	D, N	D, N	D, N
ShootLat	53.0000 to 66.0000	50.0000 to 64.0000	50.0000 to 64.0000	50.0000 to 64.0000
ShootLong	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000
HaulLat	53.0000 to 66.0000	50.0000 to 64.0000	50.0000 to 64.0000	50.0000 to 64.0000
HaulLong	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000	0.0000 to 59.0000
StatRec	Appendix	Appendix	Appendix	Appendix
Depth	10 to 150, space5 to 150 in Sub-div. 22 + 24, -9	10 to 300, -9	10 to 600	5 to 150, -9
HaulVal	I, V, N	I, V	I, V	I, V
HydroStNo				
StdSpecRecCode	See Appendix V	See Appendix V	See Appendix V	See Appendix V
BycSpecRecCode	See Appendix V	See Appendix V	See Appendix V	See Appendix V
DataTypes	R, C, S	R, C, S	R, C, S	R, C, S
Netopening	1.5 to 10.0, -9	2.5 to 10.0, -9	2.5 to 10.0, -9	2.5 to 10.0, -9
Tickler	-9	-9	-9	0 – 8
Rigging	-9	-9	-9	S, M, FM
Distance	1850 to 9999, -9	1850 to 9999, -9	1850 to 9999, -9	1850 to 9999, -9
Warplngt	100 to 999, -9	100 to 999, -9	100 to 999, -9	10 to 500
Warpdia	10 to 60, -9	10 to 60, -9	10 to 60, -9	10 to 60, -9
WarpDen				
DoorSurface	1.0 to 10.0, -9	3.0 to 10.0, -9	3.0 to 10.0, -9	-9
DoorWgt	50 to 2000, -9	500 to 2000, -9	500 to 2000, -9	-9
DoorSpread	25 to 200, -9	48 to 180, -9	48 to 180, -9	-9
WingSpread	12 to 30, -9	12 to 30, -9	12 to 30, -9	12 to 30, -9
Buoyancy	50 to 200, -9	50 to 200, -9	50 to 200, -9	-9
KiteDim	0.5 to 2.0, -9	0.5 to 2.0, -9	0.5 to 2.0, -9	-9
WgtGroundRope	0 to 800, -9	0 to 300, -9	0 to 300, -9	-9
TowDir	1 to 360, -9	1 to 360, -9	1 to 360, -9	1 to 360, -9
GroundSpeed	2.0 to 6.0, -9	2.0 to 6.0, -9	2.0 to 6.0, -9	2.0 to 6.0, -9
SpeedWater	1.0 to 9.9, -9	1.0 to 9.9, -9	1.0 to 9.9, -9	1.0 to 9.9, -9
SurCurDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
SurCurSpeed	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9
BotCurDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
ButCurSpeed	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9	0 to 10.0, -9

WindDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
WindSpeed	0 to 100, -9	0 to 100, -9	0 to 100, -9	-9
SwellDir	0 to 360, -9	0 to 360, -9	0 to 360, -9	0 to 360, -9
SwellHight	0 to 25.0, -9	0 to 25.0, -9	0 to 25.0, -9	0 to 25.0, -9
SurTemp	-1.0 to 30.0, -9	-1.0 to 30.0, -9	-1.0 to 30.0, -9	-1.0 to 30.0, -9
BotTemp	1.0 to 20.0, -9	1.0 to 20.0, -9	1.0 to 20.0, -9	1.0 to 20.0, -9
SurSal	10.00-38.00, -9	10.00-38.00, -9	10.00-38.00, -9	10.00-38.00, -9
BotSal	20.00-38.00, -9	20.00-38.00, -9	20.00-38.00, -9	20.00-38.00, -9
ThermoCline	y=yes, n=no, -9	y=yes, n=no, -9	y=yes, n=no, -9	y=yes, n=no, -9
ThClineDepth	5 to 100, -9	5 to 100, -9	5 to 100, -9	5 to 100, -9

RECORD TYPE 2 (Length frequency distribution - HL)

Field name	BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	HL	HL	HL	HL
SpecCodeType	N, T	N, T	N, T	N, T
SpecCode	See Appendix VII	See Appendix VII	See Appendix VII	See Appendix VII
SpecVal	See Appendix VIII	See Appendix VIII	See Appendix VIII	See Appendix VIII
Sex	M, F, U, -9	M, F, U	M, F, U	M, F, U
TotalNo	0 to 9999999, -9	., 0, 1, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9
CatIdentifier	1 to 5	1 to 999, -9	1 to 999, -9	1 to 999, -9
NoMeas	0 to 999, -9	0 to 9999999, -9	0 to 9999999, -9	0 to 9999999, -9
SubFactor	1 - 999.999	1 to 5	1 to 5	1 to 5
SubWgt	0 to 40000, -9	0 to 999, -9	0 to 999, -9	0 to 999, -9
CatCatchWgt	0 to 10000000, -9	1 - 999.999	1 - 999.999	1 - 999.999
LngtCode	., 0, 1, 2, 5, 9	0 to 40000, -9	0 to 40000, -9	0 to 40000, -9
LngtClass	1 to 999, -9	0 to 10000000, -9	0 to 10000000, -9	0 to 10000000, -9
HLNoAtLngt	1 to 999999, -9	1 to 999999, -9	1 to 999999, -9	1 to 999999, -9

RECORD TYPE 3 (SMALK's - CA)

Field name	BITS	IBTS NS	IBTS Atlantic	BTS
RecordType	CA	CA	CA	CA
AreaType	22 to 32, see Appendix IX	0 to 3	0 to 3	0 or 4
AreaCode	See Appendix IX	See Appendix IX	See Appendix IX	See Appendix IX
LngtCode	., 0, 1, 2, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9	., 0, 1, 5, 9
LngtClass	1 to 999, -9	1 to 999, -9	1 to 999, -9	1 to 999, -9
Sex	M, F, U, -9	M, F, U	M, F, U	M, F, U
Maturity	1 to 5, -9	1 to 4, space	1 to 4, space	1 to 4, space, UK; I, M, H, R, S
PlusGr	+, -9	+, -9	+, -9	+, -9
age	0 to 99, -9	0 to 99, -9	0 to 99, -9	0 to 99, -9
CANoAtLngt	1 to 999	1 to 999	1 to 999	1 to 999
IndWgt	0 to 99999, -9	0 to 99999, -9	0 to 99999, -9	0 to 99999, -9

Table 3. Comments to fields

RECORD TYPE 1 (Haul information - HH)

Field Name	COMMENTS
RecordType	Fixed value: HH
Quarter	
Country	ICES alpha codes for countries
Ship	
Gear	Preliminary code 1)
SweepLngt	
GearExp	S = Bobbins, D = Double sweeps, -9 = unknown
DoorType	P = Polyvalent, V = Vee, F = Flat, K = Kram Waco, -9 = unknown
StNo	National coding system
HaulNo	Sequential numbering by cruise
Year	
Month	
Day	
TimeShot	In UTC
Stratum	
HaulDur	In minutes 2)
DayNight	Not known = -9
ShootLat	Shooting position: latitude decimals
ShootLong	Shooting position: longitude decimals
HaulLat	Hauling position: latitude decimals
HaulLong	Hauling position: longitude decimals
StatRec	
Depth	Depth from surface in metres, Unknown = -9
HaulVal	Invalid =I, Valid =V or no oxygen = N, C = calibrated
HydroStNo	Station no as reported to the ICES hydrographer
StdSpecRecCode	Standard species recording code
BycSpecRecCode	Bycatch species recording code
DataTypes	R = raw data by haul, C = calculated no/hour, S = Sub sample
Netopening	In metres.
Rigging	Only applying to BTS survey; F = Flip-up rope , M = Chain mat
Tickler	Only applying to BTS survey; number of tickler chains
Distance	Distance towed over ground (m)
Warplngt	in metres
Warpdia	In millimetres
WarpDen	Kg/linear meter.
DoorSurface	In squaremetres
DoorWgt	In kilogrammes
DoorSpread	In metres
WingSpread	In metres
Buoyancy	In kilogrammes
KiteDim	In squaremetres
WgtGroundRope	In kilogrammes
TowDir	
GroundSpeed	Ground speed of trawl. Knots
SpeedWater	Trawl speed through. Knots
SurCurDir	Slack water =0
SurCurSpeed	Metres per sec
BotCurDir	Slack water =0
ButCurSpeed	Metres per sec

WindDir	**0 = calm or 360=north, 0=variable**
WindSpeed	Metres per sec
SwellDir	**360=north, 0=variable**
SwellHight	Metres
SurTemp	Degree Celsius
BotTemp	Degree Celsius
SurSal	
BotSal	
ThermoCline	Defined as 2 degrees change in temperature over 10 meters
ThClineDepth	Depth from surface in metres

RECORD TYPE 2 (Length frequency distribution - HL)

Field Name	COMMENTS
RecordType	Fixed value: HL
SpecCodeType	N = NODC or T = TSN
SpecCode	Official NODC code or TSN code
SpecVal	
Sex	Male = M, Female =F, measured but unknown = U, -9 not measured
TotalNo	Not known = -9, total number catch per species and sex. If Data type C then = total number per haul per hour
CatIdentifier	If DataType = C then category number = 1, else 1 to 5, per species and sex
NoMeas	No specimen measured per sub sample if data type = S or haul if data type = C or R. If Sex is measured NoMeas have to be per sex.
SubFactor	If data type=R or C then sub sampling factor = 1
SubWgt	In g. Not known = -9
CatCatchWgt	Catch weight per category or weight per haul per hour (if data type = C). If Sex is measured CatCatchWgt have to be per sex. In g. Not known = -9
LngtCode	0.5 cm length class = 0, 1 cm length class = 1
LngtClass	Identifier of lower bound of length distribution, eg. 65-70 cm=65 For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
HLNoAtLngt	No at length is either by category or by haul and hour. Length classes with zero catch should be excluded from the record (Category catch number equals the sum of no at length).

RECORD TYPE 3 (SMALK's - CA)

Field Name	COMMENTS
RecordType	Fixed value: CA
AreaType	APPENDIX VI
AreaCode	APPENDIX VII
LngtCode	0.5 cm length class = 0, 1 cm length class = 1
LngtClass	Identifier of lower bound of length distribution, eg. 65-70 cm=65, For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
Sex	Male = M, Female = F, measured but unknown = U, -9 not measured
Maturity	See Appendix I
PlusGr	Plus group = +, else space 4)
age	Unknown age/rings= -9 5)
CANoAtLngt	6)
IndWgt	The individual weight of the fish in the record (in gram).

APPENDIX I – Maturity key

IBTS NS, IBTS Atl. And BTS

1. Virgin
    a. Male — Testes very thin translucent ribbon along an unbranched blood vessel. No sign of development.
    b. Female — Ovaries small, elongated, whitish, translucent. No sign of development.
2. Maturing
    a. Male — Development has obviously started, colour is progressing towards creamy white and testes are filling more and more of the body cavity but sperm cannot be extruded with only moderate pressure.
    b. Female — Development has obviously started, eggs are becoming larger and the ovaries are filling more and more of the body cavity but eggs cannot be extruded with only moderated pressure.
3. Spawning
    a. Male — Will extrude sperm under moderate pressure to advanced stage of extruding sperm freely with some sperm still in the gonad.
    b. Female — Will extrude eggs under moderate pressure to advanced stage of extruding eggs freely with some eggs still in the gonad.
4. Spent
    a. Male — Testes shrunken with little sperm in the gonads but often some in the gonoducts which can be extruded under light pressure. Resting condition firm, not translucent, showing no development.
    b. Female — Ovaries shrunken with few residual eggs and much slime. Resting condition, firm, not translucent, showing no development.

BITS

1. Virgin (Immature) — As IBTS
2. Maturing (Mature) — As IBTS
3. Spawning (Mature) — As IBTS
4. Spent (Mature) — As IBTS
5. Resting (Mature/immature) 1)
    a. Male — Testes firm, not translucent, showing no development.
    b. Female — Ovaries firm, not translucent, showing no development.

1) Should be used when the investigation was during the prespawning and early spawning time (still no spent individuals). Individuals will not contribute stock in the present year.

BTS UK

I Immature
M Maturing
H Hyaline
R Running
S Spent

APPENDIX II – Country and ship codes

IBTS NS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Sweden	SWE	Argos	ARG
United Kingdom (England and Wales)	ENG	Cirolana	CIR
Denmark	DEN	Dana (new)	DAN2
Norway	NOR	Haakon Vasby	HAV
United Kingdom (Scotland)	SCO	Scotia (new)	SCO3
France	FRA	Thalassa (new)	THA2
Netherlands	NED	Tridens (new)	TRI2
Germany	GFR	Walther Herwig III	WAH3

BITS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Sweden	SWE	Argos	ARG
Denmark	DEN	Dana (new)	DAN2
		Havfisken	HAF
Germany	GFR	Solea	SOL
		Clupea	CLP
Estonia	EST		KOOT
Latvia	LAT	Commercial vessel	CLV
Poland	POL	Baltica	BAL
Russia	RUS		VSH

BTS

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Belgium	BEL		
Germany	GFR		
United Kingdom (England and Wales)	ENG	Corystes	COR
		CEFAS Endeavour	CEN

IBTS Atl.

COUNTRY	ICES' CODE	SHIP NAME	ICES' CODE
Ireland	IRL		
France	FRA	Thalassa (new)	THA2
United Kingdom (England and Wales)	ENG	Cirolana	CIR
United Kingdom (Scotland)	SCO	Scotia (new)	SCO3

APPENDIX III – Gear codes

IBTS NS

Grand Ouverture Verticale	GOV

BITS

Small TV trawl	TVS
Large TV trawl	TVL

BTS

Beam Trawl	BT

IBTS Atl.

Grand Ouverture Verticale	GOV

APPENDIX IV – Recorded species codes used in record type 1

Recorded standard species list codes
1 = All standard species recorded

Recorded bycatch species list codes
1 = Open ended by-catch list (all species recorded)

IBTS NS standard species

Species	NODC	TSN
Herring	8747010201	161722
Sprat	8747011701	161789
Mackerel	8850030302	172414
Cod	8791030402	164712
Haddock	8791031301	164744
Whiting	8791031801	164758
Norway pout	8791031703	164756
Saithe	8791030901	164727

BITS standard species

Species	NODC	TSN
Herring	8747010201	161722
Sprat	8747011701	161789
Cod	8791030402	164712
Flounder	8857041402	172894

BTS

Plaice
Sole

IBTS Atl.

Cod	8791030402	164712
Whiting	8791031801	164758
Megrim		
Hake		
Mackerel	8850030302	172414
Lophius spp		

APPENDIX V – Species validity code

0 = Invalid information	Information lost
1 = Valid information	Length composition recorded; applies also when no per haul is zero.
4 = Total no per hour only	Catch sampled for No per hour only; no length measurements.

APPENDIX VI – Area types and sampling areas

0 = ICES Statistical Rectangles
2 = Standard Roundfish Areas
4 = Baltic Sub-division
5 = BTS Otoliths Areas

APPENDIX VII – Indices areas

IBTS NS

Herring - *MAP*
Sprat - *MAP*
Mackerel - *MAP*
Cod - *MAP*
Haddock - *MAP*
Whiting - *MAP*
Norway pout - *MAP*
Saithe - *MAP*

BITS

Cod - *MAP*

BTS

Plaice - *MAP*
Sole - *MAP*

IBTS Atl.

Cod - *MAP*
Whiting - *MAP*
Megrim - *MAP*
Hake - *MAP*
Mackerel - *MAP*
Lophius spp - *MAP*

International Council for the Exploration of the Sea

Addendum to ICES CM 2003/H:

MANUAL

FOR THE BALTIC INTERNATIONAL TRAWL SURVEYS

Updated and agreed during the meeting of the Baltic International Fish Survey Working Group

Copenhagen, Denmark
8–12 April 2002

Version April 2002

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

TABLE OF CONTENTS

Section **Page**

1 INTRODUCTION

At the ICES Annual Science Conference in September 1995, the Baltic Fish Committee decided, that a manual to be used at trawl surveys in the Baltic area should be elaborated (C. Res. 1995/2:41). This manual should in its context follow the format of the manual used for the International Bottom Trawl Surveys (IBTS).

The manual for the Baltic international demersal trawl surveys was elaborated by the ICES Baltic International Survey Working Group (BIFS) and also in the frame of the EU project BITS.

All participants of the Baltic international demersal trawl surveys (BITS) should conduct their national surveys according to this manual.

If important changes of the Manual will be necessary a Corrigendum should be prepared during a BIFS meeting and distributed to all participants of the BITS.

2 THE FISHING METHOD

2.1 Standard fishing gear

All participants should use the TV3 trawl. Two types of the trawl were developed for different sizes of research vessels, one 520 meshes in circumference and one 930 meshes. The description and use of the trawls are given in Appendix XIII and Appendix XIV, respectively. They are taken from Annex 2 of the Final and Consolidated Report of the EU Study Project ISDBITS (No 98/099). The following changes were carried out. In Appendix XIII the “Parts List” in the position “Trawl doors” is changed, and the “Check list for rigg” was exchanged. In Appendix XIV a drawing of the Danish stone panel is added.

The small trawl should be used for vessels up to around 800 HP and the larger trawl for vessels with higher towing power.

Quality control

During use the trawls shall be checked at regular intervals by taking a number of check measurements on the geometry of the nets. (The intervals and a list of check measurements will be given in the above mentioned detailed trawl specification.)

2.2 Fishing positions

The international trawl surveys are carried out in form of a stratified random survey. The depth layers within a ICES sub-division are used for stratification. Only depth layers from 10 to 120 m depending on the subdivision are covered by the surveys. The depth layers per ICES square aggregated on 10 m depth layers are given in Appendix XI.

The allocation of the number of trawl stations to a sub-division is done according to its area (60 %) and the density pattern of cod (40 %). This procedure is also used for the subsequent allocation of the number of trawl stations to the depth strata within the subdivision. The method is described in detail by the BIFS Working Group (ICES CM 2002/H:??).

The allocation will be updated and the stations will be randomly selected from the Clear Tow Database by the coordinator every year.

If a selected station can’t be realized by a vessel during a survey (e.g. gill nets are on that position) then a new fishing position within the same depth strata and close as possible to the pre-selected one should be taken.

2.3 Standard fishing operation

The standard haul shall be performed using a standard towing speed of 3 knots. The speed should be measured as the speed over the ground.

The standard haul shall last for 30 minutes (Please note that the **reporting of the catch for the BITS Database is catch per 1 hour**). Start time is defined as the moment when the vertical net opening is stable at the stated towing speed. Stop is defined as the starts of hauling back the trawl.

Trawling shall only take place during daylight, defined in the checking program as the time between 15 minutes before sunrise until 15 minutes past sunset.

Fishing must not be directed towards fish densities or shoals located by means of fish finding equipment like echo sounder and sonar.

Quality control

The horizontal distance between the upper wing-ends should be monitored if possible during the whole tow. The following table gives the limits of the wing-end distance and the corresponding height of the trawl at the centre of the headline.

Trawl measurements at 3 knots in metres	Distance between upper Wingends	Approximate corresponding height at centre of headline
TV3, 520 meshes	13.5 - 14.5	2.2 - 2.5
TV3, 930 meshes	26 - 27	5.5 – 6.5

3 SAMPLING OF TRAWL CATCHES

The following guidelines are to be used for each haul during the survey.
All forms should be filled in using a pencil in order to allow correcting and stay waterproof.
The working up of the catch can be seen as a number of processes succeeding each other.

3.1 Estimating the total weight of the catch

Purpose:.
To achieve an estimate of the total weight of the fish and "other" caught in the given haul.
Preconditions:
The fishing method and the gear performance are in accordance with the specifications given in section 2 in this manual.
The total catch weight must be estimated by one of the following methods.

1. Weighting the total catch by use of a balance.

2. Counting the number of standard filled baskets. The estimated average weight of the baskets is estimated by weighting five random selected baskets.

3. By adding up the total estimated weight or weighted weight of each species (will often be achieved during estimation of the species composition).

The results are recorded in kilograms.

3.2 Estimating the species composition of the catch

Purpose:
Species composition of catches should express the total weight and number of specimens of given species in catch.
Preconditions:
The fishing method and the gear performance are in accordance with the specifications given in section 2 in this manual.
Guidelines:.
All catch is sorted by species, storing different species separately in boxes or baskets for further analyses. In order to simplify further working up of the catch, only boxes or baskets of same size and material should be used.
Certain species that are hard to distinguish from each another may be grouped by genus or higher taxonomic units.
In cases of exceptionally big catch (e.g. over 500 kg) or other circumstances, not allowing the sorting of all catch, the species composition should be estimated using sub-sampling.
The procedure for sub-sampling is one of the following depending on the circumstances:

1. If all species appear fairly frequently in the catch, simultaneous sub-sampling of all species in the whole catch should be used:

A. Three sub-samples each weighting app. 100 kg's, depending of the impression of the species included in the catch, are sorted by species. The samples must be taken from the first, middle and last sections of the trawl cod-end. Be aware of, that the three sub-samples together should represent the whole catch.

B. Each species from the three sub-samples are pooled and each species are weighted separately. The weights are recorded.

C. The total weight of all species (c) in the three sub-samples is estimated by adding the weight of the three samples.

D. The total catch weight of each species is estimated by raising the sub-sample weight for a given species with the ratio between the total catch weight and the summed weight of all sub-samples.

E. All total and sub-sample weights are recorded.

2 If some species appears in very low numbers in the catch, while other species appears in high numbers, sub-sampling of only the frequent species in the catch may be applied.

A. The species appearing with low frequency are sorted out of the whole catch by species and weighted.

B. The rest of the catch is treated as specified in method 1.

C. All total and sub-sample weights are recorded on the Species-form.

Non-fish species should be recorded as well. This group might be grouped and recorded as invertebrates, botanicals or just "Other". Non-organic material (stones, barrels etc.) should be recorded as "Other".
The sorted and weighed fish are then used for the following **length, age and maturity sampling**.

3.3 Length composition

Purpose:
Length composition should express the number of specimens of given species per length croup in catch.
Preconditions:
The whole catch or a representative sub-sample of the catch is sorted by species.
Guidelines:
Length distributions (length compositions) should be recorded for all fish species caught.
If the number of a given species does not significantly exceed the number recommended below all individuals are measured.
If the number of individuals of a given species significantly exceed the number recommended below the following procedure must be adapted:

1. All individuals of a given species in the catch of the given species are subdivided into a number of sub-samples. Each sub-sample approximately of the size recommended below.

2. One of the sub-samples is randomly selected for length measurements.

Always measure the whole sub-sample. Never stop in the middle because you have realised that your sub-sample is too large. In most cases a biased length distribution will be the result.
If you realise that your sub-sample is to small then randomly select another of the sub-samples and continue obtaining the length frequency measuring all of it. If you must, divide this sub-sample into a number of sub-sub-samples and continue the measuring procedure by measuring one or more randomly selected sub-sub-samples).
Length of the fish is defined as total length (measured from the tip of the nose to the tip of caudal fin).
Length is measured to 0.5 cm below for herring and sprat (e.g. lengths in the range of 10.0-10.4 cm are equal to 10.0 cm and lengths 10.5-10.9 cm are equal to 10.5 cm).
For all other species the length is measured to 1 cm below (e.g. lengths in the range of 20.0-20.9 cm are equal to 20.0 cm).
If a certain species is caught in two clearly distinct size categories, both of these size categories should be sampled separately. The number of fish from each sample should follow the sample sizes given below.
Minimum number of individuals to be length measured (in sample or sub-sample):

Number of length-classes	Number of length measurements
1 - 10	100
11 - 20	200
more then 20	300

The dependence of the number of individuals to be measured on the number of length-classes of the total length range (Müller, 1996) is illustrated in Figure 1.
During the length measurements the above specified number of fish of each species per length group are collected and stored separately by the length-groups for **age, sex, individual mean weight and maturity** estimations.

3.4 Age, sex, individual weight and maturity sampling procedure

Purpose:

The purpose is to estimate distributions of age, sex, weight and maturity for each length class
The complete number of age determinations is used to establish age-length-key (ALK) per Subdivision and quarter. ALKs is used for converting the length distribution on a given aggregation level into an age distribution. The determination of sex and maturity stage is done in order to produce maturity ogives for estimating the Spawning Stock biomass (SSB). The individual weight is used for calculating the mean weight per length class, which is used for converting catch in weight into catch in numbers and the weight at age for calculating the SSB and total biomass. Apart from the mentioned purposes, there might be additional purposes (identifying stock components etc.).

Guidelines:

The samples are collected on the basis of country, quarter and ICES Subdivision for all species.
It is recommended that each country collect otoliths by each haul, so the otoliths are distributed all over the Subdivision.
The following species are sampled for age, sex, weight and maturity estimation:

- Herring
- Sprat
- Cod
- Flounder

The procedure of re-measuring the fish, weighting, estimating of sex, maturity stage and the cutting of otoliths might be made most efficient in one work-procedure for each individual in the above-mentioned sequence.

Consequently the number of fish selected for estimating of sex, maturity stage and cutting of otoliths are equal.

Estimating individual/mean weight.

After length measuring the fish, if possible the individual weight of each fish is estimated and recorded. If it is impossible to achieve the individual weight, the number and total weight is recorded in order to calculate the mean weight of the individuals in the group. The weights are estimated by use of an electronic balance. The weight is measured in grams. A minimum of five specimens must be weighted even though less are used for cutting of otoliths.

Estimation of sex and maturity stage.

The abdomen of each individual is cut open and the gonads are examined in order to estimate the sex. If the individual is mature the sexes can easily be distinguished, but for immature individuals the task is difficult and special literature about the subject have to consulted.

In the same process the maturity stage is determined according to the classification description of the different stages given in Appendix I or according to the code practiced on the national level. If a national code is used the national coding must be converted into the BITS 5 stage code according to Appendix II before the data are submitted to ICES.

Cutting of otoliths.

The technique for cutting otoliths depends on the species. For descriptions of these techniques, please consult the literature about the subject.

The optimum number of otoliths per length class and ICES Subdivision can not be given in a universal form. A description of the optimum sample size of age readings and length measurements dependent on a universal cost function is given in Oeberst (1999).

The analyses showed that the necessary number age readings in an length class is dependent on:

- the portion of the length class within the length frequency and
- the maximum variance of the portions of the age groups within the length class.

The table below gives the minimum number of otoliths from each length group, which must be cut per country, survey, Subdivision and species based on the length distribution.

Length-class	Minimum number of age readings
With probably only one age group (age group 0, 1)	2 to 5
With probably more than on age group	
Portion of the length class less than 5%	10
Portion of the length class more than 5%	20

Since the collection of the otoliths should be distributed over the whole survey time in an ICES Sub-division, the actual length frequency of the survey can be used to choose the number of otoliths per length-class.

The otoliths may be:

1. read during the survey, if proper facilities and experienced age readers are available on board. Store the otoliths in ice-boxes, envelopes or other suitable containers.
2. stored for later age determining.

In both cases the containers must be labelled with indication of: species, cruse number, date, sub-division, length class.

4 ENVIRONMENTAL DATA

At each haul, the following hydrographical data should be collected:

- surface temperature,
- bottom temperature,
- surface salinity,
- bottom salinity,
- bottom oxygen.

The sampling procedure of the hydrographical data should be according to the standard specified by ICES.

5 EXCHANGE SPECIFICATIONS FOR BITS DATA

5.1 Deadlines of reporting

Participating countries should submit the data in exchange format of BITS to ICES to the following deadlines:

Data	Deadlines
Preliminary data 1q (HL and CA records only for cod)	Before WGBFAS in April
Final data 1q	1st June
Final data 4q	1st April

For cod catch at age data **per 1 hour** by station (BYFS format) should be also prepared and submitted to the member of WGBFAS that is responsible for the cod assessment before the meeting.

When sending the data to the ICES Secretariat the form in section 5.5 has to be filled in and send together with the records. This will provide an overview of the data for later use and help the entering of the data to the database.

5.2 Data Checking

Before the data (in ASCII coding) are submitted to ICES, they should be checked by the checking program available from the ICES Secretariat. It can found in the web (www.ices.dk ,click down Marine data center-> Baltic International Trawl Surveys).

5.3 Format of data

Four distinct types of computer records have been defined for standard storage of the BITS data:

TYPE 1 : Record with detailed haul information

TYPE 1A: Record with additional haul information

TYPE 2 : Length frequency data

TYPE 4 : Sex-maturity-age-length keys (SMALK's) for ICES Sub-Division.

The detailed formats of these four record types are given section 5.4.1 - 5.4.4 of the present manual.

Details of environmental data should be submitted to the Hydrographic Service of ICES according to established procedures. The national hydrographic station number must be reported in Record TYPE 1 to enable the link to be made between haul data and environmental data.

5.4 File structure and name

When delivering the data to the ICES Secretariat one file should only contain data from one year and survey. The name of the file should be month (the first day of the survey), country (ICES country code) and year, e.g. 03EST98.csv. In addition all the fish species the country intends to report have to be included in the file when sending it to the ICES Secretariat. Later corrections and updates can be made.

The records must be ordered in such a way that each record of TYPE 1 is followed by a variable number of records of TYPE 2, ordered by species. The number and kind of species recorded must agree with the species recording code as specified in record TYPE 1. For examples of the various codes see Appendix V.

Records of TYPE 4 should follow at the end of the file after the last species record of TYPE 2 for the last haul.

Records of TYPE 1A should be submitted in a separate file.

5.4.1 Record type 1

SPECIFICATIONS FOR RECORD TYPE 1 (Haul information)

POSITION	NAME	TYPE*	M/O**	RANGE	COMMENTS
1-2	Record type	2A	M	HH	Fixed value: HH
3	Quarter	1N	M	1 to 4	
4-6	Country	3A	M	See Appendix III	ICES alpha codes for countries
7-10	Ship	4AN	M	See Appendix III	
11-20	Gear	10AN	M	See Appendix IV	Preliminary code 1)
21-26	Station number	6AN	M		National coding system
27-29	Haul no	3N	M	1 to 999	Sequential numbering by cruise
30-31	Year	2N	M	65 to 99 or 00 to 20	
32-33	Month	2N	M	1 to 12	
34-35	Day	2N	M	1 to 28/29/30/31	
36-39	Time shot	4N	M	1 to 2400, 9999	In UTC
40-42	Haul duration	3N	M	5 to 150	In minutes 2)
43	Day/night	1A	M	D, N, space	Not known = space filled
44-45	Lat. degrees	2N	M	53 to 66	Shooting position: Degree Lat.
46-47	Lat. minutes	2N	M	0 to 59	Shooting position: Minute Lat.
48-49	Lon. degrees	2N	M	11 to 31	Shooting position: Degree Lon.
50-51	Lon. minutes	2N	M	0 to 59	Shooting position: Minute Lon.
52	East/West	1A	M	E	Fixed value: E
53-55	Depth	3N	M	10 to 150, space 5 to 150 in Sub-div. 22 + 24	Depth from surface in metres, space filled=not known
56	Haul validity	1A	M	I, V, N	Invalid =I, Valid =V or no oxygen = N, C = calibrated
57-64	Hydrographic station number	8AN	O		Station no as reported to the ICES hydrographer
65-66	Species Recording Code	2N	M	See Appendix V	Use position 65 for standard and 66 for bycatch codes
67-69	Netopening	3N	O	15 to 100	In metres x 10
70-73	Distance	4N	O	1850 to 9999	Distance towed over ground (m)
74-76	Warp lenght	3N	O	100 to 999	in metres
77-78	Warp diameter	2N	O	10 to 60	In millimetres
79-81	Door surface	3N	O	10 to 100	In squaremetres x 10
82-85	Door weight	4N	O	50 to 2000	In kilogrammes
86-89	Buoyancy	4N	O	50 to 200	In kilogrammes
90-91	Kite dimensions	2N	O	5 to 20	In squaremetres x 10
92-95	Weight ground rope	4N	O	0 to 800	In kilogrammes
96-98	Door spread	3N	O	25 to 200	In metres
99-100	Paddingfield	2A	M	Spaces	Filled up with spaces

* All numeric fields (N) right justified, except when spaces are used to indicate no information. All alpha (A) and mixed alpha/numeric fields (AN) left justified, space filled.

** M=mandatory, O=optional. For all optional fields spaces are valid and indicate not known.

COMMENTS:

1. ICES is maintaining this code list. Laboratories should ask the Secretariat for new codes, if the gear they report is not included in the list. Numerical information on gear aspects is defined in position 67-98 and is only required for the GOV trawl.

2. For the historical data a haul duration up to 150 minutes is legal. For present data the haul duration must not be longer than 90 minutes.

5.4.2 Record Type 1A

SPECIFICATIONS FOR RECORD TYPE 1A (Haul information)

POSITION	NAME	TYPE*	M/O**	RANGE	COMMENTS
1-2	Record type	2A	M	HE	Fixed value: HE
3	Quarter	1N	M	1 to 4	
4-6	Country	3A	M	See Appendix III	ICES alpha codes for countries
7-10	Ship	4AN	M	See Appendix III	
11-20	Gear	10AN	M	See Appendix IV	Preliminary code 1)
21-26	Station number	6AN	O		National coding system
27-29	Haul no	3N	M	1 to 999	Sequential numbering by cruise
30-31	Year	2N	M	65 to 99 or 00 to 20	
32-33	Lat. degrees	2N	M	53 to 66	Hauling position: Degree Lat.
34-35	Lat. minutes	2N	M	0 to 59	Hauling position: Minute Lat.
36-37	Lon. degrees	2N	M	11 to 31	Hauling position: Degree Lon.
38-39	Lon. minutes	2N	M	0 to 59	Hauling position: Minute Lon.
40	East/West	1A	M	E	Fixed value: E
41-43	Towing direction	3N	O	1 to 360	
44-45	Ground speed	2N	O	20 to 60	Ground speed of trawl. Knots x 10
46-47	Seed through water	2N	O	10 to 99	Trawl speed through. Knots x 10
48-49	Wing spread	2N	O	12 to 30	Metres
50-52	Surface current direction	3N	O	0 to 360	Slack water =0
53-55	Surface current speed	3N	O	0 to 100	Metres per sec x 10
56-58	Bottom current direction	3N	O	0 to 360	Slack water =0
59-61	Bottom current speed	3N	O	0 to 100	Metres per sec x 10
62-64	Wind direction	3N	O	0 to 360	0 = calm
65-67	Wind speed	3N	O	0 to 100	Metres per sec
68-70	Swell direction	3N	O	0 to 360	
71-73	Swell height	3N	O	0 to 999	Metres x 10
74-100	Paddingfield	27A	M	Spaces	Filled up with spaces

* All numeric fields (N) right justified, zero filled, except when spaces are used to indicate no information.

All alpha (A) and mixed alpha/numeric fields (AN) left justified, space filled.

** M=mandatory, O=optional.

For all optional fields spaces are valid and indicate not known.

COMMENTS:

1) ICES is maintaining this code list. Laboratories should ask the Secretariat for new codes, if the gear they report is not included in the list. Numerical information on gear aspects is only required for the GOV trawl

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5.4.3 Record Type 2

SPECIFICATIONS FOR RECORD TYPE 2 (Length frequency distribution)

POSITION	NAME	TYPE*	M/O**	RANGE	COMMENTS
1-2	Record type	2A	M	HL	Fixed value: HL
3	Quarter	1N	M	1 to 4	See Record Type 1
4-6	Country	3A	M	See Appendix III	See Record Type 1
7-10	Ship	4AN	M	See Appendix III	See Record Type 1
11-20	Gear	10AN	M	See Appendix IV	See Record Type 1
21-26	Station number	6AN	O		See Record Type 1
27-29	Haul no	3N	M	1 to 999	See Record Type 1
30-31	Year	2N	M	65 to 99 or 00 to 20	See Record Type 1
32-41	Species code	10 A	M	See Appendix VII	Official NODC code
42-43	Validity code	2N	M	See Appendix VIII	
44-50	No/hour	7N	M	0 to 9999999	No specimen caught per hour
51-55	Catch weight/Hour	5N	M	0 to 99999, spaces	In 100g. Not known = spaces
56-58	No measured	3N	M	0 to 999, spaces	Not known = spaces
59	Length class code	1AN	M	., 0, 1, 2, 5, 9	0.1 cm length class=. 0.5 cm length class = 0 1 cm length class = 1 2 cm length class = 2 5 cm length class = 5 +group =9
60-62	Min. length class	3N	M	1 to 999, spaces	Identifier of lower bound of length distribution, eg. 65-70 cm=65 For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
63-68	No at length/hour	6N	M	1 to 999999, spaces	Length classes with zero catch should be excluded from the record (no/hour equals the sum of no at length).
69	Sex	1A	O		Male = M, Female =F
70-100	Paddingfield	31A	M	Spaces	Filled up with spaces

* All numeric fields (N) right justified, zero filled, except when spaces are used to indicate no information.

All alpha (A) and mixed alpha/numeric fields (AN) left justified, space filled.

** M=mandatory, O=optional.

For all optional fields spaces are valid and indicate not known.

COMMENTS:

1) Total catch weights should be given per hour fishing.
2) If the number measured is zero then the remainder of the record should be filled with spaces.
3) Size classes smaller than those defined in the BITS manual for reporting length distributions of the various species are allowed.

5.4.4 Record Type 4

SPECIFICATION FOR RECORD TYPE 4 (SMALK's)

POSITION	NAME	TYPE*	M/O**	RANGE	COMMENTS 1)
1-2	Record type	2A	M	CA	Fixed value: CA
3	Quarter	1N	M	1 to 4	See Record Type 1
4-6	Country	3A	M	See Appendix III	See Record Type 1
7-10	Ship	4AN	M	See Appendix III	See Record Type 1
11-20	Gear	10AN	M	See Appendix IV	See Record Type 1
21-26	Station number	6AN	O		See Record Type 1
27-29	Haul no	3N	M	1 to 999	See Record Type 1
30-31	Year	2N	M	65 to 99 or 00 to 20	See Record Type 1
32-41	Species code	10A	M	See Appendix VII	Official NODC code
42-43	Sub-Division area	2N	M	22 to 32, see Appendix IX	ICES Baltic Sub-Division code 7)
44-47	Rectangle area	4 AN	M	See Appendix IX	ICES Statistical Rectangles
48-51	Paddingfield	4 A	M	Spaces	Filled up with spaces
52	Length class code	1AN	M	., 0, 1, 2, 5	0.1 cm length class =. 0.5 cm length class = 0 1 cm length class = 1 2 cm length class = 2 5 cm length class = 5 (+group not allowed) 2)
53-55	Min. length class	3N	M	1 to 999, spaces	Identifier of lower bound of length distribution, eg. 65-70 cm=65 For classes less than 1 cm there will be an implied decimal point after the 2nd digit, eg. 30.5-31.0 cm=305
56	Sex	1A	M	M, F, space	Male = M, Female = F, Unknown = space
57	Maturity	1AN	M	1 to 5, space	See Appendix I 3)
58	+group identifier	1A	M	+, space	Plus group = +, else space 4)
59-60	Age	2N	M	0 to 99, spaces	Unknown age =spaces 5)
61-63	Number	3N	M	1 to 999	6)
64-68	Individual mean weight (g)	5N	O	0 to 99999, spaces	The mean weight of the number of fish in the record (in gram).
68-100	Paddingfield	32 A	M	Spaces	Filled up with spaces

* All numeric fields (N) right justified, zero filled, except when spaces are used to indicate no information.

All alpha (A) and mixed alpha/numeric fields (AN) left justified, space filled.

** M=mandatory, O=optional.

For all optional fields spaces are valid and indicate not known.

COMMENTS:

1) Otolith samples may refer to an individual haul or to groups of hauls in the same rectangle or within one sampling area, depending on the procedures on board. If detailed information is available, it would seem appropriate to refer back to the haul no and/or rectangle; these data are optional rather than mandatory.
2) See Record Type 2.
3) Sex maturity data are explicitly demanded for cod.
4) A plus group refers to the age indicated AND older, respectively to a reading of more than or equal to the specified number of rings.
5) For herring and sprat the number of rings must be recorded. For all other species the age.
6) An additional field has been reserved for no of fish, which allows the information to be presented in a more aggregated form, rather than that identical information has to be recorded for all individual fish of the same size, sex, maturity and age group.
7) Standard ICES Sub-Division (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32)

5.5 Input BITS data

Checklist with detailed information per survey compiled by: ....date: ....

Year:

Quarter:

Country:

Vessel:

Fishing gear:

Mesh size in the codend (in mm):

Comments on gear:

Hydrography (y/n):

- Stations no.:
- CTD-probe (y/n):
- Surface temperature (y/n):
- Bottom temperature (y/n):
- Surface salinity (y/n):
- Bottom salinity (y/n):
- Bottom oxygen (y/n):

Haul duration:

Day/night (trawling):

Other comments:

ICES Sub-division:	22	23	24	25	26	27	28	29	30	31	32
Number of hauls:											

STANDARD SPECIES:	Measured (y/n)	Aged (n - no, o - otoliths, s - scale)	Aged plus group used	Grouped by what stratification? (depth or ICES-rec.)	Sex (y/n)	Maturity (y/n)	Fish health condition (y/n)	Stomach fullness (y/n)
Herring:								
Sprat:								
Cod:								
Flounder:								

BYCATCH	Measured (y/n)	Counted (y/n)	Aged (y/n)
Plaice:			
Dab:			
Turbot:			
Brill:			
Sole:			
All other bychatch:			

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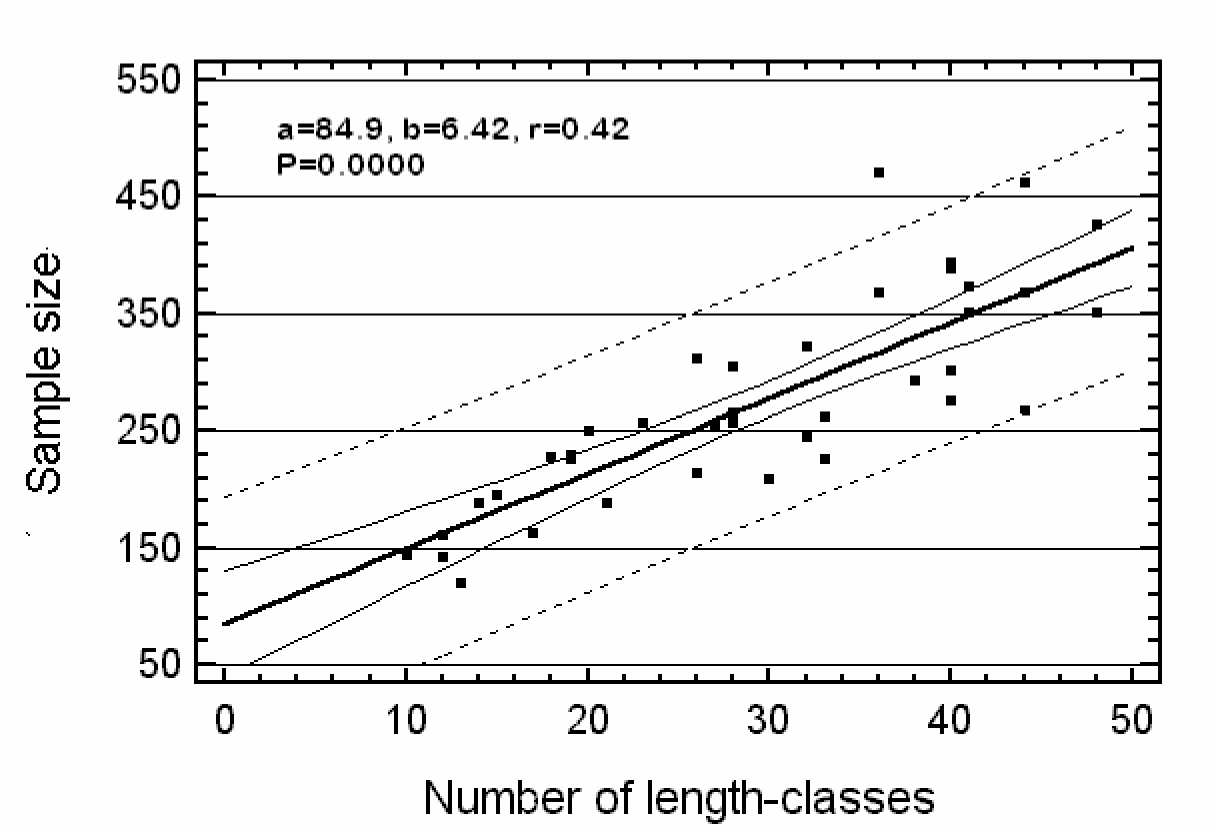


Figure 1. Relationship between the number to be measured and the number of length groups of the total length range in the sample of the catch (after Müller, 1996).

APPENDIX I

MATURITY KEY

1.VIRGIN

Male: Testes very thin translucent ribbon lying along an unbranched blood vessel. No sign of development.

Female: Ovaries small, elongated, whitish, translucent. No sign of development.

2. MATURING

Male: Development has obviously started, colour is progressing towards creamy white and the testes are filling more and more of the body cavity but sperm cannot be extruded with only moderate pressure.

Female: Development has obviously started, eggs are becoming larger and the ovaries are filling more and more of the body cavity but eggs cannot be extruded with only moderate pressure.

3. SPAWNING

Male: Will extrude sperm under moderate pressure to advanced stage of extruding sperm freely with some sperm still in the gonad.

Female: Will extrude eggs under moderate pressure to advanced stage of extruding eggs freely with some eggs still in the gonad.

4. SPENT

Male: Testes shrunken with little sperm in the gonads but often some in the gonoducts which can be extruded under light pressure.

Female: Ovaries shrunken with few residual eggs and much slime.

5. RESTING (see remarks in ICES CM 1997/J:4, chapter 2.5)

Male: Testes firm, not translucent, showing no development.

Female: Ovaries firm, not translucent, showing no development.

Possibilities to classify the maturity stages of the BITS key:

Maturity stage (BITS code)	Purpose of classification: Estimation of spawning stock size	Purpose of classification: Estimation of sexual maturity
1. VIRGIN	immature (nonspawner)	immature
2. MATURING	mature (spawner)	mature
3. SPAWNING	mature (spawner)	mature
4. SPENT	mature (spawner)	mature
5. RESTING	'immature' (nonspawner)	mature

APPENDIX II – CONVERSION TABLES FOR MATURITY KEYS

The table convert the codes of the national maturity keys into the codes of the BITS key for cod.

Country Species Source	BITS All ICES (1997)	Denmark Cod Modif. from Maier (1908), Berner (1960)	Estonia All Kiselevich (1923), Pravdin (1966)	Finland not available	Germany Cod Modif. from Maier (1908). Berner (1960)	Latvia Cod Kiselevich (1923), Pravdin (1966)	Poland Cod Maier (1908), Chrzan (1951)	Russia Cod Sorokin (1957, 1960) modified by Alekseev, Allekseeva (1996)	Sweden Cod Modif. from Maier (1908)
Maturity stage (1)	Code								
VIRGIN (immature)	1	I,II	I		I	Juvenis, II	I	Juv., II	I
MATURING (mature)	2	III-V	II-IV		III-V	III, IV	III-V	III, IV	III-V
SPAWNING (mature)	3	VI,VII	V		VI,VII	V	VI,VII	V, VI (V), VI (IV)	VI
SPENT (mature)	4	VIII	VI		VIII	VI	VIII	VI	VII,VIII
RESTING (mature/ immature[2])	5	IX,X	II		II	II	II	VI - II	II

[1]sexual maturity for estimating the proportion of spawners.
[2]should be used when the investigation was during the prespawning and early spawning time (still no spent individuals).
Individuals will not contribute to the spawning stock in the present year.

The table convert the codes of the national maturity key into the codes of the BITS key for herring

Country Species Source	BITS All ICES (1997)	Denmark	Estonia All Kiselevich (1923), Pravdin (1966)	Finland not available	Germany Herring Modif. from Heincke (1998)	Latvia Herring Kiselevich (1923)	Poland Herring Modif. fr. Maier. Popiel (1955) Strzyzewska(1969)	Russia Herring Kiselevich (1923)	Sweden Herring ICES (1962)
Maturity stage ([1])	Code								
VIRGIN (immature)	1		I		I	I	I,II	Juv., II	I,II
MATURING (mature)	2		II-IV		III,IV	III, IV	III-V	III, IV	III-V
SPAWNING (mature)	3		V		V,VI	V	VI,VII	V	VI
SPENT (mature)	4		VI		VII,VIII	VI	VIII	VI	VII
RESTING (mature/ immature[2])	5		II		II, IX	II (VI)	-	VI (II)	VIII

[1]sexual maturity for estimating the proportion of spawners.
[2]should be used when the investigation was during the prespawning and early spawning time (still no spent individuals). Individuals will not contribute to the spawning stock in the present year.

The table convert the codes of the national maturity key into the codes of the BITS key for sprat

Country Species Source	BITS All ICES(1997)	Denmark No estimations	Estonia All Kiselevich (1923), Pravdin (1966)	Finland not available	Germany Sprat Rechlin (unpublished)	Latvia Sprat Alekseev, Alekseeva (1996)	Poland Sprat Maier (1908), Elwertowski (1957)	Russia Sprat Alekseev, Alekseeva (1996)	Sweden not available
Maturity stage ([1])	Code								
VIRGIN (immature)	1		I		I	I	I	Juv., II	
MATURING (mature)	2		II-IV		III,IV	III, IV, VI (III) VI (IV)	III-V	III, IV	
SPAWNING (mature)	3		V		V,VI	V, VI (V)	VI,VII	V, VI (V), VI (IV)	
SPENT (mature)	4		VI		VII,VIII	VI	VIII	VI	
RESTING (mature/ immature[2])	5		II		II	II	II	VI (II)	

[1]sexual maturity for estimating the proportion of spawners (mature individuals).
[2]should be used when the investigation was during the prespawning and early spawning time (still no spent individuals)
Individuals will not contribute to the spawning stock in the present year.

The table convert the codes of the national maturity key into the codes of the BITS key for flatfishes

Country Species Source	BITS All ICES (1997)	Denmark not available	Estonia All Kiselevich (1923), Pravdin (1966)	Finland not available	Germany Flatfish Maier (1908)	Latvia Kiselevich (1923), Pravdin (1966)	Poland Flatfish Maier (1908)	Russia Alekseev, Alekseeva (1996)	Sweden not available
Maturity stage ([1])	Code								
VIRGIN (immature)	1		I		I	Juvenis, II	I	Juv., II	
MATURING (mature)	2		II-IV		III-V	III, VI	III-V	III, IV	
SPAWNING (mature)	3		V		VI,VII	V	VI,VII	V, VI (V), VI (IV)	
SPENT (mature)	4		VI		VIII	VI	VIII	VI	
RESTING (mature/ immature[2])	5		II		II	II	II	VI (II)	

[1] sexual maturity for estimating the proportion of spawners (mature individuals).
[2] should be used when the investigation was during the prespawning and early spawning time (still no spent individuals). Individuals will not contribute to the spawning stock in the present year.

APPENDIX III – ALPHA CODES FOR COUNTRIES AND SHIPS

COUNTRY	ICES CODE 1)	SHIP´S NAME	BITS CODE
Denmark	DEN	Dana (old)	DAN
		Dana (new)	DAN2
		J.C. Svabo	JCS
		Havfisken	HAF
		Havkatten	HAK
Germany	GFR	Anton Dohrn (old)	AND
		Anton Dohrn (new)	AND2
		Solea	SOL
		Walther Herwig	WAH
		Clupea	CLP
		Eisbär	EIS
Sweden	SWE	Thesis	THE
		Skagerak	SKA
		Argos	ARG
		Ancylus	ACY
Estonia	EST	Koha	KOH
		Solveig	SLG
Finland	FIN		
Latvia	LAT 1)	Baltijas Petnieks	BPE
		Zvezda Baltiki	ZBA
		Monokristal	MON
		Commercial Latvia Vessel	CLV
Poland	POL	Baltica	BAL
Russia	RUS	Monokristal	MON
		Atlantida	ATLD
		Atlantniro	ATL
		Voskhod	VOS
Lithuania	LTU 1)	Darius	DAR

Note 1). Country code for Latvia and Lithuania codes refer to the FAO, ISO Alpha 3 code system.

APPENDIX IV – ALPHANUMERIC CODES FOR DEMERSL TRAWL GEARS

TRAWL SPECIFICATION	TRAWL POPULAR NAME	RESEARCH VESSEL
DT	Russian bottom trawl	Monokristal
LPT	Latvian Pelagic Trawl	Baltijas Petnieks, Zvezda Baltiki
LBT	Latvian Bottom trawl	Baltijas Petnieks
GOV	Grand Overture Verticale	Argos, Dana
DBT	Danish bottom trawl	Dana
EXP	Danish winged bottom trawl	Dana
SON	Sonderborg trawl	Clupea, Solea
H20	Herring ground trawl (H20/25)	Solea, Eisbär
P20	Herring bottom trawl (P20/25)	Commercial Vessel, Baltica
TV1	Large TV trawl	Havfisken
TV2	Small TV trawl	Havkatten
FOT	Fotö bottom trawl	Argos
LCT	Lithuanian cod trawl	Darius
ESB	Estonian small bottom trawl	Koha
HAK	Hake-4M	Atlantniro, Atlantida
CHP	Cod Hopper	Solea
MWT	Mid water trawl 664	Solea
TV3	TV trawl	All vessels
TVL	TV3 930 meshes	All vessels participating in the BITS besides vessels using TVS
TVS	TV3 520 meshes	Havfisken, Solea,Solveig,LAT?

Within the gear field the following positions have been reserved for recording various types of rigging:

Position 14-16: Sweep length in m. (Numeric, right justified, zero filled. Spaces for unknown. Code 000 indicates the semi-pelagic rigging, this specification is associated with the GOV.)

Position 17: Exceptions (B=Bobbins used, D=Double sweeps, space=standard or not known).

Position 18: Door type (P=Polyvalent, V=Vee F=Flat, K=Karm Waco, space=others or not known).

Further quantitative numeric information on rigging of gear is defined in positions 74-95, in Record Type 1.

NB: This code must still be considered as a preliminary one. More detailed information on the gears used in the past is required before a completely comprehensive coding system can be developed.

APPENDIX V – RECORDED SPECIES CODES USED IN RECORD TYPE 1.

Standard species for Baltic International Trawl surveys are listed in Appendix VI. NODC species codes are given in Appendix VII.

NB: Zero catches of a particular species in a haul may be included in or excluded from the file. However, any species deliberately excluded from a subset, or an invalid species for a particular haul, should be included for each haul with a species validity code 0 !!.

RECORDED STANDARD SPECIES LIST CODES (POSITION 65)

0 = No standard species recorded
1 = All (4) standard species recorded
2 = Pelagic (2) standard species recorded Note 1)
3 = Bottom (2) standard species recorded 1)
4 = Individual (1) standard species recorded 2)

RECORDED BY-CATCH SPECIES LIST CODES (POSITION 66)

0 = No by-catch species recorded
1 = Open ended by-catch list - All species recorded
4 = Closed by-catch list - Only flatfish (4) species recorded 1)

1) For definition see Appendix VI.
2) If this code is applied, zero catches of the species recorded must be recorded in Record Type 2 format.

APPENDIX VI – OFFICIAL 10-NUMERIC NODC SPECIES CODES FOR STANDARD AND CLOSED BY-CATCH LISTS

REPORTED GROUP	SPECIES	NODC code
Standard Pelagic species	Herring	8747010201
	Sprat	8747011701
Standard Bottom species	Cod	8791030402
	Flounder	8857041402
By-catch Flatfish	Plaice	8857041502
	Dab	8857040904
	Turbot	8857030402
	Brill	8857030403
	Sole	8858010601

APPENDIX VII – OFFICIAL NODC CODE FOR FISH SPECIES (IN TAXONOMIC ORDER)

8603010000	Petromyzonidae		
8603010200	Lampetra	8603010217	Lampetra fluviatilis
		8603010218	Lampetra planeri
8603010300	Petromyzon	8603010301	Petromyzon marinus
8606010000	Myxinidae		
8606010200	Myxine	8606010201	Myxine glutinosa
8705010000	Chlamydoselachidae		
8705010100	Chlamydoselach	8705010101	Chlamydoselach anguineus
8705020000	Hexanchidae		
8705020100	Hexanchus	8705020101	Hexanchus griseus
8707040000	Lamnidae		
8707040200	Cetorhinus	8707040201	Cetorhinus maximus
8707040300	Lamna	8707040302	Lamna nasus
8707040400	Alopias	8707040401	Alopias vulpinus
8707040500	Isurus	8707040501	Isurus oxyrhinchus
8708010000	Scyliorhinidae		
8708010200	Galeus	8708010203	Galeus melastomus
8708010300	Scyliorhinus	8708010306	Scyliorhinus caniculus
		8708010307	Scyliorhinus stellaris
8708010700	Pseudotriakis	8708010701	Pseudotriakis microdon
8708020000	Carcharinidae		
8708020100	Galeorhinus	8708020102	Galeorhinus galeus
8708020200	Galeocerdo	8708020201	Galeocerdo cuvier
8708020400	Mustelus	8708020408	Mustelus asterias
		8708020409	Mustelus mustelus
		8708020410	Mustelus punctulatus
8708020600	Prionace	8708020601	Prionace glauca
8708030000	Sphyrnidae		
8708030100	Sphyrna	8708030102	Sphyrna zygaena
		8708030103	Sphyrna lewini
		8708030105	Sphyrna tudes
8710010000	Squalidae		
8710010100	Somniosus	8710010102	Somniosus microcephalus
8710010200	Squalus	8710010201	Squalus acanthias
		8710010204	Squalus blainvillei
8710010300	Centrophorus	8710010301	Centrophorus granulosus
		8710010302	Centrophorus squamosus
		8710010303	Centrophorus uyato
8710010400	Dalatias	8710010401	Dalatias licha
8710010500	Etmopterus	8710010503	Etmopterus princeps
		8710010510	Etmopterus spinax
8710010700	Oxynotus	8710010702	Oxynotus centrina
		8710010703	Oxynotus paradoxus
8710010900	Centroscyllium	8710010901	Centroscyllium fabricii
8710011000	Echinorhinus	8710011001	Echinorhinus brucus
8710011200	Centroscymnus	8710011201	Centroscymnus coelolepis
		8710011202	Centroscymnus crepidater
8710011400	Deania	8710011401	Deania calceus
8710011600	Scymnodon	8710011601	Scymnodon ringens

		8710011602	Scymnodon obscurus
8711010000	Squatinidae		
8711010100	Squatina	8711010103	Squatina squatina
8713030000	Torpedinidae		
8713030100	Torpedo	8713030102	Torpedo nobiliana
		8713030104	Torpedo torpedo
		8713030105	Torpedo marmorata
8713040000	Rajidae		
8713040100	Raja	8713040134	Raja radiata
		8713040138	Raja brachyura
		8713040140	Raja microocellata
		8713040141	Raja montagui
		8713040142	Raja hyperborea
		8713040143	Raja batis
		8713040144	Raja nidarosiensis
		8713040145	Raja oxyrhynchus
		8713040146	Raja fullonica
8713040147	Raja circularis		
		8713040148	Raja naevus
		8713040150	Raja fyllae
		8713040151	Raja alba
		8713040153	Raja lintea
		8713040158	Raja undulata
		8713040159	Raja clavata
8713040800	Bathyraja	8713040801	Bathyraja pallida
		8713040803	Bathyraja spinicauda
8713050000	Dasyatidae		
8713050100	Dasyatis	8713050141	Dasyatis pastinacus
8713070000	Myliobatidae		
8713070200	Myliobatis	8713070204	Myliobatis aquila
8713080000	Mobulidae		
8713080200	Mobula	8713080205	Mobula mobular
8716020000	Chimaeridae		
8716020100	Hydrolagus	8716020103	Hydrolagus mirabilis
8716020200	Chimaera	8716020202	Chimaera monstrosa
8716030000	Rhinochimaeridae		
8716030200	Rhinochimaera	8716030201	Rhinochimaera atlantica
8729010000	Acipenseridae		
8729010100	Acipenser	8729010107	Acipenser sturio
8741010000	Anguillidae		
8741010100	Anguilla	8741010102	Anguilla anguilla
8741050000	Muraenidae		
8741050500	Muraena	8741050505	Muraena helena
8741120000	Congridae		
8741120100	Conger	8741120111	Conger conger
8741150000	Synaphobranchidae		
8741150100	Synaphobranchus	8741150104	Synaphobranchus kaupi
8741200000	Serrivomeridae		
8741200100	Serrivomer	8741200102	Serrivomer beani
		8741200104	Serrivomer parabeani
8741210000	Nemichthyidae		

8741210100	Avocettina	8741210102	Avocettina infans
8741210200	Nemichthys	8741210202	Nemichthys scolopaceus
8743030000	Notacanthidae		
8743030200	Polyacanthonotus	8743030204	Polyacanthonotus rissoanus
8743030300	Notocanthus	8743030301	Notocanthus chemnitzii
		8743030302	Notocanthus bonaparti
8747010000	Clupeidae		
8747010100	Alosa	8747010107	Alosa alosa
		8747010109	Alosa fallax
8747010200	Clupea	8747010201	Clupea harengus
8747011700	Sprattus	8747011701	Sprattus sprattus
8747012200	Sardina	8747012201	Sardina pilchardus
8747020000	Engraulidae		
8747020100	Engraulis	8747020104	Engraulis encrasicolus
8755010000	Salmonidae		
8755010100	Coregonus	8755010115	Coregonus oxyrhynchus
		8755010116	Coregonus albula
8755010200	Oncorhynchus	8755010201	Oncorhynchus gorbuscha
		8755010202	Oncorhynchus keta
8755010300	Salmo	8755010302	Salmo gairdneri
		8755010305	Salmo salar
		8755010306	Salmo trutta
8755010400	Salvelinus	8755010402	Salvelinus alpinus
		8755010404	Salvelinus fontinalis
8755010700	Thymallus	8755010704	Thymallus thymallus
8755010800	Hucho	8755010801	Hucho hucho
8755030000	Osmeridae		
8755030200	Mallotus	8755030201	Mallotus villosus
8755030300	Osmerus	8755030301	Osmerus eperlanus
8756010000	Argentinidae		
8756010200	Argentina	8756010203	Argentina silus
		8756010237	Argentina sphyraena
8758010000	Esocidae		
8758010100	Esox	8758010101	Esox lucius
8758020000	Umbridae		
8758020100	Umbra	8758020101	Umbra pygmaea
8758020103	Umbra krameri		
8759010000	Gonostomatidae		
8759010500	Maurolicus	8759010501	Maurolicus muelleri
8759020000	Sternoptychidae		
8759020100	Argyropelecus	8759020107	Argyropelecus olfersii
8760010000	Alepocephalidae		
8760010300	Alepocephalus	8760010302	Alepocephalus rostratus
		8760010305	Alepocephalus bairdi
8762070000	Paralepididae		
8762070200	Notolepis	8762070201	Notolepis rissoi
8762070400	Paralepis	8762070402	Paralepis coregonoides
8762140000	Myctophidae		
8762140300	Lampanyctus	8762140317	Lampanyctus crocodilus
8776010000	Cyprinidae		
8776010600	Notemigonus	8776010601	Notemigonus crysoleucas

8776014900	Abramis	8776014901	Abramis brama
8776017400	Rutilus	8776017401	Rutilus rutilus
8776019900	Vimba	8776019901	Vimba vimba
8784010000	Gobiesocidae		
8784010600	Lepadogaster	8784010601	Lepadogaster candollei
		8784010603	Lepadogaster lepadogaster
8784010700	Diplecogaster	8784010701	Diplecogaster bimaculata
8784010800	Apletodon	8784010801	Apletodon microcephalus
8786010000	Lophiidae		
8786010100	Lophius	8786010103	Lophius piscatorius
		8786010104	Lophius budegassa
8787020000	Antennariidae		
8787020200	Histrio	8787020201	Histrio histrio
8787020200	Antennarius	8787020203	Antennarius radiosus
8788030000	Himantolophiidae		
8788030200	Himantolophus	8788030201	Himantolophus groenlandicus
8788100000	Linophrynidae		
8788100100	Linophryne	8788100102	Linophryne lucifer
8791010000	Moridae		
8791010100	Antimora	8791010101	Antimora rostrata
8791010200	Laemonema	8791010203	Laemonema latifrons
8791010400	Mora	8791010401	Mora moro
8791010500	Lepidion	8791010501	Lepidion eques
8791010600	Halargyreus	8791010601	Halargyreus affinis
8791030000	Gadidae		
8791030200	Boreogadus	8791030201	Boreogadus saida
8791030400	Gadus	8791030402	Gadus morhua
8791030800	Lota	8791030801	Lota lota
8791030900	Pollachius	8791030901	Pollachius virens
		8791030902	Pollachius pollachius
8791031100	Brosme	8791031101	Brosme brosme
8791031300	Melanogrammus	8791031301	Melanogrammus aeglefinus
8791031500	Rhinonemus	8791031501	Rhinonemus cimbrius
8791031600	Phycis	8791031602	Phycis blennoides
8791031700	Trisopterus	8791031701	Trisopterus minutus
		8791031702	Trisopterus luscus
		8791031703	Trisopterus esmarki
8791031800	Merlangius	8791031801	Merlangius merlangus
8791031900	Molva	8791031901	Molva molva
		8791031902	Molva dipterygia
		8791031904	Molva macropthalma
8791032000	Gaidropsurus	8791032001	Gaidropsurus vulgaris
		8791032002	Gaidropsurus mediterraneus
8791032100	Gadiculus	8791032101	Gadiculus argenteus
8791032200	Micromesistius	8791032201	Micromesistius poutassou
8791032300	Raniceps	8791032301	Raniceps raninus
8791032400	Ciliata	8791032401	Ciliata mustela
		8791032402	Ciliata septentrionalis
8791032500	Onogadus	8791032501	Onogadus argenteus

8791032600	Antonogadus	8791032601	Antonogadus macropthalmus
8791040000	Merluccidae		
8791040100	Merluccius	8791040105	Merluccius merluccius
8792010000	Ophidiidae		
8792010600	Ophidion	8792010607	Ophidion barbatum
8792020000	Carapidae		
8792020200	Echiodon	8792020202	Echiodon drummondi
8793010000	Zoarcidae		
8793010500	Lycenchelys	8793010513	Lycenchelys sarsi
8793010700	Lycodes	8793010724	Lycodes vahlii
		8793010725	Lycodes esmarkii
8793012000	Zoarces	8793012001	Zoarces viviparus
8794010000	Macrouridae		
8794010100	Coryphaenoides	8794010117	Coryphaenoides rupestris
8794010600	Malacocephalus	8794010601	Malacocephalus laevis
8794010800	Nezumia	8794010801	Nezumia aequalis
8794011500	Trachyrhynchus	8794011501	Trachyrhynchus trachyrhynchus
		8794011502	Trachyrhynchus murrayi
8794011600	Macrourus	8794011601	Macrourus berglax
8803010000	Exocoetidae		
8803010100	Cypselurus	8803010101	Cypselurus heterurus
		8803010106	Cypselurus pinnatibarbatus
8803010500	Danichthys	8803010501	Danichthys rondeletii
8803010700	Exocoetus	8803010701	Exocoetus obtusirostris
8803020000	Belonidae		
8803020500	Belone	8803020502	Belone belone
8803030000	Scomberesocidae		
8803030200	Scomberesox	8803030201	Scomberesox saurus
8805020000	Atherinidae		
8805021000	Atherina	8805021002	Atherina boyeri
		8805021003	Atherina presbyter
8810010000	Diretmidae		
8810010100	Diretmus	8810010101	Diretmus argenteus
8810020000	Trachichthyidae		
8810020100	Gephyroberyx	8810020101	Gephyroberyx darwini
8810020200	Hoplostethus	8810020201	Hoplostethus atlanticus
		8810020202	Hoplostethus mediterraneus
8810050000	Berycidae		
8810050100	Beryx	8810050101	Beryx decadactylus
		8810050102	Beryx splendens
8811030000	Zeidae		
8811030300	Zeus	8811030301	Zeus faber
8811060000	Caproidae		
8811060300	Capros	8811060301	Capros aper
8813010000	Lampridae		
8813010100	Lampris	8813010102	Lampris guttatus
8815020000	Trachipteridae		
8815020100	Trachipterus	8815020102	Trachipterus arcticus

8815030000	Regalecidae		
8815030100	Regalecus	8815030101	Regalecus glesne
8818010000	Gasterosteidae		
8818010100	Gasterosteus	8818010101	Gasterosteus aculeatus
8818010200	Pungitius	8818010201	Pungitius pungitius
8818010500	Spinachia	8818010501	Spinachia spinachia
8819030000	Macrorhamphosidae		
8819030100	Macrorhamphosus	8819030101	Macrorhamphosus scolopax
8820020000	Syngnathidae		
8820020100	Syngnathus	8820020119	Syngnathus rostellatus
		8820020120	Syngnathus acus
		8820020123	Syngnathus typhle
8820020200	Hippocampus	8820020209	Hippocampus hippocampus
		8820020210	Hippocampus ramulosus
8820022100	Entelurus	8820022101	Entelurus aequoreus
8820022200	Nerophis	8820022201	Nerophis lumbriciformis
		8820022202	Nerophis ophidion
8826010000	Scorpaenidae		
8826010100	Sebastes	8826010139	Sebastes marinus
		8826010151	Sebastes mentella
		8826010175	Sebastes viviparus
8826010300	Helicolenus	8826010301	Helicolenus dactylopterus
8826010600	Scorpaena	8826010628	Scorpaena scropha
		8826010629	Scorpaena porcus
8826011100	Trachyscorpia	8826011101	Trachyscorpia cristulata
8826020000	Triglidae		
8826020300	Peristedion	8826020316	Peristedion cataphractum
8826020500	Trigla	8826020501	Trigla lucerna
		8826020503	Trigla lyra
8826020600	Eutrigla	8826020601	Eutrigla gurnardus
8826020700	Trigloporus	8826020701	Trigloporus lastoviza
8826020800	Aspitrigla	8826020801	Aspitrigla cuculus
		8826020802	Aspitrigla obscura
8831010000	Icelidae		
8831010100	Icelus	8831010101	Icelus bicornis
8831020000	Cottidae		
8831020300	Artediellus	8831020308	Artediellus europaeus
8831020800	Cottus	8831020825	Cottus gobio
8831022200	Myoxocephalus	8831022205	Myoxocephalus quadricornis
		8831022207	Myoxocephalus scorpius
8831023800	Triglops	8831023807	Triglops murrayi
8831024600	Taurulus	8831024601	Taurulus bubalis
		8831024602	Taurulus lilljeborgi
8831080000	Agonidae		
8831080800	Agonus	8831080801	Agonus decagonus
		8831080803	Agonus cataphractus
8831090000	Cyclopteridae		
8831090200	Careproctus	8831090232	Careproctus longipinnis

		8831090233	Careproctus reinhardi
8831090800	Liparis	8831090828	Liparis liparis
		8831090860	Liparis montagui
8831091500	Cyclopterus	8831091501	Cyclopterus lumpus
8835020000	Serranidae		
8835020100	Morone	8835020102	Morone saxatilis
8835020400	Epinephelus	8835020435	Epinephelus guaza
8835022300	Serranus	8835022316	Serranus cabrilla
8835022800	Polyprion	8835022801	Polyprion americanus
8835160000	Centrarchidae		
8835160200	Ambloplites	8835160201	Ambloplites rupestris
8835160500	Lepomis	8835160505	Lepomis gibbosus
8835160600	Micropterus	8835160601	Micropterus dolomieui
		8835160602	Micropterus salmoides
8835180000	Apogonidae		
8835180400	Epigonus	8835180403	Epigonus telescopus
8835181200	Rhectogramma	8835181201	Rhectogramma sherborni
8835200200	Perca	8835200200	Perca fluviatilis
8835200400	Stizostedion	8835200403	Stizostedion lucioperca
8835200600	Gymnocephalus	8835200601	Gymnocephalus cernua
8835270000	Echeneidae		
8835270100	Remora	8835270103	Remora remora
8835280000	Carangidae		
8835280100	Trachurus	8835280103	Trachurus trachurus
		8835280105	Trachurus mediterraneus
		8835280106	Trachurus picturatus
8835280800	Seriola	8835280801	Seriola dumerili
8835280900	Trachinotus	8835280911	Trachinotus ovatus
8835281500	Naucrates	8835281501	Naucrates ductor
8835282400	Lichia	8835282401	Lichia amia
8835330000	Caristiidae		
8835330100	Caristius	8835330101	Caristius macropus
8835430000	Sparidae		
8835430100	Dentex	8835430102	Dentex macropthalmus
		8835430105	Dentex dentex
8835430600	Pagrus	8835430601	Pagrus pagrus
8835430800	Pagellus	8835430801	Pagellus bogaraveo
		8835430804	Pagellus erythrinus
8835430900	Boops	8835430901	Boops boops
8835431100	Sparus	8835431101	Sparus aurata
		8835431102	Sparus pagurus
8835431200	Spondyliosoma	8835431201	Spondyliosoma cantharus
8835440000	Sciaenidae		
8835441100	Umbrina	8835441107	Umbrina canariensis
		8835441108	Umbrina cirrosa
8835442700	Argyrosomus	8835442701	Argyrosomus regium
8835450000	Mullidae		
8835450200	Mullus	8835450202	Mullus surmuletus
		8835450203	Mullus barbatus
8835700000	Cepolidae		
8835700100	Cepola	8835700102	Cepola rubescens
8835710000	Bramidae		

8835710100	Brama	8835710102	Brama brama
8835710300	Pterycombus	8835710301	Pterycombus brama
8835710400	Taractes	8835710401	Taractes longipinnis
		8835710403	Taractes asper
8835720000	Dicentrarchidae		
8835720100	Dicentrarchus	8835720101	Dicentrarchus labrax
		8835720102	Dicentrarchus punctatus
8836010000	Mugilidae		
8836010100	Mugil	8836010101	Mugil cephalus
8836010700	Chelon	8836010704	Chelon labrosus
8836010900	Liza	8836010901	Liza ramada
		8836010902	Liza auratus
8839010000	Labridae		
8839012300	Coris	8839012306	Coris julis
8839013300	Crenilabrus	8839013301	Crenilabrus melops
8839013400	Centrolabrus	8839013401	Centrolabrus exoletus
8839013500	Ctenolabrus	8839013501	Ctenolabrus rupestris
8839013600	Labrus	8839013603	Labrus berggylta
		8839013605	Labrus mixtus
8839013700	Acantholabrus	8839013701	Acantholabrus palloni
8840060000	Trachinidae		
8840060100	Trachinus	8840060101	Trachinus vipera
		8840060102	Trachinus draco
8842010000	Blenniidae		
8842010100	Blennius	8842010104	Blennius ocellaris
		8842010110	Blennius gattorugine
		8842010115	Blennius pholis
8842012400	Coryphoblennius	8842012401	Coryphoblennius galerita
8842020000	Anarhichadidae		
8842020100	Anarhichas	8842020102	Anarhichas denticulatus
		8842020103	Anarhichas lupus
		8842020104	Anarhichas minor
8842120000	Stichaeidae		
8842120500	Chirolophis	8842120505	Chirolophis ascanii
8842120900	Lumpenus	8842120905	Lumpenus lampretaeformis
8842121800	Leptoclinus	8842121801	Leptoclinus maculatus
8842130000	Pholididae		
8842130200	Pholis	8842130209	Pholis gunnellus
8845010000	Ammodytidae		
8845010100	Ammodytes	8845010105	Ammodytes tobianus
		8845010106	Ammodytes marinus
8845010200	Gymnammodytes	8845010201	Gymnammodytes semisquamatus
8845010300	Hyperoplus	8845010301	Hyperoplus lanceolatus
		8845010302	Hyperoplus immaculatus
8846010000	Callionymidae		
8846010100	Callionymus	8846010106	Callionymus lyra
		8846010107	Callionymus maculatus
		8846010120	Callionymus reticulatus
8847010000	Gobiidae		
8847011300	Gobius	8847011304	Gobius auratus

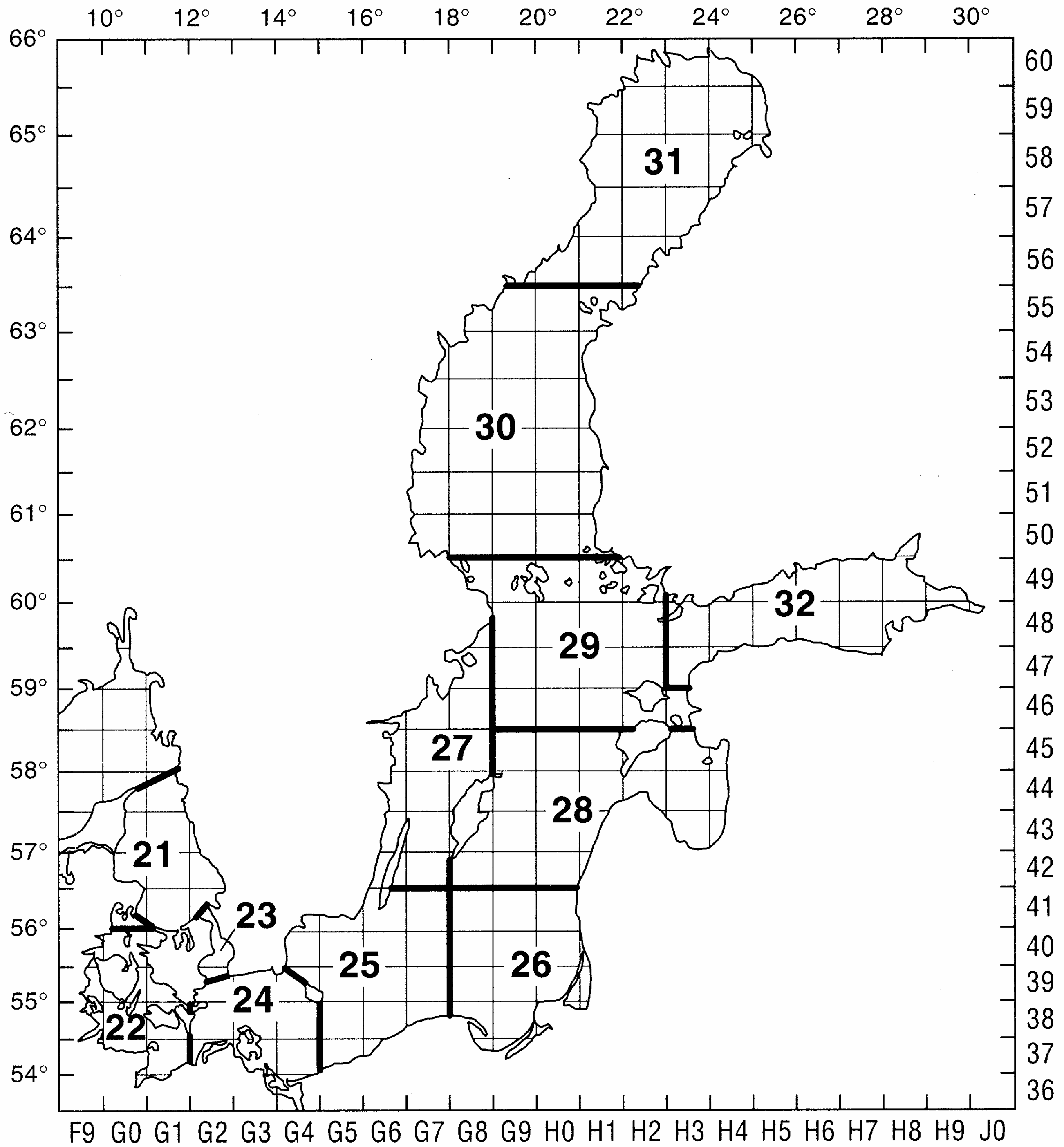
		8847011307	Gobius cobitis
		8847011308	Gobius cruentatus
		8847011316	Gobius niger
		8847011320	Gobius paganellus
		8847011325	Gobius gasteveni
8847014900	Crystallogobius	8847014901	Crystallogobius linearis
8847015000	Gobiusculus	8847015001	Gobiusculus flavescens
8847015100	Pomatoschistus	8847015101	Pomatoschistus minutus
		8847015102	Pomatoschistus pictus
		8847015103	Pomatoschistus microps
		8847015104	Pomatoschistus norvegicus
8847016500	Lebetus	8847016501	Lebetus orca
		8847016502	Lebetus guilleti
8847016600	Aphia	8847016601	Aphia minuta
8847016700	Lesueurigobius	8847016702	Lesueurigobius friesii
8847016800	Buenia	8847016802	Buenia jeffreysii
8847016900	Thorogobius	8847016901	Thorogobius ephippiatus
8847017500	Neogobius	8847017500	Neogobius melanostomus
8850010000	Gemplydae		
8850010400	Ruvettus	8850010401	Ruvettus pretiosus
8850010700	Nesarchus	8850010701	Nesarchus nasutus
8850020000	Trichiuridae		
8850020100	Benthodesmus	8850020101	Benthodesmus simonyi
8850020200	Trichiurus	8850020201	Trichiurus lepturus
8850020300	Aphanopus	8850020301	Aphanopus carbo
8850020400	Lepidopus	8850020401	Lepidopus caudatus
8850030000	Scombridae		
8850030100	Euthynnus	8850030101	Euthynnus pelamis
		8850030105	Euthynnus quadripunctatus
8850030200	Sarda	8850030202	Sarda sarda
8850030300	Scomber	8850030301	Scomber colias
		8850030302	Scomber scombrus
8850030400	Thunnus	8850030401	Thunnus alalunga
		8850030402	Thunnus thynnus
		8850030403	Thunnus albacares
		8850030404	Thunnus obesus
8850030700	Auxis	8850030701	Auxis rochei
		8850030702	Auxis thazard
8850031200	Orcynopsis	8850031201	Orcynopsis unicolor
8850040000	Xiphiidae		
8850040100	Xiphias	8850040101	Xiphias gladius
8850050000	Luvaridae		
8850050100	Luvarus	8850050101	Luvarus imperialis
8850060000	Istiophoridae		
8850060100	Istiophorus	8850060101	Istiophorus platypterus
8850060300	Tetrapterus	8850060301	Tetrapterus albidus
8851010000	Centrolophidae		
8851010300	Centrolophus	8851010301	Centrolophus niger
8851020000	Nomeidae		
8851020200	Cubiceps	8851020203	Cubiceps gracilis
8851030000	Stromateidae		

8851030200	Hyperoglyphe	8851030201	Hyperoglyphe perciforma
8851030400	Schedophilus	8851030401	Schedophilus medusophagus
8857030000	Bothidae		
8857030400	Scophthalmus	8857030402	Scophthalmus maximus
		8857030403	Scophthalmus rhombus
8857031700	Arnoglossus	8857031702	Arnoglossus laterna
		8857031703	Arnoglossus imperialis
		8857031706	Arnoglossus thori
8857032100	Zeugopterus	8857032101	Zeugopterus punctatus
8857032200	Phrynorhombus	8857032201	Phrynorhombus norvegicus
		8857032202	Phrynorhombus regius
8857032300	Lepidorhombus	8857032301	Lepidorhombus boscii
		8857032302	Lepidorhombus whiffiagonis
8857040000	Pleuronectidae		
8857040500	Glyptocephalus	8857040502	Glyptocephalus cynoglossus
8857040600	Hippoglossoides	8857040603	Hippoglossoides platessoides
8857040900	Limanda	8857040904	Limanda limanda
8857041200	Microstomus	8857041202	Microstomus kitt
8857041400	Platichthys	8857041402	Platichthys flesus
8857041500	Pleuronectes	8857041502	Pleuronectes platessa
8857041800	Reinhardtius	8857041801	Reinhardtius hippoglossoides
8857041900	Hippoglossus	8857041902	Hippoglossus hippoglossus
8858010000	Soleidae		
8858010600	Solea	8858010601	Solea solea
		8858010610	Solea lascaris
8858010800	Buglossidium	8858010801	Buglossidium luteum
8858010900	Microchirus	8858010902	Microchirus azevia
		8858010903	Microchirus variegatus
8858011000	Bathysolea	8858011001	Bathysolea profundicola
8858011100	Dicologlossa	8858011101	Dicologlossa cuneata
8858020000	Cynoglossidae		
8858020200	Cynoglossus	8858020201	Cynoglossus browni
8860020000	Balistidae		
8860020200	Balistes	8860020205	Balistes carolinensis
8860020500	Canthidermis	8860020501	Canthidermis maculatus
8861010000	Tetradontidae		
8861010100	Lagocephalus	8861010102	Lagocephalus lagocephalus
8861040000	Molidae		
8861040100	Mola	8861040101	Mola mola
8861040200	Ranzania	8861040201	Ranzania laevis

APPENDIX VIII – SPECIES VALIDITY CODE

0 =	INVALID INFORMATION	Information lost. A note should be given with the cause for the classification as invalid.
1 =	VALID INFORMATION	No per hour and total length composition recorded; applies also when No per hour is zero.
4 =	TOTAL NO PER HOUR ONLY	Catch sampled for No per hour only; no length measurements.
9 =	VALID INFORMATION AVAILABLE BUT NOT RECORDED ON THE FILE	Data not processed on the file

APPENDIX IX – SUB/DIVISIONS AND RECTANGELS CODES



APPENPPENDIX X MAX. LENGTH OF FISH SPECIES IN THE BITS CHECKING PROGRAM

NODC code	Latin name	English name	Max length (cm)
	Clupeiformes		120
8747010201	*Clupea harengus*	Herring	040
8747011701	*sprattus sprattus*	Sprat	018
8747010100	*Alosa fallax*	Shad	050
8747020104	*Engraulis encrasicolus*	european anchovy	020
8755010306	*Salmo trutta*	sea trout	095
8755010302	*Salmo gairdneri*	rainbow trout	050
8755010115	*Coregonus lavaretus*	Whitefish	065
8755030301	*Osmerus eperlanus*	Smelt	029
8758010101	*Esox lucius*	Pike	120
8791030000	***Gadiformes***		120
8791030402	*Gadus morrhua*	Cod	135
8791031801	*Enchelyopus cimbrius*	four-bearded rockling	035
8791031801	*Merlangius merlangus*	Whiting	060
8857040000	***Pleuronectiformes***		060
8857041402	*Platichthys flesus*	Flounder	052
8857041502	*Pleuronectes platessa*	Plaice	057
8857040904	*Limanda limanda*	common dab	040
8857030402	*Scophthalmus maximus*	Turbot	060
	Perciformes		085
8835200403	*Stizostedion lucioperca*	Pikeperch	085
8835200202	*Perca fluviatilis*	Perch	040
8835200601	*Gymnocephalus cernua*	Ruff	015
8842130209	*Pholis gunnellus*	Butterfish	020
8842120905	*Lumpenus Lampretaeformis*	serpent blenny	035
8793012001	*Zoarces viviparus*	eel pout	040
8845010105	*Ammodytes tobianus*	sand eel	020
8845010301	*Hyperoplus lanceolatus*	greater sand eel	035
8850030302	*Scomber scombrus*	Mackerel	065
8835280103	*Trachurus Trachurus*	horse mackerel	045
8847010000	*Gobiidae*	Gobies	007
8847017505	*Neogobius melanostomus*	round goby	025
8831022207	*Myoxocephalus scorpius*	sea scorpion	035
8831080803	*Agonus cataphractus*	Pogge	020
8831091501	*Cyclopterus lumpus*	Lumpfish	045
8831090828	*Liparis liparis*	sea snail	010
8818010000	***Gasterosteiformes***		007
8818010101	*Gasterosteus aculeatus*	Stickleback	007
8776010000	***Cypriniformes***		060
8776014901	*Abramis brama*	Bream	060
8776010601	*Vimba vimba*	Vimba	040
8776017401	*Rutilus rutilus*	Roach	030
8741010000	***Anguilliformes***		180
8741010102	*Anguilla anguilla*	Eel	180
8603010000	***Petromyzoniformes***		090
8603010300	*Petromyzon sp.*	Lampreys	090

APPENDIX XI.

Assignment of the quarters of squares to the ICES subdivisions

				10°00				12°00				14°00				16°00				18°00				20°00					
		F9	F9	G0	G0	G1	G1	G2	G2	G3	G3	G4	G4	G5	G5	G6	G6	G7	G7	G8	G8	G9	G9	H0	H0	H1	H1	H2	H2
	50																												
60°30	50																												
	49																			29	29	29	29	29	29	29	29	29	29
60°00	49																			29	29	29	29	29	29	29	29	29	29
	48																					29	29	29	29	29	29	29	29
59°30	48																				29	29	29	29	29	29	29	29	29
	47																			27	27	29	29	29	29	29	29	29	29
59°00	47																			27	27	29	29	29	29	29	29	29	29
	46																	27	27	27	27	29	29	29	29	29	29	29	29
58°30	46															27	27	27	27	27	27	29	29	29	29	29	29	29	29
	45															27	27	27	27	27	27	28	28	28	28	28	28		
58°00	45																27	27	27	27	27	28	28	28	28	28	28		
	44					21	21									27	27	27	27	27	27	28	28	28	28	28	28		
57°30	44				21	21	21										27	27	27	27	28	28	28	28	28	28	28		
	43				21	21	21	21								27	27	27	27	27	28	28	28	28	28	28	28		
57°00	43			21	21	21	21	21								27	27	27	27	27	28	28	28	28	28	28			
	42			21	21	21	21	21	21							27	27	27	27	28	28	28	28	28	28	28			
56°30	42			21	21	21	21	21	21							27	27	27	27	28	28	28	28	28	28	28			
	41				21	21	21	21	21							25	25	25	25	26	26	26	26	26	26				
56°00	41			22	22	21	21	23	23			25	25	25	25	25	25	25	25	26	26	26	26	26	26	26			
	40			22	22	22	22	23	23			25	25	25	25	25	25	25	25	26	26	26	26	26	26	26			
55°30	40		22	22	22	22		23	23			25	25	25	25	25	25	25	25	26	26	26	26	26	26	26			
	39		22		22	22		23	23	24	24	24	25	25	25	25	25	25	25	26	26	26	26	26	26	26			
55°00	39		22	22	22	22	22	24	24	24	24	24	24	25	25	25	25	25	25	26	26	26	26	26	26				
	38		22	22	22	22	22	24	24	24	24	24	24	25	25	25	25	25	25	26	26	26	26	26					
54°30	38		22	22	22	22	22	24	24	24	24	24	24	25	25	25	25	25		26	26	26	26	26	26				
	37			22	22	22	22	24	24	24	24	24	24	25	25	25					26	26	26						
54°00	37				22	22	22	24		24	24	24	24	25	25														
	36				22																								
	36																												
		F9	F9	G0	G0	G1	G1	G2	G2	G3	G3	G4	G4	G5	G5	G6	G6	G7	G7	G8	G8	G9	G9	H0	H0	H1	H1	H2	H2

APPENDIX XII

Areas per 10 m depth range by square.

Strata Depth interval	**SD 21**	44G0	44G1	43G0	43G1	43G2	42G0	42G1	42G2	41G0	41G1	39G0
total	**6123.3**	**233.7**	**612.6**	**507.4**	**926.1**	**143.9**	**662.3**	**980.3**	**647.0**	**62.2**	**993.3**	**354.4**
0 - 9	**1166.6**	12.8	79.0	278.0	214.2	35.7	355.3	92.1	37.3	13.3	31.1	17.8
10 - 19	**1677.5**	39.5	44.8	143.9	121.2	37.9	307.0	438.6	154.6	41.1	298.9	50.0
20 - 29	**1419.5**	100.3	12.8	46.5	77.9	27.0	0.0	182.0	198.5	7.8	575.6	191.1
30 - 39	**846.8**	75.8	81.1	31.4	109.3	15.1	0.0	196.3	162.3	0.0	83.3	92.2
40 - 49	**467.7**	5.3	120.6	7.6	168.8	16.2	0.0	58.1	83.3	0.0	4.4	3.3
50 - 59	**255.1**	0.0	106.7	0.0	123.3	11.9	0.0	3.3	9.9	0.0	0.0	0.0
60 - 69	**100.1**	0.0	43.8	0.0	50.8	0.0	0.0	4.4	1.1	0.0	0.0	0.0
70 - 79	**79.4**	0.0	47.0	0.0	30.3	0.0	0.0	2.2	0.0	0.0	0.0	0.0
80 - 89	**46.1**	0.0	28.8	0.0	16.2	0.0	0.0	1.1	0.0	0.0	0.0	0.0
90 - 99	**32.1**	0.0	23.5	0.0	7.6	0.0	0.0	1.1	0.0	0.0	0.0	0.0
100 - 150	**32.1**	0.0	24.5	0.0	6.5	0.0	0.0	1.1	0.0	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

strata Depth interval	**SD 22**	41G0	40F9	40G0	40G1	39F9	39G0	39G1	38F9	38G0	38G1	37G0	37G1	36G0
total	**5162.8**	**186.7**	**90.0**	**790.1**	**282.5**	**263.3**	**338.6**	**412.7**	**90.0**	**928.1**	**528.7**	**278.1**	**820.2**	**153.7**
0 - 9	**1489.5**	32.2	21.4	238.6	117.1	83.2	99.2	161.9	27.7	166.2	334.8	72.4	99.3	35.5
10 - 19	**2132.9**	55.6	67.5	327.5	159.8	91.2	142.5	206.3	30.0	417.9	105.0	171.8	243.0	114.7
20 - 29	**1436.9**	94.4	1.1	184.6	4.5	84.4	90.1	31.9	32.3	312.8	85.4	33.9	477.9	3.5
30 - 39	**92.3**	3.3	0.0	32.6	1.1	4.6	6.8	9.1	0.0	31.2	3.5	0.0	0.0	0.0
40 - 49	**10.1**	1.1	0.0	6.8	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
50 - 59	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60 - 69	**1.1**	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0
70 - 79	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80 - 89	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90 - 99	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100 - 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

strata Depth interval	**SD 23**	41g2	40g2	39g2
total	**896.5**	**186.7**	**384.9**	**324.9**
0 - 9	**319.2**	32.2	200.3	86.6
10 - 19	**403.4**	55.6	165.5	182.4
20 - 29	**166.1**	94.4	15.8	55.9
30 - 39	**6.7**	3.3	3.4	0.0
40 - 49	**1.1**	1.1	0.0	0.0
50 - 59	**0.0**	0.0	0.0	0.0
60 - 69	**0.0**	0.0	0.0	0.0
70 - 79	**0.0**	0.0	0.0	0.0
80 - 89	**0.0**	0.0	0.0	0.0
90 - 99	**0.0**	0.0	0.0	0.0
100 - 150	**0.0**	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0

strata Depth interval	SD 24	39G2	39G3	39G4	38G2	38G3	38G4	37G2	37G3	37G4
total	**6509.3**	**430.9**	**819.7**	**598.5**	**948.9**	**939.6**	**1038.9**	**266.4**	**461.5**	**1004.9**
0 - 9	**785.4**	88.9	31.9	21.7	85.4	78.5	2.3	92.3	271.1	113.3
10 - 19	**2461.5**	205.2	76.4	83.2	557.5	99.3	255.1	136.7	182.3	865.8
20 - 29	**1091.3**	127.7	114.0	63.8	252.8	170.8	292.0	37.4	8.2	24.5
30 - 39	**621.4**	9.1	176.7	65.0	49.6	152.4	167.4	0.0	0.0	1.2
40 - 49	**1396.6**	0.0	420.7	328.3	3.5	438.6	205.5	0.0	0.0	0.0
50 - 59	**124.3**	0.0	0.0	28.5	0.0	0.0	95.8	0.0	0.0	0.0
60 - 69	**28.8**	0.0	0.0	8.0	0.0	0.0	20.8	0.0	0.0	0.0
70 - 79	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80 - 89	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90 - 99	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100 - 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

strata Depth interval	SD 25	41G4	41G5	41G6	41G7	40G4	40G5	40G6	40G7	39G4	39G5	39G6	39G7	38G5	38G6	38G7	37G5	37G6
total	**12615.9**	**113.3**	**307.8**	**876.7**	**1000.0**	**747.4**	**1013.0**	**1013.0**	**1013.0**	**249.7**	**986.1**	**1026.0**	**1026.0**	**1038.9**	**940.8**	**475.6**	**657.8**	**130.9**
0 - 9	**332.5**	41.1	88.9	88.9	0.0	39.4	1.1	0.0	0.0	2.3	4.6	0.0	0.0	1.2	10.4	20.8	24.5	9.3
10 - 19	**1110.7**	21.1	57.8	132.2	26.7	122.7	7.9	0.0	63.0	2.3	4.6	8.0	0.0	3.5	188.2	118.9	289.8	64.3
20 - 29	**1324.6**	20.0	61.1	101.1	140.0	135.1	11.3	0.0	115.9	11.4	6.8	51.3	0.0	4.6	207.8	277.0	140.2	40.9
30 - 39	**2096.5**	31.1	82.2	250.0	358.9	86.7	88.9	185.7	318.5	10.3	9.1	67.3	78.7	33.5	301.3	58.9	119.2	16.4
40 - 49	**1749.4**	0.0	17.8	128.9	231.1	162.1	221.7	261.1	118.2	36.5	18.2	78.7	183.5	86.6	151.2	0.0	53.7	0.0
50 - 59	**1504.4**	0.0	0.0	96.7	184.4	70.9	139.6	174.5	129.4	47.9	34.2	109.4	189.2	249.3	48.5	0.0	30.4	0.0
60 - 69	**1531.6**	0.0	0.0	72.2	57.8	46.1	180.1	171.1	243.1	53.6	49.0	199.5	119.7	322.1	17.3	0.0	0.0	0.0
70 - 79	**1505.4**	0.0	0.0	6.7	1.1	75.4	228.5	197.0	24.8	73.0	169.9	249.7	239.4	223.9	16.2	0.0	0.0	0.0
80 - 89	**797.5**	0.0	0.0	0.0	0.0	9.0	115.9	23.6	0.0	12.5	212.0	158.5	151.6	114.3	0.0	0.0	0.0	0.0
90 - 99	**638.2**	0.0	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	457.1	103.7	59.3	0.0	0.0	0.0	0.0	0.0
100 - 150	**25.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	0.0	4.6	0.0	0.0	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

strata Depth interval	SD 26	41G8	41G9	41H0	41H1	40G8	40G9	40H0	40H1	39G8	39G9	39H0	39H1	38G8	38G9	38H0	37G8	37G9
total	**10967.1**	**1000.0**	**1000.0**	**982.2**	**15.6**	**1013.0**	**1013.0**	**1013.0**	**69.8**	**1026.0**	**1026.0**	**877.8**	**11.4**	**698.4**	**922.3**	**40.4**	**107.5**	**150.7**
0 - 9	**218.0**	0.0	0.0	37.8	8.9	0.0	0.0	4.5	28.1	0.0	0.0	11.4	4.6	60.0	21.9	9.2	18.7	12.9
10 - 19	**475.3**	2.2	0.0	123.3	6.7	0.0	0.0	28.1	14.6	0.0	0.0	46.7	4.6	110.8	50.8	23.1	46.7	17.5
20 - 29	**713.9**	85.6	0.0	157.8	0.0	0.0	0.0	48.4	27.0	4.6	0.0	177.8	2.3	121.2	48.5	8.1	15.2	17.5
30 - 39	**1189.8**	142.2	0.0	355.6	0.0	0.0	0.0	208.2	0.0	25.1	2.3	274.7	0.0	78.5	68.1	0.0	11.7	23.4
40 - 49	**674.0**	78.9	7.8	81.1	0.0	0.0	0.0	203.7	0.0	17.1	9.1	177.8	0.0	35.8	32.3	0.0	5.8	24.5
50 - 59	**844.5**	72.2	95.6	101.1	0.0	39.4	65.3	206.0	0.0	36.5	17.1	101.5	0.0	31.2	54.3	0.0	7.0	17.5
60 - 69	**966.4**	32.2	137.8	58.9	0.0	85.5	182.3	141.8	0.0	69.5	76.4	66.1	0.0	46.2	38.1	0.0	2.3	29.2
70 - 79	**944.4**	47.8	63.3	36.7	0.0	68.7	194.7	100.2	0.0	148.2	102.6	17.1	0.0	39.2	117.7	0.0	0.0	8.2
80 - 89	**1488.2**	48.9	54.4	18.9	0.0	168.8	328.7	72.0	0.0	438.9	204.1	4.6	0.0	45.0	103.9	0.0	0.0	0.0
90 - 99	**1383.4**	104.4	61.1	10.0	0.0	210.5	192.5	0.0	0.0	283.9	336.3	0.0	0.0	71.6	113.1	0.0	0.0	0.0
100 - 150	**2069.2**	385.6	580.0	1.1	0.0	440.1	49.5	0.0	0.0	2.3	278.2	0.0	0.0	58.9	273.6	0.0	0.0	0.0
> 150	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

strata Depth interval	SD 27	42G6	42G7	43G6	43G7	43G8	44G6	44G7	44G8	45G6	45G7	45G8	46G6	46G7	46G8	47G8
total	**8826.6**	**427.7**	**986.9**	**389.5**	**945.6**	**189.3**	**331.9**	**960.5**	**435.4**	**194.7**	**947.2**	**947.2**	**78.2**	**598.1**	**915.9**	**478.6**
0 - 9	**1014.8**	150.2	0.0	108.2	26.0	66.0	121.7	0.0	8.5	117.9	28.4	0.0	36.5	121.9	28.1	201.4
10 - 19	**700.5**	111.8	0.0	60.6	45.4	53.0	61.9	1.1	10.7	42.1	36.8	0.0	28.1	102.1	28.1	118.6
20 - 29	**525.3**	31.8	3.3	114.7	41.1	30.3	44.8	1.1	11.7	20.0	46.3	0.0	8.3	91.7	20.8	59.3
30 - 39	**415.7**	23.0	14.3	70.3	47.6	38.9	27.7	3.2	8.5	10.5	33.7	1.1	4.2	74.0	20.8	37.8
40 - 49	**538.2**	23.0	24.1	32.5	92.0	1.1	55.5	24.5	18.1	4.2	92.6	13.7	1.0	75.0	54.2	26.6
50 - 59	**562.5**	25.2	205.1	3.2	76.8	0.0	17.1	45.9	9.6	0.0	52.6	13.7	0.0	51.1	45.8	16.4
60 - 69	**463.9**	23.0	168.9	0.0	66.0	0.0	3.2	39.5	10.7	0.0	52.6	11.6	0.0	26.1	57.3	5.1
70 - 79	**532.3**	38.4	190.8	0.0	100.6	0.0	0.0	50.2	23.5	0.0	57.9	23.2	0.0	14.6	26.1	7.2
80 - 89	**634.0**	1.1	201.8	0.0	110.4	0.0	0.0	64.0	54.4	0.0	91.6	42.1	0.0	19.8	43.8	5.1
90 - 99	**961.6**	0.0	154.6	0.0	145.0	0.0	0.0	233.7	124.9	0.0	90.5	144.2	0.0	15.6	53.1	0.0
100 - 150	**1782.0**	0.0	24.1	0.0	194.7	0.0	0.0	399.1	154.7	0.0	280.0	521.0	0.0	6.3	201.1	1.0
> 150	**695.8**	0.0	0.0	0.0	0.0	0.0	0.0	98.2	0.0	0.0	84.2	176.8	0.0	0.0	336.6	0.0

strata Depth interval	SD 28	42G8	42G9	42H0	42H1	43G8	43G9	43H0	43H1	44G8	44G9	44H0	44H1	45G9	45H0	45H1
total	**11398.4**	**963.9**	**986.9**	**982.5**	**75.7**	**347.3**	**973.7**	**973.7**	**434.9**	**100.3**	**923.1**	**960.5**	**887.9**	**937.7**	**947.2**	**903.0**
0 - 9	**353.5**	9.9	0.0	18.6	28.5	41.1	1.1	0.0	38.9	13.9	34.2	0.0	72.6	16.8	0.0	77.9
10 - 19	**733.7**	62.5	0.0	66.9	30.7	56.3	2.2	5.4	117.9	22.4	44.8	4.3	180.4	28.4	0.0	111.6
20 - 29	**974.3**	239.0	0.0	84.4	16.4	59.5	10.8	40.0	114.7	39.5	30.9	4.3	151.5	25.3	0.0	157.9
30 - 39	**881.0**	227.0	0.0	102.0	0.0	56.3	18.4	64.9	49.8	24.5	63.0	2.1	112.1	31.6	14.7	114.7
40 - 49	**772.7**	117.3	0.0	89.9	0.0	35.7	19.5	97.4	26.0	0.0	60.8	25.6	112.1	62.1	23.2	103.1
50 - 59	**825.2**	68.0	0.0	112.9	0.0	33.5	30.3	94.1	28.1	0.0	65.1	37.4	149.4	46.3	25.3	134.7
60 - 69	**621.4**	23.0	0.0	73.5	0.0	17.3	40.0	51.9	54.1	0.0	57.6	55.5	76.8	51.6	41.0	78.9
70 - 79	**479.7**	48.2	0.0	65.8	0.0	11.9	44.4	49.8	5.4	0.0	53.4	52.3	14.9	53.7	42.1	37.9
80 - 89	**614.3**	36.2	0.0	38.4	0.0	8.7	59.5	82.2	0.0	0.0	73.6	60.8	13.9	58.9	147.3	34.7
90 - 99	**774.5**	37.3	0.0	37.3	0.0	8.7	71.4	73.6	0.0	0.0	105.7	122.7	4.3	89.5	175.8	48.4
100 - 150	**2935.0**	95.4	540.6	219.3	0.0	18.4	440.3	135.2	0.0	0.0	265.7	470.6	0.0	301.0	445.2	3.2
> 150	**1433.1**	0.0	446.3	73.5	0.0	0.0	235.9	279.1	0.0	0.0	68.3	124.9	0.0	172.6	32.6	0.0